

III.—Oolitic Fossils of the Greenough River District, Western Australia,

BY

R. ETHERIDGE,

Curator of the Australian Museum, Sydney, N.S.W.

I.—INTRODUCTION.

Through the kindness of Mr. A. Gibb Maitland, Government Geologist, I have lately had the pleasure of examining a collection of the Oolitic fossils of the Greenough River District.

The principal, and really only important, paper dealing with West Australian Mesozoic fossils, up to a comparatively recent date, was that of the late Charles Moore * of Bath, England. He enumerated a large number of species occurring in that State and of these he described or figured eleven; nine were described as new, and twenty were believed to be identical with European species. I am now in a position to figure some of these exotic forms mentioned by Moore. In 1904, Mr. F. Chapman published a paper dealing with West Australian Jurassic fossils in the National Museum, Melbourne, † but no new forms were described.

II.—DESCRIPTION OF THE SPECIES.

CLASS ANNELIDA.

GENUS SERPULA, *Linnaeus*, 1758.

(*Systema*, Ed. X., p. 786).

SERPULA CONFORMIS, *Goldfuss*.

(Plate IV., Fig. 1.)

Serpula conformis, Goldfuss, *Petrefacta Germaniæ*, 2nd Edit., 1862, I., p. 212, pl. 67, f. 13, *a* and *b*.

Obs.—A few small *Serpulæ* are attached to the surfaces of Mollusca. There is no feature to distinguish them from the above carinate Oolitic species.

Moore enumerated *Serpulæ* but without attaching specific names.

Loc.—Tibraddon Station, Greenough River.

* Moore—*Quart. Journ. Geol. Soc.*, 1870, XXVI., pp. 228-261, pls.

† Chapman—*Proc. R. Soc., Vict.*, 1904, XVI., (n.s.), p. 327.

CLASS BRACHIOPODA.

GENUS RHYCHONELLA, *Fischer*, 1809.

(Notice Foss. Gouv. Moscou, p. 35.)

RHYCHONELLA VARIABILIS, *Schlotheim*.

(Plate IX., Figs. 3 and 6).

Rhychonella variabilis (Schlotheim), Davidson, Mon. Brit. Oolitic and Liassic Brach., 1852, pt. 3, p. 78 (for synonymy), pl. 15, f. 8-10, pl. 16, f. 1-6.

Obs.—This species was first recorded by Mr. Moore.* In the present collection are biplicate and triplicate individuals, answering to the varieties *bidens* and *triplicata* of Phillips.

Loc.—Snake Farm, Greenough River.

CLASS PELECYPODA.

GENUS OSTREA, *Linnaeus*, 1758.

(Systema, Ed. X., p. 696).

OSTREA THOLIFORMIS, † *sp. nov.*

(Plate VII., Figs. 2-7.)

Sp. Chars.—Lower valve obtusely conical, irregularly low-dome or cupola-shaped, with a large concave scar of attachment; test very thick. Upper valve flat, a little concave, or the surface rolling. Cardinal margin in both valves well developed, extending the entire width of the upper valve; chondrophore comparatively large; resilium furrows both in the chondrophore and on cardinal margin are strong. Adductor scar in the upper valve oblique and transversely ovate, with exsert lower margin. Well developed latilaminæ on the exterior of both valves.

Obs.—There are ten examples of this oyster in the collection. It is a solid and substantial, although not large form; one specimen is sub-lobate, the others irregularly round, or oval, in marginal outline. It may possibly belong to one of Bayle's sections of the Genus *Pycnodonta* or *Rhynchostreon*. In the works and collections at my command I am unable to find any species precisely like it but the nearest is *O. akkabensis*, Krumbeck, ‡ from the Syrian "Glandarienalk."

A second species of oyster is possibly present (Pl. IX., fig. 2). It is an upper valve, flat and deltoid in outline, not unlike the same valve of the Kimmeridgian *O. deltoidea*, Sby., but rather less deltoid.

Loc.—Tibraddon and Sandspring Stations, Snake Farm, Greenough River; Fossil Hill, two miles East of Moonyuccneeka Railway Station.

* Moore—Quart. Journ. Geol. Soc., 1870, XXVI., pp. 231, 232, pl. 10, f. 11 and 12.

† *Tholus*—a dome or cupola.

‡ Krumbeck—Beitrag Pal. Geol. Oster.—Ung. Oriens, 1905, XVIII., Heft 1 and 2, pl. 12, f. 1 and 2.

GENUS *ALECTRYONIA*, *Fischer*, 1806.

(Bull. Soc. Imp. Nat. Moscou, VIII.)

ALECTRYONIA MARSHII, *J. Sby.*, *sp.*

(Plate IV., Figs. 5-7 ; Pl. V., Fig. 4).

Ostrea diluviana, Parkinson, Organic Remains, etc., 1811, III., p. 217, pl. 15, f. 1.*Ostrea Marshii*, J. Sowerby, Min. Conchol., 1816, I., p. 103, pl. 48.*Ostrea Marshii*, Goldfuss, Petrefacta Germanice, 1833, II., lief. 4, pl. 73.*Ostrea Marshii*, Morris and Lycett, Mon. Moll. Gt. Oolite, 1854, pt. 3, p. 126, pl. 14, f. 2, 2a.*Ostrea Marshii*, Moore, Quart. Journ. Geol. Soc., 1870, XXVI., p. 232.*Alectryonia Marshii*, Fischer, Man. Conch. et Pal. Conch., 1886, fas. X., p. 926, f. 690.*Ostrea Marshii*, Muller in Bernhardt's Deutsch-Ost-Afrika, 1900, VII., p. 16, f. 1, 1a.

Obs.—There are several specimens, and all may pass as varieties of this well known and widely spread shell, "very variable in form," as James Sowerby said, and shown in Goldfuss' beautiful figures. Both the ovately oblong and fan-shaped varieties are present, and the zig-zag frontal edges are also strongly in evidence. Our specimens accord best with Goldfuss' figures *a*, *b*, *f*, and perhaps *k*. The elevated adductor is also very apparent in one. The area, as in foreign examples, is triangular and shell-like and vertically divided by a central wide chandrophore.

Locs.—Tibraddon and Sandspring Stations, Greenough River.

GENUS *CTENOSTREON*, *Eichwald*, 1868.

(Lethæa Rossica, 1868, II., p. 455.)

CTENOSTREON PECTINIFORMIS, *Schl.*, *sp.**Ostracites pectiniformis*, Schlotheim, Petrefactenkunde, 1820, I., p. 231.*Ctenostreon pectiniformis*, Eth., fil., Rec. Austr. Mus., 1901, IV., No. 1, p. 14, pl. 3 (for synonymy).*Ctenostreon pectiniformis*, Chapman, Proc. R. Soc. Viet., 1904, XIV., (n.s.), pt. 2, p. 329, pl. 30, f. 1.

