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THE CEPHALOPOD GENERA *CYRTENDOCERAS* AND *OELANDOCERAS*.

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The generic term *Cyrtendoceras* was proposed by Adolf Remele in 1886 for a fragment of a cephalopod for which however he never supplied a specific name. Several years ago the Remele collection came into the possession of the Museum of Natural History at Berlin, and the specimen upon which Remele founded his genus *Cyrtendoceras* was loaned to the writer for study. It is described here under the name *Cyrtendoceras remelei*. This specimen is by no means the best, among those known at present, to serve as a genotype, but it is at least adequate, and therefore is here accepted.

In 1892, Gerhard Holm described two species under the names *Endoceras* (*Cyrtocerina*) *hircus* and *Endoceras* (*Cyrtocerina*) *schmidti*, which evidently are congeneric with Remele's type of *Cyrtendoceras*. These also were borrowed for study.

In the U. S. National Museum there is a fourth species of this genus, here described under the name *Cyrtendoceras estoniense*.

In addition, Dr. Gustaf Troedsson called to my attention the presence of certain cephalopods in the collections of the Royal Museum of Natural History and of the Geological Survey of Sweden, both at Stockholm, which agree with *Cyrtendoceras* in the location of the siphuncle on the concave side of the curved conch, but differ in the relatively much smaller size of these siphuncles. These specimens are described here under the names *Oelandoceras haelluddenense*, *Oelandoceras byrumense*, and *Oelandoceras kristdalaense*.

In 1906 Dr. Rudolf Ruedemann described a species under the name *Cyrtendoceras* (?) *priscum*, but the reference of this species to the genus *Cyrtendoceras* is indicated in the original

description as doubtful, and on that account the latter can scarcely be cited as the first named species *definitely* referred to *Cyrtendoceras*. It is a much smaller form, strongly coiled, and, in the opinion of the present writer, is generically distinct.

For the loan of the various specimens here cited, the writer is indebted to Dr. W. O. Dietrich, Dr. Gustaf Troedsson, Dr. R. S. Bassler, and Dr. Rudolf Ruedemann. Their kindness is greatly appreciated.

All of the species here described came from the *Orthoceras* limestone of the Baltic areas of Europe. In American terminology their horizon is approximately Chazyan, but no more definite correlation is possible since no trace of the fauna of the *Orthoceras* limestone has been discovered so far anywhere in American areas.

Both *Cyrtendoceras* and *Oelandoceras* have their siphuncles located on the concave side of the conch, and therefore are endogastric. In *Cyrtendoceras* the septal necks extend backward for a length of one camera and then invaginate into the tops of the necks immediately beneath. Within the camerae they present concave vertical outlines. Their structure, therefore, is holochaoanoidal and their relationship is with the *Endoceratida*.

In *Oelandoceras*, on the contrary, the septal necks appear to be short, and to terminate within the upper part of the camerae. The gap between the successive septal necks is occupied by thin connecting rings which extend downward from the lower margin of one septal neck and invaginate at the base into the neck immediately beneath. These connecting rings do not present concave vertical outlines. If this interpretation of their structure is correct, *Oelandoceras* presents an ellipochoanoidal structure, similar to that of the *Orthochoanites* of Hyatt.

There is a possibility that the ellipochoanoidal structure of *Oelandoceras* developed from the holochaoanoidal structure of forms similar to *Cyrtendoceras*. In holochaoanoidal forms the septa appear to grow backward from the septa from which they originate. In *Oelandoceras* the upper part of the septal neck, which develops first, is thicker than the lower part, which develops later. The thinner part apparently corresponds to the connecting ring of ellipochoanoidal conchs. It is not always possible to determine definitely whether a certain conch presents holochaoanoidal or ellipochoanoidal structure, and the subject merits further study.

The original description of *Cyrtendoceras*, as presented by Remele, is here republished, in free translation.

