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KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND

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TREAAARSEXPEDITIONENTIL CHRISTIAN DEN X's LAND 1931-34

UNDER LEDELSE AF LAUGE KOCH

ON THE PLACODERMI OF THE
UPPER DEVONIAN OF EAST GREENLAND

SECOND SUPPLEMENT TO PART I

BY

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WITH 13 FIGURES IN THE TEXT AND 6 PLATES

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BIANCO LUNOS BOGTRYKKERI A/S

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INTRODUCTION

The large collection of Upper Devonian vertebrates brought home by the Danish East Greenland expedition in 1936 includes among others also a new *Phyllolepis*-species, *Phyllolepis nielseni*, and a few plates of *Euarthrodires*. This new *Phyllolepis* and *Euarthrodire* material will be described in the present paper, which is most properly published as a second supplement to Part I of the monograph "On the *Placodermi* of the Upper Devonian of East Greenland". Part I of this monograph and the first supplement to that were published respectively in 1934 and 1936 (STENSIÖ 1934; 1936).

Phyllolepis nielseni to be described here is of interest mainly from a stratigraphical point of view. Unlike *Ph. orvini* it does not come from the *Phyllolepis*-series, but from one of the lower horizons in the lowermost red division of the *Remigolepis*-series, and thus from a horizon slightly above the *Phyllolepis*-series (cf. SÄVE-SÖDERBERGH 1934, pp. 22—25, 40—50; JOHANSSON 1935, pp. 9—34).

The lowermost red division of the *Remigolepis*-series is rather rich in vertebrates. These vertebrates are still very imperfectly studied, but, as far as is known, they include: *Bothriolepis* n. sp., *Remigolepis* spp. *Phyllolepis nielseni* n. sp., *Holoptychid* *Crossopterygians* (of the *H. nobilissimus*-type), *Rhizodontid* *Crossopterygians*, possibly one or a few real *Dipnoans*, representatives of a probably new group of *Dipnoan*-like *Choanata* (cf. STENSIÖ 1934, p. 5; SÄVE-SÖDERBERGH 1934, pp. 24, 25, 44; 1937), and *Ichthyostegid* *Stegocephalians*.

As it thus contains two genera, *Bothriolepis* and *Phyllolepis*, in common with the *Phyllolepis*-series, the lowermost red division of the *Remigolepis*-series is evidently in regard to its fauna to a certain degree intermediate between the *Phyllolepis*-series and the upper divisions in its own series. At any rate it is now clear that there is a somewhat more gradual transition between the fauna of the *Phyllolepis*-series and that of the *Remigolepis*-series than previously supposed.

For the privilege of studying the material here under consideration I am highly indebted to Dr. LAUGE KOCH, the leader of the Danish East Greenland expeditions.

Order **Phyllolepida**.

Genus **Phyllolepis**

with remarks on the previously described species of this genus.

Phyllolepis is still the only genus known of the order *Phyllolepida* (cf. STENSIÖ 1936, p. 30).

For an account of the general organization and structure of *Phyllolepis* the reader is referred to the parts of the present monograph published in 1934 and 1936 (STENSIÖ 1934; 1936).

Of the eight species of *Phyllolepis* named and described as yet only the following five would be valid: *Ph. concentrica* AGASSIZ (AGASSIZ 1844, p. 67; WOODWARD 1891, pp. 313—314; 1914; 1921, p. 31; FRITSCH 1888, p. 90; STENSIÖ 1934, pp. 13—29; 1936, pp. 9—27), *Ph. undulata* LOHEST (LOHEST 1888, pp. 155—167; LERICHE 1931, pp. 7—14), *Ph. delicatula* NEWBERRY (NEWBERRY 1889, p. 97), *Ph. elegans* HUSSAKOFF & BRYANT (HUSSAKOFF & BRYANT 1918, pp. 21—22) and *Ph. orvini* (HEINTZ 1930, pp. 38—42; 1932 a, pp. 5—14; STENSIÖ 1934, pp. 34—54; 1936). We shall now enter in some detail upon these five species.

