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ADDITIONS TO THE EO-TRIASSIC INVERTEBRATE FAUNA OF EAST GREENLAND

BY

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WITH 5 TEXT-FIGURES AND 23 PLATES

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CONTENTS

A. INTRODUCTION

The present paper is an amplification of my previous account of the Eo-Triassic Invertebrate Fauna of East Greenland which appeared in Vol. LXXXIII of these memoirs (1930). That paper dealt with the fossils that had been collected in East Greenland between 1927 and 1929; and although I had then a considerable number of specimens, they belonged largely to comparatively few, common forms, while the majority remained incompletely known, being represented only by poorly preserved examples. Moreover, the absence of accurate stratigraphical information necessitated the succession in time of the *Ophiceras*-, the *Vishnuites*-, and the *Proptychites*-beds, respectively, being put forward as little more than a guess. My critics thus missed the importance, for general correlation, of the Eo-Triassic of East Greenland. Arthaber[1]) called it a limited, local fauna and, apparently, was under the impression that I had created 24 genera and sub-genera for 21 species of ammonites. In reality, these were distributed among only five genera and two sub-genera, one of each being new. Kutassy[2]) echoed the same opinions and complained that I put nearly every new species into a new sub-genus. A glance at the greatly augmented list of species now recorded from East Greenland will show how little justification there is for these complaints.

In the present memoir the number of East Greenland ammonites is brought up to a total of 46 (or 47) species and 20 varieties, but the number of genera is not increased; there are, however, three new sub-genera. Of the six genera known from East Greenland, five thus date from the last century. There was a good deal of condensed systematic matter in the previous volume, incorporated partly on account of the long delay in the publication of my Catalogue of the Triassic Ammonoidea in the British Museum. Since this fuller discussion, however, is now available, the classification proposed in the Catalogue will here be adopted, thus simplifying the systematic arrangement. In the chapter on the

[1]) N. Jahrb. f. Min. etc. Ref. 1931, III, p. 630

[2]) Fossilium Catalogus, I, pars 56 (1933), p. 378

palaeontological results of the present enquiry I am attempting to justify the elasticity of my classification and to meet the criticisms so far encountered.

The new material now described includes in the first place the additional collections of Lauge Koch, Noe-Nygaard and R. Bøgvad, made in 1930 and 1931 and already referred to in Dr. Lauge Koch's "Carboniferous and Triassic Stratigraphy of East Greenland".[1]) The lists there given, however, based on my provisional identifications, neither included the new forms, nor were the stratigraphical divisions as yet sufficiently clear to emphasise the differences in the various, similar, *Ophiceras* faunas. The importance of one of these, in particular, namely the Cape Stosch No. 7 assemblage, was completely missed by the writer, owing to the attempt to accomodate the different forms in existing species. Then Mr. Noe-Nygaard, who had been at work in the southern Triassic area during the autumn and winter of 1931 and in 1932, sent his collections; and the most comprehensive collections of all, with excellent stratigraphical summaries, by Mr. Eigil Nielsen, reached me during 1932 and 1933. Since the work of Mr. Nielsen forms the subject of a separate memoir in this publication, it will be unnecessary here to go into geological details or to discuss the localities, apart from the faunal sequences. Localities that are not listed in Section C have been added to the locality numbers in the case of the figured specimens only.

My thanks are due to Dr. Lauge Koch, the leader of all these Danish expeditions to East Greenland, for entrusting me with the description of the rich new collections and for giving me a free hand with the illustrations, and to Messrs. Eigil Nielsen and Noe-Nygaard for communicating to me the stratigraphical information with all the necessary detail; also to the Keeper of the Geology Department of the British Museum (Natural History), Dr. W. D. Lang, for again giving me all facilities in connection with the storing and the preparation of the new collections.

Throughout this work, as in my Monograph of the Ammonoidea of the Gault and in my Trias Catalogue, I am distinguishing the illustrations here given by using capitals for the plates (for example, Plate VII) as against small letters (pl. vii) for figures in other publications, or in the previous memoir. All the ammonites previously described are rediscussed because these fossils form the most important faunal element in the Eo-Triassic deposits of East Greenland. Only nine new species of other invertebrates (not including some annelid remains) are described, while two forms of *Anodontophora* have been given new names. The total of all the groups of invertebrates, excluding the ammonites, is still only thirty-two.

[1]) Medd. om Grønl. vol. LXXXIII (1931).

B. SPECIFIC DESCRIPTIONS

I. *Phylum Mollusca.*

a. Class *Cephalopoda.*

Order *Ammonoidea.*

Family *Otoceratidae*, Hyatt, 1900.

The close affinity of this family with the unkeeled Ophiceratidae was discussed in my Trias Catalogue. I may direct attention in this connection to the very curious form here described as *Proptychites anomalus*, with its unusual suture-line, having a very wide first lateral lobe. This somewhat resembles the suture-line of *Otoceras*, just as another Proptychitid, namely *Pachyproptychites otoceratoides* (Diener) resembles *Otoceras* in its flared umbilical edge. Since *Proptychites* has now been found associated with *Ophiceras*, if not *Otoceras*, it is propable that they all have a common origin, and that the presence of a keel in *Otoceras* is of no more significance than it is in *Vishnuites*. *Otoceras* cannot thus be grouped in a different sub-order or super-family on account of the presence of a keel.

The range of *Otoceras* in East Greenland is now known to extend through about 400 feet of strata and it is associated at first with *Glyptophiceras* and then with *Ophiceras*, but it has completely disappeared in the lower *Vishnuites* beds.

Genus *OTOCERAS*, Griesbach 1880.

Otoceras boreale, nom. nov.

Plate I, figs. 1a,b, 6; Plate II, figs. 2—3; Plate III, figs. 1—3; Plate IV, fig. 1; Plate V, fig. 1; Plate VI, fig. 8.

1930. *Otoceras* aff. *fissisellatum*, Diener: Spath, "Eotriassic Invertebrate Fauna of E. Greenland", *loc. cit.*, p. 10, pl. I, figs. 1a-d.

1931. — - - Diener: Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, pp. 79, etc.

1934. — - - Diener: Spath, B. M. Catalogue, vol. IV, p. 68.

I previously recorded the occurrence of about a dozen individuals from Clavering Island, but they were so fragmentary that it remained uncertain whether they all belonged to one species. I suggested that on the discovery of better material the Arctic forms may turn out to represent a species-group of *Otoceras* with its own, local, characteristics. Although there are now numerous specimens from many localities on the north coast of Hold-with-Hope, as well as from Clavering Island, there is not a single, complete example, so that it has been necessary to illustrate a number of specimens. Some of these show the suture-line and whorl-shape (Plate III, fig. 1), but most examples are crushed and flattened, and except in the case of a few small examples (e. g. Pl. III, figs. 2—3) only one side is preserved. The outline whorl-section given in Plate I, fig. 1b is thus restored, but this example, like that represented in Plate II, fig. 2, shows the characteristic, spiral depression just outside the prominent, umbilical rim and the faint, wavy folds on the lateral area. The two or three spiral ridges, below the keel, on each side, already noticed in the previous account, are still clearly visible in the large fragment figured in Plate V, fig. 1, but the sigmoidal striation of the test is best seen in the crushed body-chamber portion represented in Plate IV, fig. 1. Compared with the similar fragment figured in 1930 (pl. i, fig. 1a) there seems to be a difference in the width of the umbilicus, but this is now believed to be entirely due to the compression in the rock. Thus the fragment illustrated in Plate I, fig. 6, is quite flattened, and does not even show the flared, umbilical rim, but a comparison of figs. 3a (Plate II), and figs. 1b, 2b and 3b (Plate III) will show that the whorl-section of uncrushed examples is tolerably uniform and essentially the same as previously figured (1930, pl. i, fig. 1d), except in one small example (No. 175). This has a much wider ventral area than the other specimens, flatter even than that of d'Orbigny's[1]) drawing of *Asteroceras stellare* (non Sowerby), but with concave inner whorl-sides. This section is quite unlike that of any Himalayan species of *Otoceras* and might be compared to that of the Permian *Prototoceras trochoides* (Abich)[2]), except for the presence of three keels in addition to two more ventro-lateral edges, and the greater thickness. The suture-line is sufficiently shown to prove that the specimen is not a *Prototoceras* and it is apparently similar to the suture-line of all the other examples of the present species.

The suture-line was incompletely known when I compared the Arctic forms to Diener's *O. fissisellatum*, chiefly on the strength of the bifid second lateral saddle. But the double saddle figured in 1930 (fig. 1b,

[1]) Paléont. Française, Terr. Jurass. I. Céphalopodes, 1844, pl. xiv, fig. 2.

[2]) See Frech und Arthaber, Palaeozoicum in Armenien und Persien. Beitr. Pal. Geol. Österr.-Ung. etc., vol. xii (1898), pl. xix, figs. 1—3.

pl. I) was the first auxiliary saddle, followed by two more simple saddles on the umbilical slope; and on comparing the complete suture-lines now illustrated with those of the Himalayan forms figured by Diener[1]) it will be seen that there are other differences, especially in the subdivision of the first lateral lobe. In view of the fact that, for example, *O. draupadi*, Diener[2]) may show different saddles on opposite sides, it would seem futile to stress these differences. The details of the incisions in the first lateral lobe also vary considerably in the three suture-lines of the present species represented in Plate I, fig. 6, Plate III, fig. 1 a, and Plate VI, fig. 8, and the auxiliary saddles on the umbilical slope, especially, may differ within rather wide limits. But the internal (dorsal) portion of the suture-line (see Plate II, fig. 3 b) is again quite different from that of the Himalayan *O. woodwardi* Griesbach, as figured by Diener[3]). Since all the species of *Otoceras* are closely allied, it seems that the peculiarities of its suture-line alone justify the specific separation of *O. boreale*.

There are two other features, however, that could be taken to support this separation, namely the gigantic size of the Arctic forms and their occurrence at a higher level than the examples described below under *Otoceras* sp. ind. The fragment figured in Plate III, fig. 1 is septate to a diameter of over 200 mm. Allowing for half a whorl of body-chamber, this example originally cannot have been less than 300 mm in diameter, whereas the largest Himalayan specimen of *O. woodwardi* although entirely chambered, measured only 152 mm. It could be claimed that those other species of *Otoceras* that come closer to the present form in their suture-lines, are only known in comparatively small specimens, and that comparison with the large boreal form is therefore difficult. At the diameter of the two small examples now figured in Plate III, figs. 2–3, however, the whorl-shape of *O. boreale* is also distinct from that of any of Diener's species.

Horizon: Upper Otoceratan, Upper and Lower *Ophiceras* beds.

Localities: 1930: Clavering Island 6 (2); 1932–33: 115—116 (1); 118 (Plate I, fig. 6); 174 (1); 175 (1); 243 (8); 309 (5, including Plate IV, fig. 1); 310 (9, including Plate III, figs. 2, 3, Plate VI, fig. 8); 340 (Plate V, fig. 1); 349 (Plate I, fig. 1); 382 (1); 386 (Plate II, fig. 3); 413 (1); 436 (5); 452 (1); 459 (1); 524 (4); 543 (2); 582 (Plate III, fig. 1); 658 (1); 660 (2); 661 (2); 674 (1); 701 (Plate II, fig. 2); 769 (1); 786 (2); 787 (2).

[1]) Cephalopoda of the Lower Trias. Pal. Indica, ser. XV, Himalayan Fossils, vol. II, pt. 1, 1897, pls. II–V.

[2]) *Ibid.*, p. 164, pl. IV, figs. 3a, b.

[3]) *Ibid.*, pl. VII, fig. 16.

Otoceras sp. ind.

(Plate III, fig. 4; Plate VI, fig. 7?)

1931. *Otoceras* aff. *woodwardi*, Griesbach: Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, p. 79.

A number of specimens of *Otoceras* have been collected in the *Glyptophiceras* beds; but they are mostly crushed fragments and in the absence of the characteristic, projecting umbilical edge, identification may not be easy. The suture-line was preserved in but a single fragment (Plate VI, fig. 7) which is almost unrecognisable and badly worn; but the two double saddles are so similar to the second lateral- and first auxiliary saddles of *O. boreale* that the *Otoceras* remains in the lower beds could have been taken to be specifically identical with *O. boreale*. There is, however, a single uncrushed example which shows a far more inflated whorl-section than *O. boreale*, as will be seen on comparing fig. 3a of Plate II with fig. 4 of Plate III. The difference is especially marked in the dorsal area and the fastigate periphery of the fragment here described is even less acute on the inner whorl than in the similar *O. woodwardi*, Griesbach[1]) with which I at first compared this fragment.

It is, of course, impossible to state whether the *Otoceras* remains in the lower beds all belong to the same species and whether this differs from the later *O. boreale* merely in the whorl-section. It is, however, important to note that the earlier examples include some of considerable size, at least as large as *O. woodwardi*, and that the suture-line shows no resemblance to that of the far less megalomorph Permian *Prototoceras*.

Horizon:— Lower Otoceratan, lower *Glyptophiceras* beds.

Localities:— 1930 and 1931:— Cape Stosch 25 and 25a (6, including Plate III, fig. 4); 1932:— 264 (3, including Plate VI, fig. 7); 606 (1, in matrix of Plate XIV, fig. 7).

Family *Ophiceratidae*, Arthaber emend.

The recognition, within *Ophiceras*, of the sub-genera *Acanthophiceras*, Diener (for the forms with distant, blunt, lateral bulges), and of *Lytophiceras*, Spath (for the more compressed forms of the *chamunda-sakuntala* group), prompts the creation of two more sub-genera to accomodate the very discoidal and flattened forms of the *subkyokticum-wordiei* type on the one hand *(Discophiceras)* and the very loosely-coiled species of the *subdemissum* group on the other *(Metophiceras)*. The last is transitional to *Glyptophiceras* and has a suture-line distinct from that of all the other groups. *Discophiceras* appears to lead to some

[1]) See Diener, *loc. cit.* (1897), pls. II and III.

Paranoritids, but the most interesting passage-form is *O. (Lytophiceras) dubium*, sp. nov., with a truncate venter on the inner whorls of most of the individuals.

Genus *OPHICERAS*, Griesbach, 1880.

Ophiceras greenlandicum, Spath.

Plate II, figs. 1a,b; Plate V, figs. 5a,b; Plate X, figs. 1a,b; Plate XIX, figs. 11a,b.

1930. *Ophiceras greenlandicum*, Spath: Eotriassic Invertebrate Fauna of E. Greenland, *loc cit.*, p. 16, pl. II, figs. 12a,b.
1931. — — , Spath; Lauge Koch: Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, p. 81.

The holotype of this species, figured in 1930, shows the characteristic shape and coiling, also the suture-line, but the ornamentation is seen more distinctly on the example now figured in Plate V, figs. 5a,b. This ornamentation consists of blunt, almost rursiradiate, folds which tend to become more closely-spaced on the body-chamber, and there may be fine striae in between the larger folds. In the fragment represented in Plate II, figs. 1a,b, which may be separated as a var. *crassa* nov., the ribbing has become unusually distinct, suggesting a transition to *Glyptophiceras* as well as to *Acanthophiceras*. The high umbilical slope and comparatively small umbilicus, however, allow of easy distinction from the former, while *Acanthophiceras* has distant bulges of a different type, as can be seen on comparison with fig. 3 of Plate V[1]).

Another example figured in Plate X, figs. 1a,b has flatter whorl-sides, noticeable especially on the earlier volutions, in the umbilicus. It shows some resemblance to the Himalayan *O. platyspira*, Diener[2]), except in the whorl-section, and may be separated as a var. ***subplatyspira***, nov.; it differs but little from the holotype in proportions, as will be seen from the following table:—

	Diameter mm	Whorl-height %	Thickness %	Umbilicus %
Holotype	85	34	26	41
Plate V, fig. 5	73	36	27	40
var. *subplatyspira* ..	89	35	28	39

The largest fragments now available (e. g. 243x) indicate that this species reached a diameter of over 110 mm.

The transitional example previously figured (pl. I, fig. 2) as a passage-form to *O. sakuntala* is now referred to the var. *aperta* of *O. commune*, being identical with the example here figured in Plate IV, figs.

[1]) See also Diener, *loc. cit.* (1897), pl. IX, fig. 4a.
[2]) *Loc. cit* (1897), pl. XII, fig. 5.

3a,b. The second, crushed example omitted in the above synonymy (my previous pl. IV, fig. 5) cannot be definitely identified with *O. greenlandicum* as it is too immature. The more favourably preserved immature specimen, however, figured in 1930 in pl. IV, fig. 12 is identical with the larger example represented in Plate XV, fig. 9 which illustrates the appearance of a form like *O. (L.) commune*, var. *aperta* at an intermediate, adolescent stage. Its suture-line is similar to that of the other example of *O. (L.) commune*, figured on the same plate (fig. 4). The whorl-shape in the two species is already distinct at a small diameter and the inner whorls of *O. greenlandicum* are less discoidal, less involute and less compressed. These small examples are difficult to distinguish from inner whorls of the smooth *O. medium*, Griesbach and the external lobe in some is almost as sharply bifid as in Diener's[1] drawing of the suture-line of the Himalayan form.

The body-chamber fragment figured in Plate XIX, figs. 11a,b, has an unusual and markedly trigonal whorl-section, with comparatively narrow periphery, but strongly convergent sides and a very prominent umbilical edge. Since it is the only example seen and since its septate whorls are unknown, it can only doubfully be attached to the present species. Yet it emphazises the most conspicuous distinguishing feature between *O. greenlandicum* and the closely allied, smaller *O. subsakuntala*, namely, the difference in whorl-section.

Horizon:— Upper Otoceratan, *Ophiceras* beds (upper).

Localities:— Many localities between Rivers 1 and 16, e. g. 436, 547, 690 (see Section C), also 1 (1930) and Clavering Island (loc. 780).

Ophiceras transitorium Spath.

Plate VI, figs. 1a,b; Plate VII, fig. 1; Plate IX, figs. 2a,b; Plate XI, figs. 1a,b,2; Plate XII, figs. 4a,b.

1930. *Ophiceras transitorium* Spath: Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 17, pl. II, figs. 10a,b.

1931. Spath: Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, p. 84.

The holotype of this species is rather small, but two typical, larger examples are now figured in Plate VI, fig. 1, and Plate XII, fig. 4. Unfortunately, the periphery is weathered in both and in fig. 1b (Plate VI) the left-hand half of the external lobe therefore appears shorter than the right-hand half. Corrosion of the periphery has also affected the shape of the ventral lobe in the ribbed example figured in Plate IX, fig. 2 and the periphery is almost fastigate, whereas in typical examples it is evenly arched. Since the present species occurs together with keeled forms of *Vishnuites* and since they may all be affected by similar corrosion of the ventral area, it is often impossible correctly to identify poorly-preserved or transitional fragments.

In spite of the corrosion, the ribbing seen in the example last discussed (Plate IX, fig. 2) is too distinct to unite it with the perfectly smooth, typical forms (which, however, are always internal casts). It may therefore be separated as a var. ***costata***, nov., the ribbing corresponding to that found in *O. greenlandicum* (Plate V, fig. 5a) or in *O. tibeticum*, Griesbach[1]).

The suture-line (Plate XI, fig. 2) is slightly more advanced than that of the two species just mentioned, the saddles being more elongated, but there is often asymmetry of the two sides, the width of the second, lateral saddle especially being variable. On account of the unusual width of the first, lateral saddle, however, on both sides, in the form figured in Plate XI, figs. 1a,b, it may be convenient to separate this as a var. ***latisellata***, nov. The difference in the isolated suture-lines (figs. 1b and 2 of Plate XI) is slight, but the appearance, in side-view (fig. 1a) is considerably changed in this variety, as compared with typical examples.

In some examples the whorl-thickness is reduced and these are therefore transitional to *O. (L.) vishnuoides* on the one hand and to *Proptychites simplex* on the other.

The specimen represented in Plate VII, fig. 1 has the inner whorls rather poorly exposed but it is fairly complete and is now figured because it is usually large, and because it has an elliptical outline. Diener characterised *O. serpentinum* and *O. chamunda* as merely elliptical varieties of *O. tibeticum* and *O. sakuntala*, respectively, and in my previous account of *O. chamunda* I made it clear that I attached no value to the elliptical distortion. Yet since Arthaber[2]) went out of his way to assert that not a single specimen of the Greenland forms of *Ophiceras* showed this elliptical mode of growth, I thought it advisable to figure some examples, including *O. transitorium* which is particularly often distorted, although the Greenland Triassic rocks are neither mechanically deformed not metamorphosed, as are their Himalayan equivalents.

The large example has the following dimensions:—

Diameter	98 mm
Height of last whorl (in % of diameter)	38 %
Thickness	28 %
Umbilicus	36 %

[1]) See Diener, *loc. cit.* (1897), pl. VIII, fig. 1.
[2]) N. Jahrb. f. Min. etc. (Ref)., 1931, III, p. 629.

It therefore has only a slightly smaller umbilicus than the superficially similar *O. greenlandicum*, but the absence of a distinct umbilical slope, the suture-line, and especially the sub-acute periphery of the inner whorls suggest reference to the present species.

Horizon:— Lower Gyronitan, Lower and Middle *Vishnuites* beds.

Localities:— Most localities between Rivers 6 and 17 (see Section C).

Sub-genus *LYTOPHICERAS*, Spath, 1930.

Ophiceras (Lytophiceras) commune, Spath.

Plate IV, figs. 3a, b; Plate XIII, fig. 13; Plate XV, figs. 1a, b, 4a, b, 9; Plate XIX, fig. 8.

1930.	*Ophiceras (Lytophiceras) commune*,		Spath: Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 24, pl. II, figs. 9a-d, 13, 14; pl. III, fig. 3; pl. IV, figs. 3, 11.
1930.	—	*greenlandicum*,	Spath, *partim; ibid.*, pl. I, fig. 2; pl. IV, fig. 12.
1930.	—	*chamunda*	(Diener) Spath, *ibid.*, pl. IV, figs. 1a, b, 8a, b.
1931.	—	*(Lytophiceras) commune*,	Spath: Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland. *loc. cit.*, p. 81.

This species was described as extremely close to *O. (L.) sakuntala*, with identical proportions, and a comparison of the Himalayan lectotype (Diener's, pl. x, fig. 1)[1]) with the holotype of *O. (L.) commune* previously figured (pl. III, fig. 3) will show that the differences are very slight, although the inner whorls of the Greenland form are more compressed and flattened laterally. It is probable that the present specis is merely a local variant of *O. (L.) sakuntala*, for it is known that each locality impresses upon its inhabitants its own peculiar stamp, and the preservation of the Himalayan forms (in a black, metamorphic, limestone) is so different from that of most of the Greenland examples that identification is inadvisable. Moreover, *O. (L.) sakuntala* has been interpreted so widely and so differently by various authors, including myself, that the continued use of the name for a Greenland species would at once raise difficulties.

The abundant new material available allowed of a still more comprehensive interpretation of the present species. There are now so many individuals varying in different directions that the giving of new names, while easy enough for certain extreme examples, would only cause endless trouble so soon as a large assemblage from the *commune* beds of any given locality had to be named; and as such assemblages often occur in a single block, no benefit would result from so much labour.

[1]) Mem. Geol. Surv. India, Pal. Indica, ser. XV, Himalayan Fossils, vol. II, Cephalopoda of the Lower Trias, 1897.

The present species therefore is now taken to include not only the forms previously compared to Noetling and Frech's *O. evolutum*, but also a slightly more widely-umbilicated variety, an example of which is now illustrated (Plate IV, fig. 3). This is identical with the specimen figured in 1930 (pl. I, fig. 2) as a transition between *O. greenlandicum* and *O. sakuntala*. I pointed out that this form had almost the same proportions as the species I then referred to as *O. evolutum*; but it now seems preferable to consider it merely a variety (var. ***aperta***, nov.) of *O. (L.) commune*. It has the umbilical edge, on the outer whorls, like the typical forms, but the width of the umbilicus is 36—37 °/₀ as against 29 °/₀ or 30 °/₀.

In the forms previously considered to be perhaps referable to *O. sakuntala*, var. *evoluta*, Frech and Noetling (my pl. III, fig. 1) the umbilicus is as wide as in the var. *aperta*, but there is no umbilical edge. This variety may be named var. ***evolvens***, nov., since all the other characters agree with those of *O. commune* of the same beds. There are numerous transitions between the type and the two varieties as well as between the var. *aperta* and the var. *evolvens* and the example previously figured in pl. III, fig. 4 is one of them.

The smaller specimen represented in Plate XV, figs. 4a,b, with the septa rather irregularly spaced, on account of the lack of a distinct, umbilical rim, may be referred to the var. *evolvens*; but the more involute original of figs. 1a,b of the same plate (XV) differs from the example figured in 1930 (pl. IV, fig. 1) as *O. (L.) chamunda* merely in its more conspicuous umbilical slope, separated from the side by a distinct edge[1]). This character alone does not now seem sufficient for separation of the two forms and the differences between the originals of my previous pl. IV, figs. 1 and 3 were enhanced by slightly different modes of preservation which at that time were believed to be more significant than they are now known to be.

Some fragments probably referable to the var. *evolvens* now before me (e. g. no 390p) indicate that this form also grew to over 100 mm in diameter and there may be very distinct but close lineation on the body-chamber. An example of 108 mm (loc. 90) has two-thirds of the outer whorl as body-chamber.

Since the interpretation of *O. (L.) sakuntala* has now been restricted, the differences between that species and the admittedly closely allied *O. (L.) commune* are far less than those between the latter and *O. subsakuntala*. The greatest thickness in both species is near the umbilical border, but whereas in *O. (L.) commune* and *sakuntala* the whorl sides are generally distinctly convergent towards the narrowly arched periphery, *O. (L.) subsakuntala* has a comparatively broad ventral area.

[1]) As in the smaller original of my (1930) pl. IV, fig. 8.

The absence, in the present species, of the high umbilical slope of the young *O. (L.) sakuntala* is noticeable, for instance, in immature specimens like that figured in 1930 (pl. iv, fig. 11.) But at larger diameters there is rather too much variability in this feature and in the distinctness of the edge in the many examples now referred to the present species. Altogether then *O. (L.) commune* and *O. (L.) sakuntala* are often indistinguishable in the adult, although the latter tends to sharpen its periphery with increase in size, whereas *O. (L.) commune* begins with a more compressed early stage and then tends to become somewhat less discoidal.

The example figured in Plate XIII, fig. 13 came from locality 294, high in the *Vishnuites* beds, but it cannot be separated from such specimens of *O. (L.) commune*, with a conspicuous, umbilical rim, as the original of Plate XV, fig. 1. Since there is nothing comparable from any of the other localities, even in the Lower *Vishnuites* beds, it seems probable that there was some discrepancy, perhaps during the packing or unpacking of this specimen; but I am recording it in view of the enormous time-range of *Ophiceras* of the *sakuntala*-type, said to occur in the Californian *Meekoceras* beds[1]) and still in the late Upper Eotriassic *Albanites* Beds of Albania[2]).

The example figured in Plate XIX, fig. 8, and similar fragments from Clavering Island were at first taken to represent an early mutation of the present species, characterised by a more elliptical whorl-section; but there is too much variability in this character (as in *O. [L.] sakuntala* itself), and identical fragments still occur in the higher *Ophiceras* beds. Some umbilical casts, however, occurring with the fragments just discussed, seem to show the more convex, inner whorls, in the deep umbilicus, that characterise the restricted *O. sakuntala.* In one, the umbilical slope is inclined at only about 45° and there is not even a distinct edge, but, instead, a groove, halfway up, breaking the uniformity of the slope and simulating a double, umbilical suture. It is the height of the umbilical slope, already in the young, rather than the presence of a distinct edge that seems characteristic of the Himalayan species, whereas the inner whorls of *O. (L.) commune*, visible in the umbilicus of the small example, previously figured in pl. iv, fig. 11, have a low wall and are distinctly flattened. In side-view, the example represented in my (1930) pl. iv, fig. 8 is indistinguishable from a similarly sized Himalayan specimen of *O. (L.) sakuntala* (B. M., no. C. 28526) named by Diener himself; and apart from the slightly different whorl-section there

[1]) J. P. Smith: Lower Triassic Ammonoids of North America. U.S. Geol. Surv. Prof. Pap. 167, 1932, p. 50, pl. LIV, figs. 1–17, pl. LVI, figs. 13–18.

[2]) Arthaber: Trias von Albanien. Beitr. Pal. Geol. Österr.-Ung. vol. XXIV (1911), p. 239, pl. XXI, figs. 4a, b.

seems to be only the difference in coiling, shown in the umbilicus, to allow of differentiation of the two forms. Even this coiling, however, is subject to individual variation and the example of *O. (L.) commune* now figured in Plate XV, fig. 1 has not only the characteristic, deep, umbilicus of *O. (L.) sakuntala*, but also its strongly projected striation. The inner whorls of this example, if broken out, also may be indistinguishable from young Himalayan specimens of *O. (L.) sakuntala*, but later the periphery becomes slightly broader in the Greenland form. On the other hand, the body-chamber fragment figured in Plate XIX, fig. 8, has a distinctly narrowing venter, almost like *O. (Discophiceras) wordiei* and the region of greatest whorl-thickness is imperceptibly rounding off into the gently convex sides on the one hand and into the umbilical slope on the other. A corresponding piece taken out of the holotype of *O. (L.) commune*, however, would not be distinguishable from the fragment here figured.

Horizon:— Uppera Otoceratan, Lower and Upper *Ophiceras* beds.

Localities:— Most of the localities from Cape Stosch to River 16 (see Section C); Cape Franklin; Clavering Island; Nathorst Fjord (locs. 27, 31—33, 56, 1703).

Ophiceras (Lytophiceras) subsakuntala, nom. nov.

Plate XV, figs. 3a,b; Text-fig. 1a.

1930. *Ophiceras (Lytophiceras) sakuntala*, Diener: Spath, *partim*, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 19, pl. II, fig. 8; pl. IV, fig. 7;
1930. — — *ptychodes*, Diener; Spath, *partim*, *ibid.*, p. 21, pl. IV, figs. 4a,b; pl. V, figs. 3a,b.

A new name is suggested for the Greenland form chiefly on account of the very broad ventral area, well seen in my (1930) pl. IV, fig. 4b, but the more or less strongly developed striation that previously caused separation of the present species into two distinct forms *(O. sakuntala* and *O. ptychodes)* is not now taken to be of specific importance. In 1930, I also laid stress on the presence of a distinct, umbilical rim, when contrasting the originals of pl. II, fig. 8 (as *O. "sakuntala"*) and pl. IV, fig. 3 *(O. commune)*, but the study of the very abundant new material has shown that there is as considerable variability in this character as in the striation.

As type of the present form may be taken the complete example figured (as *O. ptychodes*) in my (1930) pl. IV, fig. 4, while a paratype, previously described as a passage-form from *O. ptychodes* to *O. sakuntala* (pl. V, fig. 3) differs merely in having less conspicuous striation. The specimen figured in pl. IV, fig. 7 as *O. sakuntala* is identical with the corresponding portions of the holotype and paratype, but the original of pl. II, fig. 8 has a more conspicuous umbilical slope than the other examples. It differs from the similar *O. (L.) commune* and the Himalayan true *O. (L.) sakuntala* merely in its greater thickness, shown in the wider ventral area, but in the case of transitional specimens, especially to the var. *aperta* of *O. (L.) commune*, definite identification may be impossible at this diameter.

The width of the umbilicus in *O. (L.) subsakuntala* may vary from 36 °/₀ (in the holotype) to 30 °/₀ (in the transitions to the more typical *O. (L.) commune*). In is on account of this close affinity with forms of the *sakuntala* group that the present species is now referred to *Lytophiceras* rather than *Ophiceras* s. s., but it is clearly transitional to *O. greenlandicum* which also has a fairly wide umbilicus (37—41 °/₀). Its very prominent umbilical edge links this species with *O. tibeticum* rather than the forms of the *sakuntala* group, but a passage-form between *O. greenlandicum* and *O. subsakuntala* (no. 1a 30) combines the typical *tibeticum* ornament with a gently rounded umbilical edge. Other examples again (e.g. nos. 1c 30, 1d 30) are indistinguishable in side-view from *O. (L.) ptychodes*, but are referred to the present form merely on account of the wide venter. As soon as this becomes narrower, distinction from the slender *O. (L.) ptychodes* is very difficult and has to be based merely on the wider umbilicus.

The suture-line represented in Text-fig. 1a (p. 48) was taken from one of these ribbed varieties, with an umbilicus of 35 °/₀ and it shows an unusually dependent umbilical lobe. The saddles are narrower than in *O. (L.) commune*, but there are too many transitions in this respect to make the suture-line a reliable diagnostic character and in one example (No. 98a) transitional to *O. greenlandicum* the lobes are ascending towards the umbilical suture.

The example figured in Plate XV, fig. 3 has a constriction just behind the apertural margin, most pronounced on the inner whorl-side and a second, distinct only on the venter, a short distance beyond the first constriction. This is reminiscent of *O. stricturatum* Frech and Noetling[1]); but although the example here figured might be considered to be merely a dwarfed *O. greenlandicum*, it is not a distinct species. A Kashmir example referred by Diener[2]) to *O. medium*, Griesbach, shows a similar constriction near the end.

Horizon:- Upper Otoceratan, *Ophiceras* beds.

Localities: West of Cape Stosch and at least as far east as River 13 (see Section C); Nathorst Fjord (locs. 27, 56); Clavering Island.

[1]) In Frech, Lethaea palaeozoica, II, 4. Dyas, 1902, p. 634f, fig. 3.
[2]) *Loc. cit.* (1913), pl. I, figs. 5a, b.

Ophiceras (Lytophiceras) aff. *ptychodes*, Diener.

(Plate XIX, fig. 9).

1930.	*Ophiceras*	*(Lytophiceras)*	*ptychodes*,	Diener; Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit. (partim)*, p. 2?, *non pl.* IV, fig. 4.
non 1931.	—	—	—	, Diener; Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, p. 81.
1934.	—	—	—	, Diener; Spath, Brit. Mus. Cat. Fossil Cephalopoda, pt. IV, vol. I, p. 78, pl. I, fig. 1.

The previous interpretation was too comprehensive and the example figured in 1930 is now given a new name (see under *O. (L.) subsakuntala*). In the case of the two examples previously described as transitional between *O. ptychodes* and *O. sakuntala* (pl. IV, fig. 7 and pl. V, fig. 3) there is still less resemblance to Diener's original *O. ptychodes*. These Greenland forms all have a wider periphery than the Himalayan specimens and while they constitute a special, local development of the *sakuntala* group, as does *O. ptychodes*, itself, they are much too inflated to be grouped together with the slender form (Plate XIX, fig. 9) to which the present species is now restricted. There are, however, compressed varieties of *O. (L.) subsakuntala* (e. g. No. 547a) that come close to the present form.

This does not seem to be common in the collections before me and there is nothing from Greenland resembling the Kashmir example figured in my B. M. Catalogue. On the other hand, the fragment shows good agreement with the lectotype (Diener's pl. XI, fig. 3); but since *O. (L.) ptychodes* is merely a ribbed variety of *O. (L.) sakuntala* and the Greenland form is probably an equivalent development of *O. (L.) commune*, the use of the name *ptychodes* may be considered open to criticism.

Almost every one of the smooth species of *Ophiceras* here described has its more or less costate developments or varieties; and in view of the considerable differences between the Greenland and Kashmir examples (the latter of which differs from the type also in its sub-acute periphery) definite identification is not possible. The whorl-section of the fragment here figured is intermediate between that of *O. (L.) commune* and *O. (L.) chamunda*, represented in the same plate (XIX, figs. 8 and 10) and agrees with Diener's fig. 3b (pl. XI). This is almost the only character her relied on for diagnosing this species; for laterally similar fragments with *ptychodes*-ribbing of e. g. *O. (L.) subsakuntala* have a wide venter while in *O. (Disc.) kochi* var. *falcata*, the periphery is more sharpened.

The suture-line of the fragment here figured has its three saddles regularly increasing in height towards the umbilicus. This is a feature which it has in common with the *ptychodes*-like variety of *O. (L.) ultimum*, figured in Plate XIV, fig. 3, but the latter also has a wide periphery.

Horizon:— Upper Otoceratan, lower *Ophiceras* beds.

Localities: Clavering Island and east of Cape Stosch (663).

Ophiceras (Lytophiceras) ligatum, nom. nov.

(Plate XI, figs. 3a,b).

1930. *Ophiceras (Lytophiceras)* aff. *sakuntala*, Diener; Spath *partim*, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 20, pl. VIII, figs. 11—12.

1931. *Ophiceras* aff. *sakuntala*, Diener; Lauge Koch: Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, p. 83.

This species requires a new name not only because it is the most distinctly constricted form of *Ophiceras* so far known, but also because it belongs to that curious fauna with *Otoceras* and *Bellerophon*, discussed by Lauge Koch, which has not been definitely rediscovered up to the present (see p. 80). In addition to the seven or eight examples known from the loose *Bellerophon* block, previously discussed (1930, p. 65), there are now several additional specimens, all from a single locality (243, marked Lower *Ophiceras* Beds). But as the collections from there include *Vishnuites* as well as *Otoceras* and as they are obviously derived from various horizons, it is not yet known whether the present species occurs at a distinctive level, apparently somewhere in the lower *Ophiceras* beds.

The two examples previously figured did not show the constrictions in the rather defective photographs, but the larger of them (fig. 11) is still the best example available and its earlier portion (with the *Myalina* removed) is now refigured, viewed from both sides (Plate XI, figs. 3a,b). It will be seen that the *Desmoceras*-like constrictions (which suggested the name) are slightly sigmoidal, distinctly oblique forwards, and rather closely-spaced, there being about seven or eight to the whorl at a diameter of 30—40 mm. Later they become indistinct, and probably disappear altogether, but the largest known example, still in the septate stage, is only about 37 mm in diameter.

The umbilicus is smaller than in the otherwise similar (but unconstricted) example of *O. sakuntala*, Diener to which I previously compared the Greenland forms (Diener's pl. x, figs. 5a,b). The whorl-section is the same in the two species, with convergent sides and a narrowly arched periphery; and some umbilical casts from the same block show the characteristic deep umbilicus and convex inner whorls of *O. (L.) sakuntala*, so that this species as well as *O. (L.) commune* are extremely close to the Himalayan form. The suture-line has rather slender saddles, but is much like that of another specimen of *O. sakuntala*, figured by Diener (pl. x, fig. 2d).

Horizon:— Upper Otoceratan, probably Lower *Ophiceras* beds.

Localities:— Cape Stosch (1927, loose block) and 243 (1932).

Ophiceras (Lytophiceras) chamunda, Diener.

(Plate VIII, figs. 8a, b; Plate XIX, fig. 10).

1930. *Ophiceras (Lytophiceras) chamunda*, Diener: Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 20 *(partim)*, *non* pl. IV, figs. 1, 8.

1931. — — —, Diener: Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, p. 81.

1934. — — —, Diener: Spath, Brit. Mus. Cat. Fossil Cephalopoda, pt. IV, vol. I, p. 77.

I have already pointed out that unless this species be restricted to the more flattened, more discoidal forms, as represented by Diener's fig. 3 (pl. XII) it cannot be separated from *O. sakuntala*. To that form seem to belong, for example, the originals of Diener's figs. 1 and 2 (pl. XII) whereas his fig. 3 (pl. x) although described as a typical *O. sakuntala*, is more involute than the type (fig. 1). It might be more appropriately referred to the present species, but it differs again in its more concentric umbilication. In any case a typical East Greenland example is now figured in Plate VIII, fig. 8 and it does not seem to me to differ from the metatype in the British Museum (Natural History) to which I referred recently, except in preservation, the Himalayan example being deformed in the metamorphosed limestone.

In view of Diener's observations as to the variability of the umbilical slopes on opposite sides in the same individual, I may say that the distinctness of this umbilical slope in the present form seems to me a useful diagnostic character. It certainly helps to differentiate *O. (L.) chamunda*, as here restricted, from the similarly involute forms of *Discophiceras*, in spite of the apparent resemblance in the outline sectional views. For, as can be seen in the side-views of *O. (L.) chamunda* and, for example *O. (Discophiceras) compressum* (Plate VIII, figs. 1 and 8) the character of the umbilical wall (and its edge) is quite different; and *O. (D.) wordiei* is still less closely comparable latter is worn on the right-hand side and thus appears too compressed, but it agrees with what I consider to be the true Himalayan *O. (L.) chamunda*, as interpreted by Diener's own metatypes in the British Museum.

It is possible that the example previously figured (pl. VIII, fig. 13) as *O. (L.) wordiei* represents a transition to the present species, since its umbilical slope is comparatively high. Its inner whorls (on the side not figured) and its size, however, link it with the former and with *O. (L.) commune*.

Horizon:— Upper Otoceratan, lower *Ophiceras* beds.

Localities:— Clavering Island; Spath Plateau River 16 and west of it (e. g. 309—10, 736); Cape Franklin?

Ophiceras (Lytophiceras) kilenense, sp. nov.

(Plate VI, figs. 6a, b).

This species is based on the complete example figured in plate VI, fig. 6, which has the following dimensions.

Diameter	61 mm		
Height of last whorl	36 °/₀	of the	diameter
Thickness of last whorl	20 °/₀	- -	—
Umbilicus	36 °/₀	- -	—

The whorl-section is compressed, with slightly convergent sides and with the greatest thickness near the rounded umbilical border. The venter is narrowly arched. There is indistinct sigmoidal striation and there may be some faint bulges on the body-chamber (of internal casts), but otherwise the sides are smooth. The suture-line has three simple saddles and the lobes are only faintly toothed.

