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ON THE OCCURRENCE OF THE GENUS *PTYCHOCERAS* (?) AND OTHER ADDITIONAL FOSSILS IN THE CRETACEOUS BEDS OF THE NORTHERN TERRITORY OF SOUTH AUSTRALIA.

By R. ETHERIDGE, Junr., Curator.

(Plates xiv. and xv.)

Since the completion of my study of the Cretaceous fossils of South Australia and the Northern Territory,[1] a few additional forms have been collected by Messrs. Christie and Godfrey from the latter beds, near the Point Charles Lighthouse, and presented by them to the Trustees. The most important of the series is a small *Ptychoceras*, a genus not hitherto recorded as Australian. The other specimens comprise amongst them the phragmocone of a small Belemnite, fourteen millimetres long by eight millimetres in diameter, several specimens of a small *Nucula*, two admirably preserved *Scaphites eruciformis*, mihi, exhibiting the sculpture and sutures, an *Avellana*-like univalve, possibly an *Alaria*, a peculiar dermal tubercle, and a number of curious concretious and coprolite-like bodies.

The whole of these fossils are in the condition of limonite casts, highly glazed.

I have selected the following as worthy of description :—

Genus Nucula, *Lamarck*, 1799.

(Prodrome—Mém. Soc. Hist. Nat. Paris, 1799, p. 87.)

NUCULA SEJUGATA, *sp. nov.*

(Plate xiv., fig. 9; Plate xv., fig. 5).

Sp. Char.—Shell (cast) oval, compressed; cardinal margin oblique anteriorly, and straight posteriorly; anterior ends somewhat produced, and all three margins—anterior, posterior and ventral—regularly rounded, the posterior obliquely so below; anterior and posterior slopes small and narrow. Lunule fairly deep; escutcheon long and narrow. Posterior teeth exceeding twelve in number.

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[1] Etheridge—Mem. Roy. Soc. S. Austr., ii., 1, 1892, p. 1.

Obs.—The casts of this *Nucula*, although common, in their present condition present few distinctive characters, at the same time I am not able to refer it to any of the already known Australian species. The posterior teeth are visible in several specimens, and although it is impossible to be sure of their exact number, it can safely be asserted that they exceed twelve in a series in each valve. There are no appreciable diagonal ridges, and the posterior slopes, both anterior and posterior, were small and narrow. No traces of the adductor scars or pallial impressions remain. As it will only be by the merest chance that specimens like these or further features will be obtained, I purpose calling this form *Nucula sejugata*,[2] in allusion to the isolated position of the beds in which it occurs.

Genus Avellana, *D'Orbigny*, 1842.[3]

(Pal. Franç. Terr. Crét., Gastropodes, ii., Livr. 43-48, 1842, pl. 168-69; Livr. 49-60, 1843, p. 131).

AVELLANA CAROLENSIS,[4] *sp. nov.*

(Plate xv., figs. 3, 4 and 11.)

Obs.—This is a small globose shell of four or perhaps five convex whorls, with a short moderately acute spire. The body-whorl is globose and comparatively large, and displays traces of very numerous spiral punctate lines. The mouth is unfortunately filled with a plug of limonite, and the characters of the inner lip quite effaced. The revolving punctate lines, however, indicate the Tornatellidæ, and in this family the genus *Avellana* seems to advance the strongest claim for its reception. On the other hand, the spire is too elevated and distinct from the body-whorl for a true *Avellana*, and much more so for *Euptycha*, Meek. Such as it is, the fossil is certainly distinct from any other Australian Cretaceous univalve with which I am acquainted, the only possible ally being Moore's *Cinulia depressa*,[5] from Wollumbilla, in Queensland.

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2 *Sejugatus*—Separated, isolated.

3 See note by Stoliczka—Cret. Fauna S. India, Gasteropoda (Pal. Ind.), ii., pts. 7-10, p. 406.

4 In allusion to the locality.

5 Moore—Quart. Journ. Geol. Soc., xxvi., 1870, p. 256, pl. x., f. 20.

Genus Ptychoceras, *D'Orbigny*, 1842.

