NOTES ON A COLLECTION OF TERTIARY LIMESTONES AND THEIR FOSSIL CONTENTS, FROM KING ISLAND.

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(Plates VI., VII.)

Introductory Remarks.

The samples of limestone and limestone-fossils herein described were collected by Mr. J. A. Kershaw, F.E.S., whilst on a recent exploring trip to King Island. Mr. Kershaw informs me that he found this limestone cropping out on the extreme south-east part of the island, and well exposed in the river bed and banks of the Seal River. The outcrop showed a vertical thickness of about 25 feet. The limestone in places was very hard, and the horizontal bedding could be clearly seen on account of the weathering of the softer layers; the more compact limestones projecting as ledges. The polyzoal rock with pectens was found outcropping at the surface of the upper levels. In the absence of any further note as to the relation of the hard limestone to the polyzoal rock, it may be inferred that the latter overlies the hard limestone; and, if this be the case, we have a similar sequence to that of the polyzoal rock of the Grange Burn, which is underlain by the hard pink limestone cropping out at the junction of Grange Burn and Muddy Creek.

The present collection does not comprise many determinable fossils, but, nevertheless, is of great interest, for although several outcrops of tertiary limestone have already been reported from King Island,* no fossils seem to have been collected.†

Prof. Baldwin Spencer, in his report on the general results of the expedition to that locality in 1887,‡ states that the limestone "lies directly upon the granite, and is widely distributed. Thus it was cut through (though the depth of the bed was not recorded) in laying the foundation for the Wickham lighthouse before the grey granite was reached. Again, an outcrop occurs half way from here to Yellow Rock, and on the east coast one a little south of Lavinia Point, and another at the Blow-hole Creek. On the west it is well marked on the coast between the Pass and Ettrick Rivers, inland near Porky Lagoon, and again forms an extensive formation

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* See "Expedition to King Island, November, 1887."—Vict. Nat., vol. iv., Jan., 1888.

† Since writing the above and following account of the fossils (May, 1909), I have seen a paper by Mr. F. Debenham, B.A., entitled "Notes on the Geology of King Island, Bass Straits."—Proc. R. Soc. N. S. Wales, vol. xliv., 1910, pp. 560-576. That author describes therein this same Tertiary limestone of the Seal River, and records *Pecten* aff. *antiaustralis*, Tate; *Lima* cf. *bassi*, T. Woods; *Hipponyx* cf. *australis*; *Turritella* sp., (?) *Hemithyris*, and *Retepora*. These determinations were made by Mr. W. S. Dun, F.G.S., who regards this limestone (and rightly so from the present examination) as belonging to the Table Cape Series.

‡ *Loc. supra cit.*, p. 163.

on the surface inland from Fitzmaurice Bay." Mr. Kershaw's discovery of the same limestone series at the Seal River is therefore additional to the previous records.

During a recent expedition Mr. E. B. Nicholls obtained specimens of a limestone of similar age to the above, and largely composed of polyzoa, which he collected on the east coast, 8 or 9 miles south of Sea Elephant River. This also is a new locality. The specimens have been presented by Mr. Nicholls to the Museum.

General Description.

One variety of the limestone from the Seal River is of a pale ochreous colour, fragmental in structure and of a friable nature. Hand specimens of this rock are seen to consist chiefly of polyzoa with occasional shells of pectens and other mollusca. It bears a strong resemblance to certain beds of polyzoal rock at Waurn Ponds, Batesford, and Torquay.

A harder limestone, associated with the polyzoal rock, is yellow to pink in colour, close textured, and occasionally cavernous, with a tendency to the development of crystalline calcite in the hollows. This rock, like the former, contains much polyzoa and numerous echinoid spines. In its hard texture and pink colour it is closely comparable with the compact limestone of the beds occurring in association with the older basalt on the banks of the Moorabool River, near Maude (W.T.M. 2 and 4 in Nat. Mus. Coll.).

A microscopical examination of thin sections of the friable limestone (Pl. VII., fig. 5) shows the same organic constituents as the compact rock, with the exception that the former has a liberal proportion of clear calcitic cement between the individual grains, whilst the hard limestone has a cement of the nature of a dense pinkish-brown calcareous mud (Pl. VII., fig. 6).

DESCRIPTION OF THE FOSSILS.

THALLOPHYTES.

Boring (?) Fungi.

Palaeachlya tuberosa, sp. nov.

(Plate VII., Fig. 4.)

Some of the shell fragments in the pink limestone were seen to be perforated by a parasitic boring organism. Remains of this kind are frequently met with in both recent and fossil shells and corals, as well as in fish-scales, teeth, and bones. Certain of these are referred to algæ, whilst others are regarded as fungi.† It is probable that the form herein dealt with is of the nature of a fungus, since the thallus is merely constricted and not distinctly septate, and has sporangium-like terminations.

* 30th November, 1908.

† See Seward. Fossil Plants, vol. i., 1898, p. 127.

Description of the borings of P. tuberosa.—Found in shell fragments which are generally more or less water-worn. Perforations (A type), at first slender, entering the shell at right angles to the shell surface or nearly so,* subsequently becoming slightly tortuous, and tending to give off short branches, gradually increasing in width until terminated by a blunt or swollen end; colour, amber yellow. Other perforations in association (B type), commencing as an extremely fine short tube, which suddenly develops a more or less globular termination (? sporangium). Colour, deep reddish brown. Tubes and terminal swellings usually more or less filled with granular material, probably of the nature of spores, some of which are also seen scattered in the neighbourhood of the (?) sporangium. As mentioned above, no distinct septation of the vegetative structure visible, but occasional constrictions occur through the course of the tube. The borings average 13 micra in diameter, and 86 micra in length; sub-globose terminations averaging 18 micra in diameter.

