TRANSACTIONS AND PROCEEDINGS

AND

REPORT

OF THE

ROYAL SOCIETY of SOUTH AUSTRALIA.

VOL. VII.

(FOR 1883-84.)

Adelaide:
G. ROBERTSON, 103, KING WILLIAM STREET.
1885.

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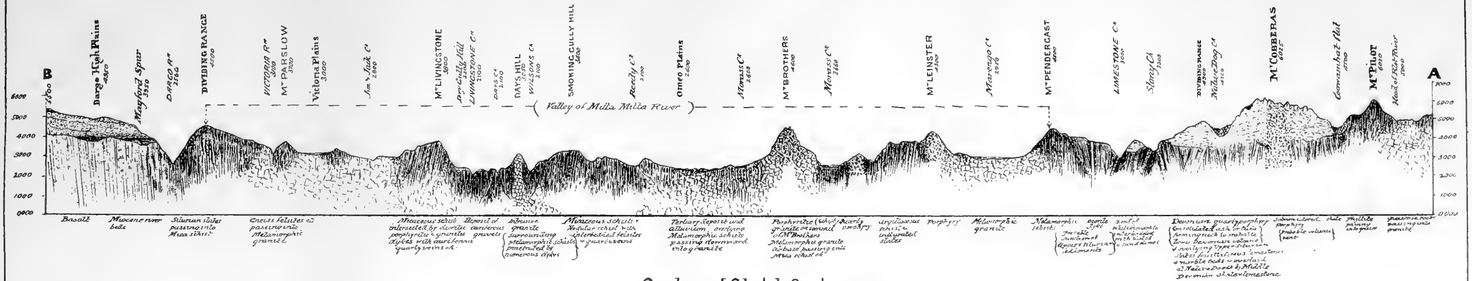

Geological Sketch Section

Australian Alps

James Stirling del. 1.11.83

SCALE

VERTICAL 4000 Ft to 1 inch

HORIZONTAL 4 miles to 1 inch

Plate II.

DAYS HILL (NEAR OMEO)

Shewing Intrusive Granite

Notes on a Geological Sketch-Section through the Australian Alps.

By James Stirling, F.L.S., Corr. Member.

Plates I. and II.

[Read February 5, 1884.]

An examination of the different rock masses which compose the Australian Alps reveals many interesting geological features, not only in respect to their stratigraphical relations, but in the evidences of long-continued denudation which has laid bare the deep-seated crystalline schists and their intrusive rock masses. The surface configuration over which the sectional line has been determined is most varied, passing from the porphyritic bosses of the rugged Cobberas Mountains, across the Upper Silurian slates and marble-beds in the valley of Limestone Creek, through the metamorphic schists and granites of the Mitta-Mitta source-basin and its included Omeo plains and tableland, to the Main Dividing Range; thence across the deep gorge formed by the Dargo River (where the metamorphic schists merge into unaltered Lower Silurian slates and sandstones) to the basaltic tableland of the Dargo high plains, which has sealed up the river valleys of Miocene age.

The lithological characters of the different rock masses are as follows:—At A are a series of open mossy upland flats, forming a low gap in the Main Dividing Range. These flats are made up of deposits of Tertiary or Post-Tertiary gravels, containing stream-tin and fine gold, and rest on a bottom of decomposing granite. The gravels are overlain by a moderate depth of alluvium, held together by the thin wiry interlaced roots of various Alpine shrubs. Samples of stannite in a quartz matrix have been found in the ridges *in situ*, indicating a probable lode not far distant. On the spurs from Mount Pilot the granite merges upward into a coarse granitoid schist, while on a high lateral range proceeding westerly the latter rock passes into a series of highly-inclined argillaceo-mica schists.*

Descending the southern slopes of Mount Pilot, towards Forest Hill, the open park-like basin of Coowambat Flat is reached; here are seen outcrops of yellowish to bluish and greyish shales, calcareous shales, and limestones, the last containing numerous impressions of minute brachipoda and corals of alleged Middle Devonian age.*

These limestones and shales dip about N. 85° W. at 65°, and rest unconformably on the Silurian sediments to the north, and on the brownish fragmental quartz porphyries which make up the mass of the Cobberas Mountain to the south. Higher up on the north-west side of the Cobberas Mountain are isolated patches of reddish conglomerates, apparently younger than the shales of Coowambat.

On the eastern side of the Cobberas Mountain are seen dense, almost granitic, salmon-coloured porphyries, made up of translucent whitish quartz crystals and prisms of orthoclase-felspar imbedded in a reddish felsitic base, with plates of hexagonal mica of a greenish-bronze colour, and, according to the microscopic examination by my friend Mr. Howitt, F.G.S., "an amorphous, yellowish-green, apparently hydrated, mineral found sparingly in small cavities." The summit of Mount Cobberas consists of bosses of compact fragmental porphyries, having similar petrographical characters to those on the eastern side, with the addition of the imbedded fragments of indurated slate and other rocks, thus forming a trappean breccia. These fragmental porphyries are continuous on the south and south-west side of the mountain to the sources of the Native Dog Creek, where outcrops of fossiliferous limestone are observable. This limestone is similar to that at Coowambat, and probably of the same age; but, unlike the latter, it is wholly surrounded by the quartz porphyries, filling a pocket in these igneous rocks. From this place northerly across the Main Dividing Range towards Limestone Creek the porphyries are more silicious in character, stand out in large weathered blocks, and yield a gritty, although not unfertile, soil.

At Stony Creek, erosion has laid bare thick beds of fossiliferous limestone, marble and slaty shale, the first containing among other molluscs the well-known *Spirigerina reticularis*, common to Upper Silurian and Lower Devonian formations, and undescribed species of *Beyrichia* and *Atrypa*. The marble beds are crowded with stems of *Actinocrinus* and obscure impressions of trilobites.†

The unaltered fossiliferous limestones, at this place, are in direct contact with the overlying porphyries, while the crystallization of the rocks increases with the depth. This would appear to confirm the suggestions made by Mr. Howitt

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* "Devonian Rocks of North Gippsland," by A. M. Howitt, F.G.S.

† "On Caves Perforating Marble Deposits, Limestone Creek," by J. Stirling, F.L.S. Trans. Roy. Socy. Vict., 1883, p. 11.

in his valuable paper on the Devonian rocks of North Gippsland, viz., that "the great masses of quartz porphyries" (such as those I have described, p. 2) "are the denuded stumps of the volcanoes, around which accumulations of felstone ash and agglomerate, with felsitic rocks of indefinite character are seen to be grouped."* In other words, they are the last traces, though obscure as to their original characters by metamorphism, of the once trachytic ash and agglomerates of Upper Palæzoic volcanoes.

Crossing the spur dividing Stony Creek and Limestone Creek, the porphyries are seen to be penetrated by strings and veins of quartz, and in some places to assume an almost vesicular appearance. At lower levels towards Limestone Creek, the sedimentary rocks again appear, consisting of finely-laminated slates, sandstones, and interbedded bands of whitish marble or dense blue limestone, dipping W. at 70°. The marble bands are from 10 to 250 feet thick, more saccharoidal than the Stony Creek deposits, but full of seams of limonite, parallel to the bedding planes, and much jointed; they are also perforated by numerous caves. On the grassy sub-alpine flats of Limestone Creek are deposits of auriferous Tertiary gravels from 5 to 12 feet deep. Ascending the steep spurs to the west, the slates become more corrugated and micaceous. On the upland flats, near the crest of the range, masses of diorite are seen; the rich carpeting of grasses proving the fertility of the soil decomposed from these potash-yielding rocks. These intrusive masses are probably connected with the periods of Palæozoic volcanic activity, as the rocks at contact are indurated and otherwise altered. As the crest of the range is reached, the slates become very much corrugated, micaceous, and full of quartz veins; further to the north, along the line of these semi-altered slates, veins of micaceous iron-ore are plentiful in a quartz matrix. On the crests of the range the rocks assume a vertical dip and decidedly metamorphic character as gneissose schists; while in descending towards Marengo Creek masses of granite are seen standing out in huge tors. This is probably a metamorphic granite, and is continuous across the valley of the Marengo Creek to Mount Leinster, which is a bold rounded peak on the Dividing Range. At the summit of this mountain the granite gives place to quartz-porphyry of an intrusive character, which has apparently been exposed by sub-aerial denudation.

On the west side the metamorphic schists are constituted of argillaceous, argillaceo-micaceous, and areno-argillaceous materials dipping from vertical to 85° to W. On the slopes

* "Devonian Rocks of Gippsland;" p. 200.

towards Morass Creek, masses of quartz-porphyry are again seen, the argillaceous rocks at contact assuming a jaspery silicified appearance. The gradual passage from the unaltered Silurian sediments into mica schist, gneiss and granite, plainly to be seen on the outer margin of the metamorphic area at Omeo, is in striking contrast to the sharp well-defined line of demarcation between the intrusive porphyries and the argillaceous sediments they invade. The metamorphic schists occupy the bed of Morass Creek, and are overlain by a considerable depth of alluvium, where crossed by the line of section. Ascending the thickly-wooded slopes of Mount Brothers the schists give place to a ternary granite similar in texture to that occupying the valley of the Marengo Creek, but towards the crest of the mountain, the latter is replaced by a distinct porphyritic granite, made up of large prismatic crystals of whitish felspar scattered through a base of smaller felspathic crystals, with quartz and black mica. The huge blocks which occupy the crest of the mountain stand out in rounded masses, exfoliating in concentric layers. Descending to the south, towards Omeo Plains, the metamorphic schists, which underlie this lacustrine area, appear to pass downward into a metamorphic granite; while to the east, at Mount Sisters, about three miles distant, are bluffy outcrops of an intrusive granite, which further to the east passes into a quartz-porphyry.

The Omeo Plains consist of about 16,000 acres of splendid agricultural land; fine open plains, with the Omeo Lake in their centre. Some idea of the fertility of these sub-alpine tablelands may be gleaned when it is stated that in 1882 fifty to sixty bushels of wheat to the acre was not an uncommon yield. On the southern margin of these plains, towards Omeo, are open, well-grassed ridges, showing outcrops of mica and argillaceo-mica schists; further to the south, at Smoking Gully Hill, are bands of nodular argillaceous schist, intersected by brownish quartz porphyry dykes and seams of igneous, probably diabasic, rock. At lower levels, these argillaceo-mica schists pass into hard crystalline rocks, gneissose and quartzitic schist very much ramified by numerous igneous and intrusive dykes; these are well seen in the bed of Wilson's Creek, an affluent of Livingstone Creek. Ascending the rounded eminence to the south, known as Day's Hill, a mass of intrusive granite is seen to have been lain bare at the crest of the hill. The schistose rocks at contact are very much altered, assuming the character of hornfels. The rough sketch represented by plate II. will serve to illustrate the peculiar features of this intrusive mass, and also indicate the position of the alluvial gold workings in the bed of an ancient lake or tarn, which extended, in Tertiary times, from the base of Day's Hill to Mount Livingstone. At Day's Creek, on the southern base of the former hill, erosion has lain bare several interesting sections of the strata, showing numerous intrusive dykes intersecting the beds of quartzite, gneiss, and mica schist, which form the metamorphic rocks at this place. These dykes are dioritic, felsitic and, probably, diabasic, and have all altered the bounding rocks to a more or less distance from contact. One noticeable feature of them is that the mica schists, in the passage downwards, pass into a rock resembling that variety of the felspar-group known as porphyritic gneiss.

On the western slopes of Day's Hill are deposits of Tertiary auriferous gravels, fully 100 feet above the present level of Livingstone Creek. These gravels form part of what was evidently a continuous mass extending to the base of Mount Livingstone, about three miles distant, and now partially degraded by the erosion of the Livingstone Creek. The upper portion of these deposits consists of rounded fragments of various rocks, now found *in situ*, such as quartz, mica schist, gneiss, felstones, diorites, &c., in every stage of decay, from exfoliation in concentric layers to kaolin and magnesian clay. It is at the bottom of these gravels that the auriferous wash-dirt occurs. At Dry Hill, near Mount Livingstone, they have been exposed by mining operations to a depth of 60 feet, and are here seen to rest on what is locally called a "false bottom" of decomposing boulders of igneous rock of larger dimensions, to a depth of 40 feet, where the bed rocks occur. The boulders are evidently derived from volcanic caps similar to those remaining *in situ*. The bed of the ancient lake has been eroded on three sides, and the surrounding hills degraded. It is stated that there are at least four of these lake basins along the valley of the Livingstone Creek, which have been drained by the creek having cut through their margins.

In the basin of Dry Gully (one of the creeks which has eroded its passage along the margin of the ancient lake) are rich auriferous reefs, intersecting the metamorphic schists, the quartz becoming highly pyritous at a depth of 100 feet and lower. The following minerals have also been found in the neighbourhood:—Phosphate, carbonate and sulphide of lead, silicate and carbonate of copper, native silver, argentiferous galena, rutile, black tourmaline plentiful in quartz seams, fibrolite, micaceous iron-ore, &c. From Mount Livingstone, which is made up of argillaceous and micaceous schists with bands of nodular argillaceous schist and gneiss, the sectional line crosses some fine uplands of limited extent, as at Jim and Jack and Parslow's Plains, where large masses of granite are seen to form the principal rock. On the spurs to the east of

Parslow's Plains, there are signs of silicification and induration with numerous felsitic dykes, indicating an intrusive granite; but on the western side towards Mount Parslow, the granitic rock masses appear to pass upward into coarse gneiss and mica schists—the gneissic rocks forming the principal mass in the bed of the Victoria River. From the Victoria River to the crest of the Main Dividing Range the rocks are principally metamorphic, veined with white quartz and intersected by dioritic and felsitic dykes; but in descending towards the Dargo River the gradual passage from gneissose rocks to mica schist, thence to micaceous shales and the unaltered Silurian slates and sandstones is plainly seen. On King's Spur there is also a leptynite schist containing decomposed garnets, and a band of rock composed of quartz and green hornblende.*

Ascending what is known as Mayford Spur on the west side of the Dargo River, the slates and sandstones are continuous for about 1,400 feet above the level of that river, where they are seen to be overlain by deposits of heavy auriferous gravels, with bands of foliated sandy clay containing impressions of the Miocene plant *Cinnamomum polymorphoides*, McCoy. In this locality at similar levels are masses of silicious conglomerates and ferruginous bands containing imperfect Lauraceous leaves and *Salisburia Murraya*, McCoy, nearly allied to some Miocene forms from the arctic regions.† These Miocene deposits are overlain by extensive sheets of basalt, forming the Dargo High Plains at elevations of from 4,000 to 5,000 feet above sea level. As this section traverses an extent of territory not yet examined by the Geological Survey of Victoria, it may be interesting to conclude with an outline of the probable stratigraphical relations of the different rock masses.

Silurian.

There does not appear to be any remnants of Pre-Silurian or Archæan rocks within the area; it is not improbable, however, that the Palæozoic volcanic and plutonic activities have completely transmuted any such Archæan sediments into the granitic masses, now laid bare by denudation within the Lower Silurian areas. The great mass of metamorphic schists, &c., would appear to be simply the metamorphosed Lower Silurian sediments, although there are not wanting evidences that the Upper Silurian rocks have been tilted, folded, and compressed along with the Lower Silurian, and, like them, subjected to the influence of metamorphic action. Mr. Selwyn remarks‡

* "Progress Report Geol. Surv., Victoria, 1878," p. 98.

† "Progress Report Geol. Surv., Victoria," vol. 5.

‡ "Intercolonial Exhibition Essays."

that there is considerable unconformability between the Upper and Lower Silurian rocks of Victoria, which would appear to indicate that the Lower Silurian were subjected to considerable denudation, and to periods of plutonic activity before the upper beds were laid down. Whether the regional metamorphism of the Mitta Mitta source basin is connected with plutonic forces during Silurian times by the lowering of the area within the influences of central heat, which would recompose and crystallise the lower portions of the crumpled Palæozoic sediments, or are the "latest results of that general process of transmutation, which all sedimentary deposits have undergone and are still undergoing from the moment they begin to be covered more or less thickly with other more recent deposits," is still a matter of uncertainty. The researches of Mr. Howitt* among the Devonian rocks of Gippsland have unmistakeably shown that the close of the Silurian or the beginning of the Devonian periods in the Australian Alps was one of powerful volcanic activity, during which the porphyries of Mount Cobberas and adjacent mountains were laid down as accumulations of ash or tufa, subsequently consolidated; and there is every probability that the intrusive porphyries, which have invaded the metamorphic schists, are connected with the volcanic and plutonic activity of that time.

Devonian.

The representatives of this system, crossed by the line of section as at Coowambat and Native Dog Creek, are indicated by the fossils to be Middle Devonian, and as they are evidently superior to the porphyries upon which they rest unconformably, the latter may provisionally be classed as Lower Devonian. The absence of Lower Devonian sediments is noticeable—indeed, I am not aware that any such exist in Victoria. The Middle Devonian formation is well developed in the isolated patches of limestone at Bindi, on the Tambo River, and Buchan, on the Buchan River, to the south from the line of section. At both of these places an abundance of its characteristic fossil, *Spirifera levæcosta*, may be collected; while at Mount Tambo, to the east of the Omeo Plains, bold outcrops of purple conglomerates and sandstones are seen, apparently stratigraphically superior to the marine limestones at Bindi, and are regarded by Mr. Howitt as of Upper Devonian age.* All these Devonian areas form now mere pockets in the land surface, indicating vast periods of time, during which the oscillations of the surface resulted—first, in subsidence, during which they were laid down on the bed of the ocean; and, second, in emergence and folding, occasioned

* "Devonian Rocks of Gippsland," A. M. Howitt, F.G.S.

probably by plutonic and volcanic action; and, thirdly, in extensive sub-aerial denudation when the crests of the curves were removed.

Miocene Tertiaries.

From the laying down of the Upper Devonian sediments to the sealing up of the Miocene valleys by the lava-flows, there is a manifest break in the continuity of geological formation, which can only, I think, be accounted for by supposing, either that powerful denudation has removed any remnants of Mesozoic formations, or that volcanic activities, which terminated the Devonian period, raised the land surface to above sea level so that no Mesozoic sediments were deposited. To the north of the line of section, are other and more extensive lava-flows covering Miocene river-beds, as at Bogong High Plains, 6,000 feet above sea level. The extent and geotectonic features of this area, indeed, of the whole of the area embraced by the Tertiary basalts, have been so ably delineated by the Government geologist, Mr. Murray,* that I must refer those desirous of obtaining valuable information on these areas to that gentleman's published reports. It may, however, be interesting to note that according to the petrographical examinations by Mr. Howitt, no good distinction exists either in structure or composition between the so-called older and newer basalts of Victoria (among the latter have been classed the basalts of the Western District). To those desirous of obtaining complete scientific knowledge of the structure and composition of the intrusive rocks invading the metamorphic areas, Mr. Howitt's contributions† to the subject will be specially valuable, leaving nothing to be desired on the score of accurate information of the structural and stratigraphical relations of the rock masses within the areas he has examined. As this gentleman is at present assiduously working at the area south from the line of section described in this paper, his determinations of the composition of the dykes and intrusive masses may be looked forward to with considerable interest. In the meantime, the information supplied may not be without interest to geological readers.

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* "Geol. Sur., Victoria,—Dargo and Bogong," vol. 5.

† "Granites and Diorites of Swift's Creek," by A. W. Howitt, F.G.S. Trans. Roy. Soc., Victoria.

"Rocks of Noyong," Trans. Roy. Soc., Victoria, 1883.

Notes on the Supposed Coal-beds of the Fitzgerald River.

By Samuel Dixon.

(From a letter addressed to Professor R. Tate.)

[Read February 5, 1884.]

As to the mineral pitch or bituminous substance reported for years past to exist in Kangaroo Island, I feel positive, it is washed up by the sea and perhaps borne by it a considerable distance.

In 1867, I spent a long time on the south coast of West Australia searching for it, and found it in every case, undoubtedly brought there by the sea, as the whole littoral between Cape Arid and Doubtful Island Bay is Post-Miocene resting on granite and micaceous schists

I was induced to make the expedition owing to the late Mr. Roe, Surveyor-General of Western Australia, reporting the existence of coal on the Fitzgerald River; and it was thought some connection might exist between the known occurrence of the bitumen and the reported beds of coal; but unfortunately for the theory and myself too, the supposed coal was nothing but a few very thin beds of brown lignite more or less mixed with quartz pebbles and with fragments of gum of the grass-tree and portions of the seed vessels and leaves of Eucalypts, and seemed to me undoubtedly of the same geological age as the bright-hued sandstones—green, purple, pink, &c.—which are cut through by the Fitzgerald and its trifling tributaries.

I am also of opinion that Mr. Gregory is mistaken in reporting this bed of lignite as resting unconformably on carboniferous shales (see Proceedings of the Geological Society for 1861, p. 480), as there are no shales of that character, but only metamorphic sandstones, jaspers and micaceous schists, the latter being similar to those exposed by the sea close to the bore made by Messrs. O'Halloran and others on the neck at Kangaroo Island.

The only interest this bed possesses will, I think, be found in its containing the flora of the period of depostion of the Murray Cliffs; and the sandstones of the Fitzgerald seem to me to represent the original shore of the sea of that period and I further think it will be found that in general characteristics the flora then was very similar to the present, and belonged to a similarly dry climate.

LIST OF SOUTH AUSTRALIAN MICRO-LEPIDOPTERA.

By E. MEYRICK, B.A.

[Read July 8, 1884.]

The following list includes all the described species of *Micro-Lepidoptera* known to me as inhabiting the colony of South Australia—about 180 in all. Besides these, however, I possess many others as yet undescribed, which cannot therefore be included here. The whole form only an insignificant fraction of the number probably occurring, which I estimate at not less than 4,000. The main purpose of the list is thus to convey to residents in the colony some idea of the work which lies before them in the discovery and study of these groups. In the identification of specimens, and in any other respects, I shall always be very glad to assist any who may care to communicate with me.

The species hereafter given were mostly taken by myself during a collecting tour made in 1882. I collected round Adelaide and on the Mount Lofty Range early in October, and at Quorn, Petersburg, and Wirrabara Forest later in the month; at the beginning of November I passed through Wallaroo, and paid a visit to Port Lincoln; and in the middle of the same month I was at Mount Gambier. I examined also the collection made by Mr. E. Guest, of Balhannah, on the Mount Lofty Range, and that in the possession of the University Museum; also a few species collected by Prof. Tate and the Rev. T. Blackburn. To these and my other South Australian friends I am, moreover, indebted for much kindness and valuable assistance during my visit.

Those species marked with an asterisk are not yet known to me as occurring outside South Australia.

The undescribed species which I obtained will be found published from time to time in my papers in the "Proceedings of the Linnean Society of New South Wales," the "Transactions of the Entomological Society of London," and elsewhere.

PYRALIDINA.

EPIPASCHIADÆ.

*Catamola funerea, *Walk.* Ardrossan.
 elassota, *Meyr.* Quorn.
Stericta habitalis, *Gn.* Mount Lofty, Ardrossan.

PYRALIDIDÆ.

*Balanotis hercophora, *Meyr.* Port Darwin.
Ocrasa albidalis, *Walk.* Mount Lofty.
Asopia farinalis, *L.* Mount Lofty; introduced from Europe.
Oenogenes fugalis, *Feld.* Mount Graham.
Persicoptera pulchrinalis, *Gn.* Mount Lofty.

MUSOTIMIDÆ.

Musotima ochropteralis, *Gn.* Mount Lofty.

HYDROCAMPIDÆ.

Paraponyx nitens, *Butl.* Lake Alexandrina.

BOTYDIDÆ.

Pachyarches psittacalis, *Hb.* Port Darwin.
Phacellura indica, *Saund.* Port Darwin.
Glyphodes excelsalis, *Walk.* Port Darwin.
diurnalis, *Gn.* Port Darwin.
Sceliodes cordalis, *Dbld.* Mount Lofty.
Nomophila noctuella, *Schiff.* Mount Lofty, Wirrabara, Port Lincoln.
Hellula undalis, *F.* Mount Lofty, Quorn, Port Lincoln.
Mecyna polygonalis, *Hb.* Adelaide, Quorn, Port Lincoln. Larva on *Templetonia egena* and *T. retusa.*
*Metallarcha calliaspis, *Meyr.* Petersburg, Port Lincoln; amongst *Beyeria opaca.*
*Metallarcha diplochrysa, *Meyr.* Petersburg, Port Lincoln, Beachport; amongst *Beyeria opaca.*
*Metallarcha epichrysa, *Meyr.* Quorn, Petersburg; amongst *Dodonæa lobulata.*
*Metallarcha eurychrysa, *Meyr.* Ardrossan.
*Eurycreon xenogama, *Meyr.* Adelaide (foot of the range).
capnochroa, *Meyr.* Port Lincoln.
*Criophthona finitima, *Meyr.* Quorn.
Sedenia rupalis, *Gn.* Quorn, Port Lincoln, Kangaroo Island.
cervalis, *Gn.* Mount Lofty, Wirrabara.
Tritæa ustalis, *Walk.* Adelaide, Wirrabara, Ardrossan.

SCOPARIADÆ.

Eclipsiodes crypsixantha, *Meyr.* Port Lincoln.
Tetraprosopus Meyrickii, *Butl.* Mount Gambier; on trunks of Eucalyptus.
Xeroscopa philonephes, *Meyr.* Mount Lofty.
*Scoparia epicryma, *Meyr.* Mount Gambier.
eremitis, *Meyr.* Wirrabara.
* homala, *Meyr.* Adelaide; on fences.
spelæa, *Meyr.* Wirrabara, Mount Gambier.

CRAMBIDÆ.

Thinasotia bivittella, *Don.* Adelaide, Ardrossan.
relatalis, *Walk.* Mount Lofty.
opulentella, *Z.* Mount Lofty.
grammella, *Z.* Mount Lofty.
lativittalis, *Walk.* Ardrossan.
Diptychophora ochracealis, *Walk.* (præmaturella, *Meyr.*). Adelaide, Mount Gambier.
Ptochostola dimidiella, *Meyr.* Penola.

PHYCIDIDÆ.

Ceroprepes almella, *Meyr.* Ardrossan.
Tylochares cosmiella, *Meyr.* Mount Lofty, Wirrabara.
Cateremna leucarma, *Meyr.* Mount Lofty.
subarcuella, *Meyr.* Ardrossan.
Zophodia (?) ensiferella, *Meyr.* Mount Lofty, Port Lincoln.
Eucarphia vulgatella, *Meyr.* Mount Lofty, Ardrossan, Port Lincoln.
Etiella chrysoporella, *Meyr.* Adelaide, Quorn.
Behrii, *Z.* Mount Gambier, Adelaide, Wirrabara, Port Lincoln.
Salebria oculiferella, *Meyr.* Mount Lofty, Ardrossan.
* gypsopa, *Meyr.* Adelaide, Port Wakefield.
*Heosphora euryzona, *Meyr.* Wirrabara.
Crocydopora stenopterella, *Meyr.* Adelaide, Wirrabara, Quorn, Port Lincoln.
Homœosoma vagella, *Z.* Mount Gambier, Adelaide, Wirrabara, Port Lincoln.
Anerastia distichella, *Meyr.* Wirrabara, Port Lincoln.
Ephestia elutella, *Hb.* Adelaide—introduced from Europe.

GALLERIADÆ.

Aphomia latro, *Z.* Adelaide.

TORTRICINA.

GRAPHOLITHIDÆ.

Scolioplecta comptana, *Walk.* Mount Lofty.
Aphelia lanceolana, *Hb.* Mount Lofty; a cosmopolitan species.
Stigmonota iridescens, *Meyr.* Adelaide.
Crocidosema plebeiana, *Z.* Mount Lofty, Port Lincoln; introduced from Europe.
Palæobia anguillana, *Meyr.* Port Lincoln.
fidana, *Meyr.* Adelaide.
Holocola perspectana, *Walk.* Quorn, Port Lincoln.
biscissana, *Meyr.* Wirrabara, Port Lincoln.
Strepsiceros ejectana, *Walk.* Port Lincoln.
macropetana, *Meyr.* Mount Gambier, Mount Lofty, Wirrabara, Port Lincoln.

Tortricidæ.

Dichelia mediana, *Walk.* Mount Lofty.
isoscelana, *Meyr.* Mount Lofty.
Capua chimerinana, *Meyr.* Mount Lofty.
melancrocana, *Meyr.* Mount Lofty.
Pyrgotis insignana, *Meyr.* Mount Lofty.
Acropolitis dolosana, *Walk.* Mount Lofty.
lignigerana, *Walk.* Mount Lofty.
signigerana, *Walk.* Mount Lofty.
Isochorista ranulana, *Meyr.* Mount Lofty, Wirrabara.
panæolana, *Meyr.* Mount Lofty.
Proselena annosana, *Meyr.* Wirrabara.
Palæotoma styphelana, *Meyr.* Mount Lofty.
Cacœcia lythrodana, *Meyr.* Mount Lofty.
postvittana, *Walk.* Mount Gambier, Mount Lofty, Port Lincoln.
Cacœcia liquidana, *Meyr.* Mount Lofty, Wirrabara, Port Lincoln.
Cacœcia tessulatana, *Meyr.* Wallaroo, Port Lincoln.
Tortrix subfurcatana, *Walk.* Mount Lofty.
glaphyrana, *Meyr.* Mount Lofty, Port Lincoln.
indigestana, *Meyr.* Port Lincoln.
standishana, *Newm.* Mount Lofty.
Dipterina rupicolana, *Meyr.* Mount Lofty.
Arotrophora arcuatalis, *Walk.* Mount Gambier, Wirrabara.

Conchylididæ.

Heliocosma incongruana, *Walk.* Mount Lofty.
Heterocrossa neurophorella, *Meyr.* Mount Lofty.

TINEINA.

Gelechiadæ.

Bryotropha simplicella, *Walk.* Adelaide.
Lita solanella, *Boisd.* Adelaide.
Gelechia aversella, *Walk.* Quorn, Wirrabara.

Cryptolechiadæ.

Cryptophasa unipunctana, *Don.* Mount Lofty.
Chalarotona parabolella, *Walk.* Mount Lofty.

Depressariadæ.

Semnoceros radiosella, *Walk.* Mount Lofty.

Oecophoridæ.

Palparia aurata, *Walk.* Mount Lofty, Ardrossan.
semijunctella, *Walk.* Ardrossan.
uncinella, *Z.* Port Lincoln.

Eochroa callianassa, *Meyr.* Mount Lofty.
dejunctella, *Walk.* Mount Lofty.
protophaës, *Meyr.* Mount Lofty.
Heliocausta severa, *Meyr.* Wirrabara.
elæodes, *Meyr.* Mount Lofty.
* paralyrgis, *Meyr.* Mount Lofty.
parthenopa, *Meyr.* Mount Lofty.
euselma, *Meyr.* Mount Lofty.
Hoplitica sobriella, *Walk.* Mount Lofty.
repandula, *Z.* Mount Lofty.
pudica, *Z.* Mount Lofty.
*Eulechria episema, *Meyr.* Mount Lofty.
* leucophanes, *Meyr.* Port Lincoln.
* tanyscia, *Meyr.* Mount Gambier, Adelaide, Petersburg.
*Eulechria sciophanes, *Meyr.* Quorn.
* ombrophora, *Meyr.* Quorn.
* aceræa, *Meyr.* Petersburg.
*Oenochroa endochlora, *Meyr.* Quorn, Wirrabara, Ardrossan.
Linosticha canephora, *Meyr.* Mount Gambier.
Phlœopola banausa, *Meyr.* Adelaide; darker than usual.
* exarcha, *Meyr.* Mount Gambier.
*Mesolecta psacasta, *Meyr.* Port Lincoln.
*Nephogenes philopsamma, *Meyr.* Wallaroo.
* æthalea, *Meyr.* Mount Gambier, Mount Lofty.
Philobota arabella, *Newm.* Mount Lofty.
* biophora, *Meyr.* Adelaide.
auriceps, *Butl.* Mount Lofty.
* hypocausta, *Meyr.* Adelaide.
* pedetis, *Meyr.* Mount Lofty, Wirrabara, Port Lincoln.
Philobota herodiella, *Feld.* Mount Lofty.
productella, *Walk.* Mount Gambier, Adelaide, Petersburg, Port Lincoln.
*Philobota crocobapta, *Meyr.* Port Lincoln.
pretiosella, *Walk.* Mount Lofty.
* brochosema, *Meyr.* Mount Lofty.
interlineatella, *Walk.* Port Lincoln.
xanthiella, *Walk.* Mount Lofty.
bimaculana, *Don.* Mount Lofty.
*Compsotropha charidotis, *Meyr.* Wirrabara.
Peltophora atricollis, *Meyr.* Mount Lofty.
argutella, *Z.* Mount Lofty, Wirrabara, Port Lincoln, Ardrossan.
Saropla cælatella, *Meyr.* Port Lincoln.
*Coeranica eritima, *Meyr.* Quorn, Wirrabara, Port Lincoln.
Coesyra dichrœlla, *Z.* Mount Lofty.

Coesyra distephana, *Meyr.* Port Lincoln.
basilica, *Meyr.* Wallaroo.
zygophora, *Meyr.* Port Lincoln.
parvula, *Meyr.* Mount Lofty.
* aspasia, *Meyr.* Port Lincoln.
* apothyma, *Meyr.* Petersburg.
*Microbela epicona, *Meyr.* Petersburg, Ardrossan.
Heterozyga coppatias, *Meyr.* Adelaide.
Oxythecta hieroglyphica, *Meyr.* Port Lincoln.
*Crepidosceles exanthema, *Meyr.* Quorn.
*Ocystola thymodes, *Meyr.* Quorn.
* tyranna, *Meyr.* Quorn.
* enoplia, *Meyr.* Port Lincoln.
* crystallina, *Meyr.* Mount Lofty.
* chionea, *Meyr.* Wirrabara.
* homoleuca, *Meyr.* Wirrabara.
Oecophora pseudospretella, *Stt.* Port Lincoln; introduced from Europe.
Crossophora suppletella, *Walk.* Mount Gambier.