(Pal. Franç. Terr. Crét., Cephalopodes, i., Livr. 33-42, 1842, p. 554).

PTYCHOCERAS (?) CLOSTEROIDES,[6] *sp. nov.*

(Plate xv., figs. 6-9.)

Sp. char.—Shell small, composed (at least) of three subcylindrical limbs, variable in section. Neanic (or youngest limb) small, delicate, round, and pipe-like; ephebic (or second) limb transversely oval, enlarging slowly, convex on the venter, slightly flattened laterally, and somewhat concave on the dorsal aspect; gerontic (or third) limb stouter than the other two combined, convex on the venter, very little compressed laterally, but swelling slightly at its union with the second limb, and the dorsum concave, with a well marked contact furrow, in which reposes the first limb. Ephebic-gerontic umbilical depression shallow and somewhat pyriform in outline. Surface smooth, sculpture unknown.

Obs.—The largest specimen in the collection is twenty millimetres long by seven millimetres wide, but none of them are perfect. The three limbs are very apparent in all, the youngest limb in several specimens projecting beyond the broken ends of the second and third limbs, and looking like a miniature siphuncle. The youngest limb is unquestionably circular in outline, the second transversely oval with a concave face, and the third limb round-oval in section with a concave emarginate face. The ventral siphuncle and sutures are visible only on one specimen, but the latter, in consequence of the mode of preservation, are not sufficiently distinct for description; the cameræ were very shallow. Viewing the specimens longitudinally there appears to be a certain degree of curvature. For instance, in the direction stated the gerontic outline is faintly convex, whilst the ephebic is rather concave. In Pl. xv., fig. 9, representing a transverse section of the whole, the relation of the three limbs to one another is distinctly visible.

In a majority of instances *Ptychoceras* is described as possessing a once reflected shell, but some authors—for instance, D'Orbigny, Ooster, Stoliczka, Gabb, and Whitfield—have described twice reflected individuals. Whether or no the perfect state of *Ptychoceras* consists of two, three, or more limbs is, I believe, still an open question; at any rate Gabb has proposed for the twice reflected shells the generic name *Diptychoceras*.[7] He

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[6] κλωστήρ, ῆρος, ὁ—A hank, and *oides*—resemblance.

[7] Gabb—Pal. California, ii., Sect. 2, 1869, p. 143.

remarked as follows:—"In the present (1869) state of our knowledge it seems that there is a well-defined group of species characterized by two straight parallel limbs, the larger, or newer of which never develops beyond a certain point on the length of the smaller; while another group . . . . . has this larger limb continued and again reflected. Should it be ascertained that there is a gradation between the two, or that other species have more than two reflections, then there will be good grounds for doubting the validity of my genus; until then, I believe we have sufficient reasons for maintaining it."

Meek rejected[8] *Diptychoceras*, but Zittel admitted[9] it. Had our Australian form simply possessed the three limbs it would unquestionably be referred to Gabb's genus, for whatever the name may be worth, but the deeply excavated contact furrow on the ephebic and gerontic limbs, particularly the latter, immediately calls to mind the much debated *Solenoceras*, Conrad. This author described his genus as differing "from *Ptychoceras*, D'Orbigny, in the smaller tube lying in a furrow of the larger one, which is straight only for a short distance from the junctions and then suddenly recurved."[10] Both Meek and Whitfield have touched on this question. The former remarks as follows of the type, *Ptychoceras annulifer*, Morton, sp.—"A small species that not only had its limbs in contact, but the smaller limb received into a deep furrow along the inner side of the larger. It shows no positive evidence of more than one folding upon itself; but then the specimen is broken off at both ends, so that we can hardly be sure as to the exact form of the mature unbroken shell. At the larger of the broken ends, there is, in the type specimen, some slight appearance of the commencement of another bend *outward* or *away from* the inner limb. Unfortunately, however, the specimen is hardly in a condition to be altogether satisfactory on this point. . . . . . If, however, it *did* make a bend there in the direction supposed, *Solenoceras* would certainly be a good genus. If not, I should think the more deeply embracing characters of the large limb could hardly alone form a sufficient generic distinction."[11]