The species may be compared to the Himalayan *O. medium* Griesbach[1]) but lacks its prominent umbilical edge and slope. The proportions are almost the same in the two species, the whorl-height being approximately equal to the width of the umbilicus, but the very compressed whorl-section with its low and rounded umbilical edge is the most characteristic distinguishing feature of the present species. In some compressed examples of *O. greenlandicum* or *O. commune* var. *aperta* (see Plate XV, fig. 9), with similar proportions, the umbilical slope and edge are also very prominent, but the periphery is much broader. The only other compressed species of *Lytophiceras* with a similarly wide umbilicus is *L. vishnuoides*; but this can be distinguished by its whorl-

[1]) See Diener, *loc. cit.* (1897), p. 118, pl. IX, figs. 1—2.

section with high, almost parallel, sides and by its slightly more advanced suture-line, resembling that of *Vishnuites*.

This species is not common and the few examples known apparently include transitions to *O. (L.) commune*, characterised by a higher whorl-side and a less compressed section than the type.

Horizon: Lower *Vishnuites* (and Upper *Ophiceras*?) Beds.

Localities:— 368, 663, 678, 679, 680, 715—716 (1933).

Ophiceras (Lytophiceras) ultimum, sp. nov.

(Plate I, fig. 2; Plate XI, fig. 5; Plate XIII, figs. 8a,b; Plate XIV, figs. 1—3).

Owing to the generally poor state of preservation of the examples of *Ophiceras* in the higher beds I was at first unable to distinguish them from crushed specimens of *O. (L.) subsakuntala* and *O. (L.) chamunda*; and even now the differences that suggest separation of the present form under a new name may be considered by some to be very slight. Since, however, they are constant enough to enable me now to distinguish the high zonal forms from the lower ones, a separate name is advisable from a stratigraphical point of view alone.

The dimensions of the holotype and some other examples are as follows:—

	Holotype	Pl. XIV, fig. 3	Pl. XI, fig. 5 (var. *ambigua*)	Pl. XIII, fig. 8 (var. *ambigua*)
Diameter	60	70	67	50 mm
Height	43	43	45	45 °/₀
Thickness	25 ?	25	?	26 °/₀
Umbilicus	28	28	28	28 °/₀

The most characteristic features are the compressed whorl-section with flattened sides yet a broad venter, and the absence of an umbilical edge or slope, combined with a suture-line whose saddles are elongated, slender, and ascending towards the umbilicus. The wide venter is evenly arched, but owing to the fact that the earlier whorls are generally crushed or corroded there is often an appearance of a keel.

Since the present form differs from the closely allied *O. (L.) dubium* chiefly in its larger umbilicus, it might be expected, perhaps, to show truncation of the periphery of the inner whorls, but there is apparently no tendency to truncation any more than to carination. The example figured in Plate I, fig. 2, though perhaps not definitely identifiable, owing to its small size and the absence of the suture-line, shows the appearance in the younger stages, but the body-chamber (Plate XIV, fig. 3) may acquire ribbing as in *O. (L.) ptychodes*, only far less conspicuous. The small example also shows the characteristic undercut, umbilical border (as distinct from the conspicuous slope of most other species of *Ophiceras*), but this is not shown in the var. *ambigua*. The latter, therefore is attached to the present species only with doubt since the two examples known have a simple *Ophiceras* suture-line, but they may yet turn out to belong to a separate species, somewhat intermediate between the present species and *O. (L.) dubium* on the one hand and the more evolute *O. (L.) commune* on the other.

Horizon:— Middle and Upper *Vishnuites* Beds.

Localities:— Many localities between Rivers 6 and 16 (see Section C); var. *ambigua* from 138 and 146.

Ophiceras (Lytophiceras) dubium, sp. nov.

(Plate II, figs. 4a-d; Plate XI; figs. 8a,b; Plate XII, figs. 7a-c; Plate XIII, figs. 11—12; Plate XIV, figs. 4, 5).

As holotype of this species may be taken the example figured in Plate XIV, figs. 5a,b, because it is intermediate between the more inflated individual represented in Plate XII, figs. 7a,b, and the more involute, truncated original of Plate XIV, figs. 4a,b. There are many transitions between these extremes (differing in the earlier stages), but the adult of all are so similar that specific separation would be impracticable; yet it could easily be maintained that the individuals with truncated venters (in the young) are generically different.

The dimensions of the three examples already mentioned compare as follows:—

	Holotype	Plate XII, fig. 7	Plate XIV, fig. 4a
Diameter in mm	48	53	34 mm
Whorl-height (in °/₀ of diameter) ..	47	45	53 °/₀
Whorl-thickness (in °/₀ of diameter)	23	24	24 °/₀
Umbilicus (in °/₀ of diameter)	20	23	15 °/₀

Since the species is markedly excentrumbilicate, the differences in the dimensions are not of significance. Even the young example figured in Plate XIV, figs. 4f,g clearly shows the widening out of the umbilicus on the last half whorl (body-chamber) and it is clear that on further growth, this individual would not have materially differed from the original of fig. 4a,b or the holotype (5a,b). The greatest variability, however, is in the shape of the periphery, which may be faintly or distinctly truncate to varying diameters in the young of some specimens while others remain just narrowly arched; but the truncation is always lost on the adult body-chamber, which, occasionally is rather inflated.

The example figured in Plate XII, fig. 7 which, so far as can be seen, is not truncate on the inner whorls, retains part of its test. There is fine, sigmoidal, striation, but on internal casts (Plate XIII, fig. 12) this ornamentation may be preserved as distinctly as on the test. The holotype is almost smooth (test and internal cast), but just before the mouth-border there is a faint, sigmoidal constriction. In other examples, this constriction may be farther away from the peristome, while in some there are merely one or two irregular folds on the body-chamber. The mouth-border is slightly flared in some examples, i. e. it opens out, trumpet-wise; the length of the body-chamber is just over half of the last whorl (215—235°). There is no umbilical edge and the sides slope gently and with a concavity down to the umbilical suture, generally showing the rursiradiate beginning of the fine striae of growth.

The suture-line (Plate XII, fig. 7c; Plate XIV, fig. 4e) is very simple, and the toothing of the lobes is often so fine as to be invisible except with a lens. There is some variability in the shape of the three saddles and lobes, but the auxiliary lobe is always shallow and simple and there are no indentations, as in more advanced, but externally similar, types like *Koninckites*.

The unusually strongly ornamented example figured in Plate XIV, figs. 3a,b and already described under *O. (L.) ultimum*, on account of its small umbilicus might be taken to represent a transition to the present form; but its general appearance is really rather distinct and there is no suggestion of truncation of the inner whorls. If the small example figured in Plate I, fig. 2 represents the young of that species, then there are no real transitions between the two forms, and if it were not for the *Ophiceras* suture-line of the present species, even generic separation could be suggested. While however, in similar Paranoritids the suture-line is more complicated, the Gyronitids are more advanced in the truncation of the periphery, with the exception of *Gyrophiceras*, which is apparently another and different transition between the Ophiceratidae and the later stocks.

The size of the umbilicus and suture-line, at first sight, suggested reference (of the specimens collected in 1930) to *O. (Discophiceras) wordiei* and *O. (D.) subkyokticum*, while body-chamber portions were attributed to *O. chamunda* and *O. ptychodes*. The latter two, as now restricted, differ in whorl-section and the earlier volutions, of course, are very different. In *O. (Discophiceras) wordiei* and *O. (D.) subkyokticum* the umbilical slope is convex, not concave, as in the form here described; and there is no tendency either to inflation of the outer whorls or to truncation of the inner.

Horizon:— Upper *Vishnuites* and Lower *Proptychites* Beds.

Localities: – Cape Stosch (7 [1930], 101, 108, 125, 240 [1932]) and Stensiö Plateau (300, 638 [1932—33]).

Ophiceras (Lytophiceras) vishnuoides, sp. nov.
(Plate VIII, figs. 7a,b).

This species is morphologically intermediate between *Ophiceras transitorium* on the one hand, and *Vishnuites wordiei* and *V. decipiens* on the other; and some may consider it significant that whereas there are hundreds of individuals of these two species of *Vishnuites*, even the holotype of the present form is incomplete, and, moreover, only a fragment of a much larger shell. It might thus have been described as merely a compressed variety of *O. transitorium*, but I believe that the three forms which for systematic reasons, are described as *O. (Lytophiceras) vishnuoides* and *Vishnuites wordiei* and *V. decipiens* are merely extremes of one large species group. The presence or absence of a keel, while making a considerable difference to the appearance of the shells, is a feature of minor importance. Moreover, as explained below under *Vishnuites*, the keel is often transitory, but owing to the poor preservation of many examples of *Vishnuites* and the frequent weathering of the periphery, it is not always possible to refer a given example to its proper genus or to ascertain whether an earlier stage may have been keeled.

The inner whorls of the present species, so far as they can be seen in section, and in a small paratype (357c), are uncarinate and although there is a very slight asymmetry in the position of the ventral lobe, there does not seem to have been corrosion of the periphery. It is narrowly arched and there is no suggestion even of the fastigation that characterises the less acute examples of *Vishnuites*. The umbilical slope is distinct, but not steep, and the lateral aspect of *L. vishnioides* is very similar to that of *Vishnuites wordiei*, but the inner whorls are more involute, so that more of the side of the penultimate whorl is seen in the umbilicus of the present form than in *V. wordiei*. The suture-lines, however, are again almost identical, although in the present form the auxiliary lobe is followed by half of a fairly individualised umbilical saddle. Judging by the approximation of the last few suture-lines, it seems that the holotype-specimen only lacks the body-chamber which was probably just over another half whorl in length, giving a maximum diameter of approximately 80—90 mm. The dimensions are:—

Diameter	65 mm
Height	40 %
Thickness	21 %
Umbilicus	35 %

Another body-chamber fragment (357b), exactly half a whorl in length (at 67 mm diameter), shows the last suture-line, but the apertural end is incomplete.

O. (L.) leptodiscus, sp. nov., described below, differs in its smaller umbilicus and flatter sides, while *O. (L.) kilenense* has a simpler suture-line. Compressed examples of *O. (L.) commune* and its var. *evolvens* may be very similar, but can be distinguished by their suture-lines, with the lateral lobe much narrower in proportion to the two accompanying saddles, and without the umbilical half-saddle.

Horizon:— Middle *Vishnuites* Beds.

Localities:— 352 (1932) and others of the many *Vishnuites* localities, e. g. 69, 167, 168, 232, 357, 710.

Ophiceras (Lytophiceras) leptodiscus, sp. nov.

(Plate XII, figs. 5a, b).

This species stands in the same relationship to *Vishnuites decipiens* as *O. (L.) vishnuoides* does to *V. wordiei*, that is to say the present species differs from the last *(O. vishnuoides)* chiefly in being more involute. The dimensions of the holotype are:—

Diameter	44 mm
Height	43 %
Thickness	23 %
Umbilicus	27 %

In all characters, including the suture-line, there is complete agreement with *V. decipiens*, but the periphery is unkeeled in the present form. In the holotype, which is entirely septate, there is even a slight waviness of the venter, as though caused by blunt ribbing, continuous across the periphery. A similar ventral aspect is found in the holotype of the more inflated *O. (L.) ultimum*, figured in Plate XIV, fig. 3b. Both are internal casts, but the present form has almost smooth sides. The whorl-section is greatly compressed, with almost parallel sides, but the greatest thickness near the rounded, umbilical border. The latter is convex, so that it gradually becomes undercut where it joins the umbilical suture. This suggests comparison with the small example of *O. (L.) ultimum*, figured in Plate I, fig. 2, but while this is already more inflated than the present form, at the diameter of the holotype of the present species, *O. (L.) ultimum* has already a much broader venter. While *O. (L.) commune* is less compressed, the more discoidal *O. (L.) chamunda* differs from *O. (L.) leptodiscus* in its conspicuous umbilical slope and different whorl-section, also by its suture-line.

The example figured in Plate XI, fig. 11, seems to show that there is probably yet another species of *Lytophiceras* in the *Vishnuites* Beds of East Greenland. It corresponds to the involute var. *discoidea* of *V.*

decipiens in side-view, but it has a rounded venter. Its suture-line is more like that of *O. transitorium* than that of the present form, and it is also more inflated than *O. (L.) leptodiscus.* The small umbilicus, however (26 °/₀ of the diameter), links it with the latter species.

Horizon:— Middle *Vishnuites* Beds.

Locality:— 180 (1932).

Sub-genus *DISCOPHICERAS*, nov.

Sub-genotype:— *Ophiceras (Discophiceras) subkyokticum*, Spath, *loc. cit.* (1930), p. 27, pl. VI, figs. 3—8).

Diagnosis:— *Ophiceras* with tendency to flat, discoidal, shape and high whorl-sides, small, often excentric umbilicus, and narrowing or sharpening of the periphery. Suture-line as in *O. (Lytophiceras) commune* or *O. (L.) sakuntala*, in most species, but slightly more advanced in the genotype.

Remarks:— The four species described below seem to form a special, local, group of *Ophiceras*, but they are connected by various transitions with *O. (Lytophiceras) commune*, so that their separation as a distinct sub-genus is prompted merely by systematic convenience.

Ophiceras (Discophiceras) kochi, Spath.

(Plate XV, fig. 2; Plate XVI, fig. 1).

1930. *Ophiceras (Lytophiceras) kochi*, Spath: Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 23, pl. IV, figs. 10a, b.

The unusually distinct ribbing of this species (combined with the compressed, almost sharpened, periphery) makes it easily recognisable, but the forms now figured (Plate XV, fig. 2; Plate XVI, fig. 1) are only provisionally attached to the present species as a variety *falcata*, nov. Unfortunately it is available in only a few examples; but since they differ from the holotype of *O. kochi* not only in their more sigmoidal ribbing but also in their smaller umbilicus, they might be held to be specifically separable. Since, however, there is considerable variability in such more distinctly ornamented species of *Ophiceras*, as *O. ptychodes*, it seems preferable to interpret *O. kochi* similarly widely and to make it include the examples now figured, pending the discovery of better material.

The measurements of this var. *falcata* are as follows:—

	Plate XV, fig. 2	Plate XVI, fig. 1	Transition to *D. wordiei*
Diameter	84 mm	88 mm	74 mm
Height	36 %	40 %	37 %
Thickness	?	20 % ?	.21 %
Umbilicus	33 %	32 %	.32 %

The thickness is approximately the same in this var. *falcata* as in the holotype (20 %).

The comparatively narrow umbilicus suggests that the form now figured might have been at least equally appropriately attached to *O. (D.) compressum* as a ribbed variety, but it lacks the distinct umbilical edge of that species. The smooth *O. (D.) wordiei* is more like the present form in this respect, but its umbilicus is considerably smaller still. There is, however, at least one example, listed in the above table of measurements as a transition between *O. (D.) wordiei* and the var. *falcata* of the present species, that leads directly to the next species; and while in typical examples of *O. (D.) wordiei* the periphery is less sharp, the umbilicus smaller and more excentric, and there is no ribbing, there is sufficient variation in all these features to make the identification of transitional fragments a matter of personal opinion.

Although the present form has (for a species of *Discophiceras*) a comparatively large umbilicus, the thinness of the periphery alone prevents confusion with forms of *Lytophiceras*, like *L. ptychodes*, which has similar ribbing.

Horizon:— Upper Otoceratan, Upper *Ophiceras* Beds.

Localities:— Many localities between Cape Stosch and River 16, e. g. 115—116, 117—118, 122, 436, 690.

Ophiceras (Discophiceras) compressum, sp. nov.

(Plate VII, figs. 9a, b; Plate VIII, figs. 1—2).

This new species is based on the example figured in Plate VII, fig. 9 and its distinctive features are the well-marked umbilical edge and the unusually projected striation, combined with a flat, discoidal, shape. The dimensions of the holotype and of one of the examples of a more involute variety (var. *involuta*, nov., Plate VIII, fig. 1) are as follows:

	Holotype	var. *involuta*
Diameter	105 mm	75 mm
Height	34 %	39 %
Thickness	?	? 18 %
Umbilicus	35 %	35 %

The whorl-section is compressed and tends to have a narrowly arched, sometimes almost sharpened periphery. This may be unduly accentuated by the frequent crushing of the examples in the nodules, and it might be held that the whorl-sections represented in fig. 9b of Plate VII and fig. 1b of Plate VIII do not differ enough from that of *O. (Lytophiceras) chamunda* (Plate VIII, fig. 8b) for subgeneric separation of these two species. The flat and parallel whorl-sides, however, combined with the entirely different umbilicus make separation easy. In at least one example (17d 1930) the venter is provided with fine spiral lines. The suture-line is essentially the same as that of the more involute *O. (D.) wordiei*, which lacks the characteristic umbilical edge.

Similarly compressed species of *Lytophiceras*, like *L. vishnuoides* are distinguished from the present species by the suture-line, but even *L. commune* var. *evolvens* lacks the narrow periphery and characteristic, umbilical slope of the present species. In the case of crushed specimens, however, confusion with the last form is possible.

Horizon:— Upper Otoceratan, Upper *Ophiceras* Beds.

Localities:— Cape Stosch (17, 1930) to River 15 (e. g., 89, 102, 115—116, 122, 413, 436, 491—492, 690, 737).

Ophiceras (Discophiceras) wordiei, Spath.

(Plate VII, figs. 7a,b; Plate VIII, figs. 5a,b; Plate XVI, figs. 8a,b; Text-fig. 1h)

1930. *Ophiceras (Lytophiceras) wordiei*, Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 26, pl. v, figs. 1, 2, 9; pl. vi, figs. 1—2; pl. xii, fig. 14.

1931. — —, Spath: Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, p. 81.

This species which is again very abundantly represented in the new collections was interpreted rather widely in 1930, but it does not seem necessary to restrict it, even now, when a slightly more evolute variety (Plate VIII, fig. 5) and an extreme form with a modifiied body-chamber (Plate XVI, fig. 8) can be added to the inflated and involute varieties, previously figured, and to the transitions to species like *O. (L.) commune*. In the example figured in Plate VIII, fig. 5, of 87 mm diameter, the umbilicus is 28 % of the diameter, instead of 25 %, and the suture-line shows a rather conspicuously serrated auxiliary lobe. But I am figuring in Plate VII, figs. 7a,b a fragment of the typical *O. wordiei* that shows how the suture-line may vary on opposite sides in the same individual, the width of the second lateral saddle especially being inconstant (see also Text-fig. 1 h, p. 48). It has been stated[1]) that the eye is not to be trusted in such matters and that compass-measurement is essential. I hope the time will never come when such measurements are necessary to identify a given ammonite — or rather to prove that its two sides, being unequal, belong to two different species. Those who take Buckman's contention seriously may also like to measure and compare the depths of the lobes in the first and last suture-lines of the fragment figured in Plate VII, fig. 7. To me it does not seem worth while, although I realise, of course, that a change often occurs near the end of the septate stages. As I stated before [2]), this complication introduced into the study of ammonites is futile, considering the variability of the suture-line.

The example figured in Plate XVI, fig. 8 shows a curious bulge accompanied by a constriction just behind the plain mouth-border. This is reminiscent of the terminal portion of the body-chamber in *O. stricturatum*, Frech and Noetling[3]), which I previously[4]) characterised as scarcely constituting a separate species. Though apparently quite different, the bulge in this example is essentially the same as the corresponding constriction in the specimen of *O. (L.) subsakuntala* figured in Plate XV, fig. 3. In spite of its somewhat different aspect, this large, constricted specimen agrees with the example previously figured in pl. v, fig. 1.

The two crushed ammonites represented in Plate IX, fig. 6 are referred to *Vishnuites (Paravishnuites) oxynotus* chiefly on account of their ornamentation, but they could not be distinguished from examples of *O. (D.) wordiei*, such as that figured (1930) in pl. vi, fig. 1, if they were similary crushed. These examples seem to pass by many intermediate forms into *O. (D.) subkyokticum*, but apart from the size of the umbilicus, the suture-line is a useful distinguishing feature, being more advanced in the latter species. This is not due merely to its increased whorl-height, for the saddles are typically broader in *O. (D.) wordiei* than in *O. (D.) subkyokticum*; but in some of the passage forms between these two species, previously figured, there is considerable variation in the shape of the saddles and lobes and often only one of the saddles becomes narrower than the first lateral lobe.

Horizon: — Upper Otoceratan, (Lower? and) Upper *Ophiceras* beds.

Localities: — Most localities between Rivers 1 and 16 (see Section C). Nathorst Fjord (loc. 27).

[1]) S. S. Buckman, Type Ammonites, vol. VI, 1926, p. 8.
[2]) Notes on Yorkshire Ammonites. The Naturalist, Nov. 1926, p. 326.
[3]) Lethaea palaeozoica, vol. II, pt. III, 1901, p. 634f, fig. 3.
[4]) Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 25.

Ophiceras (Discophiceras) subkyokticum, Spath.

Plate I, figs. 3a,b; Plate VIII, figs. 6a,b; Plate XII, figs. 6a,b; Plate XIII, figs. 6a,b, 9; Plate XVIII, figs. 2a,b).

1930. *Ophiceras (Lytophiceras) subkyokticum*, Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 27, pl. v, figs. 4–8, pl. vi, figs. 3–8.

1931. . Spath: Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland, p. 81.

The few additional examples now figured include one of those transitions to *O. (D.) wordiei* which are so frequent but often difficult to identify at a small diameter. There are now also two examples from Nathorst Fjord, poorly preserved, in a dark, metamorphosed micaceous sandstone matrix, and a typical larger specimen (Plate XIII, fig. 9) with the beginning of the body-chamber.

The restriction of this species to a low horizon and its evident affinity with *O. (D.) wordiei* clearly indicate the taxonomic position of this species. The resemblance to the later *Koninckites* is superficial and due largely to the comparatively small umbilicus and the discoidal whorl-shape. There is never the slightest suggestion of truncation of the periphery.

The differences in the suture-line, already referred to under *O. (D.) wordiei*, are generally useful for distinguishing young examples that still have a comparatively open umbilicus; but in transitional specimens the relative width of the first lateral lobe and saddle may vary considerably. One of these passage-forms to *O. (D.) wordiei* is the example figured in (1930) pl. ix, fig. 4, which combines the suture-line of the present species with a slightly larger umbilicus.

The body-chamber of a somewhat doubtful and incomplete example from Nathorst Fjord is apparently inflated, as in *O. (L.) dubium*, which also has a small umbilicus.

Horizon:— Upper Otoceratan, (Lower? and) Upper *Ophiceras* beds.

Localities:— Many localities between Rivers 1 and 16 (see Section C), including loc. 1 (1930) and 17 (1930). Also from Nathorst Fjord (locs. 171, 172).

Sub-genus *METOPHICERAS*, nov.

Sub-genotype:— *M. subdemissum*, *nom. nov.* (= *O. demissum*, Oppel sp. in Spath, 1930, p. 14, pl. ii, fig. 1).

Diagnosis:— *Ophiceras* with tendency to lateral flattening and compression of whorls but combined with a very open umbilicus. Suture-line typically with same elements as in *Ophiceras* s. s., but with the first lateral lobe situated almost at the middle of the side and with the second lateral saddle on the umbilical slope.

Remarks:— *M. subdemissum* and the more involute *M. noe-nygaardi* are distinct enough, but *M. praecursor* owing to its ornamented outer whorl, has affinities with *Glyptophiceras* as well as *Acanthophiceras*. The Himalayan *O. demissum* (Oppel) of doubtful affinities, is only provisionally included here, but if Diener's[1]) smaller Kashmir example represents Oppel's species, this would be somewhat intermediate between the first two Greenland forms described below. In that case, however, Diener's larger Kashmir specimen, like some of his Himalayan examples, previously discussed (1930, p. 14), do not belong here.

Ophiceras (Metophiceras) subdemissum, nom. nov.

(Plate XIII, fig. 3; Plate XVII, figs. 3a,b; Plate XVIII, figs. 3a,b; Plate XIX, fig. 2.)

1930. *Ophiceras* aff. *demissum* (Oppel) Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 14, pl. II, figs. 1—7, pl. XII, fig. 1 (?).

1931. — *demissum* (Oppel) Spath: Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, p. 79.

1934. *Ophiceras* cf. *demissum* (Oppel) Spath, Brit. Mus. Cat. Foss. Cephalopoda, pt. IV, vol. I, p. 74, text-fig. 34d, p. 124.

In view of the uncertain affinities of Oppel's holotype, previously referred to, it seems best to distinguish the common Greenland species with a separate name. The Himalayan material before me (and mentioned in my Catalogue) is altogether inadequate for a redefinition of this species. The small examples resemble Diener's[2]) figs. 5—7 of his pl. XIV, but even their generic position is uncertain; for Oppel's type itself may represent merely the nucleus of a form of some allied genus.

The faint sigmoidal striation of the typical Greenland examples, with their characteristic flattened whorl-sides, is shown in Plate XIX, fig. 2. This specimen formed part of a large cluster, with hundreds of individuals, and there is undoubted identity with the example previously figured (1930, pl. II, fig. 1) which may be taken as the holotype of the present species. Its dimensions are:—

Diameter	49 mm
Height	39 %
Thickness	20 %
Umbilicus	52 %

[1]) Triassic Faunae Kashmir. Mem. Geol. Surv. India, Pal. Indica, N. S., vol. V, no. 1, pl. I, fig. 9 only.

[2]) *Loc. cit.* (Pal. Indica), ser. XV, vol. II, 1897.

The example figured in Plate XVII, fig. 3, with stronger ornamentation, is now taken to be merely a variety (var. *ornata* nov.) of the present species because it formed part of one of these clusters, apparently common at just one level in the Lower *Ophiceras* beds. This var. *ornata*, however, is already transitional to certain forms of *Glyptophiceras;* and for example the inner whorls of *G. serpentinum* are very similar to those of the present species as well as of the other forms of *Metophiceras*. Even the var. *ornata*, however, never has distinct ribs or bulges, such as characterise *Glyptophiceras;* on the other hand there may be found faint constrictions or other irregularities and individual variation is particularly conspicuous when the striation extends either to the narrowly arched venter or to the distinct umbilical edge, both normally smooth. At least one of the examples from locality 243 shows iridescence, a very unusual preservation in East Greenland.

There is considerable variation in the suture-line, as apparently also in the small Himalayan examples. There is generally a second lateral saddle, but in the example figured in Plate XVII, fig. 3a, the first lateral lobe of the last suture-line shown has fourteen minute teeth, so that the goniatitic appearance of the suture-line previously depicted (pl. II, fig. 1c) is deceptive. In many of the smaller specimens, however, the denticulations are scarcely perceptible. The complete suture-line now figured (Plate XIII, fig. 3) and previously illustrated in my Catalogue, was taken from an example (174a) transitional to the var. *ornata*, with broad saddles and a wide lateral lobe; but in other specimens the elements may be much slenderer.

The specimen figured in Plate XVIII, fig. 3 would seem to be a transition to *O. (M.) noe-nygaardi*, with higher whorls, but this is only because the last volution is displaced near the end. In examples of *Metophiceras* that are entirely crushed (Plate VI, fig. 3) it may be still more difficult to appraise the original whorl-height and if the deformation affects the ornament as well, specific separation may be impossible.

The young of the var. *ornata* of *O. (M.) subdemissum* may be indistinguishable from the inner whorls of *O. (M.) praescursor*, but the early volutions of the typical forms are easily separated from *Glyptophiceras minor* by their compression and from *G. minimum* by the elliptical (instead of a rectangular) outline. *G. pseudellipticum*, however, is again closer and before the appearance of the characteristic ribbing, i. e. at diameters below 20 mm, the appearance is almost identical. Separation, then, has to be based on the suture-line which is much simpler in the present form.

Horizon: — Upper Otoceratan, Lower *Ophiceras* beds.

Localities: — Many localities between Rivers 1 and 16 (see Section C.). Clavering Island. Nathorst Fjord (locs. 27, 56).

Ophiceras (Metophiceras) noe-nygaardi, sp. nov.
(Plate VIII, figs. 4a, b).

This species, although very close to the other two forms of *Metophiceras* here described, is separated from them on account of differences in dimensions as well as in ornamentation. The measurements of the holotype which has nearly half a whorl of body-chamber, are as follows:—

Diameter	40 mm
Height	35 °/₀
Thickness	20 °/₀
Umbilicus	39 °/₀

Since the typical example of *O. (M.) subdemissum* figured in 1930 (pl. II, fig. 1) has an umbilicus of 52 °/₀ of the diameter, it will be seen that the difference is rather considerable, but the suture-lines are very similar in the two forms. Moreover the falcoid ribbing of the present form (about twenty-two faint ribs on the outer whorl) links it with *O. (M.) praecursor* rather than *O. (M.) subdemissum*, but, owing to the increased whorl-height, the falcoid ribs give the present form an aspect distinct from that of the other species and this is enhanced by the subrectangular whorl-section.

There are numerous crushed specimens, comparable to that figured in Plate VI, fig. 3 which on account of the deformation do not allow of measurement of the width of the umbilicus; but uncrushed passage-forms between *O. (M.) subdemissum* and the present species also exist. The subrectangular whorl-section, with flattened sides and a subtabulate periphery, distinguishes *O. (M.) noe-nygaardi* from forms of *Lytophiceras* with a similar umbilical with.

Horizon:— Upper Otoceratan, Lower *Ophiceras* beds.

Localities:— Most of the localities where *M. subdemissum* occurs e. g. 524, 413, 309—10, 16, 22; Clavering Island 6 (1930).

Ophiceras (Metophiceras) praecursor sp. nov.
(Plate I, figs. 7a, b; Plate VI, figs. 3a, b).

This transitional species acquires distinct bulges while still in the septate stage and might therefore be assigned to *Glyptophiceras*; but since the earlier whorls are indistinguishable from those of *O. (M.) subdemissum* and since it is connected with that species and its var. *ornata* by examples like that figured in Plate VI, fig. 3 it seems preferable to refer it to the present sub-genus.

The holotype and the transitional example just mentioned, have the following dimensions:—

	Plate I, fig. 7	Plate VI, fig. 3
Diameter	52 mm	59 mm
Height	31 %	30 %
Thickness	22? %	?
Umbilicus	47 %	47 %

The restored outline whorl-section given in Plate I, fig. 7b may be considered to be too inflated since the specimens are all crushed and therefore show a very narrow periphery and are much flattened; but the restoration seems justified by the high umbilical slope at the end of the specimen which is almost entirely septate. The sides are flattened, especially on the inner whorls, where the ornamentation is faint. On the last whorl of the holotype, there appear first rather distant and then more closely-spaced bulges, most prominent on the inner whorl-side, close to the rounded umbilical edge. This ornamentation is reminiscent of that of *Acanthophiceras*, although the bulges are less blunt, and there is also some similarity to the species described below as *Glyptophiceras serpentinum* (Plate XIII, fig. 1), but the ribbing in that species is "catagenetic", not "anagenetic", as in the form now discussed.

The suture-line resembles that of *O. (M.) subdemissum* (Plate XIII, fig. 3) but the external lobe is deeper and the second lateral saddle is much more elevated and succeeded by a more conspicuous umbilical lobe. The body-chamber occupied the last half-whorl in two examples (701d,e) of over 60 mm diameter, which are apparently complete though with the mouth-border imperfect.

O. (Acanthophiceras) poulseni, described below, differs from the present form in developing a comparatively smooth outer whorl, after an early, plicated, stage, that is, its development is just the reverse of that of the form here described.

Horizon:— Upper Otoceratan, lower *Ophiceras* beds.

Localities:— Between Rivers 1 and 16 (e. g. 174—175, 413, 701); Clavering Island; Nathorst Fjord (loc. 56).

Sub-genus *ACANTHOPHICERAS*, Diener, 1916.

Ophiceras (Acanthophiceras) subgibbosum, sp. nov.

(Plate V, figs. 3a,b).

1930. *Ophiceras (Acanthophiceras?)* sp. juv. aff. *gibbosum*, Griesbach: Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 28, pl. IV, figs. 6a,b (? 9a,b)

1931. — sp. juv. aff. *gibbosum*; Lauge Koch: Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, p. 81.

The typical example of this form, now figured, has the following dimensions:

Diameter	39 mm
Height	37 %
Thickness	29 %
Umbilicus	37 %

Like the more doubtful, smaller, specimen previously figured, it is characterised by its compressed whorl-section and comparatively narrow periphery. The sides are almost concave, as compared with the strongly convex whorl-sides of Griesbach's *O. (A.) gibbosum*, or especially the extreme Himalayan example recently figured in my Catalogue[1]), which could, perhaps, be separated specifically. The holotype, represented in Plate V, fig. 3, has merely the beginning of the body-chamber, being septate almost to the end.

There are eight bulges on the outer whorl, about as distantly spaced as in Griesbach's type specimen; but owing to the fact that this lacks the earlier half of the last whorl comparison is not easy. Diener's other specimens are transitional to *O. tibeticum* and have smooth inner whorls, so that they cannot even be included in the sub-genus *Acanthophiceras*. The Kashmir form figured by Diener[2]) as *O.* cf. *gibbosum*, on the other hand, while a typical *Acanthophiceras*, is more evolute and like the example in the British Museum, already referred to, has a much more conspicuous umbilical border than the compressed form here described.

There is no sign of spiral striation on the Greenland casts, but the suture-line differs from that figured by Diener[3]) merely in its very shallow umbilical lobe which, in the holotype, is scarcely separated off from the second lateral saddle. In the smaller and more doubtful example previously figured, the more individualised umbilical lobe is dependent, but this example is not only from an earlier bed, but also has a narrower periphery than the type.

Horizon:— Middle *Vishnuites* Beds (and below?).

Locality: 357 (Stensiö Plateau).

Ophiceras (Acanthophiceras) poulseni, sp. nov.

(Plate XI, figs. 6a, b 7).

This form is closely connected with *O. (Lytophiceras) commune*, but it is now referred to *Acanthophiceras* on account of the bulges on

[1]) *Loc. cit.* (1934), Plate I, fig. 4.
[2]) *Loc. cit.* (1913), p. 18, pl. I, fig. 3.
[3]) *Loc. cit.* (1897), pl. IV, fig. 5b.

the inner whorls. These are less closely coiled than in the young of either *O. (A.) subgibbosum*, above described, or of the true *O. (A). gibbosum*, Griesbach, but the specific separation of body-chamber fragments of the present species from those of other *Ophiceras* may be impossible. The differences in dimensions are seen from the following figures:—

	Holotype (fig. 6)	Plate XI, fig. 7
Diameter	55 mm	55 mm
Height	36 %	36 %
Thickness	25 %	24 %
Umbilicus	37 %	37 %

At the diameter of the small example of *O. (A.) subgibbosum*, previously figured (pl. IV, fig. 6) the umbilicus is entirely different, so that confusion is impossible. At the same stage the present form has a wider ventral area, more evenly rounded, and a conspicuous umbilical border. At over 35 mm diameter, the bulges are lost and on the body-chamber there is merely faint costation or lineation, as in *O. greenlandicum*, or some individuals of *O. commune* (Plate XV, fig. 9). The whorl-section is nearly elliptical; the greatest thickness is at the prominent umbilical edge, but the flattened sides are nearly parallel, and the venter is evenly rounded.

The suture-line is essentially the same as in the other species of *Acanthophiceras*, but it is also similar to that of *O. (L.) commune*. The large Himalayan example of *O. gibbosum*, recently figured in my Catalogue, has a deeper external lobe.

Since forms like *O. serpentinum*, Diener[1]) and *O. greenlandicum*, may show ornamentation on the inner as well as the outer whorls, it is clear that *Acanthophiceras* is only an extreme within the genus *Ophiceras;* but *Glyptophiceras* which appeared in East Greenland before *Ophiceras*, is merely a somewhat homoeomorphous development of the same root-stock. Since the present species is connected by transitions with *O. (L.) commune* and especially *O. greenlandicum*, its reference to *Acanthophiceras* may be open to criticism; but although far less extreme than *O. (A.) gibbosum*, the form here described is clearly characterised by its nodate inner whorls.

Horizon:— Upper Otoceratan, upper *Ophiceras* beds.

Localities:— 1932 (278, 397).

[1]) *Loc. cit.* (Pal. Indica, 1897), p. 110, pl. XIII, figs. 1—7.

Genus *VISHNUITES*, Diener, 1897.

Vishnuites wordiei, Spath.

(Plate IV, figs. 5a,b; Plate XII, figs. 2a,b).

1930. *Vishnuites wordiei*, Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 31, pl. II, figs. 11a,b.
1931. — —, Lauge Koch: Carboniferous and Triassic Stratigraphy E. Greenland, *loc. cit.*, pp. 47, 84.
1934. — —, Spath; Brit. Mus. Cat. Cephalopoda, vol. IV, p. 88.
1934. — —, Spath; Collignon: Pal. Madagascar. XX. Les Céphalopodes du Trias inférieur. Ann. de Paléont, vol. XXII (1933) p. 20.

When this species was described, only a single specimen was available, and the subsequent discovery of abundant material has shown that one of the presumed characteristics of this form, namely the subtricarinate periphery, is rather an unusual feature, most of the examples having merely a fastigate venter. The inner whorls of the holotype were not well exposed, but the typical small example now figured in Plate IV, figs. 5a,b, although far more closely septate, illustrates the appearance of this species at a smaller diameter. The larger specimen figured in Plate XII, figs. 2a,b shows the faint bulges of the earlier half of the outer whorl, reminiscent of *Acanthophiceras*, which are also seen in the holotype.

There are transitions to *V. decipiens*, as mentioned below; and the form figured in Plate XII, fig. 3, unfortunately available in only a single example, similarly is somewhat intermediate between the two. It differs, however, in suture-line. This is characterised by low and wide saddles, quite different from the slender saddles of the typical examples of *V. wordiei*. Its umbilicus also is slightly smaller and it is apparently the only example of a *Vishnuites* from the *Ophiceras* Beds. It is thus possible that it really represents a new and early species. One-third of the outer whorl is already body-chamber.

Horizon:— Middle *Vishnuites* Beds (and lower?).

Localities:— Many localities between River 6 (Spath Plateau) and north side of Stensiö Plateau (see Section C.). The doubtful *V.* sp. nov. cf. *wordiei* (Plate XII, fig. 3) from the *commune* beds? (Cape Stosch 1, 1930).

Vishnuites decipiens, Spath.

(Plate IV, figs. 4a,b; Plate IX, figs. 3a,b; Plate X, figs. 2–5; Plate XII, figs. 1a,b; Plate XIII, figs. 4, 7.

1930. *Vishnuites decipiens*, Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 31, pl. III, figs. 2a-g; pl. IV, figs. 2a,b.
1931. - , Spath, Lauge Koch: Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, pp. 47 etc.
1934. - , Spath, Collignon: Pal. Madagascar, XX, *loc. cit.*, p. 20.

A number of additional examples of this species are now figured to show that the septation — dependent on rate of growth, food supply etc. — is rather too inconstant to be used for the recognition of varieties within the species, although the holotype in this respect differs considerably from the extreme var. *fissiseptata*, previously figured (pl IV, fig. 2). Thus the typical examples represented in Plate IV, fig. 4 and Plate X, figs. 2a,b become comparatively fissiseptate on the latter part of the outer whorl, while the original of fig. 4 of Plate X has close septation on almost the whole of the last whorl, but the earlier volutions are again sparsely septate, as in the type. The examples figured in Plate X, fig. 3 and the still larger specimen illustrated in Plate IX, fig. 3 are also rather fissiseptate, but on account of their less flattened whorl-sides, these two examples may be considered to be transitional to *V. wordiei* as well as to *Ophiceras transitorium*. The larger specimen is worn on the periphery; in the ventral view (Plate IX, fig. 3b) this, therefore, appears rather too acute, while conversely the costate variety of *O. transitorium*, figured in the same Plate (IX, fig. 2b), owing to similar corrosion of the periphery, with resultant asymmetry of the suture-line, is almost carinate in places. There may be great difficulty in identifying worn fragments, but since this inflated variety of the present species, intermediate to *O. transitorium*, is rather common, it may be separated with a new name (var. *rotunda*, nov). From the measurements of the typical example of this variety and of the larger, second specimen, here figured, it will be seen that in the wider umbilicus, this variety resembles *V. wordiei*, but the umbilical slope is evenly rounded and comparatively gentle and the sides are perfectly smooth. It ought to be added that the apparent absence of a keel in the ventral views (Plate X, figs. 3b, 2b) is due less to defective preservation than to bad photography. The dimensions of the two examples of the var. *rotunda*, just mentioned, are:—

	Plate X, fig. 3	Plate IX fig. 3
Diameter................	54 mm	62 mm
Height..................	40 %	43 %
Thickness...............	24 %	24 %
Umbilicus...............	33 %	34 %

The thickness of the holotype of this species was erroneously given as 29 % instead of 27 %; and as the abundant new material now before me suggests that a rather comprehensive interpretation of this form is desirable, I would characterise the holotype as more transitional to *V. wordiei* than any of the other examples so far figured. Although the whorl-thickness is the same in the two species, it is just the subtrigonal section with convex sides and the prominent umbilical border that, in addition to a larger umbilicus, differentiate *V. wordiei* from the flattened *V. decipiens*.

