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SECOND REPORT

OF THE

GEOLOGICAL SURVEY OF NATAL AND ZULULAND.

BY

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By R. ETHERIDGE, ESQ.,

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

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CRETACEOUS FOSSILS OF NATAL,

COLLECTED BY

MR. WILLIAM ANDERSON, Government Geologist.

PART I.—THE UMKWELANE HILL DEPOSIT,

BY

R. ETHERIDGE, ESQ.,

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

I.—INTRODUCTION.

The fossils described in subsequent pages were forwarded to me by Mr. William Anderson, Government Geologist of Natal, for determination and description. They were collected at Umkwelane Hill, about twenty miles above the mouth of the Umfolosi river, which flows into Saint Lucia Bay, on the Zululand coast.

The deposit may be described in general terms as a shelly limestone, the matrix a calcareo-arenaceous rock of a grey-brown colour. It is so crammed with fossils as to become a shell-agglomerate, the matrix harder than the fossils. The result is that in attempting to disengage the latter the shells invariably break up. This has rendered extraction for descriptive purposes almost an impossibility, and I have in consequence had to depend on portions. Fortunately, however, some of the more important species are so plentiful that the general characters of each can be more or less constructed.

This fossiliferous deposit was evidently known to Mr. C. L. Griesbach. In his most instructive paper "On the Geology of Natal" "in South Africa," * he speaks of the "Cretaceous Rocks of South" "Africa," and says, "Between the rivers Umtamfuna † and Umzam-" "bani, about five miles from the southern boundary line of Natal, on the" "south-eastern coast of Africa, some deposits are found which at first" "sight seem to be of the same material. They consist of sandy marls" "and hard sandstones of a greyish-brown colour, with a few calcareous" "concretions. . . . These rocks only extend for a short distance, and" "only form isolated cliffs. They are found, too, at the Impengati river," "and at some of the more southern rivulets which run into the sea" "between the boundary of Natal and the St. John's river (Umzim-"

* Quart. Journ. Geol. Soc., 1871, xxvii., p. 53.

† Griesbach spells this locality Umt*am*funa, but Mr. Hellier Baily writes it Umt*a*funa (Quart. Journ. Geol. Soc., 1855, xi., p. 453).

"vooboo). The same are also recognised in the bed of a small stream" "running into the St. Lucia Bay in the Zulu country. The strata" "forming these deposits are perfectly horizontal, and they rest upon a" "sandstone of much older age, which belongs to the very interesting" "series of the Karoo formation." * The latter portion of the quotation is the only reference I am acquainted with directly bearing, possibly, on the spot from which Mr. Anderson's fossils were collected.

The Umtafuna Beds were, previous to the appearance of Mr. Griesbach's paper, referred to by Capt. R. J. Garden,† and the fossils collected by him described by Mr. W. H. Baily,‡ who considered the collection to represent a series "probably palæontologically equivalent" "to the Upper Greensand of this country [England] and *Craie Chloritée*" "of France." § Subsequently Prof. R. Tate, when dealing with the fossils of the Uitenhage formation, referred to this deposit and its contents in a table of the South African Secondary Beds as "Cretaceous." ||

II.—DESCRIPTION OF THE SPECIES.

1. PELECYPODA.

GENUS OSTREA, *Linnæus*, 1758.
(Systema Nat., Ed. X., 1758, p. 696.)
(Pl. II., Figs. 1 and 2.)

Obs.—The existence of Oysters in the Umkwelane Beds is shown by a few small specimens in a poor state of preservation. One is the interior of a valve and its relief, having a diameter of one and a quarter inches. It is almost circular, and exhibits traces of a crenulated margin. The adductor impression is subantral.

Another specimen consists of a small, thin, flat valve, with a longitudinal diameter of eight millimetres and a transverse diameter of six millimetres. There is an obscure umbo and a few concentric laminæ.

GENUS EXOGYRA, *Say*, 1819.
(American Journ. Sci., 1819, i., p. 381, ii., p. 43.)
(Pl. II., Figs. 3–6.)

Obs.—Indefinite examples of a small *Exogyra*-like bivalve, but the material is much too limited to permit of satisfactory determination. The flat valve very much resembles Tate's *Placunopsis imbricata*,¶ and the convex valve his *Ostrea* (*Exogyra*) *jonesiana*.** In both instances, Tate's and mine, the two are probably the upper and lower valves of one form.

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* Quart. Journ. Geol. Soc., 1871, xxvii., pp. 60–61.
† *Ibid.*, 1855, xi., p. 453.
‡ *Ibid.*, p. 454.
§ *Ibid.*, p. 464.
|| *Ibid.*, 1867, xxiii., p. 167.
¶ Quart. Journ. Geol. Soc., 1867, xxiii., p. 154, t. 8, f. 7.
** *Ibid.*, p. 154, t. 8, f. 3*a–c*

GENUS NEITHEA, *Drouet*, 1824.
(Ann. Soc. Linn. Par., 1824, iii., p. 183.*)
(Pl. II., Fig. 13.)

Obs.—A cast of a portion of the lower or convex valve, with what appears to be a part of one auricle, may be referred here. There are portions of five primary costæ remaining, prominent and rounded, the intercostal spaces faintly concave or flattened, and without traces of secondary costæ on the body of the shell, but on the lateral slope there are traces of these crenulating the margin. The umbo is imperfect, but enough remains to show that it was high and much over-curved. The remaining auricle is small and triangular, and if this feature were omitted the specimen might pass for a portion of a valve of *Cucullæa Kraussi*, Tate,† but on the whole I give the preference to *Neithea*. Baily quotes *Pecten quinquecostatus* from the Umtafuna and Umzambani deposit,‡ and so does Griesbach.§

GENUS MELINA, *Retzius*, 1788.
(Dissert. Hist. Nat., 1788, p. 22.)
MELINA ANDERSONI, *sp. nov.*
(Pl. II., Figs. 7–10.)

Sp. Char.—Shell subquadrate, equivalve, tumid, strongly biconvex, alate posteriorly; cardinal margins long and straight, thickened and flattened with oval resilifers extending for rather less than half their length; ventral margins rounded. Anterior ends very small, formed only by the steep anterior slopes which are hollowed immediately below the umbones, and then swell out below; no auricles. Posterior ends composed of almost four-fifths of the valves, very tumid and convex from the umbos downwards, rapidly falling away still further posteriorly to more or less flattened alations; posterior slopes ill defined, rounded; posterior cardinal angles obtusely rounded. Umbos quite anterior, incurved. Adductor impressions invisible. Sculpture of regular, concentric, somewhat gradate laminæ, with finer intermediate lines, the former becoming flatter and less marked on the posterior wings. Test laminar, thin.

Obs.—An exceedingly tumid and convex form, with a thin test, laminar in structure, and externally resembling some forms of equivalve *Inoceramus*. There do not appear to be any anterior auricles, but the ends are steep and under the umbone excavate, simulating the so-called "circumscribed lunule" of *Anopæa*, Eichwald.** The resilifers are also similar to those of that genus, but whether or no our

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* *Teste* Herrmannsen, Indicis Gen. Mal., ii., p. 110.
† See Holub and Neumayr, Denk. K. Akad. Wissenschaft., Wien, 1882, xliv., p. 275, t. 2, f. 2*a–c*.
‡ Quart. Journ. Geol. Soc., 1855, xi., p. 462.
§ *Ibid.*, 1871, xxvii., p. 66.
** Lethæa Rossica, 1865–68, ii., p. 479.

shell possessed the "rib-like tooth in the left valve below the beak" I am unable to say, nor have I seen any definite trace of a byssal sinus. As in many other shells with a thin test, there is no trace on the internal cast of the adductor scars.

Melina Andersoni bears no relation to *M. Atherstoni*, Sharpe, sp.,* of the Zwartkop Group, and is named in honour of Mr. William Anderson, Government Geologist of Natal.

GENUS GERVILLIA, *Defrance*, 1820.
(Dict. Sci. Nat., 1820, xviii., p. 502.)
(Pl. II., Figs. 11 and 12.)

Obs.—Two small forms of this genus are present in the collection, both single valves.

One (Pl. II., Fig. 11), is longitudinally ovate, without any apparent anterior alation, but possessing a strong diagonal ridge proceeding from a finely pointed umbo, and an alate posterior end, which is, unfortunately, broken off short. The sculpture consisted of very delicate concentric lines. Although so small it may possibly be of the type of *G. linguloides*, Forbes, of the Atherfield Clay of the south of England.

The second specimen (Pl. II., Fig. 12), unlike the preceding one, exhibits an anterior alation, and a small posterior wing, and in consequence a proportionately longer cardinal margin. The surface bore fine latilaminæ and intermediate delicate striæ. It is of the type of *G. alæformis*, D'Orb., a Neocomian species.

Every probability exists that both these little shells are species of *Gervillia*.

GENUS PINNA, *Linnæus*, 1758.
(Systema Nat., Ed. x., 1758, p. 707.)

Obs.—A single specimen in the form of the median portion of an exfoliated left valve, one and three quarter inches long, by one and a half inches wide. Beyond the fact that it represents the genus little more can be said of it, other than that it seems to represent a more elongated species than *P. Atherstoni*, Sharpe,† of the Uitenhage Group.

GENUS MYTILUS (*Linnæus*), *Lamarck*, 1799.
(Mém. Soc. Hist. Nat. Paris, 1799, p. 88.)
(Pl. I., Fig 7.)

Obs.—A portion of a valve apparently of a Mytiloid shell, possessing characters of its own sufficient for future recognition, and is

* Trans. Geol. Soc., 1856, vii. (2), Pt. 4, p. 193, t. 22, f. 4, 4*a*–*b*.
† *Ibid.*, 1856, vii. (2), Pt. 4, p. 193, t. 22, f. 1.

therefore figured. The surface is covered with rough latilaminæ reminding one of those of *Inoceramus*, but the structure of the test does not accord with that of the latter.

Genus Trigonia, *Bruguiere*, 1789.

(Encycl. Méthod., 1789, t. xiv.)