Ph. concentrica, the first known species of the genus, was erected by AGASSIZ in 1844 (p. 67) for an anterior piece of a fairly large median dorsal plate from Clashbennie in Scotland (cf. AGASSIZ 1844, pl. 24, fig. 1). This piece, which thus is the holotype of *Ph. concentrica*, does not show clearly the antero-lateral margin that was attached to the anterior dorso-lateral plate nor does it give any idea concerning the exact shape and proportions of the plate otherwise. As in addition its ornament is of much the same type to that in other species, it is evident that it hardly exhibits any characters of real importance for a determination as to species.

The holotype just referred to of *Ph. concentrica* has unfortunately become lost (cf. WOODWARD 1891, p. 314). In such circumstances a neotype of *Ph. concentrica* should be chosen; and for such a type the most complete specimen referred to that species—the specimen from Dura Den described by WOODWARD in 1914 and 1921 (cf. WOODWARD 1914; 1921, p. 31; cf. STENSIÖ 1934, text-fig. 2; 1936, text-figs. 3, 5, 8)—would be best suited. However, according to current rules of nomenclature (RICHTER 1925, p. 108), a specimen from the type locality should, if possible, be preferred in a case like this one. Of specimens from this locality, Clashbennie, only the imperfect left anterior ventro-lateral plate figured by the writer in 1936 in text-fig. 6B (STENSIÖ 1936) and in text-fig. 1 in the present paper could be taken into consideration. At any rate this is the best preserved plate from Clashbennie known to the writer (cf. WOODWARD 1891, p. 314).

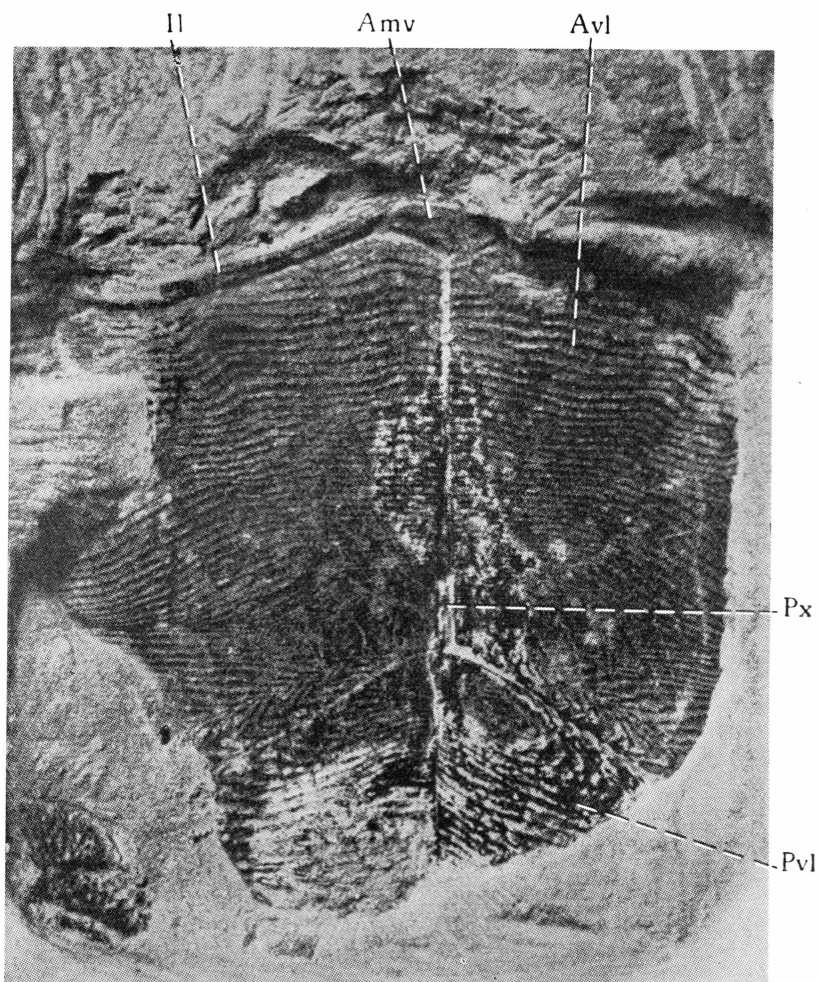
This anterior ventro-lateral plate from Clashbennie (text-fig. 1; cf. also the table on p. 7) is from a fairly large individual. Its anterior broad division is imperfectly preserved, but it is clearly seen that it is long and bounded laterally by a convex lateral margin, not so much shorter