Obs.—Five examples in a poor state of preservation add little to our previous knowledge of Australian form of this species. One has the fistulous spines produced into regular elongate tubes, as shown in one of Lycett's figures.*

Locs.—Tibraddon and Sandspring Stations, Greenough River ; Fossil Hill, two miles East of Moonyoonooka Railway Station.

* Lycett—Suppl. Mon. Moll. Gt. Oolite, 1863, pl. 29, f. 1.

GENUS PECTEN, O. F. Müller, 1776.

(Zool. Donicæ Prod., p. XXXI.)

PECTEN (?) CINCTUS, J. Sowerby.

(Plate IX., Fig. 1).

Pecten cinctus, J. Sowerby, Min. Conchol., IV., p. 96, pl. 371.

Pecten cinctus, Moore, Quart. Journ. Geol. Soc., 1870, XXVI., pp. 230, 231, and 232.

Pecten cinctus, Chapman, Proc. R. Soc. Vict., 1904, XVI. (n.s.), pt. 2. p. 328.

Obs.—The name *P. cinctus*, J. Sby. appeared in Moore's list of West Australian Oolitic fossils, but no complete description of either the British shell, or its supposed Australian analogue has, so far as I am aware, appeared. The original figure displays a shell defective in the region of the auricles and cardinal margin, whilst all the West Australian specimens within my knowledge are in a poor or incomplete state of preservation. In all I have nine specimens before me, seven forming a portion of the present collection and two in the Australian Museum; the largest of these measures seventeen centimeters by sixteen and a half.

I do not by any means feel satisfied our Australian shells are Sowerby's species. Sowerby said the valves of the British shell were of nearly equal convexity, but in the present instance the valves are very far from being nearly equally convex; indeed five are actually plano-convex.

The shell is sub-orbicular, more or less plano-convex, one valve moderately convex, the other flat, or nearly so; the test is thick, but as a rule much exfoliated. In the convex valve, one of the auricles (? anterior) is flat and wing-like, undivided from the body of the shell, and possibly slightly falcate along the outer margin. On the flat valve one auricle (? anterior) is triangular with a strongly falcate, or even segmoidal outer margin. The other ear of the same valve, of which a portion is still visible on one specimen, is, judging from the direction of the ornamenting laminae, rectangular; one of the flat valves is ornamented with fine concentric lines. It may be pointed out that Sowerby's figure corresponds to the flat valve of our shells.

Locs.—Tibraddon Station; a quarter of a mile North-West, and half a mile North of Woolanooka; Sandspring Station, Greenough River; Snake River, Greenough River District.

PECTEN (?), *sp.*

(Plate VIII., Figs. 5 and 6.)

Obs.—I previously refer to *Pecten* two small slightly oblique valves, almost round in outline, very moderately convex and with small flat ill-defined triangular auricles. A very large number of strong costæ decorate the surfaces, either all of one size or alter-

nately larger and smaller, the latter interpolated, the former sometimes bifurcate. The umbo was acute and overhung the cardinal margin.

I believe this to be one of those unsatisfactory forms oscillating between *Pecten* and *Radula* and in all probability in want of a particular generic designation.

Loc.—Sandspring Station, Greenough River.

GENUS RADULA, *Klein*, 1753.

(*Tent. Meth. Ostrac.*, p. 135).

RADULA DUPLICATA, *J. de C. Sowerby*.

(Plate VIII., Figs. 7 and 8).

Plagiostoma duplicata, *J. de C. Sby.*, *Min. Conchol.*, 1827, V., p. 114, pl. 559, f. 3.

Lima duplicata, *Morris and Lycett*, *Mon. Moll. Gt. Oolite*, 1853, pt. II., p. 26, pl. 3, f. 6 and 6a.

Obs.—Of rather common occurrence throughout the hand specimens of matrix are portions of a small *Radula*. The auricles always either hidden or defective, and all that can be said of the specimens is that the size is small, the outline oblique, and the surface covered with many radiating, direct, strong, angular costæ; between these are very much finer ribs, occupying the centres of the valleys or inter-costal spaces, and not reaching to the umbos.

In their present condition it is impossible to distinguish these fossils from the corresponding portions of *R. duplicata*.

Locs.—Sandspring Station, and a quarter of a mile South of Tibraddon Station, Greenough River.

GENUS MODIOLA, *Lamarck*, 1799.

(*Min. Soc. Hist. Nat. Paris*, 1799, p. 87).

MODIOLA MAITLANDI, *sp. nov.*

(Plate V., Fig. 1 and 2).

Sp. Chars.—Shell large, bold, gibbous, oblique, strongly medio-liform, and transversely elongate. Cardinal margins straight, about three-quarters the length of the shell; valves convex along the obtuse diagonal ridges, which are at first nearly parallel to the cardinal margins, and then curve outwards and downwards, the valves steep on the fore side, flat on the hind surface. Anterior ends very small, almost undeveloped, the margin bluntly rounded. Ventral margins long, concave in the centre, convex at both ends. Sculpture of fine concentric lines and broad latilaminæ of growth.

Obs.—This fine shell, of which the interior is unknown, appears to be an addition to the West Australian list. For an Oolitic *Modiola* its size appears to be unusual, and quite vies with that of

M. alatus, Krumbeck, * of the Glandarienkalk of Syria ; it differs from this, however, in the possession of pronounced diagonal ridges and insinuated ventral margins.

M. Maillandi is not unlike some *Myoconchæ*, particularly Cretaceous species. Even amongst *Modiola*, the size is more akin to that of the recent species *Modiola vagina*, Lamk, than it is to most fossil forms. It is named in honour of Mr. A. Gibb Maitland, Government Geologist.

Locs.—Tibraddon and Sandspring Stations, Greenough River.

GENUS CUCULLÆA, Lamarck, 1801.

(Système, p. 116).

CUCULLÆA SEMISTRIATA, Moore.

(Plate VI., Figs. 1 and 2 ; Pl. VIII., fig. 3).

Cucullæa semistriata, Moore, Quart. Journ. Geol. Soc., 1870, XXVI., 250, pl. 14, f. 3.

Cucullæa semistriata, Eth. fil., Ann. Rept. Dept. Mines, N. S. Wales for 1889 (1890), p. 239.

Sp. Chars.—Shell obliquely oblong, quadrate, robust, inflated. Cardinal margins considerably less than the width of the shell ; umbonal regions high, prominent ; umbos depressed, flattened above, the apices curving over the area ; the latter wide, with sharp margins, and deeply excavated, the ligamentary grooves widely V-shaped, about fourteen on each moiety of the area. Anterior ends obtuse, the margins very slightly rounded or almost truncate ; anterior slopes slightly flattened but steep. Posterior ends obliquely produced, obtusely pointed ; margins above oblique, below obtusely rounded ; posterior slopes forming scalene triangles, long, slightly concave ; diagonal ridges prominent above. Articuli strong ; medium denticles numerous and oblique ; lateral teeth three on each side, large and strong, the upper one practically horizontal, the median slightly oblique, the lower decidedly oblique. Sculpture of deep latilaminar grooves with between them finer concentric lines, crossed on the anterior slopes by fine radii producing a cancellated surface.