In his "Palæontology of the Black Hills of Dakatoa," Mr. R. P. Whitfield refers to the bending of the shell in the three genera *Ptychoceras*, *Diptychoceras*, and *Solenoceras*, and states that in two new species described by him (*P. meekanum* and *P. crassum*), some of the specimens exhibit a "prolonged curved

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[8] Meek—Report U.S. Geol. Survey Territories (Hayden's), ix., 1876, p. 410.
[9] Zittel—Handb. Pal., i. Abth., 2, p. 445.
[10] Whitfield—Mon. U.S. Geol. Surv., xviii., 1892, p. 272.
[11] Meek—Report U.S. Geol. Surv. Territories (Haydens's), ix., 1876, p. 411.

portion of the smaller limb."[12] The same author enters more fully into the structure of *Solenoceras* in his "Gasteropoda and Cephalopoda of the Raritan Clays and Greensand Marls of New Jersey." He says—"Mr. Gabb, although admitting the genus as a valid one, is inclined to dispute the deflection of the outer part of the tube. This would leave the genus to stand entirely upon the feature of the smaller tube lying in a groove of the larger one . . . . . . On examining Dr. Morton's specimen [*i.e.* the type] I think there is every evidence that can be derived from an internal cast by such a shell that the supposed deflection of the tube at the outer end of the fragment is only the thickening and rounding out of the completed or adult aperture of the shell."[13]

The Australian specimens are, as I have already said, only portions of individuals, yet they conclusively show a three-limbed shell with sharp and well-marked contact furrows in both what I have termed the ephebic and gerontic limbs. It follows from this that my *P.? closteroides* unites more or less the characters of all three genera, *Ptychoceras*, *Diptychoceras*, and *Solenoceras*. It has fundamentally two limbs as in *Ptychoceras*, acquires three limbs as in *Diptychoceras*, and displays embracing features by the two younger limbs similar to that described in *Solenoceras*. At the same time the fossils are too imperfect to display any free deflection such as is said to exist in the third genus.

P.? closteroides is closely allied to *P.? forbesianus*, Stoliczka,[14] from the Ootatoor Group of India, which exhibits precisely the same peculiarities of a three-limbed shell, with the youngest limb strongly embraced by the two others.

Genus Scaphites, *Parkinson*, 1811.

(Organic Remains Former World, 1811, p. 145.)

Scaphites eruciformis, *Eth, fil.*

(Plate xiv., fig. 10; Plate xv., fig. 10.)

Scaphites eruciformis Eth. fil., Mem. R. Soc. S. Austr., ii., Pt. 1, 1892, p. 45, pl. vii., f. 10 and 11.

Obs.—Two excellent specimens of the inrolled position of the shell are in the collection, both exhibiting the sculpture, and one

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[12] U.S. Geogr. and Geol. Surv. Rocky Mt. Region (Powell's).
[13] Whitfield—Mon. U.S. Geol. Surv., xviii., 1992, pp. 271-272.
[14] Stoliczka—Foss. Cephalopoda Cretaceous Rocks S. India (Pal. Ind.), Ser. 3, pts. 10-13, 1866, p. 195, pl, lxxxx., f. 11.

the sutures. The sharp transverse sculpture threads start from the umbilicus as a single line, but immediately bifurcate, and branches then passing over the venter singly; here and there, however, a single tread is interpolated amongst the others. At a point on one of the flanks is a peculiar anastomosis of three threads, but whether an occasional charactor, or the result of injury during life, I am unable to say. I figure the sutures as exposed on the shell (Pl. xiv., fig. 10.) but from a rounding off of the edges the finer details are lost, and description is impossible. The siphonal line on the centre of the venter is also plainly visible as a faint groove.

Tubercle

(Plate xiv., figs. 6-8.)

