G.U.P.
XVII.

MONOGRAPHS

OF

THE GEOLOGICAL DEPARTMENT OF THE HUNTERIAN MUSEUM GLASGOW UNIVERSITY

IV

REPORTS ON GEOLOGICAL COLLECTIONS FROM THE COASTLANDS OF KENYA COLONY

MADE BY

MISS M. M'KINNON WOOD

With Introduction by J. W. Gregory, LL.D., D.Sc., F.R.S., and Report on the Ammonites by L. F. Spath, D.Sc., F.G.S.; Report on the other Mesozoic Mollusca and Brachiopods by J. Weir, M.A., Ph.D., F.G.S.; Report on the Kainozoic Mollusca by L. R. Cox, M.A., F.G.S.; Report on the Cheilostomata by H. D. Thomas, M.A., Ph.D., F.G.S.; Report on the Echinoidea by Ethel D. Currie, B.Sc., Ph.D., F.G.S.; Report on the Corals by J. W. Gregory, LL.D., D.Sc., F.R.S.; Report on the Ostracoda and Foraminifera by Mary H. Latham, M.A.; Report on the Fossil Plants by S. Williams, M.Sc., Ph.D.; Report on Igneous Rocks by Agnes Neilson, M.A.; and on the Stratigraphy of the Kenya Coastlands and a List of Localities by Miss M'Kinnon Wood

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III. THE JURASSIC AMMONITE FAUNAS OF THE NEIGHBOURHOOD OF MOMBASA

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

CONTENTS

A. INTRODUCTION

SEQUANIAN-KIMMERIDGIAN ammonites have long been known to occur at Mombasa by the works of Beyrich and Futterer; and Prof. Dacqué,[1] who gave an excellent historical summary of the investigation of the East African Jurassic, added some Argovian species in 1910. Bathonian ammonites were first described by the writer [2] in 1920, but Callovian species were not recorded till several years later.[3] I have mentioned on several occasions that there was an extensive collection of Mombasa ammonites in the British Museum and I had often thought of working them out in detail; but it was not until by the kindness of Prof. J. W. Gregory, F.R.S., I was invited to examine the very fine and much more varied series of Kenya ammonites collected by Miss McKinnon Wood that an opportunity offered to study all the Museum specimens and to revise a few that had already been recorded as of interest. The results of the examination of these 450 ammonites are discussed in the following pages. Since a fuller account of many of the species is being published in connection with my "Revision of the Jurassic Cephalopoda of Kachh (Cutch)," it has been possible to shorten the systematic descriptions. A more detailed comparison of the various faunas with corresponding assemblages from India must also be deferred until all the Kachh forms are dealt with.

I stated on a previous occasion [4] that "Beyrich and Futterer had undoubtedly been right in considering the Kimmeridgian *acanthicus* zone to be represented in their Mombasa material." But most of the ammonites then known were of Sequanian age [5] and I considered that "the outcrops of Middle Kimmeridgian beds in the south-east of Kenya colony were limited or had been overlooked by the later collectors." Unfortunately the higher beds of the Mombasa Jurassic are still comparatively poorly represented in the new collections, but I can now record at least two more species of *Waagenia*, in addition to some lamellose aptychi from possibly still higher (Middle Kimmeridgian) beds.

Dacqué [6] was wrong in considering that Hildebrandt's material offered no indication of the presence, in the Jurassic of Mombasa, of beds younger than "Oxfordian" (*i.e.* the *bimammatus* zone of the Argovian). He certainly omitted to discuss the value, as a time index, of *Waagenia hildebrandti* (Beyrich) [7]; but nevertheless, Dacqué's very careful account of the Mombasa ammonites in particular, and the East African Jurassics in general, will be of permanent value. Dietrich's [8] criticism of Dacqué's work, on the other hand, seems to be based on the entirely fortuitous assumption that no earlier beds than those characterised by Beyrich's and Futterer's Middle Kimmeridgian forms could be represented in the Mombasa Jurassic. Dacqué's record of a Peltoceratid (*Peltoceras* aff. *arduennense*, d'Orbigny sp.) of undoubted Argovian age makes it probable that even the varied series of Jurassic ammonites at present at the disposal of the writer does not include all there is to be found in the neighbourhood of Mombasa. In other words there is a possibility that even the last gaps in the Jurassic sequence from the Kimmeridgian down to the Bajocian may yet be filled. There is, as yet, no representative of the Divesian other than certain

[1] "Dogger und Malm aus Ostafrika," *Beitr. Pal. Geol. Österr.-Ung., etc.*, xxiii., 1910, p. 2.

[2] "On Jurassic Ammonites from East Africa, etc.," *Geol. Mag.*, lvii., 1920, pp. 311-320, 351-362, Pl. V.

[3] In Gregory: "Further Jurassic Fossils from Kenya Colony," *Geol. Mag.* lxiv., 1927, p. 325; and Spath: "Revision of the Jurassic Cephalopoda of Kachh (Cutch)," *Mem. Geol. Surv. India, Pal. Indica*, New Ser., ix., No. 2, Pt. II. 1928), p. 105.

[4] In "Ammonites and Aptychi," Pt. VII. of *Hunterian Museum Monograph*, No. 1, on Collection of Fossils and Rocks from Somaliland, 20th January, 1925, p. 159.

[5] See Renevier: *Chronographie Géologique*, 1896, p. 570, Pl. VI.

[6] *Loc. cit.*, (1910), p. 5.

[7] In his paper "Der Jura in der Umgebung des lemurischen Kontinents" (*Geol. Rundschau*, i., 1910, p. 159) Dacqué mentioned Bathonian, Lower and Upper "Oxfordian" faunas, but doubted the presence of higher Jurassic beds.

[8] "Ueber eine dem mittleren Sauriermergel am Tendaguru aequivalente rein marine Kimmeridgebildung in Mahokondo, etc.," *Palaeontogr.*, Suppl. VII., II. Reihe, Pt. I., 1925, p. 18.

Perisphinctids, but *Peltoceras* of the *athleta*-group, common in Kachh and recorded from Madagascar, are known from Pendambili in Tanganyika.

Prof. Gregory stated in 1900 [1] that he collected a number of cephalopods in the Mombasa district which Mr. Crick, of the Natural History Museum, had undertaken to describe. There is a fragmentary manuscript by the late G. C. Crick, written about 1901 and entitled " On the Fossil Cephalopoda from East Africa, collected by Dr. J. W. Gregory," but it is out of date and unfit for publication as it stands. There are detailed notes on the " Previous literature of the subject " ; they end with an added pencilled reference to E. E. Walker's Report on the Geology of the East Africa Protectorate (Foreign Office, 1903), and it is probable that the purchase by the Museum, in 1902, of a much larger collection (183 ammonites) from Mr. Kässner made Crick abandon his attempt to describe separately Prof. Gregory's collection (of only forty-one specimens). The two Phylloceratids, eleven Lytoceratids and the six examples of *Aspidoceras* were dealt with, and I am quoting from these descriptions below ; but the appearance of Dacqué's account in 1910 (with different names for these forms) had already made Crick's work valueless, except for some careful synonymies. In addition, Crick's identifications of the few Perisphinctids he began to describe are obviously inacceptable. The Callovian form figured in my " Revision of the Jurassic Cephalopoda of Kachh " (Plate LXXX., Figs. 9*a*, *b*) he named *Perisphinctes polyplocus* (Reinecke), which was later altered to *P. inconditus* Fontannes ; whilst the *Taramelliceras* sp. recorded below was described as *Nautilus* sp. In another unfinished MS. on a collection of Jurassic ammonites from Kukatta on the Juba River (2° 8′ N. lat.) in Northern Kenya (now Italian Somaliland) [2] Crick stated that several fragments in Dr. Gregory's collection appeared to belong to *Perisphinctes beyrichi*, Futterer, but the specimens were not marked. Crick's account thus has been used only in the preparation of a few synonymies, but for permission to make full use of these collections as of other ammonites in the Natural History Museum, the writer tenders his thanks to the Keeper of the Geology Department. My thanks are also due to Mr. A. G. Brighton and the authorities of the Sedgwick Museum, Cambridge, for the loan of the ammonites collected by the late E. E. Walker.

B. SYSTEMATIC DESCRIPTIONS

Order AMMONOIDEA.

I. Family PHYLLOCERATIDAE, Zittel emend.

a. Sub-Family PHYLLOCERATINAE, Prinz emend. Spath.

1. Genus PHYLLOCERAS, Suess.

Phylloceras aff. *kudernatschi* (Hauer). S10261

1920. *Phylloceras* aff. *kudernatschi* (Hauer), Spath : " Jurassic Ammonites from East Africa," *Geol. Mag.*, p. 312.
1927. *Phylloceras kudernatschi* (Hauer), Spath : " Revision Jurass. Ceph. Kachh," *loc. cit.*, Pt. I., p. 39.
1927. *Phylloceras* cfr. *kudernatschi* (Hauer), Burckhardt : " Cefalop. Juras. Medio de Oaxaca, etc.," *Bol. Inst. Geol. Mexico*, No. 47, p. 9, Pl. I., f. 1-3.

A limonitic fragment, entirely septate, is probably identical with the form figured in 1920. It has the elliptical whorl-section of Kudernatsch's Fig. 6,[3] but its saddle-endings are more broadly phylloid, which may be only due to its smaller size.

Horizon. Bathonian ? (Upper Bajocian to Lower Callovian).
Locality. 21 (Mombasa Pipe Line, Mile 11/11-13).

[1] " Contributions to the Geology of British East Africa," Pt. III., *Quart. Journ. Geol. Soc.*, lvi., 1900, p. 226.

[2] A brief account of the geology of this area, by Mr. Parkinson, with notes on the cephalopods by G. C. Crick and on some Tertiary non-marine molluscs by R. B. Newton, was published in *Quart. Jour. Geol. Soc.*,. 1917 (lxxii., Proc., pp. ii.-v.). These notes were reprinted in a more detailed account by Mr. John Parkinson, " Report on the Geology and Geography of the Northern Part of the East Africa Protectorate," *Colonial Office Reports, Misc.* No. 91, 8vo., H.M. Stationery Office, London 1920 [Cmd. 729].

[3] " Die Ammoniten v. Swinitza," *Abh. k. k. geol. Reichsanst.*, i., Pt. II., 1852, Pl. I.

Phylloceras cf. *plicatum*, Neumayr. S10291

1871. *Phylloceras plicatum*, Neumayr: "Jurastudien 3.—Phylloceraten des Dogger und Malm," *Jahrb. k. k. geol. Reichsanst.*, xxi., p. 313, Pl. XII, f. 7 *a-c*.

I mentioned on a previous occasion that a number of Mombasa examples in the British Museum showed the blunt plication of Neumayr's species and its allies, like *P. praeposterium*, Fontannes,[1] *P. plicatius*, Uhlig,[2] and *P. sub-plicatius*, Burckhardt.[3] To these might be added *P. leptoptychum*, Herbich [4] and *P. consanguinum*, Gemmellaro,[5] which were both united by Uhlig with *P. praeposterium*. It is possible that the Mombasa specimens are identical with the Mahokondo (Tanganyika) *P. subplicatius*, Burckhardt, lately described by Dietrich [6] and he, indeed, lists this form also from Mombasa (p. 6), but all the examples before me (with the exception of the doubtful impression of inner whorls) are body-chambers; and owing to differences in size there is also considerable variation in the coarseness of the ribbing and the rib-bundles. They may resemble the Callovian form described below as *P.* (*Macrophylloceras* ?) *semiplicatum* in continuing the rib-bundles across the periphery at very large diameters, but the two fragments [7] that show this feature, although from Changamwe and therefore apparently of Kimmeridgian age, may also belong to *P.* (*M.* ?) *semiplicatum*, since the other eight fragments are identical in their typical *plicatum* ornamentation. I cannot see any difference from the true Argovian *P. plicatum* in any of the Kimmeridgian forms above cited, except, perhaps, *P. plicatius*, with more sigmoidal ribs.

Horizon. Kimmeridgian (Lower).

Localities. 14 (Shore of the Changamwe Peninsula north and south of the Makupa Bridge (Miss McKinnon Wood Colln., 2 specimens); Changamwe (Kässner Colln., B.M., Nos. C 8097, 813, 40, 79, 81 [C. 8180 ?], [C. 8240 ?]; Krantz, C. 10878 [10879 ?]). One of the specimens (No. C. 8179) includes a fragment of *Hemilytoceras fraasi* (Dacqué).

Phylloceras isotypum, Benecke. (Pl. I., f. 1.) S10200

1865. *Ammonites isotypus*, Benecke: "Ueber Trias und Jura in den Südalpen," *Geogn.-Pal. Beitr.*, p. 184, Pl. VII., f. 1-2.
1871. *Phylloceras isotypum* (Benecke), Neumayr: *Op. cit.*, *Jahrb. k. k. geol. Reichsanst.*, xxi. p. 314, Pl. XIII., f. 3.
1872. *Phylloceras isotypum* (Benecke), G. G. Gemmellaro: *Giornale Scienze Naturali ed Economiche*, viii., p. 137, Pl. III., f. 1.
1873. *Phylloceras isotypum* (Benecke), Neumayr: *Abh. k. k. geol. Reichsanst.*, v., Ht. 6, p. 158.
1875. *Ammonites isotypus*, Benecke: E. Favre, "Description des Fossiles du terrain jurassique de la montagne des Voirons, Savoie," *Mém. Soc. Pal. Suisse*, ii., 1875, p. 17, Pl. II., f. 1, 2.
1877. *Ammonites* (*Phylloceras*) *isotypus*, Benecke: E. Favre, "La zone à *Ammonites acanthicus* dans les Alpes de la Suisse et de la Savoie," *Mém. Soc. Pal. Suisse*, iv., 1877, p. 13.
1878. *Phylloceras isotypum* (Benecke), Gemmellaro: "Sopra i Cefalopodi della zona inferiore degli strati con *Aspidoceras acanthicum* di Sicilia," *Atti Accad. Gioenia Sci. Nat. Catania*, (3), xii., 1878, p. 159.
1878. *Phylloceras isotypum* (Benecke), F. Herbich: "Das Szeklerland," *Mitt. Jahrb. k. Ungar. geol. Anstalt*, v., Pt. II., p. 140, Pl. II., f. 1 *a*, *b*.
1872-1882. *Phylloceras isotypum* (Benecke), Gemmellaro: "Sopra i Cefalopodi della zona con *Aspidoceras acanthicum*, Opp. sp. di Burgilamuni, presso Favara, provincia di Girgenti": *Sopra alcune Faune giuresi e liasiche della Sicilia*, No. 2, p. 30, Pl. VIII., f. 1.
1872-1882. *Phylloceras isotypum* (Benecke), Gemmellaro: "Sopra i Cefalopodi della zona inferiore degli strati con *Aspidoceras acanthicum* di Sicilia," *Sopra alcune Faune giuresi e liasiche della Sicilia*, No. 7, p. 176.

[1] In Dumortier and Fontannes: "Description des Ammonites de la zone à *Amm. tenuilobatus*, etc.," 1876, p. 38, Pl. VI., f. 1-2.

[2] "Fauna of the Spiti Shales," *Pal. Indica*, Ser. XV., iv., fc. 1 (1903), p. 4, Pl. II., f. 5.

[3] "Faunes Jurassiques et Crétaciques de San Pedro del Gallo," *Bol. Inst. Geol. Mexico*, No. 29, 1912, p. 40, Pl. VIII., f. 1-6.

[4] "Das Szeklerland, etc.," *Mitt. Jahrb. k. Ungar. Geol. Anst.*, v., 1878, p. 141, Pl. I., f. 5.

[5] "Sopra i cefalopodi della zona inferiore degli strati con *Aspidoceras acanthicum* di Sicilia," *Faune giurese e liasiche di Sicilia*, No. 7, 1878, p. 177, Pl. XV., f. 2-3.

[6] "Ueber eine . . . marine Kimmeridgebildung in Mahokondo," *Palaeontogr.*, Suppl. VII, II. Reihe, Tl. I., f. 1, 1925, p. 8, Pl. I., f. 1.

[7] One of these, purchased from Krantz in 1906, was labelled: "*Perisphinctes* nova forma, Gruppe Virgati (Unicum)." (B.M., No. C. 10878) and the other (typical) *P.* cf. *plicatum*, above listed (C. 10878) was identified as *Perisphinctes* cf. *virgatus*, Sow. [sic].

1880. *Phylloceras isotypum* (Benecke), C. F. Parona, *Atti R. Inst. Venete*, (5), vi., Pt. II., p. 876.
1886. *Phylloceras isotypum* (Benecke), E. Nicolis and C. F. Parona: *Boll. Soc. geol. Ital.*, iv. (1885), p. 50.
1896. *Phylloceras isotypum* (Benecke), Canavari: "Strati con *Aspidoceras acanthicum* di Mte. Serra," *Pal. Italica*, ii., p. 32.
1907. *Phylloceras isotypum* (Benecke), Pervinquière: *Études de Pal. Tunisienne—I.*: "Céphalopodes des Terrains Secondaires," p. 11.
1913. *Phylloceras* cf. *isotypum* (Benecke), Spath: "Jurassic Ammonites from Jebel Zaghuan," *Quart. Journ. Geol. Soc.*, lxix., p. 565.

This species is known from Mombasa in at least one typical example, figured in Pl. I., f. 1*a*, *b*, which is entirely septate. The radii are distinct only on the outer half of the whorl-side and not perfectly straight but slightly sigmoidal. At 90 mm. diameter, the thickness is 38% as against 36% in Benecke's type.

Crick referred to this species half of an inner whorl of a *Phylloceras*, about 33 mm. in diameter, to which is attached a fragment of the umbilical portion of the succeeding whorl, showing at its anterior termination part of a septal surface. The specimen is partly crushed but there are numerous, fine simple ribs on the inner whorl, slightly sigmoidal and extending almost, if not quite, to the very small umbilicus. Where the whorl had a height of 16 mm., the thickness appears to have been about 10 mm. The suture-line is not clearly visible, but this example may well represent the early volutions of one of the other species of *Phylloceras* here described, *i.e.* the more compressed *Ph. saxonicum*.

Horizon. Kimmeridgian.

Localities. 14 (Shore of the Changamwe Peninsula, north and south of Makupa Bridge) and "below Changamwe" (Gregory Colln., B.M., No. C. 8911 ?).

Phylloceras aff. *saxonicum*, Neumayr. S10292

1871. *Phylloceras saxonicum*, Neumayr: "Phylloceraten, etc.," *loc. cit.*, p. 315, Pl. XIII., f. 4; Pl. XIV., f. 1-2.
1913. *Phylloceras* cf. *saxonicum*: Neumayr, Spath, "Jurassic Ammonites from Jebel Zaghuan," *loc. cit.*, p. 564.

There is a fairly complete internal cast of about 90 mm. diameter, septate to the end and showing the suture-lines. Two indeterminable fragments of this or an allied species from another locality are associated with a later fauna.

This form is now also known from Kachh and figured in Pl. XCI., f. 6*a-c*, of the writer's "Revision."

Horizon. Kimmeridgian (Lower and Middle).

Locality. Changamwe (Kässner Colln., B.M., No. C. 8139), and 11a (East slopes of Coroa Mombasa; 2 doubtful fragments ?, Miss McKinnon Wood Colln.).

Phylloceras (*Macrophylloceras* ?) *semiplicatum*, nom. nov. (Pl. II., f. 1.) S10214

A new name seems advisable for this form which differs from the earlier *P. kudernatschi* (Hauer) as well as from the later *P. plicatum*, Neumayr. It may include the "*P. plicatum*" recorded by various authors from Callovian beds. As type of the species must be taken the example here figured in Pl. II., f. 1, which shows the suture-line as well as the fairly pronounced lineation, but on the body-chambers of larger specimens, the peripheral ribbing may become very strong. In the later forms, here assigned to *P. plicatum*, Neumayr, the blunt folds at all sizes are thickened at the middle of the side and gradually disappear again before reaching the periphery. At the same time the radii are only exceptionally thickened where they happen to coincide with the most convex portion of a given bundle. In such typical *P. kudernatschi* as those figured by Popovici-Hatzeg [1] the lineation is similar but the bulges are less conspicuous and the lateral curve is less pronounced. In the present species, on the other hand, the folds become more pronounced towards the periphery and the inner half of the whorl-side may be almost smooth. At the same time the striae and bulges are more distinctly interrelated, as in the Liassic *Partschiceras*,[2] or the typical *Macrophylloceras ptychostoma*, Benecke sp.[3] As in most of the conservative lineages within the

[1] "Les Céphal. Jurass. du Mt. Strunga," *Mém. Soc. Géol. France. Pal.*, xiii., fc. 3, 1905, p. 10, Pl. I., f. 1-4.

[2] See *e.g. Phylloceras partschi* (Stur) in Burckhardt, "Beitr. z. Kenntnis der Jura- und Kreideformation der Cordillere," *Palaeontogr.*, l., 1903, Pl. I., f. 1.

[3] *Geogn. Pal. Beiträge*, i., 1866, p. 185, Pl. X., f. 2 *a-b*.

Phylloceratidae, however, evolution proceeded very slowly and on the whole the changes from *P. kudernatschi* to the present species on the one hand and to the Argovian *P. plicatum* on the other are very slight and likely to be more pronounced in some individuals than in others, so that merely the association with forms of a higher horizon may give the clue to their specific identity. The small septate nucleus of a *Phylloceras* from locality 19, listed below, is included here merely because it occurred together with Callovian ammonites

The Kachh example previously[1] recorded as *Phylloceras* sp. nov.? cf. *plicatum* is intermediate between *P. kudernatschi* and *P. plicatum* and differs from the present species in the absence of peripheral folds as well as in its prosinuate ventral ribbing.

Horizon. Callovian (lower)

Localities. 16 (Hill north-east of the Mteza Jetty, 2 specimens); 17 (Kenya-Uganda Rly., mile 9/14-15, 16 specimens); 19 (same, mile 10/6, one doubtful nucleus). All Miss McKinnon Wood Colln.

2. Genus PHYLLOPACHYCERAS, Spath.

Phyllopachyceras ? sp, juv. ind. S10262

A crushed body-chamber of a shell about 35 mm. in diameter, with the inner whorls missing but apparently smooth to a diameter of 25 mm., may be provisionally attached to this genus and may belong to a form like *P. viator*, d'Orbigny.[2] Judging by the figure, the inner whorls of d'Orbigny's form seem to be more inflated and more distinctly ribbed, but the poor state of preservation of the Mombasa fragment prevents closer comparison.

Horizon. Callovian.

Locality. 41 (River bed, between the Senawe and the Ndsovuni). Miss McKinnon Wood Colln.

b. Sub-Family CALLIPHYLLOCERATINAE, Spath.

1. Genus CALLIPHYLLOCERAS, Spath.

Calliphylloceras cf. *disputabile* (Zittel). S10296

1920. ***Phylloceras*** **cf. *disputabile*,** Zittel, Spath: "Jurassic Ammon. from East Africa," *loc. cit.*, p. 318, Pl. V., f. 4 *a-d*.

1927. ***Calliphylloceras*** **aff. *disputabile*** (Zittel), Spath: "Revision Jurassic Cephal. Kachh," *loc. cit.*, Pt. I., p. 50.

Three small and fragmentary examples in a state of preservation very similar to that of the limonitic fragment recorded in 1920 may belong to the same species, but cannot be specifically identified. The constrictions prevent comparison with the smooth, immature Bajocian *Phylloceras tatricum* (Pusch), figured by Vacek,[3] but I previously mentioned that Haug [4] had quoted *P. disputabile* from the Upper Bajocian zone of "*Sonninia*" *romani* and "*Cosmoceras*" *subfurcatum*.

Horizon. Upper Bajocian or Bathonian.

Locality. 21 (Mombasa Pipe Line, mile 11/11-13).

Calliphylloceras demidoffi (Rousseau). (Pl. I., f. 6*a*, *b*). S10209. S10263

1927. ***Calliphylloceras*** **aff. *demidoffi*** (Rousseau), Spath: "Revision Cephal. Kachh," *loc. cit.*, Pt. I., p. 52, Pl. VII., f. 8.

Two fairly typical examples, one of which is here figured, are referable to this species, as represented by d'Orbigny's *Ammonites* "*tatricus*" [5] (=*Amm. puschi*, Oppel [6]). In the body chamber fragment

[1] Spath, *loc. cit.*, "Revision Jurass. Ceph. Kachh," Pt. I., p. 40.

[2] *Pal. Franç. Terr. Jurass.*, 1848, p. 471, Pl. CLXXII., f. 1, 2. See also Tsytovitch, "Sur quelq. Ammon. callov. de la Crimée, etc." *Ann. géol. min. Russie*, xiv., 1912, p. 196, Pl. II., f. 1 *a-c*.

[3] "Oolithe von Cap S. Vigilio," *Abh. k. k. geol. Reichsanst.*, xii., 1886, Pl. V., f. 3-4.

[4] "Les Chaines subalpines, etc.," *Bull. Serv. Carte Géol. France*, iii., No. 21, 1891, pp. 70-73.

[5] *Pal. Franç. Terr. Jurass.*, 1848, Pl. CLXXX.

[6] *Pal. Mitt.*, 1863, p. 217.

(Pl. I., f. 6) the anterior end is formed by the last septal surface, but the smaller, septate specimen well displays the suture-line. The Kachh example, previously figured, is only slightly less inflated, and has constrictions as pronounced as those of the body-chamber fragment here figured.

Horizon. Callovian (Lower).

Localities. 16 (Hill north-east of the Mteza Jetty) and 17 (Kenya-Uganda Rly., mile 9/14-15). Miss McKinnon Wood Colln.

Calliphylloceras aff. *benacense* (Catullo). S10297

1910. *Phylloceras malayanum*, G. Boehm, Dacqué : " Dogger und Malm aus Ostafrika," *loc. cit.*, p. 6, Pl. I., f. 2 only.

1927. *Calliphylloceras* cf. *benacense* (Catullo), Herbich sp. in Spath : " Revision Jurass. Cephalop. Kachh," *loc. cit.*, Pt. I., p. 54.

I mentioned before that one of the two fragmentary specimens before me from Mombasa is more correctly attached to the common *C. benacense* (Catullo) [1] than to *Phylloceras malayanum*, G. Boehm.[2] The constrictions are almost straight, as in Gemmellaro's figure of Catullo's species.[3] I now find that Crick had already attached a large fragment in Prof. Gregory's collection to this species and there are two more such body-chamber fragments of large individuals. They have the prorsiradiate striation of the ventral area seen in *Calliphylloceras empedocles* (Gemmellaro) [4] and may also be referred to the present species.

Horizon. Kimmeridgian.

Localities. Changamwe (Prof. Gregory Colln., B.M., No. C. 8910, and Kässner Colln., Nos. C. 8070, 8182, 8211) ; 14 (Shore of the Changamwe Peninsula, Miss McKinnon Wood Colln.).

2. Genus HOLCOPHYLLOCERAS, Spath.

Holcophylloceras zignodianum (d'Orbigny). S10298

1843. *Ammonites zignodianus* (d'Orbigny) : *Pal. Franç. Terr. Jurass.*, p. 493, Pl. CLXXXII., f. 1-4.

1927. *Holcophylloceras zignodianum* (d'Orbigny), Spath : " Revision Jurassic Cephal. Kachh," *loc. cit.*, Pt. 1, pp. 55, 58.

1928. *Phylloceras* cf. *zignoi* (d'Orbigny), Sayn and Roman : " Monogr. Strat. et Pal. du Jurassique Moyen de la Voulte-sur-Rhône," *Trav. Lab. Géol. Lyon*, fc. xiii., Mem. No. 11, p. 118.

Two typical fragments are referable to this species rather than to the Bajocian *H. ultramontanum* (Zittel).[5] The linguiform processes of the constrictions are as distinct as in the small example figured by d'Orbigny (Figs. 3-4) or in the typical examples from Les Blaches, near Castellane, Basses Alpes (B.M., Nos. 73496 *a*, *b*, Astier Colln.) previously recorded.

Horizon. Bathonian ?

Locality. 21 (Mombasa Pipe Line, mile 11/11-13).

Holcophylloceras mediterraneum (Neumayr). S1

1927. *Holcophylloceras mediterraneum* (Neumayr), Spath : " Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. I., p. 58.

There are five typical fragments, septate and body-chambers. They are all internal casts and the constrictions are more deeply impressed than in the Caucasian example, with part of the test preserved, figured by Neumayr and Uhlig.[6]

Horizon. Callovian.

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15, Miss McKinnon Wood Colln.).

[1] T. A. Catullo, " Appendice seconda al Catalogo degli Ammoniti delle Alpi Venete," 1849, p. 9, Pl. XIII., f. 1.

[2] " Beitr. z. Geol. v. Niederländ. Indien," i., 3, *Oxford des Wai Galo. Palaeontogr.*, Suppl. IV., 2, 1907, p. 78, Pl. XII.-XV., type being Pl. XII., f. 7.

[3] " Sopra i Cefalopodi della zona inferiore degli strati con *Aspidoceras acanthicum* di Sicilia," *Sopra alcune Faune giuresi e liasiche della Sicilia*, 1878, No. 7, p. 180, Pl. XV., f. 1 ; Pl. XVII., f. 1.

[4] *Ibid.*, Pl. XVI., f. 4.

[5] See Vacek, " Oolithe von Cap. S. Vigilio," *loc. cit.*, (1886), Pl. V., f. 15-20.

[6] " Jurafossilien des Kaukasus," *Denk. Akad. Wiss. Wien*, lix., 1892, Pl. I., f. 1.

S10201 - 10203

Holcophylloceras mesolcum (Dietrich). (Pl. I., f. 2 *a-d*).

S10

1925. *Phylloceras mesolcum*, Dietrich : " Kimmeridge in Mahokondo," *loc. cit.*, p. 8, Pl. I., f. 4-5.
1927. *Holcophylloceras* aff. *polyolcum* (Benecke), Spath : " Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. I., p. 60, Pl. VI., f. 1, 2 *a-f*, Pl. VII., f. 5. S10

Dietrich's name is adopted for this species represented by a number of examples of which three are here figured. This form was fully discussed in 1927 when I first intended to name it,[1] but then left it provisionally in *H. polyolcum* (Benecke) with which it is connected by numerous transitions.[2] In Kachh, *H. mesolcum* is very common in the Middle and Upper Kimmeridgian (Lower and Middle Katrol Beds) and still occurs in the Portlandian *sparsiplicatus* beds (associated with numerous *Haploceras elimatum*, *Hildoglochiceras*, *Ptychophylloceras angelini* and *P. gemminum*, Oppel sp., etc.), but it is replaced in the Tithonian Lower Umia beds (*transitorius* zone) by *H. silesiacum* (Oppel). In the examples referred to this last species, the terminal leaflets of the saddles (especially the first lateral) are distinctly more subdivided than in even much larger examples of *H. mesolcum*.[3]

Horizon. Kimmeridgian.