GLYPHIPTERYGIDÆ.

Hypertropha tortriciformis, *Gn.* (desumptana, *Walk.*). Mount Lofty, Quorn, Port Lincoln.
Eupselia carpocapsella, *Walk.* Mount Lofty, Quorn.
theorella, *Meyr.* Quorn.
Glyphipteryx meteora, *Meyr.* Mount Lofty, Wirrabara.
palæomorpha, *Meyr.* Mount Gambier.
Phryganostola euthybelemna, *Meyr.* Wirrabara.

PLUTELLIDÆ.

Thudaca obliquella, *Walk.* Mount Lofty, Port Lincoln.
Plutella cruciferarum, *Z.* Adelaide, Wirrabara, Quorn, Port Lincoln; introduced from Europe.

TINEADÆ.

Chrysoryctis irruptella, *Walk.* Port Lincoln.
purella, *Walk.* Mount Lofty, Quorn.
Scardia (?) australasiella, *Don.* Wirrabara, Port Lincoln.
Blabophanes meliorella, *Walk.* Mount Lofty, Wirrabara, Port Lincoln.
Blabophanes ethelella, *Newm.* Wirrabara.
Tinea pellionella, *L.* Mount Lofty, Port Lincoln; introduced from Europe.

HYPONOMEUTIDÆ.

Endrosis lacteella, *Schiff.* Kingston, Mount Lofty; introduced from Europe.

Gracilariadæ.

Gracilaria alysidota, *Meyr.* Port Lincoln.
didymella, *Meyr.* Petersburg, Port Lincoln.

Bedelliadæ.

Bedellia somnulentella, *Z.* Port Lincoln.

Remarks on the "Red Glow."

By Clement L. Wragge, F.R.G.S., F.R. Met. Soc.

[Read May 6, 1884.]

After some preliminary observations, the author proceeds:—

It seems very evident that there exists even now some reflecting medium in the upper regions of our atmosphere altogether *abnormal* and at a great height, as evidenced by the prolongation of the intense glow apart from the ordinary phenomenon of twilight caused by common atmospheric refraction. What, then, is this medium? this great reflector that is the *primary* cause of these exquisite glows that invest our landscapes with such lurid unearthly tints, and call to mind the idea of life in Mars? From a scanty perusal of the masses of evidence and observation already accumulated, my present belief is that our planet is surrounded by an abormal envelope of *dust*, either cosmic or telluric. Once prove this—and its proof *appears* easy—and the "sun glow" phenomena may be explained, as pointed out by Prof. Michie Smith, of Madras, in accordance with facts illustrated by Mr. Aitken before the Royal Society of Edinburgh (Trans. R.S.E., vol. xxx., p. 337). The sun's rays as white light fall on the dust particles, whose minute spiculæ scatter and absorb, reflect, sift, and split up the rays at the proper angles, and with greater or less intensity, according to the thickness of the air strata and height of the reflecting medium. These spiculæ may assist the condensation of vapour into that light haze so generally observed, and cause ice spiculæ deep enough to give the effects of absorption, but not to such an extent as to form cloud. Hence I, at present, *insist* that vapour and meteorological factors, if they influence the displays at all—as I shall presently inquire—are entirely *secondary;* and as such modify and regulate the passage of light, so assisting in the production of that galaxy of varying tint and colour which we have so admiringly beheld. The determination of the nature of the primary reflecting layer, and to determine how it came to occupy its present position, are the chief points in the discussion. It has been argued that vapour is the *main* cause, absorbing certain of the sun's rays. I confess that this hypothesis appears to me wholly absurd and untenable. The cause, as I have already strongly emphasised, is abnormal. How, then, could vapour be the main cause? How is it that the aqueous vapour of our atmosphere never before (to my knowledge, at least) assumed this peculiar state? If there was such an abnormal amount of vapour high in the atmosphere as to give rise to sunsets and sunrises which by their wondrous beauty have astonished both savage and civilised men, at least no known factors in terrestrial meteorology could possibly have first occasioned it. Moreover, I shall show from my own observations that the spectroscope has denied the existence of this vapour on occasions of some of the finest sunset displays. I see no objection, however, to the main dust theory, and it can, I consider, equally be held under the hypothesis of either cosmic or telluric dust. Each is equally tenable, but analysis of collected material can only determine the truth. It is known that some 10,000,000 meteorites enter our atmosphere daily, their matter being dissipated in dust in the higher regions, at an average height of twenty to forty miles. This meteoric matter is trifling when compared with the volume of the atmosphere itself, which is said to weigh 5,178,000,000,000,000 tons, while only 182,500 tons of ordinary meteoric matter are precipitated yearly, if we take, according to Prof. Langley, an average of 500 tons of meteoric dust cast into our atmosphere each day. But the earth, as Mr. Ranyard supposes, may have encountered a huge meteoric zone of dust, which augmented to a vast extent the normal dust envelope with which we are surrounded.

Now, what are the objections to this theory of abnormal cosmic dust? First, Mr. Ellery, considering the major diameter of our elliptical orbit, declares it must be impossible, since such a zone must have a breadth of about 183,000,000 miles. This certainly appears to upset the hypothesis of cosmic dust. But let us for a moment consider. Our entire system, with its diameter of some 5,491,996,000 miles, is but an atom lost in the immensity of space; our gigantic sun, with his diameter of 852,900 miles, a star of the Milky Way, resembling in physical constitution, as the spectroscope proves, others of the so-called "fixed stars" of the Kosmos.

I ask, then, is it unthinkable that our *entire system*, in its lightning speed through space, should have encountered some gigantic zone of cosmic material enveloping the whole of it?

Next it is supposed that any cosmic material would be consumed by the heat of impact. Of this it is, I think, impossible to speak positively, as the amount of consumption and dissipation would bear a ratio to the velocity of impact and of the meteoric dust-belt, and such would probably offer little resistance to the atmosphere, being extremely fine and impalpable. Favouring the condensation of a hazy vapour it would, however, *primarily* give rise to the sun-glow. I shall presently endeavour to show why the dust does not fall quickly to the earth, no matter what may be its origin. Possibly it may be related to the cause of the zodiacal light, which, according to one hypothesis, is formed of myriads of solid particles.

Coming now to the telluric hypothesis, the mass of evidence relating to the Javan eruptions points strongly to Krakatoa as the cause. The eruptions commenced in May last, culminating in the fearful convulsions of August 26th. Consider the immense amount of volcanic dust erupted; counted probably by millions of tons of dust, and exceeding by far the dust contributed by meteorites during the whole year. Consider the tearing asunder of the atmosphere over that mighty furnace, and the height to which particles of dust would be launched. Some idea of the atmospheric wave generated is gathered from the fact that the barometer on board a steamer 150 miles distant rose and fell half-an-inch every two or three minutes, as reported by Mr. Bishop, of Honolulu. Observations show that this gigantic air wave was visible on the barometer curves at several stations for five days after its origin; that its velocity was 674 miles an hour, that it travelled before its extinction more than 82,200 miles, and that it passed $3\frac{1}{4}$ times round the entire circumference of the earth. ("Nature," No. 738, p. 182). Apart from the blood-red and green suns, showers of dust and pumice and other startling phenomena, of which we have heard so much, and which I pass by, my opinion as to Krakatoa being the cause is greatly strengthened by the overwhelming fact that material brought down by rain in Holland and snow in Spain—crystals of hypersthene, pyroxene, and magnetic iron with volcanic glass—has been proved to be identical with the matter found in the Java ashes. It is objected, with much reason, to this volcanic theory:—How could the dust have spread so rapidly as to reach Trinidad in a week, while it took double that time to travel to India and Ceylon. This objection seems as fatal to the volcanic hypothesis as does Mr. Ellery's to the meteoric one; and with our knowledge of the general distribution of atmospheric pressure at that season of the year, is a difficult one to meet. Our first thoughts are of the great low pressure areas of Central Asia at that summer season; and we wonder why the heavier air currents which set inland from over the cooler ocean to take the place of the heated ascending currents of the Asiatic continent, did not convey the dust to India first. Perhaps closer consideration will enable us to give a satisfactory answer. The eruption of Krakatoa took place in a zone of low barometer, in a branch of the equatorial calm belt. My own observations on

Ben Nevis have lately shown that *over* a surface low pressure area there exists a relatively high-pressure region, caused by the accumulation of the air in higher regions, carried upwards by the warm ascending currents; and especially must this be the case at great elevations in low latitudes. We have but a faint idea of the actual force of that eruption. It would at any rate carry volcanic dust far into the higher atmosphere, and land it safely on the high-pressure zone existing high over the calm belt. Bear in mind now that a similar high-pressure area existed in the upper atmosphere over the surface low-pressure areas of India and Central Asia; and that the tendency of motion of this lofty high-pressure was towards the southern hemisphere, where a general surface high-pressure existed, overtopped, as in the case of all surface anticyclones, by a relatively lower pressure. Thus currents from the upper atmosphere of Southern Asia would flow southwards to preserve equilibrium, and feed the surface high pressure of the southern hemisphere at that season of the year. These currents would (but only for a short time on account of its proximity) hinder the dust from approaching India, and would carry it southwards, causing the "red glows" to be experienced earlier in Australia and South Africa, for instance, than in European latitudes. But I have still to offer some explanation of the fact of the "red glow" phenomena travelling due west, via the Seychelles, Cape Coast Castle, and Trinidad, at the rate of nearly 70 miles an hour, reaching the latter place, 11,700 miles away, within a week. I see no way at present of accounting for this, but on the theory that, owing to the rapid rotation of the earth at the equator, viz., 507 yards a second, or 1,038 miles an hour, the *higher* atmosphere in equatorial region lags behind, causing a strong current to set westwards from the same causes that explain, for instance, the phenomena of the north-east and south-east trade winds; and the circulation of the tides assisted by the earth's rotation as a secondary result of the moon's attractive influence. This equatorial east wind, if such exists, is in the high-pressure zone over the calm belt, and sends off branches to northward or southward of the Line respectively to maintain the great systems of surface anticyclones in either hemisphere, according to the geographical distribution of land and water and the season of the year.

The objection that more dust should have been expelled to spread so widely will not hold in my opinion, as we have but a faint idea of the vast amount actually expelled and diffused by the currents as impalpable powder.

Lastly we have one common objection to the main dust theory, viz., How can the matter remain suspended for such a long period in opposition to that force which we call gravity?

It is pretty clear that the suspension over the weight of atmosphere of impalpable dust in the rarified regions may be prolonged for an indefinite period. Not that it has no tendency to fall. On the other hand, I conceive, as I have already hinted, that it is subject to great alterations of level, depending probably on barometric pressure, which may intensify or minimise the "sun-glow;" though, as I shall afterwards show, this connection is hardly determined. The upward currents in times of low barometer at the earth's surface, when—allowing for differences of altitude—a comparatively high or accumulated pressure (as I have already shown) seems to prevail aloft, would buoy it up, as an upward current does a feather or ordinary motes of dust; and it would keep playing over the tops of the upward currents on a plan analogous to the phenomena of the so-called "willow-leaves" on the solar photosphere which are reasonably supposed to be the tops or crests of the currents in the sun. If this is so, the objection to floating dust even higher than 40 miles—the traditional height of the twilight-producing atmosphere—is overcome. Again, according to Faraday, metallic gold, when minutely divided, required months to subside when suspended in water; and on this experiment I see no reason why the dust-powder should not remain suspended over the haze of vapour. But if objection is raised to these explanations of the suspension, we have the repulsive agency of electricity to account for it, as has already been suggested, assuming that the dust, if from Krakatoa, is negatively electrified. The particles would mutually repel each other, as in the case of electrified gold-leaf, and be repelled and buoyed up by the repulsive action of the earth.

I have endeavoured to meet the chief objections to the dust theory, and will now proceed to a few words in conclusion on the atmospheric or possible *secondary* causes of the "sun-glows."

My meteorological and spectroscopic observations in connection with the glow are very conflicting, and further discussion of them is necessary before I can see my way to establish a connection. That the glows have become intermittent, and have been observed to be less intense during times of low barometer, seems certain. This may be explained by supposing an abundance of absorbing vapour, meteorologically derived, which would be increased by the primary stratum of dust favouring condensation. So the red light of less refrangibility would be impeded or cut off and partly absorbed by the vapour of a low-pressure area, and we might expect the "red-glow" to be not so intense, while the more refrangible green and blue tints of the sunset would not be interfered with. I think Mr. Todd has also observed this minimum of intensity during periods of low barometer. Under such conditions the dust would probably be at a higher level. The displays certainly seem to have been especially fine when the air was dry and the red light unimpeded, during times of high barometer; and at such times (considering the downpour of air upon the centre of an anticyclonic system) I conclude that the dust stratum is lower. For instance, near Warsaw, in Russia, on November 30th, 1883, barometer 30·16; January 2nd last, 30·46; and January 3rd, 30·27; on all of which days the "red-glow" is reported as being intense*. Prof. Piazzi Smyth also corroborates this. So to a certain extent do my own observations made at the Torrens Observatory, near Adelaide; but on other occasions the sunset displays seem to be entirely indifferent to barometric and hygrometric influences. I will give a few examples.

On January 28th the barometer was high—30·22 at sea-level—and the sunset and red "after-glow" magnificent—the latter appearing on the horizon about one hour and a quarter after sundown like some great fire. Relative humidity at 9 o'clock was 77 %, indicating a decidedly moist condition of the atmosphere for South Australia—hardly in accord with the dry air and high barometer theory so ably advocated by Professor Piazzi Smyth, but on this occasion I had not access to the spectroscope.

On January 30th the same phenomena were almost identical, but the barometer was *lower*, relative humidity *less*—69 %†—*yet* a broad nebulous band to the left of the D line in the spectrum indicated much moisture in the thick strata of the atmosphere. Under such spectroscopic conditions I should have expected that the red rays would have been stopped off and absorbed by the abundance of aqueous vapour shown by the spectroscope. In these two instances the results of observation appear decidedly conflicting.

On March 5th the glow was again magnificent, barometer at 30·07 and pressure gradually decreasing, with a *dry* surface me to enter the following verbatim remark in my notes at the time:—"My spectroscopic observations of to-night, taken as they were about 5° above the horizon, *prove* unquestionably to my mind that these wondrous sunset phenomena are *not* due to vapour. Not even at that altitude was earth moisture detected of any note." It is, however, noteworthy that lemon-yellow effects have lately prevailed at sunset to the exclusion of the red, and that the telluric bands in the spectrum rapidly darken, indicating rapid absorption as the sun sinks.

Again, on April 7th:—"*No* deep red after glow was visible, yet the air, by hygrometer and spectroscope, was *dry*, and the red glow might have been confidently expected; and the barometer was high."

In conclusion, I have great difficulty at present in connecting these abnormal sunset effects absolutely with any meteorological factors of which we are cognisant at the earth's surface; and I can only look to the primary cause, high in the atmosphere, whose effects may be regulated by atmospheric conditions.

Notes on the Physical and Geological Features of the Basin of the Lower Murray River.

By Professor Ralph Tate, F.G.S., F.L.S., &c.

Plate III.

[Read June 3 and July 1, 1884.]

CONTENTS.

Introduction.

Captain Charles Sturt entered what is now South Australian territory towards the end of January, 1829, and navigated the river Murray to its mouth. His published observations* remain to this day the only connected account of the physical and geological features of the Lower Murray-river.

"A Study about the River Murray" is the title of a paper read before this Society July 3, 1883, and of a pamphlet, privately printed, by Mr. S. Pollitzer. That work deals essentially with river hydraulics, though some geological matters are introduced.

Facts in support of a large loss of water of the river by subterranean drainage are put forth by Mr. Rawlinson in Trans. Roy. Soc. S. Aust., vol. I., pp. 124-126, 1878, and by myself in vol. IV., pp. 132-133, 1881.

The purely geological works and papers treating of the area under review are few. Firstly, there are the above-quoted volumes by Sturt, upon which Tenison-Woods, in his "Geological Observations in South Australia," 1862, has largely drawn for his disconnected account of the geological features of the Murray-river. My own efforts in this connection have been of a fragmentary kind, and will be found at the following references: — "Strata Exposed in the Government Well, Murray Plains," Geological Magazine, November, 1877; "Correlation of the Coral-bearing Strata in South Australia," Trans. Roy. Soc. S. Aust., vol. I., 1878; "Correlation of the Older Tertiary deposits of South Australia," id. vol. II., pp. li.-

* Two Expeditions into the Interior of Southern Australia; 2 vols. 1834.

Table III.

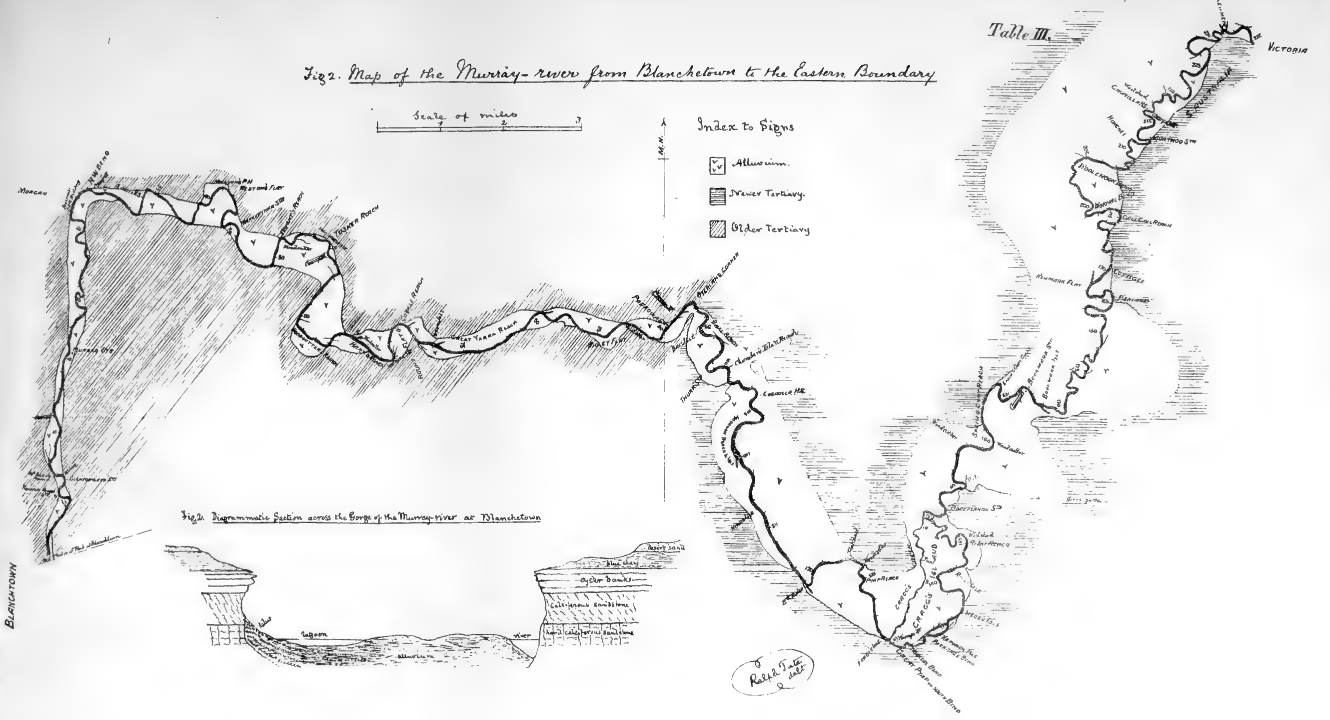


Fig. 2. Map of the Murray-river from Blanchetown to the Eastern Boundary

Fig. 2. Diagrammatic Section across the Gorge of the Murray-river at Blanchetown

lviii., 1879; and "Geological Sections around north-east shore of Lake Alexandrina," id. vol. IV., p. 144, 1881.

The literature of the palæontology of the Tertiary deposits of the Lower Murray-river is more extensive than that of its geology, and will be referred to when I come to speak on that part of my subject.

My personal knowledge of the Lower Murray-river is the result of several weeks' sojourn in each year during the last eight years at various points of its course from the North-west Bend to its mouth. That part of the river from the North-west Bend to the frontier was explored during a boat excursion occupying three weeks in the month of January of the present year.

Physical Features of the Murray-plateau.

If you approach the Murray from the westward, say in the latitude of Truro, you will see from the summit of the pass over the Belvidere Range, that the precipitous front of the Range, composed of Pre-Silurian rocks, bounds a vast sea of green without any sensible interruption so far as the eye can reach. You are looking down on the "mallee scrub" or desert of the Murray, the chief constituents of which are several species of Eucalyptus, notably *E. dumosa*, *E. uncinata*, and *E. oleosa*. "The trees grow close together like reeds, and certainly not thicker, without a branch, until about fourteen feet from the ground, and so dense are they, that ten and twelve stems may be counted springing from one root, and occupy little more than a square foot of ground. Where a road has been cut through it, it appears as though there were a high wall on each side." *

By a rapid descent from the Range we reach, at an elevation of about 400 feet above sea level, the edge of the talus, which stretches out on to the plateau for a distance of about sixteen miles. Here begins the true Murray plateau, with its out-croppings of limestone, and though its surface is somewhat undulating yet it preserves a pretty uniform level of not perhaps more than 200 feet elevation throughout its whole breadth, which extends far beyond the confines of this colony. At the southward this plateau ends in an ill-defined escarpment at Wellington, where the river discharges itself into Lake Alexandrina.

This extensive plateau is interrupted by the gorge of the Murray-river, for it cannot be called a valley, since it is enclosed by lofty continuous cliffs, appearing as if the plateau had been rent asunder to allow of a passage for its waters; the river occupies, however, a very small part of the bed of the gorge.

* T. Woods, "Geol. Observ.," p. 34.

The country through which the Murray flows from the boundary of the colony to Lake Alexandrina is essentially the same; and as the gorge-like feature persists throughout, it might be thought because of this uniformity that the geological structure is identical from end to end, but it is not so.

From structural and physiographic features I divide the course of the South Australian portion of the river into three sections:—

1. From the boundary to Overland Corner. This length of the river is 143 miles, whilst the distance between the two places is only 60 miles. The width of the gorge varies from six to two and a half miles.

2. From Overland Corner to Lake Alexandrina. At the former locality the gorge suddenly contracts to a width of about one mile; and as far as the North-west Bend the average width is one mile and a quarter, whilst south hence to below Blanchetown, it is three-quarters of a mile. Here and there it opens out to greater width as at Mannum, but is again contracted at its southern end.

3. The Lacustrine section from Wellington to its mouth.

[Mr. Pollitzer divides the river from Blanchetown according to his estimate of the rock nature of the cliffs into four sections:—1. Blanchetown to the North-west Bend, limestone. 2. North-west Bend to Overland Corner, partly limestone and partly sandstone. 3. Overland Corner to the Great South Bend, and 4. Thence to the Boundary. The third and fourth, "sandstone in various shapes, and clay."]

The cliffs of the upper section of the river are composed chiefly of sand, whilst those of the lower section are marine calciferous sandstone, as long since observed by Sturt, who writes "a remarkable change in the geology of the country, as well as to an apparent alteration in the natural productions—the cliffs of sand and clay ceased, and were succeeded by a fossil formation" (*loc. cit.*, II., p. 139). Indeed, as I shall hereafter explain, we have at Overland Corner—the locality indicated by Sturt in the foregoing quotation—the junction of two sets of unconformable beds.

Hydrographical Notes.

On the accompanying map (pl. III., fig. 1) the unshaded portion indicates a depressed area within the cliffs sufficiently low to be inundated by high floods; in the upper section of the river this is relatively of great extent, and is closely reticulated with creeks and lagoons; in the lower section the river sweeps along a line of cliffs, having on the other side an alluvial bank beyond which is a more depressed area occupied by a lagoon stretching to the foot of the opposite cliff. (See pl. III., fig. 2).

The extent of the flood-waters is marked by the presence of the "box" or "swamp gum-tree" (*Eucalyptus largiflorens*); it and the red gum-tree (*E. rostrata*) are the only species of the genus inhabiting the alluvial tracts. The latter grows about the permanent water; whilst its congener prefers drier ground, though it is evident that its seeds require longish immersion in water to effect germination. *E. largiflorens* attains a maximum height of about 100 feet where growing in spots annually flooded; but depauperated specimens may here and there be seen considerably beyond the limits of the greatest flood on record, which seems to demonstrate that at no distant date still higher floods have occurred than we know of. This fact is so well-known on the river that no permanent habitation of any value is erected within the zone of the "box."

Mr. Pollitzer has shown by table the fluctuations of the water-level at Overland Corner during the last five years, from which we gather the highest elevation above zero of the Overland Corner gauge, for each year, to be as follows:—1879, 18 feet in December; 1880, 18 feet in January; 1881, 10 feet in January; 1882, 10 feet in November; 1883, 9 feet in January. The river is at a minimum level varying from March to May, begins to rise with the winter rains in June, and has the largest volume by the melting of snow in the summer months of December and January. The volume of water is largely dependent on these two sources, and an intermittent supply is furnished by the Darling. The tropical rainfall, which comes usually in February and March, and partially so in December, sets the Darling in flood. The flood-waters of the Darling reach the Murray after an interval of four weeks, the average velocity being about 50 miles per day. The volume of water in the Darling is at other times insignificant. If the tropical rains of December be heavy, and should the winter at the sources of the Murray be protracted, then the united flood-waters of the two rivers deluge the whole country within the gorge of the Lower Murray—these exceptionally high floods occur only at long intervals of time.

In the upper section of the river the flood-waters have a great area over which to spread themselves, whilst within the narrow gorge of the lower section the volume of water is compressed, and in consequence the maximum heights of the flood are here very much greater than they are in the upper section. The highest flood-marks at Morgan are 36 feet above summer water-level.

The much-discussed question of how to improve the navigability of the Murray raises several subsidiary ones, the importance of which has been either overlooked or ignored. If the river were an equally discharging one, some earnest consideration might be given to the suggestions made by Mr. Pollitzer and in part entertained by the Government, viz., that of shortening the river-way by canals and by narrowing the width of the old river-bed. Of course an actual obstruction to navigation is presented by snags and a few rocky bars, which should be removed. But considering the very intermittent flow, our object should be rather to impound the waters than to seek by reduction of length of waterway to run them off at three, four, or more times their present velocity. Another question involved, and one which touches vested interests, is what effect would the proposed scheme have upon the periodic flooding of the alluvial flats. The effect would simply be to render unavailable for summer pasturage a vast extent of country, which now by natural irrigation secures to the grazier feed at a time when the upland country is totally unable to support his stock.

Mr. Pollitzer has pointed out among other defects of the river "the feeding of dead branches. Happily they are scarce on the Murray. There are innumerable creeks fed by the Murray, but only by its high water; at low almost all of them are dry." No doubt the vast reticulation of creeks and lagoons of the upper section of the river, filled when the river is in flood, is actually a reservoir which by discharging into the river as the water falls, helps to maintain a larger volume of flow than would be otherwise possible. But with respect to the bifurcation of the river by islands the case is different, as thereby the area is increased at the expense of depth of water. In the case of Craigie's Creek, which is the most prominent among the by-channels of the Murray, the defect may be overcome at comparatively trifling cost by simply damming it at the incurrent end, which interrupts a nearly straight line of river bank, and is, moreover, only a few yards across.

The water of the Murray is always thick with suspended matter, its white opacity increasing with the rise of the river. After flood the water of the lagoons and creeks has become clear, and its discharge into the river when falling materially helps to diminish its muddiness. This discharge, taking place during the summer months, is doubtless the chief source of the large quantity of organic matter dissolved in the water. A jar of muddy water taken at this time will, if freely exposed, become offensive before it has become clear. The lagoons and creeks are teeming with animal and vegetable life. The falling water is marked by the putrescent remains of animals and bleached masses of vegetable matter. Dying and dead snails of species of *Lymnæa* and *Bulinus* crowd in myriads the depressions on the dessicating muddy flats. The water moved by the wind laves the shore and contaminates itself with its own rejectamenta.

One property of the water of the Murray is the remarkably low quantity of saline matter in solution, and its softness. Water collected in January in a fast falling river yielded at the rate of seven grains of dissolved earthy matter per gallon, whilst the quantity of calcic carbonate was 3·9 grains only per gallon.

River Alluvium.

It has been stated that the river occupies only a small part of the gorge, the rest being an alluvial deposit. The alluvium of the banks consists largely of fine sand mixed with fine clay in sufficient amount that when the whole is moistened to admit of being shaped into a cohering mass; when dry, however, the whole is perfectly incoherent. In the more inward-lying parts of the alluvial tract more clay has accumulated. The materials of the cliffs have not contributed, except in a partial way, to the formation of the alluvium; conspicuous among the constituents of the alluvium are spangles of white mica, which clearly indicate transport from a distance, as that mineral is not present in the cliffs of the Murray until an inlier of mica slate, fourteen miles north of Mannum, is reached; a distance of more than 300 miles from the Boundary.

Mr. Pollitzer insists that the alluvium "actually is a marine deposit" (p. 10). Whether his hypothesis, "that the gorge was made by a salt-water stream formed by the receding sea," demanded a marine deposit, or whether it was an inference based on the fact "that if you bore a hole in these deposits you will meet with brackish water, in spite of having fresh Murray water within a few inches," I cannot say; but it is most certainly true that Mr. Pollitzer has ignored the evidences of its fresh-water origin in the form of numerous shells still living in the river and its lagoons, whilst the existence of brackish water in the deposit admits of other explanation. In fig. 2, plate III., which represents a cross section of the gorge, I show that the debris of the cliff adjacent to the lagoon is interstratified with a clayey alluvium. The bed of talus, which is composed of sand and angular pieces of stone, admits freely the passage of water, whilst the contiguous clays confine it within that stratum. The water in the taluses is derived from the surface flow down the cliff-face, and in its passage takes up salt from the calciferous sand-rock. As some evidence of the appreciable quantity of the sodic chloride in the calciferous sand-rock, I have to state that the steep face of the cliff occupied by that rock is where protected by an overhanging ledge covered by a sheet of hard brittle material of an eighth to one-fourth inch thick, constituted of the disintegrated calciferous sand cemented by common salt. An analysis of 40 grains dried at 100° C. yielded 16·28 grains of common salt extracted by distilled water and weighed after heating to redness. A portion of the calciferous sand-rock, taken from beyond a few inches of the surface, yielded the following:—

Salts extracted by boiling water	0·4
Salts dissolved by hydrochloric acid* ...	11·1
Insoluble residue	88·5
	100·0

It is, therefore, no longer a matter for wonder that the pent-up waters within the alluvium are brackish.

In no instance in the lower section of the river do the walls of the gorge approach so closely as to confine the river, and very rarely are the alluvial flats in opposition, the rule being that the river flows along one side of the gorge for a more or less straight course of varying lengths, whence it gradually curves inward, and finally impinges on the opposite wall; so that cliff and alluvium confine the river alternately on the one side, and alluvium and cliff on the other.

The course of the river is not so circuitous in this section as it is in the upper, where the river for long distances meanders through the alluvium; and here the course of the river is undergoing rapid change. The concave bank is continually being worked upon by the falling waters, whilst considerable deposition takes place on the corresponding convex-face. In some instances the periodic extension of the alluvium is distinctly marked by lines of red gum trees, graduating from saplings near the water's edge to full grown trees at several chains inward.

Origin of the Gorge of the River.

I think it will be conceded by all who have thoughtfully examined the rocky walls between which the river flows that they were once continuous, and that their separation is the result of the wearing action of the river itself. I am also of opinion that the gorge from Overland Corner to Wellington was at one time occupied by a stream covering its whole breadth. The irregularities of the gorge might be explained by the contour of the original surface and the varying degree of hardness of its rocky material rather than by the variability of the rock structure at present water-level, though the latter circumstance might have operated to form the minor sinuosi-

* Determined by difference.

ties of the gorge. The plateau of the Older Tertiary rocks in which the gorge of the lower section of the river has been formed ends in a comparatively lofty escarpment at Overland Corner, which Captain Sturt estimated at 200 to 300 feet. This was an over-estimate for the cliffs, though it might be correct for the plateau. The cliffs are, however, higher there than anywhere else on the river. What is the line of the escarpment back from the river I do not know, but abutting against that escarpment are beds of Newer Tertiary age, formed chiefly of loose material, constituting a plateau the mean elevation of which is below that of the escarpment at Overland Corner.

The materials of the minor plateau are of fresh-water origin —at any rate, no palæontological evidences have been adduced for or against—whilst the extreme angularity of the sand constituents and their false bedded arrangement demonstrate rapid accumulation such as takes place where torrential streams debouch into lake basins. We may apply here Sir A. C. Ramsay's opinion to the determination of the physical conditions under which the formation was deposited. He has stated* that the red colour which stains the Keuper Sandstone and Marl is due to the presence of peroxide of iron, which he believes to have been precipitated from carbonate, and which could only have taken place in inland isolated waters; an opinion that is confirmed by other facts which tend to prove that the rocks in question were formed in a lake or lakes. This belief he afterwards† extended to formations of older date.

The sharp sands, which form a considerable part of the material of the cliffs of the upper section of the river, not only vary in size, but also in colour, some portions being quite colourless, whilst others are deeply stained with red, and in several instances the oxide of iron has compacted the material into a firm grit-stone. In all cases the red colour of the sands or grits is superficial, as by treatment with hydrochloric acid it is totally discharged. Here, then, we have non-fossiliferous sands, highly stained with hydrated oxide of iron, whilst the other physical conditions under which they were accumulated all tend to confirm the view that they were formed in inland waters, and not in an open sea. However, this much is certain, that since the elevation of the Older Tertiary sea-bed to form the Murray Plain, some portions beyond Overland Corner have been denuded, and that a considerable depth and vast quantity of sands and loam have been deposited against the escarpment

* Quart. Journ. Geol. Soc., vol. xxviii., pp. 189, 1871.