***Cyrtendoceras* (Remele) Foerste.**

Tageblatt der 59. Versammlung Deutscher Naturforscher und Aertzte zu Berlin vom 18.-24. September, 1886, p. 338 (1886).

Mr. Remele exhibits a peculiar curved cephalopod from Ordovician drift in the vicinity of Wriezen (in the Province of Brandenburg). This fossil, which is of fair size, represents a new generic type, called *Cyrtendoceras* by the speaker. In addition to a strong sickle-like curvature, exactly as in *Cyrtoceras*, the conch exhibits a very gradual increase in size, as well as very numerous camerae. Most remarkable of all, however, is the location of the siphuncle in the immediate vicinity of the concavely curved side of the conch. This siphuncle agrees with that of the vaginate orthoceroids (*Endoceras* Hall) not only in its marginal location, but also in its structure, since it is girdled by oblique transverse annulations which indicate the lower ends of the backward directed septal funnels, and which occur at intervals equal to those between the septa.

The drift material enclosing this conch is a limestone, chiefly of a light greenish-gray color, but locally with light brownish-gray parts, and with isolated yellowish plates of calcite. Among other fossils it contains, as more noteworthy, also *Echinospaerites aurantium* Gyllenhal sp., *Illaeus centaurus* Angelin, and *Orthoceras barrandei* Dewitz. The two fossils named last indicate that this rock belongs to the Swedish Upper Gray *Orthoceras* limestone, although it differs in appearance from that usually presented by the rock of this horizon.

This specimen on which Remele founded his genus *Cyrtendoceras* is described in the following lines under the name *Cyrtendoceras remelei*.

The *Illaeus centaurus* Angelin is not identical with that of Dalman, and its name was changed by Gerhard Holm to *Illaeus chiron*.

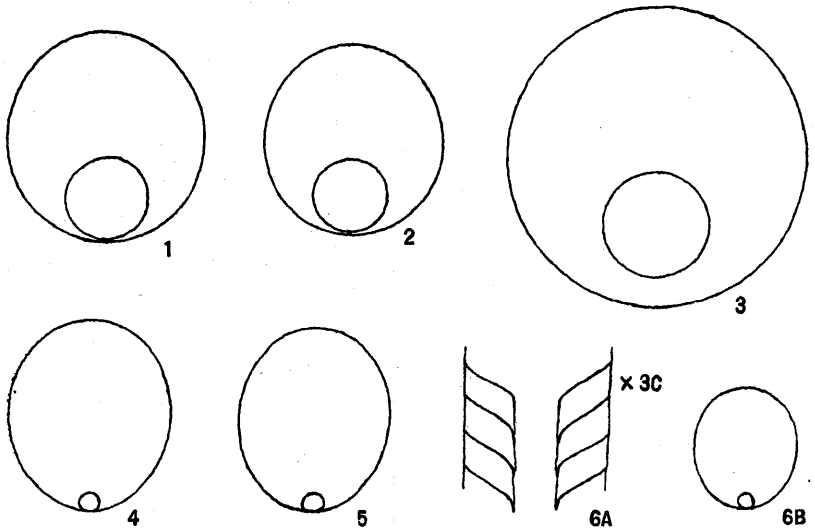
***Cyrtendoceras remelei* sp. nov.**

(Plate II, Figures 2 A, B, C.)

Specimen approximately 45 mm. long when measured along its convex outline. Curved lengthwise, its radius of curvature along its convex outline being 40 mm. Its dorsoventral outline enlarges from 18 mm. at its base to 21 mm. at a point 37 mm. farther up. Its lateral diameter appears to be only from 1.5 to 2 mm. less than its dorsoventral one. The cross-section is more narrowly rounded along the convex side of the conch than along its concave side. There are 6 camerae in a length equal to the dorsoventral diameter of the conch. The sutures of the septa curve faintly downward laterally. The concavity of the upper septa equals almost 5 mm. Where the dorsoventral diameter of the conch is 21 mm., that of the siphuncle is 9 mm. The

latter is circular in cross-section, and its distance from the adjacent wall of the conch is at least 0.5 mm. The shell is thin and its surface appears to have been weakly annulated, though the evidence for this is not clear.