Localities. 11b (Eastern slopes of Coroa Mombasa) ; 14 (Shore of Changamwe Peninsula, north and south of Makupa Bridge). Miss McKinnon Wood Colln. Changamwe (B.M., No. C. 10880).

3. Genus PTYCHOPHYLLOCERAS, Spath.

S10210 - 1021

Ptychophylloceras vicarium (Waagen). (Pl. I., f. 8 *a-c* ; Pl. II., f. 2.)

S1

1927. *Ptychophylloceras vicarium* (Waagen), Spath : " Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. I., p. 43. S1

Three of the ten examples here referred to Waagen's species are illustrated in Pl. I., f. 8 *a-c*, and Pl. II., f. 2, since they well display the suture-line. In general appearance they show perfect agreement with *P. jaraense* (Waagen) which species occurs, associated with Dhosa Oolite forms, also in Madagascar, according to specimens kindly sent to me by Mlle. E. Basse of Paris. The tetraphyllic subdivision of the terminal leaflets of the principal saddles is, however, only just indicated in the Callovian form. In the young, the umbilical " rosette " is very distinct ; near the aperture, the constrictions are longer, shallower and wider, also more closely spaced, so that the outer whorl of the example figured in Pl. II., f. 2, shows altogether about 14 constrictions. In the earlier stages these constrictions are continued to the periphery, but, there, are faint ; bulges on the venter appear only after about 40 mm., but it is possible that they are confined to the body-chamber and independent of the actual size; for one of the septate fragments (without ventral ridges) must have belonged to an individual of about twice the size of that figured in Pl. II., f. 2.

Horizon. Callovian.

Localities. 16 (Hill north-east of the Mteza Jetty) ; 17 (Kenya-Uganda Rly., mile 9/14-15). Miss McKinnon Wood Colln.

Ptychophylloceras subptychoicum (Dacqué) emend. (Pl. I., f. 7).

1910. *Phylloceras subptychoicum*, Dacqué : " Dogger und Malm aus Ostafrika," *loc. cit.*, p. 7, Pl. II., f. 1.
1927. *Ptychophylloceras subptychoicum* (Dacqué), Spath : " Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. I., p. 46.

The Mombasa topotype of Dacqué's form (as emended) in the British Museum, previously quoted, is now figured (Pl. I., f. 6) and it will be seen that the tetraphyllic subdivision of the terminal leaflets of the principal saddles is, indeed, less developed than in the typical *P. ptychoicum*. Since describing the latter I have received a number of additional examples and the suture-line of one of these, unusually well preserved, is being figured in my Kachh work. Zittel's [4] figure is somewhat diagrammatic, but the differences between the suture-lines of *P. ptychoicum* and *P. subptychoicum* are not striking enough to show in poorly preserved or weathered specimens. I agree with Dietrich [5] in not putting any value on the presence on

[1] In one place (p. 39) the suggested MS. name (*H. pascoei*) was inadvertently inserted.

[2] One example (Sedgwick Museum) representing the end of the body-chamber of an individual much larger than that figured in my Kachh Pl. VI., f. 1, has the constrictions so close that it was labelled " *Harpoceras* ? "

[3] Compare Pl. CI., f. 5, of my " Revision Jurass. Cephal. Kachh."

[4] " Fauna der Älteren Tithonbildungen," *Palaeontogr.*, Suppl., 1870, Pl. I., f. 11.

[5] *Loc. cit.* (Mahokondo, 1925), p. 8.

the umbilical side of the first lateral saddle of an unusually projecting leaflet, since this is quite distinct also in *P. ptychoicum*; moreover in 1913, when I [1] referred to this feature, I wrongly took it to apply to the strongly projecting inner branch of the external saddle. On comparing the suture-line of *P. feddeni* (Waagen's f. 1 *c*) with that of *P. ptychoicum* (Waagen's f. 2 *c*) it will be seen that in both this inner (umbilical) leaflet of the external saddle (below the subdivided top-leaflet) is more strongly developed than its counterpart on the siphonal side, whilst in the suture-line of the true *P. ptychoicum* figured in my Pl. CII., f. 1 (Kachh Revision) the upper half of the external saddle is symmetrical. Waagen happened to figure an exceptional suture line (the only one) in which this prominent inner branch of the external saddle shows signs of subdivision; normally the two lower leaflets are equal-sized, whereas in *P. subptychoicum* the prominence of the umbilical one is certainly striking. More important, however, than this seems to me to be the generally more advanced complication of the suture-line of *P. ptychoicum* as a whole, as distinct in well-preserved specimens as that noticed in *Holcophylloceras mesolcum* and its descendant *H. silesiacum*. But whether the increased whorl-thickness is of diagnostic value is doubtful, and in any case *P. subptychoicum* cannot now be considered to be a Corallian fore-runner of *P. ptychoicum* of the Middle and Upper Kimmeridgian.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (Kässner Colln., B.M., No. C. 8137).

Ptychophylloceras cf. *insulare* (Waagen). S10264

1927. *Ptychophylloceras insulare* (Waagen), Spath: "Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. I., p. 45.

A fragmentary example of a *Ptychophylloceras* shows close labial ridges on the body-chamber and almost entire, rounded, terminal leaflets of its saddles on what is preserved of the septate inner whorls. Unfortunately it is too poorly preserved to be figured and the measurements cannot be given, but the whorl-section was apparently slightly compressed, with the thickness only four-fifths of the whorl-height. It is probable that it belongs to *P. insulare*, but this species is incompletely known.

Horizon. Argovian (?).

Locality. 15 (South shore of Port Reitz), Miss McKinnon Wood Colln.

4. Genus SOWERBYCERAS, Parona and Bonarelli.

Sowerbyceras loryi (Munier-Chalmas).

1927. *Sowerbyceras loryi* (Munier-Chalmas), Spath: "Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. I., p. 63, Pl. VI., f. 4.

A characteristic body-chamber fragment of this form was found in the matrix of a specimen purchased in 1906 as *Aptychus* ? sp. and apparently accepted as such by Crick, although it is probably some crushed pelecypod. There are traces (internal cast and impression) of probably two smaller individuals of the present species in the same piece of matrix.

Horizon. Kimmeridgian.

Locality. Changamwe (B.M., No. C. 10882).

II. Family LYTOCERATIDAE, Neumayr emend.

a. Sub-Family LYTOCERATINAE, s.s. Spath.

1. Genus THYSANOLYTOCERAS, Buckman.

Thysanolytoceras cf. *adeloides* (Kudernatsch). S10265

1927. *Thysanolytoceras adeloides* (Kudernatsch), Spath: "Revision Jurass. Cephalop. Kachh," *loc. cit.*, Pt. I., p. 67, Pl. VI., f. 5; Pl. VII., f. 1.

A fragment of a gigantic *Lytoceras*, still septate where the whorl-height amounts to about 90 mm. and the thickness to over 100 mm., is attached to this species merely because it was found in association with a Callovian fauna. It represents the internal cast of but a single air-chamber.

Horizon. Callovian.

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15). Miss McKinnon Wood Colln.

[1] "Jurassic Ammonites from Jebel Zaghuan," *Quart. Journ. Geol. Soc.*, lxix., 1912, p. 562, Pl. LIII., f. 1.

b. Sub-Family HEMILYTOCERATINAE, Spath.

1. Genus HEMILYTOCERAS, Spath.

S10304
S.10305

Hemilytocèras fraasi (Dacqué). (Pl. II., f. 4, 5.)

1910. *Lytoceras fraasi*, Dacqué : " Dogger und Malm aus Ostafrika," *loc. cit.*, p. 8, Pl. I., f. 4.
1925. *Lytoceras* aff. *fraasi*, Dacqué, Dietrich : " Kimmeridge-bildung in Mahokondo," *loc. cit.*, p. 7, Pl. II., f. 3.
1927. *Lytoceras fraasi*, Dacqué, Spath : " Revision Jurass. Cephalop. Kachh," *loc. cit.*, Pt. I., p. 70.

Two typical examples of this species are figured in Pl. II., f. 4-5, but there are many more fragments that can less definitely be referred to the same form. Eleven of these from Prof. Gregory's collection were described in detail by Crick, before the appearance of Prof. Dacqué's memoir, and he attached them to *Lytoceras polycyclum*, Neumayr, var. *camertina*, Canavari.[1] He wrote : " If I am right in placing all Dr. Gregory's examples of this genus in the same species, this must have attained considerable dimensions, for in the collection there are several portions of the body-chamber of a large size, one of these, a somewhat crushed example, having a height of 50 mm. That these large fragments belong to the same species as the smaller examples seems pretty certain, for the sculpture of the test of the preceding whorl as shown by the impression that is preserved on their dorsal area agrees perfectly with the sculpture of the smaller specimens."

The dimensions of the example figured in Pl. II., f. 5, are :

Diameter in mm. - - - - - -	60	28	13
Height of last whorl (in % of diameter) -	·32	·29	·31
Thickness ,, ,, ,, ,, ,, -	·29	(?)	(?)
Width of the umbilicus (in % of diameter) -	·46	·47	·46

In another slightly crushed example (B.M., No. C. 8072) the dimensions are :

Diameter in mm. - - - - - -	71	32
Height of last whorl (in % of diameter) -	·35	·34
Thickness ,, ,, ,, ,, ,, -	·35(?)	(?)
Width of the umbilicus (in % of diameter) -	·45	·50

Crick added to the description cited above that a small specimen of 10·5 mm. diameter showed the initial chamber, but I cannot find the example. It may be noted that the protoconch of a closely allied form (*Protetragonites quadrisulcatum*, d'Orbigny, sp.) has already been figured by Barrande.[2]

The suture-line is clearly visible in the specimen figured in Pl. II., f. 5. Another fragment, the natural cast of the posterior portion of a body-chamber, exhibits portions of each muscular scar. This was described by Crick [3] as *Lytoceras quadrisulcatum*, d'Orbigny, sp.

With regard to the correctness of Crick's identification, it seems that the quicker coiling and more depressed-circular cross-section at larger diameters are the only obvious distinctions of Dacqué's species from the Italian form, but since nearly all the body-chambers are more or less crushed it is difficult to say whether any of them belong to the more inflated *H. montanum* (Oppel) as I previously suggested, or to the more compressed *Lytoceras polycyclum*, Neumayr, var. *camertina*, Canavari. The most favourably preserved body-chamber before me, of a shell about 120 mm. in diameter, has a whorl-height of 34 and a thickness of 36% and may thus possibly belong to a species different from the thinner specimens here figured.

Horizon. Kimmeridgian.

Localities. Changamwe (B.M., Nos. C. 8899-909, Prof. J. W. Gregory Colln., Nos. C. 8072, 8087, 8110-11, 141, 212, Kässner Colln.) ; 14 (north and south of Makupa Bridge), and 11b (E. slopes of Coroa Mombasa). Miss McKinnon Wood Colln.

[1] *Loc. cit.*, (*Pal. Italica*, ii.), 1896, p. 40, Pl. VII., f. 1-3.
[2] *Syst. Silur. de la Bohème*, ii., Suppl. (1877), Pl. CDXC., f. 11.
[3] " Muscular Attachment, etc.," *Trans. Linn. Soc.* (2), vii., 1898, p. 92.

Hemilytoceras cf. *montanum* (Oppel).

1927. *Hemilytoceras* cf. *montanum* (Oppel), Spath: "Revision Jurass. Cephalop. Kachh," *loc. cit.*, Pt. I, p. 70, Pl. VI., f. 3.

The impression of a Lytoceras in the matrix of one of the lamellose aptychi recorded below indicates a form with a more depressed whorl-section than *H. fraasi* already at a diameter of only about 30 mm. Moreover, it probably comes from a later bed, so it may be listed separately, although the specific identification is merely tentative. What can be seen of the ornamentation of the test agrees with that of the inner whorls of Zittel's [1] large specimen.

Horizon. Kimmeridgian (Middle ?).

Locality. Changamwe (B.M., No. C. 10883).

III. Family OPPELIDAE, Haug emend.

a. Sub-Family OPPELINAE, s.s. Spath.

1. Genus OPPELIA, Waagen.

Oppelia sp. ind. (Pl. II., f. 7.) S10215

The small, septate fragment here figured is characterised by a comparatively simple suture-line, resembling that of Sowerby's type of *Oppelia subradiata* (B.M., No. 43943), but without a siphonal branch of the external saddle. The ornament is also coarser, though similar to that of larger examples of *O. subradiata, e.g.* the earlier half of the outer whorl of Favre's [2] Sully form, or the last half of the var. *E.* from Bayeux figured by Grossouvre.[3] The small example figured by Schloenbach [4] in f. 6 is more delicately ribbed but the rounded periphery and suture-line of the Mombasa fragment again point to a form like *Alcidia subdiscus* (Oppel),[5] although the adult shells look different. There are many species of the *subradiata* group, however, and the specific identification with a European form of the single Mombasa fragment is obviously impossible. Nothing comparable is known from Kachh, where the earliest ammonitiferous beds are of Bathonian age, or from Madagascar and Persia where Bajocian ammonites have been collected.

Horizon. Bajocian (Upper).

Locality. 21 (Mombasa Pipe Line, mile 11/11-13). Miss McKinnon Wood Colln.

2. Genus ALCIDIA, Rollier.

Alcidia mombasensis, sp. nov. (Pl. II., f. 11, 12*a*, *b*.) S10221 - 10222

As type of this new species may be taken the example figured in Pl. II., f. 11, which shows over half a whorl of body-chamber and has the following dimensions:

Diameter in mm. - - - - - - -	46
Height of the last whorl (in % of diameter) - -	.51
Thickness ,, ,, (,, ,,) - -	.22
Width of the umbilicus (,, ,,) - -	·21

The whorl-section is compressed, with its greatest thickness at the indistinct median spiral band whence it slopes very gently to the vertical umbilical wall on one side and the fastigate periphery on the other. There is a faint keel with two indistinct lateral grooves. The ribbing is first coarsely anguliradiate, more pronounced than in the immature *Alcidia* figured in Pl. II., f. 10, but not so strong as in f. 15. On the body-chamber there is a characteristic tendency to differentiation of the ribs of the outer whorl-side into longer sickles and short secondaries in between, as in *Oppelia mamertensis* (Waagen), although the

[1] *Loc. cit.* (Ältere Tithonbildungen, 1870), Pl. XXVI., f. 4 *b*.

[2] "*Oppelia* du Jurassique Moyen," *Mém. Soc. Pal. Suisse*, xxxviii. (1912), Pl. I., f. 1 *a*.

[3] "Bajocien-Bathonien de la Nièvre," *Bull. Soc. Géol. France*, (4), xviii., Pl. XIII., f. 7.

[4] "Jurassische Ammoniten," *Palaeontogr.*, xiii., 1865, Pl. XXX.

[5] See Favre, *loc. cit.*, (1912), text-figs. on pp. 28-9.

intercalated ribs are not nearly so fine. This species has recently been well described and figured by M. P. Petitclerc,[1] to whom I owe a typical specimen ; the suture-line of this form, however, has a deep external lobe. The example of " *Oppelia subcostaria* " figured by Waagen [2] in his f. 5 *a*, *b*, is probably a closer ally of the present species than is *O. mamertensis*, but it is more involute and less distinctly ribbed. Steinmann's [3] *Oppelia exotica* is more inflated in the umbilical region and also has less pronounced costation.

The body-chamber fragment figured in Pl. II., f. 12 *a*, *b*, formed part of a shell that seems to have had a slightly smaller umbilicus than the type. It may represent a transition to Waagen's *Oppelia subcostaria* which is probably identical with Rollier's *Alcidia obsoleta*.[4] A small fragment of a third example seems to have formed the earlier part of a body-chamber since its ribbing is not yet projected peripherally.

Horizon. Callovian (Lower ?).

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln.

Alcidia obsoleta (Rollier). (Pl. II., f. 14.) S10224

1928. *Alcidia* aff. *obsoleta* (Rollier), Spath : " Revision Jurassic Cephal. Kachh," *loc. cit.*, Pt. II., p. 83.

The small fragment here figured well shows the suture-line but little else ; it is almost smooth and has a rounded periphery with a very faint keel. It belongs to the *subcostaria* group and seems to be identical with Waagen's large example,[5] the type of Rollier's species. Its deep and spreading first lateral lobe distinguishes it from the other Kachh forms, except *A. inflata*, as much as from *A. subdiscus* (d'Orbigny) whilst the lobes and saddles of Loczy's " *Oppelia virgata* " [6] were described as broad-stemmed. The useless illustrations do not seem to confirm this but do not give the external lobe.

Horizon. Callovian (Lower).

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln.

Alcidia sp. ind. (Pl. II., f. 10.) S10220 S10267

The immature form here figured may possibly represent the pre-scaphitoid stage of a form of *Paroecotraustes* but it differs from the inner whorls of *P.* aff. *conjungens* described below as well as from those of the forms of *Alcidia* here recorded. The outer whorl-portion belongs to the body-chamber and shows neither geniculation nor degeneration of the ribbing or rounding of the neatly fastigate periphery. The immature *A. haugi*, Popovici-Hatzeg sp.[7] has a less compressed whorl-section and broader ventral area and typically coarser ornamentation, although one of the examples figured by its author (Pl. XII., f. 3) has the lateral aspect of the specimen here discussed.

A small indeterminable fragment of probably yet another form of *Alcidia* is more inflated and more coarsely ornamented, like *A. inflata*, Spath [8] or the true *A. haugi*, above referred to.

Horizon. Callovian.

Localities. 17 (Kenya-Uganda Rly., mile 9/14-15) and 45 (Rare River). Miss McKinnon Wood Colln.

[1] *Essai sur la faune du Callovien*, Vesoul, 1915, p. 50, P. III., f. 4-5 ; Pl. XI., f. 5.

[2] " Formenreihe des *Ammonites subradiatus*," Benecke's *Geogn. Pal. Beitr.*, ii., Pt. II., 1869, p. 193, Pl. XIX., f. 5 *a*, *b*.

[3] " Zur Kenntniss der Jura- und Kreideformation von Caracoles," *N. Jb. f. Min.*, etc., Beil. Bd. I., 1881, p. 266, Pl. XI., f. 5. 6.

[4] See Spath, *loc. cit.* (Kachh Revision, Pt. II., 1928), p. 83.

[5] *Loc. cit.*, (1869), Pl. XIX., f. 2 *a*, *b*, *c*.

[6] " Monographie der Villanyer Callovien-Ammoniten," *Geol. Hungarica*, i., 1915, p. 335, Pl. III., f. 6-7 (German translation available 1925).

[7] " Céphalopodes du Jurassique Moyen du Mt. Strunga," *Mém. Soc. Géol. France, Paléont.*, xiii., fc. 3, 1905, p. 18, Pl. XII., f. 3 ; Pl. XIII., f. 2-10.

[8] *Loc. cit.* (Kachh Revision, Pt. II.), 1928, p. 85, Pl. X., f. 3 *a-c*.

3. Genus PAROECOTRAUSTES, Spath.

Paroecotraustes conjungens (Mayer). (Pl. II., f. 9 *a-c.*) S10217 - 1021

1865. *Ammonites conjungens*, Mayer : " Descript. Coq. fossiles des terrains Jurassiques," *Journ. de Conchyliologie*, xiii., Pl. VIII., f. 6.
1869. *Oecotraustes conjungens* (Mayer), Waagen : " Formenreihe d. *Ammonites subradiatus*," *loc. cit.*, p. 232, Pl. XX., f. 5 *a-c.*
1928. *Paroecotraustes conjungens* (Mayer), Spath : " Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. II., p. 80.

Two of the three oecotraustid (scaphitoid) body-chambers here figured are complete to the aperture, but the peristome is damaged. The inner whorls of the same two examples show fairly complex *Alcidia*-suture-lines. The Hungarian form figured by Loczy [1] as " *Oppelia* (*Oecotraustes*) *conjungens* " and discussed previously in connection with the somewhat similar *Subbonarellia manialensis*, Spath,[2] differs from the Mombasa forms chiefly in its smaller size. The " extreme variety " figured by Waagen seems to differ merely in the perfect smoothness of the terminal portion, but in such a variable species as the present, no two examples are identical.

Horizon. Callovian (Lower).
Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln.

Paroecotraustes aff. *serrigerus* (Waagen). (Pl. II., f. 15.) S10225

1869. *Oecotraustes serrigerus*, Waagen : " Formenreihe des *Amm. subradiatus*," *loc. cit.*, p. 230, Pl. XX., f. 7 *a, b.*
1928. *Paroecotraustes serrigerus* (Waagen), Spath : " Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. II., p. 81.

The example figured in Pl. II., f. 15, is preserved as an impression on a nodule (the photograph representing a squeeze) but the portion that might have shown oecotraustid excentricity is missing. The open, smooth, umbilicus, however, and the characteristic anguli-rursiradiate ornamentation point to a species like Waagen's *Oecotraustes serrigerus* rather than to a form of *Alcidia*, like *A. haugi*, Popovici-Hatzeg sp., already referred to, or *A. inflexa* (Grossouvre).[3] I previously stated that Waagen's f. 8 had been taken as type of *P. serrigerus* and that Buckman considered f. 7 to belong apparently to quite another species ; I am becoming more and more suspicious of this spurious " accuracy " and even doubt now whether Buckman's selection of f. 8 rather than of 7 holds, after so many other authors have given their interpretations of Waagen's species.

Horizon. Callovian (Lower).
Locality. 17 (Kenya-Uganda Rly., mile 9/14-15). Miss McKinnon Wood Colln.

b. Sub-Family HECTICOCERATINAE, Spath.

1. Genus HECTICOCERAS, Bonarelli.

Hecticoceras sp. ind.

1928. *Hecticoceras* sp. aff. *turgidum*, Loczy, Spath : " Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. II., p. 105.

The fragment previously recorded is still the only example of this species available. It shows very good agreement with the fragment of a *Hecticoceras hecticum* (Reinecke) figured by Stehn [4] from South America, and has the same fine peripheral striation.

Horizon. Callovian (Lower).
Locality. 8-10 miles north-west of Mombasa (B.M., No. C. 19661, Rev. Chas. New Colln.).

[1] " Monographie der Villányer Callovien-Ammoniten," *Geol. Hungar.*, i., 1915, p. 337, Pl. III., f. 8-9.
[2] *Loc. cit.*, (Kachh Revision, Pt. II., 1928), p. 99.
[3] " L'Étage Bathonien," *Bull. Soc. Géol. France*, (3), xvi., Pl. III., f. 2-6.
[4] " Zur Kenntniss des Bathonien und Callovien in Südamerika," *N. Jb. f. Min.*, etc., Beil. XLIX., 1923, Pl. III., f. 1.

2. Genus LUNULOCERAS, Bonarelli.

Lunuloceras ? sp. ind. (Pl. II., f. 16.) S10226

The crushed example here figured may not be specifically identifiable, but it shows a general resemblance to the *Hecticoceras lunula* (Zieten) figured by Lee.[1] The scaphitoid shape is due to accidental deformation, but *Oecotraustes grossouvrei*, Parona and Bonarelli,[2] with a similar simple suture-line and only slightly less close costation, is probably another allied form.

Horizon. Callovian.

Locality. 16 (Hill north-east of the Mteza Jetty). Miss McKinnon Wood Colln.

3. Genus SUBLUNULOCERAS, Spath.

Sublunuloceras aff. *dynastes* (Waagen). (Pl. II., f. 13.) S10223

1927. *Sublunuloceras dynastes* (Waagen), Spath : " Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. II., p. 125, Pl. XI., f. 2, 3.

The fragment of which the peripheral view is here given shows good agreement in most characters with the Kachh examples previously figured. The suture-line, however, is more complex, although ascending towards the umbilicus. *S. dynastes* was previously assumed to come only from the *athleta* beds, but it is probable that it occurs already in earlier Callovian strata, even in Kachh.

Horizon. Callovian.

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15) ; Miss McKinnon Wood Colln.

c. Sub-Family TARAMELLICERATINAE, Spath.

1. Genus TARAMELLICERAS, Del Campana.

Taramelliceras cf. *trachinotum* (Oppel). (Pl. II., f. 6.)

1910. *Oppelia* (*Neumayria*) *trachynota* (Oppel), Dacqué ; " Jura v. Ostafrika," *loc. cit.*, p. 9, Pl. III., f. 5.
1928. *Taramelliceras trachinotum* (Oppel), Spath : " Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. II., p. 136.

The fragment here figured is the " third example " of an East African *Taramelliceras* which I recorded in 1928, but Prof. Dacqué's interpretation of *T. trachinotum*,[3] questioned by Dietrich [4] may be too narrow. He states that in the true *T. trachinotum* there are never more than three ribs to each tubercle, whereas in the fragment here described there are only two, and the intervening ribs are longer and continued on to the periphery. In the side-view, Pl. II., f. 6, the fragment is tilted towards the observer so as to show part of the ventral area. This resulted in a fore-shortening of the lower half of the whorl-side which, however, is intact to the perpendicular umbilical wall. The section corresponds to that figured by Choffat,[5] and the impression of the inner whorl, in the dorsal area, shows single ribs, as in the earlier *bachianum-callicerum* group. On the whole, however, there is more resemblance to the Mombasa fragment figured by Dacqué than to other forms of *Taramelliceras* ; and considering that there is only a small body-chamber fragment available, it is difficult to decide whether this, perhaps, belonged to a form intermediate between the *bachianum* group and the true *T. trachinotum*. It may be added, however, that the fragment shows a whorl-height of 48 mm. and a thickness of 33 mm., exactly as in Oppel's [6] type, and is thus comparatively inflated, more so than the very similar Crussol form figured by Fontannes.[7]

Horizon. Kimmeridgian (Lower ?).

Locality. Changamwe (Kässner Colln., B.M., No. C. 8136).

[1] " Étude Strat. et Pal. de la Chaine de la Faucille," *Mém. Soc. Pal. Suisse*, xxxii., 1905, Pl. I., f. 4.

[2] " Faune du Callovien inférieur de Savoie," *Mém. Acad. Sci., etc., Savoie*, (4), vi., 1897, p. 131, Pl. III., f. 4.

[3] The original spelling, right or wrong, is here adhered to in every case, unless it be obviously a misprint.

[4] *Loc. cit.* (Mahokondo, 1925), p. 18.

[5] " Faune Jurassique Portugal. I. Ammonites du Lusitanien," *Trav. Géol. Portug.*, 1893, Pl. XVII., f. 3 *b*.

[6] *Pal. Mitt., III. Ueber Jurassische Cephalopoden* (2), 1863, p. 214, Pl. LVI., f. 4 *a, b*.

[7] *Calcaires du Château de Crussol*, 1879, Pl. V., f. 2.

Taramelliceras cf. *kachhense* (Waagen). S10268

1928. *Taramelliceras kachhense* (Waagen), Spath : " Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. II., p. 134, Pl. VIII., f. 2, 4 ; Pl. XIV., f. 6, 12, 13 ; Pl. XVII., f. 3 ; Pl. XVIII., f. 1, 6.

The septate fragment of a large form of *Taramelliceras* seems to be referable to this species, but comprises merely three air-chambers. The suture-line is well shown, very complex, and though not exactly like the somewhat diagrammatic figure given by Waagen [1] can be well matched by suture-lines of several of the numerous specimens of this species described in 1928 and many others since received. Beyrich's *Ammonites trachynotus* [2] may possibly belong to a form like Waagen's *Oppelia trachynota* (=*T. akher*, Spath), or the present species. It was identified by Dacqué with his own and Futterer's *O. trachynota*, but Dietrich states that it has four ribs to each tubercle, not three.

Horizon. Kimmeridgian (Middle ?).

Locality. 11a (Eastern slopes of Coroa Mombasa).

Taramelliceras ? sp. ind.

Compare 1887. *Ammonites flexuosus gigas*, Quenstedt : *Ammoniten des Schwäbischen Jura*, Pt. III., p. 909, Pl. XCVIII., f. 8.

What I take to be the smooth terminal portion of a gigantic Oppelid was described by Crick as *Nautilus* ? sp. He thought it might have belonged to : " the body-chamber of a Nautilus allied to *N. haxagonus*, J. de C. Sowerby." It is only an internal cast and formed part of a whorl now 50 mm. in height, but originally much higher. The periphery is flattened, about 17 mm. wide, and bears a feeble median keel provided with one tubercle and having a shallow groove on each side. There is no trace of the septa. The sides are ornamented with sigmoidal lines of growth, prorsiradiate peripherally, as in *Streblites*, and the faint, notched keel on a flat periphery perhaps also suggests this genus [3] rather than *Taramelliceras*, which the fragment perhaps resembles only because half the whorl-height is missing.

Horizon. Kimmeridgian (Lower).

Locality. Below Changamwe (J. W. Gregory Colln., B.M., No. C. 8937).

d. APTYCHI OF OPPELIDAE.

(LAMELLAPTYCHI, Trauth.[4])

S10?

1928. *Aptychi* (ad fam. Oppelidae), Spath : " Revision Jurass. Cephal. Kachh," *loc. cit.*, (Pt. II.), p. 152.

Ten fragmentary, thick, lamellose (imbricate) aptychi, of the general aspect of *A. euglyptus*, Oppel,[5] have been found at two localities whence, however, no ammonites are known. It is probable that these aptychi belonged to forms of *Taramelliceras*. The impression of another, in a light ochreous rock, is accompanied by the natural mould of the *Hemilytoceras* cf. *montanum* (Oppel) recorded above.

Horizon. Kimmeridgian (Middle ?).

Localities. 12 (north shore of Port Tudor, north of Freretown) and 56 (West of Makupa Bridge), Miss McKinnon Wood Colln. ; also " Changamwe " (B.M., No. C. 10883).

[1] *Loc. cit.*, (1875), Pl. X., f. 4.

[2] " Ueber Hildebrandt's geologische Sammlungen von Mombassa," *Monatsber. Berl. Akad. Wiss.*, 1878, p. 767.

[3] See Periphery of *Ammonites pictus tegulatus* in Quenstedt, *loc. cit.*, (1887), Pl. CXX., f. 4.

[4] " Aptychenstudien," I., *Ann. Naturh. Mus. Wien*, 1927, pp. 216, etc.

[5] " Ueber Jurass. Cephalop.," III., *Pal. Mitt.*, 1863, Pl. LXX., f. 5.

IV. Family HILDOCERATIDAE, Hyatt emend.

a. Sub-Family SONNININAE, Buckman emend.

1. Genus DORSETENSIA, S. Buckman.

S10207
S.10201

Dorsetensia sp. juv. ? cf. *edouardiana* (d'Orbigny). (Pl. I., f. 5 *a*, *b*.)

1846. *Ammonites edouardianus*, d'Orbigny : *Pal. Franç. Terr. Jurass.*, p. 392, Pl. CXXX., f. 3-5.