Observations.—The shortness of the perforations and their characteristic clavate terminals serve to distinguish the present form from Duncan's *Palaeachlya perforans*,† which that author found very widely distributed in geological time; one example described having occurred in a foraminifer of Ordovician age.‡

MM. Bornet and Flahault§ have described a boring organism, *Lithopythium*, which they refer to the fungi. Their species, *L. queketti*, bears certain resemblances to the above form; it has a tortuous and filamentous thallus, with globular sporangia at the terminations and outer angles of the sinuses. It differs, however, in the closely interlacing habit of the thallus and the perfectly globular sporangia.

With regard to Australian occurrences of *Palaeachlya*, Mr. R. Etheridge, jun., has described *P. tortuosa* as a parasitic species within a Queensland monticuliporid of Carbo-permian age.|| The chief characters of that species are, a flexuous tube, circular in section, with the terminations irregularly enlarged and with occasional swellings along the course of the tube. Another species instituted by Etheridge is *P. torquis*,¶ found in the coenosteum of a species of *Favosites* from the Devonian limestone of Tamworth, New South Wales. This form consists of slender contorted tubes, filled with yellow granular matter, and having a diameter of ·01 mm. It will be seen that the tube of this species is comparable in size to

* In the case of a prismatic shell, the boring seems to be facilitated by the organism penetrating along the principal axial line or prismatic direction, for easy solution of its base of attack may constitute an important factor in its growth.

† Quart. Journ. Geol. Soc., vol. xxxii., 1876, p. 205, pl. xvi.

‡ *Loc. cit.*, pl. xvi., fig. 5.

§ "Sur les Algues Perforantes," Bull. Soc. Bot., France, vol. xxxvi., 1889, p. clxxii., pl. xii., figs. 5, 6.

|| Rec. Geol. Surv. N.S.W., vol. ii., pt. 3, 1891, p. 95, pl. vii., fig. 1.

¶ Rec. Aust. Mus., vol. iii., No. 5, 1899, p. 121, pl. xxiii., fig. 5.

the above-described form, but which differs, in the very limited length of the tubes, their swollen ends, and occasional bifurcation. It is worthy of notice that Professor Duncan, in his paper previously referred to, figures some very diverse forms under his diagnosis of *Palaeachlya perforans*, and that one of his examples, from a Tasmanian Tertiary coral (*Thamnastraea*) is distinct from our species in that the tubes are excessively slender, long, and tortuous.* *P. tuberosa* also occurs in shell fragments in the limestone of the Moorabool Valley at Maude.

In the pink limestone; Seal River.

Marine Algæ—RHODOPHYCEÆ.

LITHOTHAMNIUM SP.

Minute fragments of this calcareous alga were seen in thin sections of both limestones, but were too imperfect to compare with any Tertiary examples already described. They belong to a ramose form, since a terminal fragment was observed, showing the characteristic curved and divergent series of cells. The cells from a well-developed branchlet showed a height of ·034 mm. and a width of ·019 mm.

FORAMINIFERA.

GLOBIGERINA cf. BULLOIDES, d'Orbigny.

(Plate VI., Fig. 1.)

G. bulloides, d'Orbigny, 1826, Ann. Sci. Nat., vol. VII., p. 277, No. 1.—Modèles, Nos. 17 and 76.

G. bulloides, d'Orb., Brady, 1884, Rep. Chall., vol. IX., p. 593, pl. lxxvii., lxxix., figs. 3–7.

A nearly median section of a *Globigerina* shell occurs in a thin slice of the hard pink limestone. Its test is moderately thick, and from the regular helicoid form, it appears to be referable to *G. bulloides*. This species has been recorded by Mr. Howchin from the Muddy Creek (lower) beds (Balcombian), Waurn Ponds (Janjukian), and Mount Gambier (Barwonian).

TRUNCATULINA LOBATULA, Walker and Jacob, sp.

Nautilus lobatulus, Walker and Jacob, 1798, Adams' Essays, Kanmacher's Ed., p. 642, pl. xiv., fig. 36.

Truncatulina lobatula, W. and J. sp., d'Orbigny, 1839, Foram. Canaries, p. 134, pl. ii., figs. 22–24.

One example, with unusually well-inflated chambers, was found in washings from the polyzoal limestone.

This species has been recorded by Mr. Howchin from the older beds of Muddy Creek, the Government Well at Murray Flats, the Government Bore at Kent Town, Adelaide, and from the west end of Torrens Lake, Adelaide, the last in comparatively younger strata.

* Q. J. G. S., vol. xxxii., 1876, pl. xvi., fig. 1.

TRUNCATULINA VARIABILIS, d'Orbigny.

(Plate VII., Fig. 6*a*.)

T. variabilis, d'Orbigny, 1826, Ann. Sci. Nat., Vol. VII., p. 279, No. 8 ; Brady, 1884, Rep. Chall., Vol. IX., p. 661, pl. xciii., figs. 6, 7.

A good example of *T. variabilis* is seen in a thin section of the pink limestone from the Seal River. It is easily recognised by its thin test and numerous chambers arranged in a tortuous and broken-spiral fashion.

From the Australian Tertiaries, Mr. Howchin obtained this species in the older beds of Muddy Creek.

TRUNCATULINA UNGERIANA, d'Orbigny sp.