† Op. cit., p. 241.

by the action of fresh water. To allow of such an accumulation the water must have been impounded by that escarpment. The surplus water would escape at the lowest level, and follow the trend of the ground—deflected at intervals by obstructions—and would discharge itself over the littoral escarpment near Wellington. Thus while the river was reducing its bed to an uniform slope throughout its length from Overland Corner, it would at its effluent end be cutting its way back. Probably, because of the soft nature of the material forming the channel, the rate of excavation by the moving water has been greater than that at the falls; however, by their united action there has been formed the mighty gorge. As the level of the impounded waters fell below the upper level of their sediments, so they would be eroded by the current thus established, and initiate the gorge of the upper section of the river. Finally, the whole gorge is excavated to its present depth, and a uniform slope of the river bed being formed erosion has ceased. As the volume of water in the bed decreased, so its shallow parts became silted up and finally dry, except when floods occurred and deposited fresh sediments upon the flats.

My theory may seem at first sight so startling as to place it beyond the pale of acceptance, as it involves the existence of a vast lacustrine area and a river of far greater volume than is at present, and this implies a correspondingly increased rainfall if the drainage area were the same then as now, which may be taken for granted. There are many independent evidences existing that this continent has passed through a period when its rainfall was greatly in excess, and was perhaps augmented by glacial conditions. The storage capacity for water of our lake basins in the dry zone of Central Australia is vastly superior to their present condition. Lake Eyre, for instance, its margin is 40 feet below sea-level, whereas if filled its depth would be increased by not less than a hundred feet, and its area enlarged many times. And yet there is evidence that at one time it was a vast expanse of water, and the vegetation in its vicinity capable to sustain life in such huge creatures as the Diprotodons, whose remains are scattered widely in and around its basin; a country in its present state abandoned, even by the kangaroo. As I have elsewhere* pointed out, the existence of those gigantic herbivorous marsupials in such localities demands climatic conditions favourable to the growth of a vegetation capable of supporting them, and that their extinction is attributable to those climatic changes which brought about dessication, involving a reduction in volume of the waters of inland lakes, and finally converting their basins into salt-pans.

* Trans. Roy. Soc., S. Aust., vol. ii., p. lxvii., 1879.

Though there is no palæontological evidence by which to correlate the sands and loams forming the cliffs of the upper section of the Lower Murray River with the Drifts characterised by the Pliocene marsupials; yet the physical conditions under which each seem to have been accumulated point to contemporaneity.

Sections of the Older Tertiary Deposits of the Lower Section of the River.

In a paper Notes on the "Correlation of the Coral-bearing strata of South Australia,"* I presented a generalized section of the strata in the cliffs of the River Murray, in which the following subdivisions in descending were adopted:—Lacustrine, Upper (Marine) Murravian, Middle (Marine) Murravian, and Lower (Marine) Murravian. In the following year, in my presidential address, "Outlines of South Australian Geology,"† these views are repeated, and are accompanied by a numerical statement as regards the community of species between the Upper Murravian and the Muddy Creek deposits. Further studies at the section which supplied the chief material for the comparison have convinced me that my Upper Murravian should be restricted to the oyster banks,‡ and that the underlying beds, rich in gastropods, merge into the main mass of the Middle Murravian. This re-arrangement, which places the Muddy Creek beds on the horizon of the Middle Murravian, does not materially affect the deductions drawn from my survey of the census of the fauna at each of the two localities.

I may best describe the strata of the Older Tertiary cliffs by means of an illustrative

Section taken near Glenforslan, four miles north from Blanchetown.

	FT.	IN.
Lacustrine.		
1. Travertine cover and thin-bedded sandy limestone	7	5
2. Red and blue clay	5	7
3. Compact earthy argillaceous limestone	5	3
4. Friable sandstone, with occasional layers of coarse sand	5	5
Upper Murravian.		
5. Oyster-bank	0	10
6. Friable sandstone, with fragments of shells and cidaris	8	9
7. Oyster-bank	2	6
8. Red and yellow clayey sand, with scattered oysters	2	4

* Trans. Roy. Soc. S. Aust., vol. I., p. 120; 1878.
† Op. cit., vol. II., p. liii.; 1879.
‡ Poste p.

Middle Murravian.

	FT.	IN.
9. Dense mass of *Cellepora Gambieriensis* in a reddish calcareous paste; a few oysters and fish teeth	2	0
10. White friable earthy limestone, stained atop with iron; phosphatic concretions. Highly charged with *Waldheimia Macleani*, and casts of molluscs in gypsum	4	4
11. Yellow limestone, with *Toricula Murrayana* in gypsum	0	6
12. Light grey calciferous sandstone, with a thick bank of *Cellepora Gambieriensis*	6	0
13. Id. with banks of *Cellepora Gambieriensis*	43	4

Lower Murravian.

14. Hard grey calciferous sandstone, with *Lovenia Forbesi*, *Cellepora Gambieriensis*, *Nautilus* sp. in gypsum	1	4
15. Brown friable calciferous sandstone, weathering with a rough exterior	2	8
16. Hard grey calciferous sandstone, with casts of *Torcula Murrayana*	0	7
17. Brown friable calciferous sandstone	3	0
18. As No. 16	0	10
19. As Nos. 17 and 15, *Panopæa* sp.	1	6
20. As No. 18	1	5
21. Yellow-grey friable calciferous sandstone, with casts of *Torcula* in gypsum	14	8
Total to river level	120	3

From Overland Corner to south of Blanchetown, the beds show decided undulations particularly noticeable in those of the Lower Series, the brown hard sandstones of which acquire locally enlarged proportions. To the eastward of the North-West-Bend the calciferous sand-rock shows local attenuations and the Upper Murravian is proportionally thickened (see North-West-Bend Section). Hence the dip is referable to variations in the thicknesses of the several beds, for if we note the levels for a long line of cliffs, it will be found that the beds have no general inclination.

SECTION AT NORTH-WEST-BEND HEAD STATION.

Lacustrine.

	FT.	IN.
1. Sand		
2. Marly clay, with travertine cover ($1\frac{1}{2}''$)	3	$8\frac{1}{2}$

Upper Murravian.

	FT.	IN.
3. Hard sandstone	2	0
4. Soft sandstone, false-bedded	8	2
5. Oyster-bank—a dense mass of shells in a calcareous paste. Oysters, pearl-shells, *Trigonia acuticosta*, &c., and casts of univalves	8	0
6. Sand-rocks unfossiliferous	10	0
Middle Murravian.		
7. Yellowish-grey calcareo-argillaceous sand-rock with hardish bands of *Cellepora Gambieriensis*. Polyzoa abundant, numerous palliobranchs and echinoderms.	42	10
Total to river level	74	8½

Going eastward, the oyster-bed thickens and at a mile from the Station the section consists of about 40 feet of oysters and 20 feet of yellow calciferous sand-rock.

SECTION AT FOUR MILES SOUTH FROM MORGAN.

Lacustrine.

	FT.	IN.
1. Reddish-coloured calciferous clays	54	0
Upper Murravian.		
2. Oyster bank	12	0
Middle Murravian.		
3. Hard, lumpy, yellow sandstone	10	0
4. Yellowish-grey limestone with clayey-sand layers	10	10
5. Yellowish-brown clayey-sand with *Cellepora Gambieriensis*	5	4
6. Id. with hard lumps and imperfectly stony bands. Very fossiliferous, particularly rich in gastropods	16	5
7. Shell sand with streak of stiff blue clay	0	3
8. As No. 6	5	0
9. Yellow soft calciferous sandstone	43	6
Total to river level	157	4

PALÆONTOLOGY OF THE OLDER TERTIARY DEPOSITS.

Bibliography.—So far as known to me, the following is a brief digest of previous writings in connection with Murravian fossils.

The earliest reference to the existence of fossils in the

Murray cliffs is by Captain Sturt, who collected on his voyage down the river, some of which are figured in the account of his exploration.* In an appendix, pp. 253 and 254, the author gives a list of the fossils collected from this formation, embracing Polyzoa, 8; Echinoderms, 3; Lamellibranchs, 16; Palliobranch, 1; Gastropods, 14. Most of those of the first three classes are referred to by specific names employed for European tertiary fossils. Of those figured a shrewd guess can be made at the species referred to, but in no case can Captain Sturt's determination be accepted.

As giving a better insight into the present state of our knowledge of the palæontology of the formation, I arrange the subject matter of this progress report according to zoological classification.

CLASS MAMMALIA.

Zeuglodon Harwoodii, Sanger, is figured and described in Proc. Lin. Soc., N.S.W., vol. 5, p. 298, 1880. Remains of this interesting and aberrant cetacean were obtained near Wellington.

CLASS GASTROPODA.

Marginella Wentworthi, Tenison Woods, and *M. propinqua*, Tate, are recorded in my "Fossil Marginellidæ of Australasia," Trans. Roy. Soc., S. Aust., vol. i., pp. 92 and 94, 1878. *Cassis textilis* and *Fissurellidæa malleata* are described id. vol. v., pp. 45, 46; and *Torcula Murrayana* and *Leiostraca Johnstoniana* in Proc. Roy. Soc., Tasm., 1884.

CLASS LAMELLIBRANCHIATA.

Trigonia acuticostata is recorded by Bednall, Trans. Roy. Soc., S. Aust., vol. i., p. 82, 1878. *Zenatiopsis angustata*, gen. et spec. nov., and *Lepton crassum* are described in vol. ii. of the same Proceedings, pp. 129 and 130; and *Corbula ephamilla*, *Chione dimorphophylla* and *Lima Jeffreysiana* in Proc. Roy. Soc., Tasm., 1884.

CLASS PALLIOBRANCHIATA.

Waldheimia Taylori, Etheridge, is figured and described in Annals and Mag. Nat. Hist., January, 1876; and in my monograph of the Tertiary Palliobranchs of Australia (Trans. Roy. Soc. S. Aust., vol. iii., pp. 140—17, plates vii. to xi., 1880) the following are described and recorded:—*Terebratula vitreoides*, Woods; *Waldheimia Garibaldiana*, Davidson; *W. divaricata*, Tate; *W. Tateana*, Woods; *W. grandis*, Woods; *W. Macleani*, Tate; *W. Coriœnsis*, McCoy; *Terebratulina Scoulari*, Tate;

* Two Expeditions into the Interior of Southern Australia, 1834, vol. ii., plates 2 et 3.

T. Davidsoni, Etheridge; *Magasella compta*, Sowerby; *M. Woodsiana*, Tate; and *Rhynchonella squamosa*, Hutton.

CLASS POLYZOA.

The Rev. J. E. Tenison Woods, in Trans. Roy. Soc., Victoria, vol. vi., applied new names to some of the forms figured by Sturt, but these have been ignored by Mr. Waters in his several papers dealing with this class in the Older Tertiary of Australia.

Mr. Woods has, moreover described and figured from the Murravian deposits, the following *Selenariadæ*:—*Cupularia rutella* and *Selenaria alata*. Trans. Roy. Soc., S. Aust., vol. iii., 1880.

Mr. Waters has recently occupied himself with the determination of the Cyclostamatous and Chilostomatous species occurring in the River Murray cliffs from material furnished by me. His paper will appear in a forthcoming number of the Proceedings of the Geological Society of London; in the meanwhile an approximate summary of his results, as communicated by letter to me, is given at p. 18.

CLASS CRUSTACEA.

Prof. G. Brady furnishes a list of four species of Ostracoda obtained from the Government Well between the Burra and North-West Bend (Geological Magazine, July, 1876). The species are *Bairdia ovata*, G. B.; *Macrocypris acuminata*, Reuss; *Cythere Normani*, G. B.; and *Paracypris decora*, G. B.

CLASS ECHINODERMATA.

Dr. Laube ("Ueber einige fossile Echiniden von den Murray Cliffs" in Sitz. d. k. Akad. d. Wissench., Wien, 1869) describes and figures, as new, eight species, viz., *Echinus Woodsii* (Psammechinus), *Temnechinus novus* (Paradoxechinus), *Micraster brevistella*, *Arachnoides australis* (Monostychia), *Catopygus elegans*, *Echinolampas ovulum* (= *E. Gambieriensis*, Woods), *Eupatagus Murrayensis*, *E. Wrightii*, and records *Lovenia Forbesii*.

Professor Dr. Duncan, in Quart. Journ. Geol. Soc., vol. xxxiii., p. 44 et seq., 1877, adds as new species *Eupatagus rotundus* and *Megalaster compressus*.

CLASS ACTINOZOA.

The coral fauna of the Murray Cliffs has been catalogued by me in the first volume of our Transactions. It comprises seven species, one of which, *Deltocyathus alatus*, was described and figured as new by Tenison Woods in the same volume. The other species are *D. viola*, *Sphenotrochus australis*, *Flabellum*

Victoriæ, Placotrochus deltoideus, Antillia lens, and *Balanophyllia australiensis.*

CLASS FORAMINIFERA.

Mr. H. B. Brady, in Geological Magazine for July, 1876, gives a list of 24 species determined by him from material obtained in sinking the Government Well between Burra and North-West Bend.

Summary of recorded species.

Mammalia	1
Gastropoda	6
Lamellibranchiata	6
Palliobranchiata	13
Polyzoa	39
Crustacea	4
Echinodermata	11
Actinozoa	7
Foraminifera	24
Total	111

The major part of the species upon which the above summary is based consists of those which have been described from the actual beds, whilst the rest has been included on good authority. Many more remain to be catalogued, as may be gathered by reference to a census of the fauna of the Gastropod-bed near Morgan submitted by me in the second volume of our Transactions, p. liv., 1878. Since that time gatherings have been repeatedly made, and the elaboration of the species has received some attention. Many species have been identified with those of the Mollusca described by Woods and McCoy, and of Echinoderms by Duncan; but a large proportion has yet to be named. However, the Lamellibranchs are in course of treatment by me after the plan adopted with regard to the Palliobranchs of the Older Tertiary of Australia, and I trust that before the lapse of many months the results will be before you. When the Gastropods shall have been similarly elaborated, it will then be possible to correlate the various fossiliferous beds, and to promulgate more decided opinions as to the relationship of the faunæ *inter se* and to those of other Tertiary areas and to recent ones.

In the lists of the characteristic species of the several subdivisions of the Murravian formation which follow I have included only those of which diagnoses have been published, many of which are for the first time recorded as Murravian fossils.

SPECIES OF UPPER MURRAVIAN.

The fauna of this subdivision is very meagre, and it is only at few spots where other than the ubiquitous oyster is found; and then, for the most part, the tests have more or less exfoliated, so that it is not always possible to refer them to their generic position. Besides the oyster there is a large *Margaritifera*, *Trigonia acuticostata*, McCoy, *Pectunculus laticostatus? Arca*, 2 spp., *Tellina*, *Mactra*, &c., *Clypeaster Gippslandicus*, McCoy.

SPECIES OF THE MIDDLE MURRAVIAN.

The soft calciferous sandstone which makes up the chief part of the sub-formation, and which maintains a uniform character from Overland Corner to many miles south of Blanchetown, is especially rich in members of the families Ostreidæ, Limidæ, Anomiadæ and Pectinidæ, in Palliobranchs, Polyzoa, and Echinoderms.

About Mannum the formation consists of red raggy limestones, full of *Lovenia Forbesii* throughout its whole thickness of about 150 feet, and of overlying coarse polyzoal rock of about 10 feet; in the latter *Catopygus elegans* occurs. The upper 40 or 50 feet contain the same assemblage of fossils as the Middle Murravian further north; and I incline to the opinion that the whole embraces both the Middle and Lower Series, but because of its lithological and, concurrently, palæontological uniformity they are here not separable.

Referring back to the 'Section at four miles south from Morgan,' the beds numbered five to eight inclusive deserve especial notice from the profusion of their fossils and from the circumstance that the habitat is unique so far as regards the cliffs. Here because of the slight admixture of argillaceous matter in the matrix, the tests of gastropods and of many bivalves have been well preserved, but this condition is maintained only for about 350 yards, measured along the front of the cliff, beyond that the shells gradually disappear with the diminution of clay, and finally at half-a-mile distant the beds have merged into the limestones, caverned with casts, and the ordinary calciferous rock. The absence of argillaceous matter in the marine beds forming the gorge of the river is remarkable; but at varying distances beyond, well-sinkings have revealed the occasional presence of clays, which are usually rich in fossils identical with those of beds 5 to 8 just treated of.

The blue marl in the following section yielded fossils of this character:—

GOVERNMENT WELL, BETWEEN BURRA AND NORTH-WEST-BEND.

	FT.
Red loamy clay (Pliocene)	40
Light-coloured sandstone with casts of shells ...	10
Gravelly ironstone and layers of clay ... }	81
Blue marl ... ... }	
Sandstone without shells	17
Running sand	6
Total	154

Similar results were obtained in a well-sinking five miles east of the above, and at "nine-mile camp," near North-West Bend. Again, at Westbrook, about eleven miles north of Wellington and one and a-half east from the river, a blue marl occurs near the bottom of a well, sixty feet deep, charged with fossils in an excellent state of preservation.

Charcharodon angustidens, *Ag.*; Otodus Desori, *Ag.*; Lamna elegans, *Ag.*

Aturia australis, *McCoy.*

Typhis McCoyi, *Woods*; Triton Abbottii, *Woods*; Ranella Prattii, *Woods*; Nassa Tatei, *Woods*; Ancillaria semilævis, *Woods*; A. mucronata, *Sow.*; A. hebera, *Hutton* (*?*); Cassis textilis, *Tate*; Voluta Hannafordi, *McCoy*; V. antiscalaris, *McCoy*; V. strophodon, *McCoy*; Marginella Wentworthi, *Woods*; M. propinqua, *Tate*; Niso psila, *Woods*; Eulima acutispira, *Woods*; Leiostraca Johnstoni, *Tate*; Mangelia bidens, *Woods*; Daphnella gracillima, *Woods*; Triforis sulcata, T. Wilkinsoni, and T. planata, *Woods*; Cerithium cibarioides, *Woods*; Cypræa gigas, C. leptorhyncha, and C. consobrina, *McCoy*; Trivia avellanoides, *McCoy*; Conus Traillii, *Woods*; Cancellaria varicifera, *Woods*; Torcula Murrayana, *Tate*; Natica polita and N. Hamiltonensis, *Woods*; Solarium acutum, *Woods*; Minolia strigata, *Woods*; Liotia Roblini, *Johnston*; Cyclostrema acuticarinata, *Woods*; Xenophora undulata (?); Fissurellidæa malleata, *Tate*; Emarginula transenna, *Woods*; Cylichna exigua, *Woods*; Bulla scrobiculata, *Woods*; Pecten Yahliensis, P. Foulcheri, and P. incertus, *Woods*; P. Darwini, *Sow.*; P. Atkinsoni, *Johnston*; P. spondyloides, *Tate*; Lima Bassii, *Woods*; L. Jeffreysiana, *Tate*; Spondylus pseudoradula, *McCoy*; Leda inconspicua, *Woods*; Nucula tumida, *Woods*; N. Atkinsoni, *Johnston*; Limopsis Belcheri, Pectunculus laticostatus (?).

Cucullæa Coriœnsis, *McCoy*; Crasatella oblonga, *Woods*; Lepton crassum, *Tate*; Chama lamellifera, *Woods*; Cardium pseudomagnum, *McCoy*; Chione Cainozoica, *Woods*; C. dimorphophylla, *Tate*; Corbula ephamilla, *Tate.*

Rhynchonella squamosa, *Hutton;* Terebratulina Scoulari, *Tate;* T. Davidsoni, *Etheridge;* Magasella Woodsiana, *Tate;* Waldheimia Garibaldiana, *Davidson;* W. grandis, *Woods;* W. Taylori, *Etheridge;* W. Tateana, *Woods*; W. Macleani, *Tate*; W. divaricata, *Tate*; W. Coriœnsis, *McCoy*; Terebratula vitreoides, *Woods.*

All the Polyzoa enumerated by Mr. Waters.

Leiocidaris australis, *Duncan*; Echinus Woodsii, *Laube*; Temnechinus novus, *Laube*; Catopygus elegans, *Laube*; Micraster brevistella, *Laube*; Brissiopsis Archeri, *Woods*; Holaster australiæ, *Duncan*; Echinolampas Gambieriensis, *Woods*; Lovenia Forbesii, *Woods*; Eupatagus rotundus, *Duncan*; E. Murrayensis and E. Wrightii, *Laube*; Arachnoides australis, *Laube*; Megalaster compressus, *Duncan.*

Deltocyathus viola, *Duncan*; D. alatus, *Woods*; D. excisus, *Duncan*; Sphenotrochus australis, *Duncan*; Flabellum Victoriæ, Placotrochus deltoideus, Antillia lens, Balanophyllia Australiensis, *Duncan.*

The ostracods and foraminifera catalogued by the Messrs Brady.

SPECIES OF THE LOWER MURRAVIAN.

This series is characterized rather by lithological than palæontological characters, which latter are somewhat negative, as the species are few in number and somewhat sparsely distributed. It is often highly charged with gypsum, and then fossils are rarely present. Cetacean remains have occured to me only at this horizon, notably at MacBean's Pound, four miles from Blanchetown, whence I obtained the entire lower jaw of a balenoid whale, six feet long, and at Murbko, 14 miles north of Blanchetown, whence I extracted a cranium. The anterior half of a Paguroid-fish in excellent preservation was obtained at Morgan from these beds.

At Morundi, a few miles south from Blanchetown, this series is represented by a brown sandy calciferous rock of about 40 feet thick, distinctly bedded, with lines of echinoderms in the planes. Here *Lovenia Forbesii* and *Magasella Woodsiana* occur in great profusion; it is also the chief station for *Megalaster compressus.*

SECTIONS OF THE NEWER TERTIARY DEPOSITS OF THE UPPER SECTION OF THE RIVER.

1. *At the Boundary*, 235 *miles from Blanchetown.*—The cliff at the river margin is composed of about 20 feet of red loam, whilst back from the river coarse-grained sand-rock appears at a higher level.

2. *Section of cliff at* 226 *miles from Blanchetown* :—

Grey sand with thin layers of sand-rock,	about 40 feet.
Sand-rock	2 to 3 ft.
Red sand	10 feet.
Total	52 feet.

The whole more or less false-bedded.

3. *At Murthoo,* 212 *miles from Blanchetown.*—The channel of the river is, here, contracted and shallowed by a reef of ferrous sand-rock, which forms the base of the cliff, whilst its main mass is composed of a white, coarse, false-bedded sand.

4. *At Spring-Cart Gully*, 164 *miles from Blanchetown.*—The cliff at this place is the highest on the upper section of the river, and consists chiefly of sharp sands, but has towards its upper part a thickly-bedded freestone, consisting of angular quartz grains cemented by amorphous felsitic matter. This stone, which is used as a building material, is comparable with some of the softer felsitic quartzose sandstones of Pre-Silurian age occuring in the Mount Lofty Range.

5. *Pyap Reach*, 123 *miles from Blanchetown* :—

Red and white clayey sand, sprinkled with mica-flakes, ...	about 10 feet
Red loamy clay	15 "

6. *Cliff at* 101 *miles from Blanchetown* :—

Reddish sands	about 10 feet
Dirty yellow or greenish sharp sands ..	10 "
Coarse quartzose sand-rock; grains sub-angular and coated with hydrated ferrous oxide...	15 "
Grey, angular, coarse sand	30 "
Hard calciferous sand-rock with a few Older Tertiary fossils	5 "
Total	70 "

This last section is instructive, as it is the only one known to me in which the actual superposition of the sharp fluviatile sands upon the marine beds is visible, though the same phenomenon may be inferred at Overland Corner. This section is distant in a straight line from Overland Corner four miles only, and yet in that short distance the whole character of the stratigraphy has changed, as at the latter place the very high cliffs consist of calciferous sandstone of marine origin, overlain by oyster banks, and these by blue clay. The evidence of the unconformability at Overland Corner is, I think, sufficiently clear, as on the western flank of the scarped cliff there appears at a little below the level of the oyster bank ferruginous sand, which in the form of a minor escarpment skirts the river for a few miles to the eastward and sweeps round Lake Bonney, where the sand is white and exceedingly large in grain.

As to the areas occupied by the Newer and Older Tertiary deposits respectively, the information in my possession is too fragmentary to allow of an attempt at definition, though it may be useful to record it.

West side of the River Murray.—At the Half-way House, on the edge of the mallee scrub on the road to Blanchetown from Truro, a well-sinking commencing in red drift penetrated oyster banks at 110 feet from the surface.

The Government Well and other sinkings adjacent prove that the subter-structure of the Desert is Older Tertiary.

The most distant locality from the river at which Older Tertiary fossils have been obtained is in a well sinking at the north-east corner of County Burra, forty-seven miles due north from Morgan.

North side of the River Murray.—The following section indicates the northern extension of the Newer Tertiary.

Well-sinking at Oakvale, about ten miles due west from 74 milepost measured from the River Murray, on the boundary between South Australia and New South Wales (communicated by Mr. D. Cudmore) :—

At 175 feet, yellow ochreous clay.
At 180 " grey pipeclay.
At 190 " id.
At 196 " black clay, with much quartzose sand.

Doubtlessly the whole of the depressed area about the Lower Darling is constituted of Newer Tertiary.

South side of the River Murray.—The geological structure of the country which intervenes between the river at the Boundary and the Tatiara is, so far as I know, quite blank ; but it is not unreasonable to suppose that the Newer Tertiary at these places is coterminous. The Tatiara is an oasis on the edge of the mallee scrub, in the one direction, and of the heathlands of the South-East in the other ; it owes its reputation to deep loamy soils, the upper members of an extensive lacustrine deposit, as is partly revealed by a well-sinking at Border Town, of which the following is a summary of the facts :—

Pipeclay	30 feet.
Diatomaceous earth	21 "
Bituminous shale and clay ...	40 "
Total	91 feet.

The Rev. Tenison-Woods* supplies an account of another sinking at Bingham Station, Tatiara; "the whole depth of 75 feet was occupied by beds of variegated sands of various thickness," the lower 10 feet consisting of sand and clay. According to the same geologist, the most northerly exposures of Older Tertiary are "on the upper part of the Red Cave Range near Broad Meadows, and at Kybobolite on the same range, but about nine miles north," op. cit., p. 18. The Older Tertiary occupies a comparatively small area in our South-Eastern district, in the form of a table land of an average elevation of about 200 feet, but inclining from south to north. From Kybobolite the escarpment passes south by way of the Cave Range, east of Narracoorte, to about six miles west of Penola, thence by Kalangadoo and Glencoe to its most westerly boundary at Mount Graham. The last place is also the western termination of the overlying volcanic masses of the Mount Burr Range. From the Mount Burr Range the outcrop approaches to within about sixteen miles west from Mount Gambier, thence to Port MacDonnell and the Glenelg River; much, however, of this portion of the country is covered by ash beds and recent marine deposits. The marine pleistocene deposits flank the Older Tertiary from the Glenelg to Cape Northumberland, and thence to Narracoorte; to the north of which older, though Newer Tertiary, deposits complete the isolation of the Mount Gambier beds.

Leading Botanical Features.

In this chapter I wish to set forth the leading floral characteristics of the Murray region, as they are sufficiently varied in relation to geological and hygrometric conditions to justify a short review. An enumeration of the species, about 650, constituting the flora is unnecessary, as that has already been made in my "Census of the Flora of South Australia" and "Supplements" thereto, published in the Transactions of the Society.

I. OF THE GORGE.

(*a*) *Fluviatile*:—Ranunculus aquatilis, Limnanthemum, two sp.; Hydrilla, Valisneria, Ottelia, Potamogeton, three sp.; Cyperaceæ, Panicum spinescens ("Water-grass"), Azolla, two sp.

(*b*) *Alluvium*:—Myosurus, Ranunculus parviflorus, var.; Eucalyptus rostrata ("Red-gum"), E. largiflorens ("Box"), Callistemon brachyandrus, Muhlenbeckia Cunninghami ("Polygnum-bush,") which forms dense belts around the lagoons, Abutilon Avicenniæ, Acacia stenophylla, Swainsonia Greyana ("Darling-pea"), Glycrrhiza psolaroides, various

* Rep. Geol. of the South-East, p. 13; 1866.

species of Salsolaceæ, notably Atriplex nummularium ("Cabbage salt-bush"), A. semibaccatum and Bassia salsuginosa, Epaltes australis, Senecio Cunninghami, Helichrysum lucidum, Exocarpos stricta, Limosella aquatica, Glossostigma, Gratiola, two sp., Stemodia Morgania, Eremophila divaricata, Cyperaceæ, species of Panicum, Andropogon, Eragrostis, &c., Marsilea quadrifolia.

(c) *Cliffs* at the water line:—Swainsonia Greyana, Wahlenbergia, Aspidium molle, also stragglers from the alluvial tracts.

Some of the above-named species are more or less restricted to one or the other section of the river, thus:—

LOWER SECTION.	UPPER SECTION.
	Glycyrrhiza psolaroides
Limnanthemum exaltatum	L. crenatum
Gratiola Peruviana	G. pedunculata
Aspidium molle	Ottelia ovalifolia
Azolla rubra	A. pinnata

II. TABLE LAND OR MURRAY DESERT OF THE LOWER SECTION.

On the western side of the river, as far north as Morgan, the surface of the plateau is more or less stony (rubbly travertine) and covered with mallee scrub; but on the eastern and northern sides the oyster banks are succeeded by clays, and these at higher levels by sands. In accordance with these different petrological features so the prevailing floral characters vary. The greatest number of species occurs along the trail of the sand over the underlying clays as might be expected from hygrometric conditions; here, also, exist the "native wells."

(a) *Stony Surfaces.*—The constituents of the "mallee scrub," in the open parts of which prevail *Casuarina suberosa*, many shrubby Asters, Acacias, Cassias, Templetonia egena, and Grevillea Huegelii; and during early spring many humble annuals appear in considerable profusion, such as Alyssum, Erysimum, composites, Goodenias, Bromus arenarius.

(b) *Clay Surfaces.*—The mallee scrub of the stony surfaces is interspersed with glades, which occupy clay depressions on which water remains for some time after heavy rains. Here the mallee does not grow, from which we may infer that its seed cannot withstand prolonged immersion in water. This is, however, the favourite habitat of *Myoporum playtycarpum*, so-called "sandal wood." The vegetation on the lacustrine clays is the same as that of the glades, and its chief constituents are the better kinds of fodder plants, Rhagodias, Kochias, Lycium, Dodonæa spp., Tetragonia expansa.

(c) *Sand Surfaces.*—Here, again, we have mallee scrub, with an undergrowth of the *Festuca irritans* (" Porcupine-grass" or spinifex), Asters, and Zygophyllum, spp.; and where the sand is not too deep forests of *Callitris verrucosa* prevail. On the edge of the sand ridges a profusion of herbaceous species grow after copious rains, including several Swainsonias, Myriocephalus Stuartii, Helipterum polygalifolium, H. moschatum, Crinum pedunculatum, Ophioglossum vulgatum.

Explanations to Plate III.

Fig. 1. Sketch-map of the Geology about the Gorge of the River Murray from the Boundary to Blanchetown (based on Mr. Pollitzer's chart).

Fig. 2. Diagrammatic Section across the Gorge of the Lower Section of the River.

A Rare and Curious Hemipterous Insect.

By J. G. O. Tepper, F.L.S., Corr. Memb.

[Read November 6, 1883.]

Figures 1 and 2, Plate IIIa.

A small though very curious insect was lately obtained by me in the hills near Adelaide. It belongs to the Heteroptera, sub-division Hemiptera, is related to the family of Berytidæ, and resembles somewhat the English species *Neides depressum*, and also some of the Hydromeridæ, or water-bugs, especially the genus *Ranatra* in its excessively thin and long limbs.

The body is linear in outline, and five-sixteenths of an inch long; its greatest width—a little posterior to the middle of the abdomen—is one-thirty-second of an inch, the remainder varying between this width and less than the one-sixty-fourth of an inch immediately behind the eyes. Its general colour is ashy brown above, with part of the prothorax and the legs rufus; below it is very dark brown.

The head is conical, ending in a proboscis which is slightly curved forward and downward, and is twice as long as the head, the latter being two-thirds of the length of the prothorax, and the two conjointly are about one-third of that of the remaining part. The proboscis consists apparently of an elastic bristle in a sheath opening with a slit upwards, and has four joints, admitting alternate flexure up and down, the last joint being black.

The eyes are lateral, oval, slightly projecting, and have a small protuberance or horn between them. Before them, but closer together, the long clubbed antennæ are inserted upon a blunt conical base. They consist apparently of seven joints. The first or basal joint is short and several times the diameter of the remainder, which is extremely slender, *i.e.*, about one-half of the thickness of a fine human hair, but nearly equalling in length that of the whole body. The second joint is the longest, forming nearly one-half of the whole, its anterior extremity suddenly expanding into a short cylindrical club, which is darker in colour than the rest. The third and fourth joints are of equal length, and together about two-thirds of the second, both slightly widening at the anterior joints, these being also dark in tint. The three or four last joints form an ovate club, the two middle ones being the thickest, black, and equal in diameter to the club at the end of the second. The prothorax is sub-conic-pyramidal, widest behind; its posterior upper angles formed by short spines. But little curved above, it is slightly rough and the medium line distinctly raised. The mesothorax and metathorax are very short, together not equalling the prothorax, and greatly compressed from above. The abdomen is long, flatly compressed, with distinct margin and nine joints, the terminal two being the smallest.