Trigonia umkwelanensis, *sp. nov.*

(Pl. I., Figs. 14–19.)

Sp. Char.—Shell ovately sub-trigonal, very inequilateral, and very moderately tumid. Cardinal margins arched anteriorly and centrally, but almost straight posteriorly; anterior and ventral margins regularly rounded. Anterior ends small and compressed; posterior ends long, the valves very gradually losing their convexity towards the produced rostrations, the margins of which are obliquely rounded. Umbones sub-anterior, but little elevated; diagonal ridges very faintly marked, curved; posterior slopes elongately triangular, flattened, and traversed by one longitudinal median groove. Cardinal teeth unknown. Anterior adductor scars faintly marked; posterior adductor scars triangular, excavate on their anterior sides; pallial line distinct; intermarginal areas very wide, particularly posteriorly; siphonal ridges strongly impressed in casts. Sculpture consisting of plain strong costæ, about twelve in number, sub-concentric on the umbonal regions, becoming gradually less and less curved, until on the posterior ends they become vertical (longitudinal); on the posterior slopes are sub-crescentic rugæ, one corresponding to each costa; neither tubercles nor granules at any stage of growth.

Obs.—I have given this shell a distinctive name in relation to the locality yielding it. I believe it to be a member of the group of *T. scabra*, Lamk., as defined by Stoliczka, and *T. elegans*, Baily,* but not having seen the cardinal teeth I cannot speak with certainty. It is, however, distinguished from both the foregoing by an entire absence of tubercles and granules in the sculpture, and from the latter alone by possessing a less number of costæ. There are a large number of specimens in all stages of growth from four mm. in longest diameter to thirty mm., representing the adult condition; none, unfortunately, are perfect, but the condition of the portions is such that the characters of the species can readily be arrived at.

The outline to a great extent resembles *Trigonia Shepstonei*, Griesbach,† as well as that of *T. elegans*, Baily,‡ but the sculpture is wholly different from that of the former, and the posterior cardinal margin straighter. The costæ very closely resemble those of *T.*

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* Quart. Journ. Geol. Soc., 1855, xi., t. 13, f. 3*a* and *b*.
† *Ibid.*, 1871, xxvi., p. 66, t. 3, f. 11.
‡ *Ibid.* 1855, xi., p. 461, t. 13, f. 3.

ventricosa, Krauss, * from the Uitenhage Formation, but the umbonal region of the latter is far too elevated for our shell. This feature is particularly well shown in the recent figures of *T. ventricosa* given by Müller †

It is interesting to note that in *T. umkwelanensis*, we have a *Trigonia*, more or less resembling one from the *Umtafuna* horizon in Natal, or as Griesbach terms it the Izinhluzabalungu deposits.

GENUS TRIGONARCA, *Conrad*, 1862.
(Proc. Acad. Nat. Sci. Philadel., 1862, xiv., p. 289.)
TRIGONARCA UMZAMBANIENSIS, *Baily*, sp.
(Pl. I., Figs. 1–5.)

Arca umzambaniensis, Baily, Quart. Journ. Geol. Soc., 1855, xi. p. 460, t. 13, f. 1.

Obs.—The specimens before me are all imperfect, as it was found impossible to extract other than imperfect ones from the agglomerate. Such as they are, however, they indicate a tumid, obliquely triangular, carinate and abruptly truncate shell. The cardinal margins are moderately long, and slightly curved, the ventral margins obliquely curved anteriorly, nearly straight centrally, and rounded posteriorly, with the faintest indications of cinctures; the posterior margins are obliquely and sharply truncate. From the not very prominent umbos very elevated keel-like diagonal ridges pass, forming the highest portions of the valves, with the posterior slopes almost at right-angles to them, whilst the remainder of the surfaces are flattened and gradually slope away to the anterior margins. The cardinal areas are moderately wide, triangular, arched on each side of the umbones, and bear about five strong arched ligamental grooves, with indications of vertical teeth in the centre of the articulus. The intermarginal areas within the valves were deeply excavate, the margins of the latter denticulate, and the test solid and thick.

The sculpture is both concentric and radiate, the concentric lines fine, with at irregular distances more deeply impressed latilaminæ, crossed by fine and very numerous costæ, producing by their intersection a fine cancellation.

I believe this to be Baily's species, although the position in which his figure represents the shell renders identification rather difficult. His expression, "the keel is elevated, and is the highest part of the shell," however, completely describes the present fossil. On the other hand the valves of *Arca capensis*, Griesbach,‡ are uniformly rounded, and the diagonal ridges do not constitute the highest portions of the

* Nova Acta Acad. Cæs. Leopol.—Carol. Nat. Gur., 1850, xxii., p. 456, t. 49, f. 2.
† Bornhardt's Deutsch-Ost-Afrika, 1900, vii., t. 19, f. 4 and 5.
‡ Quart. Journ. Geol. Soc., 1871, xxvii., p. 66, t. 3, f. 10, 10*a* and *b*,

valves. As Griesbach expresses it, "Mr. Baily's figure represents a much flatter specimen than mine."

The articulus is imperfect in all the specimens I have examined, but the external appearance of the valves is so unmistakably that of the genus *Trigonarca*, Conrad, particularly those forms figured by Stoliczka from the Indian Cretaceous beds, that I do not hesitate to refer Mr. Anderson's fossils to it. Amongst the Indian species may be mentioned *T. abrupta*, Forbes,* of the Trichinopoly Group, even more than to *T. trichinopolitensis*, Forbes, with which Mr. Baily compared his species.

GENUS LATIARCA, *Conrad*, 1862.

(Proc. Acad. Nat. Sci. Philadel., 1862, xiv.)

LATIARCA (?) NATALENSIS, *Baily*, *sp.*

(Pl. I., Figs. 10–12*a*.)

Arca natalensis, Baily, Quart. Journ. Geol. Soc., 1855, xi., p. 461, t. 13, f. 2*a* and *b*.

Obs.—Numerous fragmentary examples of an Arca, presenting all the external features of Baily's species. They represent a transverse obliquely-ovate shell, produced ventro-posteriorly, inflated, but with the general surfaces gently rounded between the anterior margins and the diagonal ridges, the highest point of each valve being in a line with its umbo. The cardinal margins are very little arched, and the ventral margins rounded, passing obliquely into the anterior margins; the posterior edges are obliquely truncate. The posterior diagonal ridges are obtusely rounded, the posterior slopes flat, and almost at right angles to the remainder of the valve surfaces. The sculpture is both concentric and radiate, with very numerous costæ covering the whole of the valves, sharp at the extremities, somewhat flattened centrally. There are the usual latilaminæ at irregular distances apart, with intermediate fine lines, which in passing over the costæ decussate them and produce a succession of remarkably fine frills. Two of the costæ on the posterior slopes are often more prominent than the others, with the surface between the cardinal margins and the first costa, between the latter and the second, and between this and the posterior diagonal ridges slightly concave, the last concavity exhibiting a central groove. These can even be faintly distinguished in Baily's figure.

It may be added from Baily's description and figure that the cardinal area is large with four divaricating ligamentary grooves. The central cardinal teeth are slightly oblique, the laterals declining outwards, and bent down at their inner ends. The adductor impressions do not appear to be strong, but the intermarginal area is wide, and the margins interlocking.

* Stoliczka, Cret. Fauna S. India (Pal. Ind.), 1871, iii., Pts. 5–8, p. 352, t. 19, f. 4, 5, and 5*a*.

It appears to me, on the whole, that this shell should be referred to *Latiarca*, Conrad, although it is impossible to say, from Baily's figure, whether or no both the central and lateral teeth were striated, or only the latter, as in *Idonearca*, Conrad.

Baily suggested a resemblance between his specimens and *Arca japetica*, Forbes (*Macrodon* vel *Grammatodon*, Stoliczka),* but this form appears to me to be too much inflated.

GENUS CARDIUM, *Linnæus*, 1758.
(Systema Nat., Ed. x., 1758, p. 678.)
CARDIUM BULLEN-NEWTONI, *sp. nov.*
(Pl. II., Figs. 14–16.)

Sp. Char.—Shell ovately subquadrangular, subinequilateral, inflated, especially in the umbonal region; edges internally denticulated; test thick. Cardinal margins short, rather less than the actual width of the valves. Anterior and ventral margins rounded; anterior slopes not truncate, but obliquely declinate. Posterior margins slightly rounded, forming by their junctions with the cardinal margins slight alations; posterior diagonal ridges sharply defined, but not carinate; posterior slopes truncated. Umbonal regions inflated, and the umbones high. Adductor scars faint, but placed high up on the anterior and posterior slopes. Sculpture consisting of numerous (more than twenty) projecting rounded costæ, separated by flat valleys of greater width than themselves, crossed at intervals by fine concentric frills, which echinate the costæ.

Obs.—This is a common and characteristic shell at Umkwelane Hill, but the specimens are always fragmentary. To a slight extent it resembles *Cardium denticulatum*, Baily,† but is much more tumid in the umbonal regions, with the result that the anterior and posterior slopes are more pronounced. The free extension of the costæ on the posterior margins represented in Baily's figure of *C. denticulatum* is not an uncommon feature in species of this genus, and in itself hardly a specific character, although I have seen no definite trace of it in the present shell. The latter is more nearly allied to *C.* (*Acanthocardium*) *pullatum*, Stol.,‡ of the Indian Trichinopoly Group, but seems to be rather more longitudinally elongated, and also to differ in the same points as it does from *C. denticulatum*, but in a less degree. The outline generally is that of *C.* (*Trachycardium*) *productum*, Sby., as figured by Zittel from the Gosau deposits, even to the slight posterior alation in each valve. This species, referred by Stoliczka to *Trachycardium*, Morch, is placed by Gabb § in a special genus—*Granocardium*. The information I possess regarding

* Cret. Fauna S. India (Pal. Ind.), 1871, iii., Pts. 5–8, p. 350, t. 18, f. 6–11.
† Quart. Journ. Geol. Soc., 1855, xi., t. 13, f. 4*a* and *b*.
‡ Cret. Fauna S. India (Pal. Ind.), 1870, iii., Pts. 1–4, p. 218, t. 11, f. 8–10.
§ Pal. California, 1869, ii., Sect. 3, p. 266.

the articulus of *C. Bullen-Newtoni* is very meagre. There seems to be a long and stout projecting cardinal tooth in the right valve. There is no suggestion of the sculpture of *C. productum* and its allies.