(Plate VI., Figs. 2*a–c*.)

Rotalina ungeriana, d'Orbigny, 1846, Foram. Foss. Vien., p. 157, pl. viii., figs. 16–18.

Truncatulina ungeriana, d'Orbigny sp., Brady, 1884, Rep. Chall., Vol. IX., p. 664, pl. xciv., figs. 9*a–c*.

A small example with a very deep and conical inferior face was found in the washings of the polyzoal rock.

Mr. Howchin recorded this form as occurring in the Lower and Upper Muddy Creek beds, at Mount Gambier, the Bore on the Murray Flats, and the Kent Town Bore, Adelaide.

ANTHOZOA.

ALCYONARIA.

MOPSEA HAMILTONI, Thomson sp.

(Plate VI., Figs. 3 *a*, *b* ; 4.)

Isis hamiltoni, Thomson, 1908, Trans. and Proc. N.Z. Inst., Vol. XI., p. 99, pl. xiv., fig. 1.

In the present series there are two calcareous joints of an alcyonarian which may be referred to the above species. One of them is more or less cylindrical (subquadrate), and longitudinally grooved with comparatively coarse and deep furrows. Ridges often once bifurcated and slightly twisted. A few impressed puncta visible along the surface of the ridges and sometimes in the furrows. A scar on the side of this specimen seems to indicate the position of a branchlet. End of axis dilated and meeting the internodal surface to form a tolerably sharp angle. Terminal face subconical, furrowed, and subdivided into a series of primary septa, and by further division into as many again. These furrows are generally continuous with those on the lateral surface. There is a small conical papilla in the centre of the articular surface. Diameter of axis, 2·5 mm.

The second specimen is much shorter, slightly stouter, and with the lateral furrows crossed by little bars or dissepiments, giving the grooves a distinctly punctate appearance.

There is no doubt of the relationship of the two specimens figured, since all the chief characters are common to both.

Observations.—*Mopsea hamiltoni* has been lately described by Mr. J. A. Thomson, from the greensands accompanying the limestones at Kakanui, New Zealand. Mr. Thomson remarks on the apparent identity of Duncan's New Zealand example, *Isis* sp.*, with the type above referred to, and the writer had come to the same conclusion regarding these, and also the Cape Otway specimens figured by Duncan,† prior to seeing Mr. Hamilton's paper. The fossils, however, belong to the genus *Mopsea* and not to *Isis*, as will be seen on comparing the structure of the joints with those of the species of *Mopsea* still found living round the Australian coast. Duncan's remarks upon the affinities of the fossils did not clear the ground for later students, for, in following Ehrenberg, he says, "It is this branching from the calcareous body which distinguishes the genus *Isis* from *Mopsea*, in which the branching starts from the horny substance (*loc. cit.*, p. 673). In point of fact, the typical *Mopsea encrinula*, to which our species is allied, shows the branching to take place on the calcareous internodes by the formation of a horny node, in some cases, however, so close to the node as to appear to start from it, when in reality it is attached to the calcareous joint (see also Wright and Studer, Chall. Rep. on Alcyonaria, p. 40).

The above species is distinct from Tenison Woods' *Isis dactyla*,‡ in having finer lateral striations and concentrically lineate condyles. *Isis melitensis* of Goldfuss,§ is more nearly related to *I. dactyla* in having fine and numerous lateral furrows; whilst the internodal faces are acutely conoidal and devoid of radial grooves. Goldfuss' species was found in the Pliocene of Sicily and Piedmont.

The above species was found in the polyzoal rock of the Seal River outcrop.

ECHINODERMATA.

Cidaris (*Leiocidaris*) cf. australiae, Duncan sp.

Leiocidaris australiae, Duncan, 1877, Quart. Journ. Geol. Soc., Vol. XXXIII., p. 45, pl. iii., figs. 1, 2.

There is a somewhat worn fragment of the test of a cidarid in the present series. It shows a portion of the interambulacral area with two primary tubercles and a line of ambulacral pores. Only the one species above mentioned has been recorded from our Tertiaries, and the present specimen, so far as the fragment shows, is probably referable to it. It was first described from the Cape

* Quart. Journ. Geol. Soc., vol. xxxi., 1875, p. 675, pl. xxxviiiB., figs. 1, 1*a*.
† *Loc. supra cit.*, p. 674, pl. xxxviiiA., figs. 5, 5*a*.
‡ Palæont. New Zealand, pt. iv., "Corals and Bryozoa of the Neozoic Period in New Zealand," 1880, p. 7, pl. i., fig. 1.
§ Petrefacta Germaniae, 1826–1833, vol. i., p. 20, pl. vii., fig. 17.

Otway beds (Janjukian). It also occurs in the Lower Aldingan beds, and the higher zones of the Balcombian, as at Bairnsdale, and has also been recorded from Beaumaris (Kalimnan).

Found in the polyzoal rock.

SPINES OF ECHINOIDS.

(Plate VII., Fig. 5 *a.*)

Several varieties of echinoid spines are met with in thin sections of the polyzoal rock. In their asperous surface and average dimensions they resemble the smaller secondary spines of the *Cidaris* type.

CHAETOPODA.

SPIRORBIS SP.

Two of the valves of pectens have attached to their external surface some remains of annelid tubes referable to *Spirorbis.* The tubes are not sufficiently well-preserved for description. The superior face is convex and subconical, excavate centrally and the surface of the tube transversely wrinkled, whilst a median ridge runs along the upper surface bordered by two lateral ridges. The tube varies somewhat in diameter, averaging about 1·25 mm.