Obs.—Moore speaks of the “hinge-area bounded by a lanceolate straight space,” which does not appear on the specimens before me. This species very closely resembles Goldfuss’ illustration† of *C. oblonga*, J. Sby. So far as I have been able to isolate the articulus, the shell appears to be a true *Cucullæa*, at the same time the muscular scars have not been seen. *C. semistriata* is represented by the greatest number of individuals, and it may be distinguished generally by its oblong-quadrate robust form.

* Krumbeck—Beitrag Pal. Geol. Osterr.—Ung. Orient, 1905, XVIII., left 1 and 2, pl. 11, f. 4 and 5.

† Goldfuss—Petrefacta Germaniæ, Thiel 2, pl. 123, f. 2.

Locs.—Tibraddon and Sandspring Stations and half a mile North of Woolanooka, Greenough River; Fossil Hill, two miles East of Moonyoonooka Railway Station, Greenough River District.

CUCULLÆA TIBRADDONENSIS, sp. nov.

(Plate V., Fig. 3 and 4).

(?) *Cucullæa, sp.* Moore, Quart. Jour., Geol. Soc., 1870, XXVI., p. 250.

Sp. Chars.—Transverse obliquely oblong, produced posteriorly only moderately inflated in the umbonal region. Cardinal margins about two-thirds the length of the shell; umbos depressed, flattened above. Area narrow, deep; ligamentary grooves five on each area half. Anterior ends rather obtuse, the margins almost vertical above, rounded below, the antero-cardinal junctions forming a right angle; anterior slopes obtuse. Posterior ends long, produced, narrow, wedge-shaped, the margins all rounded, and without postero-cardinal angles; diagonal ridges sharp umbonally becoming obtuse in their downward course and dying out; posterior slopes slightly concave. Sculpture of latilaminæ, which are strong and corrugated on the posterior extremities, with intermediate finer concentric lines, and umbonal radii.

Obs.—Moore recorded four species of *Cucullæa* from West Australia, viz., *C. oblonga*, J. Sby., *C. inflata*, Moore, *C. semistriata*, Moore, and a fourth, to which no name was given, this last "distinguished by its being much narrower or transversely elongated." There is a strong probability of this being the shell in question. It may be at once distinguished from the others by its wedge-like produced posterior end.

Locs.—Tibraddon and Sandspring Stations, Greenough River.

CUCULLÆA, sp.

(Plate VII., Fig. 1; Pl. VIII., Figs. 1 and 2).

Obs.—The collection contains four single valves that may be Moore's first species of West Australian *Cucullæa* (*C. inflata*), although neither of them appear to be sufficiently inflated to answer to his figures. The shells before me possess an outline quite dissimilar to those referred to *C. semistriata*. It is quadrate, somewhat obliquely so, longer than broad. The cardinal margins, as Moore says of his *C. inflata*, are shorter than the width of the shell, and the umbos median and much elevated. The largest specimen is by no means perfect, but the anterior and posterior ends appear to be truncate, and there is certainly a strong posterior diagonal ridge, again as described by Moore, and a wide posterior slope. The area is wide and very high, with many ligamental furrows (more than fifteen). The entire valve is sculptured with fine concentric lines on wide latilaminæ, and anterior radii.

Moore recorded*, but neither described nor figured, the European *C. oblonga*, J. Sby.† as a West Australian species. He said "*C. oblonga* is the most frequent [species] of this genus." Sowerby's figure is drawn from a point of view very difficult for determinative purposes, but notwithstanding this, I have not seen a *Cucullæa* from West Australia I could refer to it, although the present form approaches nearest.

Loc.—Fossil Hill, two miles East of Moonyoonooka; Sand-spring Station, Greenough River.

GENUS TRIGONIA, *Bruguère*, 1789.

(Encycl. Méthod. I., pl. 14).

TRIGONIA MOOREI, *Lycett*. ‡

(Plate IV).

Trigonia Moorei, *Lycett*. Brit. Fos. Trigonæ, No. 4, 1878, p. 151, fig.

Trigonia Moorei, Moore, Quart. Jour. Geol. Soc., 1870, XXVI., p. 254, pl. 14, f. 9 and 10.

Trigonia Moorei, *Eth. fil.*, Rec. Austr. Mus., 1904, No. 4, pl. 27, f. 3 and 4.

Sp. Chars.—Shell irregularly quadrate, posteriorly oblique; valves generally compressed, in advanced age becoming inflated; anterior cardinal margins short, steep; posterior cardinal margins moderately long; umbonal regions high; umbos much more anterior than posterior, fine, very slightly opisthogyrate; escutcheon elongately cordate, almost reaching to the posterior cardinal angles, bounded by fairly well pronounced carinæ; ligamentary aperture heart-shaped, short. Anterior ends small comparatively, entirely confined between the upper parts of the cinctures and the anterior margins which are rounded; posterior ends much compressed, the margins short and oblique; cinctures on leaving the umbos at first nearly vertical, then sweeping down so as to just miss the postero-ventral angles, broad and shallow; diagonal ridges prominent; posterior slopes flattened, each traversed by a median radial groove. Ventral margins well rounded on the anterior side, and nearly straight medianally to the postero-ventral angles. Sculpture anterior to the cinctures of 20–23 sharp, outstanding, concentric lyræ, separated by wide, flat valleys, the former almost vertical along the anterior margins; on arriving at the cinctures the lyræ rise into flat transverse nodes, but pass over the former as faint flat laminae, terminating at the diagonal ridges as prominent transverse echinating nodes; posterior slopes bear fine curved radii and transverse ridges giving rise to a scabrous surface, the points of intersection nodose; on the escutcheon this scabrous sculpture occurs at its very apex immediately under the umbos, the remainder

* Moore—Quart. Journ. Geol. Soc., 1870, XXVI., pp. 231, 250.

† Sowerby—Min. Conchol., 1818, III., p. 7, pl. 206, f. 1 and 2.

‡ Non *T. Moorei*, *Garich*.

of the surface bearing lines. Articles much arched, strong ; hinge plates thick ; nymphæ small, erect ; triangular cardinal callosity of the left valve well developed and projecting horizontally above, but distinctly hollowed below ; posterior tooth of the right valve long, fitting into a correspondingly long and deep socket of the left valve ; posterior tooth of the left valve also large and projecting.

