TRANSACTIONS AND PROCEEDINGS

OF THE

ROYAL SOCIETY of SOUTH AUSTRALIA

(INCORPORATED).

VOL. XLII.

[WITH THIRTY-TWO PLATES AND TWELVE FIGURES IN THE TEXT.]

EDITED BY WALTER HOWCHIN, F.G.S.,
ASSISTED BY ARTHUR M. LEA, F.E.S.

PRICE, TWELVE SHILLINGS AND SIXPENCE.

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(INCORPORATED).

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CONTENTS.

THE

Transactions

OF

The Royal Society of South Australia.

Vol. XLII.

On the Habitat and Method of Occurrence in South Australia of Two Genera of Lycopods hitherto unrecorded for the State.

By T. G. B. Osborn, M.Sc., Professor of Botany in the University of Adelaide.

[Read November 13, 1917.]

Plate I.

In the course of his presidential address to Section K (Botany) of the British Association delivered at Sydney in 1914 Professor Bower remarked that "the most peculiar living lycopods are certainly *Isoëtes* and *Phylloglossum*." At that time neither of the two genera were included in the South Australian flora. It is the purpose of this note to record their occurrence, together with certain observations that seem of interest upon the plants as they grow in the field; for it appears at least worthy of remark that in South Australia *Isoëtes* and *Phylloglossum* occur side by side as members of a flora specialized to peculiar edaphic and climatic conditions.

Isoëtes.

The species of *Isoëtes* to be recorded is *Isoëtes Drummondii*, A. Br. Bentham (**1:** p. 672) gives the locality for this species as Swan River, and in Sadebeck's monograph on the genus (**10:** p. 776) this is the only locality cited. Von Mueller (**8:** p. 506) records it for the southern district of Victoria, with the remark that it is always submerged. The new census of New South Wales plants (**7:** p. 8) records it for that State, and in a letter Mr. Maiden states that "it is recorded from Pine Mountain on the Upper Murray River, and also from a mountain 2,500 feet high on the Victorian side of the Murray." This record is apparently that given by Ewart and Rees (**6:** p. 5).

The species is of interest in that though it belongs to the section *Aquatica* it is seldom submerged; in one of its known South Australian stations submergence could not take place, in the others submergence would be infrequent. The South Australian specimens on the whole agree well with the diagnosis given by Sadebeck for this section of the genus. The leaves have the usual four wide air passages bounded at the thinnest part by two or three layers of cells, while there are no sclerenchyma strands.

The stock is trilobed (1), small, averaging 1 cm. in cross section. From 8-19 leaves are present, 6-7 cms. in length; the stomates are developed in four rows over the air chambers of the leaf. There is no indusium present covering the sporangia. The megaspores have numerous blunt papillae on all faces, the angular ribs are very prominent. Sadebeck gives the colour of the spores as yellow-white (**10:** p. 777). When observed fresh from the South Australian specimens they vary from a pale greenish-white to olive-green when wet, but are a pure chalky-white when dry. It was only when taken from decaying sporangia and themselves decayed that they appeared yellowish.

The localities are (2):—

(a) National Park, Belair, near Pines Oval.
(b) Roadside below Anstey Hill, near Tea Tree Gully (Miss M. I. Collins).
(c) Victor Harbour, wet sandy soil at Mount Breckan.

Phylloglossum.

Phylloglossum belongs to a monotypic genus; *Phylloglossum Drummondii*, Kunze, being the only species. It is recorded by Bentham (**1:** p. 672) from Western Australia, Victoria, and Tasmania. Maiden and Betche (**7:** p. 8) include it in the New South Wales flora. It is also well known as occurring in the North Island of New Zealand (**4:** p. 1032). The record of the plant from South Australia thus bridges over the gap in its distribution along the southern part of Australia.

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(1) In one instance a bilobed stock has been observed. The specimen in all other respects agreed with the normal trilobed form.

(2) While this note is passing through the press further records for *Isoëtes* have been made at Blackwood and Kersbrook. The habitat in each case was sandy loam, swampy in winter, though not submerged, and in summer dry and baked hard. *Isoëtes* is now known from stations more than 50 miles apart along the Mount Lofty Ranges. It is probably not uncommon but is easily overlooked, since its tufts of leaves superficially resemble those formed by non-flowering specimens of several species of phanaerogams occurring in the area.—Added 24/9/18.

The South Australian specimens, in common with those from the other Australian States, appear to differ somewhat from the New Zealand form in being more slender and in possessing fewer leaves.

The general morphology of this plant is so well known that it is sufficient to say in explanation of what follows that from a subterranean storage tuber a cylindrical stem is produced, crowned by a whorl of linear-subulate leaves. From the stem there arise exogenously 1-3 horizontal, unbranched roots. There is also produced each year at the end of a stalk one new storage tuber. The plant may produce a short cone borne terminally on a peduncle about thrice the length of the leaves.

The plants generally occur gregariously. In order that an accurate idea of the composition of the *Phylloglossum* population might be obtained, three typical areas were

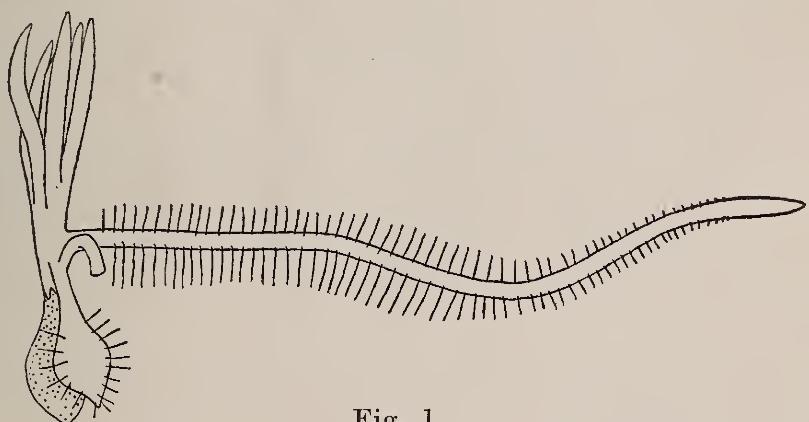

Fig. 1.

Phylloglossum Drummondii. Six-leaved plant with two roots, the full length of one of which is shown in its natural position. The very numerous root hairs are merely indicated diagrammatically as are the hairs on the new tuber. Camera lucida outline $\times 2\frac{1}{3}$.

selected and about 100 sq. cms. of surface soil removed from each to the laboratory. There the sods were carefully washed and the individual plants dissected out. The observations here recorded are thus based to a great extent upon a complete census of all the individuals in certain areas and not upon picked plants. In all 184 plants were counted from the 300 sq. cms. of soil examined. The following points seem worthy of note in connection with the occurrence of the plant in the field :—

(a) Though the course of the roots is described as horizontal, many of the published figures hardly bear this out, possibly because they have been drawn from spirit or herbarium material. Thomas (**12:** p. 291) says: "Its roots

spread horizontally and seldom far downwards into the ground." An examination of living South Australian material fully confirms this; occasionally the upper-surface of the root appears above the ground level. The roots are decidedly long in relation to the size of the plant, and their appearance, projecting at right angles from the stem, is very striking (text fig. 1). A second feature shown by the root is the great abundance of long root hairs. They are only with difficulty to be separated from the soil particles, the rhizoids of a species of *Fossombronia* and filaments of various green algae that occur on or near the surface of the soil. The number of roots is stated to be 1-3. Out of 184 South Australian specimens in which the number was actually counted only 41 had more than a single root.

(b) It would appear that the Australian plants of *Phylloglossum* consistently have fewer leaves than those growing in New Zealand and are less robust (**12:** p. 290). Bertrand (**2**) and Bower (**3:** p. 665) record a maximum number of eight. Eight is the greatest number of leaves found on South Australian specimens; plants with but three leaves occur most plentifully, and there is a high percentage with but a single leaf. (All these specimens grew from tubers of the previous year, there is no question of sporlings to be considered.) Apparently no strict connection exists between the number of leaves and roots that a plant may form. The statistics for 184 specimens are set out in the following table:—

Number of leaves	1	2	3	4	5	6	7	8
Total number of plants	39	29	48	29	27	7	1	4
Number with one root	39	25	43	19	13	2	1	1
Number with two roots	—	4	3	9	12	5	—	1
Number with three roots	—	—	2	1	2	—	—	2

Thus, while it frequently happens that a plant with a high number of leaves has more than a single root, plants with 7 or 8 leaves may have but one root, and conversely plants with 2 or 3 leaves may have as many roots as leaves. No plants have been found in which the number of roots was in excess of the number of leaves.

(c) The small proportion of fertile plants observed among the South Australian specimens is noteworthy. Of the 184 individuals enumerated above but 4 bore cones. They had respectively 2, 3, 5, and 6 leaves. Thomas (**12:** p. 290) has drawn attention to the point that there appears to be no necessary connection between the number of leaves and spore production. Observations in the field in South Australia confirm this.

(d) With a solitary exception all the South Australian specimens of *Phylloglossum* had produced but a single tuber.

An increase in the number of individuals by the formation of two new tubers in a growing season is theoretically possible. Thomas (**12:** p. 290) says this is "quite a common occurrence," though Cheeseman (**4:** p. 1033) says it is rare. A large number (over 100) of Western Australian plants were recently examined by Miss Sampson (**11:** p. 317), who found they had all formed but a single new tuber. It would seem that, in Australia at any rate, the multiplication of individual plants by the formation of more than one annual storage tuber is uncommon.

The exception mentioned above was a fertile plant with 5 leaves and 2 roots that had formed one tuber stalk, which forked at the distal end, producing two tubers. This is figured, and will be more fully described should it prove of anatomical interest (text fig. 2).

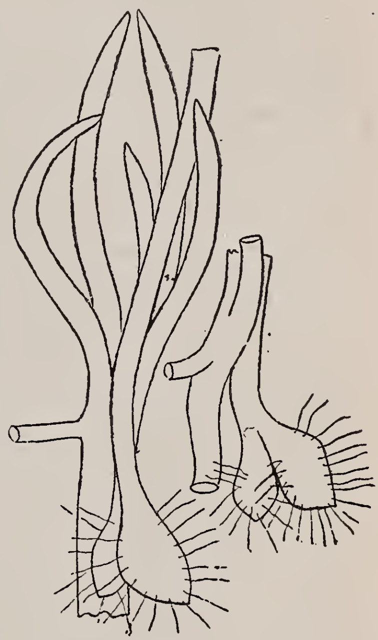

Fig. 2.

Phylloglossum Drummondii. Fertile plant producing two new tubers in one growing season by a bifurcation of the distal end of the tuber stalk. Camera lucida outline ×3½.

At present the only known South Australian station for *Phylloglossum Drummondii* is National Park, Belair.

HABITAT.

It has not been found possible to obtain much information as to the conditions of growth of *Isoëtes Drummondii* in other Australian States. The record made by Ewart and Rees (**6:** p. 5) states that the habitat was "in pools on summit, in granite basins on bare rock," and Professor Ewart has kindly furnished the supplementary information that "it was completely submerged in summer time." I have not had an opportunity of examining one of these specimens, but I gratefully acknowledge the kindness of Professor Ewart in loaning me a specimen from the National Herbarium, Victoria, collected in "subsaline p. [places?], Little Desert, Lowan, North-west Victoria." The megaspore measurements of this specimen agree with those from South Australia. The species may be said to be common in parts of the National Park, growing in damp sandy soils derived from decomposed Cambrian quartzites. The habitat and soil is similar at

Tea Tree Gully. At Victor Harbour the soil is also sandy alluvium overlying the glacial deposits near the mouth of the Hindmarsh River. At this last station some of the specimens were found submerged to a depth of 6 cms. in a waterhole caused by the removal of a tree stump. This pool only contains water during the wet season. Most plants, however, were growing in the open some distance from standing water. In neither of the localities about Adelaide has *Isoëtes* been found submerged. The method of growth of the plant is incidentally referred to below in discussing the plant community in which *Phylloglossum* occurs at Belair.

It is unfortunate but inevitable that of the numerous investigators of *Phylloglossum* only one (Thomas) had access to material growing in the field. The information available as to the natural occurrence of the plant is thus very slight.

Thomas points out that the plant is not a semiaquatic (**12:** p. 291). He says: "*Phylloglossum*, it is true, being a very small plant, can only grow whilst the surface soil is fairly moist, hence it forms a tuber and rests during the dry season. So far as I have seen the plant grows rather better on a hill-top, or at any rate it grows there at least as well as it does down the slope, and I have never found it in an actual swamp. It grows well on a slope where water can never lodge."

The locality given in Cheeseman's Flora (**4:** p. 1033) is "barren clay hills" in the North Island of New Zealand.

In the account by Diels of the Western Australian flora *Phylloglossum* is recorded amongst the "miniature" plants (ephemerals) of the "alluvial formation" in the south-west province (**5:** p. 256). This alluvial flora is included by him in the "swamp formations." It is explained, however, that the area is only a seasonal swamp. The soil retains the rains, and for a time is saturated *(das Land überschwemmen)*. It dries slowly, and in the process becomes baked as hard as a brick (p. 249). The tree vegetation is an open stand of eucalypts *(E. patens, E. rudis,* or *E. rostrata)* with local patches of melaleucas. The undergrowth may be shrubby, but in areas in which the water lies for weeks together the shrubs give place to undershrubs or herbs. These latter have a limited growing period, since growth is at a standstill while the ground is sodden, as also when it has dried up. The perennial herbaceous plants of such an area have rhizomes or other underground storage organs, *e.g.*, tuberous droseras and numerous Liliaceae and Orchidaceae. Annuals, especially "miniature" annuals (ephemerals), occur together with the bulbous plants. The similarity in composition between this Western Australian flora and that of the South Australian locality to be described is very striking.

In the National Park, Belair, there is an alluvial flat about half a mile long and some 300 yards across, bounded on either side by a small creek, on the further banks of which the land rises steeply. The surface soil is a cold grey sandy loam formed by decomposition of quartzite rocks of Cambrian Age. The subsoil as exposed by the creek banks is somewhat gravelly, owing to the presence of waterworn stones. The drainage of the flat, however, is insufficient, for the run-off is very slight, and since the area lies in a trough a quantity of water reaches it by soakage. In spite of the sandy nature of the soil there is sufficient silt to prevent rapid percolation of the water, so that frequently, following heavy downpours during the rainy months, there is a shimmer of surface water over the area. During the summer both creeks cease running, and the alluvial area becomes very dry, the soil baking hard at the surface.

There are thus two sharply-defined seasons, neither suitable to the growth of herbaceous plants: the summer when the soil is too dry, and the winter when it is sodden and cold. The active vegetative period for most plants is thus limited to the conclusion of the wet season, when in addition to a rise in the average temperature the ground is reasonably dry for days together. On an average, August to October inclusive may be taken as the chief period of vegetative activity for most flowering plants. During the early part of the wet season (May-July) except for *Drosera Whittakeri* there are few flowering plants to be seen. There is, however, a considerable growth of cryptogams (hepatics, mosses, and algae). Both *Isoëtes* and *Phylloglossum* appear early in the season. They were just visible on May 28 this year (1918), and had not died down till early in November, 1917. They thus have a much longer vegetative period than most of the herbaceous seed plants.

There are occasional trees of *Eucalyptus leucoxylon* (blue gum) and *E. viminalis* (manna gum), ranging up to about 18 m. in height, also *E. odorata* (peppermint), which in this situation often shows a coppice or mallee habit and does not exceed about 5 m. *Acacia pycnantha* (golden wattle) forms the main underwood, but is infrequent. Scattered bushes of *Leptospermum scoparium* are frequent.

Of the undershrubs *Hibbertia stricta* (30 cm.) is the most common. A variety of other undershrubs occur, but only as occasional bushes. Upon the surrounding slopes shrubs to a great extent replace the herbaceous plants to be described below. The alluvial flat flora there gives place to the sclerophyllous scrub or woodland typical of the area.

The swampy nature of the soil is indicated by the sedge, *Schoenus apogon*, which is the dominant ground species, growing in tufted patches but never forming a continuous carpet. Gramineae are hardly noticeable until the ground becomes drier at the close of the wet season. After the spring-flowering bulbous and tuberous plants have died down they become a more prominent element in the flora. The native perennials *Neurachne alopecuroides*, *Danthonia setacea*, and *Stipa semibarbata*, and the introduced annual *Briza major*, are the chief grasses.

The herbaceous perennials (other than grasses) are divisable into two groups: the first, containing such plants as *Halorrhagis*, *Goodenia*, *Helichrysum*, possess stout root stocks, and during the dry season die down more or less completely, but show no special modification; the second and more numerous group is the geophytes. The earliest of these to appear is *Drosera Whittakeri*, which comes into leaf soon after the first winter rains (May-June), and is to be found flowering when the whole area is sodden. *Hypoxis glabella* and *Wurmbea dioica* both flower before there is any sign of the ground drying up (July-August). The majority of the species, however, do not flower till September-October, by which time the ground is appreciably drier, though following a period of heavy precipitation it may remain sodden with a shimmer of surface water for a day or two. The liliaceous *Burchardia umbellata* is the latest geophyte to appear, and may be seen in full bloom when most of the others have died down. On the bare ground between the larger plants a great variety of ephemerals is to be found. The complete vegetative and flowering periods of these plants is limited to a few weeks at the close of the wet season. This miniature flora is a notable constituent in the sclerophyllous areas of South Australia, whether on quartzite, alluvial sands, or in the scrub woodland that develops upon the coastal dunes. Upon the alluvial area considered, as also upon the quartzite wherever there be a local accumulation of water, the abundance of the Centrolepidaceae is especially worthy of note. *Centrolepis aristata* is most frequent, often dominating the ephemeral florula. *Centrolepis strigosa*, *Cyperus tenellus*, and *Stylidium despecta* are all locally abundant. The little bladderwort, *Polypompholyx tenella*, is one of the rarer members of the flora.

Hepaticae are general elements in this ground flora, *e.g.*, *Reboulia hemispherica*, and notably a species of *Fossombronia*.

The following analysis of the flora is fairly complete in regard to the vascular plants, though additional species of orchids might still further increase the number of geophytes:—

Trees.

Eucalyptus leucoxylon	Eucalyptus odorata
E. viminalis	

Shrubs.

Acacia pycnantha
Leptospermum scoparium

Undershrubs (less than ·5 m.).

Grevillea lavandulacea
Hibberta stricta
H. sericea
Pimelia humilis
Pultenea largiflorens
Dillwynia hespidula
Brachyloma humifusa

Herbaceous perennials (with no special storage organs).

Danthonia setacea
Neurachne alopecuroides
Stipa semibarbata
Ranunculus lappaceus
Halorrhagis tetragona
Brunonia australis
Goodenia geniculata
Wahlenbergia gracilis
Helichrysum scorpioides
H. Baxteri
Leptorrhynchos squamatus

Herbaceous perennials (nature of subterranean storage organ indicated).

Phylloglossum Drummondii (tuber)
Isoëtes Drummondii (stock)
Arthropodium strictum (root tuber)
Burchardia umbellata (swollen stem)
Caesia vittata (root tuber)
Chamaescilla corymbosa (root tuber)
Thysanotus Patersoni (root tuber)
Wurmbea dioica (bulb)
Hypoxis glabella (corm)
*Sparaxis tricolor (corm)
Caladenia Menzesii (tuber)
C. reticulata (tuber)
C. dilatata (tuber)
C. leptochila (tuber)
C. deformis (tuber)
Diuris maculata (tuber)
D. pedunculata (tuber)
D. palustris (tuber)
D. longifolia (tuber)
Glossodia major (tuber)
Thelymitra antennifera (tuber)
T. luteocilium (tuber)
Drosera auriculata (tuber)
D. Whittakeri (tuber)
Microseris Forsteri (root tuber)

Annuals.

*Aira caryophyllea
*Briza major
*Briza minor
Schoenus apogon

Ephemerals (miniature annuals).

Aphelia pumilo
Centrolepis aristata
C. strigosa
Cyperus tenellus
Juncus bufonius
Triglochin centricarpa
Drosera glanduligera
Tillaea purpurata
Hydrocotyle callicarpa
Daucus brachiatus
Polypompholyx tenella
Stylidium calcarata
S. despecta
Helipterum exiguum
Rutidosis pumilo

Species marked * are not native, but established members of the alien flora.

The foregoing analysis of the flora shows the area to belong to the formation of sclerophyllous woodland which occurs in the Adelaide district, especially on quartzite (**9**: p. 114). The undergrowth of shrubby plants, the absence of a ground-covering of grass, the large number of bulbous and tuberous plants, together with ephemerals, are all characteristic of this formation. As yet the associations within this formation have to be defined. Forest is represented in the Adelaide district by stringybark *(Eucalyptus obliqua* and *capitellata)*, while scrub is typical of the quartzite hill slopes.

The characteristic scrub association of the sclerophyllous woodland has *Eucalyptus leucoxylon* as the dominant tree, but the bulk of the vegetation consists of very many species of shrubs averaging 1-1·5 m. high, and sometimes forming a close thicket. But little shade is cast, however, owing to the small size of the leaves. Such an association has been compared with the *maqui* of the Mediterranean, or the *chaparral* of California by Warming (**13:** p. 308). Bulbous and tuberous plants are common in this association in South Australia, as in those of the Mediterranean and Cape Colony. In the alluvial area considered they are, however, unusually abundant. It is, moreover atypical in the abundance of the sedge *(Schoenus apogon)* and in the change between the relative proportions of shrubs on the one hand and geophytes and ephemerals on the other. In this respect it agrees with the alluvial swamp described by Diels *(loc. cit.)*. Provided it be understood that the presence of standing water, or indeed any considerable soil moisture, is merely seasonal, and that there is a prolonged period in which the ground is baked hard, the area may be regarded as a swamp. True fresh-water swamps, the soil of which is wet most of the year, are not common in the hilly regions of South Australia, and they present a very different flora.

It is as members of the geophytic element in this seasonal swamp on alluvial sands that *Isoëtes* and *Phylloglossum* occur. *Isoëtes* appears to have a wider range, but in all other stations known at present it is a geophyte on alluvial sandy soil, only isolated plants being actually submerged during the growing season. *Isoëtes* (fig. 3) agrees with many of its cogeners in general size and approximate depth to which the stock is buried. *Phylloglossum* is a much smaller plant than the other geophytes, for which reason Diels perhaps was led to class it with the ephemerals. It is, however, not ephemeral, but typically geophilous in its growth. Its annual tuber, sunken by a stalk to a constant average depth, is functionally comparable with the many other tubers, etc., developed by its geophytic neighbours, from which *Phylloglossum* differs so markedly in size.

Summary.

1. *Isoëtes Drummondii* and *Phylloglossum Drummondii* are recorded for the first time from South Australia, thus

Fig. 3.

Diagram to show the root relationship of some of the geophytes. Reading from left to right: *Thelymitra antennifera*, (Orchid.), *Chamaescilla corymbosa* (Liliac.), *Drosera auriculata*, *Wurmbea dioica* (Liliac.), *Isoëtes Drummondii*, *Glossodia major* (Orchid.), *Phylloglossum Drummondii*, *Hypoxis glabella* (Amaryl.), *Drosera Whittakeri*, *Thysanotus Patersoni* (Liliac.). Ground level indicated by horizontal dotted line. Fig. approx. nat. size.

completing the range of the latter species along southern Australia.

2. A description is given of the association in which *Isoëtes* and *Phylloglossum* occur together. It is regarded as a seasonal swamp developed upon alluvial soil within the formation of sclerophyllous woodland.

3. In South Australia both genera are members of a considerable geophilous element within this association.

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DESCRIPTION OF PLATE I.

Fig. 1. General view of a portion of the area discussed. In the centre is a large tree of *Eucalyptus leucoxylon*, small trees in foreground *Acacia pycnantha*. The bulk of the grass-like vegetation is *Schoenus apogon*, low shrubby plants *Hibbertia*. The white flowers are *Sparaxis*. The dense vegetation in the immediate background is developed along a creek bed.

Fig. 2. *Phylloglossum Drummondii* plants growing *in situ*. Four fertile plants are to be seen with the peduncles elongated to two or three times the length of the leaves. The strobili are ripe.

The Deflections of Columns under Axial and Eccentric Loading.

By R. W. Chapman, M.A., B.C.E.

[Read May 9, 1918.]

In a paper (1) published in *The Physical Review* for March, 1917, Mr. R. W. Burgess has demonstrated that the ordinary method of solution, for the problem of determining the deflection of a column under load, leads to results that are very considerably in error when applied to the case of a long, thin column, pin-jointed at the ends, and subjected to compression along its axis. In all such problems the solution is obtained by the integration of a certain differential equation. The exact solution is, as a rule, somewhat difficult; but a very simple solution can generally be obtained by neglecting the term involving the square of $\frac{dy}{dx}$, and as this is supposed to give results that are quite sufficiently accurate for all practical purposes, the usual solution of the problem is obtained in this way. This is the method universally adopted in all the text books on Engineering and Physics. It comes, therefore, somewhat as a shock to learn from Mr. Burgess that this universal method of calculation, when applied to determine the deflection of a pin-jointed column under axial load, leads to results that are in error by as much as 100 per cent. One naturally thinks of all the other problems, fundamental in engineering practice, in which the computations of practical engineers are all based upon formulae derived by precisely the same approximate method of solution, and one wonders whether all this practice is fundamentally defective. Of such, for instance, are all computations on continuous girders and all calculations of beam deflections.

As an illustration we will consider the case of the deflection of a beam supported at each end and loaded with a concentrated load W at the centre.

Let l denote the span, and take the origin of co-ordinates at the centre of the beam.

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(1) "The Comparison of a certain Case of the Elastic Curve with its Approximation."

Then the equation to be solved, in order to find the deflection, is

$$E\,I\,\frac{\dfrac{d\,p}{d\,x}}{(1+p^2)^{\frac{3}{2}}} = \frac{W}{2}\left(\frac{l}{2} - x\right)$$

$$\text{where } p = \frac{d\,y}{d\,x}$$

In the usual text-book solutions the denominator on the left-hand side is taken as equivalent to unity, but an exact solution may be obtained as follows:—

Integrating the above equation as it stands, we have

$$\frac{E\,I\,p}{\sqrt{(1+p^2)}} = \frac{W}{2}\,\frac{l}{2}\,x - \frac{W\,x^2}{4} \quad (\text{since } x=o \text{ when } p=o)$$

$$\text{Put } a^2 = \frac{4\,E\,I}{W}$$

$$\therefore \frac{p^2}{1+p^2} = \frac{(lx-x^2)^2}{a^4}$$

from which we get

$$p = \frac{\dfrac{l^2}{4} - \left(\dfrac{l}{2} - x\right)^2}{\sqrt{\left[a^4 - \left\{\dfrac{l^2}{4} - \left(\dfrac{l}{2} - x\right)^2\right\}^2\right]}}$$

$$\text{Now put } \frac{l}{2} - x = \frac{l}{2}\cos\phi$$

$$\therefore d\,x = \frac{l}{2}\sin\phi\,d\,\phi$$

$\therefore$ deflection at centre $= y$

$$= \int_0^{\frac{\pi}{2}} \frac{\dfrac{l^2}{4}\sin^2\phi\,\dfrac{l}{2}\sin\phi\,d\,\phi}{\sqrt{\left(a^4 - \dfrac{l^4}{16}\sin^4\phi\right)}}$$

$$= \int_0^{\frac{\pi}{2}} \frac{l^3}{8\,a^2} \sin^3 \phi \left(1 - \frac{l^4}{16\,a^4} \sin^4 \phi\right)^{-\frac{1}{2}} d\,\phi$$

= (expanding by the Binomial Theorem)

$$\frac{l^3}{8\,a^2} \int_0^{\frac{\pi}{2}} \sin^3 \phi \left(1 + \frac{l^4}{32\,a^4} \sin^4 \phi + \text{----}\right) d\,\phi$$

Now integrate each term separately, and we get

$$y = \frac{l^3}{8\,a^2} \tfrac{2}{3} + \frac{l^7}{8 \times 32 a^6} \tfrac{6}{7} \cdot \tfrac{4}{5} \cdot \tfrac{2}{3} + \text{----}$$

$$= \frac{l^3\,W}{48\,E\,I} + \frac{1}{560} \cdot \frac{l^7\,W^3}{64\,E^3\,I^3} + \text{----}$$

The first term of this series is the deflection as usually computed, so that if we denote this by d, we have

$$y = d + \frac{108}{35} \cdot \frac{d^3}{l^2}$$

The ratio of the error made by the ordinary computation to d is thus:

$$\frac{108}{35} \cdot \frac{d^2}{l^2}$$

Since $\frac{d}{l}$ is usually in practical calculations something considerably less than ·01, it follows that the error is not worth taking account of and is really quite negligible.

Similar results apply in other cases of the deflections of beams, so that it seems that in such computations the ordinary method of calculation is quite good enough. It appears that the usual mode of solution can only lead to errors of a serious nature, when, in addition to $\left(\frac{dy}{dx}\right)^2$ the equation to be solved contains other terms that are themselves of a small order comparable to $\frac{d\,y}{d\,x}$, and in problems on the deflections of beams this is not the case.

But in the case of columns the error made is of much more importance. Here, in certain cases at any rate, the error made in calculating the deflection of the column under load by the approximate method is considerable, and when the computed deflection is made the basis for determining the stress in the material, as is done in most modern column formulae, the result may be seriously in error. Accordingly in this paper an attempt is made to compute the deflections of columns without resort to the usual approximations.

Case 1.—Pin-jointed Column with Axial Load.

This is the case that has been worked out by Burgess, and his calculations will not be repeated here.

If I denotes the moment of inertia of the cross section of the column; E, the coefficient of elasticity; and P, the compressive force along the axis, let

$$\frac{E\,I}{P} = a^2$$

Then if l denotes the length of the column, measured around the curve, and h the deflection at the centre, it is demonstrated that

$$l = 2a\int_0^{\frac{\pi}{2}} \sqrt{\left(\frac{d\,\phi}{1 - \frac{h^2}{4a^2}\sin^2\phi}\right)} = 2\,a\,K$$

where K is the complete elliptic integral of the first kind with the modulus $k = \frac{h}{2\,a}$.

Burgess then proceeds by expansion in series to obtain an expression for h in terms of l and a. From the available tables of elliptic integrals, however, the value of h may be obtained much more simply. These tables give corresponding values of k and K, that is of $\frac{h}{2\,a}$ and $\frac{l}{2a}$, from which again we may deduce the corresponding value of h/l.

It will be seen that if there is no deflection of the column, so that $h = o$, the integral gives $l/a = \pi$ or $P = E\,I\;\pi^2/l$, which is Euler's value for the greatest value of P that will not cause collapse of the column. Consequently in order to bend the column $l/2\,a$ must $> \frac{1}{2}\,\pi$. Once this value is exceeded, the tables show that the deflection increases rapidly with increase of P.

The table given at the end of the paper has been formed in the manner indicated above, and gives corresponding values of $l/2a$ and h/l. Values intermediate to those given may be obtained quite correctly, to the given number of decimal places, by interpolation.

Case 2.—Pin-jointed Column with Eccentric Loading.

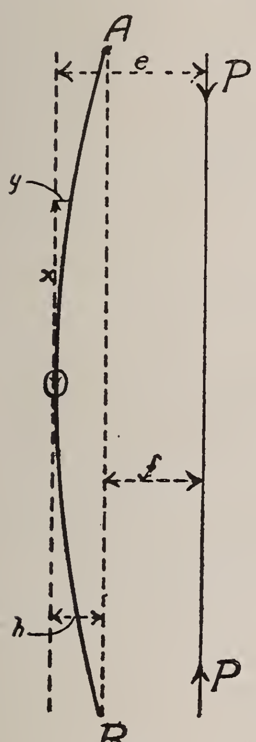

Fig. 1.

In this case, if $A\,B$ (fig. 1) denotes the original axis of the column, the compressive force P is assumed to act along a line parallel to $A\,B$ at a distance f from it.

Let the deflection at the centre be h.

Take the origin of co-ordinates at O, the centre of the bent column.

Let $e=f+h$.

Then the fundamental equation, without any approximations, is

$$\frac{E\,I\,p\,\dfrac{d\,p}{d\,y}}{(1+p^2)^{\frac{3}{2}}} = P\,(e-y), \text{ where } p$$

denotes $\dfrac{d\,y}{d\,x}$

Write $\dfrac{E\,I}{P} = a^2$ and integrate

$$\therefore \frac{2a^2}{(1+p^2)^{\frac{1}{2}}} = y^2 - 2\,e\,y + 2\,a^2 = (e-y)^2 - e^2 + 2a^2$$

since $p=o$ when $y=o$.

from which

$$p^2 = \frac{4\,a^4 - (y^2 - 2\,e\,y + 2\,a^2)^2}{(y^2 - 2\,e\,y + 2a^2)^2}$$

Now write $e-y=e\cos\phi$

$$\therefore\ d\,y = e\sin\phi\,d\,\phi$$

$$\therefore\ \frac{2\,a^2}{(1+p^2)^{\frac{1}{2}}} = 2\,a^2 - e^2\sin^2\phi$$

$$\text{and } p^2 = \frac{4a^4 - (2a^2 - e^2 \sin^2 \phi)^2}{(2a^2 - e^2 \sin^2 \phi)^2}$$

∴ integrating round the curve, the length of the column

$$= l = 2\int_0^h \sqrt{\left(1 + \frac{1}{p^2}\right)} dy$$

$$= 2\int \frac{2a^2}{\sqrt{\{4a^4 - (2a^2 - e^2 \sin^2 \phi)^2\}}} e \sin \phi \, d\phi$$

$$= 2\int \frac{2a^2 \, d\phi}{\sqrt{(4a^2 - e^2 \sin^2 \phi)}}$$

$$= 2a\int_0^{\phi_1} \frac{d\phi}{\sqrt{\left(1 - \frac{e^2}{4a^2} \sin^2 \phi\right)}}$$

The limits of the integral are from $y = o$ to $y = h$.

When $y = o$, $\phi = o$.

When $y = h$, $\cos \phi = \frac{e - h}{e} = \frac{f}{h + f}$

$$\therefore \cos \phi_1 = \frac{f}{h + f}$$

The value of $\frac{l}{2a}$ is thus expressed in terms of an elliptic integral having a conveniently small modulus $\frac{e}{2a}$, but, as the integral is not this time a complete one, the value of h is not so easily determined as in the previous case.

The integral reduces to the form in case 1 if $f = o$. Also if $e = f$, so that there is no bending, $\frac{l}{2a} = o \therefore P = o$, so that bending begins in this case as soon as any load is put on.

In the ordinary notation of elliptic integrals we have

$$\frac{l}{2a} = F(\theta, \phi)$$

where $\sin\theta = \frac{e}{2a}$ and $\cos\phi = \frac{f}{h+f}$

or, more neatly, in the inverse notation,

$$\frac{f}{h+f} = cn\,(u, k)$$

where $u = \frac{l}{2a}$ and $k = \frac{e}{2a}$

According to Euler's theory, the maximum value of $\frac{l}{2a}$ when the load is axial is $\frac{1}{2}\pi$. For eccentric loading, therefore, the value must certainly be less than this. In cases of any importance to engineers the value of $\frac{e}{2a}$ is quite small, commonly of the order of ·1 or less.

Now the function $cn\,(u, k)$ may be expanded in series, and we have (Cayley, Elliptic Functions, p. 57):

$$cn\,(u, k) = 1 - \frac{u^2}{\lfloor 2} + (1 + 4k^2)\frac{u^4}{\lfloor 4} - (1 + 44k^2 + 16k^4)\frac{u^6}{\lfloor 6} + \cdots$$

But we know that

$$\cos u = 1 - \frac{u^2}{\lfloor 2} + \frac{u^4}{\lfloor 4} - \frac{u^6}{\lfloor 6} + \cdots$$

And as $\frac{l}{2a}$ is never much greater than 1 and k or $\frac{e}{2a}$ is quite small, it follows that it is quite sufficiently accurate to write $\cos u$ in place of $cn\,(u, k)$ and thus obtain the result

$$\frac{f}{h+f} = \cos\frac{l}{2a}$$

from which h may be simply determined. In applying this formula, of course $\frac{l}{2a}$ represents the circular measure of the angle, the cosine of which is to be taken.

If $\dfrac{l}{2a} = 1$ and $k = 0{\cdot}1$, the error made by computing h from this simple formula is only 0·2 per cent. If $k = 0{\cdot}2$ the error amounts to 0·8 per cent. If $k = 0{\cdot}3$ the error is 1·8 per cent. If $\dfrac{l}{2a} < 1$ the error will be still less.

The error made in using this simple formula does not become appreciable unless $\dfrac{l}{2a}$ is considerably greater than 1 and k has also a considerable value. In such cases we may write the equation to be solved in the form

$$k\ cn\ (u,\ k) = \frac{f}{2a}$$

where $u = \left(\dfrac{l}{2a}\right)$ and $\dfrac{f}{2a}$ are known and $k \left(= \dfrac{e}{2a}\right)$ is to be determined. A numerical solution of this equation may then be found by the aid of the published tables of the values of elliptic functions. But for the practical problems of engineering this process is not required, and the simplified approximate formula may be adopted.

An inspection of a table of Elliptic Integrals shows that the integral representing the value of $\dfrac{l}{2a}$ is < 1 for all values of k provided that the value of ϕ is not more than 49°,

$$i.e., \text{ if } \frac{f}{h+f} \text{ is not } < \cos 49°$$

or provided that h is not more than ·524 f.

Numerical Illustration.

Suppose that we wish to compute the deflection of a steel column in the form of a British standard steel joist 8″ × 4″ and 9′ 6″ long, under a load of 30,000 lbs., the line of action of the load being 0·5″ from the axis of the column.

From the tables of standard sections we find the least value of I is 3·57.

∴ taking the modulus of elasticity as 30,000,000 lbs. per square inch, we have

$$a^2 = \frac{E\,I}{P} = \frac{30000000 \times 3{\cdot}57}{30000} = 3570$$

$$\therefore a = 59{\cdot}805$$

$$\therefore \frac{l}{2a} = \frac{114}{119{\cdot}61} = {\cdot}953 = \text{the circular measure of } 54^\circ\ 36'$$

$$\therefore \frac{f}{h+f} = \cos 54^\circ\ 36' = {\cdot}579$$

Now putting $f = 0{\cdot}5''$, this gives us $h = {\cdot}364''$.

It will be seen that in this example, as in most practical cases, the value of k in the exact equation $= \dfrac{e}{2a} = \dfrac{{\cdot}864}{119{\cdot}6}$ is quite small, so that the approximate method of solution used gives no appreciable error.

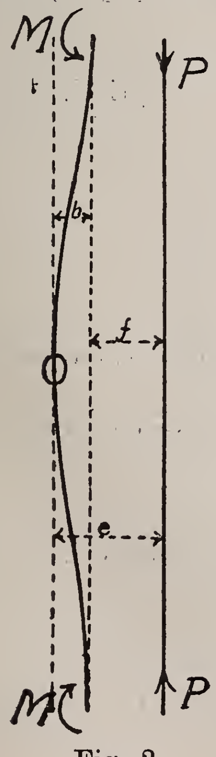

Fig. 2

Case 3.—Column with Fixed Ends and Eccentric Loading.

In this case the ends of the column are supposed to be rigidly held parallel to the direction of the compressive stress. This requires the application of a bending movement M at each end (see fig. 2).

Taking the origin of co-ordinates at the centre of the bent column, and using the same notation as before, we have

$$\frac{E\,I\,p\,\dfrac{dp}{dy}}{(1+p^2)^{\frac{3}{2}}} = P\,(e-y) - M$$

$$= P\,(e-y) - P\,c$$

writing $M = P\,c$

Put $\dfrac{E\,I}{P} = a^2$ as before and integrate

$$\therefore \frac{2a^2}{(1+p^2)^{\frac{1}{2}}} = y^2 - 2\,(e-c)\,y + 2a^2 \text{ (since } p=o \text{ when } y=o)$$

also $p=o$ when $y=h$

$$\therefore h^2 - 2\,(e-c)\,h = o \qquad \therefore e-c = \frac{h}{2}$$

$$\therefore \frac{2\,a^2}{(1+p^2)^{\frac{1}{2}}} = y^2 - h\,y + 2\,a^2$$

This is a differential equation of the same form as in Case 2. Dealing with it in precisely the same manner, we obtain the result

$$l = 2\,a \int_0^{\pi} \frac{d\,\phi}{\sqrt{1 - \dfrac{h^2}{16a^2}\sin^2\theta}}$$

$$= 4\,a \int_0^{\frac{\pi}{2}} \frac{d\,\phi}{\sqrt{1 - \dfrac{h^2}{16a^2}\sin^2\theta}}$$

the limits of the integral in this case taking a more simple form.

Thus $\dfrac{l}{4a} = K$, where K is the complete elliptic integral of the first kind with $k = \dfrac{h}{4a}$.

If $h=o$, or there is no deflection, $\dfrac{l}{4a} = \dfrac{\pi}{2}$

i.e., $P = \dfrac{4\,E\,I\,\pi^2}{l^2}$ is the least value of P which can produce any deflection, and we see that the least possible value of $\dfrac{l}{4\,a}$ is $\dfrac{\pi}{2}$.

The bending moment at the top and bottom of the column $= P\,f - M = P\,(e-h) - P\,c = P\,\dfrac{h}{2}$.

The bending moment at the centre of the column $\doteq P\,(e-h) = P\,\dfrac{h}{2}$ also.

In this case the deflection h of the column in no way depends upon the eccentricity of the loading. The further the line of stress is from the axis of the column the greater will be the bending moment M upon the holding supports at the ends, but, provided these remain firm, the deflection of the column is in no way affected.

The table supplied to enable computations to be made of the deflection in Case 1 will also serve for the same purpose for Case 3.

In modern formulae for the computation of the load on long columns, especially when there is eccentricity of loading, the deflection of the column under load is made the basis of the formula used. In many of these the assumptions made as to the deflection of the column are far from correct according to the foregoing calculations. The object of the writer is to make some contribution towards that more exact knowledge necessary for progress in engineering design.

Table giving maximum of deflections of Pin-jointed Columns under axial load or deflections of Columns with ends fixed under any load the line of action of which is parallel to the axis:—

Values of $\frac{l}{2a}$ for pin-jointed columns or $\frac{l}{4a}$ for columns with fixed ends.	Corresponding values of $\frac{h}{l}$.
1·57080	0
1·57092	·0111
1·57127	·0222
1·57187	·0333
1·57271	·0444
1·57379	·0554
1·57511	·0664
1·57668	·0773
1·57849	·0882
1·58054	·0990
1·58284	·1097
1·58539	·1204
1·58820	·1310
1·59125	·1414
1·59457	·1517
1·59814	·1619
1·60198	·1721

In this table l = length of column.
h = maximum deflection.

$$a^2 = \frac{E\,I}{P} \text{ where } P \text{ is the load in compression.}$$

Notes on Australian Orchids, together with a Description of Some New Species.

By R. S. Rogers, M.A., M.D.

[Read May 9, 1918.]

Plates II. to IV.

1. Calochilus cupreus, n. sp.

Plate ii.

A robust plant 15 inches to 2 feet in height. Leaf comparatively short, $4\frac{1}{2}$-6 inches, rather rigid or fleshy, triangular in section, erect, pointed, channelled on the inside.

Stem-bracts 2, from 2 to 3 inches long, coppery coloured, subulate, clasping, lower one close to insertion of leaf, upper one about middle of stem; floral bracts subtending pedicels of flowers, subulate, $1\frac{1}{2}$ inches or less in length.

Flowers in a raceme of 8 to 15, with prevailing tints of yellow and reddish-brown.

Sepals equal in length, yellow with reddish-brown stripes or dots; the dorsal one ovate, cucullate, shortly acuminate, streaked or dotted with reddish-brown markings; the lateral ones ovate-lanceolate, slightly narrower than the dorsal sepal.

Lateral petals narrowly ovate-lanceolate, slightly shorter and much narrower than the sepals, yellow with darker stripes.

Labellum with fleshy rectangular base and wide triangular lamina, longer than perianth, protruding between lateral sepals, golden-yellow, with fimbriated margins and reddish-blue hairs with metallic lustre; basal portion with brilliant reddish-blue raised lines with metallic sheen, the two outer ones rather fleshy glandular linear-lanceolate, the intervening ones linear, sometimes fused at their bases or along their course, all ending in free divergent hair-like extremities; other hairs on lamina not dense and rather shorter than in other species of *Calochilus;* tip of labellum recurved and ending in a short, hairless, sinuous ribbon.

Column short and widely winged, with reddish-brown markings, very open at base with a comma-shaped purple gland at each lower angle; no castellated ridge connecting the glands, but generally a more or less indistinct yellowish-brown marking between them; anther long, horizontal, with duck-bill point; stigma just below the anther, transverse, reniform with convex margin directed downwards.

Three valid species of *Calochilus* have been recorded, and from these the new species differs mainly in the following particulars:—

1. The leaf is relatively shorter and much more rigid than in the other species. It is also triangular in section, whereas the section is crescentic in the others.
2. The raceme bears a large number of flowers, *viz.*, 8 to 15, whereas 8 flowers may probably be regarded as the maximum in other species.
3. Its copper-coloured bracts and the colour of its flowers are distinctive.
4. The glabrous oblong base of the labellum with the characteristic raised lines, serve at once to distinguish it from other members of the genus.

The following differential table will further show the relations of *Galochilus cupreus* to other species:—

Column-wing without dark gland on each side near base of column. Tip of labellum ligulate	1. *C. paludosus*
Column-wing with dark gland on each side near base of column.	
Tip of labellum without ligulate process, whole of surface of labellum hirsute ...	2. *C. Robertsoni*
Tip of labellum with ligulate process, labellum not hairy at base.	
Base of labellum glabrous, with several raised longitudinal lines	3. *C. cupreus*
Base of labellum smooth and thickened, without raised longitudinal lines ...	4. *C. campestris*

It should be noted the *C. paludosus*, Br., is incorrectly figured in Fitzgerald's Australian Orchids with two glands at the base of the column. This is not in conformity with the original description in Brown's Prodomus, nor is it supported by Bentham in the Flora Australiensis, nor indeed is it supported by Fitzgerald himself in Moore's Flora of New South Wales (see page 394).

Of the above species, *C. paludosus* has been recorded only from Queensland and New South Wales; *C. campestris* from all the Eastern States, including Tasmania; and *C. Robertsoni* from New South Wales, Victoria, South Australia, and Western Australia.

The new species was found by Mrs. R. S. Rogers near McLaren Vale early in November. The plants were mostly in advanced fruit, and evidently bloom in October.

The name *cupreus* has reference to the coppery colour of the bracts and flowers.

2. Pterostylis pusilla, n. sp.

Plate iii.

A slender, glabrous plant, $2\frac{1}{2}$ to $3\frac{1}{2}$ inches high; 2 closely sheathing bracts on stem and one subtending each flower.

Flowers 1 to 4, on relatively long, slender pedicels. Leaves shortly petiolate, oblong-lanceolate, in a green radical rosette.

Galea from ovary to extreme point of dorsal sepal $\frac{1}{3}$ inch or less, with short recurved point and dark green stripes; lateral sepals conjoined, subulate, reflexed, margins involute, about the same length as galea.

Labellum fleshy, on a wide claw, reddish-green, oblong-ovate, concave on its upper-surface, with thickened posterior margin; tip straight; under-surface with deep mesial channel running from base to tip between two pyriform swellings, the apices of which are directed forward, but do not reach the tip; a few long hairs from lateral margins but not from posterior margin, lower mesial channel beset with very stiff transverse hairs, tip and posterior margin shortly ciliated.

Column incurved, much shorter than galea, membranous wings roughly quadrangular, with rounded or obtuse angles, anterior margins and lower lobe ciliated; a secondary expansion, ovate-lanceolate in shape, on either side of stigma, extending from the membranous wings to the junction of the middle and lower third of column; stigma rather narrow, oblong-elliptical.

The affinities of this *Pterostylis* are with *P. rufa*, *P. Mitchelli*, and *P. squamata*.

From all of these it is readily distinguished by the diminutive size of the plant and flowers and by the absence of caudae to the lateral sepals.

From *P. rufa*, Br., it further differs in the possession of a *green*, as opposed to a *withered* radical rosette of leaves; also in a fleshy, as opposed to a membranous labellum, the tip of which is quite straight in the new species and upturned in the other; also in the absence of long hairs or setae from the vestigial appendage, represented in this instance by a thickened posterior margin; the column wings have rounded angles and are without points, whereas in *P. rufa* they are acute, the upper one being produced into a short point.

From *P. Mitchelli*, Lindl., it further differs in regard to its labellum, which has turgid pyriform swellings on its under-surface, and has a straight tip as opposed to a depressed tip in the former species; also in the absence of a point to the upper angle of the column-wings; the stigmas likewise are quite different, being narrow oblong-elliptical in *P. pusilla* and semi-elliptical in *P. Mitchelli*.

From *P. squamata*, Br., it may be distinguished by the absence of the *withered* radical rosette and numerous stem-bracts which characterize that species; also by the absence of long hairs on the vestigial appendage and by the presence of turgid pyriform swellings on the under-surface of the labellum.

The following table will indicate the position of the new *Pterostylis* in regard to related species:—

Leaves in a radical rosette, persistent or fading away before flowering; flowers usually multiple.	
Sepals all obtuse, lower lip shortly bilobed; flowers diminutive; rosette green.	
Slender species, appendage labellum pointing backwards	1. *P. mutica*
Rather stout species, appendage labellum looking forwards	2. *P. cycnocephala*
Sepals caudate or acute, lower lip deeply bilobed.	
Sepals caudate; labellum fleshy, tip depressed; bracts few; rosette green; flowers not diminutive ...	3. *P. Mitchelli*
Sepals caudate; labellum fleshy, tip upturned; bracts numerous; rosette withered; flowers not diminutive ...	4. *P. squamata*
Sepals caudate; labellum membranous, tip upturned; bracts few; rosette withered; flowers not diminutive ...	5. *P. rufa*
Sepals acute but not caudate; labellum fleshy, tip straight; bracts 2, rosette green; flowers diminutive	6. *P. pusilla*

This plant blooms early in October, which is later than *P. Mitchelli*, so far as this State is concerned, but considerably earlier than *P. rufa* or *P. squamata*.

It has reached me from the following localities:—South Australia—Geranium, Miss Nora E. Jacob; Wirrega, Prof. Osborn. Victoria—The Grampians, C. Walter; Greensborough, E. E. Pescott; Blackburn, Miss Dorothy Coleman.

The specific name *pusilla* has reference to its diminutive size.

3. Prasophyllum regium, n. sp.

Plant robust, $2\frac{1}{2}$ to $3\frac{1}{2}$ or more feet high; leaf not reaching to top of spike; bracts somewhat small and rather acute, subtending each flower, about one-third length of ovary.

Flowers in rather a loose spike; spike sometimes 16 inches long, and comprising upwards of 50 flowers; lower flowers distant; ovaries long and very attenuated.

Sepals acute and rather narrow, about equal in length, 6 lines; lateral sepals distinct at extreme base and tips, connate elsewhere; dorsal sepal reflexed in mature flower.

Petals rather narrow, falcate-lanceolate, shorter than sepals, about 5 lines.

Labellum on a distinct and narrow claw, oblong-lanceolate, margins crenulate, erect in its basal third, horizontal in its anterior part, nearly as long as the petals; inner plate with wide orbicular base and free entire margins, suddenly contracting at the bend into a rather bluntly lanceolate part with entire margins, extending to within a short distance of the tip.

Column with a blunt sessile anther; long, narrow rostellum greatly exceeding in length the anther; caudicle very long and strap-like; lateral wings blunt, oblong-falcate, membranous, with a basal thickening on dorsal margin, much higher than rostellum.

Found by Dr. R. Pulleine, December, 1917, a little south of Manjimup, not far from Forest Diamond Tree, Western Australia.

Two large Western Australian *prasophylla* have been described under the name of *P. giganteum* by Lindley (Swan River Appendix, 1839, and Genera et Species, 1840) and Endlicher (Plantae Preissianae, 1844-7) respectively. The Latin descriptions are not in either case sufficiently definite and detailed to enable one to identify the plant, but Bentham, who had access to both types, states that they are not forms of the same species. He reduces Lindley's species to *P. elatum*, Br., and Endlicher's to *P. Fimbria*, Reich. f.

The new species certainly cannot be referred either to *P. elatum* or *P. Fimbria*, although it bears a superficial resemblance to both.

It must also be differentiated from three other tall Eastern *Prasophylla*, *viz.*, *P. australe*, Br., *P. flavum*, Br., and *P. odoratum*, Rogers.

All the above species, including *P. regium*, generally exceed 2 feet in height, but only in the latter have I seen a spike bearing between 50 and 60 flowers, or indeed anything approaching this number.

It falls under Bentham's Section 2, *Podochilus*, in which the labellum is on a distinct claw.

The following table will effect the necessary separation:—

Plants tall, generally exceeding 2 feet in height.

Labellum sessile, lateral sepals connate, at least in the middle.

Labellum sharply flexed; with very much raised prominent inner plate scarcely reaching beyond bend; lateral appendages of column not exceeding rostellum in height; leaf-lamina long ... 1. *P. australe*

Labellum gradually recurved; inner plate not prominent, beginning about middle and extending nearly to tip; lateral appendages of column not exceeding rostellum in height; leaf-lamina exceptionally short, rarely exceeding 1 inch ... ... 2. *P. flavum*

Labellum hardly recurved; inner plate with free margins covering most of surface of lamina, extending nearly to tip, not prominent; lateral appendages of column much exceeding rostellum in height; leaf-lamina rather long ... ... 3. *P. elatum*

Labellum on a distinct claw. Lateral sepals connate or free.

Lateral sepals connate.

Labellum gradually recurved; inner plate with free margins copiously fringed, and within it a second rather conspicuous plate; lateral appendages not exceeding rostellum; ovary elongated ... ... 4. *P. Fimbria*

Labellum recurved at right angles; inner plate orbicular-lanceolate with free entire margin, extending nearly to tip, no secondary plate; lateral appendages column as long as in *P. elatum* much exceeding rostellum; ovary very narrow, elongated ... ... 5. *P. regium*

Lateral sepals free and divergent.

Labellum sharply reflexed about middle; inner plate not reaching far beyond bend in voluminous membranous part of lamina; lateral appendages column not so high as rostellum; ovary turgid ... ... 6. *P. odoratum*

The new species differs from *P. elatum* not only in its possession of a distinct claw to the labellum, but also in the shape of the labellum and inner plate, the former being oblong-lanceolate, whilst the latter is orbicular in its basal portion and narrow-lanceolate anteriorly; while in *P. elatum* both labellum and inner plate are ovate. Further, the rostellum and perianth segments are much wider in *P. elatum* than in *P. regium*.

4. Caladenia testacea, Br.

A slender plant, 6 to 17 inches high, with a slightly hairy stem and rather acute bract near middle; leaf narrow-linear to oblong-lanceolate, not nearly so hairy as in most *Caladenias*.

Flowers in a raceme, 1 to 5 on slender pedicels, each subtended by an acute bract reaching to the base of the ovary.

Perianth segments covered with short glandular hairs; generally dark reddish-brown, except towards the base and inner sides, where they are light coloured; sometimes quite white; lateral sepals and lateral petals spreading, about equal in length, 5 lines, falcate-lanceolate, contracted at base; dorsal sepal a trifle shorter, much incurved.

Labellum on a moveable claw, with basal portion erect against column; tip triangular recurved; lateral lobes not well defined, sometimes almost absent; margins entire except towards the tip, the edges of which are shortly, bluntly, and rather sparsely denticulated; calli of lamina in 4 rows, reaching to within a short distance of the tip, where the rows are not so well defined, clavate, the stalks shorter towards the tip; two or three pink stripes near base.

Column shorter than dorsal sepal, beneath which it is incurved, markedly winged, especially in its upper half; anther with a short point; stigma circular just below anther.

The buds are characteristic, being bluntly falcate in shape, with dark glandular exteriors.

This *Caladenia* has not hitherto appeared on the records of this State, although there are specimens in the University Herbarium, collected in November at Glencoe and Millicent Flats. Notes in the folder by the late Professor Tate indicate that he thought of calling it *C. quadraserriata*, but finally left it unidentified and undescribed.

It has been recorded from all the Eastern States except Queensland.

The following are some localities in which it has been found:—New South Wales—Port Jackson to Blue Mountains, R. Brown, A. Cunningham, Woolls, and others; Mount Penang, Rogers. Victoria—Port Phillip, Gunn; Upper Fern Tree Gully, Pescott; Cravensville, Braine; Grampians, Pescott, French, jun., and Audas. Tasmania—Port Dalrymple, R. Brown; Southport, C. Stuart; Hobart and Circular Head, R. C. Gunn; Gould Country and St. Patrick River, A. Simson; Sandford, Miss A. L. Rogers. South Australia—Glencoe and Millicent Flats, R. Tate.

It blooms in October and November. Its relations to the other *Caladenias* will be shown below when dealing with *C. congesta.*

5. Caladenia congesta, Br.

Plant slender, from 7 to 24 inches high; leaf linear; stem slightly hairy, with a closely-appressed rather acute bract about the middle.

Flowers pink, rarely white, single or in a scattered raceme of 2 or 3, on slender pedicels, subtended by a bract often reaching as high as the hairy ovary.

Segments of perianth covered with glandular hairs; lateral sepals spreading, lanceolate, contracted at base, about

9 lines long; lateral petals falcate, narrower and rather shorter than lateral sepals; dorsal sepal shorter than the other segments, incurved over column, contracted at base.

Labellum pink, about 4½ lines, on a rather long and narrow claw, basal portion rather erect against column, the lamina gradually curved forward, divided very distinctly into 3 lobes; margins entire; lateral lobes falcate, acute, reaching well beyond the middle of labellum; middle lobe oblong-lanceolate; calli dark crimson, imbricate, completely covering middle lobe, at first placed longitudinally in 2 rather obscure rows, the two nearest the claw being stalked, the others large sessile, flat-topped; calli in anterior half arranged transversely, large, sessile, more or less oblong, flat-topped.

Column rather shorter than dorsal sepal and labellum, incurved, with rather wide wings, especially in its upper portion, blotched with pink markings; anther mucronate; stigma circular, disc-like, just below the anther.

Found by Mr. J. M. Black in Glencoe scrub, November 27, 1917. Only a single specimen was seen, the normal time of blooming being earlier in the month.

This plant has not hitherto been recorded from this State, but it occurs in New South Wales, Victoria, and Tasmania. I have never received or seen it from Western Australia, although Bentham notes a plant in Lindley's herbarium as possibly belonging to this species.

Caladenia testacea, Br., and *Caladenia congesta*, Br., belong to Bentham's Section Eucaladenia, in which "the sepals are acute or obscurely acuminate, rarely obtuse, the dorsal one usually erect and concave. Labellum inconspicuously veined, the disc with 2 or more rows of calli (sometimes arranged or united at the base almost in a semicircle)."

They fall under the subsection where the flowers are pink or white, *leaf narrow-linear or absent*, labellum with broad lateral lobes.

DIFFERENTIAL TABLE.

Leaf narrow-linear or absent; flowers pink, pinkish, or white.
  Calli arranged distinctly or obscurely in 2 rows.
    Labellum not exceeding half length of lateral sepals; lateral lobes broad, obtuse, and prominent, middle lobe denticulated; leaf narrow-linear; flowers pink or white ... ... *C. carnea*, Br.
    Labellum exceeding half length of lateral sepals; lateral lobes falcate, almost acute, incurved; middle lobe entire; leaf absent at time of flowering ... *C. aphylla*, Benth.

Labellum not exceeding half length of lateral sepals; lateral lobes entire, acute, falcate; middle lobe entirely covered with large crowded calli, arranged posteriorly in 2 obscure rows; leaf linear ... ... *C. congesta*, Br.

Calli arranged in 4 rows.

Lateral lobes of labellum ill-defined, the margins entire posteriorly, denticulated or fringed anteriorly; calli not reaching tip; dorsal sepal gradually incurved; column gradually bent forward, striped with pink; lateral sepals about 5 lines; flowers generally reddish-brown, but sometimes white *C. testacea*, Br.

Lateral lobes of labellum broad, definite, obtuse, margins entire throughout; dorsal sepal abruptly incurved at or below middle; column abruptly bent forward; lateral sepals about 8 lines; flowers whitish ... ... *C. cucullata*, Fitz.

Labellum hardly 3-lobed, contracting to a point for about two-thirds length, markedly denticulated for same length; calli reaching to tip; dorsal sepal gradually incurved; lateral sepals about 9 lines; flowers white *C. dimorpha*, Fitz.

Caladenia congesta is a larger species than *C. testacea*, with larger flowers, the lateral sepals being about 9 lines as compared with 5 lines in the latter plant. The pink flowers of the former species are quite unlike the reddish-brown or white colours of *C. testacea*.

Distribution:—New South Wales—Near Bathurst, A. Cunningham; Bowral, Sheaffe. Victoria—Cravensville, A. B. Braine. Tasmania—Port Dalrymple, R. Brown; Cheshunt and Port Sorrell, Archer. South Australia—Glencoe, J. M. Black.

6. Drakea Huntiana, F. v. M.

Plate iv.

A somewhat sturdy little plant, 3½ to 7 inches in height; leafless at the time of flowering; with 2 rather blunt, short, clasping bracts on the stem and a small sheathing radical bract; stem generally reddish-brown, sometimes green.

Flowers reddish-green, or occasionally quite green; 2 to 7; reversed; on fairly long, slender pedicels (about ½ inch), each pedicel embraced by a short obtuse bract; ovary slender, terete.

Segments of perianth nearly equal in length, about 2 lines, all reflexed against the ovary; lateral sepals green or reddish-green, oblong-spathulate, convex on outer surface, concave on inner, reflexed against ovary like a pair of insect's wings; dorsal sepal green or reddish-green, quite blunt, about same width as lateral sepals, concave, reflexed against the ovary and slightly incurved towards the column; lateral petals narrow-linear, much narrower than the sepals, green, rather blunt, reflexed against the sides of the ovary.

Column green or greenish-red, acutely reflexed from its base towards the ovary, about the same length as the perianth segments. The upper half expanded in a concave disc-like surface, from the edges of which proceed two pairs of appendages of nearly equal length; the upper pair narrow-lanceolate, divergent, curving forward on each side of the apex of the anther; the inferior pair falcate-lanceolate, divergent, curving upwards and forwards on each side of the stigma. Rostellum rudimentary. Stigma prominent, very wide, reniform, the concave border immediately below and in contact with the anther.

Labellum articulated by a moveable joint to a linear projection of the column 3 lines long; peltate on a linear claw which is nearly as long as the column-foot. Lamina reddish-purple, insectiform, about as long as the claw (3 lines); anteriorly giving origin to a pair of pedunculated processes, each terminating in a globular purple gland; posteriorly dividing into two long narrow-lanceolate, divergent tails, from which proceed numerous long-jointed, purplish or reddish hairs; an intermediate or thoracic portion, on the under-surface of which is inserted the claw, fringed with numerous long purple hairs, on its upper-surface a large purple triangular gland, situated at the base of the anterior peduncles.

The reversed appearance of the flowers is due to the fact that the column and perianth segments are all acutely reflexed on the ovary.

In the bud the upper-surface of the lamina is in close apposition with the front of the column, the pair of pedunculated glands embracing its extreme base at its junction with the foot; the triangular gland in contact with the middle of the undilated portion of the column; the rest of the intermediate portion covers the stigma, and lies between the lower pair of columnar processes which clasp it; the posterior divergent tails curl up between the upper pair of columnar processes, giving off hairs over the anther and tip of the dorsal sepal, which at this stage is in close contact with the back of the column.

At this stage, also, the segments of the perianth form a complete covering to the reproductive mechanism; the lateral sepals protecting the antero-lateral aspects, their tips being in close apposition with the tip of the dorsal sepal, and their inner margins in close contact, except for a small slit in the middle, through which is seen to project the angular process formed by the junction of the columnar foot and labellar claw.

When the flower is about to expand the lateral sepals separate and suddenly rotate on their bases, so as to take up a position on the opposite side of the ovary, with their convex surfaces now facing each other; the dorsal sepal also retracts a little from the column; the columnar processes relax their grip of the lamina, and the labellum suddenly flies out with the claw at right angles to the columnar foot.

Baron von Mueller mentions that "Mr. Bauerlin noticed in *D. Huntiana*, that at the slightest touch the labellum snatches across to the anther and stigma, subsequently returning with slowness to its remote positions."

Through the kindness of Mr. A. B. Braine, who supplied me with fresh specimens of this plant, I was able to closely observe the mechanism of expansion, but never on any occasion did I find the labellum irritable. I understand, too, that Mr. Braine, who was able to study them under more natural conditions, also failed to observe irritability. So remarkable a conformation is exceedingly suggestive of this peculiarity, and it is possible that irritable movements are only displayed under certain meteorological conditions.

This singular and rare little orchid was first recorded from Mount Tingi Ringy (4,700 feet), and later at Blackheath (L. H. Stephenson), in the Blue Mountains. It has not hitherto been recorded from any other locality. The present plants have reached me from Cravensville, near Tallangatta, in Victoria, and were collected by Mr. A. B. Braine in December, 1917.

The genus *Drakea* contains 5 known species, two of which, *D. irritabilis*, Reich., and *D. Huntiana*, F. v. M., are natives of Eastern Australia; the others, *D. elastica*, Lindl., *D. glyptodon*, Fitz., and *D. ciliata*, Reich., come from Western Australia.

DIFFERENTIAL TABLE.

Labellum articulated directly by its claw to column without intervening basal projection; lanceolate or ovate-lanceolate leaf at time of flowering.
  Leaf-like bract on stem; column not reflexed on ovary ... ... *D. ciliata*
Labellum articulated at end of basal projection of column.
  Leafless at time of flowering.
    Dorsal sepal greatly exceeding other segments of perianth, column reflexed at right angles with ovary ... ... *D. irritabilis*
    Segments of perianth about equal in length; column actually reflexed on ovary ... ... *D. Huntiana*
  Leaf present at time of flowering; rigid, orbicular or ovate-cordate.

Posterior lobe of lamina of labellum broad, upturned, smooth; middle portion glandular and very hairy; anterior lobe hairy and very glandular; anther with marked sharp point	*D. elastica*
Posterior lobe of lamina smooth, horizontal, conical; middle portion very hairy, not glandular; anterior lobe very glandular, not hairy; anther quite blunt	*D. glyptodon*

7. Chiloglottis Muelleri, Fitz.

This very rare orchid, which was discovered by Mr. C. French, sen., on the Lodden River, Victoria, and described by the late R. D. Fitzgerald many years ago, seems to have been lost sight of since that period.

Recently I have received it from three localities, *viz.*, Fern Tree Gully, Healesville, and Ben Cairn, near Warburton.

The specimens were collected between October 27 and December 3, 1917, and I am indebted for them to Mr. E. E. Pescott, of Melbourne.

Strangely enough, it has never received recognition in Victoria, and does not appear on the listed plants of that State. It was merged by Baron von Mueller into *C. Gunnii*, Lindl., from which, however, it differs in several important respects.

These differences may be shown as follows:—

	C. Muelleri.	*C. Gunnii.*
1. Plant ...	Rather slender.	Rather stout.
2. Leaves ...	Relatively long and narrow; elliptical-lanceolate or oblong-lanceolate.	Relatively short and broad; oblong-lanceolate or ovate.
3. Flower ...	Narrow; quite green.	Broad; reddish-brown.
4. Labellum ...	Ovate-lanceolate; green.	Broadly ovate; reddish-brown.
5. Calli	Dark bottle-green or brown; generally sessile but occasionally very shortly stalked; mostly large with rounded or elongated contours; often crescentic, reniform or sausage-shaped; irregularly grouped in centre and at base of lamina.	Reddish-brown; a large, long-stalked, clavate callus at base of lamina, and a short, thick, almost sessile gland in front of this near the centre: a somewhat irregular row of small stalked calli on either side of these.
6. Petals ...	Spreading.	Ascending.

All my specimens were found growing on the trunks of tree-ferns *(Dicksonia)*. This habit appears to be shared in a much more limited extent by *C. Gunii*, and is referred to by Mueller,[1] C. French, sen., and others.

An illustration of the plant will be found in Fitzgerald's Australian Orchids, vol. ii., plate 16.

EXPLANATION OF PLATES.

Plate II.

Calochilus cupreus.

The central figures show the plant in its natural size.

Fig. 1. Upper-surface of labellum, ×2. Shows the fleshy glabrous rectangular base with the longitudinal raised lines and the hairy triangular lamina.

,, 2. Side view of the same, ×2. Shows the tip of the labellum produced into a ligulate process.

,, 3. Front view of column, ×2. Shows in its upper part the duck-bill anther, immediately below which is the rostellum, situated in the upper concave margin of the stigma. The dark comma-shaped glands are shown within the column wings at the base.

,, 4. Side view of the same, ×2. Shows anther in profile, and also the lateral winging of the column.

Plate III.

Pterostylis pusilla.

Central figure showing plant in its natural size.

Fig. 1. A flower (natural size) from the front.

,, 2. Labellum from above, ×3. Note labellum with raised lateral and posterior margins and scooped-out upper-surface, with long hairs on sides and very short ones on tip and vestigial appendage; the broad claw; the pyriform bodies on the lower-surface are partly to be seen projecting on each side of the labellum at the base.

,, 3. Lateral view of labellum and claw, ×3.

,, 4. Labellum seen from below, ×3. Note the pyriform bodies, one on each side of the deep central channel which traverses the entire length of the lower-surface.

,, 5. Column from front, ×3. Note the membranous wings just below the anther, and the secondary ovate-lanceolate expansion traversed by the narrow stigma.

,, 6. Column in profile, ×3. Note its curvature; also the side views of the anther and the membranous wings.

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(1) Fragmenta, viii., 151; x., 117.

Plate IV.

Drakea Huntiana, F. v. M.

At each side of the plate the plant is shown in its natural size; on the right with two flowers expanded, and on the left a flower about to expand and several very young buds.

Fig. 1. Labellum seen from above, $\times 3$. In the upper part of the drawing note the columnar foot (projection) articulated with the labellar claw, which is of about equal length; also the two anterior peduncles terminating in globular glands and the large triangular gland lying between them; also the divergent posterior tails with their numerous hairs.

,, 2. An enlargement of a bud just about to expand. The lateral sepals have already rotated to the opposite side of the ovary, but the claw-like processes of the column have not yet released their grip of the labellum.

,, 3. Lateral view of fully-expanded flower, $\times 3$. Note that the flower appears inverted owing to the acute flexion of the column and perianth segments on the ovary. The claw is seen to be inserted into the undersurface of the middle or thoracic segment of the labellum.

,, 4. Front view of column, $\times 3$. This shows the lower unexpanded portion of the column and also the upper expanded part. In the latter will be seen the upper and lower claw-like processes, the anther between the former and stigma between the latter.

ADDITIONS TO THE FLORA OF SOUTH AUSTRALIA. No. 13.

By J. M. Black.

[Read June 13, 1918.]

Plates V. to VIII.

Most of the notes in this paper are the result of a visit to the 90-mile Desert and the South-eastern District made in the end of November and the beginning of December of last year. Several other collectors have also kindly furnished me with specimens from various parts of the State, some of which are dealt with here.

Two species believed to be new to science, in the genera *Dicrastylis* and *Limnanthemum*, are described.

The following species, native in other parts of Australia, are here recorded for the first time in South Australia:—*Cardamine tenuifolia*, *Hydrocotyle plebeia*, *Hypolaena exsulca*, *Goodenia humilis*, *Melaleuca fasciculiflora*, *M. pauperiflora*, *Potamogeton tricarinatus*, *Scaevola nitida*.

Aliens are indicated by an asterisk, and the new introductions recorded are:—*Atriplex patulum*, *Carthamus glaucus*, *Dipsacus fullonum*, *Festuca elatior*, *Leontodon hispidus*, *Medicago orbicularis*, *Moenchia erecta*, *Pentaschistis Thunbergii*.

Where a new record is made for one of Tate's districts, the name of the district is given within brackets immediately after the locality.

Marsileaceae.

Marsilea Drummondii, A. Braun. "Nardoo." Bordertown, growing in mud along the Tatiara Creek (Dist. T). Leaflets silky on both sides and entire at summit.

Selaginellaceae.

Selaginella Preissiana, Spring. Dismal Swamp.

Coniferae.

Callitris propinqua, R. Br. Scrub near Enfield. Large or small tree with spreading branches.

Potamogetonaceae.

Potamogeton tricarinatus, A. Benn. Renmark (E. C. Black). River Murray, without exact locality (Mrs. Mellor).

Floating leaves 15-nerved. First record for South Australia; the type came from the Murrumbidgee River, N.S.W. *P. Tepperi*, A. Benn. Finniss R. (H. Griffith); drains at Millicent. Upper leaves 19-23-nerved; those of the Millicent specimens are broad-ovate or quite orbicular.

Gramineae.

Lepturus incurvatus, Trin. Robe (C. D. Black); Beachport (Dist. G).

Danthonia penicillata, (Labill.) F. v. M., var. *racemosa*, Maid. et Betche. Cheltenham; Keith; Millicent; Bordertown. A small grass 20-30 cm. high, with filiform, hispid leaves; the short broad outer glumes and short awn not much exceeding the lateral lobes give it the aspect of *D. carphoides*, F. v. M., but the lateral lobes are twice as long as the base.

Calamagrostis aemula, (R. Br.) Steud. Beachport. In south-eastern specimens the bristle of the rhachilla is $\frac{1}{2}$ or $\frac{3}{4}$ as long as the flowering glume, and the spikelet is 6 mm. long, while in the midland and northern specimens the bristle is very short or the rhachilla is merely produced in a tuft of hairs at the base of the palea, and the spikelets are rather shorter. An inland form with the ordinary small spikelets, but with the panicle much exceeding the leaves, as in var. *Billardieri*, is found at Millicent and Kybybolite. Mr. E. S. Alcock states that it is known at the former place as "Blown grass," because the ripe panicles are broken off near the base of the brittle stems and collect in bunches along the fences. Var. *plebeia*, Maid. et Betche (*Deyeuxia plebeia*, Benth.). Beachport.

Glyceria fluitans, R. Br. Dismal Swamp (Dist. G). Rooting at the nodes below water; erect stems 1-1·50 m. high.

Poa caespitosa, Forst., var. *laevis*, Benth. Beachport. Not tall; leaves filiform, smooth; panicle contracted, short (about 3 cm. long). Var. *tenera*, Benth. Caroline scrub. Rootstock creeping; stems more or less procumbent; panicle 1-2 cm. long, lowest branch solitary, or the panicle reduced to a raceme of 2 or 3 spikelets, each containing only 2-3 flowers.

Stipa flavescens, Labill. Robe; Beachport (Dist. G). *S. setacea*, R. Br. Bordertown (Dist. T). *S. pubescens*, R. Br. West of Bordertown; Keith (Dist. T); Beachport (Dist. G). *S. teretifolia*, Steud. Robe (C. D. Black); Beachport (Dist. G).

Amphibromus nervosus, (R. Br.) Hook. f. (*A. Neesii*, Steud.). Belair road. Brown's original specific name cannot, under the laws of nomenclature, be rejected in favour of Steudel's later appellation.

Sporobolus indicus, R. Br. Naracoorte (Dist. T; H. W. Andrew).

Triodia irritans, R. Br. Keith (Dist. T).

Panicum prolutum, F. v. M. Reserve of railway reservoir, Bordertown (Dist. T).

**Festuca elatior*, L., var. *arundinacea*, Hack. Millicent. First record for South Australia.—Europe, temperate Asia, and North Africa.

**Pentaschistis Thunbergii*. Golden Grove (H. W. Andrew). First record. Growing over a considerable patch of ground.—A handsome South African grass, common near Cape Town. Determination made at Royal Botanic Garden, Kew.

**Poa pratensis*, L. Common about Millicent, especially near drains and swamps; Blue Lake, Mount Gambier; Robe.

**Agrostis verticillata*, Vill. Common in wet ground at Millicent.

**Aira caryophyllea*, L. Caroline scrub.

**Polypogon maritimus*, Willd. Woolley Lake, Beachport. Already recorded for Robe.

**Hordeum maritimum*, With. Millicent; Bordertown.

**Lagurus ovatus*, L. Beachport; Caroline scrub. This beautiful Mediterranean grass appears to be spreading all round our coastline.

Cyperaceae.

Cyperus tenellus, L. Between Mount Gambier and Glencoe; Dismal Swamp (Dist. G). *C. Gunnii*, Hook. f. Myponga; near Onkaparinga River at Ambleside (Dist. A); between Mount Gambier and Glencoe (Dist. G).

Scirpus cernuus, Vahl. Onkaparinga River at Ambleside; Beachport; Dismal Swamp; drains at Millicent. *S. antarcticus*, L. Between Glencoe and Lake Edward.

Schoenus axillaris, (R. Br.) Poir. Millicent (Dist. G). Almost all the spikelets examined contained 2 fertile flowers, and, when ripe, 2 nuts, so that the early description by Hooker f. (Fl. Nov. Zel., i. 274) seems to be more correct than the later one by Bentham, Mueller, and others. *S. nitens*, (R. Br.) Poir. Beachport; Millicent drains; Glenelg River. *S. apogon*, Roem. et Schult. West of Bordertown (Dist. T).

Gahnia trifida, Labill. Robe (C. D. Black); shores of Lake George near Beachport (Dist. G). Locally known as "Cutting Grass." Nut about 2 mm. long, black and shining when ripe; leaves very rough downwards. *Cladium filum*, R. Br., which is scarcely to be distinguished from *G. trifida* except by the long, narrow, light-coloured nut and the smoother leaves, is also found at Robe.

Carex Gunniana, Boott. Drains at Millicent. A form remarkable for its broad leaves (to 9 mm.) with scabrous margins and the lowest female spikelet on a long peduncle, sometimes twice as long as the spikelet. *C. inversa*, R. Br. Bordertown railway reserve (Dist. T).

Cladium junceum, R. Br. Keith (Dist. T).

Lepidosperma exaltatum, R. Br. Between Mount Gambier and Glencoe; Dismal Swamp. Stems 1-1·50 m. high; growing near water. *L. longitudinale*, Labill. Myponga (Dist. A; A. D. Black). *L. concavum*, R. Br. Stansbury (Dist. Y); Tintinara; Keith (Dist. T).

L. elatius, Labill., is given by Tate (Fl., 265) for the Adelaide district, but the only specimen in his herbarium is from Mount Macedon, Victoria. Mueller, in his Key to the System of Victorian Plants, does not record it for any place further west than his "Southern District," which includes the country round Port Phillip as far west as Cape Otway. The occurrence of this plant in our State seems doubtful.

Chorizandra enodis, Nees. West of Bordertown (Dist. T).

Restionaceae.

Hypolaena exsulca, R. Br. Keith. First record of this Western Australian species in our State. The male plant appears indistinguishable from that of *H. fastigiata*, but the female has flexuose branches covered with a white, almost scaly tomentum; style-branches very short, much thickened towards the base. *H. fastigiata*, R. Br. Keith (Dist. T).

Lepidobolus drapetocoleus, F. v. M. Keith; Bordertown (Dist. T).

Centrolepidaceae.

Brizula pumilio, (F. v. M.) Hieron. Between Glencoe and Lake Edward. Stems 1-3 cm. high.

Centrolepis glabra, (F. v. M.) Hieron. Dismal Swamp (Dist. G). Stems red, 20-35 mm. long; leaves shorter.

Trithuria submersa, Hook. f. Dismal Swamp (Dist. G). A dwarf, reddish plant, growing in mud; involucral bracts 4, not "5 or 6 or sometimes 1 or 2 more," as stated by Bentham. Hooker (Fl. Tasm., ii., 79) says 4; Hieronymus (Nat. Pflanzenfam.) says 2-4. In the flowers I examined the 3 styles were divided to the base into 2 branches. The name *Juncella*, F. v. M., has been substituted for *Trithuria* by Hieronymus in the Nat. Pflanzenfam., and by Maiden and Betche in the Census of N.S.W. Plants, on the ground of priority, but as Mueller's name was announced in 1854 without any description, it cannot, under art. 38 of the Vienna rules, replace Hooker's name, published with a description in 1860. Mueller himself accepted this position in his 1st and 2nd Census.

Juncaceae.

Juncus maritimus, Lamk., var. *australiensis*, Buch. Robe; Beachport (Dist. G).

**J. capitatus*, Weig. Dismal Swamp.

Liliaceae.

Dianella revoluta, R. Br. Cummins, E.P. (Dist. L); Bordertown (Dist. T).

Arthropodium fimbriatum, R. Br. Keith (Dist. T). *A. minus*, R. Br. Bordertown (Dist. T).

Burchardia umbellata, R. Br. Keith (Dist. T).

Tricoryne elatior, R. Br. Keith; Bordertown (Dist. T).

Casuarinaceae.

Casuarina Luehmannii, R. T. Baker. "Bull Oak." Bordertown. Teeth usually 12, mostly truncate owing to the points having fallen; branchlets nearly 2 mm. in diameter, hoary with a minute pubescence visible under the lens, and very bitter to the taste, so that it is said stock will not eat this oak, although they are fond of most Casuarinas. Cones with the valves in only 2 rows in the specimens seen and therefore much depressed. *C. stricta*, Ait. Wooley Lake, Beachport, on sandy slope near the sea; branchlets drooping. *C. suberosa*, Otto et Dietr. Scrub between Macclesfield and Strathalbyn; Barossa Ranges (Dist. A); Keith; Tintinara. At Keith this was a dwarf shrub 1-1·50 m. high, and in the Tintinara specimens many of the flowers in the cone were abortive, especially towards the summit, which was consequently produced in the form of a beak; valves of fertile flowers very prominent; sheathing-teeth 6.

Salicaceae.

**Populus alba*, L. "White Poplar." Millicent. Spreading numerously by suckers in several places, some of the young trees standing 4 m. high.

Proteaceae.

Hakea vittata, R. Br. Beachport (Dist. G). A low shrub, not more than 30 cm. high; stems procumbent. *H. ulicina*, R. Br., var. *flexilis*, F. v. M. East Wellington; Keith; Bordertown.

Polygonaceae.

Rumex Brownii, Campd. Dismal Swamp. Dwarf form about 10 cm. high, with 3 teeth on each side of the inner perianth-segments, as in most South Australian specimens. Deceptively like stunted forms of **R. acetosella*, L. (Sorrel), which were growing in the same damp ground. *R. bidens*, R. Br. Drains at Millicent; Lake Edward.

CHENOPODIACEAE.

Atriplex angulatum, Benth. Willochra Creek, near Quorn. Perianth appears quite distinct from that of *A. campanulatum*, Benth., although the two species were united by Mueller. This is the first time I have seen this plant. The specimen was collected on the Willochra Creek by Mr. Vosler, the Californian parasitologist who visited this country in March, 1918.

**A. patulum*, L. "Common Orache." Outer Harbour, close to sea and inland from Henley Beach, fruiting perianth submuricate; ballast dump, Port Adelaide, perianth smooth (H. W. Andrew). First record for South Australia.—A common and very variable weed of the Old World.

Chenopodium glaucum, L. A form with small leaves (mostly 5-10 mm. long) and succulent red stems, is numerous on the bed of Lake Ormerod, near Naracoorte, when the water recedes.

PORTULACACEAE.

Anacampseros australiana, J. M. Black. On February 2, 1918, a plant of this species, cultivated in my garden, opened its flowers for the first time in my experience, the 5 very pale pink concave petals almost erect and as long as the sepals; stamens 8. The flowering state in which the calyx scarcely opens and the petals are much shorter than the sepals, and on which the description was founded, is therefore not constant, although it appears to be the normal one.

Claytonia australasica, Hook. f. Swamps at Murray Bridge (Dist. M); Dismal Swamp.

CARYOPHYLLACEAE.

**Moenchia erecta*, (L.) Gaertn. Between Glencoe and Lake Edward. A small weed of Central and Southern Europe. First record for South Australia; recorded for Victoria (as *Cerastium quaternellum)* in 1893.

**Silene conica*, L. Millicent, roadsides and fields. Already recorded for Robe in 1911.

CRUCIFERAE.

Cardamine tenuifolia, Hook. Dismal Swamp. Growing in water; stems weak. This plant, with its large white petals, leaves all with linear lobes and pod terminating in a style 2 mm. long, is so distinct in appearance from *C. hirsuta*, L., that I prefer to follow Bentham in keeping it a separate species. Not previously recorded in South Australia.

Brassica adpressa*, (Moench) Boiss. (*Sinapis incana*, L.) "Hoary Mustard." Roadsides and uncultivated fields; said also to occur in cultivation. Locally called "Buchan weed." Also at Naracoorte (H. W. Andrew). A European weed, previously recorded for Port Lincoln. In the South-east it appears to take the place of the Wild Turnip (Rapistrum rugosum*) of the North.

**Alyssum maritimum*, Lamk. Millicent. Growing wild in abundance on allotments and fields near the town. Already recorded for Robe.

Resedaceae.

**Reseda alba*, L. "White Mignonette." This handsome plant, previously found on Kangaroo Island and at Robe, is common on vacant land near the railway station, Beachport.

Crassulaceae.

Tillaea colorata, Nees. Dr. C. H. Ostenfeld, of Copenhagen, who is writing a series of papers on the flora of Western Australia, tells me in a letter that, having compared specimens of *T. acuminata*, Reader, with *T. adscendens* and *T. colorata*, Nees, he finds they are all one and the same species, and as Nees' specific name has a priority of 54 years it must replace that of Reader in our flora. *Colorata* is chosen, because *adscendens* is already employed for a species of *Crassula*, with which *Tillaea* has been recently united as a subgenus by European botanists. *T. macrantha*, Hook. f., var. *pedicellosa*, F. v. M. Between Glencoe and Lake Edward. *T. recurva*, Hook. f. Dismal Swamp. Petals 4, white, nearly twice as long as the sepals; scale oblong, nearly half as long as the carpel, which contains 3-4 seeds. *T. Sieberiana*, Schult. Hundred of Caroline.

Leguminosae.

Dillwynia ericifolia, Sm., var. *peduncularis*, Benth. Penola Forest (W. Gill); between Mount Gambier and Glencoe. *D. hispida*, Lindl. Bordertown; Keith (Dist. T); between Murray Bridge and Callington (Dist. M).

Pultenaea pedunculata, Hook. Bordertown (Dist. T). *P. tenuifolia*, R. Br. Strathalbyn (Dist. A); Warunda (Dist. L; H. Griffith). Var. *recurvifolia*, Benth. Mount Burr, near Millicent.

Acacia farinosa, Lindl. Edilillie; Lake Wangary (Dist. L; H. Griffith); Port Vincent (Dist. Y).

A. acinacea, Lindl. Bordertown (Dist. T). A small shrub, only 50 cm. high or less, with spreading stems and branches, sometimes very long and procumbent; Mount Thisbe, K.I. (Dist. K; H. Griffith). The specimens from Bordertown have the phyllodia broader in the centre and more contracted towards the base than those from Eyre Peninsula and Kangaroo Island, and the pod is broader (4-5 mm. as against 3 mm.).

A. retinodes, Schlecht. The phyllodia vary from linear-lanceolate and 3-5 mm. broad to oblanceolate and 6-12 mm. broad. In maritime forms from Wedge Island and Beachport they are thick and rigid, with a breadth of 10-25 mm.

A. salicina, Lindl. "Umbrella Bush." Naracoorte (Dist. T; H. W. Andrew).

A. rigens, A. Cunn. Monarto South (Dist. A; Miss A. McMahon).

A. Menzelii, J. M. Black. Through the kindness of Miss A. McMahon, school teacher at Monarto South, pods and seeds of this species have now been obtained, and are figured on plate v. The pods of *A. Menzelii* are linear, straight or curved, 25-45 mm. long, 2-3 mm. broad, the valves viscid-pustulate; the seeds black, shining, oblong, 4 mm. long by 1½ mm. broad, the last 2 folds of the funicle swollen into a large, fleshy aril. They show a close relationship to those of *A. rigens* and *A. Bynoeana*, but the pod of *Menzelii* is much straighter and the seeds are narrower.

A. Bynoeana, Benth. After reading the original description of *A. Wilhelmiana*, F. v. M., in Trans. Phil. Soc. Vic., i., 37 (erroneously quoted as "*A. Wilhelmsiana*" and the reference as "Trans. Phil. Inst. Vict." in Fl. Aust., ii., 339), I have no doubt that this species is the same as *A. Bynoeana*. Mueller describes it as having "phyllodia incurved, upright, short, linear, filiform, compressed, ending in a broader, blunt, recurved apex, above or on both sides furrowed and furnished with 2 thin veins." This description agrees with *A. Bynoeana* and not with *A. calamifolia*, of which Bentham wished to make it a short-leaved variety. Besides *A. Wilhelmiana* comes from the "mallee scrub on the Murray, where it was first discovered by Mr. Wilhelmi," and that is just the locality where *A. Bynoeana* is found. This identification, if corroborated by examination of the types, would entail no change of name, as *A. Bynoeana* has the right of priority by at least one year. In specimens from Loxton and Karoonda the phyllodes are flat and 2-3 mm. broad, much resembling those of *A. sclerophylla*, but the latter has the phyllodes with 3 prominent nerves and 4 faint intermediate ones on each surface, while those of *A. Bynoeana* have 2 prominent nerves and (in the broad-leaved form) 2-3 faint intermediate ones, and the mucro is curved at a more acute angle.

A. microcarpa, F. v. M. Yumali (Dist. T; S. A. White); Halbury scrub (Dist. N).

**Trifolium resupinatum*, L. "Reversed Clover." Stockyards at Mount Gambier; roadside between Mount Gambier and Glencoe; common at Millicent. First record for South Australia, although listed for Victoria by Mueller in 1887. It is rather conspicuous by its bright pink flowers, and in its woolliness bears considerable resemblance to *T. tomentosum* and *T. fragiferum*. The former is also common in the South-east. **T. incarnatum*, L. "Crimson Clover." Between Mount Gambier and Glencoe.

**Medicago orbicularis*, All. Field near Collinswood (H. W. Andrew). This flat-podded medic has not previously been noticed in S.A., but was recorded for Victoria in 1907.—Mediterranean region. **M. lupulina*, L. "Black Medic." Very common in moist place near Millicent. **M. hispida*, Gaertn., var. *inermis*, Urb. (*M. reticulata*, Benth.). Bordertown. Var. *lappacea*. Millicent. Pod black and larger than in var. *denticulata*, Urb. (*M. denticulata*, Willd.).

**Cytisus canariensis*, L. "Canary Broom." Established in fields and roadsides near Mount Gambier

Geraniaceae.

Pelargonium Rodneyanum, Lindl. Naracoorte; Bordertown; Keith. Petals pink, streaked with crimson. *P. australe*, Willd., var. *erodioides*, Benth. Beachport; Caroline Scrub; Dismal Swamp.

**Geranium molle*, L. This delicate little plant, rare near Adelaide, is common in the moister climate of Mount Gambier.

Euphorbiaceae.

Beyeria viscosa, (Labill.) Miq., and *B. opaca*, F. v. M. Tate, in his Flora, gives *B. viscosa* for the Adelaide district, and in another place (although I have lost the reference) he says, "Mount Lofty Range, near water." His herbarium, however, contains no typical specimens of that species. Bentham (Fl. Aust., vi., 65) gives only *B. opaca* for South Australia. Mueller, in Fragm., i., 230 (1859), united *B. opaca* with *B. viscosa*, but later on he changed his opinion, and they remain distinct in his 1st and 2nd Census. Bentham distinguished *B. opaca* chiefly by its smaller leaves, and laid little stress on the length of the pedicel or the shape of the fruit. In his key to the system of Victorian plants (1887-8) Mueller divided the species as follows:—

Leaves oval or elliptical-lanceolate; stalklets much longer than calyx; fruit comparatively large ... *B. viscosa*

Leaves broad-linear, blunt; stalklets about as long as the calyx; fruit comparatively small ... ... *B. opaca*

Unfortunately many South Australian specimens, especially from Robe and Beachport, in the South-east, have leaves broadly lanceolate and acute, 2-4 cm. long, but the pedicels are always short, never as long as the almost globular fruit, and very different from specimens collected in Tasmania, which have pedicels 12-15 mm. long, much longer than the large obovoid capsule, which is almost lobed, owing to the deep furrows between the cells. This is the typical *B. viscosa*, as shown in Labillardière's figure. In short, if the two species are distinguished by the pedicels and fruits, we do not, on the present evidence, possess *B. viscosa* in South Australia; if they are distinguished by the leaves, we do. Probably the two species should be united, but if they are maintained distinct, I should feel inclined to make the pedicels and fruit the leading characteristic, and in that case we have only *B. opaca*, with the following localities: Robe, Beachport, Port Vincent, Kangaroo Island, Marino, Cape Thevenard (leaves lanceolate or oblanceolate, long or short, acute or obtuse, very white below); Loxton, Ooldea (leaves oblanceolate, short, light green below); Alawoona, Loxton, Yaninee, Gladstone, Quorn (leaves broad-linear, usually short, 1-2 cm. long). Var. *linearis*, Benth. Torrens Gorge; Clarendon.

Phyllanthus trachyspermus, F. v. M. Mount Lyndhurst (border of Dists. C and S). Sent to the Department of Agriculture under suspicion of poisoning stock.

Bertya Mitchellii, J. Muell. Eight miles inland from Port Broughton (Dist. N; F. S. Salisbury); Yumali (Dist. T.; S. A. White). This species has been recently united with *B. oleifolia*, Planch., from which it was distinguished in the Fl. Aust. by its narrower leaves.

**Euphorbia helioscopia*, L. Paddock near Walkerville terminus (H. W. Andrew). Already recorded from Port Lincoln.

Rhamnaceae.

Spyridium eriocephalum, Fenzl., var. n. **adpressum.** *Variat foliis confertis adpressis subcylindricis 3 mm. longis apiculo deflexo terminatis, petiolis brevibus sed conspicuis, capitulis sessilibus, foliis floralibus 2-3.*

Port Lincoln; Edilillie (H. Griffith). A slender shrub, easily recognized by its small, crowded, erect, glossy leaves. The typical form of *S. eriocephalum*, with spreading leaves 3-10 mm. long, is found at Karoonda and in other parts of the Murray scrub, Woodchester, Keith, Bordertown, Stansbury, and Minnipa. It is a shrub with intricate branches, about 50 cm. high. A form with thicker and broader leaves, sometimes with a slight groove on the upper face, occurs on Kangaroo Island and at Port Vincent.

S. vexilliferum, Reiss. The typical form, with rather long, spreading leaves, hispid and deeply grooved above owing to the prominent midrib below, is found in many parts of the Mount Lofty Range, while var. *latifolium*, Benth., grows at Square Waterhole, at Victor Harbor, and on Kangaroo Island.

S. bifidum, F. v. M. The typical form, with cuneate bifid leaves, occurs at Port Lincoln and Hog Bay, K.I.; also in the Flinders Range near Beetaloo, with the leaves narrower and merely emarginate or sometimes entire at the summit; from Port Lincoln I have specimens with the same foliage, large heads, and conspicuous floral leaves, but all the leaves entire at the summit.

Cryptandra amara, Sm. Yumali (Dist. T; S. A. White). Var. *longiflora*, F. v. M. Bundaleer (Dist. N). *C. tomentosa*, Lindl. Yumali (Dist. T; S. A. White).

Malvaceae.

Hibiscus Drummondii, Turcz. Hundred of Goode. B. P. Bowering. Already recorded for Minnipa.

Sterculiaceae.

Thomasia petalocalyx. F. v. M. Pinery near Reedbeds; Sandergrove; Port Willunga; Kingscote, K.I. The calyx is divided to ½-1 mm. from the base, so that in this respect there is nothing to distinguish this species from a *Lasiopetalum*. The anthers, however, open in slits extending about halfway down the cells.

Dilleniaceae.

Hibbertia stricta, R. Br., var. *hirtiflora*, Benth. Cape Borda (H. Griffith); Tintinara; Keith. Sepals villous: stamens about 9; carpels 6-ovulate, but usually only 1 of the 2 carpels ripens a seed, which is globular and arillate at base. Var. *canescens*, Benth. Snug Cove; Ravine Creek, K.I. (H. Griffith). *H. fasciculata*, R. Br. Between Mount Gambier and Glencoe. Petals obovate, not emarginate; leaves very slender.

Violaceae.