The genus is mentioned by Tate* as occurring in our older Tertiary beds. The above specimens occur in the polyzoal rock.

POLYZOA—Cyclostomata.

HETEROPORA PISIFORMIS, MacGillivray.

(Plate VI., Figs. 5, 6.)

H. pisiformis, MacGillivray, 1895, Trans. R. Soc., Vict., p. 144, pl. xxi., fig. 15.

The definition of this species, which Dr. T. S. Hall furnished for the late Dr. MacGillivray's report, runs as follows:—" Zooecium nearly spherical, apparently free. Surface closely covered by rounded polygonal apertures of varying size, so that it is not evident in many cases which are zooecia and which are cancelli, as all gradations in size are present. Bounding walls of aperture stout. The apertures of all sizes usually closed by a concave porous plate placed slightly within the mouth."

Three examples were found in crushings from the polyzoal limestone of the Seal River. One was perfectly spherical, and subsequently fell to pieces owing to incipient fracture. The zoarium here figured is spherically topped, but appears to be adherent to a foreign particle at the base, so that it has assumed the shape of a fig. The third specimen was partly damaged, but still shows a clavate outline, and of this a section was made, which exhibits the curvi-radiate arrangement of the zooecia.

This species has hitherto been recorded only from Spring Creek, Torquay (Janjukian).

* Proc. Roy. Soc., N.S.W., vol. xxii., pt. 2, 1888, p. 251.

POLYZOA—Chilostomata.

Selenaria marginata, T. Woods.

(Plate VII., Fig. 3.)

S. marginata, T. Woods, 1880, Trans. R. Soc., S.A., Vol. III., p. 9, pl. ii., figs. 9*a–d*.

The zoaria are abundant in the hard pink limestone. In thin sections of the rock they are cut in all possible directions, and show the characteristic form of the thyrostome. Where the sections cut through the apex, there is usually seen an adventitious shell or detrital fragment immersed in the apical portion. The zooecial margins are rounded, and there are numerous vibracular cells interspaced at the angles of the zooecia, of about half their size, and with a cribriform wall. A section parallel with and close to the dorsal side shows the radial areolæ to be non-porous, as in MacGillivray's var. *lucens*.*

Selenaria concinna, T. Woods.

(Plate VI., Fig. 7.)

S. concinna, T. Woods, 1880, Trans. R. Soc., S.A., Vol. III., p. 10, pl. ii., figs. 11*a–e*.

Sections of the entire zoarium occur in the hard pink limestone. They show the characteristic shield-shaped outline of the zooecium, whilst the apical zooecia have in some cases the projecting tongue on the proximal border, which is feebly developed in this species and more strongly shown in the allied *S. otwayensis*, Maplestone.† The elongate vibracularia cells can also be made out, more than one showing the opening with the serrate border typical of this species.

Tenison Woods recorded this form from the Kalimnan of Muddy Creek. It is also distributed in the lower beds, of Barwonian age, in Victoria (Maplestone).

Amphiblestrum (?) bursarium, MacGillivray.

A. bursarium, MacGillivray, 1887, Trans. and Proc. R. Soc., Vict., Vol. XXIII., p. 66, pl. ii., fig. 2.

Idem, 1895, Trans. R. Soc., Vict., Vol. IV., p. 41, pl. v., fig. 22.

Part of a large zoarium, about 20 mm. square, from which the front walls of nearly all the zooecia have been removed. Zooecia subquadrate to elongate, alternate; more generally quadrate than in MacGillivray's figured specimens. Zooecial margins thick, granular, or furrowed.

Occurs in the polyzoal rock.

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* Trans. R. Soc., Victoria, vol. iv., 1895, p. 48, pl. vii., fig. 11 (named *lucens* in text and *lucida* in explanation to plate).

† Proc. R. Soc., Victoria, vol. xvi. (N.S.), pt. ii., 1904, p. 216, pl. xxv., fig. 8.

(?) Lepralia cf. crassatina, MacGillivray.

Lepralia crassatina, MacGillivray, 1895, Trans. R. Soc., Vict., Vol. IV., p. 74, pl. viii., fig. 4.

Our example is represented by a small cluster of encrusting zooecia, somewhat inflated, with sub-hexagonal margins. In its general characters it agrees with the above species, with the exception that many of the zooecia tend to become sub-elliptical by crowding. It has the porous front wall to the zooecium and semicircular thyrostome as in the above form. Mr. Maplestone has pointed out to me that MacGillivray's species appears to belong more properly to *Macropora* than to *Lepralia*. A comparison may be made with *Macropora clarkei*, T. Woods sp.* That species, however, has a generally depressed or even concave zooecial wall, and the zooecia are distinctly broader than in our form. (?) *L. crassatina* occurs throughout our Tertiary series, being found in the lower beds of the Muddy Creek series, at the Moorabool River and Waurn Ponds; and is also found living off New Zealand.

Found attached to a valve of *Placunanomia* in the polyzoal rock of the Seal River.

Adeona sp.

A portion of the branched stem which supports the flabellate zoarium occurs on the surface of one of the slabs of polyzoal limestone. It measures 40 mm. in length and 27 mm. across at the widest part, where there are nine branches.

BRACHIOPODA.

Magellania cf. divaricata, Tate sp.

A cast of a brachiopod shell occurs in the hard pink limestone, which is referable to one or other of the closely related species *M. divaricata*, Tate sp.† or *M. garibaldiana*, Davidson sp.‡ The radial plication seen in the present example is common to both species, but the shell of *M. divaricata* is typically narrower, and shows a marked lateral compression in the region of the beak, also to be seen in our specimen.