Thus I would also include in the latter the very acute body-chamber figured in Plate XIII, fig. 7, resembling *V. pralambha*, Diener, the genotype of *Vishnuites*. Such oxynote examples are connected by transitions with the typical, sub-acute forms and the still blunter var. *rotunda*, but the thickness also varies in these individuals. Two such oxynote body-chamber examples have the following proportions:—

	Plate XIII, fig. 7	No. 357d
Diameter................	55 mm	60 mm
Height..................	42 %	46 %
Thickness...............	21 %	22 %
Umbilicus...............	29 %	28 %

The great compression, combined with the very low umbilical wall and elliptical whorl-section make it desirable to separate this form also as a new variety (var. *acuta*). The still thinner *V. pralambha* differs chiefly in its slender second lateral saddle, but connects directly with this var. *acuta*. I may add that in three typical *Vishnuites* assemblages the number of examples of each was as follows:—

	No. 357	No. 673	No. 731
Vishnuites decipiens............	12	4	17
var. *rotunda*.	11	4	19
var. *acuta*...	2		--
— — var. *discoidea*	--	—	1
— *wordiei*..............	4	4	2
Ophiceras transitorium...........	5	2	1
(Lytophiceras) vishnuoides..............	3		

but owing to the difficulty of separating the less well preserved examples of *V. decipiens* var. *rotunda* from the type on the one hand and from *O. transitorium* on the other, these figures are only approximate.

The small example figured in Plate XIII, fig. 4 has a narrower umbilicus than the typical forms and a flatter whorl-side, but its preservation, unfortunately, is such that it is impossible to tell whether its thinness is due, at least partly, to corrosion. It may belong to the same form as the original of Plate XII, fig. 1, of similar proportions, but the acute periphery of this individual seems to be largely the result of weathering. It is improbable that these are worn examples of *Ophiceras (Lytophi-*

ceras) leptodiscus, and they are directly connected with such more evolute examples attached to the present species as that figured in Plate X, fig. 5, which may also conceivably represent a new variety, if not a new species. The dimensions of the three examples compare as follows:—

	Plate XIII, fig. 4	Plate XII, fig. 1	Plate X, fig. 5
Diameter.............	37	38	91 mm
Height................	49	48	44 °/$_0$
Thickness............	19	23	20 °/$_0$
Umbilicus............	23	22	28 °/$_0$

Until more specimens in a better state of preservation are found, it seems advisable to consider the first two individuals with a narrow umbilicus also merely as a variety (var. *discoidea*, nov.) of the present species. The third specimen is unusually large, but its preservation is also defective and it is clearly impossible to separate it merely on account of its size.

It ought to be added that, in some individuals, spiral striae are visible on the subacute periphery, simulating fine tricarination, and occasionally the venter may have a wavy outline, as in Plate III, fig. 5a.

Horizon:— Middle and Lower *Vishnuites* Beds.

Localities:— Many localities between River 6 (Spath Plateau) and north side of Stensiö Plateau (see Section C.).

Sub-genus *PARAVISHNUITES*, nov.

Sub-genotype:— *Vishnuites (Paravishnuites) oxynotus*, sp. nov., Plate III, figs. 5a-c.

Diagnosis:— Rather narrowly-umbilicate, compressed, oxycones, with faint, almost radial, striation or lineation, rarely costation, and low but distinct umbilical wall. Suture-line as in *Ophiceras*, with serration of lobes rather more distinct, at least in the genotype.

Remarks:— This sub-genus is proposed because the species of *Vishnuites* here described are clearly connected with two different groups of *Ophiceras*, namely *O. (Lytophiceras) vishnuoides* and *O. (L.) leptodiscus* in the case of the two species above described and *O. (Discophiceras) compressum* in the case of the species here separated as *Paravishnuites*. The crushed examples figured in Plate IX, fig. 6 show how close these forms are to *O. (Discophiceras) compressum* or *O. (D.) wordiei*, the provisional determination, in this state of preservation, having to be based merely on the radial ornamentation, although the well-marked umbilical slope may also be considered suggestive. *Vishnuites* is thus not strictly monophyletic, but since a simple form like *Ophiceras medium*, Griesbach, is the probable root of all the discoidal and keeled offshoots, it seems preferable not to carry the subdivision further.

Vishnuites (Paravishnuites) oxynotus, sp. nov.
(Plate III, figs. 5a-c).

The dimensions of the holotype (Plate III, fig. 5) are as follows.

Diameter	55 mm
Height	43 °/₀
Thickness	17 °/₀
Umbilicus	27 °/₀

The whorl-section is greatly compressed, with acute periphery, gently rounded, almost flat, sides and the greatest thickness at or near the well-marked but rounded, umbilical border. The umbilical wall is steep and comparatively high. The sides are almost smooth, with apparently radial, irregular, blunt, folds on the cast and striae of growth on the test. The latter are reclined on the umbilical wall, but projected and slightly sigmoidal on the sides and superimposed on the bulges which are most marked near the venter, so as to make the periphery slightly crenulate. Fig. 5a shows the termination of the septate stage; in fig. 5b, part of the body-chamber can be seen.

The suture-line has a general resemblance to that of *Ophiceras (Discophiceras) wordiei*, but the external saddle is rather slenderer and the denticulation of the lobes is more pronounced. The external, first and second lateral lobes have four, five, and four teeth respectively and the first (lowest) two teeth of the ascending auxiliary series are particularly strongly marked, whereas in the example of *O. (D.) wordiei* figured in Plate VII, fig. 7 the numbers are two, eleven and seven for the first three lobes, with about twelve minute teeth in the auxiliary row.

The periphery is uniformly sharp throughout, more acute than that of the species described below as *V. (P.) striatus*. I at first did not separate this form, even as a variety, from the present species, but although the latter is known in only a single example, the additional differences in suture-line, umbilical border, and ornamentation, make it desirable to describe it separately. The inner whorls, seen in the umbilicus, are apparently similar in the two forms and comparable to

Horizon:— Upper Otoceratan, *Ophiceras* beds (upper?).

Locality:— 284 (1932), associated only with one small *Glyptophiceras*, but by preservation probably from the *commune* beds.

Vishnuites (Paravishnuites) striatus sp. nov.
(Plate I, figs. 5a,b; Plate IX, figs. 6a,b).

This species is based on the complete and perfectly preserved example figured in Plate I, fig. 5, which has the mouth-border intact and over half a whorl of body-chamber. Its dimensions and those of two other specimens are:—

	Holotype	Plate IX, fig. 6b	No. 284c
Diameter.............	40	50	51 mm
Height...............	50	50	45 %
Thickness............	20	(?)	19 %
Umbilicus............	23	22	23 %

The whorl-section is less acute than that of the last species; the periphery is extremely narrowly rounded, but not strictly oxynote. The umbilical border is also more rounded than in *V. (P.) oxynotus* and less distinctly marked off from the side, while the ornamentation consists of subfalcoid striae which die out just before they reach the periphery. The plain mouth-border follows the direction of the striae of growth and is only slightly biconcave forward. There is a short rostrum, slightly elevated as well as projected.

The suture-line has a far broader external saddle than that of *V. (P.) oxynotus* and the very low median saddle across the siphonal area subdivides a much simpler external lobe, with only one or two prongs on each side. The inner whorls are well displayed along a break across a paratype (N. 284c), which also has half a whorl of body-chamber. At 3 mm diameter the whorl-section is rounded and slightly compressed, but at 5 mm it has become elliptical, while at 8.5 mm, it is as compressed as in the young *Ophiceras (Lytophiceras) commune*, previously figured (pl. IV, fig. 11b). At 14 mm the periphery is narrowly rounded, but the actual sharpening of the ventral area is conspicuous only at 20 mm and over.

The small umbilicus alone is sufficient to distinguish this species from all the other *Vishnuites* so far described. In the case of crushed examples, however, separation from *O. (Discophiceras) compressum* may be impossible (compare Plate IX, fig. 6).

Horizon:— Upper Otoceratan, *Ophiceras* beds.

Localities:— 284, 661, and 690 (1932—33), the last associated

Genus *GLYPTOPHICERAS*, Spath, 1930.

Glyptophiceras triviale, sp. nov.

(Plate VI, figs. 2, 9; Plate VII, figs. 2—5; Plate XIV, fig. 7; Plate XX, fig. 1).

The first two species of *Glyptophiceras*, here described as new, are miniature forerunners of the larger species of the next higher beds; but they are separated not only on account of their smaller size, but because the succession of growth-stages is different. Two typical examples of the present form here figured, and another paratype, have the following dimensions:—

	Holotype Plate VII, fig. 2	Paratype I Plate VI, fig. 2	Paratype II No. 130
Diameter	13	16	18 mm
Height	35	33	36 %
Thickness	(?)	20(?)	22 %
Umbilicus	42	42	40 %

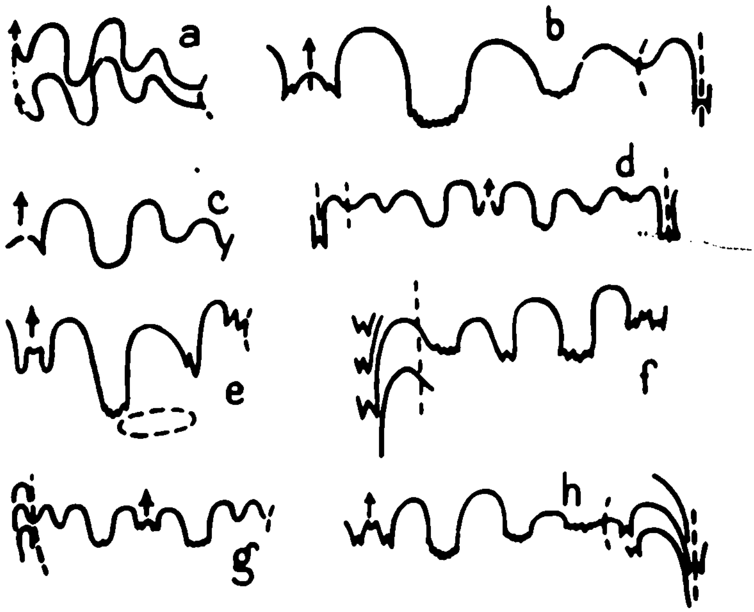
The whorl-section, on account of the crushing, is now very compressed in most examples, but a well-rounded umbilical border or an evenly arched periphery can be seen in some, and judging by paratype II, the section originally was probably comparable to the whorl-section represented in fig. 8e of Plate VII. The ornamentation consists of, first, comparatively distant bulges (nine to the whorl) at a diameter below 5 mm, and, then, closer costae (twelve to half a whorl), until, at about 10 mm diameter, there is a sudden change to irregular lineation or to mere striae of growth, i. e. apparent smoothness. There may, however, be rejuvenation of the ornament, as in *Polymorphites* of the Lower Lias, which the Greenland examples, indeed, resemble. The squeeze of an impression, figured in Plate VII, fig. 3, probably complete at under 30 mm diameter, shows about 8 final costae, after a prolonged finely-striate stage. Its inner whorls, like those of the small specimens represented in figs. 4 and 5 of the same Plate, are more distinctly nodate, so that they may be considered to be transitional to *G. polare*.

The suture-line (Text-fig. 1c) is visible in the second paratype above listed and shows a slenderer first lateral and a more advanced second lateral saddle than that of the young *Glyptophiceras* aff. *minor*, figured in 1930 (pl. IX, fig. 10). The toothing of the lobes is probably very fine, and it was not observed merely because the matrix is a comparatively coarse, micaceous sandstone.

The holotype is embedded in a slab of rock (not included in the figure), together with many other individuals of the present species; and three specimens of the same rock are figured to show the association of *Glyptophiceras triviale* with *Otoceras* (Plate XIV, fig. 7), with a *Pro-*

ductus (Plate VI, fig. 9) and with a Carboniferous (derived) *Stenopora*? (Plate XX, fig. 1).

In view of the Palaeozoic character of some of these elements in the *Glyptophiceras* Beds, it might be thought that the present species could belong to the genus *Paraceltites*, Gemmellaro. The enlarged figure of *P. plicatus* given by Frech[1]), indeed, shows considerable resemblance to *G. triviale* and *G. polare*; the coiling of the inner whorls and the suture-lines, however, are different in the two stocks. These are here



Text-fig. 1. Suture-lines of (a) *Ophiceras (Lytophiceras) subsakuntala* sp. nov., with unusually dependent umbilical lobe. (Loc. 243). (b) *Glyptophiceras nielseni*, sp. nov. var. *modesta* nov. (Plate IX, fig. 4), enlarged ×4. (Copy from Spath, 1934, p. 124, text-fig. 34e). (c) *G. triviale*, sp. nov. paratype II, enlarged × 5. (d) *G.* aff. *pascoei*, Spath, var. *rotunda* nov. (Loc. 1, 1930) (e) *G. extremum* (Plate XI, fig. 4), enlarged × 1½. (f) *G.* aff. *gracile*, Spath, transitional to *G. pseudelliptivum*, Spath, enlarged × 3½. (Loc. 524d). (g) *G.* aff. *serpentinum*, sp. nov., transitional to *O. (M.) praecursor* sp. nov. (Loc. 543). (*h*) *Ophiceras (Discophiceras) wordiei*, Spath (Loc. 17, 1930). All from lowest Eotrias (Otoceratan) of East Greenland.

held to be only distantly related in so far as they are both derivatives of Paralecanitinae[2]).

Horizon: Lower Otoceratan, *Glyptophiceras triviale* zone.

Localities: Cape Stosch (25, 1930 and Kløft 1 1931); River I (264, 266, 606, 616; 1933).

[1]) Lethaea geognostica, I, 2. Lief. 3. Die Dyas, 1901, pl. LXVII fig. 10
[2]) See Spath, *loc. cit.* (Catalogue), 1934, p. 19.

Glyptophiceras polare sp. nov.
(Plate XIV, fig. 6).

This form is based on the example figured in Plate XIV, fig. 6 which has the following dimensions:—

Diameter	28 mm
Height	27 %
Thickness	(?)
Umbilicus	48 %

The whorl-section was probably similar to that of the last species, for although the holotype is crushed, the comparatively narrow ventral area, compared with the higher sides, indicates a compressed, elliptical section. The umbilical border is well rounded, but distinct, at least on the inner whorls. The ornamentation consists of, first, seven strong nodes to the whorl and then ten weaker ones, degenerating into costae. On the outer whorl, only very feeble and slightly sigmoidal ribs are left, passing finally into striae. The suture-line is not preserved in the holotype, but it was probably like that of the last species.

This form resembles certain Himalayan types like "*Xenodiscus*" *himalayanus*, Diener (non Griesbach[1]) or *Danubites lissarensis*, Diener[2]), but these are larger and more advanced in suture-line, i. e. they are closer to the Greenland forms described as *G. pascoei* and *G. nielseni*. In the present form, the innermost whorls are the most highly tuberculate, up to a diameter of only 7 mm, when decline already begins. Even the much later "*Danubites*" *nivalis*, Diener[3]), is still smooth at that stage and the tuberculation in all the Himalayan forms changes into more regular costation, as it does in the later Greenland species.

There are numerous transitions to *G. triviale*, with earlier loss of the initial, tuberculate, stage, and in the case of many fragments in the slabs of rock, referred to under the last species, specific separation is impossible.

Horizon:— Lower Otoceratan. *Glyptophiceras triviale* zone.

Locality:— Cape Stosch 25 (1930).

Glyptophiceras minimum, sp. nov.
(Plate VIII, figs. 8a,b).

1930. *Glyptophiceras* sp. ind., Spath, *partim*, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 38, pl. VII, figs. 9a,b, 10a,b

[1]) *Loc. cit.* (1913), pl. II, figs. 3—4.
[2]) *Loc. cit.* (1897), pl. XIV, fig. 9.
[3]) *Loc. cit.* (1897), p. 51, pl. XV, figs 18, 19.

As type of this new species may be taken the example previously (1930) figured in plate VII, fig. 10a, b, which has the following dimensions:

	Holotype	Paratype (1930, pl. VII, fig. 9)	Plate VIII, fig. 3
Diameter in mm	18.5	17	15 mm
Height	31	32	31 %
Thickness	25	27	27 %
Umbilicus	46	46	46 %

The whorl-section is subrectangular, with flattened sides and venter, but rounded peripheral edges and umbilical margins. The ribbing is comparatively fine and close, sigmoidal, but pronounced only on the inner whorl-sides. The earliest volutions are smooth or almost smooth; and towards the end of the body-chamber (which is over half a whorl in length) there is a return to smoothness. The mouth-border is plain, following the course of the sigmoidal striae of growth, and the ventral sinus forward is only slight. The three figured examples are all complete, but there is some variation in the ornament, one of them (1930, pl. VII, fig. 9) being somewhat transitional to *G. gracile*.

The suture-line agrees with that of *G. minor*, but the two lateral saddles are generally more developed than in the suture-line figured in 1930 (pl. VII, fig. 7c). This, of course, is not a specific distinction, but *G. minor* differs also in being less compressed, less flattened peripherally, and in having less distinctive ornamentation. The inner whorls of *G. pseudellipticum*, though somewhat similar, are characterised by the evenly arched venter.

Horizon:— Upper Otoceratan, *Ophiceras* beds.

Localities:— 1 (1930); 397 (1932).

Glyptophiceras minor, Spath.

(Plate I, figs. 4a, b; Plate VII, fig. 6; Plate XIII, fig. 5).

1930. *Glyptophiceras minor*, Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 33, pl. VII, figs. 7—8; pl. VIII, figs. 14—15.

1931. , Spath: Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, pp. 79, 87.

There is little to add to the description of this species. The example now figured in Plate I, fig. 4 well shows the slight sinus forward of the striation on the broad periphery. Plate VII, fig. 6 was taken from the squeeze of an impression in a nodule and is referred to the present species merely on the strength of its fine lineation, the venter not being preserved. But it may have belonged to a more compressed form, judging by its rather low umbilical wall and flat sides, unless these were the result of crushing. The other species of *Glyptophiceras*, here described, however, are even less closely comparable, and the young of *Metophiceras* are more loosely coiled. In the case of poorly preserved sandstone casts (Plate VII, figs. 8a-e) correct identification may be impossible.

The small example previously recorded (in Koch, locality 25a) from the *Glyptophiceras* Beds is preserved in a matrix different from that of *G. triviale* or *G. polare* and appears to have come from beds above. Moreover its suture-line suggests that it may represent the inner whorls of a *Metophiceras (subdemissum* group).

The squeeze, enlarged × 2, of another impression (Plate XIII, fig. 5) is comparable to the inner whorls of the example illustrated in Plate VII, fig. 6.

Horizon:— Otoceratan, upper *Glyptophiceras* and *Ophiceras* beds.

Localities:— New: 54, 55, 57, 59, 117—118, 243, 367 (1932); 563, 610, 656, 686 (1933). Cape Stosch (1, 17, and 25a?); Clavering Island, Cape Franklin (2, 9, 10, partly young *Metophiceras*?).

Glyptophiceras pseudellipticum, Spath.

1930. *Glyptophiceras pseudellipticum*, Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 37, pl. VIII, figs. 8a, b.
1931. — — , Spath: Lauge Koch, *loc. cit.*, pp. 79, 81.

There is little additional material of this species, or at least nothing complete enough to be definitely identified with the unique holotype; but isolated inner whorls are difficult to separate from those of other *Glyptophiceras*, or, in the absence of the suture-line, even of *Metophiceras*. Many of the specimens of *Glyptophiceras* also are badly preserved on the two halves of split nodules, so that the rarity of this form may be due partly to lack of suitable material. There are, however, transitions to the more inflated and very common *G. gracile* (e. g. specimen 452a, or 524d, from which was taken the suture-line figured in Text-fig. 1f) with more sigmoidal ribbing appearing at an earlier stage. The Clavering Island example (6) previously recorded by Dr. Lauge Koch is less than 30 mm in diameter and therefore also somewhat doubtful, while the Cape Stosch specimens (1 and 18) are now partly referred to new species.

Horizon:— Upper Otoceratan, *Ophiceras* beds.

Localities:— Cape Stosch and Clavering Island?; 397 (1932).

Glyptophiceras gracile, Spath.

(Plate XI, fig. 9; Plate XVII, figs. 6a, b; Plate XVIII, figs. 5a, b, 6).

1930. *Glyptophiceras gracile*, Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 34, pl. VII, figs. 3—6; pl. VIII, figs. 9a, b, 10a, b.

1931. *Glyptophiceras gracile*, Spath; Lauge Koch: Carboniferous and Triassic Stratigraphy of E Greenland. *loc. cit.*, p. 79.

The ornamentation in this species is rather variable and several varieties can be recognised, in addition to passage-forms to species like *G. pascoei* (e. g. 1930, pl. VIII, fig. 10). The last may be compared to the larger example now figured in Plate XVIII, figs. 5a,b, and as these coarser individuals are rather common, they may be attributed to a new var. ***robusta***. This differs from the typical forms (e. g., Plate XI, fig. 9) in having longer smooth and distantly costate stages, the latter persisting on the body-chamber. The peripheral view of another example of the same variety is figured in Plate XVIII, fig. 6, and the smooth, young, form represented in Plate XVII, figs. 6a,b, represents the early stage, when the absence of ornamentation might cause confusion with other Ophiceratids.

It has already been mentioned that there are transitions to the compressed *G. pseudellipticum* (e. g., Text-fig. 1f, p. 48) with clearly bifid second lateral and dorsal lobes; and by the feeble development of the intermediate, distantly costate, stage, or its more or less complete omission, there are produced passage-forms to *G. minor*. The form previously figured (pl. VIII, figs. 9a,b) as *G.* sp. ind. is now also included in the present species as a var. ***retrorsa*** nov. Its ribbing is closer and distinctly rursiradiate, but it can now be matched by larger examples that clearly belong to the present species. There are many fragments, however, that cannot be specifically identified. In these identifications, it is not always possible to obtain a majority of characters in favour of one species, since there are so few decisive features; and it is not safe to stress the character that happens to be the most useful, in the present case, the ornamentation, since it varies so at different stages, as will be seem from the very large specimen figured in (1930) pl. VII, fig. 3. Fortunately since all the Greenland species that are liable to be confused in fragments come from more or less the same beds and can be accurately dated, there is no practical difficulty.

Horizon:— Otoceratan, chiefly lower *Ophiceras* zone.

Localities:— Cape Stosch to River 15, e. g. nos. 53, 102, 117—118, 378, 397, 447, 452, 521, 524, 529, 656, 661, 687 (1932—1933); Clavering Island.

Glyptophiceras serpentinum, sp. nov.

(Plate XIII, figs. 1a,b).

This new species is transitional between *Ophiceras (Metophiceras) praecursor* and the more typical *Glyptophiceras* of the *pascoei* group; and there are passage-forms, unfortunately mostly crushed, with the exception of one, the suture-line of which is here figured (Text-fig. 1g, p. 48). The holotype has the following proportions:—

Diameter	51 mm
Height	28 %
Thickness	< 20 (?)
Umbilicus	53 %

The whorl-section is compressed, with flattened sides and narrowly arched venter, also a rounded umbilical edge, but rather a high and steep wall. In the transitional specimen (543) already mentioned, the proportion of whorl-height to thickness is as 12:7, but the holotype may not have been so compressed. The ribbing begins early, and apart from first increasing, gradually and almost imperceptibly, and then slightly declining, it is remarkably uniform throughout the septate stage. The holotype includes only a quarter of a whorl of body-chamber and there the degeneration of the ribbing is rapid. Finally there is only fine striation.

The suture-line is very similar to that of the passage form here figured and the lobes are distinctly toothed. Compared with the suture-line of *Ophiceras (Metophiceras) subdemissum* (Plate XIII, fig. 3) the most conspicuous difference is in the size of the umbilical lobe and the height of the second lateral saddle. There is almost no overlapping of the whorls in either species.

This species shows some resemblance to *G. salomonii* Diener[1]) from the *Ophiceras* layer of Pastannah, Kashmir, but it is more loosely coiled. The rather coarsely-ribbed, medium-sized whorls of that species, moreover, bring it closer to *G. pascoei* than to the present species. *G. ophioides*, Spath[2]) is also similar, but it has the whorl-shape and pseudo-constrictions of *G. kashmiricum*, Spath[3]) and a much more broadly-rounded periphery.

Horizon:— Otoceratan, lower *Ophiceras* zone.

Localities:— 445, 452, 658.

Glyptophiceras nielseni, sp. nov.

(Plate V, figs. 2a,b; Plate IX, figs. 4—5; Plate XI, fig. 10; Plate XVII, fig. 2a,b; Plate XIX, figs. 1a,b).

1930. *Glyptophiceras pascoei*, partim. Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, pl. VIII, figs. 2 and 6 only.

This characteristic form has proved to be very abundant, but it was previously represented only by small specimens which were pro-

[1]) *Loc. cit.* (1913), pl. II, figs. 5a,b.
[2]) *Loc. cit.* (Catalogue), 1934, p. 82, pl. XII, fig. 1.
[3]) *Ibid.*, p. 83, pl. I, figs. 3a,b.

visionally included in *G. pascoei*. The differences in the present species may be briefly stated to consist of (1) looser coiling; (2) a slenderer whorl-section; (3) distant spacing of the early, stronger, ribs; (4) earlier cessation of this coarse stage and degeneration of the ornamentation beginning already on the septate whorls.

The holotype (Plate XIX, fig. 1) and two examples of a new variety, have the following dimensions:—

	Holotype	(Pl. IX, fig. 4 (var. *modesta*)	Pl X, fig. 2 (var. *modesta*)
Diameter.............	52	43	33 mm
Height...............	28	30	27 °/₀
Thickness	22 (?)	23	24 °/₀
Umbilicus...........	53	51	53 °/₀

The typical ornamentation is also shown in the examples represented in Plate IX, fig. 5 and Plate XI, fig. 10, but the former is crushed-in on one side and therefore appears too compressed while the second (squeeze of an impression) and the comparable inner whorls figured in Plate XVII, fig. 2 are already transitional to such a more coarsely-ribbed form as that figured in Plate IV, fig. 2 and discussed under *G. pascoei*.

In the var. ***modesta***, nov., on the other hand, somewhat resembling the more involute and less slender *G. gracile*, the costae of the earlier whorls are but faint, so that the degeneration of the ornamentation to the irregular striae of the body-chamber is far less conspicuous than in the type. This variety, in side view, therefore resembles the Himalayan example figured by v. Krafft and Diener[1]) as "*Xenodiscus*" *rotula* (*non* Waagen), except in coiling; both this, however, and "*X*". *kapila* represented in v. Krafft and Diener's fig. 2 (pl. xxvii) differ considerably in whorl-section. The original "*Danubites*" *kapila*, Diener[2]), described as from the *subrobustus* beds, is still less closely comparable and seems to have the long straight ribs of *Anakashmirites*. Moreover, the ribs are apparently thickened at the outer ends, which is quite against inclusion in *Glyptophiceras*.

Horizon:— Otoceratan, chiefly lower *Ophiceras* zone.

Localities:— Many localities between Rivers 6 and 16, e. g. 115—116, 243, 309—10, 397, 457, 661. Clavering Island.

[1]) *Loc. cit.* (1909), pl. xxvii, fig. 4.
[2]) *Loc. cit.* (1897), p. 50, pl. xv, figs. 16a-c.

Glyptophiceras pascoei, Spath.

(Plate IV, figs. 2a,b; Plate VI, figs. 5a,b; Plate XIII, figs. 2a,b).

1930. *Glyptophiceras pascoei*, Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 36, pl. VIII, figs. 1, 3—5, 16 (non 2, 6, 7).
1931. — , Spath: Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, pp. 79, 81.
1934. — , Spath: Spath, Brit. Mus. Cat. Cephalopoda, pt. IV, Vol. I, p. 83.

The previous interpretation of this species was rather comprehensive and it is now restricted to those common examples in which the change from coarse and distant, to finer and closer, costation occurs at a diameter of about 40 mm. The two doubtful specimens figured in (1930) pl. VIII, figs. 2 and 6 are thus now attached to *G. nielseni*, while the original of fig. 7 is probably transitional to that species, like the example here figured in Plate XVII, figs. 2a,b. The latter, however, is already very close to the more typical *G. pascoei* figured in Plate IV, figs. 2a,b, with the outer half-whorl a (temporary) body-chamber; the former (pl. VIII, fig. 7), with its unusual repetition of closely and distantly-ribbed stages, in the absence of the later whorls, cannot yet be definitely placed.

The original of Plate XIII, fig. 2 represents a coarsely ornamented and more macromorph variety (var. ***rotunda***, nov.) which is transitional to the two species described below as *G. subextremum* and *G. extremum*. The characteristic, inflated whorl-section is shown also in the young example of this variety, figured in Plate VI, figs. 5a,b; but at the same diameter *G. extremum* differs merely in having the tubercles distantly spaced and in their developing from coarse to fine instead of from fine to coarse, as in the present variety.

The suture-line given in Text-fig. 1d (p. 48) was taken from a fragment, probably of the var. *rotunda*, and differs from that previously figured (1930, pl. VIII, fig. 16) merely in not having the characteristic two teeth in the second lateral lobe. The internal (dorsal) lobe was at first represented as rounded, instead of bifid, but this was due only to the base having been worn away.

Horizon:— Otoceratan, (?upper *Glyptophiceras* and) lower and upper *Ophiceras* beds.

Localities:— Many localities between Cape Stosch and River 16, e. g. 367, 397, 436, 656, 676, 690; also Loc. 1, 1930 and 10, 1930. Clavering Island.

Glyptophiceras subextremum, sp. nov.
(Plate V, figs. 6a, b; Plate VI, figs. 4a, b).

This form is intermediate between *G. pascoei* and *G. extremum*, on the one hand, and *G. serpentinum* and *Metophiceras* on the other. It may be briefly defined as showing a return to a smooth and flattened, compressed outer whorl after an earlier coarsely tuberculate stage, almost rivalling that of *G. extremum* in the prominence of the bullae which, however, are most strongly developed at the umbilical end. The holotype (Plate VI, fig. 4) and a new variety (var. *plicatella*, nov.) have the following measurements:—

	Holotype	var. *plicatella* Plate V, fig. 6
Diameter	64 mm	72 mm
Height	31 °/₀	31 °/₀
Thickness	24? °/₀	21? °/₀
Umbilicus	50 °/₀	50 °/₀

The two outline whorl-sections here given are restored and it is possible that the difference in thickness between the holotype and the var. *plicatella* is apparent, not real. The side not figured in Plate V, fig. 6a is crushed and embedded in matrix, but since the rather narrowly arched periphery can be well seen it seems possible that the holotype (which also has only one side preserved) was similarly compressed, instead of being more rounded, as shown in the restoration. This rounding, of course, conspicuous on the earlier whorls, is only gradually lost on the flattened outer whorls, but the comparatively high umbilical slope alone suggests a greater thickness than the apparently narrow periphery permits. Examples of *G. pascoei*, or at least transitions to that form (e. g. 349c, 524d), similarly crushed in nodules, however, may also show flattening of the outer whorl, so that whorl-section alone could not be relied on in separating this species.

The ornamentation consists of course bullae, spaced rather distantly, to a diameter of about 50 mm, as in the var. *rotunda* of *G. pascoei*, but they are unusually blunt and most prominent on the inner whorl-side, so that the difference between these forms in the more favourably preserved specimens is striking. The holotype, with apparently the complete body-chamber, becomes smooth rather suddenly, after the cessation of the bullate stage. There are only very fine sigmoidal striae of growth, convex forward on the umbilical slope and, again, on the outer whorl-side; and in the aperture there is what can only be a very thin, chitinous *anaptychus*. Its almost semicircular, fine, lineation, however, suggests a whorl-shape much wider than that here given in the restorations, already discussed. Only half is preserved, so that the shape appears to be that of a common *Aptychus*, of the broad *latus* outline; but there is such general resemblance to the Devonian *Pelanaptychus* figured by Foord and Crick[1]) that the median fracture must be accidental. The *Anaptychus*-like body, previously[2]) recorded in an example of *G. minor*, is more rugose, like the *anaptychi* of Lower Lias *Arietites;* moreover, it is calcareous, not black and shiny like the present, horny, example.

In the var. *plicatella*, the decline from the bullate stage to first, costation, and then lineation, is gradual, so that body-chambers are rather distinct. *G. serpentinum* shows a corresponding decline, but lacks the early bullae; and in *G pascoei* and especially *G. gracile*, with somewhat similar but smaller body-chambers, the ornamentation of the inner whorls also is different.

Horizon:— Otoceratan, lower *Ophiceras* beds.

Localities:— 117—118 (1932); 661, 701 (1933).

Glyptophiceras extremum, sp. nov.

(Plate XI, fig. 4; Plate XVIII, fig. 4; Plate XIX, figs. 7a-c).

The holotype of this distinctive new species figured in Plate XIX, fig. 7, and a paratype, have the following dimensions:—

	Holotype	Plate XI, fig. 4	
Diameter	48	62	48 mm
Height	29	26	28 %
Thickness	33	28	31 %
Umbilicus	51	54	53 %

The whorl-section is rounded but, owing to the prominence of the tubercles, almost coronate on the earlier whorls, with the region of greatest thickness, however, still at the middle of the sides. The inner whorls acquire about five distant and very prominent tubercles, directly on a primitive smooth stage, and these tubercles soon become more bullate and approximate and finally degenerate on the body-chamber. The paratype which is a less extreme individual than the holotype, has slenderer whorls and less conspicuous tubercles and may therefore be considered to be somewhat transitional to *G. pascoei* and especially its var. *rotunda*. Both the examples here figured have over half a whorl of body-chamber but it is probable that the holotype was not fully grown.

[1]) Catalogue Fossil Cephalopoda British Museum, vol. III, 1897, p. 278, fig. 138 (B. M., No. C 1717).

[2]) *Loc. cit.* (1930), p. 33, pl. VIII, fig. 14.

The suture-line of this holotype (Plate XVIII, fig. 4) seems rather different from that of the paratype (Text-fig. 1e, p. 48), the latter having the two-pronged second lateral saddle of *G. pascoei*. Since, however, there is some variation in the suture-lines of these highly ornamented species, owing to the interference of the tubercles, and since it is not always possible to detect the incisions in the umbilical lobes, not much importance is attached to these apparent differences. They are significant, however, in view of the variability of the suture-line in the genus *Paratirolites*, Stoyanow, recently discussed[1]), which has great external similarity to the present species. In the genus *Paratirolites*, doubtfully referred to the family Stephanitidae, the tubercles are placed at the outer end of the costae[2]) and this feature alone seems sufficient to indicate that Stoyanow's forms cannot have anything to do with the species of *Glyptophiceras* here discussed, in spite of their superficial similarity.

Horizon:— *Otoceras* Beds, *Ophiceras* zone.

Localities:— 397 (1932); 691 and 736 (1933).

Family *Gyronitidae*, Waagen emend.

Genus *PRIONOLOBUS*, Waagen.

Prionolobus (?) sp. nov. ?

(Plate V, figs. 4a,b).

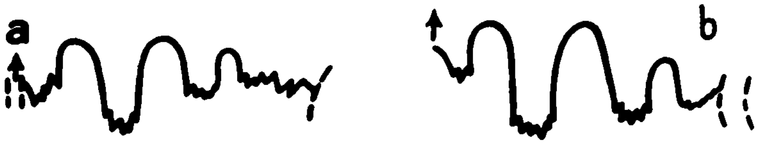
The single fragment of this form so far found is too small to be given a name, yet there seems to be no doubt that it is entirely distinct, not only from any other East Greenland species but from all the Indian forms hitherto described. Its most characteristic feature is the compressed whorl-section, with a very narrow and sharply truncate periphery. The greatest thickness is near the high and perpendicular umbilical wall, but it is probable that the sides were originally more evenly rounded than they are now; for on the side not figured, at least immediately below the periphery and again near the umbilical border, the shell has been crushed. The denticulations in the ventral lobe, however, are so well preserved on each side of the truncate periphery that the latter — though a very unusual feature among the Eotriassic ammonites of East Greenland — may be accepted as being original and not due to crushing or weathering. Slight corrosion, however, has affected the sides which are

[1]) Spath, *loc. cit.* (Catalogue), 1934, p. 366.

[2]) See Stoyanow "On the Character of the Boundary of Palaeozoic and Mesozoic near Djulfa". Mem. Imp. Russ. Min. Soc., vol. XLVII, pt. 1 (1910), e. g. pl. IX, fig. 8 ("*Xenodiscus* aff. *kapila*").

entirely smooth, although the suture-lines are almost perfectly preserved, at least on the figured side.

This suture-line (Text-fig. 2a) is similar to that of the forms described below as *Proptychites grandis* and *P. subdiscoides*, and more complicated that that of *Prionolobus lilangensis* (v. Krafft)[1]) which also has a broader periphery. Another allied species is probably *P. planulatus* (de Koninck)[2]), but the auxiliary elements in that species are simplified by wear, as in the present form on the side not figured. It should be added that the presence of some major elements in the auxiliary series which would seem to link up the form here described rather with the Paranoritids than the Gyronitids, is not taken to be against its inclusion in the genus



Text-fig. 2. Suture-lines of (a) *Prionolobus* (?, sp. nov.? figured in Plate V, figs. 4a, b. *Vishnuites* Beds. (b) *Proptychites grandis* sp. nov. figured in Plate XIV, fig. 9. *Vishnuites* Beds.

Prionolobus. It must be repeated, however, that if the truncation of the periphery be accidental, the present form would have to be included in *Proptychites subdiscoides*.

Horizon:— *Vishnuites* Beds, probably upper (see p. 93).

Locality:— 721 (1933), associated with *Ophiceras (Lytophiceras) ultimum*.

Family *Proptychitidae*, Waagen emend.

Genus *PROPTYCHITES*, Waagen.

Proptychites rosenkrantzi, Spath.

(Plate XV, fig. 8; Plate XVI, figs. 2—7; Plate XVII, figs. 4—5; Plate XVIII, fig. 7; Plate XIX, figs. 4—5).

1930. *Proptychites rosenkrantzi*, Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 40, pl. VII, figs. 1 a, b; 2a-h.

1931. — — , Spath; Lauge Koch: Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, p. 85.

Large examples, like the holotype, seem to be very rare; and the fragmentary and crushed specimen figured in Plate XVIII, fig. 7 is the

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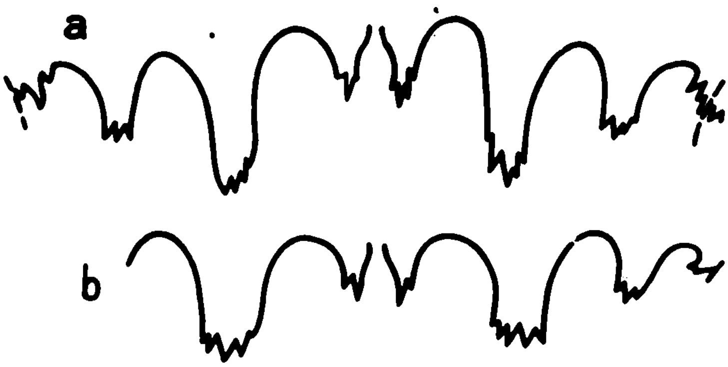
[1] In v. Krafft and Diener: Lower Triassic Cephalopoda from Spiti, Malla Johar and Byans. Mem. Geol. Surv. India, Pal. Indica, ser. XV, vol. VI, No. 1 (1909, p. 23, pl. I, figs. 1—3, 5—7.

[2] See Waagen, *loc. cit.* (1895), p. 255, pl. XXXIX, figs. 2a, b; pl. XL, fig. 1.

only one among the new material good enough to be figured. It seems to differ in suture-line, notably in having an apparently simple, bifid, second lateral lobe and the auxiliary series almost entirely on the umbilical wall. These differences, however, even if not due to the state of preservation of this large example, are not considered to be of significance, any more than the almost acute periphery of the holotype. For there are now many medium-sized specimens, comparable to those figured in Plate XVII, fig. 5 and Plate XIX, fig. 4 and it seems not only that the periphery, in undisturbed specimens, is more rounded, but that there is considerable variation in the suture-lines.

Thus it will beseen from Text-figs. 3 and 4 that the subdivisions and



Text-fig. 3. Suture-lines of *Proptychites rosenkrantzi* Spath, from two examples from locality 297. Eo-Triassic, East Greenland.

length of the lobes vary a good deal while the second lateral saddle may even be notched, on one side only, or on both. At smaller diameters (Plate XVI, fig. 3; Plate XIX, fig. 5) the suture-line is essentially the same as in the typical large specimens. There is, however, variation also in thickness and while the small example figured in Plate XVI, fig. 3 at 33 mm diameter, has a whorl-thickness of only 33 %, in others (e. g. 171a) it may be as much as 44 % (at 46 mm diameter). In this var. ***obesa***, nov., the umbilical rim may also be projecting, almost as in *Pachyproptychites*, but this appears to be dependent on the presence of the test (compare also Plate XVII, fig. 4) for in casts (Plate XVII, fig. 5) the edge is rounded.

The ornamentation is generally faint (Plate XVII, fig. 5; Plate XIX, fig. 4) and in a body-chamber like that figured in Plate XVI, fig. 2, does not differ from the ornamentation of the Himalayan example of *P. markhami*, Diener, which I recently described[1]). Occasionally there are more marked pleats (Plate XVII, fig. 4; Plate XIX, fig. 5) or spiral lines on the periphery.

[1]) *Loc. cit.*, Spath (B. M. Catalogue, 1934), p. 169

P. anomalus, described below, differs merely in suture-line; *P. intermedius* also in suture-line and dimensions. The evolute form figured in Plate XV, figs. 8a,b, as *P.* sp. ind aff. *rosenkrantzi* seems to have a much wider umbilicus than the type; and if this feature were permanent, it might be sufficient even for specific separation. Unfortunately this unique example is so incomplete and so badly preserved that it must be provisionally referred to the present species.