Viola hederacea, Labill. Growing in shady spots under stringybarks in the Caroline scrub, also round lakes at Dismal Swamp. Petals violet, edged with white.

Hybanthus floribundus, (Lindl.) F. v. M. Karoonda (Dist. M; E. Ashby); Beetaloo (Dist. N).

Thymelaeaceae.

Pimelea octophylla, R. Br. Keith (Dist. T).

Lythraceae.

Lythrum salicaria, L. Murray Bridge (Dist. M; A. R. Hilton). *L. hyssopifolia*, L. Bordertown (Dist. T).

Myrtaceae.

Eucalyptus oleosa, F. v. M. Enfield, in a small patch of untouched scrub; Strathalbyn; Dublin scrub (Dist. A); Cis-Murray scrub near Monarto (Dist. M). On the western side of the Murray it is a "scrub mallee"; at Enfield it is a large or small tree with a very rough bark, and resembles "peppermint" *(E. odorata)*.

E. ovata, Labill. *(E. Gunnii*, F. v. M., non Hook. f.). Myponga, a large tree with rough, dark bark on the stem, umbels 4-8-flowered; Glenelg River, a small tree; Cape Northumberland; road from Mount Gambier to Glencoe, a small tree about 4 m. high, with light bark except at the very base, and drooping branches, some of the leaves ovate-lanceolate.

E. capitellata, Sm. "Stringybark." Glencoe (with large fruits); Bordertown (with smaller ones).

E. obliqua, L'Hér. Hd. of Caroline; Millicent; road from Mount Gambier to Glencoe. "Stringybark," and also sometimes called "Messmate" in the South-East, as in Victoria.

E. diversifolia, Bonpl. Beachport.

E. viminalis, Labill. Dismal Swamp. A large tree with dark bark and spreading branches.

E. uncinata, Turcz. Keith. A whipstick mallee, 1·50-2 m. high, with light bark, buds 8-12 in umbel.

E. leucoxylon, F. v. M. Bordertown. A large tree with glaucous foliage, but with the small, almost hemispherical fruits of var. *pauperita*, J. E. Brown; valves of capsule usually 7.

E. incrassata, Labill. Keith; Bordertown. The form with large fruits (15 mm. long); the brown bark peeling off in the usual way and lying in long strips on the ground.

Melaleuca pauperiflora, F. v. M. (plate v.). One of the "Paper-bark teatrees." Dublin scrub (H. Griffith); between Iron Knob and Franklin Harbor (J. Sincock); Minnipa; a few miles north of Murat Bay. A Western Australian species, now first recorded for S.A., and hitherto confused (in our State) with *M. pustulata*. The determination was made by Mr. Edwin Cheel, botanical assistant at the Sydney National Herbarium, who is devoting special attention to this genus. The species is recognizable by its blunt, compressed-cylindrical leaves, 4-6 mm. long, with a shallow groove running along the upper face, and by the short, obtuse calyx-lobes. The small ovoid or globular fruits are in clusters of 2-6 on the previous year's wood. A single specimen exists in the Tate Herbarium unlabelled, but a loose label is marked "Ardrossan," and it probably exists on Yorke Peninsula. The shrubs which I saw north of Murat Bay were 2-3 m. high, with loose, light-coloured, papery bark.

M. fasciculiflora, Benth. Torrens Gorge; Beachport. The Tate Herbarium contains similar specimens from Port Lincoln district and Yallum. A shrub, usually rather low and always growing near fresh water; a Western Australian species not hitherto recorded for S.A., because it has been confused with *M. ericifolia*, Sm. This identification is also due to Mr. Cheel. The white flowers grow in small clusters on the previous year's wood, but sometimes flowers which are male only form small globose terminal heads; the fruits, which are truncate, rough, and somewhat corky, occur still lower on the branches, solitary or in clusters of 2 to 6; the leaves are 3-8 mm. long, flat above, convex below, and with 2 parallel rows of more or less immersed tubercles on the under-surface. The filaments in each bundle vary from 10-20, while in Bentham's description they are given as 7-11.

M. quadrifaria, F. v. M. (plate v.). The type was collected at Eucla by J. D. Batt in 1886, and sent to Baron von Mueller, who evidently intended to describe it in Wing's Southern Science Record. In the 2nd Census (1889) the reference is: "F. v. M., in Wing's S. Sc. Rec., April, 1886." In the 1st supplement of the Index Kewensis (1895) it appears as "F. Muell., in Wing's South. Sc. Record, N.S., ii. (April, 1886)." In spite of these two statements it appears certain that the number for April, 1886, was never published. The copies of this periodical in the Adelaide and Melbourne Public Libraries and in the Victorian National Herbarium contain no such number. Mr. F. A. G. Barnard, writing in the Victorian Naturalist, xvi., 112-3 (1899), claims to have a complete set of the Record, and says that the undertaking was frequently interrupted owing to pecuniary difficulties, and that only four monthly numbers were issued in 1885 and one (for January) in 1886, after which publication ceased altogether. The only known description of *M. quadrifaria* is in Tate's Fl. Extra-trop. S.A., 93, and is as follows:—

Leaves elongate, recurved-pointed.
Leaves opposite in 4 decussate rows; flowers in well-developed heads ... ... *quadrifaria*

The leaves are not elongate, being only 4-6 mm. long, and as short as those of any other South Australian species except *M. gibbosa*, while the point is rather slightly oblique than recurved. The remainder of the description would apply equally well to a number of other species of the genus. There is no specimen in the Tate Herbarium, and Professor Ewart very kindly lent me one from the Victorian National

Herbarium for examination and drawing. In order to validate Mueller's name a short diagnosis is here given:—

Melaleuca quadrifaria, F. v. M. *Herb. (tab. v). Frutex fere glaber, ramulis ad folia inserenda excavatis, floriferis incrassatis puberulis, foliis sessilibus decussatis confertis erectiusculis 4-6 mm. longis semicylindricis (supra planis vel parum canaliculatis infra convexis) acutis apice paululum recurvis basi latâ obliquâ orbiculari subpeltatim affixis, floribus albis circiter 15 in capitulum terminale aggregatis, calyce ovoideo 4 mm. longo, lobis acutis 1 mm. longis, filamentis cujusque phalangis 7-11 ungui duplo longioribus, fructibus globosis circiter 3 mm. diametro.*

Although the leaves in size and shape rather resemble those of *M. cymbifolia* and *cuticularis* than those of any species belonging to Bentham's Series vii., *Peltatae*, Mueller was no doubt right in placing it in his Census next to *M. tamariscina*, on account of the manner in which the leaves are attached by their broad base almost peltately to the excavations of the branchlets, leaving behind them, when they fall, large circular scars. A copy of some manuscript notes by Mueller was also supplied by Professor Ewart, and (if I interpret the contractions correctly) they are as follows:—"Bracts very narrow, shorter than calyx; axis slightly downy; calyx glabrous, its lobes deltoid, 3 times shorter than the tube and hardly half as long as the orbicular white petals; stamens 7-11 in each bundle, the filaments arising fascicularly from the connate part and surpassing it nearly twice in length."

M. Wilsonii, F. v. M. West of Bordertown. A straggling shrub about 1·50 m. high; filaments 11-15; fruiting-calyx 5-angled at summit by the persistant portion of the lobes.

M. squarrosa, Sm. Dismal Swamp; Glenelg River; between Mount Gambier and Glencoe. Petals and filaments white, a variation in colour already noticed by Mueller (Fragm., v., 55).

Oenotheraceae.

Epilobium glabellum, Forst. Near Glenelg River; Beachport. At Dismal Swamp a dwarf form was common, 3-10 cm. high; leaves only 6-12 mm. long, glabrous, oblong, irregularly and rather prominently toothed; flowers small; perhaps a distinct species. *E. junceum*, Forst. Waterfall Gully; Scott Creek; Woodside; Hamilton.

Halorrhagidaceae.

Halorrhagis heterophylla, Brongn. Bordertown (Dist. T). Small, rather typical specimens, hispid, with leaves lanceolate, entire or 3-lobed.

Umbelliferae.

Hydrocotyle plebeia, R. Br. Beachport. Creeping among other plants in sheltered spots. Resembles *H. pterocarpa*, F. v. M., but the fruit, although not quite ripe, has no sign of wings, and is 1½-2 mm. broad; plant glabrous, except for a small tuft of hairs at the base of the leaf, which is also sometimes found in *H. pterocarpa;* petals purple, spreading. A Western Australian species, not hitherto recorded for South Australia. Bentham suggests that *H. pterocarpa* may prove to be a variety of *H. plebeia*.

**Pastinaca sativa*, L. "Parsnip." Growing wild along the railway reserve, Millicent, to a height of 1½ m. Recorded by Bentham as growing near Adelaide, but I have not previously seen it wild.

**Conium maculatum*, L. "Hemlock." This handsome but poisonous weed is becoming common in fields and vacant lots near Mount Gambier and Millicent.

Epacridaceae.

Acrotriche ovalifolia, R. Br. Beachport. Fruit 3-4-celled.

A. serrulata, R. Br. Beachport (Dist. G). An almost glabrous plant, the leaves broader than usual, and 6-10-nerved below. My specimens are in fruit only, and possibly represent a new species.

Brachyloma ciliatum, Benth. Between Mount Gambier and Glencoe. A small shrub 20-30 cm. high, apparently rare, or at least localized.

Leucopogon costatus, F. v. M. Keith (Dist. T). Appears to be the first record of this species on the mainland. The new specimens agree with those from Western Bay, K.I. Leaves only 2-3 mm. long, ciliolate, often half-clasping by the cordate base; bracteoles small; sepals oblong, ciliolate, longer than the corolla-tube; ovary 2-celled.

Gentianaceae.

Limnanthemum stygium, *n. sp. (tab. vi.). Herba aquatica stolonifera, foliis radicalibus longe petiolatis ovato-cordatis 20-25 mm. longis; caule florifero unum folium oblongum petiolatum racemum suffulcientem gerente; pedicellis geminatis bracteolatis ad basin racemi folio florali vel bracteâ amplexicauli suffultis; calycis segmentis ovatis 3-nerviis 3-4 mm. longis, corollae roseae lobis margine fimbrillatis calycem vix superantibus ad basin staminum barbatis, stigmate late bilobo, fructu ignoto.*

Dismal Swamp, 15 miles north of Mount Gambier. A small water-plant, near *L. geminatum*, (R. Br.) Griseb., but differs in the pink and shorter corolla, the leaves ovate instead of orbicular, and to some extent in the inflorescence. The specific name is given in allusion to the name of the locality, but the swamp has now been drained to a considerable extent, and consists chiefly of small lakes or marshes, interspersed with woodland.

Sebaea albidiflora, F. v. M. Robe; Dismal Swamp.

CONVOLVULACEAE.

Wilsonia Backhousii, Hook. f. Covering considerable areas on the flats beside Lake George at Beachport. The following observations were made on the fresh plant:—Leaves succulent, lanceolate, tapering at base; corolla white, the tube nearly twice as long as the green, succulent calyx; anthers oblong, purple, spirally twisted after flowering; stigmas ovoid, greenish, somewhat laterally affixed to the summit of the geniculate style-branches.

Evolvulus alsinoides, L. Wynbring, East-West Railway (Dist. W; S. A. White).

Cuscuta tasmanica, Engelm. Beachport, on southern shores of Lake George. The whole plant has an orange tint, so that its tangled masses make broad orange patches or bands on the ground, sometimes taking the shape of rings. Parasitic on *Wilsonia Backhousii*, *Lepturus incurvatus*, and other lowly plants.

**Convolvulus arvensis*, L. Millicent. Flowers almost white.

BORRAGINACEAE.

Cynoglossum suaveolens, R. Br. Millicent; Lucindale. Corolla white; scales closing the throat yellow; flowers not scented.

VERBENACEAE.

Dicrastylis verticillata, *n. sp. (tab. vii.). Fruticulus ramosus, omnino pilis stellato-ramosis vestitus, foliis plerisque ternis verticillatis sessilibus linearibus 7-10 mm. longis margine revolutis et saepe rugosis, floribus subsessilibus in fasciculos ternos 2-4-floros (cymas abbreviatas) aggregatis verticillastros distantes formantibus, bracteolis sub quoque fasciculo 2 lanceolatis, bracteis verticillastri 3 ovatis, omnibus longe ciliatis, calyce 4 mm. longo usque ad basin in segmenta linearia diviso, corollae albidae tubo calycem subaequante intus barbato, lobo infimo orbiculato 4 mm. longo ceteros breves rotundatos multo superante, staminibus 5 exsertis, ovario stylo et parte inferiore ramorum styli dense pilosis, ramis stylo longioribus.*

Hundred of Goode, north of Murat Bay (B. P. Bowering). Placed in *Dicrastylis* on account of the long style branches and the 5 stamens, the leading characteristics of that genus, but in the large lowest lobe of the corolla and the verticillate, arrangement of the leaves in 3's it stands near several species of *Pityrodia.* In the shape of the leaves and flowers it bears a resemblance to *D. parvifolia*, F. v. M., which also has one of the corolla-lobes larger than the others, but it differs in the whorled arrangement of foliage and flowers, which gives it somewhat the aspect of a Labiate. The calyx and corolla are also twice as large in *D. verticillata*, and the inflorescence distinguishes it from any hitherto described species of *Dicrastylis.*

Solanaceae.

**Lycium campanulatum*, E. Mey. "Boxthorn." Millicent and Mount Gambier; numerous in places.

Scrophulariaceae.

Mimulus repens, R. Br. Lake Ormerod (Dist. T; H. W. Andrew).

Mazus pumilio, R. Br. Millicent drains; Dismal Swamp.

Limosella aquatica, L. Dismal Swamp.

**Bartsia viscosa*, L. Millicent. Already recorded from Myponga.

**Veronica anagallis*, L. "Water Speedwell." Main drain at Millicent. A common and rather coarse plant, the hollow stems rising 20-30 cm. above the water. The stems are pubescent, with spreading hairs below the water-line, elsewhere the plant is glabrous. It must have been naturalized for many years in the South-east, as there is a specimen from Millicent in the Tate Herbarium.

Myoporaceae.

Myoporum acuminatum, R. Br. (*M. montanum*, R. Br.). Wooley Lake, Beachport (Dist. G); Wirrabara (Dist. N).

Rubiaceae.

Opercularia ovata, Hook. f. Between Glencoe and Lake Edward. Stems procumbent and sheltered under the scrub; stamens only 2 in the flowers examined.

Galium Gaudichaudii, DC. In sand near Salt Lake, Beachport. A small plant with erect or ascending stems and hispid leaves, sometimes with a woody root-stock and far-spreading roots, so as to appear perennial; fruits smooth when fresh; corolla light-yellow.

Caprifoliaceae.

Sambucus Gaudichaudiana, DC. A solitary specimen of this beautifully scented shrub was growing in the scrub on the hillside above Wooley Lake, Beachport.

Dipsacaceae.

******Dipsacus fullonum*, L. "Fuller's Teasel." Tantanoola. The scales of the receptacle are hooked, but 3 or 4 of the involucral bracts are ascending, thus showing a tendency towards the wild European plant (*D. silvestris*, Huds.). First record for South Australia.

**Scabiosa maritima*, L. "Purple pincushion." Common at Millicent, as it is near Adelaide.

Campanulaceae.

Lobelia concolor, R. Br. Bordertown, in drains near railway reservoir (Dist. T).

Goodeniaceae.

Velleia paradoxa, R. Br. Clare (H. W. Andrew). Flowers white instead of yellow. Bordertown (Dist. T), luxuriant specimens, over 60 cm. high.

Scaevola nitida, R. Br. Beachport. Hitherto recorded only for Western Australia.

Goodenia humilis, R. Br. Dismal Swamp, near Mount Gambier. First record for South Australia, but given in the Fl. Aust. for the Glenelg River, Vict., which runs close to our border. *G. glauca*, F. v. M. Bordertown (Dist. T). *G. varia*, R. Br. Bordertown (Dist. T). *G. pinnatifida*, Schlecht. Bordertown. A form more glabrous than usual, and with many of the radical leaves oblanceolate and entire.

Selliera radicans, Cav. Millicent; Glenelg River (Dist. G); Lake Ormerod (Dist. T; H. W. Andrew).

Dampiera marifolia, Benth. One mile west of Bordertown (Dist. T).

Stylidiaceae.

Stylidium graminifolium, Swartz. Between Mount Gambier and Glencoe. Slender specimens compared with those of the Mount Lofty Range; leaves about 10 cm. long.

Compositae.

Brachycome debilis, Sond. Robe (C. D. Black); Hundred of Caroline (Dist. G).

Cotula reptans, Benth. Beachport; Millicent drains.

Senecio lautus, Sol., var. *lanceolatus*, Benth. Beachport. A handsome perennial 1½ m. high; ray-flowers 6-8, those of the disk about 25; leaves broad, deeply toothed or lobed, with large, stem-clasping auricles.

Eclipta platyglossa, F. v. M. River Murray (H. Griffith); Renmark (H. W. Andrew); Bordertown. A variable species; the achenes are sometimes warted, as in Mueller's description

(Fragm., ii., 135), and in plate 39 of Pl. Vict., and sometimes quite smooth. The leaves vary much in size.

Helichrysum leucopsidium, DC. Bordertown (Dist. T).

Cassinia aculeata, R. Br., *C. laevis*, R. Br., and *Humea punctulata*, F. v. M. In these Transactions, xii., 63 (1889), Professor Tate wrote: —

"*Cassinia laevis*. This proves to be conspecific with *Humea punctulata*, and the correct designation will be *Cassinia punctulata*, F. v. M. and Tate. It is recorded as *Humea cassiniacea* in the Ardrossan list, and as *Cassinia alasia*, F. v. M., MS., from Coonalpyn."

The proposal here made to substitute such a combination as *C. punctulata* (*H. punctulata* only dates from 1863) for *C. laevis*, which dates from 1817, is, of course, impossible. In his Census at p. 67 of the same volume of the transactions, and in Fl. Extratrop., S.A., published in the following year (1890), Tate retains both *C. laevis*, *C. punctulata*, and *C. aculeata*. Mueller, in his 2nd Census (1889) dropped *Humea punctulata*, but did not reproduce the specific name under *Cassinia*. Thus, in his Flora, Tate appears desirous of introducing *C. punctulata* as a species intermediate between *aculeata* and *laevis*, and in his description (p. 123) he repeats the old error which was made as regards *Humea punctulata* ("one flower in each headlet"). This mistake arose because the original specimens submitted to Mueller were in bud only (Fragm., iii., 137), and it was repeated by Bentham (Fl. Aust., iii., 590). Turning to the Tate Herbarium we find the only specimens labelled "*C. aculeata*" are from the eastern States, the leaves typically scabrous-hispid, with short hairs on the upper face. Under "*C. laevis*" are some specimens from the Flinders and Gawler Ranges, the branchlets white-tomentose, the panicle or corymb varying greatly in size and density, the lateral branches sometimes exceeding the inflorescence. The type of *C. laevis* came from the head of Spencer Gulf. Under "*C. punctulata*" Tate has placed various specimens collected at places from Port Elliot to Melrose, with leaves similarly glabrous above, but with the branchlets less hairy and often viscid. They do not appear specifically different from *C. laevis*, and that was evidently Mueller's opinion also. Nor do I think, with the specimens we now possess, that a specific difference can be maintained between *C. aculeata* and *C. laevis*. At first I thought this could be done under Brown's original formula—that *C. aculeata* had leaves hispid above, while *C. laevis* had them smooth—but in the 90-mile Desert, just west of Bordertown, I collected specimens with the young leaves scabrous and hispid, and the older ones glabrous and smooth, in some cases even the young leaves were glabrous. Thus it would seem that the two constitute one species, coalescing about the border of South Australia and Victoria. Bentham appears to me to sanction the union when he writes (Fl. Aust., iii., 586) that the leaves of *C. aculeata* are "very rarely smooth or nearly so." They are of equal date, but *C. aculeata* has priority of paging. The arrangement for South Australia would therefore be:—

C. aculeata, R. Br. (approaching the type), Bordertown. Var. *laevis*, Port Elliot; Murray Lagoon, K.I.; Caloot, near Mannum; Coonalpyn; Sherlock; Ardrossan scrub; Pitcairn Station, near Nackara; Beetaloo; Melrose; Telowie Gorge; Telowie scrub; Aroona; Gawler Ranges.

[Since writing this I have received from Hawker (Miss Reed) a typical specimen of *C. aculeata* as regards the scabrous leaves, which are also conspicuously decurrent; flowers 10-12 in head; pappus-bristles about 12, barbellate in the upper part only.]

Olearia picridifolia, Benth. Yumali (S. A. White). See these Trans., xxxv., 2. *O. pimeleoides*, var. *minor*, Benth. Yumali (Dist. T; S. A. White).

Helichrysum retusum, Sond. et F. v. M. Yumali (Dist. T; S. A. White). *H. ferrugineum*, Less. This rather rare shrub, which in our specimens has always a white (not rusty) tomentum, was found on the Glenelg River and at Lake Edward, near Glencoe.

Calocephalus Dittrichii, F. v. M. (pl. viii.). The drawing was made from a specimen in Mr. Walter Gill's herbarium, collected on Coward Springs Mound, November 19, 1891. The type came from near Charlotte Waters, N.T. It is given for District C in Tate's Flora, but there is no specimen in the Tate Herbarium. Professor Ewart says that Mr. Gill's specimen agrees well with the type in the Victorian National Herbarium, and it is certainly the same as a named specimen which Mr. J. H. Maiden kindly sent me from the National Herbarium of New South Wales, and which was collected by Max Koch near Catt Springs, Murnpeowie, in September, 1898. The species is recorded by Moore for the northern interior of New South Wales. The original description was published by Baron von Mueller in Uhlworms Botanisches Centralblatt, xxvii., 300 (1886), and as this periodical is very rare, if not inaccessible, in Australia, the diagnosis, kindly supplied by Professor Ewart, is here given in full:—

"*Calocephalus Dittrichii* (*Myriocephalus Dittrichii*, F. v. M. Coll.). Annual, woolly-tomentose, neither tall nor much branched; leaves scattered, linear, blunt, nearly flat or somewhat channelled, slightly broader at the base; glomerules rather small, terminal, solitary, depressed-globular, the summit of the branchlets forming often a short peduncle; general involucre not exceeding the glomerule, constituted of several rows of bracts; the latter green, narrow, woolly, and terminated by a minute scarious yellow glabrous ovate- or cordate-roundish lamina; general receptacle small, not conspicuous, elevated, bearing numerous flower heads; bracts constituting the ultimate involucres several, oblong or linear-cuneate, hyaline, 1-nerved, woolly only under the small yellow roundish radiating lamina; flowers minute, 11-24 in each head; corolla slender, gradually widening upwards; achenes truncate-ellipsoid, subtle-papillular; pappus very tender, white, formed of very few laxely plumous-bearded somewhat intricate bristles, those at the summit slightly tufted, at the very base connate.

"Near Charlotte Waters; Lieutenant Dittrich; collected during Mr. Lindsay's expedition.

"The specimens seen about hand-high. Leaves $\frac{1}{3}$-$\frac{2}{3}$ inches long, the lowest early evanescent. Clusters of flower-heads about $\frac{1}{2}$ inch broad. General receptacle crowded with the persistent woolly involucral bracts. Flower-heads with their proper bracts singly separable; the latter hardly exceeding the corollas, appressed. Neither stamens nor stigmas exserted. Achenes pale-brown, nearly all ripening.

"Among congeners this well-marked species finds its place nearest to *C. Francisii*, differing, however, already in external feature, in the extensive vestiture, in glomerules constantly broader than long, in more developed general involucre and bright appendages of the ultimate involucral scales. Some relationship to the genus *Myriocephalus* is indicated by the copiousness of the empty involucrating bracts of the glomerule. On superficial inspection this plant might easily be passed as an *Angianthus* or *Craspedia*, especially as it was found accompanied by a small variety of *C. pleiocephala*."

Professor Ewart adds:—"The original description is given in English among the literature references in the Botanisches Centralblatt, following a reference from Wing's Southern Science Record, vol. 2, May, 1886, in which no reference to the plant occurs. Evidently Baron v. Mueller sent the description direct to the Botanisches Centralblatt, where it was issued among the records of published literature."

Among South Australian species *C. Dittrichii* stands nearest to *C. platycephalus*, from which it differs in fewer branches, closer tomentum, shorter leaves, compound heads more compact and more globular, pappus-bristles less flexuose and united at base in a broader ring.

Erechthites prenanthoides, DC. Blue Lake and Leg-of-mutton Lake, Mount Gambier; Robe. *E. picridioides*, Turcz.

Murray Bridge; Sherlock; Kangaroo Island; Port Lincoln; Robe; Beachport (Dist. G). On the road between Mount Gambier and Glencoe were found puzzling specimens with the involucre and leaves of *prenanthoides*, but the panicle less open and a woolly tomentum on the under-surface of the leaves.

Olearia ramulosa, Benth. I have not found in South Australia anything answering to the typical form of this species, as it occurs, for instance, near Melbourne, with 6-10 ray-flowers, about 8 disk-flowers, and an involucre about 5 mm. long. The form we have here tends toward *O. revoluta*, F. v. M., var. *minor*, Benth., and *O. floribunda*, Benth., but appears to have usually longer leaves and ligules than the former and much longer leaves than the latter. It is a shrub from 50 cm. to 1·50 m. high, with leaves usually 5-15 mm. long, linear or linear-oblong; involucre about 3 mm. long; ray-flowers 3-4, rarely 2, ligule conspicuous, 2-4 mm. long and much longer than the style and its branches; disk-flowers 3-4, rarely 5 or 6. Flowering more or less from October to June. Greenhill Road; Mount Lofty; Myponga; Slape Gully; Waterfall Gully; Burnside; Black Hill; between Kingscote and Cassini, K.I.; near Port Vincent, Y.P. Usually an inland shrub, but I have a specimen from an island in Pondalowie Bay, Y.P. (S. A. White), a maritime form with thick leaves, showing the white tomentum below and almost indistinguishable, except by the ligulate flowers, from specimens of *O. axillaris*, taken by the same collector on the shores of Pondalowie Bay. Indeed, the distinction between several species consists of little more than the comparative length of the ligule, and as this is a variable quantity, I have little doubt that further investigations throughout Australia will result in *O. tubuliflora*, *axillaris*, *revoluta*, *exilifolia*, and *floribunda* being united with *O. ramulosa*, (Labill.) Benth., as varieties or forms. Diels and Pritzel (Fragm. phyt. Aust. occid.) consider that several Western Australian species, including *axillaris*, *revoluta*, and *exilifolia*, had better be united with *ramulosa*, and they quote Mueller's remarks (Fragm., v., 65) as to the variable length of the ligule.

O. axillaris, F. v. M. Glenelg; Henley Beach; Port Vincent and Pondalowie Bay, Y.P.; Coorong. A large, spreading shrub, usually 2-3 m. high, growing among the sandhills close to the sea; the young leaves often snow-white; hairs of the achenes forked. Flowering March to May.

O. tubuliflora, Benth. Slape Gully; Kangarilla. An erect shrub, 1-2 m. high, growing close to creek; ray-flowers 3-4, rarely 5, without any ligule; disk-flowers the same number.

O. glandulosa, (Labill.) Benth. Myponga (Dist. A). Shrub 1-1·50 m. high, growing in swampy country; ray-flowers 12-20.

*_Lactuca scariola_, L. "Prickly Lettuce." Berri; numerous but not widely spread (H. W. Andrew). First record for South Australia, although it was observed some years ago in the Eastern States.—Europe.

*_Taraxacum officinale_, Weber. "European Dandelion." Common on roadsides at Mount Gambier.

*_Leontodon hispidus_, L. "Common Hawkbit." Millicent, near drains. First record for South Australia. A European and West-Asiatic weed.

*_Senecio elegans_, L. "Purple Ragwort." This showy Cape plant, already recorded for Robe, grows numerously at Beachport on sandhills close to the sea, beneath the shelter of _Acacia longifolia._

*_Scorzonera laciniata_, L. Paddock at Mile End goods sheds (H. W. Andrew). Previously recorded from Collinswood.

*_Cirsium arvense_, Scop. This troublesome weed has been found growing in patches near Mount Gambier.

*_Chrysanthemum Parthenium_, Bernh. "Feverfew." Roadside near Mount Barker (H. W. Andrew). Not previously found wild in South Australia, but recorded for Victoria in 1893.

*_Carthamus glaucus_, Bieb. _(Kentrophyllum glaucum_, Fisch. et Mey.). Naracoorte (H. W. Andrew). Occupying large areas in this district. Distinguished from _C. lanatus_, L. _(K. lanatum_, DC.), by its smaller flower-heads, the inner involucral bracts all entire, and none of the middle ones contracted near the summit, and then dilated into a small appendage, as in _C. lanatus_, flowers purple instead of yellow, and smaller achenes. A prickly weed of the eastern Mediterranean region, which does not appear to have been previously recorded in Australia. It has, however, been established in the South-East for some time, because a single head was sent to me from Bordertown in 1909.

DESCRIPTION OF PLATES.

Plate V.

Melaleuca quadrifaria, F. v. M. 1, flowering branch; 2, fruiting branch; 3, under-surface of leaf, showing the oblique orbicular base; 4, transverse section of leaf.

Melaleuca pauperiflora, F. v. M. 5, flowering branch; 6, fruiting branch; 7, bud and bract; 8, leaf; 9, transverse section of leaf.

Acacia Menzelii, J. M. Black. 10, pods; 11, seed.

Plate VI.

Limnanthemum stygium, n. sp. 1, flower; 2, transverse section of ovary.

Plate VII.

Dicrastylis verticillata, n. sp. 1, flower; 2, corolla; 3, pistil; 4, transverse section of ovary, showing the 4 cells, with 2 of the partitions much thinner than the other 2; 5, ovary more advanced, with 2 ripening and 2 abortive ovules, the 2 thin partitions being gradually pressed out of position; 6, bracts and bracteoles at base of flower-whorl, which is regarded from above:—*a*, *a*, *a*, the 3 bracts; *b*, *b*, the bracteoles (2 at the base of each cluster); *c*, *c*, *c*, the bases (concrete peduncles[?]) of the 3 clusters or reduced cymes, all the flowers having been removed; *d*, axis of the flowering branch. 7, anther and part of filament; 8, corolla in bud viewed from above:—*e*, *e*, the 2 lateral lobes folded outside the others; *f*, *f*, the 2 upper lobes; *g*, the lowest and largest lobe. 9, transverse section of leaf; 10, upper-surface of leaf near summit; 11, lower-surface of same.

Plate VIII.

Calocephalus Dittrichii, F. v. M. 1, flower; 2, style; 3, bract of general involucre; 4, outer bract of partial involucre; 5, innermost bract of same.

A Review of the Australian Representatives of the Genus Ischnoradsia.

By Edwin Ashby.

[Read April 11, 1918.]

This genus, one of the subdivisions of the Ischnochitonidae, Dall, was made by Shuttleworth in 1853 (Berner Mittheil, 1853, p. 65), the characteristics being described as follows:— "Valves having sharp but rather thick insertion plates, those of the median valves with two or several slits. Girdle covered with convex, pebble-like, smooth scales. Type, *Chiton australis*, Sowerby." In addition to the Australian representatives, several species have been found in Japanese waters. Four species have been described as from Australia.

In the "Mag. Nat. Hist. (Charlesworth)", vol. iv., June, 1840, Sowerby described (p. 290) *Chiton australis* (Conch. Illus., fig. 46), Australia, and (p. 291) *Chiton evanidus* (Conch. Illus., fig. 139), New Holland. Reeve in 1847, pl. xxi., sp. 142, *Chiton novae-hollandiae*, New Holland, Mus. Brit., and *Chiton metallicus*, Rve., Conch. Icon., t. 17, f. 1041, 1847.

Pilsbry made *I. evanidus* and *I. metallicus* synonymous with *I. australis*, Sby., retaining two Australian species only, *I. australis*, Sby., and *I. novae-hollandiae*, Rve. Iredale and May, in the Proc. Mal. Soc., vol. xii., pts. ii. and iii., 1916, revive the name *evanida*, Sby., and distinguish two species in Tasmania, the Eastern corresponding with Sowerby's description of his *evanidus*:—"Central areas smooth in the middle, faintly striated at the sides; lateral areas rather elevated, with radiating granular striae." And go on to say:—"The North-west Tasmanian form differs in the absolutely smoothness of its pleural areas, and seems identical with the South Australian shells known as *I. novae-hollandiae*, Reeve."

I can endorse Iredale and May's contention that the North-west Tasmanian form is identical with the South Australian shell. The examination of a fairly extensive series from North-west, Eastern, and Southern Tasmania, Mid-Victoria, and South Australia in my own collection, and also a series from Port Arthur, South-east Tasmania, from the collections of Mr. W. L. May and Dr. Torr, establishes the fact to my mind that only one species is common to these localities. All the adult shells from the widely-extended places are more or less ornamented with striae. "The absolute smoothness of the pleural area," quoted by Iredale and May, is only met with in juvenile shells, and the majority of adults conform to Sowerby's description of *evanida*.

Reeve's *I. novae-hollandiae* (1847) must therefore be relegated to the place of a synonym of Sowerby's *I. evanida* (1840).

But while the majority of adult specimens conform to Sowerby's description of *I. evanida*, a few show continuous ribbing throughout the pleural area and right across the dorsal area, a characteristic that heretofore has been considered the most marked distinguishing feature of *I. australis*, Sby. This ribbed character is shown in one of the Port Arthur shells only 63 mm. long, and one collected by Dr. Torr at Stanley, North Tasmania, only 55 mm. long, while a Port Arthur shell 80 mm. long is typical *evanida*.

Then, again, while the form in which the pleural area is ribbed right across is rare in South Australia, Dr. Torr has a specimen he informs me that he collected at Tungkallilla, on the South Australian coast open to the ocean, which is 45 mm. long, but is as strongly ribbed as the Port Jackson specimens of *I. australis*, and from the same locality a shell 33 mm. long showing as extensive ribbing in proportion to its age and size.

But none of these strongly-ribbed variants from type from South Australia, Tasmania, and Victoria that I have examined, show the widely-spaced, prominent ribbing in the lateral area that is present in the Port Jackson shells. On the other hand, shells from Bulli, N.S.W., a good way south of Port Jackson, show a departure from the typical shell from that port in that the anterior valve is similar to the form occurring in the southern States, the ribbing being less pronounced and closer together.

To sum up the evidence before us in regard to specimens from the States of South Australia, Tasmania, and Victoria:—

(1) No really adult shells are absolutely smooth in the pleural area as described by Reeve.

(2) That the age at which the shells from any of the localities referred to begins to show partial ribbing varies very much.

(3) That living alongside with *I. evanida*, Sby., in some parts of each of the three States named are shells in which the ribbing is as extensive, and closely approximates to, the Port Jackson, N.S.W., *I. australis*, Sby.

(4) That all the adult shells from the southern States show a similar sculpture in the lateral area, *viz.*, ribbing nearer together and less pronounced than is the case with the Port Jackson shell, but vary as regards the sculpture of the pleural area, from faint, broken ribbing over a portion of the area, to, in a limited number of cases, the area completely covered with strong ribbing, as in *I. australis*, Sby.

Conclusion.—On first commencing this inquiry I expected that the conclusions come to by Mr. Hedley in his very suggestive paper on "The Effect of the Bassian Isthmus upon the existing Marine Fauna," Proc. Linn. Soc. N.S. Wales, xxviii., 1903 (1904), would be amply supported by the distribution of the genus under review. That *I. australis*, Sby., would probably extend down from New South Wales to the Gippsland coast, and as the western side of the lost isthmus is reached, say the west side of Wilson Promontory, be replaced more or less abruptly by *I. evanida*, Sby. But in view of the fact that juvenile shells of both are equally smooth and inseparable, and the extreme variability of the southern form, we must conclude that all Australian representatives of this genus have a common ancestry, that the southern shells only represent a race, and do not warrant more than subspecific rank, and may be even relegated, as a result of future investigation, to the subordinate place of a mere variety. I conclude that the strongly-ribbed shells that occur (although but rarely) with the smoother forms in the south, are the progenitors of that section of the species that spread northward; while the more variable but smoother form spreads westward. The evidence points to the distribution of this genus in Australian waters having taken place since the breaking down of the Bassian Isthmus and the existence of the present straits. We must, therefore, conclude that the known Australian representatives of the genus *Ischnoradsia* are limited to one species and one subspecies, *Ischnoradsia australis*, Sowerby (1840), and *Ischnoradsia australis evanida*, Sowerby (1840), the former inhabiting New South Wales, and the latter the States of Victoria, Tasmania, and South Australia.

NOTE BY W. L. MAY, SANDFORD, TASMANIA.

Having been more or less associated with my friend Edwin Ashby in his investigation into *Ischnoradsia*, I am thoroughly in accord with his treatment in the present communication. From a superficial glance at specimens from the various Australasian localities, they appear as one species, in shape, size, and colour, and this impression is confirmed by an examination of the girdle, which is practically the same in all.

To maintain the several separate species, *viz.*, *australis*, *evanida*, and *novae-hollandiae*, we have to rely solely on the absence or presence, in varying degrees, of the longitudinal sculpture; and as this can be shown to be quite inconstant in the southern and western shells, and as some of these approximate rather nearly to the Port Jackson form, it seems necessary to treat them all as members of one variable species, but for convenience to maintain *evanida* for the southern and generally smoother form either as a subspecies, which is perhaps preferable, or as a variety.

ERRORS AND CORRECTIONS.

Page 68, fifth line from bottom:—For *S. posidonia* read *S. posidonialis*.

Page 80, eleventh line from bottom, should read:—Australian waters." I have a specimen collected by myself

Page 85, first line of table:—For CALLOCHITON read CALLISTOCHITON.

Monograph on the Genus Stenochiton (Order Polyplacophora), with Descriptions of Two New Species.

By Edwin Ashby.

[Read May 9, 1918.]

Plates XIII. and XIV.

The genus *Stenochiton* was formed by Adams and Angas in 1864 (Ad. and Ang., P.Z.S., 1864, p. 193) for the reception of the South Australian shell described by the same workers under the specific name of *juloides*.

The characteristics of the genus of which *S. juloides* was the type are enumerated by Adams and Angas as follows:—"Shell elongated, narrow, convex; valves longer than wide, not carinated; apex of the posterior valve subcentral; plates of insertion multifissate in the end valves, the intermediate valves having 5 fissures on each side; girdle covered with very minute, polished, imbricating scales." Carpenter (MS.) refers the then only species known to his own later group *Stenoradsia*, but Pilsbry (in Man. of Con., vol. xiv., p. 55) says:—"*Stenochiton*, however, seems to have as much individuality as most of the divisions *Ischnochiton*, and may be allowed to stand as a subgenus." He somewhat modifies Adams and Angas' characteristics, retaining the following as the distinguishing characteristics of the subgenus:—"Shell very much elongated, roundly arched, valves ischnoid, the central valves having several slits; girdle having minute, smooth, imbricating scales." As will be shown later, some species that evidently should be placed in this genus only show one slit in the central valves, and in one the scales are minutely striated.

Since Pilsbry wrote the above, two additional species have been described. One by W. T. Bednall in 1897 (Proc. Mal. Soc., vol. ii., pt. 4), under the specific name of *pilsbryanus*. The habitat is given as Troubridge Shoal, Gulf St. Vincent, "on seaweed (?) *Zostera*." A third species was described by myself under the name of *pallens* in 1900 (Trans. Roy. Soc. of S.A., 1900). While I have every reason to believe that one or other of the two species described in this paper as new under the respective names of *posidonialis* and *cymodocealis* must have been the form described by Mr. Bednall, his description will not coincide with either of these very distinct forms. Either his figures and descriptions are at fault, or he described a fifth species that I have not yet been able to identify.

Every effort has been made to get a sight of the type. Mr. E. H. Matthews writes me, February 28, 1918, that he sent all his own and the late Mr. Bednall's types to Mr. Tom Iredale in London. The larger parcel reached London safely; the smaller one, which may have contained the type of this species under review, went down.

Mr. Matthews was good enough to send me some nice specimens that he refers to Bednall's *pilsbryanus*. These are the same species I am describing herein as *S. posidonialis*, and differ materially from Bednall's description in that the anterior valve is concave and not convex, as stated by Bednall, and the posterior valve is very flat and not strongly elevated and arched, as shown in Bednall's drawing, also the mucro is differently placed.

On the other hand, the figure of the posterior valve in Mr. Bednall's paper well illustrates the same valve herein described and figured under the name of *S. cymodocealis*, and his statement that the anterior valve is convex also corresponds, but the figure marked (1) in Mr. Bednall's description does not show the distinctive tapering characteristics in that species, and his statement that the "raised character of the lateral area does not extend to the outer anterior angle of tegmentum" does not correspond.

We are, therefore, with the material available, quite unable to determine which, if either, of these very distinct species was described by Mr. Bednall. Part of the description appears to refer to one and the balance to the other. Personally, in spite of the fact that Mr. Matthews, in common with all other South Australian collectors, has in the past referred the species hereunder described under the name of *S. posidonialis*, to Mr. Bednall's shell, and it is well known in all Australian collections of *Polyplacophora* under that name, I am strongly inclined to think that the other species herein described as *S. cymodocealis*, or one nearly allied to it, is the species described by Bednall. Unless the type is still in existence it will be impossible to satisfactorily determine this question, so for the time being we shall have to add the two species herein described to our list of *Stenochitons*. Iredale and May, in their paper on "Mis-named Tasmanian Chitons" (Mal. Soc. vol. xii., pts. ii. and iii., p. 105, Nov., 1916), think they recognize in Blainville's *Chiton longicymba* (1825) from King Island a member, though not yet identified, of the genus *Stenochiton*. I cannot concur with this opinion, and think that Blainville's shell was more likely either *Ischnochiton virgatus*, Reeve, or a near ally. The blue spots he speaks of are very marked in that species, and the shell is comparatively smooth.

Distribution.—It is remarkable that the whole of the known species of this interesting genus have been described from South Australia. Up to the present I believe there are only two records of the occurrence of members of this genus in the other States. *Stenochiton pallens*, Ashby, from Port Phillip Heads, Victoria, wrongly identified by Sykes (Proc. Mal. Soc., vol. ii., pt. 2, July, 1896) as *S. juloides*, Ad. and Ang., and correctly identified by Gatliffe and Gabriel (Proc. Soc. Vict., 30 (N.S.), pt. i., 1917, p. 26), one specimen only. And *S. juloides* three valves only in shell-sand, Albany, W.A. (Torr: Trans. Roy. Soc., S. Austr., xxxv., 1911, p. 96). The other localities given by Hedley (in Jour. Roy. Soc. W. Austr., vol. viii., 1914-1915, p. 23) have probably been copied in error from the records of the next species in Torr's paper. We have, therefore, the remarkable fact that outside of the two occurrences above referred to, no representatives of this interesting genus have so far been found outside of South Australian waters.

Habits.—Bednall (in Proc. Mal. Soc., vol. 88, pt. 4, April, 1897, p. 142) gives the habitat of the few specimens of *S. juloides* that had then come under his notice, "found living on Pinna shells below low-water mark." And on the same page he records the fact that the specimens he describes under the name of *S. pilsbryanus* were found on "seaweed *(Zostera)*, Troubridge Shoal, St. Vincent Gulf." Dr. Torr (Trans. Roy. Soc., S. Austr., vol. xxxvi., 1912) states that he had collected *S. juloides* by dredging and in shell-sand, and quotes Mr. Riddle as having found specimens on "old boots and bottles, and especially near the roots of *Zostera*, by dredging or with grappling iron—they are rarely found in shallow water." And on the same page he records having taken specimens of *Stenochiton pilsbryanus*, Bednall, "on *Zostera* (sea-weed)." And again, "Two large specimens by Mr. F. L. Saunders on seaweed at Aldinga," and "near the roots of *Zostera* at Wool Bay and other places by Mr. Riddle." I am now able to throw a good deal of light on the habits of members of this genus. The discovery of *Stenochiton juloides*, Ad. and Ang., on bottles, boots, etc., is evidently purely accidental. They live on the marine plant belonging to the order Fluviales known as *Posidonia australis*. I have found them in many localities at the base of the long ribbon-like leaves of this well-known plant. During the last week of December last, at Normanville, in this State, in company with Mr. F. L. Saunders, who with his brother had taken them in the same locality in numbers before, I was able by means of a strong digging hook to get well down into the roots of the *Posidonia*, and found enclosed in the brown sheaths of past leaves which enwrap the underground stems of that plant a large number of this *Stenochiton*. The spots that seemed to be especially attractive were beds of old, vigorous plants of *Posidonia* growing in sheltered pools (at low water), with a coarse sand or shell-grit bottom. The *Stenochitons* were usually about 3 inches deep in the shell grit, buried in the brown sheaths of *Posidonia*, but in a few cases odd specimens were found on the bases of the leaves outside the sand. Until recently most of the specimens that have been collected were these odd ones that had not worked their way down in the grit. The species hereunder described under the name of *S. posidonialis* also lives on the same plant, *Posidonia australis*, and I have found it in every locality I have visited in this State where this plant is growing. It is almost always found on the white or near the white bases of the leaves, just above the sand, and does not seem to bury itself in it. The best way to obtain it is to pull up bunches of *Posidonia* from as low down as possible, and search the white bases of the leaves for the *Stenochiton*. If held up to the sunlight they are easily perceived, even when on the reverse side of the leaf. The species hereinafter described as *Stenochiton cymodocealis* is found on the cylindrical stems of the marine plant *Cymodocea antarctica*, which belongs to the same order as the preceding. I am indebted to Mr. F. L. Saunders for pointing out this plant to me, he having on a previous occasion taken this *Stenochiton* at Normanville on this plant, but had wrongly identified it as *Stenochiton pallens*, Ashby. I was able to obtain a nice series at that locality, and on searching the same plant afterwards at Cape Jervis, Encounter Bay, and still more recently at Marino, I have been able to find it at all these localities. The favourite spots seem to be the sheltered or shore side of beds of *Cymodocea*, growing in situations more or less sheltered. They are to be found usually only an inch or two above the point where the plant stems enter the sand. In no case have I found them on the short, flat leaves of this plant. The girdle of this *Stenochiton* is in nature strongly incurved, almost reaching right round the cylindrical stems of the plant. The fourth species, *Stenochiton pallens*, Ashby, has up to the present only been found by dredging, and the plant it lives upon has not, therefore, been identified.

Colour protection.—There is surely some connection between the habits of these four species and the markings and colouration that is peculiar to them. *S. juloides* is dark brown in colour, of the same tone as the brown sheath of *Posidonia*. *S. posidonia* is normally yellowish-green, and shell is very transparent, so that it blends remarkably well with the leaf it is on. It is nearly always found on the basal portions of the leaf that are either very pale green or whitish. The markings are suggestive of dashes of darker green on the leaf. In some case the ground-colour of this species is white, or nearly so, harmonizing well with the lower parts of the leaves. *S. cymodocealis*, while often in colour and markings resembling the darker-green form of the former species, is usually variegated by darker markings, and the dorsal area often shows pinkish shades, thus harmonizing to a striking degree with the various growths that so often encrust the stems of *Cymodocea*. Of the plant which is the host of *Stenochiton pallens* we have, as before stated, no actual knowledge, but we are surely justified in deducing from the habits of its congeners that it lives on a plant probably belonging to the same order Fluviales, that the portions of the plant it affects are probably pale brown, buff, or cream in colour, and also that as only dredged specimens have been found, the plant is either a deep-water species or a pale and colourless variety growing in deeper waters; or perhaps it lives upon the dying or dead leaves, with which undoubtedly its colour would well harmonize.

Food.—I have attempted to keep the three first-named species in an aquarium, supplied with their respective host plants, but although care was taken to keep the temperature cool, they all died, and no results were obtained. Possibly these plants do not throw off sufficient oxygen. I think there is little doubt that *Stenochitons* live on the plants of the order Fluviales, are nocturnal, in common with most of the Polyplacophora. I have seen portions of the stems of *Cymodocea* eaten in a way that would suggest that it had been done by the *Stenochiton*. Further, the *Posidonia* which is frequented by two of the genus is almost invariably clean, no small encrusting growths being present, and therefore it is doubtful whether they would find any other food than the leaves of *Posidonia*. I am indebted to Mr. J. M. Black for the indentification of the two marine plants referred to. There is a close outward resemblance between *Posidonia australis* and *Zostera tasmanica*, and therefore, owing to my inability to find specimens of the "sea grass" I have referred to as *Posidonia australis* in flower or fruit, it is possible that Mr. J. M. Black, who has been good enough to examine and identify for me the specimens I sent him, may not have had sufficient data for accurate determination. He says, "Judging only by the breadth of the leaves and the nervation, the specimen sent is *Posidonia australis*, and not a *Zostera*." I think it not unlikely that the two species of *Stenochiton* I have referred to as living on *Posidonia* may live on *Zostera tasmanica* just as freely.

Classification.—The partial elucidation of the life history of members of the genus *Stenochiton* recorded in the foregoing, which supplies strong circumstantial evidence that not only in habits but also in food they are very distinct from any other of our Australian forms of the Polyplacophora, together with the external characteristics that differentiate them from other genera of the Ischnochitonidae, suggests that further investigation will reveal other differences, possibly internal ones, and warrants the elevation of the subgenus *Stenochiton* to the rank of a genus. I therefore propose to revive Adams and Angas' genus *Stenochiton*, of which *Stenochiton juloides*, Ad. and Ang., is the type. In some respects it is unfortunate that this species should have to stand as the type of the genus, because it exhibits several peculiarities that are not common to those I consider its congeners. For the present we must deem these specific distinctions only. The discovery of three or four new species that show several striking characteristics in common with *Stenochiton juloides*, that differentiate them from other members of the Ischnochitonidae, makes it desirable to retain only a portion of the characteristics cited by Adams and Angas as distinguishing the genus and the adding of others.

Generic description.—Shell usually elongated, highly polished, almost unsculptured, convex, *i.e.*, rounded or arched as distinct from carinated, plates of insertion small, multi-fissate in the end valves, girdle clothed with very minute, polished, imbricating scales. Living on plants of the order Fluviales. *Stenochiton (sensu stricto)* will then be a subgenus of the genus *Stenochiton*, distinguished by the elongated character of the shell. A second subgenus will have to be formed to receive a broad-shelled species that was collected by the late Professor Tate on plants belonging to the order Fluviales. This specimen has been placed in my hands by Dr. Torr to be dealt with in a future paper.

Conclusion.—I am hopeful that the investigations of future workers, not only in the other States of Australia, but also throughout the world, wherever plants belonging to the order *Fluviales* are found, will, now we know where and how to search, reveal many new forms of this genus. As *Posidonia oceanica*, an allied form to the Australian member, occurs extensively in the Mediterranean Sea and the European shores of the Atlantic, it seems only reasonable to conclude that there will be forms of Polyplacophora living on it that will exhibit some of the modifications peculiar to the *Stenochitons* of Australia.

Stenochiton cymodocealis, n. sp.

Pls. xiii. and xiv., figs. 1, 4, 5, 11, and 12 *(a, b, c, d, e)*.

General appearance.—Shell long, sides almost straight for $\frac{2}{3}$ of lateral, and then curving rapidly over dorsal area, width of shell less than $\frac{1}{3}$ of total length, dorsal area rounded, shell exceptionally highly arched; the whole shell is very polished.

Colour.—The general colour is green, the dorsal area ornamented with a number of longitudinal pale-green lines, closely packed, and only discernible under lens. The rest of shell decorated with a number of broad, dark-green longitudinal dashes. The megalopores, in the form of pale-green dots, are under a compound microscope visible on the anterior and posterior valves and on the lateral areas, but not as marked as in *S. posidonialis*. Inside of valves green.

Anterior valve.—Slope very steep, without sculpture, convex. In one specimen I counted 24 slits or grooves; the interior in this is irregularly fluted, each flute ending in a blunt rounded tooth, a feature very distinct from any other known member of this genus, or any other member of the Ischnochitonidae, I believe. The slits are continued in shallow grooves, indistinctly pitted. After photographing the interior of this valve it met with a mishap, and is lost, and therefore I have had to replace it with another from a specimen of considerably larger size, which shows considerable differences; the slits are 12 or 13, the teeth are blunt and irregular knobs, the fluted appearance so much in evidence in the former valve is hardly perceptible in this one; perhaps with increased age the fluting is filled in.

Posterior valve.—Highly arched, mucro central, prominent, posterior slope steep, nearly straight, but in type becoming slightly convex as it nears the girdle, shell highly polished, slits 13 to 15, a broad notch in the sutural laminae of this valve.

Median valve.—Uniformly smooth and glossy, the lateral area strongly raised, and if looked at longitudinally with lens, the anterior margin of this area is seen to be uneven, due to shallow sulci following the growth lines; so polished is the shell that this undulating character of the margin of this area is indiscernible unless the shell is held at a considerable angle.

Median and dorsal areas.—Smooth and dorsal area in some valves slightly beaked, 1 slit.

Girdle.—Clothed with small, closely-packed, smooth, imbricating scales, circular in shape, and thick in proportion to their diameter, reminding one of opalescent, flattened pebbles. The dark line showing in plate follows the contour of each valve. In life when looked at from above the only portion of the girdle showing is the narrow strip between this line and the shell. A darkish blotch extends across the girdle opposite each suture and at irregular intervals round the anterior valve.

Measurements.—Total length of type, 10 mm. (shown in plate with girdle flattened out); breadth, 3·5 mm.; the specimen shown in plate with recurved girdle as in nature measures, length 8 mm., breadth 2 mm. I have specimens that measure 12 mm. by 2·75 mm., girdle recurved.

Locality.—I have found this species on the cylindrical stems of *Cymodocea antarctica* at Marino, Normanville, Cape Jervis, and Encounter Bay, all in South Australia, and Dr. Torr has specimens found in shell-sand at Aldinga.

Specific name.—I have designated this species under the specific name of *cymodocealis*, after the generic name of the plant that is its host, and probably its food plant also. The plant was named after a sea nymph.

Variation.—While the type is green all over, the decoration being due to either lighter or darker shades of the same green, the species is subject to considerable variation both in colour and markings. In one from Normanville, the apex of the anterior valve and the blunt beak of the next four valves is bright pink, also the ground-colour of pale olive that is present in most is in this specimen replaced with silvery-green, the markings mottled instead of striped, and the posterior margins of each valve decorated with 1 to 3 blackish dots, which without the aid of a lens look like pits. One other specimen from this locality has a dark-pink line the whole length of the dorsal area.

Remarks.—This shell is easily distinguished from any other known *Stenochiton* by its highly arched character. The general appearance is that of a canoe turned bottom upwards. This effect is added to by the incurved girdle. In life, with the exception of the anterior and posterior portions, the whole of the girdle curves round clasping the hard cylindrical stem of the host plant, sometimes meeting on the other side. While the animal is able to flatten out the girdle enough to creep about on the surface of a bottle, it is evidently an abnormal position. In endeavouring to flatten out the girdles for figuring purposes I spoilt several specimens, and have, I fear, expanded the valves somewhat, giving a total width beyond what is true to nature.

I am indebted to Mr. F. L. Saunders for pointing out to me the host plant. He had previously found specimens at Normanville, and wrongly identified the shell as *Stenochiton pallens*, Ashby.

I am presenting the type and other specimens figured to the South Australian Museum.

STENOCHITON POSIDONIALIS, n. sp.

Pls. xiii. and xiv., figs. 2, 6, and 13 *(a, b, c, d)*.

General appearance.—Shell long, flat, rounded, smooth, and highly polished. The whole shell is exceptionally flat as compared with other members of this genus.

Colour and markings.—General colour olive-green; pleural area white; dorsal area largely white, suggestive of a white streak down the full length of the back. Lateral areas olive-green, with two dark spots on the posterior margins on either side, and a darker olive-green blotch near the apex. All the areas are ornamented more or less with brown or dark olive-green colour streaks. Under compound microscope the megalopores are very pronounced on the anterior and posterior valves and lateral areas of median valves, the surface being apparently peppered all over with white spots. The pleural and dorsal areas under the same power are decorated with a number of white confluent streaks, which in the dorsal area form a complete network or mesh. Inside of shell, pale olive-green and white.

Anterior valve.—Very distinct from others of this genus, in that this valve is distinctly concave, broad, and flat, nearly as long as wide, without sculpture. Under microscope (2-inch objective and eye-piece) this valve is covered with white dots. Inside of valve has 18 slits at fairly regular intervals, each slit continued as a groove, irregularly and deeply pitted, to the apex of the shell. The teeth are sharp, square edged; colour, pale olive-green and white.

Posterior valve.—Longer than wide, mucro anterior, hardly distinguishable, but in large shell from Cape Jervis the mucro is practically median; posterior slope very flat, almost straight, but slightly concave. This feature is nothing like so noticeable as in the anterior valve. Slits 19, each continued in a groove to mucro; margin of teeth between slits slightly crenulate under 2-inch objective.

Median valves.—Uniformly smooth and glossy. The lateral area is raised, but not as strongly so as in *S. cymodocealis*. Slits 2 (in one case a suggestion of a third); the slits are continued in grooves deeply pitted for their whole length. The dorsal area is not beaked in some valves, but in others slight beaking is perceptible.

Note.—In a large specimen 20 mm. long, breadth just under 5 mm. collected by myself at Cape Jervis, the lateral area is distinctly raised, the line of demarcation between it and the pleural area being clearly defined from the dorsal area to the girdle. Two or three strong concentric sulci, following the growth lines in the lateral areas, are present, giving a slightly corrugated appearance to that area. Similar shells to these large Cape Jervis ones were obtained by Dr. Torr at Corny Point, Yorke Peninsula. Pleural and dorsal areas smooth, highly polished. Under 2-inch objective and eye-piece both these areas are apparently thickly grooved with shallow wavy grooves that coalesce in places, but by holding the shell sideways a good lens reveals the fact that the shell is absolutely unsculptured. Dorsal area is not beaked.

Girdle.—Less than ·5 mm. in width. A dark blotch extends across the girdle at each suture and irregularly in front of the anterior valve. Is covered with small, closely-imbricating scales, only a portion of their rounded ends being visible, but which are when exposed found to be flattened, elliptical, rounded at ends, straight-sided, about twice as long as wide. The outer two or three rows are drawn out into coarse, transparent hairs or spicules, forming a distinct fringe.

Measurements.—Type (flat view in figure in plate): length, 9·5 mm.; width, including girdle, 3·5 mm.

Localities.—I have found it on the eastern side of Gulf St. Vincent wherever I have searched for it on *Posidonia australis;* also at Port Lincoln; and Dr. Torr has found the large form exceedingly plentiful at Corny Point on Spencer Gulf.

Specific name.—I have designated this species under the specific name of *posidonialis,* after the generic name of the plant which is its host, and probably its food plant. It is always, as far as my experience goes, found near the whitish base of the ribbon-like green leaves of *Posidonia australis,* just above where the leaves enter the sand. The plant was named after Poseidon, a god of the sea.

Variation.—While the normal colouration is transparent green to olive-green, flecked or streaked with dark-green markings, in some specimens obtained by myself at Marino, and others collected by Dr. Torr at Corny Point, up to 15 mm. in length, the ground-colour is almost white, ornamented with a V-shaped, dark-brown blotch in anterior and posterior valves, and a V-shaped brown marking covering each dorsal area; the whole of the 4th valve and lateral area of the 3rd valve also dark brown. In a specimen, 17 mm. long, from Largs, sent me by Mr. E. H. Matthews, the ground-colour is dingy buff, with a V-shaped brown blotch on 1st and last valves, and a brown streak continuing through all the dorsal areas. Dr. Torr has also a similar specimen. In another of Dr. Torr's, the shell is orange colour.

Remarks.—This shell is easily distinguished from any other known *Stenochiton* by the shape of the anterior valve, which is distinctly concave, the general flat character of the shell, and the exceptionally flat posterior valve, the mucro being hardly perceptible. The figure in plate showing side view will sufficiently demonstrate these differences.

I am presenting the type to the South Australian Museum.

STENOCHITON PALLENS, Ashby
(Trans. Roy. Soc. S. Austr., vol. xxiv, p. 86, 1900).
Pl. xiv., fig. 14 *(a, b)*.

General appearance.—Shell glossy, elongated, evenly arched and rounded, side slope curved. *Colour*—Cream, mottled with pink and pale brown.

Anterior valve.—Smooth and glossy, except for several growth-lines, that nearer the outer margin being the deeper. This valve is longitudinally very short, being twice as wide as long (see measurements). Slits 13, at very irregular distances apart.

Posterior valve.—Shield-shape, tapering rapidly; mucro posterior, only slightly raised. A deep sulcus traverses the valve a short distance from the margin, preserving the shield-like outline of the shell. A shallow diagonal depression crosses the valve from the mucro to the suture. Surface of shell glossy and smooth, slight growth-lines visible under the microscope. Slits six; the teeth are very irregular in contour.

Median valves.—Uniformly smooth and glossy, showing numerous growth lines, which are continued right across the dorsal area. The three areas are hardly distinguishable, except that the lateral area is slightly raised. The posterior margin is finely serrated like a file where the valves are not worn; this sculpture is very shallow. Four of the median valves have one broad wedge-shaped slit on each side; two valves have two slits on each side. *Inside of shell* glossy white, sinus broad and shallow, sutural laminae only slightly produced.

Girdle.—Under pocket lens appears whitish and felt-like. The margin fringed with white spicules, but under 1-inch objective the girdle is seen to be crowded with masses of small, irregular, imbricating scales, which are finely striated. Owing to the condition of girdle I have been unable to determine the exact shape of scales or verify the statement that they are finely striated. In the foregoing I have where possible followed the original description.

Measurements.—Anterior valve of disarticulated type, longitudinal length 1·75 mm., breadth 3·5 mm. Anterior valve of co-type, longitudinal length 2·5 mm., breadth 5·5 mm. Posterior valve about the same width at anterior margin as valve is long. Width 5 mm., tapering evenly to 2 mm., then rounded off abruptly. Length of valve, 4·5 mm. Valves 2 to 6 are all 6 mm. wide and about 3 mm. in length at the dorsal area, and are therefore twice as broad as long. Valve 7 tapers a little.

Habitat.—I think the statement in the original description, Gulf St. Vincent, is probably correct, but one of the three original specimens dredged by Dr. J. C. Verco, now in Dr. Torr's collection, is labelled "Spencer Gulf." Messrs. Gatliff and Gabriel have now added Port Phillip Heads, Victoria, as a locality (see previous reference). At present our knowledge of this species is limited to four specimens.

Remarks.—Under this heading in the original description the statement in the second line, "the first valve being the broadest," should have read "the first median valve being the broadest." A reference to the measurements given above will clear this up.

The great breadth, in proportion to its short longitudinal length, of the anterior valve easily distinguishes this species from any other known form.

I am presenting type to the South Australian Museum.

STENOCHITON JULOIDES, Adams and Angas (Proc. Zool. Soc., 1864, p. 193; *op. cit.*, 1865, pl. ii., fig. 15).

Pls. xiii. and xiv., figs. 3, 8, 9, and 10.

As no description, I believe, of this species occurs in any Australian literature, it may be well to redescribe it here.

General appearance.—Shell very solid and elongated, sides much curved, the arch being continued evenly from the girdle right over the dorsal area. Width of shell, one-seventh of total length. The whole shell highly polished.

Colour and markings.—Colour dark chocolate, merging in the pleural areas into maroon. (Col. Plates Soc. Française des Chrysanthémistes, 343, No. 4, and 341, No. 3). Many specimens are much flecked and streaked with grey dashes, giving a grey-chocolate effect.

Inside colour.—Anterior valve bluish-grey, others whitish-grey with the brown of outer shell showing through.

Anterior valve.—Strongly convex, considerably longer than wide, unsculptured except for several shallow sulci following the growth-lines, highly polished, inside many slits, counted 17, which are continued in grooves to the apex; the pitting of these grooves is only just discernable under a 2-inch objective and eye piece.

Posterior valve.—Mucro posterior (Carpenter states median), the anterior portion of valve quite smooth and rounded longitudinally, forming a V-shaped area the full width of the valve at the suture (in the specimen described 5·5 mm. wide and a length to the mucro of 5 mm.). The posterior portion is highly polished and unsculptured, except for a number of concentric sulci following the growth-lines. The posterior area where it abuts on the anterior V-shaped portion is highly raised, the anterior margin forming a rounded diagonal ridge; this ridge is formed by a deep sulci commencing quite shallow at mucro and increasing in depth until the anterior margin of valve is reached at the girdle. The slope behind mucro almost straight but slightly concave near girdle.

Median valves.—Lateral area more strongly raised than is the case in any other known species of *Stenochiton.* This area is, in common with the rest of the shell, highly polished, the only sculpture being several concentric grooves following the growth-lines. The strong diagonal ridge which divides this area from the pleural area is formed by a rapid drop from the anterior margin to the pleural area, and not by any definite raising of the lateral area.

Pleural and dorsal areas.—Indistinguishable from one another, except that the latter is usually outlined by a dark V-shaped mark. Both areas are smooth and highly polished, but the pleural area, where it abuts on the lateral, has the appearance of being broadly hollowed out, thus adding to the abruptness of the separating ridge that forms the anterior margin of the lateral area. Slits 3 to 4 very narrow (Carpenter gives central valve 3 slits, Adams and Angas 5 slits). This character seems rather specific than generic. Girdle narrow, clothed with small, closely-packed, imbricating scales, which are more flattened than in *Stenochiton cymodocea*, and although straight-sided are almost as broad as long. The scales in the outer row are lengthened and pointed, under 1-inch objective resembling short blunt spicules. The effect of a fringed edge is hardly perceptible.

Measurements.—Total length of dried specimen not disarticulated, 40 mm. Length of valves taken longitudinally at suture: (1) 5 mm., (2) 3 mm., (3) 4 mm., (4) 4·25 mm., (5) 5·5 mm., (6) 6 mm., (7) 5·5 mm., (8) 5·5 mm. Breadth of valves: (6) 6·5 mm., anterior valve 4 mm., posterior valve nearly 6 mm. It will be seen that the shell is widest at the sixth valve, and tapers forward to the anterior valve. The tapering of the posterior valve is rapid, as has been before alluded to.

Remarks.—The shape of the anterior valve, great length of the shell, and the raised lateral area with its abrupt ridge, easily distinguish this species. They are rather specific differences than generic characters.

Note.—While I have in the choice of distinguishing names departed somewhat from the fashion that has mostly been followed heretofore by workers in *Polyplacophora*, I deem no apology is necessary. The striking habits of the group dealt with suggest that their names should be chosen with reference to them, rather than to their valvular structure.

EXPLANATION OF PLATES.

Plate XIII.

Fig. 1. *Stenochiton cymodocealis*, n. sp., side view.
,, 2. ,, *posidonialis*, n. sp., side view.
,, 3. ,, *juloides*, Ad. and Ang., side view.
,, 4. ,, *cymodocealis*, n. sp., from above, natural position.
,, 5. ,, ,, n. sp., from above, flattened-out girdle.
,, 6. ,, *posidonialis*, n. sp., from above.
,, 7. ,, *juloides*, Ad. and Ang., from above.

Plate XIV.

Fig. 8. *Stenochiton juliodes*, Ad. and Ang., posterior valve.
,, 9. ,, ,, Ad. and Ang., median valve.
,, 10. ,, ,, Ad. and Ang., anterior valve.
,, 11. ,, *cymodocealis*, n. sp., *in situ*, on stem of *cymodocea*.
,, 12. ,, ,, *(a)* anterior valve.
(b) median valve.
(c) median, showing arch.
(d) posterior valve.
(e) inside of anterior valve, showing teeth.
,, 13. ,, *posidonialis*, n. sp., *(a)* anterior valve.
(b) median valve.
(c) posterior valve.
(d) inside of anterior valve, showing teeth.
,, 14. ,, *pallens*, Ashby, *(a)* anterior valve.
(b) median valve.

Notes on South Australian Polyplacophora, with Additions to the Fauna; together with a List of Australian Polyplacophora, showing their Distribution in the Australian States.

By Edwin Ashby.

[Read June 13, 1918.]

In presenting this list of Australian Polyplacophora the writer is conscious of many imperfections. It was prepared originally for his personal use, as an aid to the further study of the very interesting order of mollusca dealt with. But on submitting the rough draft to his friends, Mr. W. L. May and Dr. W. G. Torr, he has been encouraged to offer it for publication at once. As far as possible the latest classification has been adopted and the list kept as concise as possible, the writer contenting himself with giving a bibliography of the various works and papers consulted.

The list presents many peculiarities of distribution, but comments thereon are beyond the limits of this paper.

While lists of the Polyplacophora recorded from several of the individual States have from time to time been presented, no complete list for the whole of Australia appears to have been compiled previously. Mr. T. Iredale's list (Proc. Mal. Soc., vol. ix., pt. iii., p. 158, Sept. 1910) is incomplete, and intended only to illustrate his very interesting paper.

I have with some misgivings included the fauna of Norfolk Island and Lord Howe Island in the New South Wales list, thereby increasing the number of species credited to that State.

The number of species and subspecies recorded from the respective States are as follows:—Western Australia, 40; South Australia, 70; Victoria, 36; Tasmania, 44; New South Wales, 41; Queensland, 30. The total for Australia is 147, a few of which are doubtful. South Australia has the honour of holding easily the first place as to number of species, and, in fact, about half the total known Australian species have now been recorded from that State. (I have in my collection a specimen of *Acanthochiton zealandicus*, Quoy. and Gaim., labelled "New South Wales," but no further data. I have not felt justified in placing it on the Australian list until further data are forthcoming.)

Notes and Additions to South Australian Fauna.

Lepidopleurus liratus, Ad. and Ang., 1864 (*Terenochiton*, Iredale). This shell has heretofore been labelled in our collections. "*L. inquinatus*, Reeve, 1847." Many years ago I pointed out to my friends that it did not agree with the New Zealand shell. We are indebted to Mr. Iredale for its identification with *L. liratus*, Ad. and Ang.

Lepidopleurus badius, Hed. and Hull (*Terenochiton*, Iredale). (Rec. Aust. Mus., vol. vii., No. 4, 1909.) I am glad to be able to place this interesting *Lepidopleurus* on our South Australian list. On December 28, 1917, Mr. F. L. Saunders and I visited Cape Jervis, when Mr. Saunders was successful in finding two nice specimens. (Unfortunately my bottle of *Lepidopleurus* was washed out of my pocket, so to Mr. Saunders belongs the honour of finding the first fully-identified specimen.) On March 14, 1918, I again visited Cape Jervis, and was successful in getting another. In February, 1917, I found a carinated *Lepidopleurus*, which I put aside for identification. It approaches *L. badius* very closely, but shows some differences, and will need further investigation to accurately determine the question. Mr. Saunders kindly lent me his specimen to send over to Messrs. Gatliff and Gabriel, and later to Mr. Hull, who all have stated that it is certainly a typical *L. badius*, previously only recorded from New South Wales.

Lepidopleurus columnarius, Hed. and May, 1918 (*Terenochiton*, Iredale). Messrs. Gatliff and Gabriel (Roy. Soc. Vic., vol. xxx., N.S., pt. i., p. 24) have identified Dr. Torr's *L. pelagicus* (Torr: Trans. Roy. Soc. S. Austr., vol. xxxvi., p. 165) with the latter species, and so *L. columnarius* must be added to our South Australian list.

Ischnochiton wilsoni, Sykes, 1896 (Proc. Mal. Soc., vol. ii., pt. 2, July, 1896, p. 89). In addition to the two specimens recorded by Dr. Torr in his valuable paper on South Australian *Polyplacophora* (Trans. Roy. Soc. S. Austr., vol. xxxvi., 1912) "as probably all that have been found in South Australian Polyplacophora (Trans. Roy. Soc. S. Austr., vol. at Aldinga Bay about seventeen years ago.

Ischnochiton atkinsoni, Iredale and May, 1916 (Proc. Mal. Soc., vol. xxii., pts. 2 and 3, Nov., 1916). This is another addition to our South Australian fauna. In January, 1917, Dr. Torr and I spent some time at Port Lincoln, and we both collected a nice series of a shell we at the time referred to a variety of *I. crispus*, Reeve. Mr. Gatliff suggested at the time that our shell might possibly be Iredale and May's *I. atkinsoni*. Recently I have been able to pay more attention to this group, and Mr. May has kindly lent me his co-types, so I am able to say that the Port Lincoln shells are undoubtedly referable to that species, although showing some slight variations. It is easily differentiated from *I. crispus* by its small finely-striated scales.

Ischnochiton falcatus, Hull, 1912 (Proc. Roy. Soc. Vict., vol. xxv., N.S., pt. 1, Aug., 1912). I have a specimen of this shell marked Gulf St. Vincent, and have found amongst my papers the commencement of a written description in my own handwriting dated 1900, so the shell must have been collected prior to that year. The strong ribbing in the pleural area, and the coarse toothing of the posterior margin of the lateral areas, easily distinguishes it from its congeners. It is an interesting addition to the South Australian fauna.

Ischnochiton milligani, Iredale and May, 1916 (Proc. Mal. Soc., vol. xii., pts. 2 and 3, p. 109, Nov., 1916). This shell, which is a subspecies of the well-known New South Wales shell *I. proteus*, Reeve, for many years was wrongly labelled in Australian collections "*I. divergens.*" We are indebted to Dr. Torr, who has collected Polyplacophora throughout the Australian States more extensively than any other worker, for the addition to the South Australian fauna of this very fine form. He obtained a single but splendid specimen at Cape Northumberland in January, 1914. The measurements are, 45 mm. × 21 mm.

Haploplax pura, Sykes, 1896 (Proc. Mal. Soc., vol. ii., pt. 2, July, 1896). I am glad to be able to record this as a South Australian shell, having collected a single specimen at Marino on February 12, 1917. I am indebted to Messrs. Gatliff and Gabriel for its identification, they having compared it with typical specimens in their collection.

Heterozona subviridis, Iredale and May, 1916 (Proc. Mal. Soc., vol. xii., pts. 2 and 3, p. 105, Nov., 1916). I am able to include this shell in the list of Victorian shells, as in looking through with Mr. W. L. May a fine series of *Ischnochiton crispus* sent me some years ago by Mr. Gabriel from Back Beach, Phillip Island, Victoria, we were able to pick out four specimens of Messrs. Iredale and May's shell.

Rhyssoplax calliozona, Pilsbry, 1894, Torr in Trans. Roy. Soc. S. Austr., vol. xxxvi., 1912, gives measurement of largest dried specimen as 55 mm. × 25 mm. I have one collected at Cape Jervis on December 28, 1917, measuring 65 mm. × 35 mm., in splendid condition. It was accompanied by others of exceptional size.

Rhyssoplax bednalli, Pilsbry, 1895. In addition to the localities given by Dr. Torr (Trans. Roy. Soc. S. Austr., vol. xxxvi., p. 154, 1912), I can add that of Warrenben, in South Australia, from which I have one valve.

Loricella angasi, Ad. and Ang., 1864. I have taken at different times three large specimens alive at Marino in deep holes at lowest tide measuring 67 mm. × 40 mm., and one at Aldinga Bay measuring 67 mm. × 47 mm.

Onithochiton ashbyi, Bed. and Matt., 1906. Torr (Trans. Roy. Soc. S. Austr., vol. xxxvi., p. 151, 1912) refers to only one specimen having been taken. The type was collected by me at Aldinga Bay prior to 1898 and placed in Mr. Bednall's hands for description. Several years later I took a second specimen from the same spot about a quarter of a mile south of Aldinga jetty in a large sheltered pool. This is the one referred to in Torr's paper, and is still in my possession. When alive its girdle and valves were brilliant green and pink harmonizing with the calcareous growths on the rock upon which it was found. In January, 1918, Dr. Torr was successful in finding a third specimen at Corny Point, Yorke Peninsula.

Acanthochiton maughani, Torr and Ashby, 1898. In Torr's paper (Trans. Roy. Soc. S. Austr., vol. xxxvi., p. 162, 1912) only one locality is given for South Australia. I collected it at Aldinga Bay in 1897 and at Port Noarlunga and Marino in 1899. It is, as far as my experience goes, always a rare species in this State.

Acanthochiton cornutus, Torr and Ashby, 1898 (Trans. Roy. Soc. S. Austr., vol. xxii., pt. 2, p. 217, Torr and Ashby). The type locality is given as Marino at low tide. It was taken by me on the reef which at low water is quite shallow, many rocks being exposed. In Torr's paper (Trans. Roy. Soc. S. Austr., vol. xxxvi., p. 161, 1912) he says, "This is evidently a deep-water species." I think it doubtful whether the occurrences he refers to have been correctly identified. I have not myself seen a second specimen. The existence of eyes in the dorsal area, as referred to in the addendum to the original paper by Torr and Ashby, should make it easy of identification. I should be exceedingly grateful to any collector who may meet with this shell if he would kindly place a specimen or specimens at my disposal, in order that the remarkable discovery of eyes in an *Acanthochiton* may receive further elucidation.

Anisoradsia mawlei, Iredale and May, 1916 (Proc. Mal. Soc., vol. xii., pts. 2 and 3, p. 108, Nov., 1916). Subspecies *saundersi*, n. subsp. When at Port Lincoln in January, 1917, with Dr. Torr, I collected several specimens of an *Ischnochiton* evidently new to this State. On comparing it with Iredale and May's Tasmanian shell *mawlei*, for which they formed a new subgenus *Anisoradsia*, a close general resemblance was discernable, but it differs in several respects.

It is certainly deserving of subspecific rank. My material is rather limited, so that it may on further examination and comparison with a more extended series be found to deserve full specific rank. *Anterior valve.*—The radial ribbing in this valve is in straight lines, somewhat broken, giving a shallow, nodulose appearance to these ribs, whereas the sculpture of the dominant form *(mawlei)* is wavy. *Median valves.*—The broken concentric ribbing of the lateral area easily distinguishes it from typical *mawlei*. In this subspecies the sculpture is very coarse. The concentric ribs are better described as exceptionally coarse nodules, more or less running into one another; this feature is especially marked towards the posterior margin of this area. *Posterior valve.*—The sculpture of this valve behind the mucro is much coarser than is the case in the dominant form *(mawlei)*. In other respects the characteristics seem to accord. I am naming it in honour of Mr. F. L. Saunders, who is an earnest South Australian collector, and to whom belongs the credit of having first noticed the "host plant" of *Stenochiton cymodocealis*, Ashby.

Distribution of Australian Polyplacophora.

Order POLYPLACOPHORA.

Suborder LEPIDOPLEURINA.

Family Lepidopleuridae, Pilsbry.

		S.A.	W.A.	Vic.	N.S.W.	Tas.
Genus Lepidopleurus.						
Subgen. Terenochiton, Iredale.						
liratus, Ad. and Ang., 1864		x				x
matthewsianus, Bednall, 1906 ...		x				x
badius, Hedley and Hull, 1906 ...		x			x	
norfolcensis, Hedley and Hull, 1912					x	
catenatus, Hedley and Hull, 1912					x	
columnarius, Hedley and May, 1908		x				x
niger, Torr, 1911			x			
Subgen. Choriplax.						
grayi, Ad. and Ang.					x	

Suborder CHITONINA.

Family Callochitonidae, Thiele.

		S.A.	W.A.	Vic.	N.S.W.	Tas.
Genus Callochiton.						
platessa, Gould, 1846	x	x	x	x	x	x
rufus, Ashby, 1900		x	x			
mayi, Torr, 1912		x				x
elongatus, May, 1918						x
Genus Eudoxochiton.						
Subgen. Eudoxoplax, Iredale and May ...						
inornatus, Ten. Woods						x
Subgen. Chaetopleura.						
biarmata, Rochebrune, 1882			x			

Family Ischnochitonidae, Pilsbry.

	Q.	S.A.	W.A.	Vic	N.S.W.	Tas.
Genus Stenochiton.						
Subgen. Stenochiton.						
juloides, Ad. and Ang., 1865 ...		x	x			
pilsbryanus, Bednall, 1896		x				
posidonialis, Ashby, 1918		x				
cymodocealis, Ashby, 1918		x				
pallens, Ashby, 1900		x				
Subgen. Zostericola, MS., Ashby, 1918 ...		x				
Genus Ischnochiton.						
Subgen. Ischnochiton.						
pilsbryi, Bednall, 1896		x				
torri, Iredale and May, 1916 ...		x		x		
crispus, Reeve, 1847	x				x	
subsp. *decoratus*, Sykes, 1896 ...		x	x	x		x
atkinsoni, Iredale and May, 1916		x		x		x
ptychius, Pilsbry, 1894		x	x	x		
tateanus, Bednall, 1897		x	x	x		x
falcatus, Hull, 1912		x		x		x
wilsoni, Sykes, 1896=*levis*, Torr ...		x		x		
proteus, Reeve, 1847	x				x	
subsp. *milligani*, Iredale and May, 1916		x		x		x
gabrieli, Hull, 1912				x		
albinus, Thiele, 1911		x				
indifferens, Thiele, 1911			x			
intermedius, Hedley and Hull, 1912					x	
bednalli, Torr, 1912		x				
contractus, Reeve, 1847 *(decussatus)*		x	x			
lineolatus, Blain., 1825 *(contractus)*		x	x	x		x
fruticosus, Gould, 1846		x			x	
virgatus, Reeve, 1848		x		x		x
Subgen. Haploplax.						
thomasi, Bednall, 1896		x				
smaragdinus, Angas, 1867	x				x	
var. *picturatus*, Pilsbry	x				x	
subsp. *resplendens*, Bed. and Matt.		x	x	x		x
lentiginosa, Sowerby					x	
pura, Sykes, 1896		x		x		
mayi, Pilsbry, 1895						x
Doubtful Ischnochitons.						
adelaidensis, Reeve						
variegatus, Ad. and Ang., 1864 ...						
cancellatus, Sowerby						
carinculatus, Reeve						
arbutum, Reeve						
sculptus, Sowerby						
longicymba, Blain., 1825						
ustulatus, Reeve, 1847						
Subgen. Anisoradsia, Iredale and May.						
mawlei, Iredale and May, 1916 ...						x
subsp. *saundersi*, Ashby, 1918 ...		x				
Subgen. Ischnoradsia, Shuttl.						
australis, Sowerby, 1840			x		x	
subsp. *evanida*, Sowerby, 1840 ...		x		x		x
Subgen. Heterozona, Carp., MS., Pilsbry.						
cariosus, Carp. and Pils., 1873 ...		x	x	x		x
sub-viridis, Iredale and May, 1916				x		x

Family Callistoplacinae.

	Q.	S.A.	W.A.	Vic.	N.S.W.	Tas.
Genus Callochiton, Pilsbry.						
antiquus, Reeve, 1847	x				x	
subsp. *mawlei*, Iredale and May		x	x	x		x
recons, Thiele, 1911			x			

Family Mopaliidae.

	Q.	S.A.	W.A.	Vic.	N.S.W.	Tas.
Genus Plaxiphora, Gray.						
Subgen. Plaxiphora.						
albida, Blain., 1825		x		x	x	x
paeteliana, Thiele, 1911					x	
hedleyi, Torr, 1911			x			
pustulosa, Torr, 1911			x			
zebra, Torr, 1911			x			
Subgen. Poneroplax, Iredale.						
costata, Blain.	x	x	x	x		x
Subgen. Frembleya, H. and A. Ad.						
conspersa, Ad. and Ang., 1864 ...		x				
matthewsi, Iredale, 1901 (?), var.		x				

Family Cryptoconchidae, (Burrow, 1815) Iredale.

	Q.	S.A.	W.A.	Vic.	N.S.W.	Tas.
Genus Acanthochiton, Gray, 1821.						
Subgen. Acanthochiton.						
sueri, Blain., syn. *asbestoides*, Smith	x	x	x	x	x	x
granostriatus, Pilsbry, 1894		x		x	x	x
crocodilus, Torr and Ashby, 1898		x				
cornutus, Torr and Ashby, 1898 ...		x				
maughani, Torr and Ashby, 1898		x			x	
exilis, Torr and Ashby, 1898 ...		x				
pilsbryi, Sykes, 1896				x		
lachrymosa, May and Torr, 1912 ...						x
brevispinosa, Sowerby, 1843			x			
deliciosus, Thiele, 1911			x			
sub-viridis, Torr, 1911			x			
verconis, Torr and Ashby, 1898 ...		x	x			
retrojectus, Pilsbry, 1894	x				x	
(?) subsp. *rufus*, Torr, 1912 ...		x				
variabilis, Ad. and Ang., 1864 ...	x	x			x	x
kimberi, Torr, 1912		x				x
leuconotus, Hed. and Hull, 1912 ...					x	
approximans, Hed. and Hull, 1912					x	
coxi, Pilsbry, 1894					x	
Subgen. Notoplax, Adams.						
matthewsi, Bed. and Pils., 1894 ...		x		x		
speciosus, H. Adams, 1861		x	x	x		x
wilsoni, Sykes, 1896		x		x		x
glyptus, Sykes, 1896				x		
Subgen. Macandrellus, Dall., 1878 = Loboplax, Pilsbry.						
costatus, Ad. and Ang., 1864 ...	x	x			x	x
rubrostratus, Torr, 1912		x				x
Doubtful Acanthochitons.						
tatei, Torr and Ashby, 1898, (?) *granostriatus*, Pilsbry						
bakeri, Torr, 1912, impossible of identification						

Family Cryptoplacidae, Dall.

	Q.	S.A.	W.A.	Vic.	N.S.W.	Tas.
Genus Cryptoplax.						
burrowi, Smith, 1884	x					
gunni, Reeve, 1847		x	x	x		
striatus, Lam., 1819		x		x	x	x
oculatus, Quoy and Gaim., 1834 ...	x					
hartmeyeri, Thiele, 1911			x			
michaelseni, Thiele, 1911			x			

Family Chitonidae.

	Q.	S.A.	W.A.	Vic.	N.S.W.	Tas.
Genus Rhyssoplax, Thiele, 1893.						
jugosus, Gould, 1846					x	
subsp. *diaphora*, Ire. and May, 1916		x		x		x
coxi, Pilsbry, 1894	x				x	
torrianus, Hed. and Hull, 1909 ...		x	x			x
calliozona, Pilsbry, 1894		x				x
exoptanda, Bednall, 1897		x	x	x		
bednalli, Pilsbry, 1895		x	x			
tricostalis, Pilsbry, 1894		x	x	x		x
limans, Sykes, 1896	x	x		x	x	
corypheus, Hed. and Hull, 1912 ...					x	
verconis, Torr and Ashby, 1898 ...		x		x		
oruktus, Maughan, 1900...		x				x
aureo-maculata, Bed. and Matt. ...		x				x
vauclusensis, Hed. and Hull, 1909	x				x	
translucens, Hed. and Hull, 1909	x				x	
coccus, Menke, 1844			x			
howensis, Hed. and Hull, 1912 ...					x	
Genus Amaurochiton, Thiele, 1893.						
glaucus, Gray, 1828						x
Genus Sypharochiton, Thiele, 1893.						
pelli-serpentis, Q. and Gaim., 1835					x	
subsp. *maugenaus*, Ire. and May, 1916						x
funereus, Hed. and Hull, 1912					x	
Genus Sclerochiton, Cpr.						
miles, Pilsbry, 1892	x					
curtisianus, Smith, 1884	x					
Doubtful Chitons.						
exiguus, Sowerby, 1843						
pulcherrimus, Sowerby, 1841						
Genus Tonicia, Gray.						
carpenteri, Ang.					x	
hullianus, Torr, 1911			x			
picta, Reeve, 1847	x					
fortilirata, Reeve, 1847	x					
Subgen. Lucilina, Dall.						
confossa, Gould, 1846	x					
delecta, Thiele, 1911			x			
Genus Acanthopleura.						
spinosa, Bruge., 1792	x		x			
Subgen. Amphitomura, Pilsbry.						
gemmata, Blain., 1825=*spiniger*, Sowerby			x			
aculeata, Linne., 1758	x					

	Q.	S.A.	W.A.	Vic.	N.S.W.	Tas.
Genus Lorica.						
volvox, Reeve, 1847					x	
subsp. *cimolia,* Reeve, 1847 ...		x	x	x		x
Genus Loricella.						
angasi, Ad. and Ang., 1864		x		x	x	x
Genus Schizochiton.						
incisus, Sowerby, 1841	x					
Genus Onithochiton, Gray.						
scholvieni, Thiele, 1910	x		x			
ashbyi, Bed. and Matt., 1906 ...		x				
quercinus, Gould	x				x	
rugulosus, Angas					x	
discrepans, Hed. and Hull, 1912 ...					x	
Genus Liolophura.						
gaimardi, Blain.	x				x	
subsp. *queenslandica,* Pils., 1894	x					
georgiana, Quoy and Gaim., 1835...			x			

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Australian Fungi: Notes and Descriptions. No. 1.

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[Read July 11, 1918.]

Plates IX. to XII.

In submitting these notes and descriptions of some of the higher Australian fungi, we would like to point out the difficulties surrounding the identification of our species. The individuals of most species vary considerably amongst themselves, and, unless there is some outstanding common feature, extremes may not be recognized. Most of the fleshy species alter vastly in drying, the spores being frequently the only constant feature. To study a species properly it is therefore necessary to know it in the field, to write a full description of it when fresh, to have it figured in colours, to preserve specimens by drying as quickly as possibly and in formalin, and to measure the spores. It is very often exceptionally hard to say whether Australian species, which resemble extra-Australian ones, are or are not the same. Coloured plates of European species may be compared with our fresh plants or with coloured drawings of them, the dry plants of both may be examined sometimes side by side and their spores may be compared, and the descriptions of fresh plants of each considered. In these cases, if essentials agree, the diagnosis may be considered reasonably sound. We have adopted the plan of referring Australian plants to European species if there seems reasonable ground for considering them the same, even in the absence of authentically identified dry European plants with which to compare them. We, however, also add to such identifications our own descriptions of the Australian plants. If later the latter are found to be distinct, the error is thus easily rectified, and meanwhile we prevent undue multiplication of specific names. For the Australian higher fungi to be adequately known, it is essential that coloured drawings should be prepared and published of each. We have already over 150 of these, and hope that means may sometime be found to make them available to the scientific public.

We are deeply grateful to a generous benefactor of this Society for enabling those in this series to be reproduced.

The references to plates, under "colour tints noted," are to those by Henri Dauthenay in "Répertoire de Couleurs

. . . publié par la Société Française des Chrysanthémistes et René Oberthür''—the only colour index at present available to us.

The species considered are numbered consecutively for the convenience of possible reference in future papers.

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BROWN-SPORED AGARICS.

Rozites.

According to Massee (Brit. Fung. Flora, ii., p. 232, 1893), though "the genus *Locellinia*, Gillet, founded for the reception of a rusty-spored species having a universal veil that remains at the base of the stem as a volva, differs from *Acetabularia*, Berk., in having a secondary veil and adnate gills, nevertheless Saccardo has made the mistake of sinking Berkeley's genus, and placing the species in *Locellinia*." Cooke, in his Handbook of Australian Fungi, 1892, follows Saccardo, as does Hennings in Engler and Prantl's Die Natürlichen Pflanzenfamilien. On the other hand, the latter author, under the genus *Rozites*, Karst., defines this as having a ring on the stem and with the young plant enveloped in a universal veil, which later on remains as fragments on the surface of the cap and as a sheath at the base of the stem. The Australian plant we have found has when young such a universal veil, rupturing in the way indicated, a marked secondary veil forming later ragged fragments of a ring, and adnate and later nearly free gills. It is obviously *Rozites* as defined by Hennings, but also, we take it, the *Locellinia* of Gillet referred to by Massee. At present we adopt *Rozites* as being less liable to cause confusion.

1. *Rozites australiensis*, n. sp.—The young plant with a subglobose or pear-shaped head up to 3 inches across, on a broad stem 3 inches high and 2½ inches broad, which contracts into a conical root; adherent to the upper part of the stem and separated from the cap are large ragged fragments of a universal veil (=volva) disclosing beneath the secondary veil; viscid when moist; pure white or with a slight brownish tint. When adult, pileus up to 11 inches across, expanding to convex and then nearly plane and usually broadly gibbous, sometimes with a depression in the umbo, smooth, white with a slight brownish tint, sometimes cracking, with fragments of the veil at the edge. Gills when very young pale

straw and adnate, finally slightly sinuate and nearly free (S.A.), in the New South Wales specimens adnate with a trace of decurrence, moderately close, rather narrow, pale salmony-brown becoming more cinnamony, finally rich rusty brown. Stem when adult up to 6 inches high, 1½ to 2 inches broad, becoming bulbous below and then contracting into a conical root, white, slightly fibrous, solid, with large ragged fragments of a rather superior ring, and below this the remains of the universal veil (volva) are usually distinguishable (S.A.). The New South Wales (1918) specimens show a sheathing base to the lower two-thirds of the stem, comprised of superimposed split layers of the universal veil seen in the young plant, surmounted by a broad upwardly-concave persistent ring. Stem (N.S.W.) attached to white mycelial threads traversing the ground and forming indefinite masses. Flesh tough, white. No smell. Spores in the mass rich ferruginous brown, microscopically yellow-brown, oblique, with pointed ends, 8·5 to 10·5 × 5 to 6 μ.

On the ground under trees, sometimes subcaespitose. Found in exactly the same spot, forming a colony some 20 yards in diameter, about 1½ miles due west of Mount Lofty, South Australia, in May, 1910, and April, 1917. We also have a specimen, locality not noted, from New South Wales, and in May, 1918, at Wauchope and Kendall found several colonies in forests.

Pileus ad 20 cm. latus, convexus, plerumque late gibbosus, interdum in umbone depressus, aliquanto glaber, albidus sed fuscum tinctus. Lamellae juventute substramineae, adnatae, demum minime sinuatae et stipite paene disjunctae, modice confertae, subfulvae, mox cinnamoneae, demum ferrugineae. Stipes ad 15 cm. altus, 2·5 cm. crassus, basi sensim bulbosus, albidus, subfibratus, annulo subsuperiore. Volva imperfecta. Sporae perferrugineae, obliquae, 8·5-10·5 × 5-6 μ.

Colour tints noted: New South Wales—Pileus shows tints of pale-yellowish flesh, No. 68; gills near snuff-brown (deep bistre), No. 303, at first Ton 1, then Ton 3. South Australia—Spore mass and dried gills near bistre, No. 328, Ton 4.

Pholiota.

2. *Pholiota disrupta*, Cooke and Massee: Grev., xix., 89; Cooke: Handb. Austr. Fungi, No. 220. Previously recorded, Victoria.—The following description of a plant collected by us agrees fairly well with that of *P. disrupta* given by Cooke in his Handb. of Austr. Fungi (No. 220):—"Stout. Pileus 4½ inches across, slightly convex, smooth or

finely rough, whitish with a dirty-brownish tint. Gills moderately crowded, adnate, whitish with a brown tint in certain lights, later becoming coffee coloured, and finally cinnamon-brown. Stem $3\frac{1}{2}$ inches high, $\frac{7}{8}$ inch in diameter above, expanding below to a somewhat bulbous base $1\frac{1}{4}$ inch thick, with a conical almost fusiform root, mealy white and somewhat silky fibrous. Ring $\frac{5}{8}$ inch from the gills, pendulous, torn, a rich reddish-brown from fallen spores. Spores brown, 11 to 11·5 × 5·5 μ, oblique, with one or both ends pointed."

On the ground under a rock, Milson Island, Hawkesbury River, May, 1913. In the description given by Cooke, the cap is said to be at first smooth, then cracked deeply into large areolae. Our specimen was smooth when gathered, but is irregularly wrinkled when dry. The spore measurements given by Cooke are larger than ours, *viz.*, 14 × 9 μ. Our spores are perhaps rather bright to be called "dusky ferruginous"—*P. disrupta* is placed in the section *Phaeotae* by Cooke—but the tint "tawny-brown," applied to the colour of the spores in the description, could be applied to those of our specimen. Cooke records the species for Victoria.

3. *Pholiota pudica*, Fries.: Hymen. Eur., p. 118; Sacc.: Syll., v., 3065; Cooke: Illustrs., pl. 362; Cooke: Handb. Austr. Fungi, No. 221. Previous Australian record, Victoria.—We refer to this species a pure-white *Pholiota* with a slightly hollow stem found growing in caespitose fashion amongst bark at the base of a Eucalyptus on Milson Island, Hawkesbury River, in March, 1912. Spores oval, brownish, 7·2 to 9 × 5·5 μ.