PELECYPODA.

Pinna reticosa, sp. nov.

(Plate VI., Fig. 8.)

Description.—Shell triangular, elongate. Valve moderately convex, with a strong umbonal ridge, slightly sinuous throughout its length. Antero-ventral border short and curving backward to meet the postero-ventral edge in a rounded angle. Posterior border

* MacGillivray, *op cit.*, p. 55, pl. viii., figs. 5, 6.

† (?) *Waldheimia divaricata*, Tate. Trans. Phil. Soc., Adelaide, 1880, p. 10, pl. viii., figs. 8, *a*, *b*.

‡ *Waldheimia garibaldiana*, Davidson. Geologist, vol. v., 1862, p. 446, pl. xxiv., fig. 9. *W. garibaldiana*, *W. macropora*, McCoy. Prod. Pal. Victoria, Dec., v., 1877, pl. xliii., figs. 4, 6. *W. garibaldiana*, Dav., Tate, Trans. Phil. Soc., Adelaide, 1880, p. 7, pl. xi., figs. *a–c*.

transversely truncated, forming a right angle with the dorsal margin. Dorsal line slightly concave. Umbo convex and incurved to the ventral side. Dorsal slope with about nine flat longitudinal ribs crossed at fairly regular intervals by transverse flat ridges. Ventral slope marked by numerous incurved ridge-like growth lines.

Length (approximate, minus the extreme point of the umbo), 15·5 mm.; greatest width, 7 mm.

Observations.—This is a small species of *Pinna* which, in its strong convexity, narrow umbonal area, and the general outline resembles *P. cordata*, Pritchard*, with the exception that our shell is of a more oblong form. *P. reticosa* is distinct in having the dorsal ribs transversely cancellated by flat ridges parallel with the growth lines. The above form differs from *P. semicostata*, Tate,† in the relative narrowness of the proximal part of the shell, and the absence of scales on the ribs. Professor Tate has also recorded a species of *Pinna* (sp. indet.) from the Calciferous sandrock, River Murray cliffs, near Morgan, which agrees generally with the above-named species *P. reticosa*, and he gives the following description‡:—"Apical portions only known. Valves acutely angulated, with faint longitudinal ribs separated by broad interspaces on the ventral slope, crossed by undulose ridges."

From the polyzoal limestone of Seal River, King Island.

VULSELLA LAEVIGATA, Tate.

V. laevigata, Tate, 1886, Trans. R. Soc., S.A., Vol. VIII., p. 29, pl. iii., figs. 3*a*, *b*.

A right valve, somewhat imperfect, occurs in the polyzoal rock. It is interesting to record this form in the King Island material, since it has only been noted hitherto from the lower beds at Aldinga.

PECTEN ALDINGENSIS, Tate.

P. aldingensis, Tate, Trans. R. Soc., S.A., Vol. VIII., 1886, p. 16, pl. vii., figs. 1*a–c*.

Two typical valves of this species are found in the present series. The larger specimen shows, towards the front margin, some distant, concentric lamellæ traversing the ribs, a character mentioned by Tate in his original description of the species.

It is interesting to find the above species in the present series, since, with the exception of Stansbury, S.A., Tate's original record appears to be the only other locality known, viz., Aldinga Bay, South Australia, in glauconitic limestone (Lower Aldingan).

Found in the polyzoal rock, Seal River.

* Proc. R. Soc., Victoria, vol. vii. (N.S.), 1895, p. 228, pl. xii., figs. 4, 5.
† Trans. R. Soc., South Australia, vol. viii., 1886, p. 29, pl. xii., fig. 9.
‡ *Loc. supra cit.*, p. 30.

PECTEN PRAECURSOR, Chapman.

(Plate VII., Figs. 1, 2.)

P. consobrinus var. Tate, 1899, Trans. R. Soc., S.A., Vol. XXIII., p. 269.

P. praecursor, Chapman, 1912, see present Memoir (No. 4), p. 36, pl. V., figs. 1, 2, 3.

Perhaps the most abundant fossil remains in the Seal River polyzoal rock, with the exception of the polyzoa, are those of *Pecten*. Of this genus the species *P. aldingensis* is readily recognised, but the remaining specimens show a considerable diversity of ornament, partly due to the condition of the shells, so that it was somewhat difficult to settle their points of relationship. There are, however, several fairly well-preserved fragments which show that *P. praecursor* is present, and was an abundant form. One of the more perfect valves represented in the present series is nearly flat, and by the curvature of the ribs is seen to be a left valve. There are about ten or eleven primary folds with a strong median rib, on either side of which are one or two secondary ribs, and between these numerous riblets. Another specimen shows a part of the ventral margin of the valve, in which the surface ornament is particularly well-preserved. The surface of the ribs is concentrically relieved by a series of imbricating lamellæ similar to that seen on well-preserved examples of *P. antiaustralis*.* The paucity of the ribs precludes any reference to that species, and, moreover, the intercostal spaces in our specimen are distinctly of a granular shagreen character.

P. praecursor is a characteristic fossil of the lower beds at Aldinga, as well as of many localities, chiefly (or all ?) Janjukian, in Victoria.

Frequent in the polyzoal rock, Seal River.

LIMA BASSI, T. Woods.

(Plate VI., Fig. 9.)