Occurrence.—Found in a loose boulder at Eberswalde, Germany; evidently from some locality in the Ordovician in the Baltic area. Label dated May 23, 1884. In the light gray *Orthoceras* limestone, the horizon with typical *Lituitidae*.



SECTIONS SHOWING LOCATION AND RELATIVE SIZE OF SIPHUNCLES.

1. *Cyrtendoceras hircus*, section 50 mm. above base. (Plate I, Figs. 1 A, B.)
2. *Cyrtendoceras estoniense*, section at top of type. (Plate II, Figs. 3 A, B.)
3. *Cyrtendoceras schmidti*, section 30 mm. above base. (Plate I, Figs. 2 A, B.)
4. *Oelandoceras byrumense*, section 32 mm. above base. (Plate II, Figs. 1 A, B.)
5. *Oelandoceras kristdalense*, section at base. (Plate II, Figs. 4 A, B, C.)
6. *Oelandoceras haelluddenense*: A, transverse vertical section, magnified 3 diameters, but not including entire width of conch; B, section 38 mm. above base. (Plate I, Figs. 3 A, B.)

The rock fragment containing the *Cyrtendoceras remelei* contains also a straight conch which may be the straightened part of a *Lituites lituus*; also a conch with a coiled portion 30 mm. in diameter from which the living chamber continues tangentially for a length of 20 mm., the surface striae being directly transverse, identified as *Lituites procerus* Remele (Text figure 7) on the label; and, finally, a small orthoceroid with central siphuncle, which may be a fragment of *Orthoceras barrandei* Dewitz, as identified by Remele. (Plate II, figure 5.)

Remarks.—The siphuncle of this species differs from that of *Cyrtendoceras hircus* and *Cyrtendoceras estoniense* in not being in actual contact with the concave side of the conch, though only slightly removed from the latter. On the contrary, it differs from that of *Cyrtendoceras schmidtii* in being much closer to this side, the interval in the latter species being about 3 or 4 mm. From the latter species, *Cyrtendoceras remelei* differs by traces of weak annulation, both on the surface of the shell and also on the cast of its interior; and the number of camerae within a length equal to the dorsoventral diameter is relatively greater at an earlier stage of growth.

This specimen is selected here as the genotype, thus conforming, as far as possible, with the intentions of Remele.



7. *Lituites procerus* Remele; lateral view.

***Cyrtendoceras hircus* (Holm).**

(Plate I, Figures 1 A, B; Text Figure 1.)

Endoceras (Cyrtocerina) hircus Holm. Geol. Foren. i Stockholm Forhandl., vol. 14, p. 127, pl. 4, figs. 1-3; pl. 5, figs. 1-5 (1892).

Holotype 115 mm. long when measured along its convex outline. Curved lengthwise, the lower half of its convex outline having a radius of 40 mm., changing to 52 mm. along its upper half. Only the basal part of the living chamber, for a length of 6 mm., is preserved. The dorsoventral diameter enlarges from 18.5 mm. at the base of the specimen to 36 mm. at the base of the living chamber, the corresponding lateral diameters being estimated at 17 mm. and 30 mm. The number of camerae in a length equal to the dorsoventral diameter of the conch varies from 5 at the lower end of the specimen to 7.3 at its top. The siphuncle is large, compared with the dorsoventral diameter of the conch, its dorsoventral diameter increasing from 8 mm. at its lower

end to 13 mm. at its top. The cross-section of the siphuncle is assumed to have been circular. The concavity of the septa varies from 4.5 mm. at the lower end of the specimen to 9 mm. at its top. The septal necks curve convexly inward for the greater part of their vertical outlines, changing to convexly outward a short distance before invaginating into the top of the neck directly beneath. In consequence, the segments of the siphuncle within the camerae present concave vertical outlines. The thickness of the shell varies from 0.2 mm. along its convex outline to 0.5 mm. along its concave one. Its surface is transverse striated and weakly ribbed or annulated. Their course is almost directly transverse, the downward curvature along the convex side of the conch being slight. The striae are relatively low and broad, and number 9 or 10 in a length of 10 mm. The annulations are only weakly defined, and vary from 4 in a length of 10 mm. at 50 mm. above the base of the specimen to about 2 in 10 mm. farther up, their distances apart being somewhat irregular.

