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5. *On the Cephalopoda of the Uitenhage Beds.*

By L. F. Spath, D.Sc., F.G.S.

(With Plates XIII–XV and 1 Text-figure.)

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I. Introduction.

The Invertebrata of the Uitenhage fauna have received such admirable and exhaustive treatment at the hand of Dr. F. L. Kitchin * that a fresh discussion of some of the Cephalopods may seem unnecessary. I have, however, lately had the privilege of examining a very fine collection of Uitenhage Ammonoidea, made by Dr. S. H. Haughton in the course of his survey work. This collection comprises not only some new forms, notably an example of a genus (*Eodesmoceras*) not hitherto recorded from these beds (or indeed from

* "The Invertebrate Fauna and Palaeontological Relations of the Uitenhage Series," Annals S. Afr. Mus., vol. vii, part 2, No. 3, 1908.

Africa), but specimens of previously known forms that on account of more favourable preservation supplement our knowledge. Additional illustrations of these species or their suture-lines may thus prove generally acceptable. Moreover, a number of specimens in the British Museum, not previously recorded, on closer study also proved worthy of description or illustration. In the present paper the number of Cephalopoda known from the Uitenhage Beds is thus brought up to twenty; eight of these were not represented in the collections examined by Dr. Kitchin.

My best thanks are due to Dr. S. H. Haughton for submitting this interesting fauna to me, and to Dr. W. D. Lang, F.R.S., the Keeper of the Geological Department of the British Museum (Natural History), for facilitating my work by allowing me, as always, to make the fullest possible use of the rich collections in his charge.

II. Remarks on the Uitenhage Fauna.

The most striking features of the Cephalopod fauna of the Uitenhage Beds are, first, the abundance of gigantic Olcostephanids, apparently unknown (in a similar size) from anywhere else, also of *Bochianites africanus*, and, second, the apparent scarcity of the other forms recorded, as of Belemnites and Nautili. This may be due partly to accidents of collection, but it is a characteristic that cannot fail to impress any observer who compares the Uitenhage fauna with a corresponding assemblage from another part of the world. Thus at Speeton,* in bed D_2, there occur *Rogersites* (though small in comparison with those of the Uitenhage Beds) associated with the same type of *Bochianites*—that is to say, there occur the two dominant Uitenhage genera, in the company of similar *Hoplitides* and *Distoloceras*. One of the last was, in fact, attached to an Uitenhage species (*Distoloceras spinosissimum*, Hausmann). There can be no doubt that the Uitenhage fauna is of Upper Valanginian age and corresponds to my Hoplitidan age or to what in the south of France has been called the "zone of *Saynoceras verrucosum* and *Kilianella roubaudiana*." Unfortunately no finer zoning of the beds in the Uitenhage Series is as yet possible.

In the Speeton succession Belemnites form the most important element of the cephalopod fauna; and as Danford † has shown,

* Spath, "The Ammonites of the Speeton Clay and the Subdivisions of the Neocomian," Geol. Mag., vol. lxi, 1924, table to p. 80.

† "Notes on the Belemnites of the Speeton Clays," Trans. Hull Geol. Soc., vol. v, part 1, 1906, p. 6.

" they swarm at the very compact base of D_2, *Belemnites lateralis* and *B. russiensis* being perhaps most abundant, while the Compound Nodular Band (D_1) seems mainly tenanted by *B. explanatoides*." In Northern Germany, also, according to Stolley,* *Acroteuthis*, almost the only group of Belemnites represented in the Lower Neocomian, is of the greatest importance, whilst *Hibolites*, so abundant in the Mediterranean Valanginian, is practically absent. The fresh-water beds of the south of England and the Boulonnais, of course, yield no Cephalopods; but when marine beds appear again, at the south-eastern border of the Paris Basin (Aube, Yonne), only doubtful *Rhynchoteuthis* are recorded. In the Southern Mediterranean facies, however, in addition to the *Hibolites* just mentioned and the characteristic flattened Belemnites of the genus *Duvalia*, there is a rich ammonite fauna, including not only numerous Neocomitids, but abundant Phylloceratids and Lytoceratids. The last are entirely unknown from the Uitenhage Beds, and forms of the other two ammonite families are extremely rare in comparison with the dominant Olcostephanids and *Bochianites*.

In North Africa we meet with the same Mediterranean facies; and in Tunisia, at least, the pyritised ammonites of the Valanginian marls (in localities like Hammam Lif) are the same as those of South-eastern France. But according to Haug † the abundance of *Duvalia* in the Lowest Cretaceous of Madagascar makes it necessary to attach this to the Mediterranean Province and indicates in a certain manner the existence of direct communications with the Tethys.

The Neocomian fauna recorded by Wray ‡ from Fernao Vellozo in Mozambique (Portuguese East Africa) was regarded as presenting a facies resembling that of the Uitenhage Series. Newton § referred to the fossils, presented by Mr. Wray to the British Museum, as awaiting systematic description; and as his two ammonites are before me, I may briefly discuss them in this connection. One was quite correctly compared to *Rogersites schenki* (Oppel), and does not differ, except in its small size, from such Uitenhage *Rogersites* (admittedly of very narrow specific interpretation) as those listed below under *R. sphaeroidalis* (*e.g.* No. 194). The second example, described by

* " Belemniten der Unteren Kreide Norddeutschlands," IV. Jahresb. Niedersachs. Geol. Ver. Hannover (Geol. Abt.), 1911, p. 177.

† Traité de Géologie, vol. ii. fasc. 2, 1907, p. 1232.

‡ " Observations sur la géologie du district de Mozambique," Comm. Serv. Géol. Portugal, vol. xi, 1915, pp. 69–84.

§ Appendix to Teale, " Geology of Portuguese East Africa, etc.," Trans. Geol. Soc. S. Afr., vol. xxvi (1923), 1924, p. 157.

Mr. Wray as a small *Phylloceras*, " not sufficiently well preserved to allow of specific determination," I believe to be a *Neolissoceras*, probably *N. grasianum* (d'Orbigny) itself, which species, according to Kilian,* ranges from the *boissieri* zone or the Infravalanginian up to the Hauterivian. It also is a Mediterranean element.

But any attempt to consider the Uitenhage fauna more closely comparable to such an assemblage (with Polyptychitids) as that found at Speeton, than to Mediterranean faunas seems to be negatived by the comparatively rich *Lytoceras* fauna known from Mahiba Hill, west of Port Amelia, Portuguese East Africa. When the late Mr. R. B. Newton † first recorded this fauna, including Belemnites, he stated that I had considered the *Lytoceras* fragments insufficient for stratigraphical purposes, but quite well supporting a lower Cretaceous horizon. Unfortunately Mr. Newton at that time did not realise the value of some other fragments in the same collection, for he only showed me some of the more favourably preserved examples of *Lytoceras* of that assemblage. Even these are not specifically determinable, but the portion of the periphery of a Neocomitid (*Lyticoceras* of the type of *L. regalis* [Bean] or *Neocomites neocomiensis* [d'Orbigny] as figured by Sayn ‡), and the impression of a fragment of the Uitenhage *Bochianites africanus* are decisive and unmistakable. These are accompanied by similarly characteristic forms of the Belemnite genus *Duvalia*. From Madagascar the latter is recorded together with the Infravalanginian genus *Protacanthodiscus* (group of *Hoplites andreaei*, Kilian), doubtful Neocomitids, and the later *Rogersites madagascariensis* (Lemoine §), which, as Kilian || has pointed out, belongs to the group of *R. atherstoni*, and cannot be compared to the boreal genus *Simbirskites*. There is thus no doubt that the Valanginian ammonites of both Madagascar and Portuguese East Africa confirm Haug's view, already quoted, and it appears probable that the curious resemblance between *Rogersites* and the Polyptychitids, hitherto known almost entirely from the boreal province, is a case of homoeomorphy, although both sprang from *Spiticeras*.

In view of the occurrence of Valanginian deposits and genera with Mediterranean affinities further south, it would not be surprising to

* In Frech, Lethaea Geognostica, II, Mesozoicum, 3. Kreide, I, 1 (1910), p. 174.

† *Loc. cit.*, Trans. Geol. Soc. S. Afr., vol. xxvi, 1924, p. 156.

‡ " Ammonites pyriteuses des marnes valanginiennes du S. E. de la France," Mém. Soc. Géol. France, vol. xv, fasc. 2, Mem. No. 23², 1907, pl. vii, figs. 5*b*, 6*b*.