The identification of the impression here figured and of a second, still smaller example is provisional, since neither suture-line nor periphery is preserved. There is an indication of a crushed keel, apparently more prominent than in young *Fontannesia* from the English Inferior Oolite (*concava* zone) and more like that of young *Dorsetensia*. Both have identical ribbing ; but young Grammoceratids (*Dumortieria*, etc.) from the Upper Lias also may be very similar (compare *e.g.* the figure of *Dumortieria* sp. in Zittel's Text-Book).[1] It may be recalled here that an Australian form described by Crick [2] as *Ammonites* (*Dorsetensia*) *clarkei* was held to be probably the same species as that recorded by Moore as *Amm. radians*, Schlotheim, a Liassic species ; and comparing the impressions here discussed with the inner whorls of such species as *Dumortieria exacta*, S. Buckman [3] (*e.g.* B.M., No. C. 9889 from Penn Wood, near Stroud, Gloucestershire) one notices the greatest resemblance. On the whole, however, I am inclined to consider the curvature of the ribs (with a more pronounced lateral bend) to indicate the Bajocian genera *Fontannesia* or *Dorsetensia* rather than an earlier Grammoceratid. Some immature topotypes of *Fontannesia explanata*, S. Buckman [4] in my collection from Bradford Abbas seem particularly similar in side-view, but lack the keel, whilst the young *Dorsetensia edouardiana* (d'Orbigny) figured by Buckman [5] is probably still closer.

The definite identification of the present form and therefore the determination of the exact age of this earliest ammonitiferous bed in East Africa will have to be deferred until more material is collected.

Horizon. Bajocian (*humphriesianum* or *sauzei* zone ?).

Locality. 26 (Mombasa Pipe Line, miles 16 to 17) Miss McKinnon Wood Colln.

V. Family STEPHANOCERATIDAE, Neumayr emend.[6]

a. Sub-Family STEPHANOCERATINAE, Neumayr emend. Spath.

1. Genus STEPHANOCERAS, Waagen.

Stephanoceras cf. *tenuicostatum*, Hochstetter. S10269

1897. *Stephanoceras tenuicostatum*, Hochstetter : " Klippe von St. Veit bei Wien," *Jahrb. k.k. Geol. Reichsanst.*, xlvii., p. 130, Pl. III., f. 3 *a*, *b*.

The specific identification of three fragmentary specimens must remain uncertain but they are certainly comparable to Bajocian *Stephanoceras* of the *humphriesianum* group rather than to the Bathonian *St. rectelobatum* (Hauer).[7] The largest seems to have slightly more prominent tubercles than Hochstetter's type, but a second example, although poorly preserved, differs in the opposite direction, becoming almost smooth, although its inner whorl has the typical primaries. The suture-line of this second example is as complex as that of typical *Stephanoceras* from the English Upper Bajocian ; in a third and small fragment, however, the suture-line is simpler, although the second lateral and auxiliary lobes are still strongly oblique.

Horizon. Bajocian (Upper).

Locality. 21 (Mombasa Pipe Line, mile 11/11-13. Miss McKinnon Wood Colln.

[1] Transl. Eastman., 1st ed. (1900), p. 576, f. 1201.

[2] " Jurassic Cephalopoda from Western Australia," *Geol. Mag.*, 1894, p. 388, Pl. XII., f. 2 *a-c*.

[3] " Inf. Ool. Ammon.," *Mon. Pal. Soc.*, Pt. VI., 1892, Pl. XLV., f. 6-7 (sub *Dumortieria subundulata* Branco sp.).

[4] *Loc. cit.*, (1892), Pl. XLVI., f. 6-7 ; the immature examples above mentioned agree with a metatype of Buckman in the British Museum.

[5] *Ibid.*, Pl. LII., f. 11-12.

[6] The adoption of super-families among the *Trachyostraca* gives a distorted classificatory picture in view of the inclusion, in only two families Phylloceratidae and Lytoceratidae, of the less diverse, but more important, ancestral stock of the *Leiostraca*.

[7] *Sitzungsber. k. Akad. Wiss. Wien*, xxiv., 1857, p. 156, Pl. I., f. 5 ; Pl. II., f. 10.

b. Sub-Family MACROCEPHALITINAE, Buckman emend.

1. Genus MACROCEPHALITES (v. Sutner MS.) Zittel.

Macrocephalites cf. *macrocephalus* (Schlotheim). S10270

1928. *Macrocephalites macrocephalus* (Schlotheim), Spath: "Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. III., pp. 169, etc.

A specifically unidentifiable fragment of a Macrocephalitid shows the complex suture-line, fine ribbing and inflated whorl-shape of Quenstedt's *Ammonites macrocephalus*.[1] It may well represent the true *M. macrocephalus* as previously defined.

Horizon. Callovian (Lowest).

Locality. 19 (Kenya-Uganda Rly. mile 10/6). Miss McKinnon Wood Colln.

Macrocephalites chariensis (Waagen) var. *simplex* nov. (Pl. III., f. 2.) S10227 S.1

1928. *Macrocephalites chariensis* (Waagen), Spath: "Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. III., p. 179.

The example here figured shows the simpler suture-line of the African variety of this characteristic species, also the slightly coarser ribbing. A smaller example does not differ much in its costation from Waagen's type, but a third body-chamber fragment is again very coarsely ribbed. A fourth example, finally, differs from the typical *M. chariensis* merely in its prorsosinuate ribs on the ventral area. Among the numerous Kachh examples before me, there is also great variation.

In Mr. Raj Nath's collection (only partly available when Part III. of my Kachh work was published) the present species is represented especially from beds 15-18 of Jumara (=Upper *dimerus* zone), just above the beds with *Pleurocephalites habyensis*.

Horizon. Callovian (Lower).

Localities. 16 (Hill N.E. of the Mteza Jetty); 17 (Kenya-Uganda Rly., mile 9/14-15); and 18a (East of fault, *ibid.*, mile 10/5). Miss McKinnon Wood Colln.

2. Genus PLEUROCEPHALITES, S. Buckman.

Pleurocephalites aff. *habyensis*, Spath. (Pl. I., f. 9.) S.10213. S.10274.

A typical body-chamber fragment and a crushed and more doubtful example, as well as some immature specimens like that figured in Pl. I., f. 9, may be attached to this species, but the specific identification of small fragments of *Pleurocephalites* is impossible. In Mr. Raj Nath's collection from Kachh, examples of this species, identical with the large body-chamber fragment above mentioned, are labelled bed 21 of Jumara which is at the base of my *dimerus* zone.

Horizon. Callovian (Lower).

Localities. 16 (Hill N.E. of the Mteza Jetty); 17 (Kenya-Uganda Rly., mile 9/14-15); and 45 (Rare River); Miss McKinnon Wood Colln.

Pleurocephalites ? sp. nov. (Pl. II., f. 8 *a-c.*) S.10216

The fragmentary example here figured resembles "*Sphaeroceras*" *extremum*, Tornquist,[2] in whorl-shape, but it has stronger primary ribs on the inner whorls, which give its deep umbilicus a Cadoceratid appearance. On the outer whorl which is still septate, only the peripheral ribs remain, as in "*Sphaeroceras*" *rotundum*, Tornquist,[3] but the very depressed whorl-section and high and perpendicular umbilical wall are very distinct; also the Cadoceratid, simplified suture-line. The resemblance to young *Kheraiceras* is superficial, but it may be found that the present new species is connected by transitions with *Macrocephalites chariensis*, with similar ribbing on the outer whorl. Until more complete specimens are

[1] "Ammoniten des Schwäbischen Jura," II., *Br. Jura*, 1885, p. 646, Pl. LXXVI., f. 1.

[2] "Dogger am Espinazito-Pass," *Pal. Abhandl.*, Dames und Koken, N.F., iv., 1898, p. 47, Pl. VI., f. 5-6.

[3] *Ibid.*, p. 49, Pl. VI., f. 1-4.

discovered, even the generic position of the form now discussed must remain uncertain. "*Macrocephalites*" *cadoceroides*, Burckhardt [1] has quite different inner whorls.

Horizon. Callovian (Lower).

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln.

3. Genus KAMPTOKEPHALITES, S. Buckman.

Kamptokephalites ? sp. ind.

1928. *Kamptokephalites* ? sp. (trans. to *Idiocycloceras*), Spath : "Revision Jurass. Cephal. Kachh," *loc. cit.*, *Pal. Indica*, p. 252.

The body-chamber fragment previously discussed was at first taken to be an Argovian *Dhosaites* (or rather *Prograyiceras*) but seems to attach itself as naturally to *Kamptokephalites*. The strongly prorsosinuate peripheral ribbing suggests comparison with *K. lamellosus* as figured by Waagen,[2] but the ribs of the Mombasa form are far stronger and more distinct, at least on the body-chamber, whilst on the septate portion the peripheral sinus seems to have been more acute, as in *Idiocycloceras*. But the differences are unimportant and as there is in the Walker Collection a fragment of another form of *Prograyiceras* of the *rabai*-group my first identification may be more correct.

Horizon. Callovian (Lower), or Argovian.

Locality. 8-10 miles north-west of Mombasa. Rev. Chas. New Colln. (B.M., No. C. 19664).

4. Genus DOLIKEPHALITES, S. Buckman.

Dolikephalites sp. juv.

Compare 1928. *Dolikephalites gracilis*, Spath : "Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. III., p. 173.

Three minute specimens of Macrocephalitids, associated with the *M.* cf. *macrocephalus*, listed above, seem to be referable to *Dolikephalites* and they resemble such immature Cornbrash examples as those figured by Blake [3] as *Macrocephalites typicus*, or the other species previously discussed. But the inner whorls of a *Dolikephalites subcompressus* (Waagen) in Mr. Raj Nath's collection, from his bed 11 (base of my *rehmanni* zone) are absolutely indistinguishable from the original of Blake's Pl. IV., f. 5 (B.M., No. C. 11792) of a much lower horizon.

Horizon. Callovian (Lowest).

Locality. 19 (Kenya-Uganda Rly., mile 10/6). Miss McKinnon Wood Colln.

c. Sub-Family MAYAITINAE, Spath.

1. Genus MAYAITES, Spath.

Mayaites ? sp. ind. cf. *olcostephanoides* (Tornquist). (Pl. II., f. 3.) S.102

1924. *Mayaites* sp. (transitional from *M. olcostephanoides*, Tornquist sp. to *Dhosaites*), Spath : "Blake Collection of Ammonites from Kachh," *loc. cit.* (*Pal. Indica*), p. 10.

1928. *Indocephalites* sp. nov. ? Spath : "Revision Jurass. Cephal. Kachh," *loc. cit.* (*Pal. Indica*, Pt. III.), p. 223, Pl. XXI., f. 8.

The suture-line of this form was previously figured ; and after having first referred to this "undescribed species" as transitional in shape and ornamentation between *Mayaites olcostephanoides*, Tornquist sp.[4] and *Dhosaites*, I later assigned it doubtfully to the genus *Indocephalites*. The discovery of a smaller example, however, of a closely allied species, with the ribs projected peripherally (from a locality where only ammonites of a much higher horizon have been found) seems to settle the problem of the true generic

[1] "Cefalop. del Jurass. Medio de Oaxaca," *Bol. Inst. Geol. Mexico*, No. 47, 1927, p. 29, Pl. XIV.

[2] *Loc. cit.*, (*Pal. Indica*, 1875), Pl. XXXIII., f. 4 *c* (sub *Stephanoceras subtrapezinum*, Waagen).

[3] "Fauna of the Cornbrash," *Mon. Pal. Soc.*, 1905, Pt. I., p. 42, Pl. III., f. 2 *a*, *b*, Pl. IV., f 5 *a*, *b* (B.M. Nos. C. 5073a and 11792).

[4] "Fragmente einer Oxfordfauna von Mtaru, etc.," *Jahrb. Hamburg Wiss. Anst.*, x., Pt. II., 1893, p. 8, Pl. I., f.1-3.

affinity of this species. The preservation of the additional example is again that of the Callovian (not the Argovian) forms, but although I can see no satisfactory reason for separating this form from *Indocephalites*, yet the inner whorls may be assumed to be different.

There is no resemblance to *Macrocephalites rabai*, Dacqué [1] or to G. Böhm's *M. bambusae*, with which the Mombasa form had aptly been compared. Again the suture-line does not resemble that of *Tornquistes* [2] nearly so much as that of *Indocephalites*, and differs from that of Tornquist's " *Macrocephalites* " *horologium* or " M." *stuhlmanni*,[3] although the drawings may be diagrammatic. The presence of a constriction in *M. horologium* makes it doubtful whether the *olcostephanoides* group is correctly referred to *Mayaites*, and I mentioned previously that the suture-line of the specimen here figured differed from that of the Indian *Mayaites*. Unfortunately the additional example has the septate inner whorls replaced by coarsely crystalline calcite, and thus rendered unrecognisable. The elucidation of the affinities of the East African *rabai-olcostephanoides* groups is therefore matter for future work when better material is available.

Horizon. Argovian ?

Locality. Mombasa (B.M., No. C. 10988, J. T. Last Colln.) and 15 (South shore of Port Reitz, Miss McKinnon Wood Colln.).

VI. Family PERISPHINCTIDAE, Hyatt emend.

a. Sub-Family PROPLANULITINAE, Buckman emend.

A detailed discussion of this family as well as of the other subdivisions of Perisphinctida is published in Part IV. of the writer's Revision of the Jurassic Cephalopoda of Kachh. Since, however, the present account is likely to appear first, it is necessary to indicate the genotypes of the new groups whose names are here used. For the present family, the new names are :

Sivajiceras, gen. nov. (established for the group of *Perisphinctes paramorphus* Waagen (*loc. cit.*, 1875, p. 162, Pl. XLVI., f. 1 *a*, *b*) which also includes *S. congener* (Waagen), *S. fissum* (Sowerby non Waagen), *S. aurcum* nom. nov. (= *Perisphinctes* cf. *funatus* Waagen non Oppel sp.) and a number of new Kachh species.

Hubertoceras, gen. nov. established for the group of *Perisphinctes omphalodes*, *P. dhosaensis*, *P. mutans* and *P. arcicosta*, Waagen (genotype : *Perisphinctes omphalodes*, Waagen, *loc. cit.*, 1875, p. 150, Pl. XXXVII, f. 2 *a*, *b*.

The genus *Kinkeliniceras*, Buckman, which includes not only the East African *Proplanulites kinkelini*, Dacqué,[4] but such Kachh species as *K. angygaster* (Waagen), has not been recognised among the Mombasa material at my disposal ; and the three species of Proplanulitids discussed below, of course, give only a very inadequate idea of the great variety of forms known in these genera.

1. Genus SIVAJICERAS, nov.

Sivajiceras ? sp. ind.

S.10276

Associated with some Macrocephalitids there occurred the impression of an immature form with the coarse and blunt ribbing of the young *Sivajiceras paramorphum* figured by Waagen.[5] The identification is, of course, quite tentative since no feature except the ribbing is preserved.

Horizon. Callovian (Lowest).

Locality. 19 (Kenya-Uganda Rly., mile 10/6). Miss McKinnon Wood Colln.

[1] *Loc. cit.* (" Dogger und Malm aus Ostafrika," *loc. cit.*, 1910), p. 11, Pl. II., f. 2 (the original of text-fig. I, p. 11, however, is much closer and more like *Mayaites* ? *olcostephanoides*, Tornquist).

[2] See P. de Loriol, " Moll. et Brach. de l'Oxfordien supér. et moyen du Jura Bernois," *Mém. Soc. Pal. Suisse*, xxiii., 1896, Pls. II.-IV.

[3] *Loc. cit.* (1893), Pl. I., f. 4, Pl. III., f. 5.

[4] *Loc. cit.* (1910), p. 36, Pl. V., f. 1 ; Pl. VI., f. 3. Via " *Proplanulites* " *pendambilianus*, Dacqué (*ibid.*, Pl. VI., f. 4) this is connected with *Hubertoceras arcicosta* (Waagen) on the one hand and *Choffatia lateralis* (Waagen) on the other.

[5] *Loc. cit.* (1875), p. 162, Pl. XLVI., f. 2 *a*.

2. Genus HUBERTOCERAS, nov.

Hubertoceras arcicosta (Waagen). (Pl. VII., f. 3 *a*, *b*). S.10258

1875. *Perisphinctes arcicosta*, Waagen : " Jurassic Cephalopoda of Kutch," *loc. cit.*, p. 167, Pl. LVIII., f. 2.

A Mombasa example of this species, complete to the mouth-border, has been figured in Part IV. of the writer's " Revision of the Jurassic Cephalopoda of Kachh " (Pl. LXXX, f. 9 *a*, *b*). It is slightly more compressed and the ribbing of the body-chamber is closer than in the more typical forms of this species, so that there is resemblance to forms of *Choffatia*, like *C. lateralis* (Waagen), but the suture-line is simplified, as in typical *Hubertoceras*. On the other hand the septate inner whorls of another example here figured, showing even better agreement with Waagen's type on account of their greater whorl-thickness, are transitional to *Choffatia* in the more complex suture-line. Their *omphalodes*-like ribbing, however, is very characteristic.

Horizon. Callovian (Lower).

Localities. 16 (Hill north-east of the Mteza Jetty), Miss McKinnon Wood Colln. ; " between Shimba and the coast " (J. W. Gregory Colln., B.M., No. C. 8934).

Hubertoceras sp. ind. S.10277

A body-chamber fragment probably belongs to a form of the group of *H. mutans* (Waagen),[1] but cannot be definitely identified. A smaller, septate fragment of another form, on account of its complex suture-line, is perhaps closer to *Sivajiceras*.

Horizon. Callovian (Lower).

Locality. 16 (Hill north-east of Mteza Jetty), Miss McKinnon Wood Colln.

b. Sub-Family GROSSOUVRINAE, nov.

A number of genera grouping themselves round *Choffatia* and *Grossouvria*, Siemiradzki, are now included in a separate family, discussed elsewhere. The former genus is based on a Kachh species, *C. cobra* (Waagen) which had generally been misinterpreted ; its allies include such well-known species as *C. perdagata* and *C. lateralis* (Waagen), *C. balinensis*, *C. furcula* (Neumayr), *C. baluchistanensis* (Noetling), *C. waageni* (Teisseyre) etc., which are now all included in *Choffatia*. The only new name here used is :

Indosphinctes, gen. nov. proposed for the group of *Amm. calvus*, Sowerby (in Sykes, *Trans. Geol. Soc.* (2) v., p. 719, Pl. LXI., f. 9 ; B.M., No. R. 10075 G. S. Coll.) which also includes *Perisphinctes indicus*, Siemiradzki (=*P. spirorbis*, Waagen non Neumayr), *P. patina*, Neumayr, *P. abichi*, Neumayr and Uhlig, *P. choffati* (Parona and Bonarelli), etc.

Definitions of these genera and a discussion of their allies *Grossouvria* and *Subgrossouvria* are given in Part IV. of the writer's " Revision of the Jurassic Cephalopoda of Kachh."

1. Genus INDOSPHINCTES, nov.

Indosphinctes abichi (Neumayr and Uhlig). (Pl. IV., f. 3 *a*, *b*, 6.) S.10232. 10233 S.1002

1892. *Perisphinctes abichi*, Neumayr and Uhlig : " Jurafossilien des Kaukasus," *loc. cit.*, p. 66, Pl. III., f. 1 only.

There is one typical body-chamber fragment of this species, but some more doubtful examples, like those figured in Pl. IV., f. 3, and 6, can only provisionally be included here. The form described below as *Indosphinctes* sp. nov. is more involute than *I. abichi*, but its inner whorls probably are very similar. In Kachh, Mr. Raj Nath has found forms like the present in his beds 15-17 of Jumara, belonging to the upper *dimerus* zone.

The type of the present species is Neumayr and Uhlig's smaller specimen and Parona and Bonarelli's *P. choffati* [2] may have been separated merely because the Caucasian form was said to be of Kimmeridgian age.

Horizon. Callovian (Lower).

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln.

[1] *Loc. cit.* (Jurassic Cephal. Kutch), p. 151, Pl. XXIX., f. 1 *a*, *b*.

[2] " Faune du Callovien infér. de Savoie," *Mém. Acad. Sci. Savoie*, (4), vi., 1897, p. 174, Pl. VIII., f. 3, 3 *a*.

Indosphinctes sp. nov. S10279

1915. *Perisphinctes* sp. nov. Krenkel : " Kelloway Fauna v. Popilani," *Palaeontographica*, lxi., Pl. XXIII., f. 6.

Some fragments of an *abichi*-like, but more involute, form seem to be closely comparable to the Popelany example figured by Krenkel. It seems preferable not to name this species until the history of Krenkel's specimen has been traced. In any case the Mombasa fragments are too incomplete to allow of definite specific identification.

Horizon. Callovian (Lower).

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln. ; ? B.M. No. C. 19668 (Rev. Chas. New Colln., labelled " 8-10 miles N.W. of Mombasa ").

Indosphinctes patina (Neumayr).

1870. *Perisphinctes patina*, Neumayr : " Ueber Cephalopoden d. *Macroceph.*-Schichten," *Jahrb. k.k. geol. Reichsanst.*, x., p. 149, Pl. VIII., f. 1.
1897. *Perisphinctes patina*, Neumayr, Parona and Bonarelli : " Callovien infér. Savoie," *loc. cit.*, p. 174.
1899. *Perisphinctes patina*, Neumayr, Siemiradzki : " Monographische Beschreibung der Ammoniten-Gattung *Perisphinctes*," *Palaeontogr.*, xlv., p. 297.
1915. *Perisphinctes patina*, Neumayr, Petitclerc : " Callovien des Deux Sèvres," *loc. cit.*, p. 73.
1924. *Perisphinctes patina*, Neumayr, Roman : " Callovien de Naves," *loc. cit.*, p. 80 (pars).

Three portions of large individuals, two of which show the finely divided external and internal suture-lines, may be referred to this species, but they are too fragmentary to be figured. At Jumara in Kachh, according to Mr. Raj Nath's collection, *I. patina* occurs in bed 12 which is at the top of my *diadematus* zone. A small example from this bed and a new allied species are being figured in Part. IV. of my Kachh memoir (Pl. CII., f. 2, 3).

Horizon. Callovian (Lower).

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln.

Indosphinctes aff. *subpatina* (Petitclerc). (Pl. V., f. 1 *a*, *b*.) S10251

1915. *Perisphinctes subpatina*, Petitclerc : " Essai sur la faune du Callovien, etc." Vesoul, p. 74, Pl. VIII., f. 1.

The septate inner whorls here figured may not be specifically determinable, but they probably belonged to a form like Petitclerc's *Perisphinctes subpatina*, judging by a fine Prahecq (Deux Sèvres) example which I owe to the kindness of the author.

Horizon. Callovian (Lower).

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln.

S10257 S10

Indosphinctes sp. ind. (Pl. VII., f. 2.)

The fragment here figured has the ornamentation of Uhlig's *P. abichi*, above discussed, or of Parona and Bonarelli's *P. choffati*,[1] but its ribbing is very feebly developed. It is here figured because it well shows the very complex suture-line. Another fragment probably belongs to still a different form of *Indosphinctes*, but is too small to be definitely identified. It is not quite so smooth as the figured example and intermediate to *I. patina* above described.

Horizon. Callovian (Lower)..

Locality. 16 (Hill N.E. of the Mteza Jetty), Miss McKinnon Wood Colln.

[1] *Loc. cit.* (Callovien de Chanaz), *Mém Acad. Savoie* (4), VI, 1897, p. 174, Pl. VIII., f. 3, 3*a*.

2. Genus CHOFFATIA, Siemiradzki.

Choffatia aff. *furcula* (Neumayr). S10310

1871. *Perisphinctes furcula*, Neumayr: "Cephalop. Fauna d. Oolithe v. Balin," *Abh. k.k. geol. Reichsanst.*, v, p. 41, Pl. XV, f. 1.
1928. *Perisphinctes furcula*, Neumayr, Stefanini: "Moll. e. Brach. Calloviani del Caracorum," *Sped. Ital. Filippi*, vi., p. 65, Pl. IX., f. 3 (?).

A fragmentary specimen probably belongs to this form, but it cannot be definitely identified. A Kachh form, previously [1] recorded as *Grossouvria* aff. *curvicosta* (Oppel) Waagen sp. from the middle *macrocephalus* (*dimerus* beds) of Jumara, is now being figured (Pl. LIV., f. 7 *a*, *b*) as *Choffatia* aff. *furcula*, but is more inflated than the Mombasa fragment. On the other hand a Kachh form referred to Noetling's [2] *Choffatia baluchistanensis* (my Pl. XLVIII., f. 8 *a*, *b*) with similar compression, has the primary ribs less thickened.

Horizon. Callovian (Lower).

Locality. 41 (bed of unnamed river between the Senawe and the Ndsovuni), Miss McKinnon Wood Colln.

Choffatia lateralis (Waagen). (Pl. IV., f. 2 *a*, *b*.) S10231

1875. *Perisphinctes lateralis*, Waagen: "Jurassic Cephalopoda of Kutch," *loc. cit.*, p. 165, Pl. LVIII., f. 3, 3 *a*.
1927. *Grossouvria* (*lateralis* group), Gregory: *loc. cit.* (*Geol. Mag.*), p. 325.

The Mombasa form recorded by Prof. Gregory is being figured in Pl. LXXXI., f. 2 of my Kachh Revision, and is considered to represent the true *C. lateralis*. The example now figured (Pl. IV., f. 2) has a slightly coarser and more inflated early stage and is thus somewhat transitional to *Hubertoceras arcicosta*. Waagen's type is missing and the figure has to be relied on, but it is apparently fairly accurate. At Jumara, Mr. Raj Nath has found both species in his bed 6 (top of my *rehmanni* zone) with *Idiocycloceras singulare* and abundant *Sivajiceras*.

Horizon. Callovian (Lower).

Localities. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln., and mile 10/6 (J. W. Gregory Colln.).

Choffatia sp. ind. S10280

The internal cast of the posterior end of the body-chamber of a very large form of *Choffatia* is interesting because it shows muscle-scars. There are only three oblique primary ribs, without secondaries, and the widely-arched periphery is quite smooth, as in *C. cobra* (Waagen).[3] Specific identification of such fragments, however, is impossible. Nothing exactly like the present specimen seems to have been found in Kachh.

Horizon. Callovian (Lower).

Locality. 16 (Hill north-east of the Mteza Jetty), Miss McKinnon Wood Colln.

Choffatia aff. *recuperoi* (Gemmellaro). (Pl. IV., f. 13; Pl. V., f. 6.) S10248.1C

1872. *Perisphinctes recuperoi*, Gemmellaro: *Sopra alcune faune Giurese e Liasiche della Sicilia*," p. 26, Pl. V., f. 9-11.
[non 1875. *Perisphinctes recuperoi*, Gemmellaro, Waagen: "Jurass. Cephal. Kutch," *loc. cit.*, p. 172, Pl. XLIII., f. 1 *a*, *b* = *C. soorkaensis*, nom. nov.]

The umbilical cast of an example of about 60-70 mm. diameter and a number of smaller individuals like those here figured are tentatively assigned to this species. They are, however, probably closer to the

[1] Spath, "Blake Collection of Ammonites from Kachh," *Pal. Indica*, N.S., ix., No. 1, 1924, p. 22 (No. 531 from bed 11, Jumara).

[2] "Fauna of the Kelloway of Mazir Drik," *Pal. Indica*, Ser. XVI., 1896, p. 19, Pl. XIII., f. 2, 2 *a*.

[3] *Loc. cit* (Jurass. Cephal. Kutch), 1875, p. 174, Pl. XLV., f. 1 *a-c*.

larger Naves example, figured by Roman,[1] than to the Sicilian type, in which the straight and close ribbing of the inner whorls persists to a comparatively large diameter. The *recuperoi*-group is transitional between *Choffatia* and *Subgrossouvria*, Spath (=*aberrans* group), and in Kachh seems to occur especially in the *rehmanni* zone or lower *anceps* beds.

Horizon. Callovian (Lower).

Localities. 16 (Hill N.E. of the Mteza Jetty), and 17 (Kenya-Uganda Rly., mile 9/14-15). Miss McKinnon Wood Colln.

3. Genus GROSSOUVRIA, Siemiradzki.

Grossouvria cf. *curvicosta* (Oppel) auct. (Pl. IV., f. 5 *a*, *b*.) S10237

1857. *Ammonites curvicosta*, Oppel: "Juraformation Englands, etc.," *Württ. Naturwiss. Jahresh.*, xiii., p. 555, No. 30.

The type of this species is the coarsely ribbed example figured by Quenstedt.[2] Such an immature specimen as that here figured can only tentatively be referred to Oppel's form, for there are many other species of *Grossouvria* that have similar inner whorls. An example in the Model Collection in the British Museum (No. C. 29478) from the *jason* zone of Neidlingen, Würtemberg, is labelled *Per. curvicosta* (Oppel) var. *plana*, nobis. It is closely comparable to one of Waagen's Kachh forms (*Per. curvicosta* of Pl. XXXIX., f. 6 only) which I am re-figuring (Pl. LXIII, f. 7) and consider to be a transition between *G. kontkiewiczi*,[3] and the more micromorph *G. gracilis*, Siemiradzki, discussed below. The Mombasa form here figured, however, with a malformed venter, not visible in the photograph, shows much closer resemblance to the inner whorls of another of Waagen's *Per. curvicosta*, namely the original of his Pl. XXXIX., f. 5 *a*, *b*. This was compared by Loczy [4] with his *G. anomala* and I am accepting the identification, but its inner whorls are more rounded than those of the third of Waagen's *Per. curvicosta* (the original of Pl. XXXIX., f. 5). I am leaving this in *G. curvicosta* (Oppel) but its inner whorls are poorly preserved (see my Pl. LXIII., f. 8) and probably were never quite so coarsely ribbed as those of the Naves example figured by Roman.[5] The specific identification of the small Mombasa specimen here figured is thus open to criticism, there being nothing strictly comparable to Oppel's type.

Horizon. Callovian (Lower).

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln.

Grossouvria aff. *evexa* (Quenstedt). (Pl. IV., f. 10; Pl. V., f. 2 *a*, *b*, 7, 8; Pl. VII., f. 7.) SIC

1885. *Ammonites convolutus evexus*, Quenstedt: *Ammoniten d. Schwäb. Jura*, ii., p. 691, Pl. LXXXI., f. 15-19.
1894. *Perisphinctes evexus* (Quenstedt), Siemiradzki: "Ammon. Fauna d. Poln. Eisen-Oolithe," *loc. cit.*, p. 512, Pl. XXXVIII., f. 5.
1898. *Perisphinctes planus*, Siemiradzki: "Monograph. Ammoniten-Gattung *Perisphinctes*," *loc. cit.*, p. 127.

The five examples here figured and some less well preserved fragments and umbilical casts, though showing slight differences, may all be included in this species, characterised by a fairly simple suture-line. The various interpretations of this species and of *G. plana*, Siemiradzki emend. Spath, given by writers like Lee [6] and Loczy,[7] are discussed in my Kachh Memoir. *G.* aff. *gracilis*, recorded below, is more micromorph, with a modified, finely-ribbed body-chamber at small diameters; *G. elegans* has straighter ribbing which is curiously projected on the periphery.

Horizon.—Callovian.

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln.

[1] "Études sur le Callovien de la vallée du Rhone. I. Le Callovien de Naves," *Trav. Lab. Géol. Lyon*, fc. VI., Mém. No. 5, 1924, p. 99, Pl. XI., f. 3.