GENUS PROTOCARDIUM, *Beyrich*, 1845.

(Zeit. Malakol., 1845, p. 17.)

PROTOCARDIUM HILLANUM, *J. Sby., sp., var.* umkwelanensis, *var. nov.*

(Pl. I., Fig. 6.)

Obs.—A thick rotund subequilateral right valve, with the surface regularly and evenly convex, the posterior slope forming a continuity of the general convexity, and not a truncate surface. The anterior and ventral margins are regularly rounded, and the posterior margins obliquely truncate. The posterior slope occupies slightly less than one-third the width of the valve, and is not separated from the body of the latter by a diagonal ridge, the surface being flush. It is decorated certainly by twelve, and perhaps fourteen, radiating costæ, crossed by wavy concentric laminæ, the remainder of the valve by flattened rugæ, fine on the umbonal region and gradually increasing in strength towards the front.

Griesbach, in his list of Izinhluzabalungu fossils, records *Cardium hillanum*,* to which the present fossil bears a strong resemblance, although it seems to be more produced posteriorly and more truncate. Allowing, however, for the wide variation of form in the Indian shells figured by Stoliczka,† it will be difficult to exclude the present valve from the above species. With the view of distinguishing its occurrence in the Umkwelane beds the above varietal name is used.

GENUS ERIPHYLA, *Gabb*, 1864.

(Pal. California, 1864, i., Sect. 4, p. 180.)

ERIPHYLA LENTICULARIS, *Goldfuss.*

(Pl. I., Figs. 20–21.)

Eriphyla lenticularis (Goldf.), Stoliczka, Cret. Fauna S. India (Pal. Ind.), 1870, iii., Pts. 1–4, p. 181, t. 6, f. 7–13.

Sp. Char.—Shell roundly-discoidal, compressed, but thickest in the middle, gradually sloping away on all sides. Cardinal margins slightly arched; anterior, posterior, and ventral margins rounded and insensibly graduating into one another. Umbones small, pointed, touching; lunule lenticular, moderately deep and long. Sculpture consisting of broad latilaminæ, bearing close regular, fine, concentric lines, becoming more marked towards the front or ventral margin; no radii.

* Quart. Journ. Geol. Soc., 1870, xxvii., p. 62.

† Cret. Fauna S. India (Pal. Ind.), 1870, iii., Pts. 1–4, p. 219, t. 12, f. 8–10; t. 13, f. 1–3.

Obs.—I have not succeeded in isolating the articulus of this fossil, but it is so like the above species of the Upper Cretaceous of Europe, and the Indian Trichinopoly Group, that I do not hesitate to regard the shells collected by Mr. Anderson as a small variety of it. There is also a marked resemblance to Tate's *Astarte pinchiniana*,* from the Uitenhage Formation.

ERIPHYLA (?) RUPERT-JONESI, *sp. nov.*
(Pl. I., Fig. 8.)

Sp. Char.—Shell ovate-subtrigonal, inequilateral, rather compressed. Cardinal margins long; ventral margins rounded. Anterior ends somewhat narrowed, the margins rounded, and the surface gently convex; no pronounced anterior or posterior slopes. Lunule long, elongately heart-shaped, well divided off from the anterior ends. Escutcheon long and deep. Anterior adductor impressions rather excavate; posterior adductor impressions flush with the inner surface of the valves, sub-pyriform in outline, concentrically lined. Pallial lines well within the margins, leaving wide intermarginal areas; sinuses wide and moderately deep; tongues short and wide. Sculpture consisting of very regular concentric rugæ.

Obs.—In common with most of the shells in this deposit, the remains of the present one are too fragmentary to permit of the preparation of a more detailed description. The principal characters are the very oblique anterior outline, a well-marked elongated lunule, and a similar escutcheon.

E. Rupert-Jonesi closely resembles those forms referred to *Eriphyla* by Müller, from Eastern Africa, such as *E. Stuhlmanni*, Müller.† *Venus arcotensis*, Forbes, recorded by Griesbach ‡ from the Izinhluzabulungu Beds, may be distinguished by the characters indicated above, and so may both *Astarte longlandsiana*, Tate,§ and *A. pinchiniana*, Tate, || both occurring in the Uitenhage Formation, as well as *A Hertzogii*, Haurm,¶ of the same beds. The last named species is also a much more inflated one, a feature well shown in Goldfuss' figure.**

The rapidly inclined anterior outline and elongated escutcheon are very like the similar characters of *Astarte* (?) *Barroni*, Newton,†† from the Jurassic beds of Madagascar, but the correspondence stops here. Another species, figured by Müller ‡‡ from the Kimmeridgian of German East Africa—*Astarte, sp.* is by no means unlike.

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* Quart. Journ. Geol. Soc., 1867, xxiii., t. 9, f. 7*a* and *b*.
† Bornhart's Deutsch-Ost-Afrika, 1900, vii., t. 21, f. 3.
‡ Quart. Journ. Geol. Soc., 1871, xxvii., p. 62.
§ *Ibid.*, 1867, xxiii., p. 158, t. 8. f. 5*a* and *b*.
|| *Ibid.*, p. 157, t. 9, f. 7*a* and *b*.
¶ Nova Acta for 1847 (1850), p. 447, t. 47, f. 2*a* to *e*.
** Petrefacta Germaniæ, t. 149, f. 10*b*.
†† Quart. Journ. Geol. Soc., 1889, xlv., t. 14, f. 9.
‡‡ Bornhart's Deutsch-Ost-Afrika, 1900, vii., t. 17, f. 7.

GENUS CYTHEREA, *Lamarck*, 1806.

(Ann. Mus., Paris, 1806, vii., p. 132.)

CYTHEREA (?) KAFFRARIA, *sp. nov.*

(Pl. ii., Figs. 20–22.)

Sp. Char.—Shell of medium size, oblong, gently convex, inequilateral, moderately produced posteriorly. Cardinal margin arched, with a marked degree of obliquity on the posterior end; ventral margins rounded; anterior margins fully rounded; posterior margins obtusely rounded. Umbones small, acute, rather projecting, and very prosogyrate; anterior and posterior slopes ill-defined, no diagonal ridges; lunule inconspicuous, hardly defined from the anterior ends. Sculpture of very sharp and regular concentric rugæ.

Obs.—This is a common shell in the deposit. In the absence of details of the articulus, it is devoid of definite characters, other than the sharp and very prosogyrate umbones, oblique posterior cardinal margin, and very regular concentric rugæ. It possesses a general resemblance to *Cytherea sculpturata*, Stol.,* of the Cretaceous (Arrialoor Group) of Southern India, except that the anterior ends are less produced, the posterior cardinal margin more obliquely inclined, and the lunule is undefined.

GENUS CICATREA, *Stoliczka*, 1870.

(Cret. Fauna S. India (Pal. Ind.), 1870, iii., Pts. 1–4, p. 192.)

CICATREA, *sp. ind.*

(Pl. I., Fig. 13.)

Obs.—An interesting fragment is represented in the above figure that from its very sharp and slightly sigmoidal diagonal keel or ridge and obliquely truncated posterior end suggests a reference to either *Cicatrea*, Stoliczka,† or *Pseudo-trapezium*, Fischer. ‡ It is an internal cast with indications of a thick test, and so far as the outline can be conjectured with a strong resemblance to *Cypricardia bathonica*, D'Orb, § the type of *Pseudo-trapezium*, or to *P. rostratum*, M. and L. sp. || The fragmentary state of the specimen renders it impossible to refer it with any certainty to either of the foregoing genera, and more particularly to *Cicatrea*, with its peculiar articulus and bifurcated ligament groove. Again, a comparison may with advantage be made with a shell termed by Stoliczka *Cyprina Forbesiana*, in which there is also a very strong diagonal ridge. Amongst already described South African fossils *Corbula* (?) *rockiana*, Tate, ¶ from the Uitenhage formation, presents a faint resemblance, but this form is a much less oblique shell.

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* Cretaceous Fauna S. India (Pal. Ind.), 1870, iii., Pts. 1–4, p. 173, t. 7, f. 7–9.
† Cret. Fauna S. India (Pal. Ind.), 1870, iii., Pts. 1–4, p. 192.
‡ Man. Conchyl. et Pal. Conchyl., 1887, fas. 11, p. 1075.
§ Morris and Lycett, Mon. Gt. Oolite Mollusca, 1853, Pt. 2, p. 75, t. 7, f. 8.
|| *Ibid., loc. cit.* f. 9.
¶ Quart. Journ. Geol. Soc., 1867, xxiii., p. 159, t. 8, f. 8.

GENUS TAPES, *Mühlfeldt*, 1811.

(Ges. Nat. Freunde Mag. Berlin, 1811, v., p. 51.)

Obs.—A single and very imperfect specimen (Pl. I., Fig 9) may be referable to this genus.

GENUS DONAX, *Linnæus*, 1758.

(Systema Nat., Ed. x., 1758, p. 682.)

DONAX ANDERSONI, *sp. nov.*

(Pl. II., Figs. 23–25.)

Sp. Char.—Shell small, ovately trigonal, moderately convex. Cardinal margins abruptly arched beneath the umbones, the anterior portions slightly convex, and the posterior rapidly bent down, almost forming right angles; ventral margins rounded dentate.* Anterior ends long, produced, and obtusely pointed; posterior ends short, truncated above, slightly oblique and rounded below. Umbones small, apparently turned to the posterior. Articulus unknown, except that there seems to be a long lateral in the right valve; escutcheon long, occupying the whole of the cardinal margins on the posterior ends. Sculpture of numerous, close, and very fine radiating costæ.