§ Études Géologiques dans le Nord de Madagascar, Paris, 1906, p. 182, pl. i, fig. 3.

|| *Loc. cit.*, Lethaea, 1910, p. 215.

find them also in Tanganyika Territory. No ammonites of undoubted pre-Hauterivian and post-Portlandian age, however, seem as yet to have been discovered in this part of Africa. Krenkel * already thought it probable that there was a considerable gap between the Upper Jurassic and the Lower Cretaceous; but he wrongly assumed some Hauterivian forms he described to be comparable to Valanginian Uitenhage species. His "*Holcostephanus*" *dacquei* belongs to the *sulcosus* group (=*Subastieria*, Spath) which, at Speeton, is even later than the true *Olcostephanus* of the basal Hauterivian. Also Krenkel's "new variety" of *Phylloceras rogersi*, Kitchin, since renamed by Zwierzycki, is as unsuitable for exact dating as are obviously the lamellibranchs. Among the Tanganyika forms later described by Zwierzycki † as coming from the *Trigonia schwarzi* beds, there is, indeed, a form that may be a *Valanginites*, namely, "*Holcostephanus*" *crassus* Zwierzycki; there are also some very doubtful fragments attributed to "*Hoplites*" cf. *neocomiensis* (d'Orbigny), and a "*Bochianites*" that on account of its more elaborate suture-line does not compare well with the Valanginian species known. But in the new collections from the *Trigonia schwarzi* beds of Tendaguru, now before me, there is not a single form that can be attributed to a pre-Hauterivian species; and the "*Astieria*" forms from Mikadi, especially, including all the species described by Zwierzycki, are true *Holcostephanus* and show no close similarity to the presumably earlier Uitenhage *Rogersites* here discussed. On the other hand they are associated not only with Hauterivian Holcodiscids and Crioceratids, and with Barremian *Heteroceras*, Lytoceratids, etc., but even with Lower Aptian *Ancyloceras* and *Prochelonicera*s, in the same facies (from Niongala). There is apparently a conformable succession from the Hauterivian to the Aptian; but there are no undoubted Valanginian ammonites, and perhaps no marine equivalent of the Uitenhage beds.

Whether the Upper Saurian Beds of Tendaguru with traces of a Wealden flora, but now correlated with the Purbeck,‡ are of a

* "Untere Kreide von Deutsch-Ostafrika," Beitr. Pal. Geol. Österr.-Ung., vol. xxiii, 1910, p. 230.

† "Cephalopoden Fauna der Tendaguru Schichten in Deutsch-Ostafrika," Wiss. Ergeb. Tendaguru Exped., 1909–12, pt. 3, Archiv f. Biontologie, vol. iii, Heft 4, 1914, p. 83.

‡ See Dietrich. "Das Alter der Trigonien Schichten am Tendaguru," Centralblatt fur Mineralogie, etc., B, 1927, p. 63. Since the above was written, Dr. F. L. Kitchin's important paper, "On the Age of the Upper and Middle Deinosaur Deposits at Tendaguru, Tanganyika Territory," has appeared (Geol. Mag., vol. lxvi, No. 779, May 1929, pp. 193–220).

corresponding age is doubtful. It seems improbable that they completely bridge the wide gap between the basal Hauterivian above and the *Trigonia smeei* beds with Portlandian ammonites below. But it may be advisable to discuss the relations of these *smeei* beds with the so-called Umia group of Kachh, since this is also often compared with the Uitenhage Series, and since we cannot trace the Neocomian farther northward, nothing pre-Barremian being known from either Jebel Moghara, east of Suez,* or from Somaliland.† On a previous occasion,‡ however, I recorded certain doubtful (either entirely new or else poorly preserved) ammonites from Somaliland that might have belonged to the *privasensis* zone of the uppermost Jurassic (Tithonian) or the *boissieri* zone of the Lowest Cretaceous (Infra-Valanginian). They were somewhat reminiscent of Mediterranean types, like Pomel's forms from Lamoricière in Algeria and the Infra-Valanginian of Tunisia, and resembled the fauna of the lowest Cretaceous of the Argentine, since described; and although I stated that the existence, in that part of Somaliland, of beds of so late an age was not yet proved, yet I thought it would tend to confirm a temporary marine transgression across Northern Africa during Tithonian and Lower Cretaceous times. It may be recalled in this connection that the Upper Kimmeridgian ammonites described, including Virgatitids, were also entirely new, and that nothing like them was known from the whole of Africa or the Indo-Madagascan Province.

Now, in Kachh we have the Katrol Beds of Gudjinsir in the northwest, which were considered by Waagen to represent the lowest Katrol, apparently resting directly on the Dhosa Oolite. In reality these beds are much later than the Katrol Beds of the Katrol Range and the south of Kachh generally. They yield an abundance of *Haploceras elimatum* (Oppel) in addition to *Hildoglochiceras*, a *Streblites*, *Ptychophylloceras angelini*, *P. gemminum* (Oppel), etc., and Perisphinctids of the *sparsiplicatus* group to be described in the next part of my Revision of the Jurassic Cephalopod Fauna of Kachh. This is not unlike the fauna of the *Trigonia smeei* beds of Tanganyika, perhaps also of the glauconitic sandstones of Antsalova in Madagascar;

* H. Douvillé, "Terrains Secondaires dans le Massif du Moghara. Paléont.," Mém. Acad. Sci., vol. liv (2), 1916, pp. 89 ff.

† Mayer-Eymar, "Über Neocom-Versteinerungen aus dem Somaliland," Vierteljahrschr. Naturf. Ges. Zürich, vol. xxxviii, 1893, pp. 1–17.

‡ "Ammonites and Aptychi," Part VII of Monograph on Collection of Fossils and Rocks from Somaliland, Hunterian Museum, Glasgow, 1925. pp. 111–164.

and it is now taken to be of Portlandian age rather than Upper Kimmeridgian. The *Zamia* shales of Wynne * are possibly still higher. On the other side of the Jumara Dome (north-west) where there is an unexamined series of rocks between the Dhosa Oolite scarp and the lowest ammonite-bearing bed of the Umia group, the latter has yielded an abundance of often gigantic *Virgatosphinctes* † of the *denseplicatus-frequens* group ; but there is a second ridge of similar oolitic rock with still later Tithonian ammonites behind it, yielding new species comparable to some described from the *Proniceras* beds of the Crimea and Mexico, and to forms of Himalayitidae of the Spiti Shales. This higher fauna was entirely unknown to Waagen, who, on the other hand, wrongly listed Katrol forms from the Umia Beds.

Separated from these Lower Umia scarps with undoubted Tithonian ammonites by further ridges and a thickness of barren sandstones of probably several hundred feet, there follows a *Trigonia* Bed ; and above a further unknown thickness of sandstones of the Upper Umia group, lie the remnants of marine Aptian beds at Ukra Hill. The matrix (red and yellow limestones and ironstones) is identical with that of many of the Jurassic forms. According to Mr. Raj Nath, who has lately investigated the Kachh deposits and kindly allowed me to figure some of his ammonites in the forthcoming memoir, the presence of a fault on one side and the igneous mass of Ukra Hill on the other, prevent the establishment of a definite succession up to the Aptian. Throughout the great thickness of these sandstones, however, as Wynne showed long ago, plant remains are common and there is no trace of any ammonites of, apparently, the *privasensis* zone of the uppermost Tithonian, certainly not of the Infra-Valanginian and the whole of the Lower, Middle, and Upper Neocomian (Valanginian, Hauterivian, and Barremian). *Trigonia* in Kachh, also, have been found in the Katrol, Lower and Upper Umia groups and well above the horizon at which most of the plant fossils have been obtained. Whatever the relations of the lamellibranchs (of unknown ranges) of the Upper Umia group to those of the Uitenhage Series may be, the striking dissimilarity in the ammonite faunas of the two areas is now explained by their great difference in age.

In the fauna of the Spiti Shales, Valanginian elements, notably

* See Spath, "Revision of the Jurassic Cephalopod Fauna of Kachh (Cutch)," Pal. Indica (N.S.), vol. ix, Mem. No. 2, fasc. 2, p. 159.

† One of these giants encloses *Trigonia retrorsa*, Kitchin, and numerous *Acanthothyris multistriata*, Kitchin.

Rogersites again occur, and I have lately been able to examine a lower Neocomian fauna from Southern Persia with the characteristic ammonites of the Valanginian Marls of the south of France. But the *Olcostephanus* known from the Salt Range (Kalabagh and Chichali Pass) and from the Samana area (in the similarly glauconitic Belemnite Beds of Thal) * are Lower Hauterivian forms, and are as closely allied to those of *e.g.* the Crimea (where Upper Valanginian *Rogersites* also occur) as to those of the *Trigonia schwarzi* Beds of Tendaguru.

Turning now to South America, we find Valanginian faunas with *Rogersites* and *Bochianites*, resembling the Uitenhage forms well developed in Colombia, and I have on a previous occasion correlated these "*Valanginites* Beds" of Colombia with deposits of Hoplitidan age from localities as far apart as Speeton and Spiti. In Mexico, Böse † has lately compared with the Uitenhage species, *R. atherstoni* and *R. baini*, some forms of his *Astieria* Beds which probably include, and are certainly underlain by, Valanginian beds. We could compare the Uitenhage ammonites with these forms at least as well as with the Valanginian species known from farther south, *e.g.* "*Astieria*" *laticosta* Stehn ‡ from the Argentine Andes which on account of its association with forms of the "zone of *Spiticeras damesi* (Steuer)," comparable to the new Somaliland forms above discussed, is probably of earlier Valanginian date, although somewhat intermediate between *Valanginites* and *Rogersites* and resembling the East African *V.*? *crassus* (Zwierzycki). It is clearly premature to generalise from the scanty data of the distribution of comparable Valanginian ammonites at present available, and I may repeat what I wrote in connection with the discussion of an Albian fauna from Nigeria: § "As in the case of the Eotriassic fauna of East Greenland lately recorded, the distribution of the African Cretaceous Ammonites might well be used as evidence in favour of the permanence of the Continents, *i.e.* in the present case, of the huge ancient land-mass south of the Sahara, since Pre-Cambrian times, with only its fringe occasionally submerged."

* See Spath, "The Fossil Fauna of the Samana Range and Neighbouring Areas," Part V. The Cretaceous Cephalopods, etc., Mem. Geol. Surv. India., Pal. Indica, N.S. (in press), pl. viii, figs. 1–3.