Occurrence.—Vedby, in Oeland, Sweden; in the gray Lituites limestone member of the Orthoceras limestone. No. *Mo. 4493*, Riksmuseum, Stockholm, Sweden.

Remarks.—At the base of the holotype the upper part of an endocone apparently is preserved for a length of at least 2 camerae. Where the dorsoventral diameter of the siphuncle is 8 mm., that of the endocone is scarcely 6 mm. In figure 5 on Plate V of the publication by Holm, cited above, there is an endocone figured for a length of 25 mm., its lower end probably having been at least 5 mm. longer.

***Cyrtendoceras estoniense* sp. nov.**

(Plate II, Figures 3 A, B; Text Figure 2.)

Holotype 93 mm. long when measured along its convex outline. Curved lengthwise, with a radius of 60 mm. along the lower part of its convex outline, changing to 120 mm. toward its top. The dorsoventral diameter enlarges from 10 mm. at its base to 24.5 mm. at a point 90 mm. farther up. The corresponding lateral diameters are estimated as being about the same, the cross-section being either circular or nearly so. At the base of the specimen is a single camera 2 mm. long, indicating 5 camerae in a length equal to the dorsoventral diameter of the conch. At its top the septal necks indicate the presence of 5 camerae in a length of 26 mm. At the base of the specimen the diameter of the siphuncle is 3.5 mm., while at the top it varies between 8 and 9 mm., being widest at the septa. At the lower end of the specimen this siphuncle is in contact with the concave side of the conch, while at its top it is 1 mm. distant. The septal necks present concave vertical outlines within each of the camerae. Along midlength a long endocone, or rather the solidified matrix or spiculum filling its interior, is exposed. Apparently this spiculum is 32 mm. long, but its surface continues to show faint annulations for some distance below the point at which it becomes free

from the inner walls of the siphuncle. The surface of the shell is distinctly but not strongly annulated, the annulations being directly transverse. At its lower end there are slightly over 5 annulations in a length equal to the dorsoventral diameter of the conch, this number being exactly 5 at its top. In addition, the surface of the shell is transversely striated, 9 striae occupying a length of 2 mm. at the base of the specimen, but 12.5 mm. at its top. At its base they are closely crowded; at its top they are widely separated, the intervals between the striae being much greater than the width of the latter.

Occurrence.—From some unknown locality in Estonia. Labelled as coming from the Vaginatenkalk of Schmidt, the horizon B 3, to which the name Kunda formation is applied by Raymond. No. 84762, U. S. National Museum.

***Cyrtendoceras schmidti* (Holm).**

(Plate I, Figures 2 A, B; Text Figure 3.)

Endoceras (Cyrtoceras) schmidti Holm. Geol. Foren. i Stockholm Forhandl., vol. 14, p. 129, pl. 6, figs. 1, 2 (1892).

Holotype 120 mm. long when measured along its convex outline. Curved lengthwise, the lower half of its convex outline having a radius of 70 mm., changing to 80 mm. along its upper part. Only a part of the phragmacone is at hand, and there is no distinct shortening of its upper camerae to indicate that the conch had reached its gerontic stage. The specimen is broken in such a way that the concave outline of the conch is not preserved; however, its dorsoventral diameter is estimated to have increased from 34 mm. at its base to 44 mm. at its top. The corresponding lateral diameters are estimated at 30 mm. and 40 mm. The number of camerae in a length equal to the dorsoventral diameter of the conch is about 4.5 along the entire specimen. The sutures of the septa curve slightly downward laterally. The concavity of the upper septa equals about 13 mm. The diameter of the siphuncle can be estimated only at mid-length of the specimen, this diameter being approximately 14 mm. where that of the conch is about 39 mm. As far as can be determined from the holotype, the siphuncle was not in contact with the concave side of the conch, but was between 3 and 4 mm. distant from the latter. The surface of the shell, as far as preserved, appears to be smooth.