4. *Pholiota recedens*, Cooke and Massee: Grev., xviii., 25; Cooke: Handb. Austr. Fungi, No. 217. Previous Australian record, Victoria.—We refer, with some hesitation, the following common plant in the Sydney district to *P. recedens*. Pileus $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter, hemispherical or conico-campanulate, then expanded, sometimes slightly umbonate, smooth, brownish-tan, edge becoming dark brown on drying and striate, slightly hygrophanous, when young sometimes showing some lighter yellow shreds on the pileus the colour of the ring. Gills adnate but slightly sinuate and with a slight decurrent tooth or adnexed and seceding, moderately distant, ferruginous tan. Stem 2 inches high, slightly striate, hollow, slightly thickened below, ferruginous tan. Ring marked, distant, reflexed, striate above, yellowish-brown. Spores yellow-brown, obliquely flask-shaped, 9 to 13 × 6 to 7 μ.

On the ground, Neutral Bay and Mosman, Sydney, May, June, and August (D. I. C., Watercolour No. 21; Miss Clarke, Watercolour No. 136.)

Colour tints noted:—Pileus at the periphery when moist near brownish-terracotta, No. 322, Ton 2, with darker lines, in the centre darker than mineral brown, No. 339, Ton 4. Gills near hazel, No. 324, Ton 4. Ring, yellowish-buff, No. 310, Ton 2. Spore mass rather browner than yellow ochre, No. 326, Ton 2.

5. *Pholiota eriogena*, Fries.: Pl. Preiss, ii., 132; Sacc.: Syll., v., 3128; Cooke: Handb. Austr. Fungi, No. 230. Previously recorded, Western Australia. — The description given by Cooke of *P. eriogena*, Fr., in Pl. Preiss., is very short and will probably fit a number of species. As it is based on Australian plants, we refer the following species to it to avoid multiplication of specific names. Our plants agree well with the description and plates of *P. discolor* of Peck. Pileus $\frac{1}{2}$ to 1 inch in diameter, convex, sometimes irregular, dark brown or reddish-brown becoming pale tan or reddish-tan, slightly viscid and not striate (one collection; Blue Mountains), edge at first turned in. Gills adnate, moderately crowded, light or reddish-brown. Stems 1 to $1\frac{1}{2}$ inch high, pallid becoming brownish or brown, at first mealy, slightly striate, slightly hollow, base slightly enlarged with a white mycelial attachment. Superior ring not very marked and evanescent. Spores pear-shaped, 7 to $7{\cdot}8 \times 5\ \mu$.

On wood, single, Blue Mountains, May, 1914; Terrigal, June, 1914; Bulli, May, 1914—all in New South Wales.

6. *Pholiota unicolor*, Flora Danica, t. 1071, fig. 1; Cooke: Handb. Brit. Fungi, p. 149; Cooke: Illustrs., pl. 356B.—We place the following species under *P. unicolor*, though it has resemblances to *P. marginata*. In Cooke's Illustrations of the former, the small specimens show umbonation, whilst in ours even large ones show prominent umbos. Our specimens also seem to be larger than *P. unicolor*, whilst the gills cannot be called triangular. The plants grow singly, whilst in *P. unicolor* they are said to be subcaespitose and in *P. marginata* solitary or gregarious. Pileus up to $1\frac{1}{4}$ inch in diameter, convex, at first deep reddish-tan to watery yellow-brown, drying to a pale brown, edge finely striate when moist, smooth, umbonate, sometimes acutely so. Gills adnate or with a decurrent tooth, reddish-brown to pallid cinnamon becoming dingy cinnamon, moderately close. Stem $1\frac{1}{2}$ inch high, slightly attenuated upwards, base a little swollen, covered with whitish-mealy fibrils, brownish below, solid. Ring moderately distant, marked or sometimes slight. Spores $7{\cdot}5$ to $10{\cdot}4 \times 4$ to $5{\cdot}2\ \mu$.

Scattered on fallen trunks. Mount Wilson, June, 1915 (Miss Clarke, Watercolour No. 85); Leura, June, 1916; Lisarow, August, 1916—all in New South Wales.

7. *Pholiota marginata*, Batsch.: Elench. Fung., f. 207; Cooke: Illustrs., pl. 372; Sacc.: Syll., v., 3130; Cooke: Handb. Austr. Fungi, No. 229. Previous Australian record, Victoria.—We refer the following to this species:—Pileus 1 inch in diameter, convex, slightly distorted, smooth, pale tanny-white to tan, sometimes a pale centre and darker periphery. Gills adnate, moderately crowded, cinnamon. Stem $1\frac{1}{4}$ inch high, moderately slender, attenuated upwards, with a central brownish ring, sometimes brownish above the ring and whitish below, sometimes brownish or pallid brown or brown with white streaks throughout, hollow. Caespitose amongst or on old wood and sawdust. Spores 6 to 7 × 4·5 to 5 μ.

Milson Island, Hawkesbury River, July, 1912 (Miss Clarke, Watercolour No. 8).

8. *Pholiota pumila*, Fries.: Mon., i., p. 321; Fries.: Icones, ii., p. 5, pl. 105; Cooke: Illustrs., pl. 503A; Sacc.: Syll., v., 3135; Cooke: Handb. Austr. Fungi, No. 231. Previous Australian records, New South Wales, Victoria.—We describe our specimens thus:—Pileus up to $\frac{3}{8}$ inch in diameter, broadly conical or convex, then nearly plane, trace of an umbo or apex somewhat pointed, faintly striate near the edge, dark reddish-brown to yellow-brown and waxy looking when moist, finely granular with a lens, hygrophanous, opaque and pallid brown when dry. Gills adnate, with a trace of decurrence, moderately close to rather distant, pallid brown to reddish-brown. Stem 1 inch high, pallid brown to dark brown, somewhat silvery-mealy, solid or slightly hollow. Ring superior to rather distant, filmy, later disappearing. Spores oblique, one end acute, yellow-brown, 7 to 8 × 4 to 4·5 μ.

Amongst moss. The Spit, Sydney, July, 1916 (Herb., J. B. C., Form. Sp., No. 216); Mosman, Sydney, August, 1914 (several acuminate cystidia, 34 × 8 μ); Neutral Bay, April, 1918.

Colour tints noted:—Pileus when moist near brown-pink, No. 297, Ton 3; gills near Ton 2.

Cortinarius.

9. *Cortinarius (Phlegmacium) variicolor*, var. *nemorensis*, Fries.: Hymen. Eur., p. 339; Cooke: Illustrs., pl. 863; Massee: Brit. Fung. Flora, ii., p. 99.—Specimens which we think may be this variety we describe as follows:—Pileus $1\frac{3}{4}$ inch across, convex, very irregular, dark brown with perhaps a tinge of purple, viscid. Gills moderately close, dingy

violet, then yellow-cinnamon, from distortion of the cap variously attached being sometimes slightly decurrent, at others adnate or deeply ventricose and slightly cut out. Stem $1\frac{3}{4}$ inch high, stout, a little swollen at the base ($\frac{3}{4}$ inch in diameter), conical below this, finely striate, yellowish with tinges of violet. Superior veil. Flesh of stem turning violet. Caespitose. Spores 7·5 to 8·2 × 5·2 μ.

National Park (N.S.W.), July, 1916; (?) this species, Milson Island, Hawkesbury River (N.S.W.), July, 1912.

The following, with intensely glutinous caps, seem to belong to the same species as the above:—Pileus up to $2\frac{1}{2}$ inches high, at first convex and rather irregular, then more expanded, fibrously streaked, pale tan with a stony tint and then deeper tan and the edge pallid with a lavendar tinge, or dark brown with a voilet tinge and paler edge. Gills sinuately adnexed or adnate, moderately crowded, at first brown with a voilet tinge, finally cinnamon. Stem up to 2 inches high and $\frac{3}{8}$ inch thick, stoutish, often flattened, fibrously streaked, whitish, sometimes voilet tinted when damaged. Flesh of cap with a faint brownish tint, of stem faint voilet. Cobweb veil when young; superior ring. Spores flask-shaped, 8 to 8·5 × 5·2 μ.

Mosman, Sydney, April, 1915 (Herb., J. B. C., Form. Sp., 64); Hornsby (N.S.W.), June, 1916 (no violet tint noticed in gills; stem violet; veil violet; spores finely rough).

10. *Cortinarius (Phlegmacium) corrosus*, Fries.: Epicr., p. 266; Cooke: Illustrs., pl. 715; Massee: Brit. Fung. Flora, ii., p. 108.—We refer the following to this species:—Pileus $1\frac{1}{2}$ inch in diameter, convex, irregular, rather fibrously streaked, apparently sticky, dark tan. Gills moderately close, adnate with a slight decurrent tooth, dark cinnamon, drying bright ferruginous with a pale edge. Stem stout, whitish, slightly streaked, solid, base slightly bulbous with a free edge, doubtful remains of the cobweb veil. Spores with one end more pointed, 8·2 × 5·2 μ.

On the ground. Mosman, June, 1915.

11. *Cortinarius (Phleg.) decoloratus*, Fries.: Monogr., ii., p. 30; Cooke: Illustrs., pl. 729; Massee: Brit. Fung. Flora, ii., p. 113; Cooke: Handb. Austr. Fungi, No. 360 (Vict.).—We place the following under this species:—Pileus up to $2\frac{1}{2}$ inches in diameter, plane or irregular and a little depressed, very viscid, wax coloured. Gills adnate, slightly ventricose, pallid cream with a brownish tint, then a little browner, moderately close. Stem up to $2\frac{1}{2}$ inches high, slightly attenuated downwards, silky fibrous, hollow, white. Spores yellow-brown, oblique, 7 to 8 × 5·2 μ.

Lane Cove River, Sydney, June, 1916.

12. *Cortinarius (Phleg.) largus*, Fries.: Monogr., ii., p. 10; Cooke: Illustrs., pl. 701; Massee: Brit. Fung. Flora, ii. p. 99.—The following appears to be this species, though the spores are a little narrower. Pileus finally up to 9 inches across, convex, then irregular, then irregularly upturned, viscid when moist, dark tan, finally becoming scorched brown, very slightly fibrous when young, then smooth. Gills deeply sinuately adnexed, close, pallid brownish-white with a faint violet tinge, soon losing the violet to become pale brown, then more cinnamon, finally dark reddish-brown. Stem $3\frac{1}{2}$ inches high, $1\frac{1}{2}$ inch broad above, at first very stout with a non-marginate bulb of 2 inches, when adult the bulb not noticeable, root conical, solid, white tinged with the brown spores. Remains of a cobweb veil when young. Tough. Flesh white, $1\frac{1}{2}$ inch thick. No smell. Spores microscopically yellow-brown, oblique, one end pointed, 10·4 to 12 × 5 μ.

Caespitose on the ground. Mount Lofty (S.A.), April, 1917.

13. *Cortinarius (Phleg.* [?]*) rotundisporus*, n.sp. (pl. ix., figs. 3 and 4).—Pileus up to 1 inch in diameter, slightly viscid when moist, surface dull, convex with a trace of an umbo, the edge a little turned in when young, occasionally of a beautiful mauve colour, becoming pallid with a greyish-blue tint and traces of brown when dry. Gills adnate or with a trace of decurrence and slightly sinuate and ventricose, moderately close, dingy flesh-tinted drying pale yellow-brown then browner. Stem up to 2 inches high, attenuated upwards, rather bulbous below, slightly striate, slender to moderately slender or rather stout, white tinged with the colour of the cap, with remains of a superior cobweb veil (bluish when young), hollow. Flesh of the stem and cap pallid watery or turning yellowish in the stem, no blue. Spores smooth, nearly subspherical, 6·8 to 7·4 × 5·5 to 6 μ.

Subcaespitose under trees, Bradley Head and Mosman, Sydney, May, 1917, and April, 1918 (Miss Clarke, Water-colour No. 152).

Colour tints noted:—Pileus when dry becoming creamy-yellow, No. 30, Tons 2 and 3, tinged more or less with eucalyptus green, No. 248, Ton. 2. Stem tinted with the colours of the pileus. Gills when dry yellow-ochre, No. 326, Ton 1. Spore mass near snuff brown (deep bistre), No. 303, Ton 3. Pileus and stem of one specimen tinged with lavender-blue (violet-blue), No. 204, paler than Ton 1.

It is probable that this species should be placed under *Myxamicium*. In one specimen the stem seemed to be viscid as well as the cap. The specific name *rotundisporus* is given on account of the subspherical spores.

Pileus ad 3·5 cm. latus, paulo viscidus, convexus, paulo umbonatus, margine initio paulo involuto, pallido-flavus et glauco-violaceus coloratus. Lamellae adnate et minime sinuatae, subventricosae, paulo confertae, fusco-carneae, deinde flavo-ochraceae. Stipes ad 6 cm. altus, sursum attenuatus, paulo bulbosus, minime striatus, albidus et ad pileum similiter coloratus. Velum initio coeruleus. Caro pallida. Sporae glabrae, subsphericae, 6·8-7·4 × 5·5-6 μ.

14. *Cortinarius (Myxacium) archeri*, Berk.: Fl. Tas., t. 181, f. 7; Sacc.: Syll., 3763; Cooke: No. 361.—This species, recorded for Tasmania, is not rare in the Sydney district. Our description is as follows:—Pileus 2 to 5 inches in diameter, convex, then sometimes slightly depressed, intensely glutinous, rich brownish-violet, later becoming dry and shining and tan-brown with a deep violet streaky edge or light to dark chestnut only, edge turned in when young. Gills adnate or with a very slight sinus, or with a decurrent tooth, moderately close, pallid earthy with a violet tinge, then cinnamon or snuff-brown. Stem up to 3 or 4 inches high, glutinous, base bulbous and up to more than 1 inch thick, attenuating upwards to $\frac{5}{8}$ inch thick, conical below the bulb and ending in mycelial threads, hollow, pallid with a marked violet tint below the fugacious ring. Ring sometimes marked and persistent. Veil cobwebby, reddish-brown. Spores yellow-brown, ends rather pointed, rather elongated, very finely rough, 12 to 14·5 × 7 to 7·5 μ.

Hawkesbury River, June, 1912; locality not stated; Neutral Bay, Sydney, April, May, and June; Gladesville, Sydney (M. Flockton), May, 1910; Cheltenham, Sydney (A. A. Hamilton), May, 1910; Penshurst, Sydney, June, 1907.

Colour tints noted:—Edge of pileus when half-grown tinted with lavender-blue (violet-blue), No. 204, Tons 1 to 3; later the peripheral third of the pileus raw umber, No. 301, and the centre near brown-pink, No. 297, Ton 1. Lamellae when mature near snuff-brown (deep bistre), No. 303, Ton 2, with a slight lavender tint. Stem when very young lavender-blue (violet-blue), No. 204, Ton 4. Spore mass brown-pink, No. 297, Ton 4.

15. *Cortinarius (Myx.) vibratilis*, Fries.: Monogr., ii., p. 43; Cooke: Illustrs., pl. 744; Massee: Brit. Fung. Flora, ii., p. 92.—We give the following description of the specimens we thus refer:—Pileus up to $1\frac{1}{2}$ inch in diameter, glutinous, convex then plane, subgibbous in one collection,

rich tan to dark yellow-brown. Gills sinuately adnexed or as if adnate and then seceding, moderately close, pale salmon or pallid cinnamon. Stem 1½ inch high, moderately stout, somewhat swollen below, viscid below the brown median remains of the veil, solid or hollow, white, sometimes fibrously streaked. Taste bitter. Spores yellow-brown, 8·5 to, occasionally, 10·5 × 5·2 μ.

On the ground. The Spit, Sydney, July, 1916; Sydney, July; Mount Lofty (S.A.), July, 1914 (cap 2 inches in diameter, stem not noted as sticky, spores distinctly larger and usually 10·5 μ long; this may be a distinct species).

16. *Cortinarius (Dermocybe) camurus*, Fries.: Epicr., p. 285; Cooke: Illustrs., pl. 784; Massee: Brit. Fung. Flora, ii., p. 61.—The following resembles the description of this species and also Cooke's illustration of it, save that the umbo may be acute and not obtuse. Pileus 1 to 1½ inch broad, ¾ inch high, conico-convex with an acute, sometimes obtuse, umbo, edge slightly incurved, finely fibrously striate, not viscid, dark tan or with the apex nearly black, succeeded by chestnut-tan or reddish-brown with the periphery lighter, drying rather shiny and striate. Gills adnate or slightly sinuate, moderately close, edge crenate, slightly ventricose, reddish-cinnamon. Stem 3 inches high, rigid, moderately slender, attenuated upwards, slightly fibrillose or silky striate, slightly hollow, white or pallid whitish. Ring imperfect. Brown(?) or whitish cobwebby universal veil. Flesh thin, attenuated towards the edge. Slight seminal smell. When young with the edge turned in and the cap conico-acute. Caepitose at the base of tree-trunks. Spores yellow-brown, sometimes slightly warted, 8·5 to 10·4 × 5 to 6 μ.

Neutral Bay, Sydney, April and May, 1915 (Miss Clarke, Watercolour No. 74; Herb., J. B. C., Form. Sp., 102); at base of tree, Mosman, Sydney, July, 1916 (spores finely warted); Hawkesbury River, May, 1915 (cap ½ inch in diameter, reddish-brown; gills adnexed; stem 1 inch high, moderately stout, solid; flesh pale reddish-brown; spores smooth). Bradley Head, Sydney, May, 1917; Kendall (N.S.W.), May, 1917.

Colour tints noted:—Pileus tan colour, No. 317, Tons 2-4, apex very dark; gills cinnamon, No. 323, Ton 3; spore mass near Ru ochre, No. 314, Ton 1.

17. *Cortinarius (Dermocybe) miltinus*, Fries.: Epicr., p. 287; Cooke: Illustrs., pl. 785A; Massee: Brit. Fung. Flora, ii., p. 65.—We describe specimens collected at Bradley Head. Sydney, in April, 1918, thus:—Pileus up to 2 inches (5 cm.) in diameter, convex, finally upturned and rather wavy, subgibbous, dry, matt, reddish-brown, paler when old. Gills

sinuate, rather ventricose, moderately close, blood-red brown, later more rusty. Stem up to $1\frac{3}{4}$ inches (4·5 cm.) high, moderately slender, sometimes flattened, slightly fibrously streaked, blood-reddish-brown, hollow. Veil reddish-brown. Flesh of cap white over the stem attachment, very thin elsewhere; flesh of the stem reddish-brown peripherally. Spores 7 to 8 × 4·2 μ.

Colour tints noted:—Pileus in places red ochre (red-brown terracotta), No. 332, Ton 1; with tinges in the centre rather more purplish than blood-red brown, No. 337, Ton 2; other parts of the pileus (peripherally) approaching tan colour, No. 317, Ton. 1. Stem at the base approaching garnet brown, No. 164, Ton 1, and also the blood-red brown of the pileus, No. 337, Ton 2. Gills near dark Indian red (red-brown), No. 338, Ton 4; later, from the spores, turning more to mineral brown, No. 339, Ton 2, with touches of cinnamon. Spore mass near hazel, No. 324, Ton 4.

The following appear to be smaller specimens of this species:—Pileus $\frac{3}{8}$ to $1\frac{1}{4}$ inch in diameter, convex, then upturned, sometimes umbonate, dark tanny or yellow-brown, with a lens finely fibrillose, edge turned in. Gills adnate, moderately close or moderately distant, pallid cinnamon to reddish-brown. Remains of a yellow-brown cobweb veil. Stem 1 to 2 inches high, slender, finely striate, white at the top but very soon blood-red from the fibres of the universal veil seen in very young plants covering the cap and stem with blood-red, solid. Spores yellow-brown, (?) finely rough, 8·5 × 5·2 μ.

On the ground, North Bridge, Sydney, July, 1916 (Herb., J. B. C., Form. Sp., 211); National Park (N.S.W.), July, 1916.

18. *Cortinarius (Dermocybe) venetus*, Fries.: Epicr., p. 291; Cooke: Illustrs., pl. 833B; Massee: Brit. Fung. Flora, ii., p. 73.—We place the following under *C. venetus*:—Pileus up to 2 inches or more in diameter, convex, usually gibbous, edge turned in, then expanding and irregular, smooth, bright yellow-green to olive-green or brownish-green. Gills broadly adnexed and slightly sinuate, sometimes with a decurrent tooth, moderately close, pale yellow-brown, then cinnamony-yellow, later dark yellow-brown. Stem up to 3 inches high and $\frac{5}{8}$ inch broad, wavy, pallid yellowish or whitish, sometimes reddish-brown below ([?] from veil), fibrillose, solid or with a tendency to be hollow. Flesh white with a pale yellow tint, thin except in the centre; when injured by insects turning reddish-brown. Remains of cobweb veil on the upper part of the stem. Spores smooth, oblique, rather elongated, 8 to 11 × 5·2 to 7 μ.

Usually in clumps. Under *Casuarina*, Milson Island, Hawkesbury River, June, 1913 (cap noted as slightly sticky when moist, sometimes when old with fibrous dark-brown scales forming a solid patch in the centre; D. I. C., Watercolour No. 27); Mount Wilson (N.S.W.), June, 1915; Lane Cove River, Sydney, June, 1916; Mount Lofty (S.A.), July, 1914 (cap up to $3\frac{1}{4}$ inches in diameter, uniform dark green or olive-green or green-tinged shades of brown, somewhat striate, spores 8·5 to 9 × 5·2 μ).

19. *Cortinarius (Telamonia) austro-evernius*, n. sp. (pl. ix., figs. 5 and 6).—The following seems to be the Australian representative of *C. evernius*:—Pileus up to 2 inches in diameter, convex, then expanded and wavy, finally sometimes upturned and splitting, dull violet with the periphery paler, drying to a pale brown with a slight violet tint or tanny-brown, obscurely striate, not viscid, smooth. Gills adnate, moderately close, not connected by veins, violet-cinnamon becoming browner, drying to a ferruginous brown. Stem up to 3 inches high, slender, solid or slightly hollow above, silky fibrillose, shining, the light being reflected so as to give a somewhat banded appearance, voilet tinted or pallid whitish with traces of violet. Flesh thick in the centre of the cap, then becoming almost suddenly thin, white or violet tinted. Spores very finely rough, 7 to 8·5 × 5·2 to 6 μ. Smell pleasant. Slightly caespitose.

Under bushes. Lane Cove River, Sydney, June, 1916 (Miss P. Clarke, Watercolour No. 110; Herb., J. B. C., Form. Sp., 194); North Bridge, Sydney, June, 1916; National Park (N.S.W.), July, 1916; Bradley Head, Sydney, May, 1917.

The following description of another collection shows the variation in the species:—Pileus $\frac{3}{4}$ inch in diameter, conico-campanulate and broadly and obtusely umbonate, then expanding to $1\frac{1}{2}$ inch in diameter with a slight umbo, not viscid, dull brownish-violet, paler at the periphery. Gills adnate, moderately distant, at first pallid brown with a violet tint, then rusty-cinnamon without violet. Stem 1 inch high, stout, then more slender, white with a pale lilac tint. Whitish fibrillose veil. Flesh of the cap solid in the centre, then thin, violet tinted. No smell. Spores 8·5 × 5·2 to 6·6 μ, occasionally much larger.

Under bushes, Lane Cove River, Sydney, June, 1916 (Miss P. Clarke, Watercolour No. 111; Herb., J. B. C., Form. Sp., 195).

Pileus ad 5 cm. latus, convexus deinde expansus, obscuro-violaceus, exsiccatus pallido-fuscus et leviter violaceus, promiscue striatus, non viscidus, glaber. Lamellae adnatae, aliquanto confertae, violaceo-cinnamoneae, deinde fuscae, exsiccatae ferrugineo-fuscae. Stipes ad 7·5 cm. longus, gracilis, sericeo-fibrillosus, candidus, violaceus aut pallido-violaceo-albidus. Caro albido- et violaceo-colorata. Sporae 7-8·5 × 5·2-6 μ.

Paxillus.

20. *Paxillus aureus, auct.* (?).—Specimens of this species have been kindly identified for us by C. G. Lloyd. Plants collected at Somersby Falls, near Gosford, New South Wales, in May, 1915, we describe as follows:—At first small, orbicular, attached by the back, hymenial surface slightly concave and saucer-like, pale yellow, the gills thick and honeycomb-like, upper-surface white. Finally somewhat flabelliform, 1 inch broad and $\frac{3}{4}$ inch high, the upper-surface white and matt, laterally attached; gills rather thick, radiating, dividing, connected by numerous wrinkles, buff coloured; on rotten log; spores pale yellowish, elliptical but often irregular, 4 to 4·8 × 3 μ.

Large and handsome specimens (those identified by Lloyd) were found under a fallen log at Wiseman Ferry (N.S.W.) in August, 1915; the spores, borne on tetrasporous basidia, were pale yellowish (?), rod-shaped, 3·5 × 1·5 μ; the dried plants show radiating gills connected by wrinkles, the gills being a rich golden-brown near their bases and dark brown at the distal ends.

21. *Phylloporus rhodozanthus*, (Schw.) Bres.; *Paxillus paradoxus*, (Kalchb.); Cooke: Illustrs., pl. 884; Cooke: Handb. Austr. Fungi, No. 369, fig. 38 (Vict., Q'land.).—From Petch's account (New York State Museum, Rep. of State Botanist, 1908, p. 40) this is a variable species and has been referred to various genera and described under different specific names. The species as met with by us also seems rather variable. The usual form has a relatively short, stout stem and adnato-decurrent gills, but occasional specimens are met with exhibiting longer and more slender stems and deeply decurrent gills. The stems usually show only a trace of brown or reddish-brown. Our usual specimens agree well with Petch's description and the spore measurements with his. Massee, in his British Fungus Flora, gives the spore measurements as 20 to 22 × 7 to 8 μ, which must either be an error or our plants and the American ones belong to a different species.

A composite description of our plant is as follows:—Pileus 2 inches or more in diameter, convex, sometimes distorted, tomentose or villose matt, dark umber to brownish, reddish-brown, pale yellowish-brown or stony-brown. Flesh thick. Gills almost adnate to decurrent, moderately close, sometimes branching and anastomosing, a little wrinkled, apparently not easily separable from the hymenophore, bright canary-yellow to greenish-yellow, often becoming darker spotted when old, with a hand lens seen to be bristling with cystidia. Stem 2 inches, occasionally more, high by $\frac{1}{2}$ inch in diameter above, occasionally long and slender, slightly attenuated downwards, usually stout, rarely flexous, usually central, slightly fibrillose and villous, not scaly, solid, brittle, pale brown and yellowish or reddish-brown just below the gills, sometimes whitish or pallid with a faint brown tint due to punctate points. Spores in the mass greenish-brown, microscopically pale yellowish-green, elongated, somewhat twisted, rather "mummy-shaped" like typical *Boletus* spores, 7·8 to 16 × 3·8 to 5·5 μ, usually about 12 × 5·2 μ. Cystidia acuminate, blunt-topped, 70 × 10·4 to 15 μ. In young specimens, the edge is markedly turned in and the gills may be crenulate and show forking and irregular buttressing folds.

Milson Island, Hawkesbury River, June, 1912, and November, 1914, also April, 1915 (apparently a young specimen with adnate yellow gills, stem 1 inch long, white, attenuated upwards); Neutral Bay, Sydney, April, 1915 (young specimen: pileus $1\frac{1}{2}$ inch across, viscid, dark brown, edge markedly turned in, gills decurrent, vivid pale yellow), and February, 1917 (Miss Clarke, Watercolour No. 145), and March, 1917; Hill Top, Southern Line, February, 1911 and 1917 (E. C.); Leura, Blue Mountains, February, 1911 (T. Steel); Lane Cove River, Sydney, April, 1913 (stem long and slender, gills deeply decurrent, spores 7·8 to 10·4 × 4 μ, the spores distinctly smaller and perhaps paler than in the stouter forms; Miss Clarke, Watercolour No. 144)—all in New South Wales; under bushes, Morphett Vale (S.A.), July, 1914 (a much stouter form).

Colour tints noted:—Pileus hazel, No. 324, Tons 1-4; snuff-brown (deep bistre), No. 303, Ton 2. Gills canary-yellow (yellow-green), No. 17, Ton 4; primrose-yellow, No. 19, Ton 2. Stem snow-white, No. 2 (J. B. C.).

Pileus when fresh snuff-brown, No. 303, Ton 3, shading to dark fawn, No. 307, Ton 3, when dry—also a tendency towards tints of mineral-brown, No. 339, Ton 1. Gills yellow-lake (old gold), No. 33, Ton 1, to yellow-tan colour, No. 315, Ton 1, or yolk-yellow, No. 24, Ton 3; in certain stages approaching yellow cadmium, No. 47, Ton 3. Upper part of stem cream-yellow, No. 30, Ton 2, to amber-yellow, No. 28, Tons, 2, 3 (E. C.).

22. *Paxillus crassus*, Fries.: Epicr., p. 318; Cooke: Illustrs., pl. 877; Massee: Brit. Fung. Flora, ii., p. 11;

Cooke: Handb. Austr. Fungi, No. 370 (Q'land).—We have specimens collected at Port Hacking, near Sydney, in August, 1915, that very closely resemble Cooke's illustration of *P. crassus*, which has been recorded for Queensland. The gills, however, seem more "crowded" than "rather distant." The spores were elongated, of the same shape as in *P. paradoxus*, microscopically greenish-yellow, and 11 to 14 × 4·2 to 5 μ in size (as against 15 to 18 × 7 to 8 μ given by Massee).

23. *Paxillus*, sp.—These specimens, collected by one of us (J. B. C.) at Mount Lofty, South Australia, in May, 1900, resemble the preceding, save that the stem is stouter and they have dried darker. The plants were often very large, with the caps orange-brown to yellow-brown when fresh, the decurrent gills brownish, and the stems solid and whitish. The spores were elongated, "mummy-shaped," like those of *P. paradoxus*, greenish-yellow microscopically, and 12 to 15·5 × 5 μ in size.

24. *Paxillus involutus*, Fries.: Epicr., p. 317; Cooke: Illustrs., pl. 875; Massee: Brit. Fung. Flora, ii., p. 9.—The following resembles a dried specimen of this species from England kindly sent to us by Miss Wakefield, save that the gills have dried a darker brown. The spores also agree. Pileus 3 inches in diameter, slightly convex with the centre slightly depressed, dark brown, matt. Gills dark earthy-brown, moderately close, decurrent. Stem ¾ inch high, stout, brownish with fine punctate spots, solid. Flesh turning a little brownish. Spores yellow-brown, not "mummy-shaped," 8 to 9 × 5 μ (English specimens, 7·5 to 10·5 × 5 μ).

Under a tree, National Park, South Australia, April, 1917.

Hebeloma.

25. *Hebeloma crustuliniforme*, Bulliard; Cooke: Illustrs., pl. 507; Massee: Brit. Fung. Flora, ii., p. 176.—The following species, evidently introduced, agrees best with the description of *H. crustuliniforme*:—Pileus up to 3 inches across, irregular, convex then nearly plane, often shiny, biscuit colour or sometimes mouse-brown in the centre, paler towards the periphery, the brown in the centre sometimes appearing as if seen through a fine whitish film. Gills sinuately adnexed, moderately close, pallid fleshy-brown becoming browner, edge finely serrate. Stem up to 2½ inches high, usually stout, sometimes slender, white, somewhat fibrillose, mealy above, stuffed. Spores microscopically dull brown, oblique, one end finely pointed, apparently finely rough ([?]from drying), 11 to 12 × 6 to 7 μ.

Caespitose in large clumps under English oak, chestnut, and other introduced trees, National Park (S.A.), April, 1917.

Hitherto not found under any native trees *(e.g., Eugenia, Eucalyptus)* planted or growing in the neighbourhood. This seems to be the same species that, about twenty years ago, grew in great abundance under *Pinus insignis* at the Parkside Mental Home. It has died out from this situation for many years, in spite of no alteration having occurred in its surroundings. Perhaps the soil became exhausted for it, as is the case in some of the fairy-ring species. The plants have a slight resemblance to the common mushroom, accentuated by the gills having a somewhat flesh-coloured tint, and they have been mistaken for this by persons of little observation. The species is obviously an introduced one, as is evidenced by its clinging to the neighbourhood of introduced trees, but it is remarkable that these should be of several species.

26. *Hebeloma subcollariatum*, Berk. and Br.: Ann. Nat. Hist., n. 1942; Cooke: Illustrs., pl. 506; Massee: Brit. Fung. Flora, ii., p. 175.—We describe our Australian specimens as follows:—Pileus up to 1 inch or more in diameter, hemispherical, then convex, sometimes finally upturned, slightly viscid, pale yellow-brown, sometimes browner on top, when very young edge turned in and closed in by the veil, later with a few mealy flakes, the remains of the veil, and with fragments of the veil round the edge, veil rarely forming an imperfect ring. Gills sinuate-adnate, discoloured a greyish-brown, when dry reddish-brown, $\frac{1}{4}$ inch deep. Flesh of cap white, $\frac{1}{8}$ inch deep. Stem up to $1\frac{3}{4}$ inch high, attenuated downwards, base a little swollen and with abundant fine rooting mycelium, hollow or stuffed, pale brownish, but almost white, finely mealy, when young shaggy from the universal veil. Spores in the mass dark brown, not purplish-brown, microscopically yellowish-brown, usually 12 to 14 $\times$ 8·5 μ, sometimes 11 to 17 $\times$ 7 to 10·4 μ, occasionally (Manildra specimens) 15·5 to 19 $\times$ 10 to 12 μ.

On dung or by roadsides, usually near horse-dung. Sydney, February, March, April; Narrabeen, February, December; Milson Island, Hawkesbury River, June; Orange, November; Manildra, October; Wellington, November; Narromine, May; Narrabri, November; Hill Top, December; Cooma (C. C. Settar), January; Mummulgum, near Casino, December; Byron Bay and Murwillumbah, April—all in New South Wales. Adelaide, July and September.

Colour tints noted:—Pileus honey-yellow, No. 35, Tons 1, 2. Gills in certain lights near otter-brown, No. 354, Ton 1. Spore mass between snuff-brown, No. 303, Ton 1, and chocolate, No. 343, Ton 1.

27. *Hebeloma montanum*, n. sp. (pl. ix., figs. 1 and 2).—Pileus $1\frac{1}{2}$ inch or more in diameter when expanded, convex,

edge at first a little turned in, broadly gibbous, sometimes with a depression around the umbo, rather sticky, yellowish-brown, apex often darker, with scattered brown scales. Veil evident when young, remaining for a while as an appendiculate margin to the pileus. Gills slightly sinuately adnate, moderately crowded, dark cinnamon. Stem up to $2\frac{1}{2}$ inches high, firm, later hollow, fibrously streaked with brown fibrils below, brownish below, paler and mealy above, base a little swollen. Spores dull brown, $7 \times 3{\cdot}6\ \mu$, occasionally $8{\cdot}5 \times 4\ \mu$.

Amongst grass in damp forest, Mount Wilson, Blue Mountains, June, 1915 (Miss Clarke, Watercolour No. 82; Herb., J. B. C., Form. Sp., 127).

Pileus 3 vel 3 + cm. latus, convexus, margine initio paulo involuto, lato-gibbosus, paulo viscidus, flavo-fuscus, apice saepe atro-fusco, squamis dispersis fuscis. Velum initio evidens, deinde appendiculatum. Lamellae minime sinuato-adnatae, paulo confertae, atro-cinnamoneae. Stipes ad 6 cm. altus, firmus, demum tubulosus, deorsum fibrillis fuscis, sursum pallido-fuscus et farinosus, base paulo bulbosus. Sporae fuscae, $7\text{-}8{\cdot}5 \times 3{\cdot}6$ to $4\ \mu$.

Inocybe.

Spores rough or irregular. Cystidia present.

28. *Inocybe asterospora*, Quelet: Bull. Soc. Bot. France, xxvi., p. 50; Cooke: Illustrs., pl. 385; Massee: Brit. Fung. Flora, ii., p. 194.—The following appears to be typical *I. asterospora*, and is a distinctly larger plant than the next species:—Pileus $1\frac{1}{4}$ inch in diameter, convex with a large conical umbo, somewhat golden-brown, fibrillose. Gills adnexed, nearly free, moderately close, cinnamon-brown. Stem $1\frac{1}{4}$ inch high, moderately stout, slightly attenuated upwards, striate, pallid-brown tinted, solid, fibrous. Spores irregularly nodular, 7, $8{\cdot}5$, $8{\cdot}5 \times 7\ \mu$. Cystidia 40×12 to $14\ \mu$.

Mount Lofty, South Australia, April, 1917. We have also collected typical specimens at Bradley Head, Sydney, in April, 1918. In these, the pileus was up to $1\frac{3}{4}$ inch in diameter, the gills were at first dingy pallid-brown and were sinuately adnexed, the stem was $2\frac{1}{2}$ inches high and $\frac{1}{4}$ inch thick and was pallid fleshy-brownish and had a slightly swollen base, whilst the spores measured $8{\cdot}5$ to $10{\cdot}4\ \mu$, and cystidia were present. On crushing, there was a strong seminal smell. We have also collected specimens at Mosman (December and May; formalin specimen) and Suspension Bridge, Sydney, April. (Miss Clarke, Watercolour No. 182.)

The following colour tints were noted:—Pileus near dark chocolate-brown (carob-brown), No. 342, Ton. 1. Stem buff, No. 309, Ton 1. Spore mass chocolate, No. 343, Ton 2.

29. *Inocybe subasterospora*, n. sp. (pl. x., figs. 4 and 5).—The following common species in the Sydney district agrees fairly well with Cooke's illustrations of *I. asterospora*, save that the plants are smaller. It also resembles somewhat Cooke's figures of *I. maritima*. As it seems clearly distinct from the South Australian specimens, we give it a new name which indicates its affinity:—Pileus occasionally up to $1\frac{1}{4}$ inch in diameter, slightly convex, sometimes depressed, subgibbous to occasionally papillately umbonate, dark brown, occasionally lighter or rusty-brown and often more chestnut at the periphery, usually fibrously streaked and splitting, occasionally more scaly. Gills adnate to adnexed, separating from the stem, moderately crowded, pale milk-coffee coloured, then cinnamon, sometimes with a white edge. Stem up to $1\frac{1}{2}$ inch high, moderately stout, solid, slightly fibrillose, pale brownish, slightly mealy above, base sometimes a little swollen. Spores irregularly knobby, 7 to 9 × 5·2 to 7 μ. Cystidia numerous, ventricose, apices usually knobby, 42 × 17, 47 × 15·5, 50 × 14, 55 × 21·5, 70 × 17 μ, etc.

Sydney district, March to July, October, December; Pittwater, April; Parramatta, July; Milson Island, Hawkesbury River, July, November; Hill Top (E. C.), May; localities not noted (several); locality not stated (stem white but cap dark). (Miss Clarke, Watercolour No. 33; D. I. C., Watercolour No. 63; Herb., J. B. C., Form. Sp., November, 1914).

Pileus interdum ad 3 cm. latus, aliquanto convexus, interdum depressus, subgibbosus, interdum papilloso-umbonatus, fuscus, interdum pallido-fuscus aut ferrugineo-fuscus, vulgo fibratus et fissus, interdum aliquanto squamosus. Lamellae adnatae aut adnexae, stipite secedentes, aliquanto confertae, pallido-cinereo-fuscae, deinde cinnamoneae, interdum marginibus albidis. Stipes ad 3·75 cm. altus, aliquanto crassus, non cavus, aliquanto fibrillosus, pallido-fuscus, in parte superiore aliquanto farinosus, base interdum aliquanto inflato. Sporae nodis irregularibus, 7-9 × 5·2-7 μ. Cystidia ventricosa, apicibus vulgo nodosis, 42 × 17, 47 × 15.5, 50 × 14, 55 × 21·5, 70 × 17 μ, etc.

30. *Inocybe gomphodes*, Kalchb.: Grev., viii., 152, tab. 142, f. 8; Sacc.: Syll., v., 3235; Cooke: Handb. Austr. Fungi, No. 237 (N.S.W.).—The following we believe to be Kalchbrenner's *I. gomphodes*, his figure of which it resembles. In the original description, there is no reference

to the character of the spores or the presence or absence of cystidia:—Pileus up to $1\frac{1}{4}$ inch in diameter, conico-campanulate with the edge turned in, gradually expanding to convex with a large obtuse umbo, then nearly plane on top with an umbo and convex edge, fibrously streaked, cap sometimes splitting when old or the fibres separating and curling up, light brownish-tan. Gills deeply sinuately adnexed, nearly reaching the stem and then ascending so as to be nearly free. Stem 2 inches high, moderately stout, solid, whitish, somewhat mealy. Spores irregular and knobby, 7 to 9 × 4·4 to 5·2 μ. Cystidia ventricose or clavate, apices rough, 52 × 10·4, 42 × 14 μ.

On the ground, Milson Island, Hawkesbury River, November, 1914 (Herb., J. B. C., Form. Sp., 22), and May, 1915.

31. *Inocybe albidipes*, n. sp. (pl. x., fig. 3).—Pileus up to 1 inch in diameter, when young acutely umbonate, later gibbous and nearly plane, light to yellowish-brown, apex darker, silky fibrous or radiately fibrillosely rimose or striate and cracking. Gills moderately close, adnate to adnexed or nearly free, dingy greyish-brown becoming dark cinnamon, edge not white. Stem up to $1\frac{1}{2}$ inch high, rather stout, slightly fibrillose, base swollen or with a marginate bulb, solid, white, or occasionally with a slight yellowish tint. Spores knobby, 7 to 8·5 × 5 μ, 7 μ. Cystidia ventricose with rough apices, 42 to 60 × 14 to 20 μ.

Neutral Bay, May, 1915 (Herb., J. B. C., Form. Sp., 109) and 1916; North Sydney, April, 1915 and 1918; Chatswood, May, 1916 (Miss Clarke, Watercolour No. 97); Mosman, June, 1915, and December, 1916 (Herb., J. B. C., Form. Sp., 262); Lane Cove River, May, 1916—all in the Sydney district.

Colour tints noted:—Pileus dark fawn, No. 307, Ton 1 or paler, apex darker and browner than Ton 4.

Pileus ad 2·5 cm. latus, acute umbonatus, deinde gibbosus et subplanus, fusco-cervinus, apice fuscus, sericeo-fibrosus aut fibrilloso-rimosus. Lamellae subconfertae, adnatae aut adnexae, cinereo-albidae, deinde pallido-fuscae, denique fusco-cinnamoneae. Stipes ad 3·75 cm. altus, subfibrillosus, ad basem bulbosus, solidus, albus aut stramineo-albidus. Sporae verrucosae, 7 to 8·5 × 5 μ, 7 μ. Cystidia ventricosa, apicibus aspris, 42-60 × 14-20 μ.

Spores smooth. Cystidia present.

32. *Inocybe obscura*, Pers.: Syn., p. 347; Cooke: Illustrs., pl. 427; Massee: Brit. Fung. Flora, ii., p. 190.—

We refer the following to this species:—Pileus up to $1\frac{1}{4}$ inch in diameter, slightly convex, slightly umbonate, somewhat streaked to fibrillosely scaly, brownish with a violet tinge to violet-brown. Gills moderately crowded, slightly sinuate to adnexed, pallid smoky-brown, edges finely serrate. Stem $1\frac{1}{2}$ inch high, violet tinted, paler above, base slightly bulbous, solid, stringy. Strong scented, when dry a strong mousey smell; one specimen with a seminal smell when fresh. Spores smooth, brown, 7 to 8·5 × 5·2 μ. Cystidia elongated flask-shaped, rough at the apices, 50 × 12 to 17 μ.

Hawkesbury River, under rocks, November, 1914; Sydney, May, 1915.

33. *Inocybe flocculosa*, Berk.: Engl. Fl., v., p. 97; Cooke: Illustrs., pl. 393; Massee: Brit. Fung. Flora, ii., p. 188; Cooke: Handb. Austr. Fungi, No. 236 (Vict.).—The following descriptions are composite pictures of two groups of specimens, which we at first thought comprised two species, but on careful comparison think should both be referred to *I. flocculosa.* They indicate the variations in individuals of a species which may easily lead to an undue multiplication of specific names.

(a) Pileus up to $\frac{1}{2}$ inch in diameter, conico-campanulate to conico-expanded, slightly umbonate, a tendency to striation, pale straw-brown to dull dark cinnamon-brown, apex sometimes dark reddish-brown and periphery pale yellowish-brown, interwoven fibres round the edge usually forming a just discernible whitish line. Gills slightly sinuately adnexed to just adnexed, moderately close to moderately distant, cinnamon. Stem up to $1\frac{1}{4}$ inch high, slender, slightly bulbous at the base, slightly hollow, stringy, pale brown or the colour of the cap, covered with mealy fibres which often form a white base. Spores smooth, pointed, oblique, sometimes rather triangular, 7 to 9 × 4·5 to 6·6 μ. Cystidia somewhat fusiform, or elongated fusiform, or elongated diamond-shaped or flask-shaped, thick walled, apices rough, 42 to 70 × 8·5 μ, 42 to 63 × 11 to 14·5 μ.

On the ground, often under rocks, shrubs, or banks. Milson Island, Hawkesbury River, May, 1915 (D. I. C., Watercolour No. 52; Herb., J. B. C., Form. Sp., 116); Neutral Bay, Sydney, April, 1915, and May, 1913 and 1916; Lane Cove River, Sydney, May 1915; North Bridge, Sydney, June, 1916.

(b) Pileus $\frac{1}{2}$ inch or a little more in diameter, convex then nearly plane, gibbous or with an acute umbo, fibrously striate, splitting, bistre brown to dark brown. Gills moderately close to moderately distant, adnate, reddish-brown to brown. Stem $\frac{3}{4}$ to 1 inch high, slender, solid, pallid brown

and fibrously streaked and mealy, sometimes with whitish fibrillose scales at the base. Spores pale brown, smooth, oblique, sometimes rather triangular, 6·8 to 8·5 × 5·2 μ. Cystidia numerous, thick walled, ventricose or fusiform, often elongated, 25 to 70 × 8·5 to 17 μ.

Gregarious on the ground. Mount Irvine (N.S.W.), June, 1915; Bumberry (N.S.W.), October, 1916; Mount Lofty (S.A.), July, 1914; Neutral Bay, Sydney, May, 1915 (gills just adnexed, dingy cinnamon, edges white and very finely serrate; Herb., J. B. C., Form. Sp., 105).

Colour tints noted:—Pileus near snuff-brown (deep bistre), No. 303, Ton 1; apex of cap near raw umber, No. 301, Ton 4, periphery shading to pallid.

34. *Inocybe australiensis*, n. sp. (pl. x., fig. 2).—Pileus up to ½ inch in diameter, convex, sometimes somewhat umbonate, covered in a rather echinulate way with dark brown, almost black, projecting fibrous scales, which are wart-like above and more imbricate below. Gills adnexed, crowded, cinnamon or dark brown. Stem 1¼ inch high, pallid brown to dark brown, mealy above, solid, base a little swollen. Spores brown, smooth, oblique, 6 to 7 × 4 to 5 μ. Cystidia numerous, ventricose or narrow ventricose, 42 to 70 × 8·5 to 10·5 μ.

Neutral Bay, Sydney, May, 1915 (Herb., J. B. C., Form. Sp., 106; Chatswood, Sydney, May, 1916 (Miss Clarke, Watercolour No. 96); Sydney.

Pileus ad 1·5 cm. latus, convexus, interdum paulo umbonatus, squamis subnigris fibrosis vestitus. Lamellae adnexae, confertae, cinnamoneae vel atro-fuscae. Stipes 3 cm. altus, pallido-fuscus aut fuscus, sursum farinosus, non tubulosus, base minime bulbosa. Sporae fuscae, glabrae, obliquae, 6-7 × 4-5 μ. Cystidia ventricosa vel angusto-ventricosa, 50-70 × 10·5, 42 × 8·5 μ.

Flammula.

35. *Flammula carbonaria*, Fries.: Syst. Myc., i., p. 252; Cooke: Illustrs., pl. 442; Massee: Brit. Fung. Flora, ii., p. 133.—The following seems best referable to this species, though it is smaller, and has cystidia which are not mentioned in descriptions of the species:—Pileus ½ to 1 inch in diameter, convex, edge turned in when young, dark tan to chestnut, periphery paler, in one collection with a teat-like umbo. Gills adnate, moderately crowded, pallid then dark cinnamon, edge noted as finely toothed in the Dubbo specimens. Stem 1 inch high, whitish to pallid, sometimes with brownish fibrils, stuffed. Taste not bitter. Spores yellow-brown, 6·8 to 8·2 × 3·5 to 5 μ; cystidia fringing the edge of

the gills, acuminate or clavate with rough apices and swollen bases, 43 to 48 × 8·5 to 10·4 μ.

Usually densely caespitose with rooting mycelial strands amongst or near the charcoal of burnt logs. Milson Island, Hawkesbury River, May, 1913, and October and November, 1914; Spring Vale, near Dubbo, July, 1915; Suspension Bridge, Sydney, April, 1915 (cap viscid).

36. *Flammula californica*, Earle.—The following is the original description (the reference we do not know) of this species found in California:—"Gregarious or caespitose, under trees, probably from buried rotten wood; pileus 4-7 cm., expanded, subumbonate, pale ochre-brown, umbo often darker, glabrous, subhygrophanous, margin entire; lamellae subsinuate-decurrent, heterophyllous, crowded, subventricose, pale ochraceous to fusco-ferruginous; spores ferruginous, elliptic, 6-7 × 4 μ; stalk 5-6 cm. × 3-4 mm., subequal, slightly enlarged at apex and base, glabrous above, brown fibrillose below, base white mycelioid, bringing up attached sand and fragments, pale brown, apex yellowish-white, solid; flesh cream coloured, unchanging, taste and smell mild. The glabrous subhygrophanous pileus places this species in the section Udae." The fact that this species was described from America as being found in plantations of Eucalyptus directed our attention specially to it. The form which we refer to a new variety, var. *communis*, we at first thought might be it. Compared with specimens of *F. californica*, kindly forwarded to the National Herbarium by C. F. Baker, and identified by Earle, however, the spores are distinctly larger. Though the spores of the specimens under consideration are somewhat broader and rounder than those of the American *F. californica*, they resemble them closely, and the dry plants appear very similar. Cystidia are common on our species and its varieties, and we found a few in the American plants.

We describe our collection as follows:—Pileus ½ inch in diameter, convex, gibbous, not definitely viscid, centre brown, rest yellowish. Gills adnate, moderately crowded, dull greenish-yellowish. Stem 1 inch high, slender, hollow, fibrillosely striate, pallid yellowish. No taste. Spores almost subspherical or triangular, pale brownish microscopically, 5·2 to 6 × 4 μ. Cystidia ventricose, 40 × 10 μ.

On the ground, Lane Cove River, Sydney, May, 1916.

36A. *Flammula californica*, var. *communis*, var. nov. (pl. xi., figs. 3 and 4).—The following differs, more especially in the distinctly larger spores. It is relatively common in the Sydney district and somewhat variable. Pileus up to 2 inches in diameter, convex, then flattened or upturned, gibbous, viscid when moist, sometimes slightly streaky with fibrils or with a few widely separated scales, dark tan or reddish-brown with a pale yellow-brown periphery, in a very young plant the edge turned in and a fibrillose veil. Gills adnate or sinuate with a slight decurrent tooth, moderately close, yellowish-green or pale yellow-brown, drying dark cinnamon. Stem $\frac{7}{8}$ to 2 inches high, slender, slightly attenuated upwards, slightly hollow, base a little bulbous, fibrous, apex not mealy, clad below with brownish fibrillose scales with white mycelium at the base, yellowish-brown above. Flesh white, becoming yellow (?). No taste. Sometimes gregarious. Spores elliptical, dingy brown microscopically, 7·8 to 9 × 5 to 6·3 μ. Cystidia ventricose with acuminate apices, 50 × 10·5 to 13·8 μ.

Milson Island, Hawkesbury River, July, 1912, and May, 1913 (D. I. C., Watercolour No. 12); Neutral Bay, Sydney, April, 1915 (Miss Clarke, Watercolour No. 58), June, 1914 and 1916, July, 1916; other localities, near Sydney, April to July; Lane Cove River, Sydney, June, 1916 (spores yellow-brown); Brookvale, July, 1916; Terrigal, June, 1914; Hill Top, April, May; Lilyvale (A. A. Hamilton), April, 1912; The Oaks, June, 1914; Leura (T. Steel), February, 1911, and (J. B. C.) June, 1916; Kendall, May, 1917—all in New South Wales. The following are larger forms usually found amongst fallen leaves:—North Bridge, Sydney, June, 1916 (cystidia 42 × 13·8 μ); Sydney, March, 1914, and June, 1916; Lane Cove River, June, 1916; on a stump, Mosman, May, 1916 (cap up to 3 inches across, cystidia 35 to 60 × 14 μ); Lisarow, August, 1916—all in New South Wales.

Colour tints noted:—Centre of pileus madder brown (brownish-terracotta), No. 334, Ton 4, periphery paler. Lamellae straw-yellow, No. 31, Tons 2, 3. When drying, pileus near fawn, No. 308, Ton 1, the centre near Ton 4. The lower part of the stem the same tint but paler, the scales about Ton 3. Lamellae golden-bronze-green, No. 298, Ton 2 (J. B. C.).

Pileus brown-pink, No. 297, Tons 3, 4, to burnt umber, No. 304, Ton 1. Gills snuff-brown, No. 303, Ton 1, to mineral-brown, No. 339, Tons 1, 2. Upper part of stem cream-yellow, No. 30, Ton 2, to amber-yellow, No. 28, Tons 2, 3 (E. C.).

Pileus ad 5 cm. latus, convexus, mox planus aut repandus, gibbosus, interdum viscidus, fuscus, margine pallido-fusco. Lamellae adnatae vel sinuatae et minime decurrentes, paulo confertae, flavo-viridae deinde pallido-flavo-fuscae, exsiccatae cinnamoneae. Stipes ad 5 cm. altus, gracilis, sursum paulo attenuatus, paulo tubulosus, base paulo bulboso, fibrillosus, deorsum squamis fibrillosis fuscis, sursum flavo-fuscus. Sporae ellipticae, fuscae, 7·8-9 × 5-6·3 μ. Cystidia ventricosa, apicibus acuminatis, 50 × 10·5-13·5 μ.

The following form of *Flammula californica*, var. *communis*, seems worthy of separate mention. Pileus up to 1 inch in diameter, convex, then more expanded, slightly umbonate, tanny-brown becoming darker, slightly viscid when young and moist. Gills at first adnate, then slightly adnexed, moderately close, pallid dingy yellowish-brown becoming dingy cinnamon. Stem up to 1 inch high, slender, slightly hollow, slightly striate, whitish flecked with small brownish scales from the veil, which are also seen on the edge of the cap when young. Flesh somewhat dingy. Rather caespitose. Spores tawny, 7 × 4·8 μ. A few flask-shaped cystidia with rough apices, 25 × 12 μ.

On the ground, Mosman, December, 1916 (Herb., J. B. C., Form. Sp., 265).

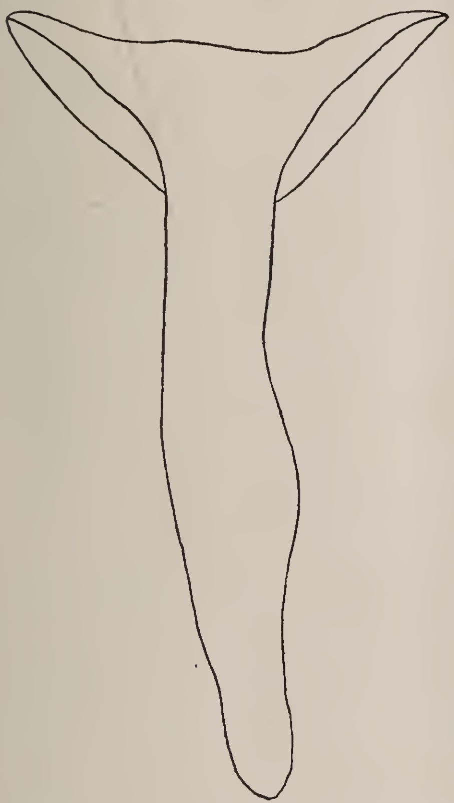
37. *Flammula fusa*, Batsch: f. 189; Cooke: Illustrs., pl. 433; Massee: Brit. Fung. Flora, ii., p. 134; Cooke: Handb. Austr. Fungi, No. 257 (Vict.).—The following seems to be this species. It has a strong resemblance to a large form of our *F. filicea*, but grows on the ground:—Pileus 4 inches in diameter, nearly plane, a little rugose, tanny-brown. Gills adnate with a decurrent tooth, moderately close, bright ferruginous. Stem 2½ inches high, moderately stout, apparently solid, fibrously striate, pallid brownish, with a fusiform root. Flesh yellowish. Spores ferruginous, finely rough (1/12-inch lens), 7 × 5 μ.

On the ground, Lisarow (N.S.W.), December, 1916.

38. *Flammula limonia*, Cke. and Massee: Grev., xv., 94; Sacc.: Syll., v., 3379; Cooke: Handb. Austr. Fungi, No. 259.—This species is recorded by Cooke for "Victoria, Cudgegong River, and Lake Bonney." The following, collected on rich soil at Beaumont, near Adelaide, in September, 1913, and on road-sweepings, Adelaide, in July, 1914, appear to be it:—Pileus up to 4 inches in diameter, hemispherical, then gradually expanded, finally with the edge upturned, when young brownish-yellow, glutinous, finally a pale lemon-yellow, edge sometimes obscurely striate. Gills adnate, ventricose, rather crowded, pallid white becoming greyish with a brown tint, finally when old a dark greyish or earthy brown. Stem up to 3 inches high, whitish or pale yellow, attenuated slightly downwards, sometimes shaggy-scaly towards the base, fibrously rooting below, stuffed in one collection, markedly hollow in another. Veil in one collection leaving ragged remains on the edge of the pileus and on the stem, absent in the other. Occasionally slightly caespitose.

Spores oval, rather elongated, light brown, 14 to 16·5 × 8 to 8·5 μ.

39. *Flammula radicata*, n. sp. (pl. x., fig. 1).—Pileus about 4 inches in diameter, occasionally as much as 9, slightly convex to plane or slightly depressed with irregular depressions and bumps, pallid white to yellowish-tan or dark chestnut, apparently not viscid. Gills adnate to decurrent, moderately crowded, narrow, many short, not branched, easily separating from the hymenophore, pale cinnamon to rich reddish-brown. Stem up to $4\frac{1}{2}$ inches high, stout, $\frac{3}{4}$ to $1\frac{1}{4}$ inch thick, slightly attenuated upwards, slightly bulbous, extending downwards as a long tapering root up to $1\frac{1}{4}$ inch in length or more in large specimens, stuffed, mealy-white with brownish stains or streaky brownish fibrillose. Spores elongated, oblique, 7 to 11 × 5·2 to 6·3 μ, in one specimen 6 to 7 × 3·5 μ.



Flammula radicata, n. sp. Section.

Bursting through the ground and often partly covered with the sandy soil in which the plants are found. Milson Island, Hawkesbury River, under trees amongst leaves, July, 1912; Hawkesbury River, May, 1913 (Miss Clarke, Watercolour No. 16); Bulli Pass, April; The Oaks, June, 1914—all in New South Wales.

Pileus circum 10 cm. interdum ad 23 cm. latus, convexus ad planus aut minime depressus, irregularibus cavis et verrucis, pallido-albus ad fulvo-helvolus aut gilvo-fuscens, non ut videtur viscidus. Lamellae adnatae ad decurrentes, mediocriter confertae, angustae, multae breves, non ramosae, facile ab hymenophora secedentes, pallide cinnamoneae ad vivo-rufofuscae. Stipes ad 12 cm. longus, crassus, 2 ad 3 cm. latus, minime attenuatus sursum, subbulbosus, descendens deorsum radice longe attenuato ad 3 cm. longo vel ultra in magnis specimentibus, farctus, farinoso-albus cum fuscis maculis aut striatulo-fusco-fibrillosus. Sporae elongatae, obliquae, 7 to 11 × 5·2 to 6·3 μ.

40. *Flammula filicea*, Cooke: Seem. Journ. Bot., i., p. 66, pl. iii., fig. 1; Cooke: Illustrs., pl. 450; Massee: Brit. Fung. Flora, ii., p. 142.—We have recorded this species for various localities in New South Wales and South Australia in the Journ. Roy. Soc. N.S. Wales, 1914, p. 434. Further experience emphasizes its variability, and we are inclined to think that it is really only an extreme form of *F. sapinea*, and that many of our specimens might be classified as the latter. Our specimens vary from slender small forms to large stout ones, and the cap from squamulose to villous or nearly smooth. In specimens found at Neutral Bay, Sydney, in February, 1917, the cap had in places a greenish hue, the rest being yellowish-brown with punctate scales, whilst the base of the stem was rather purplish-brown. This type, which is not uncommon, seems to merge into *F. purpurata*, which, we think, may be only a variety of *F. filicea* (or *F. sapinea)*. We have the following additional records and dates of *F. filicea*:—Sydney, several localities; Tuggerah; National Park; Kew—all in New South Wales. January, March to July, October.

Colour tints noted:—Pileus sometimes Mars yellow, No. 316, Tons 1, 2. Spores in thick masses very near bistre, No. 328, Ton 4; in thin masses, redder than Ton 1.

Since these notes were written we have had a letter, in answer to enquiries as to the possible relationship of *F. filicea*, *F. purpurata*, and *F. purpureo-nitens* to *F. sapinea*, from Miss E. M. Wakefield, of Kew Herbarium. She has very kindly looked into the matter as far as possible, and writes as follows:—"I think it quite likely that *F. filicea* is only a form of *F. sapinea*. *F. purpureo-nitens*, however, apart from the difference of colour, seems to have had a perfectly smooth, shining pileus, and also has broader and browner spores. We have no specimen of *F. purpurata*, and I have never seen it; but I have never seen any trace of purple on British specimens of *F. sapinea*."

41. *Flammula purpureo-nitens*, Cooke and Massee: Grev., xv., 94; Sacc.: Syll., v., 3393; Cooke: Handb. Austr. Fungi, No. 266 (Vict., Q'land, W. Austr.).—We have previously recorded from New South Wales *(loc. cit.*, p. 436) what we believe to be this species. It may be only a dark form of *F. filicea*. We have the following from Somersby Falls, near Gosford, New South Wales (May, 1915):—Pileus $\frac{3}{4}$ inch in diameter, convex, slightly fibrous, dark reddish-brown becoming blackish. Gills sinuately adnexed, moderately crowded, reddish-gold, edges darker and

usually finely serrate. Stem $1\frac{1}{4}$ inch high, slightly striate, hollow, dark reddish-brown. Spores finely warty, 8 to $8{\cdot}2 \times 5{\cdot}2$ μ. On a fallen log.

42. *Flammula purpurata*, Cooke and Massee: Grev., xviii., p. 73; Cooke: Illustrs., p. 964; Massee: Brit. Fung. Flora, ii., p. 143.—The following *Flammula* (pl. ix., fig. 7) is evidently very close to, if it is not actually, *F. purpurata*. It closely resembles Cooke's illustration. It is also evidently near *F. filicea*, and perhaps the latter and *F. purpurata* are forms of one species:—Pileus $\frac{3}{4}$ inch across, convex, edge turned in when young with remains of the veil, dark madder brown with a tinge of purple, strongly villoso-fibro-scaly, in one specimen the edge of the cap beyond the gills when viewed from the underside against a strong light showing a greenish tinge. Gills close, adnate with a decurrent tooth, pale yellowish drying to a bright ferruginous. Stem 1 inch high, slender to moderately stout, pallid, fibrously striate, no definite trace of a ring. Spores 7 to $8 \times 5{\cdot}2$ μ, finely rough under a 1/12-inch lens.

On a rotten stump, Mosman, Sydney, July, 1916 (Miss Clarke, Watercolour No. 130).

43. *Flammula excentrica*, n. sp. (pl. xi., figs. 1 and 2).—The following species, in its bright ferruginous spores and general appearance resembling a *Flammula* but with an excentric stem, has been met with on several occasions:—Pileus up to 4 inches broad and 3 inches from before backwards, convex to nearly plane, rather wavy, at first yellowish-tan and sometimes flecked with minute fibrous scales, finally rich reddish-brown or dark reddish-tan (very dark brown when dry in one specimen), sometimes paler in the centre, surface dull or somewhat villous, moist looking when old. Gills very crowded, at first pale yellowish-cinnamon, finally rich ochreous-brown, almost auburn, reflecting the light, adnate or slightly sinuate with a decurrent tooth. Stem up to 2 inches long, often much less, short, excentric, attenuated downwards, firm, sometimes hollow, brownish or reddish-brown or pale yellowish-brown, fibrous or striate, no collar or ring. Flesh reddish-brown. Spores bright ferruginous, finely rough, 6 to $7 \times 4{\cdot}2$ to $5{\cdot}5$ μ, occasionally $8{\cdot}5$ to $12 \times 5{\cdot}2$ to 6 μ.

On fallen logs or attached to buried wood. Neutral Bay, July, 1912 (Miss Clarke, Watercolour No. 1); Terrigal, June, 1914; Milson Island, Hawkesbury River, April, 1915; Ryde, May, 1916; Mosman, October, 1916; attached 3 feet up a *Melaleuca* stump, Lane Cove River, Sydney, June, 1916; Kendall, May, 1917—all in New South Wales.

Colour tints noted:—Pileus when drying approaching Mars yellow, No. 316, Tons 1 and 2, scales darker approaching Ton 3; sometimes neutral orange, No. 319, Ton 1. Lamellae near Roman ochre, No. 327, Ton 1; then raw sienna, No. 329, Tons 2 and 3, in the high lights with darker reflections; in certain lights approaching orange cadmium, No. 49, Tons 1 to 3.

Pileus 10 × 7·5 cm., convexus aut aliquanto planus, flavo-ferrugineus, aliquanto villosus. Lamellae confertae, nitido-flavo-ferrugineae, adnatae aut minime sinuatae. Stipes ad 5 cm. altus vel minus, excentricus, deorsum attenuatus, firmus, fibrillosus, ferrugineo-fuscus. Caro fuscida. Sporae ferrugineae, 6-7, interdum 8·5-12 × 5·2-6 μ.

Bolbitius.

44. *Bolbitius flavidus*, Bolton; *Agaricus flavidus*, Bolton: p. 149, pl. 149; Cooke: Illustrs., p. 689; Massee: Brit. Fung. Flora, ii., p. 204.—We refer the following to this species:—Pileus 1½ inches in diameter, occasionally up to 2¼ inches, when young obliquely conical, then conico-campanulate, finally slightly convex, viscid, when moist sometimes semi-transparent and greyish and apparently striate from the gills showing through, bright yellow with a greenish tint or pale canary-yellow or creamy-white with a suspicion of yellow or pallid brown when old, sometimes almost white. Gills nearly or just free, moderately close, pale becoming brown. Stem 1½ inch high, occasionally up to 3¼ inches, slender, attenuated upwards or slightly attenuated in the middle, hollow, slightly mealy, whitish, sometimes very pale yellowish-white. Partially deliquescing. Spores bright brown, oval with one end slightly flattened, thick walled, 10 to 13·5 × 7 to 10 μ.

On dung and manured ground. Milson Island, Hawkesbury River, April, May, and June, 1913 (D. I. C., Watercolour No. 28); Neutral Bay, Sydney, October and November, 1913, and May, 1914 (D. I. C., Watercolour No. 30); Manly, January, 1915; Mummulgum, near Casino, October, 1916; Adelaide, July, 1914 (cap whitish).

Naucoria.

45. *Naucoria horizontalis*, Bull.: t. 324; Cooke: Illustrs., pl. 601B; Massee: Brit. Fung. Flora, ii., p. 155.—We have recorded this species for New South Wales in Journ. Roy. Soc. N.S. Wales, 1914, p. 436. We describe our Australian specimens as follows:—Pileus usually ¼ to ⅓ inch, occasionally up to ¾ inch, in diameter, convex, sometimes flabelliform

or kidney-shaped, centre sometimes a little depressed or sometimes with a slight acute umbo, later more flattened, faintly striate, villous looking, pale brownish-straw to orangey-brown. Gills adnexed, almost free, moderately distant, crenulate, colour of cap. Stem $\frac{1}{4}$ to $\frac{1}{2}$ inch long, slender, central or a little excentric or sometimes nearly lateral, attenuated downwards, sometimes with some whitish mycelium at the base, slightly brownish. Spores yellow-brown microscopically, oval, 7 to 9 × 5 to 6·5 μ.

On fallen logs or bark of dying Eucalyptus *(E. piperita)*. Neutral Bay, Sydney, March, April, May, July (D. I. C., Watercolour No. 17).

Colour tints noted:—Pileus and gills near brown-pink, No. 297, Ton 1, the gills warmer.

46. *Naucoria semiflexa*, Berk. and Broome: Ann. Nat. Hist., n. 1246; Cooke: Illustrs., pl. 509A; Massee: Brit. Fung. Flora, ii., p. 156.—We refer the following to this species, with Cooke's illustration of which it agrees:—Pileus $\frac{1}{2}$ inch in diameter, convex, waxy-brown flecked with white scales, drying to a pale yellowish-brown. At first the whole plant is covered with a whitish meal and the edge of the pileus is a little turned in; later the meal is left covering the cap and stem. Gills pallid brownish and adnate when very young; then becoming somewhat ventricose and adnexed and reddish-brown to dingy cinnamon, edge finely serrate. Stem about $\frac{1}{2}$ inch long, central, curved from its situation on upright trunks, mealy-white, solid. Spores pale yellow-brown, 8 to 8·5 × 4·5 to 5 μ.

On trunk of a living eucalypt. Bingham Springs, near Bumberry (N.S.W.), September, 1916 (Herb., J. B. C., Form. Sp., 237).

Galera.

47. *Galera tenera*, Schaeff.: t. 70, f. 6-8; Cooke: Illustrs., pl. 461; Massee: Brit. Fung. Flora, ii., p. 144; Cooke: Handb. Austr. Fungi, No. 284, fig. 26 (Vict., Tas.).—The spores of our specimens are distinctly larger than the measurements given by Massee (12 to 13 × 7 μ) for this species. The stem also seems paler than the descriptions would lead one to infer. We have found the spores of specimens of *G. tenera* from California, identified by Prof. Peck, to measure 13·8 to 15·5 × 8·5 to 10 μ. These seem identical in size and colour with spores from two collections found on or near horse-dung at Adelaide in July, 1914. In these two collections, however, our notes state that the stems are "pallid whitish," and the formalin specimens show likewise stems a little paler than our other specimens. Possibly the Adelaide species is not the same as the New South Wales one,

but if so it is probably the true *G. tenera*. For the present, however, we leave them all under *G. tenera*. We thus describe our specimens:—Pileus $\frac{3}{4}$ to 1 inch broad by $\frac{5}{8}$ inch high, conical, then conico-campanulate, when moist dark watery brown to ferruginous and finely striate, drying from the centre to a pale yellowish-brown or fawny-white and becoming atomate, apex sometimes more rufous when dry, edge not turned in when young, in one collection the cap noted as slightly viscid when young. Gills adnate to just free, ascending, narrow, moderately close, reddish-brown to yellowish-cinnamon. Stem up to 3 inches or more high, slender, wavy, polished, sometimes finely striate, pallid with a rufous tinge to pale brownish with a darker base, sometimes hollow, not rooting. No smell. Spores yellowish-brown, oval, thick walled, 12·5 to 20 × 8 to 11·5 μ.

On dung, occasionally on manured soil or grassy ground. Mosman, Sydney, May; Milson Island, Hawkesbury River, February, April, May, June; Ryde, Sydney, May; Orange, October—all in New South Wales (Miss Clarke, Watercolour No. 23). Adelaide, July.

48. *Galera campanulata*, Massee: Brit. Fung. Flora, ii., p. 145; *G. siligenea*, Fr., in Cooke's Illustrs., pl. 1156.—We refer the following with some doubt to this species. It has been found coming up in grass and lawns, whilst *G. tenera* appears chiefly on dung:—Pileus $\frac{3}{8}$ inch × $\frac{3}{8}$ inch to $\frac{3}{4}$ inch × $\frac{3}{4}$ inch, conical, then expanding to become broadly conical, pale brownish-fawn or pale tan or very pale fawnish-white, apex acute or obtuse, sometimes with a dark-tan umbo, finely striate, in one collection slightly sticky. Gills just adnexed to adnate (one collection), close, narrow, yellowish to reddish-brown or pale fawn. Stem $1\frac{3}{4}$ to 2 inches high, white to whitish, silky, finely striate, base slightly bulbous, attenuated upwards, hollow. Spores 10·5 to (occasionally) 13·8 or 15·5 × 7·3 to 8·5 μ.

Sydney, February and March, 1914; Hawkesbury River, November, 1914 (Miss Clarke, Watercolour No. 40); Adelaide, September, 1913; Neutral Bay, Sydney, December, 1916 (cap apparently not hygrophanous).

The spores of our specimens referred to *G. tenera* are usually distinctly larger than those of this species, whilst in formalin specimens of the two the tinted stem of the former can be easily recognized when compared with the white one of this species.

49. *Galera rubiginosa*, Pers.: Syn., p. 385; Cooke: Illustrs., pl. 464B; Massee: Brit. Fung. Flora, ii. p. 148.—Though the following species (pl. xi., fig. 7) has spores a little broader and, from Cooke's illustration, gills more

broadly attached, it seems undoubtedly to be the Australian representative of *G. rubiginosa*:—Pileus $\frac{3}{8}$ inch broad and high, conico-campanulate, obtusely umbonate, dark chestnut when moist, tan coloured when dry, coarsely ribbed to the umbo. Gills adnate, broad, moderately distant, dark reddish-brown. Stem $1\frac{1}{4}$ inch high, slender, dark brown, slightly hollow. Spores yellow-brown, finely rough under 1-12-inch lens, obliquely oval, 10·5 to 11 × 7·5 μ.

Amongst moss on rocks, Mosman, July, 1916 (Miss Clarke, Watercolour No. 132).

50. *Galera hypnorum*, Batsch: f. 26; Cooke: Illustrs., pl. 465A; Massee: Brit. Fung. Flora, ii., p. 149; Cooke: Handb. Austr. Fungi, No. 286 (Vict., S. Austr.).—Though the following species (pl. xi., fig. 8) has the edge somewhat turned in when young, we nevertheless believe it to be a *Galera* and the Australian representative of *G. hypnorum*:—Pileus $\frac{1}{4}$ inch broad and 5/16 inch high, conico-campanulate, without a definite umbo, dark yellow-brown drying to a pallid tan, striate, edge a little turned in when young so that the cap is nearly globular. Gills moderately distant, ascending, adnate, not ventricose, yellow-brown. Stem up to 1 inch high, slender, yellow-brown. Spores yellow-brown, oval, oblique, showing apparently a narrow flange on each side towards one end, giving the spores a winged appearance, 8 to 9 × 5·2 to 6 μ.

Amongst moss on flat rocks, Mosman, Sydney, July, 1916; amongst moss on fallen trunks, Lisarow (N.S.W.), August, 1916 (Miss Clarke, Watercolour No. 133).

In the Sydney district there are three fairly common species—*G. rubiginosa*, the above *G. hypnorum*, and *Psilocybe musci*—found growing amongst moss, which all somewhat resemble each other and are all hygrophanous. They may be readily distinguished, however, as follows:—*G. rubiginosa* has a darker reddish-brown cap and reddish-brown gills; *G. hypnorum* has a yellow-brown cap, ascending gills less broadly attached than the preceding and yellowish, and the characteristic slightly "winged" spores; *Ps. musci* has a cap of a darker tint than *G. rubiginosa* and usually definitely obtusely umbonate, the darker gills are so broadly attached as to be sometimes slightly decurrent, whilst the spores are a pale porphyry-slate colour under the microscope.

Tubaria.

51. *Tubaria furfuracea*, Pers.: Syn., p. 454; Cooke: Illustrs., pl. 603; Massee: Brit. Fung. Flora, ii., p. 122; Cooke: Handb. Aust. Fungi, No. 288, fig. 20 (Vict., Q'land, Tas., Lake Bonney).—We refer the following to this

species:—Pileus up to 1 inch in diameter, hemispherical or rather campanulate, then convex, centre deeply dimpled, brown or reddish-brown, drying pallid, rugose striate. Gills adnate when quite young, then definitely but slightly decurrent, rather distant, deep, cinnamon to reddish-brown. Stem up to $1\frac{1}{4}$ inch high, slender, a little wavy, dark brown or reddish-brown above and darker below, granular, often with whitish down at the base, slightly hollow. Spores microscopically yellow-brown, 8 to 8·5, occasionally $10 \times 5{\cdot}2\ \mu$.

On the ground, Orange, October, 1916; Manildra, October, 1916—both in New South Wales.

52. *Tubaria inquilina*, Fries.: Syst. Myc., i., p. 264; Cooke: Illustrs., pl. 497; Massee: Brit. Fung. Flora, ii., p. 126; Cooke: Handb. Austr. Fungi, No. 289 (N.S. Wales).—We have some doubt in placing the following under this species:—Pileus up to $\frac{1}{2}$ inch in diameter, convex, flattened atop and slightly umbilicate, coarsely striate, dingy tan, edge not turned in when young. Flesh thin. Gills arcuate, slightly decurrent, deep, moderately distant, many short, pinkish-tan, when dry earthy-brown. Stem a little over 1 inch high, finely mealy, darker brown than the cap. Spores microscopically a very pale dirty dull brown, 8·5 to, occasionally, $10{\cdot}4 \times 5$ to $5{\cdot}5\ \mu$.

On clay soil, Adelaide, July, 1914.

Crepidotus.

53. *Crepidotus mollis*, Schaeffer: t. 213; Cooke: Illustrs., pl. 498; Massee: Brit. Fung. Flora, ii., p. 117; Cooke: Handb. Austr. Fungi, No. 293.—This species has been recorded by Cooke for Victoria and Western Australia, and by ourselves (Journ. Roy. Soc. N.S. Wales, 1914, p. 436) for New South Wales. We describe our Australian specimens as follows:—Pileus up to 1 inch across, occasionally more, convex, fan-shaped, sometimes striate, smooth, white then dingy watery brownish, somewhat hygrophanous, smooth, edge turned in when young. Gills thin to rather thick, moderately close to rather distant, at first pallid and then pale brownish. Laterally attached by a very short almost obsolete downy stem. Spores in the mass snuff-brown (deep bistre), No. 303, Ton 3, obliquely oval, 7 to $8{\cdot}5 \times 4$ to $5{\cdot}2\ \mu$.

On rotten stumps and trunks, Mosman, June, July, October; Terrigal, June (spores 8·5 to $10{\cdot}4 \times 5{\cdot}5\ \mu$); Lisarow, June, August, December—all in New South Wales.

54. *Crepidotus globigerus*, Berk.: Linn. J., xiii., p. 158; Sacc.: Syll., v., 3610; Cooke: Handb. Austr. Fungi, No. 294 (Vict.).—Our plants agree with the description of this species, to which we refer them. They also, however,

agree perfectly with Peck's dscription of *C. malachius*, B. and C., and with his figure of it (N. York State Mus., Rep. of State Botanist, 1907, p. 139, pl. 112, figs. 1-4). Our plants we thus describe:—Pileus about 1 inch in diameter, occasionally 2 inches broad by 1½ inch from before backwards, edge slightly striate, at first pure white or whitish, then pallid white becoming greyish translucent. Gills pallid becoming dirty greyish-brown, edge finely serrate, moderately distant. Attached by a fluffy white base. Spores dingy brown, thick walled, noted as very finely warted with an oil-immersion lens in one case, spherical, 5·5 to 9 μ.

On fallen logs, Tuggerah, October, 1914; Narrabeen, April, 1915 (Herb., J. B. C., Form. Sp., 61); National Park, July, 1916—all in New South Wales.

55. *Crepidotus salmonicolor*, n. sp.—Pileus up to 2 inches broad and 1¼ inch deep, convex, dull, pale pinkish, laterally attached. Gills moderately distant, many short, rich pinky-salmon becoming more ferruginous. Spores in the mass salmony-brown, microscopically pale brown, pear-shaped, 6·6 × 4·8 μ. On rotten fallen trunk in brush forest. Mummulgum, near Casino (N.S.W.), December, 1916. The colour of the gills and of the shed spores suggests that the plants might belong to *Claudopus*, but the tint in the mass is much browner than, for instance, that of *Pluteus cervinus*, so we refer the species to *Crepidotus*.

Pileus ad 5 cm. latus, 30 mm. crassus, convexus, siccus, pallido-carnosus, a latere adjunctus. Lamellae paulo distantes, multae breves, ferventer incarnatae, mox magis ferrugineae. Sporae in toto salmoni-coloribus-fuscae, per amplificationem pallido-fuscae, piriformes, 6·6 × 4·8 μ.

PURPLE OR PORPHYRY-SPORED AGARICS.

Psalliota.

56. *Psalliota campestris*, (L.); Cooke: Illustrs., pl. 526; Massee: Brit. Fung. Flora, i., p. 410; Cooke: Handb. Austr. Fungi, No. 307 (Vict., Q'land, N.S. Wales, S. Austr., Tas.). —We consider as the typical form of this species, the common variety having when young a smooth pure white cap, pink gills, and a pleasant but not scented smell. It seems widely distributed in pastures throughout Australia, and may be found at almost any period of the year provided weather conditions are favourable. Spores 6·3 to 9 × 4·2 to 5·5 μ, usually 7 to 8 × 5 μ.

We have noted specimens as follows:—Sydney district, January, April; Hawkesbury River, March; Dubbo, June;

Kew, January, May—all in New South Wales; Adelaide, autumn.

Occasionally, especially in shady places, this pure white form has a definite pink tinge in the cap, which is also finely fibrillose. Wet conditions seem to favour this. We have noted this feature several times, and have a specimen collected at Sydney in June—gills rich pink, just reaching the stem, ring distant and single, spores $7{\cdot}2 \times 5\ \mu$.

56A. *Psalliota campestris*, var. *hortensis*, Cooke: Illustrs., pl. 527.—Mushrooms with brownish fibrillose scales on the cap are not uncommon in the Sydney district. The following is the most marked form we have met with. It had not been cultivated:—Pileus up to 4 inches in diameter, densely covered with reddish-brown fibrillose scales. Gills rounded near the stem and just free, pink then purplish-brown. Flesh white, somewhat tinted brownish. Stem 3 inches high, up to $\frac{3}{4}$ inch thick, with a small cavity, base slightly bulbous. Ring ample, moderately distant. Spores $5{\cdot}2 \times 3{\cdot}4\ \mu$.

Neutral Bay, Sydney, April, 1915 (Miss Clarke, Watercolour No. 67). Specimens obtained at Milson Island, Hawkesbury River, in January, 1915, had the scales more numerous in the centre and a moderately slender, solid stem; spores usually $5{\cdot}5 \times 3{\cdot}4\ \mu$, occasionally $6{\cdot}8 \times 3{\cdot}4\ \mu$.

56B. *Psalliota campestris*, var. *sylvicola*, Vittad.; Cooke: Illustrs., pl. 529; Cooke: Handb. Austr. Fungi, No. 307 (Vict.).—We have several collections of specimens which we believe belong to this variety. The pilei are comparatively smooth and white or pallid whitish, and the stems more or less elongated and bulbous at their bases. The smell is also rather strong. Spores $4{\cdot}5$ to $8 \times 2{\cdot}5$ to $5\ \mu$.

Sydney district, various collectors, February, March, June, July, October.

57. *Psalliota arvensis*, var. *villaticus*, Brond; Cooke: Illustrs., pl. 585; Massee: Brit. Fung. Flora, i., p. 413.—We refer the following to this variety, with Cooke's illustration of which it agrees. It appears also to agree fairly well with the description and Cooke's plate of *P. augustus*, Fr., so we may be mistaken in our reference:—Pileus up to 4 inches in diameter, at first rather campanulate, finally slightly convex and wavy, when young covered with small brown scales so as to appear uniformly brown, when adult the brown scales more separated. Gills just about reaching the stem, at first nearly white, then very pale pink, then purplish. Stem 3 inches high, stout, white, mealy, solid. Ring thick, ample. Flesh turning yellowish or reddish-brown when bruised. Smell slightly fragrant and unlike that of *P. campestris*. Spores usually $5{\cdot}8 \times 4\ \mu$, occasionally

$6{\cdot}8 \times 5\ \mu$. Plants when cooked were found to be less palatable than those of *P. campestris*, and had a definite but slight fragrant taste.

On manured soil, Botanic Gardens, Sydney, November, 1916 (Miss Clarke, Watercolour No. 139), July, 1907, and February and March, 1917; Heathcote (E. Lower), May, 1912.

57A. *Psalliota arvensis*, var. *iodoformis*, var. nov. (pl. xii., figs. 1 and 2).—This variety, to which we can find no reference, is characterized by its very strong iodoform smell. When brought into a house, the whole building is filled with this smell, which persists after drying. One of us has eaten specimens without any ill-effects, though the taste was rather unpleasant owing to the partial persistence of the smell. On the other hand, the following experience, for the notes of which we are indebted to Miss C. M. le Plastrier, of Sydney, indicates the need for great caution in tasting such plants:—"*Re* the iodoform-odour agarics. Three of us ate some. The odour was attributed by us not to the mushroom, but to the nurse who was with us at the time (it was during my father's last illness). As soon as we tasted iodoform, we stopped eating, and so did not partake heavily. The effects were a burning in the throat and restlessness. It was at the evening meal they were served, and not one of us (three in all) slept that night, falling off only towards morning. There was in my own case a certain amount of nausea (probably due to imagination). The agarics grew in great abundance in the shade of a large *Schinus molle*, and though they were close to the wire fence of a fowl-yard, and even grew on the other side of the wire, the fowls never touched them, though when I gave them an ordinary agaric they ate it readily."

Pileus 4 inches or more in diameter, campanulate, then convex, sometimes with the centre depressed, smooth, pure white, sometimes with a faint brown tint in places. Gills nearly reaching the stem, rounded, white to pallid, remaining pale for long, then becoming pinkish, finally purplish-brown. Stem up to 5 inches high, slender, often flexuous, base not bulbous but rooting, slightly attenuated downwards, with spongy pith or hollow, silky-white. Ring very marked, not definitely double. Flesh of the stem showing reddish to yellow-orange stains when cut. Strong iodoform smell. Spores 5 to $6{\cdot}3 \times 3{\cdot}5\ \mu$.

Densely caespitose, often in depressions amongst grass. Neutral Bay, Sydney, April, 1913 (Miss C. le Plastrier), March, 1914, and April, 1915 and 1916; Mosman, Sydney, March, 1916; Milson Island, Hawkesbury River, May, 1913; Gordon, Sydney, April, 1916 (C. Wickham). (Miss Clarke, Watercolour No. 77.)

Pileus 10 cm. aut plura latus, campanulatus, mox convexus, interdum centro depresso, levis, clare albus aut umbrinus maculatus. Lamellae confertae, stipiti adnatae, obtusae, albae ad pallidae, diu lividae, mox carnosae, demum purpureo-umbrinae. Stipes ad 12 cm. longus, gracilis, saepe flexuosus, non bulbosus sed radiciformis, sensim attenuatus deorsum, annulo amplo non plane duplici. Sporae 5 to 6·3 × 3·5 μ.

57B. *Psalliota arvensis*, var. *fragrans*, var. nov. (pl. xii., figs. 3 and 4).—We have met with this distinct variety on a number of occasions. It may be readily distinguished from the common field mushroom by slight yellowish stains on the cap, by the pallid colour of the gills when young, and by the definite though slight fragrant smell. Pileus up to 3½ inches in diameter, usually much less, at first hemispherical, then convex, sometimes conical with a depressed centre, sometimes gibbous, smooth, shining, pure white, later with faint rusty or yellowish stains, when bruised turning yellowish. Gills close, free or just reaching the stem, whitish for long, then pallid greyish or pale creamy-pink, finally purplish-brown. Stem 3½ inches high or less, sometimes up to ½ inch thick, slender or stout, slightly hollow or solid, with a pointed root, white, sometimes later with a reddish tint. Texture sometimes tougher than that of *P. campestris*. Slight but definite fragrant smell. Spores sometimes 7 to 8·5 × 4·2 to 5·2 μ, sometimes 5·2 × 3·4 μ; of 11 collections in which the spores were measured, 5 gave the larger size and 5 the smaller, whilst one varied from the higher to the lower: there seem to be no other essential differences between the two.

Milson Island, Hawkesbury River, January, April, May; Sydney, April, December; locality(?), September; Forbes, August; Lisarow, April, May; Bumberry, near Manildra, October; Kendall, May (Miss Clarke, Watercolour No. 158); Byron Bay, April (cap flecked with minute brown scales)—all in New South Wales.

Colour tints noted:—Pileus showing stains of yellow ochre, No. 326, Ton 2. Gills when mature approaching but paler than purple-black, No. 345, Ton 1.

Pileus ad 9 cm. latus, primo hemisphericus mox convexus, levis candidus clare-albus, demum quasi ferrugineus aut flavus maculatus, si contusus flavescens. Lamellae confertae, solutae aut paene solutae, albidae, deinde pallidae, denique pupureo-fuscae. Stipes ad 8·75 cm. latus, albus, tenuis aut crassus, aliquanto cavus aut solidus. Odor aliquanto fragrans. Sporae 7-8 × 4·2-5·2 μ.

58. *Psalliota pratensis*, Schaeff.; *Agaricus pratensis*, Schaeff.: Icon., t. 96; Cooke: Illustrs., pl. 525; Massee: Brit. Fung. Flora, i., p. 414.—We refer the following to this species, though the gills are not rounded behind and the stem is not hollow. Our plants agree well with Cooke's Illustrations:—Pileus up to 4 inches in diameter when mature, at first rather globose and with the centre depressed, finally convex and somewhat umbonate, creamy coloured, clad with fibrillose dark-brown concentric scales, very thick at the disc, giving with the ground-colour a dark grey-scaled appearance to the cap. Gills just reaching the stem, then free, not rounded behind, crowded, narrow, whitish for a long time, then passing through pale pinkish to brown and dark purple-brown. Stem up to 4½ inches high, ½ inch thick, base usually bulbous, smooth or scurfily squamous to the ring, white or tinged faintly reddish, stuffed with downy fibrils. Flesh ⅜ inch thick. Veil long persistent, finally rupturing to leave a voluminous dependent ragged ring at the junction of the upper ⅓ or ¼ of the stem with the remainder. Spores 5·2 to 5·5 × 3·4 μ, occasionally 6·8 × 3·4 μ. When cooked, the taste resembles that of *P. campestris*.

Milson Island, Hawkesbury River (N.S.W.), January and April, 1915 (Miss Clarke, Watercolour No. 65).

59. *Psalliota elatior*, Cooke and Mass.: Grev. viii., 3; Cooke: Handb. Austr. Fungi, No. 310, fig. 28.—This species is recorded by Cooke (No. 310) for Victoria. We describe our specimens as follows:—Pileus 1 inch or more in diameter, at first convex, then more expanded and covered with pinky-fawn squamules, becoming darker at the gibbous umbo, later reddish-brown from fibrous scales, especially over the umbo, finally slightly upturned and gibbous, blackish-brown and slightly fibrous. Gills free, close, at first pinky-white, then rich pink, finally purplish-brown. Stem up to 2 inches high, slightly attenuated upwards, whitish, fibrillosely streaked, then pinkish-white and smoother, slightly bulbous, slightly hollow. Ring rather distant. Flesh white. The colour partly dissolves in formalin solution to a reddish-brown tint. Spores 5·2 to 5·5 × 3·4 μ.

In a wood, Narrabeen, near Sydney, April, 1915 (Miss Clarke, Watercolour No. 48; Herb., J. B. C., Form. Sp., 48); under *Casuarina*, Suspension Bridge, Sydney, April, 1915; Mosman, Sydney, April, 1915.

Stropharia.

60. *Stropharia obturata*, Fr.; Harper: Trans. Wisc. Acad. of Sci., Arts, etc., xvii., pt. ii., No. 3, plate; Massee:

Brit. Fung. Flora, i., p. 400.—The following, from the decided smaller size of the spores, seems not to be *S. coronilla*, Bull.; *S. melasperma*, Bull.; or *S. bilamellata*, Peck, all of which it somewhat resembles. On its general likeness to the photograph of *S. obturata* given by Harper, and from the description of this species quoted by this author, we at present place it here. The cap is not noted as being "rimosely-squamulose" when fresh, but some of our dried specimens suggest that this was the case:—Pileus up to $2\frac{1}{2}$ inches in diameter, eventually plane or a little upturned, edge turned in, slightly sticky, finely woolly or fibrous, with white fragments of the veil at the edge, reddish-tan or pale brownish with a violet tinge in one collection. Gills slightly sinuately adnate or simply adnate, broad, moderately close, greyish-brown, then browner, purplish-brown when dry. Stem up to $1\frac{3}{4}$ inch high, silky-white, slightly curved, stout, solid, attenuated downwards, with long ramifying white mycelial threads at the base. A marked whitish ring, marked by the gills on its upper-surface, sometimes fragmentary, close to the cap, the stem below the ring with scattered fibrous scales as if from remnants of the veil. Flesh thick, white. Spores dark purplish-brown or purple porphyry, slightly flattened on one side, 6 to 7·5 × 3·4 to 4·8 μ.

On the ground, Neutral Bay, Sydney, May, 1915, and June, 1916 (D. I. C., Watercolour No. 67); Wahroonga (W. B. Stokes), May, 1915; Lisarow, June, 1916—all in New South Wales.

61. *Stropharia stercoraria*, Fries.: Syst. Myc., i., p. 291; Cooke: Illustrs., pl. 538; Massee: Brit. Fung. Flora, i., p. 404.—The chief differences between *S. stercoraria* and *S. semiglobata* seem to consist in the former being larger, having a distinct pith in the stem and having larger spores, whilst *S. semiglobata* has a "persistently hemispherical" cap. Harper (Trans. Wisconsin Acad. of Sc., Arts, and Letters, vol. xvii., 1914, p. 1022) says that *S. stercoraria* is distinguished from *S. semiglobata* by "the more expanded pileus, the stuffed and more floccose stem, the larger size, larger spores, and plane not clouded gills." He adds, however, that these distinctions do not always hold good, and that he has found the spores of *S. semiglobata* as large as any described for *S. stercoraria*. He gives the spores of the former as 13 to 14 × 8 to 9 μ or larger, and of the latter as 16 × 10 μ. The common dung *Stropharia* of Australia seems to be *S. stercoraria*, inasmuch as it is not "persistently hemispherical," but expands, and has spores measuring up to 20 μ or more. The stems, however, are hollow, a characteristic apparently of *S. semiglobata* as compared with "stuffed with

a distinct pith." The gills are also often clouded. We believe that all the specimens we have met with belong to one species, and that this is the *S. semiglobata* recorded in Cooke's Handbook (No. 313) for all the States. Taking everything into consideration, we prefer to place the plants for the present under *S. stercoraria*.

Stems up to 4 inches high, hollow, with whitish pith. Pileus sometimes becoming brown. Spores 14 to 24 × 7 to 12 μ, usually about 16 to 19 × 9 to 10 μ.

On dung. Sydney district, January, March, May, June, July, September, December; Liverpool; Parramatta, March; Milson Island, Hawkesbury River, November; The Oaks, June; Hill Top, July; Leura, February; Bumberry, October; Coonamble; Orange, October, November—all in New South Wales. Adelaide, September.

In the following, the spores are rather smaller:—Narrabeen, December (spores 13·5 to 14 × 8·5 μ); locality not stated (spores 13·5 to 14·5 × 9 μ); Cowra, June (spores 14·5 to 16 × 9 μ); Mummulgum, near Casino, December (spores 12 to 15·5 × 8 to 8·5 μ, pileus expanding); Gladesville, Sydney (spores 11 to 12 × 7 to 9 μ).

62. *Stropharia umbonatescens*, Peck: N. York State Mus. Rep., 30, p. 41; Harper: Trans. Wisc. Acad., etc., xviii., p. 1023.—The following is the original description by Peck, as quoted by E. T. Harper:—"Pileus at first conical, subacute, then expanded and umbonate, smooth, viscid, yellow, the umbo inclining to reddish. Lamellae plane, broad, at length ventricose, blackish-brown with a slight olivaceous tint. Stem equal, slender, hollow, generally a little paler than the pileus. Spores purplish-brown, almost black, 10 × 15 to $18\frac{1}{2}$ μ. Plant 3 to 4 inches high, pileus 6 to 12 lines broad, dung in pastures." Harper, in reference to his specimens, adds to the above description:—"The plants are very close to *Stropharia mammillata*, Kalch., and probably belong to that species, but the pileus is rather umbonate than papillate, and the spores are elliptical rather than ovate or pyramidal, as in the description of *Stropharia mammillata*."