The legs are extremely long and slender—scarcely, if at all, thicker than the antennæ. The first pair are the shortest, the last the longest, and the middle intermediate in length, being all equal in thickness. The outer extremity of the femur forms a club similar to that of the second joint of the antennæ, but much larger; the corresponding end of the tibia widens but slightly and is, as well as the clubs, dark brown. The tarsi are formed of three short joints, semicircular, and a short sharp claw. Two specimens only (one imperfect) were obtained by shaking low trees of *Eucalyptus obliqua*, or stringybark, not in flower. It is evidently carnivorous, and, as shown by its structure, must have habits analogous to those of the Mantidæ, its long thin legs indicating that its prey, though weak, must be quick and active. The wings are perfect, though somewhat short, allowing one-half the larger, beside the terminal, joint of the abdomen to project, and exhibit rather strong ribs, denoting vigorous power of flight.

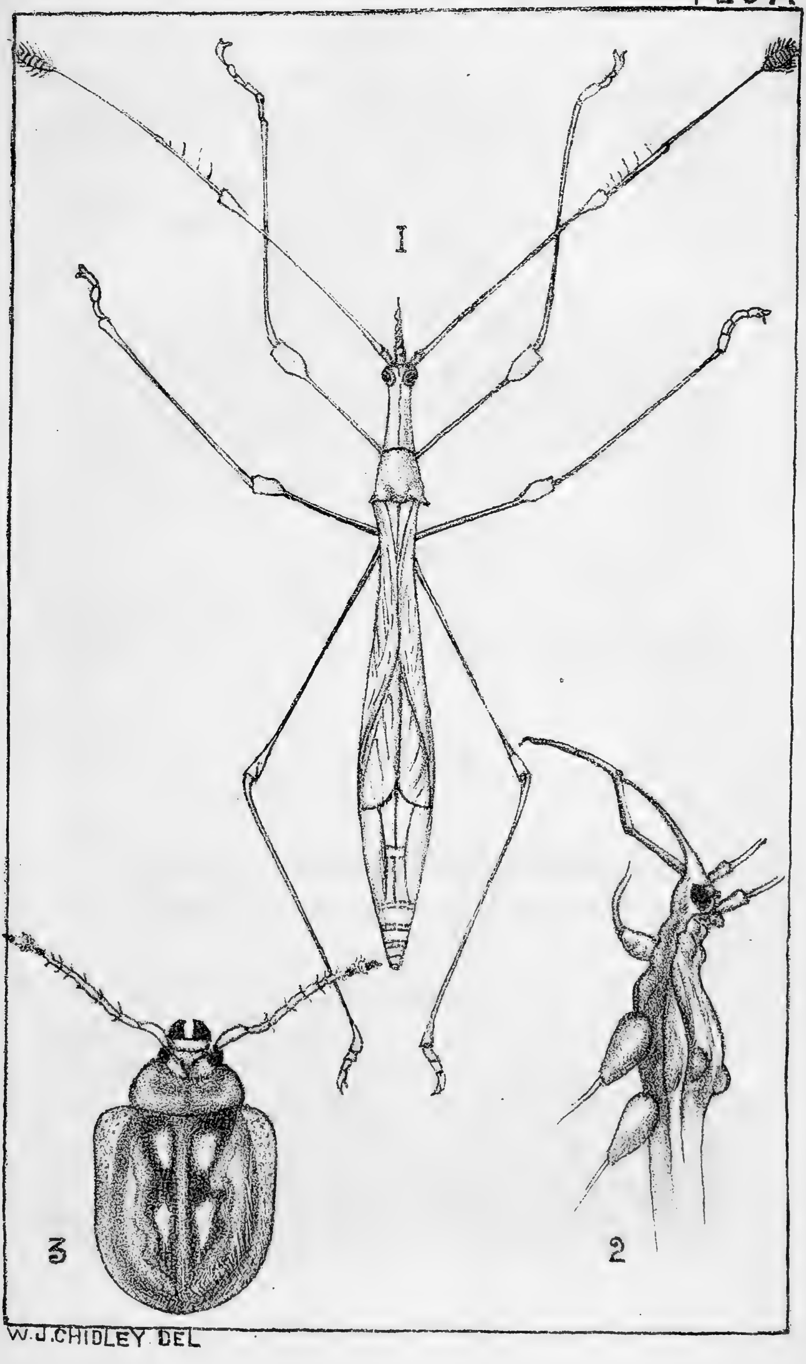
A Beautiful and Rare Beetle.

By J. G. O. Tepper, F.L.S., Corr. Memb.

[Read November 6, 1883.]

Plate IIIa. Fig. 3.

The insect to be described, enlarged six diameters, is rather rare; it feeds upon the leaves of some *Eucalypti*, as *E. odoratus* and *E. obliqua*, &c., found in the hill districts. The specimen under review was obtained near Mount Lofty, but the same species had been previously captured in the Barossa Ranges. Its season of occurrence, in the perfect state, extends from the early part of October into the summer months, but nothing has been observed about its metamorphoses. It is one of the most magnificently coloured Coleoptera of this province, PL. 3 A



W. J. CHIDLEY DEL.

but its beautiful tints are so evanescent that a few days after death scarcely a trace of them remains, being merged into a uniform dull yellow or red. By this disappearance it is proved that the glowing colours are not due to any pigment, as in most insects, but the action of light upon its internal living tissues. These tissues shrink when losing their moisture after death, and thereby also lose the property of exhibiting the glowing metallic tints mentioned; consequently no museum specimen can reveal the fact to a distant entomologist.

The beetle belongs to the genus *Paropsis*, so numerously represented in Australia. The sexes differ slightly in size, the female being about five-sixteenths of an inch in length, and the male a quarter of an inch. All the outer integuments are smooth, excepting microscopical grooves and dots upon pro-thorax and elytra. The outline of form is that usual to the genus, a somewhat broad oval, slightly compressed. The head and prothorax are light green; the eyes, exterior edges of the maxillæ (with large triangular terminal lobe), mandibles, and the edges of the four last joints of the antennæ are black or dark brown, the remainder of the mouth parts and antennæ are light yellow. The margin of the elytra is yellowish green, and finely pitted; this is succeeded by a narrow band of dull purple, followed by another of green with metallic lustre; the outer edge of the latter is smooth, the inner shows three serrations, rendering it unequal in width at different parts, and is again—but irregularly—bordered by dull purple. Near the narrow purple median line two longitudinally extended spots of somewhat irregular form occur on each side, resembling burnished gold in colour and lustre, the anterior one preceded by a small bright crimson dot in the angle between the commencement of the green band and the metallic golden spot; the posterior one being succeeded by a rather larger one of the same bright crimson; the remaining space is filled in by a dark dull blood-red colour. The underside of the whole body is yellowish green, and the legs pale greenish yellow.

Explanation of Plate IIIa.

Fig. 1. New hemipterous insect, as seen from above, enlarged twelve times.

Fig. 2. Anterior part of same, showing the proboscis partly removed from the sheath; the large coxæ, and quadrangular form of the anterior part of the body.

Fig. 3. *Paropsis* spec. nov,, enlarged six times.

Plants of Kangaroo Island.

By J. G. O. Tepper, F.L.S., Corr. Memb.

[Read July 15, 1884.]

From the 9th to the 19th of last month I spent on Kangaroo island, engaged officially in collecting specimens, principally zoological and mineral, for the South Australian Museum. The locality so examined only extended from Queenscliffe to Cape Willoughby and back to Hog Bay. In this examination six days were spent, and subsequently I examined the neighbourhoods of Queenscliffe and Brownlow for a few days more. Availing myself of the opportunity I gathered as many plants as circumstances permitted without neglecting the chief object of my visit. Besides the plants thus collected, others, well known to me, were dotted off on the margin of Professor Tate's excellent census of the Kangaroo Island flora.

The time was about the most unfavourable part of the year considered botanically, and therefore the result is much smaller than it would have been if the journey had been undertaken in spring or early summer, or if I had leisure to examine carefully some more favourable localities. Notwithstanding these disadvantages 214 species noted in the above work were observed or collected, and 18 species and varieties not mentioned therein, besides several too imperfect to allow certain identification. In enumerating these 18 species, inclusive of varieties, such remarks will be made regarding their habits as appear to be worthy of note.

Billardiera scandens, Smith (Pittosporeæ).—It occurs in the scrub west of Cape Willoughby, the soil consisting of sands and sandy clays over granite, quartzites, &c. The same plant also occurs in a small circumscribed area east of the public cemetery between Clarendon and Kangarilla, and is easily known by its narrow leaves with recurved and undulating margins, yellowish flowers, and other distinctions.

Correa speciosa, cor. variety viridiflora, Andrews (Rutaceæ). *Correa speciosa*, variety glabra, Lindley.—The former is plentiful in rather low-lying sandy parts of the scrub from Queenscliffe around American Beach, &c., and forms tall, intricately branched, very dense shrubs from two to seven feet high with small leaves and greenish flowers. The latter was only noticed on the limestone hills close to the coast of Queenscliffe, forms very low, weak, semi-prostrate shrubs about 12 inches high, and very small white flowers. The real typical C. speciosa, with its large, yellow-red, bell-shaped flowers, was noticed sparingly on the high ground west of Cape Willoughby, forming, as it ever does where I have seen it, low, open, erect shrubs, some 8 to 12 inches high. Bentham, in recording the first two as varieties (Flora, I., page 354), says:—"I follow F. Mueller in uniting under one name all Correas with a truncate four-toothed calyx, united petals, and four of the filaments dilated. At the same time, although the following races may be found to pass into each other, yet they appear generally so distinct, that I feel some hesitation in refusing to recognise them as species." In these sentiments I am sure many, and not laymen only, will heartily agree, as it seems strange indeed to call dissimilar plants by the same name. In my humble opinion the term "*variety*" ought to be limited to florists' flowers, *where it is known* that the seed of any one plant will produce seedlings of different or aberrant forms, freely inter-crossing, and again producing varied offspring in fairly even proportion; and to such spontaneous, aberrant, and inconstant forms in natural circumstances, where they are intermixed indiscriminately, so that without any stretch of imagination it can be assumed that they resulted, as in the former case, from the seed of a common plant. I doubt if any one knowing the above three plants in a living state could assume that the seed of either would give rise to all, especially as they occur in circumscribed areas far apart, seldom intermixed—C. glabra, for example, in Victoria, South Australia, and Western Australia; in the last, I believe, the only form. Let such well-marked forms as these stand as species, under a distinct simple appellation, till they be proved to be varieties in the sense mentioned above.

Templetonia sp., very likely T. retusa, R. Br. (Legumin).—An erect slender shrub, 2 to 2½ feet, with obovate leaves one inch or more in length, on the limestone hills west of Mount Tisbet. No flowers were seen.

Acacia notabilis, F. v. M.—A low, slender tree with few branches. In sandy scrubs near Brownlow and elsewhere, and of the same habit as in Yorke's Peninsula.

Acacia longifolia, Willdenow.—A tree or shrub much resembling the Golden Wattle (A. pygnantha) in size and habit, excepting that the leaves are much narrower and the bark lighter and smoother. Plentiful at White Gum Gully, south of Hog Bay, along the roadside.

Melaleuca decussata, R. Br. (Myrtaceæ).—A small shrub two to four feet high. On the rich, loose soil in the depression between the limestone ridges west of Mount Tisbet.

Eucalyptus goniocalyx, F. v. M.—Fair-sized trees, Hog Bay

River. E. odoratus, Behr. (Peppermint gum), near Antichamber Bay.

Aster tubuliflorus, F. v. M. (Compositæ).—Sandy scrub near Brownlow, &c.

Scævola humilis, R. Br. (Goodeniaceæ).—Low ground near Lashmar's Lagoon and Antichamber Bay.

Westringia sp. (Goodeniaceæ).—An erect shrub 2 to 2½ feet high, with slender branches and pale puce or white flowers, small leaves in whorls of three and slender straight branchlets; possibly W. eremicola, A. Cunn., or a species related to it. It occurs, but not plentifully, in the scrub west of Cape Willoughby. Fruit not seen.

Styphelia Woodsi, F. v. M. (Epacrideæ).—A low, dense, erect shrub on the limestone hills west of Mount Tisbet.

Callitris sp.—A small shrubby tree only a few feet high, the leaves of which are very different from those of the only other two species hitherto known in South Australia. Mr. Horswill, third keeper lighthouse, Cape Willoughby, handed me the specimen seen, but without fruit.

Xanthorrhœa sp. (Liliaceæ).—The "Yacka (Yucca?) Tree" of the islanders. It forms one of the most peculiar features of the island, its stem 6 to 12 inches thick, rises sometimes to a height of 12 feet, is either branchless or bears a few, but these seldom number more than two or three. The leaves are long, narrow, stiff, and brittle, resembling those of X. semiplana, but the midrib is more prominent; the spike reaches 8 to 10 feet in length, being 1¼ inch and more in diameter. Bentham's description of X. arborea suits best for it, but it is more likely a related species (if not the same) to that recorded from Flinders Island under the name of X. hastilis, R. Br., by Gunn in Hooker's Flora of Tasmania, of which Bentham says (Fl. Austr. vii., 115) it "must belong to some other species, but having no specimen it is impossible to identify it." Certainly it is neither X. quadrangulata, F. v. M., which occurs sparingly near Cape Willoughby, and has evenly four-sided grass-like leaves; nor X. semiplana, which is stemless, and has quite different leaf-marks on the interior of the rind.

Lepidosperma lineare, R. Br. (Cyperaceæ).—In the scrub lands of Hundred of Haines and elsewhere. A usually large form compared with the specimen observed about Clarendon, &c.

Poa syrtica, F. v. M. (Gramineæ).—A low, stiff, small-tufted grass near high-water mark along the beach at Brownlow to Cygnet River.

Lagurus ovatus, L.—Probably introduced, a conspicuously white-headed grass about Queenscliffe.

A very curious aberrant form is also shown by *Ixodia achylloides*, compared with the very common plant, inhabiting the higher slopes and ridges of the Adelaide ranges. At the latter locality its stems and branches are regularly and constantly four-sided, thick, and fleshy; those of dwarfed specimens a few inches high always compressed. In the island this form also occurs near Cape Willoughby, but sparingly and intermixed with another which spreads over most of the scrub lands between this place and Queenscliffe, with slender, round, woody stems and branches, very different in aspect, but the flowers are apparently similar. Blooming specimens vary from one inch in height above the ground to two feet.

A very pretty green Alga occurs near Queenscliffe which I have not noticed either at Ardrossan or elsewhere in St. Vincent Gulf, viz., *Caulerpa scalpelliformis*, Aghard. Its leaf-like branches are toothed, almost pinnate, and grow from a thick base forming large tufts.

Specimens of all the plants (except the Xanthorrhœa) were submitted to Baron Sir Ferd. von Mueller, who was so kind as to identify them for me in his usual most obliging manner.

Variation of the Compass in South Australia.

By Charles Hope Harris.

[Read August 5, 1884.]

[ABRIDGED.]

The first information we have as to the variation (declination) of the compass in South Australia is that Flinders, in 1802, when off Eucla, crossed a line of no variation—the needle, which had been pointing west of true north, showed no variation for a short distance, and then pointed east of true north, the declination increasing as his vessel advanced along the coast. The first reliable magnetic bearing known to the author is one given by Colonel Light in 1837. It is shown on a plan of the city of Adelaide and surrounding sections, drawn by Arrowsmith, in London. It shows one of the leading survey lines N. 8° 47′ W. The true bearing of this line, determined astronomically by the author, is 3° 33′, so that the variation in 1837 was 5° 14′ E. In 1841 a Mr. Forrest (of the Royal Sappers and Miners) officially recorded the variation as being 5° 9′ E. at the north-west corner of the city. In 1850 Mr Painter, well-known as an efficient and painstaking surveyor, observed the variation at Cape Willoughby to be 5° 6′ E. In 1857-9 Mr. Goyder, Surveyor-General, found the variation to be at Mount Remarkable 5° 39′ 13″; at Mount Serle, 5° 0′ 6″; at Termination Hill, north of Lake Torrens, 5° 22′ 40″; and near Mount Margaret, about 4° 3′; so that we have the variation since 1837 fairly well recorded.

The next question of interest is whether the variation is at present increasing or decreasing, and what the amount of change known as the "annual variation" may be. Dealing first with Arrowsmith's plan, the magnetic bearing of the line given in 1837 as 8° 47′ W. is now 9° 15′ W., showing an *increase* of 28′ in 45 years, or at the rate of 36″ per annum.

Taking, next, the variation given by Forrest in 1841 of 5° 9′, the mean variation read off by the author on the same spot with three needles has varied from 5° 30′ to 5° 43′. These values indicate an increase at the rate of from 30″ to 45″ per annum.

During the last six months the author has been systematically recording magnetic bearings in the city of Adelaide, with the following somewhat remarkable result:—The mean aggregate bearings of the streets parallel to North and South terraces are found to be 30′ higher than the mean aggregate bearings of the streets parallel to West-terrace and King William-street, even after all allowance has been made for defect of alignment, and due precautions taken to secure their intersections at right angles to one another. The average of 80 readings brings out a magnetic bearing of N. 81° 10′ E. for streets parallel to South-terrace, and of N. 9° 20′ W. for King William-street and the streets parallel to it. The true bearings, determined astronomically, are 86° 28′, and 3° 32′ respectively; so that one set of observations gives a magnetic variation of 5° 18′, and the other a variation of 5° 48′. The discrepancy is attributed by the author to local attraction—as, for instance, by telegraphic wires, gas and water mains, building stone* &c. The author is disposed to believe that the latter more nearly represents the true magnetic bearing.

It is difficult, however, to assign a definite value to the magnetic declination at any epoch until the laws of the diurnal and other oscillations are more completely known. The author has made many observations on the diurnal oscillation. At Adelaide the needle moves towards the east from about 8 a.m. until after 1 p.m., and returns during the afternoon to the position it occupied in the morning. This is, of course, the inverse of what is observed in the northern hemisphere. The range at Adelaide was observed by the author to be 13′ in December, 1883; 4′ in May, 1884; and† as much as 16′ in October, 1884.

* The author has found the stone walls of his house to be strongly magnetic.

† Added since the paper was sent in.

Notes on the Crepuscular Glimmer or Red Glow.

By W. A. Jones.

[Read September 2, 1884.]

There have been several theories suggested to explain the phenomena, namely, volcanic dust, meteoric dust, ice, and vapour.

Although the dust theory has seemed most popular, I think it can be shown that the mass of evidence against it is overwhelming, and that the theory connecting the glows with some peculiar deportment of vapour is the only one competent to explain the most important phases.

Having carefully observed for upwards of eleven months, I have gleaned a number of interesting facts tending to prove that some form of water is present. But, apart from these, there are a number of facts controverting more or less the dust theories.

Bluish-green suns have been noticed at various times. To my own knowledge the same appearances of the sun took place in England in 1866 in the summer, and in Australia in 1879. The statement that the sun is green is not borne out by experiment with the polariscope, as if so the sun should appear green when the light is dimished. The bluish-green appearance reported appeared to be a subjective phenomenon to the excessive light of the sun if not too brilliant to prevent its being looked at for a short time.

According to Captain Lee's experience of 12 years the harmatan, a so-called dry fog, consists of remarkably fine red dust—1. The whole sky is tinted a dirty red. 2. The tinge is evident by moonlight. 3. The moon and sun are both reddened as they set.

But during the glow period the moon on setting and rising portrays no sky colours and gives only a white misty twilight that varies in brightness and extent with the moon's phases. No cross polarization is observable in the moonlight before or after she rises or sets.

We have important evidence in the fact that the glow changes in extent, intensity, in tint, in form, and in time of duration, as my notes conclusively show.

General Strachey has collected the barographs from the chief meteorological stations, and shows that a great wave passed round the earth both east and west immediately after the Krakatoa explosion. After reductions for temperature he found that the excess of velocity of waves travelling east over the velocity of waves travelling west was about 32 miles an hour, and he states how this may be explained by the fact that the winds along the wave paths would on the whole be from the west, which would cause an increase in the rate of one set and decrease in that of the other, so that the difference of 32 miles would correspond to an average westerly wind of 16 miles an hour.

Now, the dates on which the phenomenon was recorded at various places necessitate a rate of progression averaging 2,000 miles a day, and we can hardly imagine this average increase being set up over at least half the equator so immediately after the eruption, whilst from various persons we get the news that these colours were seen before the date of the eruption even commencing.

At the Mathematical Society, Port Adelaide, February 27th, when the subject was before that Society, I stated that I had seen similar appearances in July, 1883, especially in the mornings, and also that in February, when at Port Victoria, I witnessed some of the most beautiful rosy sunsets, which I likened in my letters home to the fairy transformation scenes.

Our Astronomer Royal, Mr. Chas. Todd, C.M.G., stated that he had news of these appearances occurring before the date of the explosion.

Mr. Neison, Government astronomer of Natal, says that they commenced there in February, 1883, but on a less grand scale, gradually becoming more marked until June. For the next two months nothing was noticed. At the end of August they became most vivid—on the 21st and 22nd noticeable but not vivid, next five days stormy with much rain and lightning, on 28th and 29th vivid, 30th rainy, 31st vivid. In September, 1st, 2nd, 3rd, and 5th vivid, and most remarkably fading away into green and purple in the east. Then a week of much rain, and the displays vanished for four months.

Now for a remarkable point. In the Transvaal they were first noticed on September 2, and were prominent there whilst invisible at Natal, though the places were only separated by a distance of 250 miles.

Sydney Hooper states that he has observed sunsets for 30 years, and has always found the crimson glow coming a considerable time after other tints.

E. Ranstorm, a landscape painter, states that from 30 years experience he is certain similar displays take place every year.

The analysis of snows and rains has given entirely different results in various cases:—1. The analyses by Nordenskiöld, the celebrated Arctic explorer, show that snow which fell in Sweden contained iron, silica, phosphorus, and cobalt, the quantity of the last named being relatively great. 2. In a communication to *Knowledge*, an F.R.A.S. claims to have found in hailstones which fell at the period of a fine glow green plant cells, spores of fungi, a few diatoms, and some rotifera or their eggs? 3. Mattieu Williams examined snow that fell at Harrow, and found large quantities of black oxide of iron easily separated by the magnet from the remainder of impurities. Some of his experiments leading him to infer the presence of nickel in the iron, which is characteristic of meteoric iron, he considers it to be meteoric. 4. Mr. Ranyard examined this and found it satisfactorily free from terrestrial dust. 5. Of McPherson's analysis we learn that the snow he collected contained hypersthene, pyroxene, magnetic iron, and volcanic glass, all of which were present in the volcanic ashes—(6) whilst M. Renard states that he finds the dust which fell at Batavia from Java to consist mainly of glassy particles, among which may be distinguished plagioclase, augite, rhombic pyroxene, and magnetite, the silica amounting to 65 per cent. Now, although the silica amounts to over half it has not been noticed in the majority of dust samples dragged out of the air by snow, rain, or hail. Again, there is no proof that the snow, &c., might not have brought its impurities from the lower strata of air most likely to be dust laden.

The absence of the rainband in the spectrum is no proof that the air does not contain water in some form. Thus, although it has been shown by a number that the glow has been existing when the spectroscope has shown an absence of watery vapour, the results of an investigation by F. W. Cory, of England, and presented by him to the Meteorological Society, show that a rainband as high as 75 per cent. was followed by a slight rain, and one of 10 per cent. by a heavy fall of snow. They also shew that the spectrum is not affected previously to a snowstorm except negatively, as the rainband diminished several days before snow. He suggests that when vapour is transformed into crystals of snow it does not give a rainband. Observations with the rainband spectroscope are not accepted by all meteorologists. "For example," says Hazen, "if it is turned to different parts of the sky and then to a white wall 50 feet or so distant it will be found impossible to tell between the rainband of the whole sky and that of the 50 feet," and "yet," he says in his paper to the Philosophical Society, Washington, "we find it insisted that the instrument must be turned to different points in the sky."

I thought at first that this objection was hardly fair, and I attributed the similarity of spectra to the white surface reflecting proportionately the sky-light and all its peculiarities, and judged that if the spectroscope were brought within a few feet of the wall the lines would remain the same. I tried them with a white wall and found that the absorption lines disappear almost completely at an interval of three or four feet. When 20 feet off I noticed a nearly similar spectrum to that of the sky. On another occasion with a white disc I got most lines up to within a few inches of the slit. Thus one part of the sky might indicate by absorption bands in its spectrum a condition that was only the reflection by this portion of sky of absorption that occurred elsewhere.

The observations of equally eminent men show that the rainband is often seen at glow times:—1. At an early period of the glow, Ellery stated that the spectroscope indicated excess of moisture. 2. The reports from Magdeburg state that in the spectrum of the glow uncommonly strong rainbands were seen. 3. Professor M. Smith, of Madras, stated that a great amount of watery vapour was indicated as being in the air. 4. J. F. Donnelly had variations of absorption during one observation. He found in place of the rainband shading off from D towards E, a broad band shading off towards *a*. In a short time this band nearly disappeared, and *a* became prominent, shading off both ways, &c.

Upon consideration it appears that if the vapour were low down we might get rainbands, whilst if the vapour were high up with dry air lower down we might get dry air spectrum. And conditions could exist so that we might get both dry air and vapour bands. This is important, and in the report by J. H. Poole this case actually exists. In reference to the examination during February with one of Browing's micro-spectroscopes and comparing the results with spectrum measured in wave lengths, he finds in connection with the variable telluric lines absorption both by dry air and vapour. Thus there was nearly total obscuration of violet end of spectrum, dark green very faint, red end very brilliant, little *a* just visible, B broadened to a thick black stroke, and *c* enveloped in an aqueous vapour band. Between *c* and D, about 63, was a dry air band very sharp, but the principal dry air band was between 57 and 58. On the immediate side of D nearest to *c* was a vapour band. My own examination with the spectroscope shows that in the majority of cases where there is a glow the rainband is somewhat prominent during the early part, low down, frequently disappearing rapidly towards the latter end of the glow.

The existence of a halo or corona round the sun, the relations it bears to the glow, its inconstant character, and its intimate connection with meteorological changes, cannot be explained by the hypothesis that it is due to dust. The halo or corona round the sun is very frequently visible now, and has been before the date of the glows.

In 1880, in connection with a set of inquiries I had resolved to make into the zodiacal light, I had been paying particular attention to the appearance of the sun's surroundings, and I find that many items of the following notes agree closely with those relating to sky appearances near the sun in 1880 and at other times doubtless:—The sky rarely has the same tint over its whole surface, the blue tints being about midway from sun to horizon, approaching the sun and horizon at certain times and states of weather. The change of tint near the sun forms a halo. This changes in form, it is not always circular, in fact it is rarely circular. Its limb has various breadths. It always changes as the sun approaches the horizon. It changes in tint as the sun sinks and rises. As the change from sunrise to noon is similar to sunset but in somewhat reverse order, I shall only describe the change as the sun sinks. As the sun sinks the central area becomes apparently brighter. The breadth of the limb increases on the side nearest to the horizon. It then appears pear-shaped towards sunset. The central space lengthens from the sun on the side farthest from the horizon. The rate of change is not constant, increasing as the sun sinks. The tint of the halo is not the same at the same time on various dates. It varies from a salmon tint to a panther tint, and frequently it has different tints in different parts. The panther tint occurs when somewhat heavy clouds are present obscuring portions of the halo, which is then much more extended. When it is this colour the glow is not prominent. The rain-bands low down are then heavy. The glow varies with the halo. As the sun still sinks this pear-shaped surrounding divides at the apex, forming two dusky pyramidal columns whose base rapidly extends north and south along the horizon, changing in tint at different parts. These bases do not travel north and south to like extent. Seen from various parts in this colony they generally seem to travel farthest north. As the sun sinks below the horizon the brilliancy of the central part becomes apparent directly, so that it appears to increase in brightness. Its tint then varies from a steel colour to yellowish white on various days. This central portion seems to extend to the point occupied by the limb before it divided. When the halo is extended the glow lasts a long time. When salmon-tinted the glow is lengthy. When there is no halo there is no glow proper, but a yellowish or orange bar followed by a whitish shimmer. There have been a few splendid greenish twilights in form and duration nearly equal to the glow. On these occasions the halo was extended and had a tawny hue.

There are others who have observed the surrounding about the sun. Bozuard says:—"On November 28 an attenuated white vapour extended 30° or 40° from the sun." A number of others observed a similar phenomenon, and from their observations conclude that it was due to ice spiculæ. Mr. Kershaw, in *Knowledge*, describes the halo as a kind of rosy glow with its inner edge about 5° from the sun and outer boundary from 20° to 25°, and says ice spiculæ would account for its appearance within 20° to 30°, but its appearance within this puzzles him. Mr. Talbot, of the Transvaal, has forwarded news of appearances round the sun, and has also noticed that the halo is most extended towards the horizon, and has noticed several points in the changes of this halo similar to the changes seen here.

Although many have imputed the formation of this halo to the light refracted through ice crystals, I can find no record of any one having made an extended scrutiny during the greater portion of the glow period. Now, my experience shows that this halo or corona, whichever it may be called, is continually changing; that the space between its limb and the sun is continually changing; that this space is rarely blue; that it generally approaches to white. The space varies in extent from the sun from about 18° to 25° to 3° or 4°. The breadth of the limb frequently amounts to quite 15°, and is often so as to not to admit of measurement. But the halos round the moon, when presumably due to ice, rarely exceed in the breadth of their limb 2° or 3°. The solar halo has existed right on for a number of days, and the moon has been visible also during that period. If the halo be due to ice, the halo should also have been observable during night round the moon. My notes show that it has only been observable to me once when there has been a glow, and then it occurred late in the evening, whilst on the following morning there was scarcely any glow, the colour of halo during the day not being red, clouds being present more or less.

On the other hand, the moon has (according to my notes) been visible when the glow was prominent, and has frequently been enveloped in mist, as also some of the brighter stars and planets, whilst on all occasions when a halo round the moon has been visible it has evidently been due to matter that took the form of clouds, though not always exactly the same. On all these occasions (about 15) there was no glow.

There is evidence to show that vapour tints are not dependent on a definite angle so precisely as ice tints are. In support of this I quote authority. Herschel, in his meteorology, describes colours seen by him and a friend in Kent in 1841, thus:—"Bands of colour not in circular form around the sun, following the sinuosities of the clouds. The colours commencing from the white area forming the interior and proceeding outwards to its edge were—1st, white; 2nd, very pale pink; 3rd, blue green, a very strong colour; 4th, at the edge purplish pink considerably intense, beyond which pure blue sky. The same tints were on other clouds having no reference to the more or less proximity to the sun, but depending on the thickness of the cloud or the length of the path within it traversed by the visible rays. In fifteen minutes the bands grew broader and tints stronger, and a tendency to form a corona round the sun." "It seems impossible," he says, "to regard these colours other than the resultants of the superposition of a series of interference fringes following a regular progression of breadth due to an increasing size in the drops from the exterior to the interior of the clouds."

Forbes has shown that steam in the act of expanding, and while still transparent, is highly absorptive of the violet, blue, and a portion of the green rays of the spectrum. Supposing the vapour only in the form it had on the outside of these clouds, the red would reach us when the other tints had become faint, and yet cloud forms not exist definitely.

We have also the well known fact of hygrometric relations of air to its temperature, and also the different tints the air has before clouds form and as soon as they do form—the depth of air being seen through the numerous gaps. Thus the pure ultramarine is most marked after clouds form. And before they appear at certain temperatures the sky has a greenish blue appearance. If the upper portion of the atmosphere were at a slightly higher temperature, and if the radiation of heat by the earth had increased we might expect transparent vapour at a higher altitude than usual, or at altitudes in greater quantity than previously. There is no necessity for assuming the quantity to be great, as if so it would cause precipitation to suit the ordinary temperature. The constitution of this vapour would certainly change, and we might expect it to form into its approximate condition to watery vapour (like air charged up to the highest dew point) and to reverse its phase about sunrise with the reverse order of change in temperature.

There are further observations tending strongly to prove that the cause lies in some form of water, as I shall immediately show; but I would just refer to several difficulties, if we assume that this water came from space. Thus, if it consisted of a small-sized cloud of vapour or ice the probabilities against it striking the earth would be enormous. If it were a large-sized cloud it must have come from a great distance and would have appeared as a nebulous patch, which as it approached could hardly fail to be noticed by some of the numerous astronomical observers. But of such a phenomenon we have heard nothing. We know that cometary tails are very attenuated, and on the occasion not long ago when we expected to pass through the tail of a comet there were no extraordinary sun glows recorded. The date of this transit, as predicted by Mr. Hind, was June 30th, 1861, and there is very little doubt that the earth did pass through this tail. If the earth passed through fairly it must by reason of its atmosphere have cleared a pencil 8,000 miles in diameter at the very least and half a million miles long, of all the fine matter in that path of the earth, and yet have done this without producing any marked meteorological changes. If the tail were composed of vapour frozen or otherwise it must have been remarkably attenuated, and if dust or meteoric matter it must have been exceedingly fine, as no display of incandescence took place. The only thing noticed was a number of long faint streamers pointing to the nucleus of the comet and widening out. It is strongly probable from this that if a cloud of meteoric dust or if a cloud of aqueous vapour sufficiently extensive or dense to have supplied the atmosphere for these displays, had approached the earth, such clouds could not have escaped observation during both their approach and departure.