[2] *Cephalopoden*, 1849, Atlas, Pl. XIII., f. 2 (*Amm. convolutus parabolis*).

[3] "Ammoniten-Fauna der Polnischen Eisen-Oolithe," *Zeit. Deut. Geol. Ges.*, xlvi., 1894, p. 513, Pl. XXXVIII., f. 3-4.

[4] *Loc. cit.* (Villanyer Callovien Ammoniten), 1915, p. 386.

[5] *Loc. cit.* (Callovien de Naves), 1924, Pl. X., f. 7.

[6] "Strat. et Pal. de la Chaine de la Faucille," *Mém. Soc. Pal. Suisse*, xxxii., 1905, p. 39, Pl. I., f. 12.

[7] "Monographie der Villányer Callovien-Ammoniten," *loc. cit.*, 1915, pp. 387, 407.

S10238-10

Grossouvria aff. *gracilis* (Siemiradzki). (Pl. IV., f. 7; Pl. VIII., f. 1.)

1894. *Perisphinctes gracilis*, Siemiradzki: "Ammon. Fauna Poln. Eisen-Oolithe," *loc. cit.*, p. 516, Pl. XL., f. 4

The two complete examples here figured show the apertural lappets, like the holotype, but the body-chamber of one is slightly crushed and thus appears too flat and wide. Its length, somewhat variable, is the same (about three-quarters of a whorl), but there are differences in the suture-line. In both the Mombasa examples this is greatly simplified as in the closely allied *G. evexa*. Some years ago, while still following Buckman, I might have considered these differences of importance; but I believe now that there are already too many of these species of small *Grossouvria* and that eventually they will all be united in one *gens*, or species-group, *e.g.* in a comprehensive *G. evexa* (Quenstedt). The incompletely known *G. colleti* (Lee) [1] is another comparable form.

Horizon. Callovian.

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln.

S10234-10

Grossouvria cf. *elegans* (Siemiradzki). (Pl. IV., f. 4, 11; Pl. V., f. 4.)

1894. *Perisphinctes elegans*, Siemiradzki: "Ammon. Fauna Poln. Eisen-Oolithe," *loc. cit.*, p. 517.

1898. *Perisphinctes sciutoi* (non Gemmellaro), Siemiradzki: "Monographie Ammoniten Gattung *Perisphinctes*," *loc. cit.*, p. 128.

The three Mombasa examples, now referred to this species, like those figured as *G. evexa*, differ slightly among themselves, but they are all somewhat more rigidly ribbed than *G. evexa* or *G. gracilis*. This last, like the present form, was later included by Siemiradzki in Gemmellaro's *Per. sciutoi*.[2] By its simple suture-line, however, it is clearly characterised as a *Grossouvria* of the *evexa* group, not a *Choffatia*, like Gemmellaro's Sicilian form.

Horizon. Callovian.

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln.

S10282

Grossouvria aff. *leptoides* (Till).

1911. *Perisphinctes leptoides*, Till: "Ammoniten-Fauna des Kelloway von Villany," *Beitr. Geol. Pal. Österr.-Ung.*, xxiv., p. 64, Pl. IX., f. 1, 2; Pl. XI., f. 3.

1915. *Perisphinctes leptoides*, Till, Loczy: "Monographie der Villanyer Callovien Ammoniten," *loc. cit.*, p. 393, Pl. XII., f. 3.

A fragmentary specimen is included here because it resembles a Kachh example (Pl. LXIV., f. 4) which I am referring to this species. The affinities of this form are discussed in detail in the Kachh Memoir.

Horizon. Callovian.

Locality. 16 (Hill N.E. of the Mteza Jetty), Miss McKinnon Wood Colln.

4. Genus SUBGROSSOUVRIA, Spath.

S10283

Subgrossouvria cf. *coronaeformis* (Loczy).

1915. *Perisphinctes coronaeformis*, Loczy: "Monographie der Villanyer Callovien-Ammoniten," *loc. cit.*, p. 404, Pl. XII., f. 4.

1924. *Subgrossouvria coronaeformis* (Loczy), Spath: "Blake Collection of Ammonites from Kachh," *loc. cit.*, p. 13.

A fragmentary specimen of only about 50 mm. diameter, but showing already the body-chamber, belonged to a form like Loczy's Hungarian *P. coronaeformis*, or perhaps the same author's *P. jupiter* (non Steinmann) which I had previously considered to be possibly synonymous with the Kachh *S. aberrans* (Waagen). The ribs of the body-chamber in the Mombasa fragment are more projecting than those of the well-preserved small *S. gudjinsirensis* (Waagen) which I figured in Pl. XLII., f. 5 *a*, *b*, of my Kachh

[1] *Loc. cit.* (Faucille), 1905, p. 40, Pl. II., f. 2.

[2] "Sopra i Cefalop. della zona con *Stephanoc. macrocephalum*, etc.," *Faune Giur. e Lias. della Sicilia*, i., 1872, p. 25, Pl. IV., f. 7-9.

nograph (Part III.), but the inner whorls are much more finely and irregularly ribbed in the African m.

Horizon. Callovian.

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), Miss McKinnon Wood Colln.

Subgrossouvria ? sp. ind. (Pl. VI., f. 4 ; Pl. VII., f. 4 *a*, *b*.) S10253. 10.

Such evolute inner whorls as those here figured are specifically indeterminable but probably belonged a form like one of the *Perisphinctes euryptychus*, Neumayr, figured by Loczy.[1] The larger specimen presented in the same author's text-fig. 119 (p. 403), if correctly identified, shows that Neumayr's species a *Subgrossouvria*. It may be added that the Mombasa example, figured in Pl. VI., f. 4, has a more pressed whorl-section than the original of Pl. VII., f. 4 *a*, *b* ; and they may thus well belong to two stinct species. A larger fragment is quite unrecognisable.

Horizon. Callovian.

Locality. 17 (Kenya-Uganda Rly., mile 9/14-15), and (doubtfully) 18*a* (same, mile 10/5, east of fault). iss McKinnon Wood Colln.

5. Genus BINATISPHINCTES, Buckman emend.

Binatisphinctes aff. *credneri* (Krenkel). (Pl. I., f. 4 ; Pl. V., f. 3). S10205.

1915. *Perisphinctes credneri*, Krenkel : " Kelloway Fauna v. Popilani," *loc. cit.*, p. 239, Pl. XXIV., f. 12.

The examples here figured seem to have more coarsely ribbed inner whorls than a metatype of *Grosuvria kontkiewiczi* (Siemiradzki) [2] in the British Museum (No. C. 4990) and might be considered to be ansitional to the *arcicosta* group of *Hubertoceras* which they also resemble. In view of the occurrence, owever, in the Mombasa Callovian, of other forms of *Binatisphinctes*, it is probable that the striking semblance of the examples here discussed to Krenkel's species is not merely a case of homoeomorphy, id that they are, indeed, closely allied. The small example figured in Pl. IV., f. 8, has three-quarters of e outer whorl belonging to the body-chamber and in its irregular ribbing shows, perhaps, more resemance to Krenkel's *Per. bodeni* (Pl. XXIV, f. 5). It is only doubtfully included here.

Horizon. Callovian (Lower).

Locality. 16 (Hill N.E. of the Mteza Jetty), Miss McKinnon Wood Colln.

Binatisphinctes cf. *arlti* (Krenkel). S10284.

1915. *Perisphinctes arlti*, Krenkel : " Kelloway Fauna v. Popilani," *loc. cit.*, p. 231, Pl. XXIV., f. 1, 2.

Two fragmentary examples (of which one is merely an impression) belong to a form very close to if ot identical with Krenkel's species. On the body-chambers the ribbing does not seem to degenerate as does in the larger of the two Popilany specimens figured by Krenkel, but the mode of preservation of the ombasa examples is different, the internal casts in clay-ironstone preserving the sharpness of the ribbing nusually well. At least one of three doubtful small fragments, collected by the Rev. Chas. New, also elongs to the same or a closely allied form.

Horizon. Callovian (Lower).

Locality. 16 (Hill N.E. of the Mteza Jetty), and 17 (Kenya-Uganda Rly., mile 9/14-15), Miss IcKinnon Wood Colln. ; B.M., No. C. 19667 (and ? 19665-6) from " 8-10 miles N.W. of Mombasa " (Rev. has. New Colln.).

Binatisphinctes ? sp. ind. (Pl. I., f. 3 *a*, *b*.) S.10204.

The example here figured shows only the final portion of the body-chamber and small portions of the ner whorls, but it apparently belongs to the same group of forms as the last two. The suture-line is very

[1] *Loc. cit.* (" Monographie der Villanyer Callovien-Ammoniten "), 1915, p. 402, Pl. XI., f. 5.

[2] " Neue Beiträge z. Kenntnis der Ammoniten Fauna d. poln. Eisen-oolithe," *Zeit. Deut. geol. Ges.*, xlvi., 1894, 513, Pl. XXXVIII., f. 3-4.

simple and the type of ribbing, with peripheral interruption, is that of the *rossicus*-group for which Buckman's genus *Binatisphinctes* is adopted. This is discussed in detail in Part IV. of my Kachh Monograph.

Horizon. Callovian (Lower).

Locality. 16 (Hill N.E. of the Mteza Jetty), Miss McKinnon Wood Coll'n.

c. Sub-Family PERISPHINCTINAE, Hyatt s.s.

The genera left in this restricted family Perisphinctinae are dealt with in detail in the writer's "Revision of the Cephalopod Fauna of Kachh." There are no forms among the Mombasa material to be described here that can definitely be attached to the genus *Perisphinctes* s.s. (Waagen emend. Buckman = group of *P. biplex*, Sowerby); and no members of such typical Argovian genera as *Alligaticeras*, Buckman (=group of *P. alligatus*, Leckenby sp. and *P. birmensdorfensis* Moesch sp.), or *Otosphinctes*, Buckman (adopted for the group of *Perisphinctes rota* Waagen) can be recorded. On the other hand there are several forms of *Dichotomosphinctes*, Buckman (adopted for the group of *P. orbignyi*, P. de Loriol, *P. wartae*, Bukowski, and *P. falculae*, Rouchadzé), *Dichotomoceras*, Buckman, and *Biplices* (*colubrinus—tiziani* group) which both range from the Upper Argovian (*bimammatus* zone) into the Lower Kimmeridgian (*tenuilobatus* zone); also some members of a new genus (*Pachyplanulites*, gen. nov.) which has for genotype *Perisphinctes subevolutus*, Waagen, as represented by the example figured in my Pl. LXII., f. 2 *a*, *b*. It includes inflated forms like *P. pagri* (Waagen) and is connected with the more coarsely ribbed *Biplices* by transitions of which *B. africanus* (Dacqué), discussed below, is one. Dietrich [1] doubtfully included this species in the synonymy of his *Perisphinctes africogermanus*, the genotype of "*Pachysphinctes*," and I thought at first that this name might have to be adopted for the forms of the *subevolutus-pagri* group. Dietrich's figures, unfortunately, are not more helpful than his descriptions and might apply equally well to such *Subdichotomoceras* and Portlandian species of *Polytosphinctes* (*dorsoplanus-mendozanus* group as occur in the *Trigonia smeei* beds of Tendaguru. On the other hand, judging by Müller's [2] figures of Perisphinctids which were included by Dietrich in *Pachysphinctes*, and which agree with well defined Kachh species, it seemed possible that *Pachysphinctes* could be used for that group of inflated *Torquatisphinctes* of which Waagen's *Perisphinctes torquatus* (non Sowerby, now renamed *P. major* nom. nov.) is typical. In any case, it is now adopted for that group, although the genotype is doubtful.

Another genus of somewhat uncertain systematic position is *Prososphinctes*, Schindewolf,[3] originally created for a group of Perisphinctids differing from *Idoceras* merely in the absence of the smooth siphonal band or groove. The Mombasa form described below as *P. idoceroides* is a typical member of this group, as is Waagen's *Perisphinctes virguloides*. But the genotype of *Prososphinctes* is *P. mazuricus* (Bukowski); [4] and with this I would associate *P. consociatus* (Bukowski) which has similar *Idoceras*-like ribbing, but these are much earlier than the Upper Argovian-Lower Kimmeridgian *virguloides* group. It is thus possible that *Prososphinctes* as interpreted by the writer, includes derivatives of the earlier *Alligaticeras* as well as of the later *Dichotomosphinctes*. They agree in their *Idoceras*-like ribbing and apparently also in suture-line, so that separation, at present, is inadvisable.

1. Genus BIPLICES, Siemiradzki.

Biplices africanus (Dacqué). (Pl. IV., f. 12.) S.10247. S.102

1910. *Perisphinctes africanus*, Dacqué: "Dogger und Malm aus Ostafrika," *loc. cit.*, p. 17, Pl. III., f. 2.
1925. *Planites africanus* (Dacqué), Spath: "Ammonites and Aptychi Somaliland," *loc. cit.*, p. 122.
[non 1925 *Perisphinctes africanus*, Dacqué, Dietrich: "Kimmeridgebildung, Mahokondo," *loc. cit.*, p. 12.]

The typical example here figured, like four more in the collections before me, is easily identified, but there are several smaller or fragmentary specimens that are only provisionally included in this species. The example figured in Pl. VIII., f. 4 *a*, *b*, thus probably corresponds to the inner whorls of the *Perisphinctes* sp. ind. figured by Dacqué,[5] whilst others show more agreement with the same author's [6]

[1] *Loc. cit.* (Mahokondo, 1925), p. 12.
[2] In Bornhardt, *Deutsch-Ostafrika*, vii., 1900, Pl. XIV., f. 5; Pl. XV., f. 4.
[3] "Entwurf einer Systematik der Perisphincten," *N. Jb. f. Min*, etc., Beil. Bd. LII., B., 1925, p. 325.
[4] "Jura-Bildungen von Czenstochau in Polen," *Beitr. Pal. Österr.-Ung.*, v., Ht. 4, 1887, p. 157, Pl. XXX., f. 7-9.
[5] *Loc. cit.* (1910), Pl. II., f. 4 *a*, *b*. [6] *Ibid.*, f. 3 *a*, *b*.

Perisphinctes cfr. *pralairei* (non Favre) which had already been included by Dietrich in the synonymy of *P. africanus*. Some of these inner whorls, of course, may belong to species transitional to the *pagri*-group of *Pachyplanulites*, described below, with (typically) finer secondary ribbing.

TEXT-FIG. 1.

Biplices africanus (Dacqué). Side-view of a crushed specimen from Kukatta on the Juba River (2° 8′ N. lat.). Lower Kimmeridgian. (B.M., No. C. 20144.)

I am adding, for comparison, the figure of a crushed Jubaland example (text-fig. 1) which had already been identified by Crick with Dacqué's species.

Horizon. Lower Kimmeridgian.

Localities. Changamwe (B.M., Nos. C. 8084, 98, 102, 144, 205, 214, 219, 238, Kässner Colln., No. C. 8924, J. W. Gregory Colln.); 14 (North and south of Makupa Bridge), Miss McKinnon Wood Colln. (2 specimens). Also from Kukatta, on the Juba River (2° 8′ N. lat.) (B.M., Nos. C. 20144-6).

Biplices aff. *tiziani* (Oppel).

1863. *Ammonites tiziani*, Oppel: *Pal. Mitt.*, ii., p. 246.
1898. *Persphinctes tiziani* (Oppel), Siemiradzki: "Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 147.

A fragmentary ammonite of originally about 100 mm. diameter septate to 70 mm., and with nearly half a whorl of body-chamber, shows close agreement with *e.g.* Quenstedt's [1] f. 7, but like a portion of the body-chamber of a much larger form, cannot be definitely identified. The ribbing is perhaps slightly more approximate although not quite so close as in the closely allied *Biplices delgadoi* and B. *mogosensis* Choffat.[2]

Horizon. Lower Kimmeridgian.

Locality. Changamwe (B.M., No. C. 8922, J. W. Gregory Colln., ? C. 8163, Kässner Colln.).

[1] *Ammoniten des Schwäbischen Jura*, iii., 1887, Pl. C., f. 7.
[2] *Loc. cit.* (Ammonites du Lusitanien), 1893, Pl. XII., f. 1-8.

Biplices sp. ind. cf. *torresensis* (Choffat).

1893. *Perisphinctes torresensis*, Choffat : " Amm. du Lusitanien," *loc. cit.*, p. 55 (pars), Pl. XIV., f. 8.
1898. *Perisphinctes torresiensis*, Choffat, Siemiradzki : " Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 101.

A fragmentary example may be provisionally attached to this species, but has more involute inner whorls, with a less compressed whorl section. Specific identification, however, is probably impossible.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8187, Kässner Colln.).

2. Genus PACHYPLANULITES, gen. nov.

Pachyplanulites subevolutus (Waagen). (Pl. IV., f. 9 ; Pl. VI., f. 7.) S10244

1875. *Perisphinctes subevolutus*, Waagen : " Jurass. Cephal. Kutch," *loc. cit.*, p. 179, Pl. XLV., f. 3 only.
1898. *Perisphinctes subevolutus*, Waagen, Siemiradzki : " Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 145.

This typical Kachh species is represented by four fairly well preserved examples, of which two are here figured. A more coarsely ribbed fragment of a fifth specimen is probably transitional to *P. pagri*. The example figured by Waagen in his Pl. XXXIX., f. 7, is altogether doubtful ; it is missing and had never been registered as a figured specimen. In my Kachh Revision I am figuring one example from the Dhosa Oolite of Jumara (Pl. LXII., f. 2) and another from the Kantcote Ironstone (Pl. LXV., f. 6).

Horizon. Kimmeridgian (Lowest ?).

Localities. 14 (North and south of Makupa Bridge, Miss McKinnon Wood Colln.) and Changamwe (B.M., Nos. C. 8099, 107, 124, 220, Kässner Colln.).

Pachyplanulites subcolubrinus (Waagen).

1875. *Perisphinctes subcolubrinus*, Waagen : " Jurass. Cephal. Kutch," *loc. cit.*, p. 180, Pl. XLIX., f. 3 *a*, *b*.
1898. *Perisphinctes subcolubrinus* (Waagen), Siemiradzki : " Monographie Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 146.

An evolute form was at first taken to represent the East African equivalent of the common European *Biplices colubrinus* (Reinecke) [1] or perhaps a transition to the local *B. africanus*, with closer coiling. There is close agreement with Quenstedt's *Amm. colubrinus*,[2] allowing for the somewhat diagrammatic drawing of the inner whorls, but the constrictions are more oblique, as in *Per. subcolubrinus*, Waagen. This species is discussed in detail in Part IV. of my Kachh Monograph, where it is pointed out that Waagen's figure represents the ribbing as too flexiradiate. On comparing the Mombasa form with Waagen's holotype, I can find no essential difference, but the agreement with such typical examples of *Biplices colubrinus* from the White Jura as those previously recorded,[3] is less close. De Riaz's *Per.* cf. *colubrinus* [4] which was included by Siemiradzki in Waagen's species, has more distant and stronger costation.

Horizon. Lower Kimmeridgian.

Locality. Changamwe (B.M., No. C. 8194, Kässner Colln.).

Pachyplanulites ? sp. nov.

There are a number of fragments of a large form, probably of *Pachyplanulites*, which is characterised by its quadrate whorl-section. One fragment, with a whorl-height of 56 mm. and a thickness of 58 mm. is still septate and shows that the form must have grown to a gigantic size, but if a still larger fragment labelled by Crick " *Peltoceras* " belongs to the same species, then the reference to *Pachyplanulites* is probably incorrect. In this very large fragment (B.M., No. C. 8161) the primary ribs end in ventro-lateral nodes, but the periphery is still that of Borissyak's *Perisphinctes* aff. *sayni* (de Riaz).[5] Other indeterminable

[1] *Maris protogaei*, etc., 1818, p. 88, Pl. XII., f. 72.
[2] *Ammoniten des Schwäbischen Jura*, 1887, Pl. CI., f. 1.
[3] Spath, " Ammonites and Aptychi, Somaliland," *loc. cit.*, 1925, p. 121.
[4] *Ammoniten des Couches à* Peltoceras transversarium *de Trepl*, 1898, p. 25, Pl. VII., f. 1.
[5] " Fauna des Donez-Jura," I. Cephal., *Mém. Com. Géol. St. Pétersb.*, N.S., No. 57, 1908, Pl. VI., f. 2 *b*.

fragments, perhaps of *Nebrodites*, connect this with the form described below as *Peltoceratoides* sp., whilst some thinner whorl-portions may be transitional to *Biplices africanus*.

Horizon. Kimmeridgian (Lowest ?).

Locality. Changamwe (B.M., No. C. 8062, 69 (?), 79, 161 (?), 196, 197 (?), 199, 239, Kässner Colln. ; C. 8929, J. W. Gregory Colln.).

3. Genus DICHOTOMOSPHINCTES, Buckman.

Dichotomosphinctes krapfi (Dacqué). (Pl. III., f. 7.)

1910. *Perisphinctes* (*Virgatosphinctes*) *krapfi*, Dacqué : Dogger und Malm aus Ostafrika," *loc. cit.*, p. 13, Pl. III., f. 3 *a*, *b*.

The example here figured does not show the peculiar trifid costation (illustrated in Dacqué's text-figure 2, p. 13) except on the inner whorl, but the writer does not consider this sufficient for specific separation. The regularity of the dichotomous ribbing in the Argovian forms tends to be lost in the transitions to the Kimmeridgian *stenocyclus* group. One of the two doubtful fragments listed below has one single rib, the other one trifid rib. The closely allied *D. praestenocyclus* (Dacqué) [1] shows similar irregularities, but has peculiar, shallow, constrictions.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8149, 204, 228 (?), Kässner Colln. ; C. 8919, 21 (?), J. W. Gregory Colln.).

Dichotomosphinctes inconstans (Spath.). S.10315

1910. *Perisphinctes virguloides* (non Waagen), Dacqué : " Dogger und Malm aus Ostafrika," *loc. cit.*, p. 19, Pl. III., f. 1.

1925. *Planites inconstans*, Spath : " Ammonites and Aptychi, Somaliland," *loc. cit.*, p. 122.

This distinct species is represented only by fragments. Its general resemblance to the Argovian *Perisphinctes falculae*, Ronchadzé [2] makes it desirable to include it in the genus *Dichotomosphinctes*, although there are a number of transitional forms between this group and not only *Planites*, but also *Lithacoceras*. Two of the fragments listed below are more closely ribbed and thus probably transitional to *L. stenocyclus* or *L. mackinnon-woodi* ; two more are altogether doubtful.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., Nos. C. 8146, C. 8222, C. 8121, 168 (?), 208, C. 8203, 232, 233 (?), Kässner Colln. ; C. 8928 (?), J. W. Gregory Colln.) ; 14 (North and south of Makupa Bridge, Miss McKinnon Wood Colln.).

4. Genus DICHOTOMOCERAS, Buckman.

Dichotomoceras anomalum, sp. nov. (Pl. VI., f. 1 *a*, *b*.)

The holotype here figured has the following dimensions :

Diameter in mm. - - - - - - -	97
Height of the outer whorl (in % of diameter) - -	.37
Thickness " " (" " ") - -	.35
Width of umbilicus (" " ") - -	.39

The whorl-section is at first depressed, later circular ; but on the outer whorl, which begins at the last septal surface and consists entirely of the body-chamber, the elliptical, slightly compressed cross-section is contracted ventrally, making the periphery highly arched and comparatively narrow. The umbilical wall is always high and distinct and becomes almost vertical at the end. It is ornamented with the faint prolongations of the ribs which are strongly drawn forward at the umbilical suture. The costae become prominent at the rounded umbilical edge, but at first remain rursiradiate. At the middle of the gently convex whorl-side, where they are slightly convex forward, the ribs become unusually high and sharp so

[1] " Neue Beiträge z. Kenntnis des Jura in Abessynien," *Beitr. Pal. Geol. Österr.-Ung.*, xxvii., 1914, p. 10, Pl. II., f. 2 *a*, *b* (including probably *Perisphinctes* cf. *virguloides* (Waagen), Dacqué, *ib.*, Pl. I., f. 3, *non* Pl. III., f. 1 = *Dichotomosphinctes dacquei*, Spath, 1925, *loc. cit.*, p. 122).

[2] " Perisphinctes de l'Argovien de Chézery," *Mém. Soc. Pal. Suisse*, xlii., 1917, p. 15, Pl. I., f. 9

that the thickness is about 6 mm. less, if measured between the ribs. Near the middle, or just beyond, the ribs bifurcate and the two branches are perfectly equal, so that neither can be said to form the continuation of the primary rib, but the posterior branch shows more distinctly the biconcavity forward of the costation as a whole. The projected ventral ribbing is still very prominent, although the costae are not quite so high as at the middle of the whorl-side. On the inner whorls the ribs are, however, low and blunt, as in the *biplex*-group of *Perisphinctes* s.s. The suture-line is seen only on the earlier volutions and is quite simple, without dependent umbilical lobes.

This extremely sharply-ribbed form at first seemed so distinct from any described Perisphinctid that generic identification proved almost impossible. It was provisionally referred to *Dichotomosphinctes* chiefly because very acute ribs are found already in *D. wartae* (Bukowski), according to a typical Czenstochau example before me (B.M., No. C. 30708). But by its long secondaries the present form seemed also closely connected with the many contemporary *Lithacoceras*, described below, whilst the entirely different inner whorls again pointed to affinity with *Subdichotomoceras*, of which this species might have been held to be a forerunner. The resemblance to *D. inconstans* is perhaps less close than to *Subdichotomoceras biplicatum* (Uhlig) [1] from the Spiti Shales or *S. biplicatoides*, Spath,[2] from Somaliland, but the curvature of the ribs alone favoured reference to some earlier (*i.e.* Lower Kimmeridgian) group. Fortunately I have now come across a Wootton Basset (Wiltshire) *Dichotomoceras* which clears up the generic affinity of the present species. This perisphinctid (B.M., No. 24091) is from the iron-shot oolite that has yielded so many examples of *Ringsteadia* and is thus of uppermost Corallian age. It is either an extreme development of *Dichotomoceras dichotomum* (Buckman) [3] or else a closely related species, differing in its smaller umbilicus and longer secondaries. But its general resemblance to the still more involute Mombasa form here described is so unmistakable that not only generic position but probably also the exact horizon seem definitely fixed.

Horizon. Upper Argovian (*bimammatus* zone ?).

Locality. Changamwe (B.M., No. C. 8148, Kässner Colln.).

5. Genus PROSOSPHINCTES, Schindewolf.

Prososphinctes aff. *virguloides* (Waagen).

1875. *Perisphinctes virguloides*, Waagen: "Jurass. Cephalop. Kutch," *loc. cit.*, p. 203, Pl. XLIX., f. 1 only.

This species has been misinterpreted by most authors; it is discussed in detail in my Kachh memoir. The body-chambers of two examples of the Mombasa form before me would unhesitatingly be referred to the present species, but the inner whorls of one example show a more inflated whorl-section and closer coiling, as in the nearly allied *Lithacoceras jelskii* (Siemiradzki), whilst there is a *Morphoceras*-like excentrumbilication at the end. This difference in coiling and proportions does not seem sufficient for specific separation at the present stage, especially since the suture-lines seem very similar, but the discovery of better material in the future may show that a new name for the Mombasa species is advisable.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8171, 213, Kässner Colln.).

Prososphinctes idoceroides, sp. nov. (Pl. III., f. 5 *a*, *b*.)

This species is based on the unique example figured in Pl. III., f. 5, which has the following dimensions:

Dimensions in mm. - - - - - - -	80
Height of the last whorl (in % of diameter) - -	·31
Thickness ,, ,, (,, ,, ,,) - -	.21 (?)
Width of the umbilicus (,, ,, ,,) - -	.45

The break at the beginning of the outer whorl marks the position of the last suture-line. The whorl-section there is elliptical, as figured in f. 5 *b*, but the body-chamber itself is crushed. The ribbing is characterised by an *Idoceras*-like biconvexity, caused by the rursiradiate posterior branch, after bifurcation.

[1] "Fauna of the Spiti Shales," *loc. cit.*, 1910, p. 379, Pl. LVII., f. 1-3, Pl. LIX., f. 1 *a-c*.

[2] "Ammonites and Aptychi," *loc. cit.*, 1925, p. 126, Pl. XVI., f. 6.

[3] Type Ammonites, iii., 1919, Pl. CXXXIX, A, B, C.

There is an occasional, intercalated third peripheral rib, as in *Subnebrodites laxevolutus* (Fontannes),[1] but since the costation is continuous across the ventral area, although distinctly projected, there is greater resemblance to the same author's *Perisphinctes balnearius* (de Loriol) var. *retrofurcata*.[2] The suture-line seems to be of the general aspect of that of *P. virguloides* (Waagen).

The *Idoceras* sp. ind. figured by Dacqué [3] differs in the closer costation of its inner whorls and may be another form of *Prososphinctes* of the *virguloides* group. The smooth siphonal band is its only link with the true Idoceratids.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8147, Kässner Colln.).

d. Sub-Family ATAXIOCERATINAE, Buckman emend.

The genera included in this family (now taken in a narrower sense than in 1925)[4] are also discussed in detail in the writer's " Revision of the Cephalopod Fauna of Kachh." They include *Ataxioceras*, Fontannes, *Parataxioceras*, Schindewolf, *Planites*, de Haan emend. Buckman, and *Lithacoceras*, Hyatt (= " *Discosphinctes* " Dacqué). *Planites* (as now restricted to the *polygyratus* group) is intermediate between the *polyploci* (*Ataxioceras*) and the *biplices* (*Biplices*), but *Lithacoceras* connects rather with *Dichotomosphinctes*, via forms of the *aeneas*-group which have also been referred to *Prososphinctes*.[5] There are, however, so many transitional types between *Ataxioceras* and *Lithacoceras* that they may well be grouped together, even if they do not represent offshoots of a single group of Perisphinctids. This classification is, of course, unsatisfactory in so far as, for example, the two forms figured by Dacqué as *Perisphinctes* (*Virgatosphinctes*) *mombassanus* might be compared to *Lithacoceras* on the one hand (Pl. III., f. 4), for there are many passage-forms between this and *L. fraasi* (Dacqué), and to *Dichotomosphinctes* on the other (Pl. IV., f. 1), for this is connected by transitions with *D. krapfi* (Dacqué). Moreover, the *roubyanum* group connects up not only with these late *Dichotomosphinctes* and the more compressed *Planites*, but also with *Torquatisphinctes*, included in yet a different family, and it is impossible to draw hard and fast lines between the forms with merely dichotomous ribbing and those with occasional single or trifid ribs, those with short and those with long secondaries. The classification of passage-forms thus remains as difficult and as arbitrary as it was when they had to be accommodated in " large species " of *Perisphinctes*.

1. Genus ATAXIOCERAS, Fontannes.

Ataxioceras breviceps (Quenstedt).

1887. *Ammonites polyplocus breviceps*, Quenstedt, *Ammoniten des Schwäbischen Jura*, iii., p. 944, Pl. CIII., f. 2.
1898. *Perisphinctes breviceps* (Quenstedt), Siemiradzki: " Monographie Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 243.