Occurrence.—Kandel, in Estonia; in the Echinospaerites limestone, at the horizon C 1a. No. *Mo.* 4492, Riksmuseum, Stockholm, Sweden.

Remarks.—The structure of the siphuncle appears to be similar to that of *Cyrtendoceras hircus*. The septal necks curve inward for the greater part of the length of a camera, and then curve convexly outward just before invaginating into the top of the neck beneath. However, in *Cyrtendoceras hircus* the siphuncle is in contact with the concave wall of

conch, while in *Cyrtendoceras schmidti* it appears to have been free by an interval of several millimeters. Both conchs evidently completed more than one volution (possibly one and a half), but the apical end did not come in contact with the nearest part of the following volution.

Oelandoceras gen. nov.

Genotype: *Oelandoceras haelluddenense* Foerste.

Conch curved lengthwise, moderately compressed laterally. Camerae short, with the sutures of the septa rising toward the convex outline of the conch. Siphuncle relatively small, in contact with the concave side of the conch, its location being endogastric. The vertical outlines of the segments of the siphuncle are straight or only slightly concave, their lower margins invaginating into the top of the septal necks immediately beneath. The septal necks are short and appear to be slightly thicker than the connecting rings, the latter forming the greater part of the length of the segments of the siphuncle. This structure is most distinct in the genotype, the other two species, here referred to the same genus, not exhibiting the structure of the siphuncle equally well.

Oelandoceras haelluddenense sp. nov.

(Plate I, Figures 3 A, B; Text Figures 6 A, B.)

Holotype about 52 mm. long when measured along its convex outline, all of this length belonging to the phragmacone. Curved lengthwise, its radius of convex curvature varying from 20 mm. at the lower end of the specimen to 39 mm. at its top. Its dorsoventral diameter enlarges from 8.7 mm. near its base to 18 mm. at a point 50 mm. farther up. The corresponding lateral diameters are 7.1 mm. and 16 mm. Along the upper part of the specimen 8 camerae occur in a length equal to the dorsoventral diameter. The sutures of the septa curve slightly downward laterally, but rise higher toward the convex outline of the conch than toward the concave outline. In consequence, the sutures of the saddles on this convex side tend to be slightly angulate along their median line. The concavity of the septa is 3 mm. where the dorsoventral diameter of the conch is 16 mm. Here the diameter of the siphuncle is 2 mm. The septal necks are about two-fifths of the length of the camerae, and the connecting rings are thinner, lighter colored, and apparently cylindrical in form. The siphuncle apparently is in contact with the concave wall of the conch. The surface of the shell is striated transversely, the striae curving increasingly downward in a direction toward the convex outline of the conch, forming a broad, shallow sinus on that side, but where crossing the siphuncular side of the conch they curve downward more narrowly, forming a shallow sinus 6 or 7 mm. wide at the top of the specimen.

Occurrence.—On Oeland, at Haelludden, near Torp, in the glauconite member of the gray Vaginitenkalk. Collected by Gerhard Holm in 1893. In the paleontological collection of the Geological Survey of Sweden.

***Oelandoceras byrumense* sp. nov.**

(Plate II, Figures 1 A, B; Text Figure 4.)