We refer the following (pl. ix., fig. 8) to *S. umbonatescens*:—Pileus $\frac{3}{8}$ to $\frac{3}{4}$ inch in diameter, conico-convex, then plane, acutely umbonate or papillate, yellowish-brown with apex dark chestnut, very viscid. Gills adnate, moderately distant, dark grey. Stem 3 to $4\frac{1}{2}$ inches high, slender, fibrillosely squamulose below, hollow or partly filled with spongy pith. Ring superior, evanescent. Marked mouldy smell. Spores purplish, elliptical and somewhat oblique or a little flattened on one side, 15·5 to 20 × 8·5 to 11·2 μ.

On horse-dung probably, collected on three occasions in April, May, and June, 1915, Neutral Bay, Sydney (Miss Clarke, Watercolour No. 78; Herb., J. B. C., Form. Sp., 113). Numerous plants were collected on dung on the hills near Beaumont, Adelaide, in April, 1917—these were at first acutely conical and viscid, with the edge of the pileus a little inturned, then convex with an acute umbo, then expanding and reaching $1\frac{1}{4}$ inch in diameter; gills adnate, later with very slight decurrence or seceding, clouded grey, then dingy sooty-brown; the stem was pallid with a slight brown tinge, markedly hollow, with a slight moderately distant black ring; mouldy smell marked; spores 16·5 to 20·5 × 10·5 to 12 μ.

Hypholoma.

63. *Hypholoma fasciculare*, Huds.: Fl. Anglica, p. 615; Cooke: Illustrs., pl. 561; Massee: Brit. Fung. Flora, i., p. 382; Cooke: Handb. Austr. Fungi, No. 315 (Vict., S. Austr., Tas.).—This is a common and characteristic species in the neighbourhood of Sydney, growing in dense clusters at or near the base of old stumps, posts, etc., and frequently emerging from the ground in clumps near buried rotting timber. The yellowish tinge of the edge of the cap and the dull yellowish-green gills with the clustered habit and bitter taste render it easily recognizable.

Sydney district, Parramatta, Hawkesbury River, April to July; Hill Top, March and April; Berowra, June; Kendall, May; Mount Lofty Ranges (S.A.), June. Spores purplish, 6·5 to 8 × 3·5 to 5·2 μ. A few slightly ventricose acuminate cystidia, 35 × 10·5 μ, have occasionally been seen. Several clusters show evidence of a ring on the stem, whilst a collection obtained at Mosman in July, 1915, shows specimens with a very marked persistent ring, technically placing them in the genus *Stropharia*.

64. *Hypholoma elaeodes*, Fries.: Epicr., p. 222; Massee: Brit. Fung. Flora, i., p. 383.—The following, collected on one occasion only, seems to be this species. It agrees with Cooke's Illustrations (which, however, Massee places under *H. fascicularis*):—Pileus up to 1 inch in diameter, convex, slightly gibbous, tanny-yellow, remains of veil at the edge. Gills slightly sinuate, close, colour of cap, then becoming more umber. Stem 1 inch high, slender, mealy-white with tinges of brown shining through, fibrously streaked. Flesh yellow. Taste bitter. Spores porphyry coloured, 7 × 3·8 μ. No cystidia seen.

Caespitose at the root of a stump. Leura, Blue Mountains, June, 1916 (Miss Clarke, Watercolour No. 119).

65. *Hypholoma sublateritium*, Schaeff.: t. 49; Cooke: Illustrs., pl. 557; Massee: Brit. Fung. Flora, i., p. 380.—The following plants, collected on a fallen log at Mount Wilson, Blue Mountains, in June, 1915, seem to belong to this species rather than to *H. fasciculare*:—Pileus 2½ inches in diameter, orange-brown, yellowish towards the edge, convex, then expanded. Gills dirty yellowish-green, sinuate. Stem up to 4 inches long, markedly attenuated downwards, white above, then stained reddish-brown, shining, slightly striate, hollow. Caespitose. Bitter. Spores purplish, 6 to 8·5 × 3·8 to 4·2 μ. No cystidia seen.

66. *Hypholoma perplexum*, Peck; Harper: Trans. Wisc. Acad. of Sciences, Arts, etc., xvii., p. 1148, plate. E. T. Harper quotes Peck's original description as follows:—"Pileus convex or nearly plane, sometimes umbonate, glabrous, reddish or brownish-red, usually yellowish on the margin. Flesh white or whitish. Taste mild. Lamellae thin, close, slightly rounded behind, adnexed, pale yellow becoming tinged with green, finally purplish-brown. Stem rather slender, equal or nearly so, firm, hollow, slightly fibrillose, whitish or yellowish above, reddish-brown below. Spores 3 to 4 × 6 to 8 μ. Pileus, 2·5 to 7 cm. broad. Stem 5 to 7 cm. long, 4 to 8 mm. thick. Generally caespitose. On or about stumps or prostrate trunks of trees in woods or open places. Edible." Harper adds that Peck says that it differs from *Hypholoma sublateritium* in its "smaller size, paler margin of the pileus, somewhat umbonate pileus, mild taste, and paler and more slender stem, which is always hollow, even when young." Harper also states that this plant has usually been considered a form of *H. sublateritium*. From the descriptions Harper gives, it would appear that the gills in *H. perplexum* are "slightly rounded behind, adnexed," whilst in *H. sublateritium* they are "adnate."

The following, collected at Mount Wilson, Blue Mountains, in June, 1915, seems to belong to this species:—Pileus 2 inches in diameter, convex, dark tanny-brown, slightly gibbous. Gills rather sinuately adnexed, moderately close, brown with a greenish tinge. Stem brownish, white mealy fibrils below, base a little swollen, slightly hollow. Flesh yellow. Taste mild. Densely caespitose on a fallen log. Spores purplish-brown, 7 to 7·6 × 3·4 to 4·2 μ. No cystidia seen.

67. *Hypholoma fragile*, Peck: N. York State Mus., Mus. Bull., 131, 1909, p. 22 (pl. v., figs. 1-7).—This species has given us considerable trouble. Though closely resembling the descriptions of *H. appendiculatum* and *H. candolleanum*, it did not seem to be either. Miss E. M. Wakefield, of Kew,

has kindly forwarded us dried specimens of *H. appendiculatum (=H. candolleanum)*, from London. The spores of these are distinctly smaller than those of our plants, being 6 to 7 × 3·5 to 4 μ, whilst our plants in the dry state have less pale caps and a warm brownish tinge in the gills. The spores of plants identified as *H. candolleanum* by G. H. Robinson, and given to us by Mr. C. Brittlebank, of Melbourne, are distinctly much darker microscopically than those of our plants or Miss Wakefield's. The description and figures given by Peck of *H. fragile* seem to fit exactly our species. We quote here Peck's description:—"Pileus thin, fragile, conic or subcampanulate, becoming convex, obtuse or subumbonate, floccose-squamulose when young, with the margin slightly appendiculate with fragments of the veil, glabrous when mature, yellowish, greyish or subochraceous, the centre sometimes a little darker; lamellae thin, narrow, close, adnate, whitish or pallid becoming purplish-brown; stem slender, stuffed or hollow, glabrous or minutely floccose, white; spores 8 to 10 × 4 to 5 μ."

Our species (pl. xi., fig. 5) is common in the neighbourhood of Sydney and at Milson Island, Hawkesbury River, occurring in gardens or on rich soil, sometimes singly and sometimes in large patches. The presence of appendiculate remains of the veil round the edge of the pileus is marked in some specimens, but as a rule is very evanescent. When very young, the plants are convex, pale fawn, margin slightly incurved, showing appendiculate remains of the veil, the surface being covered occasionally with scattered whitish friable warts, also due to the remains of the universal veil. The cap soon expands, remaining somewhat convex and slightly umbonate or being wavy, still showing in some cases scattered punctate granules, and reaches a diameter of 1 to $1\frac{3}{4}$ inches. The centre is brownish-fawn or pallid clay colour, the edge pale fawn, striate. Gills moderately crowded, adnate, whitish then purplish-brown. Stem $1\frac{1}{2}$ to 2 inches high, rather fragile, slender, pure white, silky striate, perhaps slightly mealy above, hollow. Spores purplish-brown, oval, slightly oblique, 6·8 to 9 × 4 to 5·4 μ.

On the ground, somtimes caespitose. Sydney and Hawkesbury River, February to May, November; Hill Top (N.S.W.), May, 1915. (Miss Clarke, Watercolour No. 34; Herb., J. B. C., Form. Sp., 21).

Psilocybe.

68. *Psilocybe sarcocephala*, Fries.: Monogr., i., p. 429; Cooke: Illustrs., pls. 567 and 520; Massee: Brit. Fung. Flora, i., p. 364.—We consider that the following is this

species:—Pileus up to 3 inches in diameter, at first almost hemispherical, when adult convex and a little irregular or slightly dimpled, finally sometimes with the edge upturned and slightly gibbous, reddish-brown to brownish-tan or yellowish-tan on top, paler towards the periphery, sometimes pallid with a brownish tint all over, slightly viscid when moist, smooth to slightly fibrillose. Occasionally a fibrous veil is seen when young, leaving fibres on the lower part of the stem. Gills slightly but definitely sinuate, broadly adnexed, occasionally adnate, moderately close, at first nearly white, then pallid salmony, then almost a mushroom tint but not so bright, finally browny-salmon, sometimes spotted brown. Stem 3 inches high, $\frac{1}{4}$ to $\frac{1}{2}$ inch thick, stout to slender, white, mealy above, slightly fibrillose, base a little thickened, solid (noted as hollow in one collection). Flesh white, moist looking. Slight mushroomy smell. Caespitose or gregarious. Spores in the mass dull vinus brown, microscopically dull brown with a vinous tinge, oblique, one end more pointed, $8{\cdot}5$ to 9×4 to $5{\cdot}5\ \mu$, occasionally $13{\cdot}5 \times 5{\cdot}5\ \mu$.

On the ground. Hawkesbury River, July, 1912 (Miss Clarke, Watercolour No. 6), and May, 1913; Terrigal, June, 1914; on an old camp site under bushes, Lane Cove River, Sydney, June, 1916; The Spit, Sydney, July, 1916; Brookvale, July, 1916; National Park, July, 1916—all in New South Wales.

69. *Psilocybe bullacea*, Bulliard; Champ.: t. 566, f. 2; Cooke: Illustrs., pl. 608B; Massee: Brit. Fung. Flora, i., 370.—We have previously recorded this species for New South Wales and Adelaide (Journ. Roy. Soc. N.S. Wales, 1914, p. 438). We have the following additional localities or dates:—Orange, November; Sydney, March, June, July; Milson Island, Hawkesbury River; May; (?) this species, Walcha, July—all in New South Wales. Adelaide, September.

70. *Psilocybe musci*, n. sp. (pl. x., fig. 7).—Pileus $\frac{1}{4}$ inch across and $\frac{1}{4}$ inch high, conical or convex with a marked obtuse umbo, becoming nearly plane and $\frac{3}{8}$ inch across, hygrophanous, umbo a waxy yellow-brown, the rest dark brownish and striate or rugose, drying from the apex to a pallid brownish-white or tan, slightly viscid when moist, edge turned in when very young and closed with a veil, which occasionally leaves a slight ring on the stems in older specimens. Gills rather distant, broad, greyish-brown to dingy dark brown, adnate to slightly decurrent. Stem up to $1\frac{1}{4}$ inch high, slender, pallid brownish, somewhat silky striate, hollow. Plant rather tough, not fragile. Spores porphyry tinted, $7{\cdot}5$ to 9, and occasionally $10{\cdot}5$, $\times$ 5 to occasionally 6 μ.

Gregarious amongst moss on rocks in shady places. Sackville Reach, Hawkesbury River, August, 1915; Mosman, North Bridge, and The Spit, Sydney, June and July, 1916 (Miss Clarke, Watercolour No. 134; Herb., J. B. C., Form. Sps., 157, 230). This species appears to be allied to *P. bullacea*.

Pileus ·6 cm. latus, conicus aut convexus, obtuse umbonatus, deinde paene planus, hygrophanus, fuscus, postquam sicco pallido-fuscus, striatus aut rugosus. Lamellae aliquanto distantes, fuscae, adnatae aut aliquanto decurrentes. Stipes ad 3 cm. longus, tenuis, pallido-fuscus, aliquanto sericeo-striatus, aliquanto cavus. Sporae porphyraceo-coloratae, 7·5-9, interdum 10·5 × 5-6 μ.

71. *Psilocybe foenisecii*, Persoon: Icon. Descr., t. 11, f. 1; Cooke: Illustrs., pl. 590; Massee: Brit. Fung. Flora, i., p. 377; Cooke: Handb. Austr. Fungi, No. 323 (Lake Bonney).—The following, which is found growing on dung in Australia, resembles Cooke's illustration of this species and the description of it. Compared with identified specimens kindly sent to us from England by Miss Wakefield, though the size of the spores of our plants agree with that (13·8 to 15·5 × 7·5 μ) of the European species, the latter are more of a dark sooty-brown and ours of a purplish or porphyry brown. For the present at least we leave our plants under *P. foenisecii*:—Pileus up to $1\frac{1}{2}$ inch in diameter, usually less, convex to campanulate, then nearly plane, with a small acute umbo, dark brown and striate when moist, drying to a pallid yellowish or brown. Gills moderately crowded, narrow, adnate, sometimes ventricose, greyish-purple to brownish-purple when dry, edges white. Stem $1\frac{3}{4}$ to $3\frac{1}{2}$ inches high, slender, fibrously striate or finely striate below and mealy above, hollow, pallid brownish or pallid with a rufous tinge, mycelium at the base. Spores in the mass very dark purplish-black, microscopically dark purple-brown or porphyry brown, oblique, elongated, 13 to 15·5 × 7 to 8·5 μ.

On dung. National Park (N.S.W.), July, 1916; The Spit, Sydney, July, 1916; cap not noted as umbonate, gills greyish-brown, sinuate and moderately distant, stem pallid whitish, spores 12 to 13·2 × 7 μ, The Oaks (N.S.W.), June, 1914; cap not noted as umbonate, gills ascending and nearly free, stem whitish, spores 12·5 to 13·8 × 7·5 μ, Terrigal (N.S.W.), June, 1914; Ararat, Victoria, May, 1917 (E. J. Semmens).

72. *Psilocybe atomatoides*, Peck: N. York State Mus., Mus. Bull., 157, 1912, p. 96.—The following is evidently not *Psathyrella atomata*, to which with much doubt we at first referred it. It resembles more the description of Peck's

Psilocybe atomatoides, with which for the present we place it. Peck's description is as follows:—"Pileus thin, fragile, convex or subcampanulate becoming nearly plane, rugosely wrinkled, atomate, slightly and evanescently white floccose, slightly hygrophanous, greyish or ochreous-brown, sometimes with a pinkish tinge, flesh cinereous; lamellae moderately broad, subventricose, rounded behind, adnexed, cinereous becoming dark brown; stem equal, hollow, minutely flocculent when young, pruinose at the top, whitish; spores blackish-brown, 7 to 8 × 4 to 5 μ. Pileus 1·6 to 2·4 mm. broad; stem 3 to 5 cm. long, 2 mm. thick." Our species appears to differ in the gills being more adnate and the stem solid. When young the edge of the cap was "not definitely turned in," which should be the case in *Psilocybe*. We describe our plants as follows:—Pileus $\frac{1}{2}$ to $1\frac{1}{4}$ inch in diameter, conico-campanulate or broadly conical, then campanulate, then more expanded, almost membranaceous, apex pale yellowish-fawn, the rest coarsely plicate and dark umber drying to a pallid brownish, the gills showing through, some shining particles; when young, pale fawny-yellow with glistening particles, striate, edge not definitely turned in. Gills adnate, ascending, broad, moderately distant, grey then purplish-brown, clouded with the spores. Stem $1\frac{1}{2}$ to $2\frac{1}{4}$ inches high, slender, solid, shining, white, slightly brownish below, at first mealy. Tending to dissolve. Spores in the mass very dark purplish-brown (dark neutral tint, No. 346, Tons 1-4), microscopically dark brown, 6·5 to 9 × 4·4 to 5·5 μ.

On the ground amongst leaves, Mosman, Sydney, May.

73. *Psilocybe ceres*, Cooke and Massee: Grev., xvi., 72; Cooke: Handb. Austr. Fungi., No. 324, fig. 31. Previously recorded for Victoria.—This is recorded in Cooke (No. 324) for Victoria. In this work, the spore measurements given are 14 to 16 × 6 to 8 μ. The following is the description of our specimens, whose spores are a little smaller:—Pileus up to $1\frac{1}{4}$ inches broad, convex, then expanded and slightly umbonate, smooth not striate, not viscid, rich orange brick-red or rich scarlet-brick or even approaching the tint of tomatoes, veil separating early and remaining slightly attached to the edge of the pileus. Gills sinuate adnexed, moderately crowded, greyish brown becoming purplish-brown. Stem up to 4 inches long, wavy, slender, reddish-brown below and pale above or colour of the cap but paler, shining, faintly striate, firm and cartilaginous, slightly swollen below and attenuated upwards, strigose at the base, solid, later hollow, when old the flesh of the stem reddish-brown, with mycelium rooting amongst dead leaves. Spores purple-brown, thick-walled, elliptical, 10 to 12 × 5·6 to 7 μ. Occasionally caespitose.

Blue Mountains, May, 1914 (Herb., J. B. C., Form. Sp.); Mosman, Sydney, May, June, amongst fallen leaves (Miss Clarke, Watercolour No. 27); Parramatta, June, 1916 (Miss Clarke, Watercolour No. 118; Herb., J. B. C., Form. Sp., 208).

74. *Psilocybe aggregata*, n. sp. (pl. xii., figs. 5 and 6).—Pileus up to 1 inch across, usually ¾ inch, slightly convex becoming flattened, very dark chocolate-brown when moist, drying from the centre to a pale brown, faintly striate. Gills close, adnexed, slightly ventricose, colour of the moist cap. Stem short, ¾ inch long, curved, pale brown, semi-transulcent, slightly greyish, silky-fibrous, hollow. Spores in the mass dark purplish, microscopically a dark bronzy-brown, $5{\cdot}5 \times 3{\cdot}4\ \mu$. Numerous ventricose cystidia, the apices rough, 35 to $40 \times 10{\cdot}5\ \mu$.

In dense masses covering a fallen log. Leura, Blue Mountains, June, 1916 (Miss Clarke, Watercolour No. 122; Herb., J. B. C., Form. Sp., 209).

Pileus ad 2·5 cm. vulgo 1·9 cm. latus, aliquanto convexus, deinde aliquanto planus, nigro-fuscus, postquam sicco pallido-fuscus, aliquanto striatus. Lamellae confertae, adnexae, aliquanto ventricosae, nigro-fuscae. Stipes brevis, 1·9 cm. longus, curvatus, pallido-fuscus, semi-translucidus, aliquanto cinereo-pallidus et sericeo-fibratus, cavus. Sporae nigro-purpureae, $5{\cdot}5 \times 3{\cdot}4\ \mu$. Cystidia ventricosa, apicibus asperis, 30 to $40 \times 10{\cdot}5\ \mu$.

BLACK-SPORED AGARICS.

Panaeolus.

75. *Panaeolus ovatus*, Cooke and Massee: Grev., xviii., 4; Cooke: Handb. Austr. Fungi, No. 332; Cleland and Cheel: Journ. Roy. Soc. N.S. Wales, xlviii., p. 439. Previously reported for Victoria and New South Wales.—We have the following additional New South Wales records of this species. We have notes also that, when old, the cap may have a brownish tint and crack into scales.

Sydney district, including Manly and Parramatta, January to April, December; Milson Island, Hawkesbury River, January to March; Goulburn, February; Cobar (L. Abrahams), June; Baan Baa, January; Kew, January. On dung, near Adelaide, April, 1917 (stem very slightly hollow).

76. *Panaeolus retirugis*, Fries.: Epicr., p. 235; Cooke: Illustrs., pl. 627; Massee: Brit. Fung. Flora, i., p. 334; Cooke: Handb. Austr. Fungi, No. 336 (Vict.); Cleland and Cheel: Journ. Roy. Soc. N.S. Wales, 1914, p. 439 (N.S.

Wales).—Further specimens have been collected at Neutral Bay, Sydney, in May, 1916; Botanic Gardens, Sydney, April, 1915; and Penshurst, Sydney, January and July, 1910. On dung, National Park (S.A.), April, 1917 (spores 14 to 17 × 8·5 to 10·4 μ).

77. *Panaeolus campanulatus*, (L.) Fries.: Hym. Eur., p. 311; Cooke: Illustrs., pl. 629; Massee: Brit. Fung. Flora, i., p. 336; Cooke: Handb. Austr. Fungi, No. 328 (Vict.); Cleland and Cheel: Journ. Roy. Soc. N.S. Wales, 1914, p. 440 (N.S. Wales).—As indicated in our previous notes, we refer our common dung *Panaeolus* that exhibits a shining cap to this species (probably). We are not sure if, at present, we are not confusing two species under this heading. The following is a composite description of our collections:—When very small pileus cylindrical and closed by the veil, later conical or sugar-loaf, then convex and up to 1 inch broad and ¼ inch high, sometimes somewhat gibbous, when moist pale brownish with a darker edge or pale pinky-fawn or velvety-grey with a fine whitish edge, when dry shining and smooth and smoky-white or brownish. Gills adnate, ascending, narrow, crowded, dark grey. Stem 3 inches high, dirty rufous or brownish, powdery white above, somewhat striate. Spores black or dark neutral tint [Dauthenay, pl. 346 (2)], ventricose with the ends drawn in, 10·4 to 16 (occasionally) × 7 to 10·8 μ.

On dung or manured soil. Sydney district, including Manly, February to July, November; Milson Island, Hawkesbury River, May, July; Hill Top, May, July; Orange, October; The Oaks, June (edges of gills pale); Murwillumbah, April (spores rotund, 10·5 × 7 to 7·5 μ, cap not shining when dry); Terrigal, June; Tuggerah, October; Bumberry, September, 1916 (spores 13·8 × 8·5 μ, pileus not shining when dry, edge markedly turned in when young, edges of gills whitish, stem slightly hollow)—all in New South Wales. Adelaide, September, 1913 (pileus silky pale brown breaking into brownish scaly patches with silky greyish-white between or with cobweb-like brownish speckling).

78. *Panaeolus sub-balteatus*, Berk. and Br.: Ann. Nat. Hist., n. 923; Cooke: Illustrs., pl. 631B; Massee: Brit. Fung. Flora, i., p. 337.—The following we refer to this species:—Pileus 1 inch broad, ½ inch high, broadly conico-convex, then convex, obscurely umbonate, mealy, when moist mouse greyish-brown and slightly striate at the edge, when drying a dirty pale brownish-white or stone-white with a dark ring near to but within the edge that fades as drying becomes complete. Gills adnate to adnexed, moderately close, ascending, ventricose, narrow, many short, dark grey or pinkish-brown, edges paler. Stem up to 3 inches high, hollow or

solid, mealy, stringy, slightly silky striate above, pale tanny-brown or pallid flesh colour. Single or subcaespitose, on rich soil or dung or amongst grass. Spores black, the ends constricted, very variable, many swollen, 10·4 to 12, occasionally 13·8 × 7 to 8·5 μ.

Milson Island, Hawkesbury River, November, 1914 (Herb., J. B. C., Form. Sps., 2, 29), and February, 1915; Neutral Bay, Sydney, December, 1914; Botanic Gardens, Sydney; Mummulgum, near Casino, December, 1916—all in New South Wales.

79. *Panaeolus semilanceatus*, Peck: N. York State Mus., Mus. Bull. 131, p. 37.—Peck's description of this species is as follows:—"Pileus thin, conic-ovate, umbonate, greyish-brown; lamellae ascending, black when mature; stem slender, glabrous, hollow, brown: spores ellipsoid, compressed variable in size, black, 12 to 18 × 8 to 12 μ. Similar to *Psilocybe semilanceata*, Fr., in size and shape, but differing in colour and spore character." We have a common species, growing amongst grass in the Sydney district, that resembles closely dried specimens of *Psilocybe semilanceatus*, kindly sent to us by Miss E. M. Wakefield from England, but differing in the spores being black. It appears to be Peck's species. We describe specimens (pl. xi., fig. 6) as follows:—Pileus about $\frac{3}{8}$ inch high and $\frac{1}{4}$ inch wide or larger, conico-ovate, somewhat acuminate, constricted below and inturned so as sometimes to almost completely hide the gills, always showing some degree of inturning, occasionally slightly sticky, edge slightly striate, pallid greyish-straw, somewhat browner on top, pallid silky when dry, sometimes, according to moisture, showing a greyish band near the edge. Flesh whitish, thick in the centre. Gills ascending, adnate, about $\frac{1}{8}$ inch deep, greyish-black, edge white and very finely toothed. Stem up to $2\frac{3}{4}$ inches high, silky shining, hollow, twisting on section, somewhat cartilaginous and stringy, slightly attenuated downwards, pale brown. Spores dark brown to black, oval, ends pointed, 12 to occasionally 13·8 or 15·5 × 7 to 8·5 μ.

Amongst grass. Cook River, Sydney, March, 1911 (A. A. Hamilton); Botanic Gardens, Sydney. March 1914 (D. I. C., Watercolour No. 35); locality not noted, March, 1916 (Miss Clarke, Watercolour No. 39); Cremorne, Sydney, March, 1914; Milson Island, Hawkesbury River, November, 1914; Narrabeen, February, 1917; Mummulgum, near Casino, December, 1916—all in New South Wales.

Psathyrella.

80. *Psathyrella disseminata*, Pers.: Syn., p. 403; Cooke: Illustrs., pl. 657B; Massee: Brit. Fung. Flora, i., p. 345;

Cooke: Handb. Austr. Fungi, No. 344 (Vict., Q'land, Tas., W. Austr.).—We describe Australian specimens (pl. x., fig. 6) as follows:—Pileus up to ½ inch broad, conico-campanulate, greyish-brown, ribbed to the top, which is flattened and pallid white, a few shining particles, edge not turned in when young. Gills adnate, moderately distant, dark brown with a purplish tint. Stem 1 inch high or a little more, pure white, silky shining, hollow. Densely gregarious. Spore mass near dark neutral tint, No. 346, Ton 4. Spores dark bronzy-brown microscopically, one end truncate, 7 × 3·8 to 4·2 μ.

At the foot of a fence-post, Murwillumbah, April, 1916 (Herb., J. B. C., Form. Sp., 175); on ground near trunks, Lisarow, June, 1916 (spores 8 to 9 × 5 μ); Mosman, Sydney, August, 1916 (spores in the mass black, perhaps with a tinge of purple; thin spore-prints greyish-black—Miss Clarke, Watercolour No. 131; Herb., J. B. C., Form. Sp., 247); round stump, Orange, October, 1916 (spores 8·5 × 4 μ); on trunks of *Erythrina*, sp., Botanic Gardens, Sydney; Bexley, Sydney—all in New South Wales. Waterfall Gully, near Adelaide, and National Park (S.A.), April and June, 1917 (spores 7·2 to 9 × 4·2 to 4·8 μ).

DESCRIPTION OF PLATES.

Plate IX.

Fig. 1. *Hebeloma montanum*, n. sp.
,, 2. ,, ,, ,, and spores.
,, 3. *Cortinarius rotundisporus*, n. sp., with spore.
,, 4. ,, ,, ,, section.
,, 5. ,, *austro-evernius*, n. sp., with section and spore.
,, 6. ,, ,,
,, 7. *Flammula purpurata*, Cke. and Massee, with spores.
,, 8. *Stropharia umbonatescens*, Peck, and spore.

Plate X.

Fig. 1. *Flammula radicata*, n. sp., with spore and spore mass.
,, 2. *Inocybe australiensis*, n. sp., with section, cystidium, and spore.
,, 3. ,, *albidipes*, n. sp., with section, cystidium, and spore.
,, 4. ,, *subasterospora*, n. sp., with section, cystidium, and spores.
,, 5. ,, ,, n. sp.
,, 6. *Psathyrella disseminata*, Pers., and spore.
,, 7. *Psilocybe musci*, n. sp., showing moist pileus (dark brown), dry pileus (pallid), section, and spores.

Plate XI.

Fig. 1. *Flammula excentrica*, n. sp.
,, 2. ,, ,, ,, cross section, spores, and spore mass.
,, 3. ,, *californica*, var. *communis*, var. nov.
,, 4. ,, ,, ,, var. nov., cross section, cystidia, and spore.
,, 5. *Hypholoma fragile*, Peck, and spore.
,, 6. *Panaeolus semilanceatus*, Peck.
,, 7. *Galera rubiginosa*, Pers., with section and spore.
,, 8. ,, *hypnorum*, Batsch, with section and spore.

Plate XII.

Fig. 1. *Psalliota arvensis*, var. *iodoformis*, var. nov., with spore and spore mass.
,, 2. ,, ,, ,, ,, var. nov., section.
,, 3. ,, ,, ,, *fragrans*, var. nov.
,, 4. ,, ,, ,, ,, var. nov., section and spore.
,, 5. *Psilocybe aggregata*, n. sp., showing moist pileus (dark), dry pileus (pale), section, spore, and spore mass.
,, 6. ,, ,, n. sp., showing gills and cystidium.

Notes on South Australian Marine Mollusca, with Descriptions of New Species.—Part XVI.

By Jos. C. Verco, M.D. (Lond.), F.R.C.S. (Eng.).

[Read August 8, 1918.]

This paper is a continuation of the series from page 201, of vol. xxxvi., of 1912, and deals with the genera *Cypraea*, *Trivia*, and *Erato*. After enumerating for a species its localities in South Australia, those in Western Australia are given as far north as Fremantle, where I may have taken it. Further, where in the same area I have obtained species not found in South Australia, they have been listed, so as to indicate which pass round Cape Leuwin and which do not.

Cypraea reevei, Sowerby.

Cypraea reevei, Gray: Sowerby's Conch. Illus., 1832, fig. 52, Cat. Cypraeidae, 1837, No. 15; Adcock: Handlist Aquatic Moll. S. Austr., 1893, p. 5, No. 153; Shaw: Proc. Mal. Soc., 1909, vol. viii., p. 302; Verco: Trans. Roy. Soc. S. Austr., 1912, vol. xxxvi., p. 210; Hedley: Jour. Roy. Soc. W. Austr., 1916 (1915), p. 199.

Habitat.—Sowerby (1837) gives Garden Island, mouth of the Swan River, Western Australia.

Taken off Newland Head, Encounter Bay, 20 fathoms, 1 dead; in Backstairs Passage, 20 fathoms, 1 dead; Yankalilla beach (Adcock); Cape Spencer beach (Tate); Corny Point beach, Spencer Gulf; St. Francis Island beach, 1 perfect; 100 fathoms, 90 miles west of Eucla, 3 alive; 72 to 120 fathoms, 120 miles west of Eucla, 1 dead; Hopetoun beach, 2 (A. Parkinson); Esperance beach, 4; Albany beach, 3; Rottnest Island, 3.

When mature the length may be 40 mm. or only 23 mm. The relative width may vary, being 25 mm., with lengths of 36 and 39 mm. Of three taken alive in 100 fathoms one is of a uniform delicate cream colour, one a lavender-grey, and one of a rather deeper tint with four obscure darker transverse bands. The beautiful example from St. Francis Island is of a dark slate colour, with close set antero-posterior lighter lines, 4 faint broad transverse darker bands, and the whole surface finely malleated. Some more solid older specimens are of a light chestnut colour with darker chestnut bands. All have the pink tips front and back.

It is a rare shell in South Australia, and appears not to reach the Victorian boundary, is distinctly more common at the western end of the South Australian coast, and is found as far north as Rottnest. It is taken alive on the beach at Albany, and also in 100 fathoms, so that it has a wide range of depth.

Cypraea angustata, Gmelin.

Cypraea angustata, Gmelin: Syst. Nat., 1790, p. 3421, No. 40; Sowerby: Conch. Illus., 1836, fig. 105; Cat. Cyp., 1837, p. 10, No. 99; Kiener: Coq. Viv., vol. 1, 1845, p. 43, No. 36, pl. xxxv., figs. 2, 2*a*; Reeve: Conch. Icon., vol. iii., 1846, pl. xvii., fig. 91; Angas: Proc. Zool. Soc., 1865, p. 170; Sowerby: Thes. Conch., 1870, p. 30, No. 101, pl. xxviii., figs. 296, 297; Ten. Woods: Proc. Roy. Soc. Tas., 1878 (1877), p. 35; Brazier: Proc. Linn. Soc. N.S. Wales, vol. v., 1881 (1880), p. 499; Adcock: Handlist Aq. Moll. S. Austr., 1893, p. 5, No. 156; Beddome: Proc. Linn. Soc. N.S. Wales, vol. xxii., 1898, p. 568, pl. xxi., figs. 1-3; Pritchard and Gatliff: Proc. Roy. Soc. Vic., vol. xii. (N.S.), 1900 (1899), p. 181; Hedley and May: Records Austr. Mus., vol. vii., No. 2, 1908, p. 111; Hedley: Austr. Assoc. Adv. Sci., 1909, p. 361; Shaw: Proc. Mal. Soc. Lond., vol. viii., 1909, p. 306.

Gmelin gives *hab.* (?); Sowerby, in 1837, South Africa; Kiener, Indian seas and shores of New Holland; Angas gives Guichen Bay, South Australia, and adds, "It is a Tasmanian species, not extending into the South Australian gulfs, where several allied species have their habitat"; Ten. Woods gives "common" in Tasmania; Brazier questions the locality of a specimen from Moreton Bay, or the identification of the shell. But Hedley cites it from Queensland; and Hedley and May record it from 100 fathoms off Cape Pillar, Tasmania.

Sowerby, in his Thesaurus, ventures the opinion that *comptoni*, *declivis*, *piperita*, and *bicolor* are all varieties of *angustata*; while Beddome creates the varieties *subcarnea*, Ancey, *mayi*, and *albata*. Pritchard and Gatliff discuss this question fully, and declare all to be varieties. I have no hesitation in supporting these authors and in confirming Sowerby's further suspicion as to the varietal position of *C. pulicaria*, Reeve. *C. angustata*, Gmelin, the typical ventricose form, is not very common in South Australia, but is most so in the eastern part, as MacDonnell Bay, where occurs the very elegant form figured by Reeve, pl. xvii., fig. 91, covered with a bluish-white enamel. It is found, however, along the whole coastline of South Australia to the west, as far as explored, and at Albany up to 24·5 mm. in length. Like all its varieties it may have several transverse ridges.

C. angustata, Gmelin, var. **comptoni**, Gray.

Cypraea comptoni, Gray: Voy. "Fly," ii., App., 1847, p. 356, pl. i., f. 3; Angas: Proc. Zool. Soc., 1865, p. 170; Brazier: Proc. Zool. Soc., 1872, p. 85; Ten. Woods: Proc. Roy. Soc. Tas., 1878 (1877), p. 35; Adcock: Handlist Aq. Moll. S. Austr., 1893, p. 5, No. 157; Henn: Proc. Linn. Soc. N.S. Wales, vol. xx., 1896, p. 520; Beddome: Proc. Linn. Soc. N.S. Wales, vol. xxii., 1898, p. 568, pl. xxi., figs. 15, 16; Hedley: Journ. Roy. Soc. N.S. Wales, vol. li. (1917), 1918, M. 70.

Habitat.—Gray gives Port Essington; Angas, Port Lincoln, Gulf St. Vincent, and Port Adelaide Creek; Brazier, Twofold Bay, New South Wales, Cape Riche, King George Sound, and north coast of Tasmania; Pritchard and Gatliff, Victoria. It is more common along the South Australian coast than the typical *C. angustata*. It is found alive in rock pools, and has been dredged alive up to 14 fathoms. It may be 21 mm. × 12·5 × 9·5, or reach 27 × 16·5, as at St. Francis Island. Several have been taken at Albany up to 20 mm., but none on the western coast of Western Australia.

C. angustata, Gmelin, var. **declivis,** Sowerby.

Cypraea declivis, Sowerby: Thes. Conch., vol. iv., 1870, p. 31, No. 103, figs. 287, 328*, 329*; Bedodme: Proc. Linn. Soc. N.S. Wales, vol. xxii., 1898, p. 571, pl. xxi., figs. 12-14; Pritchard and Gatliff: Proc. Roy. Soc. Vict., vol. xii. (N.S.), (1899), 1900, p. 184.

Habitat.—Sowerby gives Tasmania; Pritchard and Gatliff, Victoria. The plump ventricose form, with crowded large dark-brown spots along the columellar side, smaller lighter peppered spots all over the dorsum, is found at MacDonnell Bay, 2, 25 mm. × 18 × 13·5; the narrow form, Esperance Bay, 1.

Cypraea angustata, Gm., var. *mayi,* C. E. Beddome: Proc. Linn. Soc. N.S. Wales, vol. xxii., 1898, p. 570, pl. xxi., figs. 4, 5, 6, 7.

Taken at MacDonnell Bay; at Sleaford Bay, 5, up to 26 mm. × 17 × 13·5, and down to 16·5 mm. × 12 × 8·25; also at Venus Bay, up to 29 mm. × 19 × 14·5; at Albany, 7, up to 25 mm.

Cypraea angustata, Gm., var. *subcarnea,* Ancey, C. E. Beddome: Proc. Linn. Soc. N.S. Wales, vol. xxi., 1896, part 3, p. 467; also *op. cit.*, vol. xxii., 1898, p. 571, pl. xxi., figs. 8, 9, 10.

Habitat.—Tasmania (Beddome); Victoria (Pritchard and Gatliff). This is quite rare in South Australia, but is taken in MacDonnell Bay and Lacepede Bay; and one was found at Esperance, in Western Australia.

Cypraea angustata, Gm., var. *albata,* C. E. Beddome: Proc. Linn. Soc. N.S. Wales, vol. xxii., 1898, p. 571, pl. xxi., figs. 11, 11*a*.

His type locality is Derwent River, Tasmania; but he reports a specimen from South Australia. There is a narrow pure white form like an albino—*C. comptoni,* Gray—from MacDonnell Bay and Gulf St. Vincent; also a cream-coloured plumper form without spots or dorsal bands. Others may have small reddish-brown spots on each margin, and others in addition may be dusted with very minute brownish specks. Some have the cream colour slightly tinged with brown, and yet without dots or bands, or have dots only, or faint transverse brown bands in addition. Others may be browner still, with faint brown bands, marginal dots fairly many and distinct or absent, and so merge into *C. subcarnea*.

Cypraea angustata, Gmelin, var **piperita**, Gray.

Cypraea piperita, Gray: Zool. Journ., vol. i, 1825, p. 498; Sowerby: Conch. Illus., Cyp. Cat., 1837, No. 100, fig. 24, 1832; Menke: Moll. Nov.-Holl., 1843, p. 30; Reeve: Conch. Icon., vol. iii., 1846, pl. xvii., Sp. 87; Angas: Proc. Zool. Soc., 1865, p. 170, and 1867, p. 206; Sowerby: Thes. Conch., vol. iv., 1870, p. 31, No. 104, figs. 285, 286; Ten. Woods: Proc. Roy Soc. Tas., 1878 (1877), p. 35; Tryon: Man. Conch., vol. vii., 1885, p. 189; Adcock: Handlist Aq. Moll. S. Austr., 1893, p. 5, No. 158; Beddome: Proc. Linn. Soc. N.S. Wales, vol. xxii., 1898, p. 574, pl. xxi., figs. 17, 18; Pritchard and Gatliff: Proc. Roy. Soc. Vict. (N.S.), vol. xii., 1900 (1899), p. 184; Tate and May: Proc. Linn. Soc. N.S. Wales, vol. xxvi., 1901, p. 374; Hedley: Proc. Roy. Soc. W. Austr., vol. i., p. 199; Hedley: Proc. Roy. Soc. N.S. Wales, vol. li., Supp., 1918, p. M. 70.

Sowerby, in 1870, first suggested its conspecifity with *C. angustata*, and Pritchard and Gatliff supported him. Woods, Beddome, and Tate and May kept them separate. Hedley unites them, and my examples completely intergrade.

Gray gives its habitat as New Holland; Sowerby as New South Wales; Menke as Western Australia; Angas as Port Lincoln and Port Jackson; Ten. Woods as Tasmania; Pritchard and Gatliff as Victoria.

Taken on the beach at Normanville and American River, Kangaroo Island. Dredged alive in Backstairs Passage in 13, 15, 18, 20, and 23 fathoms; in Gulf St. Vincent in 5 fathoms; in Investigator Strait, 13, 15, and 17 fathoms; and dead but fresh in 25 fathoms off Beachport; also on the beach at Esperance 1, and at Albany 4.

Cypraea angustata, Gmelin, var. **bicolor**, Gaskoin.

Cypraea bicolor, Gaskoin: Proc. Zool. Soc., 1848, p. 91, 92; Angas: Proc. Zool. Soc., 1865, p. 170; Sowerby: Thes. Conch., vol. iv., 1870, p. 31, No. 104, figs. 288, 289, 533; Tryon: Man. Conch., vol. vii., 1885, p. 189; Adcock: Handlist Aq. Moll. S. Austr., 1893, p. 5, No. 159; Beddome: Proc. Linn. Soc. N.S. Wales, vol. xxii., 1898, p. 576; Pritchard and Gatliff: Proc. Roy. Soc. Vict. (N.S.), vol. xii., 1900 (1899), p. 184; Tate and May: Proc. Linn. Soc. N.S. Wales, vol. xxvi., 1901, p. 374.

Sowerby, in 1870, made it a variety of *C. piperita*, Gray; Tryon, Pritchard and Gatliff, and Tate and May correctly concur.

Its habitat was given by Gaskoin as Australia; Angas localized it more definitely at Kangaroo Island and Port Adelaide Creek; Beddome extended it to Tasmania; and Pritchard and Gatliff recorded it from Victoria.

Taken on the beach, Kangaroo Island, Gulf St. Vincent and Spencer Gulf, Fowler Bay (Tate), and Albany 3. Dredged alive in Gulf St. Vincent, 7 fathoms 6, 17 fathoms 3. One is a *facsimile* of Sowerby's fig. 289, a small ventricose form from Miss Saul's collection; others match fig. 533, "Mr. Hugh Owen's beautiful shell from South Australia."

Cypraea angustata, Gmelin, var. **pulicaria**, Reeve.

Cypraea pulicaria, Reeve: Proc. Zool. Soc., 1845, p. 23; Conch. Icon., vol. iii., 1846, pl. xvii., Sp. 84; Gaskoin: Proc. Zool. Soc., 1848, p. 97; Sowerby: Thes. Conch., 1870, p. 31, No. 105, pl. xxviii., figs. 290, 291; Tryon: Man. Conch., vol. vii., 1885, p. 189, pl. xvi., figs. 59, 60; Tate and May: Proc. Linn. Soc., vol. xxvi., 1901, p. 445; Hidalgo: Mon. Cyp. Viv., 1907, p. 480; Verco: Trans. Roy. Soc. S. Austr., vol. xxxvi., 1912, p. 210; Hedley: Journ. Roy. Soc. W. Austr., vol. i., 1916, p. 199.

Its habitat was unknown to Reeve and Gaskoin; Sowerby and Tryon give it as Australia; Tate and May deny Tasmania, as affirmed by Paetel; Hidalgo rightly cites Geographe Bay. It has not been recorded from Victoria. E. H. Matthews has 5 worn examples from Corny Point.

Dredged in Gulf St. Vincent or Spencer Gulf, 3; one has the articulated cross bands, and sparse large dots along the sides and over the dorsum; a second has the sparse large dots on the sides and dorsum, and the articulated bands on the left base and side, but on the dorsum the middle two bands have their spots joined by narrow brown bars, while the spots of the anterior and posterior bands become blotches, and the whole surface is finely peppered and reticulated brown. Forty miles west of Eucla, in 100 to 116 fathoms, 1 was dredged alive; 80 miles west, in 80 fathoms, 1 alive, and in 100 fathoms, 2 alive, up to 20 mm.; and 90 miles west, in 100 fathoms, 4 alive, the largest 23·5 mm. long without spots of any kind, one 21 mm. with many spots on the thickened outer lip alone, one of 19 mm. with spots scattered sparsely over the dorsum and sides, none on the base or outer lip, one 19 mm. with spots scattered sparsely over the dorsum, sides, and thickened outer lip.

Esperance 3, one with the middle two rows of spots joined by a brown bar and so grading into *C. bicolor*, but with the numerous side dots coming well over the dorsum. Albany 2, up to 21·5 mm. × 12 × 9·5, typical in shape and ornament, with four equidistant cross bands of articulated squarish brown spots, and numerous smaller rounded dots on both sides, crowded towards the base, and becoming more discrete on the dorsum. Another also typical in shape with spots at both margins, also sparsely scattered over the dorsum; but these are nearly obscured by a very fine general brown reticulation, in which are faintly visible four slightly browner cross lines, due to greater thickness of the reticullation at these places.

Ellensbrook beach 16, ranging from 14·5 mm. × 8 × 6·25 to 20 mm. × 11 × 8·5, yellowish-brown. These all have transverse rows of square spots on the dorsum forming four interrupted or articulated narrow bands, of which the front one is often obsolete or absent, less frequently the back one is obsolete. Besides these there are many rather large brown dots, most numerous and deeply coloured on the thickened outer lip, numerous but more discrete on the left side of the shell, extending upwards to the centre of the dorsum. These are mostly roundish and irregularly scattered, but some tend to be squarish, and even to run in transverse lines between the bands of squarish spots. Rottnest (Mrs. Simpson) 2, up to 16·25 mm.

C. pulicaria seems to be the extreme western variant of *C. angustata*, which is the extreme eastern form, while *comptoni* and *piperita* and *bicolor* are most abundant in the middle southern Australian area. *C. angustata* is more common in Tasmania than elsewhere, and becomes gradually scarcer to the west, while *C. pulicaria* is common on the western coast of Western Australia, is rare on its southern coast, becomes very rare further east, and disappears beyond Kangaroo Island. Shaw says *C. pulicaria*, "on account of its narrower and more elongate form and finer teeth, should be regarded as a good species, and not a variety of *C. angustata*." But in well-marked *C. pulicaria* the teeth vary from 22 to 30 in shells of the same size, and in well-marked *C. angustata-comptoni* they may be just as numerous and as fine, and the shape may be as narrow and long in the latter as in the former. The colour ornament in typically shaped *C. pulicaria* also varies from uniform white through all gradations of the flea-bitten dots, and through the articulated bands and very fine pepperings and fine reticulations into *piperita* and *bicolor*, and so through *comptoni* into *declivis* and *angustata*.

Cypraea friendii, Gray.

Cypraea friendii, Gray: Zool. Miscel., 1831, vol. viii., p. 29; Gray: Descrip. Cat. of Shells, Cyp., 1832, p. 5, No. 32; Menke: Moll. Nov.-Holl., 1843, p. 29; Shaw: Proc. Mal. Journ. Lond., 1909, vol. viii., p. 303; Hedley: Journ. Roy. Soc. W. Austr., vol. i., 1916, p. 199.

Cypraea scottii, Broderip: Zool. Journ., vol. v., 1831, p. 330, pl. xiv., figs. 1-3; Sowerby: Conch. Illus., Cat. Cyp., 1837, Sp. 33, fig. 44, 1832; Kiener: Coq. Viv., vol. i., p. 110, No. 99, 1845, pl. xiv., fig. i., 1843; Reeve: Conch. Icon., vol. iii., 1845, pl. iv., fig. 10; Ten. Woods: Proc. Roy. Soc. Tas., 1878 (1877), p. 35; Tryon: Man. Conch., vol. vii., 1885, p. 176, pl. ix., figs. 29, 30; Adcock: Handlist Aq. Moll. S. Austr., p. 5, No. 154; Tate and May: Proc. Linn. Soc. N.S. Wales, vol. xxvi., 1901, p. 445; Sowerby: Thes. Conch. vol. v., 1870, p. 18, No. 54, figs. 47, 48; Shaw: Proc. Mal. Soc., vol. viii., 1909, p. 303 (gives Gaskoin, not Broderip, as the author).

This shell has generally been referred to as *C. scottii*, Brod., but Gray has priority of publication. Broderip gives as the habitat the Strait of Sunda, near Angia, Java, and Kiener the Moluccas; but Sowerby, in 1837, Garden Island, Swan River. Menke in 1843 confirms this in his "Western Coast of New Holland." Reeve cites not only Swan River for the typical shell, but Port Lincoln for his variety B, which is evidently *C. thersites*, Gaskoin. Ten. Woods writes, "In more than one work it is spoken of as Tasmanian, but I cannot find any trace of this species among cellections." So also Tate and May reject it for Tasmania. It was listed by Adcock for South Australia. Mr. E. H. Matthews has a shell from Yorke Peninsula which was regarded as *C. scottii;* it is a somewhat elongated example of *C. thersites*.

I took it on Bunbury beach. Captain Irvine, of Fremantle, told me that several specimens may somtimes be obtained from the piers of the jetty, apparently feeding on the coral-like incrustations. Tate's collection contained 5 examples ranging up to 81 mm. × 40 × 34 mm. from Geographe Bay. At Esperance Captain Douglas gave me 4 individuals said to have been gathered locally. These were much longer, wider, and higher.

Cypraea friendii, Gray, var. **thersites**, Gaskoin.

Cypraea thersites, Gaskoin: Zool. Proc., 1848, p. 90; Angas (Aricia): Proc. Zool. Soc., 1865, p. 170; Sowerby: Thes. Conch., vol. iv., 1870, p. 18, No. 55, pl. viii., figs. 49, 50; Tryon: Man. Conch., vol. vii., 1885, p. 176, pl. ix., figs. 31. 32; Adcock: Handlist Aq. Moll. S. Austr., 1893, p. 5, No. 155; Verco: Trans. Roy. Soc. S. Austr., vol. xxxvi., 1912, p. 209; Hedley: Journ. Roy. Soc. W. Austr., 1916 (1915), p. 200.

Gaskoin's habitat is "Salt Creek, Yorke Peninsula, South Australia, on clusters of zoophytes at 2-3 fathoms." Angas cites this as "the only place where it has hitherto been found." But Reeve's variety B of *C. scottii* from Port Lincoln is almost certainly this species. It has since been taken in numbers at Black Point, Gulf St. Vincent, and in Hardwicke Bay, Spencer Gulf. One was dredged by me full grown at the entrance to American River, Kangaroo Island, and 2 fragments eroded, in 40 fathoms off Beachport; also in the Great Australian Bight, alive, in 72 and 100 fathoms.

When quite young, up to 25 mm. in length, the shell is thin, pyriform, with a depressed exsert spire, and unicoloured yellow, the spire tinged with brown. Then dark brown spots and splashes up to 2 or 3 mm. in size appear over the anterior third or from the spire to the notch. At 30 mm. the colour becomes light purplish-brown, with two obscure yellowish-white transverse bands about 2 mm. wide, with about two-fourths of the shell between them. At 40 mm. the purplish tint is deeper and the spots are still discrete, or the whole dorsum may be clouded with spots of irregular shape and obscure margins running into or superimposed on one another. At 50 mm. the spots may be nearly effaced, and besides the two pale cross bands the indistinct spots may be seen to form obscure interrupted dark mahogany transverse bands. At 65 mm. the shell has grown more globular, being 50 mm. wide and 40 mm. high; it is still very thin; the outer lip is inflected, slightly convex, 14 mm. wide, and edentulous; the dorsum may have about 6 transverse dark rusty mahogany bands. After this the labrum flattens through callous deposits at the latero-labral margin, and teeth appear along the labral edge and the opposite columellar margin. The labral teeth become more valid and extend slightly over the inferior surface. They seem very often to extend to the extreme outer border, but this is an illusion due to blackish-brown rays, which extend from the border, and become narrow as they approach the teeth. These rays are absent from the columellar side, where round or oval spots are found. The teeth on both sides of the aperture are white or nearly so; also the central part of the base as well, but this varies greatly in degree, in some cases the base is almost wholly dark brown. As a rule the bordering latero-basal callus is nearly black. It may extend in varying degrees over the dorsum, and in some examples the whole dorsal surface may be very dark, producing what is popularly known as "the black cowry."

Reeve's variety B of *C. scottii* from Port Lincoln was evidently the form which Gaskoin subsequently described as *C. thersites*. It is now degraded to a varietal position.

C. friendii from Geographe Bay is a much narrower and lower shell than the South Australian *C. thersites*, and might properly be regarded as a different species, but for the Esperance shells, which relatively are broader and higher than the former, but not proportionately so broad and high as the latter.

The relative measurements are as follow :—

Western Australian Shells.

From Geographe Bay :—

1. 81 mm. × 40 × 34 = 100 × 49·4 × 42.
2. 59 mm. × 33 × 26·5 = 100 × 56 × 45.
3. 73 mm. × 41 × 33 = 100 × 56·2 × 45·2.

From Esperance :—

4. 94 mm. × 53 × 40 = 100 × 56·4 × 45·75.
5. 86 mm. × 53 × 40 = 100 × 61 × 46·5.
6. 81 mm. × 50 × 40 = 100 × 63 × 50.

South Australian Shells.

1. 75 mm. × 47 × 38 = 100 × 62·66 × 50·66.
2. 69 mm. × 44 × 35·5 = 100 × 63·77 × 51·3.
3. 80 mm. × 52 × 41·5 = 100 × 65 × 51·9.
4. 76 mm. × 50 × 41 = 100 × 66 × 54.
5. 72 mm. × 50 × 41 = 100 × 69·45 × 56·95.
6. 75 mm. × 55 × 42·5 = 100 × 73·3 × 56·6.

From these data it is plain that there is an uninterrupted gradation between the narrow and low form of *C. friendii* to the broadest and highest example of *C. thersites;* and while the narrowest of the former kind and the broadest of the latter are very unlike, the intermediate examples are too alike to be separable, although the author of the Monograph Cyp, in Thes. Conch., vol. iv., 1870, p. 18, writes in reference to them, "The two . . . although curiously allied, differ so much in proportions that they run no risk of being confounded with each other."

No distinctive feature can be found in the number or character of the *teeth*. The labral teeth in *C. thersites* vary from 23 to 28, and in *C. friendii* from 21 to 28; the columellar from 9 to 15, and from 6 to 13. The *spire* in the Geographe Bay specimens is much longer than in South Australian *C. thersites*, but in the Esperance Bay examples it is intermediate. Looking at the shell from above and behind, the ascending posterior *channel* in the Geographe Bay specimen lies well to the right of the spire, and rising above it turns to the left over the spire, whereas in some of the South Australian shells it ascends directly to, and only to the point of the spire. In other examples, however, it turns to the right of the very short spire, while in one of the Esperance shells it goes directly to its apex. So with the *lateral compression* of the shell base in front and its angular deviation to the right, there is the same gradation. The *width of the aperture* is no diagnostic. This is as narrow in the extreme western form as in the extreme eastern, while in the Esperance specimens it is wider. The base is usually very darkly and completely *coloured* in *C. friendii*, while in *C. thersites* it is generally in large part white; but sometimes it is no more completely or darkly coloured in that than in this. Usually the lateral borders are less *callous*, and less deeply blackish-brown in *C. friendii*, but this is not sufficient to specifically separate them. Their specific identity seems certain.

Cypraea armeniaca, Verco. *Cypraea umbilicata*, Sowerby: var. *armeniaca*, n. v.; Verco: Trans. Roy. Soc. S. Austr., vol. xxxvi., 1912, p. 211; Iredale: Proc. Mal. Journ., vol. xi., parts ii. and iii., 1916, p. 93; Hedley: Journ. Roy. Soc. N.S. Wales, vol. li., (1917) 1918, Suppl., p. M. 70.

Iredale proves the name *C. umbilicata*, Sowerby, to be preoccupied by Dillwyn, and renames it *C. hesitata;* so *C. armeniaca* becomes the species name, and *hesitata* the varietal. Though the latter is found to the east of Australia as far north as New South Wales, and is not very uncommon in Tasmania, yet it has not been taken along the southern coast of Victoria or South Australia, nor in my dredging off this coast up to 300 fathoms. *C. armeniaca* was dredged in the Great Australian Bight, somewhere west of Eucla, and therefore in Western Australian waters.

Cypraea caput serpentis, Linne: Syst. Nat., 1758, p. 720; Hedley: Journ. Roy. Soc. W. Austr., vol. i., 1916 (1915), p. 198; Hedley: Proc. Roy. Soc. N.S. Wales, vol. li, Suppl., 1918, p. M. 70.

This is recorded from New South Wales and Queensland, and has been sent to me from Cape Banks, Byron Bay, and Moreton Bay; from Cambridge Gulf, Broome, Carnarvon, Geraldton, and Pelsart Island. I have taken it at Rottnest Island and at Ellensbrook. It was given to me as from Albany, but I did not find it myself when collecting there, and am disposed to think it does not occur there, nor elsewhere along the southern coast of Australia.

Cypraea vitellus, Linne: Syst. Nat., x., 1758, p. 721; Angas: Proc. Zool. Soc., 1867, p. 205; Brazier: Proc. Zool. Soc., 1872, p. 83; Hedley: Journ. Roy. Soc. W. Austr., 1916 (1915), p. 200.

Menke localizes it on the western shore of New Holland; Angas in Port Jackson, Brazier makes Botany Bay its southern limit; Gross' collection has examples from Moreton Bay and North Queensland; Tate's North-west Australia; and I have taken it at Ellensbrook, south of Cape Naturaliste. Two fine specimens were given to me by a gentleman, who had them given to him at Albany, but this locality is probably incorrect; I found none there.

Cypraea helvola, Linne: Syst. Nat., 1758, p. 724; Brazier: Proc. Zool. Soc., 1872, p. 84; Hedley: Austr. Assocn. Adv. Sci., 1909, p. 362; also Journ. Roy. Soc. W. Austr., 1916 (1915), p. 199.

Brazier records it from Bellinger River beaches, New South Wales; Hedley from Queensland. It has been sent to me from Carnarvon, North-west Australia. Brazier cites it from Rowley Shoals, and I have taken it at Ellensbrook. It has not been found on the southern shores.

Cypraea cribraria, Linne: Syst. Nat., 1767, p. 1178; also Gmelin's Edition, Tom. i., pars. vi., 1789, p. 3414, No. 80; Gray: Zool. Journ., vol. iv., 1828, p. 79; Shirley: Proc. Roy. Soc. Q'land, vol. xxiii., 1911 (1910), p. 99.

Gray gives New Holland as its habitat; Shirley cites Moreton Bay. Ellensbrook, west coast of Western Australia, one beach specimen in good condition, colour slightly faded. Hedley, in Jour. Roy. Soc. W. Austr., vol. i., 1916 (1914-1915), p. 199, records *C. fallax,* Smith, Ann. Mag. Nat. Hist. (5), viii., 1881, p. 441, W. Austr.; Tryon, in Man. Conch. 1885, vol. vii., p. 190, writes:—"*C. fallax,* E. A. Smith, is an unfigured variety, credited to Western Australia. It differs from the normal shell in being larger, more pyriform, white spots smaller and less clearly defined; they appear to blend into the fawn colour of the dorsum, which is paler than in *C. cribraria.*" My shell is rather less than 1·1 inch, the maximum of *C. cribraria* given by Tryon, and less still than my cabinet specimens of this species, which reach 1·25 inch. The relative sizes of my example, and the largest of these are 27 mm. × 16 × 13 and 30 mm. × 18 × 14·5. Its dimensions, therefore, do not suggest *C. fallax,* nor does the colour ornament, for the spots are typically large, and allowing for some fading of the yellow-brown foundation tint are typically distinct. It seems, therefore, to be a typical *C. cribraria.* It has not been found on the southern shore of Australia. .

Trivia australis, Lamarck.

Cypraea australis, Lamarck: Anim. s. Vert., 1822, vol. vii., p. 404; Verco: Trans. Roy. Soc. S. Austr., vol. xxxvi., 1912, p. 215; Hedley: Journ. Roy. Soc. W. Austr., 1916 (1915), p. 200.

It has been taken along the shore of South Australia from MacDonnell Bay to Fowler Bay and on St. Francis Island. It reaches 16 mm. in length, and is well and typically coloured. Dredged off Beachport, 2 in 40 fathoms, up to 11·5 mm., 2 in 110 fathoms, and in 200 fathoms 1 showing colour spots; off Cape Jaffa, in 90 fathoms 1 eroded; off Cape Borda, Kangaroo Island, in 55 fathoms 2 very poor, in 62 fathoms 2 dead, up to 11·5 mm., typically coloured.

In the Great Australian Bight, Federal trawler "Endeavour," 40 miles west of Eucla in 110 to 116 fathoms, 1 recent, translucent, uncoloured; 80 miles west of Eucla in 80 fathoms 2 dead, up to 11 mm., showing colour at the ends; in 81 fathoms 3 recent, coloured on back and ends; 90 miles west of Eucla in 100 fathoms, 1 eroded. Taken on beach at Esperance up to 13·5 mm.; at Albany up to 12 mm.; at Ellensbrook, very many brilliantly coloured; on Rottnest Island up to 11 mm.; Cottesloe beach up to 14 mm.

Trivia globosa, Sowerby. (*Cypraea globosa*, Gray: M.S.S. Descrip. Cat. of Cyp., p. 14, No. 121). Sowerby: Conch. Illus. Cat., Sp. 117, 1837, fig. 34, 1832; Sowerby: Thes. Conch., vol. iv., 1870, p. 47, No. 167, pl. xxxv., figs. 466, 467; Angas: Proc. Zool. Soc., 1871, p. 94; Hedley: Austr. Assoc. Adv. Sci., 1909, p. 362; Shaw: Proc. Mal. Soc., vol. viii., 1909, p. 308.

Dredged by Federal trawler "Endeavour" 40 miles west of Eucla, in Great Australian Bight, in 72 fathoms 1; at 80 miles west in 81 fathoms 1. In King George Sound in 12 to 14 fathoms 3 dead, but in perfect condition, 4 mm., 3 mm., and 2·5 mm. long (Dr. Verco).

Erato bimaculata, Tate

Erato bimaculata, Tate: Adelaide Philos. Soc., 1878, vol. i., p. 88; Tate and May: Proc. Linn. Soc. N.S. Wales, vol. xxvi., 1901, p. 375, pl. xxiii., fig. 6.

Recorded by Tate on the east and west coast of Gulf St. Vincent and on the east coast of Spencer Gulf. Dredged 4 alive in 5 fathoms Gulf St. Vincent; in Backstairs Passage in 17 fathoms 11, in 22 fathoms many dead, 10 quite fresh; off Corny Point, Spencer Gulf, in 30 fathoms 1 dead.

Albany beach 1; off Bunbury, dredged, in 15 fathoms 1 dead; Rottnest Island beach 2, typical (Dr. Verco).

Erato lachryma, Sowerby.

Erato lachryma, Gray: Descrip. Cat., 1832, p. 17; Sowerby: Conch. Illus. Erato, p. 15, Sp. 5, 1837, fig. 48, 1832 (*Lachryma trifasciata*, Humphrey, M.S.S.); Sowerby: Thes. Conch., vol. iii., 1866, p. 82, Sp. 5, figs. 4, 5, 6; Reeve: Conch. Icon., 1865, fig. 9; Tate: Trans. Roy. Soc. S. Austr., 1881, vol. iv., p. 140; Tate and May: Proc. Linn. Soc. N.S. Wales, vol. xxvi., 1901, p. 375; Hedley: Austr. Assoc. Adv. Sci., 1909, p. 362.

Erato denticulata, Pritchard and Gatliff: Proc. Roy. Soc. Vict., vol. xii. (N.S.), 1900, p. 133.

Sowerby's type of 1832 was from New South Wales; in the Thes. Conch. the species was recorded from Japan in 1866. Tate identified it from Fowler Bay (Mrs.

Richards) and Tasmania (Petterd); Pritchard and Gatliff described it as a new species from Victoria; and Hedley listed it for Queensland.

Taken on the beach at Venus Bay, Port Le Hunte, and St. Francis Island, up to 7 mm. long. Dredged dead in Encounter Bay, Backstairs Passage, Gulf St. Vincent and Spencer Gulf, Investigator Strait, from 6 to 22 fathoms, alive in 17, 20, and 22 fathoms Backstairs Passage. Dredged off Beachport in 40 fathoms 4 poor and 3 moderate almost bleached, in 49 fathoms 1 large and quite fresh, in 110 fathoms 13 very poor up to 7 mm., in 150 fathoms 1 very poor, in 200 fathoms 2 poor; off Cape Jaffa in 130 fathoms 2 dead; off Cape Borda in 55 fathoms 33 nearly bleached up to 6·25 mm., 1 dead but fresh; off Neptune Islands in 45 fathoms 3 poor.

Taken on Esperance beach 2; dredged in 35 fathoms off Hopetoun 8 dead; on Albany beach 1; dredged in King George Sound in 12 to 14 fathoms 1 immature dead, and in 35 fathoms 1 broken; on Ellensbrook beach 1 of 7 mm. and 1 of 4·5 mm. in length; on Yallingup beach 6; at Bunbury on the beach 1 of 5·75 mm. length, in 5 fathoms 1 dead, in 22 fathoms 3 dead but fresh (1 immature); Rottnest Island 17 up to 7 mm. long, and typically coloured.

Aborigines of the West Coast of South Australia. Vocabularies and Ethnographical Notes.

By Daisy M. Bates.

(Communicated by J. M. Black).(1)

[Read September 12, 1918.]

The alphabet used to express native words is that of the International Phonetic Association, with slight modifications, and the characters which require explanation are as follow:—

[a] when long [a:] is the English *a* in father; when short the Scottish *a* in "man."
[e] as in "they."
[ɛ] as in bed; when long [ɛ:] as in "there."
[i] as in "pity" [piti]; when long [i:] as in "marine."
[ɔ] as English *o* in "not."
[u] as *oo* in foot; [u:] as in boot.
[ə] as *u* in "turn" or *e* in "wanderer."
[au] and [ai] nearly as *ow* in "now" and *ai* in "aisle."
A long vowel is indicated by the sign [:] placed after it.
[j] = *y* in young. [tj] and [dj] are the sounds heard in English "tune" [tju:n] and "duty" [dju:ti], and must not be confused with English *ch* or *j*, two sounds which are quite unknown in Australian languages.
[ŋ] = *ng* in "singer."
[θ] = *th* in "thin."
[ð] = *th* in "other."
[g] is always pronounced as in "go."

(1) This paper has been entrusted to me by Mrs. Bates, who has been doing philanthropic work among the aborigines at the Wîrilya native camp, near Yalata, and at other places on the West Coast, and has thus had exceptional opportunities for continuing, among natives of South Australia, the valuable observations on language and customs which she has already made with regard to those of Western Australia. My share of the work has been almost wholly confined to transliterating the native words and arranging the vocabulary alphabetically. The language dealt with here is essentially the same as that spoken at Murat Bay, of which I published a short vocabulary in these Transactions, xli., 3-8.—J. M. Black.

The stressed or accented syllable is indicated by the sign ['] placed *before* it, but in order to avoid the necessity of accenting every word, it must be understood that all words which have no mark of stress are accented on the *first* syllable, whether they contain two or more syllables.

Letters and single words in the phonetic alphabet occurring in the ordinary text are placed within square brackets.

Vocabulary of the Wîrongu Language
[wi:rɔŋu wɔŋga].

alindjira, north.
aŋgari, eye-brow.
baba, native dog.
bala, ba'lardu, he she. bala ŋarbi, he is lying down.
bal'djindjir, coachwhip bird.
balgərda, seal.
bandji warlbu, ribs.
bani uldi, come here!
bardjərda, native cat.
barna, long-tailed iguana.
baru, animal food.
bərnbərn bu:lala, bell bird.
bərnda (banda), stone.
bi:larl, pied bell magpie.
bilda, hip; also opossum.
bildabi (contraction of bilda gabi, opossum water), name of a waterhole in the Wookata district.
bi:na, ear.
bi:ra, moon, month.
bi:ri, fingernail.
bi:ria, heat (of sun).
bi:riŋ warlba, sandhill.
birli, water-bearing roots of mallee.
bi:ru bi:run, sacred kingfisher (this is also a sacred bird with the aborigines).
bɔgun bɔgun, bell bird.
bu:ka (bú:ga), stinking.
bu:kabi (contraction of bu:ka gabi, stinking water), name of settlement (Bookabie), about 26 miles from Fowler Bay.
bu:kati, boot (from the English word).
bu:lgara, sandalwood tree.
bu:ndi, species of *Acacia*.
bu:ndja, mouse.
bundjin, white-shafted fantail.

bu:ni, bird's nest.
bu:ŋgara, to smell, to stink.
burgu, fog in the upper air.
bu:rəru, small quail.
bu:ri, white stone; also white man's money.
burli, parrot (in general).
burn burn, fruit of native peach.
dalja, to spit.
dauw, edible gum of walduri, a species of *Acacia*.
djaljir, white cutting flint.
djarda, stomach.
djarda u:ndan (ŋu:ndan), empty stomach.
djarlbu, ant-eater.
dje:gi, edible grub.
djilbi, old, grey-headed man.
dji:da, bird (in general).
djildja, calf of leg.
djildjil, warbler (bird).
djilga'mərda, scorpion.
djilɔŋ, grey bell-magpie.
djina, foot, road, track.
djina'arbil, murderer's slippers.
djina'arda, evil spirit, devil.
djina'mildjarn, instep.
djina'djarda, sole of foot (lit. foot-stomach).
djina'bi:ri, toe-nail.
djindu, sun; also a species of mallee.
djindidji, species of *Myoporum*.
djiŋga, evil spirit; spirit of dead native.
djinti, rump.
djindir-djindir, wagtail, shepherd's companion.
djirbə, restless fly-catcher.
dji:rigi, grub of wattle.
dju:dilu, brush kangaroo.
dju:in dju:in, grey-crowned babbler (bird).
dju:li dju:li, bat.
djuŋgu djuŋgu (δuŋgu δuŋgu), an edible root.
durdur, soft red ochre.
δalbundjir, martin, swallow.
δan δain, female caterpillar-eater (bird).
δɛrba, inside, within.
δu:ban δa, to cover up, bury. ŋaiju δu'banδana, I have covered it up.
δu:gur, to dream; long ago, in "dream" or "ancestral times."
δu:la (du:la), cutting flints of various colours (not white).

δu :lea, little blue penguin.
gabi, water.
gabi ŋal, to drink (lit. to eat water).
garbidji (karbidji), species of wallaby.
garuraŋ, gully.
gibər, gibəra, wild turkey.
gibəra ma ("turkey food"), *Anguillaria dioica* (a small Liliaceous plant).
girgiru, hawk (in general).
gu : balu, club.
gu : dji gu : dji, dust storm.
gu : jana, "native gooseberry."
gu : ma, one.
gu : mba'lɛ : ra, whirlwind, duststorm.
gu : mbu, to urinate.
gu : mbaru, urinating.
gu : na, to void excrement.
gu : nan, elbow.
gu : njaru, thirsty.
gu : ndji, fly; gu : ndji gu : ndji, lots of flies.
gu : rarduŋal, to drink plenty.
gwa, yes.
i : rbil, hail.
jadu, good.
jalgundu, edible grub.
jagala, red mallee.
jailbuiŋ, cloud.
jambadu, far away.
janguna, white cockatoo.
jaŋgu u : ldin, going to sleep.
jara, tooth.
jari, arm.
jau, seagull.
ji : bi, breasts.
jilgi, bed (made of leaves, grass, etc.).
jini, name.
ji : ra, mouth.
ji : rgili, genuine name of Eucla.
joo, bough of a tree.
ju : ldilŋa, genuine name of Ooldea.
ju : jan (nju : jan), spear made from tree root and bartered from the district where it was obtained (north-east of Laverton, W.A.), along the edge of the Nullarbor Plains, towards Penong.
ju : ŋgu, to give.
ju : ri, to hear.
kabulu, kidney.

kadji, spear (in general).
kagal·ŋ (kɔgalɔg), cockatoo (in general).
kagu, white edible root.
kala, fire.
kala'warda, firewood.
kala'djirdjir, black-breasted plover.
'kalaia (kalia), emu.
'kalaia 'malδara, murderer's slippers, made of emu feathers and hairstring.
kalbərdi, to break.
kalbin, mallee hen.
kalda, stumpy-tailed lizard.
kalga, Venus (star).
kalgula, an edible fruit.
kali, boomerang.
kali'gali, bow-legged (lit. boomerang-legged).
kalɔŋ, heat (of fire).
kalɔŋga. burnt.
kandi, gum of sandalwood used to fasten flints on spears, etc.
kandil, ribs.
kanu, frilled lizard.
ka : ŋga, crow.
kaŋgo, shade.
kara, spider; also sandplain.
ka'rambi, an edible fruit.
karar, pearlshell ornament (article and name come from the coast of Western Australia).
kararu, light-coloured people.
karba, to dig.
kardia, myall (*Acacia* sp.).
kardidi, teeth.
kardjul, ankle.
kargala, pig-face (*Mesembryanthemum*).
kargu, yellow pipeclay.
kari, immediately, presently.
karidjal, heel.
karu, teatree (*Melaleuca*).
kata (=wana), woman's digging-stick.
kɔga, head.
kɔga lidja (liδa), sea-shells.
kɔga ŋu : rar, hair of head.
kɔgarara, east.
kɔŋu, mallee, the bark on the roots of which is eaten.
ku : δara (ku : djara), two.
ku : ga, animal food.
ku : lardi, butcher bird.

ku:lgari, fat.
ku:liba, masked wood-swallow.
kumba, fruit of *Solanum* sp.
kundəlu, *Pittosporum phillyraeoides* (tree).
ku:nḍi, club.
kuŋgara, sparrow hawk.
ku:ra, magpie.
ku':rabi (contraction of kura gabi, magpie-water), native name of township near Fowler Bay (Coorabie).
ku'raiŋ (kri:ŋ), long-tailed iguana.
ku'raiŋ gabi, settlement on West Coast (Kooringibbie); name of waterhole in vicinity.
kurdi, native peach tree *(Fusanus acuminatus)*.
kurdu, vein; also hole.
kurda'guδa, crimson-breasted chat.
kurdudu, heart.
kurgu, boobook owl.
kurli (gurli), species of sheoak.
ma, vegetable food.
madji, husband.
maδεri, dark people.
malδulu, tomorrow.
malda, neck.
ma:lu, silvery-grey or white kangaroo.
ma:mu, stillborn baby.
mambulu, saltbush.
maŋiri, throat.
mara, hand.
mara'djarda, palm of hand (lit. hand stomach).
mara'bi:ri, finger-nail.
marailja, sorcerer, medicine man.
mardarba, hard red ochre.
marngu:r, three (also used in the Murchison and Gascoyne areas, Western Australia).
mε:l, eye.
mε:lgalba, eyelash.
mənarn, bittern.
məka, no.
mərdərn (matn), wife.
mərnda, clay, ground.
mi:di, mi:rdi, back.
milbi, shoulders.
mi:rdiŋaŋga, mi:rdi bi:li:, back-bone.
mildjin, skin.
miljiliŋ, parasite on sandalwood *(Loranthus* [?]) with edible fruit.
mindara, an edible fruit.

minja, little, small.
minjiaŋ, miŋari, mindjin, mountain devil (*Moloch horridus*).
minjaru, cold.
miŋga, sick, ill.
mi:rikata, morning star.
mi:riljilji (miljil'ji:ri), superb warbler.
mi:ru (mi:la), spear-thrower.
mɔmbaingin, to sneeze.
mo:gu, edible grub.
mu:di, fish (in general).
mu:dundu, cloud.
mu:ga, voice, speech.
mu-gu, ankle.
mu:la, mu:lδa, nose.
mu:la'mambarn, moustache.
mu:liŋga, mouse.
mu:lδu, red fungus growing on dead sandalwood.
mu:lai'ɔŋu, an edible snake.
mu:ndu, diarrhoea.
mu:nduŋ, covered up with earth.
mu: ŋiri, kidney.
mu:na, head-covering, hat.
mu:na'ardu, heavy, big, strong.
mu:rdi, knee.
mu:rgu, noise.
mu:rliŋa, small lizard.
murŋu iŋgu, evening star.
nala, name of the [kɔŋu] mallee in the Eucla district and totem of a local group who call themselves [nala um] (um is a contraction of [wamu] camp).
nanθa, bad.
naruri, orphaned waterholes and country whose owners are all dead.
njanji'dji:ra, black-faced cuckoo shrike (also black-shouldered kite).
nji:ari, mountain devil (*Moloch horridus*).
njilba, fruit of a creeping plant.
njildi ju:lan, to cry.
nji:mi, lip.
njinagain, to sit down.
nju:di, netted bag of hairstring in which a child is carried.
nju:ri (nju:ni), you.
nju:rilu (nju:nigu), yours.
ŋabarli, fringed lizard.
ŋaiju (ŋaidju), I.

ŋaijugu, my.
ŋa:in, to breathe, to pant.
ŋal, to eat.
ŋalara, our, ours.
ŋaldi, liver.
ŋanana, what?
ŋanana jini, what (is your) name?
ŋanuŋga, what is it?
ŋambu garbil, evil spirit.
ŋana, me.
ŋanba (nanba), belt.
ŋaŋga, bone.
ŋagali, cloud.
ŋaŋi, frog.
ŋarbi, lying down (to sleep).
ŋarnuiŋ, chin.
ŋarga ru:ŋuni, quivering of upper part of body in the dance.
ŋaru, water-bearing roots of mallee.
ŋau, bird's egg.
ŋo:gorn, bird's egg.
ŋu:du, cheek.
ŋu:gu, temple.
ŋu:ldi, tears.
ŋu:ldu, plenty, abundance.
ŋu:lu, skin.
ŋu:lu'bu:nji, frightened.
ŋu:ŋi, bittern.
ŋu:ra, wurley, native hut of boughs and saplings.
ŋu:rar, hair.
ŋu:rar bi:rbarn, hair-cutting.
paldjari, enough.
talin, tongue.
tju:garn, a parsnip-like root.
tjurguin, a small white fruit.
θala, where? θala wen, where are you going?
θamuna, greenish edible mushroom.
θardu ini, go away, go back.
θarndu, whistling eagle.
ulba'reri, south.
undugu, thunder.
undugu woŋgan, a thunderstorm ("thunder talking").
wa, face, forehead.
wadji, yes, true.
waidjirda, bandicoot.
waiərda, opossum.
wailbela, whitefellow (from English word).

wala, angry, sulky.
waldja, eagle or eaglehawk. [waldja] is always the bird who brought the first fresh water to the natives in [δu:gur] or "dream times."
walduldu, cloud.
walga, ground fog; also fruit of small prickly plant (*Solanum* sp.[?]).
walgala, *Pholidia scoparia* (shrub).
walu (walδu), wallaby.
wana, woman's digging-stick.
wanbərdi, cool south-west winds (Eucla).
wanjiri, "native currant."
warda, shrub.
warda δadi, scrub country.
war'dargəna, Boundary Dam.
wardriŋ, wild turkey (ju:lbari dialect).
wardu, wombat.
wari (wɔri), native road leading to the principal permanent waters.
warlba, hill.
warlilja, bandicoot.
warna, sea.
waru, kangaroo (in general).
waru gu:liŋ, kangaroo in pouch.
wɛn, go.
wi:a, mother.
wi:ana, woman.
wi:ba, ant (in general).
widji widji, large ceremonial boomerang.
wi:ldjara, a long time ago.
wi:lu, curlew.
wi:lurara, west.
wi:na, white pipeclay.
wi:naga, wind.
winda, pigeon (in general).
windu, hooked twig for picking out grubs from roots.
wi:nidja, grassbird; also fantail warbler.
wi:ra, sky, clouds.
wirbiŋ, spotted ground-bird.
wi:rɔŋu wɔŋga, the native language given in this vocabulary.
wɔlindji, chest.
wɔmariŋ, spear-thrower, wommera.
wɔŋala, crow.
wɔŋga, speech, language.
wɔŋgan, speak!
wɔŋunu, small seed (nardoo[?]) pounded and made into damper.

Personal Names.

Names are often given from some circumstance attendant on birth, such as [ŋ·ŋgali] "raincloud," given to a girl child. A soft rain was falling when she was born. [dju:ndal] "summer cloud," was also the name of a little girl. Sea clouds hung over the coast and someone drew attention to them. The child's grandmother [kabarli] caught the word mentioned and gave it as a name to the newborn baby. If a bird, animal, insect, etc., is seen near the spot where the child is born, it will receive the name of such object. In the case of boy children their birth-name may be dropped after initiation, when they will be called by the name of the place where their initiation was carried out. A boy initiated in 1913 at a creek called [dji:gala], 16 miles east of Eucla, received the name of the creek. His birth-name was [gu:rardu], his mother's brother's name. Names of men:—[θarnduriŋ] and [θarnduriri], from [θarndu], the whistling eaglehawk; [bi:ra ðu:gur], "dream moon"; [wɔŋala], "crow." Names of dead relatives—grandparents usually—are frequently given to children.

Tribal or Local Group Names.

wi:rɔŋu wɔŋga (from wi:ra, cloud and wɔŋga, speech). Tarcoola Road.

ku:gurda wɔŋga (ku:ga, meat). Ooldea (ju:ldilŋa) area.

ju:lbari wɔŋga (ju:lbari, south). Fowler Bay, Great Bight, and towards Eucla.

jagarga wɔŋga (jaga, woman). Eucla area.

wadi wɔŋga (wadi, man). Near Boundary Dam.

ba:du wɔŋga (ba:du, man). Near Boundary Dam.

wɔŋgai'i: wɔŋga. Boundary Dam area.

ŋalia wɔŋga (ŋalia, our). North of Boundary Dam, in the (Musgrave[?]) ranges.

ŋaða wɔŋga (ŋaða, I, me). Near the wi:rɔŋu(?).

ŋandja wɔŋga (ŋandja, forbidden[?]). North of Boundary Dam area.

marda wɔŋga (marda, yes). Near Western Australian border.

jaga ŋu:ri (jaga, mother[?]). North-west of Ooldea.

bi:dju wɔŋga. Boundary Dam area.

kuŋgu (kundu) wɔŋga (kuŋgu or kundu, woman). North of wɔŋgai'i: wɔŋga.

andingiri. North of ŋalia wɔŋga.

njunŋa wɔŋga. North-west of wadi wɔŋga.

ku:gara wɔŋga. North of wadi wɔŋga.

djidji wɔŋga. West of Boundary Dam.

wanbiri wɔŋga. Boundary Dam area, West.
minma wɔŋga. Boundary Dam area, North.
waia wɔŋga (waia, woman). Boundary Dam area.
warbail wɔŋga (warbail, woman). Boundary Dam area.
mandjindji wɔŋga. West of border and east of Western Australian goldfields.
rabuna (Spencer's "Urabunna"[?]). Near Coward and Hergott Springs (Marree).
jairunda (Spencer's "Arunta"[?]). Towards Oodnadatta (wudnadat).
jul'u:ridja (Spencer's "Luritcha"). Finke River to Lake Amadeus, Northern Territory.

Relationship.

The following terms are used by the [wi:rɔŋu] and [ju:lbari] people, from about Tarcoola to the Western Australian border:—

ŋalara, θarburda, our own family group, who cannot intermarry.
marria, older brother (kurdana in jagaŋu:ri dialect).
baŋanu, younger brother (malaiŋ in jagaŋu:ri).
mama, father and father's brother.
ŋunduna, ŋundjub, wi:a, mother. The two first names appear to be applied to one's own mother.
wi:a, mother's sister.
kaŋgea, older sister (kaŋgəru in jagɛŋu:ri dialect).
bu:jalu, younger sister (malaiŋ in jagaŋu:ri).
wandi, kaδa, son; kaδuna, sons.
wanji, u:ndal, daughter; u:ndalŋa, daughters; also son's wife's sisters.
θamu, paternal and maternal grandfather and grand-uncle.
kabarli, paternal and maternal grandmother; also son's daughter and daughter's daughter; also wife's mother's mother and husband's mother's mother.
bɔgali, paternal and maternal granduncle; also wife's father's father and husband's father's father.
kundili, father's sister.
ka:iŋ, ka:inja, kɔmuru, mother's brother.
mərdərn (matn), own wife.
walidji, wife's sister; also husband's brother.
maruδu, wife's brother; also husband's sister.
ju:mari, u:mari, wife's mother; also husband's father.
ju:mari ka:iŋ, u:mari kɔmuru, wife's father.
madji, husband.
ju:mari wi:a, husband's mother.

gidjara, brother's son (male speaking).
gidjara, sister's son (female speaking).
wanji, u:ndalŋa, sister's daughters (male speaking).
u:ndal ju:mari, son's wife (male speaking).
ju:mari, daughter's husband (female speaking).
iŋgilji, son's wife's mother and father; also daughter's husband's mother and father.
bərda'mi:ra, two brothers who exchange wives with each other.
ŋandara, straight marriage.
njurgarda, wrong marriage (when ŋalara or θarburda intermarry).
bu:liliŋ, pu:lulin, nardugu, betrothed in infancy.
kaia'ni:a, strangers (Eucla district).
wi:**ri**ŋ'ima, strangers (about Ooldea).
kardi, karda, fully initiated man.
kala bu'rai, uninitiated young man (kala, penis).

Other terms for "our own people" are:—
ŋananidja, ŋarumba, ðu:naða, walðaða, ŋanderga.

The term for "great-grandmother" and "great-grandfather" is the same as that for "son" and "daughter." In all tribes I have found that the fourth generation begins thus, and if a fifth generation should arise, with a member of each living, the term for "great-great-grandfather" will be mama, and for "great-great-grandmother" wi:a. The sequence of generations runs thus:—

Daughter, u:ndal.	Son, wandi, kaða.
Mother: wi:a.	Father, mama.
Grandmother, kabarli.	Grandfather, θamu, bɔ**gali.**
Great-grandmother, u:ndal.	Great-grandfather, kaða.
Great-great-grandmother, wi:a.	Great-great-grandfather, mama.
Great-great-great-grandmother, kabarli.	Great-great-great-grandfather, θamu.

I have known two families of four generations—one in the Eucla area and the other in the Nor'-west—and in each family the great-grandmother was called by the name for "daughter."

Several of the relationship terms given above are identical or almost so with those of the Luritcha Tribe recorded in Messrs. Spencer and Gillen's work, "Native Tribes of Central Australia." This tribe is shown in the map (p. 3) as occupying the country between the Finke and its north-west tributaries and Lake Amadeus. [ju'lu:ridja] is the name applied to the Luritcha [lu:ritja] by the [jaga'ŋ**u:ri**].

[jaga] is the Eucla area word for "mother" and is the south-west Australian word for "woman" [jaga, jɔga, jɔg].

Place-names near Eucla.

[ku:lbari], the last male native of Ilgamba Water, properly [ji:lga'amba], name of permanent water at the head of the Bight, stated that, besides Ilgamba, the following were landing-places on the cliffs between Ilgamba and Eucla [ji:rgili]:—

δu:landa (Sponge Cove, about 3 miles west of Ilgamba).
ηo:bərnda.
kardulba or kardu'ulba.
bi:na.
burdin'jɛrba or burdin'gɛrba.
mərdi'e:rəη (about 14 miles east of Eucla).

Fishing for seal [balgərda] and little penguin [δu:lea] took place at certain seasons, the Ilgamba and Eucla natives often joining in these fishing expeditions. Descent was extremely dangerous at some of the landing places; [mərdi'e:rəη] is easy of access and is often visited by the Eucla telegraphists. At [kaldiljɛra], about six miles from Eucla, Eyre noticed the "cutting-flint quarry" on the top of the cliff. The white cutting-flints [djaljir] from [kaldiljɛra] were bartered by the Eucla natives to tribes west and east of them.

Class Systems.

I can find no class system, such as obtains among the Dieri, Urabunna, Luritcha, and other tribes mentioned by Howitt and Spencer and Gillen, amongst these tribes of the West Coast and the tribes of the Border and Eucla areas. The two-class system, similar to that of the Dieri, but with different bird names, obtains in the south-west of Western Australia, and also bears on colours—white cockatoo and crow, light and dark purple. The four-class system obtains amongst the circumcized tribes bordering the south-west of Western Australia and up to West Kimberley; in the north-east Kimberley has a sixteen-class system. Somewhere south-east of Kalgoorlie the four-class system dies out, and as the natives of the south-east areas say, "Marriages and relationships go by faces" (probably light and dark colour). I have not previously visited the south-east Kalgoorlie area, where the class system dies out. It would be interesting to know where Spencer and Gillen's northern class systems stop, and by what system they are replaced. The Eucla area system was one of small totemic groups, and apparently the

West Coast system is somewhat similar; but whatever system obtained on the West Coast in the early days, there is no system whatever at present. Most of the [ju:lbari] people are dead, and the numerous natives at present frequenting the West Coast come from districts far north and east of the Great Western Railway, and, as will be seen by the tribal names, are hopelessly mixed. One man has had as wife a woman, her own mother (his mother-in-law), and his wife's own daughter (by another father). The man became blind, "because he did this thing" the natives say. Cross-cousin, or first-cousin marriages, apparently did not obtain amongst the West Coast tribes. West of Eucla area, near Twilight Cove, I found one tribe where cross-cousin marriages was the law or rule.

Ceremonial Dances.

An interesting circumstance happened during my residence in the camps of the Eucla and West Coast natives, and that was the meeting of two "corroborees," whose starting points were in North-eastern Queensland and North-western Australia respectively. The travels of these two ceremonies occupied many years. Dr. Roth mentions having seen the north-eastern ceremony called [mu:luŋga] in the Diamantina district in 1904 (see Roth's "Bulletin"). The [mu:luŋga] arrived at Penong, on the West Coast, in 1915, taking thus eleven years to travel down from the Diamantina. Shortly before the [mu:luŋga] reached Penong the [wandjiwandji] had arrived from the Nor'-west and had been performed at that place. I have only been able to trace the [wandjiwandji] beyond Laverton, Western Australia, as yet; but I feel sure the ceremony had not its origin there. Most probably it started in the Kimberley area, where I have known the natives to "compose" new dances and send them along certian routes, to be bartered to those to whom they are shown and taught, and who in their turn barter them to other tribes. These two ceremonies represent in their travels a broad V, and, coupled with other circumstances, I assume that there has been a highway along this great distance for many generations. For instance, a turtle (sea turtle) ceremony was composed by an ancestor of one of the Broome district tribes. I saw the "dance" when I was in Broome, and noted the names of certain important objects that played their part in this special "dance." I have discovered that this "dance," with the same names, attached to similar objects, was known to the [ba:du, wadi] and other groups living in the Boundary Dam area. And if I add to this the numerous dialectic words similar in the Boundary Dam and Nor'-west areas, I think it quite possible that the route by which the present dances travelled and are travelling (the [mu:luŋga] is taking the route north-westward now, and the [wandjiwandji] north-eastward) is a very old one, and it also shows that the circumcised tribes—amongst whom only these ceremonies travel—were a horde in themselves, and that they arrived after the uncircumcised aborigines, who were the first-comers. Outside this great V the tribes—certainly of Western Australia and probably of the Eastern States—were uncircumcised, and a most important fact in connection with this is that the circumcised people were gradually encroaching upon and circumcising the tribes outside their borders. I have proved this from Point Malcolm (South Coast, Western Australia) to Ballaballa (beyond Cossack, North-western Australia). Among the groups along the line of demarcation between these two places boys had been given over to the circumcised group adjoining for initiation, but no son of a circumcised father was found to have been given to the uncircumcised tribes for initiation. With the most patient enquiry I could not find one instance of this, but of the other (where the uncircumcised boys are handed over) I found many instances.

When Sir John Forrest made his journey along the South Coast he noticed that the circumcised groups were east of Cape Arid, which was then their western boundary. They have reached Point Malcolm in the years that have passed since that journey was taken. When white settlement first took place at Geraldton, Western Australia (about the fifties), the circumcised tribes were within 20 miles of the coast. When I visited the Geraldton area in 1905 they had reached the coast, but their progress was rendered easy by white settlement. They have, therefore, the whole northern seaboard of Western Australia, down to Ballaballa in the Nor'-west, thence inland until they reach the Murchison area, where they touch the coast at Geraldton; from whence they go inland south-east until Point Malcolm is reached. From Point Malcolm they occupy the southern coast to some point in South Australia or Victoria, whence they again turn inland.

Another most interesting point in this connection is that the Kabi tribes in Queensland, described by the Rev. J. Mathew, have much in common with the south-western (Western Australian) tribes. I fully believe that were these routes followed, which the corroborees are now travelling, much important light would be thrown on the origin of the aborigines, their routes, and their dialects.

I may add that I attended two performances of the [wandjiwandji], each of which lasted a fortnight, there being three performances every twenty-four hours—at 3 p.m., 7 p.m., and when the morning star rose, just before the false dawn. Each ceremony was conducted by a different [bu : nəri] or master of ceremonies—in Eucla by [ku : lea'gara], who brought it from some point south-east from Kalgoorlie; the second was in the West Coast district, the [bu : nəri] of the second being the learner at the Eucla performance. Each of these men had the [kalaia] (emu) as their totem, the [wandjiwandji] being an "emu totem" ceremony. The totemic portion of the ceremony was strictly confined to the men, but at every portion or phase I was present. Unfortunately I was unable to get to the district where the [mu : luŋga] was performed, and so cannot compare it with Dr. Roth's account. The two performances of the [wandjiwandji] showed clearly the remarkably retentive memory of the learners, the songs in both cases were exact in every detail, also the tunes and actions of the performers.

Additions to the Flora of South Australia. No. 14.[1]

By J. M. Black.

[Read October 10, 1918.]

Plates XV. to XVIII.

Many of the specimens dealt with in this paper were collected during an excursion along the Great Northern Railway as far as Marree (Hergott) in October, 1917, and also at Yunta, on the Broken Hill line.

Species believed to be new to science, in the genera *Frankenia*, *Muehlenbeckia*, *Atriplex*, *Acacia*, and *Minuria*, are described and figured.

The following Australian species are recorded for the first time for this State:—*Solanum Oldfieldii*, *Eucalyptus vitellina*, *Stipa eremophila*, *Vittadinia scabra*, *Pimelea ammocharis*.

Alien species are distinguished in the body of the text by an asterisk. Those recorded here for the first time are:—*Mesembryanthemum angulatum*, *Sutherlandia frutescens*.

New records for Professor Tate's districts are enclosed in brackets after the name of the locality.

Juncaginaceae.

Triglochin calcitrapa, Hook. (*T. centrocarpa*, Hook., var. *calcitrapa*, Benth.). Mount Gunson (Mrs. Beckwith).

Gramineae.

Panicum prolutum, F. v. M. Railway reservoir, Hawker (Dist. S). Panicle 12-20 cm. long, lowest branches scattered, central ones verticillate or opposite; spikelets becoming purple.

Stipa eremophila, Reader. Largs Bay; Brighton; Marino; Murray Bridge; Keith; Orroroo; Yunta; Hawker; Murat Bay; Nullarbor Plain. It will be seen that this grass, here recorded for the first time for South Australia, is widely distributed in our State. The type came from Lowan, Western Victoria. Near *S. flavescens*, Labill., it is distinguished by its short ciliate ligule, longer outer glumes (the lower one 15-20 mm. long and 3-nerved, and the upper one 12-14 long and 5-nerved), and larger flowering glume

(8-10 mm. long with the stipes), clothed with rich golden or dark-brown hairs, and usually with a small "neck" or "collar" at the summit, owing to the hairs being much shorter at that spot. The panicle appears to be always embraced at base by the swollen sheath of the uppermost leaf. The northern specimens are slender and about 40 cm. high, with glabrous nodes; those from Keith and the sea-coast are stouter, with pubescent nodes. The determination of the Yunta specimens was kindly confirmed by Mr. J. W. Audas, of the National Herbarium of Victoria.

S. scabra, Lindl., nov. var. **auriculata.** *Variat ligulâ unilateraliter auriculatâ.* Laura; Yunta; Mount Gunson; Minnipa. The orifice of the leaf-sheath has on one side a long erect lobe or auricle, which is continuous with the short ciliate ligule. The lower sheaths are often pubescent with spreading hairs, and the panicle is loose and clasped by the base of the uppermost sheath. It is a less slender grass than the type, and the leaf-blades are always scabrous.