There is a typical large fragment, showing parts of the body-chamber and of two previous whorls; also the suture-line. Two smaller examples seem to be transitional to the form described below as *Planites* ? sp. aff. *inconditus* (Fontannes).

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8170, 74, 95, Kässner Colln.).

2. Genus PLANITES (de Haan) Buckman.

Planites aff. *anabreviceps* (Dacqué).

1914. *Perisphinctes anabreviceps*, Dacqué: Neue. Beitr. z. Kenntnis d. Jura in Abessynien," *loc. cit.*, p. 6, Pl. I., f. 2 *a-d*.
1925. *Planites* sp. aff. *anabreviceps* (Dacqué) : Spath, " Ammonites and Aptychi, Somaliland, *loc. cit.*, p. 121.

A body-chamber fragment is comparable to the final portion of the example figured by Dacqué, but is still larger. Definite identification, however, is impossible.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8075, Kässner Colln.).

[1] *Loc. cit.* (*Calcaires du Château de Crussol*), 1879, Pl. XI., f. 2. [2] *Ibid.*, Pl. XI., f. 1.
[3] *Loc. cit.* (" Dogger und Jura aus Ostafrika "), 1910, p. 22, Pl. I., f. 5 *a, b*.
[4] *Loc. cit.* (" Ammonites and Aptychi, Somaliland "), p. 119.
[5] Schindewolf, (" Zur Systematik der Perisphincten "), *N. Jb. f. Min.*, etc., Beil. Bd. LV., 1926, p. 500.

Planites sp. aff. *inconditus* (Fontannes).

1879. *Perisphinctes inconditus*, Fontannes : *Calcaires du Château de Crussol*, p. 69, Pl. X., f. 8-12.
1898. *Perisphinctes inconditus*, Fontannes : Siemiradzki, " Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 214.

Two Mombasa examples, although fragmentary, seem to differ from Fontannes's figures merely in their larger size. If Siemiradzki was right in including in this species the larger forms of *Ataxioceras* figured by de Loriol and Quenstedt, then the Mombasa examples must have belonged to a more *polygyratus*-like form,[1] with the oblique constrictions and inflated whorl-section of Fontannes's species retained until the end. But *Ataxioceras breviceps* (Quenstedt), including *Amm. lictor*, de Loriol non Fontannes, has similar inner whorls.

Horizon. Kimmeridgian (Lower).
Locality. Changamwe (B.M., Nos. C. 8061, 169 ; Kässner Colln.).

Planites aff. *ernesti* (P. de Loriol). S.10287

1877. *Ammonites ernesti*, P. de Loriol, " Zone à *Amm. tenuilobatus* de Baden," *loc. cit.*, p. 63, Pl. VIII., f. 1.
1898. *Perisphinctes ernesti*, P. de Loriol : Siemiradzki, " Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 244.

A typical fragment of a body-chamber is terminated by a deep constriction, and has portions of the previous whorl adhering. It belonged to a smaller individual than de Loriol's type and the ribs are not curved, as in Schneid's *Per. ernesti* or *P. breviceps*.[2]

Horizon. Kimmeridgian (Lower).
Locality. 14 (North and south of Makupa Bridge, Miss McKinnon Wood Colln.).

Planites triplex (Quenstedt).

1887. *Ammonites triplex* (non Sowerby), Quenstedt, *Ammoniten des Schwäbischen Jura*, iii., Pl. C., f. 9, 10.
1898. *Perisphinctes triplex* (Quenstedt), Siemiradzki, " Monogr. Amm. Gattung *Perisphinctes*," *loc cit.*, p. 163.

This distinct, *danubiensis*-like form is represented by half a specimen and two fragments, which show perfect agreement with Choffat's Portuguese form.[3]

Horizon. Kimmeridgian (Lower).
Locality. Changamwe (B.M., No. C. 8077, Kässner Colln. ; C. 8920, 23, J. W. Gregory Colln.).

3. Genus LITHACOCERAS, Hyatt. S10230 S.10

Lithacoceras mombassanum (Dacqué). (Pl. IV., f. 1.)

1910. *Perisphinctes mombassanus*, Dacqué : " Dogger und Malm aus Ostafrika," *loc. cit.*, p. 15, Pl. III., f. 4 ; Pl. IV., f. 1.
1925. *Planites mombassanus* (Dacqué) : Spath, Ammonites and Aptychi, Somaliland," *loc. cit.*, p. 122.

Dacqué figured two examples of which the smaller is connected by transitions with such more involute *Lithacoceras* as those figured in Pl. III., f. 1 and Pl. IV., f. 14, whilst the larger shows more resemblance to the loosely coiled *Perisphinctes* sp. nov. aff. *dybowskii*, Siemiradzki, figured by Choffat.[4] It seems advisable to take Dacqué's larger specimen (Pl. IV., f. 1) as type of this species, since it shows more superficial resemblance to two of Choffat's Portuguese forms (*Perisphinctes* sp. cfr. *polyplocoides*, and *P. polyplocoides-inconditus*, Fontannes) which had been identified by Dacqué with the present species. The secondary ribbing, however, is different, and Choffat's forms are not now believed to be identical with *L. mombassanum*. On the other hand we may well leave the two forms figured by Dacqué in the same species, for *L. mombassanum*, apparently the commonest ammonite in the collections before me, is rather variable.

What may be termed a var. **euglypha** nov. (Pl. IV., f. 1) is characterised by the almost complete absence of trifurcating ribs, but the presence of an occasional single costa, forming thus a connection with the form described below as *L. torquatiforme*. Other varieties (*e.g.* B.M., No. C. 8176) are still more

[1] See P. de Loriol, " Couches a *Amm. tenuilobatus* de Baden," *Mém. Soc. Pal. Suisse*, iv., 1877, p. 61, Pl. VII., f. 1.
[2] " Geologie d. Fränkischen Alb." I., *Geogn. Jahresh.*, xxvii., 1915, Pl. I., f. 5 ; Pl. II., f. 1.
[3] *Loc. cit.* (" Ammonites du Lusitanien "), 1893, Pl. XIII., f. 1.
[4] *Loc. cit.* (" Ammonites du Lusitanien "), 1893, Pl. X., f. 1.

coarsely ribbed and lead to *L. mackinnon-woodi*, whilst the more involute and finely ribbed variety (var. **discoidea**, represented by Dacqué, Pl. III., f. 4) forms a transition to the *lucingae*-group. At larger diameters its ribbing becomes more distant, but the umbilicus remains small, so that adult examples differ considerably from the holotype of this species. In a typical example of the discoidal variety, collected by Miss McKinnon Wood, and still septate at 95 mm. diameter, the occasional triplication of a rib is quite distinct; in most of the other specimens and fragments biplication is the rule, especially on the body-chambers, but there is great variability.

One example (B.M., No. C. 8191), with more coarsely-ribbed inner whorls, is transitional to *Dichotomosphinctes krapfi*; in another doubtful, body-chamber fragment (No. C. 8186) the projection of the peripheral ribs suggests affinity with the group of *L. aeneas* (Gemmellaro).

Horizon. Kimmeridgian (Lower).

Localities. 14 (North and south of Makupa Bridge, 4 examples, Miss McKinnon Wood Colln.); Changamwe (B.M., Nos. C. 8063, 67, 74, 82, 100, 109, 120, 164, 166, 172, 173, 175, 176, 186, 188, 189, 191, 207, 225, 226, Kässner Colln.).

Lithacoceras torquatiforme, sp. nov. (Pl. IV., f. 14.) S.10250

There are two complete examples of this form, in addition to more doubtful fragments, that on account of their shorter secondaries seem to form a connection with the *Dichotomosphinctes* discussed above. The holotype here figured shows the following dimensions:

Diameter in mm. - - - - - - -	95
Height of the last whorl (in % of the diameter) -	·36
Thickness ,, ,, (,, ,, ,,) -	·32
Width of the umbilicus (,, ,, ,,) -	·39

The whorl-section is elliptical, with very evenly rounded sides and broadly arched periphery; the smooth umbilical wall is almost perpendicular and high, but there is no distinct edge. The inner whorls do not seem to differ from those of *L. dybowskii* (Siemiradzki) as represented in Choffat's Portuguese example,[1] but on the outer whorl there is a frequency of single ribs which causes a resemblance to *Torquatisphinctes* as well as to the earlier *Perisphinctes luciae* de Riaz,[2] which on account of its rigid costation, with short secondaries, is perhaps best left in *Dichotomosphinctes*.

The ribs are inclined forward in a single curve, not biconvex, as in the varieties of *L. mombassanum*. They are of extreme sharpness and uniformly thick, branched or unbranched. Over a third of the outer whorl of the holotype apparently belonged to the body-chamber, but the suture-lines of the septate part are visible only on the inner whorls (in the umbilicus) and comparatively complex. In the paratype which, at a similar size, includes only a quarter of a whorl of body-chamber, the suture-line is distinctly seen near the end of the septate portion and it agrees with that of *L. mombassanum*.

The most important distinction of the present species from externally similar forms of the group of *Torquatisphinctes alterneplicatus* (Waagen) is the peripheral projection of the ribs, combined with lateral compression. In the Randen example of *Perisphinctes achilles* (d'Orbigny), figured by Crick,[3] with a similar type of costation, the compression is still greater and the ribbing is closer on the body-chamber.

Horizon. Kimmeridgian (Lower).

Localities. 14 (North and south of Makupa Bridge), Miss McKinnon Wood Colln.; Changamwe (B.M., No. C. 8209, C. 8103 (?), Kässner Colln.).

Lithacoceras mackinnon-woodi, sp. nov. (Text-fig. 2.)

This species is represented by the holotype here figured and a number of fragments. The former has the following dimensions:

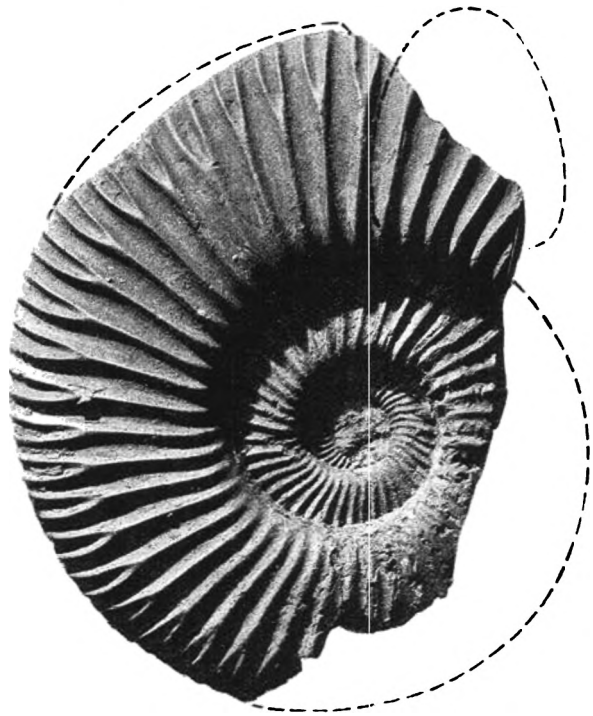
Diameter in mm. - - - - - - -	90
Height of the last whorl (in % of the diameter) -	·35
Thickness ,, ,, (,, ,, ,,) -	·30
Width of the umbilicus (,, ,, ,,) -	·39

[1] *Loc. cit.* ("Ammonites du Lusitanien"), 1893, p. 42, Pl. X., f. 1 (*Perisphinctes* sp. nov. aff. *dybowskii*, Siemiradzki).

[2] *Loc. cit.* ("Ammonites de Trept"), 1898, p. 36, Pl. X., f. 5 *a, b*.

[3] *Trans. Linn. Soc.* (2), vii., 1898, p. 102, Pl. XIX., f. 5 (B.M. No. 37017a).

The whorl-section is compressed, with distinctly flattened sides and a narrowly arched venter ; there is a high and smooth almost perpendicular umbilical wall, but a rounded edge. The ribs are sharp, regularly bifurcating at two-thirds the whorl-height, and the posterior branch is distinctly retracted although on the periphery there is again forward projection. Two-thirds of the outer whorl of the holotype belong to the body-chamber. The suture-line is preserved on the inner whorls and in general outline agrees with that of *L. mombassanum* as figured by Dacqué.



TEXT-FIG. 2.

Lithacoceras mackinnon-woodi, sp. nov. Side-view and outline whorl-section of holotype. Lower Kimmeridgian Changamwe. (B.M., No. C. 8150.)

There are passage forms between this species and the var. *discoidea* of *L. mombassanum*, *e.g.* a crushed specimen in Miss McKinnon Wood's collection (from locality 14) has the smaller umbilicus of the var. *discoidea*, but the bifid ribs of *L. mackinnon-woodi*. In other examples, again, with resemblance to the outer whorl only of *Torquatisphinctes subdolus* (Fontannes),[1] the longer secondary ribs may be due partly to crushing, but definite identification of these fragments of forms of the *mombassanum* group is impossible.

Horizon. Kimmeridgian (Lower).

Locality. 14 (North and south of Makupa Bridge, Miss McKinnon Wood Colln.) ; Changamwe (B.M., Nos. C. 8150 (and 8237) ; 8183, 84, 98, 227 (?), Kässner Colln. ; C. 8925 (?), J. W. Gregory Colln.

Lithacoceras aff. *praenuntians* (Fontannes).

1879. *Perisphinctes praenuntians*, Fontannes : *Calcaires du Château de Crussol*, p. 57, Pl. IX., f. 1.
1898. *Perisphinctes praenuntians*, Fontannes : Siemiradzki, " Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 152.

An incompletely preserved example differs from the type in developing close *Lithacoceras*-costation towards the end of the body-chamber. In *L. kreutzi* and *L. mindove* (Siemiradzki) [2] with similar outer whorls, however, the earlier volutions are less evolute, so that comparison with Fontannes's species seems still the most appropriate.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8926, J. W. Gregory Colln. ; (?) C. 8152, Kässner Colln.).

[1] *Calcaires du Château de Crussol*, 1879, p. 61, Pl. IX., f. 3 *a*, *b*.

[2] " Fauna Kopalna, etc.," *Acad. Sci. Cracow*, xviii., No. 2, 1892, pp. 41, 43, Pl. I., f. 4 ; Pl. II., f. 1.

Lithacoceras roubyanum (Fontannes). (Text-fig. 3.)

1879. *Perisphinctes roubyanus*, Fontannes : *Calcaires du Château de Crussol*, p. 56, Pl. VIII., f. 6 *a*, *b*.
1898. *Perisphinctes roubyanus*, Fontannes : Siemiradzki, " Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 162.
1925. *Planites* cf. *roubyanus* (Fontannes) : Spath, " Ammonites and Aptychi, Somaliland," *loc. cit.*, p. 123.

The five Mombasa examples listed below are all somewhat doubtful, but closer to Fontannes's type than is Siemiradzki's *Per. damesi*,[1] with its more distant costation, although this has also been included in the synonymy of the present species. On the other hand one of five crushed Jubaland specimens, figured in text-fig. 3, cannot be distinguished, even in matrix and preservation, from a typical Ardèche

TEXT-FIG. 3.

Lithacoceras roubyanum (Fontannes). Side-view of a crushed example from Kukatta, on the Juba River (2° 8′ N. lat.). Lower Kimmeridgian. (B.M., No. C. 20149.)

example of *L. roubyanum* in the British Museum (No. C. 32988). The Jubaland specimens had been referred by Crick to *Per. mombassanus*,[2] but although there are transitions between the two species, yet in *L. roubyanum* the ribbing is less sharp, and the three branches of the tripartite ribs are of about the same length, as in many *Planites*, to which this species is transitional.

Horizon. Kimmeridgian (Lower).

Localities. Changamwe (B.M., Nos. C. 8101, 216, 218, 230, Kässner Colln.) ; also from Kukatta, Juba River, East Africa (2° 8′ lat.), B.M., No. C. 20148-52.

Lithacoceras sp. nov. ? aff. *roubyanum* (Fontannes).

An imperfectly preserved but fairly complete example of 95 mm. diameter has more closely ribbed inner whorls than Fontannes's type, but the body-chamber is more like that of *L. jelskii*, with increasingly coarser costation towards the end. It probably represents a new species, but it cannot be given a name at the present stage and it is not well enough preserved to be figured. Dietrich's [3] *Perisphinctes mahokondobeyrichi* is distantly similar up to the last quarter of a whorl (where the ribbing does not separate) but its secondaries are reclined, not prorsoradiate, as in the present (and presumably earlier) form.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8123, Kässner Colln.).

[1] " Fauna Kopalna, etc.," *loc. cit.*, 1891, p. 58, Pl. V., f. 4.

[2] Taking as type of *Per. mombassanus* the example in Dacqué's Pl. III., f. 4, Crick gave the original of Dacqué's Pl. IV., f. 1, a new (MS.) name (" *Per. dacquei* ") which, however, cannot be used.

[3] *Loc. cit.* (" Kimmeridge in Mahokondo "), 1925, p. 13, Pl. III., f. 5.

Lithacoceras jelskii (Siemiradzki).

1875. *Perisphinctes martelli* (non Oppel) : Waagen, " Jurass. Cephal. Kutch," *loc. cit.*, p. 190, Pl. LV., f. 3.
1891. *Perisphinctes jelskii*, Siemiradzki : " Fauna Kopalna, etc.," *loc. cit.*, p. 47.
1898. *Perisphinctes jelskii*, Siemiradzki : " Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 274.

One Mombasa example shows very good agreement with Waagen's type, discussed in detail i Kachh work. This form must stand as the true *Per. jelskii*, notwithstanding the different interpret given to this species by various authors. Two smaller examples are too immature to be defi identified.

Horizon. Uppermost Argovian or Lower Kimmeridgian.

Localities. 8 to 10 miles northwest of Mombasa (B.M., No. C. 19662, Rev. Chas. New Colln. Changamwe (Nos. C. 8117 and 8210 ?, Kässner Colln.).

Lithacoceras aff. *unicomptum* (Fontannes pars). (Pl. VI., f. 6 *a*, *b*.)

1879. *Perisphinctes unicomptus*, Fontannes : *Calcaires du Château de Crussol*, p. 55, Pl. VIII., f. 5.

A number of examples that differ from *L. fraasi* chiefly in their open umbilicus, show close agree with a form from Andelot-les-St. Amour, Jura, in the British Museum (No. C. 13450) which is cl Fontannes figure, although in the finely-ribbed inner whorls it is perhaps transitional to the same au *Per. ardescicus*.[1] I agree with Siemiradzki [2] in keeping this 1879 form distinct from Fontannes's e (1876) [3] *Per. unicomptus* ; but the former is not identical with *Persphinctes geron*, Zittel,[4] which has ribbing. It is probable that the Mombasa fragments are merely the inner whorls of a larger, *castr* form, but at present they cannot be connected with any of the more macromorph species described b

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8065, 8119, 145, 215, 217, 224, Kässner Colln.).

Lithacoceras fraasi (Dacqué). (Pl. III., f. 1 ; Pl. VI., f. 2 *a*, *b* ; Pl. VII., f. 5 *a*, *b*.)

1910. *Perisphinctes fraasi*, Dacqué : " Dogger und Malm aus Ostafrika," *loc. cit.*, p. 20, Pl. IV., f. 3.
1914. *Discosphinctes fraasi* (Dacqué) : " Neue Beiträge z. Kenntn. d. Jura in Abessynien," *loc. cit.*, p. 10.
1925. *Perisphinctes fraasi*, Dacqué : Dietrich, " Kimmeridge in Mahokondo," *loc. cit.*, p. 13.

A typical example of this characteristic species is figured in Plate III., f. 1. It shows just the begi of the body-chamber, also the very complex suture-lines of the septate portion. At larger diam *i.e.* on the body-chamber, the ribbing tends to become finer and more irregular, as in *L. capillaceum* there are numerous transitions between the present form and the other species of *Lithacoceras* he scribed. The smaller examples figured in Pl. VI., f. 2 *a*, *b*, and Pl. VII., f. 5 *a*, *b*, differ slightly in p tions, as is shown in the following table, and may be separated as a var. **intermedia,** nov. The directly to the form described above as *L.* aff. *unicomptum* (Fontannes, pars.), probably also to *L. forme* (Dacqué).[5]

	Type.	Pl. III., f. 1.	Pl. VII., f. 5.	Pl. VI.
Diameter in mm. - - - - - - - -	77	75	71	53
Height of outer whorl (in % of diameter) - -	·46	·47	·42	·41
Thickness ,, ,, (,, ,,) - -	·35	·36	·34	·40
Width of the umbilicus (,, ,,) - -	·27	·27	·31	·33

A small, crushed, Jubaland ammonite, partially exposed on the surface of a piece of matrix perhaps, also be referred to this species, and had indeed already been labelled by Crick : " *Perisph*

[1] *Loc. cit.* (1879), p. 54, Pl. VIII., f. 3-4.

[2] " Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.* (1898), p. 239.

[3] In Dumortier and Fontannes : " Ammonites de la zone à *Amm. tenuilobatus* de Crussol, etc.," 1876, p. VIII., f. 1, 1 *a*, 1 *b*.

[4] " Ältere Tithonbildungen," *loc. cit.*, 1870, Pl. XXV., f. 3.

[5] " Neue Beitr. z. Kenntnis d. Jura in Abessynien," *loc. cit.*, 1914, p. 11. = *Perisphinctes choffati*, Dacqué (" J Somalilandes, II.") : *Beitr. Pal. Geol. Österr.-Ung.*, xvii., 1905, p. 149, Pl. XVII., f. 3.

(? *fraasi*, Dacqué)." It is entirely septate, but the suture-lines are very obscure; its dimensions are :

Diameter in mm. - - - - - - - -	30
Height of outer whorl (in % of diameter) - -	·44
Thickness ,, ,, (,, ,,) - -	?
Width of the umbilicus (,, ,,) - -	·30

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8931, J. W. Gregory Colln., and Nos. C. 8066, 76, 8114, 16, 18, 54, 63, 65, 90, 93, 8201, 2, 36, Kässner Colln.); also from Kukatta on the Juba River (2° 8′ N. lat.), B.M., No. C. 20147.

Lithacoceras castroi (Choffat). (Pl. III., f. 8.)

1893. *Perisphinctes castroi*, Choffat : " Ammonites du Lusitanien," *loc. cit.*, p. 43, Pl. X., f. 5 *a*, *b* (lectotype), 4 *a*, *b*, 6.
1898. *Perisphinctes lusitanicus*, Siemiradzki : " Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 277.

This species, as represented by Choffat's fig. 5, is before me in a number of more or less poorly preserved examples, but there are transitions to the more involute *L. fraasi* on the one hand, like the specimen here figured, and to the more finely lineate *L. capillaceum* on the other. It is probable that they are all merely individual variations of one large species. Two body-chamber fragments of very large individuals, with merely the peripheral ribbing retained, and the sides becoming smooth, are provisionally included here, although they had been labelled by Crick " *Phylloceras*." Some of the fragments may also belong to such closely related species as *L. aeneiforme* (Dacqué), already mentioned, and *L. arussiorum* (Dacqué).[1]

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., Nos. C. 8086, 8106, 13, 15, 51, 53, 56; (? C. 8071, 8178), Kässner Colln.).

Lithacoceras capillaceum (Fontannes). (Plate VI., f. 3).

1876. *Ammonites capillaceus*, Fontannes, in Dumortier and Fontannes : " Ammon. de la zone à *Amm. tenuilobatus* de Crussol," p. 78, Pl. X., f. 1.
1879. *Perisphinctes capillaceus* (Fontannes) : *Calcaires du Château de Crussol*," p. 53, Pl. VIII., f. 1-2.
1898. *Perisphinctes capillaceus* (Fontannes) : Siemiradzki, " Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 247.

Fontannes's species of 1879 does not seem to be the same as his *Ammonites capillaceus* of 1876. In any case there are several very finely ribbed *Lithacoceras* in the Mombasa fauna that can be attached to the earlier form, with the primary ribs tending to remain separate and not becoming fasciculate, or swelling into blunt folds. On the other hand the less typical example here figured is decidedly closer to the later form, as regards ribbing, but it has the smaller umbilicus and more coarsely ribbed early stage of *L. rhodanicum* (Dumortier). This figured example may also be considered to be transitional to *L. metamorphum* (Neumayr),[2] but in this species, at larger diameters, the primary ribs are more thickened, as in *L. progeron*.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., Nos. C. 8085, 8105, 143, 167, 185, 192, 223, 34-5, Kässner Colln.).

Lithacoceras progeron (Ammon).

1875. *Perisphinctes progeron*, Ammon : *Jura-Ablagerungen zwischen Regensburg und Passau*, p. 187, Pl. I., f. 2 *a*, *b*.
1898. *Perisphinctes progeron*, Ammon : Siemiradzki, " Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 279.

A number of fragments, comparable in dimensions to Ammon's figure, seem typical enough, but they are merely portions of the inner whorls of a very large form, in which only umbilical bulges and the secondary ribs near the periphery remain, as in the typical large *Lithacoceras* of the *ulmensis* group.[3] This

[1] " Jura des Somalilandes," *loc. cit.* (1905), p. 145, Pl. XVII., f. 4 *a*, *b*.

[2] " Fauna der Schichten mit *Aspidoceras acanthicum*," *Abh. k.k. geol. Reichsanst.*, v., 1873, p. 176, Pl. XXXIII., f. 7; Pl. XXXIV., f. 1.

[3] See Oppel, *Pal. Mitteil. III. Jurass. Cephalop*, 1863, p. 261, Pl. LXXIV., f. 1 (the genotype of *Lithacoceras*).

is, however, probably also the case with Ammon's septate type and perhaps with Favre's *Amm. basilicae*,[1] which also resemble some of the fragments. P. de Loriol's [2] *Amm. progeron*, like the same author's *Amm. metamorphus* (Neumayr), is closer to the example figured in Pl. VI., f. 3, and attached to *L. capillaceum* (Fontannes). One specimen, with somewhat coarser ornamentation, may be transitional to *Perisphinctes eggeri* Ammon,[3] but this species was compared to *Planites polygyratus*, and may be a less typical *Lithacoceras* than the Mombasa fragment here discussed.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., Nos. C. 8064 (incl. 8243), C. 8068, 78, 81, 83, 108, 200, 206, Kässner Colln.; C. 8927, J. W. Gregory Colln.).

Lithacoceras geron (Zittel). (Pl. VIII., f. 2.)

1870. *Perisphinctes geron*, Zittel: *Fauna d. älter. cephalop.-führ. Tithonbildungen*, p. 113, Pl. XI., f. 3.
1898. *Perisphinctes geron*, Zittel: Siemiradzki, "Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 278.

The fragment here figured is septate to the end so that the complete individual must have been of gigantic size. Another, slightly smaller, specimen retains part of the umbilical portion of the body-chamber, with coarse primaries, and may represent a transition to *L. progeron* (Ammon).

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., Nos. C. 8104, 8112, Kässner Colln.).

Lithacoceras sp. ind. cf. *aeneiforme* (Dacqué).

1905. *Perisphinctes choffati*, Dacqué: "Jura des Somalilandes," *Beitr. Pal. Geol. Oesterr.-Ung.*, xvii., p. 149. Pl. XVII., f. 3 *a*, *b*.
1914. *Perisphinctes aeneiformis*, nom. nov. Dacqué: "Neue Beitr. z. Kenntn. d. Jura in Abessynien," *loc. cit.*, p. 11.

The outer whorl of an example of 113 mm. diameter, still septate, if found separate, might have been attached to *L. fraasi* or the two Abyssinian species described by Dacqué (*L. aeneiforme* and *L. arussiorum*), but the primaries are less sharp than in the last two. On the other hand, the inner whorls, unknown in *L. aeneiforme*, are coarsely ribbed and perisphinctid in the Mombasa form here discussed, and the sudden change from one type of costation to another is paralleled only in *L. gerontoides* (Siemiradzki),[4] in certain forms of the *stenocyclus*-group, and, in a different manner, in the group of *Ataxioceras* which P. de Loriol and Siemiradzki have identified with *Perisphinctes inconditus*, Fontannes. Since in the present form the change in ribbing is from coarse to fine, it has no affinity with *L. aeneas* (Gemmellaro),[5] but its relationship to Dacqué's species is equally problematical until the inner whorls of that form are known.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8125, Kässner Colln.).

Lithacoceras kenyaense, sp. nov. (Pl. V., f. 5.) S.10252

The gigantic example here figured (reduced to $\frac{5}{6}$ of its natural size) has the inner whorls only partially preserved, but what can be seen of them indicates that they are not identical with any of the smaller forms above described. The holotype has dimensions:

Diameter in mm. - - - - - - -	257
Height of the last whorl (in % of diameter) - -	·39
Thickness ,, ,, (,, ,,) - -	·36
Width of the umbilicus (,, ,,) - -	·30

[1] "Zone à *Amm. acanthicus*, etc.," *Mém. Soc. Pal. Suisse*, iv., 1877, Pl. III., f. 9 *a*, *b*, 10 *a*, *b*.

[2] "Couches à *Amm. tenuilobatus* de Baden," *loc. cit.*, Pl. XII., f. 1-2.

[3] *Loc. cit.* (1875), p. 180, Pl. II., f. 2.

[4] See especially in Simionescu, "Studii Geol. si Pal. din Dobrogea," T. Cefal. Juras. dela Harsova, *Acad. Rom.*, xxi., 1907, p. 160, Pl. V., f. 2.

[5] *Faune Giur. e Lias. della Sicilia*, vi. (1877), p. 162, Pl. XX., f. 12.

These do not differ greatly from the measurements of a slightly smaller new Indian species of the present group, from the Kantcote Sandstone, figured in Pl. LXXI., f. 1 and Pl. LXXII., f. 1. of my Kachh memoir (as *Lithacoceras indicum*), but I do not know of any closely comparable European species.

The innermost whorls are inaccessible and probably missing altogether ; the whole of the outer whorl remaining belongs to the body-chamber, the break at *x* coinciding with the last septal edge. The suture-line is not visible, but probably similar to that of the Kachh species. The ribbing, so far as can be seen, is first closer, at least the primaries visible in the umbilicus, but on the body-chamber these change to blunt and distant folds. The secondary ribs are, first, long, and connected with the primaries, as in *e.g. L. basilicae* (Favre), above cited, but not so close, whilst Neumayr's *L. metamorphum* is probably also more finely ribbed at a comparable diameter. The whorl-section is comparatively inflated, subtrigonal, as in the small *L. basilicae*, and with the greatest whorl-thickness at the umbilical ribs.

In a doubtful fragment of another individual, still septate where the whorl-height amounts to over 70 mm., the complex, *geron*-like suture-line is well shown, but the impression of the inner whorls in the dorsal area reveals peripheral ribbing which is much coarser than that of any *Lithacoceras* here described. This suggests comparison with the *Ammonites achilles* (non d'Orbigny) described by P. de Loriol [1] from the *tenuilobatus* zone, rather than with forms of the *metamorphum* group ; but it is not certain that this fragment belongs to the same species as the holotype.