L. bassi, Tenison Woods, 1877, Proc. R. Soc., Tas. (Vol. for 1876), p. 112.

L. bassi, T. Woods, Tate, 1886, Trans. R. Soc., S.A., Vol. VIII., p. 24, pl. v., fig. 8; pl. viii., fig. 1.

An external mould of the shell occurs in the hard pink limestone. The ribs are rounded and transversely lamellated, and the interspaces also show fine and distinct transverse lamellæ. The shell is of the more elongate variety, common at Table Cape, and occasionally found also in the Balcombian.†

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* The specimens referred to by Mr. W. S. Dun, in Mr. Debenham's paper on King Island (*op. cit.* p. 567), as a *Pecten* very closely related to *P. antiaustralis*, may possibly be referable to the above-named species, *P. præcursor*, judging from the variation of ornament seen in the present series.

† Mr. W. S. Dun has already recorded *Lima* cf. *bassi* from the King Island Tertiary limestone (*loc. supra cit.*).

Placunanomia sella, Tate.

(Plate VI., Fig. 10.)

P. sella, Tate, 1886, Trans. R. Soc., S.A., Vol. VIII., p. 9, pl. v., figs. 1*a–c*.

Remains of four valves of this species are found exposed on fractured surfaces of the polyzoal limestone. It is somewhat difficult to separate the two forms *P. ione*, Gray, and *P. sella*, Tate. The latter, according to Professor Tate's synopsis of characters, is distinguished by the fine radial threads, as compared with the coarse ornament of *P. ione*, whilst in the latter the radii tend to become subspinose. It is just possible that one of our specimens may belong rather to *P. ione*, since it measures 46 mm. in height; that of Tate's example of the same species being 47 mm.

List of King Island Fossils, with Notes on their Stratigraphical Distribution in the Tertiaries of Southern Australia.

Fossils.	*Remarks.*
Palaeachlya tuberosa, sp. nov. ..	Also found in the limestone of the Moorabool Valley, at Maude.
Lithothamnium, sp.	Common in the polyzoal rock generally.
Globigerina cf. *bulloides*, d'Orbigny	Balcombian to Kalimnan.
Truncatulina lobatula, W. and J. sp.	Distributed throughout the Tertiaries.
Truncatulina variabilis, d'Orb. sp.	Barwonian.
Truncatulina ungeriana, d'Orb. sp.	Balcombian to Kalimnan.
Isis hamiltoni, Thomson ..	Previously recorded from Janjukian beds as *Isis* sp., but not specifically named.
Cidaris (*Leiocidaris*) cf. *australiae*, Duncan sp.	Chiefly Janjukian and Kalimnan; also from the Gellibrand River (Balcombian).
Spines of echinoids, indet.	
Spirorbis sp.	
Heteropora pisiformis, MacGill. ..	Only recorded locality, Spring Creek.
Selenaria marginata, T. Woods ..	Balcombian to Recent.
Selenaria concinna, T. Woods ..	Balcombian to Recent.
Amphiblestrum (?) *bursarium*, MacGill.	Balcombian to Recent.
(?) *Lepralia* cf. *crassatina*, MacGill.	Balcombian to Recent.
Adeona sp.	
Magellania cf. *divaricata*, Tate sp.	Janjukian.
Pinna reticosa sp. nov.	
Vulsella laevigata, Tate	Lower beds, Aldinga.
Pecten aldingensis, Tate ..	Lower beds, Aldinga.
Pecten praecursor, Chapm. ..	Chiefly Janjukian.
Lima bassi, T. Woods	Barwonian.
Placunanomia sella, Tate ..	Barwonian.

Note on the Age of the Beds.

The palæontological evidence of the foregoing limestone fossils strongly supports the idea of their Janjukian age. Therefore, from a physiographic stand-point, the King Island limestone beds were presumably continuous with those portions of the old sea-bed now represented by the Bird Rock Cliffs, the fossiliferous shell-beds of Table Cape, Tasmania, and the lower beds at Aldinga, South Australia. Not the least interesting fact brought out by the present examination of the King Island fossils is the occurrence in this fauna of two species of mollusca which have hitherto been known almost exclusively from the lower Aldinga beds of South Australia, thus showing a strong affinity in its facies with the fossils of that area. Although the present list of fossils is not so extensive for a complete comparison with other southern Australian horizons as could be desired, yet the evidence before us is fairly conclusive, since the already-known forms recorded here have all—excepting one doubtful polyzoan, which, however, is found living—been previously found in either the Table Cape beds, the Spring Creek series, or the lower Aldingan strata. Further than this, some are peculiar to the Janjukian group.

The correlation of the lower Aldingan beds with normal Janjukian strata is by no means new, since this relationship was long ago pointed out by Messrs. Tate and Dennant* in dealing with the Cape Otway series, also Janjukian. Those authors, however, included both the upper and lower beds at Aldinga which, as Messrs. Hall and Pritchard rightly point out,† belong to distinct stages. The first-named authors, in their second paper on the "Correlation of the Marine Tertiaries of Australia," noted (*loc. cit.*) "the comparatively large proportion of Aldingan species" in the Cape Otway section. "Thus of the forty Aldinga species present at Cape Otway, eighteen are restricted to these two sets of beds," "whilst five of the species indicated are common also to the Spring Creek Fauna."

In my examination of this collection I am under obligations to Dr. G. B. Pritchard, F.G.S., and Mr. C. M. Maplestone for helpful suggestions regarding the mollusca and polyzoa respectively.

Note on the Dune Sand of King Island.‡

In addition to the previously described limestone specimens, Mr. Kershaw also handed me for examination a sample of the dune sand from Surprise Bay, King Island.

