

ON UPPER ALBIAN AMMONOIDEA FROM
PORTUGUESE EAST AFRICA, WITH AN
APPENDIX ON UPPER CRETACEOUS AM-
MONITES FROM MAPUTOLAND

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With 10 plates

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I. INTRODUCTION.

THE following paper deals with a collection of Upper Albian Ammonoidea belonging to the Transvaal Museum and kindly sent to the writer, for description, by the Director, through Dr S.H. Haughton, Hon. Curator. There are 102 specimens, including 33 ammonites and 69 heteromorphs, all from Catuane, Portuguese East Africa. These were collected by Dr E. C. N. van Hoepen, and Dr Haughton informs me that presumably they are all from one horizon. Judging by the English type-succession of the Upper Gault, the beds from which came the South African specimens here described would correspond approximately to the *varicosum-equatoriale* zones¹.

The fauna is of great interest, for it includes not only important and new forms of the family Inflaticeratidae (comprising the common keeled ammonites of the Upper Gault) but also forms hitherto known mainly from Australia, where on account of their accidental association with Upper Aptian heteromorphs like *Tropaeum* and *Ammonitoceras* they caused difficulties in correlation.

Two specimens of the Senonian ammonite genus *Mortoniceras* and a new species of *Sharpeiceras* from the Cenomanian of "Maputoland," presented to the Transvaal Museum by Senor Morreira, are described in a short appendix.

II. SPECIFIC DESCRIPTIONS.

Family PHYLLOCERATIDAE Zittel.

Genus PHYLLOCERAS SUSS.

1. *Phylloceras velledae* (Michelin).

1841. *Ammonites velledae* (Michelin) d'Orbigny. *Pal. Franç., Terr. Crét.* vol. I, p. 280, pl. LXXXII.

1907. *Phylloceras velledae* (Michelin) Boule, Lemoine and Thévenin. "Pal. Madagascar, III Céph. Crét. Diego-Suarez," *Ann. Paléont.* vol. II, p. 7, pl. I, fig. 11.

This species, dealt with by the writer on two recent occasions², is represented by a typical specimen (no. 1399) of 135 mm. diameter and a whorl-thickness of 37 per cent. The *Phylloceras* sp. from the south branch of the

¹ See L. F. Spath, "Excursion to Folkestone, with Notes on the Zones of the Gault," *Proc. Geol. Assoc.* vol. XXXIV, 1923, p. 73. Also "Monograph of the Ammonoidea of the Gault," *Pal. Soc.* vol. for 1921 (1923), p. 4.

² "Cretaceous Cephalopoda from Zululand," *Annals South Afr. Mus.* vol. XII, part VII, no. 16, 1921, p. 273. Also "Monogr. Amm. Gault," *loc. cit.* (1923), p. 18.

Manuan Creek, Zululand (B.M. no. C 18264) recorded by Crick¹, and the example from the middle branch of the same creek, described by the writer, are identical with the specimen here discussed.

Hoppe's² *Ph. velledae* from the Ledschime fauna of Sinai, according to a cast in the British Museum, is less inflated and shows more resemblance to *Ph. seresitense* Pervinquière, a species characteristic of the uppermost Albian (*dispar* zone) and the lower Cenomanian.

Family DESMOCERATIDAE Zittel, emend. Spath.

Genus DESMOCERAS Zittel emend. Grossouvre.

2. *Desmoceras latidorsatum* (Michelin).

1903. *Puzosia latidorsata* (Michelin) Choffat. "Crétacique de Conducia," *Contrib. Connaiss. Géol. Colon. Portug. d'Afr., I. Comm. Serv. Géol. Portug.* p. 21, pl. V, figs. M-Q; pl. VI, fig. 1.

1908. *Latidorsella latidorsata* (Michelin) Jacob. "Ammonites du Crétacé Moyen," *Mém. Soc. Géol. France, Pal.* vol. xv, no. 38, p. 35, pl. IV, fig. 12 only.

1922. *Desmoceras cf. latidorsatum* (Michelin) Spath. "Cretaceous Ammonoidea from Angola," *Trans. Roy. Soc. Edinb.* vol. LIII, part 1, no. 6, p. 152.

1923. *Desmoceras latidorsatum* (Michelin) Spath. "Monograph Ammonoidea Gault," *Pal. Soc.* (1921), p. 39, pl. II, figs. 2 *a, b*, text-fig. 9 *c-e*.

Five immature examples (nos. 1343, 1344, 1345 *a-c*), the largest of which (diameter = 18 mm.) shows the suture-line, are referred to this species, already described by Choffat as the commonest species in the Cretaceous Rocks of Conducia and recorded by Crick³ and Boule, Lemoine and Thévenin⁴ from the "Cenomanian" of Zululand and Madagascar.

Desmoceras obesum (Reynès)⁵, with which I would include the var. *a* of *D. latidorsatum* of Kossmat figured by Jacob⁶, may possibly be represented in the immature South African material here discussed, but cannot be distinguished from the present species at very small diameters.

Family INFLATICERATIDAE nov.

The keeled ammonites of the Gault will be dealt with in detail in the writer's monograph (Palaeontographical Society) after completion of the description of the Hoplitid genera. A preliminary summary of their distribution has already been published elsewhere⁷ and this will dispose of the objections to the writer's detailed classification brought forward by Stieler⁸.

¹ "Cretaceous Fossils, Natal. Part III, no. 11, The Cephalopoda from the Tributaries of the Manuan Creek, Zululand," *Third Report, Geol. Surv. Natal and Zululand* (1907), p. 236.

² "Jura und Kreide der Sinaihalbinsel," *Zeit. Deutsch. Palästina Ver.* Jahrg. 1922, p. 138.

³ "Cretaceous Fossils, Natal. Part III, no. 1, The Cephalopoda from the Deposit at the North End of False Bay, Zululand," *loc. cit.* p. 211 (*Desmoceras* sp., cf. *latidorsatum*).

⁴ *Loc. cit.* (1907), p. 16, pl. II, fig. 4.

⁵ Figured in a paper by the writer on Reynès' Types of Gault Ammonites now in press (*Annales Mus. Nat. Hist. Marseille*, 1925). See also Reynès, *Bull. Soc. Scientif. Industr. . . . Marseille*, vol. iv (1876), p. 90.

⁶ *Loc. cit.* (1908), pl. IV, figs. 13 *a, b*.

⁷ "On the Ammonite Horizons of the Gault and Contiguous Deposits," *Summary of Progress, Geol. Survey* 1922 (1923), p. 140.

⁸ "Anomale Mündungen bei Inflaticeraten," *N. Jb. f. Min. etc., Beil. Bd. XLVII*, 1922, p. 339. Also "Über Gault- und Cenoman-Ammon. a. d. Cenoman d. Cap Blanc Nez," *N. Jb. f. Min. etc., 1922* (11) 2, p. 34.

This author may have consulted the geological literature fairly conscientiously but he cannot have examined topotypes of e.g. *Inflatoceras inflatum* (J. Sowerby) or of *Mojsisovicsia dürfeldi* (Steinmann). Stieler also seems to be unaware of the rich faunas of keeled ammonites existing, for example, in the *dispar* zone (uppermost Albian) and the *martimpreyi* zone (lowest Cenomanian). These two zones are almost certainly as yet far too comprehensive and probably represent long ages, divisible into a number of horizons. There appears to be no doubt that *Inflatoceras inflatum* could not occur in the same block as "*Oxytropidoceras*" *karsteni* Stieler¹, probably a much earlier (Lower) Gault form. To identify a small individual definitely as *Inflatoceras inflatum* is in any case almost impossible, even with topotypes. Stieler's interpretation of another of Sowerby's species, namely *Hysterocheras varicosum*, may therefore be queried, as his inclusion, in the Lower Gault genus *Brancoceras*, of Boule, Lemoine, and Thévenin's Madagascan *B. laferrerei*², an Upper Albian *Hysterocheras*, not yet recorded from Portuguese East Africa.

Stieler's remarks on the differences in the occurrence of ammonites of the families Dipoloceratidae and Inflatoceratidae in South America and Europe³ and his conclusions as to the transitional forms between *Oxytropidoceras* and *Inflatoceras* are thus valueless. It may suffice to point out that Stieler, for stratigraphical information, had to rely on the now antiquated researches of Price.

The four genera *Inflatoceras*, *Elobiceras*, *Prohysterocheras* and *Hysterocheras*, represented in the present collection, with *Neoharpoceras* and *Neokentroceras* are here grouped in a separate family Inflatoceratidae, comprising the Upper Albian successors of the earlier family Dipoloceratidae, now restricted to the genera *Mojsisovicsia*, *Oxytropidoceras*, *Manuaniceras* gen.nov.⁴, *Venezoliceras* gen.nov.⁵, *Fallotoceras* and *Dipoloceras*. Similarly it will be advisable to separate, as an independent family Schloenbachidae, the Cenomanian genus *Schloenbachia* Neumayr emend. Grossouvre, and allies, e.g. *Euhysterocheras* Spath, *Algericeras* gen.nov. (genotype *Mortoniceras bogharensis* [Coquand] Pervinquière; "Ammonites du Crétacé Algérien," *Mém. Soc. Géol. France, Pal.* [42] 1910, p. 67, pl. XV, figs. 33, 34 a, b) and *Prionocycloides* gen.nov. (genotype *Mortoniceras proratum* [Coquand] Pervinquière, *ibid.* p. 66, pl. XV, figs. 23, 24 a-c). The last two, of course, have nothing to do with the Senonian family Mortoniceratidae, which is now separated from the Turonian Prionotropidae.

The Lower Gault Dipoloceratidae are characterised by their sharp costation, generally with a steep forward edge, as pointed out by Stieler and Dr Douglas⁶.

¹ "Über sogenannte Mortoniceraten des Gault," *Centralbl. f. Min. etc.*, 1920, p. 395, figs. 8-9.