† "Algunas Faunas Cretacicas, etc.," Bol. Inst. Geol. Mexico, No. 42, 1923, p. 76, pl. ii, figs. 3–6, p. 77, pl. iii, figs. 1, 2.

‡ "La Fauna Neocomiana de la Cordillera Argentina, etc.," Actas Acad. Nac. Cienc. Rep. Argentina, vol. ix. p. 62, pl. ii, figs. 8, 8*a*.

§ "The Albian Ammonoidea of Nigeria," Appendix to The Nigerian Coalfield, Section II, Bull. No. 12, Geol. Surv. Nigeria, 1928, p. 54.

III. Synopsis of Cephalopoda and Descriptions of New Species.

Class **Cephalopoda.**

A.—Order NAUTILOIDEA.

Family NAUTILIDAE, Owen emend. Spath.

Genus Eutrephoceras, Hyatt, 1894.

1. *Eutrephoceras uitenhagense*, sp. nov.

(Text-figs. 1*a*, *b*.)

1856. *Nautilus* undeterm. Sharpe. "Secondary Fossils from South Africa," Trans. Geol. Soc. (II), vol. vii, p. 201.

1908. ,, sp. Kitchin. "Invertebrate Fauna of the Uitenhage Series," *loc. cit.*, p. 225.

Type.—The specimen recorded by Sharpe from the Sundays River (B.M., No. 11034, Geol. Soc. Coll.).

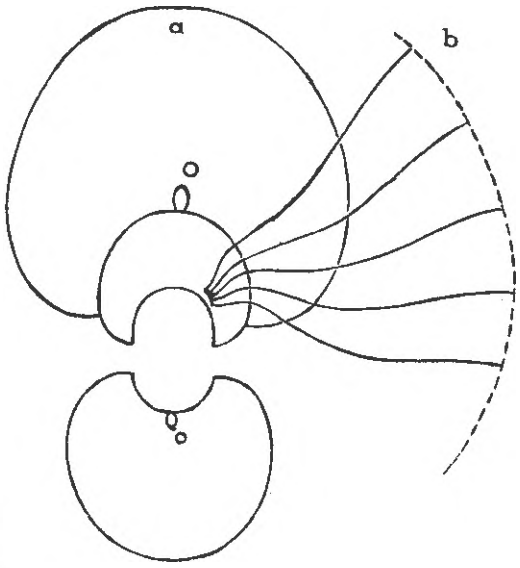
Diagnosis.—Coiling occlusal, with umbilicus nearly closed. Whorl-section rounded, slightly compressed at first, later flaring, with greatest thickness at inner third and no edge to high umbilical wall. Suture-line with slight umbilical saddle and shallow lateral lobe, straight across venter. Annular lobe strongly developed. Test entirely smooth, thick.

Measurements of Type :—

Diameter in mm. (about)	135
Height of outer whorl, in per cent. of diameter (about)	55
Thickness ,, ,, ,, ,,	74
Umbilicus	7

Remarks.—The holotype of this species, merely recorded by Sharpe as being 5½ inches in diameter, is not in a perfect state of preservation, although it shows all the characteristic features. The outer whorl is septate to the end, but this is largely corroded, as is one side of the earlier half of the outer whorl. The test is, however, preserved in patches, and the inner whorls, on being broken out, allowed of a fairly satisfactory reconstruction of this species. The excentric position of the almost dorsal siphuncle is probably not a specific character.

The form is close to *Nautilus boissieri*, Pictet,* with a similarly straight suture-line, but a thinner whorl-section. There is nothing



TEXT-FIG. 1.—*Eutrephoceras uitenhagense*, sp. nov. (*a*) Outline sectional view and (*b*) tracings of four septal edges. (Reduced to $\frac{2}{3}$ linear.) Sundays River (B.M., No. 11034, Geol. Soc. Coll.).

like the present species among numerous *Nautili* in the British Museum from the Hauterivian to Aptian deposits of the Tendaguru District, Tanganyika Territory.

B.—ORDER AMMONOIDEA.

FAMILY PHYLLOCERATIDAE, Zittel emend.

Genus PHYLLOCERAS, Suess, 1865.

2. *Phylloceras rogersi*, Kitchin.

1908. *Phylloceras rogersi*, Kitchin. "Invertebrate Fauna of the Uitenhage Series," *loc. cit.*, p. 179, pl. viii, figs. 19, 19*a–c*.

* Mélanges Paléontologiques, vol. ii, 1866, "Faune à *Terebratula diphyoides* de Berrias," p. 58, pl. viii, fig. 4.

Non 1910. *Phylloceras rogersi*, Kitchin. var. nov. Krenkel, "Untere Kreide von Deutsch-Ostafrika," Beitr. Pal. Geol. Österr.-Ung., vol. xxiii, Heft 4, p. 223, pl. xxii, fig. 9 (= *P. krenkeli*, Zwierzycki, 1914, *loc. cit.*, p. 84).

The holotype described by Kitchin still remains the only available specimen. Its suture-line and inflated whorl-shape suggest reference to *Ptychophylloceras*, i.e. the *semisulcatus* group, but there are neither ventral ridges nor umbilical sulci and the lineate ornamentation seems to prove that the species must be included in *Phylloceras* s.s.

Uhlig * took this form to represent the "northern element" in the Uitenhage fauna, together with *Belemnopsis africanus* (Tate), which he considered to show that Himalayan Belemnites spread as far as the extreme south of Africa. The rarity of these two species makes them of little value for far-reaching generalisations.

Family DESMOCERATIDAE, Zittel.

Genus Eodesmoceras, Spath, 1923.

3. *Eodesmoceras haughtoni*, sp. nov.

(Pl. XIII, figs. 2*a*–*e*.)

Type.—A specimen from "Shore of pan, Zoutpan, Uitenhage" (S.A.M., No. 227, S.H.) here figured.

Diagnosis.—Coiling platygyral (with wide and flat, compressed whorls), subleptogyral (thickness under 33 per cent. of the diameter), subangustumbilicate (umbilicus rather narrow), with narrowly arched venter and steep but rounded umbilical wall. Test with traces of very faint sigmoidal striation. Suture-line simple, with high external lobe and trifid first lateral lobe (see Pl. XIII, fig. 2*e*).

Measurements of holotype:—

Diameter in mm.	16
Height of outer whorl (in per cent. of diameter)	50
Thickness ,, ,, ,, ,,	30
Width of umbilicus ,, ,, ,,	20

* "Marine Reiche, etc.," Mitt. Geol. Ges. Wien, vol. iv, 1911, p. 408.

Remarks.—The unique example of this species, unfortunately, is incomplete, terminating in a septal surface, so that it probably represents merely the inner whorls of a larger form like *Eodesmoceras celestini* (Pictet and Campiche).* This has the same type of suture-line which does not differ from that of many Jurassic Haploceratids, at a corresponding size. The suture-line here figured (enlarged $\times 9$) was taken from the last quarter of the outer whorl of the nucleus represented in fig. 2*a* (Pl. XIII), itself enlarged three diameters; but at the end of the outer whorl there are still only three lateral and two auxiliary lobes. The outer whorl was figured separately, since its dorsal aspect (fig. 2*d*) is instructive. The inner whorls figured in figs. 2*a*, *b* were taken out of this outer whorl, but the intervening portions (not figured) are partly corroded.

Neolissoceras, which also occurs in beds of the age of the Uitenhage Series (and is, indeed, far commoner in Europe), shows the characteristic whorl-shape and peculiar umbilical wall already at small diameters. To judge by a number of specimens in the Lamplugh Collection (B.M., Nos. C32366–70, from Autan, Drome) which show the suture-line perfectly, this is more Haploceratid and less Desmoceratid than that of the present species, and the unsymmetrically divided first lateral saddle especially is more like that of the Upper Jurassic *Haploceras*.†

Family OLCOSTEPHANIDAE, Spath, 1924.

Genus Rogersites, Spath, 1924.

4. *Rogersites atherstoni* (Sharpe).

1856. *Ammonites atherstoni*, Sharpe. Trans. Geol. Soc. (II), vol. vii, p. 196, pl. xxiii, figs. 1*a*, *b*.

1908. *Holcostephanus atherstoni* (Sharpe). Kitchin, "Inverteb. Fauna, Uitenhage Series," p. 187.

1909. *Astieria atherstoni* (Sharpe). Wegner, "Uebersicht *Astieria* Formen," Neues Jahrb. f. Min., etc. (I), p. 81.

1909. *Holcostephanus atherstoni* (Sharpe). Hatch and Corstorphine, Geol. of S. Afr., p. 303, text-fig. 76*a*.

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* "Terrain Crétacé de Ste. Croix, I," Pal. Suisse, II, 2, 1860, pp. 276, 357, pl. xxxix, figs. 1, 2.

† See Spath, "Revision of the Jurassic Cephalopoda of Kachh," Pal. Indica (N.S.), vol. ix, Mem. No. 2, fasc. 4, pl. lxxxi, fig. 6*a*.

1924. *Rogersites atherstoni* (Sharpe). Spath, Geol. Mag. (Speeton Clay), p. 87.

Kitchin's exhaustive discussion of this species has not prevented authors from continuing to use Sharpe's name for other forms from various parts of the world. This is due partly to the reduced original figure which does not clearly convey the fact that the holotype represents merely the inner whorls of a gigantic form. On the other hand, examples like those figured by Burckhardt * or by Böse † from Mexico as *Astieria* cfr. *atherstoni* and *A.* ex. aff. *atherstoni* represent the outer whorls of *Olcostephanus* of the *astierianus-filosus* group such as are common in the south of France (*e.g.* B.M., No. C31110, from Moustiers Ste. Marie, Basses-Alpes).