The polariscopic examination affords very strong evidence of watery vapour as the cause of the displays. From an extended scrutiny during the whole period the following facts are adduced by the writer:—The skylight is over the greatest portion polarised in planes passing through the sun. There is a neutral place in the sky. It varies in position, being farther from the sun towards evening and early in the morning. It is not always a point, sometimes it is an elliptic area difficult to define within nice limits. The term dark side is here taken to represent the east side in the evening and west in the morning. On the dark side of the sky the polarization is about at right angles to that of the sun side. This, however, is not constant. When there is a *reddish tint* on the dark side the polarization is at a tangent to the principal boundary of the tinted surface. This area generally has an altitude of about 30°, varying in shape and rarely passing the neutral point position. When the red tint is not apparent the space below the neutral point is brightest with the nicol in cross position. The form of this space in dry air and clear evenings, when tinted, resembles two spear-like columns thickest at the base and inclined to each other, crossing at the top. On evenings when there is to be a glow the red tint appears first on this dark side, and this tint in the east disappears just when the red tint appears in the west. In cloud-patched sky the area is more extended and undefined, the tint more carmine, and duration longer. The radial polarization of the remainder of sky is not constant. When there is a red glimmer in the sun side the phenomenon of cross-polarization is apparent in the vicinity of this glow. Thus, when the long diagonal of the nicol is about perpendicular to the plane passing through the prism, the point of observation and the sun, the red tint is brightest. The position of maximum cross-polarization is continually varying in distance from the sun. It is not symmetrical. In this colony, from all the points I got intelligence, it is generally more perfect on the north of glow point. When there is a bluish green glimmer the cross-polarization is not observable in it. The cross-polarization varies with the kind of glow. It is frequently prominent beyond the limits of the red. It is best in weather when there are clouds about, and when the dew point is high. Sometimes it is visible in bright blue sky, the cross position of the nicol showing a fine red. Sometimes it is visible beneath the clouds when they are of large extent and the air seems hazy. It is not always necessary to turn the nicol 90° from the radial position, or from the position showing best blue, the red reaching its maximum in a very small angle. This is most marked when there are rain clouds not very heavy and dense, and especially when the spectroscope shows a heavy vapour band for a day or two previously. The clouds are generally low level bands, though it is also observable when the same kind of clouds are rising. When the cross-polarization is prominent the selenite colours are very fine, and seem to be most splendid at an angle of about 70° to 80° from the sun. Note.—This angle should be the angle of maximum polarization if it were due to water particles whose dimensions were not insignificant in comparison with light waves.

Placing a nicol-prism between the slit and the battery of a spectroscope, I examined the cross-position, and the result of a number of evening and morning scrutinies seems to show that when the nicol is in cross-position the spectrum is brighter at the less refrangible end, and that the principal absorption takes place between E and F. That when in the early part of the glow the lines in the red are broader when the nicol is radial and sharper when the nicol is crossed.

In examining the halo or corona I have tried to find the phenomenon of cross-polarization, but with very questionable success in the daytime. It seems to be present when there is panther-hue background and clouds obscure the sun. Cross-polarization also exists in variable degree when orange banks extend far from the sun, the cross-polarization deepening their tint and extending it in altitude, this having existed since 1880. The glimmer is frequently bluish green to southward, with somewhat northern glow. In these cases there is cross-polarization in the glow and radial polarization and selenite tints in the glimmer, brightest latest.

How is the fact of cross-polarization to be explained? Supposing the red tints to be a species of fluorescence. This *could* give the phenomenon of cross-polarization, for in the cross position we should only have the fluorescent tint and the residual tint of the polarised sky light, and in the parallel position the tint from the admixture of the two lights. If this were true we should get a gradual change of tints in passing from one position to the other. That is, a change in intensity of the respective tints with the important fact that one hue would be brighter than the other. Thus, in the cross position the non-polarised light plus the residual would be less bright than the mixed tint of the two lights in parallel position. In this case the *cross* position would always give the *most* decided difference of tint.

If dust were present in an unusual degree and light were polarised by reflection from it, the result would be that one tint would be observed, for the plane of polarization would be parallel to that of the sky. Thus the tint would be brightest in parallel and darkest in cross position. If dust were present and sky somewhat uniform, whatever occurred in sky-light would occur in dust-light polarization. Supposing the residual or unpolarised light of the sky bluish, the residual light of the dust reddish, and that both were proportionately polarised. Then, in different parts of the sky the hue of cross position should be the same with only its difference of brightness due to varying completeness of polarization in various parts of the sky. Supposing the residual light of dust greatest. Then in positions of most complete sky polarization the red tint in cross-position would be brightest; that is, more decided, and the spectroscope with nicol-prism would reveal it at any time in the day. Next, the difference of tints as the neutral point were approached would diminish until the hue of ordinary sky tint at the time would be seen. The polarization of the sky is most perfect when the sun is above the horizon. When the sun is above the cross-polarization is rarely apparent, and at the point of best polarised sky-light the residual colour is bluish grey. Hence, cross-polarization cannot be due to this cause, for the residual light is that light which is unpolarised, and at the neutral point the sky-light is the residual light. But throughout my scrutiny this point is rarely reddish, and is never tinted with any comparison to the sky that is farther away still from the sun side;

this applying especially to the time when the display commences.

On the other hand, the observations seem to afford most conclusive evidence that the variable element water is, and that dust is not, the cause for these magnificent displays. Professor Tyndall, in his experiments into the formation of clouds by the action of light when *scrupulous freedom from dust was ensured,* found sometimes as many as four reversals of the plane of polarization, which may at times be also seen in the sky when cirrus clouds are forming. He showed that the position of the neutral point depended upon the degree of attenuation of the fumes or vapour employed. He showed that the effect of introducing various fumes among the common air motes did not change their character of polarization, simply making it more bright, whilst he showed that various vapours did alter the plane of apparent polarization. I here quote portion of his remarks wherein he says:—"But when a puff of aqueous cloud or of the fumes of hydrochloric acid, hydriodic acid, or nitric acid is thrown into the beam there is a complete reversal of selenite tints. Each of these clouds twists the plane of polarization 90°." Then again, his experiments on the Alps show that the alpen glow exhibits the phenomena of apparent cross-polarization, whilst the tints he describes must have equalled in beauty if not in extent those of the crepuscular glimmer. The glows in the locality mentioned could not have been due to dust, for his experiments on bacterial life go far to show that no dust was carried into those localities, and irrespective of this the tints are observed at the times when vapour would most likely be condensed.

The fact observed by Arago that the light of the halos is partially polarised in planes tangential to their circumference seems to show that they consist of refracted light, whilst the light of the rainbow, being completely polarised in radial planes, shows that water in various forms is competent to fulfil all conditions required in the crepuscular glimmer.

There are certain relations to the barometer and to temperature which I should be happy to communicate at some future time, the points not thoroughly dealt with for want of time being as follows:—The streamers; their angles, positions, and colours. Dew point; its relations. The barometer; its relations. The red glow on the dark side of the sky, and the order of colours then coming into view. The ordinary twilight existing often as long as the red tint, stars being visible through both. The clouds being seen as dark objects on high background any evening whether there be red tints or not. The streamers never occuring when clouds are absent. Their existence when there has only been the yellow sunset tints, the rays having similar tints. And various other points all favouring the vapour theory.

Descriptions of New Species of South Australian Plants.

By Professor Ralph Tate, F.G.S., F.L.S., &c.

[Read October 7, 1884.]

Sisymbrium procumbens.

A small glabrous annual, with a few prostrate branches radiating from a leafy rosette, usually under six inches diameter. Radical leaves on long petioles about one inch long, oblong, coarsely toothed or shortly pinnatifid; stem leaves few, lyrate-pinnatifid to spathulate. Flowers small, few, yellow. Fruiting racemes of the lateral branches about one inch long with slender spreading pedicels; the pedicels about two and a-half lines long, shorter than fruit; from the radical rosette there arise a few flowers borne on erect pedicels, the fruiting pedicels longer than the pods. Pod broad, about six inches long, blunt at the top, and slightly attenuated at the base, tipped by a short broad persistent stigma. Valves nearly flat, with a prominent midrib, and conspicuously longitudinally and reticulated veined. Sepals spreading, overtopping the yellow petals. Seeds small, ovate, moderately compressed.

Claypans near Termination Hill, Lake Torrens Plain, flowering in September. *R. Tate.*

Among Australian congeners, *S. procumbens* approaches to *S. nasturtioides*, from which it differs in habit, form of leaves, in the spreading not erect fruiting pedicels, stouter pods, &c.

Kochia pentatropis.

A perennial, with a hard, almost woody base, and a herbaceous erect stem of about two feet high, with short ascending branches not usually exceeding six inches. Branches and stem clothed with a white dense cottony wool, amongst which are long soft spreading hairs; young foliage pilose. Leaves rather crowded, sessile, alternate, varying from linear and semiterete to linear-spathulate, obtuse, rather thick, a-half to three-quarters of an inch long. Flowers solitary, axillary. Fruiting perianth, with hard obconic tube two lines long, with five very prominent vertical membranous wings, bordered by an incomplete horizontal membranous expansion of four to five lines diameter; summit of the perianth shortly pyramidal. The five lobes closing over the fruit are pilose at their tips.

Calcareous loamy soil between Mounts Playfair and Parry, Aroona Range, and spreading thence along course of Mount Parry Creek. *R. Tate.*

This species has close affinity with *K. triptera*, and though the number of vertical wings is normally five for the one and three for the other, yet the latter has occasionally a fourth, as already indicated by Bentham, and the former has the fifth sometimes diminutive. Despite these approximating characters, there is the difference in habit, in shape and size of the fruiting perianth and its accessory parts, whilst the silky hairs of *K. pentatropis* is peculiar. In *K. triptera* the horizontal wings are united to form a complete ring, but in *K. pentatropis* the union is incomplete, there being always either one segment free or the continuity of the ring interrupted by at least one sinus decurrent along a vertical wing; moreover, the horizontal wing is more or less lobed between the vertical wings.

Pultenæa graveolens.

A wide-spreading shrub, usually about three, but attaining to five feet high; branchlets lax, somewhat drooping; branchlets, leaves, and calyx clothed with white soft hairs. Leaves alternate, oblong-linear, two lines long, obtuse or minutely pointed, margins slightly incurved, midrib prominent on the underside, shortly stalked. Stipules narrow-lanceolar, very small, persistent, yellow hyaline, and viscid while young. Flowers solitary in the upper axils, on peduncles half or nearly the length of the subtending leaf, forming short leafy terminal racemes. Bracteoles two, narrow-lanceolar, small, persistent, adnate to near the base of the calyx-tube, yellow-hyaline and viscid while young. Calyx ciliate, about one and a half lines long; lobes lanceolate, fine pointed, longer than the tube, the two upper ones broader and not so deeply cleft. Corolla fully twice as long as the calyx; standard, oval-cordate, a little longer than broad, yellow tinged with red at the margin and streaked with the same colour at the base; wings spathulate, yellow, as long as the standard; keel a little shorter than the wings, pale-yellow, with the upper half reddish-brown, brighter coloured on the inside. Stamens ten, free, of unequal length. Style filiform, glabrous, curved, a little longer than the stamens. Ovary longitudinally ridged, silky-hairy. Pod triangular-ovate in outline, half as long again as the calyx, valves slightly curved transversely, surface carunculate and covered with appressed silky hairs. Seed one, attached near to the base of the fruit by a strophiole, oval of a reddish colour except around the hilum, where it is black.

The foliage emits a strong odour like that of spirit contaminated with animal matter.

This species forms thickets in the open parts of the stringybark forest at Uraidla, Mount Lofty Range, flowering in October. *R. Tate.*

In Mr. Bentham's arrangement of the species *P. graveolens* will find a place in the Section Cœlophyllum, in the neighbourhood of *P. procumbens.*

Pultenæa viscidula.

An erect shrub of three feet, branches and branchlets more or less clothed with short spreading hairs, the growing ends of the latter covered with a viscous exudation. Leaves linear-terete, slender, obtuse at the end, and attenuated into a short stalk, mostly about half an inch long, channelled above by the involute margins, shortly setose. Stipules small lanceolar, opaque, blackish-brown, while young translucent yellow. Flowers few in an umbel at the end of the branchlets, shortly stalked amongst many bracts; pedicels one and a half lines long, curved. Bracts imbricate, much shorter than the pedicels, ovate, bifid and bluntly keeled. Bracteoles inserted close under the calyx, concave and keeled, strigosely-hairy on the keel, shorter than the calyx tube. Calyx under two lines long, the two upper lobes acuminate, the others somewhat narrower and acute, strigosely hairy. Petals unknown. Pods two and a half lines long, ovate acuminate; valves very convex, pubescent.

Under the shade of *Eucalyptus corynocalyx* at Karatta, on the Stun'sail Boom-river, Kangaroo Island. *R. Tate.*

P. viscidula belongs to the Section Cœlophyllum, and should have a place near *P. hibbertioides*, from which it differs by the nature of the vestiture, viscosity, form of stipules and pod, short bracteoles, &c.

Hydrocotyle crassiuscula.

A stout glabrous annual with diffuse stems elongated to one foot or more, but not rooting at the nodes. Leaves three-fourths of an inch in diameter, divided to the petiole into three oblong cuneate lobes, each with two or three short segments. Stipules broad, jagged. Peduncles short, each with an umbel of ten or more small flowers on short pedicels finally as long as the fruit. Petals valvate. Fruit more than one line broad, but not so long, didymous; the dorsal rib much elevated, acute but not winged, the intermediate ribs semicircular acutely prominent with a few minute tubercles in the enclosed pit, and a single row on the outside. Carpophore persistent.

This species is closely allied to *H. trachycarpa*, from which it differs conspicuously in its coarser growth, more deeply divided leaves, shorter peduncles, and denser umbels.

Sandy heath-ground on the elevated central part of Dudley Peninsula, Kangaroo Island, flowering in November. *R. Tate.*

Hakea Ednieana.

A tree of about twelve feet, with a somewhat hemispheric outline; branchlets and leaves clothed with short, appressed silky hairs. Leaves terete, once or twice bifid or trifid, rigid and pungent-pointed; the whole leaf usually under one and a half inch long, the divided portion somewhat longer than its stalk-like base. Flowers unknown; inflorescence a short raceme borne on a short axillary peduncle. Fruit one and a quarter inch long, three-eights inch broad, nearly straight except in the apical part, which is attenuated into a short upward-curved beak. Seeds unknown, but the impressions in the interior of fruit-valves indicate a smooth seed and a large wing.

Sparsely distributed over the stony slopes of the Aroona Range, bordering the Basin of Lake Torrens on the east. *R. Tate.*

When first observed by me, more than a year ago, the trees of the species were without flowers, and though my friend Mr. Malcolm Murray has since then frequently visited them, yet no advance to floral development has been made. Despairing to obtain the desiderated floral organs, at least for some time to come, I have thought it advisable no longer to defer the publication of those characters which seem to entitle the plant to specific rank; and in doing so I have much pleasure in imposing on it one of the names of the Conservator of Forests, Mr. J. Ednie Brown, F.L.S., whose "Forest Flora of South Australia" claims some complimentary recognition by the systematic botanist.

The protracted period intervening between the successive blossomings of this species is not singular, as other arboreous vegetation of this region exhibits the same phenomenon, notably so *Melaleuca glomerata*, which flowered during the exceptionally dry summer of 1883 after an interval of at least three years.

H. Ednieana has the unique foliage of *H. purpurea*, but in other particnlars it seems to be markedly different.

Stipa Muelleri.

Stems several feet long, wiry, slender, quite glabrous, with erect branching flowering shoots, sometimes scrambling over bushes. Leafless, except closed sheaths at the joints terminating in a small erect lamina, and membranous sheathing scales at the base of the stem. Ligule very short, not ciliated. Flowers racemose, of one, two, or three one-flowered spikelets on long filiform pedicels. Outer glumes exceeding one inch, acute; exterior glume purplish, inner green. Flowering glume on a rather long silky-hairy stipes, seven lines long, adpressed silky-hairy, the hyaline involute margins ending in a very thin acute lobe on each side of the awn, fully two lines long. Awn glabrous or minutely scabrous, stout, three inches long. Palea as long as the entire base of the glume, glabrous or minutely pubescent. Superior lodicule linear lanceolate, hyaline, two and a-half lines long; the inferior lodicules shorter, linear-oblong, opaque-white, hyaline and toothed at the end. Stamens three, anthers five to six lines long, with divergent and hair-tufted points.

Open parts in the stringybark forests (*Eucalyptus obliqua*) at Uraidla, Mount Lofty Range, and scrub lands about Mount Jagged, towards Encounter Bay; flowering in October. *R. Tate.*

The species is dedicated to Baron Sir F. von Mueller, F.R.S., as a slight tribute of my personal esteem, and in grateful acknowledgment of the assistance rendered me in my studies of South Australian plants.

Among Australian congeners this new species occupies a place near *S. flavescens* and *S. teretifolia*, from both of which it is conspicuously different by its branching leafless habit and paucity of flowers.

Additions to the Flora of Extra-Tropical South Australia.

Compiled by Professor Ralph Tate, F.G.S., F.L.S., &c.

[Read October 7, 1884.]

Sisymbrium procumbens, Tate. Claypans on Lake Torrens Plain, at the foot of the Aroona Range. *R. T.*

Bergia ammanioides, Roth. Fl. Aust., I., 180. Cooper Creek at Innaminka. *James McLeod!*

Triumfetta Winneckeana, F. v. M., in "Supplt. Census Plants of Australia." Central Australia.

Kochia pentatropis, Tate. Between Mounts Parry and Playfair, Aroona Range. *R. T.*

Scleranthus diander, R. Brown. Fl. Aust., V., 260. South Australia. *F. v. M.*, in "Supplt. Census," &c.

Isotropis Winneckeana, F. v. M., in "Supplt. Census," &c. Central Australia.

Pultenæa graveolens, Tate. Stringybark forest at Uraidla, Mount Lofty Range. *R. T.*

Pultenæa viscidula, Tate. Sugar-gum tree forests at the Stun'-sail boom River, Kangaroo Island. *R. T.*

Templetonia aculeata, Bentham, Fl. Aust., II., 170. Kanyaka, Flinders Range. *Mr. S. Dixon!*

Bauhinia Carronii, F. v. M., Fl. Aust., II., 295. Central Australia. *F. v. M.* in "Supplt. Census," &c.

Acacia erinacea, Bentham, Fl. Aust., II., 345. Eucla. Com. by *F. v. M.*

Haloragis digyna, Labillardiere, Fl. Aust., II., 475. Eucla. Com. by *F. v. M.*

Eucalyptus Oldfieldi, F. v. M., Fl. Aust., III., 237. Finke River, *H. Kempe.* Com. by *F. v. M.*.

Hakea Baxteri, R. Brown, Fl. Aust., V., 501. Near Eucla. *W. McMinn.*

Whilst engaged on the construction of the telegraph line across the Bunda plateau Mr. McMinn gathered seeds of native plants, from which Mr. F. C. S. Driffield succeeded in raising a Hakea. This Hakea has in the last two seasons borne flowers and fruits, and from these materials, obligingly placed at my disposal by Mr. Driffield, the above specific determination has been made.

Hakea Ednieana, Tate. Stony slopes of Aroona Mountain and Mount Parry. *R. T.*

Hydrocotyle crassiuscula, Tate. Dudley Peninsula, Kangaroo Island. *R. T.*

Pterigeron adscendens, Bentham. Fl. Aust., III., 533. S. Australia *F. v. M.* in "Supplt. Census &c."

Senecio platylepis, DeCandolle. Fl. Aust., III., 662. S. Aust. *F. v. M.*, op. cit.

Centunculus minimus, Linn. This addition to the Flora of Australia was obtained by me, in November, 1882, in abundance on swampy ground about Mount Graham, Lake Edward, and at Lowan near Tarpeena in the South-East; but in deference to the opinion of Sir F. von Mueller the insertion in the list of indigenous species was withheld; however, that author has since found it himself at Mount Macedon, Victoria, and has catalogued it in his recent "Supplement of the Plants of Australia."

Veronica Anagallis, Linn. This species grows abundantly in the swamps about Lake Bonney, Millicent, and Mount Graham, and as it is unaccompanied by its usual European associates—*e.g.*, *Nasturtuim officinale*, *Sium angustifolium*, *Œnanthe spp.*, *&c.*, it may be of endemic origin.

Mimulus gracilis, R. Brown. Fl. Aust., IV., 482. Swamps near Penola. *Samuel Dixon !*

The *M. gracilis* of my census belongs to *M. prostratus;* but the inclusion of the true *gracilis* can now be retained through Mr. Dixon's discovery made last year.

Buechnera linearis, R. Brown. Fl. Aust., IV., 515. S. Aust., *F. v. M.* in "Supplt. Census, &c."

Heliotropium tenuifolium, R. Brown. Fl. Aust., IV., 399. Central Australia. Com. by *F. v. M.*

Schœnus sculptus, Boeckel. Fl. Aust., VII., 376. Dudley Peninsula, Kangaroo Island, *R. T.* Port Lincoln. *Samuel Dixon !*

Stipa Muelleri, Tate. Open places in stringybark forests at Uraidla, Mount Lofty; heathy ground around Mount Jagged, Encounter Bay. *R. T.*

MISCELLANEA.

BOTANICAL NOTES.

By Professor Ralph Tate, F.G.S., F.L.S., &c.

[Read October 7, 1884.]

1. Kangaroo Island.

(a) Additions to the Flora:—

Threlkeldia diffusa was inadvertently omitted from my list published in last year's volume of the Transactions; it grows near the shore-line at American Beach, at Queenscliffe.

Templetonia retusa. Sand-hills at Cape Hart, Dudley Peninsula (T. W.* !)

Helipterum exiguum. Hog Bay River (T. W. !)

Thelymitra antennifera. Between Emu Bay and Discovery Flat (F. W. H.† !)

Prasophyllum elatum. Dudley Peninsula (Mr. T. Willson !)

Pterostylis barbata. Hog Bay River (T. W. !)

Caladenia dilatata, R. Br. Emu Bay to Discovery Flat (F. W. H. !)

Caladenia filamentosa. Hog Bay River (T. W. !) Emu Bay to Discovery Flat (F. W. H. !)

Caladenia latifolia. Same as last.

(b) The following species are no longer restricted in South Australia to Kangaroo Island, having been observed in the respective localities annexed:—

Hydrocotyle tripartita, at Lowan, near Tarpeena (R. T.)

Lobelia platycalyx, at Lake Edwards (R. T.), and at Yallum, Penola, by Miss Allen !

Schœnus sculptus, at Port Lincoln, by Mr. S. Dixon !

(c) Additional Localities:—

Drosera Menziesii, Thomasia petalocalyx, Kennedya prostrata, Pomaderris obcordata, Styphelia Richei, and *S. ovalifolia,* at Hog Bay River (T. W. !)

Grevillea ilicifolia. Between Emu Bay and Shoal Bay and towards Kinch's Station (F. W. H. !)

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* T.W.—Mrs. T. Willson, of Hog Bay River.

† F.W.H.—Mr. F. Wm. Hicks, sometime resident near Emu Bay.

Diuris longifolia and *Caladenia deformis*. Emu Bay to Discovery Flat (F. W. H.) and Hog Bay River (T. W.!)
Caladenia carnea. Emu Bay to Discovery Flat (F. W. H.!)
Pterostylis præcox. Hog Bay River (T. W.!)

2. River Murray.

The following species, which are additions to the flora of this region, were observed by me in January of this year:—
Hibiscus Krichauffianus. Desert towards the Victorian Boundary.
Atriplex semibaccatum, *Erechthites quadridentatus*, and *E. arguta*. On the river-alluvium east from Overland Corner.
Sarcostemma australe, as a low shrub with erect stiff branches; on the desert between Chowilla and the Boundary.
Ottelia ovalifolia. Lagoons and still waters of the river above Overland Corner.
Lappago racemosa. Desert beyond Chowilla.
Danthonia nervosa and *Eragrostis diandra*. Alluvial flats above Overland Corner.

3. Adelaide District.

Scleranthus pungens and *Quinetia Urvillei*. Cliff slopes by the sea between Marino and Hallett's Cove (R. T.).
Scirpus littoralis. Margins of the River Torrens; it grows also at Wilpena Pound (R. T.).

4. Lake Torrens District.

Salicornia tenuis. Stony ground on Mount Parry, Aroona Range (R. T.).

BIBLIOGRAPHICAL NOTICES.

Recent Papers relating to the Palæontology of South Australia.

1. Fossils from near Mount Hamilton and Peak.

By W. H. Huddleston, in "Geological Magazine," August, 1884, p. 339.

Here are figured the following, to which the appended notes are mine:—

Natica, sp. *N. variabilis*, Moore.
Myacites (?) australis, n. sp. May be a *Pleuromya*.
Cytherea Woodwardiana, n. sp. Genus uncertain.
Cyprina, sp. A cast; generic position very doubtful.
Modiola linguloides, n. sp. A good species.
Gervillia angustata, n. sp. Founded on very obscure impressions.

Avicula orbicularis, n. sp. *Monotis Barklyi*, Moore.

The author remarks that the general facies is not dissimilar to Jurassic, but nevertheless inclines to agree with R. Etheridge, jun., that the fossils are Cretaceous.

The new material does not help to the solution of the question as to the age of our Mesozoic beds, and it will be well to hold to my opinion that they are Jurassic, as the fauna has slight community of species with the Jurassic rocks of West Australia, and none at all with the Queensland Cretaceous.

2. On some Cretaceous Fossils from Queensland.

By R. Etheridge, jun., in Trans. Roy. Soc., N.S.W., vol. xvii.

A species of *Aucella* is figured and described with the specific name of *A. Liversidgei*, but in a supplemental note is referred to *Avicula Hughendensis*, R. Etheridge, sen.

This is identically the same as the species of *Aucella* referred to by me (Trans. Roy. Soc., S. Aust., 1882), which was obtained from a wellsinking 260 feet deep at Mombra, near Mount Browne, on the frontier of New South Wales. The deposit yielding this fossil must therefore be placed on the horizon of the Queensland Cretaceous beds.

3. Remains of Trilobites from South Australia.

By Henry Woodward, in "Geological Magazine," August, 1884, p. 342.

This communication deals with two species of trilobites obtained from the Parara limestone, near Ardrossan, which are named *Dolichometopus Tatei* and *Conocephalites australis*. The generic determinations confirm the opinion previously expressed by me of the Lower Silurian age of the beds, the author remarking that "these trilobites are clearly of Lower Silurian age, being equivalent to the Swedish, Bohemian, Tasmanian and North American beds with similar fossils."

Ralph Tate.

ABSTRACT OF PROCEEDINGS

OF THE

Royal Society of South Australia,

For 1883-84.

Ordinary Meeting, November 6, 1883.

H. T. Whittell, M.D., President, in the chair.

Ballot.—Messrs. H. C. Mais, M.I.C.E., and F. W. Andrews were elected a Fellow and Corresponding Member respectively.

Prof. Tate moved, in accordance with a written notice of motion signed by five Fellows, and presented at the last meeting of the Society—"That Rule 37 be altered, so as to allow of the election of six other members of Council instead of four, as at present." The motion was put, and unanimously carried.

W. Haacke, Ph.D., and W. E. Pickels were then elected members of the Council.

H. T. Whittell, M.D., in a short eulogistic speech, proposed a vote of thanks to the retiring President, Mr. Charles Todd, C.M.G., which was carried with acclamation.

Prof. Lamb, M.A., made some remarks upon the "Persistency of Electrical Currents in Masses of Iron," and gave the results of his experiments in the matter. As the latter were not yet complete, he decided to withhold for the present their publication.

Mr. J. G. O. Tepper, F.L.S., read some notes upon "Algæ found in St. Vincent Gulf," and exhibited specimens. He also gave some particulars respecting species of Paropsis and Heminoptera shown by him.

Ordinary Meeting, December 4, 1883.

H. T. Whittell, M.D., President, in the chair.

Ballot.—Messrs. W. E. Chapman, R. Thomson, E. H. Wainwright, B.Sc., and R. L. Mestayer, C.E., were elected Fellows.

Exhibits.—Prof. Tate showed two new specimens of stipa, namely *S. Muelleri* and *S. teretifolia*, one found at Kingscote and the other at Uraidla. Also, *Pultanea graveolens* from Uraidla, and *Mimulus gracilis* from near Penola.

W. Haacke, Ph.D., gave a description of six new medusæ found by him in St. Vincent Gulf.

Mr. G. Goyder, jun., gave some particulars respecting the action of carbonated waters upon iron pipes in the vicinity of Gawler.

Ordinary Meeting, February 5, 1884.

Prof. Tate, F.G.S., in the chair.

Ballot.—Messrs. H. St. Munton, D. J. D. Beresford, and J. W. Bussell were elected Fellows.

Exhibits.—Prof. Tate, F.G.S., showed an abnormal growth of the common *Sonchus oleraceus*. Mr. C. Todd, C.M.G., exhibited and explained an electric water level indicator, and also a miniature Gramme electrical generator. He also made some remarks upon the two comets, Pons-Brook and Ross.

Mr. W. E. Pickels, F.R.M.S., referring to the desirability of a Postal Microscopical Exchange Society, moved—"That this meeting recommend to the Council of the Royal Society of South Australia that the Hon. Sec. (W. L. Cleland, M.B.) be requested to co-operate with the Hon. Sec. (W. E. Pickels, F.R.M.S.) of the Field Naturalists' Section in drawing up a circular to be issued to the Fellows of the Society and Members of the Section, intimating that the Postal Microscopical Society of Victoria proposes to forward slides for examination. and requests slides in return.

Mr. Pariss Nesbit having seconded the proposition, it was carried.

Mr. S. Dixon sent a communication respecting the supposed discovery of coal at Kangaroo Island to the effect that he was positive that it was washed up by the sea either from some vessel or very distant place.

Mr. James Stirling, F.L.S., forwarded "Notes upon a Geological Sketch Section of the Australian Alps." In 1867 he spent a long time on the southern portion of Western Australia searching for coal, and found it in every instance undoubtedly brought there by the sea, as the whole coast between Cape Arid and Doubtful Island Bay was miocene resting on granite and micaceous schists. He had been induced to make the expedition owing to the late Mr. Roe, Surveyor-General of Western Australia, reporting the existence of coal on the Fitzgerald River, and it was thought some connection might exist between the known occurrence of the bitumen and the reported beds of coal; but the supposed coal was nothing but a thin bed of brown lignite.

Ordinary Meeting, April 8, 1884.

H. T. Whittell, M.D., President, in the chair.

Ballot.—Messrs. W. L. Neale, Otto Bœttger, W. S. Scannell, and Revs. John Watson and Robert Kelly were elected Fellows, and Mr. H. Hodgson was elected an Associate.

EXHIBITS.

Prof. Tate showed a specimen of stratified pebbles occurring in a rock at Hog Bay, and referred to in his paper upon the geology of Kangaroo Island.

Mr. J. G. O. Tepper, F.L.S., also exhibited a portion of rock from Hog Bay, showing a stratification of ironstone, with other minerals.

Mr. C. L. Wragge, F.R.G.S., laid on the table a piece of pumice stone found floating in the sea off the Straits of Sunda. The vessel passed through something like 500 miles of it.

The Rev. W. R. Fletcher, M.A., read notes respecting the Fish River Caves in New South Wales, which he had lately visited.

Prof. Tate, F.G.S., moved—"That the gossip meetings of the Royal Society and the evening meetings of the Field Naturalists' Section be held conjointly at least once a month."

Mr. Thos. D. Smeaton seconded, and the motion was carried.

Ordinary Meeting, May 6, 1884.

H. T. Whittell, M.D., President, in the chair.

EXHIBITS.

Prof. Tate, F.G.S., showed a specimen of *Stiphelia Woodsii* from Kangaroo Island, found by Mr. J. G. O. Tepper. The only other locality previously known for it being near Penola.

Mr. J. G. O. Tepper, F.L.S., showed a woody fungus shaped like a common mushroom, with turned-up edges like a frill, from Queenscliff, K.I. Also a leathery puff-ball with a large quantity of mycelium enclosing fine sand, from Mount Lofty.

Prof. Tate, F.G.S, exhibited a living echidna obtained from near Mount Gambier, which appeared to differ from the species found upon Kangaroo Island in having a shorter snout, and in the possession of a larger quantity of black hair and soft quills.

Prof. Tate, F.G.S., elicited from the members of the Board of Governors of the Adelaide Institute present, namely, Dr. Stirling and Mr. C. Todd, C.M.G., the statement that the Board were determined to avail themselves of the assistance of Australian scientific specialists in the work of classifying the zoological specimens at the South Australian Museum whenever possible.

Mr. C. L. Wragge, F.R.G.S., read a paper on the probable causation of the phenomena of the red glow after sunset.

Ordinary Meeting, June 3, 1884.

H. T. Whittell, M.D., President, in the chair.

Ballot.—Mr. E. Spiller was elected a Fellow.

EXHIBITS.

Prof. Tate, F.G.S., laid on the table a specimen of wulfenite (molybdate of lead) found near Quorn; a piece of plumbago from Mount Charles, Onkaparinga; a *Scirpus littoralis* found on the banks of the Torrens Lake; and some basalt containing in cavities some crystals, probably of arragonite and hyalite, from Mount Gambier.

Mr. J. G. O. Tepper, F.L.S., showed a mass of brown mycelium of a leathery texture, found in the heart-wood of a decaying eucalypt.

Prof. Tate, F.G.S., read the first part of a paper entitled a "Study of the Lower Murray."

Ordinary Meeting, July 8, 1884.

H. T. Whittell, M.D., President, in the chair.

Ballot.—Mr. P. O'Leary, M.R.C.S., England, was elected a Fellow.

EXHIBITS.

Mr. J. G. O. Tepper, F.L.S., showed a stipa, supposed to be *semibarbata*, from near Mount Lofty; a curious fibrous growth from beneath the bark of *Banksia marginata*.

Mr. E. Meyrick, B.A., forwarded a list of 180 micro-lepidoptera seen by him during a recent visit to South Australia.

Prof. Tate, F.G.S., read the second portion of his "Study of the Lower Murray."

Mr. J. G. O. Tepper, F.L.S., presented a paper giving particulars concerning a number of plants observed by him during a recent visit to the eastern end of Kangaroo Island.

Ordinary Meeting, August 5, 1884.