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* Trans. R. Soc., South Australia, vol. xix., 1895, p. 110.

† Proc. R. Soc., Victoria, vol. xiv. (N.S.), pt. ii., 1902, p. 79.

‡ Since writing this note (May, 1909), Mr. Debenham (*op. supra cit.* pp. 564, 565) has described the physical and chemical characters of the sand dunes of King Island, and has given a chemical analysis of the sand.

This sand consists chiefly of quartz grains (well-rounded) and rolled shell-fragments in about equal proportions, together with fragmental remains of polyzoa, echinoids, and a few worn tests of foraminifera. Of the last-named group, the following species, all common to the beaches of the southern coast of Australia, were recognised :—

Miliolina vulgaris, d'Orb. sp.
Miliolina tricarinata, d'Orb. sp.
Discorbina dimidiata, Jones and Parker.
Pulvinulina repanda, Fichtel and Moll sp.
Polystomella crispa, Linn. sp.

EXPLANATION OF PLATES.

Plate VI.

Fig. 1.—*Globigerina* cf. *bulloides*, d'Orbigny. A median section of the test. × 52.

Fig. 2.—*Truncatulina ungeriana*, d'Orbigny, sp. (stout var.): (*a*) Superior aspect; (*b*) inferior aspect; (*c*) peripheral aspect. × 52.

Fig. 3.—*Mopsea hamiltoni*, Thomson: (*a*) Lateral aspect; (*b*) articular surface. × 3.

Fig. 4.—*Mopsea hamiltoni*, Thomson. Lateral aspect of another example. × 3.

Fig. 5.—*Heteropora pisiformis*, MacGillivray. × 10.

Fig. 6.—*Heteropora pisiformis*, MacGillivray. Vertical section of a pyriform zoarium. × 26.

Fig. 7.—*Selenaria concinna*, T. Woods. A thin section in limestone, taken tangentially to the zooecial surface; showing vibracular and zooecial cells. × 52.

Fig. 8.—*Pinna reticosa*, sp. nov. × 2.

Fig. 9.—*Lima bassi*, T. Woods. A portion of the shell surface; from a wax squeeze of a mould in limestone. × 3.

Fig. 10.—*Placunanomia sella*, Tate. Nat. size.

Note.—Figures 2–6, 8, and 10 are from the polyzoal limestone of the Seal River; the remainder are from the hard limestone of the same locality.

Plate VII.

Fig. 1.—*Pecten praecursor*, Chapm. From the polyzoal rock. Nat. size.

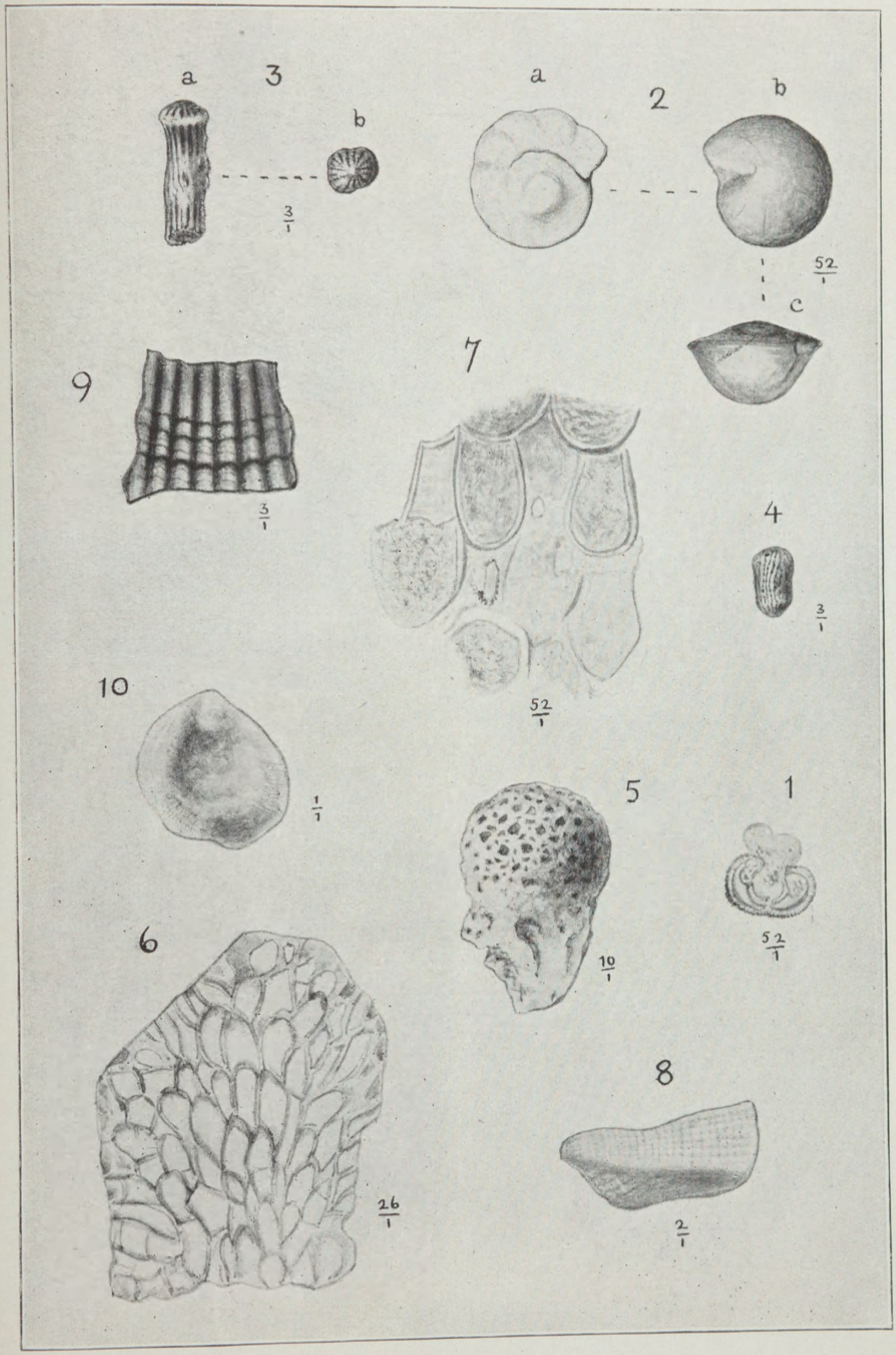
Fig. 2.—*P. praecursor*, Ch. Another specimen showing tegulate ornament on the marginal part of the valve. Polyzoal rock. Nat. size.