Obs.—This, to us well-known, shell has not been described before in detail. It is one of the most characteristic West Australian Mesozoic fossils and occurs at certain localities in great profusion. The original notes published by Mr. Moore were furnished by Dr. J. Lycett, who compared *T. Moorei* with *T. costata*. J. Sby., of the European Lower Oolite and found it to differ as follows :—(1) generally more compressed ; (2) escutcheon narrower and longer (3) posterior slopes (Lycett's area) larger, more convex, more expanded, and bipartite, the median carinæ replaced by grooves ; (4) inner carinæ (bounding the escutcheon) slightly nodular and inconspicuous ; (5) anteally the lyræ approach the valve margins almost perpendicularly ; (6) no distinct anterior truncation ; (7) diagonal ridge of the right valve stronger than that of the left. Of these characters the last does not appear to hold good when a number of specimens are examined.

Mr. F. L. Kitchin considers *T. Moorei* to be of "essentially similar aspect" to his *T. dhoensis** of the Cutch Jurassic fauna, but on a close examination the two shells need not for a moment be mistaken for one another.

There is a much higher degree of gibbosity, or inflation, in the united valves of old shells, than in those of young and median growth. In old individuals also the scabrous surface of the posterior slopes is much accentuated. Other than these points the species appear to maintain its character free of variation. The largest example to come under my notice measured two and a half inches along the cinctures from umbos to ventral margins. In absolutely unworn specimens, the interlyrate concentric striæ on crossing the cinctures rise into delicate frills.

Locs.—Tibraddon and Sandspring Stations, Greenough River ; Fossil Hill, two miles East of Moonyoonooka Railway Station ; quarter mile North-West and half mile North of Woolanooka, Greenough River and Snake Farm, Greenough River.

GENUS ASTARTE, *J. Sowerby*, 1816.

(Min. Conchol., II., p. 85).

ASTARTE CLIFTONI, *Moore*.

(Plate V., Figs. 5-8 ; Pl. VI., Fig. 3).

Astarte Cliftoni, Moore, Quart. Journ. Geol. Soc., 1870, XXVI., p. 249, pl. 13, f. 10.

Sp. Chars.—Shell ovately-trigonal, inequilateral in the extreme, compressed ; cardinal margins highly arched, strongly re-

* Kitchin—Jurassic Fauna of Cutch (Pal. Ind.), III., pt. 2, No. 1, 1903, p. 29, pl. 3, f. 1 and 2.

versed V-shaped, short on the anterior sides, and very long posteriorly. Umbos quite anterior, fine, sharp, and depressed; lunule large, deep, ovate cordiform; escutcheon very long, deep and narrow; ligamentary aperture less than half the length of the escutcheon, ligament stout. Anterior ends merely fractional from the advanced position of the umbos, their brief margin quite rounded; anterior diagonal ridges short, curved very sharp, bounding the lunule. Posterior ends consisting of what is tantamount to the entire valves, flattened, the margins rounded, forming by their junctions with the oblique cardinal margins approximate angles of 15° ; posterior slopes quite inconspicuous. Sculpture of very numerous, sharp, close, regular, concentric lyræ.

Obs.—The ovately-trigonal outline, long obliquely arched cardinal compressor margins, and compressed valves, render this an easily recognised shell. It is only to be distinguished from *A. subtrigona*, Münster,* of the Wurtemberg Inferior Oolite, by possessing a rather more oblique outline and more compressed valves. I have seen the articulus of the left valve, and it is characteristically astartiform; the central socket for the reception of the right central cardinal is remarkably large.

Loc.—Tibraddon Station, Greenough River.

CLASS GASTEROPODA.

GENUS PLEUROTOMARIA, *Defrance*†, 1824.

(Tableau, p. 114).

PLEUROTOMARIA GREENOUGHENSIS, *sp. nov.*

(Plate VIII., Figs. 9 and 10).

Sp. Chars.—Shell conical, gradate; whorls six, step-like, lower portion the larger moiety and slightly oblique, the upper half nearly horizontal; band probably represented by a slight groove around the middle of each whorl. Sculpture spiral.

Obs.—A very unsatisfactory specimen, but as univalves appear to be so scarce in collection of West Australian Mesozoic fossils, it was thought advisable to notice it. The base is incomplete, but the mouth was probably transversely oval and oblique. The finer details of sculpture also are not preserved.

Loc.—Sandspring Station, Greenough River.

CLASS CEPHALOPODA.

GENUS DORSETENSIA, *S. S. Buckman*, 1892.

(Mon. Inf. Oolite Ammonites, pt. VI., p. 302).

DORSETENSIA CLARKEI, *Crick*.

(Plate VI., Fig. 4; Plate IX., Fig. 7).

Ammonites radians, Moore (non Schlotheim), Quart. Journ. Geol. Sec., 1870, XXVI., pp. 230, 231, 232; pl. 15, f. 2.

Ammonites (Dorsetensia) Clarkei, Crick, Geol. Mag., 1894, I., (4), p. 388, pl. 12, f. 2, a-c.

Obs.—Seven examples of this species are before me in varying states of preservation, the largest with a diameter of three and a

* Münster.—In Goldfuss, Petrefacta Germaniæ, Ed. 2, 1862, II., p. 183, pl. 134, f. 17, a and b.

† Restricted, Fischer.

quarter inches. Two of the specimens exhibit five and a half whorls and still incomplete. In casts the costæ disappear on the flanks at about the sixth whorl.

Locs.—Tibraddon Station and Snake Farm, Greenough River ; Fossil Hill, two miles East of Moonyoonooka Railway Station.

GENUS PERISPHINCTES, *Waagen*, 1869.

(Benecke's Geogn-pal. Beiträge, 1869, II., p. 248).*

PERISPHINCTES CHAMPIONENSIS, *Crick* ?

Ammonites (*Perisphinctes*) *championensis*, *Crick*, Geol., Mag., 1894, I., (4), p. 436, pl. 13, f. 2 *a* and *c*.

Ammonites (*Perisphinctes*) *championensis*, *Chapman*, Proc. R. Soc. Vict., 1904, XVI. (n.s.), p. 331, pl. 30, f. 2.

Obs.—Two imperfect specimens are referred to this species one with a diameter of five and a half inches. Both exhibit the superumbilical nodes and fasciculate costæ of this and *P. robiginosus*, *Crick*, † indeed, it is very difficult to distinguish the one from the other.

Loc.—Tibraddon Station, Greenough River.

GENUS SPHÆROCERAS, *Bayle*.

SPHÆROCERAS SEMIORNATUS, *Crick* ?

(Plate IX., Fig. 8).

Ammonites Brocchi, *Moore* (non *J. Sby.*), Quart. Journ. Geol. Soc., 1870, XXVI., pp. 231, 232, pl. 15, f. 4.