S. setacea, R. Br. Leigh Creek. Stems slender but stiff, to 70 cm. high; ligule short, glabrous; leaf-sheath silky at the orifice.

Calamagrostis aemula, Steud. Yunta (border of Dists. S and M).

Glyceria ramigera, F. v M. Frome River, Marree. Mr. E. H. Russell, the well-known pastoralist, called this "Cane-grass," so apparently that name is applied in our Far North both to *G. ramigera* and *Spinifex paradoxus*.

**Schismus fasciculatus*, Beauv. Yunta.

**Avena fatua*, L. "Wild Oat." Flowering on the plains at Marree in October.

Cyperaceae.

Scirpus pungens, Vahl. Growing round a mound spring, Marree (Dist. C).

Juncaceae.

Juncus pauciflorus, R. Br. Beetaloo; Wirrabara (Dist. N).

Casuarinaceae.

Casuarina lepidophloia, F. v. M. Moolooloo (S. A. White); along Windy Creek, near Leigh Creek (Dist. S). Locally called "Black Oak." Tree about 5 m. high, with dark bark; branches mostly erect-spreading, only a few of the lowest drooping; male trees far exceeding the females in number; sheathing teeth 9-11.

PROTEACEAE.

Hakea leucoptera, R. Br., var. *Kippistiana*. Leigh Creek. Small tree or large shrub; flowers white, not scented.

H. Ednieana, Tate. Leigh Creek.

SANTALACEAE.

Fusanus spicatus, R. Br. Leigh Creek. A small tree 3-4 m. high, locally known as the "Quandong," and much smaller than *F. acuminatus*, R. Br., which is distinguished as the "Native Peach." The leaves of *F. spicatus* are thicker, broader, of a darker green, and the fruit is inedible.

POLYGONACEAE.

Muehlenbeckia coccoloboides, *nov. sp. (tab. xv.). Suffrutex circiter metralis, caulibus ramosis glaucis diffusis flexilibus basi lignosis, foliis lineari-lanceolatis margine recurvis 1-2 cm. longis caducis, floribus dioicis in fasciculos subaphyllos 3-10-floros ad nodis dispositis, bracteis calyptriformibus ocreisque tenerrimis caducissimis, perianthio masculo breviter pedicellato 5 mm. longo octandro, lobis 5 obtusis patentibus tubo paulo longioribus (rarius perianthio sexlobo enneandro), pistilli rudimento minuto, perianthio femineo ovoideo vel globoso carnoso subsessili circiter 3 mm. diametro, lobis 5 (rarius 6) erectis obtusis minutis (vix 1 mm. longis), styli ramis margine crenato-dentatis, stigmate decurrente, staminibus sterilibus connatisque vesiculam simulantibus, perianthio fructifero aucto carnoso ovoideo vel subgloboso plus minus angulato rubro vel rubescente 6-7 mm. longo fructum omnino involvente, nuce trigonâ nigrâ nitente, seminis testâ rubellâ verruculosâ, embryone laterali curvo.*

Lake Blanche; fruiting September, 1916; S. A. White. In the fleshy enlarged fruiting perianth, tipped by the minute lobes and completely enclosing the fruit, this species comes very near to the genus *Coccoloba*, but differs in its habit, which is quite that of *Muehlenbeckia*, in the dioecious flowers, narrow cotyledons, and non-ruminate albumen. It stands nearest to *M. Cunninghamii*, F. v. M., from which it is distinguished by the peculiar female perianth, the flowers in separate clusters and never in spikes, the stigmas not terminal but decurrent on the style-branches, etc.

This interesting desert plant was found by Captain White during the Museum Expedition to Cooper Creek in 1916, but his specimens were only in fruit. The seed germinated readily, and I was able to cultivate several plants in North Adelaide, but they did not produce flowers until June, 1918.

In the original specimens the fruiting perianths were all ovoid, but some of the plants which I grew developed globose perianths.

CHENOPODIACEAE.

Bassia divaricata, (R. Br.) F. v. M. Marree; Nilpena; Leigh Creek. Spines slender, yellow, divaricate, the 2 longest 6-16 mm. long; leaves cylindrical or subcompressed, glaucous, fascicled, broad and persistent at base, hairy in the axil.

B. enchylaenoides, F. v. M. Loxton, Mannum (Dist. M); Gawler Ranges (S. A. White), Yalata (Mrs. D. M. Bates; Dist. W).

B. tricornis, (Benth.) F. v. M. Marree (Dist. C).

Atriplex angulatum, Benth. Marree; Hookina; Hawker. In the large-leaved form the male clusters form an interrupted terminal spike 2-4 cm. long, with a few males accompanying the females in the upper axils; in the small-leaved form there are no spikes, the males accompanying the females in the upper clusters, the fruiting bracteoles are smaller and narrower, and the petioles much shorter. Both these forms seem to be indicated by Bentham, but further investigation may show the advisability of treating them as distinct species. The narrow bracteoles show an approach to *A. leptocarpum*, but the leaves are different.

Atriplex crassipes, *nov. sp. (tab. xvi.). Herba canofarinosa (specimine meo 17 cm. alto), caule ramisque erectis rigidis, foliis ovato-lanceolatis integris 4-8 mm. longis brevissime petiolatis, floribus monoicis, glomerulis confertis axillaribus, masculis in apice brevium ramulorum sitis et aliquot floribus femineis circumdatis, glomerulis inferioribus omnino femineis, bracteolis fructiferis parvis (circiter 2 mm. longis) rhomboideo-subtrilobis reticulatis fere ad medium usque connatis in stipite crasso cylindrico fere aequilongo stantibus semine orbiculari nigro, radiculâ supera.*

Marree (Hergott). Near *A. humile*, F. v. M., but the male flowers are not spicate, the fruiting bracteoles are smaller, distinctly stipitate, and more or less 3-lobed. It is, perhaps, nearer to the small-leaved form of *A. angulatum*, but the bracteoles are differently shaped and the stipes longer and thicker.

Atriplex nummularium, Lindl. "Oldman Saltbush." On plains at Marree and near the bed of the Frome River. The drifting sand often forms small hillocks around each shrub or cluster of shrubs. Fruiting bracteoles sometimes 10 mm. long by 15 mm. broad.

A. halimoides, Lindl., var. *conduplicatum*, F. v. M. et Tate. Marree. Fruiting bracteoles 2-edged in the connate portion then forming 2 spreading erect wings.

A. campanulatum, Benth. Yunta. Nov. var. **adnatum.** *Variat appendiculis bracteolarum linearibus non solum tubo affixis sed etiam usque ad apicem bracteolae anticae adnatis.* —Near Lyndhurst Railway Station; Marree.

Kochia humillima, F. v. M. Carrieton (Dist. N). A very puzzling form of *Kochia* was found at Leigh Creek, with the minute, soft leaves of *K. pyramidata*, but with the broad, flat-topped fruit of *K. villosa*.

Osteocarpum acropterum, F. v. M. et Tate. Marree; Willochra. Leaves green, succulent, plano-convex.

Amarantaceae.

Alternanthera nodiflora, R. Br. Marree.

Aizoaceae.

Gunniopsis zygophylloides, (F. v. M.) Maid. et Betche (*Aizoon zygophylloides*, F. v. M.). Marree. The capsule is 4-lobed and much depressed in the centre of the summit. It begins to open septicidally, but almost at the same time it splits loculicidally also, so that it finally separates into 8 valves. The placentas remain united in the centre, and the lower half of the column, which bears no placentas, is 4-winged, because the lower parts of the septa break away from the valves and remain attached to the central column. The dehiscence is therefore partly septifragal.

**Mesembryanthemum angulatum*, Thunb. Port Lincoln (H. Griffith); swamp near Port Adelaide (H. W. Andrew). South Africa. First record for this State; already recorded for Victoria.

Caryophyllaceae.

Spergularia rubra, Pers. Marree (Dist. C). Small specimens growing at waterhole.

**Herniaria hirsuta*, L. Leigh Creek. After re-examining the specimens in the Tate Herbarium labelled "*H. incana*, Lamk.," and collected on the Murray and in the North, I have no doubt they are the same plant as the above, now widely distributed throughout South Australia, and that *H. incana* should be deleted from our flora until we have better proof of its introduction.

Cruciferae.

Lepidium hyssopifolium, Desv. Waterfall Gully; Findon; Grange Road; Gladstone. Fruits arranged in long racemes.

L. fasciculatum, Thell. Gladstone; Yunta; Renmark; also Broken Hill, New South Wales. Fruits densely clustered at the ends of the branches. Both these species were placed by Bentham in the Fl. Aust. under *L. ruderale*, L., a European and Asiatic species which Dr. Thellung, in his monograph of the genus, considers does not exist in Australia. The determinations were made by Mr. J. H. Maiden.

Stenopetalum sphaerocarpum, F. v. M. Cultivated specimens show that the white petals are, when the circinnate blade is unrolled, quite twice as long as the sepals (4 mm. as against 2 mm.).

S. lineare, R. Br. Mundowdna (Dist. C).

Blennodia canescens, R. Br., var. *pterosperma*, J. M. Black. Parachilna.

Alyssum linifolium, Steph. Marree (Dist. C).

Menkea sphaerocarpa, F. v. M. Waterhole near Marree. Already recorded from Arkaringa.

**Diplotaxis tenuifolia*, DC. Common and growing luxuriantly over 1 m. high in the sandy bed of the Yunta Creek, near the railway. This weed is said to have been introduced here from Port Lincoln some years ago under the mistaken impression that it was a useful fodder plant.

Leguminosae.

Acacia colletioides, A. Cunn. Dublin scrub (Dist. A); Yunta (border of Dists. S. and M).

A. hakeoides, A. Cunn. Dublin (Dist. A; H. Griffith); Halbury, Peterborough (Dist. N); Oodnadatta (Dist. C).

A. Oswaldii, F. v. M. Yunta (border of Dists. S and M).

A. Kempeana, F. v. M. Ooldea (Dist. W; S. A. White). Flowering December, 1917.

A. oxycedrus, Sieb. Between Mount Gambier and Glencoe (E. H. Alcock). Flowering at end of August, 1917. Calyx flat-based and saucer-shaped, hairy, ½ mm. long; petals free nearly to base, smooth and glabrous, 1½ mm. long.

A. brachystachya, Benth. Ooldea (S. A. White).

Acacia rivalis, *nov. sp. (tab. xviii.). Frutex glabrescens 3-4 m. altus in alveo rivi torridi crescens, ramulis angulatis, phyllodiis lineari-lanceolatis plus minus falcatis 4-7 cm. longis circiter 3 mm. latis obscure uninerviis et penninerviis oblique mucronulatis, glandulâ marginali pusillâ paulo infra medium phyllodii sitâ, pedunculis monocephalis solitariis pubescentibus 4-6 mm. longis, capitulis parvis globosis circiter 40-floris, floribus pentameris, calycis membranacei lobis brevibus obtusis pilosis, petalis distinctis uninerviis superne pilosis calyce fere semel longioribus,* *bracteolâ hypocrateriformi, ovario glabro, legumine planiusculo recto vel leviter falcato 7-10 cm. longo 4-5 mm. lato inter semina constricto, seminibus ovato-oblongis longitudinalibus nigris, funiculo longo semel complicato itaque majorem partem seminis circumcingente.*

Growing rather numerously in the bed of a dry creek at the foot of the ranges near Hawker; flowers in bud; fruit almost ripe (October 18, 1917). A specimen was submitted to Mr. J. H. Maiden, the leading authority on Australian Acacias. He agreed that this is probably a new species, and added:—"Its affinity appears to be with *A. leprosa*, Sieb., var. *tenuifolia*, Benth., in the flowers and bracts, and with the narrow forms of *A. stricta*, Willd., in the phyllodes and general appearance, but the flowers and pods are totally different. The pods are a good deal like those of *A. calamifolia* and its allies. Without flowers and pods it could easily be mistaken for *A. aestivalis*, Pritzel, a Western Australian species." *A. rivalis* is certainly well distinguished from any other South Australian species.

Swainsona Burkei, F. v. M. Yunta (border of Dists. S and M). Only one specimen found growing near a small watercourse beside the Broken Hill Railway. Stems prostrate; leaflets 7, grey-villous; standard red with yellow base (drying purple), wings red, shorter than the yellow incurved keel. The 2 longitudinal calli at the base of the standard are much more easily observed when the plant is dried than when it is fresh.

S. campylantha, F. v. M. Near waterhole at Marree. Erect perennial about 30 cm. high; leaflets 3-5; flowers purple; pod not quite ripe, becoming glabrous, 15-23 mm. long at this stage, oblong, swollen, deeply impressed along the upper suture, not really stalked but much contracted towards the base.

Indigofera australis, Willd., var. *minor*, Benth. Hawker (Dist. S).

**Sutherlandia frutescens*, R. Br. "Bladder Senna." A garden escape established near Leigh Creek. Native of South Africa.

**Medicago minima*, L. Numerous at Millicent. A form with the spines short, thick and not hooked, so that it has a very different appearance from the ordinary form which is found in our midland and northern districts. Determined at Kew.

ZYGOPHYLLACEAE.

Zygophyllum prismatothecum, F. v. M. Marree (Dist. C). Leaf-lobes incurved at summit; petals 4, yellow, lanceolate, $2\frac{1}{2}$ mm. long; seeds 2-3 in each cell (not solitary, as stated by Bentham), when soaked exuding a dense mucus and long spiral fibres. The specimen in the Tate Herbarium is from Idracowra, Northern Territory.

Z. crenatum, F. v. M. Mernmerna (Dist. C).

Z. Billardieri, DC., var. *ammophilum*. Farina. Stems procumbent; flowers drooping; petals 4, white, lanceolate, scarcely as long as the sepals; fruit 5-7 mm. long. This form, which is found in many parts of the North and in the Murray district, is the *Z. ammophilum*, F. v. M., except that the stamens number 8 instead of 4. I have only found 4 stamens in one specimen from Edithburgh, Yorke Peninsula. It seems to me to vary too little from the type to be considered a separate species.

Sapindaceae.

Dodonaea microzyga, F. v. M. Windy Creek, near Leigh Creek. A small shrub about 50 cm. high; leaves spreading, leaflets varnished, very sticky; fruits glossy, pink, 15-18 mm. long (with the wings), dissepiments remaining attached to the axis; seeds ovoid-compressed, black.

Malvaceae.

Sida intricata, F. v. M. Hawker; Leigh Creek; Yunta (Dist. S).

Plagianthus glomeratus. Marree; Leigh Creek. The petals, which dry yellow, are described in my field-note as "light green, recurved under the calyx and between its teeth; anthers yellow."

Cienfuegosia hakeifolia, Hook. Hills near Hawker (Miss Reed).

**Modiola caroliniana*, (L.) Don. (*M. multifida*, Moench). Clarendon (H. W. Andrew).

Dilleniaceae.

Hibbertia acicularis, F. v. M., var. *sessiliflora*, J. M. Black. Wirrabara Forest.

Frankeniaceae.

Frankenia, the only genus in this family, is a difficult one, owing to the external resemblance of several of the species and to the variation in the number of floral parts which may be often found on the same plant. Even in the usually regular *F. pauciflora* flowers can be found with 4 calyx-teeth and 4 petals. To the somewhat scanty literature of the genus a valuable contribution has been made this year by Dr. C. H. Ostenfeld in his revision of the Western Australian species (Contributions to Western Australian Botany, ii., 47-55, Dansk Botan. Arkiv, 1918). An effort is here made to do the same work for the species of this State.

KEY TO THE SOUTH AUSTRALIAN SPECIES OF *Frankenia*.

Section *Toichogonia*, Niedenzu. Placentas parietal, each bearing 1 or more ovules; funicles either ascending and the ovule with an inferior micropyle, or deflexed and the ovule with a superior micropyle.

A. Placentas 3, each bearing several ovules, funicles ascending, micropyle inferior.
 a. Leaves petiolate, subcylindrical, almost glabrous; ovules 3-6 to each placenta; diffuse plant, chiefly maritime ... ... *F. pauciflora*
 b. Leaves sessile, linear, ashy; inland plants.
  1. Leaves rather flat, several at the nodes, as long as or shorter than the internodes; ovules 8-9 to each placenta; erect plant ... ... *F. foliosa*
  2. Leaves subcylindrical, few at the nodes, small but much longer than the internodes; ovules about 5 to each placenta; creeping plant ... ... *F. muscosa*

B. Placentas 2-3, each bearing 1-2 ovules; funicles deflexed, micropyle superior; leaves sessile.
 1. Placentas 3, each bearing 2 ovules; leaves ovate-cordate, glabrous and pitted above ... ... *F. cordata*
 2. Placentas 2, each bearing 1, rarely 2 ovules; leaves small, subcylindrical, ashy ... ... *F. fruticulosa*

Section *Basigonia*, Niedenzu. Placentas basal, each bearing 1 ovule on a long funicle, erect in the lower part, deflexed and often twisted in the upper part; micropyle superior.

Placentas 3, rarely 2; leaves petiolate, subcylindrical or ovate and almost flat; hairy plant ... ... *F. serpyllifolia*

Frankenia pauciflora, DC. (pl. xvii.). A diffuse shrub, scarcely 30 cm. high, growing in intricate masses in salt ground, usually near the sea; branches pubescent; leaves subcylindrical, glabrous above but sometimes covered with a white incrustation, midrib usually concealed, but prominent below in transverse section; calyx almost glabrous, 5-6 mm. long by $1\frac{1}{2}$ mm. broad; petals pink, usually 5, rarely 4, free; stamens 6; style-branches 3, stigmas decurrent on one side for $\frac{1}{2}$ or $\frac{3}{4}$ of their length; ovules 3-6 to each placenta.—Patawalonga Creek and sandhills near Glenelg; salt swamps, Port Noarlunga; Port Elliot; Beachport; Robe; Pondalowie Bay (S. A. White); salt lagoon, Dudley Peninsula, K.I.;

Bay of Shoals, K.I. (Tate Herbarium); Lake Torrens (Victorian National Herbarium).

Frankenia foliosa, *nov. sp. (tab. xvii.). Fruticulus cinereus 7-15 cm. altus, caulibus erectis ramisque dense puberulis, foliis sessilibus 3-7 mm. longis late linearibus obtusis margine revolutis sed planiusculis pilis minutis conspersis et crustâ albâ obtectis inferioribus 6-16 ad nodis aggregatis et internodia aequantibus, nervo mediano infra lato prominente, vaginâ ciliolatâ, floribus in cymas densas dichotomas dispositis, calyce ovoideo-oblongo 5 mm. longo 2-2·5 mm. lato, petalis 5 roseis liberis, staminibus 6, styli ramis 3, stigmatibus crassis dimidium ramorum decurrentibus, placentis 3 parietalibus, ovulis 8-9 ad quamque placentam, funiculis ascendentibus, micropyle inferâ, seminibus papillosis.*

Marree; Farina. An erect, dwarf, ashy-grey shrub with bright pink flowers; flowering in October and November.

Frankenia muscosa, *nov. sp. (tab. xvii.). Fruticulus nanus cinereus vel ferrugineus, caulibus ascendentibus saepe ad nodis radicantibus, foliis sessilibus parvis (circiter 3 mm. longis) sed approximatis et internodiis multo longioribus lineari-subcylindricis margine revolutis parce puberulis et crustâ albâ obtectis, nervo mediano prominente, vaginâ ciliolatâ, calyce 5 mm. longo 2·5 mm. lato 5-dentato, petalis 5, staminibus non visis, placentis 3 parietalibus, ovulis circiter 5 ad quamque placentam.*

South Australia. Dalhousie Springs.

Northern Territory. Finke River, between Crown Point and Horseshoe Bend. Captain S. A. White, who collected the specimens at both places in August, 1913, says:—"This little prostrate plant is evidently very rare. It has a moss-like appearance." The condition of the specimens showed that they grew in damp soil. Flowering was over and only one or two withered calyxes remained. The flowers are apparently solitary.

Frankenia cordata, *nov. sp. (tab. xvii.). Fruticulus ramosus, ramis parce pilosis, foliis sessilibus ovatis vel oblongis basi plus minus cordatis margine revolutis 4-6 mm. longis supra glabris punctatis infra puberulis, nervo mediano inconspicuo, vaginâ ciliolatâ, floribus solitariis, calyce 6 mm. longo basin versus in costis piloso superne glabro 5-dentato, petalis 5 apice laceratis potius quam dentatis, staminibus 4-6, styli ramis 3, stigmatibus crassis dimidium ramorum decurrentibus, placentis 3 parietalibus, ovulis 2 ad quamque placentam, funiculis deflexis, micropyle superâ.*

South Australia. Between Everard Range and Wantapella Swamp (S. A. White, August, 1914).

Northern Territory. West of Lake Amadeus (Tate Herbarium; no collector named, but probably W. H. Tietkens in his journey of 1899). Both specimens are very small.

F. fruticulosa, DC. (pl. xvii.). A small maritime shrub with minutely puberubent branches and the straggling character of *F. pauciflora*, but with small sessile often white-incrusted leaves, glabrous above, linear-subcylindrical, 2-4 mm. long; midrib prominent below; sheath ciliate; flowers solitary, usually terminating short branchlets; calyx 3-4 mm. long, 4-5-toothed, petals 4-5, white; stamens 6; placentas 2, parietal; ovules 1, very rarely 2 to each placenta and, where there are 2 ovules, the corresponding style-branch is divided into 2 branches; funicles bent downwards.—Ardrossan, Yorke Peninsula (Tate Herbarium, coll. J. G. O. Tepper); Murat Bay. As regards the identity of this species, see these Transactions, xl., 68, and xli., 49. J. Vesque, in describing the leaf of *F. fruticulosa* (Ann. sci. nat. 6me sér. xv., 125), says:—"Nervure médiane fortement saillante en dessous, formant avec les bords de la feuille deux profondes gouttières." This description applies to the species here dealt with, although it is true that it also fits one or two other species.

F. serpyllifolia, Lindl. (pl. xvi.). Dwarf shrub, in South Australian specimens 15-30 cm. high, with erect branching stems rising from a woody base; branches, leaves, and calyx pubescent or hispid (often almost bristly) with spreading hairs; leaves stalked, 3-7 mm. long, usually much shorter than the internodes, revolute on the margin so as to appear almost linear-cylindrical, or almost flat and ovate or ovate-oblong, midrib inconspicuous below; flowers in loose or compact dichotomous cymes; calyx 5-8 mm. long, 2 mm. broad; petals 5, bright pink, free; stamens 6; style-branches 3; stigmas very shortly decurrent or descending half-way along the branch; placentas 3, basal; ovule 1 to each placenta on a long bent funicle; seeds papillose, 1-2 in capsule. I have examined specimens from the following localities:—

South Australia.—Frome River, near Marree; Hawker; Leigh Creek; Mount Parry; tableland north of Callana, Lake Eyre Basin; sandy soil near Ferdinand River (the last 3 from the Tate Herbarium); east of Everard Range; Murteree, Strzelecki Creek; Innamincka; west of Port Augusta; Eringa, Lindsay Creek (S. A. White); north of Goyder Lagoon (R. Cockburn).

Northern Territory.—Henbury, Finke River (S. A. White).

Queensland.—Roxburgh Downs (F. M. Bailey); Georgina River (E. W. Bick); Diamantina River (F. M. Bailey); Monkira Station, Diamantina River (S. L. Debney); "South-western Queensland" (T. Little); between Stokes Range and Cooper Creek (Dr. Wheeler).

This is the species accepted as *F. pauciflora*, DC., var. *serpyllifolia*, Benth., in the National Herbarium of New South Wales. In the Queensland Herbarium it is sometimes labelled "var. *serpyllifolia*" and sometimes "var. *thymoides*." The only specimen in Australia of the type, collected by Sir Thomas Mitchell on the Nive River, Queensland, and described by Lindley in 1848, appears to be in the National Herbarium of New South Wales. Mr. J. H. Maiden writes:—"Our specimen of the type is merely a fragment glued down on a sheet of paper, and has only about a couple of flowers, which seem to be immature. Mr. Cheel very carefully compared it with the specimen I sent you from the Diamantina River, Queensland, a locality in the same general lie of country as that where the type was originally collected." This is the specimen collected by the late Mr. F. M. Bailey and mentioned above. It belongs to the ovate-leaved, hispid form common in Queensland and in our Far North, and certainly to the section *Basigonia*. The Queensland specimens agree very well with Lindley's short original description (Mitchell, Exped. Trop. Aust., 305):—"Tomentosa hispida, foliis oblongis planis longe ciliatis, floribus solitariis subcapitulatis pentameris, calycibus patentim hispidis."

The species here dealt with is not the same as that described and figured by Dr. Ostenfeld (*l.c.*, 51, fig. 15) as *F. serpyllifolia*. The description and figure are there based on a Western Australian specimen presented by Baron von Mueller to the Berlin Herbarium and named "*F. serpyllifolia*" by W. J. Bray in Engler, Bot. Jahrb., xxiv. (not accessible here). It has (according to Ostenfeld) the ovary of *F. pauciflora* and leaves glabrous on both surfaces. It is true that Bentham made *F. serpyllifolia* a variety of *F. pauciflora* (Fl. Aust., i., 152), but it is noteworthy that he does not mention the number of ovules, although he does so in the case of *F. pauciflora* and of var. *thymoides*. The plant which I have here described must (at least in the form with rolled leaves) be very close to, if not identical with, *F. interioris*, Ostenfeld, *l.c.*, 53, fig. 17.

Var. **eremophila**, *nov. var.* *Variat omnibus foliis lineari-subcylindricis, ramis foliis calycibusque pilis brevissimis obtusis vestitis et plus minus crustâ albâ tectis, nervo mediano infra manifestiore, staminibus 5-6, styli ramis et placentis 2-3.*

South Australia.—Ooldea (Tietkins); head of Great Bight (T. Richards); Euria (Eucla [?], T. Richards); Yalata, near Fowler Bay (R. Tate). A very minutely pubescent greyish desert plant, which should perhaps be considered a distinct species, but the specimens (all from the Tate Herbarium) are small and incomplete.

Thymelaeaceae.

Pimelea ammocharis, F. v. M. Yaninee, Eyre Peninsula (border of Dists. W and L). Received from the local school teacher per E. G. Edquist. Quoted for Central Australia in Tate's Flora, but this appears to be the first record of this beautiful silver-leaved plant in South Australia.

Pimelea curviflora, R. Br., var. *micrantha*, Benth. Hawker (Dist. S); Melrose; Gladstone; Hundred of Pirie; Murray Scrub; Collinswood.

Myrtaceae.

Eucalyptus vitellina, Naud. Road between Mount Gambier and Glencoe. A tree 5-7 m. high, often with drooping branches; bark rough and brown or grey, except on the smaller branches, where it is smooth and light in colour. The glossy leaves vary much in size and shape, are 10-20 cm. long and 12-45 mm. broad, with the lateral nerves often almost parallel with the midnerve, after the manner of *E. pauciflora*, Sieb. Umbels 3-15-flowered, the operculum either almost flat, with a small umbo, as described by Naudin, or hemispherical and umbonate; fruits ovoid-truncate, 7-8 mm. in diameter and 6-7 mm. long, the rim broad and flat. This species, as far as South Australia is concerned, was placed by Bentham (Fl. Aust., iii., 202) under *E. virgata*, Sieb., with the locality "stringybark forests 15 miles north-west of Mount Gambier." It seems to me very probable that this is the same species as was described and figured by the late J. Ednie Brown (For. Fl. S. Austr., part 4) under the name of *E. pauciflora*, Sieb. The localities quoted are Dismal Swamp and Benara Estate. Although *E. pauciflora*, Sieb., and *E. Sieberiana*, F. v. M., are both recorded by Tate for the Mount Gambier district in his Fl. Extra-trop. S. Austr., the Tate Herbarium contains no specimens. There is, however, a specimen labelled "*E. amygdalina*, Labill., Nangwarry Forest and Tarpeena, J. E. Brown and R. Tate," in the Tate Herbarium. This also appears to be the same as my specimens, and some collected later by Mr. E. S. Alcock, on the road from Mount Gambier to Glencoe, which were submitted to Mr. J. H. Maiden and determined by him as

E. vitellina. The fruits of the specimen labelled "*E. amygdalina*" by Tate are a trifle smaller than those gathered between Mount Gambier and Glencoe (about 5 mm. long by 6 mm. diameter at the summit), but otherwise agree with them. All the localities mentioned lie near together, and are in the same class of country. Mr. Maiden considers *E. vitellina* to be a hybrid between *E. pauciflora*, Sieb. (*E. coriacea*, A. Cunn.) and *E. amygdalina*, Labill., which has become more or less fixed.

E. leucoxylon, F. v. M. Wirrabara Forest. "Blue Gum." The typical form, with smooth, white and bluish bark on the stem, is found here, but there are also many trees with similar flowers and fruits, but with a rough black bark. The dark-barked form also occurs at Bordertown, with the point of the operculum much shorter than usual. Maiden (Crit. Rev. Euc., ii., 82) points out that Bentham confused *E. leucoxylon*, F. v. M., with *E. sideroxylon*, A. Cunn. In distinguishing the two species Maiden says that *E. sideroxylon* has the bark "black, furrowed, and rugged." while *E. leucoxylon* has it "whitish or bluish, smooth." It appears, therefore, that we have in South Australia either a form of *E. leucoxylon* closely approaching *E. sideroxylon*, or else the latter species itself.

E. oleosa, F. v. M. Leigh Creek. Here a rather tall tree, with lanceolate black-dotted leaves like those of *E. calycogona*, Turcz., var. *gracilis*, Maid.

Melaleuca glomerata, F. v. M. Leigh Creek. This is a "paperbark teatree," the bark white on the outside, fibrous beneath, and pealing off in thin strips.

Umbelliferae.

Didiscus glaucifolius, F. v. M. Lyndhurst Railway Station. My field-note says, "Flowers white; leaves glaucous." In other northern specimens from Oodnadatta and Strzelecki Creek most of the dried petals are blue, so that probably both colours occur.

Convolvulaceae.

Convolvulus erubescens, Sims. Three forms of this variable species were found at Hawker:—1, limb of corolla pink, rotate, almost or quite lobeless, 15-20 mm. diameter when open; leaves narrow, entire in the upper part and with 2 spreading, emarginate auricles at base. 2, limb pink, 8-10 mm. diameter, spreading-erect, with prominent rounded lobes; leaves narrow, lobed, with lobed auricles at base. 3, limb white, 6-10 mm. diameter, spreading-erect, lobes subacute; leaves broadly ovate-cordate, bluntly lobed all round.

Cressa cretica, L. Marree (Dist. C). Although this species is described as having 2 distinct styles, it has frequently one bifid style, as in the genus *Wilsonia*.

SOLANACEAE.

Solanum oligacanthum, F. v. M. Plain near Marree. Shrub about 40 cm. high; corolla purple, sinus between lobes shallow; petioles of the lowest leaves 5 mm. long, of the uppermost about 1 mm.

S. Oldfieldii, F. v. M. Near Ooldea (B. S. Jobson). First record for South Australia of this species, hitherto found only in the Western State.

S. petrophilum, F. v. M. Woolshed Flat, Warren Gorge (Dist. N); Arno Bay (Dist. L).

MYOPORACEAE.

Eremophila Freelingii, F. v. M. Shrub growing on hillsides at Leigh Creek; flowers lilac, sometimes twin or even 3 in the axil.

E. Sturtii, R. Br. Yunta (Dist. S). Flowers lilac.

RUBIACEAE.

Asperula scoparia, Hook. f. Hawker.

COMPOSITAE.

Erechthites quadridentata, DC. Hawker (Dist. S).

Calotis scabiosifolia, Sond. et F. v. M. Railway reservoir, Hawker. Rayflowers white; pappus-awns 4-5; achenes with narrow, ciliate wings; otherwise as described. Luxuriant specimens reach 30 cm. in height.

Leptorrhynchos pulchellus, F. v. M. Leigh Creek (Dist. S).

Pterigeron adscendens, Benth. Frome River, near Marree.

Minuria rigida, *nov. sp. (tab. xviii.). Fruticulus ramosus ascendens 20-30 cm. altus basi lignosus glaber absque flocculis lanosis axillaribus, foliis ovato-lanceolatis rigidulis acutissimis 5-10 mm. longis, supremis minoribus, involucris terminalibus hemisphaericis 5 mm. longis, bracteis oblongis margine scariosis acumine patente terminatis, floribus radii numerosis pallide lilacinis, disci circiter 30, achaenio radii compresso pilis biuncinatis vestito, pappi setis 15-20 achaenio maturo quadruplo brevioribus, achaenio disci abortivo, pappi setis barbellatis valde inaequalibus, longioribus 6-10 tubum corollae aequantibus cum aliquot brevioribus subpaleaceis alternantibus.*

Near waterholes and on the plains at Marree. Nearest to *M. integerrima*, Benth., but the leaves are broader, more acute (almost acuminate), and more rigid, the involucre larger and the bracts with a spreading point. The axils both of the leaves and branches are usually woolly. The leaves closely resemble those of *Ixiolaena leptolepis*, Benth. The new species differs from all previously described *Minurias* in the very short pappus of the rayflowers. The bristles only equal one-fourth of the ripe achene in length, whereas in the other species they are always longer than and often twice as long as the achene.

Helipterum uniflorum, J. M. Black. Marree. Numbers of the detached woolly fruiting heads were found clinging to the stellate-hairy under-surface of the leaves of *Solanum lacunarium*, F. v. M.

H. microglossum, (F. v. M.) Tate. Hawker.

Vittadinia scabra, DC. Marree. First record for South Australia, although it has already been found in the southern end of the Northern Territory. There is nothing to distinguish this species from forms of *V. australis* with thick, obovate, scabrous leaves except the pubescent ribless achenes.

V. australis, A. Rich., var. *pterochaeta*, F. v. M. Hawker (Miss Read).

**Sonchus asper*, Hill. "Rough Sowthistle." Hawker; Melrose; Keith; Nantabibbie. A stout plant, standing 50-150 cm. high, with prickly leaves. **S. oleraceus*, L., is also common on the plains at Hawker.

**Centaurea melitensis*, L. This weed ("Maltese Cockspur") is very common near Leigh Creek.

**Onopordon acaule*, L. Yunta. Common on the flats subject to inundation from the creek.

DESCRIPTION OF PLATES.

Plate XV.

Muehlenbeckia coccoloboides, n. sp. 1, portion of male plant. 2, portion of female plant. 3, male flower (side view). 4, the same (viewed from above). 5, stamen (front). 6, stamen (back). 7 and 8, female flowers. 9, vertical section of No. 7: *a*, epidermis of perianth; *b*, fleshy layer of perianth; *c*, the connate sterile stamens surrounding the ovary; *d*, wall of ovary; *e*, erect ovule. 10, pistil. 11 and 12, fruiting perianths showing the ovoid and globular forms. 13, vertical section of nut and seed: *f*, pericarp; *g*, warted testa of seed; *h*, albumen; *i*, curved embryo; *j*, base of fruiting perianth. 14, nut. 15, transverse section of seed (lettering as in No. 13). 16, sketch showing habit of plant.

Plate XVI.

Atriplex crassipes, n. sp. 1, female flower. 2, vertical section of same. 3, male flower. 4, fruiting bracteoles and stipes. 5, vertical section of seed. 6, vertical section of No. 4.

Frankenia serpyllifolia, Lindl. 7, flowering branch of broad-leaved form. 8, transverse section of leaf of same. 9, flowering branch of narrow-leaved form. 10, transverse section of leaf of same. 11, pistil. 12, ovary spread open. 13, seed and one valve of capsule.

Plate XVII.

Frankenia pauciflora, DC. 1, pistil. 1*a*, upper part of style branch. 2, ovule and funicle. 3, ovary spread open. 4, transverse section of leaf. 5, seed: *rh*, rhaphe; *h*, hilum. 6, transverse section of seed: *a*, *a*, albumen; *c*, *c*, cotyledons; *rh*, rhaphe.

F. foliosa, n. sp. 7, transverse section of leaf. 8, pistil. 9, vertical section of seed.

F. fruticulosa, DC. 10, transverse section of leaf. 11 and 12, pistils. 13 and 14, ovaries spread open.

F. cordata, n. sp. 15, transverse section of leaf. 16, pistil. 17, calyx. 18, ovary spread open.

F. muscosa, n. sp. 19, pair of leaves. 20, transverse section of leaf.

Plate XVIII.

Minuria rigida, n. sp. 1, disk flower. 2, ripe achene of ray. 3, 2-hooked hair of achene. 4, upper part of style of disk flower.

Acacia rivalis, n. sp. 5, bud. 6, petal. 7, bracteole. 8, seed.

Notes on the Geology of Ardrossan and Neighbourhood.

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[Read October 10, 1918.]

Plates XIX. to XXIX.

CONTENTS.

Introduction.

Ardrossan, situated in the northern portions of Yorke Peninsula, was the first locality in South Australia from which Cambrian fossils were obtained. Mr. J. G. O. Tepper, who was for several years State school teacher at Ardrossan, obtained from the local limestones some trilobite remains as well as examples of fossil "coral" (Archaeocyathinae) in sea-worn pebbles of the same limestone on the beach. These remains Professor Tate referred, tentatively, to the Lower Silurian.(1) The so-called "corals" were handed to Mr. R. Etheridge, of Sydney, for description, who recognized their affinity with the Archaeocyathinae.(2).

Soon after the discovery of these interesting fossils Mr. Tepper published two papers on the geology of the district,(3) including a geological plan and section illustrating the occurrence and succession of the beds that had yielded the remains. These papers, as the work of a pioneer, formed a useful contribution to the subjects and, although subject to correction, indicate careful observation.

Yorke Peninsula contains many points of geological interest. The basement rocks, so far as they are exposed, form fragments of the old Pre-Cambrian peneplain and are representative of the oldest Australian terrain known to us, and although the covering, formed by subsequent deposits on this primordial floor, is patchy and of no great thickness, it carries the records of many strange vicissitudes in its geological history. It was submerged during the latter part of the Cambrian period, following which is a blank, extending through several geological periods, concerning which no records have survived. It was above sea level in Permo-Carboniferous times when a great ice-sheet covered the land, leaving behind it great thicknesses of boulder clay and gritty sandstones that have disappeared by denudation except where protected in the deep-seated valleys of the southern portions of the Peninsula. The Mesozoic Age has left no remains, but a few isolated patches of the older Tertiary marine beds prove that the land was again under sea level in middle Tertiary times, and has apparently been above sea level and subject to subaerial waste from that time to the present.

(1) Trans. Philos. Soc. (Roy. Soc.) S. Austr., vol. ii., p. xxix. (1879); *ibid.*, vol. iii., p. xiii.

(2) Etheridge: Trans. Roy. Soc. S. Austr., vol. xiii., p. 10, with Editorial Note by Tate.

(3) Introduction to Cliffs and Rocks at Ardrossan, Trans. Philos. Soc. (Roy. Soc.) S. Austr., vol. ii., 1879, p. 71, Sketch of Geology and Physical His. of Hund. of Cunningham, *ibid.*, vol. iv., 1882, p. 61.

It is not a region that can be easily mapped in a geological sense. The sediments spread over its surface are relatively thin, when compared with those of a like age in other parts of the country, and have been entirely removed by denudation from many parts of the area, exposing the original Pre-Cambrian floor. Peneplanation has taken place during several successive periods which has reduced the various geological elements to a common level and has spread a covering mantle of sand, clay, and travertine limestone over the whole which effectually hides the underlying rocks from view. What makes the field work of the geologist still more difficult is the absence of eroding streams, prominent land forms, and railway cuttings, so that the only rock sections available are in the sea cliffs or in well sinkings.

Proterozoic.

PRE-CAMBRIAN.

Metamorphic and igneous rocks form the basement rocks of the district (fig. 1). So far as observed they have a north and south strike with a high angle of dip. The exposure of these beds is, for the most part, inconspicuous,

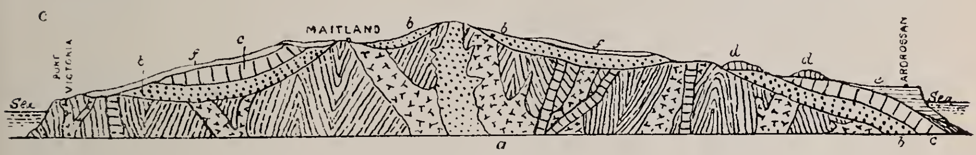

Fig. 1.

Section across Yorke Peninsula from Ardrossan to Port Victoria.

a, Pre-Cambrian Complex; *b*, Upper Cambrian Basal Grits; *c*, Upper Cambrian fossiliferous Limestone; *d*, Outliers of Lower Tertiary (Miocene) fossiliferous marine beds; *e*, Pleistocene Mottled Clay and Sandstone and silicified Grits and Conglomerates; *f*, mantle of soil and nodules of Travertine.—Howchin's "Geology of South Australia."

often occurring on cultivated land, and recognized by surface stones, or proved, at shallow depths, by borings and well sinkings, and it is certain that they cover a much greater extent of country than is represented on the official Geological Map of South Australia. In making the observations in the field, here recorded, no attempt was made to determine the extent of the Pre-Cambrian outcrops, so that the occurrences noted below are the result of casual observations met with in a general survey of the ground.

1. *Ardrossan.* At a mile and a half distance from Ardrossan, in a north-westerly direction, there is an extensive field of Pre-Cambrian outcrops, and includes the old Parara copper mine, which is on the northern side of the

main road to Arthurton. A conspicuous dyke of schorlaceous pegmatite is seen on the opposite side of the road running north and south. The country for some distance on both sides of the valley, and southwards to Dinham's quarries, is a continuous belt of igneous and metamorphic rocks, pegmatites alternating with gabbro and other basic dykes, penetrating micaceous, hornblendic, and schorlaceous schists, the latter being vertical, or nearly so.

(a) In a northerly direction the outcrops were traced through Sections 87 and 88.

(b) A costeen pit situated on, or about, Section 275, on south side of main road, showed talcose and schorlaceous schists to a depth of 4 feet, with a north and south strike, and dip 85° east; flanked on the western side by a strong dyke of pegmatite.

(c) Another costeen pit, situated on, or about, Section 277, 100 yards to the south-east of the preceding, gave a strike north-north-east and south-south-west, the beds being in vertical position.

(d) At old shaft, on Mr. Dinham's land, situated on south side of road, a little west of the Government Reservoir, the surface dumps showed talcose and chloritic schists passing into quartzite.

(e) At the back of Mr. Dinham's house a dyke of gabbro forms the bed of the road.

(f) At Mr. Allison's farmstead, situated on Section 97, a well, at the time of my visit, was being sunk near the district road, which gave the section—20 feet of red clay, 1 foot of coarse quartz grit with fossiliferous nodules from the Tertiary beds, and 4 feet of decomposing mica schist.

(g) Government bore, put down in Section 83, situated 5 miles west of Ardrossan, proved granite after passing through alternations of clay and gravel to a depth of 106 feet.

2. *Hart's Mine.* The mine is situated on the sea cliffs, a little further south than Muloowurtie Point, 8 miles from Ardrossan. The cliffs form a remarkable exposure of Pre-Cambrian rocks, mostly plutonic, and are highly coloured. The rocks are largely felspathic, large portions consisting exclusively of a massive pink felspar, which passes in places into a quartz-felspar rock, the quartz occurring in long crystals sporadically distributed through the felspar, and approaches a graphic granite. Much of the rock is coloured green, probably an epidote-syenite, and is also chloritic, in part. The syenite, in one place, was penetrated by a vein of ilmenite 2 inches in diameter. Crystals and nests of tourmaline occur, and a large rock consisting entirely of actinolite and tremolite lay upon the beach. These basement rocks are

immediately overlain by fossiliferous miocene beds, and many angular fragments of the granite, actinolite, and other of the Pre-Cambrian rocks are caught up into the base of the Tertiary beds forming a breccia of highly contrasted colours. On the north side of the exposure the beds have been greatly disturbed, and a most peculiar rock of flinty character with mammillary structure forms most of the sea cliff. There are also, in the same place, thick layers of ironstone which interpenetrate the granite rock both as sheets and as reticulations through the stone.

On the western side of Hart's mine, a little to the south, the granite is seen on the south road, and can be traced by surface stones into Section 43. The stone is a reddish, felspathic, and microcrystalline granite or granulite. On Mr. Rowe's land (Sections 103 and 104, Muloowurtie), 6 miles to the westward of Hart's mine, the surface of the ploughed land is covered with a similar fine-textured, granulitic granite, and also at the four cross roads that unite Sections 73, 74, 52, and 53 in the same neighbourhood. All these are evidently an extension of the granitic rocks seen on the beach near Hart's mine.

3. *Winulta Creek.* The Pre-Cambrian rocks are extensively developed on the border of the Hundreds of Cunningham and Tiparra, occupying, for the most part, the sides and bottom of the Winulta Valley. The features are chiefly those of a coarse pegmatite with graphic granite, in both coarse and fine varieties, and some schistose rocks. The bottom of the valley, near to the school-house, is occupied by a fine-grained pinkish syenite, which has much the appearance of a pinkish sandstone, with an exposed face that is 12 feet in thickness and 150 yards in length. Quartz veins, and a breccia included in a quartz matrix, were noticed. The rocks are usually much decomposed and in process of disintegration; granitic sand covers the sides of the hills and the valley bottom. The Pre-Cambrian rocks appear to extend for several miles in a westerly direction and, on the rises, are capped by the Cambrian basal grits and conglomerates.

4. *Weetulta.* A Government bore, put down on Section 342, Hundred of Tiparra, 16 miles almost due west of Winulta and 9 miles west of Arthurton, proved the granite, after passing through red clay and indurated gravel, at a depth of 36 feet.

5. *Arthurton.* Situated between Weetulta and Winulta. Mr. Cornish, of Maitland, forwarded to me a sample of rock from this locality which proved to be a fine-grained granite, or granulite, a common type of granite in the Ardrossan district.

6. *Maitland.* The township of Maitland is built on a floor of Pre-Cambrian rocks. Granite is seen in a shallow road-cutting on the eastern side of the township, but is masked at a slightly higher elevation by recent sediments. Two Government bores supply the following sections:—

(a) On the west park lands of the township the bore penetrated clay, limestone, and indurated sandy clay to a depth of 51 feet, when the granite was entered.

(b) Maitland "No. 1 Bore," situated at the north-eastern corner of Section 72, 1½ miles west of Maitland, passed through Recent and Cambrian beds to a depth of 199 feet before the granite was reached.

7. *Yorke Valley, Eastern Ridge.* About 14 miles west of Ardrossan and 2 miles east of Maitland, a low ridge, forming the eastern boundary of Yorke Valley, runs for many miles in a north and south direction. This ridge was examined on both sides of the main east and west road. Going in a northerly direction, by way of Sections 287 and 219, for about 2 miles, mostly over cultivated land, low out-crops and stony patches of the Pre-Cambrian rocks were observed, including pegmatite, graphic granite, felspathic, and schistose rocks. From the inconspicuousness of the out-crops the lie of the beds could not be very definitely determined, but the strike is apparently north and south, and the dip, averaging about 80°, is sometimes east and sometimes west. On the same side of the ridge, but at a lower level, a well was being sunk at the time of my visit in Mr. Wundersitz's yard (Section 214), which showed the following section:—Clay, 25 feet; decomposing mica-schist, 10 feet. This well is situated only slightly below a capping of Cambrian basal grits.

Retracing one's steps to the main road, the ridge was examined on the southern side of that boundary, through Section 212. Granite rocks were seen in patches as far as observations were carried out in that direction, and were of similar types to those seen on the northern side of the main road. From reports of the local residents this eastern ridge of the Yorke Valley carries outcrops of the granitic and metamorphic rocks for many miles.

8. *Yorke Valley, Western Ridge.* The main south road, between Maitland and Yorketown, passes along the Yorke Valley. On the western side of this road there is a low ridge, or scarp, corresponding to that on its eastern side. There is a greater cover of Cambrian rocks on the western ridge than on the eastern, but about 5 miles to the southward of Maitland, in Section 19E, an outcrop of granite was noted. The rock occurs *in situ* as well as in spheroidal lumps and

free stones of a like kind, extending north and south, with the Cambrian basal grits occurring on the rising ground.

9. *Port Victoria.* The township is situated on Spencer Gulf, in the Hundred of Wauraltee, about 14 miles to the south-west of Maitland. There is an extensive development of a Pre-Cambrian complex, on both sides of the jetty, on the beach as well as forming cliffs. The chief rock is a pinkish felsite, passing into syenite, often carrying layers and segregations of epidote; various schists (biotite schist and hornblende schist make strong contrasts of colour with the felsites and syenites), gneissic schist, and spotted schist, the last-named being very common. Close-grained felsitic veins penetrate the mass at all angles, and a gabbro, with coarse crystals of diallage and pinkish felspar, makes a striking feature. No typical granite was seen in outcrop, but one or two large coarse-grained granite boulders occurred on the south side of the jetty, indicating a local outcrop not far distant.

The angle of schistosity is high and the rock commonly weathers into strong ridges. The cliffs, which are of no great height, show vertical folia in relief. The rocks make no surface features beyond the edge of the cliffs, while the country behind is typical of the district, showing a light surface soil with much nodular travertine.

Palaeozoic.

UPPER CAMBRIAN.

Basal Grits and Conglomerates.

These beds may be briefly described as very siliceous, quartzose, gritty, passing into conglomerates, sometimes ferruginous, somewhat open in texture near the surface (probably from the loss of ingredients by weathering), and generally contain rounded or angular fragments of felspar which are weathered to an opaque white. These inclusions are most numerous where there are outcrops of pegmatite in close proximity, as at Wundersitz's quarry, near Maitland, and in the Winulta Creek.

The stratigraphical position of these grits is capable of proof. In several cases they are seen to rest directly upon the Pre-Cambrian rocks. Although in no case, to my knowledge, are their outcrops seen in close conjunction with the Cambrian limestones, yet the Maitland No. 1 Bore shows them interbedded between the Pre-Cambrian granite below and the grey crystalline limestone above, where they have a thickness of 51 feet; and on the western ridge of Yorke Valley the limestones are seen (as surface stones) in close proximity to the basal grits.

The bedding, so far as it can be tested in shallow workings, is approximately level, and the dip, when present, is slight, various, and local. It is the most characteristic formation on high ground throughout the district, but is recognized chiefly by angular stones scattered over the surface of the ground. It forms the principal building stone of the neighbourhood, but the quarries from which it is won are level with the ground. Its material undoubtedly represents the waste of the coarse pegmatites which form the dominant rocks of the crystalline series of the district.

The following outcrops, among others, were noted:—

1. *Dinham's Quarry* (pl. xix.). Situated within 2 miles of Ardrossan, towards the north-west angle of Section 77, behind Mr. Dinham's house. The stone is worked in two quarries that are parallel to each other, each quarry having a face of about 8 feet in height, with the stone dipping into the hill. The dip is south 10° east, at about 15°. The outcrop can be traced along the foot of the hill for at least half a mile to the westward of the quarries, where it passes into scrub country and is replaced by reddish sand, which is probably the decomposed remnants of the same rock. About one-eighth of a mile to the west of Dinham's quarries a small exposure of the rock is seen in a trial pit, and here the beds are apparently level.

The rock is bedded but differs greatly in the size of grain within short distances, from a fine siliceous sandstone to small gravel. The stone is much jointed, but no quartz veins were noticed. A thin slate-band occurs in one part of the quarry. Near the eastern end of the southern quarry there is a brecciated dyke which penetrates the bedding at right angles, caused by two parallel faults with displacement between the walls, which are smooth, and the pseudo-dyke is made up of broken fragments of the bed rock cemented together. The dyke has a thickness of 18 inches near the top, but widens in its downward extension. The quarrymen have left this dyke standing whilst removing the stone from either side, so that it projects 9 feet from the face of the wall of the quarry, and can be traced at surface for a distance of 32 yards.

On the northern side of the quarries the igneous and schistose rocks of the Pre-Cambrian, with discordant dip and strike, are seen to outcrop and come close up to the grits, the angular fragments of each class of rock blending in great numbers at the line of junction, but the intrusive rocks do not penetrate the grits. The rise at the back of the quarries is covered by fossiliferous Miocene cherts and travertine. The Cambrian limestones outcrop in a position $1\frac{1}{2}$ miles to the southward, in the same direction as the dip seen in Dinham's quarry, and therefore should bring the grits below the limestones.

2. *Cane's Quarry.* Situated 3½ miles north of Ardrossan, in the north-west angle of Section 95 (Hundred of Cunningham). The quarry, which is worked for building stone, is on a low ridge that crosses the east and west district road from Tiddy Widdy. The outcrops can be seen on both sides of the road, and covering these, at a slightly higher level on the western side, the ground is strewn with nodular travertine. The quarry stone is very siliceous, variable in the grain, regularly bedded, sometimes cross-bedded, more or less laminated, especially near the surface. It is roughly jointed in vertical or slightly oblique directions. The exposed quarry face measures 10 feet in height and the bedding has a dip to north-east at 15°.

3. *Whittaker's Quarry.* This is situated 4 miles in a direct line to the north-west of the preceding example, in Section 151, on the northern side of the east and west district road and nearly opposite Mr. Whittaker's house, which was built from this quarry. The outcrop is on a slight rise in the ground. The stone exposed in the quarry is 5 feet in thickness, whitish in colour, and of a gritty texture, including fragments of felspar. No dip could be recognized.

4. *Winulta Creek.* There is a great development of the Cambrian basal grits on the borders of the Hundreds of Cunningham and Tiparra, the most extensive seen in the district. The Winulta Creek is a wide, open waterway, with the Pre-Cambrian rocks forming the floor and lower slopes, on either side, and the Cambrian grits forming cappings on the higher ground. On the southern side of the valley, not far from the public school, and about 30 feet from the bottom of the valley, a quarry (Short's) shows coarse grit passing into conglomerates having a 3-feet face of stone. Angular surface stones, of the same kind, mixed with travertine can be traced to the top of the rise.

On the north side of the valley, at the same place, a prominent spur marks a strong outcrop of the beds on that side, estimated to be 50 feet in thickness. Conglomerates are interbedded with the grits (pl. xx.). Almost all the included stones consist of quartz, which are rounded and reach a maximum size of hen's eggs. There is only a small proportion of cement between the stones, which, however, is strong. The beds continue as a capping to the ridge for a considerable distance and produce some very broken and rough ground. A very large block on the summit gives a dip of 20° to the south-south-west, but I doubt whether this is true dip, and may have arisen from a slide, or otherwise an uneven floor on which deposition took place.

The same remarkable conglomerate is seen on the next spur of the hills, about half a mile to the north-west, where it is of considerable thickness and makes a very rough and broken outcrop. Further up the rise is a quarry (also Short's) which is about 120 feet above the creek level. The stone is a gritty sandstone similar to that on the southern side of the valley, containing much felspathic material, and the dip in this quarry is apparently in the form of a shallow syncline. The stone used in the building of the Winulta school-house was obtained from the two quarries referred to.

The unconformity between the Pre-Cambrian complex and the overlying Cambrian grits in this neighbourhood is very distinct.

5. *East of Winulta.* The basal grits show again on the north and south road that divides the Hundreds of Tiparra and Clinton. At a point, little more than a mile to the northward of the south-east angle of the Hundred of Tiparra, the beds outcrop, close to the road, on Section 356.

6. *Weetulta.* A Government bore put down on Section 342 (Tiparra), situated about 16 miles to the westward of Winulta, gave the following section:—

	ft.	in.
Surface soil and limestone ...	4	0
Red clay	16	6
Indurated gravel (basal grits)	15	6
Granite	76	9 (not bottomed)

7. *Three miles west of Ardrossan, on the Maitland Road.* The basal grits outcrop in Sections 41 and 80 where they cross the Maitland road as a low ridge in a north-east and south-west direction. The outcrop is almost even with the surface of the ground, covers a wide area, and exposes stones of large size. The adjacent land carries a light soil more or less strewn with nodules of travertine limestone.

8. *Wundersitz's Quarry.* This is a well-known quarry, situated on the western flanks of the Yorke Valley (eastern) ridge, 14 miles west of Ardrossan and 2 miles east of Maitland. It is within about 200 yards of the well sunk in mica-schist (mentioned on page 190) near Mr. Wundersitz's house. The quarry has a wall-face of about 10 feet in height, and the beds have a gentle roll with a slight dip to the west. The stone is usually coarse and gritty with a considerable quantity of fragmental felspar, which sometimes gives colour to the stone, which is white to reddish. The grit is said to rest on a reddish, sandy, and kaolinized clay, which has been proved by boring to be at least 6 feet in thickness. This

clay is probably the decomposed covering which formed the Pre-Cambrian floor on which the basal grits were laid down.

9. *Maitland.* The Maitland No. 1 Bore, put down about a mile from the township on its western side, proved the basal grits at that place to have a thickness of 51 feet (see page 202).

10. *Yorke Valley, Western Ridge.* About 5 to 6 miles to the southward of Maitland there is an interesting series of outcrops of the Cambrian rocks along this ridge. The top of the ridge shows outcrops of the basal grits which have been quarried for building stones in Section 16 (Hundred of Maitland) and other places. It was followed in a continuous outcrop through the properties of Messrs. William Greenslade, Joseph Kelly, and A. W. Jarrett, in Sections 1, 16, 19W, 19E, etc. Within the area mentioned the granite is seen to underlie the grits on the one side, and the Cambrian limestones to overlie them on the other.

11. *Henderson's Quarry.* I am indebted to the Rev. J. R. Andrew for the information that a quarry (owned by Mr. Henderson), in the basal grits, occurs on the north side of Section 53, Hundred of Muloowurtie, about 3 miles due west from Rogues Point. The Pre-Cambrian igneous rocks occur a little to the south of this quarry.

12. *Port Hughes.* In October, 1905, a visit was paid to Port Hughes, near Moonta, where the basal grits of the Cambrian series were seen to outcrop on the beach, and the following observations were made. The beds consist of coarse conglomerates and silicious gritty quartzites. The included pebbles consist almost entirely of quartz, much worn and rounded, and the beds generally closely resemble the basal grits as they occur at Winulta Creek. In certain zones the rock has been much fractured and the cracks subsequently filled with quartz, forming veins that intersect the matrix and pebbles without distinction. (Dip N. 20° W. at 12°).(4)

Limestones.

The Cambrian limestones (in common with the other geological outcrops) of Yorke Peninsula make no very prominent features in the landscape and give only limited sections at the surface; it is, therefore, somewhat difficult to obtain an unquestionable order of succession for the respective members of the series. This defect is, in part,

(4) For further geological information on this part of Yorke Peninsula see the comprehensive and detailed descriptions given by the Assistant Government Geologist (Mr. R. Lockhart Jack) in The Geology of the Moonta and Wallaroo Mining District, Bull. No. 6, Department of Mines, 1917.

met by Government borings in the district which will be described below.

On the evidences obtained the limestones may be classed under three divisions:—

Upper — Dark-coloured, impure, pteropod-trilobite limestones.

Middle — White, yellow, and pinkish marbles (Archaeocyathine marbles in part).

Lower — White and yellow granular-crystalline Dolomites.

The following are brief descriptions of all the exposures of these beds which have come under my notice in the neighbourhood:—

UPPER AND MIDDLE (FOSSILIFEROUS) BEDS.

1. *Horse Gully.* The most complete and interesting section of the Cambrian limestones within the district occurs at Horse (or Pavey) Gully, situated a little to the southward of Parara Head Station and 3 miles southward of Ardrossan. It forms the deepest eroded valley in the district, with sloping sides and rocky terraces, that have a maximum height of about 200 feet. The gully, in its exit to the sea and lower portions, possesses clay banks, and these continue in an upstream direction for about a quarter of a mile to the westward of the main road, beyond which the limestones make a sudden appearance in the floor and sides of the valley. The gully intersects the limestones, in an east and west direction, for about a mile and a half. The beds roll by slight synclinal and anticlinal curves, at an average angle of about 12°, which increases somewhat as the beds pass eastwards before their disappearance below sea-level. The stronger beds make small scarp-faces on the sides of the valley, and in the case of one such prominent outcrop that encircles an isolated hill near its summit, there is a striking resemblance to a monk's tonsure. This feature illustrates the approximate horizontality of the beds.

The best section occurs soon after the appearance of the limestones in the lower part of the valley, where an anticline brings into view a great thickness of beds, and the following order can be observed on the northern side of the valley:—

	Thickness in feet.
(a) At the summit is a capping of Tertiary chert, crowded with the casts of *Turritella aldingae*, forming a hill that is conspicuous from its conical form and growth of sheaoaks	50

Unconformity.

(b)	An ironstone layer on top of Cambrian limestone, probably metasomatic	1
(c)	Bluish, somewhat earthy, pteropod limestone, containing numerous small pteropods and fragments of trilobites, which weather in relief ...	30
(d)	Rubbly impure limestone; the included earthy material weathers in relief, fossils scarce ...	40
(e)	Hard siliceous limestone with impurities, fossils scarce	15
(f)	White and yellow crypto-crystalline, marble-like rock, has a clean and smooth fracture, no fossils observed at this spot (lowest bed exposed)	50
		186

In ascending the gully the siliceous and marble-like limestones, shown in the lower portions of the above section, continue to occupy the bottom of the valley and contain, sparingly, small brachiopod and molluscan remains. The limestone is sometimes laminated and pseudo-brecciated. The Archaeocyathinae make their appearance near the head of the gully, where the valley opens out before reaching the north and south district road that makes the western boundary of Section 22, a little east of the phosphate mine. The fossiliferous beds are in outcrop on the hillsides, and also in patches on cultivated land, where the stones collected from the ploughed land are gathered into heaps and make good hunting ground for fossils. The stone carrying the Archaeocyathinae is a whitish and pinkish marble which has a freer fracture than the bluish pteropod limestone, and weathers to a smooth surface. With the exception of scattered sponge spicules, which sometimes appear in relief on the weathered surfaces, no fossils other than the Archaeocyathinae were found in the limestone. Lithologically, the matrix bears a close resemblance to the marble-like rock that forms the lowest member *(f)* of the series shown in the section given above, and in which no fossils were observed. They may possibly be on the same horizon. The western outcrop, so far as could be judged, forms the axis of an anticline, as is the case with the beds referred to in the detailed section. The Archaeocyathinae have a very local development, and in many cases the fossils merge into indistinctness, as though in course of absorption into the structureless matrix. It is possible that this process of absorption of fossiliferous structures has been effectively carried out in the case of the similar marble-like limestone lower down the gully, and accounts for its nonfossiliferous condition. Associated with the Archaeocyathinae limestones are layers and nodules of cherts of various colours—reddish, greenish, dark coloured, etc.

2. *Pebbles on Beach at Ardrossan.* One of the most remarkable features of the district is the occurrence of sea-worn pebbles of the fossiliferous Cambrian limestones that are strewn along the beach over a length of several miles. They occur mostly on the southern side of the jetty and for a distance of half a mile from the latter; the pebbles have been mainly derived from the grey and pinkish marbles that contain the remains of the Archaeocyathinae. The homogeneous nature of the rock causes it to wear with a smooth surface that shows up the structure of the included fossils to perfection. It was here that the occurrence of the Archaeocyathinae in our older rocks first attracted attention in South Australia. On a stony spit, exposed at low water, about three-quarters of a mile to the southward of the Ardrossan jetty, the stones are of a more earthy kind, having been derived from the pteropod-trilobite limestones that overlie the grey and yellow marbles. Unlike the Archaeocyathinae pebbles the former are deeply etched by the action of the sea water, and consequently present a very rough surface with the impurities in the limestone, as well as the fossils, standing out in strong relief. It is a curious feature that while the upper surfaces of these pebbles are deeply incised, the undersides, that have been sunken in the sand, are relatively smooth. At Parara, 2 miles to the southward of Ardrossan, there is a clay platform, uncovered at low water, that extends for a mile out to sea. Here again there are stony spits of shingle, resting on the clay floor, among which are numerous angular stones of Cambrian limestone, including the crystalline varieties as well as the impure bluish pteropod limestones, some examples of which measured 2 feet in diameter.

The origin of these fossiliferous beach stones raises an interesting question. To account for their presence on the beach one or two explanations appear to be possible:—*(a)* River transport, or *(b)* outcrops of Cambrian limestones below sea level but within the limits of wave action. In support of the first of these suggestions, the parent rock is in the neighbourhood, and, under ordinary circumstances, their presence on the beach could be easily explained by stream erosion carrying the land waste to the sea; but such a transporting force has no existence in the neighbourhood at the present time. Horse Gully is the deepest and longest gully in the locality, and has undoubtedly been excavated by running water, and further, it is equally certain that the transported material in the excavation of the gully must have found its way into the valley of the gulf. If the stones on the beach came from the head of this gully, where a similar rock is *in situ*, then the questions arise, When did this transport take place? and, Why is not a similar agency in operation at the present time?

At the present time there are no permanent streams on Yorke Peninsula and practically no land drainage reaches the sea. Horse Gully is grass grown, and at its mouth the only evidence of stream transportation is in the form of a narrow band, about 2 feet in width, containing small stones of less size than marbles, whilst the rest of the bottom is covered with grass. On the testimony of the oldest residents, covering fifty years of experience, there has never been sufficient water in the gully to transport the smallest stones within their knowledge. The Archaeocyathinae pebbles on the beach are usually from 6 to 9 inches in diameter, with larger stones of the impure variety, which would require a considerable body of water for transport.

The possibility of the pebbles having been derived from rocky reefs through wave action is at present incapable of proof. The sea cliffs consist of clay of unknown thickness, and no investigations for testing the presence of such reefs have been carried out along the littoral and shallow margins. The more plausible suggestion seems to be that of stream erosion and delivery at some past time, and the present relatively dry condition of Horse Gully, and others of a like kind in the neighbourhood, may arise from underground channels and caves in the limestones by which the existing drainage finds a passage downwards instead of to the sea.

3. *Dowlingville.* At Thompson's Hut, Section 128 (Hundred of Cunningham) strong exposures of Cambrian limestone occur in the bottom and sides of a shallow creek, close to the main road, near Dowlingville. The outcrop measures 160 yards in length by 40 yards in width; strike, north-north-west to south-south-east; dip, 25° easterly. The stone is a dark, bluish-grey limestone, exactly corresponding to the fossiliferous beds of Horse Gully, and is sparingly fossiliferous; the only other example than that of Horse Gully of a fossiliferous Cambrian limestone within the area under observation. Little time could be devoted to fossil hunting, but several fragments of trilobites were detected in the stone. The rise on the southern side of the valley, under which the limestone passes, is thickly strewn with travertine.

LOWER LIMESTONE (DOLOMITIC).

The lowest member of the Cambrian limestones in the neighbourhood of Ardrossan is a finely granular, white or yellowish dolomitic rock. Its position in the series is defined by the Maitland No. 1 Bore (see page 202), and from the following analysis, kindly undertaken by Mr. W. S. Chapman, of the Adelaide School of Mines, it is shown to be a true dolomite:—

	Per cent.
Insoluble matter	0·88
Ferric oxide	0·67
Alumina	0·45
Calcium carbonate	54·10
Magnesium carbonate	43·51
	99·61

This is the most widely distributed member of the Cambrian limestones throughout the district (the newer beds having aparently been removed by denudation), and preserves a general uniformity of chemical and physical characteristics in all its exposures. The following are the chief localities where its outcrops can be seen:—

1. *Eastern Scarp of Coastal Ridge.* A low range with its scarp facing the sea is continuous from Horse Gully to Ardrossan. The dolomitic rock rises from beneath the marble on the northern side of Horse Gully, and has been quarried on Cliff's farm (formerly Mrs. Naughton's land), almost in a direct line with Parara Head Station. It is here a white, crystalline dolomite, with a dip west at 38°, and a little further to the westward the dip changes to the southwest at 19°. Excellent exposures are seen in a small transverse gully, about half a mile to the northward of the quarry just referred to, where the stone is a yellowish, granular dolomite (penetrated by ferro-manganese stains), with a dip of 35° facing 40° east of south. In the next gully, a little further to the northward, the beds have a south-westerly dip at 30°, and continue in outcrop along the slopes of the ridge, until they cross the Maitland road, and disappear from sight on the western side of the Ardrossan Cemetery.

2. *Rogues Gully.* Situated 2½ miles to the southward of Horse Gully and about 6 miles from Ardrossan. Deep gullies, now permanently dry, have been excavated in the dolomite beds, but as the country is covered by dense scrub it is unfavourable for geological observations. The hillsides are covered with surface rubble, but no large faces of stone are exposed, and consequently no reading of dip could be taken. The stone is saccharoidal in texture, grey or yellowish in colour, and at surface often soft through partial decomposition. The base of the beds is not exposed, but as they occupy the whole of the main and lateral gullies to the top of the adjoining heights, their thickness is estimated at not less than 100 feet.

3. *"Sliding Rocks"* (pl. xxi.). These rocks occur as an isolated exposure on the beach, $1\frac{1}{2}$ miles to the southward of Rogues Point (at the outlet of Rogues Gully), and a little to the north of Muloowurtie Point, in Section 49. The rocks make a bold ridge, 20 feet in thickness, with a strike almost due north and south and a dip east, 10° south, at 40°. The beach at this spot is narrow, and the Cambrian beds are overlain in the cliff face by horizontal strata of soft decomposing fossiliferous (Miocene) sandstones and arenaceous clays. The isolated character of the outcrop, the tabular form of the bedding, and the high dip of the beds as they pass below sea level have given rise to the descriptive name by which they are known as "sliding rocks." The beds are characteristic of the lower or granular-crystalline (dolomitic) portion of the Cambrian series.

4. *Montgomery's.* This area is situated 14 miles to the northward of Ardrossan, near the boundaries of the Hundreds of Cunningham and Clinton. A ridge of the Cambrian dolomites extends from Mr. Montgomery's farmstead (Section 172) northwards, through Section 182, into the Hundred of Clinton, and is said to occur at intervals in that direction for a good many miles. It was also traced in a westward direction, across the public road and in rises, still further to the west, in Section 173, giving a breadth of three-quarters of a mile.

In driving over the paddocks in a north-westerly direction the ground was spotted by numerous "swallows" (saucer shaped) with "crab holes," down which the water is said to rush freely in wet weather, a certain evidence of underlying limestones. If these "swallows" mark the presence of the Cambrian limestone it must have a breadth of not less than 2 miles over that country.

The stone, for the most part, is buff coloured and saccharoidal in texture, containing numerous cavities lined with crystals. It is much broken by joint planes, which are coated of a black colour, probably caused by a thin film of manganese oxide.

Over this extensive area no section could be seen sufficiently exposed to show the dip of the beds. The outcrops are marked either by flat, tabular patches, or otherwise by loose surface fragments. In Mr. Montgomery's yard, near the junction of roads (Section 172s), there is a limekiln that has been excavated in the beds and exposes about 4 feet of rock. So far as could be judged from this limited section the beds have a slight dip to the north-west.

5. *Yorke Valley.* The main road from Maitland to Yorketown follows this valley bordered by low ridges on

either side. The western ridge for several miles shows outcrops of the Pre-Cambrian basement and the Cambrian basal grits (see pages 190 and 195). At 6 miles from Maitland, in passing from Section 16 to Section 1 (Hundred of Maitland), a great change of surface features and soil occurs. In the first-named section there is little or no travertine visible, but a reddish, gritty soil, resulting from the breaking down of the basal grits; while in the latter section the ground is strewn with concretionary travertine, accompanied by a light and soft soil. On the northern side of Section 1, near Urania Head Station, evidences of the Cambrian limestone occur in the form of surface stones, often carrying a crust of travertine limestone. These are most numerous on the ground skirting the eastern side of the range, and in places are brought to the surface by the burrowing of rabbits. The rock is a characteristic brownish and yellowish saccharoidal dolomite, which apparently overlies the basal grits that outcrop along its borders.

6. *Maitland No. 1 Bore.* This bore was put down by the Government at the northern end of Section 72E, situated a little more than a mile to the westward of the township. The following is the official record of the beds passed through:—

	Thickness of strata. ft.	in.	Depth from surface. ft.	in.
Cainozoic—				
Surface soil red loam	3	6	3	6
Clay and limestone	32	0	35	6
Palaeozoic—				
Grey crystalline limestone	74	6	110	0
Grey crystalline limestone, with bands of light-blue micaceous clay rock ...	12	6	122	6
Grey crystalline limestone	5	6	128	0
Red argillaceous rock, with few specks of mica	20	0	148	0
Red crystalline limestone (see below) intermixed with quartz and felspar	51	0	199	0
Archaean—				
Red granite	41	0	240	0
Gneiss and granite	26	0	266	0

By the courtesy of the officer in charge I was permitted to examine the samples from this bore in the Engineer-in-Chief's Department, when it was found that "grey crystalline limestone," recorded from the depths 35 feet 6 inches to 128 feet (=92 feet 6 inches) represented the dolomite or lowest member of the Cambrian limestone series; the "red argillaceous rock" was a typical form of the purple slates series; while the so-called "red crystalline limestone, intermixed with quartz and felspar," contained *no limestone*, but was a typical example of the coarse basal grits found throughout the district as the lowest member of the Cambrian System.

This bore supplies important information on the geology of the district which is not otherwise available. Not only does it prove the existence of Cambrian beds in a locality where there is no surface indications of their presence, but it also supplies evidence in relation to *(a)* the position and thickness of the (basal) grits; *(b)* the dolomites as ocupying a position next to the basal grits in an ascending order of occurrence; *(c)* typical examples of purple slate interbedded with the dolomites; *(d)* the thickness of the dolomitic rocks to be something over 90 feet; none of which particulars can be definitely obtained at the surface in any part of the district. As the upper limits of the dolomite in the bore section is shown to be a surface of erosion, it is most likely that the original thickness of these beds exceeds the measurements given in the section.

Cainozoic.

No beds of an age between the Upper Cambrian and the Mid-Cainozoic, or Miocene, occur in that portion of Yorke Peninsula to which these notes refer. The Permo-Carboniferous glacial clays and erratics, which occur over wide areas in the southern portions of the Peninsula, have not been noted so far north as Ardrossan, while the geological formations that are newer than the Upper Cambrian occur within the district only as fragmentary and isolated outcrops that are remnants of much more extensive deposits.

MIOCENE.

So far as the district under notice is concerned the older fossiliferous beds of Cainozoic age are limited in their occurrence to the eastern seaboard, and are found in two parallel strips of different elevations; one of these is situated on the eastern edge of the central plateau, facing the sea, and the other occurs at or near sea level. In the case of the high-level deposits the material is limited to scattered surface stones, found on cultivated land, at an elevation of from 200 to 300 feet above sea level. These free stones are in the form of a yellowish chert, and the fossils, which are in the same material, are mainly in the form of casts. The common fossil in these cherty fragments is *Turritella aldingae*, which occurs in great numbers, and fixes the geological horizon as that of the Turritella clays and cherts of Aldinga and other places on both sides of Gulf St. Vincent, which are now considered to be of Miocene Age.

1. *The High-level Outcrops.* The top of the banks on the northern side of Horse Gully are capped by these Miocene cherts, especially the prominent knoll of the Sheaoak Hill, which is included in the section given on page 196. Similar outcrops occur at intervals on the higher ground, going northward; and after crossing the Maitland road, 1 mile from Ardrossan, surface stones belonging to these beds cover a considerable area in the neighbourhood of Dinham's quarries, where a fine example of the rare fossil, *Pleurotomaria,* was obtained. These high-level occurrences extend in a north and south direction for a distance of about 3½ miles. At Horse Gully the fossiliferous cherts rest on the Cambrian pteropod limestones, while at Dinham's they rest on the Cambrian basal grits.

2. *Outcrops at sea level.* At Rogues Point, about 5 miles to the southward of Ardrossan, the fossiliferous Miocene beds make their appearance on the beach, and from thence, for about 2 miles to the southward, they make an almost continuous feature along the beach. At the first small point in the sea cliffs, to the southward of the old jetty at Rogues Point, highly siliceous Turritella beds occupy the beach and slope upwards to the base of the cliffs, which are formed of recent deposits. At a quarter of a mile distance, in a southerly direction, near Meninie Hill, there is another exposure of these beds, highly silicified, and situated at sea level. A little further south, near a small creek, the Tertiary beds make a cliff 20 feet in height and are divided up into hard and soft layers. The silification has followed certain horizons where we find Turritella cherts forming beds about a foot in thickness, and these are separated by glauconitic clays of somewhat greater thickness, which are coloured green or red, according to the measure of oxidation to which the glauconite has been subjected. These glauconitic clays appear to be unfossiliferous, but scattered through them are cherty concretions and bifurcating cylindrical forms containing impressions and casts of fossil shells.

As the beds pass more to the southward they have a low dip to the south, and the mottled clays, which have such a striking development in the cliffs near Ardrossan, put in an appearance overlying the fossiliferous beds, attaining a thickness in the cliff face of 20 feet. Before reaching the next small projecting point in the cliffs, at the northern fence of Section 49, the consolidated freshwater sands replace the mottled clays and rest immediately on the fossiliferous Miocene.

To the southward of the last-named point the Miocene beds roll slightly, in long curves, with a maximum dip of

5°, and make a more important feature in the cea cliffs. The beds now have the form of soft, yellowish, sandy clays, and continue to "Sliding Rocks," already described (see page 201).

The Miocene beds continue to outcrop at intervals in the same direction. Near Muloowurtie Point they are so highly glauconitic that on the flat they have the appearance of a green tablecloth. At Hart's Mine, on the coast, they rest immediately on the Pre-Cambrian complex, the divisional line being a brecciated zone in which fragments of the basement rock are included in the lower portions of the Tertiary beds. They are also seen at Rocky Point, 4 miles to the southward of Hart's Mine, where they underlie the freshwater consolidated sands and pass below sea level.

PLEISTOCENE.

Not the least interesting of the geological features of this district is the occurrence of certain freshwater deposits that are of considerable antiquity. They occur as surface features in two positions. One of these is along the escarpment of the coastal ridge, near Ardrossan, and the other occurs on the beach or exposed in the sea cliffs. They represent three distinct lithological types, and probably belong to three distinct stages in relation to geological occurrence. The oldest of these are highly siliceous sands and fine gravels occurring at high levels. The intermediate in age consist of more or less consolidated sands that occur at a few places in the sea cliffs, and the newest in variegated and mottled sandy-clay typically developed in the cliffs near Ardrossan.

(a) THE OLDER SERIES.

1. *The high-level occurrences* of these beds follow a lineal course skirting the eastern flanks of the coastal ridge (pl. xxii.) from near Parara to Mr. Dinham's farm, a distance of 3 miles, the beds being about half a mile distant from the sea in the former case and 2 miles in the latter. Their most southerly exposure (pl. xxiii.) is on the northern side of the district road that runs west from Parara sheep station, past the house on Cliff's farm (late Naughton's). In this locality three outcrops of the beds occur at different levels (fig. 2), showing a vertical range in elevation of about 100 feet. Similar outcrops occur at intervals along the face of the ridge (pls. xxiv. and xxv.), some of which are several acres in extent, and pass upwards to the edge of the plateau on cultivated ground, giving a width of about one-third of a mile. Some large boulders of this rock can be seen on the

southern side of the Maitland road, about a mile from Ardrossan. The most northerly examples noted were patches of large rounded stones in the paddocks on either side of the private road going up to Mr. Dinham's farmstead in Section 77.

Lithologically, the beds give evidence of having been laid down under alluvial conditions, the fragmental material varying from fine sand to small quartz-gravel in grades up to 1 inch in diameter. The sedimentation shows rapid changes in short distances, both vertically and horizontally, and is frequently current-bedded. An extensive silicification has taken place over wide areas by the introduction of secondary silica that has converted the open sediments into a very compact, vitreous rock, with conchoidal fracture, and by blending the original quartz material with the siliceous cement makes a true quartzite. The cement is sometimes of a ferruginous character. The weathering of

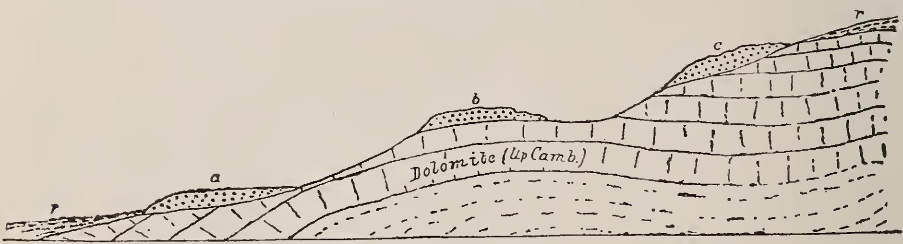

Fig. 2.

Diagrammatic Section showing 3 patches of consolidated ancient river alluvia (resting on Upper Cambrian Dolomite) at successive altitudes; *a*, *b*, *c*, consolidated river deposits; *r*, *r*, Recent mantle rock. Near district road, opposite Parara Head Station.

the rock varies according to the measure of siliceous penetration. With a high proportion of introduced silica the weathering is spheroidal (pl. xxiii.) in large blocks and smooth surfaces, as occurs at the southern end of the outcrops near Parara. With less cement the clastic portions become prominent and the stone takes on a gritty appearance. About midway between Parara and Ardrossan a portion of these beds are in a perfectly loose condition, not having passed through the processes of consolidation, and are worked as sand and gravel pits. In places a line of demarcation can be seen with consolidated sands on the one side and loose sand on the other. The breaks in the continuity of these beds have undoubtedly arisen from the weathering and removal of the looser portions of the sediments. On account of the irregular action in the silicification of the beds the outcrops sometimes weather into prominent and grotesque figures, and by the weathering-out of soft pockets on flat surfaces there are so-called human "footprints" to be seen, as often happens in cases of this kind.

Along the coastal escarpment the consolidated alluvia rest unconformably on the dolomite, or lowest member of the Cambrian limestones. In some places the silicified grits are seen to fill the joints in the Cambrian dolomite on which they rest, forming pseudo-dykes, varying in width from 1 foot to several yards. Near Dinham's they are in close proximity to the Tertiary cherts, which they apparently overlie. The upper limits of the deposits are estimated at about 300 feet above sea level.

The occurrence of two sets of siliceous grits in close proximity was at first a little confusing, notwithstanding the great disparity which exists in their respective ages, and it required a general examination of the geological area before definite conclusions could be reached with respect to their stratigraphical relationships. It is, therefore, not to be wondered at that Mr. Tepper, in his pioneer papers on the geology of the neighbourhood, should have failed to recognize the distinction which exists between the two sets of grits, and placed them in one category as "Ardrossan grits." If examples taken from the respective beds be promiscuously mixed together it becomes almost impossible to discriminate which examples are Cambrian and which are Pleistocene. The newer beds are often the more siliceous and ancient looking. Apart from the evidence in the field the chief points of distinction are: (1) the Cambrian basal grits are usually more or less arkose in their composition, including a proportion of clastic felspar, while in the alluvial grits there is an absence of felspar and the granular constituents are represented almost exclusively by quartz; and (2) the Cambrian grits are distinctly bedded, sometimes laminated and fissile, while the alluvial grits present no fissile bedding planes and form spheroidal and solid siliceous masses or massive rocks with irregular weathering. This difference is recognized in a practical way in the neighbourhood, for whilst the basal grits are commonly used for building purposes the consolidated alluvial grits are never so used.

2. *Consolidated Sandstones near Sea Level.* The occurrence of silicified fossil wood at Rocky Point, 12 miles south of Ardrossan, was brought to my knowledge by Mr. O. W. Thompson, of Ardrossan, whose uncle, now deceased, had made the discovery many years ago. Under Mr. Thompson's guidance I made two visits to the spot.

Rocky Point (pl. xxvi.) is a notable headland, about 80 feet in height. The upper portions of the cliff consist of red, white, and variegated sands and clays, and the middle and lower portions consist of layers of sandstone which are separated from each other by highly-coloured sands or clays, the whole series being horizontally bedded. The principal sandstone, which has become altered from a loose sand by the infiltration of silica, is about 3 feet 6 inches in thickness, and occurs in the series about 20 feet from the base of the cliff. The sandstone is even-grained, sometimes cross-bedded, and weathers under sea action to a rough surface, and is often cavernous. Some portions of the stone are very siliceous, while others are less so, causing much irregularity in weathering (pl. xxvii.). The upper surfaces of the stone show peculiar effects of the siliceous infiltration, producing knob-like protuberances, concentric and serpentine patterns, in low relief (apparently caused by successive waves of silicification), some of which look like artificial design, and might be compared with examples of Maori carvings. Slabs of silicified rock alternate with other beds that are less indurated, and the former are sometimes joined by connecting pillars of harder material, which in the case of cross-bedding make oblique angles with the horizontal slabs.

By the undermining action of the waves the softer beds are washed away, while the harder sandstones remain and litter the beach with very large blocks of stone. No examples of petrified wood were seen *in situ*, but examples were common on the beach, and a good supply was bagged. The Rev. J. R. Andrew (who accompanied us) in my presence picked up a beach stone of the indurated sandstone carrying the impression of a dicotyledonous leaf, which is now in the museum of the Adelaide University.

The following is a more particularized statement of the beds as they occur at Rocky Point:—

	ft.	in.	
Sandy soil	3	0	
Nodular travertine and calcareous marl	15	0	
Yellow indurated sandstone	9	0	
Indurated reddish sandstone	1	6	
Yellow sand	5	0	
Red ferruginous sand	3	0	
Calcareous clay (honeycombed)	3	0	
Yellow ferruginous sandstone with iron-stone layers	8	0	
White laminated clay with yellow and red colouration in transverse joints, and layer of pebbles on top	1	6	
Yellow sand	7	0	
Siliceous consolidated sandstone	3	6	
Red, yellow, and purple sandy-clay ...	10	0	
Yellow clay	4	0	
Fossiliferous Miocene rock (decomposed)	6	6	(above sea level)
	80	0	

Near the old jetty, situated at a quarter of a mile to the northward of Rocky Point, the beach is occupied with a large area of bedded hydrous oxide of iron, which is a development within the limits of the freshwater beds, and for a time was worked for flux.

An indurated sandstone, similar to that of Rocky Point, occurs about three-quarters of a mile to the north of Muloowurtie Point, near the northern fence of Section 49, where the beds make a small point. Here the silicification of the beds has taken a greater vertical range than at Rocky Point, but the cliffs in which they occur are not so high. As at Rocky Point the sandstone rests on the fossiliferous Miocene, which at this place is highly glauconitic, as described before. The freshwater sandstones end on the southern side of the small point, just before entering on the little bay which is immediately north of the "sliding rocks."

The siliceous sandstones differ from the silicified Tertiary beds of the neighbourhood in that while the latter are flinty the freshwater consolidated beds are sandy with a siliceous cement.

Mr. Tepper records the occurrence of petrified wood and the impression of a fossil leaf in a locality more northerly than that mentioned in these notes. His use of the term "grits" for three very distinct geological formations, and of widely different ages, creates some uncertainty as to which is intended in his descriptions. I take it, however, that the following references are intended to apply to the alluvial grits:—"The only place where distinct fossils were discovered by me is about the south-west corner of Section 41 [on the south side of the Maitland road, 4 miles from Ardrossan], where they were preserved in mottled ferruginous coarse sandstone, associated with nodules of iron oxide. . . . A single specimen of a leaf, resembling those of some *Cinnamomum* species in veination, has been found impressed upon a fragment of rock. . . . Specimens of silicified wood are much more numerous. After finding some few fragments along the beach and others among the gravels forming the upper portion of the cliffs, I succeeded in finding a spot where they strewed the ground in plenty, *viz.*, on the road crossing Horse Gully, between Sections 22 and 30. They are embedded in the clays covering the Silurian limestones."—(Geol. Hundred of Cunningham, Trans. Roy. Soc. S. Austr., vol. iv., 1882, p. 66.)

(b) THE NEWER SERIES.

The sea cliffs at Ardrossan make a striking feature. They have a maximum height of about 70 feet, and consist of three distinct beds which are unconformable with each other.

The lowest bed is very strongly coloured with iron in irregular patches, which, in contrast with the rest of the material, which is white, forms a mottled pattern (pl. xxviii.). The bed is a fine-grained argillaceous sand-rock, sufficiently indurated to resist the mechanical effects of rain, and is operated upon only slowly by the sea. Scattered sporadically through the finer material in places are small angular stones, of local derivation, including examples of the chalcedonized Miocene and small pellets of lateritic ironstone. The base is not seen, as it forms a hard floor on the beach and passes from view under the sea, and has been dredged adjacent to the end of the jetty. The lower portions of the bed are freest from stones, while towards the upper limits a layer of small stones, like small gravel, occasionally occurs. The cliffs are nearly vertical, and as the tide when high washes the base with a depth of 4 feet of water, a certain amount of undermining is going on, which causes lateral cracks at the surface, and finally sheets of the cliff face slip down to the beach, where they become divided up into large cuboidal masses on which the waves make small impression. These blocks between tides, as well as the cliff face as far up as the tides go, are penetrated by countless numbers of holes caused by a small boring phyllopod crustacean. This mottled bed, which comprises generally two-thirds or more of the cliff face, agrees in all respects with a similar mottled arenaceous clay that forms cliffs on the other side of the gulf, as well as inland. The upper portion of these mottled clays, when seen in section, usually exhibit an eroded surface.

The clay cliffs gradually decrease in height on the northern side of Ardrossan jetty, and at a distance of 1½ miles in that direction retreat in the form of low banks faced by sandhills. They also decrease in height on the southern side of the jetty and disappear, as a cliff feature, at Parara; but they are seen again at intervals where the cliffs rise to any considerable height, as, for example, south of Meninie Hill (half-way between Rogues Point and Muloowurtie Point), where by a shallow syncline in the fossiliferous Miocene the mottled clays are brought into the section showing a thickness of 20 feet.

The mottled beds can be seen in outcrop at many points inland, as, for example, on either side of the road going north from Ardrossan to Winulta. They also occur in many sinkings and bores in the neighbourhood, as in the following instances:—

Government Bore on West Park Lands, Township of Maitland.

Clay, 3 feet	Recent
Clay with limestone, 13 feet	Recent
Red and white indurated sandy-clay, 35 feet	Pleistocene
Granite (not bottomed), 181 feet	Pre-Cambrian

Government Bore on Section No. 83, Hundred of Cunningham.

Clay and gravel, 46 feet	Recent
Red and white clay, 11 feet	Pleistocene
White clay with gravel, 17 feet	Pleistocene
White clay, 30 feet	Pleistocene
Coarse gravel, 2 feet	Pleistocene
Granite (not bottomed), 393 feet	Pre-Cambrian

RECENT.

(a) Red Clays and Gravels.

In a superior position to the mottled sands and clays are red and brownish clays, which contain at various horizons layers of gravel and sand. These beds are less indurated than the mottled series, and often obscure the face of the latter through being washed down the face of the cliff by the rain. An unconformity between the two sets of beds can be recognized by a slight shelf in the cliffs (see pl. xxviii.) which marks the dividing line, as well as an uneven line of erosion between them, as is well seen in the yard at the landward end of the jetty, where an eroded gutter in the older beds is occupied by the gravel of the newer (pl. xxix.). In the sea cliffs the newer beds attain a thickness of 15 feet, or less; they are also well exposed in Clay Gully, which has its outlet at Ardrossan jetty, and are there seen to be at least 20 feet in thickness. They are comparable to similar clays that overlie the mottled beds on the eastern side of Gulf St. Vincent, and although quite independent of the existing drainage are undoubtedly Recent in their age.

The uppermost bed on the Ardrossan cliffs, as well as the most common surface deposits throughout the region now described, is a nodular travertine more or less associated with marls and loose sand.

A visit was paid to Balgowan (Port Warrenne), on Spencer Gulf, 11 miles north-west of Maitland. On the northern side of the jetty the cliffs consist of recent reddish clays, about 60 feet in height. At the jetty (Point Warrenne) there is a cliff of travertine limestone, 12 feet in height, which in parts is very compact and breaks away in large blocks. A short distance south of the jetty a flat-topped reef of travertine limestone runs for a considerable distance out to sea. In travelling between Maitland and Balgowan no definite outcrops were noticed, but the rises in the ground were usually covered by loose stones of travertine.

The large amount of the latter class of rock in the neighbourhood suggests that the Cambrian limestones probably form the bed rock of the district.

(b) *Raised Beaches.*

A common building stone in use at Port Victoria and neighbourhood is a shelly limestone, obtained from a raised beach area situated $2\frac{1}{2}$ miles to the southward of the township. I was informed that this deposit is on the landward side of the sandhills, covering low ground, several square miles in extent, and in wet seasons forms a swamp. The beach being raised above sea level and receiving surface waters highly charged with calcium carbonate, the lime conveyed in this way has cemented the shelly deposits forming a recent fossiliferous travertine. The stone is tough, and can be got in good-sized blocks, and is used for road metal as well as for building stones throughout the district. In the stones that came under observation, *Bulla australis* was present as a common form.

There is a raised beach in the neighbourhood of Parara, but its location could not be definitely fixed. Examples of *Arca trapezia*, a very characteristic shell in the older of the raised beaches of South Australia and no longer living in South Australian waters, occur in considerable numbers on the beach, and one example embedded in sandstone was picked up on the beach near Parara. It is probable that in this case the "raised" beach is situated below high-water level, as occurs also with the same bed in the vicinity of Port Adelaide.

(c) *Subsidences.*

Some of the coast features on Yorke Peninsula indicate a certain measure of subsidence, a movement which is probably in process at the present time. The evidences may be summarized under the following phenomena:—(1) Submerged platforms of travertine limestone at Parara, on the shores of Gulf St. Vincent, and also at Balgowan, on Spencer Gulf. (2) Submerged "raised" sea bed, with subfossil shells, imbedded in an indurated sandy matrix, south of Ardrossan. (3) Juvenile coast lines, indicated by narrow beach and several feet of water at base of cliffs at high tide, seen at Ardrossan, "Sliding Rocks," Edithburgh, and elsewhere. At "Sliding Rocks" the Cambrian limestones dip directly into the sea without being breached by the water (see pl. xxi.).

The fact that the coast line of South Australia, as a whole, gives evidence of recent uplift is quite consistent with the view of a recent subsidence. At Port Adelaide there are clear evidences of alternations of movement, up and down, within recent times. The evidences of subsidence are especially marked within the limits of the rift valley.

General Considerations.

1. Stratigraphical and Lithological Characteristics.

Yorke Peninsula, as a geological province, stands related to the South Australian highlands, on the east, and also to Eyre Peninsula, on the west, and yet is different from both. In common with the land lying to the eastward it possesses a Cambrian fauna, which, so far as known, is not shared by the country lying to the westward; but, like Eyre Peninsula, its dominant geological feature is that of a Pre-Cambrian massif. There is reason to think that the region now known as Yorke Peninsula has existed as a stable horst from Pre-Cambrian times, and has received less sedimentation in the interval than the country on the eastern side of Gulf St. Vincent, and has also been for longer periods under the influence of subaerial waste.

The basement (Pre-Cambrian) series, in its highly felspathoid rocks of pegmatites, syenites, porphyries, schistose rocks, and basic igneous dykes, show a striking similarity to the Pre-Cambrian complex that forms the axes of the orogenic deformations of the Mount Lofty and associated ranges. Professor Tate recognized the existence of two series of ancient rocks, separated by an unconformity, on Yorke Peninsula, but failed to see that a similar order of occurrence existed in the Mount Lofty Ranges, and the whole section, from the sea to the River Murray, was classed by him under one system as Archaean. That a major unconformity exists in the Mount Lofty Ranges, as it does on Yorke Peninsula, can be clearly demonstrated; and that the basement rocks, on either side of the Gulf, are of the same order and corresponding age, also admits of no doubt; but in the case of the Cambrian beds which rest immediately upon the Pre-Cambrian floor the order of occurrence is strikingly different in the respective areas.

Between Aldgate and Brighton, in a direct line of 12 miles, taking in Mount Lofty and the foothills on its western side, there is a series of grits, phyllites, slates, quartzites, tillites, and limestones of Lower Cambrian Age (fig. 3), having a thickness of many thousands of feet that are entirely wanting on Yorke Peninsula; and not only these, but thousands of feet of purple slates and quartzites of Upper Cambrian Age, which in other places overlie the Lower Cambrian beds and underlie the Archaeocyathinae limestones, are also absent from the section on Yorke Peninsula. This remarkable hiatus in the geological sequence must be accounted for in some way.