Fig. 3.—*Selenaria marginata*, T. Woods. A tangential section including apical region. From the pink limestone. × 14.

Fig. 4.—*Palaeachlya tuberosa*, Chapm. The organism perforating a worn shell-fragment. From the pink limestone. × 164.

Fig. 5.—Thin section of the polyzoal rock, showing a cidaroid spine, numerous polyzoa, and the granular calcitic groundmass. × 14.

Fig. 6.—Thin section of the pink limestone, showing polyzoa, shell-fragments, and foraminifera (*a* = *Truncatulina variabilis*), embedded in a fine pasty calcitic groundmass. × 14.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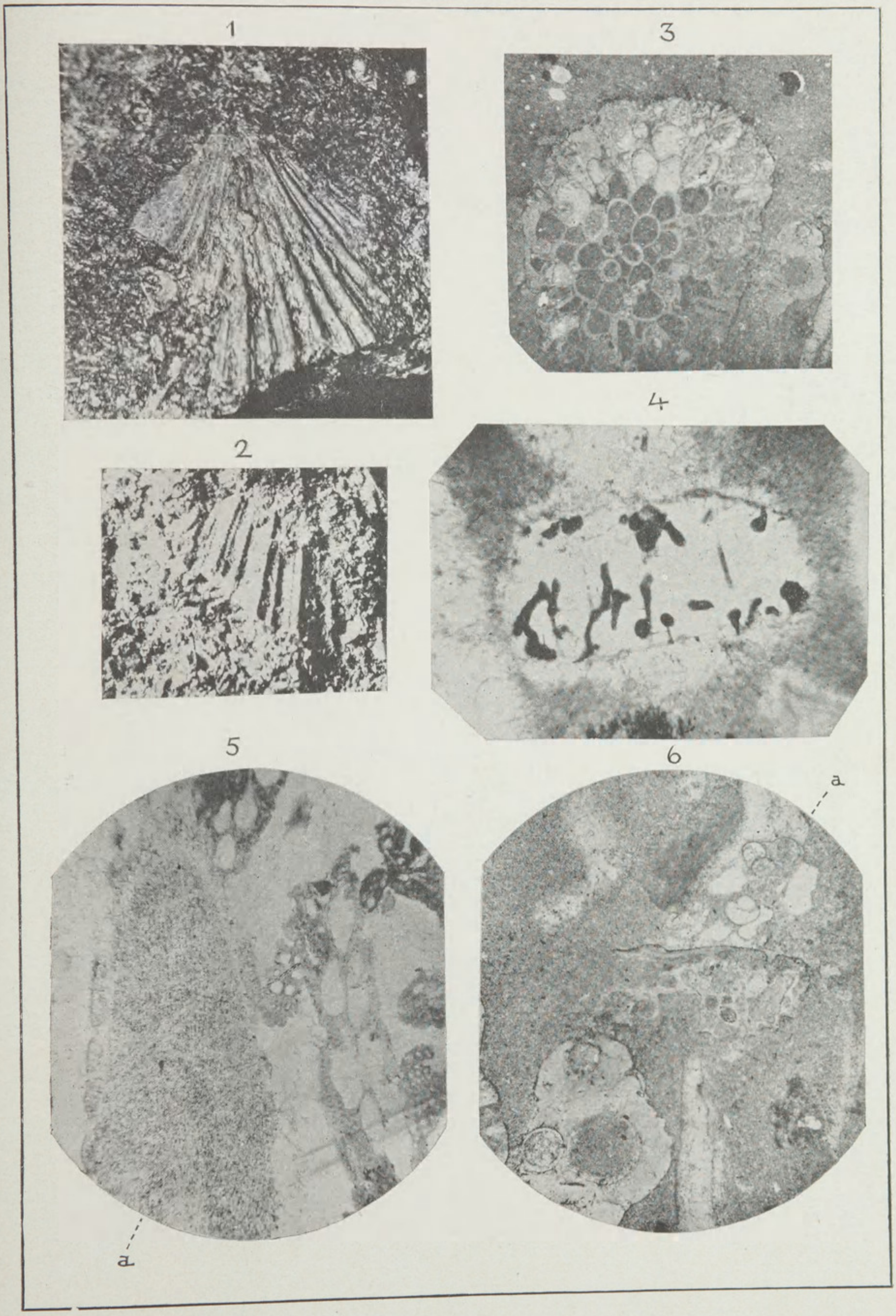
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