Ammonites (*Sphæroceras*) *semiornatus*, *Crick*, Geol. Mag., 1894, I. (4), p. 434, pl. 13, f. 1, *a* and *b*.

Obs.—A single impression or mould in limonite may represent this species judging by the remains of the sculpture ; the superumbilical or dorsal tubercle-ribs passing into more numerous median or ventral costæ are quite apparent.

Loc.—Tibraddon Station, Greenough River.

GENUS NAUTILUS, *Breynius*, 1732.

(Dissert. de Polythal).

NAUTILUS PERORNATUS, *Crick*.

Nautilus semistriatus, *Moore* (non *D'Orb.*), Quart. Journ. Geol. Soc., 1870, XXVI., pp. 230, 231, 232.

Nautilus perornatus, *Crick*, Geol. Mag. 1894, I. (4), p. 386, pl. 12, f. 1 *a* and *c*.

Obs.—In the present collection are three examples imperfect and poorly preserved, but still showing that the shell attained a

* *Fide* Neumayr.

† *Crick*—Geol. Mag., 1894, I. (4), p. 438, pl. 13, f. 3, *a*, and *b*.

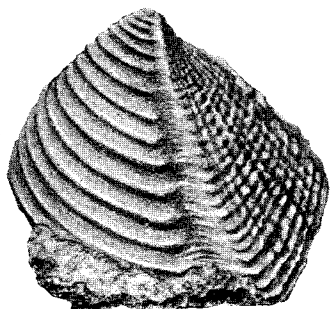
large size. The largest consists of a portion of the venter and one flank, the former bearing revolving costæ, and the latter coarse lines of growth. This specimen measures round the venter sixteen inches, and across the same, four and a half inches. The second example is similar but smaller, whilst the third is part of a flank and half a venter again exhibiting the revolving costæ, but in this instance on both, with septal sutures and camerae. The third example is a much smaller specimen, about double the size of Mr. Crick's figure.

Loc.—Tibraddon Station, Greenough River and Fossil Hill, two miles East of Moonyoonooka Railway Station.

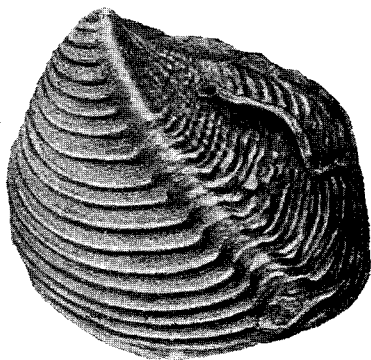
EXPLANATION OF PLATE IV.

TRIGONIA MOOREI, *Lycett.*

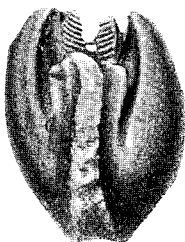
- Fig. 1.—A full grown specimen of a left valve showing the lyræ passing across the cincture as frills.
- „ 2.—A similar valve the lyræ terminating in tubercles before passing over the cincture; the posterior slope with semi-concentric lyræ and median shallow radial groove.
- „ 3.—Slightly smaller example with the eschinated sculpture of the posterior slope and well developed nodes along both sides of the cincture.
- „ 4.—A similar specimen to Fig. 3.
- „ 5.—Articulus of a left valve showing the projecting cardinal socket-like callosity and teeth.
- „ 6.—Internal cast of the right valve.
- „ 7.—Internal cast of the united valves seen from above.
- „ 8.—The same seen from the anterior.
-



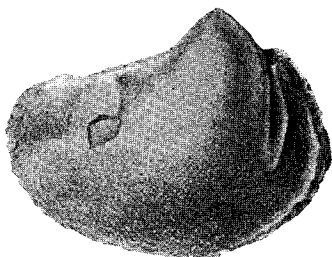
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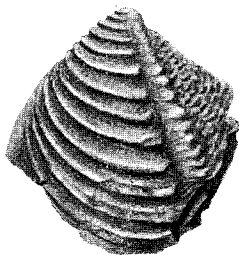
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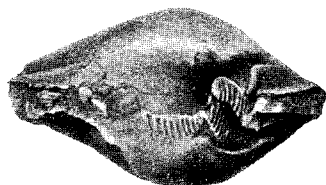
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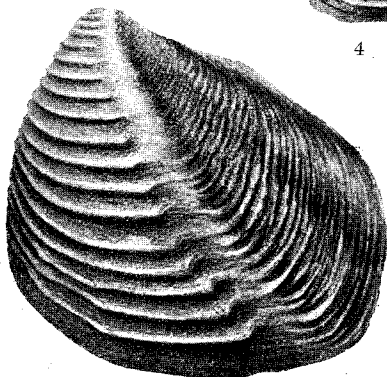
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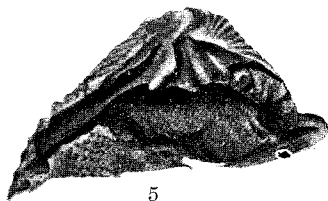
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5

EXPLANATION OF PLATE V.

MODIOLA MAITLANDI, *Eth. fil.*

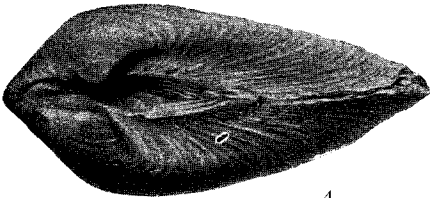
- Fig. 1.—Left valve of a well preserved example.
 „ 2.—The united valves seen from above.

CUCULLÆA TIBRADDONENSIS, *Eth. fil.*

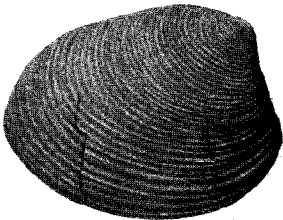
- „ 3.—Left valve slightly imperfect.
 „ 4.—The united valves seen from above, exhibiting the area.