The only closely allied form, from Kachh, has a slightly larger umbilicus, but it is still septate at 205 mm. diameter, and does not yet show the distant bulging primaries of the body-chamber, resembling thus *L. progeron* (Ammon), above described.

Horizon. Kimmeridgian (Lower).

Locality. 14 (North and south of Makupa Bridge, Miss McKinnon Wood Colln.) ; Changamwe (B.M., No. C. 8080, Kässner Colln.).

e. Sub-Family VIRGATOSPHINCTINAE, Spath.

The genera now grouped in this family may all be derived from *Torquatisphinctes*, Spath, which connects them with the ancestral Perisphinctinae in the narrower sense, whilst the sub-family Ataxioceratinae is now restricted to the discoidal offshoots that are transitional between the true Perisphinctids and the still more specialised Virgatitids and Pseudovirgatitids. *Katroliceras*, Spath, is connected not only with *Torquatisphinctes* and its offshoot *Pachysphinctes* Dietrich (adopted for the group of *Perisphinctes torquatus*, Waagen non Sowerby sp.) which lead directly to *Aulacosphinctoides*, Spath, but also with *Subdichotomoceras*, Spath, the forerunner of *Pavlovia*, Ilovaisky. By its close ally *Polytosphinctes*. Schindewolf, this is again connected with *Aulacosphinctoides* and there are many passage-forms between this and *Virgatosphinctes*, Uhlig. These and other, related, genera are discussed in detail in Part IV. of my Kachh Monograph, but there are only a few representatives among the Mombasa material at my disposal.

1. Genus TORQUATISPHINCTES, Spath.

Torquatisphinctes beyrichi (Futterer). (Pl. III., f. 6.)

1894. *Perisphinctes beyrichi*, Futterer : " Jura in Ostafrika," *loc. cit.*, p. 9. Pl. II., f. 2 (1 and 3).
1898. *Perisphinctes beyrichi*, Futterer : Siemiradzki, " Monogr. Amm. Gattung *Perisphinctes*," *loc. cit.*, p. 173.
1910. *Perisphinctes beyrichi*, Futterer : Dacqué, " Dogger und Malm aus Ostafrika," *loc. cit.*, p. 14, Pl. IV., f. 2.
1925. *Perisphinctes beyrichi*, Futterer : Spath, " Ammonites and Aptychi, Somaliland," *loc. cit.*, p. 125.

Dacqué's example agrees with the lectotype (Futterer's f. 2) and the specimen here figured is of the same nature. Another fragmentary example is too immature to be definitely identified and two more fragments with peripheral projection may be transitional to *Biplices* of the *africanus*-group.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8932, J. W. Gregory Colln. ; C. 8122, 8229, 31, Kässner Colln.).

[1] " Monogr. Pal. des couches . . . d'Oberbuchsitten," *Mém. Soc. Pal. Suisse*, vii., 1881, Pl. III., f. 1.

2. Genus KATROLICERAS, Spath.

Katroliceras pottingeri (J. de C. Sowerby).

1894. *Perisphinctes pottingeri* (Sowerby) : Futterer, " Jura in Ostafrika," *loc. cit.*, p. 7, Pl. I., f. 1, 2.
1925. *Katroliceras pottingeri* (Sowerby) : Spath, " Ammonites and Aptychi, Somaliland," *loc. cit.*, p. 159.

Futterer's identification is accepted and I am refiguring his two originals (lent to me through the kindness of Prof. Dr. J. F. Pompeckj in Berlin) in my Kachh Pl. CII., f. 5 *a-d*. Most of the fragments of *Katroliceras*, listed below, seem to belong to related species but not to *K. pottingeri* itself, and there is no specimen showing the characteristic body-chamber ornamentation.

Horizon. Kimmeridgian (Middle).

Locality. " 10 miles N.W. of Mombasa, 5 m. from the shore." Mrs. Wake Bowell Colln. (B.M., No. C. 26881).

Katroliceras sp. ind. (Pl. III., f. 3). S.10228 S.10317

There are half a dozen immature specimens and septate fragments of *Katroliceras* that are quite typical but cannot be identified specifically. The example here figured and a second, very similar specimen, agree in all characters with the inner whorls of large Kachh species described in Part IV. of my Monograph, but other fragments with depressed whorls (one of them labelled " *Pelloceras* " by Crick) may not belong to the same species.

Horizon. Kimmeridgian (Middle).

Localities. IIa (Coroa Mombasa, Miss McKinnon Wood Colln., 4 specimens) ; Changamwe (B.M., Nos. C. 8241-2, Kässner Colln.).

3. Genus SUBDICHOTOMOCERAS, Spath.

Subdichotomoceras sp. ind. S.10318

Two fragmentary examples belong to a form of the group of *S. biplicatum* (Uhlig),[1] but cannot be definitely identified with this species.

Horizon. Kimmeridgian (Middle).

Locality. IIa (Coroa Mombasa, Miss McKinnon Wood Colln.).

f. Sub-Family IDOCERATINAE, Spath.

1. Genus IDOCERAS, Burckhardt.

Idoceras ? sp. ind.

A very poorly preserved example had been referred by Crick to *Idoceras dedalum* (Gemmellaro),[2] but it seems to have a smaller unbilicus and straight peripheral ribs, and may well be a member of that group of Idoceratids (**Procraspedites,** gen. nov.) of which Burckhardt's *Craspedites praecursor* [3] may be considered to be typical. The body-chamber becomes entirely smooth, even on the periphery, but this is not preserved in the specimen under discussion. On the earlier whorl the ribbing passes across the venter without interruption or sinus, as in the Mexican form or in *Subneumayria*, Spath,[4] which may be a homoeomorphous Haploceratid offshoot. In *I. dedalus* (compare especially the Mexican examples figured by Burckhardt [5]) the peripheral chevrons are distinct, but *Involuticeras* and other Aulacostephanids (*e.g. Pararasenia*, Spath) are again more like the Mombasa example here described. Even the generic position of this must remain uncertain.

Horizon. Kimmeridgian (Middle ?).

Locality. Nyuni Mombasa. J. W. Gregory Colln. (B.M., No. C. 8936).

[1] " Fauna of the Spiti Shales," *loc. cit.*, (3), 1910, p. 379, Pls. LVII. and LIX.

[2] *Sopra alcune faune giurese e liasiche di Sicilia*, No. VII. : " Sopra i Cefalopodi della zona inferiore degli strati con *Aspidoceras acanthicum* di Sicilia," 1878, p. 190, Pl. XVII., f. 3.

[3] " La faune jurassique de Mazapil," *Bol. Inst. Geol. Mexico*, No. 23, 1906, p. 98, Pl. XVIII., f. 1-3.

[4] Group of *Neumayria ordoñezi*, Burckhardt, *ibid.*, 1906, p. 11, Pl. I., f. 4, 6-7 ; Pl. II., f. 1-4.

[5] " Faunes Jurassiques et Crétaciques de San Pedro del Gallo," *Bol. Inst. Geol. Mexico*, No. 29, 1912, p. 125, Pl. XXXIII., f. 1-6.

Idoceras cf. *balderum* (Oppel).

1925. *Idoceras balderum* (Oppel) : Spath, " Ammonites and Aptychi, Somaliland," *loc. cit.*, p. 130, Pl. XVI., f. 3.

A tolerably well preserved and almost complete example in the Sedgwick Museum differs from the type merely in its wider umbilicus. It might be possible to find its equivalent, at least in proportions, among the numerous Mexican forms described by Burckhardt ; but the specific name is unimportant in the case of a well-known type like the present ; and the Mombasa example is clearly allied to the Somaliland forms of *Idoceras*.

Horizon. Middle Kimmeridgian (lower *eudoxus* zone, *balderus* horizon).

Locality. Changamwe (E. E. Walker Colln.).

VII. Family ASPIDOCERATIDAE, Zittel emend.

a. Sub-Family PELTOCERATINAE, Spath.

1. Genus PELTOCERATOIDES, Spath.

Peltoceratoides ? sp. ind.

A large body-chamber fragment shows first distant, slightly curved, primary ribs, with an indistinct umbilical and a blunt, parabola-like, outer node, and faint peripheral secondaries, as in some extreme varieties of *Katroliceras divisum*, Quenstedt sp.[1] Later the ribs became sharper, the outer tubercle more prominent and more bullate, also the peripheral secondary ribs connecting the two outer spines, are now strong and single. The sectional outline then agrees with that of *Peltoceratoides semirugosus* (Waagen),[2] but is more depressed and the inner tubercle is less prominent. In the absence of the earlier whorls it is impossible definitely to classify this fragment. The presence of strong outer tubercles at the beginning suggests reference to an Aspidoceratid genus rather than to *Nebrodites*, Burckhardt, which might be thought to develop similar body-chambers.[3] It ought to be mentioned, however, that this species seems to be connected with the quadrate *Pachyplanulites* ? sp. recorded above by some indeterminable fragments, resembling in ornamentation *Perisphinctes acer* (Neumayr),[4] which may be a *Katroliceras*.

Horizon. Upper Argovian (? *bimammatus* zone).

Locality. Changamwe (B.M., No. C. 8142, Kässner Colln.).

b. Sub-Family ASPIDOCERATINAE, s.s.

1. Genus ASPIDOCERAS, Zittel.

Aspidoceras cf. *ægir* (Oppel). (Pl. VI., f. 5.)

1905. *Aspidoceras ægir* (Oppel) : Simionescu, " Fauna Cefalop. Juras. dela Harsova," *loc. cit.*, p. 176 (see there for synonymy).

1925. *Aspidoceras ægir* (Oppel : Dorn, " Aspidoceraten d. unterst. Malms, etc.," *Jahresb. Oberrhein. Geol. Ver.* (N.F.), xii. (1923), p. 4, Text-fig. 3.

The example here figured is entirely septate and rather too immature to be definitely identified, but it certainly belongs to a form of this group. The inner whorls of Futterer's *Asp. africanum* [5] seem more strongly tuberculate.

Horizon. Upper Argovian (? *bimammatus* zone).

Locality. Changamwe (B.M., No. C. 10881).

Aspidoceras sp. ind.

A septate fragment of a very large species shows merely two pairs of lateral spines and a suture-line with a very slender-stemmed lateral saddle which removes it at once from the externally similar large

[1] *Ammoniten des Schwäbischen Jura*, III., White Jura, 1888, Pl. CVI., f. 3, 6.

[2] *Loc. cit.* (Kutch), 1875, p. 83, Pl. XIV., f. 1, 1 *a*.

[3] Compare the similar outer whorl of " *Simoceras* " *herbichi* (Hauer) in Neumayr, *loc. cit.* (1873), Pl. XL., f. 1.

[4] *Ibid.*, Pl. XXXVIII., f. 1.

[5] *Loc. cit.* (" Jura in Ostafrika "), 1894, p. 21, Pl. IV., f. 3-4.

forms of the *pcrarmatum* group. It may belong to a species like *A. hypsclum* (Oppel),[1] but this differs in its broader lateral saddle and possibly in dimensions, for even the Roumanian example figured by Simionescu [2] has already part of the body-chamber and seems to show decline of tuberculation.

Horizon. Upper Argovian (? *bimammatus* zone).

Locality. Changamwe (B.M., No. C. 8096, Kässner Colln.).

2. Genus CLAMBITES, Rollier.

Clambites sp. ind. S.10289

A fragment of the early part of the body-chamber, by its convergent whorl-sides, compressed section, and blunt spines seems to be referable to *Clambites* rather than to *Aspidoceras*, but it is more definitely bispinous than either *C. clambus* (Oppel) or *C. schwabi* (Oppel).[3] The Roumanian form figured by Simionescu [4] as *Aspidoceras aequicostatum* (Quenstedt) is less bluntly tuberculate already on the septate portion, but *Asp. lenki*,[5] Dorn, has a similar body-chamber. Futterer's two Mkusi species have divergent whorl-sides.

Horizon. Upper Argovian (? *bimammatus* zone).

Locality. 15 (South shore of Port Reitz ; Miss McKinnon Wood Colln.).

c. Sub-Family PHYSODOCERATINAE, Schindewolf emend.

1. Genus ACANTHOSPHAERITES, Rollier.

Acanthosphaerites aff. *longispinus* (Sowerby). (Pl. VII., f. 6.)

1825. *Ammonites longispinus*, J. de C. Sowerby : *Mineral Conchology*, v., p. 164, Pl. 1., f. 2.
1919. *Aspidoceras longispinum* (Sowerby), Salfeld : " Ueber einige Aspidoceraten, etc.," 12. *Jahresb. Niedersächs. Geol. Ver. Hannover*, p. 25.

There are six examples provisionally attached to this species which had already been recorded from Mombasa by Beyrich and Futterer. Dacqué included this form in *A. iphiceroides*, whilst Crick gave a new name ("*Aspidoceras gregoryi* ") to three examples collected by Prof. Gregory. The most complete of these compares as follows with Sowerby's holotype in the British Museum :

	Mombasa Example (B.M., No. C. 8912)	Sowerby's Type. (B.M., No. 43920)	
Diameter in mm. - - - - -	60	87	60
Height of the outer whorl (in % of diameter	·45	·41	·42
Thickness " " (" " ")	·53	·53	·56
Width of the umbilicus (" " ")	·25	·31	·27

In the example here figured, in a better state of preservation, the dimensions are not quite the same as in the holotype, but Salfeld's tables also show variation and this author further pointed out that at larger diameters, the shells become more evolute. Sowerby's type has a different suture-line (and Damon's again is distinct), but it is very similar in all the forms of this group. In addition to the slight differences in dimensions the somewhat distinct type of ornamentation of the test was relied on by Crick for specific separation of the Mombasa species, but this feature seems to me still less satisfactory. In Sowerby's holotype there are fragments of test showing very fine, close, straight lines ; [6] in the Mombasa form as in all other *Acanthosphaerites* this radial striation is similar on the test, but the polished casts generally look different.

The Kachh form previously [7] listed as *Physodoceras* cf. *binodiferum* (Waagen) and figured in Pl. CXVI.,

[1] *Pal. Mitt.*, 1863, p. 229, Pl. LXIV., f. 2 *a*, *b*.
[2] *Loc. cit.* (" Fauna Cefalop. Jur. dela Harsova "), 1905, p. 151, Pl. VII., f. 2.
[3] *Pal. Mitt.*, ii., 1863, Pl. LXIII., f. 1 and 4.
[4] " Studii Geol. si Pal. din Dobrogea," I., *Acad. Romana*, No. 21, 1907, p. 178, Pl. V., f. 3.
[5] *Loc. cit.* (" Aspidoceraten d. unterst. Malms "), 1924, p. 17, Text-fig. 9.
[6] Not quite so irregular as in the Mexican *A.* aff. *longispinus*, figured by Burckhardt (*loc. cit.*, 1912), Pl. XVIII., f. 2.
[7] " Blake Collection from Kachh," *loc. cit.*, (1924), p. 15.

f. 3, of my Kachh Monograph, differs merely in its smaller whorl thickness. Schneid [1] directed attention to the great difficulty of correctly identifying these *Acanthosphaerites* that differ so slightly in their characters from the *pseudomutabilis* (or *tenuilobatus*) zone up to the *steraspis* zone. Dacqué's *Aspidoceras somalicum* [2] is a similar feebly inflated species, more closely comparable to the Kachh form than to *A. longispinus*. In the description of the abundant Kachh examples of *Acanthosphaerites*, which include many species of the Middle Kimmeridgian, it will be necessary to discuss the interpretation given to the present species by Toula,[3] who summarised previous views.

Horizon. Kimmeridgian.

Locality. Changamwe (B.M., Nos. C. 8912, 16, 17, J. W. Gregory Colln. ; C. 8091, 131, 135, Kässner Colln.).

Acanthosphaerites sp. aff. *longispinus* (Sowerby).

One fragment was doubtfully referred by Crick to *Aspidoceras acanthicum* (Oppel),[4] but he thought the suture-line differed. It seems very uncertain whether this character is of value in the present group of *Acanthosphaerites*, and there are considerable differences in the suture-lines of the *A. acanthicum* illustrated by *e.g.* Gemmellaro [5] and P. de Loriol.[6] The fragment has a more obtusely cordate whorl-shape than Sowerby's type and an inner row of tubercles, with two small spines of the outer row ; and it can certainly be compared with a corresponding portion of such an example as the Russian form figured by Pavlow.[7] Salfeld [8] has shown that *A. acanthicus* (discussed very fully recently by Toula [9]) occurs in the same zone as *A. longispinus*, and it is not impossible that some of the Mombasa fragments would be attached to some of Toula's varieties if in a better state of preservation.

Horizon. Kimmeridgian (Upper *tenuilobatus* zone).

Locality. Below Changamwe (B.M., No. C. 8914, J. W. Gregory Colln.).

Acanthosphaerites iphicerus (Oppel).

1863. *Ammonites iphicerus*, Oppel, " Jurass. Cephalopoden, III.," *loc. cit.*, p. 218, Pl. LX., f. 2.
1907. *Aspidoceras iphicerum* (Oppel), Toula, " *Acanthicus*-Schichten, etc., bei Giesshübl," *loc. cit.*, p. 67.
1919. *Aspidoceras iphicerum* (Oppel), Salfeld : " Ueber einige Aspidoceraten," *loc. cit.*, p. 27.

A fairly typical example has 150 mm. diameter, but three other specimens are rather too poorly preserved to be definitely distinguished from the other, similar, *Acanthosphaerites* here described. According to Salfeld, this species occurs with *A. acanthicus* and *A. longispinum* in the " zone of *Aulacostephanus yo* " at the top of the Lower Kimmeridgian.

Horizon. Kimmeridgian (Upper *tenuilobatus* zone).

Locality. Changamwe (B.M., No. C. 8126-8, 8092, Kässner Colln.).

[1] *Loc. cit.* (" Geol. d. Fränk. Alb "), 1915, p. 81.

[2] *Loc. cit.* (" Jura des Somalilandes "), 1905, p. 149, Pl. XVII., f. 1 *a*, *b*.

[3] " *Acanthicus*-Schichten bei Giesshübl," *Abh. k.k. geol. Reichsanst.*, xvi., Ht. 2 (1907), p. 67, Pl. XV.

[4] " Jurass. Cephalopoden, III.," *loc. cit.*, p. 219 (Oppel's original being figured in Neumayr, " Fauna der Schichten mit *Asp. acanthicum*, etc.," *loc. cit.*, 1873, p. 195, Pl. XLI.).

[5] *Faune Giur. e Lias. della Sicilia*, 1872, Pl. VII., f. 9.

[6] " Monogr. pal. de la zone à *Amm. tenuilobatus* de Baden," *loc. cit.*, 1876, Pl. XVII., f. 2 *a*.

[7] " Ammonites de la zone à *Asp. acanthicum*, etc.," *loc. cit.*, 1886, Pl. II., f. 3 *a*, *b*.

[8] *Loc. cit.* (" Ueber einige Aspidoceraten, etc.,"), 1919, p. 30.

[9] *Loc. cit.* (" *Acanthicus*-Schichten bei Giesshübl "), 1907, pp. 57 and ff.

Acanthosphaerites aff. *iphiceroides* (Waagen). (Pl. VII., f. 1 and 8.) S.10255.

1871. *Aspidoceras iphicerum* (Oppel), Waagen, *Rec. Geol. Surv. India*, iv., p. 92.
1875. *Aspidoceras iphiceroides*, Waagen, " Jurassic Fauna of Kutch," *loc. cit.*, p. 102, Pl. XXIII.
1877. *Aspidoceras iphiceroides*, Waagen : Beyrich, " Ueber jurassische Ammoniten von Mombassa," *loc. cit.*, p. 100.
1894. *Aspidoceras iphiceroides*, Waagen : Futterer, *op. cit.*, *Zeit. deut. geol. Ges.*, xlvi., p. 5, Pl. VI., f. 3.
1910. *Aspidoceras iphiceroides*, Waagen : Dacqué, " Dogger und Malm aus Ostafrika," *loc. cit.*, p. 24, Pl. I., f. 3 ; Pl. IV., f. 4.
1925. *Physodoceras richthofeni* (Müller) : Dietrich (pars), " Kimmeridge v. Mahokondo," *loc. cit.*, p. 15, Pl. II., f. 5 (?).

Such examples as those here figured agree well enough with Waagen's types to be provisionally referred to the same species, but I have not yet been able to study in detail the numerous *cycloti* from the Katrol Beds of Kachh. Meanwhile it seems preferable to keep distinct Waagen's [1] *Aspidoceras binodiferum* (included by Dacqué in the present species) as well as Müller's *A. richthofeni*, which may be closer to the Somaliland *A. pavlowi* (Burckhardt) recorded by myself in 1925.[2]

Horizon. Kimmeridgian (Lower).

Locality. 11b (Coroa Mombasa, Miss McKinnon Wood Colln.) ; Changamwe (B.M., Nos. C. 8133, Kässner Colln. ; C. 8915, J. W. Gregory Colln.).

Acanthosphaerites cf. *liparus* (Oppel).

1863. *Ammonites liparus*, Oppel : " Ueber Jurass. Ammoniten, III.," *loc. cit.*, p. 220, Pl. LIX., f. 1 *a*, *b*.
1898. *Aspidoceras* sp. Crick : *Trans. Linn. Soc.*, (2), vii., Pt. IV., p. 103, Pl. XIX., f. 6-7.
1905. *Aspidoceras liparum* (Oppel) : Simionescu, " Fauna Cefalop. Juras. dela Harsova," *loc. cit.*, p. 181, Pl. II., f. 5 (with synonymy).

The example figured by Crick was considered by him to be " related to *Aspidoceras deaki*, Herbich, as figured by Pavlow [3] from the beds with *A. acanthicum* in Eastern Russia." It may be transitional to this species, but is here doubtfully referred to the more inflated and more involute *A. liparus*. The fragment is interesting since it clearly exhibits the anterior boundary of one of the muscle-scars, as described by Crick.

Horizon. Kimmeridgian (Lower).

Locality. Below Changamwe (B.M., No. C. 8913, J. W. Gregory Colln.).

Acanthosphaerites deaki (Herbich). (Pl. VIII., f. 3, 5, 6.) S.10259

1878. *Aspidoceras deaki*, Herbich : " Das Szeklerland," *Mitt. Jahrb. k. Ung. Geol. Anst.*, v. p. 175, Pl. XIV.-XV., f. 2.
1886. *Aspidoceras deaki*, Herbich : Pavlow, " Ammonites de la zone à *Asp. acanthicum*," *Mém. Com. Géol. St. Pétersb.*, ii., No. 3, p. 76, Pl. III., f. 2-4.

The example figured in Pl. VIII., f. 5, has a slightly smaller umbilicus than Herbich's type (29% as against 34) and a greater whorl-thickness (46% compared with 40), but there is considerable variability among the 12 specimens before me and it is possible that but for the defective preservation, some of them might have been attached to *A. contemporaneus* (Favre). Dacqué's *Aspidoceras kilindianum*,[4] judging by the figures, also belongs to this assemblage, perhaps even the original *Asp. richthofeni*, Müller [5] ; but Dietrich,[6] who figures as *Physodoceras richthofeni* a strongly bituberculate form, like *A. iphiceroides*, points out the defects in Müller's figures.

Horizon. Kimmeridgian (Lower).

Localities. 11b (Coroa Mombasa, Miss McKinnon Wood Colln.) ; Changamwe (B.M., Nos. C. 8073, 88-90, 93, 129-30, 32, 34, 57, 77, Kässner Colln.).

[1] *Loc. cit.* (" Jurass. Cephal. Kutch "), 1875, p. 105, Pl. XXIV., f. 1.
[2] *Loc. cit.* (" Ammonites and Aptychi "), p. 118, Pl. XV., f. 1 *a*, *b*.
[3] " Ammonites de la zone à *Asp. acanthicum*, etc.," *loc. cit.*, 1886, Pl. III., f. 2-4.
[4] *Loc. cit.* (" Dogger und Malm aus Ostafrika "), 1910, p. 25, Pl. I., f. 9 ; Pl. III., f. 6.
[5] *Loc. cit.* (in Bornhardt, " Ostafrika," 1900), p. 524, Pl. XV., f. 2, 3.
[6] *Loc. cit.* (" Kimmeridge in Mahokondo "), 1925, p. 15.

Acanthosphaerites cf. *microplus* (Oppel).

1863. *Ammonites microplus*, Oppel: "Ueber Jurass. Cephalopoden. III.," *loc. cit.*, p. 218, Pl. LVIII., f. 4.

A Mombasa fragment belonged to an individual at least twice the size of Fontannes's figure [1] and may be compared to the large *Ammonites unispinosus* figured by Quenstedt.[2] The identification must remain tentative. The crushed form included in *A. deaki* (Herbich) and figured in Pl. VIII., f. 3, may perhaps represent a transition between this species and *A. microplus*.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8094, Kässner Colln.).

Acanthosphaerites sp. nov.

One fragment, representing the anterior part of the body-chamber of a large form, may be (somewhat inaptly) compared to Quenstedt's [3] *Amm. perarmatus* (non Sowerby) which, however, may be a true *Aspidoceras*, whereas the unknown inner whorls of the fragment here discussed are more likely to have been those of the more typical *Acanthosphaerites*. The outer spines are unusually strong and even more distant from the umbilical row than in Quenstedt's example, owing to the inner spines being close to the umbilical suture; and although it is known that the body-chambers of *Acanthosphaerites* may acquire secondary bituberculation, I do not know of any comparable form having been described in geological literature.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8160, Kässner Colln.).

Acanthosphaerites ? sp. ind.

Yet another bispinous form is represented by a body-chamber in which the tubercles are very far apart. Apart from this feature, the fragment might be compared to the outer whorl of the form of *Ammonites bispinosus* figured in Quenstedt's [4] Pl. CXVIII., f. 6.

Horizon. Kimmeridgian (Lower).

Locality. Changamwe (B.M., No. C. 8095, Kässner Colln.).

d. APTYCHUS OF ASPIDOCERATIDAE.

(*Laevaptychi*, Trauth.[5])

S.10290

1925. *Aptychi*, Spath: "Ammonites and Aptychi," *Monogr. Hunterian Museum*, i. Pt. VII., p. 153.

A single cellulose *Aptychus* is available from an isolated locality; it probably belonged to one of the forms of *Acanthosphaerites*, described above. It is identical with the Somaliland aptychi, previously recorded and referred to the group of *Aptychus latus* (Parkinson). Dietrich [6] stated that aptychi were very common at Mombasa, in situ as well as loose, but the single example in the collections before me would lead one to assume that they must be very rare.

Horizon. Kimmeridgian (Middle ?).

Locality. 57 (North shore of Changamwe Station; Miss McKinnon Wood Colln.).

[1] *Calcaires du Château de Crussol*, 1879, p. 93, Pl XII., f. 11.

[2] *Ammoniten des Schwäbischen Jura*, III., 1887, p. 1023, Pl. CXVII., f. 2.

[3] *Ammoniten des Schwäbischen Jura*," III., 1887, p. 1060, Pl. CXXII., f. 1.

[4] *Loc. cit.* (*Ammoniten des Schwäbischen Jura*, III)., 1887.

[5] *Loc. cit.* (1927), pp. 217, etc.

[6] *Loc. cit.* (" Kimmeridge von Mahokondo "), 1925, p. 15.

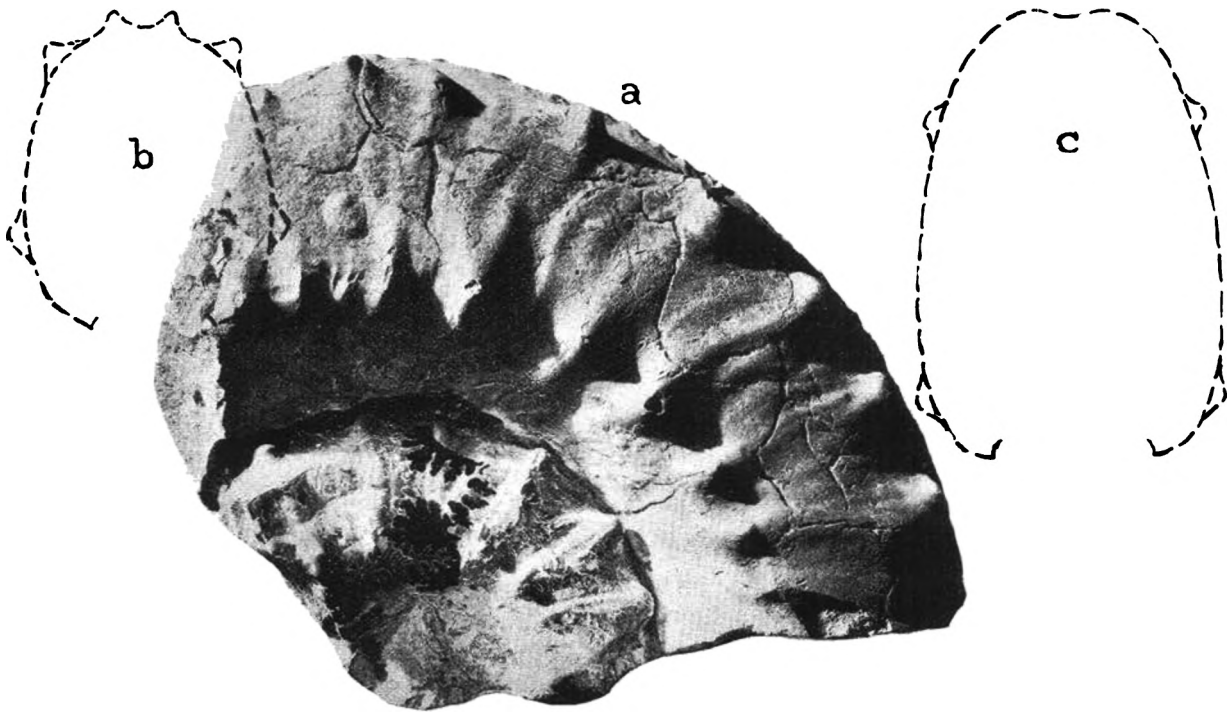
e. Sub-Family SIMOCERATINAE, Spath.

Genus WAAGENIA, Neumayr.

Waagenia cf. *hildebrandti* (Beyrich). (Text-fig. 4 *c*.)

1875. *Aspidoceras* sp. ind. Waagen : " Jurass. Cephal. Kutch," *loc. cit.*, p. 101, Pl. XXI., f. 4 *a*, *b*.
1877. *Ammonites hildebrandti*, Beyrich : " Ueber Jurass. Ammon. von Mombassa," *Monatsb. Preuss. Akad. Wiss. Berlin*, p. 101.
1894. *Waagenia hildebrandti* (Beyrich), Futterer : " Jura in Ostafrika," *loc. cit.*, p. 6, Pl. III., f. 1, 2.
1925. *Waagenia hildebrandti* (Beyrich), Spath : " Ammonites and Aptychi," *loc. cit.* (Somaliland), p. 133.
1925. *Waagenia hildebrandti* (Beyrich), Dietrich : " Kimmeridge in Mahokondo," *loc. cit.*, p. 18.