The great authority on Lower Cretaceous Ammonites, the late Prof. W. Kilian,‡ was more fortunate in his identifications, but he protested against Kitchin's numerous species, and the exclusion, from *R. atherstoni*, of various European forms. Kilian considered this species to occur "without any doubt" in the Upper Valanginian of the Jura region, but on the same and the following pages (213 and 214) he characteristically called the forms from the Jura and the south of France first "mere varieties" of Sharpe's species and then *Holcostephanus* (*Astieria*) *atherstoni* and *Holc.* (*Ast.*) *baini* "mere varieties" of *Astieria* forms common in France. On the inspection of figures, like those of Baumberger's § *Astieria* cf. *atherstoni* or *A. imbricata*, *A. actinota* and *A. leptoplana* (Baumberger), which appear to represent the inner whorls of large *Rogersites*, it certainly seems probable that Sharpe's species also occurs in the Valanginian of Europe; but they must be kept distinct from the true *Olcostephanus* ("*Astieria*") of the Lower Hauterivian, and the correct identification of immature nuclei, in any case, is generally impossible. Thus it is very uncertain whether Kilian's ‖ *Holcostephanus atherstoni* (Sharpe), var. nov., which was later named by Wegner ¶ var. *densicostata*, is really a young *Rogersites*;

* "Faune Jurassique de Mazapil," Bol. Inst. Geol. Mexico, No. 23, 1906, p. 185, pl. xi, figs. 2, 3.

† "Algunas Faunas Cretacicas, etc.," Bol. Inst. Geol. Mexico, No. 42, 1923, p. 77, pl. iii, figs. 1, 2.

‡ In Frech, Lethaea Geognostica, II, 3, 1910 (fasc. 2), p. 213.

§ "Fauna d. Unteren Kreide im Westschweizerischen Jura," Abhandl. Schweiz. Pal. Ges., vol. xxxiv, 1908, pl. xxv, fig. 4; text-fig. 123, p. 15; pl. xxvi, figs. 1–4 only.

‖ "Sur quelques fossiles remarquables de l'Hauterivien, etc.," Bull. Soc. Géol. France (4), II, 1902, p. 865, pl. lvii, figs. 1*a*, *b*.

¶ *Loc. cit.*, "*Astieria* Formen," 1909, p. 82.

and even some undoubted immature specimens of *Rogersites* in Dr. Haughton's collection cannot be satisfactorily distinguished from similar constricted young of the later *Olcostephanus*, or even the (usually more coronate) *Subastieria*, although they remain almost smooth to a diameter at which the last is already highly tuberculate and costate. In *Olcostephanus subfilosus* * also the innermost whorls are less cadicone and more prominently tuberculate and ribbed.

A large but fragmentary specimen (No. 320, S.H.) in the new collection shows that at a diameter of 230–240 mm. the ribbing has become slightly more distant and the umbilical tubercles very high but more widely spaced. Two other examples (Nos. 313 and 318, S.H.) are unfortunately less favourably preserved, whilst two more large examples (Nos. 315 and 319, S.H.) † are intermediate between *R. atherstoni* and the form described below as *R. sphaeroidalis*. They retain the open umbilicus of the former species (31 per cent. at 225 mm. diameter) and show twenty strong spines round the umbilicus (as compared with only about thirteen or fourteen in the more involute *R. sphaeroidalis*), but these transitional forms have more globose earlier whorls.

5. *Rogersites sphaeroidalis*, nom. nov.

(Pl. XIII, fig. 5 ; Pl. XV, fig. 1.)

1908. *Holcostephanus* cf. *atherstoni* (Sharpe). Kitchin, "Inverteb. Fauna, Uitenhage Series," *loc. cit.*, p. 193.

1909 ? ,, *baini* (Sharpe). Hatch and Corstorphine, Geol. of S. Afr., p. 295, text-fig. 73 (left ?).

1910 ,, (*Astieria*) cf. *atherstoni* (Sharpe). Kitchin, Kilian, *loc. cit.* (Lethaea, pt. ii), p. 214.

In his description of a form, close to *R. atherstoni*, but more inflated, Dr. Kitchin discussed a specimen in the British Museum (No. 46534) which he considered to show close agreement. This example again, in its very depressed outer whorl, resembles the specimen (No. 195, S.H.) ‡ here figured, which may be taken as the holotype of the present species. The inner whorls (Pl. XV, fig. 1) are not strikingly

* Spath, *loc. cit.*, Geol. Mag., 1924, p. 76, =*Olcostephanus astierianus*, Pavlow, non d'Orbigny, Argiles de Speeton, Moscou, 1892, p. 136, pl. xvii (x), fig. 15.

† These two and the three preceding specimens are from "just behind the house, Cuyler Manor, Uitenhage."

‡ From Cuyler Manor, Uitenhage.

different from the true *R. atherstoni*, but the whorl-section soon becomes very depressed. The portion of the outer whorl figured in Pl. XIII, fig. 5 has a thickness or breadth of 115 mm. as compared with a whorl-height of only 33 mm. (in the siphonal plane), and is thus even more depressed than the outline-section 4*b* of Pl. XV (*R. kitchini* sp. nov.). Later the whorl-thickness decreases again, and in a specimen (No. 317) of 250 mm. diameter, the shape does not differ greatly from that of the transitional forms discussed above, but the width of the umbilicus is only 24 per cent. of the diameter, and there are only thirteen or fourteen large and distant spines round the umbilicus. The ribbing is distinctly coarser than in *R. atherstoni*, also in the example (B.M., No. 46534) recorded by Dr. Kitchin, of about the same size as Sharpe's type of *R. atherstoni*; but in another very large specimen (No. 316, S.H.), indistinguishable from the present species, it remains close, as in *R. atherstoni*. This, therefore, may also be regarded as a passage-form between the two species, and there is another smaller example (No. 524, S.H.) that also seems to have rather closer costation towards the end, whilst in four still smaller specimens (Nos. 194, 312, 314, 322,* S.H.) only the inflated whorl-shape is relied on for reference to *R. sphaeroidalis*. A typical body-chamber portion in the Geol. Soc. Coll. (B.M., No. 34198, labelled *Amm. atherstoni*, but unlocalised) agrees with the example (No. 46534) discussed by Dr. Kitchin, but some crushed *Rogersites* from the A. G. Bain collection (B.M., Nos. C32206–7, labelled *Amm. atherstoni*, Sundays River) may well belong to the true *R. atherstoni*.

6. *Rogersites wilmanae* (Kitchin).

1908. *Holcostephanus wilmanae*, Kitchin. "Inverteb. Fauna, Uitenhage Series," *loc. cit.*, p. 195, pl. ix, figs. 1, 1*a*.

1909. *Astieria psilostoma* (Neumayr and Uhlig), var. *wilmanae*, Kitchin. Wegner, *loc. cit.*, "*Astieria* Formen," p. 86.

1910. *Holcostephanus* (*Astieria*) *wilmanae*, Kitchin. Kilian, *loc. cit.* (Lethaea, fasc. 2), p. 214.

This form is undoubtedly very close to Neumayr and Uhlig's *R. psilostoma*, with the same type of peristome, and to the forms separated by Wegner as var. *picteti* and var. *koeneni*. The species

* Specimens 312, 314, 322, as well as 316 and 317 above mentioned, are from "just behind Cuyler Manor, Uitenhage": 194 is also from "Cuyler Manor"; 524 from "Cliffs on Zoetgeneugd, Sundays River."

is again listed independently only because the holotype is partly crushed and its inner whorls are as yet unknown, and it is not certain that they are comparable to those of a passage form between *R. psilostoma* or *R. wilmanae* and *R. baini* here figured (Pl. XIII, fig. 3; Pl. XIV, fig. 4; Pl. XV, fig. 2).* It will be noticed that in this the constrictions are not noticeable; on the body-chamber, which occupies nearly half of the outer whorl, the ribbing becomes coarser (as in *R. baini*), but it might, perhaps, also be included in a more comprehensive and almost universal species *R. psilostoma*. The suture-line of this transitional example is well shown (see Pl. XIV, fig. 4), but while there is general agreement with the diagrammatic suture-line figured by Pictet † it is doubtful whether it is identical with the suture-line of the true *R. psilostoma* (Neumayr and Uhlig).

A specimen in the Geol. Soc. Collection (B.M., No. C32205, from the Sundays River, labelled "*Amm. atherstoni*") is not deformed by crushing, like the holotype, and whilst showing the closest agreement in external characters with Neumayr and Uhlig's ‡ type of *R. psilostoma*, shows an even more inflated whorl-section, though the periphery does not become so broad as that of *R. convolutus* (v. Koenen).§

7. *Rogersites baini* (Sharpe).

1856. *Ammonites baini*, Sharpe. Trans. Geol. Soc. (II), vol. vii, p. 197, pl. xxiii, figs. 2*a*, *b*.

1908. *Holcostephanus baini* (Sharpe). Kitchin, "Inverteb. Fauna, Uitenhage Series," p. 187.

1909. *Astieria baini* (Sharpe). Wegner, *loc. cit.* (*Astieria* Formen), p. 82.

1909. *Holcostephanus baini* (Sharpe). Hatch and Corstorphine, Geol. of S. Africa, p. 303, text-fig. 76*b*.