ASTARTE CLIFTONI, *Moore.*

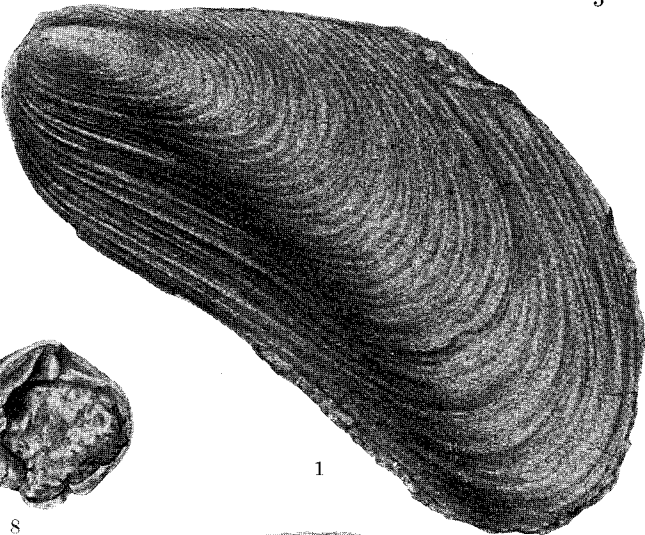
- „ 5.—Right valve showing the general outline and close regular concentric lyræ.
 „ 6.—United valves seen from above with the escutcheon and ligament.
 „ 7.—Anterior end of the united valves with the lunule.
 „ 8.—Articulus of the left valve.
-



4



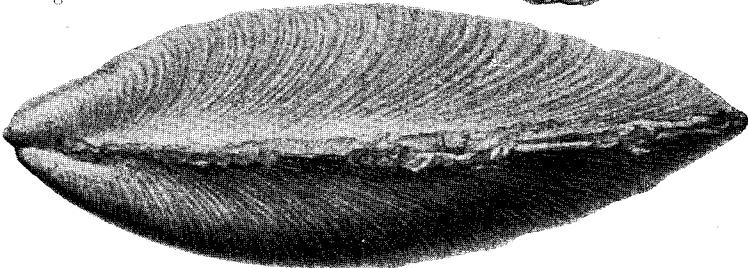
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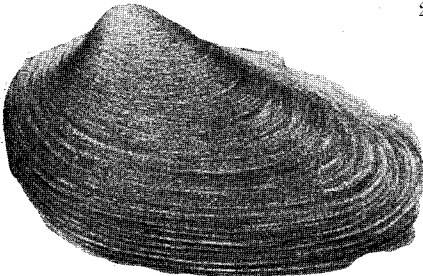
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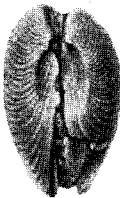
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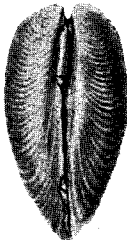
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6

EXPLANATION OF PLATE VI.

CUCULLÆA SEMISTRIATA, *Moore*.

- Fig. 1.—Left valves nearly complete.
 „ 2.—United valves seen from above, exhibiting the area.

ASTARTE CLIFTONI, *Moore*.

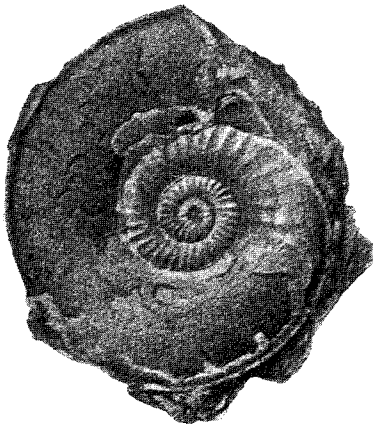
- „ 3.—Right valve of an individual with fine lyræ.

DORSETENSIA CLARKEL, *Crick*.

- „ 4.—An imperfect shell exhibiting costæ on the inner whorls, also sutures and keel of the venter.

ALECTRYONIA MARSHI, *J. Sowerby*.

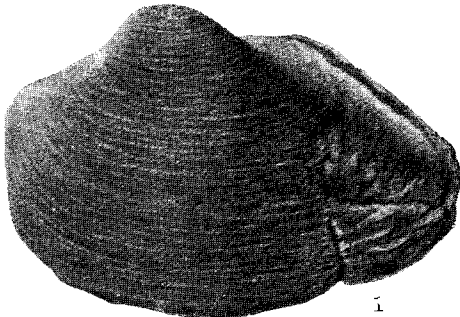
- „ 5.—Interior of portion of a fan-shaped (?) valve with the elevated adductor scar.
 „ 6.—Exterior with subradiating costæ and partial view of the zig-zag frontal edge.
 „ 7.—Interior of a subtriangular valve with the elevated adductor scar, and large triangular area and its wide chondrophore.
-