The following sketch (fig. 4) represents the occurrences and relative thicknesses of the beds in the neighbourhood of Ardrossan, Maitland, and Port Victoria:—

In this table of strata the entire Cambrian System is represented by about 300 feet in this locality, as against, probably, 15,000 feet on the eastern side of Gulf St. Vincent. The Archaeocyathinae beds represent a late stage in the Cambrian terraine, and they form a geological horizon which in other localities is both underlain and overlain by conformable sediments of Upper Cambrian Age. The missing upper members can be easily accounted for by denudation, but how can the absence of the underlying beds be explained?

The most plausible explanation that occurs to the author is that during the long Cambrian Period deposition was accompanied in South Australia by a geosynclinal downfold that formed an extensive trough in a north and south direction,

Fig. 3. Diagrammatic Section of the Lower Beds of the Cambrian Series from the River Torrens to the Sea.

A. *Pre-Cambrian Complex.* B. *Lower Cambrian.* *a*, Basal Grits and Conglomerates; *x*, Lower Phyllites; *b*, Lower Torrens-Limestone; *c*, Upper Torrens-Limestone; *d*, Thick Quartzite; *e*, Upper Phyllites; *f*, "Blue-metal" Limestone; *g*, Glen Osmond Clay-slate; *h*, Glen Osmond and Mitcham Quartzite; *i*, Upper Clay-slates; *j*, Sub-glacial Quartzite; *k*, Tillite; *l*, Impure Dolomitic Limestone; *m*, Tapley Hill Ribbon-slate; *n*, Banded Siliceous Limestones; *o*, Brighton Limestones. C. *Upper Cambrian.* *p*, Purple Slates and Quartzites; *q*, Gritty Limestone. The Permo-Carboniferous Tillite is shown unconformably resting on the Upper Cambrian of the sea cliffs at Hallett Cove.—Howchin's "Geology of South Australia."

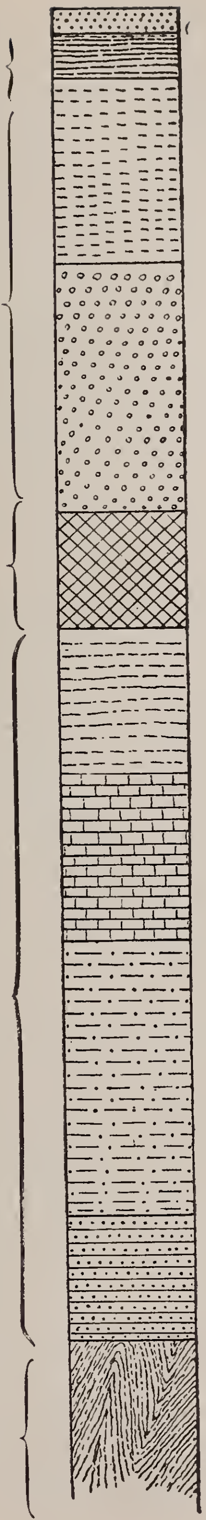

Fig. 4.
Table of Strata as they occur at Ardrossan and Neighbourhood.

bounded on the east by the Pre-Cambrian massif of the Murray and Broken Hill regions, and on the western side by a similar massif that formed the great Pre-Cambrian plateau of Eyre Peninsula. The protracted subsidence of this area permitted a vast accumulation of sediments of various kinds which would lie thickest in the centre of the geosynclinal trough, and gradually thinned towards the lateral margins, where successive overlaps of sediments would take place. This transgression of the Cambrian sea reached the horst-like massif of Yorke Peninsula only at a late stage in the development of the trough—indeed, not until shortly before or during the Archaeocyathinae stage—which will explain the absence of all the sediments that in the eastern areas form the Lower Cambrian and lower portion of the Upper Cambrian series.

A different explanation from the above might be given by supposing that the missing beds were laid down within this area and then subsequently removed by denudation before the Archaeocyathinae limestones were deposited. Such an explanation would involve an unconformity for the Archaeocyathinae beds, in relation to the missing beds, which is not borne out by comparison with other localities. Elsewhere the Archaeocyathinae beds are uniformly both underlain and overlain by thick strata of the purple slates series without any sign of interrupted sedimentation. This may be taken as presumptive evidence that no such unconformity exists on Yorke Peninsula as is implied in the above suggestion. It is assumed that the explanation based on the supposition of transgression and overlap is more in consonance with the evidence.

The Cambrian terrain on Yorke Peninsula began its history when the transgressing sea reached the level of the ancient horst and spread itself over the prepared plateau. The sea was shallow, and the advancing waves operated upon the granitic and felspathic outcrops of the older rocks over a wide littoral. The breaking down of these rocks led to the formation of coarse felspathoid grits and beds of conglomerate which are congenetic with similar arkose grits and conglomerates that form the basal beds of the Cambrian on the Mount Lofty district. The chief lithological difference in the two areas is that, on the Mount Lofty side the Pre-Cambrian and the basal grits are rich in ilmenite, while on Yorke Peninsula the latter mineral is not so extensively present either in its original condition, in the Pre-Cambrian rocks, or in its secondary form, as a clastic product, in the basal sediments.

With respect to the Cambrian limestones, those of Yorke Peninsula bear a general resemblance to the corresponding beds in the Flinders Ranges. The order of occurrence, as dolomitic in the lower members, Archaeocyathinae reefs in the middle portion, and pteropod-trilobite limestones in the upper, is much the same in both cases, but the respective beds are greatly attenuated in the Yorke Peninsula series as compared with those in the Flinders Ranges.

The Sellick Hill section of the same beds, with respect to thickness, is intermediate in this respect, being a thinner series than is developed in the Flinders Ranges, but thicker than the Yorke Peninsula series, with purple slates underlying the Archaeocyathinae limestones and impure flaggy limestones and purple slates above them.

The fossils obtained from the Ardrossan beds are reserved for further examination and description.

2. Tectonic Problems.

It is roughly estimated that the Lower and Upper Cambrian series combined have a thickness of not less than 15,000 feet.(5) So extensive a sedimentation in one area implies, as already stated, a geosynclinal fold which supplied the necessary conditions by which the great Cambrian System could be built up. Positive earth movements that occurred subsequently to the filling up of the basin exercised a lateral pressure on the sediments which threw them into folds, having a north and south direction, and developed numerous small overthrusts to the west. With respect to these movements, the very strong and stable foreland of the Pre-Cambrian massif, lying to the west, must have existed as a controlling factor, presenting a barrier to the passage of the earth waves in that direction, and compelling them to find relief in height instead of horizontal extension. In this way the Pre-Cambrian floor was raised nearly 2,000 feet higher in the centre of

(5) In a paper read before the Australasian Association for the Advancement of Science in 1907 (see Reports, vol. xi., p. 414), the author mentioned 30,000 feet to 40,000 feet as the probable thickness of the Upper and Lower Cambrian in South Australia. Since then there has been a tendency among geologists, on various considerations, to give a reduced estimate of the thicknesses of great mountain masses. These considerations, together with a wider knowledge of the tectonic structures of our highlands, led to a modification of this estimate, so that, in 1914, when in a brief outline of the Geology of South Australia, prepared for a visit of the British Association to Australia, it was stated that "on a moderate estimate the Cambrian System in South Australia represented a thickness of from 15,000 feet to 20,000 feet" (Handbook of South Australia, Brit. Assoc. Ad. Science, 1914, p. 212).

the basin than at the margins, and thereby brought to the surface and exposed to view the whole section of the Cambrian deposits at its greatest thickness.

This view of the tectonic phenomena may explain a few of the facts which seem to fall naturally into line with it:—

(a) The Mount Lofty beds, as constituting the lowest members of a thick series which reached the point of maximum depression, must have been subjected to a higher degree of metamorphism than the beds which occupied a shallower position around the margins. This is borne out by the geological features, as there is a gradual increase of metamorphic intensity as the beds are followed in a downward order towards the Cambrian base. The great field of igneous intrusion, which was developed on the eastern side of the basin, greatly modified the petrographic features on that side and had the effect of obscuring the succession.

The Yorke Peninsula region was probably situated on the western edge of the Cambrian basin, or otherwise occupied a high-level position as compared with the deeper portion, and therefore the isogeotherm conditions would be in strong contrast to those under which the more deep-seated beds were laid down. In harmony with this view the basal grits and conglomerates are but feebly fortified by secondary silicification—even less so than the comparatively recent alluvial grits of the same locality—and they give no evidence of powerful shearing, rock flowage, or mylonitic effects, such as are seen in the Mount Lofty Ranges, as, for example, at the Grey Spur in the Inman Valley. The metamorphism on Yorke Peninsula has been of the mildest type; even quartz veins in these beds are rarities, and the limestones have only undergone such slight molecular reconstructions that might take place in beds of this type at only moderate depths.

(b) Whilst on the eastern side of Gulf St. Vincent the Cambrian beds are greatly disturbed and thrown into acute folds and overthrusts (in which the beds of the Upper Cambrian have shared as well as those of the Lower), the beds on Yorke Peninsula give only slight evidences of orogenic activity. The beds, if not horizontal, make long undulations within the range of a few degrees of dip, the highest inclination being 40°, and this occurs on the beach at their eastern limits and on the margin of the rift valley. This slight deformation is what might be expected under the circumstances. The Cambrian beds formed a relatively thin capping on the strong foreland which not only presented a barrier to the oncoming earth-waves, but at the same time protected the overlying Cambrian sediments from the thrusts

directed from the east. This protective force exerted by the stable basement is evidenced by the comparatively undisturbed condition of the Cambrian beds, not only in the Ardrossan district, but in the extension of those beds in a northward direction, as well as on the western side of Lake Torrens and over the Pre-Cambrian plateau.

(c) The relation of Yorke Peninsula to the great epeirogenic uplift, that isolated the interior of the continent and rejuvenated the rivers and formed the prelude to the sculpturing of the South Australian highlands in their latest aspects, cannot be clearly defined on account of the peculiar position occupied by the region. It is almost surrounded by sea, and as a fault-block its elevation would probably be modified by the rift valleys by which it is bounded. There is evidence, however, that the region at some comparatively recent date stood higher than it does at present, from the fact that important river deposits occur in the present topography of the country at sea level, particulars of which have already been given (page 205 *et seq.).*

(d) The development of the great rift valley of South Australia with its bifurcating branches, marked by the drowned valleys of the two local gulfs, stands related to the Peninsula in a peculiar way. On the Adelaide plains, within 4 miles of the sea, the Cambrian beds have dropped to a depth of over 2,000 feet below sea level. As the sunken beds form a faulted segment of the Mount Lofty peneplain, it is not unreasonable to suppose that below this level the most of the Lower Cambrian beds occur, and below these again the Pre-Cambrian floor, at a much greater depth; and yet that Pre-Cambrian floor forms the main plateau of Yorke Peninsula as well as the axis of the Mount Lofty Ranges. The vertical displacement, as thus viewed, must be very great. The relatively high dip of the Cambrian limestones at "Sliding Rocks," where they pass below sea level at an angle of 40°, may be caused by the proximity of the rift fault, as occurs on the other side of the Gulf, at Sellick Hill, where both the Cambrian and Tertiary beds are thrown down to the west at a very high angle. In this instance at "Sliding Rocks," however, the Tertiary beds, presumably of the same age as those at Sellick Hill, and which here also overlie the Cambrian, do not participate in the downthrow.

(e) The undisturbed condition of the Permo-Carboniferous glacial beds in the southern portions of Yorke Peninsula, as well as on the eastern side of Gulf St. Vincent, is proof that this part of Australia has not been subjected to orogenic deformations since Palaeozoic times. The only forms of diastrophic modifications that have occurred in the interval

have been those of epeirogenic uplifts, block-faulting, and the developments of the great rift valley.

3. Peneplanation and Geological Cycles.

There is perhaps no part of South Australia in which long-continued atmospheric waste can be better illustrated than in the region now under description. There are no less than five distinct geological systems represented in this small area, and yet the country possesses no lines of strong relief, but maintains throughout the form of a featureless plain. This is not the result of a single period of peneplanation, but several such periods. There are tremendous gaps in the geological order of succession, indicating long periods during which denudation exceeded aggradation.

(a) pre-cambrian peneplain.

That the Pre-Cambrian complex had been reduced to a comparative level before the Cambrian sediments were laid down on this ancient floor is self-evident from the common level which this floor generally maintains under the Cambrian deposits. The Pre-Cambrian schists are usually nearly, or quite, vertical in position, as compared with a relatively low angle in the case of the Cambrian beds that rest upon them, indicating an incalculable interval of time between the respective geological systems. This comparison applies to the beds on the mainland equally with those on Yorke Peninsula. The Pre-Cambrian floor has been broken, tilted, and rifted down, in various segments, under tectonic movements; but in this floor we have the base level of the original cycle of erosion in the history of this continent—the first great cycle of peneplanation of which there is any record.

(b) palaeozoic peneplanation.

The loss that the Cambrian beds have undergone by denudation in the region now under description is excessive. That these beds originally covered the whole of what is now known as Yorke Peninsula admits of little doubt, but at present they only exist as scattered fragments. The most southerly outlier occurs at Curramulka, a narrow coastal strip is seen at Ardrossan, a few scattered stones were observed on the western side of Yorke Valley, and they were proved in the Maitland No. 1 Bore, where they are obscured in their outcrop by a mantle of surface material. They gradually make larger surface features as they pass to the northward at Dowlingville, Montgomery's, Clinton, Kainton, Port Hughes, Wallaroo, Kulpara, the Hummocks, etc.

What once constituted the upper beds of the Cambrian System on the Peninsula, of unknown thickness, has entirely disappeared. Of those that are left the fossiliferous beds, which form the highest members of the series, are nearing extinction; the dolomitic limestones, which underlie the latter, have a somewhat wider range, but come second in their restricted areas; the basal grits are a little more prevalent, again; and the rest of the country, when cleared of the more recent deposits, exposes the old Pre-Cambrian base level. Here we have the evidences of a peneplanation which began in early Palaeozoic times and has continued intermittently to the present day; the effects are seen in the few broken and disconnected remnants of great geological systems that have survived to tell the tale.

(c) CAINOZOIC PENEPLANATION.

From the close of the Cambrian period to middle Tertiary times the geological history of the greater part of Yorke Peninsula is a blank. Geological cycles may have come and gone in this interval without leaving a trace behind. A striking illustration of this is seen in the survival of an outlier of the Permo-Carboniferous till in the southern portions of the Peninsula. In this latter case favourable circumstances combined to preserve this fragment of a past age in a local patch which otherwise would have been unrepresented on the Peninsula. The occurrence of the Permo-Carboniferous deposits, as stated, helps to bridge the long interval and throws light on the geology of the Peninsula in two ways: it proves that in late Palaeozoic times the land in this region was certainly above sea level, and that the climate was very cold.

So far as we can judge from the evidences that are extant this particular region remained above sea level from the close of the Cambrian period until the great coastal submergence of Australia which took place during the Miocene period. At that time a great maritime strip of country passed below sea level and received a thick layer of sediments which in places amounted to 1,000 feet. Whether so great a thickness of these beds ever existed on Yorke Peninsula is difficult to say, probably not; but at present they are reduced to near vanishing point. On the eastern side of the Gulf fossiliferous sands and limestones of Pliocene Age are commonly found resting upon the eroded surfaces of the Miocene, but no remains of these beds have survived on the Yorke Peninsula side, having been, apparently, planed off by the denuding forces. Some indications of the underlying Miocene beds, however, still remain. On the slightly elevated rises and, at times, on the seashore these beds are represented by scattered and loose stones of a cherty kind, which might also have disappeared had it not been for the infiltration of a siliceous cement which has made them resistant to atmospheric waste.

Like the Cambrian sediments the marine Tertiary beds have been gradually reduced to a thin and almost imperceptible covering, and even the alluvium of more recent times, laid down by rivers that have long since ceased to flow, has helped to fill up the hollows in the older landscape, and thus contributed to the existing topographical dead level, which makes of several distinct geological systems a common peneplain.

4. River Systems, Past and Present.

In attempting to give an interpretation to the older hydrographic features of Yorke Peninsula it is necessary to take into account that, within comparatively recent times, the two South Australian gulfs had no existence, and this now almost isolated region formed part of a continuous land area. The time of which we speak was probably subsequent to the transgression of the sea within the limits of the rift valley, in late Pliocene times, which has left its marine sediments several hundreds of feet below the present level of the Adelaide plains. It may also be assumed that the older river system of the Peninsula dates from the time when the epeirogenic uplift was in progress, and, although rising, the differential movements had not proceeded so far as to bar the way of the rivers of Central Australia from reaching the southern coast. This conclusion is based on the facts that there are important alluvial deposits on the Peninsula which have no relationship to the existing lines of drainage, and also that the older system of drainage ran north and south, which is inconsistent with the existing coast lines.

On account of the great development of mantle rock over the country and the absence of geological sections, the evidences of the past river systems are limited, and are restricted, so far as known, chiefly to the eastern coast. The coastal scarp near Ardrossan, which can be defined as a topographical feature over a length of 2 miles, is evidently an old river terrace resting upon a Cambrian limestone floor. The terrace is built up of fine to coarse river deposits, often highly siliceous, which form outcrops that spread themselves over the face of the scarp, equal to 100 feet in height, as already described. An important river could only occur in that position when the area now covered by the waters of the Gulf was dry land. The same remark applies to the occurrence of similar alluvia in the cliffs and on the beach a few miles to the southward of Ardrossan. The difference in altitude of the respective river deposits is about 200 feet, and may mark the deepening of the river courses, consequent on the gradual rise of the land, in which case the deposits at sea level would be relatively younger than those on the higher terrace. There is every reason to think that, at that time, the rift valley was already well developed, and that a wide and shallow valley existed in the region of the present Gulf St. Vincent, which would form the main longitudinal waterway from the interior, and into which the lateral streams would find their way.

Few features have survived in the inland districts to throw further light on this subject. Yorke Valley, which probably represents one of these ancient lines of drainage, is a peculiar elongated basin-shaped valley that maintains a north and south direction for many miles. The main south road from Maitland to Yorketown passes along the bottom of this valley. No creek occupies the valley, but there is a soakage that finds its way southwards, where the valley ends in a saline marsh. In the neighbourhood of Maitland the valley has been excavated in the Pre-Cambrian basement rocks, which on the rises on either side are sometimes capped by thin layers of Cambrian grits or limestones. Every feature of this valley suggests river erosion, but belonging to a past age. It has no outlet, and is gradually filling up by rain wash from the sides. Unfortunately there are few wells in the district from which can be gathered any information as to the nature of the alluviation in the valley. Mr. B. Cornish called my attention to a bore that had been put down near Yorke Valley Public School, on Mr. Smith's land; but the only information concerning it that could be obtained was that the bore was 413 feet in depth, the first 30 feet was in clay, and there "followed rocks of various kinds." Granite was met with in the bore, but it is not likely that so great a depth would have been sunk in this rock.

Little need be said on the recent river drainage of Yorke Peninsula, as no connected water system exists at present. The area is limited in extent, and is almost flat, so that the run off is practically *nil*. There are no inland waterways, and there are only a few small channels near the coast which carry water, and these only for a few hours after a heavy rain. In this respect Yorke Peninsula bears a close likeness to Eyre Peninsula, where there is practically no natural delivery of the drainage to the sea. In southern Yorke Peninsula, where rock solution has led to the formation of depressed basins, the conditions are similar to those of inland basins of drainage; numerous small depressions receive the drainage from the soil during the winter rains, followed by the deposition of salt in summer.

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My acknowledgments are due to the Rev. J. R. Andrew, of Ardrossan, who has been most assiduous in the collection of specimens, and in many ways has furthered my objects; also to the Rev. J. C. Jennison and Mr. B. Cornish, of Maitland; and to Mr. O. W. Thompson and Mr. Tiddy, of Ardrossan, by whose valuable aid, respectively, I was enabled to visit distant places of interest.

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DESCRIPTION OF PLATES.

Plate XIX.

Basal Grits of Upper Cambrian, Dinham's Quarry, near Ardrossan.

Plate XX.

Basal Grits and Conglomerate of Upper Cambrian, Winulta Creek, near Public School.

Plate XXI.

"Sliding Rocks." Outcrops of beds of Dolomite which form the lowest members of the Upper Cambrian Limestones series and pass below sea level at "Sliding Rocks," situated 6½ miles south of Ardrossan.

Plate XXII.

General view of ancient River Terrace with consolidated beds of alluvia forming a low scarp, facing to the sea, near Ardrossan.

Plate XXIII.

Group of spheroidal masses of highly siliceous and consolidated alluvia, resting on an ancient river terrace, forming a coastal ridge, near Ardrossan.

Plate XXIV.

Silicified alluvia weathered into large irregular masses, resting on scarp-face of coastal range, near Ardrossan.

Plate XXV.

Near view of consolidated siliceous alluvia forming part of old river terrace, coastal ridge, near Ardrossan.

Plate XXVI.

View of Rocky Point (looking south), situated on coast, 12 miles southward of Ardrossan. The Point, which is 70 feet in height, consists of ancient fresh-water beds, some of which have become consolidated by the introduction of secondary silica. The higher of the two human figures seen in the photograph stands upon the chief bed of consolidated alluvium contained in the section.

Plate XXVII.

A large block of consolidated alluvial sandstone on the beach, about half-way between high and low watermark, at the base of Rocky Point cliff. The honeycomb form of the rock illustrates the irregular character of the silicification.

Plate XXVIII.

Sea cliffs at Ardrossan composed in their middle and lower portions of mottled sand-rock of Pleistocene Age. A narrow shelf, situated near the upper part of the cliffs, forms the dividing line between the Pleistocene mottled clays below and the Recent reddish clays and gravels which rest unconformably upon the former. The rain washes down the softer rocks near the top of the cliffs, and this to some extent obscures the features of the mottled beds that lie beneath.

Plate XXIX.

Section in the sea cliffs, exposed by an excavation near the landward end of the Ardrossan jetty, showing an unconformity; the lower portion of the cliff face is composed of the Pleistocene mottled sand-rock, and the upper portion, consisting of Recent reddish clays and gravels, occupies an eroded gutter in the former.

The Lepidoptera of Broken Hill, New South Wales. Part IV.

By Oswald B. Lower, F.Z.S., F.E.S., etc.

[Read October 10, 1918.]

This paper contains a supplementary list of species taken since the first part was published, together with those omitted, and a few new species. I also add the few Rhopalocera taken here.

Family ARCTIADAE.

Subfamily ARCTIANAE.

565. Spilosoma (?) cosmeta, Low.

Rather common in April and May; also occasionally from June to October. I have not yet seen the female, which is probably apterous.

Subfamily AGARISTIDAE.

566. Comocrus behri, Angas.

One specimen, in March.

This species is known to most Australian collectors as *casuarinae*, Scott. It varies somewhat in the hindwing, as the yellow postmedian band may be broken into spots or entirely absent, as in the form *flexuosa*, Wlk.

NOCTUINA.

Subfamily AGROTINAE.

567. Meliceptria aleurota, Low.

Two specimens in March. The type came from Derby, Western Australia, which habitat was accidentally omitted in the original description (Proc. Linn. Soc. N.S. Wales, 1901, p. 641).

Subfamily CUCULLIANAE.

568. Ariathisa emboloma, n. sp.

One specimen, in May.

Subfamily ACRONYCTIANAE.

569. Euplexia melanops, Low.

One specimen, at light, April.

570. Apina callisto, Wlk.

Not uncommon during March and April. A rapid day flier. Exceedingly common in the larval state, destroying a large amount of low herbage. The larvae are very partial to the "Cape weed" *(Cryptostemma coronaria)*, but a small clear-winged Ichneumon destroys huge numbers; out of seventy-five larvae I bred but three imperfect imagoes. The species is widely distributed throughout Australia.

571. Ipanica cornigera, Butl.

Taken occasionally during October and November. This is another widely distributed species, its geographical range extending from this district to New Guinea.

Subfamily SARROTHRIPINAE.

572. Elesma subglauca, Wlk.

Two specimens, in March.

Subfamily NOCTUINAE.

573. Setida quadrisignata, Wlk.

Not uncommon, at light, September to November.

574. Byturna digramma, Wlk.

Taken occasionally during March and April. The specimens taken here are generally much redder than those taken in South Australia.

Subfamily ERASTRIANAE.

575. Tarache micrastis, Low.

Two specimens, in March; also from Tennant Creek, South Australia, and Birchip, Victoria.

576. Xanthoptera opella, Swinh.

Five specimens, in March and April; also taken at Birchip, Victoria.

Subfamily ACONTIANAE.

577. Earias fabia, Stoll.

Rather common during September and October. I also take it freely at Wayville, South Australia. The markings vary from deep emerald-green to dull yellowish-fuscous.

578. Aconita congenita, Hmps.

Nine specimens, taken at dusk, in March. These were attracted to the flowers of the common "water melon." The type came from Queensland.

579. MAURILIA ICONICA, Wlk.

Four specimens, in March and April.

Subfamily CATOCALINAE.

580. OPHIDERES MATERNA, Linn.

Three specimens, in April. These were all taken at the same time at one of the city fruit stores.

581. GRAMMODES CALLIMERIS, Low.

Two specimens, in October. The type came from Cooktown, Queensland.

582. GRAMMODES CHRYSOMERA, Low.

Three specimens, in March, October, and December.

583. TRIGONODES HYPPASIA, Cram.

Five specimens, in February and July. The specimens are much smaller than those from Brisbane, Queensland.

Subfamily HYPENIDAE.

584. GONITIS SABULIFERA, Gn.

Taken occasionally, March.

585. COSMOPHILA EROSA, Hb.

Not uncommon, during March, April, and May. The specimens taken here are much darker than those from India. It stands in some collections as *xanthindyma*, Bdv., and *indica*, Wlk.

GEOMETRINA.

Subfamily MONOCTENIADAE.

586. TAXEOTIS PHÄEOPA, Low.

The female of this species is always smaller than the male. Usually taken during May and June, but I have secured specimens in September.

Subfamily SELIDOSEMIDAE.

587. AMELORA IDIOMORPHA, Low.

Two specimens, taken at light, in June and September.

588. CHLENIAS CYCLOSTICHA, Low.

One specimen (type), taken in June.

589. CHLENOMORPHA SCIOGRAMMA, n. sp.

One specimen, in November.

590. Paurocoma coniopa, n. sp.

One specimen, in May.

BOMBYCINA.

Subfamily LYMANTRIADAE.

591. Aprosita obscura, Wlk.

Two male specimens, in October and November; also from Aldgate, South Australia. Dr. Turner named a specimen *Aprosita ulothrix* (type in South Australian Museum). Walker made it a *Trichiura*, Kirby makes it a *Clathe*, but for the present we will allow Turner's genus to stand to receive it.

Subfamily NOTODONTIDAE.

592. Capusa senilis, Wlk.

Three male specimens, in November. Almost certainly attached to *Casuarina*. Being an exceedingly swift flier, it is difficult to secure perfect specimens.

Subfamily ZEUZERIDAE.

593. Zeuzera perigypsa, Low.

One specimen, in March.

594. Culama caliginosa, Wlk.

Three specimens, in April and May. The larvae feed in the roots of *Eucalypti*, and I have found pupae about 6 feet away from the trunk of the tree.

595. Hectomanes noserodes, Meyr.

Five specimens, all males (at light), in March and April.

PYRALIDINA.

Subfamily PHYCITIDAE.

596. Homoeosoma melanosticta, Low.

Three specimens, in October.

597. Myelois flaveotincta, Lucas.

Not uncommon, especially at light, September to December. The perfect insects frequent the stunted plants of *Bassia*, and lie motionless on the stems or leaves; they are then difficult to discern on account of the blending of colour.

Subfamily PYRAUSTIDAE.

598. Notarcha clytalis, Wlk.

Taken occasionally, in March and April.

599. Botys phoenicealis, Hb.

Taken occasionally, in March.

600. Semioceros (Nacoleia) mesochlora, Meyr.

Rather common, in March and April.

Subfamily ENDOTRICHINAE.

601. Endotricha puncticostalis, Wlk.

Taken occasionally, in March and April, also September. The specimens are much darker, and more shapely marked than those from Queensland.

Subfamily PTEROPHORIDAE.

602. Sphenarches caffer, Zeller.

Taken occasionally, in March.

TORTRICINA.

Subfamily TORTRICIDAE.

603. Tortrix postvittana, Wlk.

Several specimens, in March and April.

Subfamily EUCOSMIDAE.

604. Argyroploce doxasticina, Meyr.

Not uncommon, in March and April. I have recently taken this species at Wayville, South Australia.

TINEINA.

Family OECOPHORIDAE.

605. Zonopetala synarthra, Meyr.

Three specimens, in November.

606. Linosticha(?) stichoptis, Low.

One specimen, in July.

607. Linosticha sericopa, Low.

Two specimens (at light), in November.

608. Trachyntis mimica, Low.

One specimen, in March.

609. Nephogenes maculisarca, Low.

Two specimens, in October.

610. Philobota eremosema, Low.

One specimen, in November.

611. Guestia delosticha, Low.

One specimen, in March.

612. Guestia symmadelpha, Low.

One specimen, in May.

613. Pauronota lasioprepes, Low.

One specimen, in May.

614. Psecadia postica, Zeller.

Not uncommon, August and September. I have never taken this species except at light.

615. Oecophora pseudopretella, Stt.

Not uncommon, from December to March. A well-known European species.

616. Macrobathra hemitropa, Meyr.

Three specimens, September and October.

Family XYLORYCTIDAE.

617. Xylorycta parthenistis, Low.

Two specimens, in November.

In the original description (Trans. Roy. Soc. S. Austr., 1902, p. 237) the habitat was omitted. It should be:—*Hab.:* Tennant Creek, Central Australia, taken in October.

Family GELECHIADAE.

618. Aristotelia hemisarca, Low.

Several specimens, in March and April.

RHOPALOCERA.

Family PAPILIONIDAE.

619. Papilio sthenelus, Macl.

Not uncommon, October to May.

620. Papilio aegeus, Don.

Two specimens, in November.

621. Papilio anactus, Macl.

One specimen, in October.

Subfamily PIERIDAE.

622. Terias smilax, Don.

Taken occasionally, October to March.

623. Callidryas pyranthe, Linn.

Taken occasionally, in October.

624. Anaphaeis teutonia, Fab.

Rather common, October to December.

625. Delias aganippe, Don.

Fairly common, October to January.

Subfamily DANAIDAE.

626. Danais petilia, Stoll.

Rather common, during November to March.

627. Danais erippus, Cram.

Rather scarce, April.

Subfamily NYMPHALIDAE.

628. Pyrameis kershawi, McCoy.

Common, during October and November.

629. Pyrameis itea, Fab.

Not uncommon, September to March.

630. Junonia vellida, Fab.

Tolerably common, September to December.

Subfamily LYCAENIDAE.

631. Lycaena biocellata, Feld.

Common, September to March.

632. Lycaena serpentata, Herr Sch.

Not uncommon, October and November.

633. Lycaena labradus, Godt.

Not uncommon, October to December.

634. Ogyris oroetes, Hew.

Taken occasionally, in November. Frequents the flowers of *Eremophila Sturtii.*

NOCTUINA.

Subfamily CUCULLIANAE.

Ariathisa emboloma, n. sp.

♀, 40 mm. Head and thorax dark fuscous, head mixed with whitish, centre of thorax and patagia white. Antennae fuscous. Palpi whitish, terminal joint short, fuscous. Abdomen grey-whitish, beneath white. Legs grey-whitish, tarsi fuscous, ringed with whitish. Forewings elongate-triangular, costa straight, termen oblique, gently waved throughout; dark fuscous, wing between base and first line strongly mixed with whitish, sometimes mixed with pale rufous; first line strongly waved, white, edged throughout by a blackish shade, from one-quarter of costa to about one-third of dorsum; second line rather broad, waved, with a broad median projection, rather obscure in one specimen, black, more or less narrowly edged throughout with white; wing below cell between first and second lines strongly mixed with rufous, but not reaching dorsum; orbicular snow-white, centred with black; reniform black, edged anteriorly with white; cell more or less filled in with black; subterminal line strongly dentate, snow-white, from costa near apex to tornus, edged anteriorly and in one specimen posteriorly, with lanceolate black marks, which are well marked, space between second and subterminal lines strongly mixed with rufous, except at reniform, where it is suffusedly whitish; a series of four white dots on posterior half of costa; a black line along termen with a series of somewhat lunulate spots between veins; cilia grey, rufous-tinged with a rufous median line. Hindwings light smoky-fuscous, paler on basal half; line along termen as in forewings, cilia snow-white with a grey median line.

Not unlike some specimens of *Euxoa radians*, Guen.

Hab.—Pinnaroo, South Australia; two specimens, in May and June. Broken Hill, New South Wales; one specimen, in May.

GEOMETRINA.

Subfamily SELIDOSEMIDAE.

Chlenomorpha, n. gen.

Face with appressed scales. Palpi long, porrected, two and a half times width of eye, terminal joint short. Antennae of male bipectinated, apex simple. Thorax without crest. Posterior tibiae somewhat dilated. Forewings with small fovea; 10 free, 12 anastomosing with 11. Hindwings normal.

A curious genus, apparently related to *Chlenias* on the one hand, and *Paralaea*, on the other, but differing from both by the presence of fovea of forewings.

Type *sciogramma*, Low.

CHLENOMORPHA SCIOGRAMMA, n. sp.

♂ and ♀, 28-30 mm. Head, palpi, antennae, and thorax dull slaty-fuscous, palpi darker beneath, antennal pectinations 10, apical portion simple. Abdomen yellow-ochreous. Legs whitish-fuscous, posterior pair whitish. Forewings elongate-triangular, termen oblique, rather prominent on vein 3; greyish-fuscous, somewhat slaty-tinged; markings hardly traceable; a fine crenulate line from just before middle of costa to before middle of dorsum, more pronounced on dorsum; an irregular whitish line, from three-quarters of costa to just before tornus, followed by a fine whitish crenulate line, from costa just before apex to tornus; a fine black interrupted line along termen; cilia grey, with a pale fuscous subbasal line. Hindwings faintly crenulate; grey-whitish; an indistinct fuscous line from costa at one-third to one-third dorsum; a fuscous discal dot; an obscure faintly waved fuscous line, from costa at three-quarters to two-thirds of dorsum, followed by a narrow obscure whitish shade; an obscure fuscous band before termen; line along termen and cilia as in forewings. Underside of both wings grey-whitish, a blackish band just before termen, well defined on both wings.

Hab.—One male, Broken Hill, New South Wales; two females, Pinnaroo, South Australia, all taken in November.

AMELORA LITHOPEPLA, n. sp.

♀, 30 mm. Head, palpi, and thorax ochreous-grey. Antennae ochreous. Abdomen greyish-ochreous, grey-whitish beneath. Legs grey-whitish, sparsely sprinkled with fuscous scales, middle and posterior tibiae and tarsi fuscous, banded with whitish. Forewings elongate-triangular, termen gently rounded; ochreous-grey; a narrow very outwardly oblique fuscous streak, from costa at about one-fifth, reaching about one-third across wing, indicating anterior line; a very obscure pale-fuscous mark at posterior end of cell; a very short dark-fuscous outwardly-oblique mark on costa at five-sixths, indicating posterior line; from each of the costal streaks there are faint indications of waved lines reaching dorsum at one-quarter and at tornus; cilia ochreous-grey. Hindwings grey, becoming fuscous-tinged around margins; a dull-fuscous discal spot; cilia grey. Hindwings beneath with an outwards curved series of fuscous dots, from costa at five-sixths to just near tornus.

Not very near any other species of the genus.

Hab.—Dundas, Western Australia; one specimen, in October.

Paurocoma coniopa, n. sp.

♀, 28 mm. Head, palpi, antennae, and thorax dull ochreous. Abdomen grey. Legs ochreous-fuscous, posterior pair greyish. Forewings elongate-triangular, termen waved throughout, gently rounded; pale dull ochreous, more or less minutely irrorated with blackish scales; an obscure fine fuscous line, from two-fifths of costa to one-third dorsum, with two rounded projections above and below middle; a fine fuscous transverse discal dot; an obscure fascia-like fuscous shade, from five-sixths of costa to tornus; median third of wing somewhat lighter than rest of ground-colour; a fine waved blackish line along termen; cilia greyish-ochreous. Hindwings with termen as in forewings; grey-whitish, sparsely irrorated with some fine fuscous scales; line along termen as in forewings; indications of a fine waved fuscous line, from beyond middle of costa to beyond middle of dorsum; cilia whitish. Underside of hindwings with fuscous median discal dot, and submedian waved line very clear. Probably allied to *molybdina*, Low., but quite differently coloured.

Hab.—Broken Hill, New South Wales; one specimen, in May.

PYRALIDINA.

Subfamily PYRAUSTIDAE.

Metallarcha thioscia, n. sp.

♀, 20 mm. Head and thorax deep yellow. Antennae fuscous. Palpi yellow, terminal joint fuscous. Abdomen fuscous, ringed with deep yellow. Legs fuscous, posterior pair sprinkled with yellow. Forewings elongate-triangular, costa straight, termen oblique, gently rounded; dark fuscous; markings yellow; a broad dorsal streak, occupying half of wing, becoming narrowed at posterior end but continued to anal angle, where it joins a narrow streak along termen and continues almost or quite to apex; an irregular spot in cell, at one-fourth from base, a second, larger and somewhat sphenoid, in middle of wing, and a third, transverse, at three-quarters, just below costa, at four-fifths; cilia fuscous, with a darker basal line. Hindwings orange; a blackish discal spot; a moderately broad fuscous band along termen, becoming broader at apex, upper edge very slightly waved;

a narrow yellow streak along termen, sometimes obscure; cilia fuscous.

Nearest the following species, but distinct by the broad dorsal streak.

Hab.—Pinnaroo, South Australia; three specimens, in October.

METALLARCHA CLETHRODES, n. sp.

♀, 20-22 mm. Head and thorax yellow, head sprinkled with fuscous. Antennae and palpi fuscous, second joint of palpi beneath yellow. Abdomen fuscous, ringed with yellow. Legs fuscous, posterior pair sprinkled with yellow. Forewings elongate-triangular, costa straight, termen oblique, hardly rounded; orange-yellow, with shining fuscous markings; a narrow costal streak throughout; a small quadrate spot on lower edge of costal streak at one-sixth; an outwardly curved moderately thick fascia, from costa at two-fifths to dorsum in middle; a somewhat similar, but thicker fascia from just before three-quarters of costa to dorsum before tornus, indented in middle, the indentation sometimes meeting previous fascia; a thick fascia along termen, from costa, where it is broadest, to termen above tornus, where it joins previous fascia; a narrow streak of groundcolour, from five-sixths of costa, and continued along termen to tornus; cilia dark fuscous, darker basally. Hindwings bright orange; a dark-fuscous discal dot; a dark-fuscous band along termen, moderately broad, becoming broadest at apex; a narrow line of groundcolour along termen; cilia as in forewings.

Allied to *Goudii*, Low., but differs in smaller size, palpi, thorax, and narrower markings.

Hab.—Pinnaroo district, South Australia; five specimens, October and November.

METALLARCHA GOUDII, Low. (Trans. Roy. Soc. S. Austr., 1902, p. 234).

Having obtained a nice long series of this species, I am redescribing it, as the original description is faulty.

♂ and ♀, 20-30 mm. Head, palpi, antennae, and thorax dark fuscous, basal joint of palpi beneath orange, patagia yellow. Abdomen fuscous, banded with orange-yellow. Legs dark fuscous, anterior coxae and posterior tarsi and tibiae sprinkled with orange. Forewings elongate-triangular, costa straight, termen oblique, gently rounded; deep yellow, with shining fuscous markings: a rather thick streak along costa, from base to apex, attenuated posteriorly, and emitting a flattened spot near base; a slightly outwards curved fascia, from costal streak at one-third to dorsum before middle; a similar fascia from costal streak at three-fifths to dorsum at about three-quarters, strongly indented in middle, rarely reaching previous fascia, upper half much thicker; a fascia from about three-quarters of costa, reaching half across wing, thence curved around to meet preceding fascia just above indentation; whole of area of wing beyond this, excepting a narrow orange line along termen, filled in with light fuscous, minutely irrorated with yellow; cilia dark fuscous. Hindwings deep orange; a dark-fuscous discal spot; a moderately broad fuscous band along termen, strongly dilated on apical portion; a narrow orange line along termen, sometimes suffused with fuscous; cilia as in forewings.

Allied to *diplochrysa*, Meyr.

Hab.—Birchip, Victoria; two specimens. Pinnaroo district, South Australia; twenty specimens, in October and November.

TINEINA.

Family GELECHIADAE.

Aristotelia peribapta, n. sp.

♂ and ♀, 18-20 mm. Head, thorax, antennae, and palpi pale ochreous, head paler, antennae of male minutely ciliated, about half. Abdomen pale ochreous-whitish. Legs ochreous-whitish, posterior tibiae very roughly haired. Forewings elongate, moderate, apex pointed; 7 and 8 out of 6; pale ochreous-yellow, margins minutely irrorated with darker ochreous; cilia ochreous, more or less mixed with light ferruginous. Hindwings with apex pointed, produced, termen sinuate; pale fuscous; cilia as in forewings.

Not near any other of the genus. Reminds one of *Nothris meliphanes*, Low.

Hab.—Henley Beach, South Australia; five specimens, in September.

Epiphthora delochorda, n. sp.

♂, 18 mm. Head whitish. Thorax and palpi ashy-grey-whitish, palpi internally white. Antennae whitish, obscurely annulated with fuscous. Abdomen ochreous. Legs ashy-grey-whitish, posterior pair more whitish. Forewings narrow, acutely long pointed; ashy-grey-whitish; a narrow white streak along costa, from one-quarter to three-quarters; a narrow white streak along fold, obscured posteriorly; a fuscous outwardly oblique rather broad bar, from dorsum at one-third to termination of white streak along fold; cilia grey, becoming ashy-grey-whitish on apical portion. Hindwings with emargination obtuse, produced apex about one-quarter; grey, tinged with pale fuscous; cilia greyish.

Probably nearest *niphaula*, Meyr., but differs by shorter costal streak, narrower white streaks, and the oblique fuscous bar.

Hab.—Pinnaroo, South Australia; one specimen, in July.

Family TINEIDAE.

Chrysoryctis (?) idiochroa, n. sp.

♂, 20 mm. Head pale ochreous-yellow. Thorax white. Antennae ochreous. Palpi ochreous. Abdomen ochreous-orange. Legs ochreous. Forewings elongate, costa gently arched, termen very obliquely rounded; white; a fine ochreous line along costa from base to three-quarters; cilia pale ochreous. Hindwings dull ochreous-orange; cilia as in forewings. Underside of all wings dull ochreous-orange.

Probably nearest *ochracea*, Meyr.; the white forewings should make it easily recognizable.

Hab.—Broken Hill, New South Wales; one specimen, in January.

Trisyntopa, n. gen.

Head with appressed hairs. Antennae moderate, in male filiform, ciliations two, with strong basal pecten. Palpi moderate, curved, ascending, second joint tolerably smooth, terminal joint half of second, just reaching base of antennae. Abdomen moderate. Posterior tibiae rough-haired above and beneath. Forewings with veins 7 and 8 stalked, 7 to apex, 9 out of 7 above middle; 3 and 4 short-stalked. Hindwings over 1, subovate; 3 and 4 from a point, 5 approximated to 4, 6 and 7 parallel.

A curious genus not near any other known to me. The neural characters are somewhat abnormal for this group, but until further material is forthcoming it can remain here.

Type *euryspoda*, Low,

Trisyntopa euryspoda, n. sp.

♂, 25 mm. Head, palpi, and thorax ashy-grey-fuscous, palpi paler beneath. Antennae fuscous, annulated with darker, ciliations 2. Abdomen ochreous-grey, silvery-grey beneath. Legs silvery-grey, anterior and middle tibiae and tarsi infuscated. Forewings elongate, moderate, costa moderately arched, apex rounded, termen rounded; ashy-grey-whitish; veins, especially towards termen, more or less outlined with fuscous; an obscure elongate dot in cell; a second, more distinct at posterior end of cell; base of wing somewhat darker than rest; a somewhat obscure curved row of more or less disconnected spots just before and parallel to termen; cilia grey-whitish, basal half fuscous. Hindwings grey-whitish, slightly fuscous-tinged around apex; cilia white, with a fuscous subbasal line.

Hab.—Broken Hill, New South Wales; one specimen, in October.

Family ELACHISTIDAE.

Limnoecia pycnogramma, n. sp.

♂ and ♀, 20 mm. Head orange-yellow. Thorax orange-yellow, with a moderately large somewhat quadrate patch of fuscous on anterior two-thirds. Antennae fuscous, annulated with yellow. Palpi orange, terminal joint paler and mixed with fuscous anteriorly. Abdomen pale yellow. Legs fuscous, posterior pair yellow. Forewings elongate, moderate, costa gently arched, termen obliquely rounded; bright yellow, with purplish-fuscous markings; a rather thick oblique basal fascia, leaving a narrow streak of groundcolour at base; a broad median fascia occupying median third of wing, edges oblique, containing a somewhat triangular-shaped spot of groundcolour on costa, and sometimes a narrow outwardly oblique streak of groundcolour just above dorsum; a narrow streak along termen, dilated gradually to apex; cilia dark fuscous. Hindwings elongate-lanceolate, moderately broad; pale grey, finely irrorated with light fuscous; cilia orange-yellow.

Nearest *xanthopelta*, Low.

Hab.—Broken Hill, New South Wales; two specimens, in September.

Notes on Some Miscellaneous Coleoptera, with Descriptions of New Species.—Part IV.

By Arthur M. Lea, F.E.S., Museum Entomologist.

[*Contribution from the South Australian Museum.*]

[Read October 10, 1918.]

Plates XXX. to XXXII.

PSELAPHIDAE.

Articerus.

The genus *Articerus* (like *Mandalotus* of the Curculionidae and *Laius* of the Malacodermidae) contains species many of which are characterized by remarkable sexual features. In the male the metasternum is always different from that of the female, being often armed with one or two spines or projections and sometimes largely excavated; the under-surface of the abdomen of the female is usually evenly convex, with the pygidium in the normal position of that organ; but on the male the abdomen is strongly depressed towards the base, with the apex incurved and the pygidium overhanging; as a result the sex of a specimen carded in the ordinary way may be distinguished from the side, the female having the metasternum and abdomen almost continuously resting on the card, while in the male there appears a gap (sometimes of great extent) between the tip of the abdomen and the highest point of the metasternum; the tibiae of the male are often armed and sometimes have curious flanges, the femora and trochanters are also subject to great sexual variation; but the sexual variation of the antennae is seldom very pronounced. It is desirable to set unique specimens so that both surfaces may be closely examined, and in describing new species quite as much attention requires to be paid to the under-surface and appendages as to the upper-surface. At one time several exotic species were referred to the genus, but these have all been excluded by Raffray.

The following references, mostly since the date of Masters' Catalogue, have been made:—

SCHAUFUSS: Ann. Mus. Civ. Gen., 1882, pp. 176-196.
Monographs the genus (then containing several foreign species), one being described as new; this paper, except for *aurifluus* (given as for 1883), was not referred to in Masters' Catalogue.

RAFFRAY: Rev. d'Ent., Caen., 1887, p. 18.
One species described as new.

RAFFRAY: Proc. Linn. Soc. N.S. Wales, 1900, pp. 241-244.
Four species described as new.

RAFFRAY: Ann. Mus. Nat. Hung., 1903, p. 97.
One species described as new.

RAFFRAY: Ann. Soc. Ent. Fr., 1904, pp. 445, 454.
Notes on genus.

RAFFRAY: *l.c.*, 1909, p. 50.
One species described as new.

RAFFRAY: Wytsman's Gen. Insect., 1908, fasc. 64, pp. 417, 425, 426.
Notes on genus and catalogue of species.

RAFFRAY: Junk's Catal. Col., 1911, part 27, pp. 172, 173.
Catalogue of species.

BLACKBURN: Trans. Roy. Soc. S. Austr., 1889, p. 138.
One species described as new.

LEA: Proc. Roy. Soc. Vict., 1904, pp. 375, 376.
Notes on four species given.

LEA: *l.c.*, 1910, pp. 163-174.
Notes on most of the known species given and nine described as new.

LEA: *l.c.*, 1912, pp. 53-56.
Notes on several species given and one described as new.

The males of the species known to me may be tabulated as follows:—

A. Antennae circular in transverse section throughout.
a. Abdomen suddenly constricted near base ... ... *nitidicollis*
aa. Not so constricted.
b. Excavation on upper-surface of abdomen not encroaching on middle of convex portion.
c. Middle legs with femora strongly arched and trochanters very conspicuous ... *regius*
cc. Middle femora not arched and trochanters not conspicuous.
d. Metasternum strongly armed posteriorly ... ... *cremastogastri*
dd. Metasternum unarmed ... ... *fortnumi*
bb. Excavation encroaching on middle of convex portion.
e. Antennae (except for the basal constriction) of even width throughout ... ... *cylindricornis*
ee. Antennae more or less conspicuously dilated to apex.
f. Front tibiae with a very conspicuous flange on outer side ... ... *cultripes*
ff. Middle tibiae with a very conspicuous flange or tooth on outer side ... ... *hamatipes*
fff. Front or middle tibiae not flanged, or, if flanged, not on the outer side.
g. Metasternum bidentate posteriorly.
h. The teeth very conspicuous and with a common base ... ... *bispinosus*
hh. The teeth much smaller and separated at base.
i. Antennae evenly dilated to apex ... ... *femoralis*
ii. Antennae suddenly dilated near apex ... ... *bipartitus*
gg. Metasternum unidentate posteriorly.
j. Apex of abdomen bidentate.
k. Antennae conspicuously curved and almost uniformly dark ... ... *lophosternus*
kk. Antennae scarcely curved, shorter, and apex distinctly paler than base *dentiventris*
jj. Apex of abdomen unarmed.
l. Metasternum conspicuously clothed along middle ... ... *intercoxalis*
ll. Metasternum almost glabrous ... ... *gibbulus*

AA. Antennae wider than deep, at any rate in parts.
B. Middle femora enormously inflated ... ... *tumidus*
BB. Middle femora not so inflated.
C. Excavation on upper-surface of abdomen encroaching on middle of convex portion.
m. A conspicuous seta projecting from the mouth ... ... *curvicornis*
mm. Without such a seta.
n. Superficial area of each antenna about equal to that of head ... ... *dilaticornis*
nn. Much less.
o. The posterior encroachment of the excavation shallow and inconspicuous except from a few directions ... ... *brevipes*
oo. The encroachment very conspicuous.
p. Front tibiae conspicuously armed at apex ... ... *pascoeus*
pp. Front tibiae not so armed ... ... *mastersi*
CC. Excavation not encroaching as on C.
D. Antennae constricted in middle. ... ... *constricticornis*
DD. Antennae not so constricted.
E. Metasternum with a large deep excavation, behind which are two large suberect teeth.
q. Each wall of the excavation dentate in middle ... ... *griffithi*
qq. Walls not dentate ... ... *excavipectus*
EE. Metasternum at most lightly excavated posteriorly.
F. Metasternum unarmed ... ... *irregularis*
FF. Metasternum with two spines transversely placed ... ... *auriflnus*
FFF. Metasternum armed, but not transversely.
G. Middle trochanters very conspicuously armed ... ... *dentipes*
GG. Not so armed.
H. Under-surface of abdomen longitudinally sulcate ... ... *sulciventris*
HH. Under-surface excavated or foveate.
I. Sides of the excavation of under-surface with two small teeth ... ... *raffrayi*
II. Without such ... ... *coelogaster*

Notes on Table.

A. On some of the species of this section the antennae are more or less strongly curved, but they are nowhere flattened, so that a section cut anywhere through them, at right angles to their length, would be a perfect circle; on some of the species of AA *(e.g., curvicornis)* part of the antennae, more especially about the apex, is more or less circular in cross-section, but there is at least a portion between the middle and the base, where they are flattened, so as to be more or less narrowly elliptic in cross-section.

e. Seen both from below and from the sides; in *intercoxalis* the increase in width to the apex is rather slight, but quite distinct.

f. See Proc. Linn. Soc. N.S. Wales, 1900, pl. x., fig. 23.

ff. *L.c.*, fig. 40.

C. On the abdomen of *curvicornis* the excavation slopes backwards on to the convex portion of the abdomen, although there is not a special median encroachment of it; but although thus somewhat intermediate between C and CC, the species has many distinctive features; in *brevipes* the encroachment is more conspicuous than on *curvicornis*, but less than on the others; on some of the species of CC, the excavation encroaches upon the sides of the convex portion.

oo. *pascoeus* and *mastersi* are also very distinct by their sternal armature.

D. As viewed from the sides, see Proc. Linn. Soc. N.S. Wales, 1910, pl. xxvii., fig. 39.

Comments follow on the species not included in the table.

A. ANGUSTICOLLIS, Westw. The type was probably a female; judging by the description and figure it could be placed in the table as far as DD, but not beyond, as the metasternum was not mentioned.

A. ASPER, Blackb. Should be distinct by the absence of a prothoracic fovea, but the legs (except as to their colour), under-surface of abdomen, and metasternum were not mentioned, so it cannot be placed in the table beyond AA.

A. BOSTOCKI, Pasc. Schaufuss regarded this name as a probable synonym of *fortnumi*, a surmise not accepted by Raffray. By the description alone it cannot be placed in either A or AA.

A. BREVICEPS, King. Probably belongs to A of the table, but the metasternum, abdomen, and legs were not mentioned; a cotype that I examined some years ago was a female without antennae.

A. CONSTRICTIVENTRIS, Lea. A remarkable species, allied to but abundantly distinct from *nitidicollis*, with which it would be associated in the table, but the female only being known it has not been included.

A. CYLINDRICORNIS, Lea (= CYLINDRICORNIS, Raffr.).

A. DEYROLLEI, Sharp. Belongs to AA of the table, but the particulars given by Sharp are not sufficient to carry it beyond BB; it should, however, be very distinct by the absence of abdominal fascicles.

A. DUBOULAYI, Waterh. Evidently belongs to AA, but the metasternum not being mentioned, cannot be carried beyond DD; I have seen nothing approaching the original figure.

A. FALCATUS, Raffr. Allied to *curvicornis*, the description being little more than a comparison with that species; in the table it cannot be carried beyond BB.

A. FOVEICOLLIS, Raffr. The metasternum and under-surface of the abdomen were not described, but the figure given by Raffray is strikingly different from that of any other species known to me; in the table it cannot be carried beyond *ee*.

A. KINGIUS, Sharp. This name is probably synonymous with *cultripes*, over which it has precedence.

A. ODEWAHNI, Pasc. (= FORTNUMI, Hope).

A. SELYSI, Schauf. Evidently belongs to AA, but no particulars of the under-surface and legs were given, and the type was a female.

A. SETIPES, Westw. The type appears to be a male; in some respects it appears to approach *dentipes*, but differs somewhat in the antennae and legs; as the metasternum was not mentioned it cannot be placed in the table beyond DD.

A. SHARPI, Masters (= TUMIDUS, Westw.).

A. SPINIFER, Sharp. Evidently belongs to A of the table, and the male should be very distinct by its antennae, legs, and under-surface.

A. TUMIDUS, Sharp (= TUMIDUS, Westw.).

A. WESTWOODI, Sharp. Very close to if not synonymous with *curvicornis*; the latter was originally described from Victoria, but occurs also in New South Wales, Tasmania, and South Australia.

ARTICERUS DEYROLLEI, Sharp.

A female from North-western Australia (Fortescue River, taken by Mr. W. D. Dodd from a nest of *Iridomyrmex)* possibly belongs to *deyrollei* (described as from "Australia"). In general appearance it is like an elongated specimen of *curvicornis*, and the clothing of the upper-surface is somewhat similar, but the head is longer, antennae more parallel-sided, and impression of pronotum much less conspicuous. Its antennae, as seen from above, are (except about the base) parallel-sided, but from the side each appears thin from the base to near the apex, when it is strongly triangularly inflated and truncated; its abdomen is without distinct fascicles (it is the only species I have seen of which this could be said), but the margin of each near the base is rather more densely clothed than the rest of the upper-surface.

Articerus gibbulus, Sharp.

With doubts I previously(1) identified some Victorian specimens as *gibbulus;* but since then have seen four specimens in the South Australian Museum (including three males) labelled as *bostocki*, and as from Western Australia, that evidently belong to *gibbulus*, and are certainly distinct from the Victorian specimens (described on page 251 under the name of *cremastogastri*). The original description of *bostocki* is worthless, but the name (probably incorrectly) has been regarded as a synonym of *fortnumi; fortnumi* is an abundant species in South Australia, but I have seen no specimens of it from Western Australia.

Articerus dentiventris, n. sp.

♂. Dark castaneous-red; head, prothorax, and base of antennae still darker. Moderately clothed with reddish (in some lights almost golden) pubescence, becoming setae on tips of elytra; upper-surface of abdomen almost glabrous, but sides near apex with a few stiff setae, each side of base with two fascicle-like patches of clothing; metasternum conspicuously clothed along middle.

Head short, wide, and deep, a longitudinal impression on basal half; punctures dense and comparatively large. Antennae moderately long, cylindrical in section throughout, basal two-thirds rather thin, then suddenly and strongly dilated to the truncated apex. *Prothorax* moderately transverse, front angles rounded off, the hind ones almost rectangular; with a rather large and deep, subelliptic, medio-basal fovea; punctures much as on head. *Elytra* rather strongly dilated to apex, subsutural striae distinct; base with punctures as on prothorax, sparser (but quite distinct) elsewhere. Upper-surface of *abdomen* with a wide deep excavation, with two oblique flat elevations inwards of the fascicles, the posterior end encroaching on the middle of the convex portion behind the fascicles; under-surface at base

(1) Proc. Roy. Soc. Vict., 1904, p. 376.

conspicuously obliquely strigose, apex with a small fovea, overhanging which is the pygidium armed with two short acute teeth. *Metasternum* convex along middle, with a conspicuous process overhanging base of abdomen. Front and hind *tibiae* dilated about apex, the middle ones each terminated by a strong hook; middle tarsi unusually short. Length, 2 mm.

♀. Differs in having the abdomen more dilated posteriorly, its under-surface scarcely depressed below level of metasternum, almost evenly convex, not foveate at apex, not encroached upon by pygidium (which is unarmed), metasternum not ridged along middle, unarmed at apex and more sparsely clothed, and middle tibiae similar to the others at apex.

Hab.—Queensland: Stewart River, from nests of a species of *Iridomyrmex*, in appearance somewhat like *detectus* (W. D. Dodd). Type, I, 8536.

Readily distinguished from all previously described species by the remarkable metasternum and abdomen of the male; the colour is also considerably darker (at first glance the head and prothorax appear to be almost black). The setae on each side of the abdomen vary from two to four in number, and are almost spine-like, the dense patch of clothing on each side of the base is divided into two by the elevated margin; there is a stiff seta projecting from the mouth of the male, and a smaller, but still fairly distinct one, from that of the female. From some directions the end of the metasternum appears to have a conical tubercle, but this is really the upper part of an oblique (scarcely vertical) carina, whose lower end (as viewed from the side) appears to be separated from the abdomen by a notch.

Articerus lophosternus, n. sp.

♂. Dark castaneous-red; head, prothorax, and antennae still darker. Moderately clothed with rusty pubescence, becoming longer and more golden on elytra, upper-surface of abdomen glabrous except for a conspicuous oblique golden fascicle on each side of base, and for a few stiff setae at the sides and apex, a distinct line of clothing along middle of sterna, hind femora also conspicuously clothed.

Head short, wide, and deep, with a short longitudinal impression in middle; punctures dense and rather coarse. Antennae moderately long, strongly curved, cylindrical in section, rather thin about base, beyond the middle rather strongly inflated to the truncated apex. *Prothorax* about as wide as long, front angles rounded off, the others almost rectangular; with a deep and rather narrow impression on basal half; punctures much as on head. *Elytra* rather strongly dilated to apex, subsutural striae distinct; punctures at base as on prothorax, sparser but quite distinct elsewhere. Upper-surface of *abdomen* with a large basal excavation, towards each side of which are two oblique lightly elevated ridges, excavation shallowly encroaching upon convex portion; under-surface obliquely strigose about base, about apex with a small fovea, overhanging which is the pygidium armed with two short stout teeth. *Metasternum* with a narrow ridge from base to just beyond the middle, where it terminates in a small conical tubercle. Front *tibiae* lightly curved on upper-surface, lightly bisinuate on lower-surface, and terminating in a hook; middle pair with a shallow subapical notch, the apex hooked; hind pair rather thin at base, moderately dilated to middle, and then almost parallel to apex. Length, $2\frac{1}{4}$ mm.

Hab.—Queensland: Stewart River, taken in a nest of the same host-ant as that of the preceding species (W. D. Dodd). Type (unique), I. 8537.

With many of the remarkable features of the male of the preceding species, but antennae considerably longer, entirely dark, and more strongly curved, apex (although quite as wide) not so suddenly inflated, ridge of metasternum commencing nearer the base, more acutely pointed and not overhanging the abdomen, apical spines of abdomen stouter, hind femora stouter, and with a very conspicuous oblique ridge of golden setae, front tibiae less dilated near apex and with a slight notch, hind pair different, and abdominal fascicles different. The under-surface of the apical half of the antennae has a granulated appearance, and from some directions each appears to be finely but deeply constricted at the basal third.

ARTICERUS BISPINOSUS, n. sp.

♂. Bright reddish-castaneous. Moderately clothed with depressed, golden pubscence, becoming longer and more irregular on upper-surface of abdomen, near base on each side of abdomen with a semi-double fascicle; under-surface rather sparsely clothed.

Head rather short, with a fine median impression, and with fairly conspicuous punctures. Antennae moderately long, cylindrical in section, thin at the base, thence almost evenly dilated to near apex, but more rapidly (although not strongly) about apex; with numerous small granules. *Prothorax* lightly transverse, front angles rounded off; with a round and conspicuous but not very deep medio-basal fovea; punctures as on head. *Elytra* rather strongly dilated to apex, subsutural striae distinct; punctures not very dense or large but distinct, becoming denser about base. Upper-surface of *abdomen* with a wide and deep excavation, its middle distinctly encroaching upon the convex median portion; lower-surface with fine oblique striation about base, about middle with two fine oblique lines. *Metasternum* strongly elevated in middle, at summit of elevation with two strong, acute, oblique, slightly diverging spines. *Legs* comparatively long and thin; front tibiae with a small spine (invisible from most directions) near apex; middle tibiae with a short terminal spur. Length, $1\frac{1}{2}$-$1\frac{3}{4}$ mm.

♀. Differs in being wider posteriorly, abdomen evenly convex on under-surface, metasternum gently convex along middle and unarmed, and the tibiae unarmed.

Hab.—Lord Howe Island: Mounts Gower and Ledgbird. Type, I. 8535.

The armature of the metasternum of the male is exceptionally strong and double, this character alone rendering the species abundantly distinct from all others; of the described species it is nearer to *bipartitus* than to any other known to me, but it is larger, abdomen, metasternum, and legs different; the antennae are intermediate in shape between those of *bipartitus* and *cylindricornis*. The antennae from some directions appear to be gently curved throughout, the granules are more conspicuous about their middle than elsewhere. The excavation on the upper-surface of the abdomen, when viewed from behind, appears to have a wide flat oblique process (triangularly notched at its tip) semi-detached from the middle of each elytron, the space between the processes deeper than elsewhere; from other directions there appear to be four semi-detached processes; the oblique lines on the under-surface of the abdomen appear to mark the sides of a shallow depression, they are present on both sexes, but more conspicuous on the male. The male has a short stout projection from the mouth; on the female it is present, but shorter and less conspicuous.

I had examined numerous nests of ants on the island without finding an inquiline of any sort, and had given up examining their nests when Mrs. Lea, on the slopes of Mount Ledgbird, found some specimens of this species in a nest of a small, blackish, hairy *Iridomyrmex*, under a stone; subsequently I also took a few specimens in a nest of the same species of ant under dry bark of a fallen tree, high up on Mount Gower.

Articerus intercoxalis, n. sp.

♂. Reddish-castaneous; upper-surface, except of abdomen, not very shining. Clothed with rather sparse, pale, depressed pubescence, more golden and conspicuous on apical slope of elytra than elsewhere, upper-surface of abdomen more sparsely pubescent, but in addition with numerous erect or suberect setae, each side of base with a conspicuous golden fascicle, middle of metasternum moderately clothed.

Head moderately long, with a vague median line; with crowded punctures. Antennae moderately long, cylindrical in section, thin about base, then somewhat dilated and parallel-sided to near apex, where it is moderately dilated. *Prothorax* lightly transverse, front angles rounded off, with a rather large, but not very deep, medio-basal fovea; punctures much as on head. *Elytra* moderately dilated to apex, subsutural striae distinct; punctures rather dense and small but distinct, becoming crowded at base. Upper-surface of *abdomen* with a large excavation, semicircularly encroaching upon convex median portion; under-surface constricted in middle. *Metasternum* rather strongly elevated (but not acutely ridged) in middle, posterior slope with a small spine projecting obliquely backwards, a larger and stouter one between middle coxae. Front and hind *tibiae* somewhat dilated at apex, middle ones with a strong, recurved, apical hook. Length, 2 mm.

♀. Differs in being more dilated posteriorly, the metasternum only gently convex along middle and unarmed, abdomen more strongly convex on under-surface, and scarcely depressed below level of metasternum, and the middle tibiae unarmed at apex.

Hab.—South Australia: Lucindale (B. A. Feuerheerdt), Adelaide (A. M. Lea); New South Wales: Kuringai (W. du Boulay). Type, I. 8541.

In general appearance like *cylindricornis* on a small scale, but metasternum of male more convex, with a strong and acute projection between the middle coxae, front tibiae thinner and not notched, the middle ones thinner, and the apical hook at a different angle, the abdominal excavation is smaller and narrower, and the elytra are without apical fascicles. The female may be distinguished from the female of that species by its smaller size, somewhat different abdominal excavation, different prothoracic fovea, and by the absence of a golden line of clothing from the metasternum. From *regius*, which has somewhat similar antennae, it is still more distinct. In some respects it is close to *gibbulus*, but it is darker and more densely clothed, elytral punctures distinct, metasternum of male more conspicuously clothed along middle, and the intercoxal projection more conspicuous. The elytra and abdomen are somewhat paler than the rest of the upper-surface. There is a projection from the mouth, but it is too short and stout to be regarded as a bristle.

The antennae, from some directions, appear to be lightly curved near the apex. All the specimens were taken from nests of a small blackish *Iridomyrmex*, with a metallic-greenish gloss.

ARTICERUS CREMASTOGASTRI, n. sp.

♂. Bright reddish-castaneous. Moderately clothed with pale depressed pubescence, upper-surface of abdomen rather sparsely pubescent, but in addition with numerous suberect setae, each side near base with a distinct fascicle; under-surface more uniformly clothed.

Head rather short, median line lightly impressed; with crowded punctures, but becoming smaller and sparser in front. Antennae moderately long, circular in cross-section, rather strongly and suddenly curved about middle; thin at base, almost evenly dilated to apex. *Prothorax* feebly transverse, front angles rounded off; with a rather large and deep medio-basal fovea, continued as a rather shallow median line almost to apex; punctures dense and comparatively coarse, becoming smaller and sparser in front. *Elytra* moderately dilated to apex, subsutural striae rather feeble; punctures small and not very dense, becoming denser at base. Upper-surface of *abdomen* with a large basal excavation, its middle not semicircularly encroaching upon the convex median portion, but with an oblique impression on each side; under-surface finely strigose at base, constricted in middle. *Metasternum* rather lightly ridged along middle, the ridge terminating in a small but acute process near abdomen. Hind *tibiae* somewhat dilated at apex, the front ones more conspicuously so, the middle ones terminating in an acute hook. Length, 2 mm.

♀. Differs in being slightly more dilated posteriorly, antennae somewhat shorter and stouter, less suddenly (but almost as strongly) curved, metasternum less convex, unarmed, and scarcely elevated (except at the junction) above abdomen (this more strongly and evenly convex), and all tibiae simple at apex.

Hab.—Victoria: Birchip, in nests of *Cremastogaster laeviceps* (J. C. Goudie). Type, I. 8543.

Specimens of this species were previously (2) identified by me with doubts as *gibbulus*, but it differs from some specimens of that species now available from Western Australia (the original locality) in being more densely clothed, the head somewhat shorter, the antennae strongly curved, elytra with more conspicuous punctures, the metasternum differently

(2) Proc. Roy. Soc. Vict., 1904, p. 376.

armed, and no spine between middle coxae; on the western specimens the metasternum is more strongly ridged along the middle, but the ridge is more rounded, commences at the base with a spine between the middle legs, and its greatest elevation is hardly spinose and more distant from the abdomen. From *curvicornis* it differs in being larger, antennae of both sexes circular in cross-section throughout (on *curvicornis* in places the antennae are distinctly wider than deep), metasternum and legs very different, oral bristle less conspicuous, etc. Some parts are slightly paler than others, but there are no sharply defined differences. The abdominal fascicles are distinct, but smaller and less conspicuously golden than usual; the under-surface of the abdomen of the male (viewed from the sides) appears to have a few short erect spines, but these are really due to a slight congestion of short setae; the projection from the mouth is very short. The median line of the head is conspicuous from some directions. The front tibiae of the male, from a few directions, appear to have a pale membranous fringe at the inner apex, conspicuously increasing the apparent width. Both sexes have distinctly granulate antennae.

ARTICERUS SULCIVENTRIS, n. sp.

♂. Reddish-castaneous; some parts slightly darker than others. Clothed with very short pubescence, more conspicuous at apex of elytra than elsewhere, upper-surface of abdomen almost glabrous, except for a few short setae, and for a rather elongate fascicle of short clothing on each side of the base; under-surface rather indistinctly clothed, except for a distinct line along middle of metasternum.

Head unusually short and without a median line; punctures dense and rather coarse. Antennae short, scarcely longer than greatest width of head, moderately wide, lightly curved, basal half somewhat flattened, about apex briefly elliptic in cross-section. *Prothorax* distinctly transverse, widest near apex, front angles not completely rounded off; with a large, round, deep, medio-basal fovea; punctures (except in middle of apex, where they are smaller) much as on head. *Elytra* moderately dilated posteriorly, subsutural striae lightly defined; with rather dense and small, but distinct punctures, becoming crowded at base. Upper-surface of *abdomen* with a wide, deep excavation, not encroaching upon middle of convex median portion; under-surface with a rather narrow groove from base to beyond the middle. *Metasternum* sloping from base to beyond middle, where the slope terminates in a short acute spine, beyond this somewhat widely flattened or gently concave. Front and hind *tibiae* somewhat dilated at apex, the former with a small apical spine, middle pair with an acute apical hook. Length, $1\frac{3}{4}$ mm.

♀. Differs in being somewhat wider posteriorly, antennae shorter, and (as viewed from the sides) somewhat stouter, under-surface of abdomen evenly convex, not grooved, and metasternum and tibiae unarmed.

Hab.—North-western Australia: Fortescue River, from nests of a small species of *Iridomyrmex* (W. D. Dodd). Type, I. 8539.

Not very close to any other species known to me; *brevipes* (also from North-western Australia) is a shorter species, with less conspicuous prothoracic fovea, and with abdomen, legs, clothing, etc., different. The clothing of most of the upper-surface is so short that it appears almost like very small scales, but the elytra have a conspicuous apical fringe of short spines; the male has a short spine projecting from the mouth. The antennae of the male are lightly curved, viewed from above they appear to be almost parallel-sided from near the base to the truncated apex, but from the sides each appears to be rather thin on the basal half, and then evenly and rather strongly dilated; from some directions they seem to be finely longitudinally striated, but this is really due to the arrangement of the granules. From an oblique direction the widest part of the prothorax appears to be quite angular. From the sides, and in a rather poor light, the under-surface of the abdomen of the male appears to have an acute spine, but in a good light and from an oblique direction this is seen to be due to two erect setae, close together, but one on each side of the median groove.

Articerus coelogaster, n. sp.

♂. Dark castaneous-brown; elytra, upper-surface of abdomen, and appendages somewhat paler. Clothed with very short pubescence, becoming more conspicuous and golden about apex of elytra, upper-surface of abdomen with a few erect setae about sides and apex, and with a small fascicle on each side of base.

Head short, wide, and deep, without median line; punctures dense and rather coarse. Antennae short and wide. *Prothorax* lightly transverse, front angles rounded off; with a feeble medio-basal depression; punctures as on head. *Elytra* moderately dilated posteriorly, subsutural striae lightly defined; base with dense and moderately coarse punctures, smaller and sparser (but distinct) elsewhere. Upper-surface of *abdomen* with a short deep excavation, not encroaching upon the convex portion; under-surface with a large almost circular fovea, extending from base to the slightly overhanging pygidium; with two short medio-apical processes. *Metasternum* sloping upwards from base to beyond the middle, and then strongly sloping downwards to apex. Front and hind *tibiae* somewhat dilated, the middle pair short, strongly curved, and terminated by a sharp spur. Length, $2\frac{1}{4}$ mm.

Hab.—Queensland: Cairns district, from a nest of ants (F. P. Dodd). Type (unique), I. 8538.

The type was somewhat mouldy, and on cleaning it possibly some of the pubescence was removed; the species, however, is one of the most distinct in the genus; it is a rather large dark one, at first glance somewhat resembling, but really very different from, *dentiventris* and *lophosternus;* it is about the size of *dilaticornis*, but the abdomen is very different, antennae smaller, etc. Structurally it is close to *raffrayi*, but is much darker, the under-surface of the abdomen with a more sharply defined excavation (without sub-basal armature), and antennae slightly shorter. The antennae are narrow at the base, then suddenly and strongly dilated and flat, near the apex they become narrower and deeper, with the apex itself almost circular, the greatest width is almost median; seen from below the basal two-thirds appear to be finely striated. The medio-basal impression of the pronotum is, for the genus, decidedly feeble, but is quite distinct. The excavation on the under-surface of the abdomen is actually of greater extent than the one on the upper-surface; the summit of the metasternal elevation is not spinose, but from some directions appears to be slightly angular.

CUCUJIDAE.

Laemophlaeus blackburni, Grouv. (1902).

L. frenchi, Blackb. (1903).

There was not time for the description of *blackburni* to be noted in the Zoological Record when the description of *frenchi* was sent for publication; otherwise the late Rev. T. Blackburn would certainly not have redescribed this remarkably distinct species.

SCARABAEIDAE.

Neso flavipennis, Macl. (formerly *Platydesmus).*

N. yorkensis, Blackb.
N. planicollis, Blackb.

The late Rev. T. Blackburn has already [3] referred to *planicollis* as a synonym of *flavipennis;* but he was under the

(3) *Ante*, 1907, p. 274.

impression that *yorkensis* was distinct on account of the club and the base of the prothorax. The antennae, however, are very different sexually; in the male the lamellae of the club are much longer than in the female, although in that sex they are so long that a unique specimen would probably be regarded as a male. On some specimens the convexity of the prothorax is more pronounced than on others, but the difference is certainly less striking than is implied in the table, and its *apparent* convexity is subject to alteration by the closeness of its application to the elytra. Of *yorkensis* there are in the Museum a cotype male and the type female; of *planicollis* there are two cotype females and a named male (but not marked as a cotype), and, sex for sex, these agree well in structure. There are also numerous other specimens before me, and the species may be taken in abundance at lights in Northern Queensland. The head and prothorax are frequently more or less reddish-castaneous, but vary (in both sexes) almost to black, occasionally they are scarcely darker than the elytra; pale females in colour are scarcely distinguishable from some forms of *Haplonycha testaceipennis*, but may be at once distinguished by the base of the prothorax being almost simple, instead of narrowly but conspicuously upcurved as on that species.

Neso ducalis, Blackb.

The carinae on the pygidium of this species is sometimes very conspicuous, but varies so that on some specimens it is not traceable. The male differs from the female in being more parallel-sided, and with the lamellae of the club almost twice as long. The size varies from 12 to 16 mm.

Anodontonyx vigilans, Sharp.

A. creber, Blackb.
A. chalceus, Blackb.
A. indignus, Blackb.

Two specimens, one without label, the other(4) labelled "Austral.," in Dr. Sharp's writing, were sent by Mr. Arrow as *A. vigilans*, a species comented upon by the late Rev. T. Blackburn as incapable of determination(5) but as nearest in description to *chalceus*. They, in fact, agree well with three specimens from his collection labelled as *chalceus*, and their iridescence is quite as pronounced as on those specimens. They agree also with two named specimens of *indignus*, a cotype, and some other named specimens of *creber*.

(4) Almost certainly one of the specimens mentioned by Sharp.
(5) *Ante*, 1907, p. 260.

In Blackburn's table reliance was placed on the lateral parts of the prothorax being "very closely (almost confluently) punctulate" in *creber* and "much less closely" in *chalceus* and *indignus*. On the cotype of *creber* the punctures there are certainly somewhat denser than on specimens of the other supposed species, but they are also denser than on a specimen from Ballarat and two from Forest Reefs also identified by him as *creber*, and on these the punctures both there and elsewhere (including those between the first and second elytral striae) are much as on the specimens of *indignus* and *chalceus;* the two latter were distinguished by "Hind angles of prothorax quite distinct, though strongly obtuse" in *chalceus*, and "quite rounded off" in *indignus;* on the specimens in the Museum I can find no difference whatever in the actual rotundity of the angles when viewed from exactly the same direction; if viewed from different points and with the base closely applied to the elytra or not there appear to be slight differences. The apparent convexity of the prothorax of the various specimens differs also with the point of view, but from the same viewpoint the difference is extremely small, certainly not of more than individual importance.

ANODONTONYX PLANICEPS, Blackb. (formerly *Sericesthis).*
Sericesthis parvipes, Blackb.

There are in the Museum the type female, six other specimens labelled as *planiceps* by Blackburn, and numerous others. These vary in colour from light reddish-castaneous to forms whose prothorax, scutellum, and elytra are almost black; some have only the pronotum blackish, and some have the elytra dark but diluted with red about the shoulders. On some specimens, especially of the large dark ones, the clypeus is conspicuously bilobed in front, and it varies (independently of sex) to almost evenly rounded. The sizes of the elytral punctures are also somewhat variable.

Of *parvipes* there is one specimen labelled as a cotype, and I cannot distinguish this structurally from females of *planiceps*, the character relied upon by Blackburn, "Intermediate tarsi very little longer than their tibiae" as against "nearly twice as long" (of *planiceps)* is, on these specimens, more apparent than real; on some of them the claws are directed almost at a right angle to the claw joint, on others they appear to continue the line of the claw, and specimens of the latter (especially if males) appear to have much longer tarsi, but to the eye the four basal joints are just perceptibly longer than the tibia in both sexes.

Var. *ater*, n. var. Seven specimens (from Hawker) differ in having the entire upper-surface deep black, with the under-surface and appendages dark reddish-brown, becoming black in parts. The clypeus in all of them is rather conspicuously bilobed. They were sent with many other specimens having the head pale and the general colour not deep black.

Antitrogus burmeisteri, Blackb.

The table differentiating the three known species of *Antitrogus* given by Blackburn (*ante*, 1911, p. 199) readily permits of the specimens before me being divided into three aggregates, but he appears to have been in doubt as to whether the colours may not have been of more than individual importance. A long series of males (including a co-type and many specimens taken by Mr. Griffith, some of which were commented upon) indicate that the general colour varies from a rather dark reddish-brown to almost black. The size varies from 21 to 24 mm. The female is rather larger and stouter than the male, and the club is much smaller, but the proportions between the third and fourth joints of the antennae are the same; the spurs to the hind tibiae are somewhat stouter, but are otherwise scarcely different.

Antitrogus tasmanicus, Burm.

This species varies in size from 19 to 23 mm., and in colour from a reddish-brown to piceous-brown, with or without a pruinose gloss; occasionally the elytra are paler than the rest of the upper-surface. The female differs from the male as does the female of *burmeisteri*, but the proportions of the third and fourth joints of the antennae are as in its own male.

Semanopterus.

By various authors nineteen [6] names have been referred to this genus, and in dealing with these [7] Mr. Gilbert J. Arrow transfers one (*dentatus*, Blackb.) to *Eophileurus*, and regards all the others, largely by "a study of the genitalia of the males" (these, however, not being otherwise noted) as belonging to but five species. I differ from him, however, as regards two (*meridianus* and *tricostatus*) of the names, and consider that but four species can be maintained.

There are in the South Australian Museum, from the Blackburn collection, specimens of all his supposed species,

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[6] Really twenty, as Mr. Blackburn (*ante*, 1896, p. 250) refers to "my *S. punctiventris*," evidently an MS. name subsequently altered.

[7] Ann. and Mag. Nat. Hist., Ser. 8, vol. xiv., 1914, p. 267.

with the exception of *dentatus;* by the courtesy of the Curator of the Australian Museum (Mr. R. Etheridge) I have also been able to examine the types of Macleay's two species, and Mr. Arrow sent specimens which he identified as *solidus* and *subcostatus.*

SEMANOPTERUS CONVEXIUSCULUS, Macl.: Trans. Ent. Soc. N.S. Wales, ii., p. 201.

S. angustatus, Blackb.: Trans. Roy. Soc. S. Austr., 1887, p. 232; 1896, p. 252.
S. minor, Blackb.: *l.c.,* 1887, p. 233; Proc. Linn. Soc. N.S. Wales, 1888, p. 1413.
S. longicollis, Blackb.: Proc. Linn. Soc. N.S. Wales, 1888, p. 1412.
S. rectangulus, Blackb.: Trans. Roy. Soc. S. Austr., 1895, p. 41.
S. persimilis, Blackb.: *l.c.,* p. 42.
S. carinatus, Blackb.: *l.c.,* p. 43.
S. meridianus, Blackb.: *l.c.,* 1896, p. 250.
S. concentricus, Blackb.: *l.c.,* p. 251.
S. tricostatus, Blackb.: *l.c.,* p. 52.
S. distributus, Blackb.: *l.c.,* p. 252.

Pl. xxx.; pl. xxxi., figs. 21, 22; pl. xxxii., figs. 30-35, 41.

To the synonymy of this species as given by Arrow the two last names have been added, making it as above. In Blackburn's table of the genus primary use was made of the basal angles of the prothorax, and in fact it is difficult at first to accept the idea that a specimen whose basal angle of prothorax is without the slightest incurvature, as on the type of *convexiusculus* (pl. xxxii., fig. 30) can be conspecific with another whose basal angle is very conspicuously notched, as on the cotype of *rectangulus* (pl. xxxii., fig. 32), especially when these differences are accompanied by others in the pygidium, prosternum, etc. However, from examination of the actual types Mr. Arrow came to his conclusion, and in this I am reluctantly compelled to follow him. I have very carefully studied Blackburn's table of the genus with the cotypes (marked as such by himself), and believe that in preparing it he could only have closely examined the types themselves, and made no allowance for variation. For instance, *concentricus*, *angustatus*, and *minor* are stated to have the sides of prothorax "strongly incurved in front of base"; those of two cotypes of *concentricus*, a cotype of *angustatus*, and two cotypes of *minor* have the sides just perceptibly incurved to base (pl. xxxii., fig. 31); on the type female of *concentricus* there is no incurvature at all, the sides being as on the type of *convexiusculus* (pl. xxxii., fig. 30), but on a specimen he identified as *minor* (pl. xxxii., fig. 33), and which I regard as belonging to the variety *rectangulus*, there is a conspicuous notch near the base. A specimen labelled as *carinatus*, the type female of *persimilis*, two cotypes of *rectangulus*, and two of *distributus* could fairly be said to have the sides "strongly excised," as noted in the table, but a cotype of *tricostatus* (pl. xxxii., fig. 36) has but a slight incurvature there. The clothing of the pygidium is a practically useless character for a table, as the hairs are certain to become more or less abraded with age; the punctures of the pygidium are strikingly different on some of the cotypes, but here again, from them, I cannot follow Blackburn's comments. The discal depressions of the prothorax, as on most of the Dynastides, are particularly liable to variation.

Meridianus was regarded by Arrow as a synonym of *subcostatus*, but his opinion is not borne out by the type female, which placed side by side with the type of *convexiusculus* is seen to be absolutely conspecific with it, differing in a very slight degree in the basal angles and in the punctures; but in size, outline, and general sculpture the two are in perfect unison. Possibly the type male belongs to *subcostatus*, and the type female to *convexiusculus*, but this is doubtful from the description. A cotype female from Bindogundra has the prothoracic margins exactly as on the type of *convexiusculus*, but differs somewhat in the elytral punctures.

Tricostatus was apparently considered as distinct by Arrow, although all he says of it is that it is apparently confined to Western Australia.[8] A cotype male in the Museum (pl. xxxii., figs. 32, 36) agrees absolutely (except for a slight degree in the notching of the base), with a specimen pl. xxx., fig. 8, and pl. xxxii., fig. 33) identified by Blackburn as *minor)*. Two other cotype males (from Geraldton) have the prothoracic excavation exactly as on a cotype of *rectangulus*, and the basal notch as in fig. 35 (pl. xxxii.), with the third carina on each elytron less conspicuous than on the other cotype. It appears, therefore, that this name should also rank with the synonyms of *convexiusculus*.

A copy of these notes was submitted to Mr. Arrow for his opinion, which was given as follows:—"I strongly suspect that some of the specimens upon which you are relying as cotypes of Blackburn's species are not the same species as his types. *S. tricostatus* is a well-marked species, as you will see if you will examine the genitalia, which are of supreme

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[8] Blackburn, however, said that from it "a single male example . . . from North Queensland seems indistinguishable . . ."

importance in distinguishing these insects. *S. meridianus* type is a female, but is certainly not *convexiusculus*, Macl., if the latter is *angustatus*, Blackb. I have mounted and carefully compared the aedeagi of all ten types and very many other specimens, and consider my conclusions certain."

I have not felt justified in breaking up the abdomen to examine the aedeagus of any of the male types or cotypes, but three figures are given from some specimens carefully compared with them.

Five males agreed closely with *rectangulus*, and the aedeagus of one is figured (pl. xxxii., fig. 41). The aedeagi of the others all differed slightly from it and from each other; on one of them the two serrations on each side were extremely feeble.

Four males agreed closely with a specimen considered by Mr. Blackburn to be *adelaidae;* of these one has the aedeagus as on pl. xxxii., fig. 39, two had it somewhat similar although not exactly the same, but that of the fourth (pl. xxxii., fig. 40) was without the subapical notch.

It would appear, therefore, that the aedeagus in some species is just as unreliable as external features.

SEMANOPTERUS SUBCOSTATUS, Cast. *(Phileurus)*, Hist. Nat., ii., p. 116 *(Chiroplatys*, Mast. Cat., No. 2478).

S. adelaidae, Hope: Trans. Ent. Soc. Lond., iv., p. 281.
S. subaequalis, Hope: *l.c.*, p. 282.
S. depressus, Hope: *l.c.*, p. 282.
S. depressiusculus, Macl.: Trans. Ent. Soc. N.S. Wales, ii., p. 200.

Pl. xxxi., figs. 17-20; pl. xxxii., figs. 36, 39, 40.

Blackburn of *cubcostatus* remarked that it "might be almost any *Semanopterus*, but is probably *adelaidae*, Hope." Arrow says,(9) "I have already(10) expressed my opinion that the three names bestowed by Hope *(adelaidae, subaequalis*, and *depressus)* refer all to one species. To this species *depressiusculus*, Macl., and *meridianus*, Blackb., also apply, and it should be called *S. subcostatus*, Cast." In neither reference, however, does he give the grounds for his belief, and presumably the type of *subcostatus* is not in the British Museum. As regards *meridianus*, I consider that as a synonym it should be transferred to *convexiusculus*, and comment upon it under that species.

(9) *L.c.*, 1914, p. 267.

(10) *L.c.*, Ser. 8, vol. viii., 1911, p. 156; in this reference, however, he did not include *adelaidae*.

Semanopterus solidus, Burm. *(Scapanes)*, Handb. v., p. 207.

S. subaequalis, (Hope) Blackb.: Trans. Roy. Soc. S. Austr., 1887, p. 231.

Asemantus subaequalis, (? Hope), Blackb.: *l.c.*, 1896, p. 248.

Pl. xxxi., figs. 23-26; pl. xxxii., fig. 37.

Blackburn had doubts as to his identification of *subaequalis*, and these doubts were evidently well founded, as Arrow (no doubt from examination of the types) regards all three of Hope's names as belonging to but one species. The former, however, from his comments on *solidus*, evidently considered the probability of its being the same species as the one he identified as *subaequalis*. On pl. xxxi. are figures (23 and 24) of the specimens described by him as belonging to his new genus *Asemantus*, and the species he supposed to be *subaequalis;* whilst figs. 25 and 26 (pl. xxxi.) are of specimens identified by Arrow as *solidus*, they certainly belong to but one species, a fairly common one in parts of Queensland, New South Wales, Victoria, and South Australia.

Curiously enough standing under the name of *Scapanes solidus*, in many Australian collections, was one of the largest of our *Dynastides* (pl. xxxi., fig. 29),(11) but a reference to the original description proves that this legendary identification is utterly wrong.

Semanopterus leai, Blackb. *(Asemantus)*, *l.c.*, 1897, p. 29.

Pl. xxxi., figs. 27, 28; pl. xxxii., fig. 38.

Regarded by Blackburn as congeneric with the preceding species and generically distinct from *Semanopterus;* it occurs in Western Australia, and is very different from any other species of the genus.

Eupatorus australicus, Arrow, Trans. Ent. Soc. Lond., 1908, p. 354.

Pl. xxxi., fig. 29.

This species appears to be confined to the southern parts of coastal Queensland.

Corynophyllus modestus, Blackb.

A male from Queensland (Stanthorpe) differs from a cotype male of this species in having the cephalic horn larger

(11) *Eupatorus australicus*, Arrow.

and more acute, the space on the head behind it flat instead of concave, and the clypeus and tibiae reddish.

Horonotus optatus, Sharp.
H. variolicollis, Fairm.
Palmerstonia minor, Blackb.
P. pusilla, Blackb.

Prior to their despatch to the British Museum I examined the types of *minor* and *pusilla*, and was satisfied that they are but forms of *optatus*, a species that varies greatly in size, and is frequently attracted to lights in the tropical parts of Queensland. Part of this synonymy has already been recorded.

Horonotus bovilli, Blackb. (formerly *Palmerstonia)*.

A male from Cairns (E. Allen) differs from the male previously commented upon by Blackburn *(ante*, 1896, p. 254), in being considerably larger, in having the cephalic horn considerably larger, and the three prothoracic horns larger, more acute, and not placed in a transverse row (as on that specimen), but closer together, two in front and one behind; the difference to the eye is a very striking one, but the species of *Horonotus* are so variable that the difference is not likely to be more than an individual one. The stridulating file of the pygidium is a very beautiful one.

Hemipharis froggatti, Macl.

I have recently examined the types (sexes) of this species. As suspected [12] they belong to the variety *speciosa* of *H. insularis*.

Chlorobapta viridisignata, Macl.

A female in the Macleay Museum is evidently the type of this species, and as suspected [13] it is a variety of *frontalis*. On its prothorax there are two small green spots on each side; associated with it is a male with quite ordinary markings.

Diaphonia dorsalis, Don.

A male (from the Richmond River) in the Macleay Museum has the black markings much more extended than usual, the pale portion on each side of the prothorax being very narrow, the elytra are dark except for a very narrow lateral margin, and even this becomes infuscated about the apex; a second specimen (also from the Richmond River) has the pale elytral margins somewhat wider, and about the apex

(12) Trans. Roy. Soc. S. Austr., 1914, p. 149.
(13) *L.c.*, p. 156.

somewhat irregular, so that the dark portion at the summit of the apical slope appears to be trilobed.

DIAPHONIA MNISZECHII, Jans.

A specimen of this fine species is in the Macleay Museum from the Darling River.

LYRAPHORA OBLIQUATA, Westw.

A specimen labelled as from Mudgee (New South Wales) is in the Macleay Museum, but the locality is probably wrong.

GLYCYPHANA BRUNNIPES, Kirby.

There are two specimens of this species in the Macleay Museum, from North-western Australia, with the white markings occupying an unusually large proportion of the elytra.

MICROVALGUS QUINQUEDENTATUS, Lea.

Some specimens, that appear to be males of this species, differ from the females in having the apical segment of abdomen flattened in middle, and the general colours somewhat darker.

MICROVALGUS DUBIUS, Lea.

There are specimens of this species in the Macleay Museum from South Australia.

CURCULIONIDAE.

MYLLOCERUS HERBACEUS, Pasc.

Mr. Arrow sent for examination a cotype of this species; it has a strong conical tubercle projecting backwards from the under-surface of the rostrum, and all the femora are acutely and distinctly dentate; as these characters (the first of which is a very remarkable one) were not mentioned in the original description I thought that possibly a mistake had been made in the identification, and wrote to Mr. Arrow for confirmation of same. In reply he wrote, "I have examined Pascoe's type and find it has the peculiar hooked process on the rostrum and also sharply spined femora." *Mirabilis*, the only other Australian species with the under-surface of rostrum somewhat similar, belongs to a different section of the genus, and has the base of prothorax much wider and clothing very different.

ESSOLITHNA RATTULA, Pasc. (formerly *Pephricus*).

A cotype of this species, evidently the one noted as having "two fine white lines at the base of the elytra," was sent for examination; specimens were in the Macleay Museum from the Darling River. The species in general appearance is fairly close to *cordipennis*, but the space between the scrobes is strongly narrowed posteriorly, whereas on that species it is slightly dilated posteriorly; the clothing also is different. As in some respects it seemed to agree with the description of *umbratus*, some years ago specimens were sent for comparison with the type of that species, and of these the late Rev. T. Blackburn wrote, "Specimens sent are certainly not *umbratus*. Apart from colouring (which is very different) it differs, *inter alia*, as follows: Shape of prothorax—in *umbratus*, less rounded laterally with greatest width in front of middle; in your species well rounded, widest at middle. Interval between scrobes in *umbratus* continuously and evenly narrowing from base to apex, in your species at its narrowest near base." The latter character will also distinguish the species from *mediofusca*, which in many respects it resembles. There is a whitish ring on each of the femora.

Essolithna nigescens, Pasc. (formerly *Chaodius*).

A cotype of this species sent for examination has the front coxae exactly as on *Essolithna rattula*, that is to say, the intercoxal process is rather narrow, about half the width of that between the middle coxae and transversely cleft at its narrowest part; the claws are unidentate. It was only on these characters (in comparison with *Polyphrades*) that *Chaodius* was proposed as new, and I regard it is absolutely synonymous with *Essolithna*. The elytra were described as subparallel, but the shoulders are rather strongly rounded, the sides at the apical fourth are coarctate, and the sides between are gently rounded; possibly the sides are sexually variable, but the word subparallel as applied to the cotype would be misleading. The species is extremely close to *cordipennis*, but differs in having longer and narrower elytra.

Essolithna umbrata, Blackb. (*Pephricus*).

On closely examining a cotype of this species each claw is seen to have a smaller one soldered to it at the base; the smaller claw is invisible from most directions, but its presence on this species and its gradual enlargement on several species of *Polyphrades*, till at the apex the claws are noticeably cleft, but of equal size, seem to imply a doubt as to whether *Essolithna* (to which genus *Pephricus* has already been referred) can be eventually maintained as distinct.

Catasarcus pollinosus, Pasc.

C. maculatus, Pasc.

A specimen sent for examination by Mr. Arrow, marked as a cotype and bearing a label "*Catasarcus pollinosus*, Pasc.," in Pascoe's own writing, is simply a specimen of *maculatus* that has the whole of the upper-surface with a curiously leaden or varnished appearance. It was described as "having an ashy-waxy appearance above." This appearance is liable to occur on *any* species of *Catasarcus*, and I have previously commented upon it under the word "Varnishing."[14] As, however, the description of *pollinosus* was printed (p. 23) before that of *maculatus* (p. 25) the latter name must be treated as a synonym. The species occurs in abundance at King George Sound and near same.

It is quite possible that the species is the *Cneorhinus impressipennis* of Boisduval.[15] The figure of that species is certainly an extremely poor one, but, such as it is, it seems to come closer to this species than to any other before me.

Catasarcus stigmatipennis, Boi. (formerly *Cneorhinus)*.

C. transversalis, Germ.
C. memnonius, Pasc.

A specimen sent for examination by Mr. Arrow as a cotype of *memnonius* is simply an abraded[16] one of *transversalis*, the only species of the genus of which I have seen authentic specimens from any other State than Western Australia. It is common in many parts of Victoria and South Australia, is considerably variable in size, and abraded specimens have a very different appearance from ones in good condition. I am also convinced that it is the *Cneorhinus stigmatipennis* of Boisduval, described as from Port Western (near Melbourne).