1919. ,, (*Astieria*) *baini* (Sharpe). Kilian, *loc. cit.* (Lethaea, fasc. 2), p. 214.

This well-characterised species is represented by a typical fragment (No. 525, S.H., from the "Cliffs on Zoetgeneugd, Sundays River)

* B.M., No. C32204, ex Geol. Soc. Coll., from Sundays River, labelled "*Amm. baini.*"

† "Terr. Crét. Ste. Croix," Pal. Suisse, II. 2, 1860, pl. xliii, fig. 5.

‡ "Ammonitiden a. d. Hilsbildungen Norddeutschlands," Palaeontogr., vol. xxxii, 1881, p. 149, pl. xxxii, figs. 2, 2*a*.

§ "Ammonitiden d. Norddeutschen Neocom," Abhandl. K. Preuss. Geol. Land. Anst., N.F., Heft. xxiv, 1902, pp. 146, 412, pl. xxxix, figs. 4*a*, *b*.

agreeing with the outer whorl of the holotype (B.M., No. 10976A, Geol. Soc. Collection). A second example (No. 583, S.H., from Welbedachtsfontein) shows greater resemblance to the Sundays River example in the British Museum (No. 52052) referred to by Dr. Kitchin (under *Holcostephanus* cf. *baini*, p. 200), but this is not separable from the present species and differs mainly in unimportant details of ribbing and whorl-shape.

8. *Rogersites crassicostatus*, nom. nov.

1908. *Holcostephanus* cf. *baini* (Sharpe). Kitchin, "Inverteb. Fauna, Uitenhage Series," *loc. cit.*, p. 399, pl. ix, fig. 2; pl. x, fig. 1.

This form does not differ greatly from the last, but considering that *R. baini* is a small species and that the holotype of *R. crassecostatus*, *i.e.* the septate specimen figured by Kitchin, at 92 mm. diameter does not include the body-chamber, the differences seem at least as important, for systematic purposes, as those between *R. rogersi* and *R. schenki* (Oppel).* The holotype has been described by Kitchin in great detail, and since there are no additional specimens I can add but little to this description. The coarser ribbing of the inner whorls of *R. crassicostatus* seems to me an important distinguishing character, in addition to the difference in the course of the rib-curve or radial line.

9. *Rogersites rogersi* (Kitchin).

1908. *Holcostephanus rogersi*, Kitchin. "Inverteb. Fauna, Uitenhage Series," *loc. cit.*, p. 201, pl. ix, fig. 3; pl. x, fig. 2.

1909. *Astieria rogersi* (Kitchin). Wegner, *loc. cit.* (*Astieria* Formen), p. 88.

1909. *Holcostephanus rogersi*, Kitchin. Hatch and Corstorphine, Geol. of S. Africa, p. 303, text-fig. 76*c*.

1910. ,, (*Astieria*) *rogersi* (Kitchin). Kilian, *loc. cit.* (Lethaea), p. 214.

* "Ostindische Fossilreste, etc.," Palaeont. Mitteil. Mus. K. Bayer. Staates, vol. i, 1863, p. 286, pl. lxxxi, figs. 4*a–c*: Uhlig, "Fauna of the Spiti Shales," Pal. Indica, Ser. XV, vol. iv, pt. 1, 1903, p. 130, pl. xviii, figs. 2*a–e*.

A number of immature specimens * in the new collection may be referred to this species, but they are too small to be distinguished from the young of such closely allied species as *R. schenki* (Oppel). Another such immature specimen † is intermediate between the present species and *R. baini*, and two very small examples ‡ are specifically indeterminable.

10. *Rogersites modderensis* (Kitchin).

1908. *Holcostephanus modderensis*, Kitchin. "Inverteb. Fauna, Uitenhage Series," *loc. cit.*, p. 202, pl. x, figs. 3, 3*a*.

1909. *Astieria modderensis* (Kitchin). Wegner, *loc. cit.* (*Astieria* Formen), p. 89.

1910. *Holcostephanus* (*Astieria*) *modderensis*, Kitchin. Kilian, *loc. cit.* (Lethaea), p. 214.

1924. *Rogersites modderensis* (Kitchin). Spath, *loc. cit.* (Geol. Mag.), p. 86.

What is probably a large example of this species (No. 693, S.H.) was collected by Dr. Haughton in the cliffs on Zoetgeneugd, Sundays River. It is about 165 mm. in diameter and retains the small umbilical tubercles, but the whorl-section becomes less depressed with increase in size.

11. *Rogersites kitchini*, sp. nov.

(Pl. XV, figs. 4*a*, *b*.)

Type.—The Zwartkops specimen (B.M., No. C761) figured in Pl. XV, figs. 4*a*, *b* (reduced to half the natural size).

Diagnosis.—Coiling rather close (subangustumbilicate), perpachygyral (whorls extremely thick). Shape cadicone, with very high and steep umbilical wall and very broadly arched venter. Umbilical edge very pronounced, and provided with prominent spines (18 on outer whorl, successively fewer towards interior). Ribs across venter blunt and comparatively distant. Suture-line unknown.

* Nos. 310, 311, S.H., from "just behind the house, Cuyler Manor, Uitenhage"; 423, from Picnic Bush, Zwartkops River; also one specimen from one mile north of Coega Station.

† No. 582, S.H., from Welbedachtsfontein, Uitenhage.

‡ No. 410, S.H., from Picnic Bush, Zwartkops River; and 5075 from Sundays River.

Measurements of holotype :—

Diameter in mm.		about 300	
Height of whorl	(at 220 mm. diameter)	,,	40 per cent.
Thickness of whorl	(,, ,,)	,,	80 ,,
Umbilicus	(,, ,,)	,,	30 ,,

Remarks.—This gigantic species may be considered to be a morphological transition between the genus *Polyptychites* and the typical *Rogersites*. The peripheral aspect is reminiscent of such large forms of *Polyptychites* as that figured by Neumayr and Uhlig * as *Olcostephanus marginatus* (non Phillips), Roemer, but the umbilical tuberculation is that of a *Rogersites*. The genus *Valanginites* Sayn † also produced somewhat similar forms, e.g. *V. perinflatus*, Matheron ‡ and *V. stephanophorus* Matheron,§ but they are finely ribbed and thus represent a Polyptychitoid offshoot quite independent of *Rogersites*.

A large but fragmentary specimen (No. 5070) from the Sundays River, sent by Dr. Haughton, of about 175 mm. (and the general appearance of what a gigantic *R. schenki* may be supposed to be like) seems closer to the present species than to any other described form of *Rogersites*, but the umbilical tubercles are less prominent.

12. *Rogersites otoitoides*, sp. nov.

(Pl. XIV, figs. 1*a*, *b*.)

Type.—The Zwartkops (Railway Cutting) specimen (No. 876, S.H.) figured in Pl. XIV, figs. 1*a*, *b*.

Diagnosis.—Coiling rather close (subangustumbilicate), pachygyral (whorls thicker than high), with whorl-section not so depressed as in holotype of *R. atherstoni* and umbilical tubercles more prominent. Ribbing comparatively coarse, as in *R. modderensis*, but finer on the inner whorls. Peristome flared, projecting laterally and ventrally but with inward-bent " ears." Suture-line unknown.

Measurements of holotype :—

Diameter in mm.		100
Height of last whorl	(in per cent. of diameter)	40
Thickness of last whorl	(,, ,,)	50
Umbilicus	(,, ,,)	30

* *Loc. cit.*, Ammonitiden Hilsbildungen, 1881, pl. xxix.

† See Kilian, *loc. cit.* (Lethaea, II, 2, 1910), p. 196; Genolectotype, *A. perinflatus*, Matheron (see Spath, Geol. Mag., 1924, p. 86).

‡ " Recherches Paléontol. dans le Midi de la France," 1878, pl. B20, figs. 7*a*, *b*.

§ *Ibid.*, figs. 4*a*, *b* (left by Sayn in " *Astieria* " according to Kilian).

Remarks.—This species is probably closest to *R. rogersi*, which differs in its less coronate whorl-shape with less prominent tubercles and slightly closer costation. The peculiar flared peristome, with its wavy outline, is unfortunately not perfectly preserved, so that the outline drawing of fig. 1*b* is somewhat diagrammatic. It gives a better idea, however, of the shape of the peristome than would photographic top and front views.

R. psilostoma (Neumayr and Uhlig) has a similar peristome, but is also less coronate. *R. schenki* (Oppel) is undoubtedly closer, but it displays only the tubercles of the inner whorls, not part of the ribs as well; it is also more depressed and does not show the characteristic change from a comparatively close costation of the inner whorls to the coarse ribbing of the outer whorl. The latter is reminiscent of the peculiar ornamentation of *Polyptychites*, and *R. otoitoides* is probably a passage-form between this boreal stock and *Rogersites* of the *atherstoni* group. The somewhat similar *R. boussingaulti* (d'Orbigny) * also belongs to the latter group.

A fragmentary example (No. 581, S.H., from Welbedachtsfontein, Uitenhage), doubtfully attached to the present species, may perhaps represent the inner whorls of a passage-form to *R. psilostoma*.

13. *Rogersites uitenhagensis* (Kitchin).

1908. *Holcostephanus uitenhagensis*, Kitchin. "Inverteb. Fauna, Uitenhage Series," *loc. cit.*, p. 206, pl. xi.