There are a thousand or more small specimens, similar to those previously figured in 1930 (pl. VII, figs. 2a-h), and two more, in a slightly better state of preservation, are now illustrated in Plate XVI, figs. 4—5. I sectioned many of these (Plate XVI, figs. 6—7) and prepared slides of some of them, but the crystallinity of the calcite infilling of the inner whorls prevented observation of the finer details of protoconch or siphuncle.

Horizon: — *Proptychites* Beds, *rosenkrantzi* zone.

Localities: — Most localities from Cape Stosch to Stensiö Plateau (see Section C), including 16 (1930).

Proptychites anomalus, sp. nov.

(Plate XVIII, figs. 1a,b).

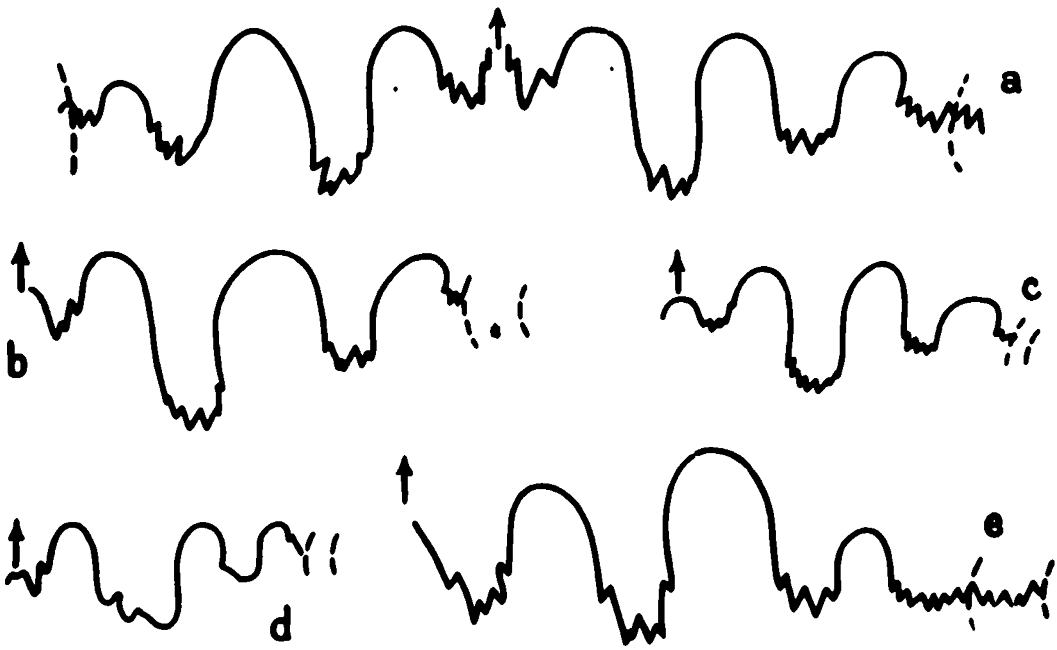
The unique example on which this species is based has the following dimensions:—

Diameter	94 mm
Height	48 °/₀
Thickness	31 °/₀
Umbilicus	21 °/₀

These differ so slightly from the proportions of the holotype of *P. rosenkrantzi* that specific separation on that basis could not have been suggested by the most convinced believer in a very narrow circumscription of ammonite species; but the suture-line is very distinct. It has an extraordinarily wide first lateral lobe, unsymmetrically subdivided by two peculiar projections, a simple and apparently entire (though somewhat angular) second lateral lobe, and an auxiliary lobe close to the umbilical border (Text-fig. 4d), also different from the serrated auxiliary elements of the typical forms of *Proptychites*. It is not probable that these peculiarities are due to defective preservation, for even the translucent, brown, test, is preserved in places; and in the fine ornamentation there is perfect agreement with the two examples of *P. rosenkrantzi*, figured in Plate XVII, fig. 5 and Plate XIX, fig. 4.

The periphery is provided with fine, spiral lines, as in many examples of the species just mentioned, and *P. anomalus* also has the characteristic, sharp, umbilical rim. There are traces of four or five additional spiral lines, placed rather far apart, on the outer whorl-side (at least on the figured side), somewhat like the specimen of *Otoceras boreale* figured in Plate V, fig. 1, though fainter.

This species is interesting on account of the reduction of its suture-line, the lobes becoming simplified before there is any frilling of the saddles. It is probable that there were similarly reduced offshoots in the Gyronitidae (e. g. *Kymatites*), but in at least some of these, the goniatitic



Text-fig. 4. Suture-lines of *Proptychites* from the Eo-Triassic of East Greenland. (a) *P. rosenkrantzi*, Spath. (Holotype, 1930, pl. VII, fig. 1). (b) Large example of Plate XVIII, fig. 7. (c) *P. simplex* sp. nov. (Holotype, Plate IX, fig. 1). (d) *P. anomalus* sp. nov. (Holotype, Plate XVII, fig. 1). (e) *P. grandis*, sp. nov. (Holotype, Plate XVII, fig. 1, reversed).

suture-line may be due to corrosion or weathering. There is no described species of *Proptychites* with a suture-line like that of *P. anomalus*, but some of the Dagnoceratinae, recently discussed[1]), could perhaps be brought into comparison with the form here described, at least as regards simplification of the lobe-line.

Horizon: — *Proptychites* Beds, *rosenkrantzi* zone.

Locality: 220 (1932), associated with *P. rosenkrantzi*.

[1]) Spath, *loc. cit.* (B. M. Catalogue, 1934), p. 268.

Proptychites intermedius, sp. nov.
(Plate XV, fig. 7; Plate XVII, figs. 7a,b).

There is only a single example of this form, but it is separated because it is intermediate in suture-line between *Ophiceras transitorium* and *P. rosenkrantzi* and because it has a more discoidal whorl-shape than the latter, with a lower umbilical wall. The measurements of the holotype are as follows:—

Diameter	42 mm
Height	48 %
Thickness	30 %
Umbilicus	24 %

In a small example (171c) of *P. rosenkrantzi*, of about the same dimensions, the proportions (45—.53—.38—.18) differed scarcely from those of the holotype of that species, so that *P. intermedium* is not only more discoidal, but also more evolute. Moreover, the greatest thickness is not at the prominent and sharp umbilical rim, but at about the middle of the gently convex side and the rounded umbilical rim passes into a perpendicular, but comparatively low umbilical wall. The specimen is septate to where the last two suture-lines are painted in in fig. 7a (Plate XVII); on the opposite side the umbilical portion of the body-chamber is preserved for nearly half a whorl.

The suture-line is characterised by an almost entire second lateral lobe and a lateral saddle that is broader than either of the other two. There is telescoping of the elements of successive suture-lines, moreover, resembling that of the example of *O. transitorium*, figured in Plate IX, fig. 2a, and even a somewhat similar corrosion of the periphery (fig. 2b) so that this form might indeed be mistaken for an *Ophiceras* rather than a *Proptychites*. On the other hand, the first lateral lobe has a distinct median tooth on the unweathered (opposite) side, as in many *Proptychites*.

This form is quite different from any of the Salt Range species, and is a far simpler type than *P. scheibleri*, Diener[1]), from the Himalayan "*Otoceras* Beds". This is also far more inflated than *P. intermedius*, while Diener's *Proptychites* sp. ind.[2]), with similarly telescoping lobe-lines, but a more advanced auxiliary series, is more compressed.

Horizon:— *Proptychites* Beds, *rosenkrantzi* zone.

Locality:— 297 (1932, associated with many *P. rosenkrantzi*).

[1]) *Loc. cit.* (Pal. Indica, 1897), pl. VI, figs. 3a-c.
[2]) *Ibid.*, figs. 5a-c.

Proptychites grandis, sp. nov.

(Plate XIV, figs. 8, 9a, b; Plate XVII, fig. 1; Text-figs. 2b, 4c.

This species is created for the unique example figured in Plate XVII, fig. 1, which unfortunately is crushed and fragmentary; but the two additional and smaller specimens, represented in Plate XIV, figs. 8 and 9 may provisionally be grouped with the larger specimen, until more and better material becomes available. The dimensions of the three examples are as follows:

	Holotype	Plate XIV, fig. 8	Plate XIV, fig. 9
Diameter	130	65	67 mm
Height	55	50	50 %
Thickness	23 ?	30 ?	27 %
Umbilicus	12	20	18 %

The differences in these dimensions are not considered to be of significance, for the umbilical slope tends to become strongly undercut so that the width of the umbilicus at larger diameters would become reduced. The thicknesses vary merely because the preservation is poor; but the sectional view given in Plate XIV, fig. 9b is approximately correct since only the right-hand side is badly worn, while the left-hand (figured side), judging, by the suture-lines, is merely slightly corroded. The whorl-section, thus, was somewhat trigonal, with an evenly arched periphery and the greatest thickness at the umbilical border. The wall is very high and perpendicular in the two smaller specimens, but definitely undercut in the holotype, which is also entirely septate. Assuming that the body-chamber was over half a whorl in length, as in the other species of *Proptychites* here described, the shell attained a maximum diameter of at least 200 mm.

The suture-line (Text-figs. 2b and 4c) is similar to that of *P. rosenkrantzi;* and although the species is earlier, its external lobe is more complicated. In the smaller specimen (Text-fig. 2b) the external lobe is shallower, but at the beginning of the outer whorl of the holotype, this lobe is also shallow. There is good agreement with the suture-line of *P. typicus*, v. Krafft[1]) and the example of that species (B. M., no. C 28546) which I recently described[2]) has the same deep umbilicus as the specimen here illustrated (Plate XIV, fig. 9a), but is more inflated. *P. discoides*, Waagen[3]) with proportions 73—.52—.22—.16, on account of its flattened whorls, is less closely comparable.

Horizon:— *Vishnuites* Beds (middle or lower?).

Localities:— 98 and 243 (1932); doubtfully 188.

[1]) In v. Krafft and Diener, *loc. cit.* (1909), pl. xix, fig. 5.

[2]) *Loc. cit.* (B. M. Catalogue, 1934), p. 169.

[3]) *Loc. cit.* (Pal. Indica, 1895), p. 174, pl. xx, fig. 1 (lectotype), 2.

Proptychites subdiscoides sp. nov.

(Plate XIII, figs. 10a,b; Plate XV, figs. 5, 6).

The measurements of the holotype (Plate XV, fig. 5) and of a paratype (Plate XIII, fig. 10) compare as follows:—

	Holotype	Paratype
Diameter	65	64 mm
Height	48	50 °/₀
Thickness	23 ?	22 °/₀
Umbilicus	21	21 °/₀

The whorl-section is approximately similar to that represented in Plate XVI, fig. 1b, but the sides are flatter and there is an appearance of greater compression generally, since the greatest thickness is at the sharp but rounded umbilical edge. The umbilical slope is perpendicular but not nearly so high as in the more narrowly umbilicate *P. grandis*. The umbilicus also seems to open out with age instead of contracting and becoming undercut. There is no sign of ornamentation and in all the three specimens available, the smooth and flat body-chamber begins at about 60—70 mm diameter.

The suture-line (Plate XV, fig. 6) resembles that of *P. grandis* as well as that of the form described as *Prionolobus* (?) sp. nov.? and is characterised by rather slender saddles. It may be compared to the suture-line of *Proptychites markhami*, as originally figured by Diener[1]), but while it is, perhaps, less complex generally, it has the peculiar outer notch in the external saddle that characterises the later *P. rosenkrantzi* and *P. anomalus*.

In spite of its discoidal shape and comparatively low umbilical wall this species is thus included in *Proptychites* on account of its suture-line and close affinity with *P. grandis*. But if inflation be considered an essential feature of *Proptychites*, the present form and *P. (Koninckites?)* sp. ind. described below, could, on the discovery of better material, perhaps be separated as an independent genus within the Proptychitidae, somewhat transitional to Paranoritidae.

Horizon:— Middle *Vishnuites* Beds.

Localities:— 292, 392 (1932), at both localities associated with *Vishnuites* spp.

Proptychites simplex sp. nov.

(Plate IX, figs. 1a,b).

There is only a single example of this distinctive species from the *Proptychites* Beds, but three, less typical, examples have been found in

[1]) *Loc. cit.* (Pal. Indica, 1897), pl. VI, figs. 4b, 6c.

lower beds and connect the present form with the compressed varieties of *Ophiceras transitorium*. The holotype has the following dimensions:—

Diameter	86 mm
Height	42 %
Thickness	22? %
Umbilicus	30 %

The whorl-section is compressed, with an evenly arched periphery and flattened sides, showing a faint spiral depression in the position of the first lateral lobe, but since the opposite side is worn and crushed, it is uncertain whether the groove is a constant feature of this species. The umbilical border is rounded but well defined; the umbilical wall apparently perpendicular. There is no trace of ornamentation on the cast.

The suture-line (Text-fig. 4c, p. 62) resembles that of *P. markhami*, Diener[1]), in its broad second lateral saddle, but the external lobe is slightly simpler. The general plan is that of the suture-line of *Ophiceras transitorium* as much as of *P. rosenkrantzi*, and the other species of *Proptychites* here described, but the absence of inflation in the umbilical region links *P. simplex* with the more involute *P. subdiscoides*, discussed above, and the still more narrowly umbilicate *P. discoides*, Waagen[2]). In the tendency to ventral compression, however, this form could also be held to be transitional to certain *Paranorites*. When the periphery is damaged or invisible, it may be difficult to separate the present form from *Vishnuites decipiens*, var. *discoidea*, nov.

Horizon:— *Proptychites* Beds (*rosenkrantzi* zone); *Vishnuites* Beds.

Locality:— 300, 359, 436 (two examples from the last associated with a *commune* fauna, but showing by their reddish matrix that they came from higher up).

Proptychites (Koninckites ?) sp. ind.

(Plate XII, figs. 8a, b).

This form is as doubtful as *Prionolobus ?* sp. nov.? described above, and is likewise discussed separately only because its most conspicuous feature — the small umbilicus — does not seem to be due entirely to the poor preservation. There is no doubt that the figured specimen is badly worn; the small second lateral saddle and the forward sweep of the auxiliary series indicate that the umbilical border is entirely worn

[1]) See in v. Krafft and Diener, *loc. cit.*, (1909), pl. XI, figs. 4, 5; pl. XII, figs. 3, 4.
[2]) *Loc. cit.* (1895), p. 174, pl. XX, fig. 1.

away and the periphery has similarly suffered from corrosion. The restored outline whorl-section, thus, must be considered to be only approximate. Even so, however, the whorl-height seems to have been at least 54 % of the diameter and the umbilicus only about 10 % and these measurements alone, if they can be trusted, would indicate that the present form is distinct from all the other Eotriassic ammonites of East Greenland.

The figured specimen is a cast, in a coarse, micaceous, sandstone matrix, and there is no trace of ornamentation. Reference to *Koninckites?* is suggested by the general resemblance to the species of the Lower Ceratite Limestone of the Salt Range, where they are similarly associated with *Proptychites*. Even if the peculiarities of the present form be taken to be due to the preservation, identity with a species like *Proptychites grandis* is not probable. On the other hand, while an involute example of *Proptychites markhami*, Diener, figured by v. Krafft and Diener[1]) has an umbilicus of 15 % of the diameter (39 mm), *Koninckites alterammonoides*, v. Krafft[2]) is closer to the Greenland form, not only in the narrow umbilicus, but also in the other characters, including the suture-line. Unfortunately, the example here figured was associated only with a still more doubtful sandstone cast (in a coarsely micaceous *Myalina* rock) of an ammonite that could have been a worn *Proptychites grandis*, since its umbilicus appears to have been about 18 % of the diameter. There is, however, an incomplete specimen from another locality (243), resembling the ammonite figured in Plate XV, fig. 5, but with a very narrow and deep umbilicus, sharp edge and perpendicular wall; if this example belongs to the present form, the restoration of the umbilical edge in fig. 8b is wrong.

Horizon:— *Vishnuites* Beds, probably middle (or lower?).

Locality:— 188 (1932).

b. Class *Gastropoda*.

The few gastropods represented in the new collections add little to our knowledge of this class. There are only two new forms, described below as *Loxonema* sp. ind., and *Undularia? (Toxoconcha?)* sp. ind., but I take this opportunity of figuring a large example of *Bellerophon borealis* Spath (Plate XIX, figs. 3a-c) identical with the holotype previously figured, and showing two distinct spiral ridges on the periphery, although these are scarcely visible in the photograph. There are now

[1]) *Loc. cit.* (1909), p. 20, pl. xi, fig. 2.
[2]) *Ibid.*, p. 70, pl. xvi, figs. 1—2.

also figured a fine and large specimen of *Naticopsis arctica*, Spath (Plate XXII, fig. 7) and two smaller examples of presumably the same form, showing different colour patterns. In one (Plate XXII, fig. 6a) the design is much coarser than in the other (fig. 6b) and in both it is more regular and finer than in the holotype (at a larger diameter). The light yellowish or brownish colour of the ground and the rich, deep brown of the pattern give these shells a particularly fresh or recent appearance, but in most of the many specimens now available, the colour markings have disappeared, so that it is impossible to say whether there are still other types than the three mentioned above, observed in only a few examples of each.

The small forms of *Worthenia* previously recorded as *W.* cf. *humilis* J. Böhm, and W.? sp. ind. are probably represented again on the slab figured in Plate XX, fig. 7 (enlarged × 2) but the preservation is too poor to allow of more accurate determination.

Family *Pyramidellidae*.

Genus *LOXONEMA*, Phillips.

Loxonema sp. ind.

(Plate XXII, fig. 10).

1931. *Loxonema* sp. ind. Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, pp. 41, 79, 85.

A portion of a slab from the *Ophiceras (Lytophiceras) dubium* bed is figured (enlarged × 2) to show the "many small *Loxonema*?" already recorded (in Lauge Koch, p. 41). The preservation is such that separation from the many Muschelkalk species figured for example by Martin Schmidt[1]) on the one hand, or the Permian forms from Kazan, described by Netschajew[2]) on the other, is impossible. The further specimens listed below are in a still worse state of preservation and may well belong even to different genera.

Horizon:— *Glyptophiceras* to *Proptychites* and *breviformis* Beds.

Localities:— Cape Stosch, localities 7, 16 and 25 (1930); 101, 171–172, 208, 367 (1932).

Genus *UNDULARIA*, Koken.

Subgenus *Toxoconcha*, Kittl.

Undularia? (Toxoconcha?) sp. ind.

A smooth cast of a small spire, 5.5 mm in length, but embedded in matrix, is attached to this genus merely because it shows the step-

[1]) Die Lebewelt unserer Trias, 1928, pp. 247—253.

[2]) Die Fauna der permischen Ablagerungen des östlichen Theils des europäischen Russlands. Trudui Obshchestra Kazan, XXVII, 1894, pp. 356 & ff., pl. XII, e. g., figs. 40—48.

like, flattened whorls of a form like *T. siliquoolithica*, Hohenstein[1]), and has the same apical angle of 25°. Since aperture and ornamentation are not preserved the identification must, of course, remain tentative.

Horizon:— Lower *breviformis* zone.

Locality:— 208, associated with *Loxonema* sp. ind.

c. Class *Scaphopoda*.

Family *Dentaliidae*.

Genus *DENTALIUM*, Linnaeus.

Dentalium (Entalis?) sp. ind.

(Plate XXI, fig. 16).

The small hollow cones are preserved in calcite on red or grey sandstone slabs and this may account for the tapering end being generally converted into a solid apex of crystalline calcite. Most are straight and, in size at least, are closer to the small Permian *D. speyeri*, Geinitz[2]) than to the larger *D. regulare*, Ahlburg[3]) from the Lower Muschelkalk. There is, however, a distinct curvature in some, though not so much as in *Entalis laevis* Schlotheim[4]). The preservation does not permit of observation of the characteristic slit of *Entalis*.

Horizon:— Top red beds (*fassaensis* zone) and *Myalina kochi* horizon.

Locality:— 363, 813.

d. Class *Pelecypoda*.

There is nothing to add to the descriptions of the following species, but in some cases examples from new localities, or else additional specimens in a better state of preservation have been figured.

Pseudomonotis (Claraia) stachei, Bittner. Plate XXI, figs. 3—9.
— *(Eumorphotis ?)* sp. ind. cf. *venetiana* (Hauer).
Gervillella aff. *exporrecta* (Lepsius?) Bittner sp. Plate XXII, figs. 9a-c.
Enantiostreon cf. *difforme* (Schlotheim). Plate XX, fig. 8; Plate XXI, fig. 13.
Anomia? (Placunopsis?) sp. ind. Plate XX, figs. 6a-c; Plate XXI, figs. 11—12, 17—18.

[1]) See M. Schmidt: "Die Lebewelt unserer Trias", 1928, p. 262, text-fig. 699.
[2]) See in Netschajew: Die Fauna der permischen Ablagerungen des östlichen Theils des europäischen Russlands, Trudui Obshchestra Kazan, vol. XXVII (1894), p. 325, pl. XI, figs. 9—10.
[3]) See M. Schmidt: "Die Lebewelt unserer Trias, 1928, p. 211, text-fig. 512.

Myalina aff. *schamarae*, Bittner. Plate XX, fig. 12; Plate XXI, fig. 15.
— *kochi*, Spath. Plate XX, fig. 4.
Nucula sp. juv. ind.
Anodontophora aff. *canalensis* (Catullo).
— aff. *fassaensis* (Wissmann), Münster sp. Plate XXII, fig. 5.
— sp. nov.?

With regard to the species of *Myalina*, there seems to be no difference between the example of *M.* aff. *schamarae*, figured in Plate XXI, fig. 15, from the *Vishnuites* beds, and the form represented in Plate XX, fig. 13, from a block of yellowish-white, calcareous sandstone out of conglomerate No. III. The *Anodontophora* (?) sp. ind., however, from the same block, figured in Plate XX, fig. 14, is different from any Eotriassic form, found *in situ*, while the small, *Pleurophorus*-like species, from an oolitic block in Conglomerate IV (Plate XXII, fig. 2), is not only entirely distinct in itself, but is associated with numerous *Myalina (Liebea)* of the *squamosa* type that are also different from anything found *in situ* in the Eo-Trias of East Greenland.

The two forms of *Myalina* figured in Plate XX, figs. 2 and 3 seem to be transitional from *M.* aff. *schamarae* to *M. kochi*. They come from intermediate beds, but they resemble the early form in being small and slender, while the true *M. kochi* is always large and has a wing-like, posterior extension of hinge-margin and shell. Most of the earlier forms compare best with Bittner's fig. 22[1]), and many are slender enough to be compared to the same author's examples of *M. vetusta* (Benecke)[2]). In fact, it has been previously mentioned that the East Greenland form is closer to *M. vetusta* in its sharp umbo; but for the present I am not giving it a new name, partly because the doubtful form figured in Plate XX, fig. 13 (and possibly referable to *M. de geeri*, Lundgren)[3]) is so similar. The poor preservation may also be held responsible for an equally doubful *Myalina* previously figured (Pl. IX, fig. 8) from the *Proptychites* beds, being labelled *Gervilleia* (?) sp. ind.

With regard to the forms of *Anodontophora*, I had referred the sandstone casts from the top red beds to *A. fassaensis* with some doubt; and the small isolated example now figured (Plate XXII, fig. 5) may not seem convincing enough to support the identification. It was figured merely to show the probable identity of the smaller form, previously

[1]) Versteinerungen aus den Trias Ablagerungen des Süd-Ussuri-Gebietes etc. Mém. Com. géol. St. Pétersb., vol. VII, No. 4 (1899), pl. IV.
[2]) *Ibid.*, p. 17, pl. IV, figs. 17—19.
[3]) Anmärkningar om permfossil från Spetsbergen. Bihang till K. Svenska Vetenskab.-Akad. Handlingar, vol. XIII, Afd. 4, 1888, p. 24, pl. I, fig. 8

referred to as *Anodontophora* ? sp. ind. cf. *fassaensis* (1930, pl. XII, fig. 15), from a red shale, with the larger casts of the grey shale (*ibid.*, pl. XI, fig. 2). Similar examples occur in a red shale, as for example at locality 3 (Finsch Islands, 1930) and when they are sufficiently well preserved for identification they show such good agreement with Frech's fig. 3d of his pl. VII[1]) that the term *fassaensis* beds, already used for stratigraphical purposes, seems well justified.

The internal cast of a left valve, figured in Plate XXI, fig. 14 as *Anodontophora* sp. nov.? ind. may be attached to the assemblage previously discussed under *A.* aff. *canalensis* (Catillo). It has an unusually deep, concentric furrow, but its shape is more trigonal than that of the Ussuri forms of Catullo's species figured by Bittner[2]). It is possible that these early forms from the *Ophiceras* and *Vishnuites* beds are new, like the associated *A.* sp. nov.?, above listed, with a much less elongated shape (1930, pl. XII, figs. 7—8).

1. Order *Anisomyaria*.

Family *Aviculidae*, Lamarck.

Genus *PSEUDOMONOTIS*, Beyrich, 1862.

Pseudomonotis sp. ind. cf. *iwanowi*, Bittner.

There is only a portion of a valve preserved on a nodule, but in spite of its defective state the specimen is described separately because in ornamentation it differs from all the other East Greenland pelecypods. There is faint, radial striation, similar to that of *Claraia stachei*, but it is crossed by far more conspicuous concentric ridges. These are distinct, lamellar, raised lines, superposed on the radii; they are regularly spaced, and quite different from the concentric folds seen in species of *Claria*. Apart from the regularity and neatness of the concentric lines, this ornamentation resembles that of the Upper Jurassic *Chlamys (Camptochlamys) intertextus* Roemer[3]) sp. It suggests comparison of the Greenland fragment with the Ussuri *Pseudomonotis iwanowi*, Bittner[4]), especially the central portion of his fig. 7, though this is a larger shell; but as in Roemer's species, the concentric lamellae in the Ussuri form also are less regular. In the absence of the hinge and wings, it is of course impossible to identify the present fragment more satisfactorily.

Horizon:— Upper *Vishnuites* beds.

Locality:— 721.

[1]) *Op. cit.* (Leitfossilien der Werfener Schichten), 1912.

[2]) *Loc. cit.* (Mém. Com. géol. St. Pétersb., vol. VII), 1899, pl. III, figs. 34—38.

[3]) See Arkell: Monograph of the British Corallian Lamellibranchia. Pal. Soc., vol. for 1928 (1930), pl. VIII, fig. 1.

[4]) *Loc. cit.* (Mém. Com. géol. St. Pétersb., vol. VII, 1899, p. 81, pl. I, figs. 1—9.

Subgenus *CLARAIA*, Bittner 1901

Pseudomonotis (Claraia) extrema, sp. nov.

(Plate XX, fig. 10; Plate XXI, fig. 2).

I mentioned in the description of *Claraia stachei* (1930, p. 49) that one or two examples, then referred to that species, might well have been attached to *C. clarai* (Emmrich). Even in those extreme examples, however, the coarse, concentric folds were confined to the anterior and posterior margins and since the preservation was generally poor and the shells were crushed, it was not considered advisable to refer these corrugated forms to a separate species. Now, however, there are some fairly well-preserved specimens, with convex left and distinctly flatter, right valves, that show that the corrugation is far coarser than in *C. clarai*, although it is strongest at the middle of the valves, not at the margins.

The general shape, hinge, and fine radial striation are the same as in *C. stachei*, Bittner, previously discussed, and I have pointed out that that species must be confined to those forms in which the radial ornamentation is more pronounced than the concentric ribbing. This is well seen in the examples now figured in Plate XXI, figs. 3 and 4, but the smaller specimens (figs. 5—7) also show distinct concentric ribs while the coarser examples represented in figs. 8 and 9 have the radial costae more pronounced. In the present form, on the other hand, the extremely coarse radial folds are far more conspicuous than the radial striae so that internal casts may appear almost smooth (Plate XXI, fig. 2) or may show only a few coarser ribs at intervals, as in certain inaequicostate *Eumorphotis*. There are four folds on the left valve and five or more, either equally coarse or slightly less prominent, folds on the right valve. The latter, therefore, shows much more resemblance to at least one of Hauer's originals of his "*Posidonomya clarae*" (Buch)[1] than do the left valves, but the many figures of *C. clarai*, given in geological literature[2]), agree in showing twice as many concentric folds as does the present form. It has been pointed out, of course, by Bittner[3]) that there is very considerable variability of *C. clarai* in every conceivable direction. The concentric folds shown in his fig. 14 (pl. XXIV) however, were considered to be "very strong", and comparison with the corresponding valve here figured (Pl. XX, fig. 10) will show that *C. extrema* may well be separated specifically, for its folds are far more conspicuous.

[1]) Über die vom Herrn Bergrath W. Fuchs in den Venetianer Alpen gesammelten Fossilien. Denkschr. K. Akad. Wiss. Wien, vo, II, 1851, pp. 112, 119, pl. XVIII, fig. 9, pl. XX, figs. 1—2

[2]) See Bittner: "Über *Pseudomonotis telleri* und verwandte Arten der unteren Trias". Jahrb. K. K. geol. Reichsanst., vol L, p. 583.

[3]) *Ibid.*, p. 585.

The malformed example figured in Plate XXI, fig. 1 shows only a single, strong, concentric fold and is therefore closer to *C. stachei*, with which species the present form is indeed, connected by many transitions. It is interesting to note that nearly all the Greenland forms of *Claraia* belong to the *clarai* group, which was considered already by F. v. Richthofen[1]) to characterise the Lower Eotrias (Alpine Seis Beds) and that there is only a single example among the abundant Greenland material that could be compared to forms of the *aurita* group of the higher Campile Beds. This specimen, although very defective, is illustrated in Plate XXI, fig. 10 and it will be seen that while there is some distant resemblance to *P. (C.) aurita* (Hauer), as figured by Frech[2]), comparison with the same author's *P. telleri*[3]) is at least equally definitely indicated.

Horizon:— *Ophiceras* and *Vishnuites* Beds.

Localities:— 514 and 634.

Pseudomonotis (Claraia) kilenensis sp. nov.

(Plate XXII, fig. 1).

As *P. (C.) extrema* differs from *P. (C.) clarai* in having only half as many concentric folds, so the present species differs from *P. (C.) stachei* in having about twenty radial ribs as against forty or more. The comparatively coarse ribs, moreover are more definitely confined to the central portion of the shell, are often irregularly spaced and have a tendency to separate more widely at the middle, so that in the most complete specimen (left centre of fig. 1, Plate XXII) there are two wide, median, interspaces. This impression of a left valve (which I consider typical) is also more elongated than similarly preserved examples of *P. (C.) stachei* and can be compared to Lepsius's[4]) fig. 1b of his *P. (C.) clarai*, as *P. (C.) stachei* resembles his fig. 1a. The concentric growth-lines are feebly marked and there are only indistinct concentric folds. The hinge-line is imperfectly preserved, but the straight posterior portion, separated from the remainder of the shell by a shallow depression, is similar to that of corresponding impressions of *P. (C.) stachei*. The convexity of the valves may also be assumed to have been the same.

Horizon:— *Vishnuites* Beds.

Locality:— 371, 372 (associated with *P. (C.) stachei*).

[1]) Geognostische Beschreibung der Umgegend von Predazzo, St. Cassian und der Seisser Alpe etc.", 1860, p. 54.

[2]) "Leitfossilien der Werfener Schichten & c.". Result. Wiss. Erforsch. Balaton Sees. Vol. I, pt. 1 Pal. Anh. VI, 1912, pl. VI, fig. 1c.

[3]) *Ibid.*, pl. II, fig. 3.

[4]) Das westliche Südtirol. Berlin, 1878, pl. I.

Subgenus *Eumorphotis*, Bittner. 1901.

Pseudomonotis (Eumorphotis) multiformis, Bittner.

(Plate XXII, fig. 8).

1899. *Pseudomonotis multiformis*, Bittner: Versteinerungen aus den Trias-Ablagerungen des Süd-Ussuri-Gebietes. Mém. Com. géol. St. Pétersb., vol. VII, No. 4, p. 10, pl. II, figs. 11—22.

1931. — *(Eumorphotis) multiformis*, Bittner; Kutassy: Fossilium Catalogus, I, pars 51, Lamellibranchiata triadica, II, p. 280.

The example here figured is incomplete and the hinge, in particular, has suffered; but the fine, radial ribbing is distinct. The specimen seemed at first to be closer to the true *P. (E.) venetiana*, Hauer sp.[1]) than the doubtful example I recorded in 1930 (p. 48) as comparable to that species. On the strength of a second specimen, however, an almost entire left valve, I am now referring this East Greenland form to *P. multiformis*. The second specimen, attached to an *Ophiceras* sp., was not discovered until after the preparation of the plates, chiefly because it was covered by matrix. The wings, unfortunately, are damaged, but the example is about the size of Bittner's fig. 21. There is the characteristic alternation of radii of varying strength, grouped into sets, as illustrated by Bittner; and the general shape and dimensions, the considerable convexity, but very slight obliqueness, all seem to confirm the identification, but the ornamentation is much more delicate than in the Fassa example figured by M. Ogilvie Gordon[2]).

From another locality (201), out of a single block, there were obtained a number of smooth casts, some with both wings, but only rarely showing remains of the striate test. Some of these could well be attached to *P. (E.) telleri*, as represented by Bittner's fig. 4[3]); in others, the test, perhaps owing to weathering, seems to be less finely striate and to show also concentric banding, at least along the ventral margin, as in *P. bocharica* Bittner[4]). Since this apparent variability, however, is probably due to the defective preservation, they may all be included either in the present form or in *P. (E.) venetiana*.

Horizon:— *Ophiceras commune* beds.

Localities:— 201?, 346, 679.

[1]) See Bittner: Beiträge zur Paläontologie insbesonders der triadischen Ablagerungen zentralasiatischer Hochgebirge. Jahrb. k. k. geol. Reichsanstalt, vol. XLVIII (1898) 1899, pl. XV (2), figs. 2, 4.

[2]) Das Grödener-, Fassa- und Enneberggebiet in den Südtiroler Dolomiten. III. Paläontologie. Abhand. Geol. Bundesanst. vol. XXIV, 2, 1927, pl. II, fig. II.

[3]) Über *Pseudomonotis telleri* und verwandte Arten der unteren Trias. Jahrb. k. k. geol. Reichsanstalt vol. 1 (1899) 1900, pl. XXII.

[4]) Ibid. (vol. XVIII), 1899, pl. XV (2), fig. 1.

2. Order *Homomyaria.*

Family *Anthracosiidae*, Amalitzky.

Genus *ANODONTOPHORA*, Cossmann.

Anodontophora suboralis, sp. nov.

(Plate XIX, figs. 6a-c; Plate XX, fig. 9).

A distinctive name seems desirable for this form which is somewhat intermediate between the small species (*Anodontophora* sp. nov.?) of the *Otoceras* beds and the common *A. breviformis* of the higher Eo-triassic, differing from the former chiefly in its larger size and in its less trigonal shape, from the latter in its oval outline and greater compression. The holotype (an internal cast in sandstone) is slightly crushed and corroded, but the left valve shows a marked ridge running from the umbo to the posterior margin. On the opposite valve, this ridge is less well marked, but the enclosed area is much narrower than in *A.* sp. nov.?, previously described, while in *A. breviformis* there is not only no such distinct ridge, but the whole posterior margin is more rounded and shorter. The posterior adductor impressions lie less close to the umbo than in the other two species already cited; the anterior pair is close to the broadly rounded anterior margin. The large but incomplete left valve figured in Plate XX, fig. 9 from the lower *breviformis* zone does not seem separable from the present form, but there is nothing from the intermediate beds to connect the two.

The *Pleuromya* cfr. *alberti* (Voltz) figured by Tommasi[1]) is somewhat similar but less oval in outline, owing to the prominent umbo.

Horizon:— *Vishnuites* beds and higher.

Localities:— [404], 648.

Anodontophora breviformis, nom. nov.

(Plate XXII, figs. 3, 4; Plate XXIII, figs. 2, 3).

1930. *Anodontophora* sp. ind. (breviform) Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 55, pl. x, figs. 8, 9; pl. XI, figs. 3a-e; pl. XII, fig. 6.

1931. — sp. (breviform) Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, p. 85 & c.

This extremely common but variable form is given an independent specific name, since the better material previously considered desirable, has now been collected and since it shows that the Greenland species is indeed distinct from the other Eotriassic forms so far described. The example now figured in Plate XXIII, fig. 3a seems to differ from

[1]) La Fauna del Trias inferiore nel versante meridionale delle Alpi. Pal. Ital., vol. I (1895), pl. II, fig. 4.

the similar specimen previously figured in pl. xi, fig. 3b in the position of the posterior adductor. This, however, seems to be variable, as is the shape, which may be more acute and elongated. Thus the two examples figured in Plate XXII, figs. 3 and 4 are less rounded and short than the typical examples, yet they come out of a block in which were also found examples apparently crushed in the opposite direction and therefore very short. In spite of the differences shown by the various specimens so far figured, especially those in one block (Plate XXIII, fig. 2) they are therefore now all included in one species. It is possible, however, that the small examples from immediately above the *Proptychites* beds represent an early mutation transitional to *A.* sp. nov. The latter has wide, triangular areas behind the umbones, almost as in *Myophoria*, and the posterior adductor is closer to the umbo than in *A. breviformis;* but the few transitional examples available are too incomplete to be separated even as a variety or mutation.

Horizon:— *Anodontophora breviformis* beds.

Localities:— Most localities between Cape Stosch and Stensiö Plateau, probably also Clavering Island.

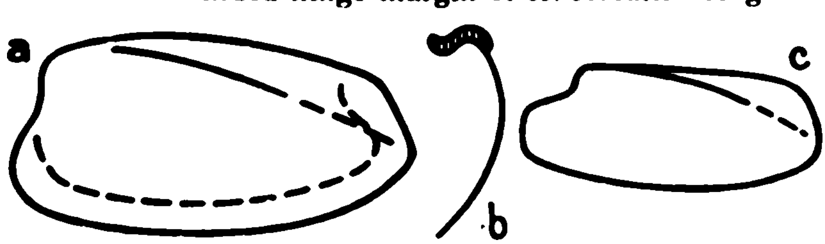
Anodontophora borealis nom. nov.

(Text-fig. 5a, b).

1930. *Anodontophora* sp. nov. cf. *subrecta*, (Bittner); Spath, Eotriassic Invertebrate Fauna of E. Greenland, *loc. cit.*, p. 53, pl. x, figs. 12a, b.

1931. — cf. *subrecta* (Bittner) Spath; Lauge Koch, Carboniferous and Triassic Stratigraphy of E. Greenland, *loc. cit.*, p. 40.

This distinctive species has now been found in numbers in a block (again with *Bellerophon* and *Eumorphotis*) and it is given a new name because its outline alone definitely separates it from *A. subrecta*. The elongated shape is illustrated in Text-fig. 6a, together with the outline of Bittner's original, and it will be seen that the forward position of the umbo and the rounded hinge margin of *A. borealis* bring it closer to



Text-fig. 5. (a, b). *Anodontophora borealis*, nom. nov. Outline diagram, with section through cast and portion of thick test. Eo-Trias (Otoceratan), East Greenland (loc. 201). (c) *A. subrecta* (Bittner). Outline after Frech, 1907, pl. vii, fig. 5b, for comparison. Muschelkalk, Hungary.

A. münsteri (Wissmann) Münster sp., previously cited, than to the true *A. subrecta*. The transverse ridge is blunt, not sharply defined, as the diagram might suggest and the test is thick, as indicated in fig. 5b. The test shows very fine lines of growth; the internal cast is perfectly smooth and the posterior adductor is only feebly marked. Other Upper Triassic species of *Anodontophora* with somewhat similar outline are still shorter, e. g. *A. donaciformis* Scalia[1]), and in those elongated species from Indo-China figured by Mansuy[2]), the umbo is placed far less forward than in the present form.

Horizon:— Lower *Ophiceras* zone.

Locality:— Cape Stosch and River 6 (201).

II. Phylum *Molluscoidea*.

Class *Brachiopoda*.

Order *Neotremata*.

Family *Discinidae*.

Genus *ORBICULOIDEA*, d'Orbigny.

Orbiculoidea cf. *spitsbergensis* (Lundgren).

1888. *Discina spitsbergensis*, Lundgren: Anmärkningar om permfossil från Spetsbergen. *Loc. cit.*, p. 13, pl. I, figs. 1—3.

The single upper, convex, valve found in breaking up a block of the very fossiliferous *Bellerophon* Sandstone has the shape of the larger *O. discoides* (Schlotheim) figured by M. Schmidt[3]), but the umbo is at less than a quarter of the length, not at a third, and the median groove is distinct as in many *Lingula*. The elongated shape is against comparison with the Permian *O. konincki* (Geinitz)[4]). The Eotriassic *Discina* sp. recorded by Bittner[5]) from the Ussuri beds was not figured, but it is probable that Lundgren's Spitsbergen species is the closest ally of the form here discussed, although it is slightly more conical.

Horizon:— *Ophiceras* beds (block with *Bellerophon*).

Locality:— 201.

[1]) La Fauna del Trias superiore del gruppo di Mte. Judica, II. Mem. Acad. Gioenia sci. nat. Catania (v) vol. v, mem. VIII, 1912, p. 40, pl. III (VI), fig. 22.

[2]) Faunes triasiques et liasiques de Na Cham, Tonkin. Mem. Serv. géol. Indochine, vol. VI, pt. 1 (1919), pl. II.

[3]) Die Lebewelt unserer Trias, 1928, p. 137, text-fig. 273 a.