Obs.—When first dealing with this little shell I took it to be a radiate *Nucula*, but the absence of taxodont teeth and a nacreous interior dispelled this idea. By combining the outline and sculpture *Donax* seems to assert the strongest claim, although it is most unfortunate that I have not been able to distinguish the pallial line impressions.

Donax is by no means a common genus in rocks of Cretaceous age. *D. latus*, Gabb,† from beds of this period in California is very like it, possessing a similarly truncated posterior end, and radiate sculpture, but our form does not exhibit the high umbonal region of Gabb's species. *D. Andersoni* is distinguished from *D. Fordii*, Conrad;‡ met with in the Raritan Clays of New Jersey, by possessing a much more truncate posterior end. Stoliczka§ has described an unnamed *Donax* from the Trichinopoly Group of India.

GENUS MACTRA, *Linnæus*, 1767.

(Systema Nat., Ed. xii., Pt. 2, p. 1125.)

MACTRA (?) ZULU, *sp. nov.*

(Pl. II., Figs. 17–19.)

Sp. Char.—Shell small, thin, sub-ovate, almost equilateral, tumid, particularly in the umbonal region. Cardinal margins arched; ventral

* Cret. Fauna S. India (Pal. Ind.), 1870, iii., Pts. 1–4, p. 173, t. 7, f. 7–9.
† Pal. California, 1869, ii., Sect. 2, Pt. 1, p. 183, t. 30, f. 75.
‡ Whitfield, Mon. U.S. Geol. Survey (Powell's), 1885, ix., p. 171, t. 23, f. 1.
§ Cret. Fauna S. India (Pal. Ind.), 1870, iii., Pts. 1–4, p. 136, t. 5, f. 4.

margins rounded. Anterior ends almost equal to the posterior, their margins, although rounded, inclined to become subangular; anterior diagonal ridges rounded and inconspicuous; anterior slopes rounded. Posterior ends slightly produced, obliquely sub-truncate, the margins oblique above; diagonal ridges sharp and keel-like; posterior slopes flattened. Umbonal region prominent, elevated; umbones apparently rather obtuse. Sculpture of regular concentric latilaminæ, bearing fine coincident lines, but assuming a roughened appearance when worn.

Obs.—This is a small and common little shell, with the outward appearance of a *Mactra;* the internal features are unknown. There is a general resemblance to *M. gracilis*, M. and H.* of the Fort Pierre Group, North American Cretaceous, and to *M. nitidula*, M. and H.† of the Fox Hills Group, of the same formation. Müller also figures a small Mollusc from the Neocomian beds of East Africa not unlike it, except that in the latter the shell is proportionately rather too long for its breadth.

GENUS CORBULA, *Bruguière*, 1792.
(Encyclop. Méthod., 1792, t. 230.)
CORBULA, *sp. ind.*
(Pl. II., Figs. 26 and 27.)

Obs.—No true *Corbula* has, so far, I believe, been described from the Upper Mesozoic beds of South Africa. The small shell now under consideration is again an example of the disadvantage arising from dealing with fragmentary material, particularly in the absence of dental characters. I can merely suggest that it may be a *Corbula*, on the grounds of its tumid umbonal region, apparent inclination to the posterior, sub-truncate posterior end, and regular, delicate, concentric rugæ. There also appear to be very delicate, almost microscopic, longitudinal decussating lines.

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2. GASTEROPODA.

GENUS ALARIA, *Morris and Lycett*, 1850.
(Mon. Moll. Gt. Oolite, 1850, Pt. 1, p. 15.)
ALARIA (?) BAILYI, *sp. nov.*
(Pl. III., Figs. 4–8*a*.)

Sp. Char.—Shell fusiform; spire elevated, of numerous whorls (eight or nine); apex obtuse, pupa-like. Whorls moderately convex;

* Report U. S. Geol. Survey Territories (Hayden's), 1876, ix., p. 209, t. 17, f. 18 *a* and *b*.
† *Ibid.*, p. 211, t. 30, f. 6, 6 *a* and *b*.

body-whorl elongately fusiform, expanding into a broad flattened wing, with a rounded and entire margin, the posterior angle obtusely pointed, and no carinæ; sutures shallow. Inner lips slightly reflected; anterior canal moderately long, straight; posterior canal none. Sculpture consisting of very delicate and regular thread-like lines extending over the surface of all the whorls, but more conspicuous on the posterior portions of the anterior whorls contiguous to the sutures; the four or five posterior whorls bear no costæ, but the remainder (anterior) carry regular, equidistant slightly curved ribs, which on the body whorl degenerate into obtuse, elongated tubercles; the intercostal spaces carry fine lines of growth, interrupting the spiral threads on the wing, the spiral threads have an uneven or fluctuating appearance.

Obs.—Portions of this shell are common throughout the deposit, although no absolutely perfect example is present. The wing is without digitations, but terminates at its upper or posterior angle in an obtuse or somewhat thickened point. The margin of the wing is rounded and entire, and there is no carina on the body-whorl. Some forms of *Alaria* possess costæ on the body-whorl—*e.g. A. rostrata*, Gabb, * apparently without carinæ leading to alar digitations. Although perhaps not a typical *Alaria*, the present species appears to coincide with the characters of that genus better than with those of any other. Had it not been for the presence of the long anterior canal, I would have felt disposed to refer this shell to *Arrhoges*, Gabb, from the presence of the obtuse posterior termination of the wing, and the all but entire absence in *Arrhoges* of a posterior canal.

In the structure of its posterior whorls *A.* (?) *Bailyi* exhibits a strong resemblance to *A. papilionacea*, Goldf., as developed in the Indian Trichinopoly Group, but the presence of costæ on the body-whorl of the former at once separates the two forms.

A. (?) *Bailyi* is in no way related to *A. coronata*, Tate,† of the Uitenhage formation.

Genus Fulguraria, *Schumacher*, 1817.

(Essai Nouv. Syst. Hab. Vers Test., 1817, p. 242.)

Fulguraria, *sp. ind.*

(Pl. III., Figs. 12 and 13.)

Obs.—A fusiform testaceous fragment exhibiting the back of the body-whorl, and indications of some of the posterior whorls appears referable to this genus. The sculpture consists of strong equidistant liræ. It appears to be of the type of *F. elongata*, D'Orb.,‡ of the Indian Trichinopoly Group.

* Whitfield, Mon. U. S. Geol. Survey, 1892, xviii., p. 119, t. 14, f. 5 and 6.
† Quart. Journ. Geol. Soc., 1867, xxiii., p. 152, t. 7, f. 9.
‡ Stoliczka, Cret. Fauna S. India (Pal. Ind.), 1867, ii., Pts. 1–4, p. 87, t. 7, f. 1–9.

GENUS ZARIA, *Gray*, 1840.

(Synop. Brit. Mus., 1840?; Ed. 1841, p. 125; Proc. Zool. Soc. 1847, Pt. 15, p. 155.)

ZARIA BONEI, *Baily* (?)

(Pl. II., Figs. 28–31; Pl. III., Fig. 9.)

Turritella Bonei, Baily, Quart. Journ. Geol. Soc., 1855, xi., p. 458, t. 12, f. 7.

Turritella multistriata, Griesbach, Quart. Journ. Geol. Soc., 1870, xxvii., p. 64.

Sp. Char.—Shell small, elongate, tapering. Whorls eight to twelve, ventricose, bevelled above and below the sutures; body-whorl convex below. Sutures deep. Aperture oval to round; inner lip produced somewhat below; outer lip insinuated. Sculpture of from three to five revolving liræ, usually three principal, and two or three subordinate, with other finer revolving striæ, subject to variation.

Obs.—This is a small and delicate shell possessing a readily recognisable sculpture. There are primarily three revolving carinæ on each whorl—*a*, one bounding the anterior edge of the suture; *b*, a second at about two-thirds the depth of the whorl from the same point; and *c*, the third at the edge of the posterior suture of each whorl. In some examples two minor carinæ occur between *b* and *c*, and in others a similar keel between *a* and *b*.

Baily described twelve whorls. I have not actually counted more than eight, but none of my specimens are perfect.

Z. Bonei is of the type of *Z. multistriata* (Reuss) Stol,* from which it appears to differ hardly at all. Stoliczka compares Baily's *Turritella Meadii*† from the Umtafuna beds, with Reuss' species, but it seems to me that the present form is much more closely allied. Mr. C. L. Griesbach appears to have been of a like mind,‡ for he places *Zaria Bonei* as a synonym of *Z. multistriata*, Reuss, and refers *T. Meadii* to *Chemnitzia undosa* (Sby.), Forbes.

The only point of difference that I can detect between the present South African shell and *Z. Bonei*, Baily, s.p., is that of size. The latter is certainly much larger, whilst all the examples of the former maintain a uniform small size.

GENUS PYROPSIS, *Conrad*, 1860.

(Journ. Acad. Nat. Sci. Philadel., 1860, xii., p. 288.)

PYROPSIS (?), *sp. ind.*

(Pl. III., Figs. 10 and 11.)

Obs.—A single mutilated specimen, with portions of the sculpture preserved, may be tentatively referred to *Pyropsis*. The sculpture

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* Cret. Fauna S. India (Pal. Ind.), 1868, ii., Pt. 5, p. 224.

† *Ibid.* p. 226.

‡ Quart. Journ. Geol. Soc., 1871, xxvii., p. 64.

consists of strong liræ on the posterior half of the body-whorl, with longitudinal costæ, becoming tuberculate at the points of intersection. Although longer in the canal than *P. cancellata*, J. de C. Sby., sp.,* of the Indian Trichinopoly Group, it is not unlike that species, although possibly a more slender form. *Pyropsis Bairdi*, M. and H., sp.,† from the Fox Hills Group of the Missouri Cretaceous, may also be advantageously compared.

GENUS PATELLA, *Linnæus*, 1758.
(Systema Nat., Ed. x., 1758, p. 780.)
PATELLA (?), *sp. ind.*
(Pl. III., Fig. 3.)