Obs.—In my Preliminary Report[15] on the fossils of this deposit I recorded the occurrence of bony scute-tubercles believed to be reptilian. A third has now reached my hands, and is figured for future elucidation. It is conical in outline with an obtuse apex, and a rather broad base, nine millimetres in fore and aft measurement, ten millimetres in a transverse direction, and eight millimetres in height. The anterior outline is gently convex, and the posterior concave. With the means at my disposal I was not able to suggest an affinity for this object, but more than one alternative suggested itself, each to be rejected in its turn—for instance: (1). It may be allied to the dermal neck tubercles of a Crocodile, although in our *Crocodilus porosus*, the apices are much more laterally compressed; (2) a general resemblance in miniature to some of the tubercle-cores of *Meiolania*; (3) abandoning the tubercle theory, it may be compared to the claws or terminal phalanges of *Agrosaurus macgillivrayi*, Seeley,[16] but the latter are too long and laterally compressed, and there is no trace of an articular face in the Port Darwin fossil.

An exact reproduction of this tubercle was subsequently forwarded to Dr. A. Smith Woodward for the benefit of his opinion. He has very kindly replied as follows:—" It seems to me to be entirely new. I do not think it belongs to a fish, and should regard it as a dermal scute of a reptile, perhaps one of the Stegosauria. In general shape it much resembles some of the dermal tubercles from the Purbeck beds provisionally referred by Owen to *Nuthetes destructor*, but these scutes are tuberculated."

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15 Etheridge—S. Austr. Parl. Papers, No. 82, 1895, p. 34.

16 Seeley—Quart. Journ. Geol. Soc., xlvii., 1891, pl. opp. p. 168, f. 6.

NODULES AND COPROLITES

(Plate xiv., figs. 1-5; Plate xv., figs. 1 and 2.)

The Point Charles deposit has yielded a very large number of small irregularly shaped nodules and shapeless pieces of limonite (Pl. xiv., fig. 4; Pl. xv., fig. 1.); none of them are more than two inches long by half to one inch wide. With these are other small, more or less spherical or oblong bodies perfectly smooth and shining (Pl. xiv., fig. 5; Pl. xv., fig. 2.) The irregularly shaped nodules on the contrary are of a darker colour than the preceeding, with a rough, pimpled, and often minutely cavernous or pitted surface, and exhibiting also shrinkage cracks; both are darker externally than internally. Still a fourth form is present in considerable quantity, in my opinion coprolitic, and having within a certain compass, a definite form—an irregular fusiform outline (Pl. xiv., figs. 1-3.) These are enlarged in the middle and taper towards the ends, which are blunt, or they may be slightly bent. The largest is two inches long by six-eighths of an inch diameter in the centre, and all of them exhibit ill-defined transverse or oblique stricture marks.

The shells, nodules, spherical bodies, and coprolites are either of a black or dark red-brown colour, but the degree of lustre is very variable, the shells and spherical bodies possessing the highest. The colour of the nodules and coprolites is, generally speaking, darker than the others. Most of the shells are a good deal worn, nearly all broken, and their angles rounded. The spherical bodies are undoubtedly concretionary, formed of concentric layers that peel off; the nodules, on the other hand, are seen on fracture to be cavernous or vesicular.

The coprolites exhibit traces of oblique constrictions representing the structure of the inner surface of the intestine of the animal voiding them; they may either be those of Reptiles or Fish. Our knowledge of these forms of life in the Australian Cretaceous is at present very limited. Amongst the former class we possess evidence of the existence of the Ichthyopterygia and Sauropterygia, with a Chelonian, *Notocheles costata*, Owen, sp. As members of the second class we have *Belonostomus*, an Aspidorhynchian Teleostomatous fish; a shark—*Lamna*; *Portheus*, a Saurodontidian Teleostomatous fish, and *Cladocyclus*, a Sphyrænidian Teleostomoid. Lastly the remains of a Saurischian Reptile—*Agrosaurus macgillivrayi*, Seeley,[17] have been described from North-east Australia, but the precise geological horizon is unknown.

The coprolites, or "bezoar stones,"[18] of the Port Darwin deposit do not display the same regular spiral as those of the

[17] Seeley—Quart. Journ. Geol. Soc., xlvii., 1891, p. 164, pl., opp. p. 164.