[4]) Deutsch. Zechst. (1848), p. 11, pl. IV, figs 25—26.

[5]) *Loc. cit.* (1899), p. 27.

III. Phylum *Vermes*.

The remaining fossils to be recorded are worm tracks, but the opportunity is taken to illustrate a portion of a slab of *Spirorbis* limestone (Plate XXII, fig. 11, enlarged × 2) to show the apparent uncoiling of some of the individuals. The occurrence of these worm tubes on a valve of *Pseudomonotis (Claraia) stachei* is illustrated in Plate XVIII, fig. 8. The worm-tubes or tracks represented in Plate XX, fig. 11 are quite irregular and rugose, perhaps owing to corrosion of the calcite, and they are only short, disconnected pieces, some of which are hollow. They are comparable to irregular *Serpula* tubes or tracks from later formations e. g. the Liassic example recently figured by Rosenkrantz[1]) from Jameson Land, but I do not know of any Eotriassic form to which they could be referred. Likewise the worm tubes figured in Plate XXIII, fig. 7 seem to me comparable only to *Serpula etalensis* (Piette) Dumortier[2]) from the Lower Lias, though they probably belong to a new species; but the shorter fragment of a larger form, represented in Plate XX, fig. 5, on account of a faint median groove, may perhaps also be compared to *Isopodichnus problematicus*, Schindewolf[3]). The two examples figured in Plate XXIII, figs. 1 and 6, on the other hand, may be compared to "*Chondrites*", recently discussed by Richter[4]), while the problematical markings on the slab figured in Plate XXIII, fig. 5 are similar to the fucoid remains previously illustrated (1930, pl. XII, fig. 5). These are all figured to indicate the shallow-water facies of the Eotriassic deposits of East Greenland in which it is not uncommon to find ammonites on one side of a slab and ripple marks on the other.

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[1]) The Lower Jurassic Rocks of East Greenland, I, Medd. om Grønl., vol. CX, No. 1, 1934, p. 39, text-fig. 12.

[2]) Etudes paléontologiques sur les dépots jurassiques du Bassin du Rhone. Pt. II (1867), p. 230, pl. XLIX, fig. 21; pl. L, figs. 3—4.

[3]) Studien aus dem Marburger Buntsandstein. IV. Senckenbergiana, vol. X, 1928, p. 30, fig. 8.

[4]) Die fossilen Fährten und Bauten der Würmer etc. Palaeont. Zeitschr., vol. IX, 1927, p. 216.

C. LOCALITIES AND TYPICAL SUCCESSIONS

Before discussing the stratigraphical results, it is necessary to list some of the most important sequences. For while there seems to have been no difficulty in recognising the broader subdivisions in the field (and they have indeed been mapped in detail by Mr. Eigil Nielsen), yet the faunal assemblages even from neighbouring successions are often so puzzlingly different that the zones here recognised may be thought to require substantiation. Among the many hundreds of assemblages before me there are very few that represent all the zones in the same section, at least by ammonitiferous deposits; and the ideal sequence therefore is based on a combination of those portions in each section that can be correlated with a certain amount of confidence. How difficult this is may be gauged by a perusal of the lists. Many numbers have been omitted altogether; they represent isolated assemblages, or collections from localities where there is either a mixture of fossils from presumably different zones (e. g. at the very prolific locality 243, River 7, judging by the more continuous sequences) or where the succession includes chiefly unfossiliferous rocks, mostly micaceous sandstones or *Spirorbis* limestones. The geological details will be included in Mr. Nielsen's account and I am therefore selecting merely those successions that help in elucidating the vertical distribution of the ammonites.

The most important sections are on the northern side of Spath Plateau, east of Cape Stosch, and between Rivers 6 and 16 (see map I in Dr. Lauge Koch's Carboniferous and Triassic Stratigraphy of East Greenland, 1931). The successions from farther east, i. e. from the northern slopes of Stensiö Plateau, Mt. Steensby and Mt. Diener are more fragmentary, as are those from the north-western side of Spath Plateau. The assemblages from Clavering Island and Cape Franklin, not to mention the few isolated localities around Nathorst Fjord, are still less helpful for correlation. The successions are all given in descending order.

a. East of Cape Stosch.

I. Plateau west of River 6.

Number	Height	Fossils
212	643 m	*Anodontophora breviformis.*
211	638 m	*Oolite* (with shell fragments in micro-section).
210	535—280 m	*Anodontophora breviformis.*
208	425 m	*Myalina* rock, with *Anodontophora breviformis, Loxonema* sp., *Undularia ? (Toxoconcha ?)* sp.
209	420 m	*Myalina* rock.
207	415 m	*Myalina* rock, with *Anodontophora breviformis.*
205	405 m	*Myalina* aff. *schamarae.*
206	388 m	*Myalina* sp. and *Anodontophora ?* sp. ind. from White Block in Conglomerate III, Plate XX, figs. 13—14.
204	329 m	*Myalina* aff. *schamarae.*
203	289 m	*Myalina* aff. *schamarae, Vishnuites* sp. ind.
202	227 m	*Anodontophora* sp. ind.
201	215 m	*Bellerophon borealis, Naticopsis arctica, Pseudomonotis (Eumorphotis)* cf. *venetiana, Myalina* aff. *schamarae Enantiostreon* cf. *difforme, Anomia (Placunopsis ?)* sp. ind., *Anodontophora borealis, Lingula borealis, Orbiculoidea* cf. *spitzbergensis.*

The last assemblage, though from a loose block, is important because it contains numerous examples of *Anodontophora borealis* which hitherto was known only from the block with *Bellerophon* and *Otoceras* found by Lauge Koch in 1927 and previously discussed. The two assemblages probably came from the same bed and its position, somewhere within the lower *Ophiceras* beds, seems comfirmed.

II. At River 6.

Number	Height	Fossils
171—172	410—500 m	*Proptychites rosenkrantzi* (including Plate XVII, fig. 4), *Naticopsis arctica, Loxonema* sp. ind., *Claraia stachei, Myalina* aff. *schamarae, Spirorbis valvata.*
171	345 m	*Anodontophora* (very small sp. ind.).
178	318 m	*Claraia stachei, Myalina* aff. *schamarae, Anodontophora* sp. ind.
176	314 m	*Ophiceras ultimum.*
177	293 m	*Vishnuites* sp. ind., *Ophiceras* cf. *transitorium.*
174—175	265—267 m	*Otoceras boreale, Ophiceras (Metophiceras) subdemissum* and var. *ornata* (including Plate XIII,

fig. 3, Plate XVII, fig. 3 and Plate XIX, fig. 2), *O. (Metophiceras)* cf. *praecursor*, *Ophiceras (Lytophiceras) subsakuntala* (Plate XV, fig. 3), *Claraia stachei* (large).

The lowest assemblage is, again, the most important and if it indicates the lower *Ophiceras* beds, as seems likely, the *commune* fauna should be found somewhere between 267 and 293 m.

III. East of River 6 (Knolden).

Number	Height	Fossils
180	338 m	*Ophiceras ultimum*, *O. vishnuoides* (Plate XII, fig. 5), *Myalina* aff. *schamarae*, *Claraia* sp.
181	333 m	*Vishnuites* sp. ind., *Claraia* sp. ind., *Spirorbis valvata*.
182	310 m	*Claraia* sp. ind., *Spirorbis valvata*.

This succession is listed only because it supplements the next, immediately to the east.

IV. East of No. 3 (Knolden).

Number	Height	Fossils
112	441 m	*Proptychites rosenkrantzi*, *Claraia stachei*.
110	385 m	*Spirorbis valvata*.
109	351 m	*Myalina* aff. *schamarae*, *Claraia stachei*, *Spirorbis valvata*.
108	329 m	*Ophiceras dubium*, *Myalina* aff. *schamarae*, *Claraia stachei*, *Spirorbis valvata*.
107	320 m	*Myalina* cf. *schamarae*.
106	313 m	*Myalina* ? sp. ind.
102	306 m	*Ophiceras wordiei*, *O.* cf. *compressum*, *Glyptophiceras gracile*, *Claraia stachei*.
103	281 m	*Bellerophon borealis*, *Naticopsis arctica*, *Pseudomonotis (Eumorphotis)* cf. *venetiana*, *Gervillella* cf. *exporrecta*, *Myalina* aff. *schamarae*, *Lingula borealis*.

Although the last assemblage lacks the characteristic *Anodontophora borealis*, it may be correlated with the fauna of the similar micaceous sandstone boulder, found by Lauge Koch in 1927. *Ophiceras dubium* occurring at only 23 m above what may be taken to be the *commune* zone (and 112 m below the *Proptychites rosenkrantzi* bed) seems out of place, since it is said to have been found also at locality 300 (on Stensiö Plateau) in the *Proptychites* Beds and its maximum horizon (at locality 7, 1930) is 56 m below the *Proptychites* conglomerate (see p. 86).

V. **Stegocephalian Ridge (River 7), west.**

Number	Height	Fossils
71—72	497 m	*Proptychites rosenkrantzi* (including Plate XVIII, fig. 7), *Naticopsis arctica*, *Claraia stachei*, *Myalina* aff. *schamarae*.
73	489 m	*Proptychites* sp. juv. (pyritised), *Claraia stachei*, *Myalina* aff. *schamarae*.
74	470 m	(Conglomerate III).
70	426 m	*Spirorbis valvata*, indeterminable pelecypods.
68	373 m	*Ophiceras* cf. *ultimum*, *Claraia stachei*.
69	358 m	*Ophiceras* cf. *ultimum*, *O. transitorium*, *O.* aff. *vishnuoides*, *Vishnuites* aff. *decipiens*, *Claraia stachei*.
66	355 m	*Claraia stachei* (large), *Serpula* sp.
65	350 m	*Myalina* aff. *schamarae*, *Spirorbis valvata*.
115—116	348 m	*Otoceras boreale*, *Ophiceras commune*, *O. compressum*, *O.* aff. *kochi*, *O.* spp., *Glyptophiceras* cf. *nielseni*, *Claraia stachei*, *Pseudomonotis*?, sp. ind. (Plate XXI, fig. 10), *Spirorbis valvata*.
117—118	340 m	*Otoceras boreale* (including Plate I, fig. 6), *Ophiceras commune*, *O. kochi*, *O. subsakuntala*, *O.* cf. *wordiei*, *O.* spp. *Glyptophiceras gracile*, *G. nielseni* var. *modesta* (Plate V, fig. 2), *G. subextremum*, *G.* cf. *minor*, *Claraia stachei*, *Lingula borealis* (Plate XXIII, fig. 4) *(Vishnuites decipiens, Ophiceras* cf. *transitorium)*.

It is almost certain that the two ammonites listed last came from higher beds, but the *Vishnuites* sequence is very incomplete.

VI. **Stegocephalian Ridge (River 7) east.**

Number	Height	Fossils
158	502 m	*Proptychites rosenkrantzi* (including Plate XVII, fig. 5), *Naticopsis arctica*, *Claraia stachei* (large), *Myalina* aff. *schamarae*.
159	389 m	*Vishnuites* cf. *decipiens*, *Bellerophon* sp., *Myalina* aff. *schamarae*.
160	368 m	*Vishnuites decipiens*, *Spirorbis valvata*.
161	361 m	*Ammonite impression* (unrecognisable); *Claraia stachei*, *Spirorbis valvata*.

VII. Fish Plateau (River 7) west 1.

Number	Height	Fossils
165	439 m	*Spirorbis valvata.*
164	406 m	*Claraia* cf. *stachei*, *Serpula* sp. ind.
169	405 m	*Ophiceras ultimum.*
170	402 m	*Vishnuites decipiens.*
167	400 m	*Ophiceras transitorium*, *O. vishnuoides*, *Vishnuites decipiens.*
163	398 m	*Ophiceras transitorium*, *Vishnuites decipiens*, *Bellerophon borealis.*
168	392 m	*Ophiceras* cf. *vishnuoides.*
166	390 m	*Claraia sp.*, *Spirorbis valvata.*

This section is useful only because it is parallel to the following (VIII) and immediately south of it.

VIII. Fish Plateau (River 7) west 2.

Number	Height	Fossils
137	439 m	*Anodontophora* cf. *canalensis.*
138	436 m	*Ophiceras ultimum* var. *ambigua* (Plate XI, fig. 5), *Claraia stachei*, *Myalina* aff. *schamarae*, worm casts.
139	430 m	*Ophiceras ultimum* (Plate XIV, fig. 3), *Myalina?* sp.
140	428 m	*Ophiceras* cf. *ultimum.*
141	425 m	*Ophiceras ultimum*, *O.* sp. nov. (Plate XI, fig. 11).
142	420 m	*Ophiceras ultimum*, *Myalina* ? sp.
143	419 m	*Ophiceras ultimum.*
144	417 m	*Ophiceras ultimum* (including Plate I, fig. 2), *Ophiceras* cf. *leptodiscus.*
145	416 m	*Naticopsis arctica.*
146	415 m	*Ophiceras ultimum*, var *ambigua* (Plate XIII, fig. 8), *Vishnuites decipiens* var. *discoidea*, *Vishnuites* spp. ind.
147	413 m	*Ophiceras ultimum*, *Vishnuites decipiens*, *Proptychites grandis.*
148	412 m	*Vishnuites* sp. aff. *decipiens.*
149	411 m	*Vishnuites decipiens*, *V. wordiei.*
150	406 m	*Vishnuites decipiens*, *Spirorbis valvata.*
151	375 m	*Ophiceras commune*, *O. wordiei.*

There is also a *Vishnuites* cf. *decipiens* from the last number, but its matrix is not that of the *commune* bed and it probably came from beds higher up in the section. The next sequence which again follows immediately to the north, appears to fit in between numbers 150 and 151.

IX. **Fish Plateau (River 7) west 3.**

Number	Height	Fossils
84	405 m	*Vishnuites decipiens.*
85	400 m	*Claraia* sp., *Spirorbis valvata* (Plate XVIII, fig. 8).
86	387 m	*Vishnuites decipiens*, *V.* sp. ind.
87	385 m	*Ophiceras* cf. *transitorium*, *Vishnuites decipiens.*
88	385 m	*Claraia* sp., *Spirorbis valvata.*
89	378 m	*Ophiceras* cf. *compressum* (large).

There are rocks with fossils apparently derived from the underlying Upper Carboniferous from lower down on River 7 (numbers 60 to 64) but they do not include anything that indicates the *Glyptophiceras* beds.

X. **Fish Plateau (centre).**

Number	Height	Fossils
15	400 m	*Ophiceras commune*, *O.* sp. ind., *Claraia stachei*, *Gervillella* aff. *exporrecta*, *Spirorbis valvata.*
9, 13, 16, 22	390 m	*Ophiceras subdemissum* and var. *ornata*, *O.* cf. *noe-nygaardi*, *Ophiceras* sp. juv., *Claraia stachei* (including Plate XXI, fig. 8), *Myalina* sp. ind., *Anomia (Placunopsis?)* sp. ind., *Spirorbis valvata.*

The lower numbers from this locality (18—21, 24) include unfossiliferous, micaceous sandstones, but the next section, further east, at River 8, has yielded ammonites at lower levels (numbers 80, 81). These, however, are doubtful *Glyptophiceras* of the type of those found at 55 (Plate VII, fig. 8) and they come from heights of 189 and 230 m. This seems a considerable distance below the *Ophiceras* beds, but there is no indication of the presence of the characteristic *Glyptophiceras triviale.*

XI. **Between Rivers 8 and 9 (Pyramiden, west).**

Number	Height	Fossils
97	669 m	*Anodontophora* aff. *breviformis.*
99	624 m	*Proptychites rosenkrantzi*, *Naticopsis arctica*, *Claraia stachei*, *Myalina* aff. *schamarae.*
96	574 m	*Claraia stachei*, *Myalina* aff. *schamarae*, *Spirorbis valvata.*
95	559 m	*Claraia* sp., *Spirorbis valvata.*
94	552 m	*Claraia* sp., *Spirorbis valvata.*
93	534 m	*Claraia* sp., *Spirorbis valvata.*

The next section, being parallel and close to this one, may be taken to supplement this meagre list.

XII. West of River 9 (Pyramiden, east).

Number	Height	Fossils
220	624 m	*Proptychites rosenkrantzi* (including Plate XVI, fig. 2); *P. anomalus* (Plate XVIII, fig. 1).
190	575 m	*Ophiceras ultimum*, *Claraia stachei*, *Myalina* aff. *schamarae*, *Spirorbis valvata*.
189	567 m	*Myalina?* sp.
188	560 m	*Proptychites (Koninckites?)* sp. nov.? (Plate XII, fig. 8), *Anodontophora* sp. ind. (small).
187	543 m	*Naticopsis arctica*.

There is also a decomposed block (No. 191) with the white *Myalina* and *Anodontophora* discussed on p. 70, which seems to indicate the presence of Conglomerate III somewhere between 570 and 630 m (where it was found, loose) and the *Proptychites* zone (624 m).

XIII. River 9 (upper).

Number	Height	Fossils
229	614 m	*Myalina* aff. *schamarae*.
234, 235	584 m	*Claraia stachei*, *Myalina* aff. *schamarae*.
231	583 m	*Claraia stachei*, *Spirorbis valvata*.
233	576 m	*Glyptophiceras* sp. ind., *Naticopsis arctica*, *Myalina* aff. *schamarae*, *Spirorbis valvata*.
221	552 m	*Ophiceras transitorium*, *Claraia* sp. ind. *Myalina* ? sp.
232	538 m	*Ophiceras vishnuoides*, *Naticopsis arctica*.
98	512 m	*Ophiceras commune* (many) and var. *aperta* (including Plate XV, figs. 4 and 9). *O. wordiei*, *O. subkyokticum*.

It should be added that the *Glyptophiceras* impression from 233 is in a matrix different from that of the other species, and that its occurrence so high in the *Vishnuites* beds is therefore suspect.

XIV. River 9 (lower).

Number	Height	Fossils
55	338 m	*Glyptophiceras?* cf. *minor* (and *Metophiceras* sp.?) Plate VII, fig. 8.
57	306 m	*Glyptophiceras minor* (Plate XIII, fig. 5), *Claraia* sp., *Spirorbis valvata*.
53	296 m	*Glyptophiceras* cf. *gracile* (loose).
59	—	*Glyptophiceras minor*, *Metophiceras* cf. *subdemissum*, *Claraia stachei*. *Spirorbis valvata*.
54	—	*Glyptophiceras* aff. *minor*, *Glyptophiceras* spp. ind., *Spirorbis valvata*.

The last is only 5—6 m above the *Productus* Limestone and just below 59 and 53, and it includes some Carboniferous polyzoans derived from the older bed. The section is not continuous with the last one, but, again, the *Glyptophiceras* beds extend to over 200 m below the *commune* zone.

XV. River 9 (Falkeryg, upper).

Number	Height	Fossils
230	759 m	*Myalina* aff. *kochi*.
228	712 m	*Anodontophora breviformis* (like Plate XXIII, fig. 2).
223	682 m	*Anodontophora breviformis* (including elongated types, Plate XXII, figs. 3—4).
224	678 m	*Anodontophora* cf. *breviformis*.
226—227	655 m	*Anodontophora breviformis* (including short and high types).
225	—	Red *Spirorbis* limestone.
239	512 m	Plant remains.
240	430 m	*Ophiceras dubium*.

The last is marked *Proptychites* beds, but it may indicate the ammonite horizon discovered by Lauge Koch at River 5 (loc. 7) in 1930 and recorded in 1931 (p. 41). There it was 56 m below what appears to be the *Proptychites* Conglomerate (III), but at No. 638 (Stensiö Plateau, Ridge 12) *Ophiceras dubium* occurs only 15 m below the bed with small *Proptychites*, i. e. at about the conglomerate level.

XVI. River 9 (Falkeryg, lower).

Number	Height	Fossils
217	422 m	*Claraia stachei*, *Spirorbis valvata*.
216, 263	417—425 m	*Proptychites rosenkrantzi* (large and small), *Naticopsis arctica*, *Claraia stachei*, *Myalina* aff. *schamarae*, *Spirorbis valvata*.
215	320 m	*Naticopsis arctica*, *Claraia stachei*, *Myalina* aff. *schamarae*, *Spirorbis valvata*.
236	320 m	*Claraia* sp., *Myalina?* sp., *Spirorbis valvata*.
237	257 m	*Ophiceras* aff. *commune*, *O.* spp. ind. *Claraia stachei*.

This section shows the *rosenkrantzi* horizon to be 160 m above the *commune* bed, as against 149 m in section V and 135 m in IV.

XVII. Ravekløft (River 9) Centre.

Number	Height	Fossils
259	350 m	*Ophiceras transitorium*, *O. ultimum*, *Vishnuites decipiens*, *Claraia stachei*, *Spirorbis valvata*.

Number	Height	Fossils
258	348 m	*Claraia* sp., *Spirorbis valvata*.
257	344 m	*Claraia stachei*, *Spirorbis valvata*.
253, 256	342 m	*Ophiceras transitorium*, *Claraia* sp., *Spirorbis valvata*.
254	340 m	*Ophiceras ultimum*, *Vishnuites decipiens*, var. *acuta*, *Claraia stachei*.
252	338 m	*Spirorbis valvata*.
249, 250	335—337 m	*Vishnuites decipiens*, *Bellerophon borealis*. *Naticopsis arctica*, *Claraia stachei*, *Myalina* aff. *schamarae*, *Spirorbis valvata*.
248	326 m	*Ophiceras* cf. *transitorium*, *Spirorbis valvata*.
247	325 m	*Vishnuites decipiens*.
246	322 m	*Vishnuites decipiens*. *Proptychites (Koninckites)?* sp. ind.
245	317 m	*Naticopsis arctica*, *Myalina* aff. *schamarae*.
262	292—300 m	*Ophiceras commune* and var. *aperta*, *Vishnuites decipiens* and var. *Myalina* aff. *schamarae*.

The *Vishnuites*, at the last level, judging by their mode of preservation, may have come down from beds above; their admixture with *Ophiceras commune*, although noticed at other localities, is almost certainly accidental.

XVIII. **Rævekløft, immediately west of XVII.**

Number	Height	Fossils
708	331 m	*Myalina* aff. *schamarae*, *Spirorbis valvata*.
707	328 m	*Ophiceras ultimum*, *Vishnuites decipiens*, *Claraia stachei*, *Spirorbis valvata*.
706	316—319 m	*Ophiceras transitorium*, *O. ultimum*, *Bellerophon borealis*, *Naticopsis arctica*, *Claraia stachei*, *Myalina* aff. *schamarae*.
705	304 m	*Ophiceras transitorium*, *O. ultimum*, *Vishnuites decipiens* and var., *Naticopsis arctica*, *Claraia stachei*, *Myalina* aff. *schamarae*.

This section is so close to the last that it may be used to supplement the list given under XVII.

XIX. **Rævekløft, immediately east of XVII.**

Number	Height	Fossils
709	378 m	*Claraia* sp., *Spirorbis valvata*.
710	328—338 m	*Ophiceras vishnuoides*, *Vishnuites decipiens* (including Plate XIII, fig. 4), *Claraia stachei*, *Myalina* sp., *Spirorbis valvata*.

Number	Height	Fossils
711	318—328 m	*Ophiceras transitorium*?, *O. ultimum*, *Vishnuites decipiens* and var., *Myalina* sp.

Like the last section this helps to supplement the succession in the lower part of the *Vishnuites* beds.

XX. **River 11.**

Number	Height	Fossils
690, 436	317—342 m	*Otoceras boreale*, *Glyptophiceras pascoei*, *O. greenlandicum*, *Ophiceras commune* and var., *O. subsakuntala*, *O. kochi*, *O. wordiei*, *O. compressum* var. *involuta*, *O. subkyokticum*, *Vishnuites (Paravishnuites) striatus* (?), *Naticopsis arctica*, *Claraia stachei*, *Spirorbis valvata*.
688	299 m	Red gypsum.
687	252 m	*Glyptophiceras* cf. *gracile*, *Claraia stachei*.
686	217 m	*Glyptophiceras* cf. *minor*, *Claraia stachei*.

The first assemblage, as the identical faunas 437 and 438 from a neighbouring section (east of River 10), may include elements from several horizons within the *Ophiceras* beds, as well as the two examples of *Proptychites* cf. *simplex*? already referred to (p. 66), from the *Vishnuites* beds above.

XXI. **River 13, west 1.**

Number	Height	Fossils
494	331—339 m	*Ophiceras transitorium*, *Vishnuites decipiens*, *Claraia stachei*, *Myalina* aff. *schamarae*, *Spirorbis valvata*.
493	313—327 m	*Ophiceras* cf. *commune* and var., *Claraia stachei*, *Myalina* sp.
491—492	299—313 m	*Ophiceras commune* and var., *O. wordiei*, *O. compressum*, *O. subkyokticum*, *Naticopsis arctica*, *Claraia stachei*, *Spirorbis valvata*.

The last assemblage also includes an example of *Vishnuites decipiens* which must have come down from higher beds, and some carbonised bodies of problematical affinity.

XXII. **River 13, west 2.**

Number	Height	Fossils
454	abt. 500 m	*Claraia stachei*, *Spirorbis valvata*.
455	419—432 m	*Ophiceras ultimum*. *Claraia stachei*, *Spirorbis*

Number	Height	Fossils
456	344 m	*Vishnuites decipiens*, *Claraia stachei*, *Spirorbis valvata.*
457	326—333 m	*O. subsakuntala*, *Ophiceras* sp. ind., *Glyptophiceras nielseni* (transition to *G. pascoei*), *Vishnuites decipiens*, *Claraia stachei*, *Spirorbis valvata.*

The last assemblage again includes *Vishnuites* which is clearly out of place. The section is close to and parallel with the next one and helps to supplement the lists.

XXIII. River 13, west 3.

Number	Height	Fossils
668	492—498 m	*Proptychites rosenkrantzi*, *Claraia* sp.
666	417—435 m	*Ophiceras ultimum*, *Vishnuites* cf. *decipiens*, *Claraia stachei*, *Myalina* aff. *schamarae*, *Spirorbis valvata*, *Serpula* sp.
664	346 m	*Ophiceras transitorium*, *Vishnuites wordiei*, *V. decipiens* and var., *Naticopsis arctica*, *Claraia stachei*, *Spirorbis valvata.*
665	336—341 m	*Ophiceras transitorium*, *Vishnuites* spp., *Claraia stachei*, *Myalina* aff. *schamarae*, *Spirorbis valvata.*
663	317 m	*Ophiceras commune*, *O.* cf. *ptychodes*, *O.* cf. *kilenense*, *Claraia stachei*, *Spirorbis valvata.*

The *commune* bed and *Proptychites* zone are here 175 m apart, as against 135 m at Section IV.

XXIV. River 13, west 4.

Number	Height	Fossils
669	435 m	*Ophiceras* cf. ultimum, *Claraia stachei.*
(?673	382—392 m	*Ophiceras transitorium* (including Plate XII, fig. 4), *Vishnuites wordiei* (including Plate IV, fig. 5), *V. decipiens* and var. (including Plate IV, fig. 4), *Naticopsis arctica*).
670 671	355 m	*O. transitorium*, *Ophiceras* cf. *ultimum* *Vishnuites wordiei*, *V. decipiens* and var., *Bellerophon borealis*, *Naticopsis arctica.*

The middle assemblage (673) was not collected in the same section and in a diagrammatic scheme, sent to me by Mr. Nielsen, it is put on the same level as 670—671, listed above and 664 in the previous section (XXIII).

XXV. **River 13, west 5.**

Number	Height	Fossils
566	296 m	Plant remains (in friable sandstone).
564 565	285 m	*Claraia stachei*, worm cast.
563	274—284 m	*Metophiceras* sp. ind., *Glyptophiceras* cf. *minor* (compare Plate VII, fig. 8).
562	261 m	*Metophiceras* sp. juv.

The fauna from 563 is probably represented again in the next section but one (following immediately to the east) by number 533.

XXVI. **River 13, east 1.**

Number	Height	Fossils
521	309 m	*Ophiceras commune*, *O. subsakuntala*, *O subkyokticum* (Plate XVIII, fig. 2), *Glyptophiceras* aff. *gracile*.
520	281 m	*Ophiceras* sp. ind.
519	259 m	*Ophiceras subsakuntala*.

These fossils were all collected loose and they probably came out of the *Ophiceras* beds at a higher level. There is, however, from close by (No. 545 at 225 m) an impression of a *Glyptophiceras*, with coarse ornamentation, in a grit that is marked "lowest *Glyptophiceras* beds".

XXVII. **River 13, east 2.**

Number	Height	Fossils
535	298 m	*Ophiceras commune* and var., *Claraia stachei*.
534	285 m	*Claraia stachei*, *Spirorbis valvata*.
533	274 m	*Metophiceras* sp. ind.

The first assemblage (535) again came out of loose blocks and the *Ophiceras commune* beds seem to be at a higher level, but although these two sections, on Mr. Nielsen's sketch map, are apparently continuous with that listed below (XXVIII) there may be a considerable break between them.

XXVIII. **River 13, east 3.**

Number	Height	Fossils
556	523 m	*Proptychites rosenkrantzi*, *Claraia stachei*.
555	436 m	*Vishnuites decipiens*.
554	432 m	*Vishnuites decipiens*.
552	428—429 m	*Vishnuites decipiens*, *Claraia stachei*.
551	426 m	*Claraia stachei*, *Spirorbis valvata*.
549	419 m	*Claraia stachei*, *Spirorbis valvata*.

Number	Height	Fossils
547	406—409 m	*Ophiceras commune* and var., *O. subsakuntala*, *O. greenlandicum* var. *subplatyspira* (Plate X, fig. 1), *Claraia stachei*.

The vertical distance between the *commune* bed and the *Proptychites rosenkrantzi* horizon is here reduced to 114 m.

XXIX. River 14 (Smalleryg) west.

Number	Height	Fossils
475, 476	426—436 m	*Ophiceras transitorium*, *Vishnuites decipiens* and var., *Naticopsis arctica*, *Claraia stachei*, *Myalina* aff. *schamarae*, *Spirorbis valvata*.
445	401—408 m	*Ophiceras commune*, var. *aperta*, *O. (Metophiceras) subdemissum* and var. *ornata*, *Glyptophiceras* aff. *serpentinum*, *Claraia stachei*, *Spirorbis valvata*.

A very similar succession follows immediately to the east and is given below under No. XXX. Although the sequences are not continuous enough to be really helpful, the assemblages are interesting.

XXX. River 14 (Smalleryg), east.

Number	Height	Fossils
399	456 m	*Ophiceras transitorium* (including Plate VI, fig. 1 and Plate VII, fig. 1), *Vishnuites decipiens* and var., *V. wordeie*, *Claraia* sp., *Spirorbis valvata*.
397	411—436 m	*Ophiceras commune* and var. *aperta*, *O. wordiei*, *O. (Acanthophiceras) poulseni* (Plate XI, fig. 6), *Glyptophiceras* aff. *minimum*, *G.* aff. *pseudellipticum*, *G. gracile*, *G.* aff. *nielseni*, *G. pascoei*, *G.* cf. *extremum*, *Claraia stachei*, *Spirorbis valvata*.

There are no fossils from the lowest *(Glyptophiceras)* beds either at these two localities or at the next three (Kilen).

XXXI. River 14 (Kilen, west, a).

Number	Height	Fossils
376	575 m	*Claraia stachei*, *Spirorbis valvata*.
375	556—562 m	*Ophiceras ultimum*, *Claraia stachei*, *Spirorbis valvata*.

Number	Height	Fossils
373	530 m	*Claraia stachei.*
372	520 m	*Claraia kilenensis.*
371	495 m	*Vishnuites* cf. *decipiens*, *Naticopsis arctica*, *Worthenia*(?) sp. ind. (Plate XX, fig. 7), *Claraia stachei*, *C. kilenensis* (Plate XXII, fig. 1), *Gervillella* aff. *exporrecta*, *Spirorbis valvata*, plant remains.
370	483—484 m	*Claraia* sp., *Myalina* sp., *Spirorbis valvata.*
368	470 m	*Ophiceras kilenense*, *O.* cf. *subkyokticum*, *O.* sp. juv. ind., *Claraia sp.*. *Spirorbis valvata.*
367	458 m	*Glyptophiceras* cf. *pascoei*, *G.* cf. *minor*, *G.* spp. ind., *Loxonema* sp., *Claraia stachei*, *Spirorbis valvata.*

A somewhat similar range, but extending to higher beds and not going quite so low, is illustrated by the fossils of the next sequence which were collected at the same spot in the following year (1933).

XXXII. River 14 (Kilen, west, b).

Number	Height	Fossils
694	457 m	*Anodontophora* cf. *breviformis.*
693	637 m	*Anodontophora breviformis*, *Myalina* aff. *schamarae.*
683	529—549 m	*Ophiceras ultimum* (including Plate XIV, fig. 2), *O.?* sp., *Naticopsis arctica*, *Claraia stachei*, *Spirorbis valvata.*
684	494 m	*Vishnuites decipiens* and var., *V. wordiei*, *Claraia* sp., *Spirorbis valvata.*
682	472 m	*Claraia stachei.*
681	469 m	*Vishnuites* cf. *decipiens*, *Naticopsis arctica*, *Claraia stachei.*
680	465 m	*Ophiceras transitorium*, *O. ultimum*, *O. kilenense*, *Vishnuites* cf. *decipiens*, *Myalina* sp.
679	464 m	*Ophiceras commune* and vars. *evolvens* and *aperta*, *O. subsakuntala*, *O. kilenense*, *Vishnuites* cf. *decipiens*, *Bellerophon borealis*, *Naticopsis arctica*, *Claraia stachei*, *Eumorphotis* aff. *multiformis*, *Myalina* aff. *schamarae.*
678	462 m	*Ophiceras commune*, *O. kilenense*, *O. wordiei*, *O. subkyokticum.*
676	460 m	*Ophiceras commune*, *Glyptophiceras pascoei*, *G.* spp., *Claraia stachei.*
675	abt. 458 m	*Ophiceras wordiei*, *Claraia stachei*, *Spirorbis valvata.*

The last assemblage was marked as coming from the lowest level of the upper *Ophiceras* zone, but even the next three higher numbers include forms from the *commune* beds.

XXXIII. River 14 (Kilen, east, a).

Number	Height	Fossils
[illegible], 724	670—678 m	*Proptychites rosenkrantzi*, *Claraia stachei*, *Anodontophora* aff. *breviformis*, *Spirorbis valvata*.
721	616—629 m	*Ophiceras ultimum*, *Prionolobus* (?) sp. nov. (Plate V, fig. 4), *Bellerophon borealis*, *Pseudomonotis* aff. *iwanowi*, *Claraia stachei*, *Myalina* aff. *schamarae*, *Spirorbis valvata*.
720	534 m	*Vishnuites decipiens*.
719	527 m	*Ophiceras transitorium*?
718	abt. 516 m	*Vishnuites decipiens*.
717	511—512 m	*Vishnuites decipiens* and vars. (including Plate X, fig. 4), *V. wordiei*, *Claraia stachei*, *Spirorbis valvata*.
715, 716	486—493 m	*Ophiceras commune* and vars., *O. kilenense*, *Vishnuites decipiens*, *Naticopsis arctica*, *Claraia stachei*, *Spirorbis valvata*.

The examples of *Vishnuites* from the last assemblage (including one with a wavy outline, mentioned on p. 44) are preserved like the accompanying *Ophiceras* and may not have come down from higher beds.

XXXIV. River 14 (Kilen, east, b).

Number	Height	Fossils
661	449—463 m	*Otoceras boreale*, *Ophiceras (Metophiceras) subdemissum*, *Glyptophiceras subextremum* (Plate VI, fig. 4), *G. nielseni*, *G.* aff. *gracile*, ?*Vishnuites (Paravishnuites) striatus* (Plate IX, fig. 6), *Gervillella* aff. *exporrecta*.
659, 660	443—449 m	*Otoceras boreale*, *Ophiceras (Metophiceras) subdemissum*, *Claraia stachei*.
658	440—443 m	*Otoceras boreale*, *Ophiceras (Metophiceras) subdemissum*, *Glyptophiceras* cf. *serpentinum*.
656	432—439 m	*Ophiceras (Metophiceras) subdemissum*, *Glyptophiceras* cf. *gracile*. *G.* cf. *pascoei*, *G.* cf. *minor*, *Claraia stachei*.

The last sequence was obtained some distance to the north of no. XXXIII: but although it is not continuous with it, it may be regarded

XXXV. River 15.

Number	Height	Fossils
730	686—736 m	*Proptychites rosenkrantzi*, *Myalina* aff. *schamarae* (Plate XX, fig. 2).
731	615—616 m	*Ophiceras transitorium*, *Vishnuites decipiens* and vars. (Plate IX, fig. 3; Plate X, figs. 2, 3), *V. wordiei* (see p. 43).
732	604 m	*Ophiceras transitorium*.
733	601 m	*Ophiceras transitorium*.
734	—	*Ophiceras* spp.
735	—	*Ophiceras commune* and var., *O.* spp., *Claraia stachei*.
736	566 m (loose)	*Ophiceras* aff. *chamunda*, *Vishnuites decipiens*, *Glyptophiceras extremum* (Plate XI, fig. 4).
737	—	*Ophiceras compressum* (Plate VII, fig. 9).
413	abt. 536 m	*Otoceras boreale*, *Ophiceras commune* and var., *O. wordiei*, *O. compressum* (Plate VIII, fig. 2), *O. (Metophiceras) noe-nygaardi*, *O. (M.) subdemissum* (Plate XVIII, fig. 3); *O. (M.)* aff. *praecursor* (Plate VI, fig. 3); *Glyptophiceras nielseni* (Plate XVII, fig. 2), *Claraia stachei*, *Gervillella* aff. *exporrecta*, *Spirorbis valvata*.

No. 737 is marked on Mr. Nielsen's sketch map as immediately below 736, but the assemblage 413 from still lower beds did not come from exactly the same line of section.

XXXVI. River 16 (Otocerasdal).

Number	Height	Fossils
298	789 m	*Anodontophora?* sp. ind. (small).
297	648 m	*Proptychites rosenkrantzi* (including Plate XIX, fig. 5), *P. intermedius* (Plate XVII, fig. 7), *Naticopsis arctica*, *Claraia stachei*.
295	606—613 m	Indeterminable ammonite, *Claraia stachei*, *Myalina* aff. *schamarae*, *Spirorbis valvata*.
294	584 m	*Claraia stachei*, *Spirorbis valvata* (?*Ophiceras commune*, Plate XIII, fig. 13).
292	546 m	*Vishnuites decipiens* and var., *V. wordiei*, *Proptychites subdiscoides* (Plate XV, fig. 5), *P.?* sp. ind., *Claraia stachei*, *Myalina* aff. *schamarae*, *Spirorbis valvata*.
291	518 m	*Claraia stachei*.
290	510—514 m	*Ophiceras commune* and var., *O. subsakuntala*.
287	498 m	*Ophiceras commune*, *O. subsakuntala*.

Number	Height	Fossils
286	494 m	*Ophiceras subsakuntala.*
284	488 m	*Vishnuites (Paravishnuites) striatus* (Plate I, fig. 5), *V. (P.) oxynotus* (Plate III, fig. 5), *Glyptophiceras ?* sp. juv. ind.
309—310	465 m	*Otoceras boreale* (including Plate III, figs. 2, 3; Plate IV, fig. 1; Plate VI, fig. 8), *Ophiceras* aff. *commune*, *O. chamunda* (Plate VIII, fig. 8), *O. wordiei*, *O. (Metophiceras) subdemissum*, *O. (M.) noe-nygaardi*, *Glyptophiceras nielseni* (Plate IX, fig. 5).

The *Proptychites rosenkrantzi* horizon here would seem to be about 184 m above the commune beds, as against 175 m in section XXIII.

XXXVII. River 16 (Blokdal, a).

Number	Height	Fossils
393	594 m	*Claraia stachei.*
392	538 m	*Vishnuites decipiens* and var., V. *wordiei* (Plate XII, fig. 2), *Proptychites subdiscoides* (including Plate XIII, fig. 10; Plate XV, fig. 6).
391	470 m	*Ophiceras transitorium*, *Vishnuites decipiens*, *Myalina* aff. *schamarae.*

The first assemblage (393) is marked "*Proptychites* beds". The sequence is cut off by an east—west fault from the lower beds to the north, listed in the next succession.

XXXVIII. River 16 (Blokdal, b).

Number	Height	Fossils
388	400—413 m	*Ophiceras wordiei*, *Naticopsis arctica*, *Claraia stachei*, *Spirorbis valvata.*
387	387 m	*Ophiceras* spp. ind.
386	368 m	*Otoceras boreale* (Plate II, fig. 3), *Ophiceras (Metophiceras) subdemissum.*
385	361 m	*Ophiceras* ? spp. ind.
384	305 m	*Ophiceras (Metophiceras ?)* sp. ind.

The indeterminable examples of *Ophiceras* from the lower beds, preserved in coarse, friable sandstones, are comparable to those from 55, represented in Plate VII, fig. 8.

XXXIX. Stensiö Plateau (Ridge 9).

Number	Height	Fossils
363	615 m	*Anodontophora fassaensis*, *Dentalium (Entalis?)* sp. ind. (Plate XXI, fig. 16).