1909. *Astieria uitenhagensis* (Kitchin). Wegner, *loc. cit.* (*Astieria* Formen), p. 89.

1909. *Holcostephanus uitenhagensis*, Kitchin. Hatch and Corstorphine, Geol. of S. Africa, p. 295, text-fig. 73 (right).

1910. „ (*Astieria*) *uitenhagensis* Kitchin. Kilian, *loc. cit.* (Lethaea, ii, 2), p. 214.

There is a crushed fragment (No. 692, S.H.) from "cliffs on Zoetgeneugd, Sundays River," of a large example of this species, recognisable by the striate whorl-side, well visible in the umbilicus and the unusual width of the latter. Kilian thought this species close to the inflated

* "Fossiles de Colombie, etc.," Paris, 1842, p. 32, pl. i, figs. 1, 2.

variety of "*Astieria*" *sayni*, Kilian,* but apart from the inflation of their inner whorls, the passage forms between *R. atherstoni* and *R. sphaeroidalis* above discussed are really much closer to the present species than is the French form.

Fam. NEOCOMITIDAE, Spath, 1924.

Gen. HOPLITIDES, v. Koenen, 1902 emend., Sayn.

14. *Hoplitides subanceps* (Tate).

(Pl. XIII, figs. 4*a–c*.)

1867.	*Ammonites subanceps*,	Tate.	South African Fossils, Quart. Journ. Geol. Soc., vol. xxiii, p. 150, pl. vii, figs. 3*a*, *b*.
1882.	,,	,,	Holub and Neumayr, Fossilien der Uitenhage Formation, *loc. cit.*, p. 273.
1896.	*Reineckeia*	,, (Tate).	Newton, Journ. Conch., vol. viii, No. 5, p. 150.
1908.	*Solgeria*	,, ,,	Kitchin, Inverteb. Fauna, Uitenhage Series, *loc. cit.*, p. 209.
1909.	*Ammonites*	,, ,,	Hatch and Corstorphine, Geol. of S. Africa, p. 303, text-fig. 76*d*.

This form is very close to species of *Hoplitides* common in the Valanginian of the south of France, e.g. *H. depereti* and *H. provincialis*, Sayn.† The suture-line of the former species was apparently drawn very diagrammatically, but it has the same oblique, bipartite lateral lobe as that of the present species. Unfortunately Tate's type, septate to near the end, if not entirely, is still the only example known.

* "Sur le Neocomien des environs de Moustier," Bull. Soc. Géol. France (3), vol. xxiii, 1896, p. 976 (=*Amm. astierianus*, pars, d'Orbigny, Pal. Française, Terr. Crét., I, 1840, pl. xxviii, fig. 4 only).

† "Ammonites pyriteuses des marnes valanginiennes du S.E. de la France," Mém. Soc. Géol. France, vol. xv, fasc. 2 (No. 23), 1907, pp. 58, 59, pl. viii, figs. 7 and 10, text-fig. 26 on p. 59.

Genus DISTOLOCERAS, Hyatt, 1900.

15. *Distoloceras spinosissimum* (Hausmann).

(Pl. XIII, fig. 1.)

1837. *Ammonites spinosissimus*, Hausmann. "Beiträge zu der Geognost. Constitut. v. S. Afrika," Göttinger Gelehrte Anzeiger, p. 1458.

1882. *Crioceras spinosissimum* (Hausmann). Holub and Neumayr, "Fossilien der Uitenhage Formation," Denkschr. K. Akad. Wiss. Wien, vol. xliv, p. 273, pl. i, fig. 1.

1896. „ „ (Hausmann MS.). Holub and Neumayr, Newton, Journ. Conch., vol. viii, No. 5, p. 150.

1908. „ „ (Hausmann). Neumayr, Kitchin, "Inverteb. Fauna, Uitenhage Series," *loc. cit.*, p. 225.

1924. *Distoloceras* cf. *spinosissimum* (Hausmann). Spath, *loc. cit.* (Geol. Mag.), p. 75.

This species was not represented either in the collections examined by Dr. Kitchin or among the new material forwarded by Dr. Haughton. But there are two examples in the British Museum, one collected by Capt. Rocke (Geol. Soc. Coll., No. I1085), which is now figured; the other (No. C10819, Miss Vaughan Williams, 1906) consisting of a similar whorl fragment with the impression of the previous whorl (not in contact) preserved in the matrix.

The innermost whorls are unfortunately as yet unknown, and in the more complete example figured by Holub and Neumayr the apparent uniformity of the ribbing of the earliest portion preserved (perhaps due to corrosion) may suggest wrong comparisons. The complex suture-line of the specimen here figured seems to agree with that of other *Distoloceras*.

The writer agrees with Uhlig * in considering that Hyatt's † genus *Distoloceras* (for *Ammonites hystrix* [Bean MS.], Phillips, in Neumayr and Uhlig) has nothing to do with the Lytoceratid genus *Pictetia*, Uhlig; and no palaeontologist would now use the family Ancyloceratidae in Hyatt's interpretation. This is no reason, however, why the name *Distoloceras* should not be used for the *hystrix-curvinodus* group and more or less uncoiled allies, leading to what I separated as *Juddiceras*.‡

16. *Distoloceras* sp. ind.

1908. *Acanthodiscus* sp. Kitchin. "Inverteb. Fauna, Uitenhage Series," *loc. cit.*, p. 207.

Dr. Kitchin compared a doubtful fragment to *Acanthodiscus hystricoides* (Uhlig),§ but this does not belong to the group of *A. radiatus* (Bruguière) to which I have previously || restricted the genus *Acanthodiscus*. It is possible that the fragment is closer to the species above discussed than Dr. Kitchin thought, the poor preservation of the earlier whorls of Holub and Neumayr's specimen showing what is probably a spurious uniformity of costation. Something similar, however, is found in *Distoloceras roemeri* (Neumayr and Uhlig),¶ Koenen, of a higher bed (*radiatus* zone of the basal Hauterivian), a species which, according to Kilian,** is one of the few German criocones that also occurs in the Neocomian of the south of France.

INCERTAE SEDIS.

Genus Bochianites, Lory, 1898.

17. *Bochianites africanus* (Tate).

(Pl. XIV, figs. 2*a–c*, 3*a–c*; Pl. XV, figs. 3*a–c*.)

1867. *Hamites africanus*, Tate. "Secondary Fossils from South Africa," Quart. Journ. Geol.

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* "Fauna of the Spiti Shales," Pal. Indica, Ser. XV, vol. iv, fasc. 2 (1910), p. 168.

† In Zittel's "Text-book of Palaeontology," first English edition of Eastman (1900), p. 588.

‡ *Loc. cit.*, Geol. Mag., 1924, p. 84.

§ "Cephaloden Fauna der Teschener und Grodischter Schichten," Denkschr. K. Akad. Wiss. Wien, vol. lxxii, 1902, p. 39, pl. i, figs. 8*a*, *b*.

|| *Loc. cit.*, Geol. Mag., 1924, p. 87.

¶ *Loc. cit.* (Ammonitiden Norddeutsch. Neocom.), 1902, p. 294, pl. xvi, figs. 5*a–c*.

** *Loc. cit.* (Lethaea, 1910), p. 271.

Soc., vol. xxiii, p. 150, pl. vii, figs. 5*a–d*.

1908. *Hamites africanus*, Tate. Kitchin, Inverteb. Fauna, Uitenhage Series, *loc. cit.*, p. 225.

There are now over twenty fragments of this species before me * which may be considered to be, next to the gigantic *Rogersites*, the most characteristic element of the Uitenhage fauna, and, as already mentioned, has been found also in Portuguese East Africa. The suture-line here figured (Pl. XV, fig. 3*d*) is composite, being taken partly from a large fragment comparable to that figured in Pl. XIV, figs. 2*a–c*, partly from one of Tate's syntypes (Pl. XIV, figs. 3*a–c*). This suture-line is essentially the same as that of *B. neocomiensis* (d'Orbigny).† The small example illustrated in Pl. XV, figs. 3*a–c*, is the original of Tate's fig. 5*c*, but his fig. 5*b* represents merely a fragment of the body-chamber of a larger individual. In the circumstances it seems advisable to consider his most complete example 5*a*, here refigured, to be the lectotype.

The Speeton forms (from bed D_2) which I ‡ listed as *B. neocomiensis* (d'Orbigny) have a more circular whorl-section, but Karsten's § *Baculites granatensis* may well be specifically identical with the present species. *B. maldonadi* (Karsten) || has a more elliptical and less triangular whorl-section, but also the same type of ribbing.

Bochianites gerardi (Stoliczka) ¶ with a similar suture-line has a more circular section, and *B. oosteri*, Sarasin and Schondelmayer ** differs not only in the absence of strong costation, but in its far less simplified suture-lines.

Bochianites was formerly believed by the writer to have originated

* Represented in Dr. Haughton's collection from Cliff on Kuduskloof (Nos. 255 and 360); Kloof on Colchester (Nos. 661–663 and two unnumbered lots) and Cliff on Zoetgeneugd (No. 268*a–c* ?). The examples in the British Museum are from the Sundays River mouth (Prince Alfred's Rest), cliff above Tunbridges, and M'Loughlin's Bluff (Geol. Soc. Coll., ex Dr. Rubidge, G. W. Stowe, Major Rocke Colls.).

† Pal. Française, Terr. Crét., vol. i, 1842, p. 560, pl. cxxxviii, fig. 4.

‡ *Loc. cit.*, Geol. Mag., 1924, pp. 75 and 86, B.M., Nos. C32375–7.