Holotype 75 mm. long when measured along its convex outline. Curved lengthwise, its radius of curvature being 60 mm. along the lower half of its convex outline, changing to 100 mm. toward its top. Its dorsoventral diameter enlarges from 22 mm. at a point 10 mm. above its base to 29.5 mm. at the bottom of the living chamber, which is 52 mm. farther up. Where the dorsoventral diameter of the conch is 28.5 mm. its lateral one is 24 mm. Here about 10 camerae occur in a length equal to the dorsoventral diameter, and the diameter of the siphuncle is slightly over 3 mm. The siphuncle is in direct contact with the concavely curved side of the conch. The sutures of the septa curve distinctly downward on approaching the siphuncle and also laterally, the saddles rising higher on the antisiphonal side of the conch than along its siphonal side. Of the living chamber a length of 16 mm. remains. The shell at this point appears to be thick and transversely striated. The structure of the siphuncle appears to be similar to that of *Oelandoceras haelluddenense*, but its details are not distinctly defined.

Occurrence.—On Oeland, at Byrum, in the glauconite bearing layer in the Vaginatenskalk. Collected by Gerhard Holm in 1891. In the paleontological collection of the Geological Survey of Sweden.

Remarks.—This species is readily distinguishable from *Oelandoceras haelluddenense* by its larger size and smaller lengthwise curvature.

***Oelandoceras kristdalaense* sp. nov.**

(Plate II, Figures 4, A, B, C; Text Figure 5.)

Holotype 40 mm. long when measured along its convex outline. Curved lengthwise, its radius of curvature along this convex outline being about 100 mm. Its dorsoventral diameter enlarges from 25 mm. at the base of the specimen to 30 mm. at a point 18 mm. farther up. The corresponding lateral diameters are 20 mm. and 23.6 mm. Immediately below the level at which the dorsoventral diameter is 30 mm. there are about 11 camerae in a corresponding length. The sutures of the septa curve downward slightly laterally and also along the upper part of the concave side of the conch, but rise distinctly along its convex side, forming broad saddles here. The siphuncle is about 3 mm. in diameter where the dorsoventral diameter of the conch is 30 mm., and is in contact with the concave side of the conch. Its structure appears similar to that of *Oelandoceras haelluddenense* but with a more concave curvature along the upper part of the vertical outline of its segments. Its structure is not clearly defined. The surface of the shell is almost smooth, but with distant transverse lines parallel to the sutures of the septa and about equal to the latter in number; also relatively distant vertical lines; both sets of lines very faint.

Occurrence.—In Smoland, Kristadala, Humlenaes; from some unknown horizon, but assumed to belong to the glauconite bearing layer of the Vaginatenskalk, since green glauconite grains are relatively abundant in the matrix. No. *Mo. 4491*, in the Riksmuseum, Stockholm, Sweden.

Remarks.—This specimen evidently is closely related to *Oelandoceras byrumense*, and may belong to the same species, but it appears less curved lengthwise than the latter at the same diameter of the conch.

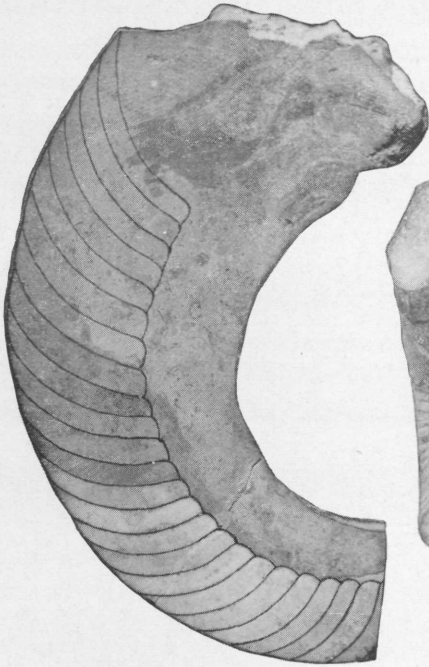
EXPLANATION OF PLATES.

PLATE I.