Number	Height	Fossils
362	543 m	*Myalina kochi.*
360	240 m	*Claraia* sp., *Spirorbis valvata.*
359	211 m	*Ophiceras ultimum, Vishnuites decipiens, V. wordiei, Proptychites* cf. *simplex?*
358	203 m	"Fucoid" markings.
364	185 m	*Vishnuites* cf. *wordiei?, Claraia stachei, Myalina* sp.
357	173 m	*Ophiceras transitorium, O. vishnuoides* (Plate VIII, fig. 7), *O. (Acanthophiceras) subgibbosum* (Plate V, fig. 3), *Vishnuites wordiei, V. decipiens* and vars. (see p. 43), *Naticopsis arctica, Claraia stachei.*
356, 355	163—165 m (loose)	*Bellerophon borealis, Myalina* aff. *schamarae.*

This section was described by Mr. Nielsen as the most complete section measured on Stensiö Plateau. No. 360 was marked "*Proptychites* zone", also 359, the fossils from which have the peculiar reddish tint of the *rosenkrantzi* horizon. They are, however, a definite *Vishnuites* assemblage. On ridge 9 of the Stensiö Plateau, the same horizon, or at least an identical assemblage (No. 647) was found at about 215 m, while on ridge 12 (No. 643) a small example of *Proptychites rosenkrantzi* occurred as high as 305 m.

XL. Mt. Steensby and Mt. Diener.

The assemblages collected from still farther east are too incomplete to be listed sequentially. On the northern side of Mt. Steensby *Anodontophora fassaensis* (No. 815) occurred at 466 m and more doubtfully (No. 816) at about 600 m, *Myalina kochi* (No. 813) at 423—435 and also (No. 808) at 521 m. Small *Proptychites rosenkrantzi*, east of the Red River ("River 22") were collected at 119—136 m (No. 807), while *Anodontophora fassaensis* was at 401 m (No. 803). West of River 23, at the easternmost end of the Triassic outcrop along this coast, the same *Anodontophora* was found at a height of 307 m (No. 792), while greenish-grey rocks with *Claraia stachei* at only 30—40 m (No. 789) probably indicate the upper *Vishnuites* beds.

b. Cape Stosch.

The sections along the north-eastern slopes of Spath Plateau, between Rivers 6 and 16 have been listed first because they are the most important; and there is only one sequence, from the north-western side of the plateau, at Cape Stosch itself, which may here be given, for comparison with the section (locality 7) published by Lauge Koch in 1931 (p. 41).

Number	Height	Fossils
129	536 m	*Anodontophora breviformis.*
131	518 m	*Anodontophora* sp. ind.
130	498 m	*Anodontophora?* sp., *Myalina?* sp.
132	494 m	*Myalina kochi*, worm-tracks.
134	482 m	*Myalina kochi*, *Anodontophora breviformis.*
133	467 m	*Anodontophora breviformis.*
128	435 m	*Anodontophora* cf. *breviformis.*
127, 135	424 m	*Anodontophora breviformis*, *Myalina* aff. *schamarae* (Plate XX, fig. 3).
126	302 m	*Anodontophora* (?) sp. ind. (Plate XXII, fig. 2) (block of conglomerate IV).
101	232 m	*Ophiceras dubium* and varieties, *Loxonema* sp. ind., *Claraia stachei*, *Spirorbis valvata.*
125	225 m	*Ophiceras dubium* (Plate XIV, fig. 5) (8—10 m over Conglomerate III).
123	144 m	*Claraia stachei*, *Spirorbis valvata.*
120	141 m	*Bellerophon borealis*, *Myalina* aff. *schamarae.*
119	130—136 m	*Claraia stachei*, *Anodontophora* sp. ind., *Spirorbis valvata.*
121	126 m	*Naticopsis arctica*, *Claraia stachei*, *Myalina* aff. *schamarae*, *Spirorbis valvata.*
122	109 m	*Ophiceras compressum*, *O. kochi* var. *falcata* (Plate XV, fig. 2).

The "new horizon", discovered by Lauge Koch and placed at 244 m is probably the same as that of the assemblage No. 101 (at 232 m) in an identical preservation, since it was described as only 5—10 cm in thickness and since the single ammonite collected at 125 (225 m) may be assumed to have come down from the higher bed. The blocks collected in 1930 were undeveloped when I stated that they contained only *Lytophiceras wordiei* and *L. subkyokticum*, the only involute ammonites then named; but on further preparation they have all turned out to belong to one new species, *Ophiceras (Lytophiceras) dubium* and its varieties, above discussed (p. 26). Again there is no reason why this new horizon should be only just above the *commune* beds, as I then held; for while the ammonites listed in 1930 were certainly forms that occur in the *commune* zone, we now know that they do not go up even into the *Vishnuites* beds. But this *dubium* horizon was stated to be 56 m below the *Proptychites* conglomerate and at section XV (see p. 86) and elsewhere (see p. 81) *O. dubium* was said to have been found in the *Proptychites* zone.

Among the other assemblages from Cape Stosch in the new collections, mention may be made of some slabs from the lower *Glyptophiceras* beds of Extra River (162—168 m) because in addition to blocks with *G. triviale*, and one with a badly preserved *Bellerophon* that may well be *B. borealis*, there are rocks made up almost entirely of fragments of Carboniferous polyzoans, *Productus*, *Spirifer*, &c. mixed with greenish mud pellets. I am figuring in Plate XX, fig. 1a slab from this locality, showing badly crushed *Glyptophiceras* cf. *triviale* in association with a *Stenopora*-like polyzoan, while another example (Plate VI, fig. 9), including both *G. triviale* and a Carboniferous *Productus*, is from the same beds at River 1.

c. Clavering Island.

The *Ophiceras* beds on Clavering Island have not been collected from sequentially and the lower beds are at a higher level than the upper, at the localities where the different assemblages before me were found. But two sets of fossils from south-west of Mt. Brinkley (777 and 778) and one from the northern end of Söderbergh Plateau (787) are identical with the assemblages recorded by Lauge Koch (1931, pp. 52, 57) and discussed by myself in 1930 (p. 70). It seems certain now that the rock with indeterminable *Ophiceras (Lytophiceras)* sp. which I then figured (Plate X, fig. 1) includes forms like those represented here in Plate XIX, figs. 8—10, and that they all come from about the same horizon. The entire fauna of this now includes —

> *Otoceras boreale*, *Ophiceras (Lytophiceras) commune*, *O. chamunda*, *O.* aff. *ptychodes* (Plate XIX, figs 8—10), *O. (Metophiceras) subdemissum* and var. *ornata*, *O. (M.)* aff. *praecursor*, *Glyptophiceras pascoei*, *G. gracile*, *G. minor*, *G.* cf. *pseudellipticum*, *G.* sp. ind., *Claraia stachei*, *Spirorbis valvata*.

On Söderbergh Plateau (No. 780) at 290—293 m Mr. Nielsen collected from what he calls the "upper beds" and the preservation of the fossils is quite different and often excellent. There are many examples of *Ophiceras* and numerous fragments, but with the exception of the fragment figured in Plate XIX, fig. 11 they are all referable to just two species, again associated with *Claraia stachei* and *Spirorbis valvata*. These two species are

The difference between the two levels may not be great, but at section XXXVI, for example, an assemblage including only these two species of *Ophiceras* was found about 45 m above an *Otoceras* — *Metophiceras* — *Glyptophiceras* assemblage corresponding to that of the lower beds on Clavering Island. The higher beds with *Anodontophora* (at 462 and 594 m) and with *Myalina* (at 568 m) cannot be satisfactorily correlated, as the fossils are poorly preserved, but the suggestion of Lauge Koch (p. 60) that the *breviformis* zone is the highest developed in this area, immediately below the basalt, seems borne out by the new material.

d. Cape Franklin.

There is no fresh evidence from west of Cape Franklin and the ammonites before me have already been listed by Lauge Koch (p. 65). The fossils from a greenish-grey shale (localities 11 and 12), marked uppermost part of the Triassic series, are crushed and difficult to identify, but they are chiefly *Ophiceras commune* and *O. subsakuntala*. There are large numbers of them, to the entire exclusion of either *Glyptophiceras*, from beds below, or anything that would indicate beds above the *commune-subsakuntala* horizon. It may not be possible to distinguish a crushed *Vishnuites* from a similarly flattened *Ophiceras* of equal umbilical width, but the associated fossils would probably have been more varied and *Gervillella* (to the exclusion of *Myalina*) also points to a low horizon.

The micaceous sandstones with *Glyptophiceras* &c. from lower levels are too incompletely explored or too unfossiliferous to be of use for purposes of finer subdivision.

e. Nathorst Fjord, Fleming Inlet and Traill Island.

The Eotriassic fossils collected by Mr. Noe-Nygaard in the southern area, chiefly on Wegener Peninsula between Fleming Inlet and Nathorst Fjord, are few and of little value for zonal purposes, but they may be listed, such as they are, on account of their general interest. The fossils of the metamorphosed, black *Ophiceras* beds or *Claraia* Shales (*Pseudomonotis* Shale of Hartz), however, are poorly preserved; and those few examples from other beds that are recognisable came out of loose blocks.

I. South-west section of Wegener Peninsula.

Number	Height	Fossils
170	694—695 m	*Ophiceras* cf. *commune?*
171	695—702 m	*Ophiceras* cf. *commune?*, *O.* cf. *wordiei?*, *O. subkyokticum* (Plate XII, fig. 6; Pl. XIII, fig. 6), *Claraia stachei*.
172	702—704 m	*Ophiceras* cf. *wordiei*, *O. subkyokticum*, *Claraia stachei*.

The only fossil marked as coming from "beds below the *Pseudomonotis* Shales" is an indeterminable *Glyptophiceras* or *Metophiceras* sp. from Tvekeglekløft (No. 22, at 240 m) on the eastern shores of Fleming Inlet, but this was found in a boulder. The preservation is the same as that of the *Metophiceras* listed below from 27 and 56.

II. Cape Seaford, Fleming Inlet.

Number	Height	Fossils
275	0—75	*Anodontophora?* sp.
276	200—230	*Anodontophora (Pleuromya?)* sp. ind., *Gervilleia?* sp. ind.
277	210 m	Indeterminable gastropods.
284—285	420 m	Indeterminable pelecypods.
283	426 m	*Anodontophora?* sp. ind.

In Pingel Valley, at the bottom of Fleming Inlet (whence comes only a single *Ophiceras* from a boulder), a succession like II is said to follow on the *Ophiceras* beds; but the fossils are clearly insufficient to determine the age of this formation (Mt. Nordenskjöld Formation?). The fossils are not comparable to any Eo-Triassic forms known from Cape Stosch; and if this formation is succeeded by the supposed Upper Triassic Cape Biot Formation (Keuper according to Nathorst) and by the Rhaetic, its age would appear to be somewhere between the Upper Eo-Trias and the Keuper. Mr. L. R. Cox of the British Museum (Natural History) who kindly examined these pelecypods for me, is of opinion that they could be of Middle or Upper Triassic age, but that they are too indefinite for specific or even generic identification.

III. Mt. Paradigma, Nathorst Fjord.

Number	Height	Fossils
27	280—300 m	*Ophiceras* cf. *commune*, *O. subsakuntala*, *O.* cf. *wordiei*, *O. (Metophiceras) subdemissum*, *Glyptophiceras?* sp. ind., *Claraia stachei*.

A similar assemblage can be recorded from the neighbouring locality:—

IV. South-western side of Snelejedalen, Nathorst Fjord.

Number	Height	Fossils
56	182—200 m	*Ophiceras commune*, *O. subsakuntala*, *O. (Metophiceras) subdemissum* and var. *ornata*, *O. (M.)* cf. *praecursor*, *Claraia stachei*,

but a block of conglomerate from below the ammonite horizon is unfossiliferous. The matrix of the ammonites, a metamorphosed black shale, is sometimes strikingly like that of the *Ophiceras* beds of the Himalayas.

V. Central Traill Island (Moon Valley).

Number	Height	Fossils
599—600		*Ophiceras* cf. *greenlandicum*, ? *Anodontophora* cf. *canalensis* ?

The preservation of these two, in a grey, micaceous sandstone, is more like that of the Cape Stosch beds than the Eo-Triassic of either Cape Franklin or Fleming Inlet.

For the present it must suffice to state that the *Ophiceras* beds are present on Wegener Peninsula, but the fossils from Depot Island and the base of Mt. Nordenskjöld are Carboniferous? (*Grammysia*, "*Astarte*", *Productus* &c.). The Eo-Triassic, between this Depot Island Formation below and the Nordenskjöld Formation above, would appear to

D. RESULTS

a. Stratigraphical.

The sequences listed above allow of subdivision of the lower Eo-Trias of East Greenland in greater detail than was warranted by the collections made up to 1929 or those of 1930 and 1931, already recorded and summarised by Lauge Koch. One of the greatest difficulties, encountered with all the collections, had been the apparent persistence of *Ophiceras* of the *sakuntala* and other types into the *Proptychites* beds; and until quite recently, when compiling lists of the fossils of some typical sections for the collector, Mr. Eigil Nielsen, I was doubful about the real affinities of these smooth body-chamber fragments. As mentioned, however, under *Ophiceras ultimum* (p. 25), this late species of *Ophiceras* is distinguishable from the earlier *O. commune* and its Himalayan equivalent, *O. sakuntala*, by certain features, though not, perhaps, if only small fragments are available; but the persistence of smooth, *sakuntala*-like forms, even in Upper Eo-Triassic deposits, has, before, given rise to confusion, e. g. in the case of the Albanian fauna, described by Arthaber.

The subdivisions of the Lower Triassic (Scythian) given in 1930 were emended in my recent Catalogue of the Fossil Cephalopoda in the British Museum (Vol. IV), because the term "Stephanitan" cannot be used for the uppermost of the ammonite ages in the Eo-Trias. Noetling's *superbus* zone, in fact, or the Upper Ceratite Limestone of the Salt Range, is characterised by an abundance of *Anasibirites*; and in western North America this genus has been found to be confined to beds between the Owenitan and Columbitan. There seems to be no doubt that the Salt Range succession is very incomplete; not only is there no lowest Eo-Trias (Otoceratan) but there must be gaps below as well as above the Upper Ceratite Limestone. The sequence therefore was emended as follows:—

Subdivisions of the Scythian.

Eo-Trias	Upper	Prohungaritan
		Columbitan
		Owenitan
	Lower	Flemingitan
		Gyronitan
		Otoceratan.

The view previously expressed (1930, p. 75) that all the Triassic ammonites found in Greenland belong to the lowest Eo-Trias needs only slight qualification. Among the new material there are species like *Prionolobus* (?) sp. nov.? or *Proptychites grandis* that are more advanced than anything occurring in the Himalayan *Otoceras* beds or even in the (equally condensed) *Ophiceras* layer of Pastannah, Kashmir, with the exception of *Pseudosageceras*. This, however, is a long-ranged survival of a stock not represented in East Greenland; and a Permian *Medlicottia*, recorded by Frebold[1]), suggests that the absence of the equally rare *Pseudosageceras* may be purely accidental, i. e. due to "collection-failure". These more advanced types include also *Ophiceras dubium*, discussed below (p. 108) and it is important to note that they come from the *Vishnuites* beds. In the next higher *Proptychites* horizon, *Ophiceras dubium* is the only ammonite left that does not belong to the genus *Proptychites*.

On deciding whether to leave the *Proptychites* beds in the Otoceratan, as I had done in 1930, when their position was only surmised, or whether to include them in the Gyronitan age, it is necessary to compare the fauna of the *Proptychites* zone of East Greenland with that of the Lower Ceratite Limestone of the Salt Range. The latter includes abundant *Gyronites*, in association with *Koninckites*, *Prionolobus* and two species of *Proptychites*. The former fauna consists largely of one form, *P. rosenkrantzi*, which, however, occurs in enormous numbers of individuals. There is no species common to the two faunas, and they are probably not contemporaneous; but as there is no apparent discontinuity in the ammonite faunas either of East Greenland (from the *Otoceras* beds up to the *Proptychites* beds), or of the Salt Range (from the Lower Ceratite Limestone up into the Ceratite Marls), it seems that the Greenland fauna is the older of the two and could therefore be included in the Otoceratan age, especially as *Ophiceras* persists, if only with a single form.

On the other hand, the *Vishnuites* beds, of a thickness of about 400 feet, are without either *Otoceras* or the typical *Ophiceras* of the *tibeticum* group and should therefore be considered to be already post-Otoceratan. The advanced forms already cited and the fact that *Proptychites grandis* is comparable to large Salt Range forms even higher than the Gyronitan, indeed, make it advisable to limit the Otoceratan to the lower zones only and the following subdivision is now suggested:—

Subdivisions of the Eo-Triassic of East Greenland.

? —	*Anodontophora* Beds........	*A. fassaensis* *Myalina kochi* *A. breviformis*

[1]) Marines Unterperm in Ostgrönland. Medd. om Grønl., vol. 84, No. 4, 1932.

Gyronitan	*Proptychites* Beds.........		*P. rosenkrantzi*
	Vishnuites Beds	upper	*Ophiceras dubium*
		middle	*V. decipiens* and *O. ultimum*
		lower	*V. decipiens* and *O. kilenense*
Otoceratan	*Ophiceras* Beds	upper	*Ophiceras commune* and *O. subsakuntala*
		lower	*O. (M.) praecursor* and *G. serpentinum*
	Glyptophiceras Beds	upper	*G. minor* and *O.* (?)sp. ind.
		lower	*G. triviale*

The distribution of the fossils in these zones is represented in the following table:—

	Glyptophiceras beds, lower	*Glyptophiceras* beds, upper	*Ophiceras* beds, lower	*Ophiceras* beds, upper	*Vishnuites* beds, lower	*Vishnuites* beds, middle	*Vishnuites* beds, upper	*Proptychites* beds	*breviformis* zone	*kochi* zone	*fassaensis* zone
1. *Otoceras boreale*			×	×							
2. — sp. ind.	×	?									
3. *Ophiceras greenlandicum*				×							
4. — *transitorium*					×	×					
5. — (?)sp. ind.		×	×								
6. — *(Lytophiceras) commune*			×	×							
7. — — *subsakuntala*				×							
8. — — aff. *ptychodes*			×								
9. — — *ligatum*			×								
10. — — *chamunda*			×								
11. — — *kilenense*				×	×						
12. — — *ultimum*						×	×				
13. — — *dubium*							×	×			
14. — — *vishnuoides*						×					
15. — — *leptodiscus*						×					
16. — *(Discophiceras) kochi*				×							
17. — — *compressum*				×							
18. — — *wordiei*				×							
19. — — *subkyokticum*				×							
20. — *(Metophiceras) subdemissum*		?	×								
21. — — *noe-nygaardi*			×								
22. — — *praecursor*			×								
23. — *(Acanthophiceras) subgibbosum*						×					
24. — — *poulseni*				×							
25. *Vishnuites wordiei*						×					
26. — *decipiens*					×	×					
27. — *(Paravishnuites) oxynotus*				×							
28. — — *striatus*				×							
29. *Glyptophiceras triviale*	×										
30. — *polare*	×										
31. — *minimum*			×	×							
32. — *minor*		×	×	×							

	Glyptophiceras beds		*Ophiceras* beds		*Vishnuites* beds			*Proptychites* beds	*breviformis* zone	*kochi* zone	*fassaensis* zone
	lower	upper	lower	upper	lower	middle	upper				
33. *Glyptophiceras pseudellipticum*			×								
34. — *gracile*			×	×							
35. — *serpentinum*			×								
36. — *nielseni*			×	×							
37. — *pascoei*		?	×	×							
38. — *subextremum*			×								
39. — *extremum*			×	?							
40. *Prionolobus* (?) sp. nov.?							×				
41. *Proptychites rosenkrantzi*								×			
42. — *anomalus*								×			
43. — *intermedius*								×			
44. — *grandis*					×	×					
45. — *subdiscoides*						×					
46. — *simplex*							?	×			
47. *Proptychites (Koninckites?)* sp. ind.						×					
48. *Bellerophon* cf. *vaceki*				×							
49. — *borealis*			×	×	×	×					
50. — sp. ind.	×										
51. *Worthenia* cf. *humilis*			×								
52. — ? sp. ind.			×			×					
53. *Naticopsis arctica*				×	×	×	×	×			
54. *Loxonema* sp. ind.	×						×	×	×		
55. *Undularia (Toxoconcha ?)* sp. ind.									×		
56. *Dentalium (Entalis ?)* sp. ind.										×	×
57. *Pseudomonotis* sp. ind. cf. *iwanowi*							×				
58. — *(Claraia) stachei*	?	×	×	×	×	×	×	×			
59. — — *extrema*				×	×						
60. — — *kilenensis*					×						
61. — *(Eumorphotis)* sp. ind. cf. *venetiana*			×	×							
62. — — *multiformis*				×							
63. *Gervillella* aff. *exporrecta*			×	×							
64. *Enantiostreon* cf. *difforme*	×		×	×							
65. *Anomia ? (Placunopsis ?)* sp. ind.				×		×	×				
66. *Myalina* aff. *schamarae*			×	×	×	×	×	×	×		
67. — *kochi*									×	×	×
68. *Nucula* sp. juv. ind.				×							
69. *Anodontophora borealis*			×								
70. — aff. *canalensis*			×	×							
71. — cf. *fassaensis*											×
72. — sp. nov.? ind.							×				
73. — sp. nov.?			×								
74. — *subovalis*						×	×		×		
75. — *breviformis*								×	×		
76. *Lingula borealis*			×								
77. *Orbiculoidea* cf. *spitzbergensis*			×								
78. *Serpula* spp.				×	×	×	×	×			
79. *Spirorbis valvata*	?	×	×	×	×	×	×	×			

The lower *Glyptophiceras* beds (*triviale* zone) have yielded, in addition, some brachiopods and polyzoans which are believed to have been worked up from the underlying (Carboniferous?) rocks. The presence of large *Otoceras* fragments in the same slabs with the *Glyptophiceras* and *Productus* etc. shows that the rock is of Triassic age, but if the supposed Palaeozoic fossils were derived from a pre-existing rock when the deposit was laid down, their preservation is not worse than that of the ammonites. To the list from the lowest bed may also have to be added *Claraia* sp., but the preservation is different, so that rock specimens bearing *Claraia* may have come down from a higher level and were collected together with those from the true *triviale* beds. The *triviale* zone is typically developed at River 1, west of Cape Stosch.

The Upper *Glyptophiceras* beds are probably developed all along the northern side of Spath Plateau, as far as River 16, but are neither so fossiliferous nor so well exposed as the higher beds. As the few ammonites from it with specific names range up into higher beds, this zone may temporarily be labelled the zone of *Glyptophiceras minor* and *Ophiceras* (?)sp. ind. This zone is represented by Nos. 562—563 in Section XXV and probably by 533 in Section XXVII (p. 90).

The Lower *Ophiceras* beds of Lauge Koch (1931, p. 78) are now referred to a lower zone of *Metophiceras praecursor* and *Glyptophiceras serpentinum* and an upper zone of *Ophiceras commune* and *O. subsakuntala*, but it is possible that a still higher horizon with *Ophiceras (Discophiceras) compressum* can be separated in the "clay with concretions". The calciferous sandstone at the top, referred to by Lauge Koch, and his Upper *Ophiceras* beds are now grouped together under the *Vishnuites* beds, but the upper division of these, with *Ophiceras dubium*, is not well represented in the sections given above and may not be present everywhere. East of River 16, that is to say on Stensiö Plateau, the middle *Vishnuites* beds form the base of the Trias, but between Rivers 6 and 9, for example, where the *Vishnuites* beds rise evenly in the cliffs and do not seem to change much in thickness, there is scarcely anything from the upper division except *Ophiceras ultimum*, which, however, is commoner in the middle *Vishnuites* beds.

I thought at first that in the *Proptychites* beds it might be possible to separate a lower horizon with small and occasionally pyritised *Proptychites* from the typical *rosenkrantzi* horizon, but this is not yet practicable and, in any case, the thickness of beds between the underlying *Proptychites* conglomerate and the *rosenkrantzi* horizon is only small. The still higher beds with *Anodontophora breviformis* also cannot yet be subdivided, the distribution of the poorly preserved forms of *Anodontophora* being too erratic, so far as can be seen. The *Myalina kochi* horizon at the base of the *Anodontophora fassaensis* beds has yielded Stegocephalians and is separated purely for stratigraphical convenience, but *Myalina kochi* is not confined to this level. The *fassaensis* beds are overlain by Cretaceous sandstones that contain only a smooth *Pecten*, apparently *P. orbicularis*, Sowerby, but some Aptian ammonites found loose on Stensiö Plateau, suggest that the whole of the Yellow Series is of Aptian age, resting directly on Eo-Trias. For these *Anodontophora* beds, often coarse sandstones, are still more definitely shallow-water deposits than the lower, ammonite-bearing "Brown and Green Series"; and while I was formerly in favour of regarding the whole of the "Variegated Series" as of Eo-Triassic age, I can see no reason why it should not be Lower Eo-Triassic, i.e. of Flemingitan age. There has always been a tendency to bridge gaps; and it would be easy to consider the *Anodontophora* beds to represent the upper Eotrias, with the Nordenskjöld Formation (presumed Muschelkalk) and the supposed Keuper Cape Biot Formation leading up to the Rhaetic. Such perfect successions do not exist anywhere. The Rhaetic plant beds, themselves only a poor representation of this great system, are overlain in one place (for example, Jameson Land) by Liassic beds with *Uptonia jamesoni* and elsewhere (Antarctic Harbour) by Bathonian strata with *Cranocephalites*. The Triassic sequence in East Greenland is very incomplete, as it is everywhere else, in any one area. I stressed this incompleteness again in my Catalogue (1934) because it seems to me that stratigraphers in general have not yet grasped its real significance.

b. **Palaeontological.**

The ammonites again form by far the most important part of the new collections; and in view of the very shallow-water and littoral character of the deposits I may say at once that in my opinion they do not represent accumulations of drifted shells. Some blocks from the *Ophiceras* beds are teeming with individuals of, for example, *O. subdemissum*, in all stages of growth. In the case of the larger shells, in nodules out of the clayey beds of the *commune* zone, the mouth-border is often perfectly preserved and in at least one case an *Anaptychus* has been found in the aperture.

The ammonites belong largely to the one family Ophiceratidae and there are many hundreds of examples of such common species as *O. commune* or *O. subsakuntala*. There is as much diversity among the members of this family in East Greenland as there is in the corresponding deposits in the Himalayas; and in the case of some groups, e. g. *Vishnuites*, which is known in only a few examples from the Himalayas, the abundant East Greenland material has considerably increased our knowledge. *Vishnuites* differs from *Ophiceras* almost only in the tendency to sharpen its periphery, and it shows the way in which a specialised, oxynote type may arise from a round-ventered, ancestral stock. In the *Vishnuites* beds, thin and thick-whorled *Ophiceras* with rounded periphery occur together with more or less acute and sharpened *Vishnuites*; and there are so many transitional types that even when the venter is perfectly preserved it is often a matter of individual opinion to decide whether there is angularity or not. The same variability applies to the young stages, but, of course, the earliest volutions are rounded in all ammonites. There is no East Greenland example quite so acute as the Himalayan *V. pralambha*, Diener, in which the venter becomes sharpened at a diameter of over 13 mm. In young specimens of *V. decipiens*, comparable to that figured in Plate IV, fig. 4, the angularity of the periphery, often not very pronounced even in the adult, is fairly constant from a diameter of only 10 mm up to the body-chamber; but there is never any sudden sharpening of the venter of the body-chamber. The extreme rarity of *Vishnuites* both at Shalshal Cliff and at Pastannah indicates that its centre of dispersal was not in the Himalayan region and it could, of course, be claimed that a series of forms, showing inheritance, at a successively earlier age, of the old-age characteristics of the parent may yet be found. But workers on ammonites have waited long enough for the adherents of the Hyatt school to produce such series, and zonally collected material tends to prove more and more clearly that new characters appear in a very irregular manner in a given population, affecting different individuals in different ways, but always at early or at least young stages, and entirely independent of the modification of the body-chambers in the adult.

The young of *Ophiceras dubium* which are in a better state of preservation than the inner whorls of most East Greenland *Vishnuites*, well illustrate the appearance of a truncate periphery, which characterises especially the Meekoceratids and other later Eotriassic stocks. The suture-line of this form, and the rounded periphery in the adult, are those of a typical *Ophiceras*, yet a large percentage of the inner whorls have a distinctly flattened periphery, while some have the two ventro-lateral edges as sharply marked as any "*Meekoceras*". Yet there are others in which it is almost impossible to see any truncation at all. Since the blocks containing all these forms have no other ammonites and since the adult are absolutely indistinguishable, except sometimes in thickness, it is clearly not a case of dealing with the young of different species. But there are many possibilities of variation on the dispersal of such a plastic species; and although the absence of tabulate descendants of *O. dubium* in East Greenland may be regrettable, I am of opinion that the Gyronitidae arose from the ancestral Ophiceratidae in some such way. The presence of a form like *Prionolobus* (?) sp. ind (Plate V, fig. 4) in East Greenland, however, shows that truncate offshoots had already been

Again, the Himalayan *O. obtuso-angulatum*, Diener[1]) and "*Meekoceras*" *dubium*, v. Krafft[2]), indicate that there were yet other ways of modifying the whorl-shape and producing transitions to families like the Flemingitidae and others discussed recently in my Catalogue. Diener stated that the species last named "might be referred to *Xenodiscus* or to *Meekoceras (Gyronites*, Waagen) or perhaps even to *Ophiceras* with almost equal reason". Nothing can illustrate better than this statement the necessity for an elastic classification. Of course, tabulation of the periphery or the acquisition of a keel, by given ammonite stocks may be useful, systematic characters, yet they indicate nothing more than adaptation to a special mode of life, nectonic or benthonic, but recurring very frequently in different stocks, right up to the top of the Cretaceous. It would be as inadvisable to stress the importance of these features as to have hard and fast definitions regarding the elements of the suture-line, when the two halves on opposite sides can be as unsymmetrical as they have been shown to be in many cases. Common-sense ought to decide where to place a given group and it is only pedants who deplore the absence of a rigidly morphological system. To deduce descent in the absence of recapitulatorial guidance, may not be easy where there are so many stratigraphical gaps. If it could be done by just reversing the biogenetic law, it would have been attempted long ago, because as I have recently again pointed out[3]), the voice of doubt was heard long ago. But the proof of all the classifications is in the practical application and elasticity in a system is as necessary as latitude in the creation of genera and species. All species of *Otoceras* are very much alike and the Himalayan forms, for example, that all come out of one bed, the one-foot main layer of *Otoceras woodwardi*, might well have been left in this one species. On the other hand, two such heterochronous forms as *Proptychites latifimbriatus* (de Koninck) from the Ceratite Marls of the Salt Range and "*P. latifimbriatus*" described by Arthaber from the *Subcolumbites* beds of Albania, forms that are not even similar, must be separated generically; but no single character can be relied on in any classification. The sub-genera of *Ophiceras* thus may be more narrowly interpreted in proportion than a large species like *Vishnuites decipiens*, but the limits of the available material will always be variable.

The remaining ammonite families represented in East Greenland are chiefly the Otoceratidae and the Proptychitidae, while there is but a single fragment of a doubtful Gyronitid. In the former two families,

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[1]) In Krafft and Diener: "Lower Triassic Cephalopoda from Spiti, Malla Johar and Byans". Pal. Indica, Ser. XV, vol. VI, Mem. no. 1, 1909, p. 82, pl. xxiv, fig. 6.

[2]) *Ibid.*, p. 50, pl. xxiv, figs. 11—14.

[3]) Spath: Revision of the Jurassic Cephalopod Fauna of Kachh (Cutch). Pal. Indica, N. S. vol. IX, Mem., no. 2, pt. VI, 1933, p. 708.

again, only one species in each is known in fair numbers, but while there are only 57 imperfect examples and fragments of *Otoceras boreale*, *Proptychites rosenkrantzi* has been collected in at least a thousand individuals. Some of the simpler forms of *Proptychites* here described show the close affinity that exists between this genus and the ancestral Ophiceratidae, the tendency being to involution, thickening in the umbilical region and inflation of the inner whorls.

It is interesting to note that as in the ammonites, so in the other groups of mollusca and molluscoidea, the additional forms are largely species of the same genera that were described before, such as *Pseudomonotis* and *Anodontophora*. Even the second brachiopod now recorded is an *Orbiculoidea*, compared to a Spitsbergen form, and there is no trace of the Terebratulids or *Spiriferina* found in Ussuri or *Rhynchonella* of the Himalayas. But considering the poverty in fossils other than ammonites of even the Himalayan lower Eo-Trias, the comparatively meagre list from East Greenland is not surprising. On the other hand, the poor state of preservation of the species of *Anodontophora* in the higher beds prevents correlation with the lamellibranch zones suggested by Frech for the Alpine Werfen beds[1]). Only the long range of *Claraia stachei* in East Greenland, from the *Glyptophiceras* beds up to the *Proptychites* beds, has an analogy in the distribution of *Claraia clarai* in the great thickness of Seis beds. The absence of corals and echinoderms, in addition to that of calcareous brachiopods, may be taken to confirm the littoral facies of the sand and clay deposits of the East Greenland Eo-Triassic, already suggested on p. 78 on account of the occurrence of ammonites on flags showing ripple-marks.

c. General and Palaeogeographical.

Since I summarised the results of my previous investigation of the Eo-Triassic ammonites of East Greenland there has been published an important posthumous work by J. Perrin Smith on the Lower Triassic Ammonoids of North America[2]). I have elsewhere[3]) had occasion to criticise this work, especially the systematics, but however much we may object to the "exuberant enthusiasm and confidence" with which J. P. Smith used recapitulatorial methods and constructed genetic lines "running unbroken from the Devonian to the end of the Cretaceous", it is impossible entirely to ignore his remarks on interregional correlation.

[1]) Leitfossilien der Werfener Schichten. Result. Wiss. Erforsch. Balaton-Sees. Vol. I, pt. 1, Pal. Anh. VI (1907), p. 50.

[2]) U. S. Geol. Survey, Professional Paper 167, 1932.

[3]) Pal. Zentralblatt, vol. III, nos. 5—6, 1933, p. 345. Also *op. cit.* (Trias Catalogue), 1934, p. 12.

First of all, I cannot agree with his statement that our knowledge of faunal zones in the Lower Triassic has become nearly as complete as it is of those in the Jurassic. Smith himself has done his best to show how little there was really known about the Eo-Triassic. His *Otoceras* zone is something very different from the Otoceratan age discussed above and now subdivided into at least four zones; and his succeeding "*Genodiscus*" zone, including a number of heterochronous formations, may be judged by his remark that it was "probably" represented in East Greenland. The sub-genus "*Genodiscus*" was based on a Timor species (*Anakashmirites lidacensis*, Welter sp.) which belongs to a fauna that does not include a single ammonite that is also found in the Lower Ceratite Limestone of the Salt Range, leave alone in the still earlier *Ophiceras* beds of Greenland; and although Smith does not appear to have seen my fuller (1930) account of the fauna of these beds, but only the earlier (1927) note, the species there quoted should have been sufficient to put him on his guard.

The Correlation Table given by Smith, in fact, is of little help in the present discussion and it is misleading, although it was uncritically copied by Arthaber[1]). Since the East Greenland and Japanese Lower Triassic occurrences, although mentioned in the text, were not marked on Smith's map (p. 14) it is impossible to say how much of the work was done in earlier days and was then left uncorrected. Yet Mathews's paper on the Lower Triassic Cephalopod Fauna of the Fort Douglas Area, Utah[2]) was largely copied, including illustrations, and the information on which the Spitsbergen (or Svalbard) sequence was based, in any case, had been published sufficiently long ago to have been differently utilised. My record of *Keyserlingites* (now *Wasatchites*) together with an assemblage that included "*Anasibirites*" and "*Goniodiscus*" (now *Hemiprionites*) from a single (the lowest) nodule-bed scarcely warranted their division into a *Keyserlingites* fauna above and *Anasibirites* beds below, separated by an (unrepresented?) *Tirolites* zone; but what justification there is for the insertion of a horizon with *Inyoites* at a still lower level may be read in Stolley[3]). It would have been just as safe to speak of Middle Triassic *Arpadites* beds. Again the inclusion of the lower part of the *Posidonomya* Shales in a still earlier Eo-Triassic horizon of *Pseudosageceras multilobatum* is erroneous. The "*Gyronites*" recorded by various authors are probably examples of the genus *Svalbardiceras*, Frebold, which cannot be of pre-*Anasibirites* age. The Spitsbergen succession, being so much higher than the Eo-Triassic of East Greenland, cannot thus be compared with the latter any more than the

[1]) Neues Jahrb. f. Min. &c. Ref. III, 1933, Heft 3, p. 600.
[2]) Walker Museum Memoirs, vol. I, No. 1, 1929.
[3]) Zur Kenntnis der arktischen Trias. Neues Jahrb. f. Min. &c., I, 1911, p. 121.

supposed *Otoceras* fauna of Timor. I have already referred to this doubtful assemblage (1930, p. 77), yet Arthaber again quoted it[1]) as indicating the *Otoceras* zone, but neither he nor J. P. Smith noticed Bonnet's records of *Otoceras* from Armenia.

Another work on the Cephalopoda of the Lower Trias of Madagascar by M. Collignon[2]) may here be discussed, although it similarly deals with higher Eo-Triassic forms. The *Ophiceras* and *Vishnuites* recorded by this author, of course, are entirely misidentified. First, if the former were true *Ophiceras*, then they could have nothing to do with *Gyronites frequens* which does not even superficially resemble the figures given by Collignon, except to the inexperienced. If Collignon follows Arthaber and Smith in identifying *Ophiceras* with *Gyronites*, which is said not to differ from it, then it can only be concluded that none of these authors had handled actual examples of these two Indian genera. *Vishnuites* is still less convincing, and like the two Timor species, wrongly cited as *Vishnuites*, in spite of my corrections, the execrably worn Madagascar example figured by Collignon, has nothing to do with this genus. The Madagascar fauna, in fact, is well characterised by its other elements, notably *Flemingites*, and includes nothing of Gyronitan or Otoceratan age, although some *Proptychites* have been described. Of these, *P. douvillei* is only distantly comparable to the Greenland forms, but its suture-line is more advanced, as is that of the other two Madagascan species which may not even be *Proptychites*. The Eo-Triassic ammonites described by Mme. Vaillant-Couturier-Treat[3]) from the northwest side of Madagascar, apparently do not indicate a Gyronitan or earlier age any more than Collignon's, and it is difficult to see how this author[4]) could consider the beds with nodules to represent in all probability the *Otoceras* and *Episageceras* zones of the Himalayas, notwithstanding the occurrence, in both areas, of *Claraia griesbachi*.

There is thus no *Otoceras* fauna known from anywhere except the few localities already discussed in 1930 and even the ammonites of the Greenland *Proptychites* beds have no equivalents among the faunas recently described. It is unfortunate that the ammonites recorded by Frebold[5]) from below the *Myalina* beds of Spitsbergen could not be determined. Their description as "including some forms possibly to be interpreted as belonging to *Ophiceras*" scarcely encourages an

[1]) *Loc. cit.* (Neues Jahrb., 1933), p. 599.

[2]) Pal. de Madagascar, XX, Annales de Paléontol., vol. XXII (1933), pp. 151—180, pls. XIV—XX; vol. XXIII (1934), pp. 1—48, pls. I—VI.

[3]) Le Permo-Trias marin. Paléontol. de Madagascar, XIX. Annales de Paléontol., vol. XXII, 1933. (Quoted in Collignon, but not yet published?).

[4]) *Loc. cit.* (1934), p. 69.

[5]) Facielle Verhältnisse des Mesozoikums im Eisfjordgebiet Spitzbergens. Skrifter om Svalbard og Ishavet, No. 37, 1931, p. 57.

attempt at correlation, especially in view of what has been said on p. 70 concerning the similarity of the species of *Myalina*. Frebold[1]) figured examples from both Spitsbergen and East Greenland, and it is true that they cannot be distinguished from some *Myalina* aff. *schamarae* from beds that contain undoubted Eo-Triassic ammonites of various horizons in the Otoceratan and Gyronitan ages. But his Greenland *Myalina* came from blocks in conglomerates, many of them with Palaeozoic fossils, but without Triassic ammonites; and I have already mentioned that the associated pelecypods are different from any found *in situ* in the Eo-Triassic. It is thus by no means established that the *Myalina* beds of Spitsbergen are Eo-Triassic, although I agree with Frebold that the presence of ammonites in sandy shales below alone suggests a Triassic rather than Permian age. But there may be considerable time gaps between the horizon of the Greenland "Zechstein" and the *Otoceras* beds on the one hand and the *Proptychites* beds of East Greenland and the lowest recognisable ammonite horizon of Spitsbergen on the other. In either case, the time interval may prove surprisingly long when ultimately established; for as I have recently[2]) shown the uppermost Permian ammonite faunas are as yet very imperfectly known. Species of *Ophiceras* are often difficult enough to distinguish in fairly well-preserved examples, as is shown by the erroneous records from Albania and California, Timor and Madagascar. Permian *Paralecanites* and *Xenaspis*[3]) may be so much like *Ophiceras* that their separation has to be based largely on stratigraphical considerations and on their association with entirely distinct faunas, but not on any real morphological differences, so far as is known at present. It seems to me clear that the upper Permian sequence will have to be considerably extended and I have suggested a probable succession; but the position in this of *Paralecanites* as well as *Xenaspis* is based on mere surmise.