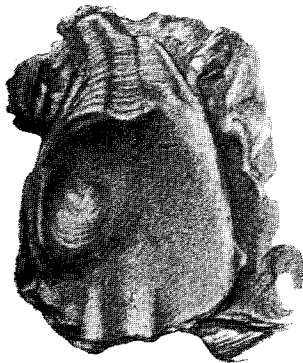
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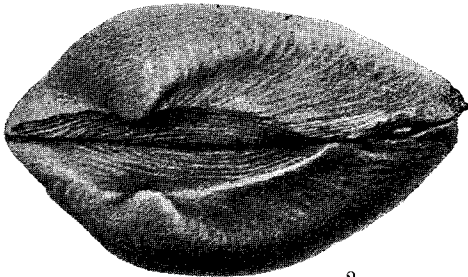
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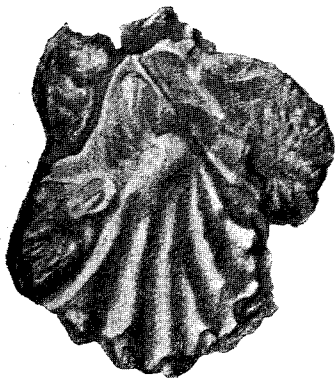
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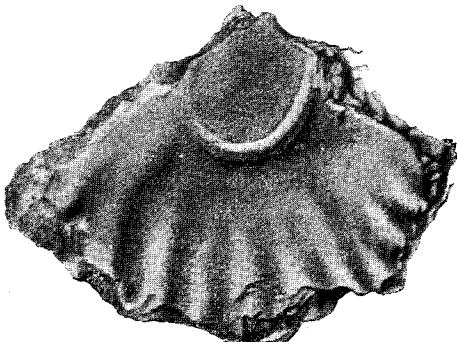
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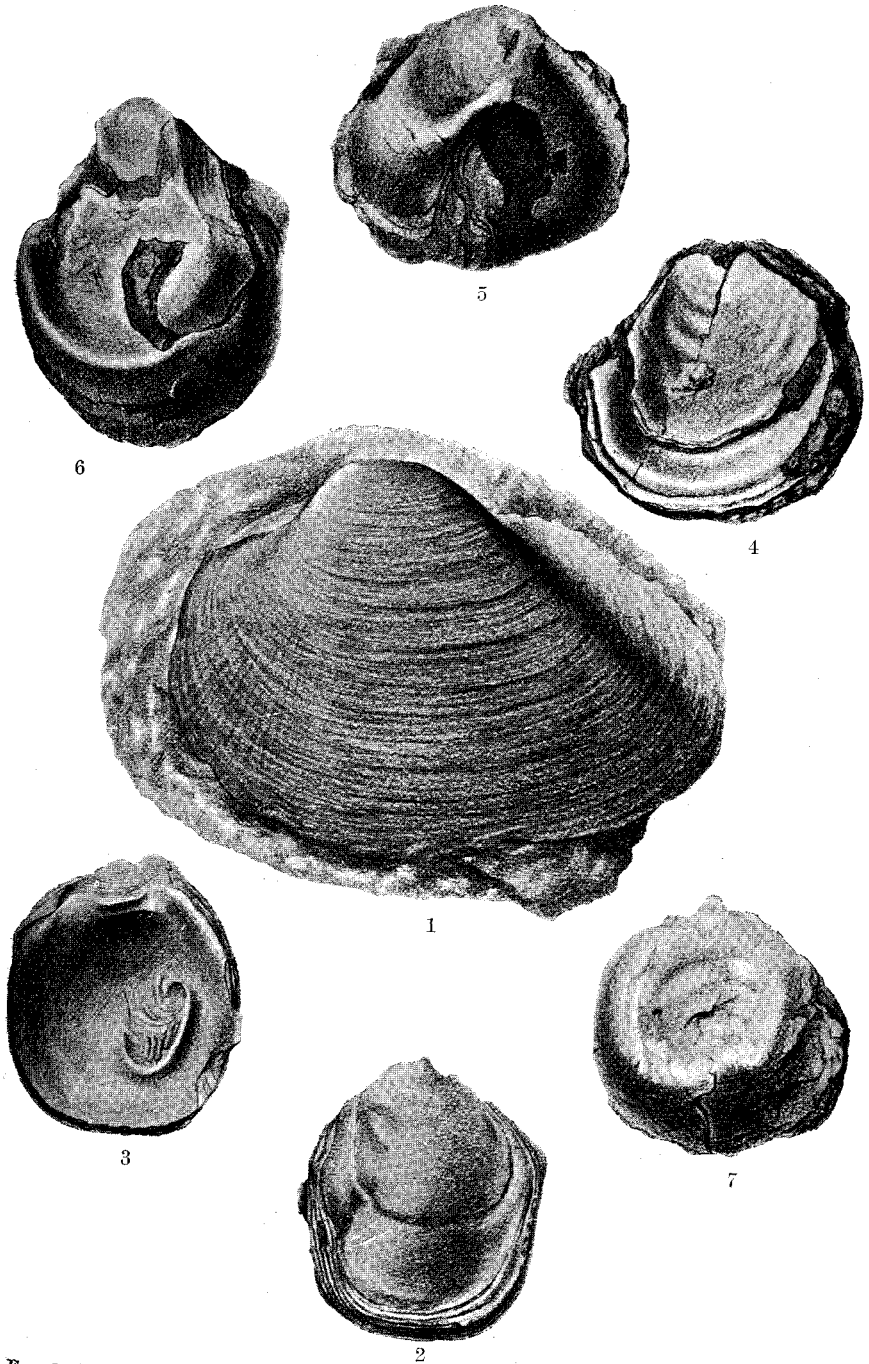
EXPLANATION OF PLATE VII.

CUCULLÆA, *sp.*

Fig. 1.—Left valve nearly complete with latelaminæ bearing subordinate concentric lines, crossed at the anterior end by fine radii. (This may be *C. inflata*, Moore.)

OSTREA THOLIFORMIS, *Eth. fil.*

- „ 2.—Exterior of flat valve.
- „ 3.—Interior of the same valve with the elevated adductor scar rim and *Serpulæ*.
- „ 4.—Another example of a flat valve.
- „ 5.—The attached dome-shaped valve more or less exfoliated.
- „ 6.—A much exfoliated attached valve.
- „ 7.—Another similar valve, but less dome-shaped than Fig. 5, and with a larger area of attachment.



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EXPLANATION OF PLATE VIII.

CUCULLÆA, *sp.*

- Fig. 1.—Imperfect Right valve, possibly referable to *C. inflata*, Moore.
 „ 2.—Umbonal elevation and partial area of the same specimen.

CUCULLÆA SEMISTRIATA, *Moore.*

- „ 3.—Umbo, area, and teeth of the articulus.

ALECTRYONIA MARSHI, *J. Sby.*

- „ 4.—An imperfect specimen exhibiting the strong subradiating costæ, and undulating or zig-zag front.

PECTEN (?), *sp.*

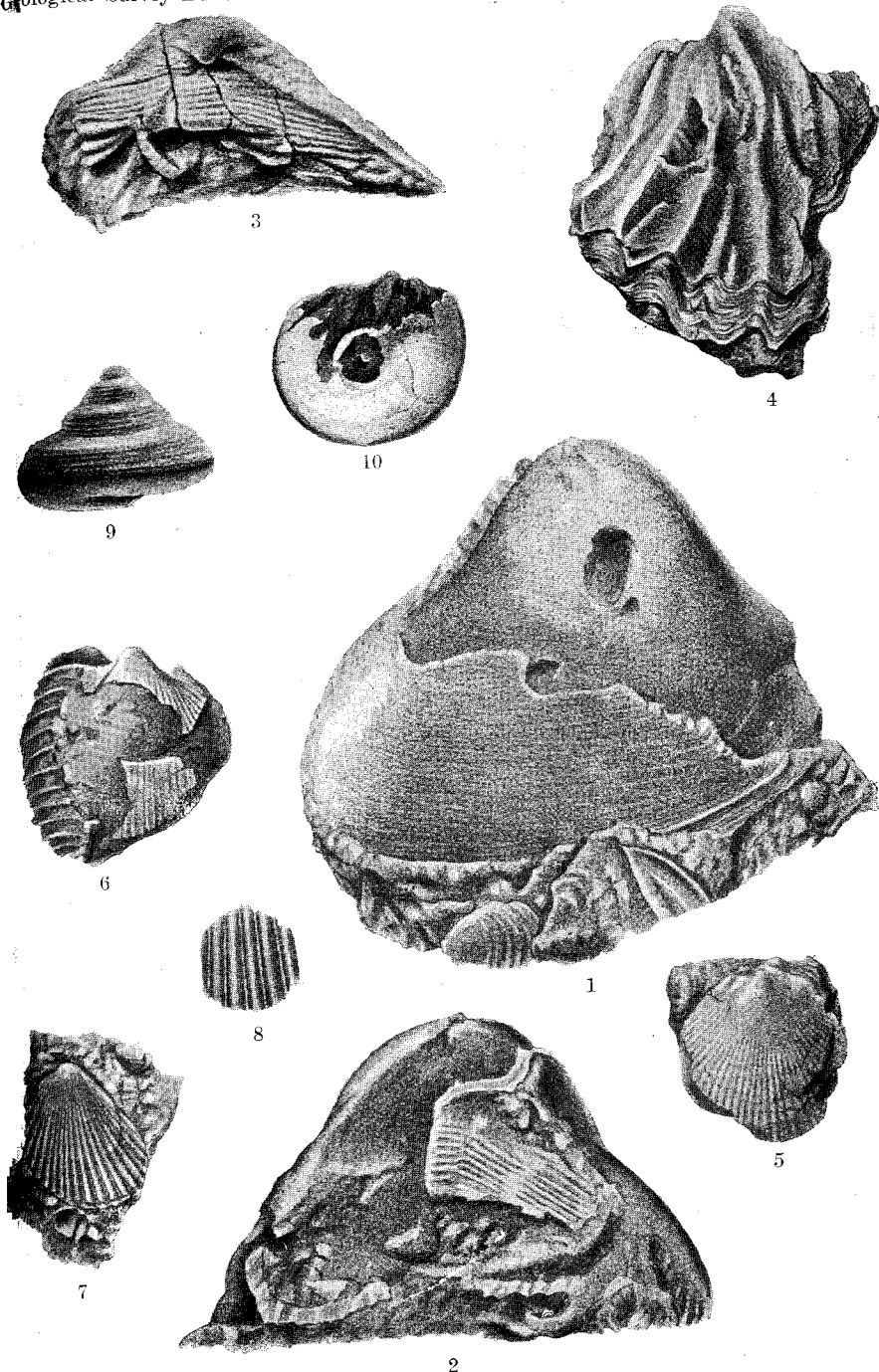
- „ 5.—A small valve provisionally referred to *Pecten* with strong costæ.
 „ 6.—Another valve, probably the opposite to that represented in Fig. 5.