§ "Geognostische Verhaltnisse des westlichen Columbien," Amtl. Ber. 32. Vers. Deutsch. Naturf. und Ärzte, Wien, 1856 (1858), p. 105, pl. ii, fig. 1.

|| *Ibid.*, pl. ii, fig. 2.

¶ "Geological Sections across the Himalayan Mountains, etc.," Mem. Geol. Surv. India, vol. v, pt. i, 1865, p. 110, pl. x, fig. 3.

** Étude monographique des Ammonites du Crétacique inférieur de Chatel-St. Denis, pt. 2, Mém. Soc. Pal. Suisse, vol. xxiv, 1902, p. 179, pl. xxiv, figs. 3 and 4, and text-fig. 6, p. 180.

from a Neocomitid stock, e.g. *Distoloceras* (via *Juddiceras*=group of *Crioceras curvicosta*, v. Koenen), but the possible connection with the Tithonian genus *Protancyloceras*, Spath (= group of *Ancyloceras gumbeli*, Oppel, and *A. gracile*, Oppel, in Zittel), has yet to be investigated. Its systematic position is thus uncertain.

18. *Bochianites glaber*, Kitchin.

1908.	*Bochianites glaber*, Kitchin.	"Inverteb. Fauna, Uitenhage Series," *loc. cit.*, p. 181, pl. viii, figs. 20, 21.
1909.	,, ,, ,,	Hatch and Corstorphine, Geol. of S. Africa, p. 303, text-fig. 76*f*.

No additional examples of this species have been collected. *Bochianites undulatus*, v. Koenen,* from the Lower Aptian, with which Dr. Kitchin had compared his species, I have on a previous occasion † stated to be a homoeomorphous development of a different stock.

C.—Order BELEMNOIDEA.

Fam. BELEMNOPSIDAE, Naef emend.

Gen. Belemnopsis, Bayle, 1878.

19. *Belemnopsis africanus* (Tate).

1867.	*Belemnites africanus* Tate.	"Secondary Fossils from South Africa," Quart. Journ. Geol. Soc., vol. xxiii, p. 151, pl. vii, figs. 2*a*, *b*.
1909.	,, ,, ,,	Boehm, Centralbl. f. Miner., etc., p. 564.
1909.	,, ,, ,,	Hatch and Corstorphine, Geol. of S. Africa, p. 303, text-fig. 76*e*.
1911.	,, ,, ,,	Uhlig, "Marine Reiche," *loc. cit.*, p. 408.
1927.	*Belemnopsis* ,, ,,	Spath, Kachh Revision, i, *loc. cit.* (Pal. Indica), p. 11.

* *Loc. cit.*, Ammonitiden Norddeutsch. Neocom., 1902, p. 393, pl. xxxv, fig. 13.

† "Notes on Ammonites," I, Geol. Mag., 1919, p. 30.

This form was not represented in the collections studied by Kitchin. In addition to the holotype (B.M., No. 26890) refigured by Boehm there is now a second small fragment (S. Afr. Mus., No. 665, S.H., from Kloof on Colchester, Sundays River). Representing merely the alveolar end of a guard, it could not be distinguished from a corresponding portion of the Upper Jurassic *B. gerardi* (Oppel), and its allies, discussed in 1927. It may be recalled here that Neumayr had considered this species to be a representative of the " absoluti," and that Haug * thought it to belong with certainty to the genus *Cylindroteuthis*.

Gen. HIBOLITES (Montfort), Mayer-Eymar, 1883.

20. *Hibolites*, sp. ind.

1908. *Belemnites* sp. Kitchin. " Inverteb. Fauna, Uitenhage Series," *loc. cit.*, p. 210.

The fact that the two fragments recorded by Dr. Kitchin were considered to represent subfusiform species, makes it probable that they are to be referred to the genus *Hibolites* so abundant in the Valanginian of the Mediterranean facies. In the North German and Speeton successions *Hibolites* are becoming of importance only in the Middle Neocomian.

* Traité de Géologie, vol. ii, fasc. 2, 1907, p. 1230.

EXPLANATION OF PLATES.

Plate XIII.

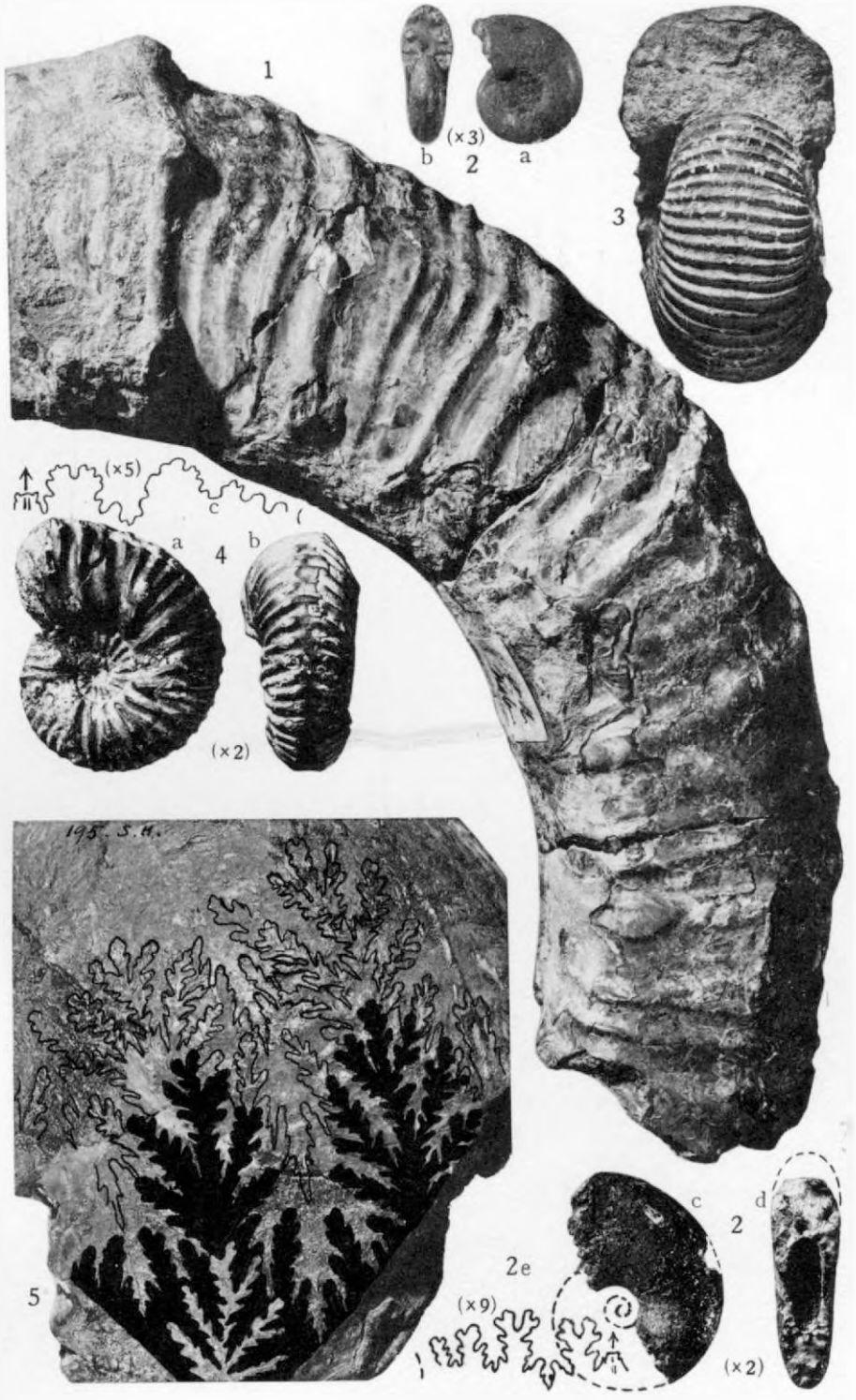
1. *Distoloceras spinosissimum* (Hausmann). Septate whorl-fragment (unlocalised), from the Geol. Soc. (ex Capt. Rocke) Coll. (B.M., No. C32194.) P. 152.
2. *Eodesmoceras haughtoni*, sp. nov. (*a*, *b*) inner whorls, enlarged (×3); (*c*, *d*) part of outer whorl (enlarged ×2), and (*e*) suture-line (diagrammatic and enlarged × 9) of holotype, from "Shore of pan, Zoutpan, Uitenhage." (No. 227, S.H.) P. 141.
3. *Rogersites* aff. *wilmanae* (Kitchin). Peripheral view of the transitional example figured in Pl. XIV, fig. 4, and Pl. XV, fig. 2. Sundays River. (B.M., No. C32204.) P. 146.
4. *Hoplitides subanceps* (Tate). Enlarged side and peripheral views of holotype (×2) and its suture-line (diagrammatic and enlarged ×5). Sundays River. (B.M., No. 10996, Geol. Soc. Coll.) P. 151.
5. *Rogersites sphaeroidalis*, sp. nov. Peripheral view of part of the outer whorl of the example figured in Pl. XV, fig. 1, showing suture-lines. Cuyler Manor, Uitenhage. (No. 195, S.H.) P. 144.

Plate XIV.