Frebold rightly insisted on the marginal character of the frequent but temporary transgressions that affected East Greenland as well as western Spitsbergen, and on the shallow-water nature of the sediments. A comparatively slight extension of Spitsbergen to the westward seems to me sufficient to supply all the sediments that have suggested to the older authors the existence of a great landmass connecting Greenland with Scandinavia; in Triassic times no less than in Callovian and Lower Cretaceous times, there must have been open marine connection

[1]) Fauna, Stratigraphie und palaeogeographische Verhaltnisse des ostgrönländischen Zechsteins. Medd. om Grønl., vol. LXXXIV, No. 1, 1931, pl. IV, figs. 1—2.

[2]) *Op. cit.* (Trias Catalogue, 1934), p. 24.

[3]) See especially Waagen: Salt Range Fossils Vol. I, Pal. Indica, ser XIII, 1887, pl. II, fig. 4.

between the North Atlantic, the Greenland and Barents Seas, the Arctic Ocean and the North Sea. The ammonite species now listed that are not local elements and new, are still forms that occur almost only in the Himalayas. The list previously given (1930, p. 81) seems now somewhat changed, owing to rectification of nomenclature, but there is no real difference. *Eumorphotis multiformis* and *Pseudomonotis* cf. *iwanowi*, in any case, can be added to the Ussuri column, while the differences between *Otoceras boreale* and *O. fissisellatum* or between *Ophiceras commune* and *O. sakuntala* are without significance, from a palaeogeographical point of view. I mentioned before that the other fossils can be equally well (or even better) matched by European forms, especially of the Alpine Werfen Beds, with their abundance of *Pseudomonotis (Claraia)*. But the extreme rarity of ammonitiferous deposits of Lower Eo-Triassic age at present prevents a more emphatic defence of Diener's reconstruction of the distribution of the continents and seas, already favoured in my previous account (1930, p. 87).

d. Summary.

1. The lowest deposits of the Eo-Triassic of East-Greenland, of Otoceratan age, are divisible into four ammonite zones.
2. The earliest of these contains derived Palaeozoic elements, like *Productus*, but is dated by fragments of large *Otoceras*.
3. The thickness of *Otoceras*-bearing beds in East Greenland (about 150 m or 500 feet) is in striking contrast to the single foot thickness of the main layer of *Otoceras woodwardi* in the Himalayas.
4. The *Vishnuites* beds with a thickness of about 130 m or 430 feet are now known to be intermediate in age between the *Otoceras*-bearing beds and the *Proptychites* zone. They are divisible into three ammonite zones, unknown from anywhere else.
5. No subdivision is attempted in the comparatively thin *Proptychites* zone. The persistence of one species of *Ophiceras* shows it to be still early Eo-Triassic, a fact of some importance in view of the appearance of *Proptychites* in the Himalayas in the shales immediately above the one-foot main layer of *Otoceras woodwardi*.
6. The succeeding thick *Anodontophora breviformis* and *A. fassaensis* beds (350 m or 1150 feet) cannot yet be subdivided or dated exactly but are probably all of lower Eo-Triassic age.
7. The Upper Yellow Series is not Triassic but Cretaceous, probably Aptian, and contains only one species of *Pecten*, of the type of *P. orbicularis* Sowerby.
8. The full Triassic sequence is so far known only from the neighbourhood of Cape Stosch. The succession seems fragmentary on Clavering

Island and only remnants of the *Ophiceras* beds have been found at Cape Franklin, on Traill Island and on Wegener Peninsula (between Nathorst Fjord and Fleming Inlet).

9. The Himalayas and Ussuri (Sea of Japan) are still the only areas where comparable, though greatly attenuated, deposits exist.
10. The truncation of the periphery, the characteristic feature of most ammonites of the next higher Eo-Triassic beds, is shown to appear first on the inner whorls of *Ophiceras dubium*.
11. The first Eo-Triassic *Anaptychus* is recorded.

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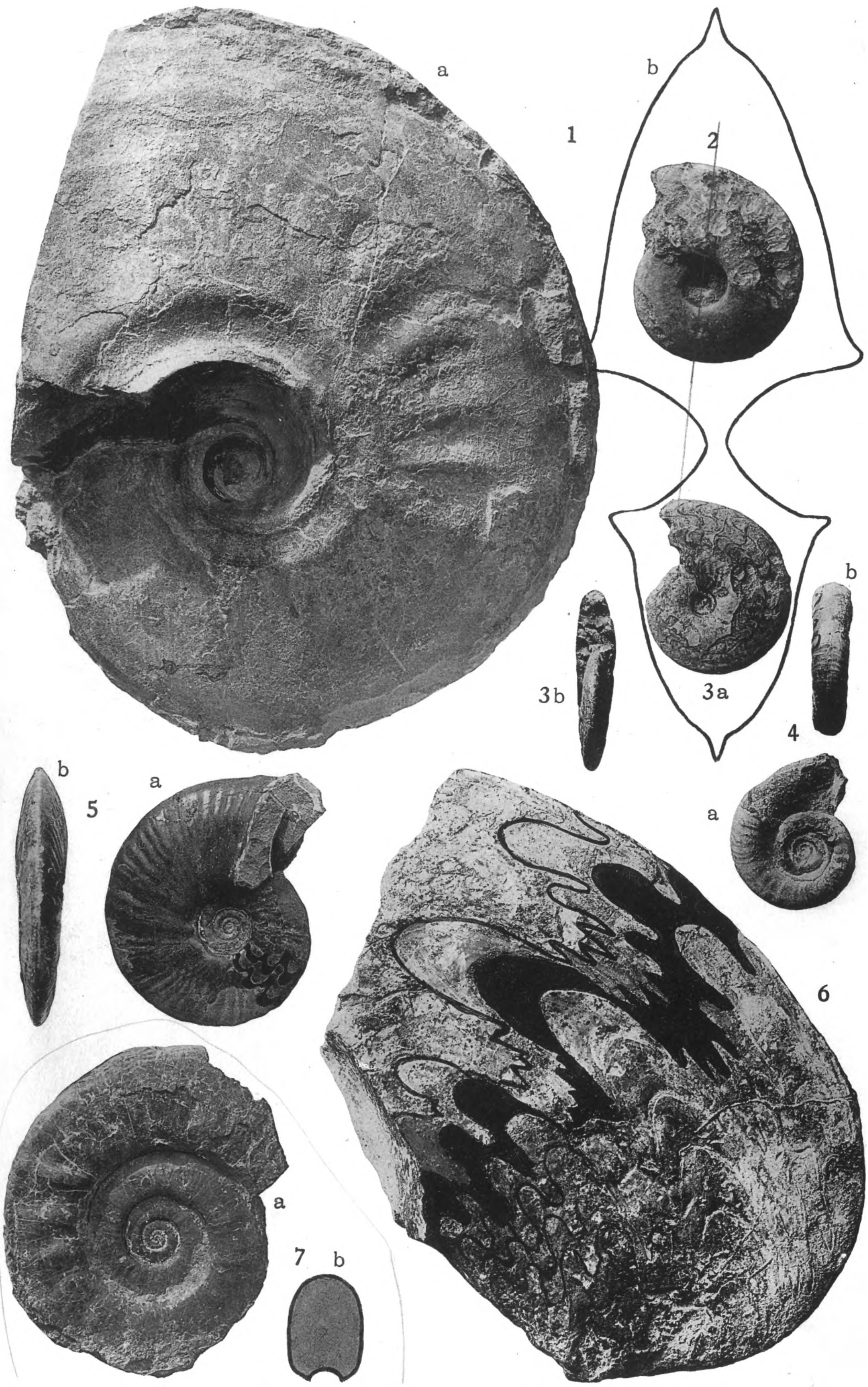
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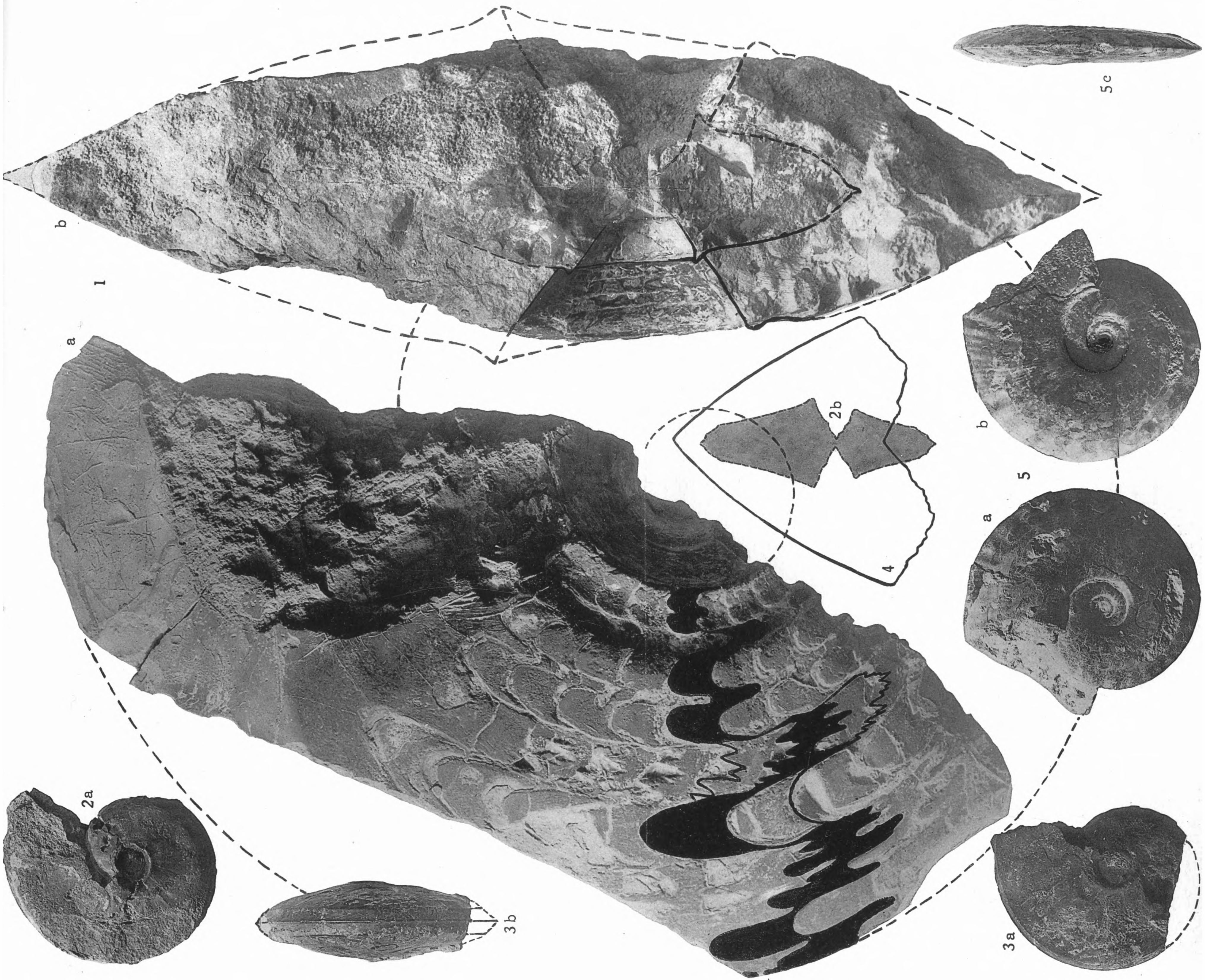
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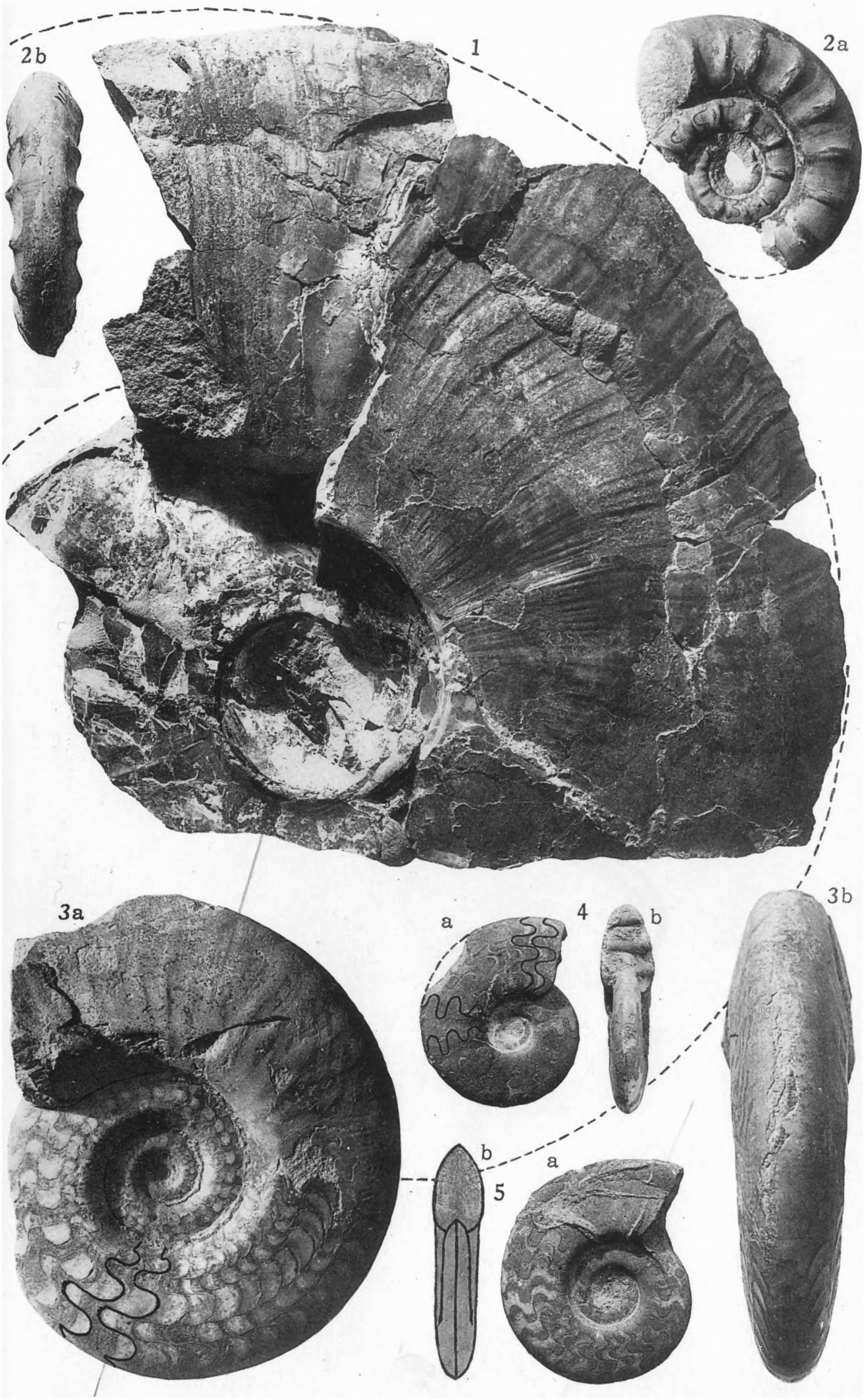
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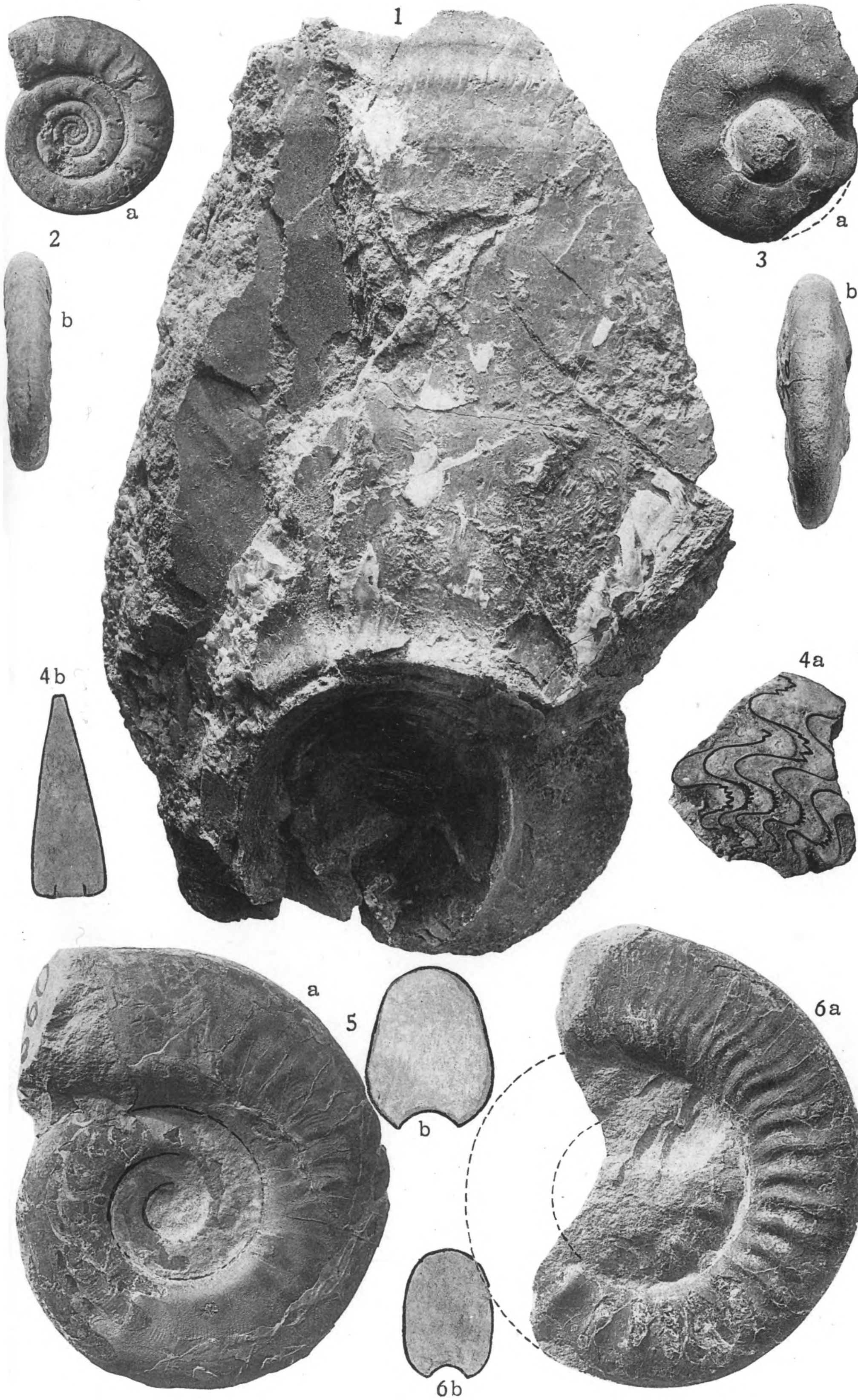
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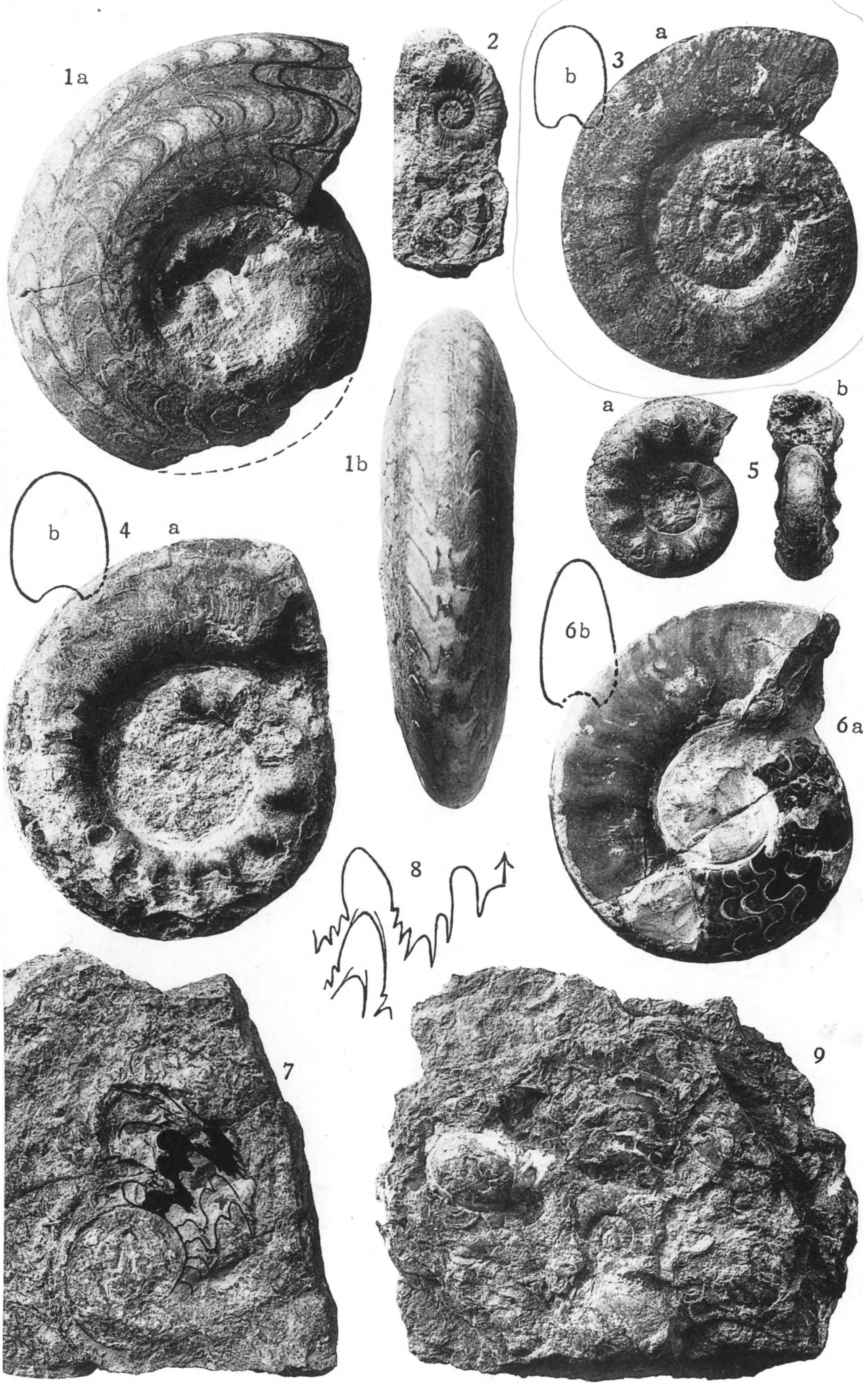
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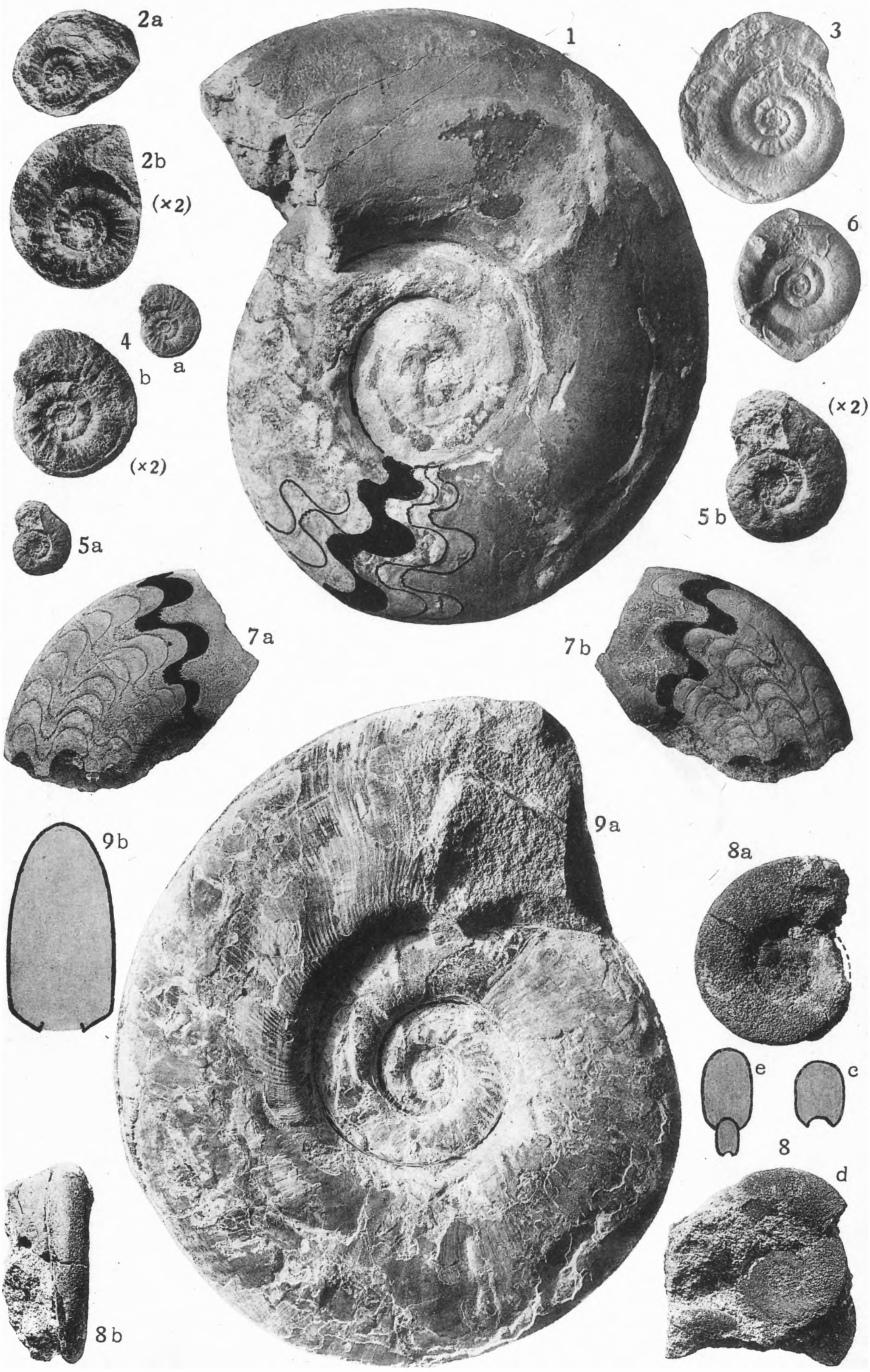
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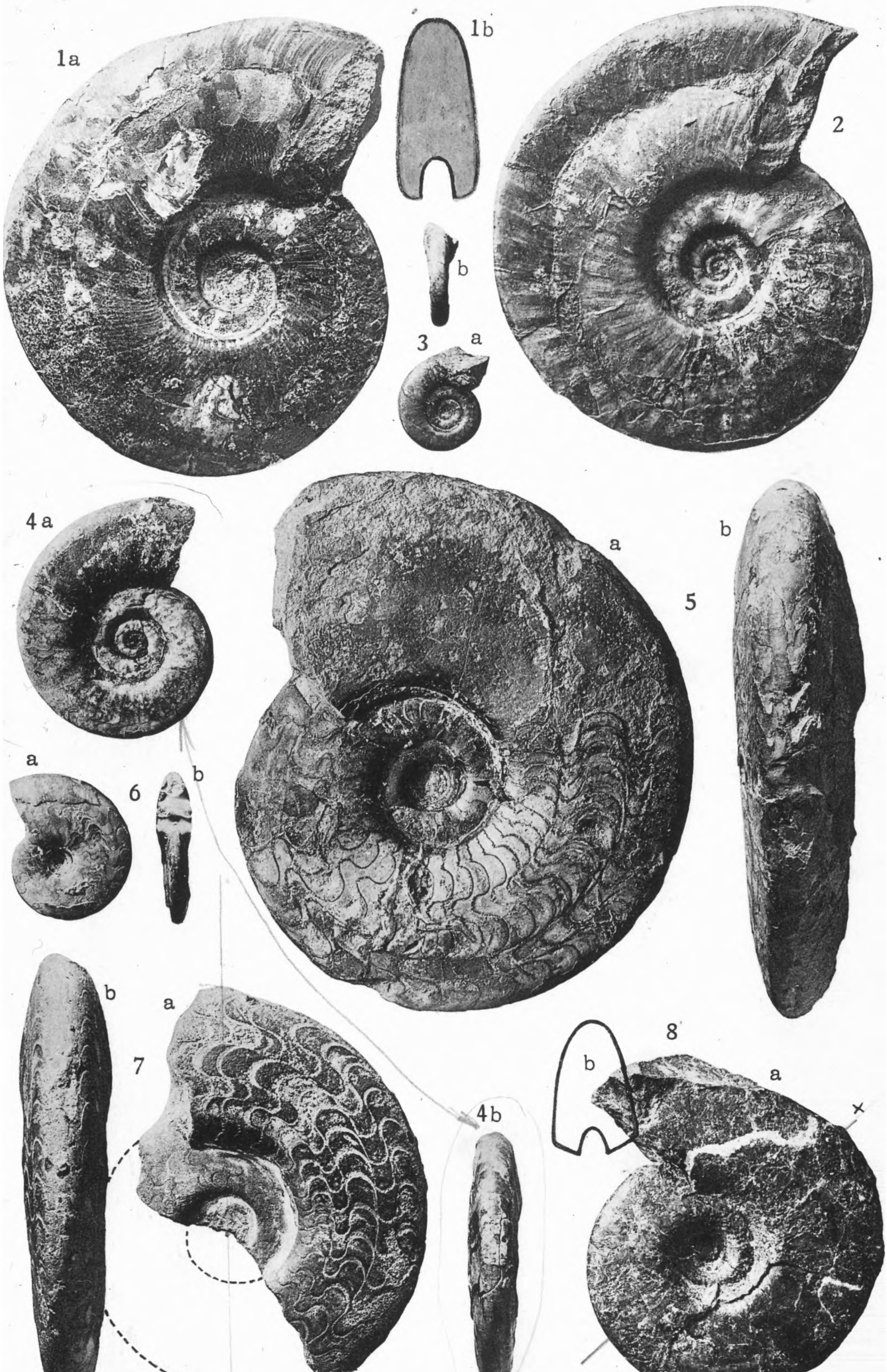
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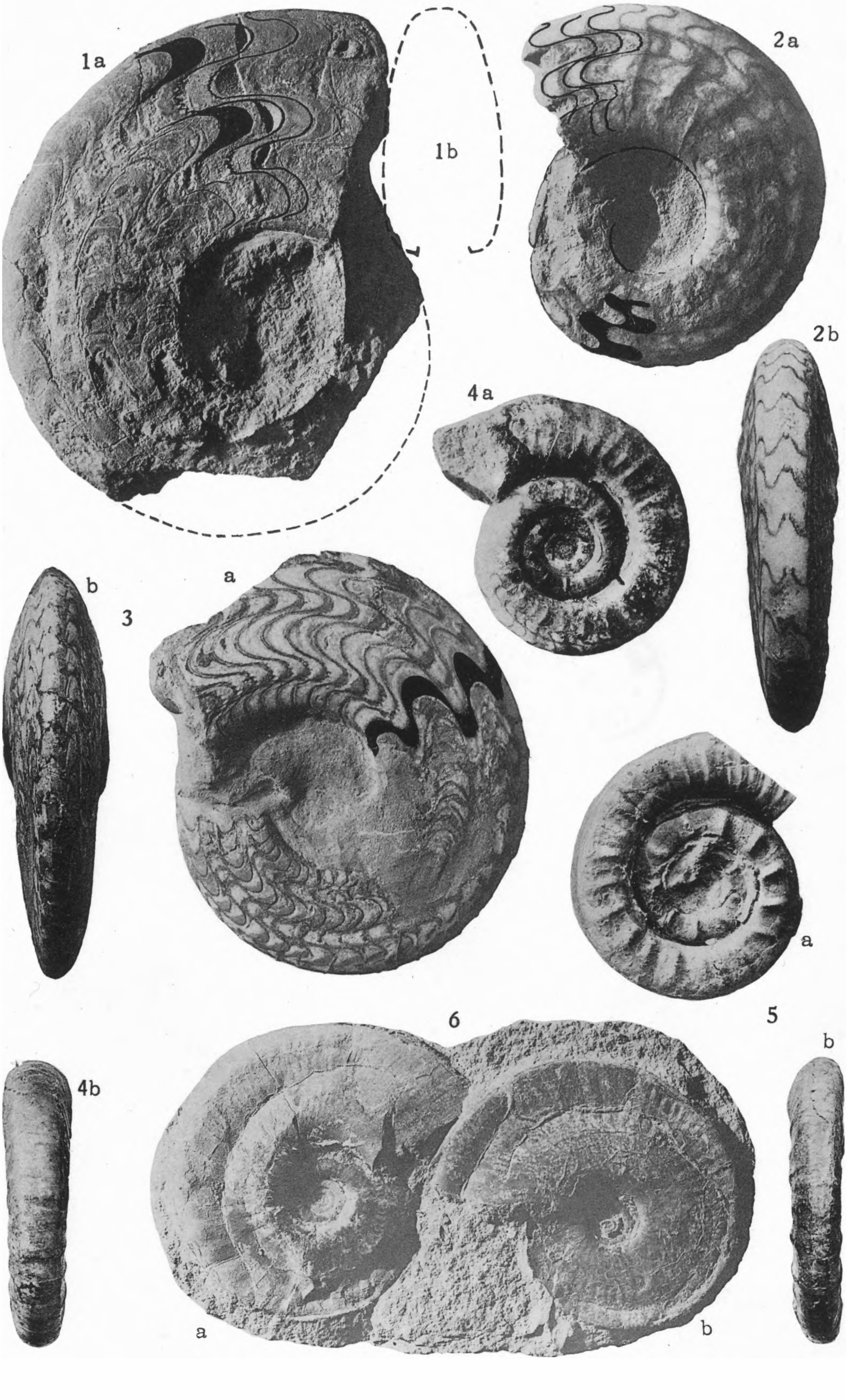
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1a
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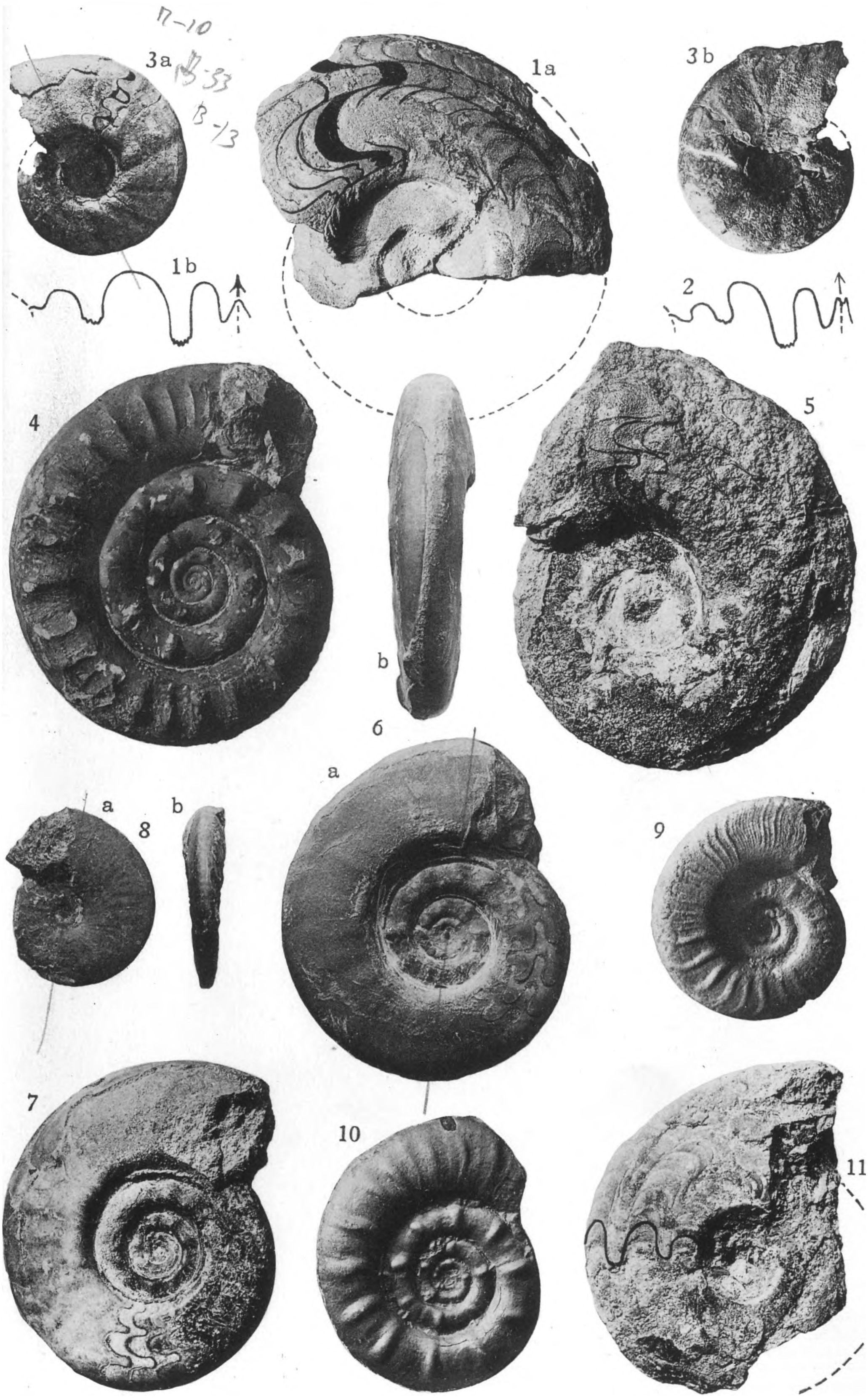