H. T. Whittell, M.D., President, in the chair.

The President mentioned that an invitation had been received from the American Academy of Sciences to appoint a delegate to attend a Science Congress at Philadelphia on September 3rd, 1884. It would be too late to send a delegate, but if any South Australian colonist was known to be travelling in that direction, it would be possible to appoint him by telegraph to attend as the representative of the Society.

Mr. C. H. Harris read a paper on "Variations of the Compass in South Australia, with some remarks on Terrestrial Magnetism."

Ordinary Meeting, September 2, 1884.

H. T. Whittell, M.D., President, in the chair.

EXHIBITS.

William Haacke, Ph.D., showed an albino specimen of the grass paroquet—*Euphenia multicolor*—the colour of the general plumage being changed into sulphur yellow; the colour of forehead, neck, shoulders, and rump changed into bright red. Also a new medusa of St. Vincent Gulf, and several specifically different *Idolea* from the same waters. Also an ovum found in the pouch of a female echidna, proving that the echidna, although a milk-giving animal, lays eggs which are hatched in the pouch.

Mr. W. A. Jones read a paper on the "Red Glow," advocating the aqueous theory of its formation.

Mr. Lionel Gee, C.E., was elected an Auditor for the current year.

Annual Meeting, October 7, 1884.

H. T. Whittell, M.D., President, in the chair.

Ballot.—Messrs. A. G. Abbott, George Gill, and F. Wheeler were elected Fellows.

Due notice having been given, it was proposed, seconded, and carried—"That Rule 38 be altered by the substitution of the words 'Public Library, Museum, and Art Gallery' in place of 'South Australian Institute.'"

The alteration of Rule 37, made at a meeting held November 6th, 1883, was also approved.

EXHIBITS.

Mr. H. C. Mais, M.I.C.E., showed photographs of sections of wood taken in the United States of America.

W. Haacke, Ph.D., exhibited two photographs and dissections of a female *Echidna hystrix*, in the pouch of which he had found the ovum shown at the last meeting. There was only one large pouch, not two small semicircular fossæ, as seen by Professor Owen. The large pouch evidently acted as an incubator for the ovum, and probably disappeared after the hatching of the young, only two small semilunar fossæ being left. He pointed out also that his specimen showed small tufts of hair on the mammary aveola, now discovered by him in several male echidnæ, which on being dissected were found to possess unmistakeable rudimentary milk glands, thus showing that the generally adopted belief that such glands were missing in the male monotremata was discredited by facts.

Mr. A. Molineux remarked that he had observed that many of the shark tribe, and especially the *Cestracion* (Port Jackson shark), exuded blood from the skin of the abdomen and on the edges of the fins when dying, and that this occurs even when every precaution is taken to prevent the fish from injuring itself after capture.

Prof. Tate forwarded papers on the "Lamellibranchs of the Older Tertiary of South Australia;" "Description of New Species of Plants in South Australia;" "Additions to the Flora of Extra-Tropical South Australia;" and "Miscellaneous Botanical Notes."

The Hon. Secretary read the Annual Report as follows:—

ANNUAL REPORT.

The Council has the honour of reporting that the work of the Society has been carried on successfully during the past year, the following papers having been laid before it:—"The persistence of Electric Currents in Masses of Iron," by Prof. Lamb, M.A.; "Notes upon Two Rare Insects," by J. G. O. Tepper, F.L.S.; "Some Algæ of Gulf St. Vincent," by J. G. O. Tepper, F.L.S.; "Some New Medusæ of Gulf St. Vincent," by W. Haacke, Ph.D.; "The Fish River Caves of New South Wales," by the Rev. W. R. Fletcher, M.A.; "The Red Glow," by C. L. Wragge, F.R.G.S.; "Microlepidoptera of South Australia," by E. Meyrick, M.A.; "A Study of the Lower Murray," by Prof. Tate, F.G.S.; "Plants of Kangaroo Island," by J. G. O. Tepper, F.L.S.; "Conspectus Familiarum of Foreign Coleoptera at the S. A. Museum," by J. G. O. Tepper, F.L.S.; "Variations of the Compass in South Australia," by C. H. Harris; "Action of Carbonated Water on Iron Pipes near Gawler," by G. Goyder, jun.; "Remarks on Pons-Brooks and Ross Comets," by C. Todd, C.M.G.; "The Electrical Water-Level Indicator," by C. Todd, C.M.G.; "The Ovum of the Echidna," by W. Haacke, Ph.D.; "The Red Glow," by W. A. Jones; "The Lamellibranchs of the Older Tertiary of South Australia," by Prof. Tate, F.G.S.; "Description of New Species of Plants in South Australia," by Prof. Tate, F.G.S.; "Additions to the Flora of Extra-Tropical South Australia; and Miscellaneous Botanical Notes," by Prof. Tate, F.G.S.

The exhibits have fully sustained the character of those of previous years by their variety and value. At a meeting held September 2nd, 1884, Dr. Haacke exhibited the ovum of an echidna which he had obtained from the pouch of a living specimen in his possession. A special interest to the whole scientific world attaches to this, as it is the first recorded exhibition of such an ovum before any scientific society, and Dr. Haacke may fairly claim a priority in the actual demonstration of the oviparous character of the birth of the echidna.

The membership of the Society consists of 126 Fellows, 12 Hon. Fellows, 14 Corresponding Members, two Life Members, and three Associates, making an increase of eight since last year. Several names have been removed from the roll, on account of death and other causes, so that the actual increase is small, although the nominations and elections during the year compare favourably with that of former ones. Amongst other deaths, your Council would specially refer to that of Mr. C. A. Wilson, who had been a Fellow of the Society for more than thirty years. During the earlier period of his membership he devoted himself with great zeal and devotion to the pursuit of natural history, confining his attention chiefly to the varieties of the Coleoptera with which the colony abounds. He always took a great interest in the affairs of the Society, and was ever a leading member, until of late years his continually-increasing ill-health obliged him to retire more into private life.

Since the last annual meeting the Field Naturalists' Section has become an accomplished fact, and from the large number of members on its roll the Council hopes that it has in this way met a popular want, and that a valuable nursery has been started, whence the Society may ultimately receive a supply of working Fellows. To further the object aimed at by the Section, the Council has during the year paid to it a grant of £10 to meet preliminary expenses.

A radical change in the constitution of what was formerly the Adelaide Institute has necessitated a corresponding change in the relations of the Society to that body—the Society no longer being incorporated with it. In future it will stand in the position of an affiliated Society to the Public Library, Museum, and Art Gallery of South Australia. The rapid increase in the School of Design, &c., &c., has necessitated the Society removing from the old room into a more commodious place in the new wing of the Museum. During the transition from the one place to the other the Council of the Adelaide University very generously put one of its lecture-rooms at the disposal of the Society, for which the warmest thanks of your Council are due.

During the past year a request has been received from the Librarian of the Public Library, Museum, &c., for a large increase in the number of the Society's Proceedings supplied (150), which your Council feels flattered in thinking indicates an increased appreciation of the work performed by the Society. The list of foreign exchanges is also ever on the increase, and amongst others is now included the Royal Society, London.

A postal microscopical exchange has also been established with the other colonies, which, it is to be hoped, will stimulate the Fellows to the formation of a section for microscopic work which shall emulate the original work now done in the natural science domains of the Society.

It being felt that many of the Fellows would appreciate some systematic teaching in natural science, it was resolved to hold the gossip meetings and the evening meetings of the Field Naturalist Section conjointly; and from the large attendance your Council has every reason to be satisfied with the result.

Owing to our representative on the Board of Governors (Mr. Todd) having been chosen as one of the Government members under the new Act, it has been necessary for the Council to elect a substitute. The decision fell upon Dr. Whittell, and his election must afford every gratification to the Fellows and Members.

Your Council has very reluctantly had to accept Prof. Tate's resignation of his seat on the Council, with its attendant offices. During Prof. Tate's connection with the Council he has devoted himself to the Society with an enthusiasm and devotion that has raised the Society from the status of a Literary Club to the distinguished position of a Scientific Society, and has made its Proceedings sought after by other scientific bodies eager for the acquisition of new facts in natural science. The very arduous duty remains for you to fill his place with a suitable occupant.

To make the Council more representative of the various branches of science contained in the Society the number of members of Council has been increased from four to six.

During the year a number of valuable works of reference and monographs have been received.

The financial statement was then made, and showed that the receipts during the year had been £269 17s. 6d., and the expenditure £229 13s. 4d. The balance in the Bank was £64 19s. 7d., and £250 was placed on deposit.

On the motion of Mr. S. Tomkinson the report aud balance-sheet were adopted.

The report of the Field Naturalists' Section was received, and appears elsewhere.

The President (H. T. Whittell, M.D.) then delivered his address.

President's Address.

It is a time honoured custom for the President of a Society which has for its object the promotion of science to deliver at the close of his year of office an address, in which it is expected that he will give a brief review of the Society's operations during the year that has passed, and also bring under notice some one or other of the more prominent inquiries to which his attention may have been specially directed.

The report which our Secretary has just read gives a short but accurate account of the year's proceedings. One of the more important of these has been the formation of the Field Naturalists' Association as a Section of this Society. That Section owes its origin to a desire expressed by a number of young men—perhaps I should be right if I were to say of young women also—to band themselves together for the purpose of mutual assistance in the practical study of the more elementary branches of natural science. The Section has been well looked after by its Secretary, Mr. Pickels, and it has had the advantage of having Professor Tate for its guide and instructor. A more capable man for this work does not exist in the Australian colonies. It is no wonder that the Section has succeeded, for with such a leader failure would be scarcely possible. And this reference to the learned Professor reminds me that what the Field Naturalists' Section has gained the parent Society has lost. The report just read has informed you that Professor Tate, after many years of efficient work on our behalf, has resigned his position and offices in connection with the Council, and has left a gap in our ranks which all of us know too well will be difficult to fill. I can but emphasize the regret expressed by the Council that the Professor has felt it necessary to retire.

During the year we have been favoured with papers on a variety of interesting subjects by members and gentlemen who take an interest in our Society. Among the contributors I may mention Professor Lamb, Professor Tate, Mr. Meyrick, the Rev. W. R. Fletcher, Dr. Haacke, Messrs. Wragge, Harris, Jones, Tepper, and Todd, some of whom have on more thay one occasion placed us under obligation. But undoubtedle the most memorable event in our year's proceedings, will be that which gives to our Society the proud boast of being the first at which the discovery was announced, by one of our own Fellows, (Dr. Haacke) that the echidna—one of the lowest types of mammalia—is oviparous, and is one of the long-sought-for connecting links between mammals and the lower classes of vertebrata. It is not my purpose to-night to discuss the views of evolutionists on the one hand or of believers in special creation on the other. Doubtless most of us have arrived at conclusions on these subjects; but whatever those conclusions may be, we shall all be ready to welcome a discovery which will leave through all time a broad mark on the historical records of scientific research, and confer lasting honours on those who have been engaged in bringing it to light. Most of us know that another naturalist announced almost simultaneously his independent discovery of the same fact. We are not at present informed when Mr. Caldwell arrived at his conclusion; but without wishing to withhold for one moment any portion of the honour that is due to him, I claim for Dr. Haacke priority as being the first to announce publicly his discovery, and the first to exhibit at a meeting of a scientific Society the egg taken from the pouch of the echidna, by which he was enabled to demonstrate the accuracy of his observations. I venture on behalf of this Society to offer to our learned *confrere* our warmest congratulations. Some credit, too, is due to our assistant Secretary (Mr. Molineux), who has been at work for some months in obtaining specimens from Kangaroo Island with the view of enabling naturalists in Adelaide to pursue their investigations.

I propose in the present address to bring under your notice the influence of micro-organisms in the production and propagation of that class of diseases which are of an infectious nature, or—to use the old-fashioned but not less expressive word of our grandmothers — which are "catching." Most members of this Society will be familiar with the fact that various animal parasites of a low type are known to live and grow in animals of a much higher organization. The papers read before the Society by Dr. Thomas on Hydatids, and by Dr. Mann on the Blood Filaria, have informed us of the destructive effects of these parasites in the internal organs of their host. In these cases we have to do with organisms of comparatively large size. You will also remember that many vegetable parasites exist and destroy living tissues, each after its own peculiar fashion. We find *sarcina* in the stomach, *oidium albicans* in the mouth, and *trichophyton tonsurans* in ringworm of the scalp and elsewhere. These, too—although the last one will split a hair till it resembles a crossing-sweeper's broom —are comparatively large, their effects are chiefly local, and they do not produce constitutional disturbance. Some of these, however, manifest a characteristic which, in the still lower organisms, is more distinctly marked. They have the property of infection. Every schoolmaster is familiar with this in the plague of ringworm so troublesome at times in our larger schools. Passing from these to organisms which are more minute, and probably of a lower type, I shall ask you to note for a few moments one or two simple experiments, which, although made on non-living material, will prepare the way for further study.

If we take any kind of organic matter—whether animal or vegetable is of no consequence—and place it in water and expose it to the air at a moderate temperature we shall see after a day or two a very thin pellicle floating on the surface. If we examine a small portion of this under a moderately high power we shall find that for the most part it consists of minute spherical or rod-shaped bodies, many of which from their peculiar gliding or undulating movements we know to be alive. If we watch them for a sufficient time we shall get further evidence of their vitality by seeing them grow, divide, and multiply. If we repeat our experiment with different materials and under varied conditions we shall find that, although the living bodies that grow in our solutions have a strong family likeness, there are differences in shape and in mode of motion which enable us to attempt some form of classification. Some of them look like simple round points; some are more rod-shaped; while others, again, are long and narrow. Some appear to be quite motionless; others glide slowly along from one side of the field to the other; while others, still, will be seen to wriggle with a spiral corkscrew kind of motion from point to point. It's a busy world we are looking at. We shall see, further, that, although all of them are minute, there are considerable differences in size, some of them being many times larger than others. If we try to obtain with the highest powers at our disposal a more intimate knowledge of their organization we find them exceedingly simple in structure—in fact, they appear to be nothing more than minute masses of protoplasm, which are probably enclosed in a cell membrane. For a long time they were supposed to belong to the animal kingdom, and their movements gave some support to this view; but in later times most observers place them in the lower orders of plants, some botanists classifying them as algæ, while others with perhaps more reason assign them to the fungi. In the French school they are commonly known as *les microbes*. In England they are more frequently included under the common term Bacteria. In one form or another they exist everywhere—in the air, in the water, and in the soil. As to their origin, there has been much contention. Some observers have gone so far as to maintain that they originate by self-generation, while others more cautious and more numerous concur with Pasteur and Tyndall that wherever we find them they owe their existence to previously existing germs, which in different modes have found their way into the fluid or structures in which they are discovered.

If we had taken the organic fluid used in the experiment already noted, and if instead of exposing it to the air we had put it into a small flask, and after boiling it for some time we had hermetically sealed up the mouth of the flask or had put into its neck a stopper of baked cotton wadding, it is probable that the fluid would have remained unchanged for an indefinite time. The boiling would kill all the Bacteria in the fluid, and the cotton would prevent the entrance of any fresh organisms from the air. If we had repeated the boiling for a few days in succession the probability would be reduced to certainty, assuming of course that all the necessary precautions were taken. A fluid so prepared is said to be sterilized, and may be used as a culture fluid for the growth of Bacteria. If we pass into it an infinitesimal quantity of a liquid containing any special form of bacterium, the bacterium will grow and multiply, chiefly by fission, and will commonly also form minute refractive granules, which in process of time will be liberated from the containing cell and fall to the bottom of the flask. These granules or spores are the seed from which new growths of Bacteria exactly like the original stock can be readily started. And just as we find it easy to kill young plants by cold or heat or injury, although the seed of such plants will bear all kinds of rough usage without harm, so, although fully developed Bacteria can be easily killed by heat and other means, the spores are almost indestructible. Germicides have but little effect on them. Alcohol will not kill them, and they have been known to germinate even after from eight to ten hours boiling.

We have seen that there are differences in form and size among the Bacteria. It is probable there are numerous varieties of species, and even of genera, which the best microscopes yet provided will not enable us to distinguish sharply one from another. We can form some opinion of this by the differences in the changes they produce in the fluids or substances in which they flourish. Some of them are probably harmless enough, but we have knowledge of many which are highly destructive, and which even produce powerful poisons in solids and liquids brought under their influence. I need only remind you of the change of the sugar of grape juice into alcohol by the action of one form of these organisms, of the conversion of alcohol into acetic acid by another form, and of the change of one of the constituents of milk into lactic acid by another form. The Bacteria, though invisible, are always working, playing, even in their destructiveness, an essential part in the progressive alternations of organic life.

We have as yet noticed the Bacteria in their relation to dead organic matter only, but we must now approach the question: Have these organisms any existence in the living body, and, if so, have they any special role either in health or disease? This is a question easier to ask than to answer. We are liable to errors, both of observation and of interpretation; but, so far as our best observers, aided by the most perfect microscopical appliances at command, have been able to learn, there is a general agreement—(1) That Bacteria do not exist in the fluids or tissues of an animal in health; (2) that in some diseased conditions, and particularly in diseases of an infectious nature, Bacteria can, as a rule, be found in abundance; (3) that in some of these diseases the Bacteria can be distinguished one from another by special modes of observation; (4) that they can be further distinguished by culture in sterilized fluids; (5) that the Bacteria cultivated in such fluids have the property of communicating a disease to healthy animals exactly resembling that affecting the animal from which the infecting material was obtained; and (6) that it is possible by modes of culture, and other means, to modify the virulence of some of the most dangerous Bacteria to such a degree that when fluid containing them is inoculated into a healthy animal it produces but a slight temporary effect, but sufficient to protect the animal for an indefinite period from further infection. These are the revelations of modern science. Let it be understood that I do not claim that all these points have been ascertained with respect to all infectious diseases. There is no need to overstate the case. I shall hope to show you that in some of these diseases the facts are established beyond a doubt, and that reasoning by analogy we are justified in the inference that what is true of some is probably true of the whole class.

Time will not permit me to take up the several points I have enumerated in regular series. I prefer, therefore, to discuss them generally; but before doing so I ask you to allow me to introduce a lesson in microscopical technology, for the want of which many well-meaning observers have fallen into errors. Many of the objects we are dealing with are so extremely minute that when magnified under glasses, which give distinct images of objects magnified in the proportion of an inch square to a square of 50 yards, do not appear larger than pins' heads, and even when so magnified would probably be invisible if not stained by a process perfected by Koch in his researches on infectious diseases. Objects so minute require special methods of examination, and I think Koch and workers of like rank are justified in refusing to notice the objections of less practised observers, who have neglected to follow the special means which they believe to be essential for successful demonstration. Koch insists on the use of oil immersion lenses, of high angle, and in the use of a powerful substage condenser (Abbe's), used without any diaphragm, so that the object shall be lighted up by an intense glare of light. I must confess that when I first heard of this mode of showing stained Bacteria I felt that if anyone had asked me "How not to do it?" I should probably have suggested some such mode of illumination. A practised microscopist is very fussy about his illumination: he works with but little light—just sufficient to bring out details, and no more. He stops out the light by diaphragms. Dallinger's best work was done under an illumination in which all the light passed through a mere pinhole, and I have no doubt that many microscopists have been deterred from following Koch's directions by a desire to preserve the details of the picture, all of which are lost under strong illumination. But on further study we find that this is the great object Koch has in view. Finding in practice that Bacteria stain much deeper than other structures in aniline dyes, he reasoned that if all the objects that are less deeply stained could be blotted out, or rather, dazzled out of the picture, and nothing remain in view but the darker colour picture of the deep-stained Bacteria and a few other objects not likely to be mistaken for them, it would be possible to distinguish these, although in a less illumined field they could not be picked out from other objects in view. General experience has proved that he is right.

I shall not ask you to burden your memories with the tiresome details of classification, but it is necessary for our purpose that we bear in mind that in disease there are at least four distinct forms of Bacteria to be recognised—(1) There is the minute rounded body—the micrococcus, existing either separately or in chains; (2) the short cylindrical cell—the bacterium proper; (3) the longer and more filamentous cylindrical cells, either isolated or in chains—the bacillus; and (4) spiral undulating filaments—the vibrio and spirillum. It is probable that in their stages of development some of these pass through different forms; but our knowledge on this subject is incomplete. In bringing to your notice the association of some of these bodies with disease we will begin with one of the most simple.

Let us take a common acute abscess. Dr. Odgston shall be our guide. This gentleman found that a small drop of matter from an acute abscess, when dried on a slide, stained and observed after Koch's method, presents to view an immense number of micrococci scattered about the field. When a minute portion of such matter was inoculated into a second and healthy animal, abscesses formed in this second subject, and the pus in these was also loaded with micrococci. A third animal inoculated from the second showed the same results, and in this way the disease could be passed on from animal to animal through an indefinite series. In some animals the cocci were found in the blood, and when this was the case well-marked constitutional disturbance was observed. There are some forms of abscesses known as cold chronic abscesses, which do not contain cocci, and in twenty inoculations with matter from these Odgston failed to develop either an abscess or constitutional disturbance. There is, therefore, an obvious connection between the micrococci and the infective properties of the pus. But Odgston carried his experiments further; he cultivated the micrococci outside the body. He made a small hole in an egg, and by suitable means he introduced a drop of pus from an acute abscess into the end farthest from the hole. He covered the opening with antiseptic dressing, and kept the egg in an incubator at 98° temperature during ten days. The egg remained sweet and fresh, but chains of micrococci were found in the albumen. A drop of this albumen was injected into an animal's back. An abscess was formed, and numerous micrococci were found in the pus, and also in the blood of the animal. These experiments were repeated, and varied by inoculating a second egg from the first, and after inoculation of an animal from this egg the same results were observed as in the first experiment.

Let us turn to another example—one of a more complicated character. It has been known from the earliest history of medicine that the injection into the tissues of a healthy body of a small quantity of putrid matter is usually followed by alarming and sometimes fatal consequences. Sometimes the animal dies in a few hours; in other cases there is a stage of incubation, in which no symptoms show themselves. Then comes fever, and after this either recovery or death. The chemists and biologists have discovered that in putrid matter there is a chemical compound (sepsin) which is an active poison, and also numerous Bacteria. When an animal dies a few hours after inoculation, he dies with symptoms of poisoning, and no abnormal growths are found in the blood or tissues. But if the animal escape the action of the poison, and dies afterwards in the second mode I have described, then we find Bacteria in most parts of the body. Koch's experiments on mice will serve as an illustration. Koch injected five drops of putrid blood into mice, and the animals died in from four to eight hours. No Bacteria could be found in the blood, nor did the fresh blood of the poisoned mouse produce any effect when injected into another mouse. If a smaller quantity of the putrid blood were injected the effects were different. Some mice escaped without injury, but others became ill and died in from two to three days. Now mark the difference. The blood of these mice was infectious, and the disease could be transmitted from one mouse to another even with only the tenth of a drop of blood. Koch carried this on through seventeen successive inoculations, and always with the same results. He inferred that the mice were killed by a micro-organism, but for a long time his closest scrutiny failed to discover it. At last, after prolonged search and the adoption of the mode of observation I have previously described, he discovered in the blood of these mice an immense number of bacilli, which were so minute as to escape detection under all the ordinary modes of examination. So long as these could be found in the blood, so long was the blood infectious; but so soon as they disappeared the blood could be injected into another animal without risk. And here we may notice a curious fact, which is probably true of all the infective Bacteria—each species appears to have its own favourite *habitat*. They flourish in some species of animals, but die or have no effect in others. Thus Koch found that if he inoculated a field mouse instead of a house mouse with infected blood the animal was not susceptible. I am not unmindful that objections have been frequently urged against the conclusions drawn from experiments of this kind on the ground that the Bacteria in these cases are the accidental products of other changes, and not the cause of the abnormal conditions in which they exist. I shall therefore bespeak your patient attention to another infectious disease, in which the life history of a rather large form of bacillus has been so thoroughly worked out by Davaine and Pasteur in France, Koch and others in Germany, and Klein in England, as to leave no room for such objections. I refer to a disease known under many names, but more commonly as charbon anthrax, splenic fever, or malignant pustule. Long before bacteria were thought of, all the world knew that anthrax was infectious from animal to animal, and in some cases from animal to man. In some Continental districts it has caused terrible destruction of cattle and sheep. In England it is less prevalent, but many workmen woolsorters and workers on skins have fallen victims to it. Twenty years ago its cause was unknown. All sorts of theories were invented to account for its existence. Of course climatic influence, weakness of system, faulty secretions, bad diet, damp pasturage, and all the other thousand and one makeshifts for covering ignorance were made to do duty. At length Davaine, attracted by some experiments of Pasteur, turned his attention to anthrax, and discovered that in the bodies of animals, dead from the disease, there exists rather large forms of bacillus, which appeared to him to be different from the ordinary micro-organisms found in putrefaction. He was not long before he found that this bacillus could be inoculated from one animal to another, and that the inoculated animal became affected with anthrax, like the one from which the inoculating material had been obtained. On these facts he based his theory that the bacillus is the cause of the disease. There is in science, as in politics, a good old Toryism, with a mission of obstruction. It is a poor mission at best, but doubtless in the evolution of truth it has its uses. The use it served with respect to this new theory of anthrax was to set many inquirers earnestly to work in many lands until one by one objections have been silenced, and it is doubtful whether to-day any pathologist of any pretentions would question the correctness of Davaine's conclusions. Let us look at the facts. Not only can the disease be communicated by inoculation from animal to animal, but the bacillus can be cultivated almost indefinitely. If a drop of anthrax blood be put into one of the sterilized flasks and maintained at blood temperature the bacillus will grow in profusion for several days. A drop taken from this flask will set going new growths in a second one, and a drop from this will start a third, and so on, down to the fiftieth, or even the hundredth generation, and yet a drop from the last culture will as certainly produce anthrax after inoculation as if the original drop of blood were the infecting agent.

In experiments on the anthrax bacilli many other interesting facts have been brought to light. The development of the spores and their resisting power against destructive agents have been well studied. It has been ascertained that these spores are not formed in the bodies of living animals, nor will the anthrax grow in a dead animal unless atmospheric air be present. The same applies to the bacillus under cultivation. Pasteur found that without air the organism does not flourish. Klein confirms this by experiments that show that in the upper stratum of a culture liquid abundant spores are formed, while the rods and filaments lower down, being more removed from the air, remain sporeless. Pasteur found, further, that temperature has a marked influence on the growth, and he reports a curious fact that in chickens, with their blood at the normal temperature—which as you remember is higher than in sheep—anthrax will not develop, but if the temperature be reduced two or three degrees by placing the lower part of the body in cold water the bacillus will flourish. If a chicken in which anthrax has been thus developed be warmed the disease will be cured. So, again, if a sheep or a cow recover from anthrax the animal is proof against further attack. Another curious experiment has been reported, that rats fed on animal food are proof against anthrax, while those fed on vegetable food quickly succumb. These are gatherings by the way from which some day we may hope to obtain practical advantages.

We may here inquire how does the anthrax bacillus kill? So far as we can learn, it acts partly by depriving the blood of its oxygen, partly by blocking up the minute vessels of important organs, and partly by forming poisons in some of the fluids of the body, analagous to what occurs in the production of alcohol from sugar. It will therefore be understood that the symptoms are of a mixed character. A glance at them as they occur in man will serve as a type of what is seen in most acute infectious diseases. The symptoms may be either local or general. In the local symptoms there is destruction of the part affected. The general symptoms have been so well described by Mr. Spears in his report to the Local Government Board on the Bradford wool-sorter's disease, that I ask your attention to a condensed account. Mr. Spears says, the course of the disease is devisible into stages. At first we have the stage of incubation; next the stage of invasion; next the acute and stormy manifestations; next, unless the patient die, the stage of recovery, followed in some cases by secondary inflammatory action. The duration of incubation could not be accurately determined. In the stage of invasion there were chilliness, great bodily weariness, and mental depression, sometimes perspirations, restlessness, sighing, yawning, aching of the limbs, dizziness, nausea, and sometimes vomiting. After a few days the sufferer suddenly becomes worse, the prostration and restlessness are more marked, the respiration is accelerated, the pulse rises to between 100 and 140 per minute, the temperature becomes variable, and as the disease progresses there may be higher fever with a temperature of 104° or 105°, with a tendency to irregular downfalls. Then come violent headache, incessant vomiting, occasional delirium, together with signs of local congestions, followed in bad cases by death, sometimes from prostration and sometimes from profound coma. Many patients in Bradford suffered from this obscure fever. The workmen suspected a certain kind of wool—the mohair from the Van district in Asia Minor—and at some of the mills they adopted the plan of drawing lots to determine who should work this kind of wool. At the time of Mr. Spears' visit a sample could not be obtained, but evidence was forthcoming from other sources. The tissues of the patients who died were examined by Dr. Greenfield at the Brown Institute, and whole colonies of the anthrax bacilli were discovered. The inoculation of animals with these bacilli or with cultivations from them produced anthrax in the animals operated on. Besides this it occurred that about the time the workmen complained, the animals on a sewage farm on which the suds from the washing of the mohair had been distributed sickened with anthrax and died in numbers.

The evidence adduced proves that there is at least one infectious disease which owes its origin to the growth and development of micro-organisms within the body of its victim, and to this cause only. And if this be true of one, why may it not be true of others which, like it, are infectious, have their stages of incubation, full development, and of retrogression, show marked febrile symptoms, seldom occur more than once in the same patient, and present in their tissues, in many examples, peculiar forms of micro-organic growths? Why, in fact, may we not infer that every infectious disorder owes its origin to its own peculiar organism? Grant, if you will, that we are in the region of hypothesis; but in the absence of other satisfactory explanations it is reasonable to adopt the one which covers a larger number of facts than any other, and which every new discovery tends to confirm.

The evidence does not rest, however, on the form of disease. There are some diseases of animals in which the facts are almost as well worked out as in anthrax. There is also a fever which attacks man, and known as relapsing fever, in which one of the spiral Bacteria (the Spirochœte Obermeieri) is always found in the blood when the fever is at its height, and disappears as the fever declines. Monkeys have been successfully inoculated with this bacterium, and have taken the fever; and it is asserted that the same results have followed in the human subject after inoculation with blood taken from a patient while the fever was high, and that no effect was produced with blood taken from the same patient when no fever was present.

In nearly all the acute infectious diseases Bacteria in some form are to be found, and cultures can be obtained from them. In measles, diphtheria, erysipelas, smallpox, vaccine lymph, and, as I have lately found, in the hybrid chicken-pox, various forms have been discovered. The history of these is not worked out. So also in typhoid fever—with which we are all too familiar—Koch's assistants at the German Board of Health announced last year the discovery of a peculiar organism which they believed to be its cause. During the last few months I have been making independent researches, and all my investigations point in this direction. And let me note that the clinical history of the disease favours the germ theory of its origin, even though no specific organism can be fixed on as its starting point. Typhoid has been carefully followed up and investigated by Government medical officers in England, and there is a uniform agreement that this fever is a disease associated with the filth of human excreta. There is strong evidence that this excreta is only infective when mixed with some of the secretions of a patient already affected. This accounts for persons being affected from drinking water from wells into which there is soakage from closets, or from a reservoir polluted by sewage, or from drinking milk supplied from some distant dairy where patients are suffering. Here in Adelaide, only a few months ago, the Central Board of Health traced twenty-three cases of typhoid to a dairy where a child was ill with the disease. In all these instances there must have been something capable of infecting the water or the milk, and this must have been something having the property of growing and increasing in the medium in which it existed. If this be not a micro-organism I must leave it to others to determine its nature. We are all interested in the discovery of the causes of that devastating malady—cholera—which now and again sweeps across Europe like a plague from its Indian home. Our newspapers have told us that the German Government sent Koch to Egypt, and afterwards to India, to investigate this disease. It is humiliating that a foreign Government should undertake a work which England ought long ago to have taken in hand; but we are none the less thankful for the light which Koch's observations have thrown on this disease. These observations have led to the discovery of a bacillus in the intestines of cholera patients which sufficiently differs in shape from others, as in Koch's opinion, to be distinguishable. It is thicker at one end than at the other, and being curved resembles a comma. Hence it is called the comma bacillus. The same bacillus was found in a tank from which the patients had drawn their supply of water. It could be cultivated like the other Bacteria, but for obvious reasons it could not be experimented with on human beings, and as cholera is not a disease of the lower animals the crucial test is not available. Koch found that this bacillus has a peculiar mode of development under cultivation; it has not been observed to form spores, and it is easily killed by absence of moisture. Supposing them to be the cause of cholera, we have the consolation of knowing that if they once become dry there is no further danger. Koch has given demonstrations before a Commission in the South of France, and this Commission confirms most of Koch's conclusions. Our British Government has lately sent Klein and Gibbes to India to make further investigations, and we await with more than ordinary expectation the result of their work.

There is another discovery of Koch's which has an interest in every part of the world where consumption or tuberculosis is known. Ever since I can remember there has been a suspicion in the medical mind that consumption is sometimes infectious. Within the last few years our German *confrère* discovered the existence of a bacillus in tubercular matter, which can be distinguished from all other micro-organisms, except that of leprosy, by its retention of aniline dye when submitted to processes which discharge the colour from other Bacteria. This bacillus can be cultivated, and if a drop of the culture fluid is inoculated into animals they soon succumb, and tubercle is found in all parts of their internal organs. These observations have been repeated all over the world, and the fact may now be considered as established. I can but hint at the great changes which this discovery must bring about in the diagnosis and treatment of tubercular disorders. I shall have an opportunity presently of showing you a group of these bacilli found in a particle of expectoration from a consumptive patient in the Adelaide Hospital. The demonstration will be made after Koch's method, and with the illumination he so strongly insists on.