RADULA DUPLICATA, *J. de C. Sby.*

- „ 7.—Portion of a valve, less the auricles.
 „ 8.—The costæ, primary and secondary, much enlarged.

PLEUROTOMARIA GREENOUGHENSIS, *Eth. fil.*

- „ 9.—The shell seen in elevation.
 „ 10.—The base.
-



EXPLANATION OF PLATE IX.

PECTEN (?) CINCTUS, *J. Sby.*

Fig. 1.—Flat valve much exfoliated, with remains of the auricles.

OSTREA, *sp.*

„ 2.—Interior of an upper or flat valve exhibiting area above, test laminae at the sides, and the adductor scar.

RHYNCHONELLA VARIABILIS, *Schlotheim.*

„ 3.—Umbo of the pedical valve, and the brachial valve with the fold occupied by three costæ.

„ 4.—Lateral view of the specimen represented in Fig. 3— $\times 3$.

„ 5.—Pedicel valve of the specimen represented in Figs. 3 and 4; the sinus occupied by two costæ— $\times 3$.

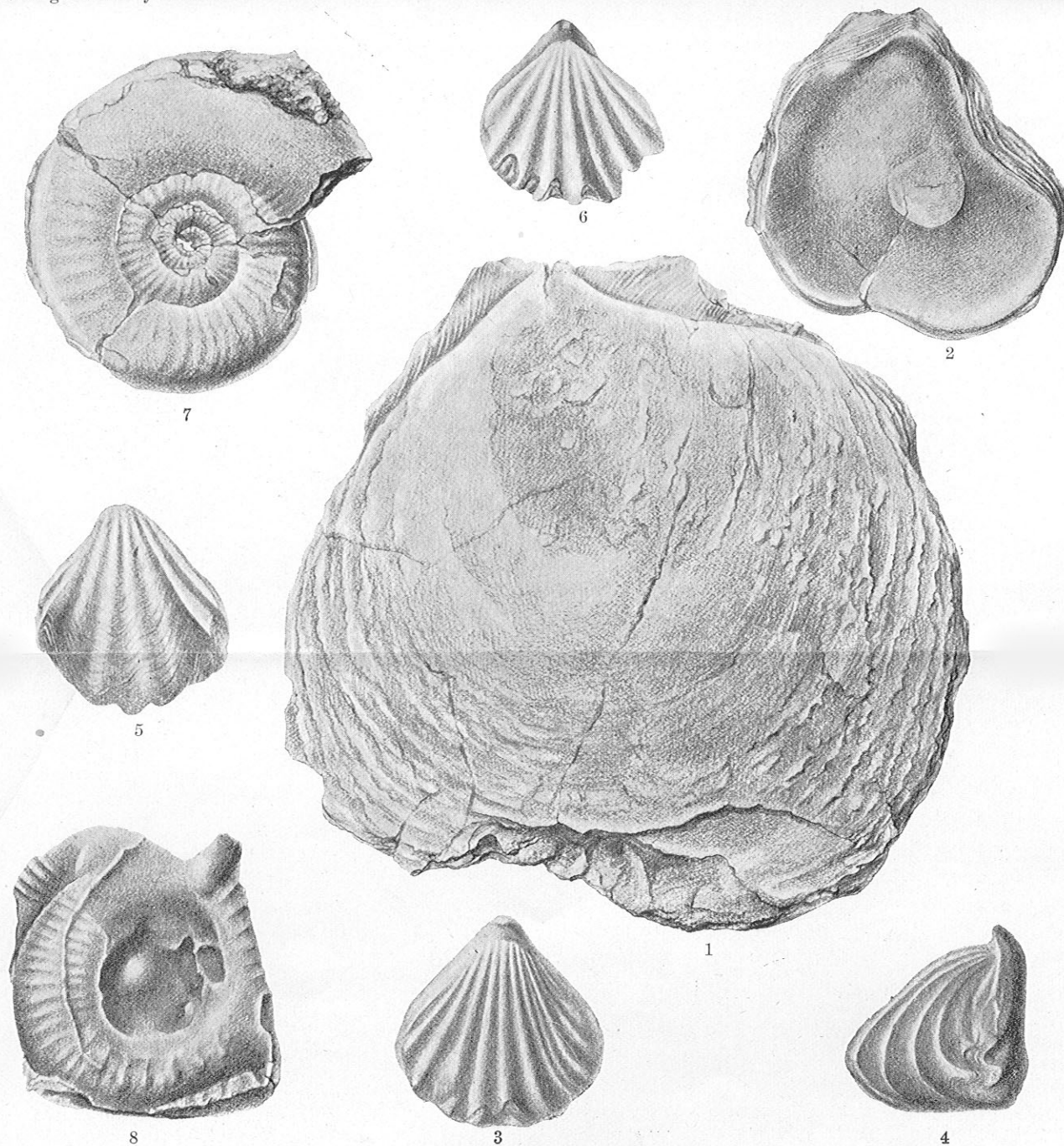
„ 6.—A second specimen, the fold of the brachial valve bearing two costæ— $\times 3$.

DORSETENSIA CLARKEI, *Crick.*

„ 7.—A large example exhibiting the costæ and keel of the venter.

SPHEROCERAS SEMIORNATUS, *Crick (?)*.

„ 8.—Cast from a natural mould in limonite displaying a very imperfect specimen.



Frank R. Leggatt, Del.