- Fig. 1. *Cyrtendoceras hircus* (Holm). A, dorsoventral section through the siphuncle; B, weathered exterior with traces of transverse markings on surface of shell. Vedby, in Oeland, Sweden; in the gray *Lituities* limestone member of the *Orthoceras* limestone. No. *Mo. 4493*, Riksmuseum, Stockholm, Sweden. (Text Figure 1.)
- Fig. 2. *Cyrtendoceras schmidti* (Holm). A, exterior surface, exposing parts of the camerae; B, dorsoventral section through the siphuncle, resulting from a break; concave outline of siphuncle reached only along lower part of specimen. Kandel, Estonia; in the *Echinosphaerites* limestone immediately over the *Orthoceras* limestone, in horizon C 1 a. No. *Mo. 4492*, Riksmuseum, Stockholm, Sweden. (Text Figure 3.)
- Fig. 3. *Oelandoceras haelluddenense* Foerste. A, concave ventral side of conch; B, lateral side. At Haelludden, near Torp, on Oeland, Sweden; in the glauconite member of the gray Vaginitenkalk or *Orthoceras* limestone. Museum of Geological Survey of Sweden. (Text Figures 6 A, B.)

PLATE II.

- Fig. 1. *Oelandoceras byrumense* Foerste. A, convex dorsal side; B, lateral view. Byrum, on Oeland, Sweden; in the glauconite bearing member of the Vaginatenskalk. Museum of Geological Survey of Sweden. (Text Figure 4.)
- Fig. 2. *Cyrtendoceras remelei* Foerste. A, lateral view; B, lower half of fragment, viewed from above, showing location of siphuncle close to concave ventral side of conch; C, cross-section, oriented as in preceding figure. In erratic boulder found at Eberswalde, northern Germany; in the upper gray member of the *Orthoceras* limestone. Museum of Natural History, Berlin, Germany.
- Fig. 3. *Cyrtendoceras estoniense* Foerste. A, lateral view; B, dorsoventral vertical section, showing greater part of length of siphuncle, with endocone at middle, and one camera at base. From unknown locality in Estonia, labelled as from the Vaginatenskalk of Schmidt, at horizon B3. No. *84762*, U. S. National Museum. (Text Figure 2.)
- Fig. 4. *Oelandoceras kristdalaense* Foerste. A, left lateral side; B, right lateral side; C, convex dorsal side; B, C, with faint transverse and vertical surface markings. Smoland, Kristdala, Humlenaes; from glauconite bearing layer in Vaginatenskalk. No. *Mo. 4491*, Riksmuseum, Stockholm, Sweden. (Text Figure 5.)
- Fig. 5. *Orthoceras* (?) *barrandei* Dewitz. In same rock fragment as the type of *Cyrtendoceras remeli*, and the specimen of *Lituities procerus* Remele shown in Text Figure 7.



1A



3A



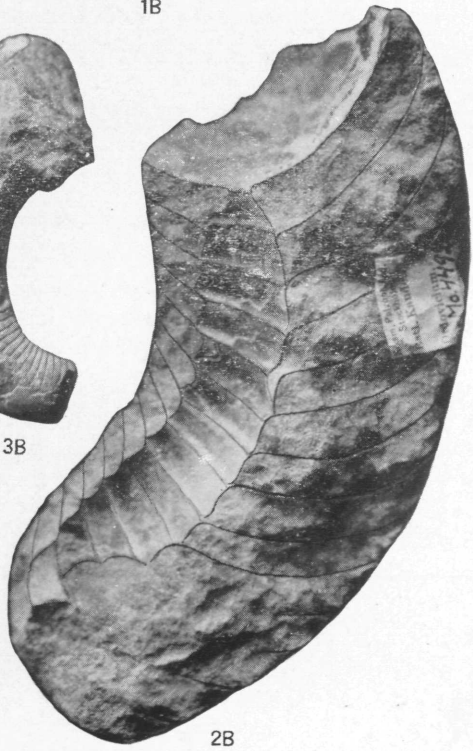
1B



2A



3B



2B