[18] Mantell—Petrifactions and their Teachings, 1851, p. 375.

Ichthyopterygia,[19] and perhaps also the Sauropterygia. The interior of the intestine in Selachians (Sharks, Dog-fish and Rays) is also spirally coiled. Mantell figured the coprolites of *Squalus* from the Chalk Marl, which exhibited a closely imbricated series of convolutions.[20] Another coprolite is that of the genus *Macropoma*, a Cœlocanthidian Ganoid from the Chalk, in which the gyrations are less numerous than in that of a shark.[21] On the whole I think it will be better to regard these coprolites, in the meantime, as those of fish ; possibly further collecting may bring to light some organism to which they can be referred with greater certainty.

My colleague, Mr. Charles Anderson, M.A., B.Sc., has made analyses of the shells, nodules, and coprolites, with the result that the composition is substantially that of limonite carrying a little phosphoric acid. The following are his detailed analyses:—

	Nodules.	Shells.	Coprolites.
Loss on ignition	12·71	12·66	12·64
Insoluble Silica (SiO_2)	3·16	3·04	4·92
Ferric-Oxide (Fe_2O_3)	80.69	81·10	79·93
Lime (CaO)	2·25	1·88	2·07
Phosphoric Anhydride (P_2O_5)	0·44	0·42	1.12
Carbonic Oxide (CO_2)	traces	traces	—
	99·25	99·10	100·68

The very low percentage of Phosphoric Anhydride notwithstanding, the mere occurrence of this in connection with animal remains on this Continent, is interesting, particularly the slight increase in the coprolites proper. I am not aware that it has been previously noticed in connection with our Cretaceous deposits. As compared with phosphatic nodules from other world-wide localities, the percentage of Phosphoric Anhydride is, of course, absurdly low, still it indicates that there possibly exist other deposits in Australia of economic importance.

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19 Owen—Palæontology, 2nd Edit., 1861, p. 221, f. 89 *(Ichthyosaurus.)*

20 Mantell—Medals of Creation, i., 1844, p. 432, lign. 99, f. 2 ; *loc cit,* ii., p. 656.

21 Mantell—*Ibid.*, i., 1844, p. 432, lign. 99, f. 1; *Id.* ii., p. 656. For further information on this subject and excellent illustrations see Buckland—Geology and Mineralogy *(Bridgewater Treatise)*, new edit., 1858, p. 190, *et seq.*, pl. xvii.

EXPLANATION OF PLATE XIV.

COPROLITES.

Fig. 1. Sub-pyriform mass, showing traces of convolutions.
„ 2. More or less fusiform mass, with slight traces of convolutions.
„ 3. Oblong coprolite somewhat constricted.

NODULES.