Obs.—In this instance again there is only a single specimen. It appears to be a much exfoliated example of a patelliform shell, possibly either *Patella* or *Tectura*. It appears to be of about the same degree of elevation as *Patella caperata*, Tate, ‡ of the Uitenhage formation, but in the absence of sculpture it cannot be safely identified with that species.

GENUS CYLICHNA, *Lovén*, 1847.§
(Ofv. K. Vet. Akad. Forhandl., 1846 (1847), p. 142.)
CYLICHNA GRIESBACHI, *sp. nov.*
(Pl. III., Figs. 14 and 15.)

Sp. Char.—Shell small, slightly more attenuated anteriorly than posteriorly, but both ends rounded; umbilicoid cavity wide, with the spire completely immersed, but still visible, and the whorls sloping towards the centre. Aperture slightly curved, broader at the anterior than the posterior end; inner lip apparently slightly reflected, with a minute fissure. Sculpture consisting of revolving deeply-cut striæ on the anterior third, and again forming a zone round the posterior edge of the body-whorl, but finer and crossed by microscopic longitudinal riblets, which disappear on the smooth median portion of the body-whorl.

Obs.—This is a small shell resembling those described by Stoliczka as *Cylichna* or *Bullina*, from the Trichinopoly and Arrialoor Groups of Southern India, although, from the infilling of matrix, I cannot detect a plait on the columella. Stoliczka's *Bullinæ* do not appear to me to coincide with the generally accepted characters of that genus, but more closely resemble *Cylichna*. The fact that the sunken

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* Stoliczka, Cret. Fauna S. India (Pal. Ind.), 1867, ii., Pts. 1–4, p. 154, t. 13, f. 1–4.
† Meek, Mon. U.S. Geol. Survey (Hayden's), 1876, ix., p. 369, t. 31, f. 10 *a* and *b*.
‡ Quart. Journ. Geol. Soc., 1867, xxiii., p. 152, t. 7. f 1.
§ *Non Cylichnus*, Burmeister, 1844.

spire is visible in the umbilicoidal cavity possibly places this shell even near *Mnestia*, H. and A. Adams.

C. Griesbachi is much too slender a species to be identical with *Actæonina Sharpeana*, Tate,* from the Zwartkop Crag. On the other hand, it closely resembles *Cylichna costata*, Gabb,† met with in the Californian Cretaceous. Named in honour of Mr. C. L. Griesbach, now Director of the Geological Survey of India, who, in 1870, contributed an excellent paper on the Geology of Natal.‡

CYLICHNA FUSULINIFORMIS, *sp. nov.*

(Pl. II., Figs. 33 and 34.)

Sp. Char.—Shell obtusely fusiform, rather stout, much more attenuated posteriorly than anteriorly, but both ends rounded. Umbilicoid cavity very minute, pin-point like; spire immersed and hidden. Aperture slightly curved, decidedly narrower posteriorly than anteriorly. Sculpture consisting of deeply-cut revolving striæ extending over the whole body-whorl.

Obs.—This form is obviously different from the preceding, being separated at once by the pin-point-like nature of the umbilicoid cavity, in fact, the apex is almost closed.

The specific name is derived from its more or less spindle-shaped outline, hence to some extent resembling a *Fusulina*.

GENUS ACTÆONINA, *D'Orbigny*, 1850.

(Prodrome Pal., 1850, i., p. 118.)

ACTÆONINA ATHERSTONEI, *Sharpe*, var. UMKWELANENSIS, *var. nov.*

(Pl. II., Fig. 38.)

Actæon Atherstonei, Sharpe, Trans. Geol. Soc., 1856, vii. (2), Pt. 4, p. 200, t. 28, f. 19.

Actæonina Atherstonei, Tate, Quart. Journ. Geol. Soc., 1867, xxiii., p. 170.

Obs.—A single individual exhibits three whorls, inclusive of the body-whorl, but the anterior portion is enveloped in matrix, so obscuring the apex from view. I cannot see any difference, so far as the shell is preserved, between this and Sharpe's figure of his *Actæon Atherstonei*, except in the sculpture. In the latter the whorls are said to be "ornamented on the lower part" only, whereas in the present instance, the spiral striæ are visible both on the posterior portion of the body-whorl and around the suture also, but on the anterior whorls confined to the sutural zone only. For distinction, therefore, I propose the

* Quart. Journ. Geol. Soc., 1867, xxiii., p. 154.
† Pal. California, 1864, i., Sect. 4, p. 143, t. 21, f. 107.
‡ Quart. Journ. Geol. Soc., 1870, xxvii., p. 53.

above varietal name. The variety is also larger than the species proper.

GENUS GYRODES, *Conrad*, 1860.

(Journ. Acad. Nat. Sci. Philadelphia, 1860, iv. (2), p. 289.)

GYRODES (?), *sp. ind.*

(Pl. II., Fig. 32; Pl. III., Fig. 1.)

Obs.—Several imperfect specimens are present in the collection, with the globose body-whorl, widely channelled suture, and oblique sculpture lines of this genus. It possessed three or four whorls in all. There is to some extent a resemblance to *Ampullaria* (?) *ignobilis*, Tate,* of the Zwarkop Crag, but it is difficult to conceive that the present shell possessed the longitudinally elongated mouth of Tate's species. *Natica multistriata*, Baily,† of the Umtafuna and Umzambani beds, does not seem to show the same flattened shoulder round the suture of the body-whorl, as in the present instance.

GENUS CHEMNITZIA, *D'Orbigny*, 1839.

(Webb and Berth., Hist. Nat. Iles Canar., Moll.; *emend.* Pal. Françe Terr. Jurassique, 1851, ii., livr. 65, p. 31.)

CHEMNITZIA, *sp. ind.*

(Pl. III., Fig. 2.)

Obs.—Two fragmentary specimens appear to indicate the presence of this genus in Mr. Anderson's gatherings. Although smaller, if not identical with, they are closely allied to *C. Sutherlandi*, Baily,‡ which Griesbach || renders synonymous with *C. undosa* (Sby.), Forbes, a member of the Trichinopoly fauna. The specimens now before me seem to represent a shell somewhat too flat on the whorls to be identical with Baily's species, and have a deeper insinuation of the outer lip, as evinced by the sculpture.

GENUS SOLARIUM, *Lamarck*, 1799.

(Mèm. Soc. Hist. Nat Paris, 1799, p. 74.)

SOLARIUM, *sp. ind.*

(Pl. II., Figs. 35–37.)

Obs.—Two imperfect examples possess the general facies of *Solarium pulchellum*, Baily,¶ of the Umtafuna and Umzambani beds.

* Quart. Journ. Geol. Soc., 1867, xxiii., p. 153.
† *Ibid.*, 1855, xi., p. 460, t. 12, f. 8*a* and *b*.
‡ *Ibid.*, p. 459, t. 12, f. 5. || *Ibid.*, 1871, xxvii., p. 65.
¶ *Ibid.*, 1855, xi., p. 457, t. 12, f. 3*a* and *b*.

The regular convexity of the whorls is, however, interrupted by a median depression or concavity, which, on the body-whorl, is midway between its periphery and suture. The sculpture is minutely decussate as in Baily's species.

D'Orbigny employed the trivial name *pulchellum* for a Neocomian *Solarium*,* but even anterior to this Michelotti gave the same name to a Falunian species.† To avoid confusion Gabb replaced Baily's name by that of *S. Bailyi*.‡

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3. CEPHALOPODA.

Genus Placenticeras, *Meek*, 1870.

(Proc. Phil. Soc. Philadelphia, 1870, xi., p. 429.)

Placenticeras kaffrarium, *sp. nov.*

(Pl. III., Fig. 16.)

Obs.—This is a portion of an Ammonite of medium size, with very distant, wide ribs, each with a small tubercle above the umbilicus, and a tumid, blunt, low tubercle on the centre of the flank. It is a discoid form, and generally compressed, with a narrow and flat venter, and a series of very small nodes along each edge, crenating it. The umbilicus is telescopic, showing only small portions of the inner whorls. The sutures are faintly visible on portions of the flanks, and appear to have a ragged outline, but not so intimately divided as in *Placenticeras placenta*, De Kay, sp., the type of the genus. The longest diameter is four and a half inches, the transverse diameter (as preserved) three inches, and the thickness one and a quarter inches. The umbilicus is one inch in diameter, and the width of the venter two-eighths of an inch.

The crenating nodes along the edges of the venter resemble those in a similar position on *P. syrtalis*, Morton,§ and *P. guadaloupæ*, Stol. (*non* Roemer).‖

Placenticeras kaffrarium is quite distinct from any other Ammonite figure from South Africa, and, although fragmentary, I venture to bestow on it the above name.

Placenticeras umkwelanensis, *sp. nov.*

(Pl. III., Figs. 17–20.)

Sp. char.—Shell lenticular, small; transverse section trigonal-sagittate; whorls deeply embracing, the older almost hidden by the younger, compressed laterally; flanks flattened, convergent; umbilicus very small, slightly telescopic. Venter very narrow and truncate,

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* Prodrome Pal., 1850, ii., p. 104. † *Ibid.*, 1852, iii., p. 45.

‡ Proc. American Phil. Soc., 1861, viii., p. 95.

§ *P. placanta*, var. *intercalare*, Meek, Report U.S. Geol. Survey Territories (Hayden's), 1876, ix., t. 23, f. 1*a* and *b*.

‖ Foss. Cephalopoda Cret. Rocks S. India (Pal. Ind.), 1864, Pt. 4, t. 47, f. 2.

flat or slightly concave, the abdominal edges sharp: dorsum deeply excavate. Siphuncle comparatively large. Septa with about twelve lateral lobes on each side, with prominent and narrow intervening saddles. Sculpture of fine sigmoidal lines: no tubercles, &c.

Obs.—This little Ammonite is quite of the type of *P. placenta*, De Kay, from the Greensand Marls of New Jersey, and the type of the genus *Placenticeras*. The surface is quite plain, and devoid of tubercles, such as ornament the flanks of *P. syrtalis*, Morton. The suture details are not preserved.