We must hasten on. What will be the practical issue of these discoveries? If it be established that every infectious disease has its own peculiar germ on which its existence depends, we have gained for the first time in the history of medicine a clue to these diseases. We get rid of the fogs of speculation and come into the light. We know at least in what direction to work in order to stamp out the enemy. Already some promise of this is being given. I was a member of the International Medical Congress in London when Pasteur startled us with the announcement that he had discovered and put to the test methods of attenuating the virus of more than one infectious disease, whereby he could safely vaccinate—as he chose to call it—animals so as to protect them from future attack. The evidence he adduced was based chiefly on experiments with the bacilli of anthrax. He had found that the bacillus ceased to grow in sterilized liquids at about 112°, although the cultivation was easy at about 107°. At this latter temperature no spores are produced. By regulating the time as well as the temperatures he obtained bacilli with different degrees of virulence, and vaccination with the lower degree protected animals from infection by the higher. At length he obtained an attenuated virus which could be safely used for protective purposes. This was an important discovery for France, where it is stated more than twenty million ("plus de vingt millions d'animaux") animals are affected with anthrax annually. The first experiment was made on fifty sheep—twenty-five were vaccinated and the other twenty-five not vaccinated. A fortnight after the vaccination all of them were inoculated with anthrax virus—the twenty-five vaccinated sheep escaped, the other twenty-five died. The success of the experiment was so marked that Pasteur and his assistants vaccinated in the departments near to Paris, in a fortnight, 20,000 sheep and a large number of cattle. There is no reason to doubt Pasteur's success in these experiments. It is, however, to be regretted that other experimenters, and particularly Klein in England, have not met with the same success in their attempt to follow Pasteur's mode of preparing his attenuations, nor have the attenuations prepared by Pasteur himself proved in Klein's hands to be so protective as was at first anticipated. It has been suggested that there are conditions necessary to certain success which even the great French chemist has not quite mastered; but that there is a basis on which to work no one who listened to Pasteur's address can doubt. I may mention here a remarkable discovery of Klein's, made while engaged on his anthrax experiments. This observer found that although he failed to confirm Pasteur's results, he could protect sheep against virulent anthrax by passing the virus through a mouse. If the blood of a mouse dead from anthrax were inoculated into a sheep there was a slight rise of temperature, but no further development of disease; and some sheep thus treated, and afterwards inoculated with strong virus four times in succession, remained free from harm. This is analogous to the attenuation of smallpox virus by the inoculation of a cow—a discovery by Jenner—which in our own times has done more for the human race than any other discovery of modern times. Is it not probable that what is true of smallpox and of anthrax may be true of all the other infectious diseases, and that steady research may enable us to attenuate the virus of all of them so as to obtain complete immunity? The tendency of discovery is in this direction. Pasteur is again to the front. Only a mail or two ago we got intelligence that after some four years' work he was able to announce that he had succeeded in attenuating the virus of that most intractable and most horrible of all infectious diseases hydrophobia, and that with this attenuated virus he could prevent animals bitten by rabid dogs being infected. He demonstrated this before a Commission in France by experiments on 38 dogs. Of these 19 were vaccinated with the attenuated virus, and all of them were shown to be proof against infection. Of the other 19 not vaccinated, six were bitten by rabid dogs, and three of them became mad; and of the others inoculated by injection of virus all became mad except two. The mode of attenuating the virus in these experiments is different from that employed in anthrax. It resembles that of Jenner for smallpox, and of Klein for anthrax. Pasteur found that the virus passed through some animals—rabbits and guinea pigs—increased in virulence, but on its being passed through monkeys it became gradually weaker, until at last it was so reduced that protection to dogs was afforded by inoculation.

Our time will not permit me to proceed further. I have but glanced at the subject under notice, but I hope sufficient has been brought out to show that we are on the threshold of a vast inquiry. In pursuing it we shall make many mistakes, but the light will come, and even our mistakes will serve as beacons against future errors. All real progress is slow. It was not till 200 years after an English writer described the parasite of that loathsome disease, the itch, that the evidence was accepted; and yet this affection is external, and the parasite is large enough to be seen with the naked eye. Now and then the discovery of the parasite was reported, but few believed it, and down to our own time little or nothing was known of its nature. We find some of the older writers stating that the disease was caused by a chemical sort of phlegm, by a peculiar ferment in the blood, by a bilious humour of the body, by deranged secretions, and so on without end. I could find you books of recent date where the same rigmarole is still indulged in to account for typhoid and other fevers. At the close of last century Lorry denied that anyone had ever seen the parasite of scabies or its eggs, and contended that the parasitic theory could not be true—(1) Because some acute diseases had been cured as soon as the itch broke out; (2) because it was known that the itch was driven in to external organs; (3) because many serious diseases could be cured by the inoculation of itch. Change the name of the disease and I will find you modern parallels equally conclusive. As late as 1833 Cazenave wrote that as to the immediate cause of scabies "it is still entirely unknown. Some have attributed it to the presence of an insect, but we believe ourselves authorized to think that the acarus scabiei has no existence." Within a year of that time there was not a clinic in Europe where the acarus had not been exhibited. If then it required 200 years to complete an inquiry of this kind under the most favourable conditions, need we be discouraged if under conditions infinitely more difficult to control, we find our progress slow, or if now and again we have to retrace our steps through straying into wrong paths. Remember that we have a grand object before us, the stamping out of all infectious diseases. Some of us cannot hope to live long enough to see this consummation, but we are encouraged to believe that younger men will take up the work which older and, it may be, feebler hands have begun; and when I look round this Society, and on its younger offspring—the Field Naturalists' Section—and when I witness that we have amongst us gentlemen who already are showing interest in microscopical and biological research, am I anticipating too much when I cherish the belief that when the chronicle shall be written of those who have helped on the work of investigation, there may be found therein the names of some South Australians who shall have been led to take their first steps by that spirit of inquiry which is the aim of this Society to create and foster.

Election of Officers.

The election of officers for the coming year was as follows:—President, Professor Lamb, M.A.; Vice-Presidents, H. C. Mais, M.I.C.E., and H. T. Whittell, M.D.; Hon. Treasurer, Walter Rutt, C.E.; Hon. Secretary, W. L. Cleland, M.B.; Council, Rev. W. Howchin, F.G.S., W. E. Pickels, F.R.M.S., R. L. Mestayer, C.E., D. B. Adamson, Charles Todd, C.M.G., and W. Haacke, Ph.D.

THE TREASURER IN ACCOUNT WITH THE ROYAL SOCIETY OF SOUTH AUSTRALIA.

Dr.	£	s.	d.	Cr.	£	s.	d.
To Balance brought forward	275	13	7	By Transactions	97	16	11
Subscriptions	97	12	6	Printing and Advertisements	20	16	3
Sale of Transactions	3	8	6	Natural History Section	50	0	0
Natural History Section	25	0	0	Assistant Secretary—Salary	21	0	0
Government Grant	130	18	6	Caretaker...	1	10	0
Interest on Deposit Receipt	12	0	0	Postage and Sundries	6	0	2
				Cupboard...	32	10	0
				Deposit Receipt	250	0	0
				Balance in Bank...	64	19	9
	£544	13	1		£544	13	1

Audited and found correct.

LIONEL C. E. GEE,
Auditor.

THOMAS D. SMEATON,
Treasurer.

6th October, 1884.

DONATIONS TO THE LIBRARY

For the Year 1883-4.

I.—Transactions, Journals, and Reports.

Presented by the respective Societies, Editors, and Governments.

Ballarat School of Mines—Annual Report, 1883.

Baltimore—American Chemical Journal. Vol. V., Nos. 4 and 5 and 6.

——— American Chemical Journal. Vol. VI., Nos. 1 to 8.

——— John Hopkins University Circulars. Vol III., Nos. 25 to 32.

Batavia—Natuarkundig Tijdschrift voor Nederlandsch-Indie. Vol. XLII. and XLIII.

Belfast—Proceedings of the Belfast Natural History and Philosophical Society for 1882-3.

Berlin—Sitzungberichte der Königlich-Preussichen Akademie der Wissenschaften zu Berlin. Nos. XXII. to LIII., and Index.

Bordeaux—Memoires de la Société des Sciences Physiques et Naturelles de Bordeaux. Second series; Tome IV.; Parts 1 and 2; 1880.

Boston—Memoirs of the Boston Society of Natural History. Vol. III., No. VI., 1883.

——— Proceedings of the Boston Society of Natural History. Vol. XXI., Part 4; Vol. XXII., Part 1; 1883.

——— Proceedings of the American Academy of Arts and Sciences. New Series. Vol. IX. Vol. X., 1882.

Buenos Aires—Boletin de la Academia Naçional de Ciencias en Cordoba (Republica Argentina). Tomo VI.; Entrega 1, 1884.

Cambridge, U.S.A.—Annual Report of the Curator of the Museum of Comparative Anatomy at Harvard University for 1882-83.

——— Bulletin of the Museum of Comparative Anatomy at Harvard College; (Whole Series, Vol. VIII. Geological Series, Vol. I.) No. 9 on the Relations of the Trianic Traps and Sandstones of the Eastern United States. No. 10 The Folded Heidelberg Limestones east of the Catskill.

Cambridge, U.S.A.—Bulletin of the Museum of Comparative Anatomy at Harvard College. Vol. XI., No. 1, Reports of the results of Dredging. Vol. XXI., Report on the Anthozoa, and on Some Additional Species dredged by the "Blake" and by the "Hawk." No. 2, a Chapter in the History of the Gulf Stream.
Nos. 3, 4, 5, 6, 7, 8, 9.
No. 10, Biblography.
No. 11, Acalephs.

Cassel—XXIX. and XXX. Bericht des Vereines für Naturkunder zu Cassel uber die Vereinesjahre vom 18 April, 1881, bis dahin, 1883.

Cincinnati—Scientific Proceedings of the Ohio Mechanics' Institute. Vol. I., No. 4, 1884.

Davenport—Proceedings of the Davenport Academy of Natural Sciences. Vol. III., parts 1, 2, 3.

Edinburgh—Royal Society of Edinburgh. List of Members, Fellows, Council, &c., 1884.

Göttingen—Nachrichten vom der K. Gesellschaft der Wissenschaften und der Georg-Augustus Universitat zu Göttingen. Aus dem Jahre, 1882.

Lausanne—Bulletin de la Société Vaudoise des Sciences Naturelles. Serie 2, vol. XIX., No. 89; vol. XX., No. 90.

Leicester—The Midland Medical Miscellany and Provincial Medical Journal. Vol. III., No. 28.

London—British Mail. January, 1884.

——— Medical Press. No. 2,357. July 2, 1884.

——— Transactions of the Entomological Society of London for 1883.

——— Proceedings of the Royal Colonial Institute. Vol. XIV.

——— Proceedings of the Royal Society. Nos. 220 to 226.

——— Journal of the Royal Microscopical Society. Series II., vol. III., parts 5 and 6; series II., vol. IV., parts 1, 2, 3, 4.

——— List of Fellows of the Royal Microscopical Society.

Montreal—Catalogue of Canadian Plants. Part I., Polypetalæ (Geological and Natural History Survey of Canada).

——— Report of Progress; 1881-82-83 (Geological and Nat. Hist. Survey of Canada); also maps.

Munich—Königlich-Bayerischen Akademie der Wissenschaften,
——— Sitzungberichte der Mathematisch-Physikalischen Classe; 1882-1883.
——— Abhandlungen der Mathematisch-Physikalischen Classe.

New Zealand—Eighteenth Annual Report on the Colonial Museum and Laboratory, together with the Fourteenth Annual Report on the Botanic Garden, New Zealand.

Nova Scotia—Transactions and Proceedings of the Nova Scotia Institute of National Science of Halifax, Nova Scotia; vol. VI., part 1.

New South Wales—Annual Report of the Department of Mines for New South Wales for 1883.
——— List of Exchanges and Presentations made by the Royal Society of New South Wales, 1883.
——— Journal and Proceedings of the Royal Society of New South Wales.
——— Royal Society, New South Wales Anniversary address by the President, H. L. Russell, B.A., M.D., F.R.A.S.
——— Proceedings of the Linnean Society of New South Wales; vol. VIII., part 3, 4; vol. IX., part 1, 2.
——— Report of the Trustees of the Australian Museum of New South Wales for 1883.
——— Report of the Free Library, Sydney, 1883-4.

Philadelphia—Proceedings of the Academy of Natural Sciences of Philadelphia. Part II., III, 1883; Part I., 1884.

Queensland—Proceedings of the Royal Society of Queensland. Vol. I.; part 1.

Rio de Janeiro—Archivos do Musen Nacional do Rio de Janeiro. Vol. IV., 1879; Vol. V., 1880.

Salem, U.S.—Bulletin of the Essex Institute, 1882. Nos. 1 to 12.

South Australia—Annual Report of the Governors of the South Australian Institute.
——— Annual Report of the Government Geologist, with plans, 1882-3.
——— Report on the Progress and Condition of the Botanic Garden, &c., for 1883.
——— Meteorological Observations made at the Adelaide Observatory in 1881. By the Government Astronomer, Chas. Todd, C.M.G., F.R.A.S., &c.

Tasmania—Papers ordered to be Printed (by the Legislative Council, &c).
———— Statistics of the Colony of Tasmania, 1882.
———— Census of Tasmania, 1881.
———— Report of the Royal Society of Tasmania for 1883.
Victoria—Statistical Register of Victoria for 1882. Part I., Blue Book; Part II., Population; Part III., Law, Crime, &c.; IV., Vital; V., Finance; VI., Population; VII., Production; VIII., Interchange.
———— Statistical Register of Victoria for 1883. Part I., Agricultural Statistics; II., Population; III., Finance.
———— Transactions and Proceedings of the Royal Society of Victoria. Vol. XX., 1883-84.
———— Census of Victoria, 1881.
———— Census of Victoria for 1882. General Report.
———— Census of Victoria for 1881. Part VII., Occupations of the People.
Vienna—Kaiserlich Akademie der Wissenchaften in Wien. Sitzung der Mathematisch-Naturwissenschaftliche Classe. Nos. 5 to 27.
——— Verhandlungen der Kaiserlich-Königlichen Geologischen Reichenstalt. Nos. 10 to 18.
——— Mittheilungen des Ornithologischen Vereines in Wien, 1884. Nos. 1 to 7.
——— Bieblatt zu den Mittheilungen des Ornithologeschen Vereines in Wien. Nos. 2 and 3.
——— Verhandlungen der K. K. Zoologisch-botanischen Gesellschaft. Jahrgang, 1883.
Washington—Daily Bulletin, &c., September, October, November, and December, 1877. Signal Officers U.S. Army.
———— First Annual Report of the Bureau of Ethnology, 1879-80. By J. W. Powell.
———— U.S. Geological Survey of the Territories. Second Annual Report, 1880-81.
———— Monographs II. Tertiary History of the Grand Canon District. Maps and Panoramas to the Twelfth Annual Report.
———— Wyoming and Idaho; parts 1 and 2.
———— Report of the Smithsonian Institution for 1881.
Würzburgh — Sitzungberichte der Physical-Medicenisch-Gesellschaft zu Wurzburg. Jahr., 1883.

Books and Pamphlets.

(Names of donors in italics.)

Australian Museum Governors—Catalogue of a Collection of Fossils in the Australian Museum.
British Museum Trustees—Fossil Sponges, British Museum.
Gardiner, M.—Determination of the Motion of the Solar System in Space.
——— Solution of the Celebrated Fundamental Question of Dynamics.
Hayter, H. H.—Handbook of Victoria.
——— Victorian Year-Book, 1882-3.
Macleay, W.—Catalogue of Australian Fishes; vols. I., II., and supplement.
Hector, James—Handbook of New Zealand, 1883.
Lamb, H.—On Electrical Motions in a Spherical Conductor.
Liversedge, A.—On the Bingera Meteorite, New South Wales. Preliminary notice.
——— The Deniliquin or Barratta Meteorite.
——— On the Chemical Composition of Certain Rocks, New South Wales, &c.
——— Rocks from New Britain and New Ireland.
Mueller, Baron F.—Observations on New Vegetable Fossils of the Auriferous Deposits.
——— The Plants Indigenous to Shark Bay and Vicinity.
——— Eucalyptographia: A Descriptive Atlas of the Eucalypts of Australia and adjoining Islands. Ninth decade.
Natterer, J.—Brasilische Sangethiere Resultate, von Reisen in der Jahren 1817 bis 1835.
Netto, L.—Aperçu sur de la Theorié de l'Evolution.
Radlkofer, L.—Ueber die Methoden in der Botanischen Systematik insbesondere die anatomische Methode.
Russell, H. C.—The Spectrum and Appearance of the Recent Comet.
——— Physical Geography and Climate of New South Wales.
——— The Sydney Observatory: History and Progress.
——— Results of Rain and River Observations for 1882.
——— Anniversary Address to Royal Society of New South Wales.

Schomburgk, R.—Description of Part of Femur of Nototherium Mitchelli. From Quarterly Journal of the Geological Society, August, 1882.
Stirling, Jas.—On the Caves Perforating Marble Deposits, Limestone Creek.
Tenison-Woods, J. E.—The Coal Resources of Queensland.
Thomas, J. D.—Hydatid Disease, with Special Reference to its Prevalence in South Australia.
Wyatt, W.—Monograph of certain Crustacean Entomostraca.
———— Some account of the Manners and Superstitions of the Adelaide and Encounter Bay Aborigines.
Salem—Pocket Guide to Salem, Mass.
——— Plummer Hall: its Libraries, its Collections, and Historical Associations.
——— North Shore of Massachusetts Bay: A Guide, 1882.

LIST OF FELLOWS, MEMBERS, &c.,

NOVEMBER 3, 1884.

Those marked (F) were present at the first meeting when the Society was founded. Those marked (L) are Life Fellows. Those marked with an asterisk have contributed papers.

HONORARY FELLOWS.

		Date of Election.
Angas, Geo. French, F.L.S., C.M.Z.S.	London	1879
Barkley, Sir Henry, K.C.M.G., K.C.B.		1857
Ellery, R. L. J., F.R.S.	Melbourne	1876
*Garran, A., LL.D.	Sydney	1853
*Hull, H. M.	Hobart	1855
Jervois, H. E. Sir W. F. D., K.C.M.G., C.B.	New Zealand	1878
Little, E.		1855
Macleay, W., F.L.S.	Sydney	1878
*Mueller, Baron F. von, K.C.M.G., F.R.S.	Melbourne	1879
Russell, H. C., B.A., F.R.A.S.	Sydney	1876
Warburton, Col. P. E., C.M.G.	Beaumont	1858
*Woods, Rev. J. E. T., F.L.S., F.G.S.	Sydney	1877

CORRESPONDING MEMBERS.

		Date of Election.
Bailey, F. M., F.L.S.	Brisbane	1881
Canham, J.	Stuart's Creek	1880
Chandler, T.	Peake	1881
*Cloud, T. C., F.C.S.	Wallaroo	1881
*East, J. J.	Mallala	1884
*Foelsche Paul	Palmerston	1882
Goldstein, J. R. Y.	Melbourne	1880
*Hayter, H. H, M.A., C.M.G., F.S.S.	Melbourne	1878
Holtze, Maurice	Palmerston	1882
*Kempe, Rev. J.	Finke, McDonnell Ranges	1880
*Richards, Mrs. A.	Fowler's Bay	1880
*Scoular, Gavin	Smithfield	1878
*Stirling, James, F.L.S.	Omeo, Victoria	1883
*Tepper, J. G. O., F.L.S.	Adelaide	1878

FELLOWS.

		Date of Election.
*Adamson, D. B.	Angas-street	1867
Abbott, A. G.	Kingston	1884
Angas, J. H.	Angaston	1874
Biggs, Col.	Edwardstown	1878
Beresford, D. J. D.	Adelaide	1884
Black, A. B.		1882
Bœttger, Otto	Flinders-street	1884
Brown, J. E., F.L.S.	Conservator of Forests, Adel.	1882
Brown, L. G.	Two Wells	1882
Browne, H Y. L.	Gov. Geologist, Adelaide	1883

Bruer, J.	King William-street	1883
Brunskill, Geo.	Morgan	1878
Burchell, F. N.	Adelaide	1881
Bussell, J. W.	Adelaide	1884
Campbell, Hon. A., M.L.C., L.R.C.P., Edin.	Adelaide	1882
Caterer, T. A., B.A.	Norwood	1882
*Chalwin, Thos., M.R.C.V.S.	Adelaide	1877
Chapple, F., B.A., B.Sc.	Prince Alfred College	1876
Chapman, W. E.	..	1883
Cleland, W. L., M.B., Ch.M., F.R.M.S.	Parkside	1879
*(L)Cooke, E.	Adelaide	1876
Cox, W. C.	Semaphore	1880
Cornish, W. H.	Adelaide	1883
Crawford, F. S.	Adelaide	1865
*Davenport, Sir Samuel	Adelaide	1856
Davies, Edward	Hutt-street	1882
Davis, F. W.	*Advertiser* Office	1882
Dobbie, A. W.	Gawler-place	1876
Driffield, F. S. C.	Adelaide	1883
Elder, Sir Thomas	Adelaide	1871
Evans, Thomas	Adelaide	1883
Farrar, G. E.	Adelaide	1882
*Fletcher, Rev. W. R., M.A.	Kent Town	1876
Foote, H.	Outalpa	1883
Fowler, W.	Kulpara	1882
Gall, D.	North Adelaide	1865
Gardner, Wm., M.D., Ch.M.	..	1882
Gee, Lionel C.E.	Adelaide	1882
Giles, George F.	Adelaide	1883
Gill, Geo.	Grenfell-street	1884
Gill, H. P.	Public Library, &c.	1883
Gosse, Charles, M.D.	Adelaide	1877
Gosse, John, M.R.C.S., Eng.	Wallaroo	1884
*Goyder, Geo., jun.	Adelaide	1880
Grundy, E. B.	Adelaide	1882
*Haacke, Wm., Ph.D.	Adelaide	1882
*Harris, C. H.	Adelaide	1883
Harrold, A. L.	Pirie-street	1876
Harry, Thomas	Adelaide	1878
*Haslam, John, C.E.	Adelaide	1883
Hay, Hon. A., M.L.C.	Linden	1861
Henry, A., M.D.	Adelaide	1882
Hill, W.	Mitcham	1884
Hopkins, Rev. W.	Glenelg	1880
*Howchin, W., F.G.S.	Goodwood East	1883
Hughes, H. W.	Booyoolie	1883
*Hullett, J. W. H.	Port Augusta	1876
Johnson, J. A.	Adelaide	1875
*Joyce, J. F., M.R.C.S., Eng.	Adelaide	1880
(F) Kay, R.	Public Library, &c.	1853
Kelly, Rev. Robert	Port Adelaide	1884
Knevett, S.	Adelaide	1878
Lamb, Prof., M.A., F.R.S.	Adelaide University	1883
Laughton, E.	Adelaide	1874
Leary, J. W.	South-terrace	1883
Lendon, A. A., M.D.	Adelaide	1884
Lloyd, J. S.	North Adelaide	1856

Magarey, A. T.	North Adelaide	1873
*Magarey, S. J., M.B.	Adelaide	1874
Mais, H. C., M.I.C.E.	Adelaide	1883
*Mayo, Geo., F.R.C.S., Eng.		1853
Mayo, G. G.	Adelaide	1874
Mestayer, R. L., C.E.	Adelaide	1883
*Meyrick, E., B.A.	Christchurch, New Zealand	1881
Middleton, W. J. E.	Kangarilla	1882
Mohan, J. H.	Crafers	1883
Molineux, A.	Kent Town	1880
(L)Murray, David	North Adelaide	1859
Munton, H. St.	Adelaide	1884
Nesbitt, W. Peel, M.B.	North Adelaide	1880
Neale, W. L.	Model School, Grote-street	1884
Nickolls, J.	Auckland, N.Z.	1883
O'Leary, P., M.R.C.S.	Port Victor	1884
Parker, Thos., C.E.	Port Adelaide	1883
Phillips, W. H.	Adelaide	1883
Pickels, W. E., F.R.M.S.	Adelaide	1883
Poulton, B., M.D.	Adelaide	1883
Rees, Roland, M.P.	Adelaide	1874
Rigaud, R. J.	*Register* Office	1882
Robertson, R., F.F.P.S.	Adelaide	1882
Rogers, Rev. N.	Moonta	1882
Russell, W.	Port Adelaide	1879
*Rutt, Walter, C.E.	Adelaide	1876
Salom, Hon. M.	Adelaide	1866
*Schomburgk, R., Ph.D.	Adelaide	1865
*Smeaton, Stirling, B.A.	Adelaide	1882
*Smeaton, Thos. D.	Adelaide	1857
Smith, E. Mitchell	Adelaide	1883
Smith, R. Barr	Adelaide	1871
Smith, William	Hydraulic Engineer's Office	1880
Smyth, C. B.	Hydraulic Engineer's Office	1884
Smyth, J. Y., B.A., B.E.	Norwood	1882
Sparks, H. Y.	Glenelg	1878
Spiller, E.	Government Printing Office	1884
*Stirling, E. C., M.D.	North Adelaide	1881
Stuckey, J. J., M.A.	Adelaide	1878
*Tate, Prof. R., F.G S.	North Adelaide	1876
*Thomas, J. D., M.D.	Adelaide	1877
Thow, Wm.	Woodville	1878
*Tietkins, W. H., F.R.G.S.	Millswood	1881
Thomson, R.	*Register* Office	1883
*Todd, Charles, C.M.G., &c.	Adelaide	1856
Tomkinson, S.	Adelaide	1876
Tyas, J. W.	Adelaide University	1882
Umbehaun, C.	General Post Office	1879
*Varley, A. K.	Mount Gambier	1883
*Verco, J. C., M.D.	North Adelaide	1878
Vickery, G.	Meadows	1868
Ware, W. L.	Adelaide	1878
Wainwright, E. H., B.Sc.	St. Peter's College	1883
Watson, Rev. John	Parkside	1884
Way, E. W., M.B.	Adelaide	1879
Way, S. J., Chief Justice	Adelaide	1859
Wheeler, F.	Adelaide	1884

White, R. A.	.. .. ..	Adelaide	1882
Whiting, J. B.	.. .. ..	Destitute Board Office ..	1882
*Whittell, H., M.D.	.. ..	Glenelg	1882
Woodward, H. O.	.. ..	Gov. Geologist's Office ..	1883
*Wragge, C. L., F.R.G.S.	.. ..	Torrens' Observatory ..	1877
Wyatt, Wm., M.R.C.S.	.. ..	Burnside..	1859
Young, Wm., M.A.	.. ..	Hindmarsh	1880

ASSOCIATES.

Burchell, D.	.. .. ..	Surveyor-General's Office ..	1883
Hodgson, Mrs.	.. .. ..	Port Victor	1884

APPENDIX.

TRANSACTIONS

OF THE

Field Naturalists' Section of the Royal Society

OF SOUTH AUSTRALIA.

This Section was established by a resolution of the Royal Society of South Australia on September 4th, 1883, and the rules adopted at the following meeting held on October 2nd, as recorded in Vol. VI. of the Transactions. In the first week of November Prof. Tate delivered a preliminary lecture in the Town Hall, under the auspices of the Royal Society, on the objects of this Section, Dr. H. T. Whittell presiding. The Chairman said that the establishment of the Section was owing to the desire of the Royal Society to meet the wishes of a number of studiously disposed persons who wished to undertake the study of Natural History from a more elementary point than that pursued by the Royal Society. Prof. Tate, in the course of a very interesting lecture, stated that it was not intended to exclude those who solely sought pleasant companionship and agreeable change, and that ladies as well as gentlemen would be welcomed. The lectures should deal with subjects alike entertaining and instructive, and that one of the chief features should be the microscope. Mr. W. H. Selway, jun., proposed a vote of thanks to the Professor, which was carried with acclamation, when the proceedings terminated with a similar vote to the Chairman.

RULES.

1. The general management of this Section shall be controlled by a Chairman, two Vice-Chairmen, a Secretary, and a Committee of eight, five to form a quorum.

2. The Chairman, Vice-Chairmen, and Committee shall be elected at the annual meeting in October.

3. The Chairman shall not be eligible for office for more than two consecutive years, and one of the Vice-Chairmen shall retire each year.

4. Candidates for admission, not being members of the Royal Society, must be proposed and seconded by two members of the Section at one meeting, and be balloted for at the next ensuing meeting; one black ball in five to exclude.

5. Evening meetings shall be held on Tuesdays, at the discretion of the Committee of Management, for the purpose of reading papers, dealing with the natural history of Australia (more particularly of the neighbourhood of Adelaide), or for the purpose of mutual instruction.

6. There shall be at least eight Field Meetings during the year; the time and place to be arranged by the Committee.

7. At the annual general meeting a statement of accounts shall be submitted by the Secretary and duly certified by two auditors appointed at the previous ordinary meeting, preparatory to being handed to the Treasurer of the Royal Society.

8. The Section may from time to time elect as honorary members those who have been proposed and seconded in the usual way, and have been unanimously elected by ballot. This shall also apply to corresponding members.

9. Any member owing the subscription to the Section and neglecting to pay the same on or before the first day of January, shall be liable to have his name removed from the list of members of the Section; provided always that written application for the same shall first have been made by or on behalf of the Treasurer of the Royal Society; and, provided also, that the Committee shall have power to restore the defaulter's name at his request, after payment of arrears.

10. The rules and regulations of the Section shall not be altered unless a written notice of motion, signed by not less than five members, be given at a meeting of the Section; and thereupon such motion may be brought forward at the next meeting.

11. Any resolution passed under rule 10, altering or repealing the rules of the Section, shall be in force until the meeting held in the month of October following; and if not then confirmed, shall thereafter be held void and of no effect.

12. On the written requisition of twenty members, delivered to the Secretary, an extraordinary general meeting may be called to consider and decide upon the subject mentioned in the requisition.

13. The Committee shall be empowered to frame rules for the conduct of excursions arranged for by them.

RULES FOR THE CONDUCT OF FIELD EXCURSIONS

1. Each member shall have the privilege of introducing two friends; such privilege not to extend to any person who shall have been a visitor at two successive meetings.
2. A Chairman to be elected as at ordinary meetings.
3. The Secretary to act as conductor, or in his absence, some member of the Committee nominated by him.
4. No change to be made in the programme, or extra expense incurred, except by the consent of two-thirds of the members present.
5. No fees, gratuities, or other expenses to be paid except through the conductor.
6. Every member or visitor to have the accommodation assigned by the conductor. Where accommodation is limited, consideration will be given to priority of application.
7. Accommodation cannot be supplied unless tickets are obtained before the time mentioned in the special circular.
8. Those who attend an excursion without previous notice will be liable to extra charge, if extra cost be thereby incurred.
9. No intoxicating liquors shall be provided at the expense of the Section.

EXCURSIONS.

First Excursion—Saturday, November 24, 1883.

Just before 2 o'clock p.m., about 60 members met at the Railway Station, North-terrace, and proceeded in a reserved carriage to Belair, where the party was met by Mr. Cooke, the keeper of the Government Farm, under whose guidance the party was placed. After passing a short distance along the line, a halt was called, and Prof. Tate explained that they were in the centre of a curiously formed basin. The sides of the railway cutting indicated that the soil was decomposing talcose slate, and that in the next cutting they would find the debris of this talcose slate, viz., angular gravel and sandy beds with underlying clays. The vegetation was entirely different from that of the surrounding area, being similar in character to heathy scrub lands. Judging from the lithological evidence, he considered these superficial beds, which were generally gold-bearing, to be of fluviatile or lacustrine origin, and co-eval with the Upland Miocenes of the Gawler district. The elevation at which they stood was just on the verge of the upper limits of the Peppermint Gum (Eucalyptus odorata) and the lower limits of the White Gum (E. leucoxylon). The characteristic flora of the heathy ground were indicated by the Grass Tree (Xanthorrhœa semiplana), the Scrub Sheaoak (Casuarina distyla), Hakeas, and other proteaceous plants, and the fact that Leptospermums and other myrtaceous plants grew here was always an assurance that the ground was amply supplied with water. The season was too late for most orchids. The professor pointed out a very rare one, Diuris sulphurea, which until last year was not known westward of the South-Eastern District. Mr. Tepper secured a specimen of Pterostylis rufa, a sensitive orchid, otherwise only occurring in the mallee regions. Professor Tate also drew attention to the most curious and interesting Pterostylis barbata, which he roughly described as a flower resembling a hood-like trap with a shutter. Should any small insect alight on this shutter, or irritable labellum, it flew up and imprisoned the insect without hurting it. For a period of some twenty minutes it would be encased, and by its efforts to escape would cover itself all over with the pollen. At the expiration of the period mentioned, the tension would be relaxed, and the fly escape, only to be caught by some other orchid, where the pollen it had brought would be utilised to secure cross fertilization. The higher slopes and the waterfall were visited, which latter is formed by an escarpment of quartzose sandstone. The following plants were found, viz.: —Native indigo (Indigofera australis), Verbena officinalis, Cynoglossum australis and suaveolens, Meionectes Brownii, and the rare Cyperus tenellus, only added to our flora in 1882. Rich fern banks were met with, and six species collected.

At half-past 5 the party assembled at the Railway Station, and returned in a reserved carriage to town.

Second Excursion—December 8, 1883.

Between 60 and 70 members proceeded to Crafers by the 2 p.m. train in a reserved carriage. On arrival the party proceeded under the leadership of the Hon. Secretary, Mr. Pickels, to the neighbourhood of Mount Lofty, when, after walking about a mile, Prof. Tate called attention to the fact that they were now in the region of the stringybark forest, and indicated the soft coarse-grained sandstone that appeared on the surface of the stringybark country, and that so far as the Mount Lofty Ranges were concerned, both were co-terminous. Of the stringybarks, two species existed here, viz., Eucalyptus obliqua and E. capitellata. The sandstones rested unconformably upon the slaty rocks. Both had a dip to the south-east, but that of the former was much the less inclined of the two, and in consequence water was encountered all along the eastern slope of the range in the form of springs issuing from the junction of the two sets of beds. At the heads of gullies, especially on the eastern flanks, ferns, lycopodiums, and other plants characteristic of humid stations abounded. With respect to the geological age of these formations little had as yet been forthcoming to replace conjecture with certainty. It was often thought by the inexperienced that the underlying slate rocks contained plant remains, and these were appealed to as affording conclusive proofs that the series contained coal. These plant-like markings are produced by the infiltration of oxide of manganese, and are not of organic origin.