² "Pal. de Madagascar: III. Céphal. Crétac. des Environs de Diego-Suarez," *Annales de Paléont.* vol. II, 1907, p. 45, pl. IX, fig. 6.

³ *Loc. cit.* (*Centralblatt*, 1920), p. 347.

⁴ Genotype: *Pseudophacoceras manuanense*, Spath, *loc. cit.* (Zululand, 1921), p. 281, pl. XXV, figs. 1 a-d. Choosing as genotype of *Pseudophacoceras* d'Orbigny's *Amm. roissyanus*, I made it a synonym of Stieler's *Oxytropidoceras*, established just previously, so that unfortunately it cannot be used for the group of ammonites (really quite distinct from the singly-costate *Oxytropidoceras roissyanus*) to which "*Pseudophacoceras*" *manuanense* belongs. I pointed out that the ornamentation of this form was somewhat reminiscent of that of *Neoharpoceras*, but that the suture-lines were very different in the two stocks.

⁵ Genotype: *Oxytropidoceras venezolense*, Stieler (= *Schloenbachia inflata*, Schlagintweit [non Sowerby]), "Die Fauna des Vracon und Cenoman in Peru," *N. Jb. f. Min. etc.*, Beil. Bd. xxxiii (1912), p. 79, figs. 1 and 2 [p. 81], *loc. cit.* (*Centralblatt*, 1920), p. 394. This is somewhat intermediate between *Mojsisovicsia* and *Oxytropidoceras*, but has already lost the single continuous costation.

⁶ "Geological Sections through the Andes, etc.," III. *Quart. Journ. Geol. Soc.* vol. LXXVII (1921), pp. 268-9, text-fig. 4 c.

In *Mojsisovicsia* this costation appears suddenly in the adult, in *Falloticerias* it is confined to the young. *Manuaniceras*, which, in costation, is transitional to the Inflaticeratid genus *Neoharpoceras*, still has the high and sharp keel of Dipoloceratidae.

The Upper Gault Inflaticeratidae generally have notched or tuberculate costation and a low keel. The Cenomanian family Schloenbachidae, which again are strongly keeled, probably have an independent origin in Desmoceratidae; some start with constricted inner whorls and all have numerous elements in their suture-lines. Morphologically, however, they appear to be connected with *Pleurohoplites* of the Upper Gault, and therefore the family Hoplitidae.

Genus INFLATICERAS Stieler.

3. *Inflaticeras africanum* sp. nov. (Pl. XXIX, figs. 2 a, b).

1922. *Subschloenbachia* sp. (similar to *S. pachys* Seeley sp., but rursiradiate) Spath. "Cretaceous Ammonoidea Angola," *loc. cit.* p. 102.

The example on which this species is based (Pl. XXIX, figs. 2 a, b) has dimensions: 65—41—43—31¹. The whorl-section is quadrangular, as in *I. pachys* (Seeley)² or *I. kiliani* (Lasswitz)³, the ventral area comparatively flat and the keel is fairly prominent. There are 36 peripheral ribs, corresponding to about 20 elongated umbilical bullae, and, unlike the two species cited, *I. africanum* has no median tubercles. The suture-line, with wide-stemmed saddles and a comparatively narrow and bifid lateral lobe, is close to that of a Cambridge Greensand example (L. F. Spath coll. no. 391) of *I. aequatoriale* (Kossmat)⁴ and the lobe-lines of specimens of *I. pachys* (L. F. Spath coll. nos. 29 c and 1867).

The Bou Thaleb (Algeria) example (B.M. no. C 6567), above cited and previously described as differing from *I. leonense* (Conrad) in having less high whorls and a closer costation, probably belongs to the species here described, but is slightly crushed obliquely. The American form, as figured by Hill⁵, is distinguished from *I. africanum* not only by its more distant costation but by a different umbilicus and probably dissimilar inner whorls.

The large *Inflaticeras* from the Manuan Creek, Zululand, described by the writer⁶ in 1921 (as *Subschloenbachia* cf. *trinodosa* Böse sp.) may represent merely a whorl-fragment of the form here described, and differs from the Mexican original⁷ by having a more depressed section. On account of difference in size comparison is difficult, but if the large whorl-fragment belong to *I. africanum*, then the resemblance of this species to *I. pachys* is confined to smaller individuals, for the latter form retains to a considerable diameter costation much closer than that of *I. trinodosum*.

¹ Diameter in mm., whorl-height, thickness and umbilicus in percentages of the diameter.

² "Ammonites from the Cambridge Greensand," *Ann. Mag. Nat. Hist.* (3), vol. xvi (1865), p. 227, pl. XI, fig. 4.

³ "Kreide-Ammon. v. Texas," *Geol. und Pal. Abhandl.* vol. x (1904), p. 25, pl. VIII, fig. 1 (text-fig. 6, p. 26), as represented by a Cambridge Greensand example (L. F. Spath coll. no. 1876).

⁴ "Untersuch. Südind. Kreideform." *Beitr. Pal. Geol. Österr.-Ung.* vol. ix (1895), p. 127 (Stoliczka, 1865, *Pal. Indica*, pl. XXIX, figs. 1, 3).

⁵ "Geogr. and Geol. Black and Grand Prairies, Texas," *21st Ann. Rep. U.S. Geol. Surv.* (1901), pl. XXXVI, figs. 1, 1 a.

⁶ *Loc. cit.* p. 285.

⁷ "Mon. Geol. y Pal. Cerro de Muleros," *Bol. Inst. Geol. Mexico*, no. 25 (1910), p. 78, pl. X, figs. 2-4.

4. *Inflatoceras* sp.ind.

A fragment (no. 1497) of the body-chamber of a very large form of *Inflatoceras* cannot be identified specifically. The outer tubercle, with transverse striae, is unusually prominent while, so far as can be seen, the spirally notched ribs with strong forward inclination bear no distinct lateral or inner tubercles. There is lack of comparable material, but the fragment of *I. stoliczkaei* (Spath), figured on a previous occasion¹, is somewhat similar, although the ribs are rectiradiate and the outer tubercle is not very prominent. The considerably earlier *I. bispinosum* (Spath)² may also produce a comparable outer whorl and in the lateral projection of the peripheral tubercle, perhaps, shews closer resemblance to the fragment here discussed than does *I. stoliczkaei*.

5. *Inflatoceras haughtoni* sp.nov. (Pl. XXIX, fig. 1 a, b; Pl. XXX, fig. 2).

The dimensions of the holotype are 120—31—38—47 and 95—30—37—47. The umbilicus is thus very wide and the coiling loose, while the depression of the whorl-section, owing to its roundness, is not so apparent as in *I. pre-rostratum* Spath³. On the outer whorl of the species here described, only the inner (umbilical) tubercle is marked; the lateral one begins to appear towards the end, but the outer pair of tubercles are distinct only on the inner whorls (Pl. XXX, fig. 2), and then show some resemblance to the projected tubercles of *Neokentroceras*. There are 44 ribs on the outer area of the final whorl (40 and 36 on the inner whorls) and without trace of forward projection the costae end at the shallow grooves accompanying a prominent but not very high keel. These 44 outer ribs correspond to 25 umbilical bullae. The suture-line is characterised by unusually slender saddles and shows good agreement with that of *I. pricei* (Spath)⁴ from the upper Nodule Bed (*orbignyi* zone) of Harris's Pit, Shenley Hill (L. F. Spath coll. no. 392) which, like its ally *I. bispinosum*, is also as yet without median tubercle, but otherwise greatly resembles the true *I. inflatum*⁵.

These species have a more compressed whorl section, higher keel, narrower umbilicus, and more conspicuous outer tubercle. *I. pre-rostratum* is less closely costate and on the outer whorl pronouncedly bispinate, and *I. meunieri* Spath⁶, which in costation agrees with the species here described, has prominent median and outer tubercles.

The form described below as *I. recticostatum* sp.nov., with more distant and comparatively coarser ribbing, seems to be connected with the present species by transitional examples, partly fragmentary (no. 1466) or immature (no. 1333), but including also the specimen represented on Pl. XXVIII, fig. 7 (no. 1419).

6. *Inflatoceras recticostatum* sp.nov. (Pl. XXVIII, figs. 2 a, b; 3; 5 a, b; 6 a, b; 7).

This species is represented by five examples of which the holotype (no. 1331, Pl. XXVIII, fig. 6 a, b: dimensions 63—30—38—48) and another typical example (no. 1332, Pl. XXVIII, fig. 2 a, b: dimensions 47—32—38—45) are here figured, also the suture-line (Pl. XXVIII, fig. 3) from an immature example (no. 1470). The specimen depicted on Pl. XXVIII,

¹ Spath, *loc. cit.* (Angola, 1922), p. 120, text-fig. C.

² *Loc. cit.* (Zululand, 1921), p. 285, pl. XXIV, fig. 9.

³ *Ibid.* p. 284.

⁴ *Loc. cit.* (Angola, 1922), p. 101.

⁵ See Spath, *loc. cit.* (Angola, 1922), p. 101, text-figs. A 1a, b.

⁶ *Ibid.* p. 115 (= *Schloenbachia inflata*, Meunier, *Bull. Soc. Géol. France*, vol. xvi (1887), p. 61, pl. I, fig. 2 only). (B.M. no. C 14812, Dr Ansorge coll., from near Catumbella.)

fig. 5 a, b (no. 1401, of dimensions 75—33—36—44) is more compressed and more involute than the type, and is considered to be a passage form to *I. prerostratum* Spath.