GENUS CRENICERAS, *Munier-Chalmas*.

(Dall in Zittel-Eastman, Text Book Pal., 1890, i., p. 569.)

CRENICERAS (?), *sp. ind.*

(Pl. III., Figs. 21 and 22.)

Obs.—A very small Ammonite, more or less embedded in matrix, but with a longitudinal diameter of seven millimetres. On the flanks are single faint distant costæ, terminating at the abdominal angles in small tubercles. The venter is sharp and bears small projecting tubercles, giving rise to an undulating peripheral outline: these are midway between each pair of abdominal tubercles, and are low and cristiform.

Creniceras Reuggeri, Oppel,* an Oxfordian species, is the only ally I have so far succeeded in finding.

GENUS HAMITES, *Parkinson*, 1811.

(Organic Remains, 1811, iii., p. 144.)

Obs.—A fragmentary fossil (Pl. III., Fig. 23) of doubtful identity, either *Hamites* or *Anisoceras*. It possesses horizontal costæ, unlike those of *H. africanus*, Tate,† of the Uitenhage formation. If an *Anisoceras*, it is similar to that termed by Griesbach, *A. rugatum*, Forbes,‡ from the Umtafuna beds.

GENUS BACULITES, *Lamarck*, 1799.

(Mém. Soc. Hist. Nat., Paris, 1799.)

Obs.—A partly exfoliated smooth fragment (Pl. III., Fig. 24), just sufficient remaining to prove the presence of yet another Cephalopod in these beds. There is no trace of the sulcations visible

* Dall, *loc. cit.*, p. 569, f. 1178.
† Quart. Journ. Geol. Soc., 1867, xxiii., p. 150, t. 7, f. 5*a–d*.
‡ *Ibid.*, 1871, xxvii., p. 63, t. 3, f. 4.

on the surface of *B. sulcatus*, Baily,* from the Umtafuna beds. From the absence of costæ, it might even be a portion of a *Ptychoceras*.

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4. PISCES.

Obs.—The remains of Fish are indicated by the presence of two fragmentary *Lamna* teeth (Pl. III., Fig. 25), of the *Lamna appendiculata* type, indicating the presence of a Shark in the Umkwelane beds.

I also figure a spine (Pl. III., Fig. 26), the only one represented in the collection, and which I have not been able to determine.

III.—GEOLOGICAL RESULTS.

In the foregoing pages I have endeavoured to demonstrate the existence in the Umkwelane Hill shell-agglomerate of at least thirty-seven species of Mollusca, either as definite specific forms, capable of future recognition, or, as indicated forms, that are certainly distinct from those in the same category, although not sufficiently perfect to warrant the attachment of specific names. These are distributed as follows:—

Pelecypoda	...	...	...	...	...	21
Gasteropoda	...	...	...	...	...	11
Cephalopoda	...	...	...	...	...	5
						37

Very divergent views are entertained by authorities on the age of the various sub-divisions of the South African Mesozoic Series, but the trend of opinion seems to be to regard the whole, from the Uitenhage formation upwards, as Cretaceous. It is not my intention to enter on a discussion of so wide a subject, but those interested in the question will find a summary in a paper "On the Occurrence" "of *Alectryonia ungulata*, in S.E. Africa; with a Notice of previous" "researches on the Cretaceous Conchology of Southern Africa," by Mr. R. B. Newton.†

The view adopted by Dr. Franz Kossmat,‡ one of the latest, if not the latest writer on the subject, and who has compared the South Indian Cretaceous with that of South Africa and other world-wide areas, is expressed in the following table of the South African Cretaceous. It is taken from both Dr. Kossmat and Mr. Newton's papers, but with the addition of the local terminology and the stratigraphical subdivisions given by Griesbach.¶

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* Quart. Journ. Geol. Soc., 1855, xi., p. 457, t. 11, f. 5*a-c*.

† Journ. Conch., 1896, viii., No. 5, p. 136 (Summary, p. 147).

‡ Jahrb. k. k. Geol. Reichsanstalt, Wien, 1894, xliv., 3 and 4 Hefts, p. 459.

¶ The stratigraphical sub-divisions of Kossmat's table are virtually the same as those previously published by Mr. C. L. Griesbach (Quart. Journ. Geol. Soc., 1871, xxvii., p. 62).

UPPER CRETACEOUS.

S. African Local Sub-divisions.	S. African Sub-divisions of Griesbach,* &c.	Indian Equivalents.	European Equivalents.
Umtafuna or Umzambani Beds (*Baily*).	*a*. Chalk ("hard limestone") with *Puzosia Gardeni*, Baily, sp.	Arrialoor Group.	*Senonian*, or Upper Chalk.
	b. Sandstone and grit, with "many fossils," mostly bivalves and univalves.	Trichinopoly Group.	*Turonian*, or Lower Chalk.
= Izinhluzabalungu Deposits (*Griesbach*).	*c*. Sandstones and grits, with *Schloenbachia umbolazi*, Baily, sp.; *S. Soutoni*, Baily, sp.; *S. Strangeri*, Baily, sp.; *Anisoceras rugatum*, Forbes, &c.	Ootatoor Group.	*Cenomanian*, or Chalk Marl, Chloritic Marl, Upper Greensand, and Gault.
Umtamfunaschichten (*Schenck*).	*d*. Soft brown sandstone, with *Trigonia Shepstonei*.		
	e. Chalky sandstone, with *Teredo*-bored wood.		

LOWER CRETACEOUS (NEOCOMIAN).

Uitenhage Formation (S. Africa).

It will be seen by a glance at Table A that I regard three species of Pelecypoda as identical, to all intents and purposes, with an equal number from the South African Upper Cretaceous; two others represented by allied forms in the same formation, and two Gasteropods, whilst one bivalve and one univalve appear to possess allied species in the South African Lower Cretaceous.

TABLE A.

Species, occurring elsewhere, allied to certain of those described in this paper.

Umkwelane Hill Species.	Allied Species.	Horizon.
Trigonarca umzambaniensis, *Baily*.	T. abrupta, *Forbes*.	Trichinopoly Group, India.
Cytherea Kaffraria, *Mihi*.	C. sculpturata, *Stol*.	Arrialoor Group, India.
Eriphyla lenticularis, *Goldf*.	E. lenticularis (*Stol*), *Goldf*.	Trichinopoly Group, India.
„ (?) Rupert-Jonesi, *Mihi*.	E. Stuhlmanni, *Müller*.	Neocomian of German East Africa.
Cardium Bullen-Newtoni, *Mihi*.	C. (Acanthocardium) pullatum, *Stol*.	Trichinopoly Group, India.
Protocardium hillanum, *Sby*., *var*. umkwelanensis, *Mihi*.	P. hillanum (*Sby*.), *Stol*.	„ „ „
Donax Andersoni, *Mihi*.	D. latus, *Gabb*.	Tejon Group, California.
Mactra zulu, *Mihi*.	M. gracilis, *Meek* and *Hayden*.	Fort Pierre Group.
	M. nitidula, *Meek* and *Hayden*.	Foxhills Group.
Alaria (?) Bailyi, *Mihi*.	A. papilionacea (*Goldf*.), *Stol*.	Trichinopoly Group, India.
Pyropsis, *sp. ind*.	P. cancellata, *J. de C. Sby*.	„ „ „
	P. Bairdi, *Meek* and *Hayden*.	Foxhills Group.
Cylichna Griesbachi, *Mihi*.	C. costata, *Gabb*.	Chico and Tejon Groups, California.
Chemnitzia, *sp. ind*.	C. undosa (*Sby*.), *Stol*.	Trichinopoly Group, India.
Fulguraria (?), *sp. ind*.	F. elongata (*D'Orb*.), *Stol*.	Trichinopoly and Arrialoor Groups, India.
Zaria Bonei, *Baily*.	Z. multistriata (*Ruess*), *Stol*.	Trichinopoly and Arrialoor Groups, India.
Placenticeras umkwelanensis, *Mihi*.	P. placenta, *De Kay*.	Greensands of New Jersey.

* In descending order.

From Table B it will be apparent that as regards exotic alliances, the Trichinopoly Group, and to some extent the Arrialoor Group also, of Southern India, claim a fair proportion of those that can be satisfactorily made out, thus :—

	Pelecypoda.	Gasteropoda.
Trichinopoly Group	4	5
Arrialoor ,, ...	1	3

TABLE B.

Principal Species believed to be identical with, or closely related to, already described South African forms.

Umkwelane Hill Species.	Already Described South African Species.	Horizon.
Exogyra, *sp. ind.*	Ostrea (Exogyra) jonesiana, *Tate* + Placunopsis imbricata, *Tate*.	Uitenhage Formation.
Trigonarca umzambaniensis, *Baily*.	T. umzambaniensis, *Baily*.	Umtafuna Beds.
Latiarca natalensis, *Baily*.	L. natalensis, *Baily*.	,, ,,
Protocardium hillanum, *Sby*, *var.* umkwelanensis, *Mihi*.	P. hillanum, *Sby*.	,, ,,
Actæonina Atherstonei, *Sharpe*, *var.* umkwelanensis, *Mihi*.	A. Atherstonei, *Sharpe*.	Uitenhage Formation.
Chemnitzia, *sp. ind.*	C. Sutherlandi, *Baily* (= C. undosa, *Sby*).	Umtafuna Beds.
Solarium, *sp. ind.*	S. pulchellum, *Baily*.	,, ,,

Puzosia Gardeni, Baily, sp., has not been observed in the present collection, nor any of the Ammonites mentioned as occurring in Griesbach's stratum *c*, nor *Teredo*-bored wood as in *e* of the same author. The fauna of the Umkwelane Hill Deposit consists, with few exceptions, of bivalves and univalves, like that of Griesbach's stratum *b*, and some of the species are identical with those met with in the latter. There appears to be a close connection between the fossils of the two beds, possibly they may actually be on the same horizon.

I do not trace any resemblance between these fossils and those forming the Australian Cretaceous fauna.