Though the stringybark country was not rich either in animal or vegetable life, yet in the course of the day many characteristic species of this tract were found—notably Aster Sonderi, with its large oak-like leaves and glorious white flowers supported on stalks a foot in length, the only known locality for this plant being the stringybark forests of the Mount Lofty Ranges ; the graceful Marianthus bignoniaceus, with pendulous, yellow and orange flowers ; and the Stylidium (Candollea) graminifolium. The last-named, being a sensitive plant, amused and interested many of the party on testing its irritability. The style, crowned by two anthers, hangs down through a notch in the corolla. When touched by an insect, or anything else, it assumes an horizontal position with great rapidity, and then rests upon the corolla. The object to be gained by this action was stated to have remained a mystery, in spite of the earnest attention which scientific men have given to the matter, and that its discovery would be hailed with satisfaction by botanical students.

An *al fresco* business meeting was then held, Professor Tate presiding, when eighteen new members were elected unanimously, after which the meeting terminated, and the party returned to Crafers.

Third Excursion—New Year's Day.

About 90 ladies and gentlemen proceeded by three coaches to Hallet's Cove for a whole-day excursion, noting by the way the thinly bedded slaty rocks and limestones interstratified by thick quartzites which compose the ascent to Tapley's Hill, and the highly crystalline arenaceous marbles occupying the higher levels. Drawing up at a house on Mr. Rymill's estate the party walked down to the valley of Field's River, a small rivulet with high and steep banks, except near the mouth where it enters the sea at Hallett's Cove, named after Capt. Hallett, who had an interest in the now deserted Worthing Mine, about a mile inland from the shore.

After lunch Professor Tate led the way to the shore. The river empties itself into the sea between two bold headlands about a mile apart, the beach being strewn with stones from the size of a pebble up to large boulders. The presence of granite was noted among these shore pebbles, having been probably transported from a distance by some natural agency, as granite does not occur *in situ* in the neighbourhood. The larger boulders were seen to be massive conglomerates containing pebbles of gneiss and quartzites. Professor Tate explained that this conglomerate was to be seen *in situ* some distance northward, and that it formed part of a series that occupied a much lower position in the sedimentary rocks of the colony. The southern headland, appropriately called Black Point, is formed of dark shales of a purple color standing nearly on edge. By approaching this point from the rear, the crest was reached, and, by looking down, it was seen that the stratification is interrupted by curves and intricate foldings.

Proceeding along the top by a narrow terrace, hemmed in above by the second cliff of horizontally stratified grey sandstone, the party arrived at a place scarcely a quarter of a mile distant from Black Point, where the surface of the underlying slate was laid bare, quite smooth, and scratched and grooved in a generally north and south direction. These polished and scratched features Prof. Tate explained as due to the action of ice at some former period, whereupon a lively discussion took place, those members well versed in recognising the toolmarks made by ice acquiescing with the opinion of the Professor. On returning, the party proceeded to examine the second line of cliffs, composed of red and grey Tertiary sandstone, and found that the sandstone, at about half the height of the cliffs, contained a number of fossil shells. Prof. Tate said that he had found between 50 and 60 species of fossils in this formation, which could be seen to better advantage at Aldinga, where corresponding beds rest on older fossiliferous rocks. This upper series he referred to the Miocene period, and the lower, at Aldinga, to the Eocene. It was the nearest place to Adelaide where the formation could be studied. The surface was of an arid character, but in spring yielded many interesting plants. Of these the following were more particularly observed, viz.:—Goodenia amplexans, G. albiflora, Myoporum parvifolium, Pittosporum phylliræoides, Ptilotus nobilis, Sida corrugata, Boerhævia diffusa.

On re-assembling at the encampment by the stream a meeting was held, Prof. Tate presiding, when several members were elected. After tea had been partaken of and an early return party taken their leave, the remaining members were conducted up the gorge, where Professor Tate pointed out the rocky walls of massive limestones, here and there crumpled and bent in a most intricate manner. Attention was also directed to a plant growing among the rocks, and gathered by Mr. Tepper, viz., Euphorbia eremophila, which the Professor said was well known to the sheepfarmer of the Far North on account of its poisonous qualities, but has rarely, if ever before, been seen in the southern parts of the colony.

At about 6 p.m. the coaches started on their homeward journey, and the city was reached at an early hour.

Fourth Excursion—February 2, 1884.

About 90 ladies and gentlemen proceeded in reserved carriages to Aldgate, from whence a special engine took them on to Bridgewater. Here they were met by Mr. E. Guest, of Balhannah, who had consented to undertake the guidance of the party through the grounds of Messrs. Dunn & Co., who had kindly granted permission. Following the mill-race the direction towards Mount George was taken. Around the sheet of water known as Dunn's dam, the following introduced plants were noticed, viz., the ribwort (Plantago lanceolata), Dutch clover (Trifolium repens), chamomile (Matricaria camomilla), sheep's sorrel (Rumex acetosella), dock (R. obtusifolius), and the yarrow (Achillea millefolium). An unsuccessful search was made for a lamprey inhabiting Cox's Creek, and believed to be a species at present unknown to the scientific world. The following native plants were pointed out by Prof. Tate as rare, viz., Siegesbeckia orientalis, Gratiola Peruviana, Prunella vulgaris, Polygonum minus, Juncus prismatocarpus, Scirpus inundatus, and one of the native fuchsias, viz., Correa decumbens, the latter said to occur nowhere else than in the valley of the Onkaparinga River.

An open-air meeting being called, presided over by Prof. Tate, ten new members were elected; and a few unimportant business details being disposed of, the party proceeded towards Mount George. On arriving at the summit, Prof. Tate stated that the upper part of Mount George was a grand rocky bluff of quartzose grits, as were also those of all the peaks in the Mount Lofty Range, whilst the slopes were composed of talcose slates. The contour was obviously due to the difference of the structure and composition of the two sets of beds. This bluff, like all the high ground around, was covered with stringybark forest, seemingly of one species, viz., Eucalyptus capitellata, corroborating the observations of Mr. J. E. Brown, F.L.S., in the "Forest Flora," that "trees of this species are more numerous in the inland stringybark forests than those of its compeer, E. obliqua." Few shrubs and plants were in flower, except Bursaria spinosa, a myrtaceous shrub; and Ixodia achilleoides, an everlasting composite. Here was also seen in great abundance a leafless orchid, Dipodium punctatum, about two feet in height, bearing numerous purplish flowers with darker spots. A few plants of Tetratheca were still found in bloom, and special attention was directed to a white double variety gathered. A few specimens of the rather rare leguminous shrub, Viminaria denudata, were found, Prof. Tate stating that its specific name alluded to its want of leaves, whose functions were performed by its long, green, filiform leafstalks, several of which were found with a small oval leaf still attached to their ends. After accomplishing the steep descent from Mount George, the members left Bridgewater by the 6.16 p.m. train, and arrived in town at half-past seven.

Fifth Excursion—Saturday, March 1, 1884.

Eighty ladies and gentlemen proceeded in reserved carriages by the 2 p.m. train to Aldgate, and were then, by the courtesy of Mr. A. G. Pendleton, the Traffic Manager, sent on to Ambleside by a special engine. Here they were met by Mr. Guest, of Balhannah, who had consented to take the lead. Following the Onkaparinga, a large red-gum tree was pointed out by Mr. Guest as one of the largest, if not the largest gum tree in the district. It was estimated to be 150 feet high, and the stem 25 feet in girth. In one of the main forks of the branches, high above the ground, a tuft of the common Bracken (Pteris aquilina) was seen growing. Under this giant of the forest a meeting was held, Prof. Tate, F.G.S., &c, presiding. Eight new members were elected. Mr. Guest exhibited the following ferns collected on his way there, viz., Gleichenia circinata, Grammitis rutæfolia, and G. leptophylla.

Proceeding along the river, Prof. Tate called attention to the fact that it was margined by thickets of the Teatree (Leptospermum lanigerum), Silver Wattle (Acacia retinodes), and the native Raspberry (Rubus parvifolius). On and near the banks were the native Daisy (Brachycome graminea), Cyperus lucidus, Goodenia ovata, Hydrocotyle vulgaris, H. asiatica, Cladium glomeratum, the Maiden Hair fern (Adiantum æthiopicum), and Potentilla anserina, hitherto not known in South Australia except in the South-East.

The Onkapringa was fairly rich in aquatic species, among which the following were collected:—Heliocharis sphacelata, Potamogeton natans, Trigloctim procera, Myriophyllum variæfolium, and Ranunculus rivularis, to which some others succeeded in adding Polyganum prostratum, Ottelia ovalifolia, and Potamageton crispus as rare plants about Adelaide. A few fresh water molluscs were obtained, viz., the river mussel

(Unio ambiguus) and a small water snail (Bulinus bullatus). The forest trees consisted chiefly of the Red Gum, Eucalyptus rostratus, E. goniocalyx, and E. capitellata. In open grassy spots were seen Calocephalus lacteus, Eryngium vesiculosum, and Lagenophora emphysopus.

The members started for town at 6 p.m., and arrived about half-past 7.

Sixth Excursion—Saturday, March 22, 1884.

The party, consisting of 35 members, including two ladies, proceeded in a reserved carriage to Alberton by the 1.50 p.m. train. On arrival Mr. Councillor Kestel met the party, and conducted them to a gravel pit near the Station sunk through two feet of loam and fourteen feet of gravel. Mr. Kestel exhibited a piece of miocene limestone containing Turritella Aldingæ; pieces of jasper, quartz crystals, and titaniferous ironsand as found in it; also some valves of the Victoria cockle or Arca trapezia. Prof. Tate said he had no hesitation in regarding the gravel as of fresh-water origin, and of the same character as that intercalated with the red loams forming the drift or pliocene deposits of the Adelaide Plain. The shells of the Arca trapezia had doubtless been found at or near the surface, and he would hazard the theory that they had been left by the aboriginals at some time, who had cooked and eaten the mollusc at their camp, as evidenced by the number of pellets of burnt clay found with the shells. Exhibiting a geological map, he showed that they were standing on the margin of a marine formation about fourteen feet above sea level, and embracing the Dry Creek marshes. It was rich in fossils, all of which, as far as known, belonging to living species. The Arca was one of the most characteristic of these, but no longer a denizen of our waters.

A business meeting was then held, at which Prof. Tate presided, when the following gentlemen were elected as honorary members, viz.:—Messrs. H. Watt and D. Best, Vice-President and Hon. Secretary of the Victorian Field Naturalists' Club respectively, and three new ordinary members. A vote of thanks was offered to Mr. Councillor Kestel for his kindness in calling attention to the gravel pit.

Prof. Tate having indicated that the route they would follow was restricted to the marine deposit just referred to and its littoral sandhills, the party proceeded through Rosewater to the North Arm, noting the characteristic vegetation by the way. Amongst these were Salicornia australis, S. arbuscula, Kochia oppositifolia, Atriplex paludosum, Frankenia lævis, Suæda maritima, Mesembrianthemum australis, and Polycnemon (Hemichroa) pentandrum. Approaching the level of ordinary tides, thickets of Avicennia offcinalis were met with, now in full bloom. Prof. Tate explained that the seeds mature in November, and germinating before shedding, the young plants were wafted by the wind to the mud flats, where they rooted at once. A large number of these, with their remarkably large embryonic leaves, were gathered by the party.

Among the samphire shrubs near high water mark some novelties peculiar to this station were obtained, viz., the pulmoniferous snails, Alexia meridionalis, Brazier, Plecotrema ciliata, *Tate*, and Ampullarina Quoyana; also, an undescribed Assiminea and a Modiola, the latter anchored in the mud by its byssal threads or beard.

Returning from the powder-magazine the party followed the railway loopline to Dry Creek. Along the line and intersecting the sandhills, at a low elevation, fragments of shells and sea pebbles were observed, and the Professor stated that about a quarter of a mile from the Dry Creek Station the margin of the elevated sea-bed was traceable as a white earthy limestone highly charged with Ampullarina Quoyana, Blandfordia striatula, Truncatellæ, and other estuarine species of mollusca.

The ground here being comparatively dry the difference of vegetation was most marked. The Salsolaceæ were most conspicuous, such as Kochia brevifolia, K. sedifolia, K. aphylla, Bassia diacantha, Atriplex semibaccatum, Chenopodium carinatum, Salsola Kali, and Angianthus tomentosus, the latter being very rare here. A quantity of the fruits of Nitraria Schoberi, the Native Grape bush, was gathered, and Euphorbia Drummondi, a spurge, specially pointed out by Professor Tate on account of its poisonous qualities.

Reaching Dry Creek the party returned in a reserved carriage by the 6.52 train to town.

Seventh Excursion—Easter Monday, April 14, 1884.

At half-past eight a.m. 60 ladies and gentlemen started in two coaches for Noarlunga jetty, which was reached near noon. After luncheon a meeting was held, when one member was elected, and then a start made for Whitton Bluff. On the road along the beach a dead specimen of the cuttle fish was found, considered as undescribed by Prof. Tate, who had attached the MS. name — "Sepia brevimana" — to it on account of its short tentacles. The tide prevented a near approach to the Bluff, which is very picturesque, and presents a grand and complete section of the older Tertiary rocks. The beds of the detached islet, known as the Gull Rock, were stated by the Professor to have the same dip as at the Bluff, and it was not therefore a part fallen from the latter. Fossils abounded in the cream-coloured chalky rock, but mostly ill-preserved. Among them the fragments of the stem of a Pentacrinus, or Stone Lily, were abundant. The upper part of the cliff was formed of mottled sands, which by the weather are worn into fantastic shapes. Moving on to the mouth of the Onkaparinga, great numbers of small Crustacea were noticed in the pools, and numerous fossils were obtained from a very fine exposure of polyzoan limestone in the cliff near the mouth of the river. Two cannons were also noticed that had been left by the "Rapid" in the early years of the colony, their rusty condition showing the neglect with which these historical relics were treated. A rare salsolaceous plant—Threskeldia diffusa—was found here, almost its only station. Prof. Tate mentioned that in his drive from Aldinga he had met the purple amaryllid, Calostemma purpurea, and also Atriplex semibaccatum—the latter on the dry hillslopes of Pedlar's Creek, a very long way from its usual habitat. Conchologists were rewarded by finding various shells, almost peculiar to this station, among them being Marcia faba.

At half-past four the members assembled at the rendezvous, had tea at the Reynella Hotel, and arrived in town at a quarter past eight.

Eighth Excursion—Saturday, May 3, 1884.

A large number of ladies and gentlemen proceeded to Glenelg in a reserved carriage at 1.45 p.m. After crossing the bridge over the Patawolonga Creek at St. Leonards, a short business meeting was held, Prof. Tate presiding, at which eight new members were elected. The party then walked along the banks of the Patawalonga and the sandhills skirting it towards Henley Beach. Attention was directed by Prof. Tate, F.G.S., to the shell-beds and their contents, indicating several changes of level since they had lived at the localities where now seen. Near highwater-mark was found the remarkable pulmoniferous snail, Ampullarina Quoyana; and higher up in less brackish water, Bythinella Victoriæ, globose in shape, and not much larger than a pin's head; and Tatea rufilabris, pyramidal, and about a quarter-inch long. Many objects interesting to the microscopist were also taken. Among the plants in the sand-hills, Melaleuca parvifolia and M. pustulata were noticed, and the rush lily (Xerotes leucocephala) was found in full flower, the attention of the members being directed to the difference in the male and female flowers. Reaching the rich flat of the Reedbeds, the party was disappointed as to the expected richness of this locality, drainage having converted it into a desert for the naturalist. A few plants of some interest were found in flower, viz., Mimulus repens, Heliotropium Curassavicum, L. (the latter previously unknown in the Adelaide district), and Polygonum minus. Of introduced weeds, Solanum nigrum and the Bathurst burr (Xanthium spinosum), were specially noticed.

On arrival at Henley Beach the special tramcar ordered did not make its appearance, owing, as subsequently ascertained, to the carelessness of the manager of the Tram Company; and the party had to crowd into an ordinary car, reaching town about a quarter-past seven.

Special Excursion—Saturday, May 17, 1884.

About 50 ladies and gentlemen proceeded by special tramcar to Unley at 2.30 p.m. in order to visit the apiary of Mr. Robertson, at his residence, Unley Wurlie. On arrival, the company were met by Mr. Robertson, who most courteously conducted them to his collection of hives, showing them both the common dark bee and also the Ligurian, and explained the structure of the hives as well as the interesting economical points connected with the bees and their keeping. When the examination was completed, a vote of thanks was tendered to Mr. Robertson for his kindness.

Ninth Excursion—Saturday, August 2, 1884.

Between 50 and 60 ladies and gentlemen assembled at the Holdfast Bay platform about 2 p.m., and proceeded to Glenelg in a special carriage. On arrival at the beach a business meeting was held, presided over by Mr. W. Howchin, F.G.S., when two new members were elected. The Chairman stated that in the absence of Prof. Tate they were favoured with the presence of Mr. W. T. Bednall, who had kindly consented to give the party the benefit of his extensive knowledge respecting Australian conchology.

After some time the members were again called together, when Mr. Bednall named the specimens obtained, mentioning interesting facts connected with their life history. The following were the more noticeable:—Murex triformis, Trigonia margaritacea, a shell never taken alive in South Australian waters as far as known, though not uncommon in Tasmania, Mactra polita, Soletellina biradiata, Phasianella australis (the Pheasant Shell), and species of Pecten, Chama, Trochus, Haliotis, Fusus, Nassa, Purpura, Natica, Conus, Cypræa, Bittium, Turritella Siliquaria, Anatina, Venus, Lucina, Mytilus, and Spondylus. Along the Patawalonga empty shells only of Marcia lævigata and Tellina decussata were found.

A detour among the sandhills was now made, when Mr. J. G. O. Tepper, F L.S., explained their formation and the fixing of the loose sand by the roots of various peculiar plants, such as Spinifex hirsutus—(the "Spinifex" of explorers is a grass, Triodia irritans)—Scirpus nodosus, Lepidosperma gladiatum, Aster axillaris, Styphelia australis, Kunzea pomifera, Myoporum parvifolia, &c., all of which were indicated. Other plants collected were Banksia marginata, Calocephalus Browni, Tetragonia implexicome, Atriplex cinerius, and Salicornia australis. Attention was directed to the uniform slope of the sheaoaks, indicating the prevalence of south-west winds.

Tenth Excursion—Monday, September 1, 1884.

Thirty members started at 8.30 a.m. per special coach for Clarendon. The morning promised fair weather, but a heavy shower on arrival and the prospect of more to follow made it unadvisable to proceed, as was contemplated, to the botanically rich scrublands between Clarendon and Kangarilla. It was therefore decided to inspect and examine the river scenery along the Onkaparinga, east of the bridge, instead. After lunch a meeting was held, presided over by Mr. J. G. O. Tepper, F.L.S., at which one new member was elected; and then the members proceeded up the right bank under the guidance of Mr. Tepper and Dr. Schmid. At the first bend it was observed that all the pines peculiar to the valley of the river —Callitris cupressiformis—had been cut down, and thereby the beauty and interest of the place much marred.

Attention was directed to the unequal denuding action of the atmosphere upon the alternating texture of the rocks, viz., micaceous and talcose shales and quartzites. The following were the more remarkable plants gathered (mostly in flower), the names of which, with a running commentary, were furnished by Mr. Tepper:—Styphelia virgata, serrulata, australis, fasciculiflora, Callistemon salignus, Melaleuca decussata, Accacia melanoxylon (the Blackwood, occasionally overloaded by the parasitic Loranthus linophyllus or Preissii), verniciflua, retinodes and obliqua, Anguillaria dioica, Cæsia vittata, Cymbonotus Lawsonianus, Microseris Forsteri, Spyridium microcarpum, Correa decumbens, Adriana quadridentata (female flowers just opening, male blossoms still immature), Glycine clandestina, Kennedya prostrata and monophylla, Hibbertia stricta, acicularis and fascicularis, Logania longifolia, Mesembrianthemum æquilaterale (depending in long festoons from some of the inacessible rockwalls), and Cassytha melantha, which spread over whole shrubs in an intricate network of cords. Of orchids only Pterostylis nana, Caladenia carnea and difformis, Diuris palustris and maculata were observed. Of sedges only one specimen of Cladium mariscus was noticed along the river bank, but very many of the pretty Luzula campestris (in flower) on the hillsides.

At 4 p.m. the coach started homeward by way of Chandler's Hill, Happy Valley, and the South-road, pelting showers at times greatly marring the pleasure of the drive.

Eleventh Excursion—Saturday, October 18, 1884.

Some 30 ladies and gentlemen assembled at the Railway Station, North-terrace, and proceeded by the 1.10 p.m. train to Belair, and from thence walked over the Government Farm or Park. The special object was the collection of Orchids, of which fifteen species were obtained, among which were Thelymitra grandis, T. longifolia (blue), T. antennifera (yellow), T. McKibinii (blood-red), Glossodia major (blue to white), and several Caladenias, among which latter a large one with white flowers and pink streaks may prove an addition to our flora. In the shade of the forest composed of red-gum (E. rostrata), white-gum (E. leucoxylon), and peppermint (E.odorata), were found plants of almost every temperate clime, as Gnaphalium Japonicum, Geranium Carolinianum (North America), Oxalis corniculata, Cape Dandelion (Cryptostemma lavendulacea), Sherardia arvensis, and numerous others to which Prof. Tate drew attention, as also to the fact that the vegetation of the scrub lands was very different from that of the Park, owing to the difference of soil and the moisture retained by it.

Wandering along the watercourse, and crossing the scrub lands at the foot of Steep Hill, the party passed into the gorge of the southern branch of Brownhill Creek, the passage of which was exceedingly rough. The most notable plant found here was Logania longifolia. In due time the members arrived at Mitcham, and returned to town by the tramcar, arriving about half-past 6 p.m.

EVENING MEETINGS.

First Evening Meeting—Tuesday, April 22, 1884.

This was held in the University, when about 60 ladies and gentlemen attended. Prof. Tate presided, and in his address reviewed the work done, advised that the proposed conversazione be postponed till they had better collections, and intimated that he was prepared to devote several evenings during the session to lectures on subjects he had made a special study.

After the Hon. Secretary, Mr. W. E. Pickels, F.R.M.S., had read the correspondence, one new member was elected, and the announcement made that two excursions were being arranged for. Mr. J. G. O. Tepper, F.L.S., exhibited fresh specimens of two orchids, the earliest of the year, viz., Eriochilus autumnalis, from the Mount Lofty Ranges, and Prasophyllum despectans, from Clarendon, its only known station in the neighbourhood, where it was discovered by him a year or two ago; also a new sundew, Drosera aphylla, from the same locality, and a beautiful lichen from Kangaroo Island, Cladonia retepora.

Mr. E. Davies brought some pink rocksalt and crystals of selenite. Mr. W. Howchin, F.G.S., showed some microscopical preparations of recent South Australian Foraminifera, illustrating the genera Biloculina, Triloculina, and Quinqueloculina; and Mr. Pickels, F.R.M.S., exhibited a fine Phasma, Tropidoderes iodomus, and some spiders sent by Mr. Guest, of Balhannah. Prof. Tate then delivered an instructive lecture on the Australian Lamprey, Geotria australis, which was followed by an animated discussion.

Second Evening Meeting—Tuesday, May 20, 1884.

This was held at the University, North-terrace, when about 30 ladies and gentlemen attended, and Prof. Tate presided. The Hon. Secretary read some correspondence, and three new members were elected. A formal vote of thanks to Mr. Robertson was passed for his kindness in inviting the members to view his apiary.

A number of plants collected by Miss J. R. G. Rogers, some 200 miles north of Farina, were exhibited. Among them were Marsdenia Leichardti and Eremophila maculata.

Mr. W. Howchin, F.G.S., showed under a microscope a number of micro-ichthyolites and other objects from the Tertiary beds underlying Adelaide, obtained from a bore in the Waterworks yard at Kent Town. An interesting specimen of an Aphrodite, or Sea Mouse, was shown by Mr. W. H. Baker, and some letters were read from America, Russia, Switzerland, and Germany desiring exchanges of entomological and botanical specimens.

The President then called upon Dr. Haacke to deliver his lecture on "How to Preserve Zoological Specimens." The lecturer explained that only the best spirit and pure water should be used; that at first weaker and gradually stronger mixtures should be used; that occasionally the glass with the specimen should be shaken, as the water tended to gravitate towards the bottom, and the spirit at the top, so that the lower part of the specimen was in danger of becoming damaged. Too many specimens should not be put into the same glass. A cordial vote of thanks to the lecturer, and the exhibition of an Australian Ant-eater, or Echidna, terminated the proceedings.

THIRD EVENING MEETING—TUESDAY, JUNE 17, 1884.

Professor R. Tate, F.G.S., in the chair. About 60 ladies and gentlemen were present. Two new members were elected. Mr. T. C. Magarey, jun., showed a marsupial, popularly known as the mallee opossum, which was pronounced by Professor Tate as the only authenticated specimen of the species outside of New South Wales. The Hon. Secretary exhibited a number of galls from Eucalyptus leucoxylon.

Dr. W. L. Cleland, F.R.M.S., delivered a short lecture on the microscope, in which he explained the action of the eye in reference to that instrument, illustrated by diagrams as well as sketches on the blackboard, and indicated the use of the various parts of single and compound microscopes.

Mr. J. G. O. Tepper, F.L.S., then read a paper on the "Collection and Preservation of Entomological Specimens," denoting the various orders of insects, and how to catch, kill, and mount them. A discussion followed this lecture, succeeded by scientific gossip, and the examination of microscopical appliances and mountings brought for the occasion by Dr. Cleland.

FOURTH EVENING MEETING—TUESDAY, JULY 15, 1884.

This was held in the room over the Picture Gallery in the Institute Building, North Terrace. Some 50 ladies and gentlemen attended, and Prof. Tate, F.G.S., presided.

The Hon. Secretary exhibited a gall of the olive tree, and Dr. W. Haacke some specimens of pumice stones, collected by Mr. A. Zietz, the preparateur at the Museum, at Diego Garcia, one of the Chagos Islands, where they had been driven ashore a short time after the eruption at Krakatoa.

Prof. Tate then called upon the Rev. W. Howchin, F.G.S., to deliver his lecture on "What is a Foraminifer?" The lecturer explained the nature of the Foraminifera, where occuring, how classified, and how they were mounted for examination, illustrating the subject by numerous diagrams. The President at the close of the lecture tendered the thanks of the Section to the lecturer for his valuable and interesting paper.

FIFTH EVENING MEETING—TUESDAY, AUGUST 19, 1884.

A large number of ladies and gentlemen attended at the Royal Society's room, and Prof. Tate, F.G.S., presided.

Mr. T. C. Magarey, M.B., exhibited a number of shells, including a valve of the Pinna, or Razor Shell, covered with aviculæ or butterfly molluscs. Mr. W. H. Selway, jun., showed an interesting collection of coralline algæ, and a specimen of a brilliant species of Stigmodera. The Hon. Secretary showed galls of the golden wattle (Acacia pycnantha), and a remarkable specimen of a fungus mycelium taken from decaying timber in a cellar in Currie-street.

The President then vacated the chair, which was taken by the Rev. W. Howchin, F.G.S., whilst Prof. Tate proceeded to address the members on "How Plants are Fertilised," and "The Mode How to Preserve Herbarium Specimens." The lecturer explained the various modes in which fertilization was brought about, especially noticing the provision in nature to prevent self-fertilization of plants. On preserving specimens the lecturer said a large amount of care had to be exercised in the collecting, and that the specimens must be dried between sheets of paper without the use of any hot iron. Exhibiting his own collecting case and travelling press, the Professor explained their working, and said that he would always be glad to assist the members in their botanical investigations. After showing some microscopical slides illustrating the structure of plants the proceedings terminated with a vote of thanks to the lecturer.

Sixth Evening Meeting—Tuesday, September 16, 1884.

The meeting was held in the Royal Society's room, in the Institute. About 70 ladies and gentlemen were present. Prof. Tate, F.G.S., in the chair. Mr. G. Mayo, F.R.C.S., exhibited some lizards from Hergott Springs, which Prof. Tate stated were a species of Grammatophora, or some allied genus. Mr. S. G. Magarey, M.B., a number of shells (Bulimus imbricata), and Helix Bednalli found near Stirling. Mr. R. H. Pulleine showed the nest of a trapdoor spider found near Hackney and Mr. H. A. A. Dombrain a rare Australian bird (Pratincola australis), at home in the deserts of the interior, but occasionally migrating southward to the coast. Mr. Tepper, F.L.S., exhibited Eriostemon pungens and a showy species of Aster (teretifolius) found growing near the highest ridges of the Mount Lofty Range. A number of dried plants brought from the South-East were shown by Mr. A. Molineux, among which were some specimens of the poisonous Swainsona, and canes of the "bulb-oak" (Casuarina suberosa ?)

Mr. R. L. Mestayer, C.E., F.R.M.S., delivered a very instructive lecture on "Mounting Objects for the Microscope," in which he described some of the most useful methods employed, and enumerated the appliances necessary to ensure success. At the conclusion the members evinced their appreciation by long and continued applause.

Mr. H. C. Mais, C.E., brought for examination a number of microscopic slides received from America, for which purpose Mr. F. Wheeler had kindly lent a number of Armstrong microscopes.

Seventh Evening Meeting—Tuesday, October 21, 1884.

A considerable number of members were in attendance, Mr. W. Howchin, F.G.S., in the chair. Prof. R. Tate, F.G.S., delivered a lecture on the "Jaws and Tongues of Snails," in which he explained their very curious structure, illustrating the subject by diagrams, and by the aid of some fresh specimens showed how to dissect the organs for microscopical examination. Referring to the common black slug (Limax maximus), he said it was possessed of the extraordinary number of 28,960 teeth.

At the close of the lecture, which was listened to with great interest, the Chairman announced that the annual meeting would be held at the present meeting instead of on the 28th, as had been advertised, when the following report was read by the Hon. Secretary :—

Annual Report.

The Field Naturalists' Section of the Royal Society was inaugurated at a meeting held on November the 13th, 1883, and the following officers were elected to control its affairs :—

CHAIRMAN :

Professor Tate, F.G.S., F.L.S.

VICE-CHAIRMEN :

Mr. H. T. Whittell, M.D., F.R.M.S.
Mr. W. Howchin, F.G.S.

COMMITTEE :

Mr. W. L. Cleland, M.B., F.R.M.S.
" H. Dean
" W. Haacke, Ph.D.
" G. F. Hussey
" A. Molineux
" W. H. Selway, jun.
" J. G. O. Tepper, F.L.S.

TREASURER :

Mr. Geo. Collis, jun.

HON. SECRETARY :

Mr. W. E. Pickels, F.R.M.S.

Though only in existence twelve months, there are 165 members on the roll.

There have been eight half-day and three whole-day excursions in connection with the Section, all of which were well attended, and very gratifying in results.

The syllabus for the winter session embraced nine papers by distinguished Fellows of the Royal Society of South Australia on various subjects intimately connected with Natural History.

The interest exhibited by Professor Tate in the formation of the Section and in the work undertaken by its members has greatly stimulated the efforts of scientific students, and there is every probability that the Section will ultimately be of considerable service to the parent Society, the Fellows of which have so kindly fostered and encouraged it.

POSTAL MICROSCOPICAL SECTION

OF THE

Royal Society of South Australia.

W. E. PICKELS, Hon. Secretary.

A box of miscroscopical objects has been received from Victoria and duly circulated among the members of this Section, and a box of South Australian objects has been made up in this colony and forwarded to Victoria and New South Wales.

FIELD NATURALISTS' SECTION OF ROYAL SOCIETY OF S.A.

ANNUAL BALANCE-SHEET, 21st OCTOBER, 1884.

Dr.	£	s.	d.
Oct. 1, 1883.—To Grant from Royal Society ...	10	0	0
Jan. 1, 1884.— " " " ...	20	0	0
Aug. 1, 1884.— " " " ...	20	0	0
	£50	0	0

Cr.	£	s.	d.	£	s.	d
Oct. 1, 1883.—By Hire Town Hall ...	3	10	0			
" " " Expenses therewith	1	0	0			
" " " Petty Cash to Sec. ...	2	0	0			
" " " Advertising Crafers	0	11	6			
Jan. 1, 1884.— " Loss on Hallet's Cove Expedition ...	1	12	6			
Feb. 23, 1884.— " Sherring & Co.—Printing	13	15	0			
Aug. 20, 1884.— " Ditto...	11	14	0			
" Postages	9	5	0			
" *Register*, Printing, 8s.; Petty Cash, 12s. ...	1	0	0			
				44	8	0
Balance in hand of Treasurer				5	12	0
				£50	0	0

Audited and found correct.

W. J. EVANS,
JOHN T. BISHOP, } Auditors.

Adelaide, 20th October, 1884.

W. E. PICKELS, Hon. Secretary.
GEORGE COLLIS, JUN., Hon. Treasurer.

LIST OF MEMBERS

OF

FIELD NATURALISTS' SECTION

OF THE

ROYAL SOCIETY OF SOUTH AUSTRALIA.

Those names marked † are Fellows of the Royal Society, S.A.
Those names before which the letter F appears are foundation members.

†FAdamson, Mr. D. B., Angas-street, Adelaide.
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FMolineux, Mr. A. E., Kent Town.
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†FMunton, Mr. H. St., North-terrace, Adelaide.
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