The fragment of which the whorl section is figured in text-fig. 4 *c* only shows the ornamentation of the body-chamber, less feebly developed than that represented in Futterer's illustration ; there is also part of the suture-line of the inner whorls. There are many similar forms of *Waagenia* before me from the Katrol Beds of Kachh, but until they have been studied in detail, it may suffice to state that Beyrich's species,



TEXT-FIG. 4.

(*a*, *b*.) *Waagenia* sp. nov. Side-view and outline whorl-section of a fragmentary specimen from Coroa Mombasa. Middle Kimmeridgian. (Miss McKinnon Wood Colln.)

(*c*.) Outline whorl-section of *Waagenia* cf. *hildebrandti* (Beyrich). North-west of Mombasa. Middle Kimmeridgian. B.M., No. C. 26882.)

although perhaps not represented by the example here figured, is considered to be distinct from the forms of the European *beckeri*-group, and is identical with the Katrol form figured by Waagen, as was clearly recognised by Beyrich and Futterer.

Horizon. Kimmeridgian (Middle).

Locality. " 10 miles north-west of Mombasa and 5 miles from the seashore, on a sandy, clay soil." (B.M., No. C. 26882, Mrs. Wake Bowell Colln.).

Waagenia sp. nov. (Text-fig. 4 *a*, *b*.)

A number of similar forms of *Waagenia* will be figured and discussed in Part V. of my Kachh Monograph. The Mombasa specimen here figured as a new species represents merely a body-chamber fragment,

with part of an earlier septate whorl that well displays the suture-line. It clearly belongs to the group of *W. beckeri* (Neumayr), but is much more coarsely tuberculate than the *W.* aff. *hybonota* described below. It may be mentioned that the large Mombasa fragment discussed above and considered to represent the final stage of *W. hildebrandti*, is much closer to *W. monacantha* (Waagen [1]) than to the present form.

Horizon. Kimmeridgian (Middle).

Locality. 11a (Coroa Mombasa, Miss McKinnon Wood Colln.).

Waagenia aff. *hybonota* (Oppel). (Pl. III., f. 4.) S.10229

1925. *Waagenia* aff. *beckeri* (Neumayr), Spath: "Ammonites and Aptychi, Somaliland," *loc. cit.*, p. 133.

The specimen here figured (being a plaster-cast of the original impression) does not show the traces of the umbilical tubercles of the next outer whorl, which are preserved in the matrix. As in the case of the Somaliland example previously recorded, specific identification cannot be absolute.

Horizon. Kimmeridgian (Middle, *steraspis* or *beckeri* zone).

Locality. 11a (Coroa Mombasa, Miss McKinnon Wood Colln.).

C. DISCUSSION OF THE AMMONITE FAUNAS OF THE DIFFERENT LOCALITIES.

The 197 specimens in Miss McKinnon Wood's Collection were collected at 16 different localities, and the assemblages are discussed below in numerical order. The 41 ammonites in Prof. Gregory's Collection came from three localities, by far the greater part from "below Changamwe, opposite Mombasa Island." This is apparently the same locality as Miss McKinnon Wood's No. 14 ("Shore of the Changamwe Peninsula, north and south of the Makupa Bridge") and the "Changamwe" whence came the 183 ammonites in the Kässner Collection in the British Museum and a few more specimens since purchased, also probably most of the twenty specimens in the E. E. Walker collection in the Sedgwick Museum, Cambridge, labelled "Changamwe Shale, between Mombasa and Jombo." These include eleven more or less indeterminable fragments of Perisphinctids, comparable to forms here described, in addition to the *Holcophylloceras*, *Prograyiceras* and *Idoceras*, already mentioned; further six *Acanthosphaerites* of which one of 240 mm. diameter shows a *polyphemus*-like body-chamber, with blunt peripheral folds. The remaining examples belong to several isolated lots, as listed below.

No. 11a (Eastern slopes of the Coroa Mombasa, lying on the surface of the ground, from the summit of the most northerly of the three hills to within a short distance of the Freretown–Malindi road). 12 specimens.

Phylloceras aff. *saxonicum*, Neumayr.
Taramelliceras cf. *kachhense* (Waagen).
Lithacoceras sp. ind.
Katroliceras sp. ind. (Pl. III., f. 3).
Subdichotomoceras sp. ind.
Waagenia sp. nov. (Text-fig. 4 *a*, *b*).
" aff. *hybonota* (Oppel) (Pl. III., f. 4).

This is clearly a Middle Kimmeridgian assemblage, referable to the *beckeri* zone. The rock is of a lighter yellow colour, more sandy and less compact than the matrix of the ammonites from the clay ironstone nodules of the beds below.

No. 11b. A little south of the above (just west of locality 10b, where no ammonites have been found). 7 specimens.

Holcophylloceras mesolcum (Dietrich) (Pl. II., f. 2 *b-d*).
Hemilytoceras cf. *fraasi* (Dacqué).
Acanthosphaerites aff. *iphiceroides* (Waagen) (Pl. VII., f. 1).
" *deaki* (Herbich) (Pl. VIII., f. 5).

This assemblage indicates a lower or lower middle Kimmeridgian age (upper *tenuilobatus* or *eudoxus* zone), but *Holcophylloceras mesolcum* goes up into the Lower Portlandian.

[1] "Jur. Cephal. Kutch," *loc. cit.*, 1875, p. 100, Pl. XXI., f. 3 *a*, *b*.

No. 12. North shore of Port Tudor, north of Freretown. Out of a shale, there are seven fragmentary

Aptychus (*Lamellaptychus*)

belonging to forms of Oppelidae. They are, perhaps, from even a higher horizon in the Kimmeridgian than the above (11a) *beckeri* assemblage and may be tentatively assigned to the *steraspis* zone. The thick, black aptychi are solid and identical in preservation with those from locality 56, but another lamellose *aptychus* in the British Museum, labelled " Changamwe," is preserved as an impression in a light, ochreous rock which also includes an impression of *Hemilytoceras* cf. *montanum* (Oppel). This might be from the *beckeri* zone.

No. 14. Shore of the Changamwe Peninsula, north and south of the Makupa Bridge (20 specimens, out of a shale).

Phylloceras isotypum (Benecke) (Pl. I., f. 1).
,, *plicatum*, Neumayr.
Calliphylloceras aff. *benacense* (Catullo).
Holcophylloceras mesolcum (Dietrich) (Pl. I., f. 2 *a*).
Hemilytoceras fraasi (Dacqué).
Biplices africanus (Dacqué) (Pl. IV., f. 12).
Pachyplanulites subevolutus (Waagen) (Pl. IV., f. 9).
Dichotomosphinctes inconstans (Spath).
Planites aff. *ernesti* (P. de Loriol).
Lithacoceras mombassanum (Dacqué).
,, ,, var. *euglypha* n. (Pl. IV., f. 1).
,, *mackinnon-woodi* sp. n.
,, *torquatiforme* sp. n. (Pl. IV., f. 14).
,, *kenyaense* sp. n. (Pl. V., f. 5).
Acanthosphaerites aff. *iphiceroides* (Pl. VIII., f. 8).

This is a typical Lower Kimmeridgian fauna (*tenuilobatus* zone) and corresponds to the assemblage described by Dacqué in 1910 and again discussed in 1914 and assigned to the earlier Sequanian *bimammatus* zone. But Dietrich was equally wrong in thinking that the lower limit of the Mombasa marls was Middle Kimmeridgian, for in addition to the forms already listed from Miss McKinnon Wood's Collection, there are the following species here described that indicate the lowest *tenuilobatus* zone or even beds of uppermost Argovian age :

Pachyplanulites subcolubrinus (Waagen).
Prososphinctes aff. *virguloides* (Waagen).
Lithacoceras jelskii (Siemiradzki).
Peltoceratoides ? sp. ind.
Aspidoceras cf. *ægir* (Oppel).
Aspidoceras sp.

The numerous *Lithacoceras* and other Perisphinctids and *Acanthosphaerites* that have been assigned to typical *tenuilobatus* zone species make it probable that the beds which yielded these forms include the whole of the lower Kimmeridgian, but at least part of the *bimammatum* zone may be included as well. Their preservation is in a darker brown, compact clay-ironstone, as contrasted with the lighter, more ochreous or sandy matrix of the Middle Kimmeridgian forms.

No. 15. South shore of Port Reitz, between Mtongwe and Funguni (ten specimens out of a shale).

Ptychophylloceras cf. *insulare* (Waagen)
Mayaites ? sp. ind. cf. *olcostephanoides* (Tornquist).
Clambites sp. ind.

In addition to these there are eight poorly preserved fragments of Perisphinctids, one of which distantly resembles those here referred to *Prososphinctes virguloides* (Waagen), whilst another might, perhaps, be tentatively attached to *Biplices africanus* (Dacqué). But they are really unidentifiable and the largest of all, with a quadrate whorl-section and straight, strong, primaries can also only doubtfully be attached to that new species of *Pachyplanulites* which has been discussed above. As a whole, however, this assemblage suggests the uppermost Argovian (*bimammatus* zone) rather than the Lower Kimmeridgian, whilst some of the forms (*e.g. Mayaites* ? sp. ind.) may be even lower Argovian.

Nos. 16, 17. Locality 16 (Hill north-east of the Mteza Jetty) and 17 (Kenya-Uganda Railway, mile 9/14-15) may be taken together as the faunas are identical. There are 110 ammonites and impressions on nodules of very compact clay ironstone out of a shale. They are internal casts of generally very good preservation.

Phylloceras (*Macrophylloceras* ?) *semiplicatum*, nom. nov.
Calliphylloceras demidoffi (Rousseau).
Holcophylloceras mediterraneum (Neumayr).
Ptychophylloceras vicarium (Waagen).
Thysanolytoceras cf. *adeloides* (Kudernatsch).
Alcidia mombasensis, sp. nov.
,, *obsoleta* (Rollier).
,, sp. ind.
Paroecotraustes conjungens (Mayer).
,, aff. *serrigerus* (Waagen).
Hecticoceras sp. ind.
Lunuloceras ? sp. ind.
Sublunuloceras aff. *dynastes* (Waagen).
Macrocephalites chariensis (Waagen)
,, ,, ,, var. *simplex* nov.
Pleurocephalites aff. *habyensis*, Spath.
,, ? sp. nov.
Hubertoceras arcicosta (Waagen).
,, sp. ind.
Indosphinctes abichi (Neumayr and Uhlig).
,, sp. nov.
,, *patina* (Neumayr).
,, aff. *subpatina* (Petitclerc).
,, sp. ind.
Choffatia aff. *furcula* (Neumayr).
,, *lateralis* (Waagen).
,, sp. ind.
,, *recuperoi* (Gemmellaro).
Grossouvria cf. *curvicosta* (Oppel) auct.
,, *evexa* (Quenstedt).
,, aff. *gracilis* (Siemiradzki).
,, aff. *elegans* (Siemiradzki).
,, aff. *leptoides* (Till).
Subgrossouvria cf. *coronaeformis* (Loczy).
,, ? sp. ind.
Binatisphinctes aff. *credneri* (Krenkel).
,, cf. *arlti* (Krenkel).
,, ? sp. ind.

In addition there is the internal cast of a small *Nautilus*, resembling at first sight *Paracenoceras kumagunense* (Waagen),[1] with its peripheral sulcus, but showing traces of rursiradiate ornamentation as in *N. mojsisovicsi* (Neumayr).[2] The fauna is unmistakably Callovian and probably includes the upper *macrocephalus* zone and perhaps part of the *anceps* beds above, although there is no trace of a *Reineckeia*.

No. 18. Kenya-Uganda Railway, mile 10/5 (shales, east of the fault). Only two fragmentary specimens are before me but they include

Macrocephalites chariensis (Waagen)

of the upper *macrocephalus* zone and already listed under Nos. 16-17 ; further an indeterminable fragment of a Perisphinctid (*Subgrossouvria* ?).

[1] See Spath, " Revision Jurass. Cephal. Kachh," *loc. cit.*, Pt. I., 1927, p. 26, Pl. IV., f. 2, 3.

[2] *Loc. cit.* (*Jahrb. k.k. geol. Reichsanst.*, xx.), 1870, p. 151, Pl. VII., f. 1.

No. 19. Kenya–Uganda Railway, mile 10/6. Six small nuclei and fragments of ammonites in a friable, ochreous matrix, weathered out of limestone boulders.

Phylloceras sp. juv.
Macrocephalites cf. *macrocephalus* (Schlotheim).
Dolikephalites sp. juv.
Sivajiceras ? sp. ind.

The entirely different preservation suggests that this fauna is of earlier date than the Callovian assemblages listed from localities 16-18 and it may be compared to the *triangularis* fauna of the Patcham limestones of Jumara in Kachh.

No. 21. Mombasa Pipe-line, mile 11/11-13. Ten limonitic specimens out of a limestone, in a preservation identical with that of the Bathonian fauna described in 1920.

Phylloceras aff. *kudernatschi* (Hauer).
Calliphylloceras cf. *disputabile* (Zittel).
Holcophylloceras zignodianum (d'Orbigny).
Oppelia sp. ind.
Stephanoceras cf. *tenuicostatum*, Hochstetter.

The last points to an Upper Bajocian rather than to a Bathonian age. *Macrocephalites* and *Stephanoceras* do overlap in Mediterranean successions and the magnitude of the Bathonian stage has probably been very greatly overrated. But it is possible that this assemblage is not strictly contemporaneous and that some of the *Phylloceras* may be Bathonian, whilst the *Stephanoceras* and perhaps the *Oppelia* are earlier.

No. 25. Mombasa Pipe-line, mile 13/11, on the south bank of the Jivani River, a little west of the pipe-line. A single crushed fragment of an ammonite in a black micaceous shale, out of a cliff composed of limestone and shale. It is an indeterminable portion of perhaps a Perisphinctid, but there is a striking identity of preservation and matrix with the Jubaland fossils referred to below as of Lower Kimmeridgian age. This resemblance, of course, may be quite accidental.

No. 26. Mombasa Pipe-line, miles 16-17. The impression of an ammonite (or two ?) here figured and described as :

Dorsetensia sp. juv. ? cf. *edouardiana* (d'Orbigny)

occurred in a grey shale, together with impressions of *Posidonomya*. The specimens cannot be later than Upper Bajocian (*humphriesianum* or *sauzei* zones) and might perhaps equally well have been compared to *Fontannesia* from the *concava* zone or even a Grammoceratid (*Dumortieria*) from the Upper Lias. The exact age of this shale is thus at present unknown.

No. 41. Bed of the unnamed river between the Senawe and the Ndsovuni, on the Mavueni–Mtanganyika track (loose). There are only two examples :

Choffatia aff. *furcula* (Neumayr).
Phyllopachyceras ? sp. juv. ind.

but they indicate the Callovian, like the faunas from 16-18.

No. 45. Rare River, just north of Konjora, out of a shale. Four small fragments, including

Pleurocephalites sp. juv.
Alcidia ? sp. ind.

also indicate the Callovian, like the last and localities 16-18.

No. 56. West of the Makupa Bridge, south of the railway. Three lamellose aptychi, out of limestone boulders, like those referred to under No. 12 and of a similar, probably Middle Kimmeridgian age.

No. 57. North shore of Changamwe Station. Also out of a limestone boulder, a single

Aptychus latus (Parkinson)

of Kimmeridgian age.

The remaining ammonites are from :

(*a*) " Nyuni Mombasa, north of Freretown " (J. W. Gregory Colln.).

Three specimens, of which two are unrecognisable Perisphinctids and one the

Idoceras ? (*Procraspedites* ?) sp. ind.

above discussed, are preserved in the friable, sandy matrix of the highest beds and probably of Middle Kimmeridgian age.

(*b*) " Between Shimba and the coast " (J. W. Gregory Colln.).

The single

Hubertoceras arcicosta (Waagen)

figured and described as of Callovian age.

(*c*) " 8-10 miles northwest of Mombasa " (Rev. Chas. New Collection).

There are 8 ammonites, of which six, including

Hecticoceras sp. ind.
Kamptokephalites ? sp. ind.
Indosphinctes sp. ind. nov. ?
Binatisphinctes cf. *arlti* (Krenkel)

are undoubtedly Callovian, whilst

Lithacoceras jelskii (Siemiradzki)

is of uppermost Argovian or lowest Kimmeridgian age. The eighth example from the same locality, a septate fragment of a Perisphinctid, may belong to that new quadrate species of *Pachyplanulites* (?), discussed above. There are also 23 belemnites, mostly *Belemnopsis grantana* (d'Orbigny), but two of the examples had been labelled already by Crick *Belemnites coquandus*, d' Orbigny, a form comparable to the *Hibolites* (*Rhopaloteuthis*) of the *sauvanausus*-group, previously discussed.

(*d*) Also labelled as having been found " 10 miles northwest of Mombasa and 5 miles from the sea-shore on a sandy, clay, soil " (Mrs. Wake Bowell Collection), there are two ammonites

Katroliceras cf. *pottingeri* (Sowerby).
Waagenia cf. *hildebrandti* (Beyrich) (Text-Fig. 4 *c*)

that correspond with the *acanthicus* zone assemblage recorded by Beyrich and Futterer, and certainly indicate the Middle Kimmeridgian. They again show the more sandy, lighter matrix, like the lamellose *aptychus*-impression that includes the *Hemilytoceras* cf. *montanum* (Oppel), already recorded.

(*e*) Merely labelled " Mombasa," there is the unique

Mayaites ? sp. ind. cf. *olcostephanoides* (Tornquist)

in the British Museum (J. T. Last Colln.), which I first identified as of Argovian age, later doubtfully as " Indocephalites ? " and now again as probably a *Mayaites*. Its matrix, like that of the additional specimen in Miss McKinnon Wood's Collection from locality 15, is that of the Callovian, not the later forms. But this material was not zonally collected and there are in the neighbourhood of Mombasa undoubted Lower Argovian strata, compared by Dacqué to the beds with *Mayaites* from Mtaru in Tanganyika Territory.

(*f*) 14 fragments of Perisphinctids and 9 oz. belemnitos from Manguja (Jas. Scott Colln.) indicate Lower Kimmeridgian at Loc. 14.

D. GENERAL CONCLUSIONS.

In the discussion of the Jurassic ammonite faunas of Somaliland, in a previous volume of these Monographs, I gave a table of zones from the Kimmeridgian up. It will be convenient to extend this table downwards to the Bajocian, to serve as a basis for the present discussion, and at the same time to modify it in accordance with the results of more recent work. It will be seen that the " polyphemeral system " is not now adopted and there is a return to the older zones ; there are, of course, local subdivisions,

but they overlap in many ways. Buckman's methods have been tried and found wanting even in the case of the English Bajocian or Inferior Oolite ; it was probably the misleading nature and local variability of this comparatively unimportant formation that first started him off on what I now consider to be a wrong track. The Middle and Upper Jurassic zones now used are as follows :

Stages.	Ages.	Zones.	
Tithonian	(Aulacosphinctan)	*privasensis*	
		pronus	
Portlandian	(Virgatosphinctan)	*transitorius*	
	(Polytosphinctan)	*dorsoplanus*	
Kimmeridgian	(Pseudovirgatitan)	*palmatus*	
	(Lithacoceratan)	*steraspis*	*
	(Katroliceratan)	*beckeri*	*
	(Idoceratan)	*eudoxus*	*
		tenuilobatus	*
Argovian	(Perisphinctan)	*bimammatus*	*
		transversarius	*
	(Cardioceratan)	*cordatus*	*
Divesian	(Peltoceratan)	*renggeri*	
		lamberti	
		athleta	?
Callovian	(Reineckeian)	*anceps*	?
		rehmanni	*
	(Macrocephalitan)	*macrocephalus*	*
Bathonian	(Oxyceritan)	*aspidoides*	*
	(Siemiradzkian)	*subcontractus*	*
	(Zigzagiceratan)	*fusca*	?
	(Parkinsonian)	*parkinsoni*	?
	(Stephanoceratan)	*humphriesianum*	*
Bajocian	(Sonninian)	*sauzei*	*
		sowerbyi	
	(Ludwigian)	*concava*	
		murchisonae	
	(Lioceratan)	*opalinum*	
		aalensis	

Those marked with an asterisk are believed to be represented in the fauna here described, or at least in the Mombasa neighbourhood.

It will be seen from the lists given under C. that the great majority of the Mombasa ammonites belong to two faunas, namely a lower Kimmeridgian fauna (of *tenuilobatus* or " *acanthicus* " age) and a Callovian fauna. In addition there is evidence of the presence of Middle Kimmeridgian beds, of the Argovian, the Bathonian and the Upper Bajocian. The lowest zone represented is as yet matter of speculation, but the crushed ammonite figured in Pl. I., f. 4, as a doubtful *Dorsetensia* is not later than the *humphriesianum* zone of the Bajocian and may be even earlier. Bajocian ammonites occur in Madagascar and Persia ; and we know from the occurrence in Madagascar and Baluchistan of the specialised Domerian genus *Bouleiceras* that direct marine connexion must have existed already in Liassic times between Eastern Africa and the Persian Gulf. In the Bajocian also this connexion extended to the Sula Islands in the Dutch East Indies, New Guinea, and Western Australia. But the few Bajocian forms so far known from the Mombasa neighbourhood are insufficient for detailed comparison with the larger and more interesting fauna from Djebel Moghara, east of Suez. There, as well as in Kenya, the fossils of the Upper Bajocian were originally pyritised but are now limonitic ; in both localities *Phylloceras*, *Oppelia* and *Stephanoceras* of the *humphriesianum* group occur. The discovery, in Kenya or the neighbouring Tanganyika, of those peculiar elements that so far are known only from Djebel Moghara would settle the problem as to whether there was direct connexion between Uhlig's " Ethiopian province " and the region of the Mediterranean Tethys, not only indirect communication by way of the Himalayan sea. Douvillé, it may be remembered, thought that the whole region from Sinai to Madagascar showed very similar conditions of deposition during the Mesozoic Period. When discussing this question on a previous occasion, I thought that the incompleteness of the Jurassic Record and the enormous length of time it represented had been greatly

underestimated. This was voicing Buckman's teaching ; without going to the other extreme, in natural reaction, and rejecting all stratigraphical " refinement," I am now wondering whether anything but confusion has been gained by it.

The Callovian faunas of East Africa (Mombasa and Pendambili), Madagascar, and Kachh have been ably compared by Dacqué. In Kachh, a classic region for the Jurassic, the beds with the doubtful impressions of an " *Occotraustes*," were at first believed by the writer to be older than the Coral and Brachiopod limestones of the Patcham Group, but Mr. Raj Nath has now found fragments of *Sivajiceras* of the *congener* group in the lowest shaly beds at Nurrha that make it probable that they also belong to my *triangularis* subzone or the lowest *Macrocephalites*-beds. In other words the Patcham Group is entirely Callovian, if we draw the line between the Bathonian and Callovian at the base of the *macrocephalus* zone. This, however, may conceivably abolish the Bathonian altogether in those Southern regions where *Macrocephalites* originated. If, on the other hand, we draw the base of the Callovian at the top of the Wiltshire Cornbrash in the English type succession, the lower or true *macrocephalus* beds should be included in the Bathonian, which is contrary to Continental usage. In any case there are a number of species, especially of Macrocephalitids and Perisphinctids common to this Callovian of East Africa, Madagascar, and Kachh. But other Perisphinctids show affinity with European elements like *Binatisphinctes*, known from Kachh only in the *athleta* beds, and as in some of the more northern deposits, there is not a trace of Reineckeids from East Africa. The resemblance of the higher Callovian of the latter region to that of Madagascar and India is thus not very pronounced.

The few Argovian ammonites so far described from East Africa are insufficient for detailed comparison. Dacqué's *Peltoceras* aff. *arduennense* can be matched in Europe as well as in Kachh and in the Sula Islands, but the East African Mayaitids are rather distinct from the Kachh species as well as from the European *Tornquistes*. They may well form a strictly local element.

In the lower Kimmeridgian again, there are some species known from Kachh, like *Pachyplanulites subevolutus* and *P. subcolubrinus*, Waagen, from the Kantcote Ironstone or *Prososphinctes virguloides* and *Lithacoceras jelskii* from what Waagen considered to be identical beds on Gangta Bét. But there is a greater number of species common with the *tenuilobatus* beds of Europe, although no early typical *Streblites* have yet been found in the Lower Kimmeridgian of Mombasa, of Jubaland farther north, of Abyssinia and Somaliland. The Jubaland fauna consists of Perisphinctids only (referred to above as *Biplices africanus*, *Lithacoceras roubyanum* and *L.* cf. *fraasi*), and the Galla- and Somaliland species described by Dacqué are also largely Perisphinctids of limited value for correlation. But to his Abyssinian forms of *Idoceras* we can now add some very fine Somaliland forms, collected by Col. Farquharson since my account was published in 1925. Nothing like this *Idoceras* fauna is yet known from Kachh or Madagascar, but it might be compared to the Mexican *Idoceras*, described by Burckhardt, although they can, of course, also be matched in Europe.

The few higher Kimmeridgian ammonites and aptychi, known from the Mombasa neighbourhood, are also too scanty to add much to my previous discussion in connection with the Somaliland fauna. *Katroliceras pottingeri*, *Taramelliceras* cf. *kachhense*, and species of *Waagenia*, like those found in Kachh, indicate close affinity of the two deposits, but they are not sufficiently distinct from the elements of the Somaliland and Tunisian faunas to justify separation in a different province. Moreover, our knowledge of the Jurassic successions in this area is as yet in its infancy and every fresh discovery invalidates previous conclusions. On completion of the description of the ammonites of the much richer Kachh Jurassics, it will be necessary to return to these attempts at correlation.

EXPLANATION OF PLATES

PLATE I.

Fig. 1. *Phylloceras isotypum* (Benecke). Kimmeridgian. Changamwe. (Miss McKinnon Wood Colln.)
Fig. 2 (*a-d*). *Holcophylloceras mesolcum* (Dietrich). (*a*) Lower (?) Kimmeridgian. Changamwe. (*b-d*) Middle Kimmeridgian. Coroa Mombasa. (Miss McKinnon Wood Colln.)
Fig. 3. (*a-b*). *Binatisphinctes* ? sp. ind. Callovian. Hill N.E. of the Mteza Jetty. (Miss McKinnon Wood Colln.)
Fig. 4. *Binatisphinctes* aff. *credneri* (Krenkel). Callovian. Same locality and collection.
Fig. 5 (*a, b*). *Dorsetensia* sp. juv. ? cf. *edouardiana* (d'Orbigny). Upper Bajocian. Mombasa Pipe-line, miles 16-17. Same Colln. (5 *b* = same as *a*, enlarged two diameters.)
Fig. 6 (*a, b*). *Calliphylloceras demidoffi* (Rousseau). Callovian. Kenya–Uganda Rly., mile 9/14-15. Same colln.
Fig. 7. *Ptychophylloceras subptychoicum* (Dacqué). Lower Kimmeridgian. Changamwe. (B.M., No. C. 8137.)
Fig. 8 (*a-c*). *Ptychophylloceras vicarium* (Waagen). Callovian. Kenya–Uganda Rly., mile 9/14-15. (Miss McKinnon Wood Colln.)
Fig. 9. *Pleurocephalites* aff. *habyensis*, Spath. Callovian. Hill N.E. of the Mteza Jetty. Same colln.

PLATE II.

Fig. 1. *Phylloceras* (*Macrophylloceras* ?) *semiplicatum*, nom. nov. Callovian. Kenya–Uganda Rly., mile 9/14-15. (Miss McKinnon Wood Colln.)
Fig. 2. *Ptychophylloceras vicarium* (Waagen). Callovian. Same locality and collection.
Fig. 3. *Mayaites* ? sp. ind. cf. *olcostephanoides* (Tornquist). Argovian ? Mombasa. (B.M., No. C. 10988.)
Figs. 4, 5. *Hemilytoceras fraasi* (Dacqué). Kimmeridgian. Changamwe. (B.M., Nos. C. 8110 and 8899.)
Fig. 6. *Taramelliceras* cf. *trachinotum* (Oppel). Kimmeridgian. Changamwe. (B.M., No. C. 8136.)
Fig. 7. *Oppelia* sp. ind. Upper Bajocian. Mombasa Pipe-line, mile 11/11-13. (Miss McKinnon Wood Colln.)
Fig. 8 (*a-c*). *Pleurocephalites* ? sp. nov. Side-view and peripheral views of outer and inner whorls. Callovian. Kenya–Uganda Rly., mile 9/14-15. Same colln.
Fig. 9 (*a-c*). *Paroecotraustes conjungens* (Mayer). Callovian. Kenya–Uganda Rly., mile 9/14-15. Same colln.
Fig. 10. *Alcidia* sp. ind. Callovian. Same locality and colln.
Figs. 11, 12 (*a, b*). *Alcidia mombasensis*, sp. nov. Callovian. Holotype (11) and side and peripheral views of a paratype (12 *a, b*). Same locality and colln.
Fig. 13. *Sublunuloceras* aff. *dynastes* (Waagen). Callovian. Peripheral view. Same locality and colln.
Fig. 14. *Alcidia obsoleta* (Rollier). Callovian. Same locality and colln.
Fig. 15. *Paroecotraustes* aff. *serrigerus* (Waagen). Callovian. Same locality and colln.
Fig. 16. *Lunuloceras* ? sp. ind. Callovian. Hill N.E. of the Mteza Jetty. Same colln.

PLATE III.

Fig. 1. *Lithacoceras fraasi* (Dacqué). Kimmeridgian. Changamwe. (B.M., No. C. 8154.)
Fig. 2. *Macrocephalites chariense* (Waagen) var. *simplex* nov. Callovian. Kenya–Uganda Rly., mile 9/14-15. (Miss McKinnon Wood Colln.)
Fig. 3. *Katroliceras* sp. ind. Middle Kimmeridgian. Coroa Mombasa. Same colln.
Fig. 4. *Waagenia* aff. *hybonota* (Oppel). Middle Kimmeridgian. Same locality and colln.
Fig. 5 (*a, b*). *Prososphinctes idoceroides*, sp. nov. Kimmeridgian. Changamwe. (B.M., No. C. 8147.)
Fig. 6. *Torquatisphinctes beyrichi* (Futterer). Kimmeridgian. Changamwe. (B.M., No. C. 8932).
Fig. 7. *Dichotomosphinctes krapfi* (Dacqué). Kimmeridgian. Changamwe. (B.M., No. C. 8149).
Fig. 8. *Lithacoceras castroi* (Choffat). Kimmeridgian. Changamwe. (B.M., No. C. 8113.)

PLATE IV.