EXPLANATION

OF

PLATES.

Unless otherwise stated, the figures in Plates I., II., and III. represent the specimens of the natural size.

PLATE I.

TRIGONARCA UMZAMBANIENSIS, *Baily, sp.*

FIG. 1.—An imperfect right valve, with sculpture.
2.—An imperfect left valve, with sculpture.
3.—The subject of Fig. 2 seen from the dorsal side to show the abrupt posterior slope and generally flattened outline of the valve.
4.—Internal cast of a smaller right valve, showing the pallial line and crenulated inner ventral margin.
5.—Portion of the area and cardinal margin of the subject of Fig. 1.

PROTOCARDIUM HILLANUM, *Sby., sp., var.* UMKWELANENSIS, *Eth. fil.*

6.—A right valve exhibiting the concentric and radiate sculpture.

MYTILUS (?), *sp. ind.*

7.—Portion of a right valve, possibly referable to this genus.

ERIPHYLA (?) RUPERT-JONESI, *Eth. fil.*

8.—A nearly complete right valve.

TAPES (?), *sp. ind.*

9.—A nearly complete left valve, with a portion of the sculpture preserved.

LATIARCA NATALENSIS, *Baily, sp.*

10.—Portion of a right valve.
11.—Nearly complete right valve of a young individual.
12.—Portion of a left valve, with the sculpture preserved.
12A.—A small portion of sculpture from Fig. 12 enlarged.

CICATREA (?), *sp. ind.*

13.—Portion of a right valve (cast), with a sharp diagonal ridge and steep posterior slope.

TRIGONIA UMKWELANENSIS, *Eth. fil.*

14.—Internal cast of a left valve.
15.—A testaceous left valve.
16.—Similar to Fig. 15.
17.—Portion of a testaceous right valve, with the sub-concentric rugæ on the posterior slope.
18.—A portion of the posterior slope of the specimen represented by Fig. 17—x 2.
19.—Internal cast of a full-grown left valve.

ERIPHYLA LENTICULARIS, *Goldf. sp.*

20.—A nearly complete right valve.
21.—A smaller and similar specimen.

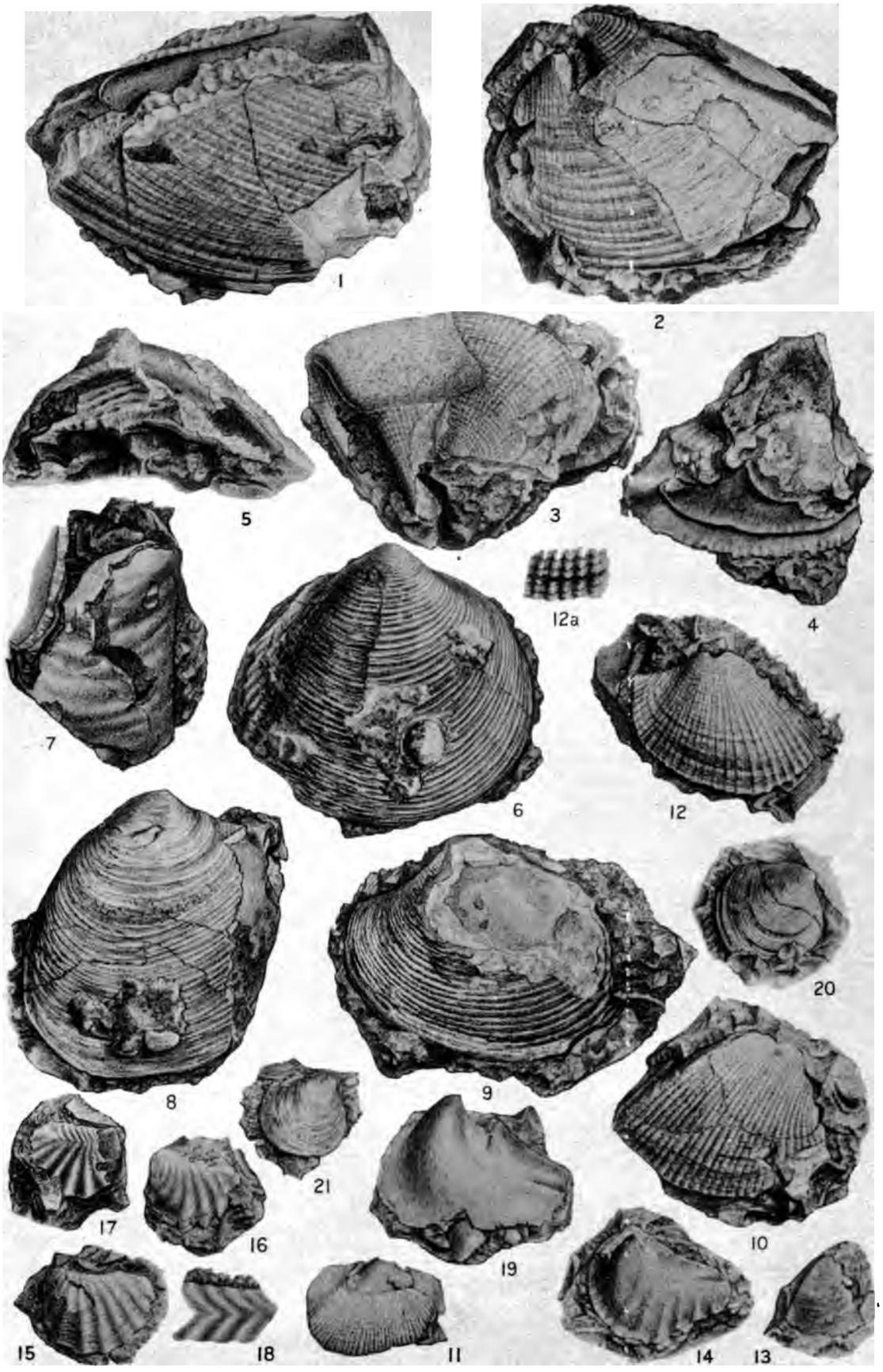

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PLATE II.

OSTREA, *sps. ind.*

FIG. 1.—Internal cast of an *Ostrea*-like shell, with a sub-central adductor impression.
2.—A small thin flat valve, with an obscure umbo and a few concentric laminæ—x 2.

EXOGYRA (?), *sp. ind.*

3.—A thin valve, possibly referable to this genus, resembling *Placunopsis imbricata*, Tate.
4.—Another specimen allied to *Ostrea* (*Exogyra*) *jonesiana*, Tate.
5.—An internal cast.
6.—Another example similar to Fig. 3—x 2.

MELINA ANDERSONI, *Eth. fil.*

7.—A left valve, more or less perfect, with strong concentric growth rugæ.
8.—Right and left valves of the same individual.
9.—A right valve.
10.—Portion of the cardinal margin exhibiting resilifers—x 2.

GERVILLIA, *sps. ind.*

11.—A small form, after the type of *G. linguloides*, Forbes—x 2.
12.—A second species to some extent resembling *G. alæformis*, D'Orb.—x 2.

NEITHEA (?), *sp. ind.*

13.—Portion of an internal cast of the convex valve.

CARDIUM BULLEN-NEWTONI, *Eth. fil.*

14.—Internal cast of a more or less perfect internal cast.
15.—A similar but larger example, exhibiting the strong diagonal ridge and steep
16.—A left valve showing traces of sculpture. [posterior slope.

MACTRA (?) ZULU, *Eth. fil.*

17.—A left (?) valve retaining the test and sculpture—x 2.
18.—Another example of the same—x 2.
19.—The regular concentric sculpture—x 3.

CYTHEREA (?) KAFFRARIA, *Eth. fil.*

20.—A nearly complete right valve, with the remains of sculpture lines.
21.—An imperfect internal cast of a left valve.
22.—Sculpture—x 3.

DONAX ANDERSONI, *Eth. fil.*

23.—A left valve, with nearly the whole of the test preserved, exhibiting radiate
24.—Internal cast of a left valve—x 2. [sculpture—x 2.
25.—Partial internal cast of a left valve—x 2.

CORBULA (?), *sp. ind.*

26.—A left (?) valve retaining the test and sculpture—x 2.
27.—Sculpture—x 3.

ZARIA BONEI, *Baily, sp.*

28.—A specimen showing eight whorls, each whorl with three revolving carinæ—x 3.
29.—Another individual with six whorls preserved, and a like number of revolving carinæ—x 3.
30.—A whorl on which there are three principal revolving carinæ, and supplementary intermediate ones—x 3.
31.—An entire whorl, and portion of a second with revolving carinæ similar to those of Fig. 30, but more oblique—x 3.

GYRODES, *sp. ind.*

32.—Body-whorl and portion of the penultimate whorl.

CYLICHNA FUSULINIFORMIS, *Eth. fil.*

33.—A specimen exhibiting the sculpture—x 3.
34.—Apex with the immersed spire—x 3.

SOLARIUM, *sp. ind.*

35.—A specimen seen from above—x 2.
36.—The same lateral view—x 2.
37.—Sculpture—x 2.

ACTÆONINA ATHERSTONI, *Sharpe, sp., var.* UMKWELANENSIS, *Eth. fil.*

38.—An example with sculpture, lateral view—x 3.