Catasarcus ovinus, Pasc.

A specimen from the British Museum bears three labels: — 1. "N. Australia." 2. "Bowring, 63.47." 3. "*Catasarcus ovinus*, Pasc. Compared with type, G. J. A." But in that institution (judging from specimens sent to me for examination) there are many specimens labelled as from North Australia and Bowring that are certainly not from the tropical portions of Australia, belonging to quite common

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(14) Proc. Linn. Soc. N.S. Wales, 1897, pp. 593, 594.

(15) Voy. "Ast.," p. 350, and Atlas, pl. vii., fig. 9.

(16) It was described as being "without any scales."

species in New South Wales, Victoria, or Western Australia. This species is a common one in Western Australia, and is the one I previously [17] surmised to be such.

Catasarcus griseus, Pasc.

A specimen sent as a cotype of *griseus* is certainly very close to the preceding one, but differs in the elytral striation being less evident posteriorly, and the punctures towards the base more or less transversely confluent (much as on many specimens of *transversalis)*. In Pascoe's table they are separated by *griseus* being "oval and more or less oblong" and by *ovinus* being "shortly ovate"; there is certainly a slight difference in the comparative widths of the specimens sent, but there are specimens of *ovinus* before me with a still greater range in width. In *griseus* the first joint of the funicle was described as "very little longer than the second," in *ovinus* as "considerably longer"; but on each of the specimens sent the first joint appears to be about one-fourth longer than the second, the proportions being exactly the same. That the two forms represent distinct species I can hardly believe; if they should eventually prove to be varieties *griseus* has priority.

Catasarcus ceratus, Pasc.

C. granulatus, Lea.

A specimen sent for examination by Mr. Arrow, marked as a cotype, and bearing a label "*Catasarcus ceratus*, Pasc.," in Pascoe's own writing, is simply a varnished one of the species I subsequently named *granulatus*. Its finer sculpture is naturally less conspicuous and the varnishing has extended even to parts of the legs. Its antennae are missing, but those of the type were wrongly described. [18]

Catasarcus longicornis, Pasc.

A Champion Bay specimen sent for examination as a cotype of *longicornis* agrees well (even as to the antennae) with a species, common about the Swan River, which I have long had as *hopei*. But probably Pascoe had another species as *hopei*, and I am not prepared to defend my identification of the latter. It might be pointed out, however, that the differences relied upon in his table by Pascoe could very well be sexual.

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(17) Trans. Roy. Soc. S. Austr., 1909, p. 155.

(18) See note Trans. Roy. Soc. S. Austr., 1909, p. 156.

Catasarcus armatus, Blackb.

Six specimens before me, from Kalgoorlie, are evidently in better condition than the type was; four of them have the elytra at the base densely clothed (mostly in three conspicuous patches) with ochreous scales, having, on close examination, a somewhat golden glitter, and similar scales rather thickly scattered elsewhere. Along the middle of the prothorax there is usually a conspicuous line of bluish scales; three of the specimens have the shoulders tuberculate, but on the others they are unarmed.

Catasarcus sericeus, Blackb.

A specimen, from Kuminin, possibly belongs to this species. Its scales, whilst mostly greenish, are considerably mixed with sooty and somewhat golden ones; the posthumeral tubercle (directly above the middle of the metasternum) is an obtuse swelling only, instead of a spine, as on most species of the genus.

Amisallus nodosus, Er.

A specimen, from Tasmania, agrees with Erichson's description of *nodosus*, but in addition to the large elytral tubercles described by him it has several small ones on the suture about summit of apical slope; these were not mentioned, but their presence on any species of the Leptopsides is of importance as an aid to identification, and *nodosus* is the only described species of *Amisallus* with such tubercles. A specimen from Mount Tambourine (Queensland) has similar sutural tubercles to the Tasmanian one, but the interior row on the right elytron is composed of five, and on the left elytron of seven, large tubercles.

Amisallus whitei, Waterh., var.

A specimen, from Cairns, differs from the typical form of this species in having a cluster of four conjoined tubercles, forming an irregular mass on each shoulder; the furrow on its prothorax is distinct, narrow, and scarcely interrupted, and the inter-ocular tubercles smaller and more obtuse than usual.

Lipothyrea chloris, Pasc., var.

Five specimens from Charters Towers differ from the typical form of this species in having the green scales replaced by ashen ones, and the size decreasing to 6 mm.; the general appearance of the smaller specimens is much like that of *arrowi*, but they are without the conspicuous long setae of that species.

Oxyops gemella, Pasc.

A specimen from "Western Australia" (the type was from Champion Bay) sent as a cotype of *gemella* is very close to *multidentata*, but differs in the front tibiae being thicker, straighter, and less conspicuously dentate. The original description is distinctly misleading (if the cotype agrees well with the type), as the elytra were noted as having the third interstice elevated throughout and as having "singulatim medio nigro-plagiatis et postice macula alba distincta notatis"; also no mention was made of a rather strong prothoracic carina. On the cotype there is a semicircular irregularly double row of large punctures or foveae, commencing near the shoulder, curved round to near suture, and then obliquely hindwards, terminating about summit of apical slope; these punctures appear darker than the adjacent parts owing to partial absence of clothing, but the space there is certainly not black. The species also occurs in South Australia and Victoria.

Ethemaia alternata, Lea.

Mr. Feuerheerdt has recently taken numerous specimens of this species. On some of them the elytral scales are mostly slaty-white, but with patches varying to sooty; on many of them there are small patches of ochreous scales at the base of the head; some of them have a second tubercle on the fifth interstice before the one crowning the apical slope.

Lycosura breweri, Pasc. (formerly Pantoreites).

L. inermis, Lea.

A cotype of *breweri* sent for examination by Mr. Arrow does not even belong to the Gonipterides, but is a *Lycosura*, and is the species I have named *inermis*.

Opsittis atomaria, Pasc.

Sediantha maritima, Lea.

Mr. Arrow sent for examination a cotype of *Opsittis atomaria*. The genus and species are the same as those I subsequently named *Sediantha maritima*. The eyes were correctly described by Pascoe as transverse, small and approximate in front, but the figure (pl. vii., fig. 8) of the side view of the head is utterly misleading. The genus is quite close to *Desiantha* of the Erirhinides, but Pascoe referred it to the *Molytides*, where I would never have thought of looking for it.

Phrenozemia.

This genus was referred by Pascoe to the group Eugnomides of the Erirhinides. A female of the typical species, *lyproides*, was recently sent to me for examination by Mr. Arrow; it bears a name label by Pascoe, and is no doubt a cotype; there are also numerous specimens from Geraldton before me that belong to the species. The genus looks out of place in the Erirhinides, and more as if it should be associated with *Medicasta*, or possibly *Acalonoma*, but regarding it as an Erirhinid it could, in Blackburn's table(19) (disregarding the position assigned to it by him on account of the "eyes as much on rostrum as on head," a scarcely correct character,(20) as the eyes, although quite frontal, are not any more "on" the rostrum than on many other Erirhinid genera), be associated with *Desiantha*, to which it is far from being closely allied; but if excluded from I of that table, it could be placed in MM,(21) and the ocular lobes being entirely wanting, it would be associated with *Omorophius*, to which also it is far from being closely allied. The eyes are rather large but not prominent, coarsely faceted, and distant from the prothorax; the head is regularly narrowed from its base to the base of the rostrum, and the eyes are so little prominent that they scarcely interfere with the general obliquity of the sides.

Phrenozemia lyproides, Pasc.

This species is individually and sexually variable. In the specific description the scales were noted as "*griseo-albis*," but in the generic one as having "a pearly lustre"; on the pronotum there is often a pale median line of scales extending forwards on to the base of the head, and backwards to beyond the scutellum; towards each side of the elytra there is often a whitish vitta, with a golden or greenish gloss, but often the scales of the upper-surface are smoky-brown, pale golden-green and golden confusedly mixed; on the under-surface and legs they are also variable, but with the paler colours prevailing; some specimens, however, have scarcely any gloss to the scales, and the expression "*griseo-albis*" well applies to them. The rostrum of the male is almost straight and almost as long as the prothorax, and the antennae, when stretched out at right angles to the rostrum, are so placed

(19) *Ante*, 1894, pp. 148-150; although tabulated by Blackburn it was apparently unknown to him.

(20) Nor can I find any warrant in Pascoe's description or in his table of genera for such a character being used.

(21) Pascoe corrected the original description of the funicle when describing a second species of the genus.

that the distance separating them is slightly greater than the distance between them and the tip of the muzzle. In the female the rostrum is thinner, more noticeably but not strongly curved, about one-fourth longer, and the distance between the antennae is scarcely more than half that between them and the tip of the muzzle. The basal segment of the abdomen of the male is moderately concave, and the second is flat in the middle; in the female the basal segment is gently convex in the middle, and the second decidedly convex.

CYROTYPHUS FASCICULARIS, Pasc.

A specimen from Coolgardie differs from the normal form of this species in being considerably larger (17 × 7 mm.), fascicles on the elytra more numerous (there are nine small ones on each side of the suture), the transverse series of four tubercles on the pronotum larger, and the apex with two fairly large ones (on the normal form these are represented by slight ridges).

CTENAPHIDES MACULATUS, Pasc. (formerly *Eurhynchus).*
C. gymnostictus, Lea.

Mr. Arrow sent a female of *Eurhynchus maculatus* for examination, marked as having been compared with the type. It is the species I subsequently named *C. gymnostictus*. Pascoe's description is somewhat misleading, as the club was given as black and the elytral interstices as having piceous spots; the elytra certainly have a spotted appearance, but this is due to small glabrous spaces, these being exactly the same colour as the rest of the derm. The scutellum was described as triangular; as a matter of fact, it is almost vertical with a conspicuous median groove.

HAPLONYX SCOLOPAX, Pasc.

A cotype of this species sent for examination proves to be, as previously suspected,(22) simply an abraded specimen of *spencei;* the sexes differ in the length of the rostrum, that of the female being distinctly longer than that of the male.

HAPLONYX DOTATUS, Pasc.

A cotype of this species is certainly but one of the many varieties of *myrrhatus*. The clothing and scales of specimens of *Haplonyx* that have been preserved in liquids often differ considerably in appearance from specimens of the same species that have been killed and kept dry. Partial abrasion also considerably alters their appearance.

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(22) *Ante*, 1910, p. 44.

Haplonyx fallaciosus, Pasc.

A cotype of this species is structurally very close to *fasciculatus*, but has the prothorax non-fasciculate. The description implies that there is but one fascicle on each elytron, but on the cotype there are five on each, three on the third interstice and two on the fifth.

Decilaus infaustus, Pasc. (formerly *Drassicus*).
Decilaus coryssopus, Lea.

A specimen sent for examination by Mr. Arrow as a cotype of *Drassicus infaustus* and agreeing with the description, agrees with the type of *D. coryssopus*. Pascoe referred it with some doubt to *Drassicus*, but it belongs to *Decilaus*; he recorded it from Wide Bay, and the cotype is so labelled; the types of *coryssopus* were from Hobart, and it is very doubtful if Wide Bay was correctly given.

Phlaeoglymma pallida, Lea.

Two specimens, from the old collection, and without locality labels, evidently belong to this species. They differ from the type in having most of the scales on the upper-surface of a dingy light brown, but in places verging to sooty. The white scales form three lines on the pronotum, of which the median line is no longer than the others. On each elytron they form an oblique stripe from the shoulder to near the suture, and another across summit of posterior declivity. On the under-surface the light-brown scales are fairly numerous. The three specimens, that I have now seen of the species, appear to be all males.

Pachyporopterus satyrus, Pasc. (*Poropterus*).
Poropterus inominatus, Pasc.

Mr. Arrow informed me that these names are synonymous, *satyrus* was recorded from Tasmania and *inominatus* from Queensland; the former occurs in many parts of Tasmania, but apparently not beyond that State. If the type of the latter was really from Queensland, I should be dubious about its being really a synonym, especially as Pascoe compared them, saying of *inominatus* that it was "shorter, less convex, the parts behind the carina marking the upper region of the epipleura, abruptly constricted, and the scales at the base of the elytra concolorous with and closely fixed to the derm, the part, except under a strong lens, appearing denuded." However, in a second communication Mr. Arrow wrote, "The single type specimen of *inominatus* bears only the loc. Queensland in Pascoe's handwriting. The only part of the above comparative description which I can confirm is the denuded appearance, which is an unmistakeable reality. I think Pascoe must have made a mistake in the locality and imagined the rest.''

Omydaus luridus, Fab. (formerly *Rhynchaenus).*

Cryptorhynchus fuliginosus, Boi.
Acalles immansuetus, Boh.
O. plinthoides, Pasc.

In commenting (23) on the synonymy of *fuliginosus*, I was somewhat dubious as to *luridus* really being the same species, as Pascoe stated that it was a *Poropterus;* I have seen the type of *fuliginosus*, which is certainly the same as *immansuetus* and *plinthoides*, and Mr. Arrow has recently compared the types of *luridus* and *plinthoides*, and considers them identical.

CHRYSOMELIDAE.

Diaphanops westermanni, Boh.

Var. *D. meyricki*, Blackb.
Var. *D. parallelus*, Blackb.

There are before me 28 specimens, all of which I believe to be *westermanni*, but they present considerable differences in size, colour, and clothing. The difference in appearance of the clothing is often due to partial abrasion (24) and to the colour of the derm upon which it is resting, but on some specimens it is beautifully regular, and on others it appears to be rougher, this, however, probably being due to some of them having been preserved in alcohol. The colour of the derm varies from entirely pale reddish-brown to entirely deep black, many specimens have the elytra and appendages conspicuously paler than the head and prothorax, some have the elytra only paler, and some have only parts of the head and of the antennae darker than the other parts. On the male the prothorax is rather shorter than on the female, and with the front angles more conspicuously rounded off, its elytra also are proportionately wider than on the female, and the antennae are slightly longer. The specimens commented upon or described by Blackburn (25) were all taken by Mr. Meyrick at Geraldton, and of these there are in the Museum two doubtfully identified as *westermanni*, two marked as

(23) Proc. Linn. Soc. N.S. Wales, 1913, p. 463.

(24) On partially abraded specimens there are seen to be seriate rows of large punctures on the elytra, but these are normally almost or quite concealed.

(25) Proc. Linn. Soc. N.S. Wales, 1889, pp. 457-9.

cotypes of *meyricki*, and one as a cotype of *parallelus*.(26) Of a pair taken *in cop.* at Geraldton the male agrees perfectly with the specimens identified as *westermanni*, the female agrees perfectly (except that the head and part of the antennae are much darker) with the cotypes of *meyricki*. Of another pair taken *in cop.* at Bunbury, the male agrees perfectly with the cotype of *parallelus;* the latter certainly has not anything near as parallel elytra as is implied by the description, these being (except for the sexual difference in width) practically the same as in the cotypes of *meyricki*.

Crioceris fuscomaculata, Clark.

C. recens, Blackb., var.

This species is very variable and is abundant in Northern Queensland. The following more or less constant colour forms may be noted:—

A. Flavous; head (neck usually excepted), scutellum, parts of under-surface and of appendages (most of femora excepted) black. In general appearance this form is close to *C. nigripes*, but differs considerably in the punctures and in the shape of the prothorax; that species appears also to have the scutellum invariably pale, on this (and in all other forms of the species) it is invariably dark. On this and on form B the elytral punctures are often surrounded by watery rings, when they appear to be considerably larger than they really are; on examining them from the sides, however, they are seen to be no larger than on the darker specimens.

B. Like A, except that on each elytron before the middle there is a conspicuous more or less rounded black spot. This is the typical form.

C. Black, elytra flavous, a large black spot on each elytron.

D. Like A, except that there is a large black blotch on the elytra occupying more than half of the surface, but leaving the basal third, margins, and apex pale.

E. Like D, except that the suture is pale throughout.

F. Black, basal fourth of elytra (and sometimes the extreme margins or portions of them) pale. This is the variety *recens*.

There are other forms varying in the under-surface and legs; one before me is entirely black, except that a narrow basal edging to each elytron and parts of the under-surface and of the femora are reddish. The pale colour on the various forms varies from a clear flavous to a rather dark red, but this may be due to age, etc.

(26) Although he stated that "a single specimen was taken."

Stethopachys formosa, Baly.

This species occurs from the Richmond River, through the coastal districts of Queensland to Darwin. In the most abundant form the elytra have five spots, three somewhat angular sub-basal ones, and two rounded or transverse subapical ones; occasionally the three sub-basal ones are conjoined, and frequently the subapical ones are; on an occasional specimen the spots are entirely absent, and occasionally they are reduced to two small subapical ones and a minute one near each shoulder; on one specimen each subhumeral spot is split up into two, so that there is a transverse series of five spots near the base. There are also other varieties, but I have seen none bearing the cephalic spot of the type.

Stethomela purpureipennis, Lea.

A specimen of this species has recently been taken at Hobart by Mr. G. H. Hardy.

Calomela tenuicornis, Lea.

Mr. Carter informs me that the locality "Sandgate" for the specimen received from him should have been "Sandstone" (half-way between Murchison and Kalgoorlie).

Arsipoda kingensis, Blackb.

The late Rev. T. Blackburn described *kingensis* as a variety of *variegata*, but I am convinced that it should be regarded as a distinct species. In addition to the King Island specimens numerous others have been taken in various parts of Tasmania, and there were two in the Blackburn collection from Adelaide, and all these differ from *variegata* in being distinctly narrower, prothoracic and elytra punctures considerably larger, colour invariably very pale, and the elytra never with darker markings. *Variegata* is certainly a variable species, but I have never seen a specimen without some darker markings, and even the palest specimens differ from *kingensis* in the structural features noted.

Chirida multicolor, Blackb.

The type of this species was described as having on its prothorax "a short broad blackish vitta running forward a short distance from the base and dilating at its front." But on a cotype the vitta, although of the shape described, is of a rather light brown. There are numerous other specimens before me (from Cairns, Mulgrave River, Mackay, and Clarence River) that structurally agree so well with the cotype that I cannot regard them as distinct, but they all have the prothorax immaculate.

EXPLANATION OF PLATES.

Plate XXX.

(All of *Semanopterus convexiusculus*, Macl.)

Fig. 1. Type, Gayndah.
,, 2. *S. angustatus*, Blackb. Cotype, South Australia.
,, 3. *S. minor*, Blackb. Cotype, South Australia.
,, 4. *S. minor*, Blackb. Type of female, South Australia.
,, 5. *S. longicollis*, Blackb. Type of female. Coonabarabran.
,, 6. *S. rectangulus*, Blackb. Type of female, Alice Springs.
,, 7. *S. rectangulus*, Blackb. Cotype, Leigh Creek.
,, 8. *S. rectangulus*, Blackb. (identified as *minor*, Blackb.). Elder Expedition.
,, 9. *S. rectangulus*, Blackb. N. Queensland.
,, 10. *S. persimilis*, Blackb. Type of female, N. Queensland.
,, 11. *S. carinatus*, Blackb. Bears name-label but is not a cotype, Queensland.
,, 12. *S. concentricus*, Blackb. Type of female, Darling Downs.
,, 13. *S. concentricus*, Blackb. Cotype, Beverley.
,, 14. *S. concentricus*, Blackb. Without name label, but numbered 6207, Nullabor Plains.
,, 15. *S. distributus*, Blackb. Type of female, Whitton.
,, 16. *S. distributus*, Blackb. Cotype, Tamworth.

Plate XXXI.

Fig. 17. *S. subcostatus*, Cast. (identified by Mr. Arrow). New South Wales.
,, 18. *S. subcostatus*, Cast. (identified by Mr. Blackburn as *adelaidae*, Hope). South Australia.
,, 19.} *S. subcostatus*, Cast. (*depressiusculus*, Macl., types).
,, 20.} Gayndah.
,, 21. *S. convexiusculus*, Macl. (*meridianus*, Blackb., type of female). New South Wales.
,, 22. *S. convexiusculus*, Macl. (*tricostatus*, Blackb., cotype). Western Australia.
,, 23.} *S. solidus*, Burm. (identified by Mr. Blackburn as *sub-*
,, 24.} *aequalis*, Hope). South Australia.
,, 25.} *S. solidus*, Burm. (identified by Mr. Arrow). Queens-
,, 26.} land.
,, 27. *S. leai*, Blackb. Cotype, Pinjarrah.
,, 28. *S. leai*, Blackb. Type of female, Western Australia.
,, 29. *Eupatorus australicus*, Arrow.

Plate XXXII.

Fig. 30. Sides of prothorax of figs. 1 and 12.
,, 31. ,, ,, ,, 2, 3, 4, 5, 13, 14, and 21.
,, 32. ,, ,, ,, 6.
,, 33. ,, ,, ,, 7, 8, and 15.
,, 34. ,, ,, ,, 9 and 10.
,, 35. ,, ,, ,, 11 and 16.
,, 36. ,, ,, ,, 17, 18, 19, 20, and 22.
,, 37. ,, ,, ,, 23, 24, 25, and 26.
,, 38. ,, ,, ,, 27 and 28.
,, 39. Aedeagus of *S. adelaidae*, Hope.
,, 40. ,, ,, ,,
,, 41. ,, *S. rectangulus*, Blackb.

Further Notes on Some Moths from Lord Howe and Norfolk Islands in the South Australian Museum.[1]

By A. Jefferis Turner, M.D., F.E.S.

[Read October 10, 1918.]

A preliminary note on some moths taken by Mr. A. M. Lea on these islands appears in these Transactions (vol. xli., 1917). My departure to England prevented me from dealing with them more thoroughly at the time, but has enabled me to obtain valuable help from Mr. Edw. Meyrick, F.R.S., Sir Geo. Hampson, and Mr. L. B. Prout in determining some of them. Some corrections will be made in the former lists, all new species described, where this can be done, and the relationships of the fauna in each case will be discussed.

At first sight the collections appeared disappointing, for they consisted mainly of well-known and widely distributed species; but a closer examination showed the presence of a considerable percentage of new species, for the most part small and inconspicuous, but of great interest. It must be remembered that Mr. Lea was mainly bent on collecting Coleoptera, and that the moths obtained were chance captures, including a large proportion taken at light. The latter might be expected to consist mainly of species feeding on common weeds and garden plants, for the most part not endemic, and some at least artificially introduced. The collections, however, establish the existence on each island of an endemic lepidopterous fauna, and there can be no doubt that by systematic collecting many interesting species would be added to the list.

Lord Howe Island.

Corrections and additions to former list:—

Arctiadae—For *n. gen.* (?) *et. sp.* (page 53) substitute *Ilema*, n. sp.

Geometridae—For *Boarmia inflexaria*, Snel. (page 53), substitute *Cleora inflexaria*, Snel. For *Cidaria* (?). sp. (page 53), substitute *Xanthorhoe* (?) n. sp.

Tineidae—*Hyponomeuta*, sp., is referable to *paurodes*, Meyr., previously known only from Queensland. Add two new species of *Blastobasis* and one of a new genus *Eretmobela*.

The following species, six in number, were taken on the island several years ago, and presented to me by Mr. G. A. Waterhouse; not one of them is endemic.

Arctiadae—*Utetheisa pulchella*, Lin.,(?) or *pulchelloides*, Hmps.(?) One female example, which might be referable to either of these widely distributed species, which can be distinguished only by the secondary sexual characters of the male. The latter occurs in the Kermadec Islands and New Zealand.

Noctuidae—*Ophideres fullonica*, Lin. Three examples. Common on the Queensland coast and throughout the Eastern tropics. Has also been taken in New Zealand. *Dasypodia cymatodes*, Gn. One female example. A common species in Queensland and New South Wales.

Sphingidae.—*Sphinx convolvuli*, Lin. Two examples. Common throughout the Eastern Hemisphere.

Geometridae—*Urolitha bipunctifera*, Wlk. One female example. Also from Queensland and New South Wales. I believe the larva feeds on the mango, and it may have been introduced.

Pyralidae.—*Botyodes asialis*, Gn. One example. Widespread throughout the Eastern tropics, including New Guinea. I have no record for Queensland, though it should occur there.

Family ARCTIADAE.

Ilema haploa, n. sp. (ἁπλοος, simple).

♂, 24-28 mm. Head, palpi, and thorax brown. Antennae brown; in male with short ciliations ($\frac{1}{2}$) and longer bristles (1). Abdomen whitish-brown. Legs brown. Forewings narrow-elongate, somewhat dilated posteriorly; costal margin bent over to form a strong costal fold on under-surface from base to $\frac{2}{3}$; pale brown; cilia pale brown. Hindwings with 6 and 7 coincident; whitish-ochreous; cilia whitish-ochreous.

Although of plain inconspicuous colouring this species appears to be not very closely related to any other in the genus. Eight male examples.

Calamidia pamphaea, n. sp. (παμφαιος all dusky).

♂, 31 mm. Head, thorax, and abdomen fuscous-brown. Palpi in male very long (5), ascending; terminal joint longer than second, spathulate; fuscous-brown. [Antennae broken.] Legs fuscous-brown. Forewings elongate, narrowly oval; brown closely irrorated with fuscous; an ill-defined median fuscous spot at $\frac{2}{3}$; cilia fuscous-brown with pale apices. Hindwings and cilia pale fuscous.

Very near the Australian *C. hirta*, Wlk., but much darker and of uniform coloration. Two male examples.

Philenora euphileta, n. sp. (εὐφιλητος, well beloved).

♂, 15 mm. Head and thorax white. Palpi dark fuscous. Antennae pale fuscous; in male shortly ciliated ($\frac{1}{2}$). Abdomen pale ochreous. Legs ochreous; anterior pair with some pale-fuscous suffusion. Forewings elongate-triangular, costa gently arched, more strongly towards apex, apex rounded, termen obliquely rounded; white; costal edge ochreous; a large fuscous blotch in disc beneath middle, where it extends from $\frac{1}{4}$ to $\frac{1}{2}$, extending nearly to dorsum, where it is only half as long; a large pale-fuscous terminal suffusion not reaching apex; cilia pale ochreous. Hindwings and cilia pale ochreous.

One example. The type is wasted and the description of the forewings is probably therefore inexact, but the species is very distinct.

Family GEOMETRIDAE.

Subfamily LARENTIANAE.

Xanthorrhoe (?) aphanta, n. sp. (ἀφαντος, inconspicuous).

♀, 24 mm. Head ochreous-whitish. Palpi $2\frac{1}{2}$; ochreous-whitish. Antennae ochreous-whitish. Thorax, abdomen, and legs ochreous-whitish with some pale-brownish irroration. Forewings triangular, costa straight to $\frac{2}{3}$, thence slightly arched, apex round-pointed, termen slightly bowed, moderately oblique; ochreous-whitish; markings fuscous-grey mixed with brownish, a moderate basal patch, its outer margin transverse, dentate; a slight suffusion beyond this; a broad median band, its anterior edge from $\frac{1}{3}$ costa to mid-dorsum, concave, wavy; posterior edge from $\frac{2}{3}$ costa to $\frac{3}{4}$ dorsum, wavy, with a single, prominent, rather obtuse, median tooth; towards costa the middle part of median band is paler and contains a transverse linear blackish discal mark; three rippled lines beyond median band, the last edged posteriorly by an interrupted dentate whitish line; a terminal series of blackish dots; cilia ochreous-whitish. Hindwings whitish with some greyish suffusion; a terminal series of dark-fuscous dots.

An inconspicuous species of ordinary *facies*. The type being a female, it is impossible to be sure that it may not belong to the genus *Cidaria*. One example.

Subfamily ACIDALIANAE.

Brachycola (?) microsticta, n. sp.
(μικροστικτος, minutely speckled).

♀, 34 mm. Head, antennae, and thorax ochreous-whitish. Palpi in female 4, slender, terminal joint $\frac{1}{2}$

second; ochreous-whitish, upper edge of second joint purple-brown. Abdomen ochreous-whitish with four suffused dark-fuscous transverse bars on dorsum. Legs ochreous-whitish. Forewings triangular, costa very slightly arched, apex acute, slightly produced, termen slightly bowed; oblique; ochreous-whitish with very scanty, fine, dark-fuscous irroration; a postmedian series of minute dark-fuscous dots on veins; a terminal series of dark-fuscous dots between veins; cilia ochreous-whitish. Hindwings with termen slightly bowed; colour and markings as forewings. Underside as upper but faintly tinged with rosy, and dots paler.

Here, also, it is impossible to be certain of the genus in the absence of the male. One example.

Family PYRALIDAE.

Subfamily PYRALINAE.

MACALLA PHOENOPASTA, n. sp.

(φοινοπαστος, sprinkled with dark red).

♂, 36 mm. Head and thorax reddish-brown irrorated with whitish. Palpi in male dilated and very long, erect; ochreous-brown irrorated with whitish. Antennae fuscous; in male moderately ciliated ($\frac{1}{2}$); antennal process in male large, reaching to middle of thorax; reddish-brown mixed with whitish, upper edge partly fuscous. Abdomen ochreous mixed with fuscous and whitish. Legs whitish mixed with dark red and fuscous, posterior pair paler. Forewings elongate-triangular, costa moderately arched, apex rounded-rectangular, termen slightly rounded, slightly oblique; in male with a short transversely linear glandular swelling on upper side of costa at $\frac{2}{3}$; whitish irregularly mixed with dark-red and greenish scales; a dark-fuscous transverse line at $\frac{1}{4}$ from lower edge of cell nearly to dorsum, margined posteriorly with reddish; a very ill-defined whitish line from costa at $\frac{4}{5}$ to dorsum before tornus, margined posteriorly with reddish, which towards dorsum forms an incomplete dentate line; some dark-fuscous streaks on veins before apex; three fuscous spots on termen beneath apex; cilia whitish. Hindwings fuscous; paler towards base; cilia whitish.

This belongs to a small Australian group within the genus, characterized by the costal gland in the male. It comprises *costigeralis*, Wlk.; *concisella*, Wlk.; *demotis*, Meyr. (which, however, I have not seen); and *prasina*, Warr. One male example.

Subfamily PYRAUSTINAE.

MECYNA INSULICOLA, n. sp. (?)
(*Insulicolus*, inhabiting an island).

♀, 35 mm. Head and thorax fuscous with some ochreous-whitish admixture. Palpi 4; fuscous, basal half of under-surface white. Antennae fuscous. Abdomen ochreous-yellow, paler beneath. Legs whitish suffused with reddish-ochreous; anterior pair more reddish. Forewings elongate-triangular, costa straight to $\frac{2}{3}$, thence strongly arched, apex rectangular, termen nearly straight, only slightly oblique; fuscous irrorated with whitish, more densely so in posterior part of disc; an ill-defined oblong dark-fuscous spot on mid-dorsum; a large transversely oval dark-fuscous spot beneath midcosta; an interrupted dark-fuscous line represented by dots on veins from $\frac{2}{3}$ costa, bent inwards below middle to join dorsal spot; terminal area tinged with dark red; cilia fuscous mixed with dark red. Hindwings ochreous-yellow, a dark-fuscous apical blotch prolonged by a narrowing process to mid-termen, containing some reddish scales; cilia ochreous, bases fuscous on apex of wing. Underside ochreous with large reddish blotch prolonged along costa and termen on both wings; forewings with an oblique fuscous mark on end of cell. One example.

This species presents a difficulty. It is very distinct from the Australian *M. ornithopteralis*, Gn. (which, however, is almost, if not quite, identical with the European *M. polygonalis)*, in which there is always a complete dark terminal band on the hindwings. On the other hand, it is very nearly similar to some examples of the American *M. reversalis*, but unless this species has been artificially introduced (which seems barely possible) it can hardly be identical. The most satisfactory way of dealing with the difficulty would probably be to regard all four forms as one species.

Family TINEIDAE.

Subfamily OECOPHORINAE.

ELAEONOMA PHAEOPASTA, n. sp. (φαιοπαστος, darkly sprinkled).

♂ and ♀, 15-17 mm. Head and palpi ochreous-whitish. Antennae ochreous-whitish; in male with extremely long ciliations (8). Thorax pale fuscous. Abdomen pale fuscous, apices of segments and tuft ochreous-whitish. Legs ochreous-whitish with a few pale-fuscous scales. Forewings not dilated, costa moderately arched, apex round-pointed, termen oblique, scarcely rounded; ochreous-whitish with patchy fuscous irroration more marked in male, especially in posterior part of disc; three well-marked fuscous discal dots, first in disc at $\frac{1}{3}$, second on fold slightly beyond first, third in disc before $\frac{2}{3}$; cilia ochreous-whitish. Hindwings and cilia grey.

But for the stalking of veins 2 and 3 of the forewing this might pass for one of the *convictella* group of the genus *Eulechria*. Three examples.

Blastobasis episema, n. sp. (ἐπισημος, distinctly marked).

♂, 17 mm. Head whitish-ochreous. Palpi whitish-ochreous; in male with second and terminal joints much enlarged, the latter obtuse. Antennae with basal joint dilated to form a small eyecap with a well-developed pecten on its lower edge; whitish-ochreous; ciliations in male 2. Thorax whitish-ochreous, anterior edge fuscous. Abdomen fuscous, basal segment, apices of segments, tuft, and underside whitish-ochreous. Legs fuscous with some whitish-ochreous admixture; posterior pair mostly whitish-ochreous. Forewings narrow, lanceolate; whitish-ochreous; markings dark fuscous; a well-marked V-shaped fascia from $\frac{1}{3}$ costa obliquely outwards, then acutely bent back to mid-dorsum; a dot above tornus, and a second between this and $\frac{2}{3}$ costa; a series of dots on apical part of costa and on termen; cilia whitish-ochreous. Hindwings lanceolate; pale grey; cilia ochreous-grey. One example.

Blastobasis dyssema, n. sp. (δυσσημος, badly marked).

♂ and ♀, 14-18 mm. Head whitish-ochreous. Palpi whitish-ochreous; in male with second and terminal joints much enlarged, the latter obtuse. Antennae with basal joint enlarged and pectinate; pale fuscous; ciliations in male 2. Thorax fuscous. Abdomen fuscous; underside, and in male tuft ochreous-whitish. Legs pale fuscous; posterior pair mostly ochreous-whitish. Forewings narrow, lanceolate; ochreous-grey, in female pale fuscous; a minute longitudinal fuscous mark in middle of disc, and another before it on fold; a fuscous dot above tornus, and another between it and $\frac{3}{4}$ costa; cilia whitish-ochreous, in female pale fuscous. Hindwings lanceolate; pale grey; cilia ochreous-grey. Five examples.

Family TINEIDAE.

Subfamily GRACILARIANAE.

Gracilaria, n. sp. One of the group allied to *xylophanes*, Turn., but distinct. Unfortunately during the journey to England both forewings became detached and lost, so that it is impossible to give a description.

Subfamily LYONETIANAE.

Erechthias, sp. One example not in a fit state for determination.

Subfamily TINEINAE.

Gen. Eretmobela, nov.

(ἐρετμοβελος, with paddle-shaped weapons—palpi).

Head smooth-scaled; side-tufts closely appressed. Labial palpi long, recurved; second joint moderate, with rough spreading short hairs anteriorly, and three or four long hair-like bristles from apex posteriorly; terminal joint longer than second, stout, obtuse, flattened, and dilated antero-posteriorly. Maxillary palpi obsolete. Antennae shorter than forewings; apices of joints dilated. Forewings with eleven veins, 2 and 3 stalked from angle of cell, 4 approximated to them at origin, 5 and 6 separate and parallel, 7 and 8 coincident and running to costa, 9 separate, 10 from upper angle of cell, 11 from $\frac{5}{6}$. Hindwings with 2 from $\frac{2}{3}$, 3, 4, 5, 6, 7 separate and parallel, forking vein in cell well marked.

Mr. Meyrick informs me that this genus is allied to *Setomorpha*, though differing in neuration.

Eretmobela phaeosema, n. sp. (φαιοσημος, dusky marked).

♀, 16 mm. Head brown-whitish mixed with fuscous. Palpi ochreous-whitish; external surface of terminal joint fuscous. Thorax fuscous, extreme apex posteriorly narrowly whitish-ochreous. [Abdomen broken.] Legs dark fuscous; middle and posterior coxae ochreous-whitish; tarsi and apex of tibia sharply annulated with ochreous-whitish. Forewings moderate, posteriorly somewhat constricted, costa strongly arched to middle, thence only slightly, apex round-pointed, termen obliquely rounded; ochreous-whitish irrorated with fuscous; markings dark fuscous; a dot on costa at $\frac{1}{4}$, an elongate mark on costa before middle, a large spot on $\frac{3}{4}$ costa, with a costal dot midway between the two preceding; irregular but well-defined dorsal blotches at $\frac{1}{4}$ and middle; a median discal dot at $\frac{1}{3}$ and a second at $\frac{2}{3}$; a terminal line dilated at tornus and interrupted above tornus; cilia fuscous obscurely barred with ochreous-whitish. Hindwings grey; cilia ochreous-whitish, on costa and dorsum grey. One example.

Mr. Lea obtained 32 species; adding the six obtained through Mr. Waterhouse we have a total of 38. Among them are 25 known species and 13 are endemic species, which have just been described. Of the 25 there are 16 which have a wide distribution, and 5 of these extend to New Zealand. These 16 species throw no light on the relationship of the local fauna; 2 of them *(Hieroxestis omoscopa* and *Trichophaga tapetiella)* are certainly introduced, and possibly this is true of some of the others. Nine species are known to occur only in Lord Howe Island and Australia *(Dasypodia cymatodes, Dichromia quinqualis, Hypena sylpha, Urolitha bipunctifera, Cleora inflexaria, Epicrocis sublignalis, Scenedra decoratalis, Diplopseustis perieresalis, Hyponomeuta paurodes)*, except that one of them *(C. inflexaria)* extends also to New Guinea, and another *(D. perieresalis)* also to New Zealand.

Of the 13 endemic species 5 admit of no definite statement of their geographical affinities. They are:—

Xanthorhoe (?) *aphanta*	*Gracilaria*, n. sp.
Mecyna insulicola	*Erechthias* (?), sp.

Eretmobela, n. gen. *et* sp.

There remain 8, which are clearly of Australian affinity. They are:—

Ilema haploa	*Macalla phoenopasta*
Calamidia pamphaea	*Elaeonoma phaeopasta*
Philenora euphileta	*Blastobasis episema*
Brachycola (?) *microsticta*	*Blastobasis dyssema*

The conclusion to be drawn is simple. Lord Howe Island is in its lepidopterous fauna merely a detached and isolated fragment of Australia. To this it is necessary to make one qualification; the relation is to that part of the Australian fauna that has Indo-Malayan affinities, and not to that part that is peculiarly and distinctively Australian. A glance at the map will show that this conclusion might have been expected. Lord Howe Island lies about 350 miles from the Australian coast, nearly in the latitude of Port Macquarie, and is not in such close relation to any other land. The lepidopterous fauna, so far as known, shows no affinity to that of New Zealand.

Norfolk Island.

Corrections and additions to former list:—

NOCTUIDAE—Delete *Ariathisa*, sp. (page 55), which was an erroneous determination, and substitute *Perigea capensis*, Gn. One example. Common in the Eastern tropics. Has also been taken in the Kermadec Islands.

GEOMETRIDAE—For *Boarmia*, n. sp. (page 55), substitute *Cleora*, n. sp.

Tineidae, Subfamily Gelechianae—Insert *Brachmia*, sp. One imperfect example, closely allied to *arotraea*, Meyr., from Ceylon and India. Subfamily Tineinae—For *Tinea*, sp. (page 56), substitute *Tinea*, n. sp.

Arctiadae—*Nesiotica cladara*, n. gen. *et* sp. This has been already described.

Family GEOMETRIDAE.

Subfamily BOARMIANAE.

Cleora idiocrossa, n. sp. (ἰδιοκροσσος, with peculiar margin).

♀, 40 mm. Head grey-whitish. Palpi 2; grey-whitish. Antennae grey-whitish. Thorax and abdomen whitish-grey with a few darker scales. Legs grey-whitish irregularly speckled with fuscous; anterior and middle tarsi annulated with fuscous. Forewings with termen dentate; 10 and 11 separate; whitish-grey sparsely irrorated with fuscous; markings brownish-grey and fuscous; antemedian and median lines brownish-grey, suffused, ill-defined; a dark-fuscous dot on lower edge of cell posterior to antemedian line; a pale-centred fuscous median spot just posterior to median line; a well-marked dark-fuscous line from $\frac{3}{4}$ costa to $\frac{2}{3}$ dorsum, strongly but irregularly dentate, slightly projecting above middle; immediately posterior to this a brownish-grey shade; twin roundish subterminal fuscous spots above middle, and a short subterminal fuscous line from dorsum; an incomplete fuscous submarginal shade; a fine dark-fuscous terminal line thickened in indentations; cilia grey-whitish, towards tornus whitish. Hindwings somewhat elongate, termen strongly dentate; as forewings but without antemedian and median lines; subterminal line completely developed. Underside whitish with fuscous median circular spots, fine dentate postmedian line, and incomplete broad terminal band on each wing.

A very distinct species of the *acaciaria* group, easily distinguished from its allies by the strongly dentate termen of both wings. Mr. Prout writes "near *samoana*, Butl., termen slightly less oblique and postmedian line less outbent at veins." One example in fair condition.

Family PYRALIDAE.

Subfamily PYRALINAE.

Endotricha dyschroa, n. sp. (δυσχροος, deficient in colour).

♂, 20 mm. Head and thorax pale fuscous slightly purplish-tinged. Palpi pale fuscous, beneath whitish. Antennae grey-whitish; ciliations in male slightly over 1.

Abdomen ochreous-whitish with some grey irroration; a minute median dorsal crimson dot on antepenultimate segment. Legs ochreous-whitish irrorated with fuscous. Forewings elongate-triangular, costa nearly straight but slightly sinuate, apex pointed, termen slightly rounded, moderately oblique; whitish, closely irrorated with fuscous, slightly purplish-tinged; a series of ill-defined ochreous-whitish dots on posterior half of costa; a fuscous subcostal dot at $\frac{2}{3}$; an ill-defined pale transverse median line; a better-marked pale subterminal line from 9/10 costa to tornus; traces of a fine fuscous terminal line; cilia purple-whitish. Hindwings whitish with some fuscous suffusion; a faint pale line from tornus towards middle; a very fine fuscous terminal line; cilia purple-whitish.

Three male examples all worn, but there seems to be no doubt as to their constituting a new species.

Subfamily PYRAUSTINAE.

Diasemia delosticha, n. sp.
(δηλοστιχος with conspicuous lines).

♂ and ♀, 16-20 mm. Head fuscous-brown. Palpi $3\frac{1}{2}$; fuscous, beneath whitish. Antennae fuscous; ciliations in male $\frac{2}{3}$. Thorax dark fuscous; margins whitish-brown, except for a dark-fuscous spot on base of patagia. Abdomen dark fuscous, apices of segments whitish. Legs brown-whitish; anterior pair except coxae fuscous. Forewings narrowly-triangular, costa straight to $\frac{4}{5}$, thence arched, apex pointed, termen sinuate, oblique; dark fuscous; a reddish-brown subcostal bar from base to $\frac{3}{5}$, indented beneath at middle of disc; an ill-defined whitish basal dorsal area; an irregular whitish median area, thinly scaled like the preceding; a very distinct, inwardly curved, slightly wavy, whitish line from $\frac{3}{4}$ costa to tornus, posteriorly suffusedly edged with reddish-brown; a whitish apical suffusion curved inwards towards tornus; cilia fuscous irregularly barred with white. Hindwings with termen strongly sinuate; dark fuscous; a whitish basal area containing a dark-fuscous subcostal spot; a white fascia from mid-costa to dorsum before tornus, slightly angled outwards in middle; a white line from $\frac{3}{4}$ costa to beneath middle of termen, bent inwards in middle; cilia white with a dark-fuscous sub-basal line, and dark-fuscous bars at apex and above middle of termen.

Nearly allied to *D. grammalis*, Dbld., from New Zealand, but in that species the posterior line of forewings terminates in dorsum well before tornus. Both species are nearly related to the European *D. litterata*, Scop. Evidently abundant, 62 specimens secured.

SCOPARIA TRITOCIRRHA, n. sp.
(τριτοκιρρὸς, three times pale yellow).

♀, 14 mm. Head and palpi grey; labial palpi $2\frac{1}{2}$. Antennae dark fuscous. Thorax fuscous. Abdomen grey. Legs fuscous irrorated, and tarsi annulated, with fuscous. Forewings narrowly triangular, costa straight to $\frac{2}{3}$, thence arched, apex round-pointed, termen nearly straight, scarcely oblique; grey; a short longitudinal pale-yellowish line, edged above with blackish, from base of costa; a broader yellowish longitudinal line before middle beneath cell, also edged with blackish above; a narrowly-oval longitudinal yellowish median spot beyond middle, edged with blackish except on dorsal margin; from its upper-surface extend two short blackish processes towards costa; blackish dots on costa at $\frac{1}{4}$, middle, and before $\frac{3}{4}$; a faintly indicated whitish spot median line; a dark-fuscous line close to termen; terminal edge yellowish; cilia grey with a fuscous sub-basal line. Hindwings pale-grey; cilia whitish with a pale-grey sub-basal line.

An inconspicuous little species, yet very distinctly characterized by the slender yellowish longitudinal markings. Three examples.

Family TORTRICIDAE.

Subfamily TORTRICINAE.

CAPUA ARIDELA, n. sp. (ἀριδηλος, most conspicuous).

♂, 21 mm. Head white. Palpi 2; white, second joint with a broad subapical dark-fuscous bar on external surface. Antennae fuscous; in male dentate, ciliations $\frac{1}{4}$. Thorax whitish-grey; patagia with basal half black, apical half white. Abdomen whitish with fuscous irroration; legs whitish with fuscous irroration; anterior pair mostly fuscous; posterior pair nearly wholly whitish. Forewings strongly dilated posteriorly; in male with a strong costal fold extending to middle; silvery-white with scanty grey irroration and sparsely scattered pale-ochreous scales; markings black; a sub-basal line slightly prolonged along dorsum; costal fold with two transverse bars and again black at apex; a median streak from sub-basal line to $\frac{2}{5}$, strongly ∽ curved; an irregular oblique band from costa before middle to dorsum beyond middle, touching median streak, and strongly bent outwards at point of junction; from the upper part of this band posteriorly is given off a strong square-ended process; an irregularly bent fascia from costa at $\frac{2}{3}$ to tornus, giving off two processes to costa before apex; a subapical costal dot; a subapical terminal mark; cilia white, bases barred with blackish. Hindwings whitish-grey, somewhat darker towards apex; cilia whitish with a faint grey sub-basal line.

Although conspicuous the coloration is probably protective on lichen-covered rocks. One example.

SCHOENOTENES CAPNOSEMA, n. sp.
(καπνοσημος, with dark markings).

♀, 17 mm. Head grey. Palpi $2\frac{1}{2}$; fuscous, apices of second and terminal joints and whole of inner surface whitish. Antennae grey. Thorax grey, posteriorly tinged with brownish. Abdomen pale grey, towards apex darker. Legs fuscous; anterior and middle tarsi annulated with whitish. Forewings rather narrow, not dilated; whitish with silvery reflections, crossed by numerous fine, wavy, ochreous-brown transverse striae; numerous small tufts of raised scales; a prominent transverse ridge of raised scales from $\frac{1}{4}$ dorsum to beyond middle, edged posteriorly by a blackish line; a similar slightly oblique ridge from costa before middle to dorsum beyond middle, with a broad blackish line on posterior edge; a tuft in mid-disc at $\frac{2}{3}$, preceded and followed by blackish spots; a slender blackish line from $\frac{4}{5}$ costa to termen above tornus, angled outwards beneath costa; a slender interrupted blackish terminal line; cilia ochreous-whitish, on tornus grey. Hindwings and cilia grey. One example.

TORTRIX, sp.

Two examples in poor condition of ordinary facies and not determinable.

Subfamily EUCOSMINAE.

ACROCLITA MACROMA, n. sp.
(μακρωμος, with elongate shoulders).

♂, 12 mm. Head green-whitish. Palpi 2; pale fuscous. Antennae grey; in male slightly serrate, minutely ciliated. Thorax brown-whitish, in centre mixed with dark fuscous; patagia in male long, extending well behind thorax. Abdomen fuscous. Legs fuscous-whitish. Forewings in male with strong costal fold extending to $\frac{1}{3}$; green with dark-fuscous markings; fold strigulated with dark fuscous; several dots and some scales in basal part of disc; a subcostal spot at $\frac{1}{3}$; a narrow interrupted fascia from $\frac{2}{3}$ costa to mid-dorsum; a second fascia from apex to $\frac{2}{3}$ dorsum, giving off a short outwardly curved line to tornus; a fine terminal line; cilia green-whitish, apices partly dark-fuscous. Hindwings dark grey; cilia grey-whitish. One example.

Family TINEIDAE.

Subfamily GELECHIANAE.

BRACHMIA, sp.

One male example, imperfect, pronounced by Mr. Meyrick to be closely allied to *Brachmia arotraea*, Meyr., from Ceylon and India.

Subfamily TINEINAE.

TINEA CAPNITIS, n. sp. (καπνιτις, smoky).

♂, 17-18 mm. Head fuscous-whitish. Palpi $2\frac{1}{2}$; fuscous, inner surface whitish. Antennae pale fuscous; in male with joints enlarged at apices, minutely ciliated. Thorax fuscous. Abdomen ochreous-whitish, suffused with fuscous on dorsum. Legs fuscous; tibiae and tarsi annulated with ochreous-whitish; posterior pair almost wholly ochreous-whitish. Forewings moderate, not dilated, costa strongly arched, apex pointed, termen very obliquely rounded; ochreous-whitish rather densely irrorated with fuscous; absence of irroration leaves an obscure pale dorsal streak containing some fuscous scales near margin; very obscure fuscous discal dots at $\frac{1}{3}$ and $\frac{2}{3}$; cilia fuscous. Hindwings and cilia grey-whitish.

A very obscure species belonging to a cosmopolitan genus, of which many species are domestic in their habits and artificially introduced. I should not have ventured to describe it, but for the decided opinion of Mr. Meyrick, who kindly examined my examples, that it is both new and endemic. Two examples.

The collection contains 33 species. Of these two are not determinable; one of these is a species of the genus *Tortrix*, the other a *Brachmia*, closely allied to *arotraea*, Meyr., from Ceylon and India. Of the remaining 31 there are 22 well-known species, 9 of which are endemic.

Of the 22 known species 15 are of wide distribution. All of these occur in Australia, six of them also on Lord Howe Island. Four of them are recorded from New Zealand and the Kermadec Islands and one from the Kermadec Islands only *(Perigea capensis)*. Of these 22 at least three *(Eucosma plebeiana, Polychrosis botrana, Hieroxestis omoscopa)*, and possibly others, have been artificially introduced. Two species *(Acidalia rubriaria* and *Crocydopora cinigerella)* occur both in Australia and New Zealand, but probably originated in the former. The remaining five—

Chloroclystis laticostata	*Corambus cuneiferellus*
Xanthorrhoe sodaliata	*Argyroploce illepida*
Acidalia hypochra	

are Australian species, though the first occurs also in the Kermadec Islands.

Of the nine endemic species five are clearly of Australian affinity—

Nesiotica cladara, n. sp.
Cleora idiocrossa, n. sp.
Endotricha dyschroa, n. sp.
Schoenotenes capnosema, n. sp.
Acroclita macroma, n. sp.

Whether the genus *Cleora* (as distinguished from *Boarmia)* occurs in New Zealand may be regarded as an open question, but the Norfolk Island species is not allied to any found in New Zealand. *Nesiotica* is a new genus closely allied to a genus described from Queensland, and the group to which it belongs is not represented in New Zealand. The genera *Endotricha*, *Schoenotenes*, and *Acroclita* are well represented in Queensland, but do not occur in New Zealand. The genera *Scoparia* and *Capua* have numerous species in both Australia and New Zealand, and no stress can be laid on the two species described from Norfolk Island. Mr. Meyrick assures me that they are not closely allied to any New Zealand species. The genus *Tinea* is cosmopolitan. There remains only *Diasemia delosticha*, which is the only new species here described clearly of New Zealand affinity.

So far as these results go, the lepidopterous fauna of Norfolk Island shows only a slender connection with that of New Zealand, but a strong connection with that of Queensland. Why the connection should be with Queensland rather than with the southern half of the continent is explained by the map. The distance from Norfolk Island to the northern extremity of New Zealand is about 450 miles, to New Caledonia (the next nearest land mass) about 550 miles. Of the lepidopterous fauna of New Caledonia I know nothing, but the 500-fathom line shows a considerable extension of shallow water around that island, together with a much greater extension westward from the Australian coast just north of the tropic. This suggests strongly a former extension westward, bringing Australia and New Caledonia into close connection, not necessarily by dry land, but with only one or two comparatively narrow intervening straits. Measuring from the 500-fathom limits that of Norfolk Island becomes nearly equidistant from those of New Caledonia and New Zealand, the distance being about 350 miles.

A Graphical Computator for Determining the most Economical Beam to carry a Given Load.

By Prof. R. W. Chapman, M.A., B.C.E.

[Read October 10, 1918.]

An ordinary rectangular beam, designed to carry a given load, will have its cross section of minimum area when it is so proportioned that it is just as likely to fail by horizontal shearing along the neutral axis as to fail by rupture in the ordinary way. For a beam of breadth b and depth d, carrying a uniformly distributed load W over a span l, the conditions that this may be the case can be readily expressed in the form:—

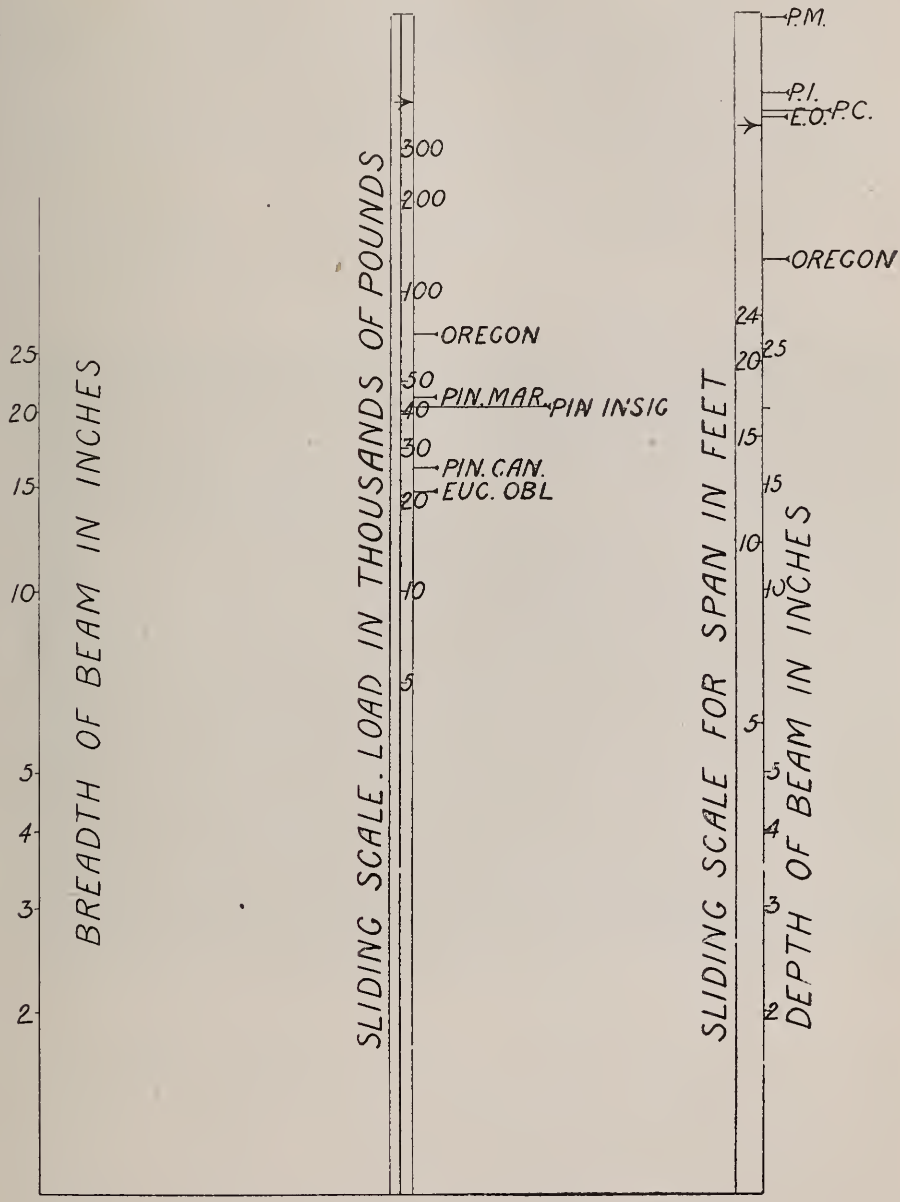
$$\log b + \log d = \log W - \log \tfrac{4}{3} s \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

$$\log d = \log l - \log \frac{f}{s} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

where s is the maximum resistance of the timber to shearing in pounds per square inch and f is the modulus of rupture.

The computing apparatus illustrated is designed to facilitate the determination of the proper size of beam required to satisfy these two equations. Standing up at right angles to the base line are two fixed logarithmic scales for the breadth and depth of the beam in inches. Midway between is another parallel scale, so that if a straight edge be placed between two points representing b and d, the intercept on the middle scale will be $\tfrac{1}{2}$ ($\log b + \log d$). This middle scale is graduated so that the distance from the base line to the graduation marked W $= \tfrac{1}{2}$ ($\log W - \log \tfrac{4}{3} s$). As the value of s depends on the nature of the timber, the middle scale is made to slide to different positions corresponding to different woods. Thus if a straight edge be placed across the three scales, the three quantities b, d, and W then in line satisfy the condition (1). Alongside the scale of depths is another sliding scale for the span, so graduated that when set to any particular timber it satisfies the condition (2).

Thus if we wish to find the minimum beam to carry a given load, we first set the two sliding scales to the marks indicated for that particular timber. Then corresponding to the given span we at once read off the proper depth of the beam, and putting a straight edge across the graduations corresponding to the depth and the load, we read off on the other scale the proper breadth of the beam.



The load to be carried should be multiplied by the appropriate factor of safety.

The computer is designed for the case of uniformly distributed loads, but it is applicable to a single concentrated load at the centre by doubling the readings on the scale for the span and to the case of a concentrated rolling load by doubling the readings on the scale for the load.

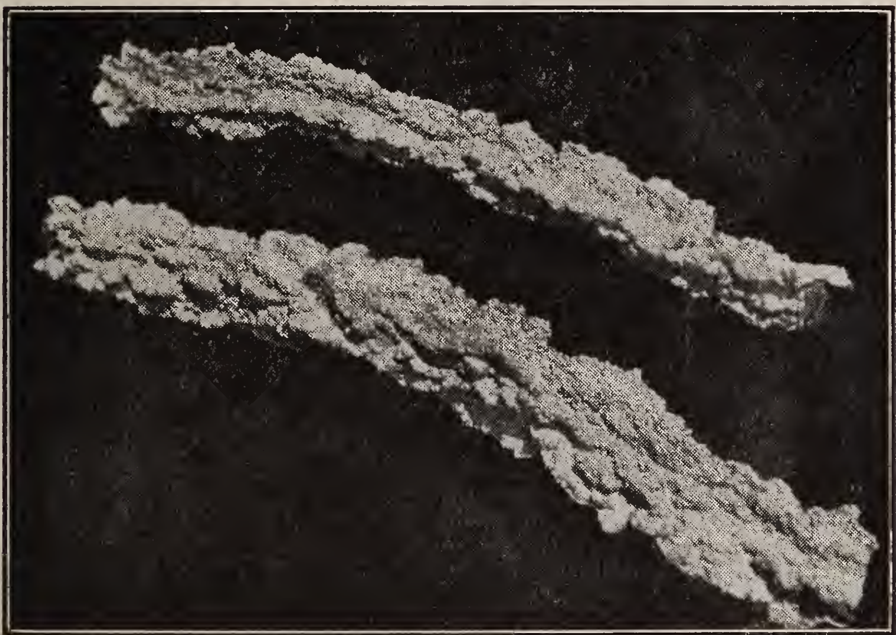
It is applicable to any timbers by setting for suitable values of f and s, but in the one shown provision is made for five timbers only, the values for f and s being the averages of a large number of tests made in the engineering laboratory at the Adelaide University. As these are timbers of considerable local importance, I append the experimental determinations of f and s:—

Timber.	f Lbs. per sq. inch.	s Lbs. per sq. inch.
Pinus insignis	6,900	776
Pinus maritima ...	4,900	730
Pinus canariensis ...	11,930	1,250
Oregon	7,430	444
Eucalyptus obliqua ...	14,100	1,448

MISCELLANEA.

Notes on the Occurrence of Fulgurites in a Sandhill at the Reedbeds, near Adelaide.

In 1908 my attention was drawn to some strange tubular objects that were standing straight up in a sand-drift upon my property at the Reedbeds. There were sections of these tubes lying on the surface which appeared to have broken off by their own weight and want of support after the sand had drifted away from them.



I dug down in the sand to ascertain to what depth these tubes went, but was unable to bottom them. There were two tubes, one a good deal larger than the other, and I was puzzled as to their origin, for although they were very rough and corrugated on the outside, the interior had a very glassy surface. It was not until nearly twelve months later that I drew Dr. Wm. McGillivray's attention to these tubes, and he expressed the opinion that the tubes were caused by lightning. Later Dr. A. M. Morgan expressed the same opinion and asked me for a fragment, which he exhibited at a meeting of the Royal Society. After this I visited the spot where the drift was steadily going on, and from time to time laying bare further portions of the tubes. I discovered that the smaller tube of the two ceased to appear much sooner than the larger one. From my knowledge of the original height of the sandhill and the position where the last portion of the larger tube was seen. it could not have been less than 20 to 23 feet in length. The two tubes went straight down and were within 3 inches of each other. The larger tube measured in diameter 39 mm. outside measurement, and varied very little, not more than 2 or 3 mm. in thickness. The smaller tube measured 22 mm., and did not vary even so much as the larger one. The figures on page 293 are reproductions from photographs of the two fulgurites, and are about half natural size.

Not within my recollection has any sandhill on my property been seen to be struck by lightning, but I well remember that thirty or more years ago thunderstorms were very frequent and large trees were struck nearly every season, but of late years such storms with lightning have been of rare occurrence.

S. A. White.

Evening Meeting, September 12, 1918.

A New Locality for Older Tertiary (Miocene) Fossiliferous Beds.

The recently constructed line to Willunga has exposed the older marine tertiary beds in two railway cuttings in the neighbourhood of Hackham. The first of these occurs 1 mile southward of the Morphett Vale railway station and extends from the 21-milepost to the 21¼-milepost. Towards the southern end of the cutting a gravel bed composed of well-rounded white-quartz pebbles, averaging in size about that of kidney beans, rests unconformably upon the fossiliferous beds. The second cutting extends from the 22¾-milepost to the 23-milepost, and is capped by travertine limestone. The beds have a maximum thickness (within sight) of 12 feet. An embankment constructed between the two cuttings has been built up from the material excavated from these cuttings. Sections of the beds can also be seen in the road cuttings which are adjacent to the first of those mentioned as occurring on the railway. On the main road to Adelaide the overlying sands and fine gravel are very conspicuous, but the underlying tertiary beds are grass grown and largely obscured by talus. Another cutting is seen on the road nearby which turns off in a westerly direction to Port Noarlunga, and here, again, the fossiliferous beds show in the rise of the road, but soon pass below surface level, and are covered, first by the small quartz gravel and then by variegated river sands of considerable thickness.

Lithologically, the beds bear a close resemblance to the argillaceous limestones of Blanche Point, with which they also agree in having *Turritella aldingae* as the characteristic fossil. The beds at Hackham, however, have a greater tendency to become cherty in their composition.

With the exception of the fossil named, the organic remains are not particularly numerous, and are present only as impressions or casts. Examples of *Siliquaria* (undescribed) sometimes occur in considerable numbers in groups, and there were also noted: *Pecten*, *Magellania*, *Cellepora gambierensis*, and spines of echinozoa.

WALTER HOWCHIN.

Evening Meeting, September 12, 1918.

Note on Lepidopleurus badius (Hedley and Hull).

Lepidopleurus badius, Hedley and Hull: Records Austr. Mus., vol. vii., No. iv., 1909, p. 260, pl. lxxiii., figs. 1, 2; Gatliff and Gabriel: Proc. Roy. Soc. Vict., vol. xxv. (N.S.), part 1, 1912, p. 171.

This species was taken by me at Cape Jervis on December 28, 1917, and is now recorded for the first time for South Australia. The species was named from New South Wales, and was later taken in Victoria. Mr. Hull and Mr. Gatliff kindly identified the South Australian shells, which were taken on the under-surface of a medium-sized boulder on the reef below water at low tide. It manifested the same habitat as at the type locality, where, "though a rare shell, fifteen specimens were found under one small stone"; for at Cape Jervis fourteen examples were taken from beneath one stone.

FRANK L. SAUNDERS,

(presented through the President).

Evening Meeting, October 10, 1918.

ABSTRACT OF PROCEEDINGS

OF THE

Royal Society of South Australia

(Incorporated)

FOR 1917-1918.

Ordinary Meeting, November 8, 1917.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

The President reported that Mr. T. M. Young, who had been nominated as Fellow, had since died.

The President reported that Honorary Fellow Professor W. H. Bragg had received the decoration Companion of the Order of the British Empire (C.B.E.) for his work as a member of the Board of Invention and Research in connection with the Admiralty.

Exhibits.—Mr. Edwin Ashby, M.B.O.U., showed two specimens of a parrot, *Platycercus elegans fleurieuensis*, Ashby (Fleurieu Peninsula rosella), the type specimen having been collected by Messrs. E. Ashby and F. E. Parsons near Second Valley last Easter, and described by Mr. Ashby in *The Emu* for July, 1917. Also, for comparison, *P. elegans adelaidae*, Gould (Adelaide rosella), *P. elegans melanopterus*, North (Kangaroo Island crimson parrot), and *P. elegans nigrescens*, Ramsay (northern crimson parrot), of North Queensland. Also the larva of a large bombex moth, found feeding on a native peach tree *(Santalum)*, near Pungonda, in the Loxton district on September 11, 1917. Mr. A. M. Lea, F.E.S., exhibited some click beetles (Elateridae), the larvae of which are locally known as wire-worms.

Papers.—The Hon. Secretary read abstracts of two papers by Prof. T. G. B. Osborn, M.Sc., "On the Habitat and Method of Occurrence in South Australia of Two Genera of Lycopods hitherto unrecorded in the State," and "Notes on South Australian Fungi, with Description of a New Species of *Puccinia*."

Ordinary Meeting, April 11, 1918.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

Nomination.—A. H. Elston was nominated as Fellow.

The President drew attention to the albums containing the portraits and signatures of the officers of the Society from its formation in 1853. This was fairly complete, and would be kept up to date.

Exhibits.—Mr. Walter Howchin, on behalf of the Museum Director, exhibited a sand-cementing fungus. The object is 6 inches in length, half of which is composed of a cylindrical stem from ⅝-inch diameter at the base to 1 inch at top of the stem. The distal end is pyriform, 1½ inches in diameter, ending in a bluntish point containing a crateriform cavity. The organic structure is limited to mycelium, which interpenetrates the mass and cements the sand grains, giving the object a definite outline. The specimen came from the Pinery, 12 miles from Balaklava, and was handed in to the Museum by the Rev. J. Blacket. Mr. L. K. Ward exhibited a stone collected by Mr. Winton from the New Burra Mine, containing fossil markings of *Cryptozoon*, this being the first known specimen from South Australia. Mr. E. Ashby showed the following birds:—*Porzanoidea plumbea immaculata* (eastern spotless crake), obtained from near Cape Jervis in March, with eggs of same from Tasmania; *Porzana fluminea* (eastern spotted crake) from Sandford, Tasmania, immature, received last February; *Hypotaenidia brachypus* (slate-breasted rail) from Blackwood; and *H. philippensis australis* (eastern buff-banded rail) from Blackwood. Mr. Edgar R. Waite showed photographs of a drain into which millions of fish had been collected by the reclamation of a swamp on the River Murray. Mr. J. M. Black exhibited an orchid new to South Australia, which he believed to be *Caladenia congesta*. Mr. A. M. Lea exhibited three samples of weevilly wheat. The largest of these had been covered with 20 inches of sand, but in 25 minutes some of the weevils had worked their way to the top. Also a large number of ferment flies that had been attracted to strong methylated spirits. Also two bombycid moths resulting from larvae found by Mr. Ashby last November. Also, on behalf of Mr. E. L. Savage, a live lizard, *Moloch horridus*, that had survived for some months by feeding on ants which had been induced to visit the box in which it was confined.

Paper. — "Polyplacophora, Genus *Ischnoradsia*," by Edwin Ashby, M.B.O.U.

Ordinary Meeting, May 9, 1918.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

Nominations.—Ernest H. Ising, Locomotive Department; H. W. Andrew, Botanical Assistant, Department of Agriculture; and the Rev. James C. Jennison, Minister of the Gospel, were nominated as Fellows.

Election.—A. H. Elston, clerk, was elected a Fellow.

The President congratulated Capt. S. A. White upon his recognition by the British Ornithological Union as a Distinguished Colonial Ornithologist. Also that an open letter, signed by himself and the Hon. Secretary, had been given to Mr. Edwin Ashby on the eve of his departure for America, introducing him to scientific workers there.

Exhibits.—Prof. Chapman showed a form of viscometer constructed by Mr. A. G. M. Michell, of Melbourne, by which the viscosity of an oil is measured by the time taken by a bearing-ball before falling from a concave cup, from which it is separated by a film of the oil $\frac{1}{1000}$ millimeter in thickness; the time in seconds divided by 50 being the viscosity. Capt. S. A. White exhibited a spray of *Eucalyptus pyriformis*, gathered in the sandhills at the Ooldea soak, on the Port Augusta to Kalgoorlie Railway. The flowers are bright scarlet, and occasionally cream-colour. Also two aboriginal grinding stones, found 15 or 20 feet below the surface of the swamp at the Reedbeds. Mr. Edgar R. Waite exhibited two necklaces from Stormy Island, to the northward of New Ireland; one, 27 feet long, made of portions of beetles' legs; the other of beetles' legs and antennae of crustaceans. Also a complete set of Australian Typhlopidae, with the exception of the species *T. waitii*. These all live underground, and feed chiefly on termites. Mr. A. M. Lea showed two drawers of showy beetles, mostly from South America, some having tufts of hair on the antennae and legs. Mr. Edquist showed two objects found in sandhills, near the roots of wattle trees, about $1\frac{1}{2}$ inches long, approximately egg-shaped, with a $\frac{1}{2}$-inch circular aperture on one side, composed of agglutinated sand. Their origin is unknown, but it was suggested that they might be the pupa cases of beetles or other insects. Mr. F. R. Zietz exhibited living specimens of four species of lizards: gecko or night-lizard *(Gymnodactylus miliusii)*; mountain devil *(Moloch horridus)*; jew or bearded lizard *(Amphibolurus barbatus)*, adult and young; and two specimens of the banded skink *(Lygosoma fasciolatum)*. Mr. Selway stated that he had recently found under a log an egg about the size of a sparrow's, which, while held in the hand, had hatched out a gecko.

Papers.—"Polyplacophora, Genus *Stenochiton*," by Edwin Ashby, M.B.O.U.; "Notes on Australian Orchids, with a Description of some New Species," by R. S. Rogers, M.A., M.D.; and "Deflection of Columns under Axial and Eccentric Loading," by Prof. R. W. Chapman, M.A., B.C.E., F.R.A.S.

Ordinary Meeting, June 13, 1918.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

The President referred to the death of Augustus Simson, J.P., of Launceston, conchologist and entomologist, and a Fellow of the Society since 1893.

Elections.—Ernest H. Ising, machinist; H. W. Andrew, botanical assistant in Department of Agriculture; and the Rev. J. C. Jennison, were elected Fellows.

Exhibits.—Capt. S. A. White stated that Mr. Howchin considered that the so-called grinding stones shown by himself last month were only cores from which flakes had been chipped, but that he still believed that they had been used for grinding. He exhibited the following birds:—Regent or warty-faced honey-eater *(Zanthomiza phrygia)* from Mount Lofty Ranges; blue-faced honey-eater *(Entomyzon cyanotis)* from River Murray; helmeted friar bird *(Neophilemon buceroides)* from Queensland; friar bird *(Tropidorhynchus corniculatus)* from Queensland; white-eared honey-eater *(Nesoptilotis leucotis)* from South Australia; pied honey-eater *(Certhionyx variegatus)* from South Australia; white-fronted honey-eater *(Gliciphila albifrons)* from South Australia; grey-headed honey-eater *(Lichenostomus keartlandi)* from Central Australia; New Holland honey-eater *(Meliornis novae hollandiae)* from South Australia; and ornate honey-eater *(Ptilotis ornatus)* from South Australia. Mr. A. M. Lea showed two drawers of exotic insects from the collection of the late Augustus Simson; also a tray of bones collected from the pellets or castings of a barn owl. These proved that in two months the bird had eaten at least 544 mice, 39 rats, 1 young rabbit, 203 sparrows, 5 starlings, 5 blackbirds, 9 frogs, 1 lizard, and numerous night-flying insects; and that it was therefore a most useful bird. Capt. White stated that birds of this species roosted in the blow holes on the Nullarbor Plains, and would help to check the threatened advance of sparrows along the East-West Railway. Mr. A. G. Edquist showed cocoon of emperor gum moth attached to leaf of apple tree, showing that the larva attacked these trees; also several hard cocoons of moths, each pierced with a minute round hole, which he suggested was for breathing purposes; also a bunch of silky material, being feathers stripped from the body of a moth to cover its eggs. Dr. J. C. Verco exhibited several shells of *Trivia*, *Erato*, and *Ovula*.

The President intimated that as the Board of the South Australian Museum contemplated publishing the results of the researches of its staff, the contributions of the latter to the Society's Transactions would be smaller in future.

Papers.—"Notes on South Australian Polyplacophora, with Additions to the Fauna, together with a list of Australian Species, showing their Distribution in the Australian States," by Edwin Ashby, M.B.O.U.; and "Additions to the Flora of South Australia, No. 13," by J. M. Black.

Ordinary Meeting, July 11, 1918.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

Resolved on the motion of Capt. S. A. White, seconded by Mr. S. Dixon: "That this Society requests the Government to introduce without delay the Bill for the Incorporation of Flinders Chase, Kangaroo Island, which has already been drafted."

Resolved on the motion of Mr. S. Dixon, seconded by Capt. S. A. White: "That the portions of land within the boundaries of the proposed Chase, at present alienated, be purchased by the Government and incorporated in the Chase."

Resolved: "That the following be a committee to bring these resolutions before the Government: Capt. S. A. White, Mr. J. M. Black, and Mr. S. Dixon."

Resolved: "That Capt. S. A. White represent this Society on a deputation about to wait on the Minister of Agriculture to urge the amendment and consolidation of the Birds Protection Act, the Animals Protection Act, and the Gun Act."

Exhibits.—Mr. Walter Howchin exhibited two broken examples of *Turbo jourdani* and two sea-worn opercula belonging to the same species, found by Mr. Bowman, of Parara, near Ardrossan. The shells, which are large examples of our largest sea shells, come from a new locality, not having been obtained in the Gulf before. The weathered condition of the shells suggests that they may have been washed out from a raised beach deposit, and would then be sub-fossil; the occurrence of *Arca trapezia* shells on the beach, a very common shell in these raised beaches, while not living in our local seas at the present time, gives further probability to this view. Mr. Howchin also exhibited the left valve of an *Ostrea hyotidoidea*, obtained from the River Murray cliffs at

Mannum. The shell is of unusual proportions and thickness, measuring 7 inches in length and $5\frac{1}{4}$ inches in breadth, while the shell has a maximum thickness of $2\frac{5}{8}$ inches, and weighs $1\frac{3}{4}$ lbs.; the ligamental cavity is $1\frac{3}{8}$ inches in length, and the muscular impression is very large and deep. It represents the only oyster known to occur in the lower marine tertiaries of Australia, but as individuals is moderately common. The largest example in the museum of the Adelaide University is very small in comparison. The shell gives evidence of age, not only in its massive development, but also in the modification of the form. The radial ribs and foliaceous scales of the younger stages of growth have become nearly obliterated by the coarseness of its shelly growth. Mr. A. M. Lea exhibited a male and female of the largest known South Australian insect, *Tropidoderus childreni*, belonging to the Phasmidae or leaf insects. The female, with legs and wings extended, measured 9 inches by 9 inches.

Papers.—"Australian Fungi and Notes and Descriptions, No. 1," by John B. Cleland, M.D., and Mr. Cheel; "Notes on South Australian Marine Mollusca, with Descriptions of New Species, Part XVI.," by Jos. C. Verco, M.D., F.R.C.S.

Ordinary Meeting, August 8, 1918.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

Capt. S. A. White reported having attended a deputation to the Attorney-General *re* amendment of the game laws, with the result that he and two others had assisted the Government in drafting a Bill for their amendment and consolidation.

Exhibits.—Mr. W. Howchin exhibited the casts of the two largest known shells of the Australian Tertiary. One of these, supplied by the President (Dr. J. C. Verco) was obtained from the flux quarries at Stansbury, Yorke Peninsula, and sent by Mr. O. H. Rogers. It is apparently a *Trochus*, and Dr. Verco thinks it may be an immature *Trochus niloticus maximus*, a form that is living on the northern shores of Australia. If this identity of species can be established it will supply another link in fixing the geological age of our tertiary beds. The other cast was that of a giant *Turbo*, which must have been at least 9 inches in diameter. The specimen, with others of a like kind, was obtained from northern Yorke Peninsula. As casts of shells are usually too indefinite to admit of scientific diagnosis neither of these forms can be described. Mr. Rogers also sent from Stansbury a fragment of a turreted shell which is probably a *Turritella*, and is much larger than any described *Turritella* of our local rocks. This was also placed on exhibit. Professor Osborn showed specimens of sweet pea *(Lathyrus odoratus)* infected with "streak" disease caused by *Bacillus lathyri.* The infection is produced by the entry of the bacillus through the stomata, and its spread is always likely to be rapid during periods of rain or heavy dew. Also various methods of demonstrating by curves the continuous or fluctuating variability shown by organisms. Capt. S. A. White showed cast of a large fossil shell, probably a volute, from Linley, near Morgan, 120 miles north-east of Adelaide; also a shell *(Pecten bifrons)* from an excavation between Port Adelaide and the Grange in the raised estuarine area; also nest of the South Australian fantail *(Rhipidura flabellifera whitei);* also stone chippings found round the Ooldea native well on the edge of the Nullarbor Plain. Dr. J. C. Verco, for Professor Grant, showed a piece of a plate glass window containing a minute round hole at the bottom of a circular depression. Various opinions as to its origin were expressed.

Paper.—The paper laid on the table by Dr. J. C. Verco at the last meeting was described by him and illustrated by exhibits.

Ordinary Meeting, September 12, 1918.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

Mr. S. Dixon reported that the committee *re* Flinders Chase, appointed on July 11, had issued a circular and interviewed many prominent men, that a preliminary meeting had been held in the Mayor's parlour, and that a deputation would wait on the Premier next week.

Exhibits.—Mr. Dixon showed a grass imported from South Africa, named *Ehrharta villosa,* var. *maxima,* which is superior to marram grass as a plant for binding drift sand. Dr. Pulleine exhibited millstones, scrapers, and axes from old native camps near Broken Hill, and for comparison palaeolithic remains from the caves in the Dordogne Valley, France; also shell axe from Mattei Island, New Britain, where there is absolutely no stone, and neolithic axes from lake dwellings, Lake Zurich, Switzerland; also a hollow stone from the banks of the River Murray, which Mr. Howchin declared to be an amygdule or chalcedonic silica lined with crystals, an unusual example of a hollow agate stone. Mr. W. Howchin showed rock specimens and fossils from near Hackham, indicating a new locality for the older tertiary beds *(vide* Miscellanea). Capt. S. A. White showed portion of the lower end of a fulgurite from

Fulham (*vide* Miscellanea); also a limestone formation from Linley, consisting of a hollow boulder with crystals in the interior; also from the Murray Cliffs, beyond Morgan, a blackened bone found upon blackened earth—probably the caudal vertebra of a large animal. Mr. W. H. Selway showed a plant resembling *Sparaxis*, found wild in the Waterfall Gully, near Adelaide. Dr. J. C. Verco showed a large series of cowries, *Cypraea moneta* and *C. annulus*, demonstrating the many varieties of each species and how they grade into each other.

Paper.—"Aborigines of West Coast of South Australia: Vocabularies and Ethnographical Notes," by Daisy M. Bates, communicated by J. M. Black.

Annual Meeting, October 10, 1918.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

Election.—W. J. Kimber, orchardist, was elected a Fellow.

The Annual Report and Balance Sheet were read and adopted.

Election of Officers.—*President*, J. C. Verco, M.D., F.R.C.S.; *Vice-Presidents*, Professor E. H. Rennie, M.A., D.Sc., F.C.S., and Lieut.-Colonel R. S. Rogers, M.A., M.D.; *Hon. Treasurer*, W. B. Poole; *Members of Council*, Samuel Dixon and Professor T. G. B. Osborn, M.Sc.; *Hon. Auditors*, W. L. Ware, J.P., and H. Whitbread; *Representative Governor* on Board of Public Library, etc., Walter Howchin, F.G.S.

Exhibits.—Mr. A. M. Lea exhibited some wheat and weevils from a badly-infected stack at Birkenhead. The stack had been enclosed with malthoid and fumigated with carbon dioxide gas, with the result that the whole of the weevils had been destroyed without injury to the wheat. Also a tube containing thousands of spring-tail insects (Poduridae) taken by Mr. H. S. Cope, of Copeville, from a string half a chain wide and three chains long.

Papers.—"Notes on the Geology of Ardrossan and its Neighbourhood," by Walter Howchin, F.G.S.; "A Graphical Computator for determining the most Economical Beam to carry a given Load," by R. W. Chapman, M.A., B.C.E., F.R.A.S.; "Notes on the occurrence of *Lepidopleurus badius* in South Australia," by Frank L. Saunders, communicated through J. C. Verco, M.D., F.R.C.S.; "The Lepidoptera of Broken Hill, N.S.W., Part IV.," by Oswald B. Lower, F.Z.S., F.E.S.; "Additions to the Flora of South

Australia, No. 14," by J. M. Black; "Notes on some Miscellaneous Coleoptera, with Description of New Species, Part IV.," by Arthur M. Lea, F.E.S.; "Lepidoptera taken by A. M. Lea on Lord Howe Island and Norfolk Island," by A. Jefferis Turner, M.D., F.E.S.

ANNUAL REPORT, 1917-18.

During the year papers in continuation of those already published upon the same subjects have been received from Dr. J. C. Verco upon "South Australian Marine Mollusca," from Mr. A. M. Black upon "Additions to the Flora of South Australia," and from Mr. Oswald B. Lower upon "The Lepidoptera of Broken Hill," and also the first paper of a new series by Dr. J. B. Cleland and Mr. Cheel upon "Australian Fungi." Such series have been a valuable feature of the Society's *Transactions* for many years. Other papers on natural history have been contributed by Professor Osborn on Lycopods and Fungi, by Dr. R. S. Rogers on Orchids, by Mr. E. Ashby on Polyplacophora, by Dr. A. Jefferis Turner on the Lepidoptera of Lord Howe and Norfolk Islands, and by Mr. A. M. Lea on Coleoptera; while further geological results were contributed by Mr. W. Howchin. The Aboriginal Languages, together with Ethnographical Notes on the Natives of our own West Coast, were dealt with in a paper by Mrs. Daisy M. Bates.

As the South Australian Museum is issuing its own publication, many valuable papers by the Museum staff have been diverted from our *Transactions*, thus relieving the pressure upon our space, and affording opportunity for further contributions from other sources.

The evening meetings have been enlivened by the exhibition of a great diversity of objects of scientific interest by the members.

The growth of the library and the distribution of our *Transactions* have been greatly interrupted by the war. Not only have exchanges with enemy countries ceased, but in many cases allied and neutral countries have postponed the dispatch of their publications until shipping space and safe transit can be assured.

The conservation of our native fauna and flora, which is of such importance on account of their very distinctive character and the fact that in many cases they embody forms of life long extinct in other parts of the world, has for many years engaged the attention of the Society. As a step towards this end the Government has prepared a Bill for the amendment and consolidation of the existing game and cognate Acts, and the assistance of one of our Fellows, Capt. S. A. White, and two other experts, has been availed of in drafting the same. With the same object in view the Society has made a renewed effort to obtain the reservation of the western portion of Kangaroo Island under the name of Flinders Chase for the protection of those animals and plants which would otherwise soon become extinct. A committee has been appointed to deal specially with this matter, and a scheme has been devised by which the Chase may be made a profitable investment by including the afforestation of portions of the land with suitable valuable timber. A pamphlet setting forth the advantages and details of the scheme has been widely distributed by the committee, and a large and influential deputation waited upon the Minister of Industry on the 27th inst. to urge the Government to seek the necessary approval of Parliament. The Minister, although personally viewing the project with favour, could only promise to lay the matter before his colleagues, and the result is not yet known.

The membership of the Society now comprises 10 Honorary Fellows, 5 Corresponding Members, 76 Fellows, and 1 Associate.

Jos. C. Verco, *President.*

Walter Rutt, *Hon. Secretary.*

ROYAL SOCIETY OF SOUTH AUSTRALIA (INCORPORATED).

Revenue and Expenditure for 1917-18.

	£ s. d.	£ s. d.
To Balance October 1, 1917		310 0 6
,, Subscriptions—		
Royal Society	83 4 0	
Field Naturalists' Section ...	16 0 0	
		99 4 0
,, Grants from Government—		
On Subscriptions	102 10 1	
For Printing Reports and Scientific Investigations ...	150 0 0	
		252 10 1
,, Grant from Public Library Board on account of cost of reproducing illustrations of Central Australian Expedition		10 0 0
,, Refund of unexpended Grant to G. N. Hardy		10 8 1
,, Receipts for use of Room by other Societies		4 12 6
,, Sale of Publications		2 12 6
,, Savings Bank Interest	4 14 5	
,, Interest transferred from Endowment Fund	142 3 5	
		146 17 10
		£836 5 6

	£ s. d.	£ s. d.
By Transactions—		
Printing	270 13 9	
Illustrating	80 16 3	
Publishing	7 3 7	
		358 13 7
,, Grant—		
Field Naturalists' Section		20 0 0
,, Library—		
Librarian, Cataloguing, Receiving, and Issuing ...	25 4 0	
Slips	2 1 3	
		27 5 3
,, Sundries—		
Cleaning and Lighting ...	10 13 4	
Printing, Postages, Stationery, and Photographs	22 10 2	
Advertising	3 1 0	
Insurance	2 10 8	
		38 15 2
,, Balance September 30, 1918—		
Savings Bank of S.A.	155 15 1	
Bank of Australasia	235 16 5	
		391 11 6
		£836 5 6

Audited and found to be correct—

W. L. Ware,
Howard Whitbread, } *Hon. Auditors.*

W. B. Poole, *Hon. Treasurer.*

Adelaide, October 4, 1918.

ENDOWMENT FUND.

(CAPITAL, £3,479 17s. 6d.)

	£	s.	d.	£	s.	d.
1917—October 1.						
To Balance				3,479	17	6
,, Interest received on Government Stock	141	17	6			
,, Savings Bank Interest	0	5	11			
				142	3	5
				£3,622	0	11

	£	s.	d.	£	s.	d.
1918—September 30.						
By £2,000 S.A. Government $3\frac{3}{4}$% Inscribed Stock at cost ...	1,997	10	0			
,, £450 S.A. Government $3\frac{3}{4}$% Inscribed Stock at cost ...	432	0	0			
,, £800 S.A. Government $3\frac{3}{4}$% Inscribed Stock at cost ...	753	10	8			
,, £500 S.A. Government Consolidated 3% Stock at cost ...	292	8	9			
,, Savings Bank Account ...	4	8	1			
				3,479	17	6
,, Interest transferred to Revenue Account				142	3	5
				£3,622	0	11

Audited and found to be correct—

W. L. WARE,
HOWARD WHITBREAD, } *Hon. Auditors.*

Adelaide, October 4, 1918.

W. B. POOLE, *Hon. Treasurer.*

DONATIONS TO THE LIBRARY

FOR THE YEAR ENDED SEPTEMBER 30, 1918.

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LIST OF FELLOWS, MEMBERS, Etc.,

AS EXISTED ON

SEPTEMBER 30, 1918.

Those marked with an asterisk have contributed papers published in the Society's Transactions.

Any change in address should be notified to the Secretary.

Note.—The publications of the Society will not be sent to those whose subscriptions are in arrears.

Date of Election.

Honorary Fellows.

1910. *Bragg, W. H., C.B.E., M.A., F.R.S., Professor of Physics, University College, London (Fellow 1886).
1893. *Cossman, M., 110, Faubourg Poissonnière, Paris.
1897. *David, T. W. Edgeworth, C.M.G., B.A., D.Sc., F.R.S., F.G.S., Professor of Geology, University of Sydney.
1890. *Etheridge, Robert, jun., Director and Curator of the Australian Museum of New South Wales, Sydney.
1905. Gill, Thomas, C.M.G., I.S.O., Under-Treasurer, Adelaide.
1905. *Hedley, Chas., Assistant Curator, Australian Museum, Sydney.
1892. *Maiden, J. H., I.S.O., F.R.S., F.L.S., Director Botanic Gardens, Sydney, New South Wales.
1898. *Meyrick, E. T., B.A., F.R.S., F.Z.S., Tohrnhanger, Marlborough, Wilts, England.
1894. *Wilson, J. T., M.D., Ch.M., Professor of Anatomy, University of Sydney, New South Wales.
1912. *Tepper, J. G. O., F.L.S., Elizabeth Street, Norwood (Corresponding Member 1878, Fellow 1886).

Corresponding Members.

1913. *Carter, H. J., B.A., Wahroonga, New South Wales.
1909. *Johncock, C. F., Clare.
1893. *Stretton, W. G., Darwin, Northern Territory.
1905. Thomson, G. M., F.L.S., Dunedin, New Zealand.
1908. *Woolnough, Walter George, D.Sc., F.G.S., Professor in Geology, University of Perth (Fellow 1902).

Fellows.

1918. Andrew, H. W., North Street, Collinswood.
1895. *Ashby, Edwin, M.B.O.U., Blackwood.
1917. Bailey, J. F., Director Botanic Garden, Adelaide.
1902. *Baker, W. H., F.L.S., Glen Osmond Road, Parkside.
1907. *Black, J. McConnell, 1, Brougham Place, North Adelaide.
1909. Bradley, Edgar J., C.E., Hydraulic Engineer's Department, Adelaide.
1912. *Broughton, A. C., Young Street, Parkside.

1911. Brown, Edgar J., M.B., D.Ph., 3, North Terrace.
1883. *Brown, H. Y. L., 286, Ward Street, North Adelaide.
1893. Brummitt, Robert, M.R.C.S., Medindie.
1916. Bull, Lionel B., Laboratory, Adelaide Hospital.
1906. Bundey, Miss Ellen Milne, 148, Molesworth Street, North Adelaide.
1907. *Chapman, R. W., M.A., B.C.E., F.R.A.S., Professor of Mathematics and Mechanics, University of Adelaide.
1904. Christie, W., 49, Rundle Street, Adelaide.
1895. *Cleland, John B., M.D., Government Bureau of Microbiology, Sydney, New South Wales.
1907. *Cooke, W. T., D.Sc., Lecturer, University of Adelaide.
1912. Corbin, H., B.Sc., University of Adelaide.
1914. Cornish, K. M., on Active Service.
1916. Darling, H. G., Franklin Street, Adelaide.
1914. Darroch, D. G., on Active Service.
1887. *Dixon, Samuel, Bath Street, New Glenelg.
1915. *Dodd, Alan P., Kuranda, N. Queensland.
1911. Dutton, H. H., Anlaby.
1902. Edquist, A. G., 20, King Street, Mile End.
1918. Elston, A. H., Childers Street, North Adelaide.
1917. Fenner, A. E., D.Sc., F.G.S., Education Department, Adelaide.
1914. Ferguson, E. W., M.B., Ch.M., Gordon Road, Roseville, Sydney.
1904. Gordon, David, c/o D. & W. Murray, Gawler Place, Adelaide.
1880. *Goyder, George, A.M., F.C.S., Gawler Place, Adelaide.
1910. *Grant, Kerr, M.Sc., Professor of Physics, University of Adelaide.
1904. Griffith, H., Brighton.
1916. Hackett, W. C., Rundle Street, Adelaide.
1916. Hancock, H. Lipson, A.M.I.C.E., M.I.M.M., M.Am.I.M.E., Kennedya, Wallaroo Mines.
1896. Hawker, E. W., F.C.S., East Bungaree, Clare.
1883. *Howchin, Walter, F.G.S., Lecturer in Geology and Palæontology, University of Adelaide.
1918. Ising, Ernest H., Loco. Department, Islington.
1912. Jack, R. L., B.E., Assistant Government Geologist, Adelaide.
1893. James, Thomas, M.R.C.S., Tranmere, Magill.
1918. Jennison, Rev. J. C., Maitland.
1910. *Johnson, E. A., M.D., M.R.C.S., 295, Pirie Street, Adelaide.
1915. Laurie, D. F., Agricultural Department, Victoria Square.
1897. *Lea, A. M., F.E.S., South Australian Museum, Adelaide.
1884. Lendon, A. A., M.D. (Lond.), M.R.C.S., Lecturer in Obstetrics, University of Adelaide, and Hon. Physician, Children's Hospital, North Adelaide.
1888. *Lower, Oswald B., F.Z.S., F.E.S., 18, Bartley Crescent, Wayville.
1914. Mathews, G. M., F.R.S.E., F.L.S., F.Z.S., Foulis Court, Fair Oak, Hants, England.
1905. *Mawson, Sir Douglas, D.Sc., B.E., Lecturer in Mineralogy and Petrology, University of Adelaide.
1874. Mayo, Geo. G., C.E., 90, Hill Street, North Adelaide.
1907. Melrose, Robert Thomson, Mount Pleasant.
1897. *Morgan, A. M., M.B., Ch.B., Angas Street, Adelaide.

1913. *OSBORN, T. G. B., M.Sc., Professor of Botany, University of Adelaide.
1886. POOLE, W. B., Savings Bank, Adelaide.
1911. POOLE, T. S., B.A., LL.B., *Register* Chambers, Grenfell Street.
1908. POPE, WILLIAM, Eagle Chambers, King William Street.
1907. PULLEINE, MAJOR R. H., M.B., North Terrace, Adelaide.
1916. RAY, WILLIAM, M.B., B.Sc., Victoria Square, Adelaide.
1885. *RENNIE, EDWARD H., M.A., D.Sc. (Lond.), F.C.S., Professor of Chemistry, University of Adelaide.
1913. RIDDLE, STAFF-SERGT. A. R., No. 7 A.G. Hospital, Keswick.
1911. ROACH, B. S., Education Department, Flinders Street, Adelaide.
1905. *ROGERS, LIEUT.-COL. R. S., M.A., M.D., Flinders Street, Adelaide.
1869. *RUTT, WALTER, C.E., College Park, Adelaide.
1891. SELWAY, W. H., Treasury, Adelaide.
1906. SNOW, FRANCIS H., National Mutual Buildings, King William Street.
1910. *STANLEY, E. R., Government Geologist, Port Moresby, Papua.
1881. *STIRLING, SIR EDWARD C., Kt., C.M.G., M.A., M.D., F.R.S., F.R.C.S., Professor of Physiology, University of Adelaide, Hon. Curator of Ethnology, South Australian Museum.
1907. SWEETAPPLE, H. A., M.D., Park Terrace, Parkside.
1897. *TORR, W. G., LL.D., M.A., B.C.L., Brighton, South Australia.
1894. *TURNER, A. JEFFERIS, M.D., F.E.S., Wickham Terrace, Brisbane, Queensland.
1878. *VERCO, JOSEPH C., M.D. (Lond.), F.R.C.S., Consulting Physician Adelaide Hospital and Children's Hospital.
1883. WAINWRIGHT, E. H., B.Sc. (Lond.), Seafield Tower, Glenelg.
1914. *WAITE, EDGAR R., F.L.S., Director South Australian Museum.
1912. WARD, LEONARD KEITH, B.A., B.E., Government Geologist, Adelaide.
1878. WARE, W. L., King William Street.
1907. WEBB, NOEL A., Barrister, Waymouth Street, Adelaide.
1904. WHITBREAD, HOWARD, c/o A. M. Bickford & Sons, Currie Street, Adelaide.
1912. *WHITE, CAPTAIN S. A., D.M.B.O.U., "Wetunga," Fulham, South Australia.
1912. *ZIETZ, F. R., South Australian Museum.