The present species is characterised by its rectiradiate costation, resembling that of *I. haughtoni*, but less close and coarser, and tending to irregularity on the outer whorl. The spirally notched ribs meet the keel at right angles, without the slightest forward projection, and on the inner whorls, the doubly-tuberculated peripheral endings of the costae resemble the peculiar flattened nodes that characterise *Neokentroceras*. The ribs, at that stage, are distinctly bituberculate, counting the twinned outer tubercle as one; a median (third or rather fourth) tubercle is not developed until with increase of diameter there begins to be room for it on the still narrow sides between the closely-set inner and outer tubercles. The whorl section in the young resembles that of some *Neokentroceras* figured on a previous occasion¹ and in the holotype is depressed owing to the prominent umbilical tubercles. The suture-line (Pl. XXVIII, fig. 3) resembles that of young examples of *Inflatoceras* of the *aequatoriale* group but also those of the Cambridge Greensand examples (e.g. L. F. Spath coll. no. 313) formerly² doubtfully referred to *Neokentroceras*.

I. prerostratum differs from the present species in having greater whorl-thickness, with a prominent umbilical tubercle nearly half-way up the side. The Bellegarde type of *I. prerostratum*, previously referred to³, however, and the Madagascan example figured by Boule, Lemoine and Thévenin⁴ as a "typical *Schloenbachia* (*Mortoniceras*) *inflatum*," on account of the difference in size are difficult to compare with the present species. They also have *Hysterocheras* or *Neokentroceras* costation on the inner whorls.

I. picteti (Spath)⁵ is close to the species here described, but remains regularly costate to a larger diameter. Its costae are finer, distinctly, if delicately, trituberculate, and the dimensions of the holotype (B.M. no. C 3822) are 70—37—43—39, as compared with 92—42—40—33 of Pictet's original figure⁶.

Inflatoceras (*Neokentroceras*?) *lemoini* sp.nov. (= *Schloenbachia tectoria* non White, in Boule, Lemoine and Thévenin, *loc. cit.* 1907, p. 36, pl. IX, fig. 2) resembles the young examples (nos. 1398 and 1470) of the present species but is still more strongly tuberculate and may lead to *Neokentroceras*. The somewhat similar Cap de la Hève specimen (B.M. no. 25325), previously⁷ compared to *I. bispinosum*, also represents a spinose type of young, but is bituberculate, without trace of a median, lateral, node. The same type of young is found again in that unnamed species of *Inflatoceras* which I had recorded⁸ as an "accelerated derivative of *I. rostratum*," and which will be described in the monograph of the Gault Ammonoidea (Palaeontographical Society) as *I. potternense*. This is connected by many transitions with *I. (Hysterocheras?) bucklandi* (Spath)⁹, and it is to be noted that one of the examples in the present collection (no. 1396) at a diameter of only 33 mm. already shows weakening of the keel, thus forming a transition to the *Hysterocheras* described below.

¹ *Loc. cit.* (Angola, 1922), p. 141, text-figs. D 3 and D 7.

² *Ibid.* p. 107.

³ B.M. no. C 10547. See Spath, *loc. cit.* (Zululand, 1921), p. 285.

⁴ *Loc. cit.* (1907), p. 40, pl. IX, figs. 7, 7a.

⁵ *Loc. cit.* (Zululand, 1921), p. 284.

⁶ In Pictet and Roux, *Moll. Grès Verts*, 1847, pl. IX, fig. 6. The dimensions given in the text (20—225, 34—44—38) are probably based on a variety of different forms. The holotype is slightly crushed elliptically.

⁷ *Loc. cit.* (Angola, 1922), p. 100.

⁸ *Ibid.* p. 123 (no. 17).

⁹ *Ibid.* p. 99.

A small fragment of an outer whorl (no. 1431) of an *Inflatoceras* much larger than the holotype of the present species may be tentatively included here.

Genus *ELOBICERAS* Spath.

7. *Elobiceras newtoni* sp.nov. (Pl. XXX, fig. 1 *a, b*; Pl. XXIX, fig. 3).

1922. "*Mortoniceras* cf. *lenzi* Crick MS." Spath. *Loc. cit.* (Angola), p. 103.

The example here figured (no. 1314) and the Nigerian specimen previously referred to are fragmentary and dissimilar in size, but probably belong to the same new form, apparently close to *Elobiceras intermedium* Spath and *E. lobitoense* (Crick MS.) Spath¹. A reconstruction of the holotype (Pl. XXX, fig. 1 *a, b*) gives the following dimensions: 100—45—40—30; those of the Nigerian specimen (B.M. no. C 20274) are approximately: 80—43—(?)·36—30. The inner whorls resemble *E. lenzi* (Szajnocha)² and are as compressed as the example of *Prohysterocheras*? sp.ind. described below (Pl. XXX, fig. 3), but show the spiral notching of *Elobiceras* already at that stage. Later the whorl-section becomes more rectangular (with almost parallel sides), more inflated and subquadrate, owing to the greatly projecting ribs with about ten transverse notches. The keel is very prominent, undercut, and accompanied by deep grooves. The ribs appear to meet this keel at right angles, as in *E. lobitoense*, but in strong, oblique, illumination fine and strongly projecting striae of growth can be seen, connecting the terminations of the ribs with the keel, as in *E. dombense* (Spath)³. The last half of the outer whorl of the holotype belongs to the body-chamber but the suture-line is well shown on the inner whorls (Pl. XXIX, fig. 3). It is characterised by a higher lateral saddle than the somewhat similar suture-lines of *Hysterocheras* and *Neokentrocheras*, and resembles in this respect the suture-lines of *Prohysterocheras burckhardti* (Böse)⁴ and allied forms of the *candollianum* group, e.g. a Wissant example (L. F. Spath coll. no. 308) of Pictet's species⁵.

The earlier part of the body-chamber of *E. lobitoense* has straight and coarsely notched costae somewhat resembling but more regular than those of the species here described. The whorl-section, however, is thinner, and less rapidly expanding and there are no ventral grooves in the Angola species. *E. lenzi*, with which the Nigerian example⁶ had been compared by Crick, is incompletely known, but fairly involute already in the young.

Genus *PROHYSTERO CERAS* Spath.

8. *Prohysterocheras* sp.ind. (Pl. XXX, fig. 3 *a, b*).

This form, represented by only one incomplete example (no. 1427), in its compressed, discoidal whorl-shape resembles the inner whorls of the holotype of *Elobiceras newtoni*, above described, but its costation is finer,

¹ *Loc. cit.* (Angola, 1922), pp. 134-6, pl. I, figs. 1 *a, b*; 2 *a-d*.

² "Zur Kenntnis d. Mittelcret. Ceph. Fauna d. Ins. Elobi a. d. W. Küste Afr.," *Denkschr. k. Akad. Wiss. Wien, Math. Nat. Kl.* vol. XLIX (1885), p. 234, pl. II, fig. 4.

³ *Loc. cit.* (Angola, 1922), pp. 103, 124 (= *Schloenbachia lenzi* Choffat, pars, non Szajnocha, in Choffat and de Loriol, "Matériaux... Angola," *Mém. Soc. Phys. Hist. Nat. Genève*, vol. xxx, 1888, pl. I, fig. 4 only).

⁴ *Loc. cit.* (1910), p. 61, pl. I, fig. 5.

⁵ See Spath, *loc. cit.* (Angola, 1922), p. 104.

⁶ From Orofu, Muri Province, 250 miles east of confluence of Rivers Benue and Niger, Northern Nigeria (J. D. Falconer coll.). In a recent lecture (*Abstract Proceed. Geol. Soc.* no. 1126, 22 December, 1924) Dr Falconer again stated that the Cretaceous of Nigeria included rocks only from the Turonian upwards (see also *Geology and Geography of Northern Nigeria*, 1911, p. 144). I had recorded the occurrence of Gault Ammonites in 1921 (*loc. cit.*, Zululand, p. 306) and 1922 (*loc. cit.*, Angola, pp. 103, 106, 134, 155).

sigmoidal, and not notched as in *Elobiceras*. The present example is more involute than *Prohysterocheras wordiei* Spath¹, the genotype, and more finely ribbed. On the other hand, *P. goodhalli* (J. Sowerby)², with a similar umbilicus of 33 per cent. of the diameter, has not only coarser but (peripherally) more projected costation, whereas *P. aplanatum* Spath³ and *P. involutum* Spath⁴ are more involute.

The suture-line of the example here described shows a large and bifid lateral saddle and a longer and straighter second lateral lobe than that of fig. 4, Pl. XXVIII, *i.e.* there is greater resemblance to the suture-line of the small *Hysterocheras* (? *Neokentrocheras*) from Angola, previously figured⁵. An unnamed *Prohysterocheras* from the *auritus* zone of Folkestone (L. F. Spath coll. no. 1870), to be described in the Monograph of the Gault Ammonoidea, shows a similar suture-line. This appears to be directly connected with the *bouchardianum* group of *Dipoloceras* (L. F. Spath coll. no. 1871). Another form of the same group, *Prohysterocheras antipodeum* Spath (= *Schloenbachia rostratus*, var. *antipodeus* Etheridge, fil.⁶), identified with *Dipoloceras bouchardianum* (d'Orbigny) by Stieler⁷, has a more quadrate whorl-section than the present species.

A very small example (no. 1471) may represent the nucleus of another specimen of a similar *Prohysterocheras*.

Genus HYSTERO CERAS Hyatt.

9. *Hysterocheras* sp.nov. ?ind.

An immature specimen (no. 1334) with close costation and only faint umbilical tubercles resembles young *Hysterocheras* before me from the Pertuis-du-Rhône without, however, agreeing with any. *H. orbignyi* (Spath)⁸ (*e.g.* L. F. Spath coll. no. 2090 from Savoy, and numerous examples from the *orbignyi* zone of Folkestone) is less closely costate; *H. carinatum* Spath⁹ (*e.g.* no. 1862) is more compressed and flatter at the sides. From the forms of *Hysterocheras* described below this incomplete specimen is distinguished by its close costation.

10. *Hysterocheras choffati* sp.nov. (Pl. XXVIII, figs. 1 *a, b*; 4; Pl. XXX, fig. 5 *a, b*).

1905. *Schloenbachia varicosa* (Sowerby) Choffat. "Nouvelles données sur la Zone Littorale d'Angola," *Comm. Serv. Géol. Portug., Colon. Port. d'Afr.* 11, p. 34, pl. IV, fig. 6 *a, b*.