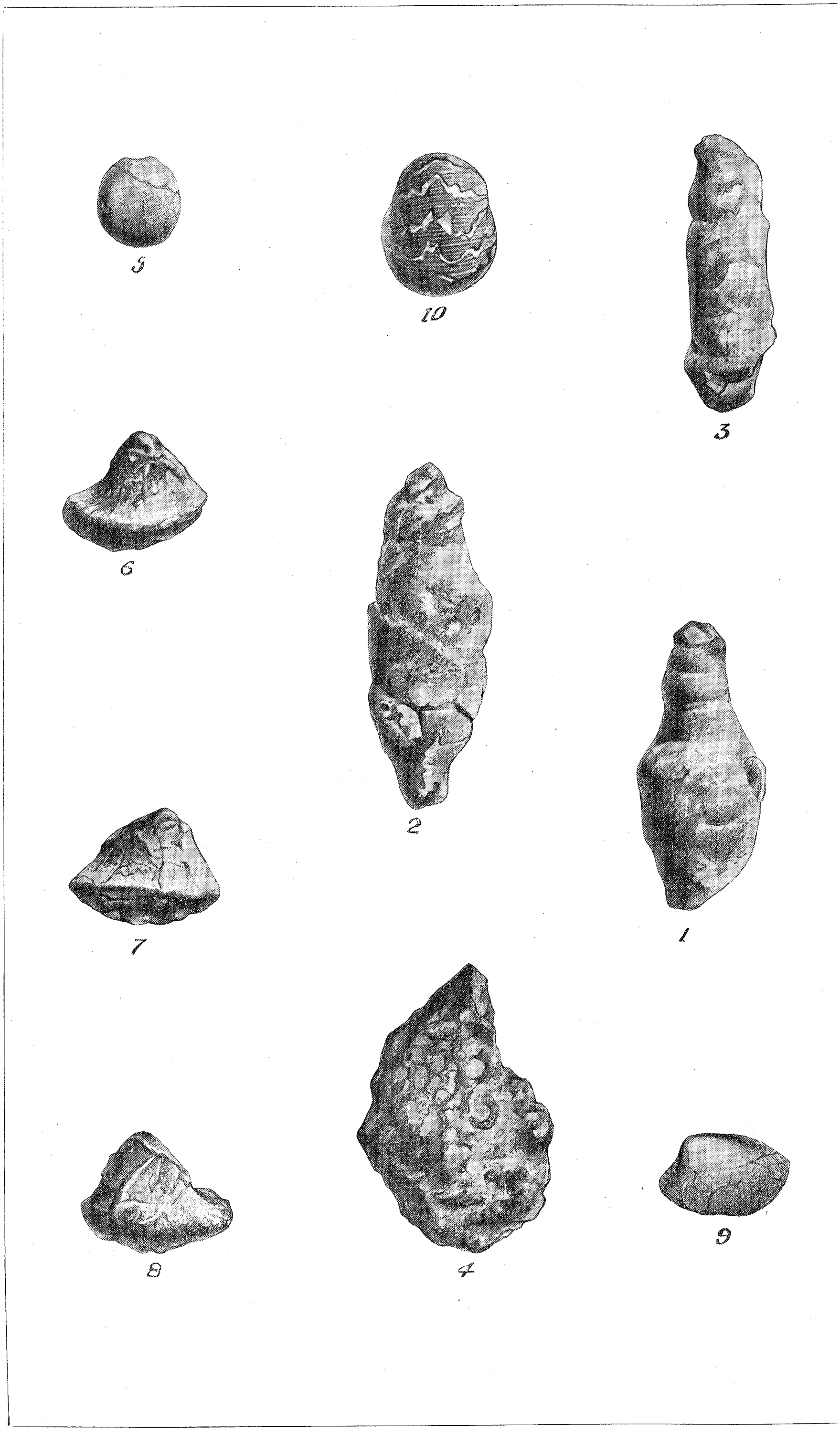
Fig. 4. Irregularly shaped mass of limonite, with roughened and partially cavernous surface.
„ 5. Spherical, smooth and shining body.

TUBERCLE.

Fig. 6. Tubercle, side view.
„ 7. „ posterior view.
„ 8. „ anterior view.

NUCULA SEJUGATA, *Eth. fil.*

Fig. 10. Cast in limonite, lateral view.



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EXPLANATION OF PLATE XV.

NODULES.

Fig. 1. Irregularly-shaped limonite nodule.
,, 2. Bean-shaped, smooth and shining limonite nodule.

AVELLANA CAROLENSIS, *Eth. fil.*

Fig. 3. Cast in limonite, dorsal view.— × 2.
,, 11. The same cast, ventral view.— × 2.
,, 4. Sculpture, highly enlarged.