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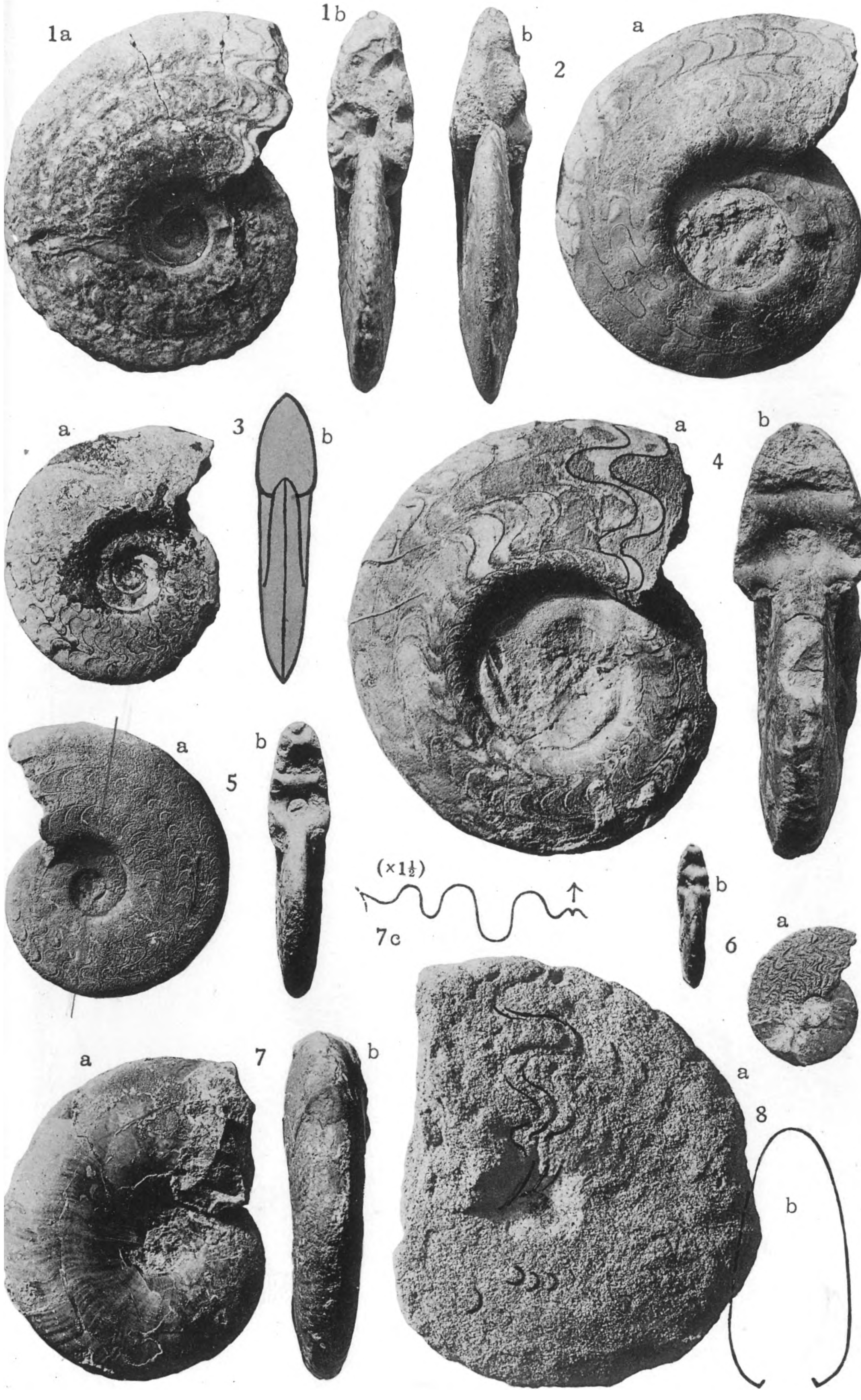
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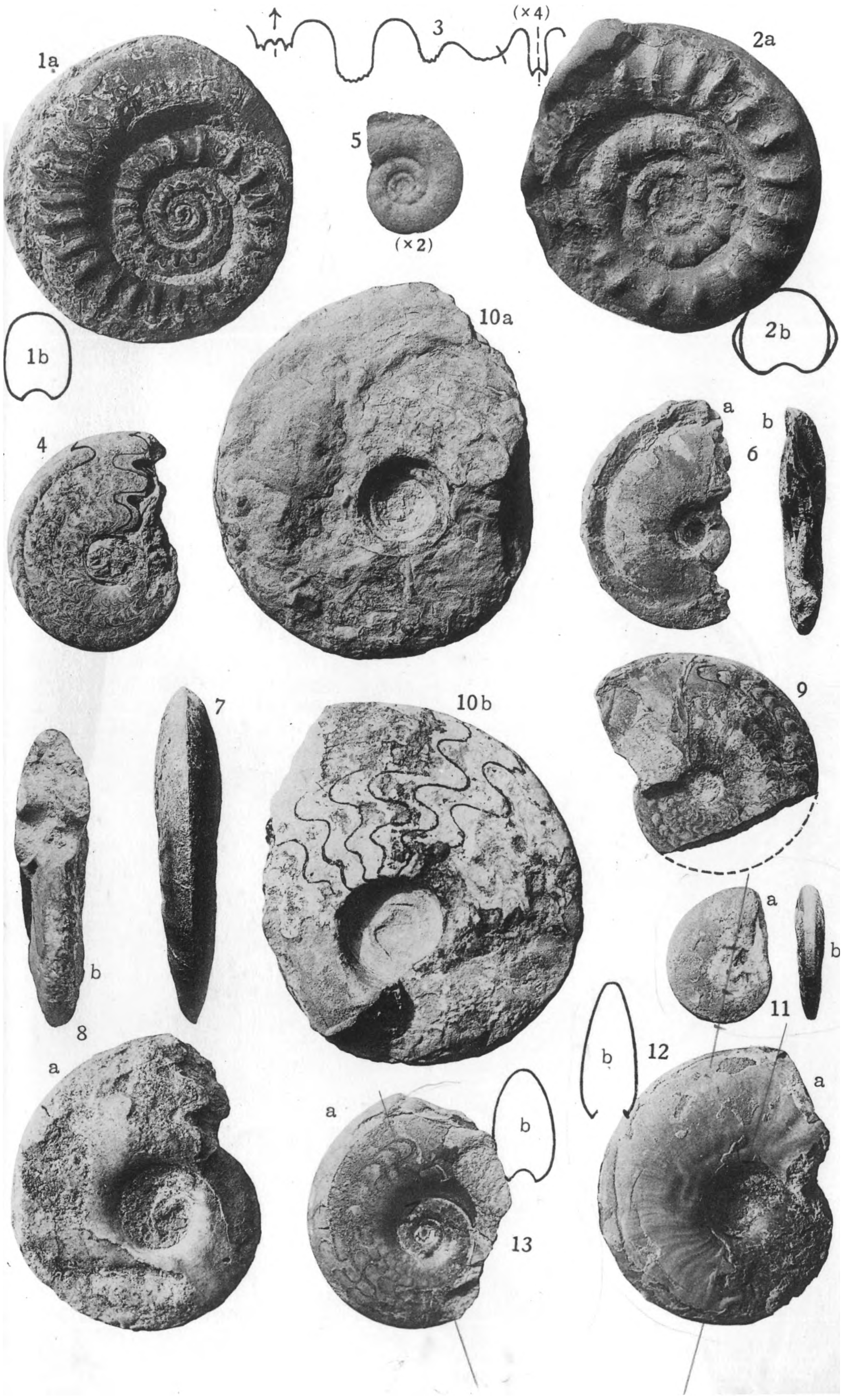
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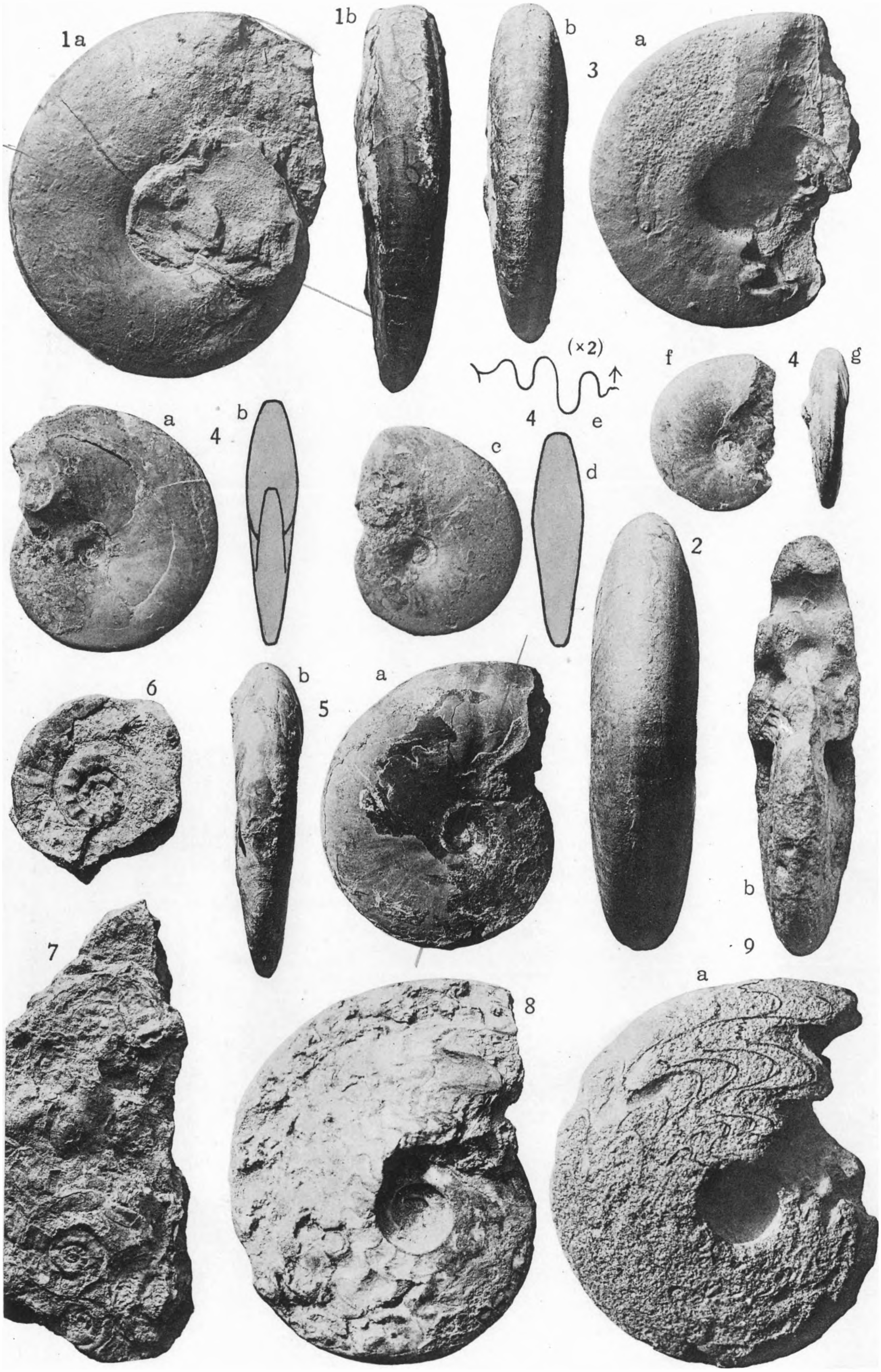
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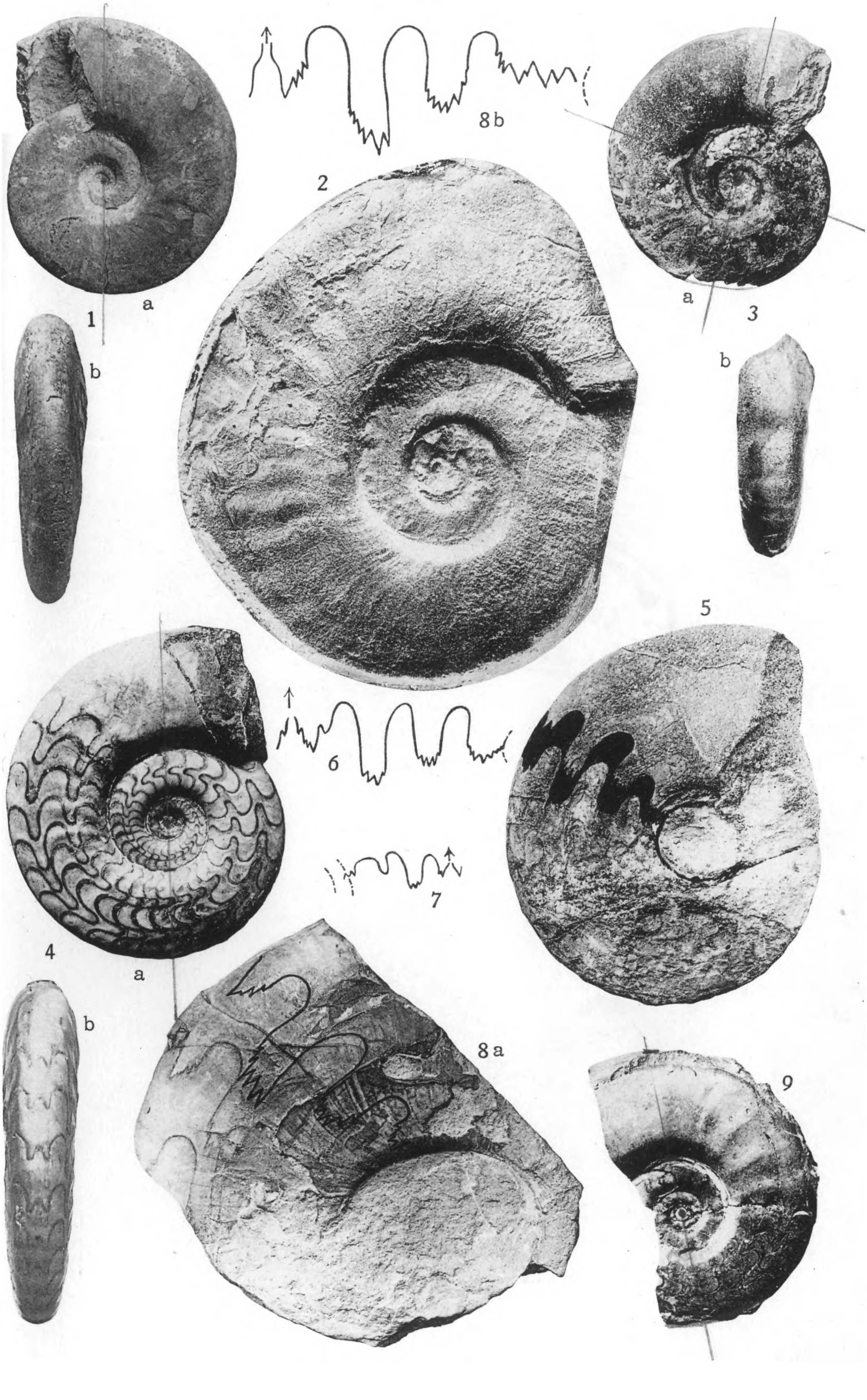
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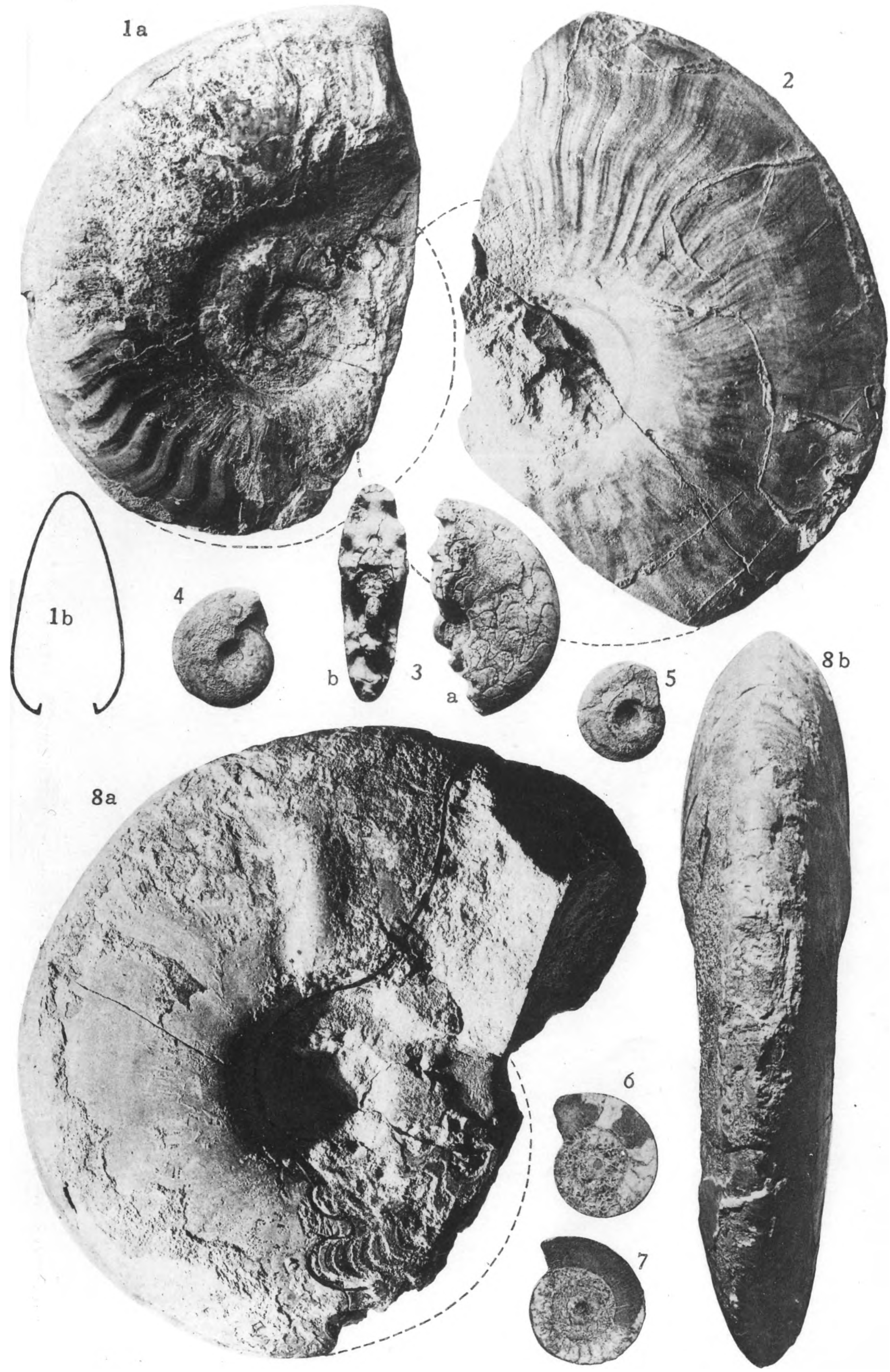
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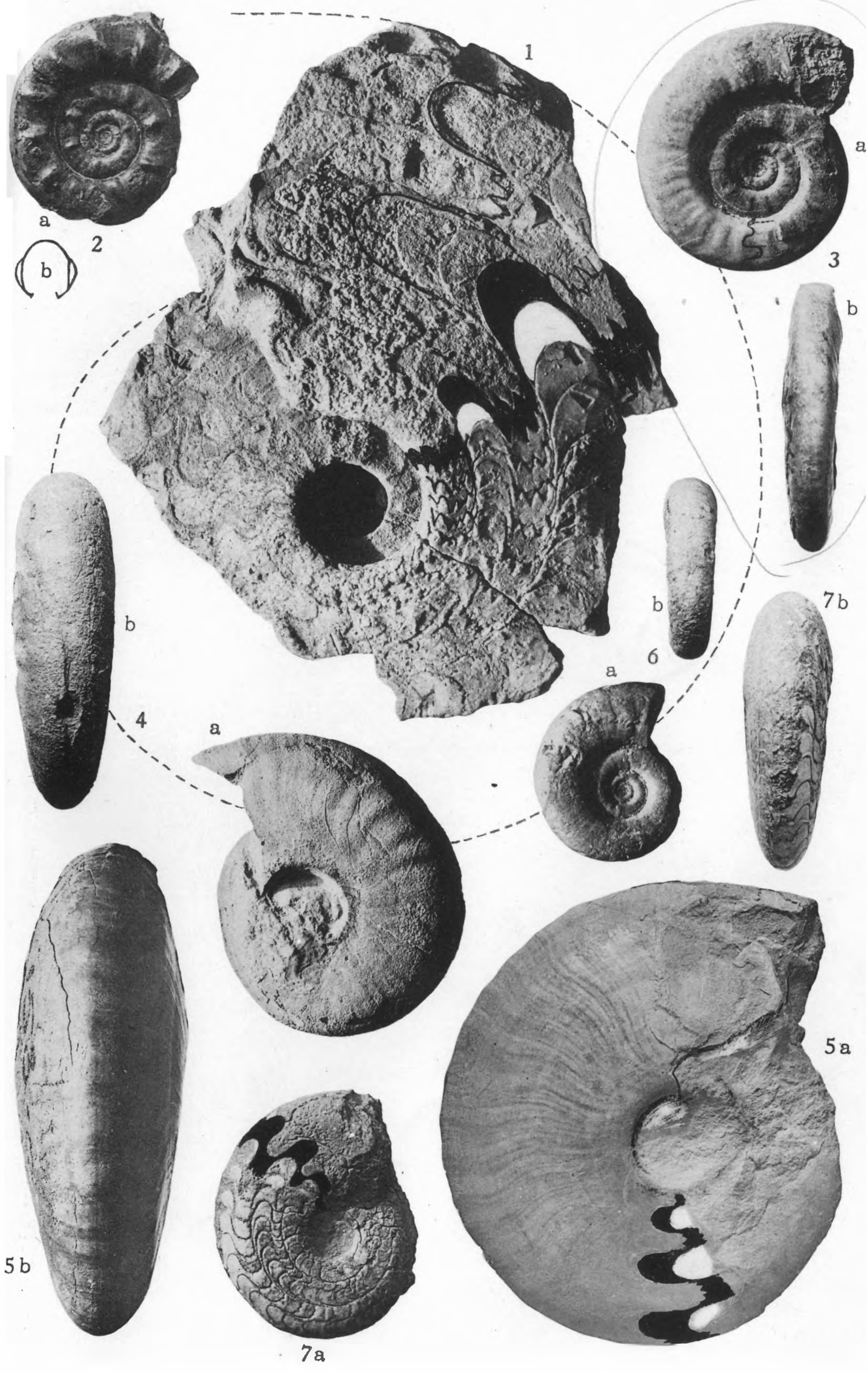
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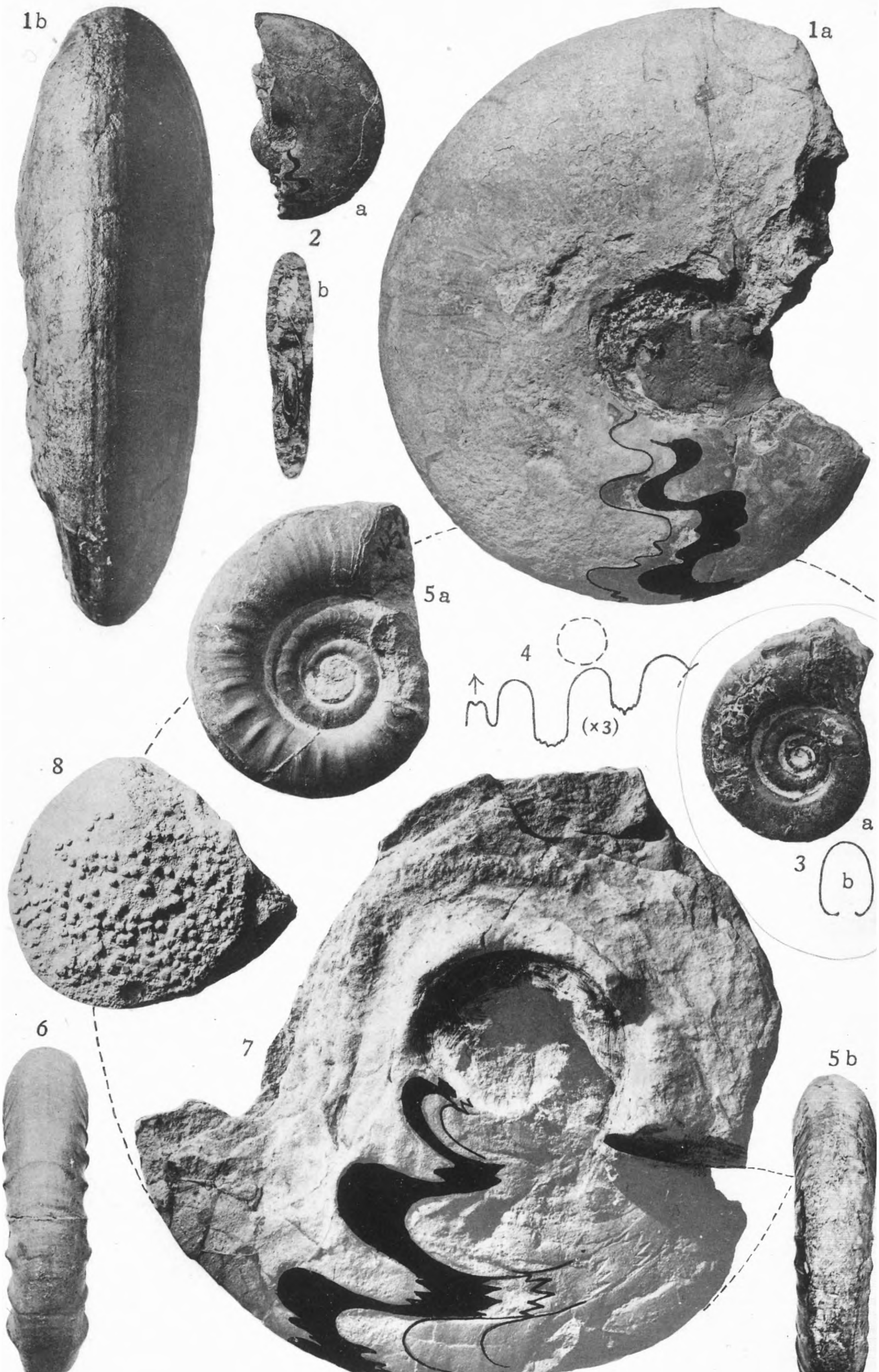
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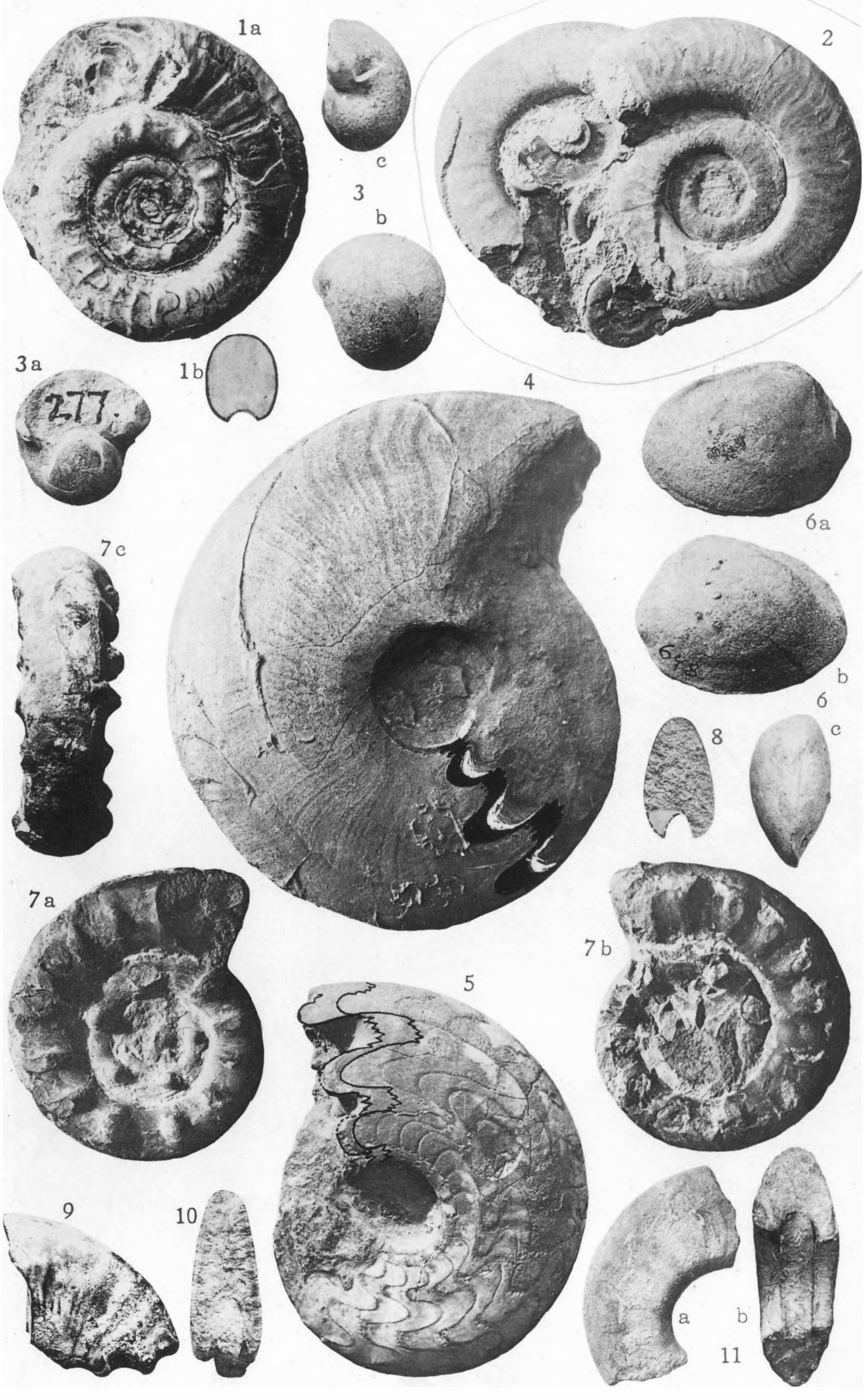
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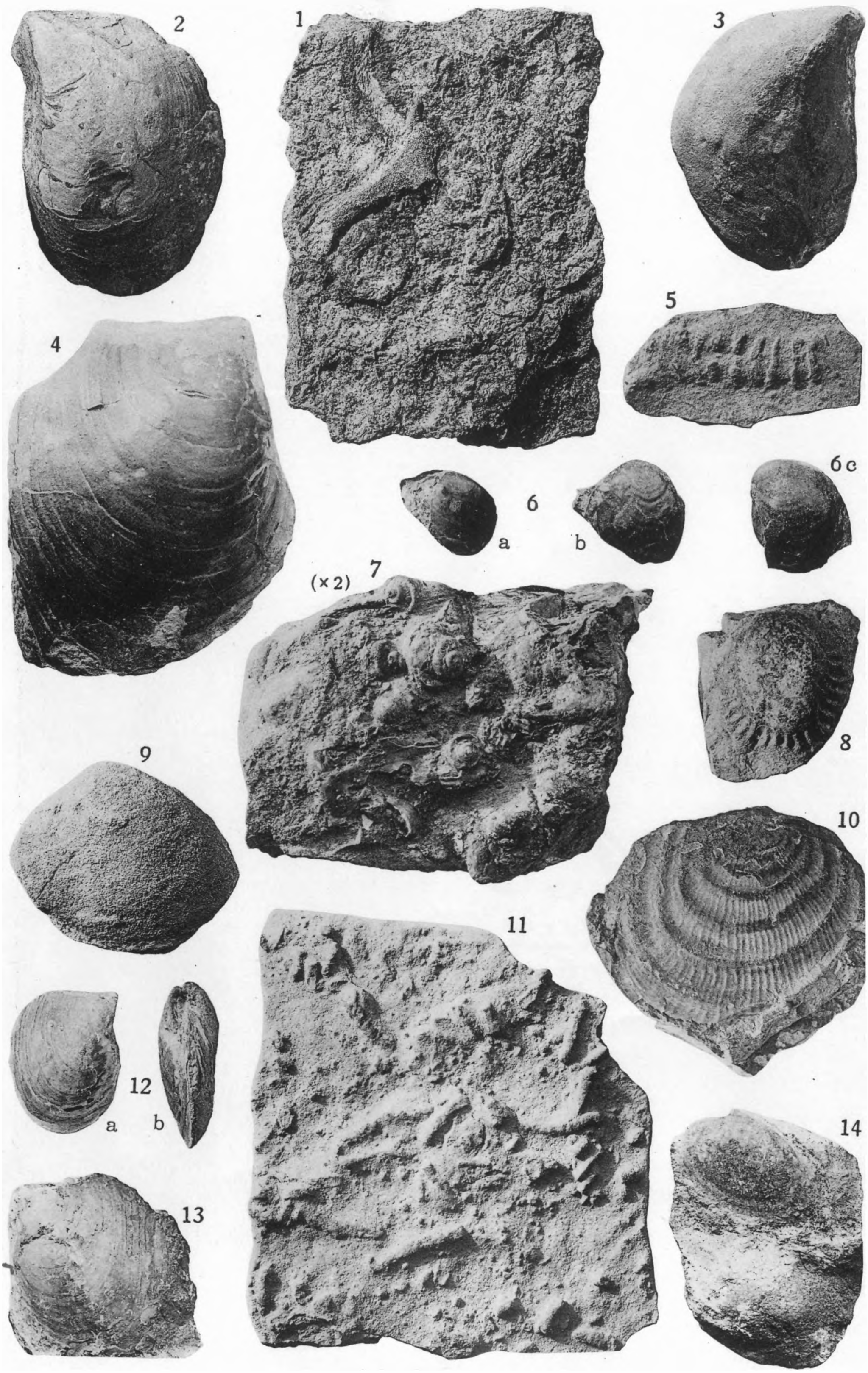
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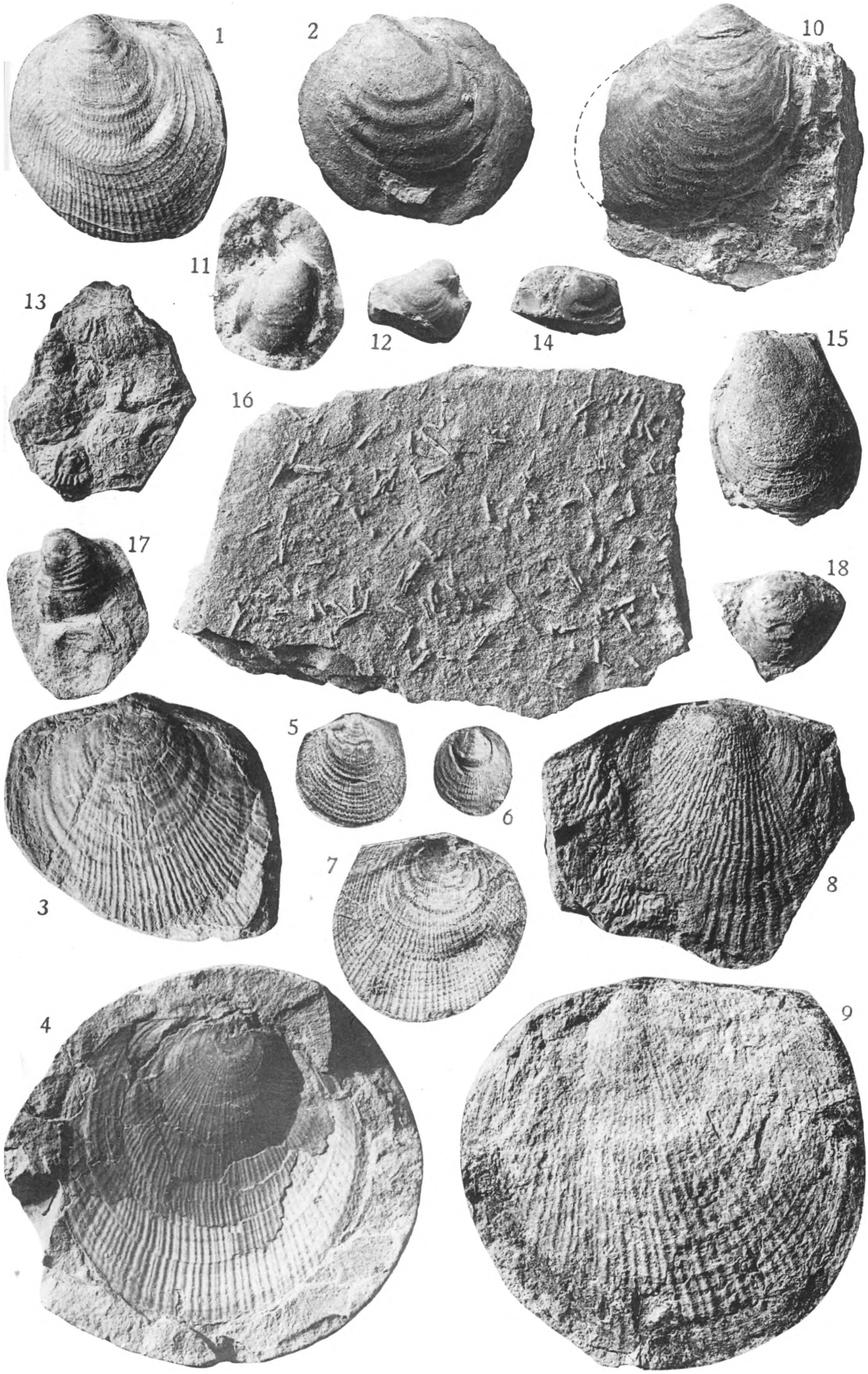
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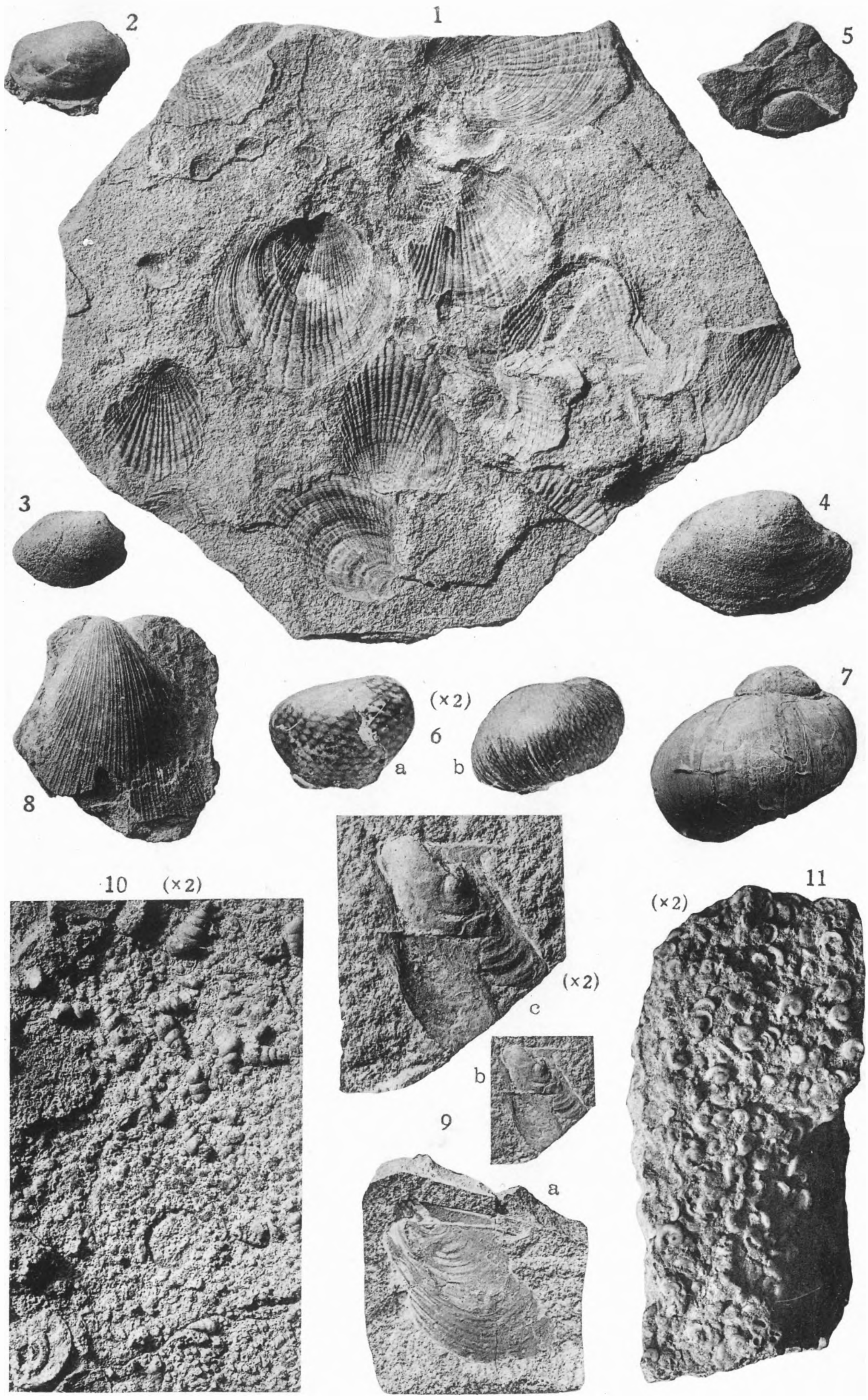
1
2
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4
(×2)
6
a
b
7
8
10 (×2)
11
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(×2)
c
b
9
a

Plate XXIII.

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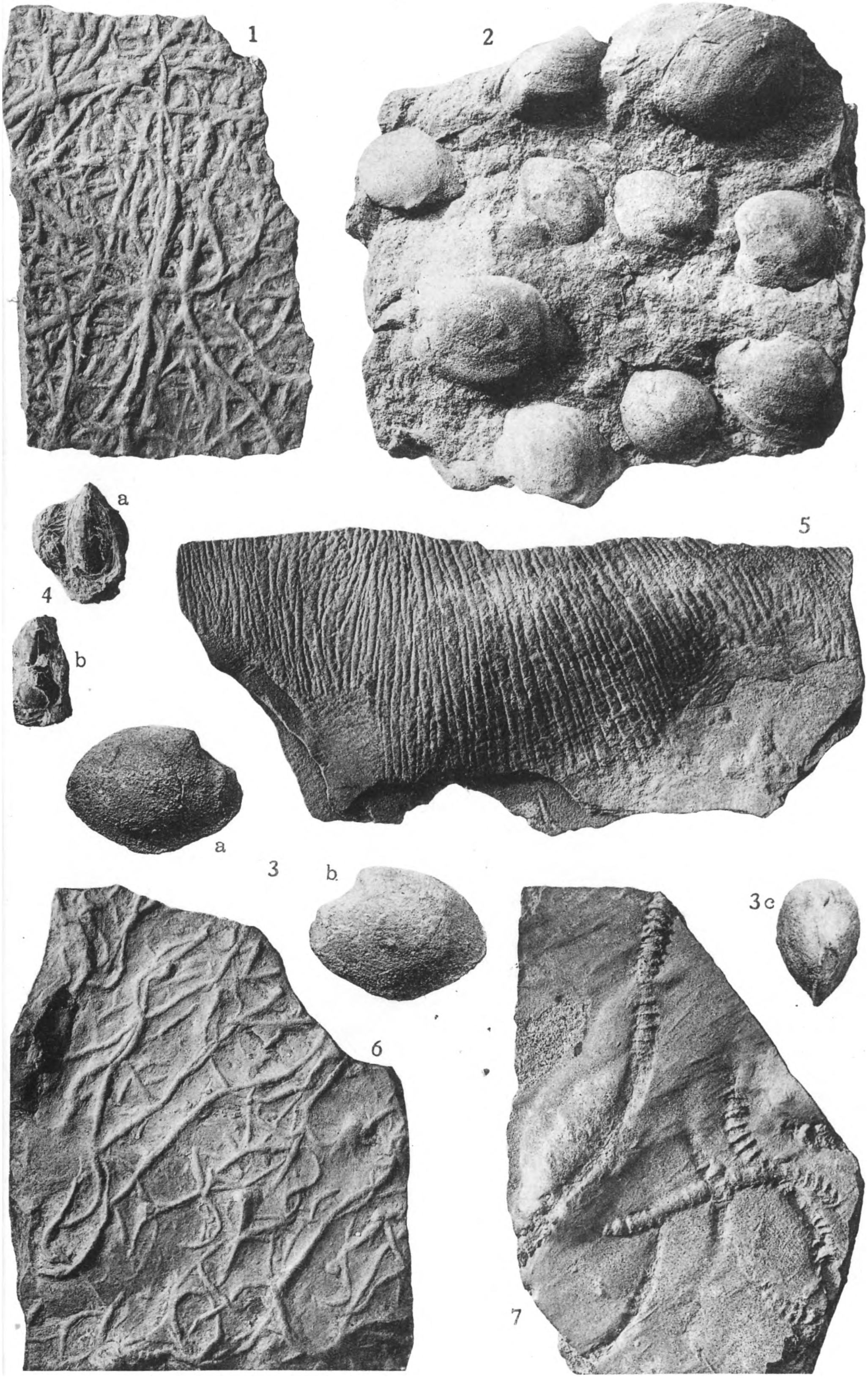
1
2
a
4
b
5
a
3
b
3c
6
7