1922. "*Schloenbachia varicosa*" (Choffat non Sowerby) Spath. *Loc. cit.* (Angola), pp. 107 and 157.

This species is represented by eight examples, two of which are here figured. The inner whorls are almost indistinguishable from those of *Inflatoceras recticostatum*, and attention has already been drawn to a passage form between this species and the present form. One of the examples under discussion (no. 1397) agreeing with the inner whorls of Pl. XXX, fig. 5, at a

¹ *Loc. cit.* (Angola, 1922), p. 143, pl. III, fig. 6 *a, b*.

² *Min. Conchol.* vol. III, p. 100 (1820), pl. CCLV (B.M. no. 43949).

³ *Loc. cit.* (Angola, 1922), p. 100.

⁴ *Ibid.* p. 104.

⁵ *Ibid.* text-fig. D 7a, p. 141.

⁶ "Lower Cretaceous Fossils from the Sources of the Barcoo, Ward, and Nive Rivers, South Central Queensland," part II, Cephalopoda, *Rec. Austral. Museum*, vol. VII, no. 4 (1909), p. 237, pl. LXVII, figs. 3-4.

⁷ *Loc. cit.* (N. Jb. f. Min. Beil. Bd. XLVII, 1922), p. 336.

⁸ *Loc. cit.* (Angola, 1922), p. 99 (= d'Orbigny, *Pal. Franç., Terr. Crét.* vol. 1, 1841, pl. LXXXVII, fig. 3 only).

⁹ *Ibid.* p. 99 (= pl. LXXXVII, fig. 4 only).

diameter of 20 mm., still has a distinct keel and in the absence of complete comparable material might well have been considered to be a young *Inflaticeras*. On the other hand, example no. 1354 has acquired the typical aspect of the holotype (Pl. XXVIII, fig. 1) already at a diameter of 30 mm., but cannot be separated from the type or the other slightly dissimilar examples, though it may, perhaps, be considered to be transitional to the still more advanced *Hysterocheras laferreirei* (Boule, Lemoine and Thévenin)¹. Again, the example (no. 1465), from which the suture-line was drawn (Pl. XXVIII, fig. 4), though worn down on one side, is more compressed and slightly more closely costate than the type. All the examples, however, agree in having tuberculate inner whorls, of the *Neokentroceras* type, ranging from the depressed type of *Hysterocheras* (? *Neokentroceras*) sp., figured previously², to the more compressed whorl-section of *H.* (? *Neokentroceras*) *pseudovaricosum* (Spath)³. The outer tubercles disappear at diameters from 20–30 mm., and soon after also the keel. The ribs, first bifurcating, later alternately long and short, now meet on the periphery in more or less pronounced chevrons, directed forwards, and finally the costae of the two sides are continuous and sharp across the whole ventral area.

In the absence of the inner whorls, the present species would thus be difficult to distinguish from *H. orbignyi*, which, moreover, has a similar suture-line. *H. varicosum* (J. de C. Sowerby)⁴ and *H. binum* (J. Sowerby)⁵ have different, more flattened costae and comparatively smooth inner whorls to a considerable diameter. On the other hand, associated with *H. varicosum* and *H. binodosum* (Stieler)⁶, at Folkestone, there occur a number of undescribed forms of *Hysterocheras* of which some, if not to be included in the present species, are at least passage forms to it from other types of the same genus. The present species itself probably belongs to the next higher zone, for zonal collecting in the Gault has shown that whereas the early *Hysterocheras*⁷ are simply costate (*cristatus* zone) or nodate at the umbilical end (*orbignyi* zone), the forms of the *varicosum* zone first show separation of the outer flattened nodosity and that only the later forms (*auritus* zone) have tuberculate (*Neokentroceras*) inner whorls. Their outer whorls, with disappearing keel and often continuous, aegoceratid ribbing, may be very similar and may make specific identification impossible. I was formerly⁸ inclined to separate generically, from the present genus, a group of flattened forms that appeared to be merely *Prohysterocheras*, showing loss of keel, but it seems more likely that *Hysterocheras* persisted, than that each Inflaticeratid genus, all specialising in definite directions, from the gigantic, rostrate *Inflaticeras* itself to the dwarfed, horned *Neokentroceras*, produced *Hysterocheras*-like offshoots⁹.

The crushed and worn fragment of a *Hysterocheras* sp.¹⁰ recorded by Crick

¹ *Loc. cit.* (1907), p. 45, pl. IX, fig. 6 a, b.

² *Loc. cit.* (Angola, 1922), fig. D 7, p. 141.

³ *Ibid.* figs. 4, 5.

⁴ *Min. Conchol.* vol. v, p. 74 (1824), pl. CDLI, fig. 5 only (lectotype), B.M. no. 43952a.

⁵ *Ibid.* vol. 1, p. 208 (1815), pl. XCII, fig. 3 (B.M. no. 43956). The reduced (pseudoceratitic) suture-line of an extreme variety of this species was figured in *Monogr. Gault Amm.* (Pal. Soc. 1923), part 1, p. 10, text-fig. 1 h.

⁶ *Loc. cit.* (*Neu. Jahrb.*, 1922, 11), p. 38, text-figs. 12–15, wrongly referred to *Brancocheras* (*senequierei* group) and separated generically from its close ally *H. varicosum*.

⁷ See Spath (*Folkestone Excursion Report*, 1923, p. 75), *Hysterocheras* sp.n. (= "*versicostatus*" Price non Michelin, B.M. no. C 12499), to be described later.

⁸ *Loc. cit.* (Angola, 1922), p. 99.

⁹ It must be remembered, however, that *Brancocheras* represents a corresponding development of an earlier Dipoloceratid, and that the specimen of a *Hysterocheras* previously recorded (Angola, 1922, p. 99; L. F. Spath coll. no. 1864), as having *cristatum* flares on the inner whorls, may again be a comparable offshoot of *Dipoloceratid* itself.

¹⁰ "Cretaceous Fossils, Natal, part III," *Third Report, Geol. Survey Natal and Zululand*, 1907, p. 248.

from Zululand (B.M. no. C 18309) may belong to the present species but is indeterminate.

11. *Hysterocheras* spp. juv.

Two very small examples (nos. 1459 and 1349) resemble *Hysterocheras* (? *Neokentrocheras*) *pseudovaricosum* (Spath) and its variety *compressa*¹ respectively, but they are too immature for accurate identification. One of the new Angola species² previously referred to as comparable to the involute *Prohysterocheras aplanatum* Spath, but with loss of keel at a very small diameter (B.M. no. C 14811), appears to belong to the same stock but has a smaller umbilicus.

Family HAMITIDAE Hyatt.

A revision of this family, based on several years' zonal collecting in the English Gault, will be attempted in the Monograph of the Gault Ammonoidea, now in course of publication by the Palaeontographical Society. The material from Portuguese East Africa to be described is fragmentary and quite insufficient for detailed discussion.

Genus HAMITES Parkinson.

12. *Hamites* sp. ind. (Pl. XXXIV, fig. 8).

A small fragment of a *Hamites* (no. 1390) apparently belongs to the typical group of *H. attenuatus* (J. Sowerby)³, but shows bifurcation of the ribs on the dorsal side, as in the less obliquely-ribbed *H. duplicatus* Pictet (= *H. virgulatus* Pictet, pars, non d'Orbigny)⁴. The fragment is part of a body-chamber and, moreover, a malformation, the ribs on the side opposite to that shown in Pl. XXXIV, fig. 8, being interrupted by a longitudinal scar, so that exact identification is impossible.

Genus TORNEUTCERAS Hyatt emend.

13. *Torneutoceras* sp. ind. (Pl. XXXII, fig. 3).

The small fragment (no. 1391) here figured is probably close to *T. tenue* (J. Sowerby)⁵ from the *varicosum* zone of Folkestone, but there is beginning differentiation of the ventral ribbing as in *T. virgulatum* (d'Orbigny)⁶ referred to on a previous occasion⁷. The fragment does not show suture-lines and cannot be identified definitely.

The genus *Torneutoceras* is provisionally retained for those Hamitids which, like the genotype *H. attenuatus* d'Orbigny non Sowerby⁸, have a smooth dorsal area and also begin to differentiate the ventral costation. The ribs are also rounded, blunt, not sharp, as in the earlier *Hamites* or the Upper Gault *Hemiptychocheras* gen. nov., created for *Ptychocheras gaultinum*, Pictet (*Moll. Grès Verts*, 1847, p. 139 (395), pl. XV, fig. 5a [typus]). *Torneutoceras* thus restricted, via *Hamites turgidus* J. Sowerby⁹, is transitional to *Idiohamites* gen. nov., proposed for *Hamites tuberculatus* J. Sowerby¹⁰, which again is

¹ *Loc. cit.* (Angola, 1922), p. 141, text-fig. D 4-5 and 6.

² *Ibid.* p. 100. Another Angola form, more advanced than *Hysterocheras choffati* and without keel already at 15 mm. diameter, has lately been presented to the British Museum by Mr F. M. Penney, F.G.S. (no. C 25427).

³ *Min. Conchol.* vol. 1, p. 137 (1814), pl. LXI, fig. 4 (lectotype, B.M. no. 43991a).

⁴ In Pictet and Campiche (*loc. cit.*, Ste Croix, 1861), p. 85 = Pictet and Roux (*loc. cit.*, Grès Verts, 1847), pl. XIV, figs. 7-9.

⁵ *Min. Conchol.* vol. 1, p. 136 (1814), pl. LXI, fig. 1 (B.M. no. 43989).

⁶ *Pal. Franç., Terr. Crét.* vol. 1, 1841, pl. CXXXIV, figs. 1-4.

⁷ *Loc. cit.* (Angola, 1922), p. 148.

⁸ *Loc. cit.* (1841), pl. CXXXI, figs. 9-13.

⁹ *Min. Conchol.* vol. III, p. 30 (1818), pl. CCXVI, fig. 6, B.M. no. 43999.