Fig. 1 (*a, b*). *Lithacoceras mombassanum* (Dacqué) var. *euglypha* nov. Kimmeridgian. Changamwe. (Miss McKinnon Wood Colln.)
Fig. 2 (*a, b*). *Choffatia* aff. *lateralis* (Waagen). Callovian, Kenya–Uganda Rly., mile 9/14-15. (Miss McKinnon Wood Colln.)
Fig. 3 (*a, b*). *Indosphinctes* cf. *abichi* (Neumayr and Uhlig). Callovian. Same locality and colln.
Fig. 4. *Grossouvria* cf. *elegans* (Siemiradzki). Callovian. Same locality and colln.
Fig. 5 (*a, b*). *Grossouvria* cf. *curvicosta* (Oppel) auct. Callovian. Same locality and colln.
Fig. 6. *Indosphinctes* cf. *abichi* (Neumayr and Uhlig). Peripheral view of an immature example. Callovian. Hill N.E. of Mteza Jetty. Same colln.
Fig. 7. *Grossouvria* aff. *gracilis* (Siemiradzki). Callovian. Kenya–Uganda Rly., mile 9/14-15. Same colln.

Fig. 8. *Binatisphinctes* sp. ind. cf. *credneri* (Krenkel). Callovian. Hill N.E. of the Mteza Jetty. Same colln.
Fig. 9. *Pachyplanulites subevolutus* (Waagen). Lower Kimmeridgian. Changamwe. (Miss McKinnon Wood Colln.)
Fig. 10. *Grossouvria* aff. *evexa* (Quenstedt). Callovian. Kenya–Uganda Rly., mile 9/14-15. Same colln.
Fig. 11. *Grossouvria* cf. *elegans* (Siemiradzki). Callovian. Same locality and colln.
Fig. 12. *Biplices africanus* (Dacqué). Kimmeridgian. Changamwe. Same colln.
Fig. 13. *Choffatia* aff. *recuperoi* (Gemmellaro). Callovian. Kenya–Uganda Rly., mile 9/14-15. Same colln.
Fig. 14 (*a*, *b*). *Lithacoceras torquatiforme*, sp. nov. Kimmeridgian. Holotype. Changamwe. Same colln.

PLATE V.

Fig. 1 (*a*, *b*). *Indosphinctes* aff. *subpatina* (Petitclerc). Callovian. Kenya–Uganda Rly., mile 9/14-15. (Miss McKinnon Wood Colln.)
Fig. 2 (*a*, *b*). *Grossouvria* aff. *evexa* (Quenstedt). Callovian. Same locality and colln.
Fig. 3. *Binatisphinctes* aff. *credneri* (Krenkel). Callovian. Hill N.E. of the Mteza Jetty. Same colln.
Fig. 4. *Grossouvria* cf. *elegans* (Siemiradzki). Callovian. Kenya–Uganda Rly., mile 9/14-15. Same colln.
Fig. 5 (*a*, *b*). *Lithacoceras kenyaense*, sp. nov Holotype (reduced to $\frac{5}{6}$ linear) and outline whorl-section. Kimmeridgian. Changamwe. Same colln.
Fig. 6. *Choffatia* aff. *recuperoi* (Gemmellaro). Callovian. Kenya–Uganda Rly., mile 9/14-15. Same colln.
Figs. 7, 8. *Grossouvria* aff. *evexa* (Quenstedt). Callovian. Same locality and colln.

PLATE VI.

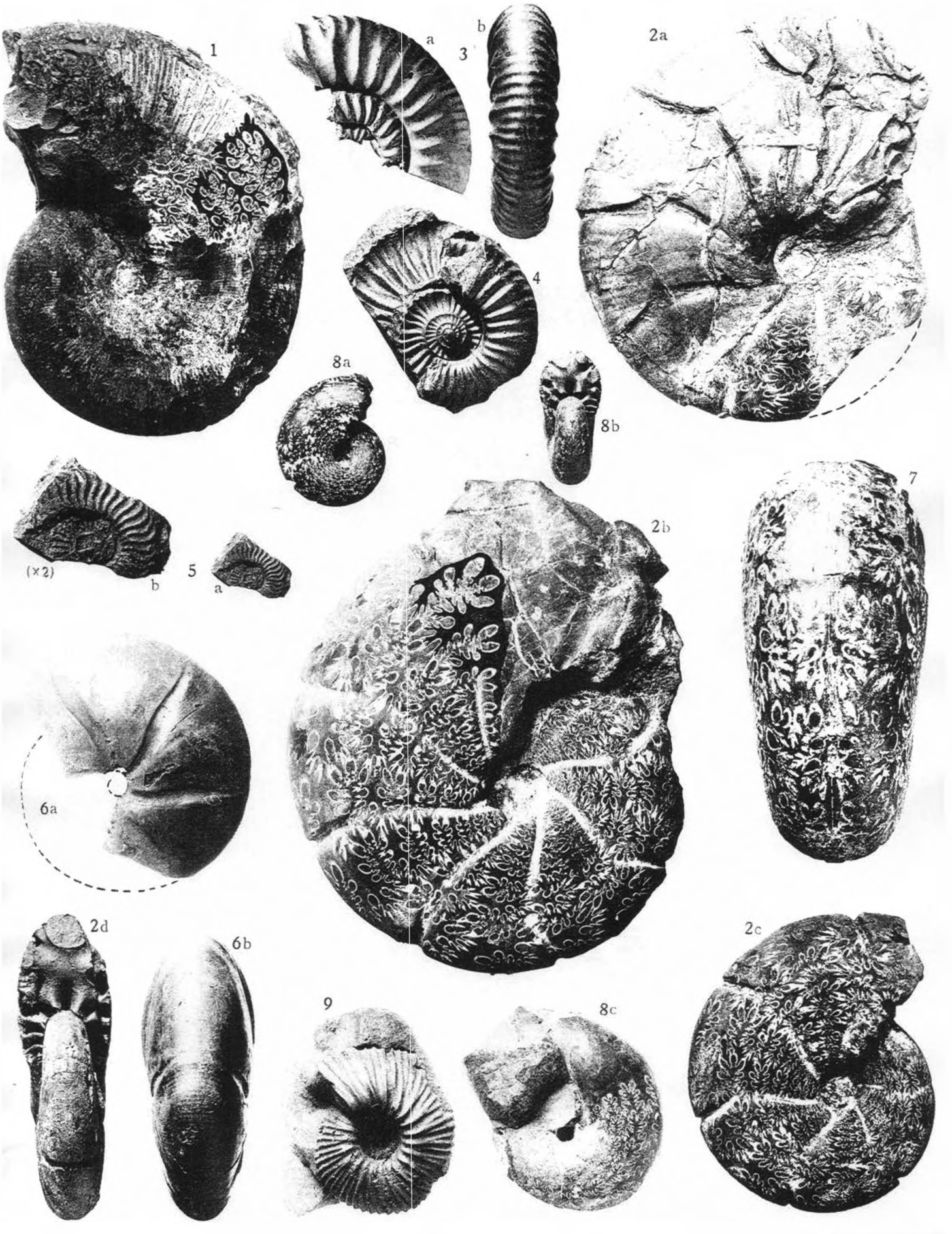
Fig. 1 (*a*, *b*). *Dichotomoceras anomalum*, sp. nov. Side and peripheral views of holotype. Lower Kimmeridgian. Changamwe. (B.M., No. C. 8148.)
Fig. 2 (*a*, *b*). *Lithacoceras fraasi* (Dacqué). Kimmeridgian. Changamwe. (B.M., No. C. 8930.)
Fig. 3. *Lithacoceras capillaceum* (Fontannes). Kimmeridgian. Changamwe. (B.M., No. C. 8105.)
Fig. 4. *Subgrossouvria* ? sp. ind. Callovian. Kenya–Uganda Rly., mile 9/14-15. (Miss McKinnon Wood Colln.)
Fig. 5. *Aspidoceras* cf. *ægir* (Oppel). Upper Argovian (? *bimammatus* zone). Changamwe. (B.M., No. C. 10881.)
Fig. 6 (*a*, *b*). *Lithacoceras* aff. *unicomptum* (Fontannes). Kimmeridgian. Changamwe. (B.M., No. C. 8145.)
Fig. 7 (*a*, *b*). *Pachyplanulites subevolutus* (Waagen). Lower Kimmeridgian. Changamwe. (B.M., No. C. 8124.)

PLATE VII.

Fig. 1. *Acanthosphaerites* aff. *iphiceroides* (Waagen). Kimmeridgian. Coroa Mombasa. (Miss McKinnon Wood Colln.)
Fig. 2. *Indosphinctes* sp. ind. Callovian. Hill N.E. of the Mteza Jetty. Same colln.
Fig. 3 (*a*, *b*). *Hubertoceras arcicosta* (Waagen). Callovian. Same locality and colln.
Fig. 4 (*a*, *b*). *Subgrossouvria* ? sp. ind. Callovian. Kenya–Uganda Rly., mile 9/14-15. Same colln.
Fig. 5 (*a*, *b*). *Lithacoceras fraasi* (Dacqué). Kimmeridgian. Changamwe. (B.M., No. C. 8931.)
Fig. 6. *Acanthosphaerites* aff. *longispinus* (Sowerby). Kimmeridgian. Changamwe. (B.M., No. C. 8131.)
Fig. 7. *Grossouvria* aff. *evexa* (Quenstedt). Callovian. Kenya–Uganda Rly., mile 9/14-15. (Miss McKinnon Wood Colln.)
Fig. 8. *Acanthosphaerites* aff. *iphiceroides* (Waagen). Kimmeridgian. Changamwe. Same colln.

PLATE VIII.

Fig. 1. *Grossouvria* aff. *gracilis* (Siemiradzki). Callovian. Kenya–Uganda Rly., mile 9/14-15. (Miss McKinnon Wood Colln.)
Fig. 2 (*a*, *b*). *Lithacoceras geron* (Zittel). Kimmeridgian. Changamwe. (B.M., No. C. 8112.)
Fig. 3. *Acanthosphaerites* aff. *deaki* (Herbich). (? Transition to *A. microplus*, Oppel). Kimmeridgian. Changamwe. (B.M., No. C. 8157.)
Fig. 4 (*a*, *b*). *Biplices* aff. *africanus* (Dacqué). Kimmeridgian. Changamwe. (B.M., No. C. 8144.)
Figs. 5, 6. *Acanthosphaerites deaki* (Herbich). Kimmeridgian. Coroa Mombasa. (Miss McKinnon Wood Colln.) [5] and Changamwe. (B.M., No. C. 8134 [6].)



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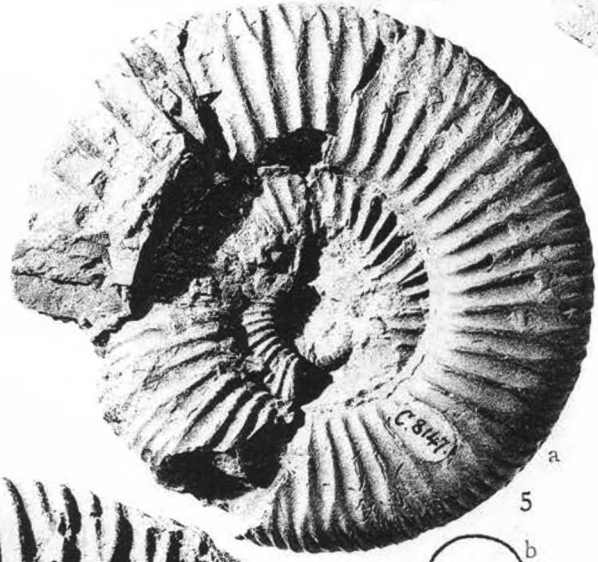

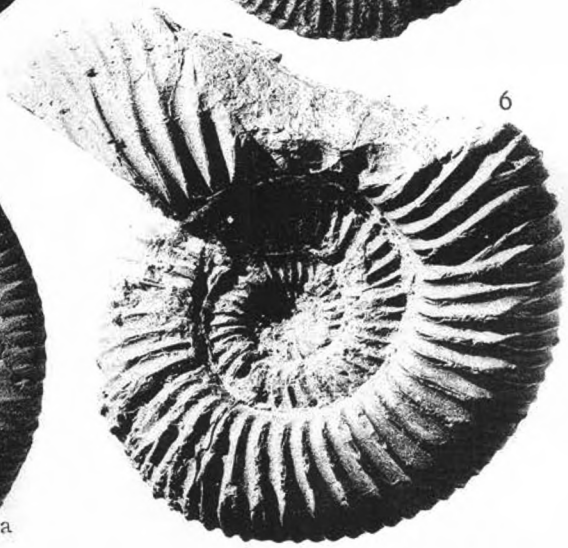

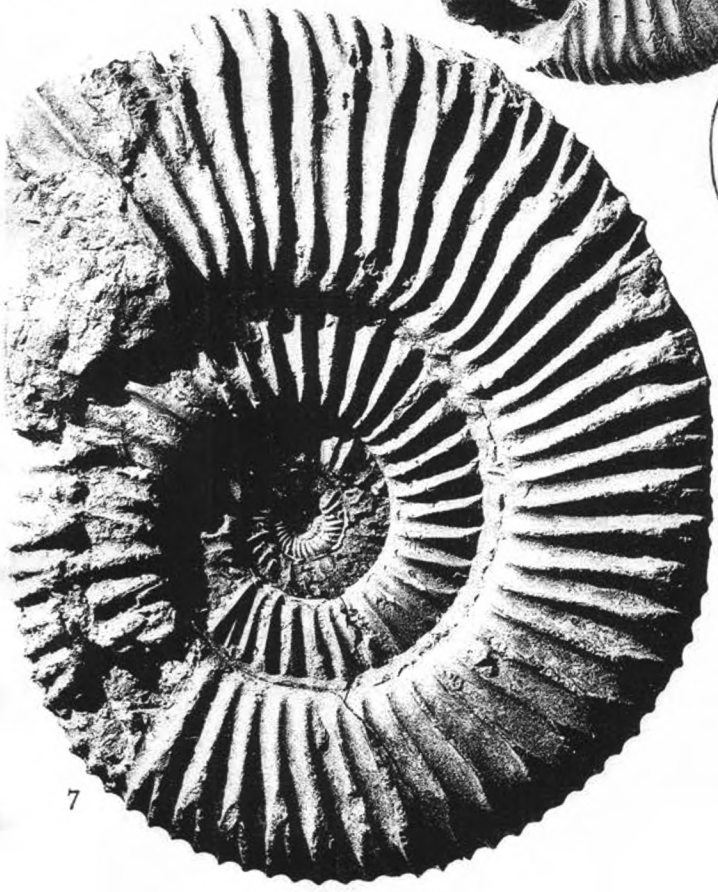

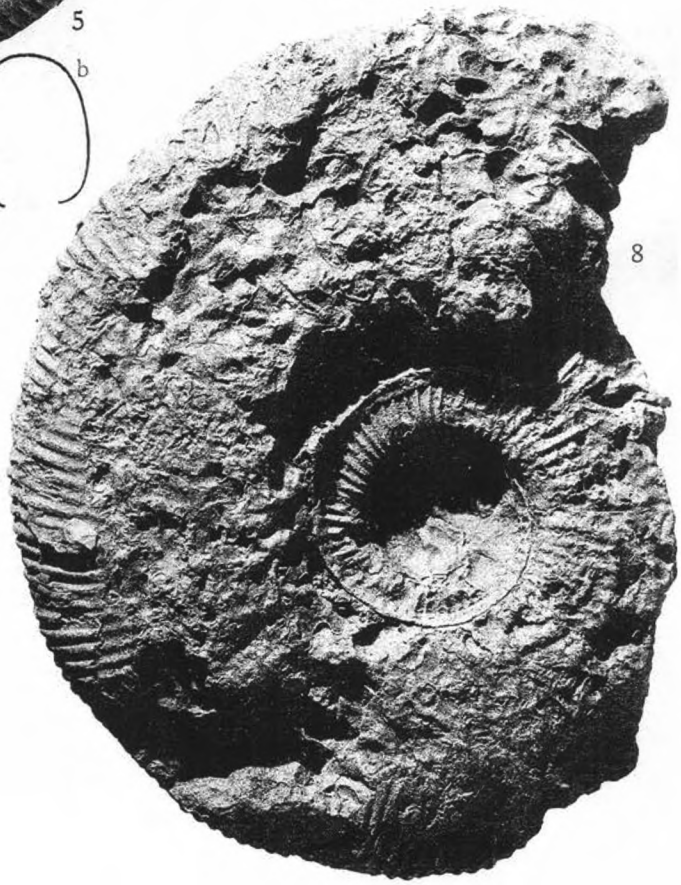

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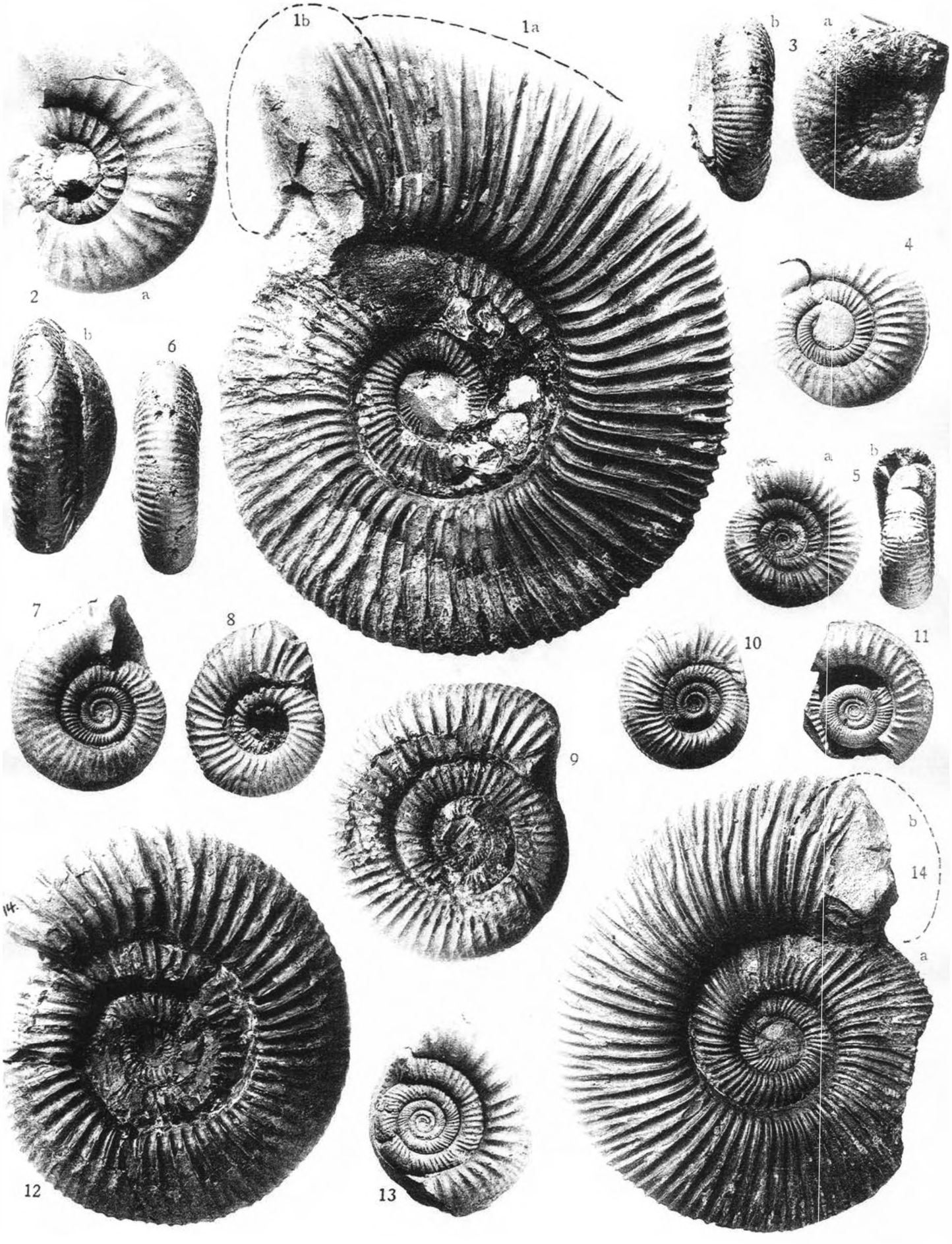

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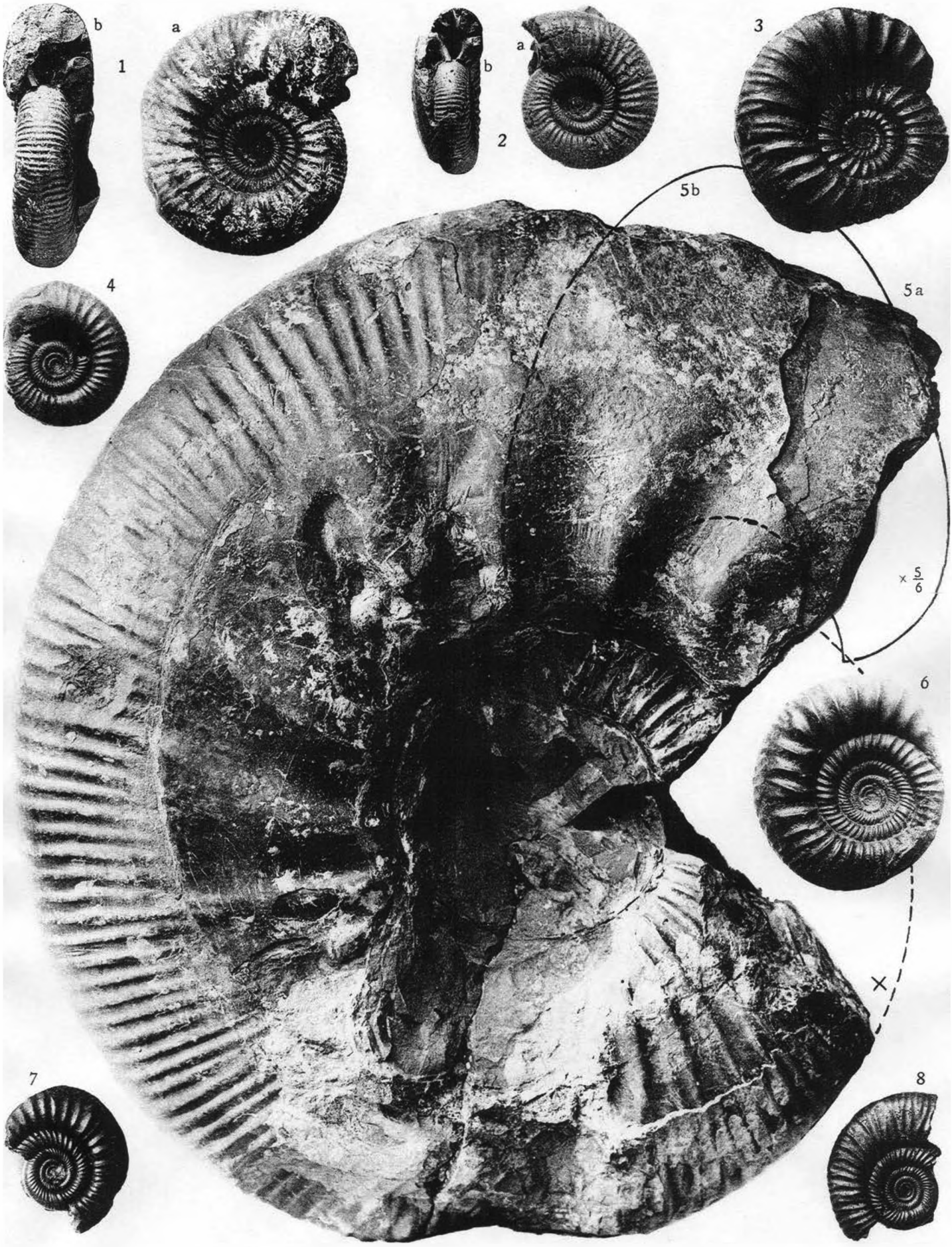

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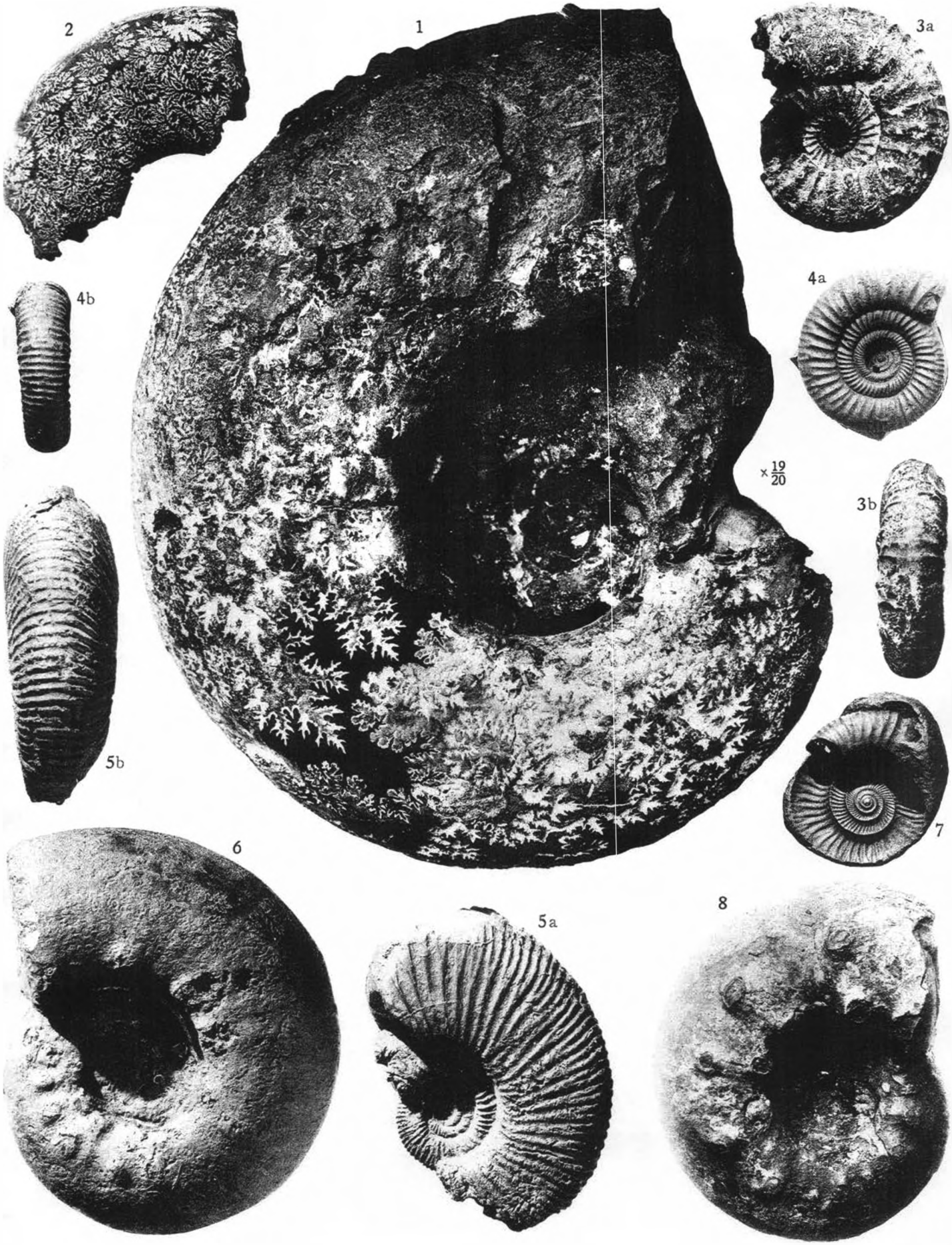

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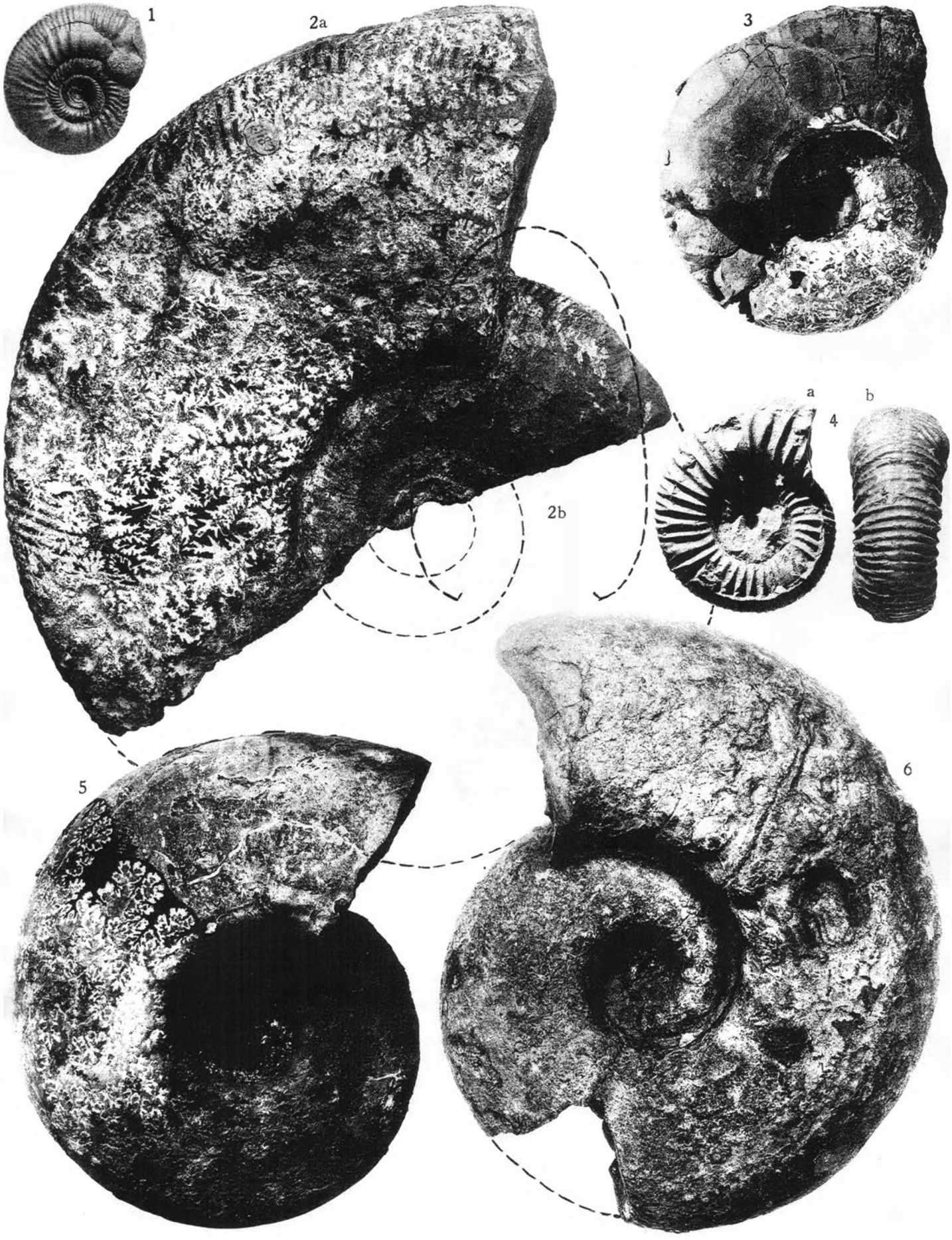

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