1. *Rogersites otoitoides*, sp. nov. Side view (*a*), with whorl-section and peristome (*b*). Railway cutting, Zwartkops. (No. 876, S.H.) P. 149.
2. *Bochianites africanus* (Tate). (*a and c*) lateral, (*b*) ventral views, (*d*) outline whorl-section of a specimen from Kloof on Colchester. (V=venter; D=dorsum.) P. 153.
3. *Bochianites africanus* (Tate). Two lateral (*a*, *b*) and dorsal (*c*) views of lectotype (*b* and *c* are inverted). Prince Alfred's Rest, Sundays River mouth. (B.M., No. C25228.) P. 153.
4. *Rogersites* aff. *wilmanae* (Kitchin). Part of side view (enlarged ×2) of Sundays River example figured in Pl. XIII, fig. 3 and Pl. XV, fig. 2. (B.M., No. C32204). P. 146.

Plate XV.

1. *Rogersites sphaeroidalis*, sp. nov. Side view of inner whorls of the specimen, of which part of the outer whorl is figured in Pl. XIII, fig. 5. Cuyler Manor, Uitenhage. (No. 195, S.H.) P. 144.
2. *Rogersites* aff. *wilmanae* (Kitchin). Side view of the Sundays River example figured in Pl. XIII, fig. 3 and Pl. XIV, fig. 4. (B.M., No. C32204.) P. 146.
3. *Bochianites africanus* (Tate). Two lateral (*a*, *c*) and ventral (*b*) views of one of the syntypes (Tate's fig. 5*c*) and suture-line (*d*), composite and enlarged ×2·5. Prince Alfred's Rest, Sundays River mouth. (B.M., No. C25229.) P. 153.
4. *Rogersites kitchini*, sp. nov. Side view (reduced to half and not quite central) and restored outline whorl-section of earlier portion (at about ×) of holotype. From Zwartkops. (B.M., No. C761.) P. 148.



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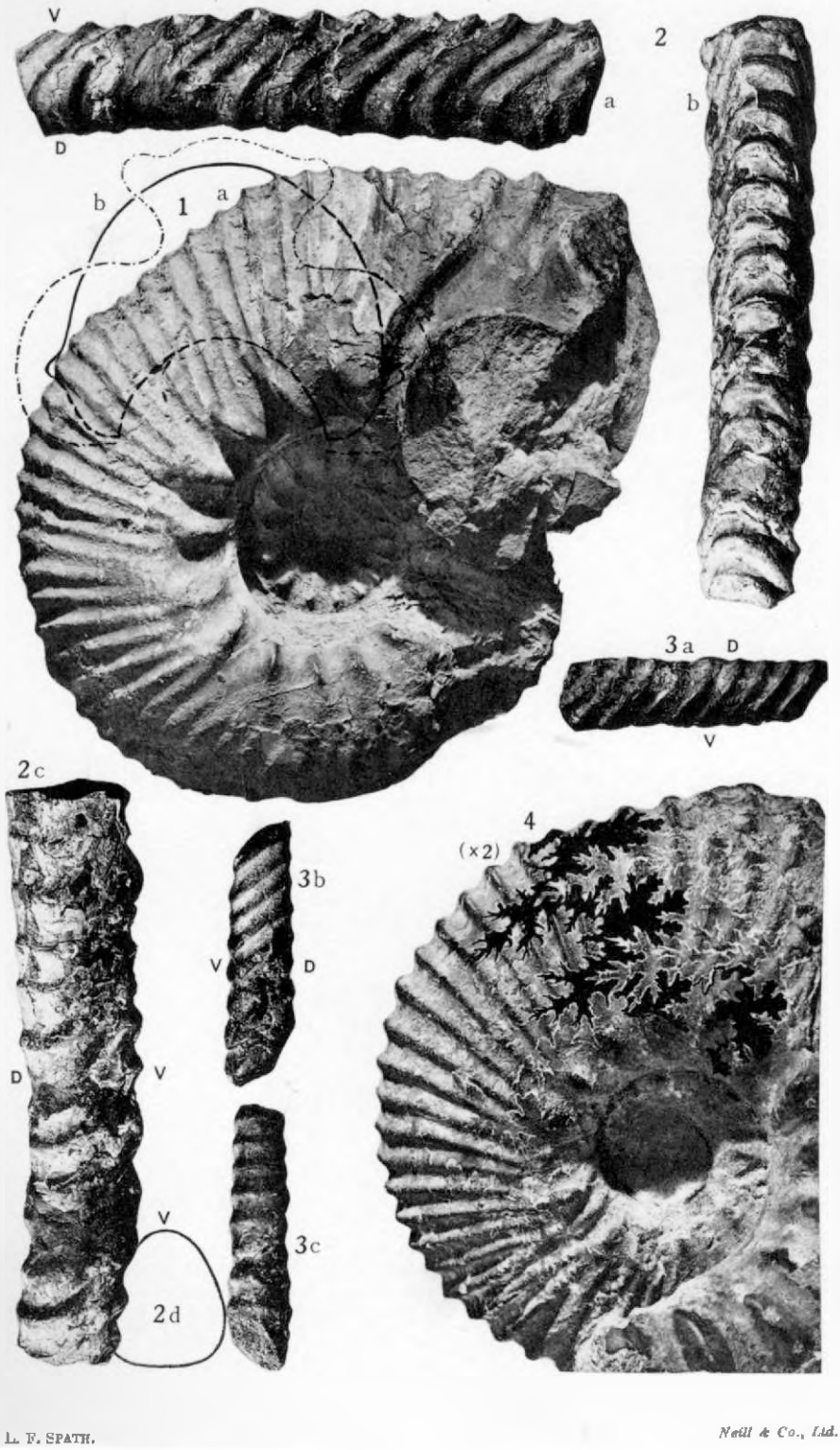

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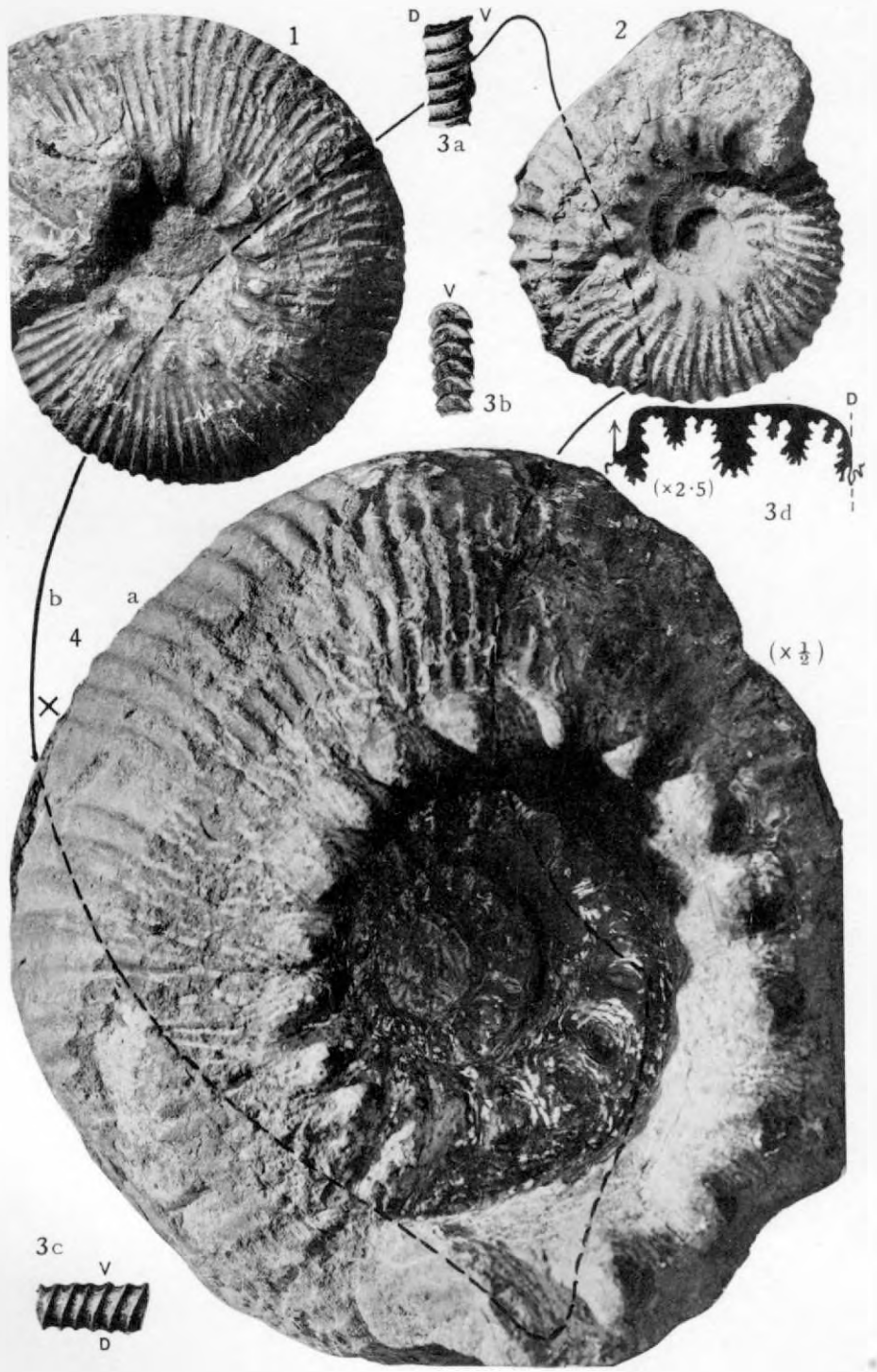

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