¹⁰ *Ibid.* fig. 5, B.M. no. 43998c (holotype).

morphologically intermediate between *Torneutoceras* and *Algerites* Pervinquier¹. The latter agrees with *Idiohamites* in "lytoceratid" suture-line and in having tuberculate ventro-lateral edges, but the coiling is closer and the ornamentation is weaker in *Algerites*. Without stressing the importance of the bifid antisiphonal lobe in these two genera, it may be convenient to unite them in a family Algeritidae nov.

Genus HELICOCERAS d'Orbigny.

14. *Helicoceras* sp.nov.? (Pl. XXX, fig. 4; Pl. XXXV, fig. 3).

The example (no. 1438) figured on Pl. XXX, fig. 4, and a second fragment (no. 1456, Pl. XXXV, fig. 3) may belong to a new species of *Helicoceras*, characterised by rather sharp costation, only slightly attenuated on the dorsal side, and by a slightly compressed whorl-section. *H. rotundum* (J. Sowerby)² is apparently closely allied but has still more acute and closer costae and a circular cross-section, also the suture-line of true *Hamites* with bifid first lateral, but trifid second lateral and internal lobes. The ribbing in *H. annulatum* d'Orbigny³ is more oblique and more distant than that of the present species and *H. gracile* d'Orbigny⁴ is difficult to compare on account of difference in size. The immature whorls (no. 1443) figured on Pl. XXXIV, fig. 4, cannot be definitely identified but show bifid lobes and saddles, very widely spaced, as in the figured specimen. Böse's "*Anisoceras*" *neohispanicum*⁵ begins with a similar open spiral.

Helicoceras thurmanni Pictet and Campiche, with alternately tuberculate and plain costation and closer to *Protanisoceras* Spath⁶ than to the true *Helicoceras*, is here separated as *Prohelicoceras* gen.nov.⁷, and will be discussed in detail when the family Hamitidae is revised. *Prohelicoceras* has so far been found in England only at Culham, Oxfordshire; *Protanisoceras* only at Folkestone, both in the *mammillatus* bed.

Family ANISOCERATIDAE Hyatt.

Genus ANISOCERAS Pictet.

15. *Anisoceras* aff. *armatum* (J. Sowerby) (Pl. XXXIV, fig. 3; Pl. XXXV, figs. 4-5; Pl. XXXVI).

A comparison of the large example figured on Pl. XXXVI with Sowerby's type⁸ will show that the African examples here described are very close indeed to the English form, rather common in the *auritus* zone. The majority of the twelve fragments before me, including the examples figured on Pl. XXXIV, fig. 3, and Pl. XXXV, fig. 4, are rather finely tuberculate and differ from Mantell's⁹ specimen from the Lower Cenomanian of Hamsey, Sussex, wrongly united with *Hamites armatus*, in having the stronger ribs much more

¹ "Ammonites du Crétacé Algérien," *Mém. Soc. Géol. France, Pal.* no. 42 (1910), p. 14, pl. I, figs. 21-25.

² *Min. Conchol.* vol. I, p. 136 (1814), pl. LXI, fig. 2 (right-hand figure, with 31 costae, B.M. no. 43990 a, beginning to decompose, apparently from *intermedius* zone).

³ *Loc. cit.* (1841), pl. CXLVIII, figs. 7-9.

⁴ *Ibid.* figs. 10-15.

⁵ "Algunas Faunas Cretácicas, etc.," *Bol. Inst. Geol. Mexico*, no. 42 (1923), p. 140, pl. X, figs. 14-19.

⁶ *Loc. cit.* ("Folkestone Excursion Report," 1923), p. 75.

⁷ Genotype: *Helicoceras thurmanni* Pictet and Campiche (*loc. cit.*, Ste Croix, 1861), pl. LVI, fig. 4 a-c.

⁸ *Min. Conchol.* vol. II, 1817, pl. CLXVIII (wrongly stated to be from the Chalk Marl).

⁹ *Fossils of the South Downs*, 1822, pl. XXIII, fig. 4 (B.M. no. 4842).

pronounced. Some are very coarsely tuberculate (Pl. XXXV, fig. 5) and as Boule, Lemoine and Thévenin¹ point out, there is resemblance then to *Anisoceras perarmatum* Pictet and Campiche². None of the examples before me, however, can be attached to this species, nor is Pictet's *A. armatum*³ identical with Sowerby's or the present forms. There is much closer affinity of the latter with Pictet's *A. saussurianum*⁴.

Anisoceras oldhamianum Stoliczka⁵ is close to some of the fragments included in the present form, but has strong ribs connecting the tubercles. The Angola specimen previously described⁶ as *A. cf. oldhamianum* is badly preserved but quite unlike the East African examples under discussion.

INCERTAE SEDIS.

The following two genera are representatives of two new families. Since a revision of the Australian Cretaceous ammonoid faunas will shortly be published and in order to avoid the creation of possible synonyms, Mr Whitehouse's nomenclature is here adopted. *Labecerases* (as genotype of which is taken an Australian specimen in the British Museum, no. C. 25355, the suture-line of which I have figured in Pl. XXXI, fig. 7) is connected with *Hamitoides* gen.nov., established for *Hamites studerianus* Pictet⁷, which is the only known European representative of the family (*Labeceratidae* nov.) to which the Australian and South African forms belong. Their connection with *Scaphitidae* will be discussed when the uncoiling Ammonoidea of the Gault are described in a future part of the writer's monograph.

Myloceras is included by Mr Whitehouse in another new family and he separates, generically, from this genus Etheridge's "*Crioceras*" *plectoides*⁸ as well as McCoy's "*Ancyloceras*" *findersi*⁹. Since the reasons for recognising three separate genera are not apparent from a perusal of Etheridge's descriptions and figures of the Australian material, it will be necessary to await the publication of Mr Whitehouse's results. Meanwhile all the African forms here described as *Myloceras* are considered to be representatives of only one species-group.

Genus LABECERAS Whitehouse MS.

16. *Labecerases plasticum* sp.nov. (Pl. XXXI, figs. 3-5, 8, 9; Pl. XXXIV, figs. 5-7).

The coiling of this form is fairly constant and ancyloceratid, as shown in Pl. XXXI, fig. 4*a*, beginning as an open spiral which, however, is not preserved to the protoconch in any of the seventeen examples before me. This mode of coiling agrees with that of the genotype above referred to and to be figured by Mr Whitehouse, also of *L. taylori*¹⁰ and *L. laqueum* (Etheridge)¹¹. The ribbing of the early spiral portion is annular, becomes finely and closely bifid

¹ *Loc. cit.* (1907), p. 55.

² *Loc. cit.* (Ste Croix, 1861), p. 65, pl. XLIX and pl. XLVIII, figs. 7-8.

³ *Ibid.* p. 62, pl. XLVIII, figs. 1-6.

⁴ In Pictet and Roux (*loc. cit.* 1847), pl. XIII, figs. 1-4.

⁵ "Cretaceous Rocks, S. India," *Mem. Geol. Survey India, Pal. Indica*, 1865, p. 175, pl. LXXXIII.

⁶ *Loc. cit.* (Angola, 1922), p. 151.

⁷ In Pictet and Roux, *loc. cit.* (1847), p. 393, pl. XV, fig. 1 *a-c* (lectotype). Fig. 3 *a, b* may be separated as *H. flexicostatus* sp.nov., fig. 4 *a, b* as *H. compressus* sp.nov.

⁸ *Loc. cit.* (*Rec. Austral. Mus.* vol. VII, 1909), p. 152, pl. XLVI, fig. 1, pl. XLVII, figs. 1-4.

⁹ *Ann. Mag. Nat. Hist.* (4), vol. xx (1867), p. 356. Etheridge, *loc. cit.* (1909), p. 153, pl. XXXIX, fig. 1 only.

¹⁰ *Loc. cit.* (1909), p. 162, pl. XLIX, figs. 3-6.

¹¹ *Ibid.* p. 160, pl. XLIX, figs. 7-9.

and prorsiradiate on the shaft and coarse, trifold or quadrifold with an inner tubercle on the hooked body-chamber. The ventral side is finely striate only on the shaft and almost smooth towards the end, when the whorl-section also changes from the early circular and later compressed elliptical shape to an almost semicircular or galeate type as illustrated in Pl. XXXIV, fig. 5. The aperture is provided with a short dorsal and two longer lateral lappets (Pl. XXXI, fig. 4 *b* and *c*). The more finely ribbed examples illustrated in Pl. XXXI, figs. 4, 5 and 8, are here considered to represent the typus of the present species, and the forms with more distantly ribbed and more inflated body-chambers (Pl. XXXI, figs. 3 and 9; Pl. XXXIV, figs. 5-7) may be separated as a var. *crassa* nov. The suture-line is variable and differs from that of the new species selected as the genotype (Pl. XXXI, fig. 7) only in comparatively unimportant details.

Labeceras taylori (Etheridge) is distinguished from the present species in having "no trace of tubercles at any stage of growth." The outer limb of its crozier is also said to be "not in the same plane as the curve of the shaft proper, and whilst returning towards the latter, does not appear to abut against it." *L. laqueum* (Etheridge) with similarity to the var. *crassa* of the form here described (e.g. Pl. XXXIV, fig. 7) was stated to have a row of small nodes along each side of the median line of the venter.

Genus MYLOCERAS Whitehouse MS.

17. *Myloceras serotinum* sp.nov. (Pl. XXXI, figs. 1, 2, 10, 11; Pl. XXXII, fig. 2; Pl. XXXIII, figs. 1, 2; Pl. XXXV, fig. 1 *a*, *b*).