ASSOCIATE.

1904. ROBINSON, MRS. H. R., "Las Conchas," Largs Bay, South Australia.

APPENDICES.

FIELD NATURALISTS' SECTION

OF THE

Royal Society of South Australia (Incorporated).

THIRTY-FIFTH ANNUAL REPORT OF THE COMMITTEE

For the Year Ended September 30, 1918.

Your Committee has much pleasure in reporting that the work of the Section has been enthusiastically carried on during the year.

The election of officers for the year resulted in the following members being elected to the respective positions:—*Chairman*, Mr. W. J. Kimber; *Vice-Chairmen*, Dr. C. Fenner, F.G.S., and Mr. J. F. Bailey; *Hon. Treasurer*, Mr. B. B. Beck; *Hon. Librarian*, Miss I. Roberts; *Hon Secretary*, Mr. Wm. Ham; *Committee*, Lieut.-Col. R. S. Rogers, M.A., M.D., Prof. T. G. B. Osborn, M.Sc., Capt. S. A. White, M.B.O.U., Mr. E. H. Lock, F.R.H.S., Mrs. R. S. Rogers, Mr. W. H. Selway, Mrs. J. F. Mellor, and Mr. E. H. Ising, and Messrs. Edwin Ashby and Percy Runge, Chairman and Secretary of the Fauna and Flora Protection Committee; *Hon. Auditors*, Mr. Walter D. Reed, F.C.P.A., and Mr. A. W. Drummond.

The Fauna and Flora Protection Committee was also elected at the annual meeting, and comprised:—Messrs. E. Ashby and P. H. Runge, Dr. R. S. Rogers, Dr. W. Ramsay Smith, Dr. R. H. Pulleine, Messrs. J. W. Mellor, W. H. Selway, J. M. Black, A. G. Edquist, E. H. Lock, A. M. Lea, S. Angel, J. Willmott, R. Llewellyn, and S. Stokes, and Capt. S. A. White.

The membership is now 157.

At the annual meeting held on September 18, 1917, the retiring President (Prof. T. G. B. Osborn, M.Sc.) delivered an instructive address on "Parasitic Flowering Plants in

South Australia. He referred particularly to such plants as *Bartsia latifolia*, and to members of the Scrophulariaceae, Loranthaceae, and Santalaceae. *Euphrasia Brownii* was also referred to and described. *Exocarpus cupressiformis* (the native cherry) the lecturer stated as probably parasitic, and some reference was made to the various species of *Loranthus*.

At an adjourned meeting held on October 2, 1917, Prof. T. G. B. Osborn, M.Sc., continued his address dealing with a common weed of the park lands *(Romulea bulbocodium)*. The speaker drew the attention of the members of the Section to the various forms of botanical work which could be done near the city. The professor hoped that the Section would be able to do some work towards a detailed study of three species of mistletoe growing on native and other trees near Adelaide. The root systems of many common plants were also well worthy of study, *e.g.*, those of the common nutgrass *(Cyperus rotundus)*, and those of various species of the native Liliaceae. Another suggestion was that the Section should undertake to compile a map showing the distribution of native trees near Adelaide, and exact census of the plants in some limited area, such, for example, as the National Park. At the same meeting many interesting specimens were shown. Mr. W. J. Kimber exhibited several shells, including the new *Volvatella*, obtained in the dredging expedition of January 29, 1917. The species was as yet undetermined, but it was described as somewhat resembling *V. pyriformis* (Pease) of Queensland. Mr. Kimber also showed a fossil from the tertiary beds at Gaza. Mrs. Harris tabled an aboriginal skull obtained from the banks of the River Torrens. Miss I. Roberts showed a specimen of Archaeocyathinae, a fossil from the Cambrian series, and a piece of chiastolite, or "luck stone," from Bimbowrie, South Australia. Other specimens tabled by Dr. Fenner included a fine beryl and several fossils forwarded from the war fronts in France, Gallipoli, and Palestine. These included *Helix* sp., brachipods, and others. Many fine orchids were tabled by Mrs. E. H. Ising and Miss Janet Davidson. Mr. Runge tabled specimens of bismuth, wolfram, asbestos, and gold ore. The Secretary showed a collection of native plants from Kangaroo Island.

On September 29 a large party, under the guidance of Prof. T. G. B. Osborn, M.Sc., took part in an excursion to Slape Gully. The leader directed the attention of members more particularly to the sundews *(Drosera)* and heath plants of the district.

The monthly meeting on October 2 was devoted to the exhibition of specimens, a number of native plants being shown by members.

On October 23 Messrs. A. Wilkinson and P. H. Williams gave an exhibition of some interesting and beautiful slides from photographs taken by themselves. Many of the slides were views taken on various excursions, while there were also fine pictures of the River Murray.

Horsnell Gully was visited by members on October 13, under the guidance of Mr. E. H. Lock. The scenic beauties were greatly admired, and specimens of the native flora gathered as well as of the English dandelion and Scotch thistle.

On October 27 the party visited the National Park, and collected a number of species of the native flora.

A large party travelled to Dunstan's Gully on November 10, when Dr. C. Fenner spoke on the physiographic features of the foothills and the geology of the Mount Lofty Range.

On October 10, 1917, the members journeyed to Ambleside under the leadership of Mr. E. H. Ising. The wonderful profusion of flowers was the outstanding feature of the outing. The leader spoke on leaves, their shapes and functions, and directed special attention to the well-known "pink eyes" *(Tetratheca ericifolia)*.

On November 24 a party travelled to Eden Hills under the guidance of Prof. T. G. B. Osborn, M.Sc. The introduced plants of the district formed the main subject of the afternoon's work, including a description of the various species of clovers. A good many species of native flowers were collected. At the conclusion of the afternoon's work the party was entertained by Mr. and Mrs. M. Symonds Clark at Eden.

On April 27, 1918, excursions were resumed by the Section, the members travelling to Aldgate to view the autumn tints, Mr. E. H. Lock being the leader. Mr. A. G. Edquist spoke on the formation of colour in the leaves both from the botanical and chemical standpoint.

On May 6 a large party travelled to Mylor, and succeeded in collecting many species of the hills flora, and studied the river and cliff formation along the River Onkaparinga.

Mr. A. M. Lea spoke on "Ants and their Guests" at the evening meeting held on May 16. He described the manner in which ants recognized other individuals from the same nest by the power of smell. Many species of ants kept slaves. Others stored up grain, which they dried to prevent germination. The honey ants of Central Australia became reservoirs of honey, which were largely availed of by the aboriginals, as had been noticed by Captain White in his recent visit to Central Australia. The use of the episcope to show various drawings illustrating ant life tended greatly to enhance the interest of the lecture.

A seaside trip was undertaken on May 18, when a party under the leadership of the President and Mr. A. G. Edquist went along the coast from the Grange towards the Semaphore. Several interesting forms of marine life were noticed and described by Mr. Kimber, after which Mr. Edquist described the characteristic plants of the sandhills bordering the shore, and spoke on the many interesting adaptations shown by such plants growing under xerophytic conditions.

On June 1 the Director of the Botanic Garden (Mr. J. F. Bailey) conducted a large party over the Garden and Botanic Park. The leader dealt more particularly with the trees growing in the garden, pointing out their modes of growth and economic uses.

The evening meeting held on June 18 was well attended. Mr. H. W. Andrew, of the Agricultural Department, gave a most interesting address on "Weeds and Seed Control." By means of lantern slides and a fine collection of well-mounted specimens the lecturer illustrated many of the most troublesome weeds which have been imported into our State to the detriment of the producers, and described the methods by which it was attempted to prevent the introduction of fresh species and to diminish the spread of existing pests.

The excursion of June 22 was devoted to the Morialta Gorge. Under Dr. C. Fenner's leadership, and with the aid of maps supplied to each member of the party, the formation of the gorge was studied. The leader clearly explained the physiographic factors which had brought about the formation of the waterfalls, the picturesque canyon, and the many other forms of rock structure to be seen in the Morialta Reserve.

On July 6, Prof. T. G. B. Osborn, M.Sc., conducted a party of members of the Section over the North Park Lands at Montefiore Hill, and gave an interesting exposition of the manner in which the common onion weed was enabled to spread with such destructive rapidity in pasture lands, and by means of specimens demonstrated the peculiar root system possessed by this plant. Several other introduced weeds were dealt with, and an adjournment was made to the banks of the Torrens. The formation of "hooks" was pointed out, and attention was directed to the colonization of the newly-formed mudbanks by various species of plants.

At the evening meeting held on July 16, Prof. T. G. B. Osborn, M.Sc., spoke on "The Variability of Organisms." By means of a card containing a number of leaves from two branches of a pittosporum plant mounted to show the number of leaves of each of various lengths, the speaker was able to vividly illustrate the variability of the plant in this respect. A graph formed from these numbers gave a curve of variability which was made the text of an interesting lecture on the subject of variability in general and the question of the limitations of its control. Another graph compiled by the speaker showed the variations in the number of ray florets in a large number of specimens of the common ox-eye daisy *(Chrysanthemum leucanthemum)* growing near Mount Lofty. In this case the graph showed that there were two apices, probably pointing out that there were really two species included, varying only in the number of ray florets. The speaker also exhibited specimens showing the ravages of the streak disease of the winter-flowering sweet pea.

The excursion of July 20 was taken in the neighbourhood of the Black Hill. Mr. E. H. Ising (the leader) spoke on the heath-like plants, particularly dealing with *Epacris* and the various species of *Styphelia*. By means of specimens and blackboard diagrams the peculiar adaptations of these plants were explained and the construction of the floral organs shown. The botanical characteristics of the styphelias were illustrated, and the distribution of the various species touched upon. In addition to the lecture the leader was able to identify and speak upon a large number of species of native flowers which had been collected by members in this locality.

Members visited Upper Sturt on August 17, under the leadership of Mr. A. G. Edquist. By special permission the party was enabled to follow the railway line into the National Park. The members were greatly pleased to find that the authorities were carefully protecting the native flora along the railway. Here many interesting native plants were noted, especially *Hardenbergia monophylla*. No collections were made, but at various points the leader dealt with the different plants seen. At a later stage Mr. Edquist delivered an address on the wattles. Specimens brought by the lecturer were handed to members, who were able to compare the foliage and flowers of the various species, the speaker giving a short account of each species, with particular reference to its suitability for planting. A general discussion on the acacias followed.

At the evening meeting held on August 20 Dr. C. Fenner, F.G.S., gave an interesting lecture on "Volcanoes and Volcanic Products," illustrated by a fine series of lantern views. With the help of the episcope the speaker was able to show specimens of the various products of volcanic activity in the shape of lavas, pumice, and volcanic bombs. Some fine specimens of obsidianites or australites were made the text of a short address, in which by means of diagrams the lecturer illustrated the various theories of their origin and distribution.

On August 24 members took the tram to Paradise, and walked to Highbury under the leadership of Mr. W. H. Selway. The geological features of the locality were explained, special attention being directed to the beds of fluviatile origin corresponding in age with the marine tertiaries of the coast. The sandy soil of Highbury is prolific in native flowers, including a considerable variety of orchids, of which several species were found, in particular *Diuris palustris*. Heath-like plants were numerous, amongst these being *Cryptandra tomentosa*. Many acacias were in full bloom, including *A. montana*, which is usually found only at higher altitudes. Dr. Fenner explained the existence of gravel beds at a high elevation, forming an apron of alluvial, the water-worn material having been deposited at the base of the ranges.

On September 14 Mr. W. H. Selway conducted an excursion to the National Park. The leader gave an interesting account of the steps which had been taken to secure the old Government Farm as a National Park, and of the various troubles which the pioneers of the movement had to encounter from the opposition of those desirous of seeing the land cut up for occupation as working men's blocks, etc.

W. J. Kimber, *Chairman.*
W. Ham, *Hon. Secretary.*

TWENTY-NINTH ANNUAL REPORT OF THE NATIVE FAUNA AND FLORA PROTECTION COMMITTEE.

On May 1, 1918, Mr. E. Ashby resigned his chairmanship prior to leaving for America, and Capt. S. A. White, C.M.B.O.U., was elected as chairman.

Several committee meetings took place during the year to discuss important questions. The chairman attended two meetings of sportsmen and others to consider the advisability of bringing in a new Bill for the protection of animals and birds. This was decided upon, and the chairman, through the courtesy of the Government, had a good share in the framing of the Act. The Bill was introduced into Parliament by the Hon. the Attorney-General (Mr. H. N. Barwell), and was keenly watched and contested, and several points were lost, the most important being the definition of an aboriginal. Still, great progress has been made, for hitherto many birds which have been unprotected will now have full protection. Many loopholes in the old Act have been rectified, and it will be much easier now to bring offenders against the Act to justice. At the time of writing this report the Bill is coming forward for the third reading.

The committee considered the seal question, for one sealer admitted having killed 1,400 seals in the last six months. The seal was placed in the totally protected list, but when before the House the clause was lost. Action is now being taken to declare both gulfs inside Kangaroo Island as a closed area or sanctuary for seals.

The Royal Society elected a committee, comprising the chairman of the committee, as well as Messrs. S. Dixon and J. M. Black, to arrange a deputation to the Government, asking that Flinders Chase, Kangaroo Island, be constituted. On Wednesday, September 10, 1918, a meeting of influential citizens took place in the Mayor's parlour, Adelaide, and the Hon. J. Lewis, M.L.C., presided. The question was discussed in all its aspects, and a committee appointed, consisting of Capt. S. A. White, Messrs. S. Dixon and J. M. Black, to arrange for a deputation. A circular was printed, setting out the objects of the Chase, and circulated amongst the members of both Houses of Parliament, citizens, etc. On September 27, a large and representative deputation waited upon the Attorney-General (Mr. H. N. Barwell). Prof. Sir Edward Stirling, the chairman of the committee, Mr. H. Robins, and others spoke, and put the situation very clearly before the Minister. The question has been before Cabinet, but the results are not yet to hand.

It can be said that much good work has been accomplished during the year, and a great deal of additional protection has been secured for our fauna and flora. Still much remains to be accomplished.

S. A. White, *Chairman.*

Field Naturalists' Section of the Royal Society.

Statement of Receipts and Expenditure for Year ended September 16, 1918.

RECEIPTS.	£	s.	d.	EXPENDITURE.	£	s.	d.
By Balance brought forward	2	13	6	To Members' Subscriptions paid to Royal Society	16	0	0
,, Grant from Royal Society	20	0	0	,, Postages	4	1	0
,, Members' Subscriptions	16	0	0	,, Stationery	0	7	0
,, Bank Interest	0	7	9	,, Hire of Hall and Lantern	3	5	8
				,, Advertising	0	9	6
				,, Printing	9	13	0
				,, Carriage	0	3	10
				,, Balance carried forward	5	1	3
	£39	1	3		£39	1	3

Excursion Account.

	£	s.	d.		£	s.	d.
By Balance brought forward	6	14	6	To Hire of Motor	6	0	0
,, Excursion Fares	12	15	6	,, Hire of Dredge	5	10	0
				,, Refreshments	0	3	9
				,, Gratuity to Sailors	0	5	0
				,, Credit Balance	7	11	3
	£19	10	0		£19	10	0

Audited and found correct,

Walter D. Reed, F.C.P.A.,
A. M. Drummond, } *Auditors.*

September 16, 1918.

W. J. Kimber, *Chairman.*
W. Ham, *Hon. Sec.*

GENERAL INDEX.

[Generic and specific names printed in italics indicate that the forms described are new.]

PLATES I. TO XXXII.

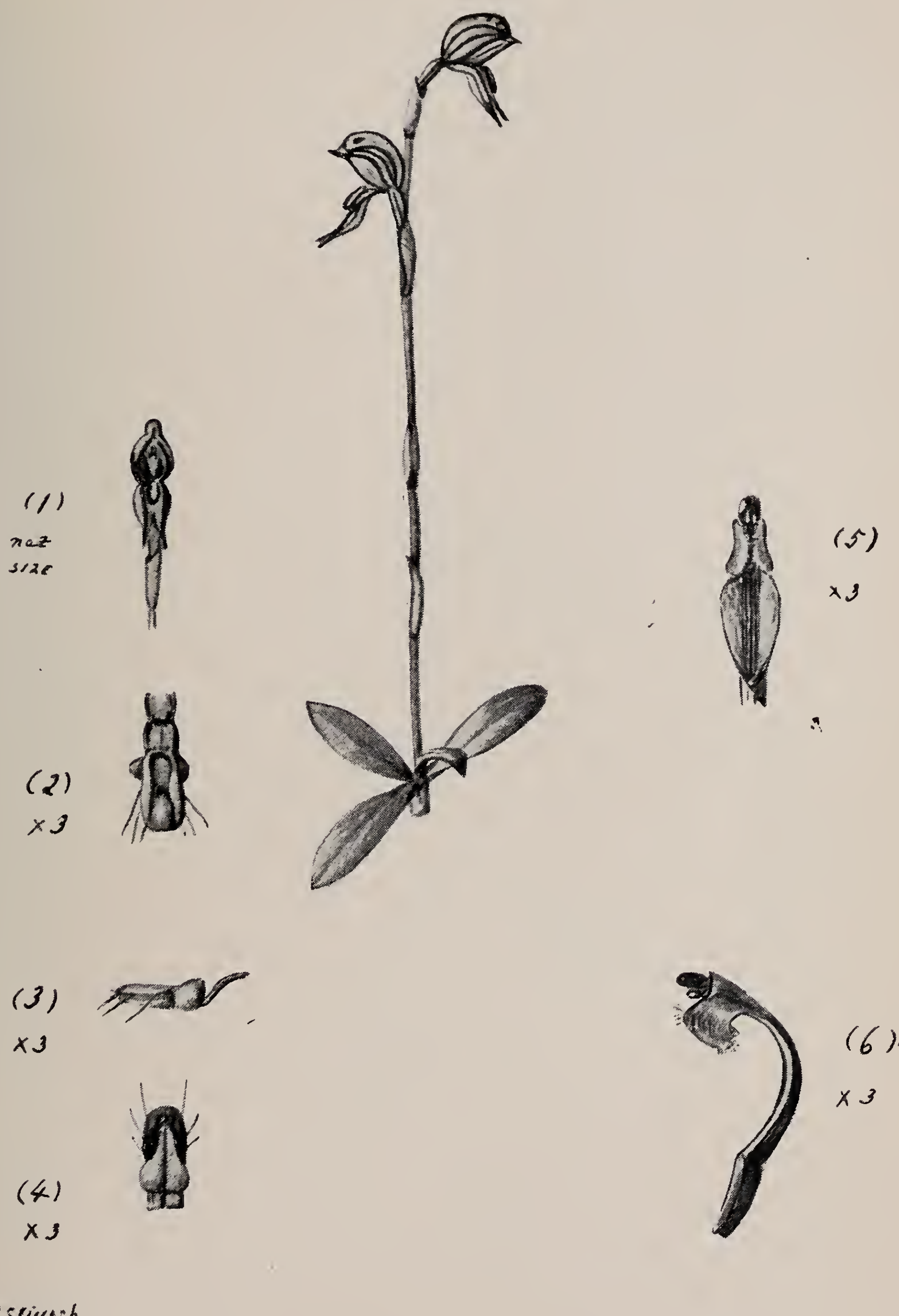
Fig. 1.

Fig. 2.

HUSSEY & GILLINGHAM LIMITED, PRINTERS & PUBLISHERS ADELAIDE, SO. AUS.

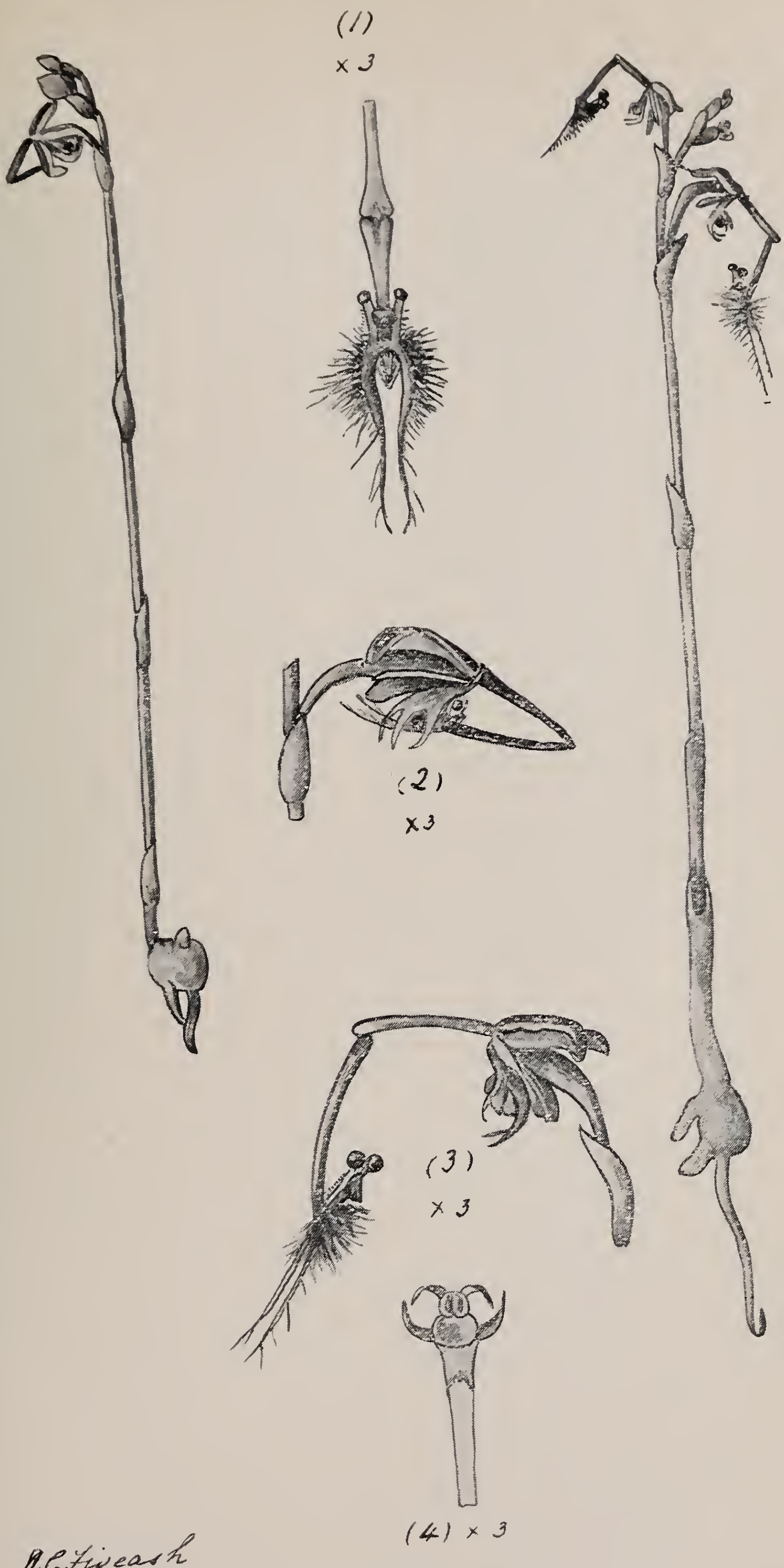
Calochilus cupreus, n. sp.

HUSSEY & GILLINGHAM LIMITED, PRINTERS & PUBLISHERS ADELAIDE, SO. AUS.



Pterostylis pusilla, n. sp.

HUSSEY & GILLINGHAM LIMITED, PRINTERS & PUBLISHERS ADELAIDE, SO. AUS.



Drakea Huntiana, F. v. M.

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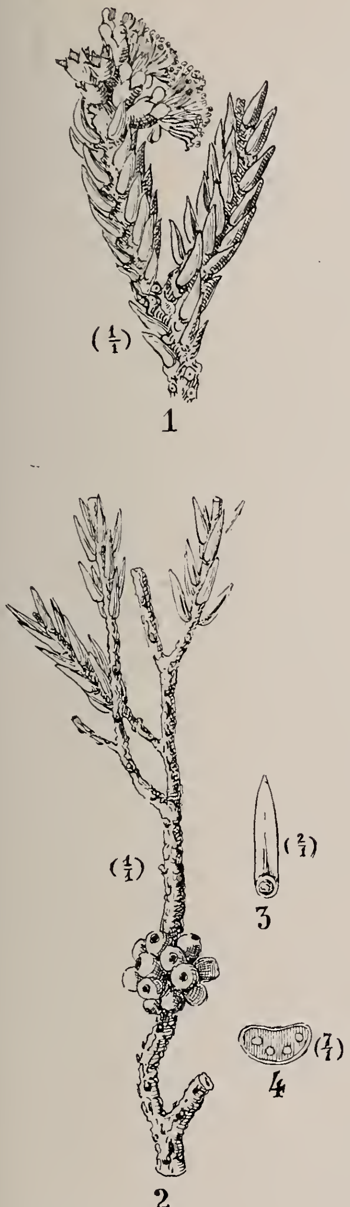
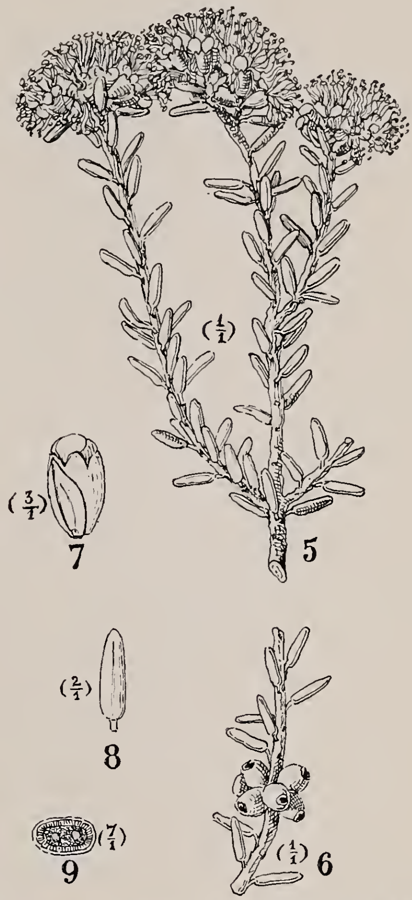


Melaleuca quadrifaria *F. v. M.*



Melaleuca pauperiflora *F.v.M.*

Acacia Menzelii *J.M.Black*

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Limnanthemum stygium

sp. nova

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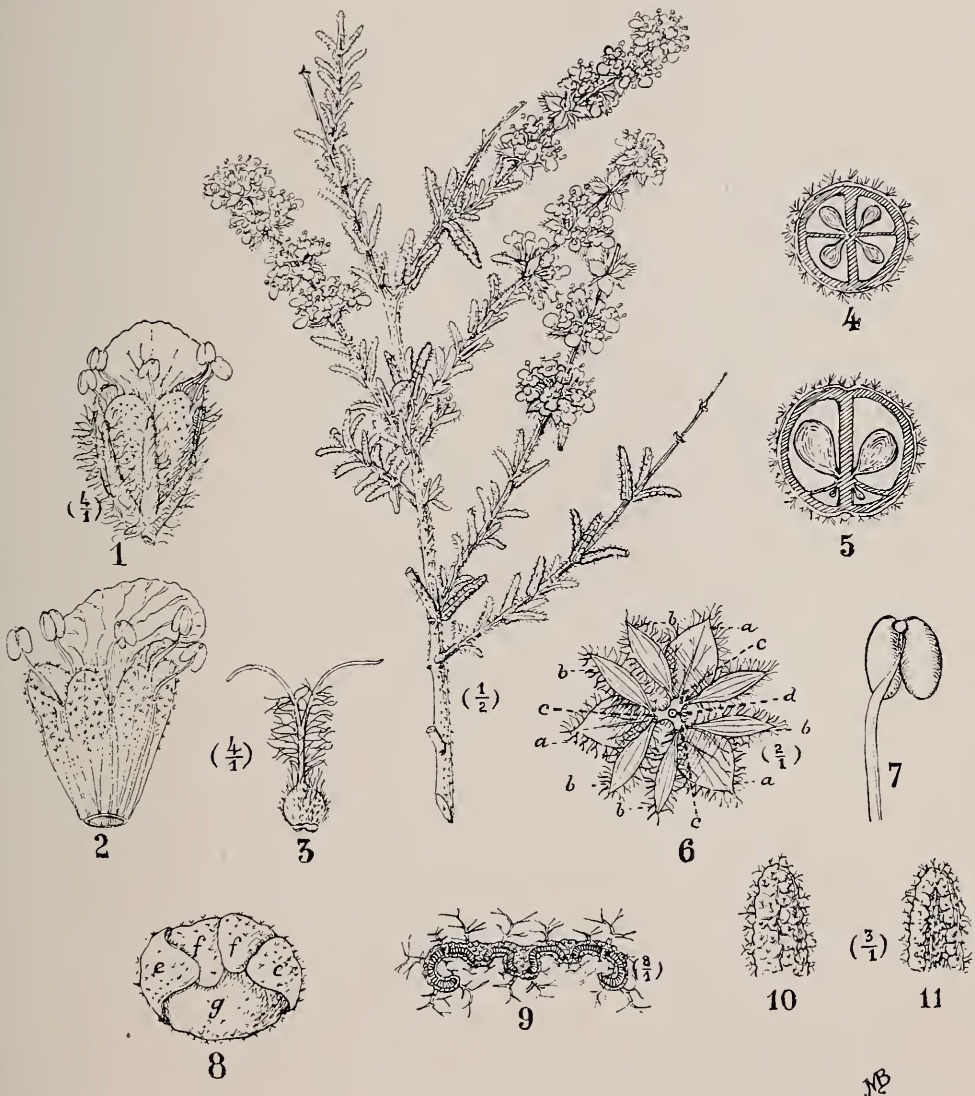

Dicrastylis verticillata *sp.n.*

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Calocephalus Dittrichii *F.v.M.*

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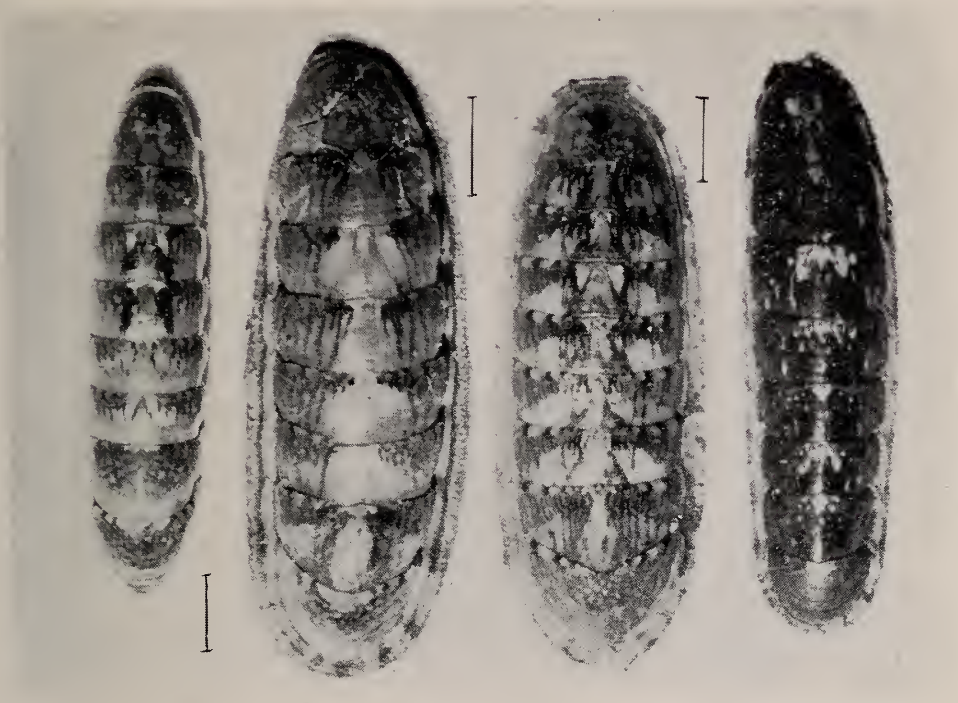

Figs. 4, 5, 6, and 7.

Figs. 1, 2, and 3.

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Fig. 8. Fig. 9. Fig. 10.

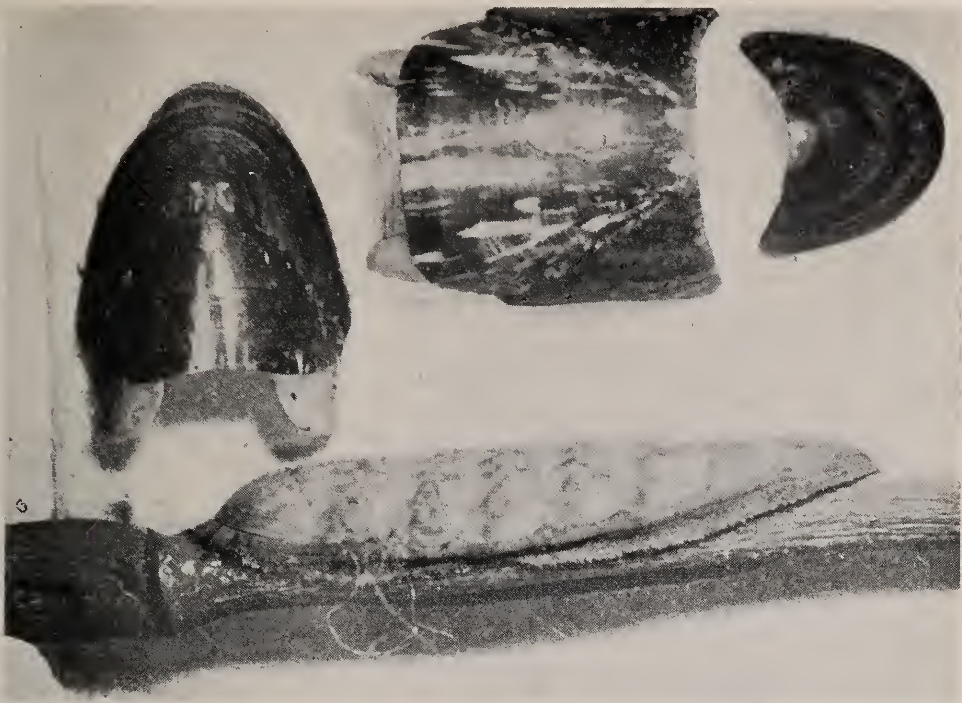

Fig. 11.

Fig. 12*a*.	Fig. 13*a*.	Fig. 14*a*.
Fig. 12*b*.	Fig. 13*b*.	Fig. 14*b*.
Fig. 12*c*.		Fig. 12*e*.
Fig, 12*d*.	Fig. 13*c*.	Fig. 13*d*.

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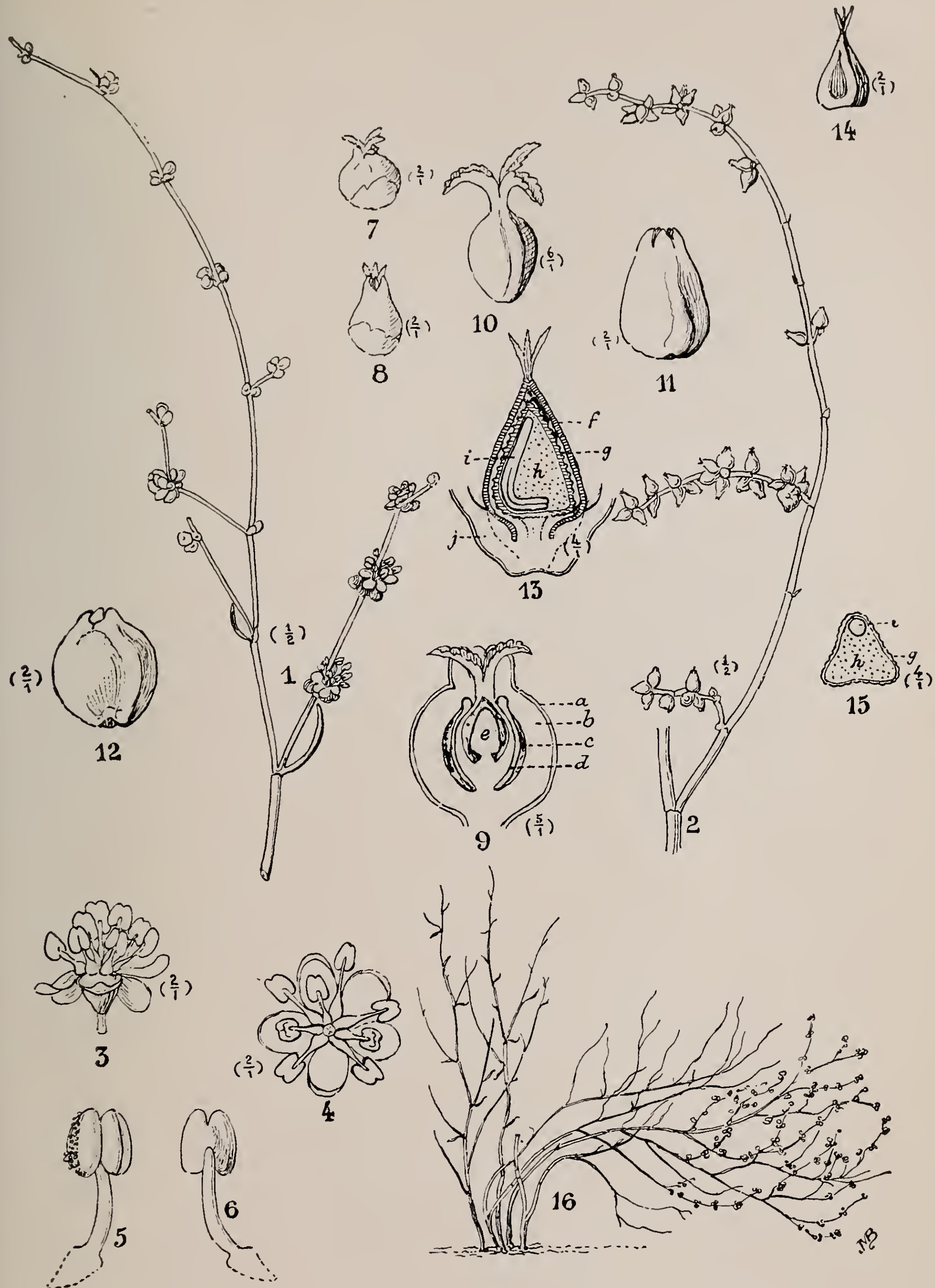

Muehlenbeckia coccoloboides *nov. sp.*

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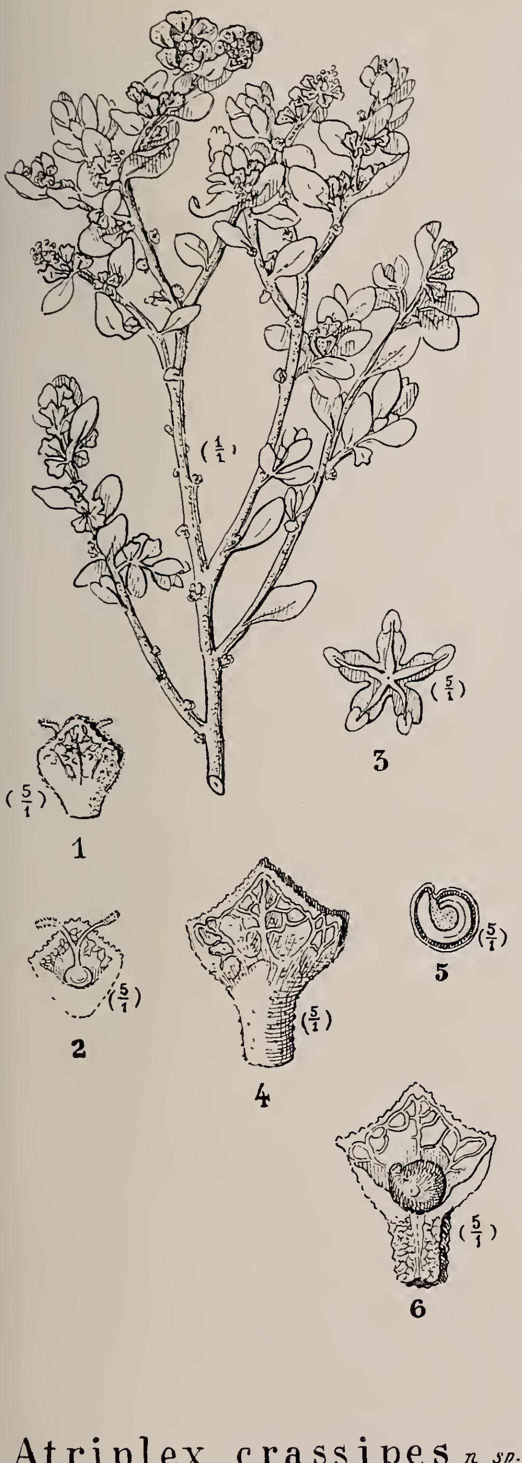
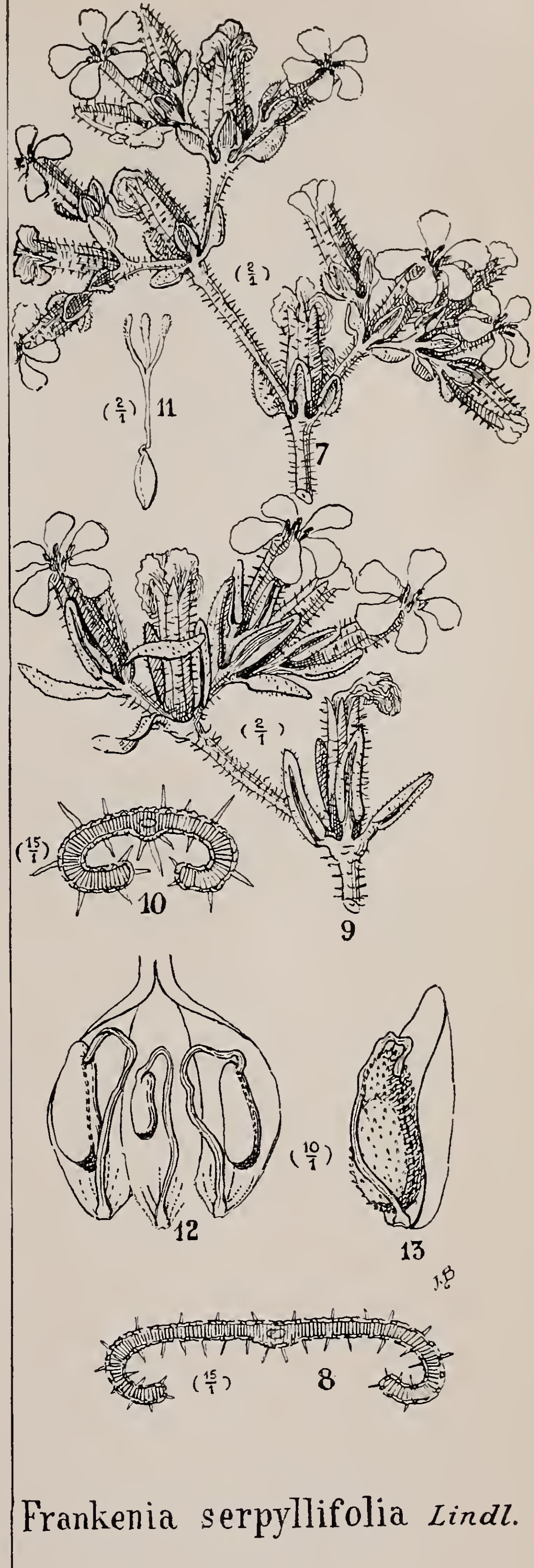


Atriplex crassipes *n. sp.*



Frankenia serpyllifolia *Lindl.*

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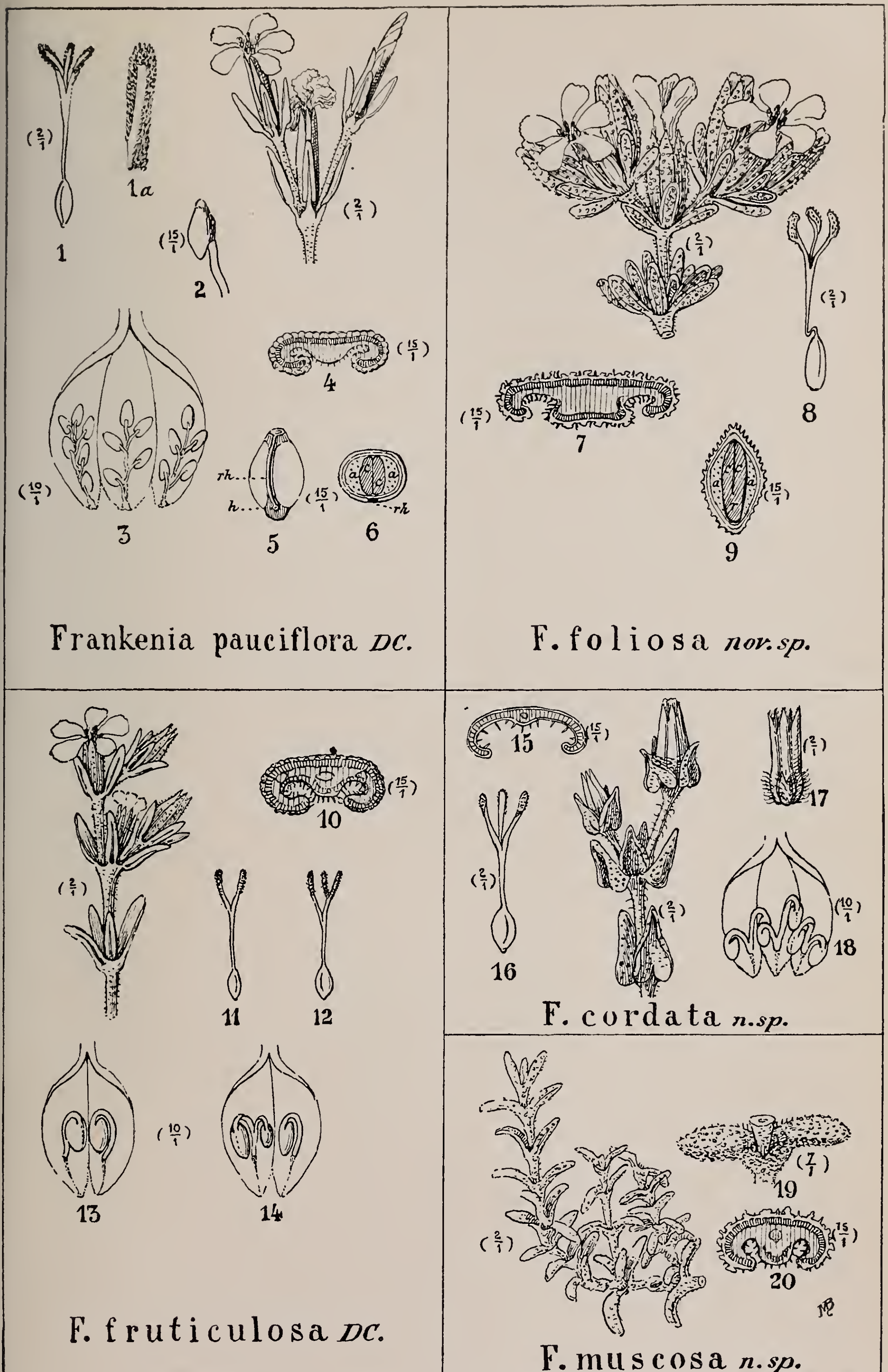

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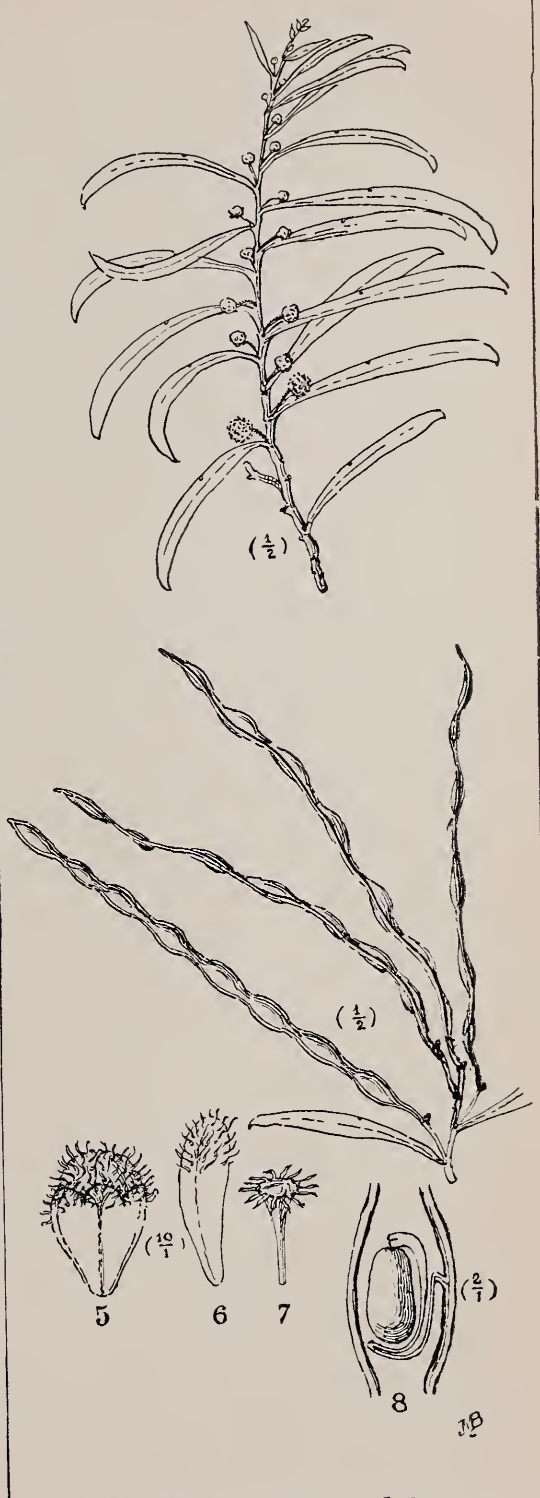
Minuria rigida *n. sp.*



Acacia rivalis *n. sp.*

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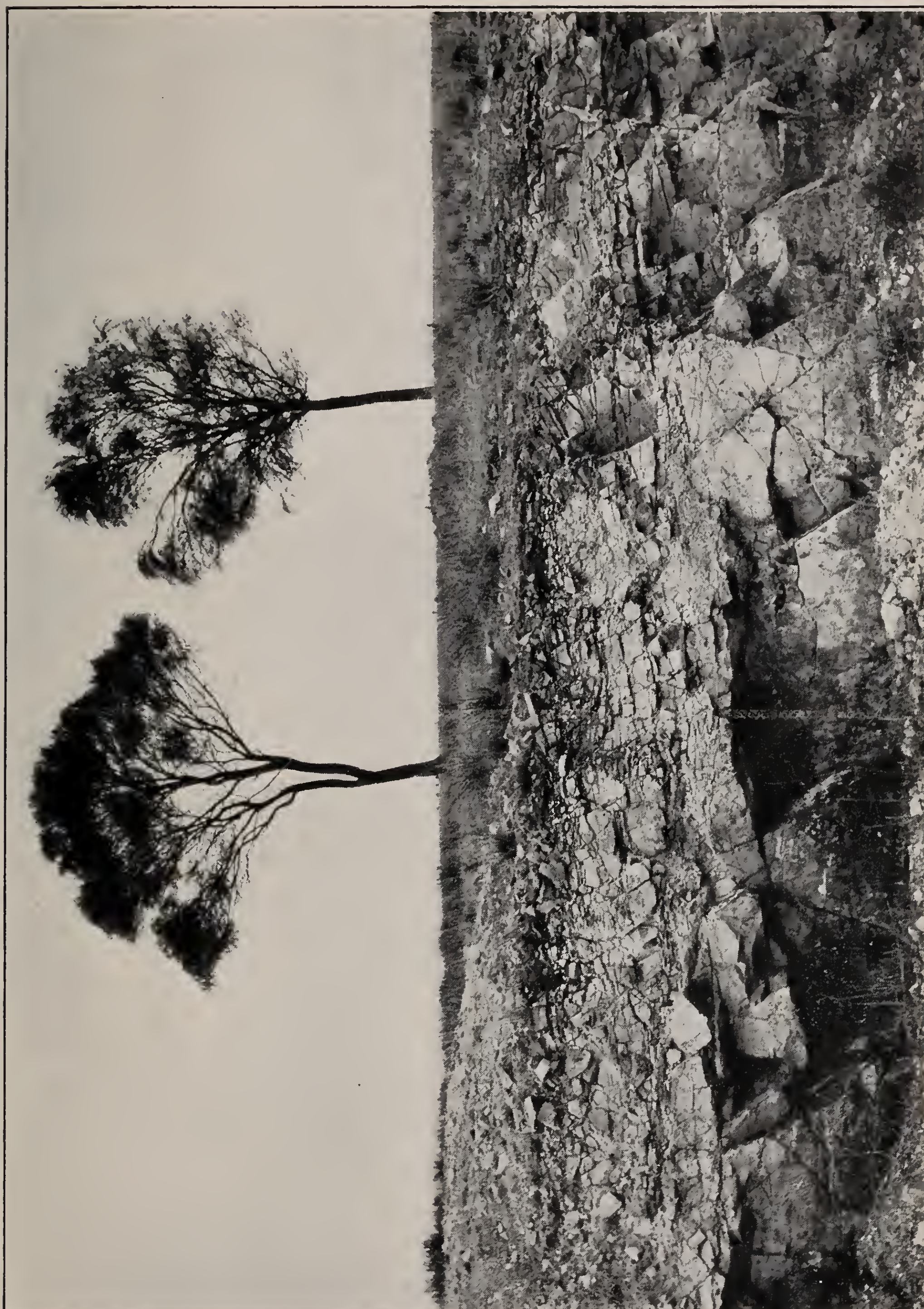

Basal Grits of the Upper Cambrian, Ardrossan.

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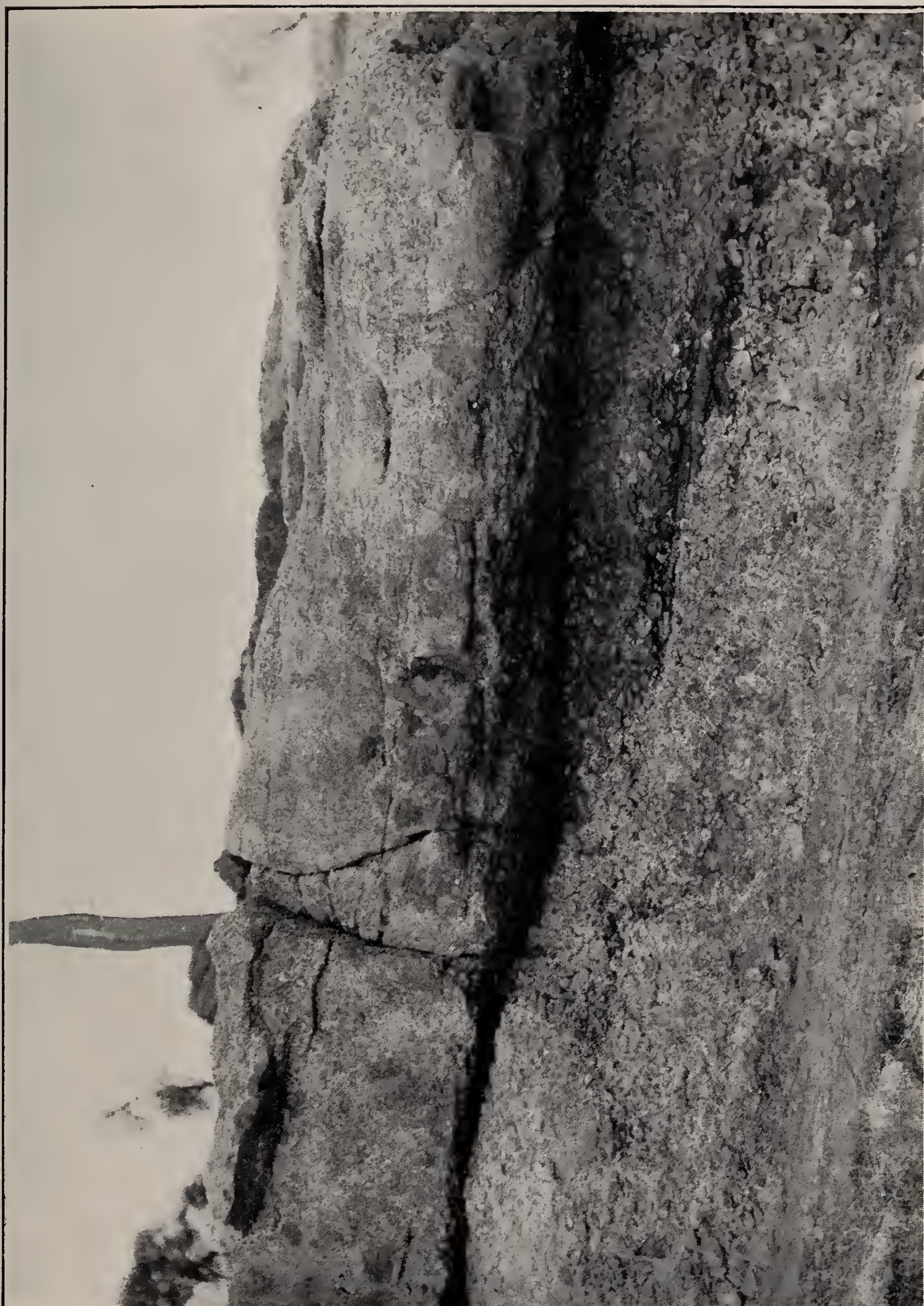

Basal Conglomerate and Grits of Upper Cambrian, Winulta Creek, Yorke Peninsula.

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Dolomites of Upper Cambrian, "Sliding Rocks," south of Ardrossan.

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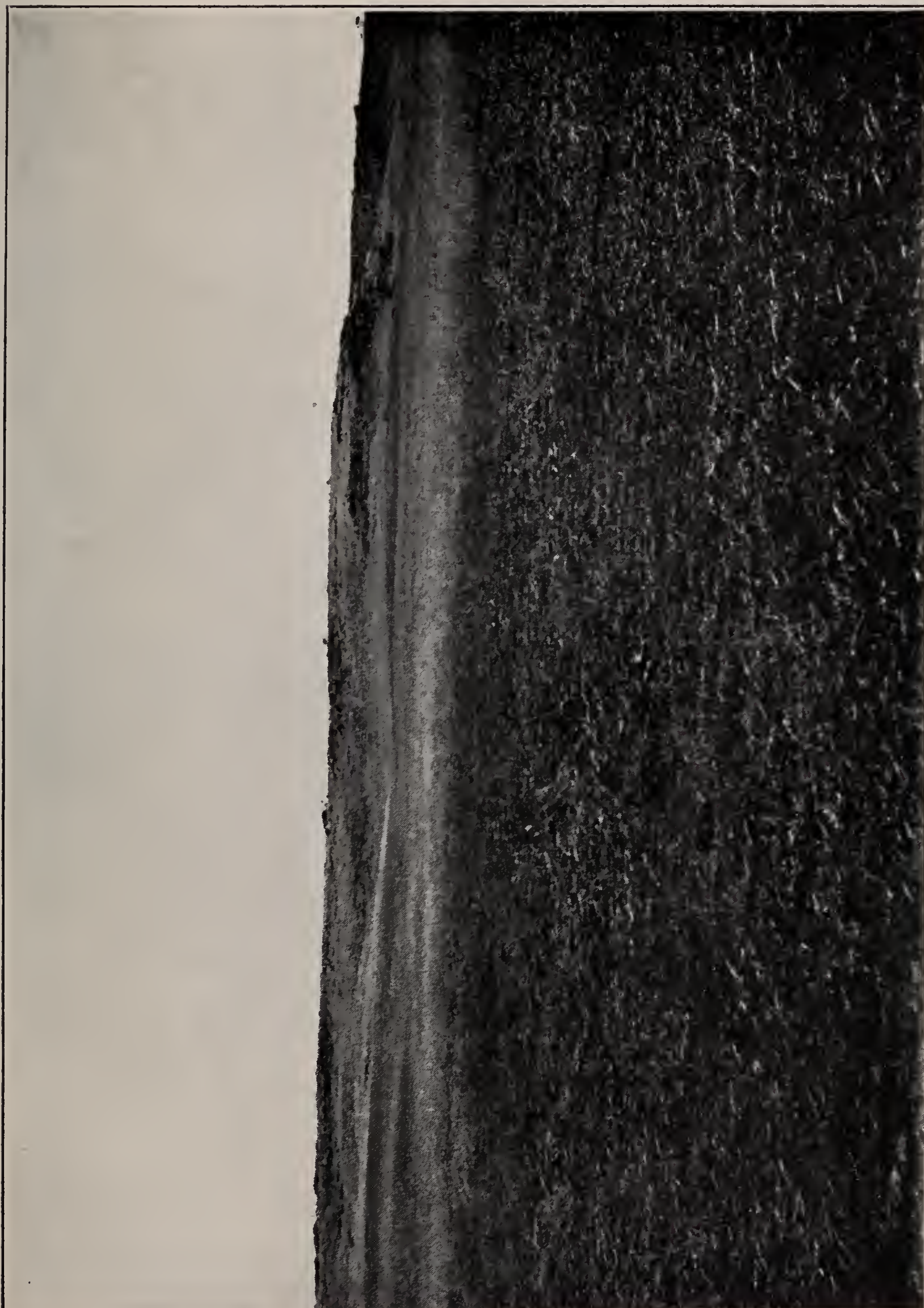

Ancient River Terrace formed of Consolidated Sands and Gravels, Ardrossan.

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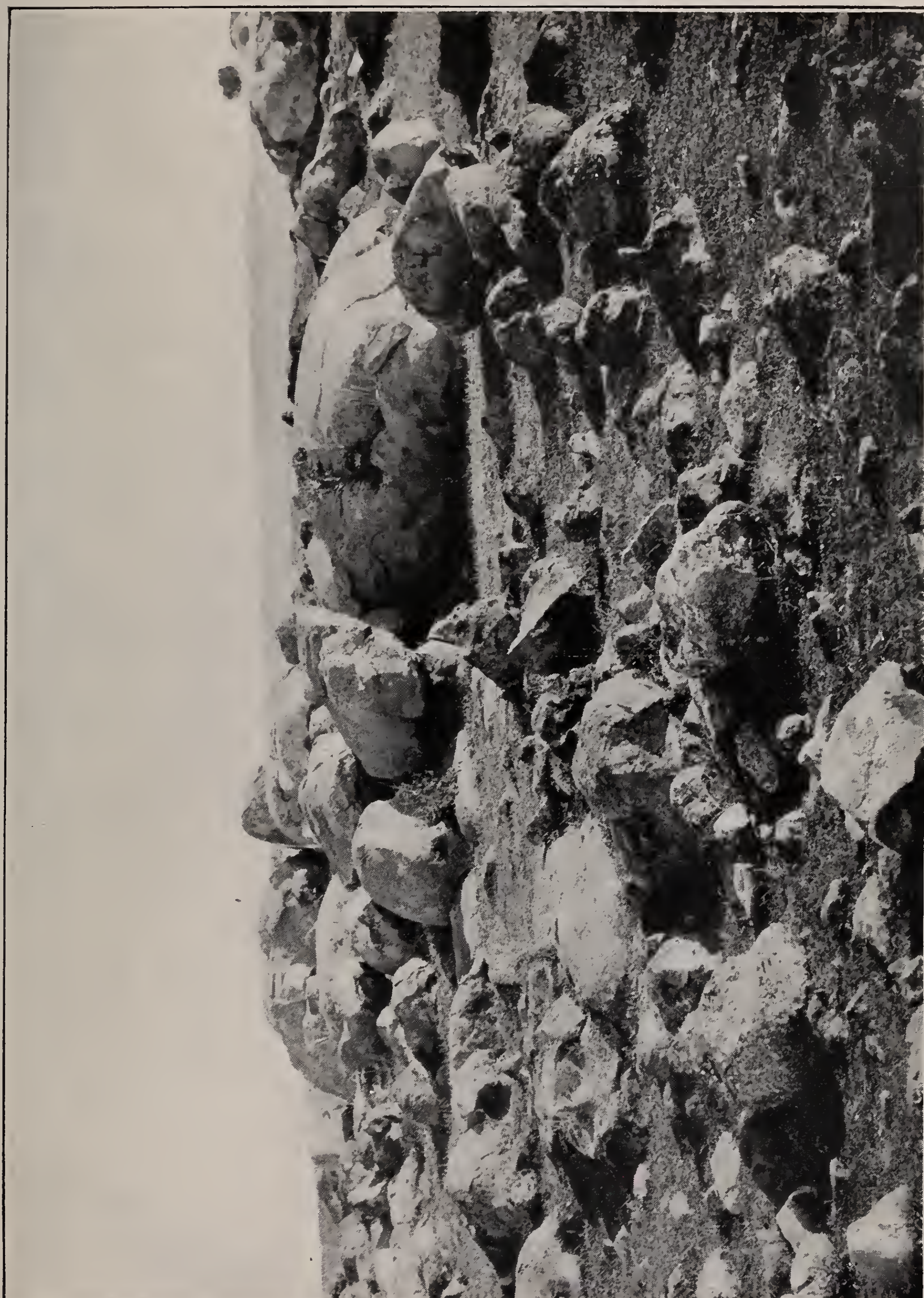

Ancient River Terrace, Ardrossan, view at southern end.

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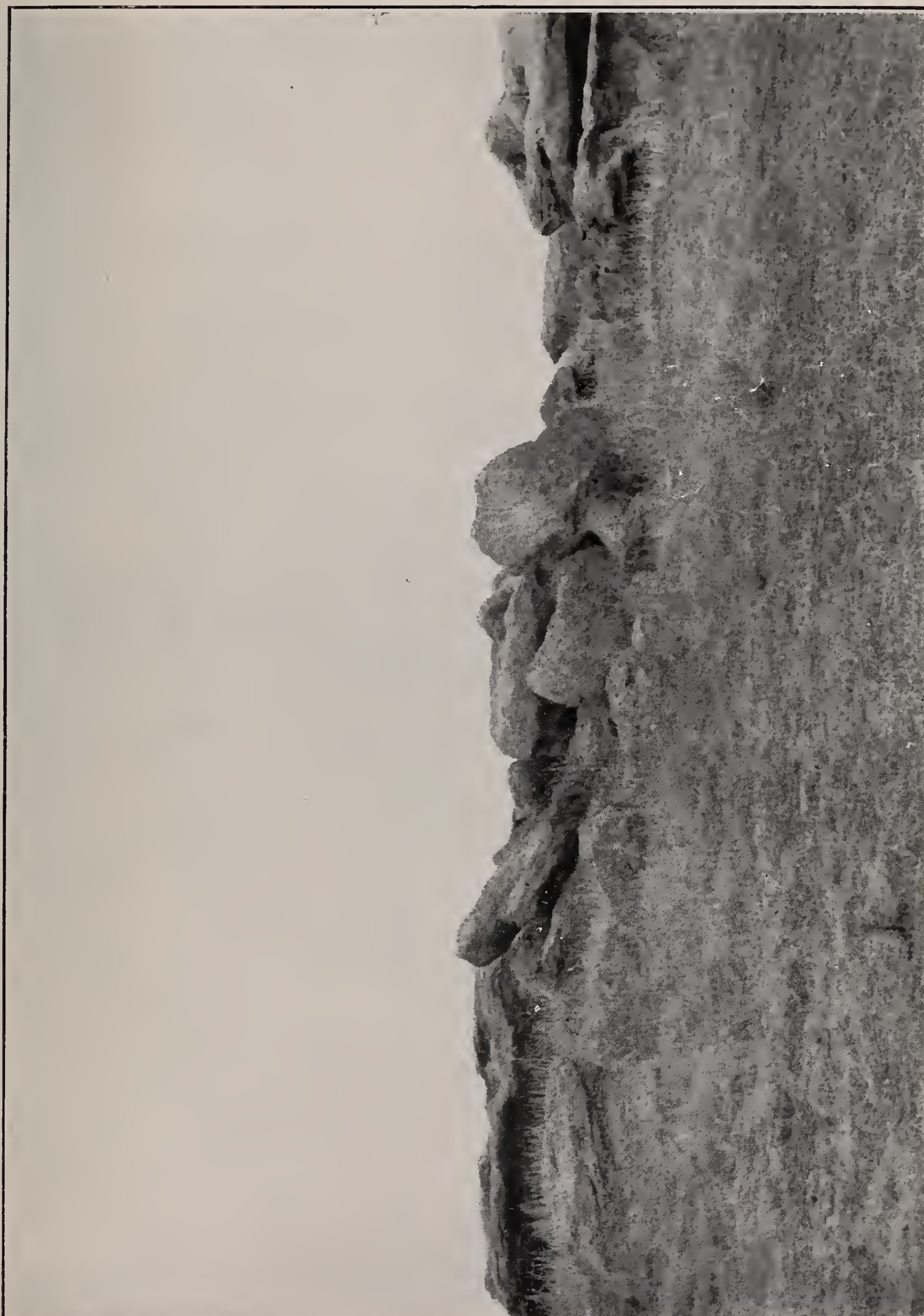

Ancient River Terrace, Ardrossan, near view.

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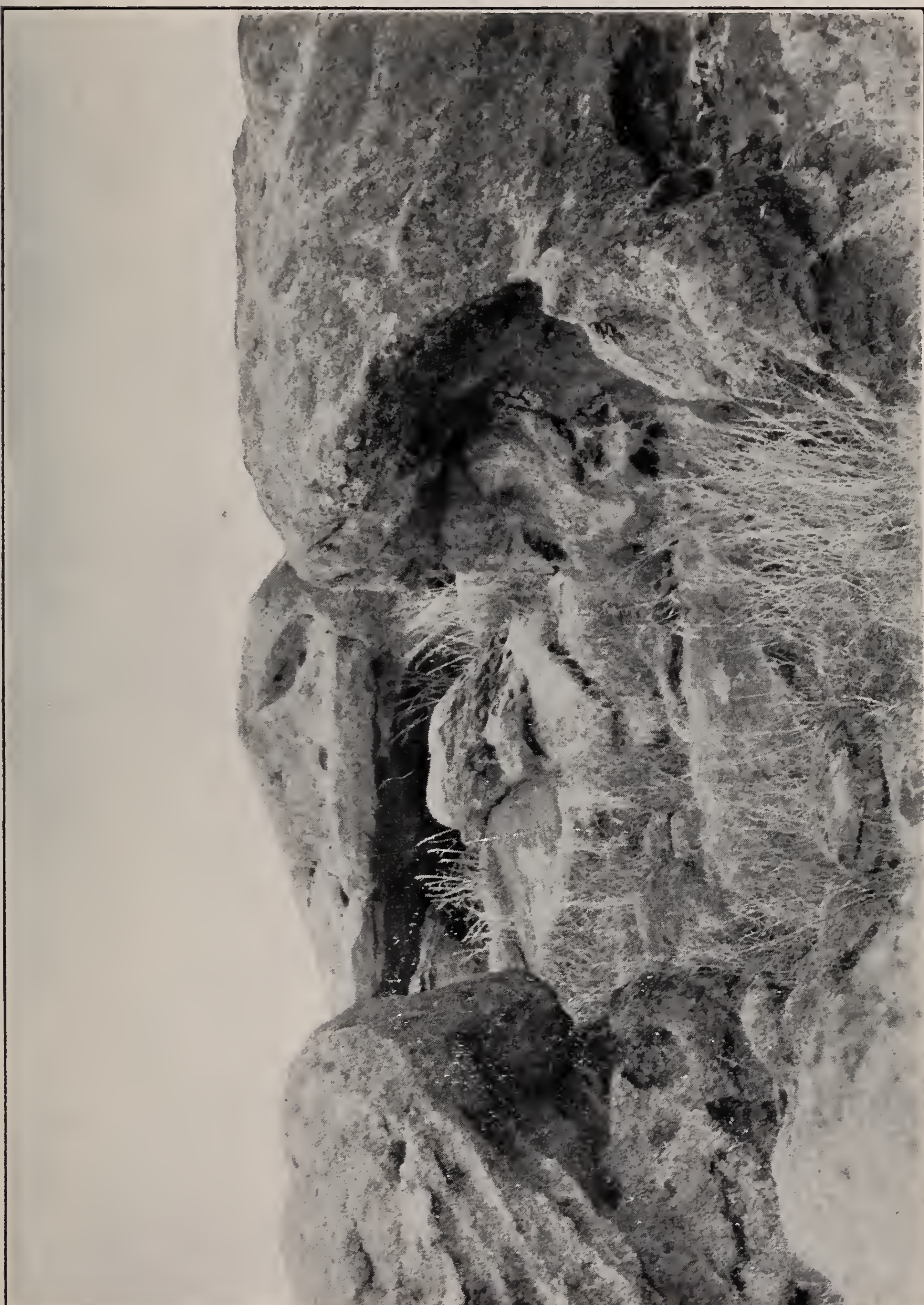

Ancient River Terrace of Consolidated Alluvium, Ardrossan, nearer view.

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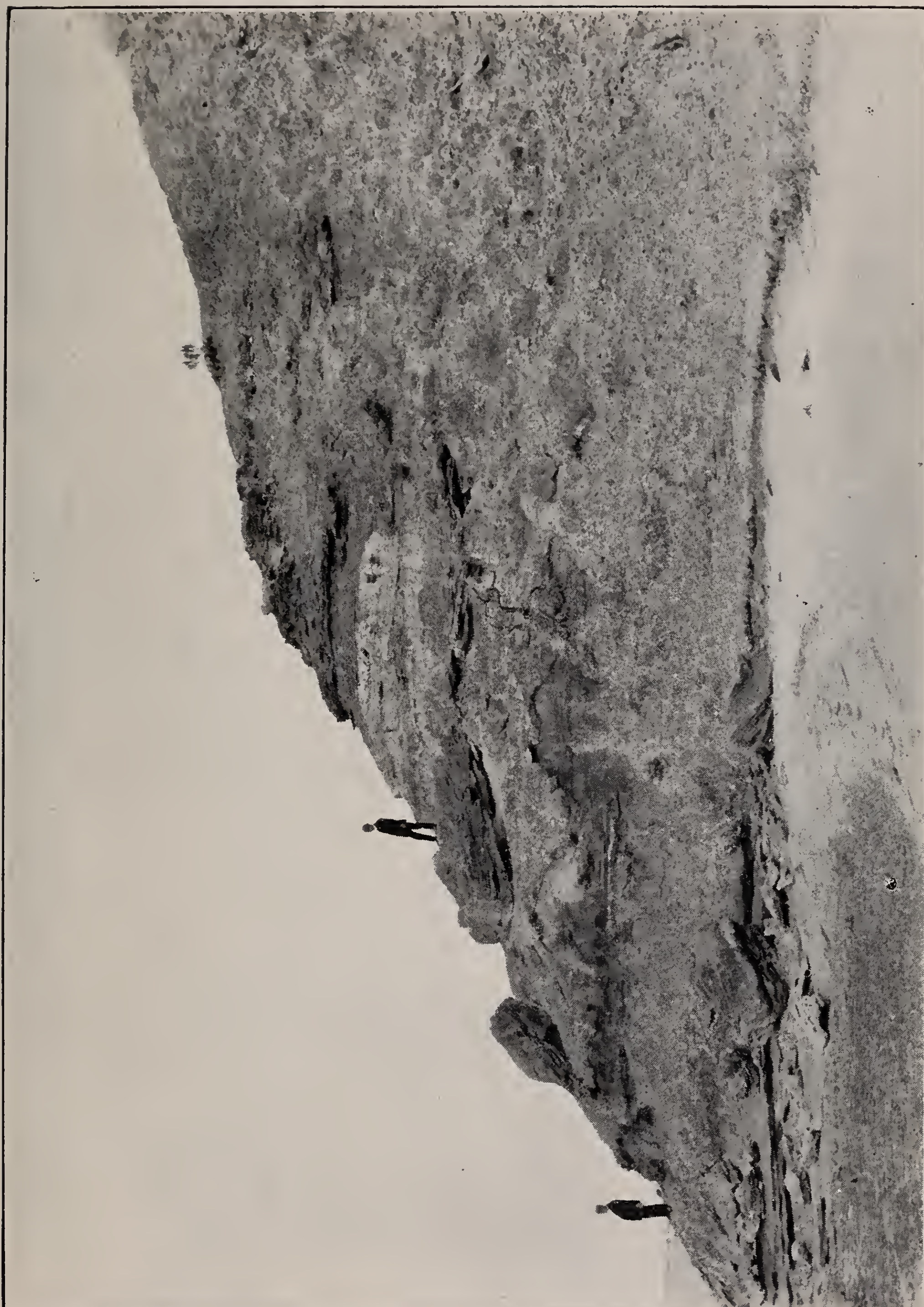

Rocky Point, south of Ardrossan.

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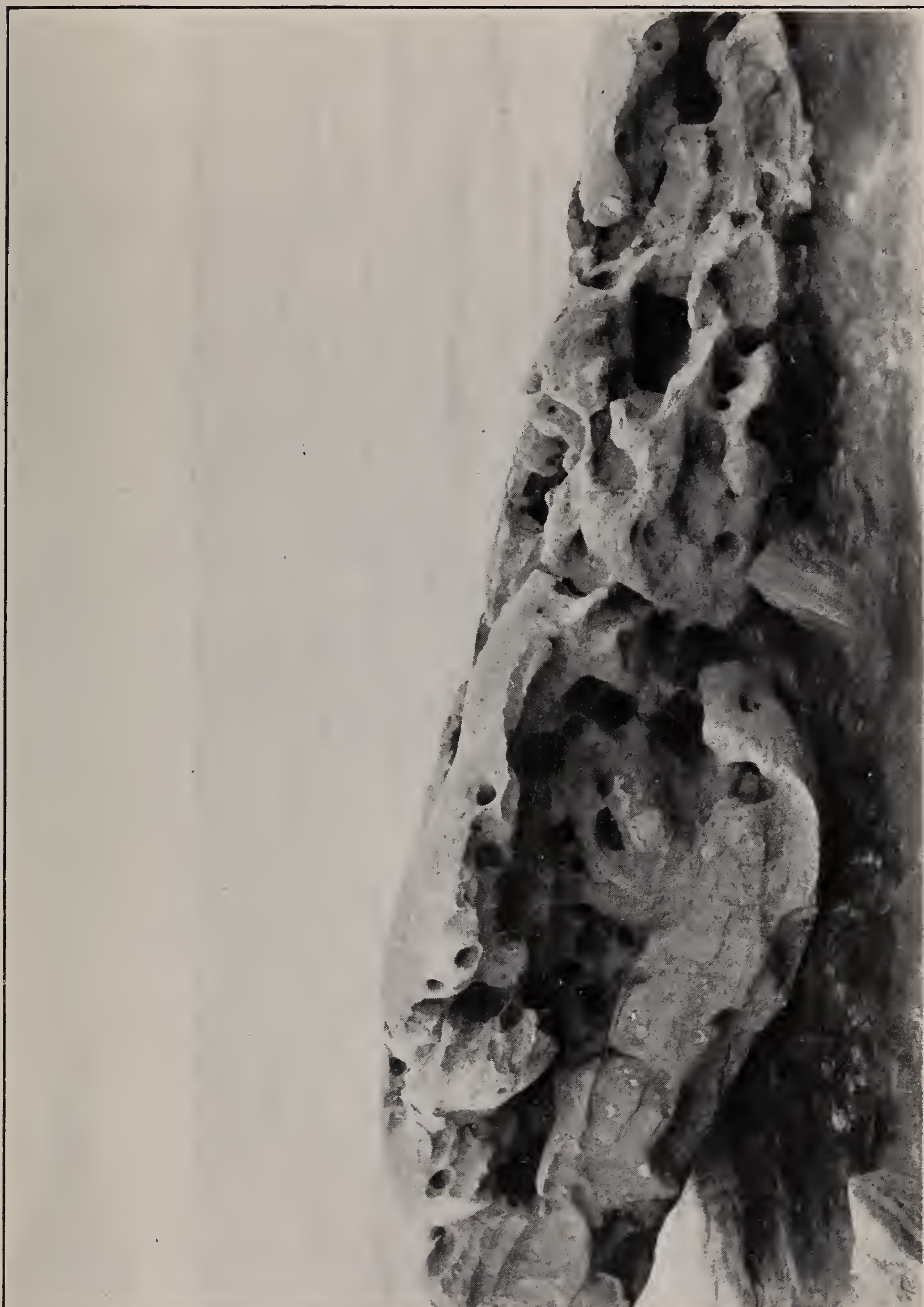

Silicified Alluvial Sandstone, between tides, Rocky Point.

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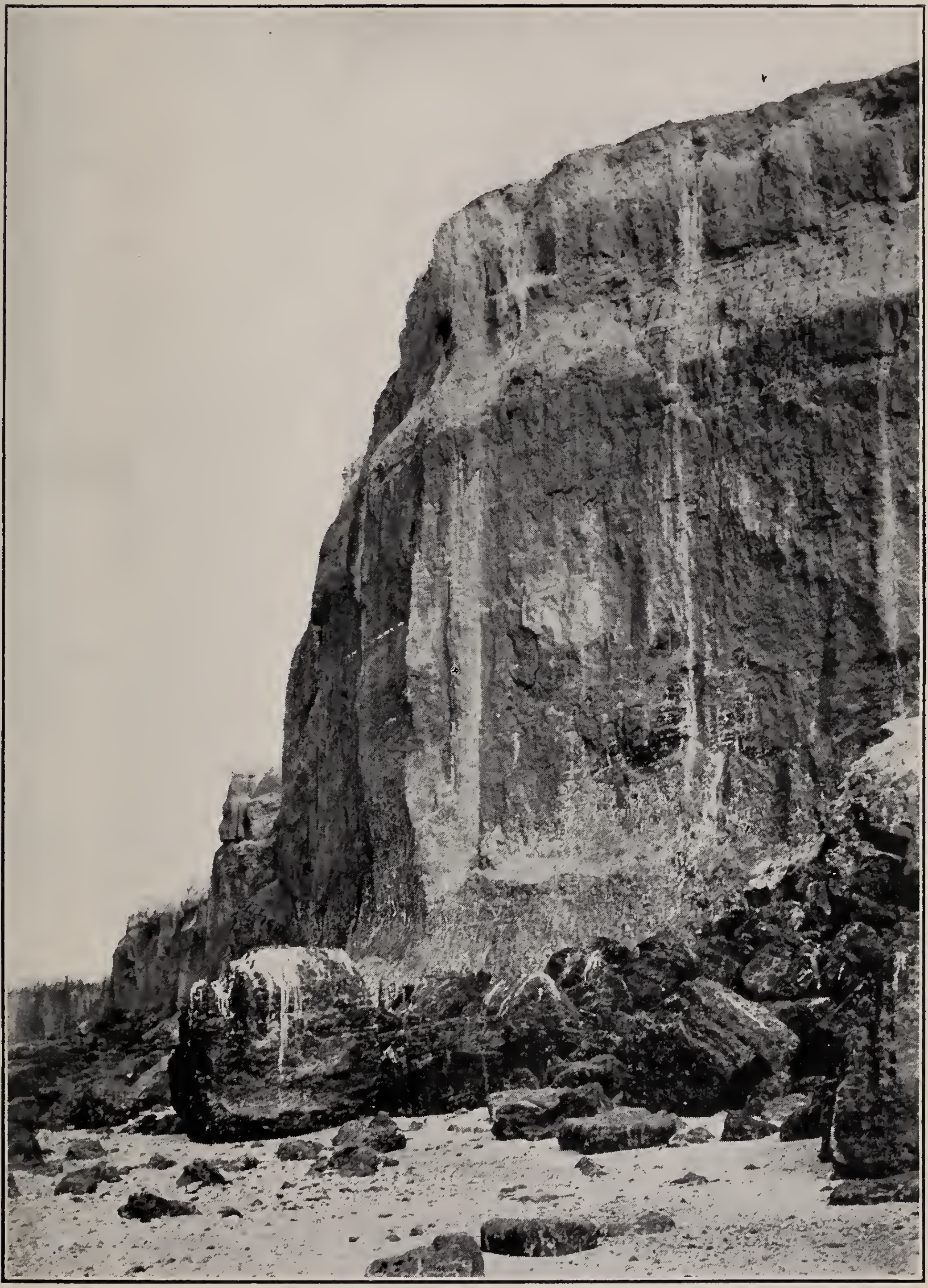

Clay Sea Cliffs, Ardrossan.

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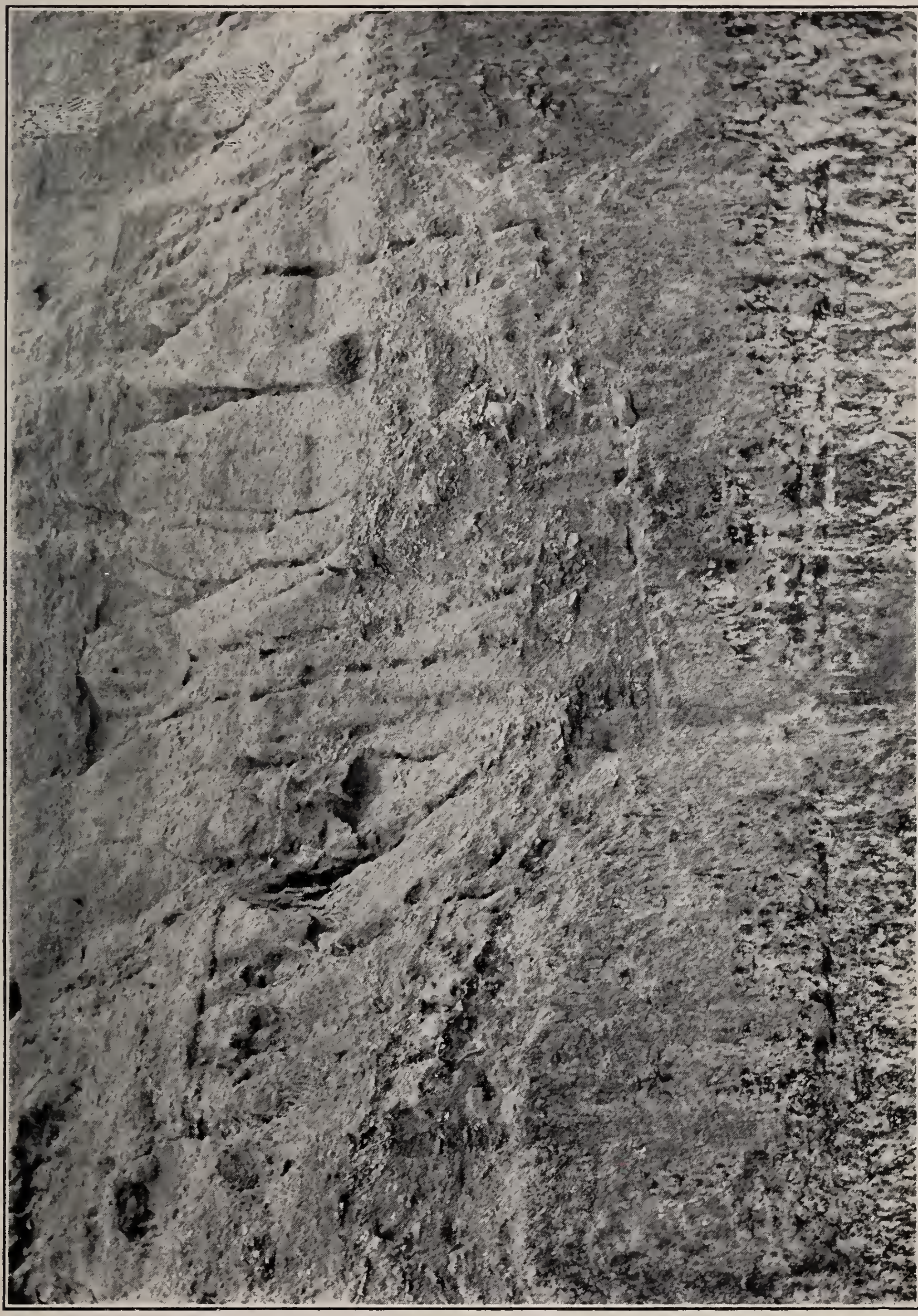

Clay Sea Cliffs, Ardrossan; showing an erosion surface, as a plane of Unconformity between the Pleistocene and Recent beds.

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Photo by H. M. Hale.

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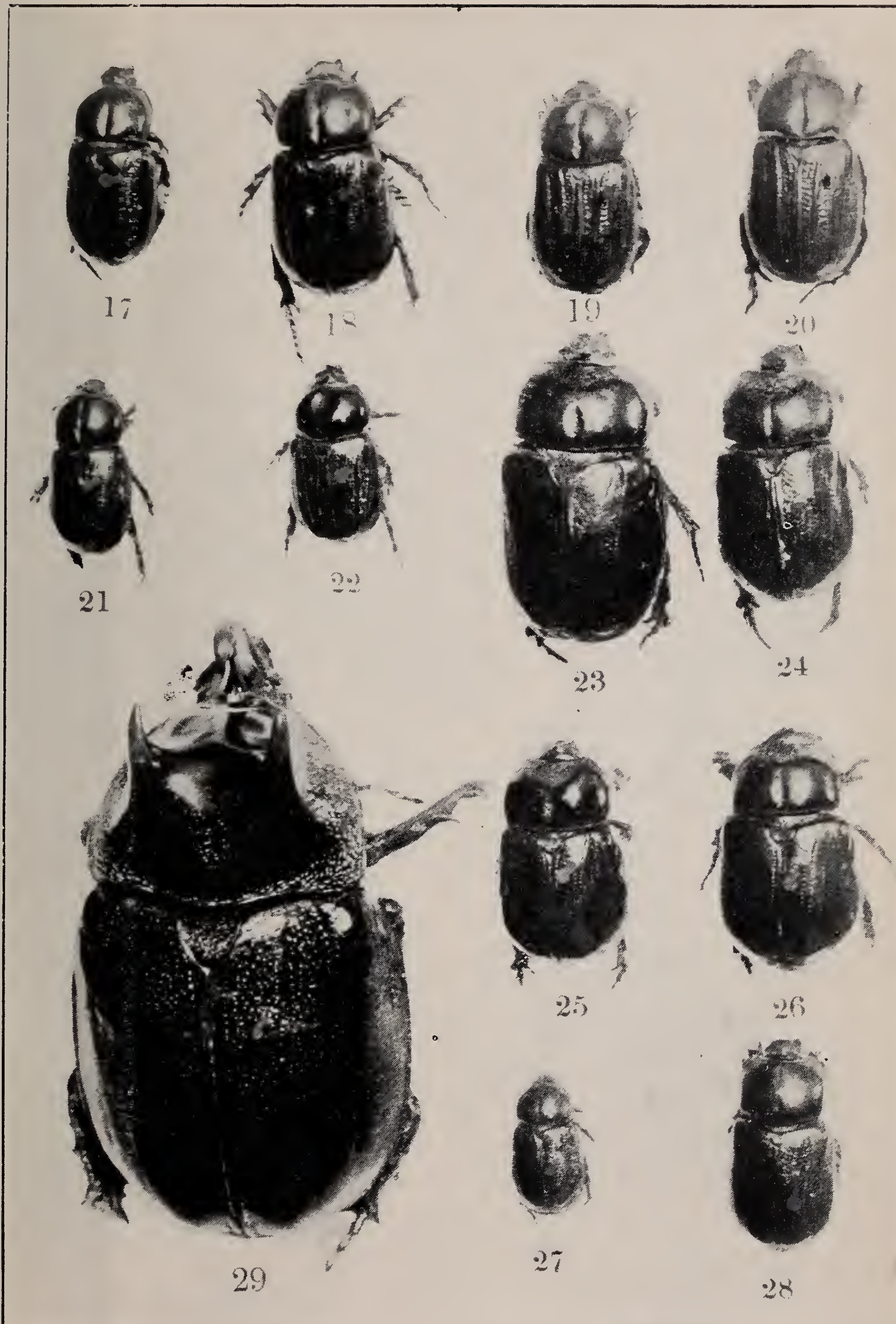

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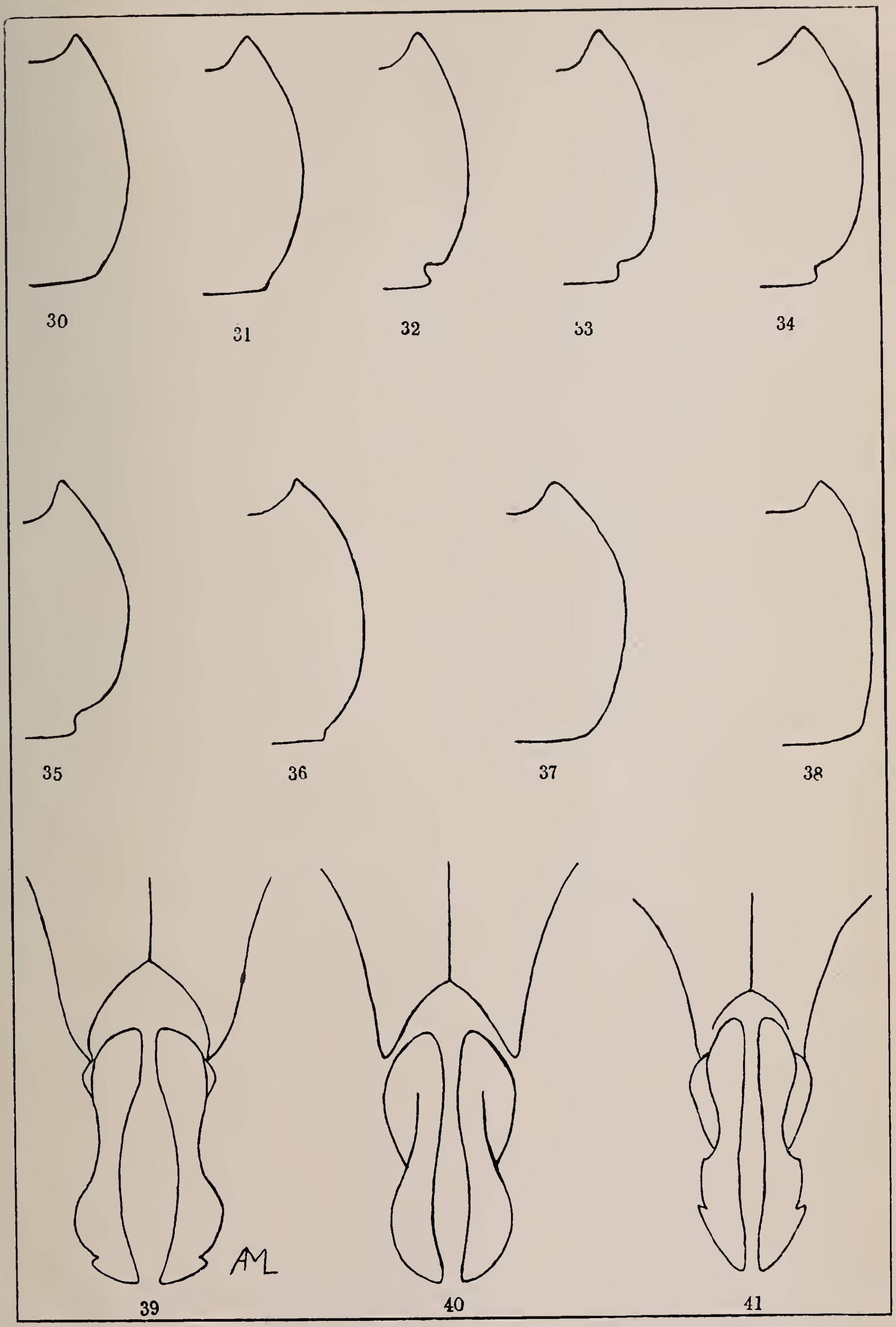

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