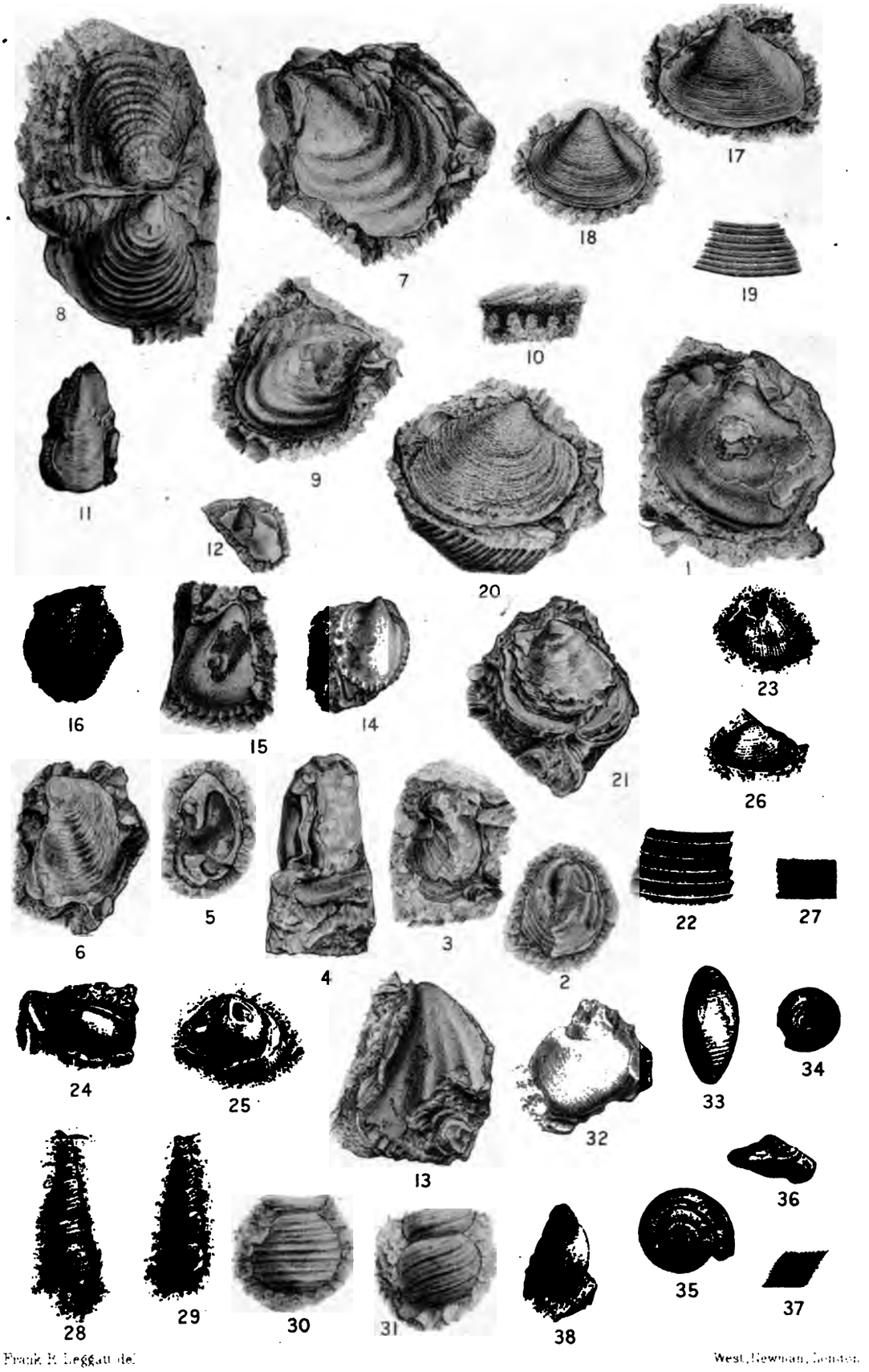

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PLATE III.

GYRODES, *sp ind.*

FIG. 1.—A shell of three whorls, with delicate oblique linear sculpture—x 3.

CHEMNITZIA SUTHERLANDI, *Baily* (?).

2.—Portions of two whorls with traces of sigmoidal linear sculpture—x 3.

PATELLA (?), *sp. ind.*

3.—A much exfoliated shell, possibly referable to this genus.

ALARIA (?) BAILYI, *Eth. fil.*

4.—An individual of seven whorls, inclusive of the body-whorl in part, exhibiting strong costæ on the four middle whorls, delicate lines of growth, but no tubercles on the body-whorl, and delicate transverse sculpture below the sutures—x 2.

5.—Body-whorl and three adjacent whorls; the three upper with costæ as in Fig. 4, and the body-whorl with obtuse tubercles, lines of growth, and broad flattened wing, with its entire margin.

6.—An imperfect body-whorl, with remains of the penultimate and anti-penultimate whorls; the body-whorl retaining the base of the anterior canal.

7.—Body-whorl exhibiting the obtuse tubercles and broken anterior canal.

8.—Two of the whorls (intermediate) exhibiting the costæ and sutural cross lineation—x 4.

8A.—Pupa-like apex—x 2.

ZARIA BONEI, *Baily, sp.* (?).

9.—Three whorls, each whorl with three strong oblique revolving carinæ—x 4.

PYROPSIS (?), *sp. ind.*

10.—An imperfect shell, possibly referable to this genus.

11.—The same specimen (Fig. 10) displaying the mouth.

FULGURARIA (?), *sp. ind.*

12.—Portion of an imperfect shell, having some of the characters of this genus, lower

13.—The same specimen (Fig. 12) seen from the upper side. [view.

CYLICHNA GRIESBACHI, *Eth. fil.*

14.—An example seen from the upper side, exhibiting the revolving striæ on the anterior part and the longitudinal striæ on the posterior portion of the whorl—3.

15.—The apex of Fig. 14, with immersed whorls—x 3.

PLACENTICERAS KAFFRARIUM, *Eth. fil.*

16.—About one-half of the Ammonite, with wide-apart obtuse ribs, and obtuse tubercles around the umbilical cavity.

PLACENTICERAS UMKWELANENSIS, *Eth. fil.*

17.—The Ammonite, side view.

18.—Portion of a larger specimen, showing weathered sutures.

19.—Section, naturally fractured, displaying lobes and saddles.

20.—The venter with keel.

CRENICERAS (?), *sp. ind.*

21.—Portion of a whorl with costæ, abdominal tubercles, and smaller tubercles along

22.—The venter with its small tubercles—x 3. [the venter—x 3.

HAMITES (?), *sp. ind.*

23.—Portion of a shell, with plain horizontal costæ—x 2.

BACULITES (?), *sp. ind.*

24.—Fragment possibly referable to this genus.

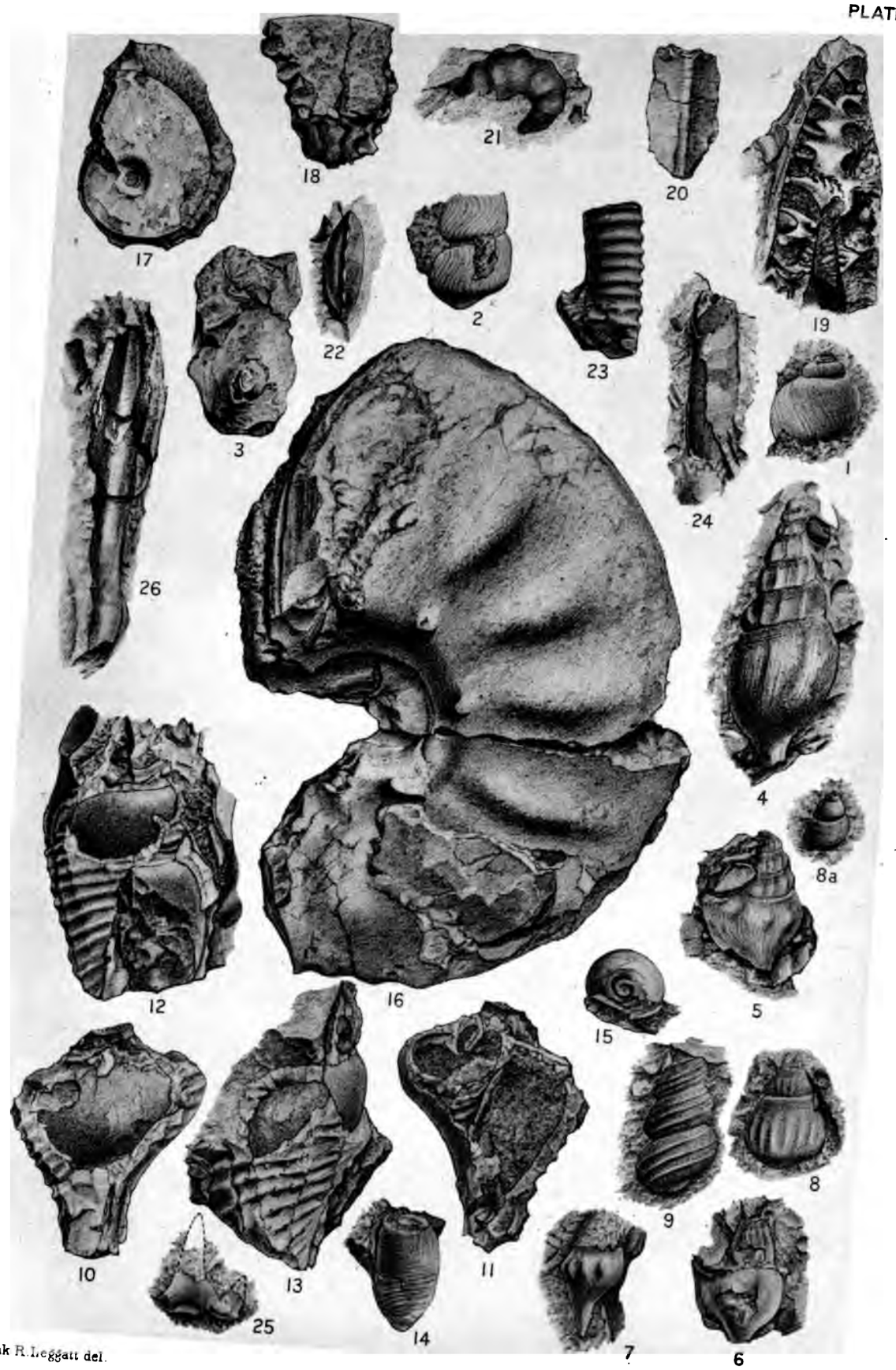
LAMNA, *sp. ind.*

25.—Basal portion of a tooth—x 2.

SPINE.

26.—Imperfect spine, undetermined—x 2.

PLATE III.



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