This form begins as an open criocone after the manner of Mexican "*Crioceras* sp.div." described and figured by Böse¹. The whorls come into contact after one complete volution, as figured on Pl. XXXV, fig. 2, but of the twenty specimens of the present species that are before me, only a few (e.g. no. 1318) have the early whorls imperfectly preserved. Several examples, however, intermediate between the form here discussed and *M. cornucopia* nov. (e.g. nos. 1369, 1389), are more satisfactory and show that the immature whorls here figured indeed belong to the genus *Myloceras*, if not necessarily to the present species. The example represented on Pl. XXXIV, fig. 4, has already been referred to as probably a young *Helicoceras*, with "lytoceratid," bifid lobes and more open coiling than that of *Myloceras*; but it shows annular ribbing not unlike that of immature specimens of the present genus. The coiling of these immature whorls is apparently very variable and often not in one plane.

The whorls, after becoming ammonitic, are compressed, especially in the var. *plana* (Pl. XXXI, figs. 1, 10), with a flattened ventral area, to a diameter of from 50-60 mm., but after forming a straight shaft the body-chamber recurves in a crozier as represented in Pl. XXXIII, figs. 1 and 2. A number of fragments represent merely the shaft (Pl. XXXV, fig. 1 *a*, *b*) or the hook of the body-chamber (Pl. XXXII, fig. 2), and of those showing merely the ammonitic portion of the shell (Pl. XXXI, figs. 1, 2, 11) the majority already have body-chambers though they are not fully grown².

The ribbing of the whorls following the criocone stage is sigmoidal, generally single, but with an occasional intermediate or bifurcating costa and periodically thickened ribs at intervals of from three to six or even eight of the ordinary ribs. The tuberculation may continue, irregularly, on the shaft or at least its earlier portion, but is definitely lost on the last hook, which is

¹ *Loc. cit.* (1923), p. 164, pl. XI, figs. 19-22.

² It has been suggested that sexual dimorphism may explain the occurrence together of shells with and without crozier. The material available, unfortunately, is insufficient, too fragmentary and too variable in preservation to test this theory.

merely irregularly costate except on the dorsal side. On the corresponding crozier, however, of the var. *rugosa*, figured in Pl. XXXII, fig. 2, the long, bifurcating ribs as well as the intermediate short ones are provided with minute tubercles along the ventro-lateral edges, to the end of the shell. The aperture, as restored in Pl. XXXIII, fig. 1, shows a slight ventral and two more prominent lateral lappets.

The suture-line is characterised by trifid lobes and bifid saddles (Pl. XXXI, fig. 11*b*) and there is greater resemblance to the suture-lines of ordinary Gault Ammonites than to the Hamitids.

Myloceras ammonoides (Etheridge), the genotype, has coarser and less ammonitic early whorls than the present species, but the outer whorl of the example figured by Etheridge on pl. XLIX, fig. 1, apart from having more numerous tubercles, is obviously quite close to the typical *M. serotinum*, here figured (Pl. XXXI, fig. 2). The two forms described below as *M. cornucopia* and *M. amaltheia* are more strongly tuberculate, but are connected with the present species by passage forms.

The fragmentary example from Madagascar, described by Boule, Lemoine and Thévenin¹ as *Crioceras joffrei*, shows whorl-section and costation not unlike those of the earlier whorls of *Myloceras serotinum*, before the more prominent periodic costae with peripheral tubercles appear. The Madagascar form, however, has apparently continuously nodate ventro-lateral edges, and so far as one can judge from the short description and the species quoted for comparison, there may be no connection whatever with the form here described.

18. *Myloceras cornucopia* sp. nov. (Pl. XXXII, figs. 1 and 4; Pl. XXXIV, fig. 1).

In coiling this form agrees with the species previously described and it has already been mentioned that there are examples, intermediate between the two forms in the coarseness of their costation, that show the early criocone stage similar to that figured in Pl. XXXV, fig. 2. In the present species tuberculation appears already at a diameter of 10 mm., and up to 30 or 40 mm. there may be only one or, owing to bifurcation, occasionally two ribs in between the tuberculate ones. The tubercles are prominent and septate, hence generally represented only by the rounded bases. They are connected across the flattened periphery by two or three secondary ribs. Later the intermediate ribs become more numerous and on the straight shaft, as in *M. serotinum*, the tuberculation shows decline. The peripheral views of this shaft, as well as the dorsal, show great resemblance to those of "*Crioceras*" *flindersi* (McCoy) in Etheridge², but the Australian form is more closely costate.

The aperture and final hook have not been preserved in any of the twelve examples studied but are probably similar to those of *M. serotinum*, especially the var. *rugosa*.

The suture-line has the bifid saddles and trifid lobes of that of the previous species, and differs only in details; e.g. the outer half of the external saddle is larger than the inner, but the position of the ventro-lateral tubercles coincides with the incision in the external saddle. Compared with the suture-lines of *Labeceras*, especially the young form represented in Pl. XXXI, fig. 9, or the Australian species here figured (Pl. XXXI, fig. 7) the agreement in general outline is striking though the drawings here given are more or less diagrammatic.

The present species is more coarsely ornamented than *M. ammonoides* (Etheridge) but shows greater resemblance to the form figured by Etheridge³

¹ *Loc. cit.* (1907), p. 52, pl. XIII, fig. 5, 5*a*.

² *Loc. cit.* (1909), pls. XXXVI-XLIV, lectotype, being pl. XXXIX, fig. 1.

³ *Loc. cit.* (1909), pl. XLI, fig. 1.

as the ammonitic portion of a large "*Crioceras*" *findersi*. Even in this form, however, the tuberculation is not quite so prominent as in the present species.

19. *Myloceras amaltheia* sp. nov. (Pl. XXXIV, fig. 2).

This species is closely allied to the two previously described and whilst resembling the more closely tuberculate *M. cornucopia* in its early whorls, on the shaft it reverts to the closer costation of *M. serotinum* (compare Pl. XXXV, fig. 1 *a, b*). This may seem insufficient for specific separation, considering the species is represented only by the figured example (no. 1311), and a doubtful shaft (no. 1428); but the latter, with its distant tubercles, is so different from the corresponding portion of *M. cornucopia* (Pl. XXXII, fig. 1) that it cannot well be included in the same species.

M. ammonoides and *M. axonoides* (Etheridge)¹ show change of a strongly tuberculate ornamentation on the inner whorls to presumably merely costate outer whorls, but their early volutions are different. On the other hand, one of the forms included by Etheridge² in "*Crioceras*" *findersi* resembles the present species, especially the slightly worn side of the holotype not figured, but the peripheral tubercles of the Australian form are closer and the costae are more distant at the beginning of the straight shaft. It seems probable that the Australian forms figured by Etheridge are more closely allied than is suggested by the different appearance of fragments from various portions of incompletely known shells, and the fact that they were mixed up accidentally with Aptian "*Crioceratids*" has, of course, increased the difficulty of correctly placing the Australian species.

III. CONCLUSIONS.

The fauna here described consists partly of elements that are characteristic of the middle part of the Upper Gault or the *varicosum* to *aequatoriale* zones of the writer's classification, corresponding to the *rostratus* (or *inflatus*) zone in a restricted sense. Such genera as *Inflatoceras* and *Hystero-ceras* and the Hamitids are common in corresponding beds of north-western Europe; *Phylloceras* and *Desmoceras* are abundant only in deposits of Mediterranean countries. The majority of specimens in the present collection, however, belong to groups of "*Crioceras*" hitherto known principally from Australia through various papers by R. Etheridge jr., ranging from 1883 to 1909 and including his well-known *Geology and Palaeontology of Queensland*, published in 1892. These had never been accurately dated, as pointed out above, but there seems to be no doubt now that they are also of Upper Gault age like the associated *Inflatoceras* and other forms. It may be mentioned that the imperfectly known *Hamites studerianus*, long since described by Pictet from the Upper Albian of the Perte-du-Rhône and Mt. Saxonnex, Savoy, may be the only European form of the family to which some of the Australian and South African forms are here referred.

Considering the state of preservation of ammonites in the Upper Gault of Folkestone and their comparative scarcity above the *varicosum* zone, also the fact that, e.g. the first British Pseudo-ceratite, an *Engonoceras* and a very unexpected element in the English Albian was not discovered until last year³, it is possible that these "*Crioceratids*" may yet be found. At the top of the *varicosum* zone at Folkestone there is a non-sequence, representing possibly a considerable time-interval. But whether these "*Crioceratids*," like the

¹ *Loc. cit.* (1909), pl. XLIX, figs. 1-2; pl. XLIV, fig. 1.

² *Ibid.* pl. XL, figs. 1-2.

³ Spath, "On a New Ammonite (*Engonoceras iris* sp. nov.) from the Gault of Folkestone," *Ann. Mag. Nat. Hist.* Ser. 9, vol. xiv, Oct. 1924, pp. 504-8.

Anahoplites uhligi fauna of the Caucasus, indicate the existence of horizons that are missing at Folkestone seems doubtful. Unfortunately zonal collecting, in extra-European areas especially, is not sufficiently advanced for a definite correlation of foreign Upper Albian deposits with the English type succession.

When revising the Albian ammonite fauna of Zululand, the writer, for zoning the Upper Gault, had to rely still largely on previous literature; and the species recorded, in any case, were little definite, though *Inflatoceras* indicated Upper Gault and *Stoliczkaia* the presence of the uppermost Albian *dispar* zone, forming the transition to the Lower Cenomanian deposits of False Bay. From our present knowledge of Mesozoic successions and the proved presence of numerous non-sequences, in all areas where revision and checking have been done, it seems improbable that at any of the Zululand exposures there may be found a continuous sequence from the *cristatum* zone through all the horizons of the Upper Gault, into the Cenomanian. Probably no beds equivalent to those from which the present fauna was obtained are developed in Zululand, or, at least, have yet been collected from. The explanation that difference of facies might account for the dissimilarity of faunas in Zululand and the neighbouring Portuguese East Africa cannot now be admitted. For the same reason the fauna from the Conducia River, just north of Mozambique, cannot be compared with that here described. Choffat¹ considered the age of the Conducia beds to be from Vraconnian to Cenomanian, Lemoine² called them Cenomanian, but in reality they include Albian as well as Senonian forms. Large *Desmoceras*, however, and other Conducia forms that suggest Upper Albian ("Vraconnian") age³ are probably later than the fauna here described and *Hysterocheras* for example did not survive even into the *aequatoriale* zone.