NUCULA SEJUGATA, *Eth. fil.*

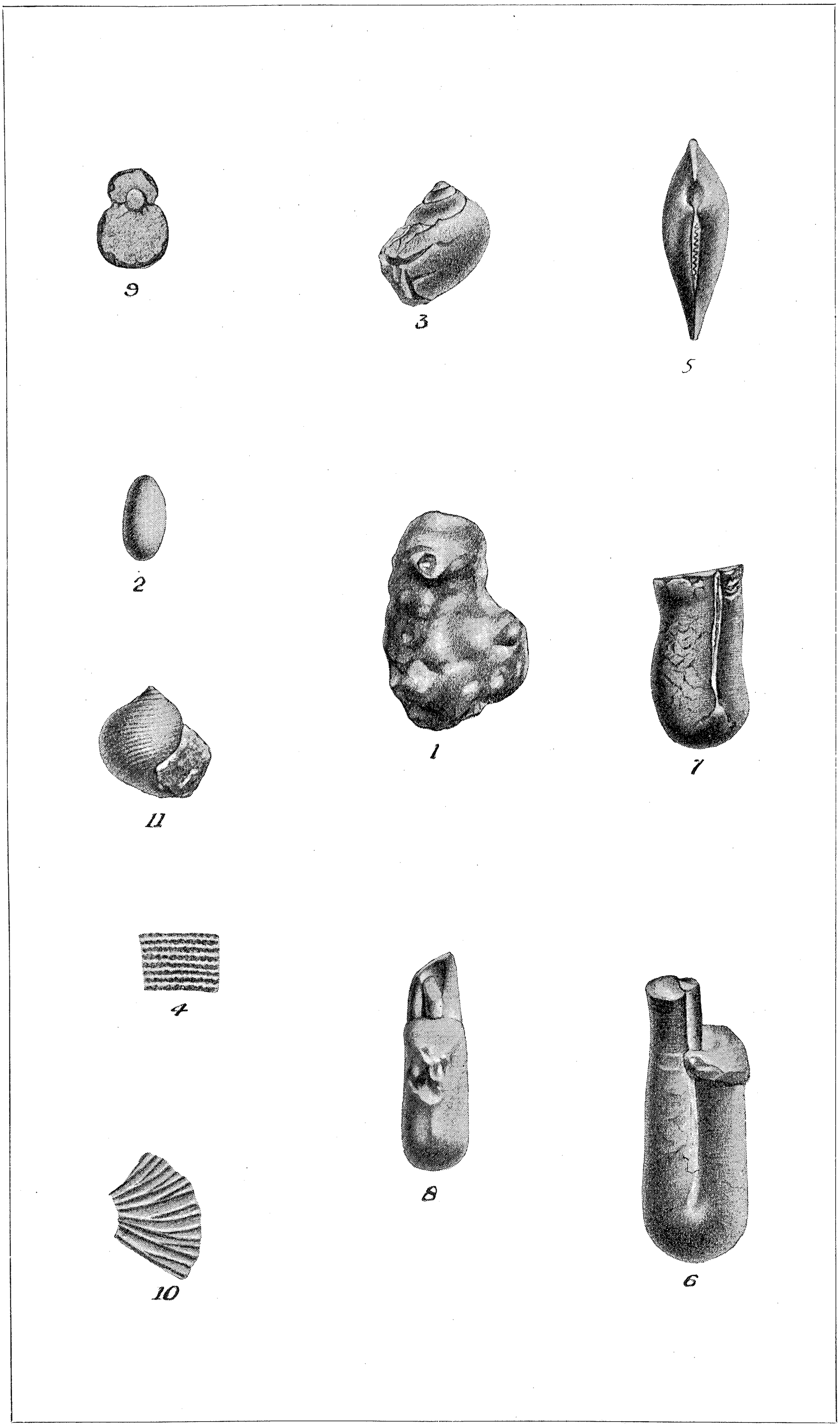
,, 5. Limonite internal cast of united valves, with hinge-line and teeth· — × 1½.

PTYCHOCERAS (?) CLOSTEROIDES, *Eth. fil.*

Fig. 6. Limonite cast, lateral view, showing the three limbs—× 2.
,, 7. Similar specimen, with the youngest limb hidden.— × 2.
,, 8. Similar specimen, exhibiting the contact furrow on the dorsum of the second limb.—× 2.
,, 9. Similar specimen, showing the cross-section of the three limbs.— × 1½.

SCAPHITES CRUCIFORMIS *Eth. fil.*

Fig. 10. Sculpture, lighly enlarged.



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