From Madagascar, also, nothing is known that corresponds with the new "Crioceratids" here described, though "*Crioceras*" *joffrei* Boule, Lemoine and Thévenin⁴, on the discovery of more complete specimens, may yet turn out to be comparable. *Inflatoceras*, however, and *Hysterocheras*, are represented by closely allied if not identical forms. The whole of the Madagascan fauna, unfortunately, has been inadequately described, and there were erroneously included in the Cenomanian forms from at least the uppermost four Albian horizons, namely *Inflatoceras*, *Hysterocheras*, *Elobiceras*, *Neokentroceras*, *Stoliczkaia*, not to mention *Douvilleiceras* (recorded, perhaps, in error, but not described) and a *Sphenodiscus*, which, on a previous occasion, I included in *Manuaniceras manuanense*, both of even earlier Albian age. With the Madagascar fauna described in such an unsatisfactory manner, the statement that certain species seemed to appear earlier in the Malgascan region and that others had persisted longer in Madagascar than in Europe, cannot be taken seriously.

The remarks made by the writer when describing an Upper Albian fauna from Angola, about a separate West African province, of course also require

¹ "Contributions à la Connaissance géologique des colonies portugaises d'Afrique, Le Crétacique de Conducia," *Com. Serv. géol. Portugal* (1903).

² *Études géologiques dans le Nord de Madagascar*, 1906, p. 396.

³ The Conducia fossils obtained by Mr Wray and referred to by Mr R. B. Newton (*Trans. Geol. Soc. S. Afr.* vol. xxvi, 1924, p. 157) include only *Desmoceras latidorsatum* (Michelin) and *Puzosia* aff. *stoliczkai* Kossmat, forms occurring in the Upper Albian of neighbouring areas.

The Fernao Vellozo beds of Mozambique (see Holmes and Wray, *Geol. Mag.* Dec. v, vol. ix, 1912, p. 415, and Wray, "Observ. sur la Géol. du district de Mozambique," *Com. Serv. géol. Portugal*, vol. xi, 1915, p. 77) which yielded *Rogersites* and *Neolissoceras* (group of *A. grasiarius* d'Orbigny, recorded by Mr Wray as "*Phylloceras* sp.") are of uppermost Valanginian age, like the Uitenhage Beds of South Africa.

⁴ *Loc. cit.* (1907), p. 52, pl. XIII, figs. 5, 5a.

modification. Without expressing any opinion on the existence of the so-called Brazilo-Ethiopian Continent, it seems that the support given previously by ammonite evidence to separate zoological provinces is valueless; for we can now show that these provinces were based on comparisons of beds of different dates. The *Elobiceras* here described is apparently indistinguishable from a Nigerian specimen in the British Museum. Choffat's *Schloenbachia varicosa* (= *Hysteroceras choffati*, here described) with a number of other Angola forms, less closely comparable on account of defective preservation, are proof that in strictly contemporaneous beds similar assemblages if not identical species are found. Ammonites are not only remarkably independent of facies but of surprisingly world-wide distribution.

It might be mentioned that the resemblance of the Madagascar fauna to that of Angola was considered slight by Boule, Lemoine and Thévenin, chiefly because few Albian and no Ceromanian or Senonian ammonites from that part of West Africa had been recorded at the time. The writer followed these authors in considering that the Angola fauna probably was more nearly related to that of the Mediterranean area than that of the Indo-Malagascan Province¹. But whilst pointing out that it had been recognised, only of late years, that the dissimilarity of certain faunas might be due to differences in age, however slight, more than to the presence of local types, I erroneously assumed geographical isolation, in the West African Bay of the Tethys, of the genus *Elobiceras*. As this is now known from practically all round Africa, not to mention Europe, recent scepticism regarding the Marine Provinces of the Cretaceous is, indeed, justified. In India also the Upper Albian-Cenomanian sequence of the Lower Utatur Group only begins with the *aequatoriale* zone.

The Queensland beds from which have been described not only "Crioceratids" closely comparable to the new forms here recorded but also allied *Inflaticeras* and *Prohysteroceras* are being dealt with by Mr Whitehouse in his revision of the Australian Cretaceous faunas, now in the press. The Queensland fauna certainly shows great similarity to that here described and suggests inclusion of both in the same zoological "Province," as practised by the older authors. From what has been said, however, in the foregoing lines it follows that this similarity is here considered to be simply due to the accidental preservation, in both Queensland and Portuguese East Africa, of beds of exactly the same Upper Albian horizon.

IV. APPENDIX.

On Upper Cretaceous Ammonites from Maputoland.

The three ammonites sent by the Transvaal Museum include two fragmentary Senonian *Mortoniceras* of types common in Pondoland and Zululand, also a Cenomanian *Sharpeiceras* allied to a form described by Choffat from the Conducia River, north of Mozambique. From Delagoa Bay, the southern shores of which are in Maputoland, only Aptian ammonites have hitherto been recorded².

Family MANTELLICERATIDAE Hyatt emend.

Hyatt³ referred the genus *Sharpeiceras*, here recorded, to the family Mantelliceratidae and erroneously included in the same genus Schlüter's *Amm. inconstans*, referred to below. Hyatt's classification, unfortunately,

¹ *Loc. cit.* (Angola, 1922), pp. 155-6.

² See Spath, *loc. cit.* (Zululand, 1921), p. 309.

³ "Pseudoceratites of the Cretaceous," *Mon. U.S. Geol. Surv.* vol. XLIV, 1903, p. 111.

owing to the author's death, was published in an unrevised condition and it is impossible now to see why, for instance, "*Schlütericeras*" (= *Mammites*) was not included in the Mammitida. In any case, Mantelliceratidae cannot be satisfactorily separated from Acanthoceratidae merely because they "never, at any stage, have a row of median ventral tubercles." The type of *Mantelliceras*, namely Sowerby's *Amm. mantelli*, is very close to if not identical with Sharpe's *Amm. navicularis*, the genotype of Hyatt's "*Calycoceras*," which was not even included in the same superfamily.

Since the "Acanthoceratids" of the Cenomanian comprise many genera, it may be advisable to retain Hyatt's family Mantelliceratidae for those groups that range themselves round the closely-allied *Mantelliceras* and *Submantelliceras* Spath¹, the former comprising such typical species as *M. couloni* (d'Orbigny), *M. hyatti* sp.nov. (= *couloni* Hyatt, pars non d'Orb.)², *M. saxbyi* (Sharpe), *M. subcostatum* sp.nov. (= *Amm. feraudianus* Sharpe, non d'Orbigny)³; the latter genus including several new forms farther removed from the ancestral *Stoliczkaia* stock than is *Mantelliceras*. Of allied genera may be mentioned *Eucalycoceras* Spath (which in the young resembles *Protacanthoceras* Spath⁴, but does not develop clavate outer tubercles), also the special offshoot *Paracalycoceras* gen.nov., proposed for *Amm. wiesti* Sharpe⁵, mistaken occasionally even for a *Pachydiscus*. These Mantelliceratids are all connected by a tendency to retain continuous costation across the venter in the adult, whereas in Acanthoceratidae s.s. there is a tendency to exaggeration of ornamentation on larger whorls. Now, although *Sharpeiceras* resembles the latter family in its clavate outer tubercles and the coarseness of its final "horns," it is united to Mantelliceratidae by its suture-line and ventral aspect, especially to the form named by Hyatt *Mantelliceras indianense*⁶. Like its possible ally *Acompsoceras*⁷, *Sharpeiceras* thus is difficult to group and until zonal collecting provides the clue to the interrelation of these various Acanthoceratid genera the separate family Mantelliceratidae cannot be considered to be well-established.

From the original Mantelliceratidae the family Douvilleiceratidae Spath⁸ has since been separated, and others of Hyatt's genera belong to Cheloniceratidae, Mammitidae and Acanthoceratidae s.s. It seems advisable to restrict the last to *Acanthoceras* Neumayr emend. Grossouvre, 1893 (genotype: *Amm. rhotomagensis* DeFrance in Brongniart = "*Metacanthoplites*" Hyatt, 1900), and its allies, such as *Euomphaloceras* Spath (an offshoot of *Acanthoceras*, via the group of *A. cunningtoni* Sharpe, the suture-line of which it retains) and *Protacanthoceras*. The last includes forms of the type of *P. hippocastanum* (Sowerby) as well as the more specialised developments of the group of *P. compressum* (Jukes-Browne) and is derived via *Eucalycoceras* from Mantelliceratidae.

¹ *Summary of Progress, Geol. Survey* (1922), 1923, p. 143.

² *Ammonites mantelli* (Sowerby) pars in Sharpe (Fossil Mollusca Chalk-Cephalopoda III, 1857), pl. XVIII, fig. 4 only (British Museum, no. 50288).

³ *Loc. cit.* (1857), pl. XXIII, fig. 6 a-c (*Mus. Pract. Geol.*, no. 7759 Geol. Soc. coll.).

⁴ *Summary of Progress, Geol. Survey* (1922), 1923, p. 143.

⁵ *Loc. cit.* (III, 1857), p. 47, pl. XXI, fig. 3 a, b.

⁶ *Loc. cit.* (1903), p. 115 (= *Amm. mantelli* Stoliczka, non Sowerby, pars, 1865, pl. XLII, fig. 1, lectotype).

⁷ If Sharpe's *Ammon. renevieri* (and unnamed allies before me) is as close to Schlüter's *Amm. bochumensis* (the genotype of *Acompsoceras*) as, with Pervinquier, we must hold, then, it is necessary to separate as a new genus *Pseudacompsoceras* gen. nov., the stock represented by *P. vectense* sp.nov. (= *Ammon. coupei* var. [non Brongniart] in Sharpe, *loc. cit.* pl. XIX, fig. 1 a-c only). The reference of this by Sharpe to Brongniart's species is significant and indicates the morphologically intermediate position of this group, to which probably Schlüter's *Amm. inconstans* also will have to be referred. These two genera are provisionally included in Schloenbachidae.

⁸ See *loc. cit.* (Monograph Amm. Gault, 1, 1923), p. 63.

Vascoceras Choffat, *Fagesia* and *Thomasites* Pervinquière are also best separated from Acanthoceratidae s.s. (as a family Vascoceratidae nov.) and to these may be added: Plesiovascoceras gen.nov., proposed for *Amm. catinus* Mantell¹. The holotype of this species resembles *Pseudosigaloceras rusticum* (Sowerby) but has lost all peripheral tuberculation on the outer whorl. Sharpe's *Amm. catinus*², with a *Fagesia* suture-line, is here renamed *Fagesia pachydiscoides* nom.nov. Another new species of *Fagesia* (B.M. no. C 8316) was collected in the upper part of the Grit Bed (*cuvieri* zone) of Folkestone.

Lyelliceratidae (with *Stoliczkaia*) are the forerunners of Mantelliceratidae and these again of Acanthoceratidae s.s., and they in their turn are replaced in the Turonian chiefly by the Vascoceratidae, Mammitidae, Metoicoceratidae and Prionotropidae.

Genus SHARPEICERAS Hyatt.

1. *Sharpeiceras florencae* sp.nov. (Pl. XXXVII).

1904. *Acanthoceras laticlavium* (Sharpe) H. Douvillé. *Moll. Foss.* in Morgan: *Miss. Scientif. en Perse*, vol. III. Et. Géol. pt. IV. Pal., p. 239, pl. XXXI, fig. 3.

This species is based on the example (no. 1492) here figured (reduced $\times \frac{2}{3}$) which shows just over a quarter of a whorl of body-chamber. Its dimensions are as follows:

At diameter of 200 mm.:	·38	·38	·33
„ „ 100 mm.:	·43	·36	·30

The whorl-section is comparatively compressed, flattened to a diameter of 100 mm., but on account of the increasing prominence of the lateral tubercle whorl-height and thickness become equal at 200 mm. diameter. The single straight costae bear four tubercles as in *S. laticlavium* (Sharpe)³, namely a small one close to the umbilical suture, a stronger one at the middle of the lateral area, a still more prominent one on the ventro-lateral edge and a fourth one on each side of the median, subconcave zone of the venter. Whereas the first three tubercles are bullate, *i.e.* elongated radially or conical, those bordering the subconcave ventral zone are clavate, *i.e.* elongated longitudinally or spirally. On the body-chamber the two outer tubercles, now paired, form highly projecting horns, unfortunately worn in the figured example.

The suture-line has the deep bifid lateral lobe of other forms of the genus *Sharpeiceras* but is comparatively simple towards the end. The last suture-line here drawn, of course, generally shows simplification, but the peripheral portion of the specimen especially is also weathered. On the inner whorls the suture-line differs from that of *S. indicum* (*Acanthoceras laticlavium* var. *indica* in Kossmat)⁴ chiefly in having a wider lateral lobe.

Sharpe's type of *S. laticlavium* before me (Museum Practical Geology, no. 7755, Geol. Soc. coll.) has ornamentation similar to that of the present species, but at a corresponding diameter (about 120 mm.) 35 ribs to the 25 of the Maputoland form. The tubercles of the Isle of Wight species, especially the peripheral ones, are also far more delicate and the ventral zone is wider and provided with a median raised line. *S. indicum* is closer to the present

¹ *Fossils of the South Downs*, 1822, p. 198, pl. XXII, fig. 10 (British Museum, no. 3379).

² "Fossil Mollusca Chalk-Cephalopoda II," *Mon. Pal. Soc.* (1855), p. 29, pl. XIII, fig. 1 (B.M. no. 88583).

³ *Ibid.* p. 31, pl. XIV, fig. 1. Sharpe's drawing does not show the median raised line of the venter which is almost a keel.

⁴ "Untersuch. Südind. Kreideform.," *Beitr. Pal. Geol. Österr.-Ung.* vol. IX (1895), p. 199, pl. XXIV, figs. 5 and 6.

species than Sharpe's form, but also has less robust outer tubercles and considerably more lateral compression. The peripheral aspect, again, is different, for the Indian form shows smaller and less clavate ventral tubercles and these are connected by ribs of which there is no trace in the present form.

Pervinquier¹ mentioned a Tunisian example of *Sharpeiceras* in which the twinned outer tubercles were extremely developed. This form may have been close to the species here described, but his "*Acanthoceras laticlavium* var. *byzacemica*,"² with twice as many outer than umbilical nodes and no tubercles in between, probably does not even belong to the genus *Sharpeiceras*.

S. mosambiquense (= *Acanthoceras laticlavium* var. *moçambiquensis* Choffat)³ probably is a close ally of *S. florencae*, but is difficult to compare on account of its large size. Its sides, however, were described as nearly flat to a diameter of 200 mm., at which stage the present form has already developed a coarsely tuberculate body-chamber. Moreover Choffat's form has a fifth tubercle and tends to compression with age.

The Persian example figured by H. Douvillé is indistinguishable in side-view from the inner whorls of the present species and less closely costate than Sharpe's type. Douvillé also records the occurrence of a large example with disappearing umbilical tubercle and replacement of the ventral one by the exaggerated ventro-lateral tubercle moving out to the periphery. Attention has already been drawn to a similar tendency in the form here described.

Sharpeiceras is not common and Sharpe's type in the Survey Collection appears to be the only existing British specimen with the exception of a doubtful fragment of a new species (British Museum, no. C 11730) from Beer, Devon. The genus, however, has been recorded from localities as far apart as France, Germany and Persia, Tunis and India. Barrois's Zone of *Ammonites laticlavius*, of course, has never been of any use; at Cap Blanc Nez, the type locality, this "zone," according to Stieler⁴, contains not only derived Lower and Upper Gault fossils but *Mantelliceras* and *Eucalycoceras* from well above the base of the Cenomanian⁵.

Family MORTONICERATIDAE nov.

Genus MORTONICERAS Meek.

2. *Mortoniceras* aff. *soutoni* (Baily).

1921. Spath: *loc. cit.* (Zululand), p. 234, pl. XX, fig. 4.

1921. v. Hoepen: "Cretaceous Cephalopoda from Pondoland," *Ann. Transv. Mus.* vol. VIII, p. 38, pls. X, XI, text-figs. 19-22.

1921. Spath: "Upper Cretaceous Ammonoidea from Pondoland," *Ann. Durban Mus.* vol. III, pt. 2, table to p. 50.

1922. Spath: "Senonian Ammonite Fauna of Pondoland," *Trans. Roy. Soc. South Africa*, vol. x, part III, p. 136, pl. VII, fig. 4.

Two large body-chamber portions may be referred to this species as interpreted on previous occasions, *i.e.* in a fairly wide sense. The larger example (no. 1491) shows part of the penultimate whorl and it shows that the ornamentation tends to develop from fine to comparatively coarse, not as in the

¹ "Études de Paléontol. Tunis. I. Céphalop. des Terrains Secondaires," *Carte Géol. Tunisie* (1907), p. 302.

² *Ibid.* p. 301, pl. XIV, fig. 4 a, b.

³ *Loc. cit.* (Le Crétacique de Conducia, 1903), p. 25, pl. IV, fig. 3 a, b; pl. VII, fig. 2 a, b.

⁴ "Über Gault- und Cenoman-Ammon. aus dem Cenoman des Cap Blanc Nez," *Neu. Jahrb. f. Min. etc.*, 1922, Bd. II, Heft 2, p. 34.

⁵ See Spath, "On the Ammonite Horizons of the Gault and Contiguous Deposits," *Summary Progress Geol. Survey* (1922), 1923, p. 143.

group of *M. umkwelanense* Crick¹, from coarse to comparatively fine. The inner tubercle is also close to the umbilical suture as in Baily's species. The whorl-height is 95 and the thickness 75 mm. and there is general resemblance to the Pondoland example in the British Museum referred to in 1922 (no. C 19441), at least of the poorly preserved inner whorls.

The smaller example (no. 1493) is less compressed, having a whorl-height and thickness of 75 and 65 mm. respectively. The umbilical tubercles also are farther away from the umbilical suture than in the typical *M. soutoni*. This second example might thus be considered to be a variety in the direction of *M. umkwelanense* Crick, but the holotype of this species (British Museum, no. C 18134) is more coarsely ornamented and has a more quadrate whorl-section, also no median-lateral (fifth) tubercle. The Zululand specimen described by the writer² as *M. aff. umkwelanense* may be closer to the second fragment here discussed than Crick's type and it shews that with increase of diameter in this group, the whorl-section changes from depressed to compressed. In the present body-chamber fragment, the keel is also still distinct as in comparable examples of Pondoland topotypes of *M. soutoni*. The specimen previously referred to (1922, p. 137) as near to the more evolute example figured by Woods³ is also closely comparable to the fragment here described.

The genus *Mortoniceras*, now known also from England, has recently been again reviewed by Yabe and Shimizu⁴. It seems, however, that their remarks are based on a perusal of the literature and not on a study of actual specimens, a risky proceeding even for the most careful authors.

¹ *Loc. cit.* (Cret. Fossils Natal, 1, 1907), p. 228, pl. XV, figs. 9, 9 a.

² *Loc. cit.* (Zululand, 1921), p. 234, text-fig. D 2, p. 297.

³ "Cretaceous Fauna of Pondoland," *Ann. South Afr. Museum*, vol. IV, part VII, no. 12, p. 337, pl. XLIII, fig. 1.

⁴ "Note on the genus *Mortoniceras*," *Japanese Journal of Geol. and Geogr.* vol. 11, no. 2 (1923), pp. 27-30.