Text-fig. 1. *Phyllolepis concentrica* AGASSIZ. Imperfect anterior ventro-lateral plate of the left side. The plate is from Clashbennie and is chosen as a neotype. Edinburgh, Roy. Scottish Mus. no. 1892/101. Somewhat diminished.

than the medial margin. The last-mentioned margin is short, its length corresponding only to 72 % or slightly more of the maximum breadth of the plate. The posterior margin is virtually as long as the medial margin, whereas in the other species it is considerably shorter. The anterior margin is distinctly concave. The postero-medial angle is not preserved, but with a high degree of probability it may be assumed to have been something like 130° . The ornament consists of numerous ridges situated rather close to each other.

The anterior ventro-lateral plate in the Dura Den specimen (text-fig. 2; also table on p. 7) is not fully exposed, but several of its characters may nevertheless be ascertained. It is easily seen that it differs from the



Text-fig. 2. *Phyllolepis woodwardi* n. sp. Ventral side of trunk armour of the holotype (the complete specimen in the British Museum, described by WOODWARD).

From Dura Den. Somewhat enlarged.

Amv, anterior median ventral plate; *Avl*, anterior ventro-lateral plate; *Il*, interolateral plate; *Px*, fragments of bone, not nearer determinable; *Pvl*, posterior ventro-lateral plate.

Clashbennie plate both in its shape as a whole and in the proportions of its margins. Above all it is clear that its medial margin is much longer and its posterior margin much shorter than in that plate. Thus the length of the medial margin seems to correspond to something like 90 %

of the probable maximum breadth of the plate, whereas the length of the posterior margin is only 70 % approximately of the length of the medial margin. The postero-medial angle is 120° and thus more acute than in the Clashbennie plate.

As is clear from the conditions in *Ph. orvini* (STENSIÖ 1936, pp. 31—46; text-figs. 2, 17, 23, 24) the bone plates of a *Phyllolepis*-

Table showing certain proportions of the anterior ventro-lateral plate in some *Phyllolepis*-species.

	<i>Ph. con-</i> <i>centrica</i> (Clash- bennie)	<i>Ph. wood-</i> <i>wardi</i> (Dura Den) ¹⁾	<i>Ph. undu-</i> <i>lata</i>	<i>Ph. or-</i> <i>vini</i> ²⁾	<i>Ph. niel-</i> <i>seni</i>
Length of medial margin : max- imum breadth.....	74 %	90 %	86 %	80-90 %	78 %
Length of posterior margin: length of medial margin.....	98-100 % (approx.)	70 %	75 %	70-78 %	78 %
Length of medial margin : distance antero-medial-postero-lateral corner.....	55 % (approx.)	69 %	70 % (approx.)	65-66 %	65 %
Length of medial margin : distance anterior margin to postero-lateral corner (parallel with the medial margin).....	72 %? (uncert.)	81 %	93 %	74-80 %	81 %
Length of lateral margin of the broad anterior part of the plate: length of medial margin.....	100 %?	83 %	62 %	81-86 %	82 %
Length of broad anterior part: distance from the anterior mar- gin to the postero-lateral corner, parallel with the medial margin	72 %?	71 % (approx.)	57 %	66-74 %	67 %
Maximum breadth : distance from the anterior margin to the postero-lateral corner, parallel with the medial margin.....	98-100 %	85 % (approx.)	106 %	86-97 %	100 %
Postero-medial angle.....	130° (approx.)	120° (approx.)	120° (approx.)	120° (approx.)	120°-125° (approx.)

¹⁾ A median dorsal plate from Dura Den described and figured by FRITSCH in Fauna d. Gaskohle (1888, II, p. 90, fig. 169) is of a larger specimen than that described by WOODWARD.
²⁾ Of *Ph. orvini* a considerable number of plates have been measured.

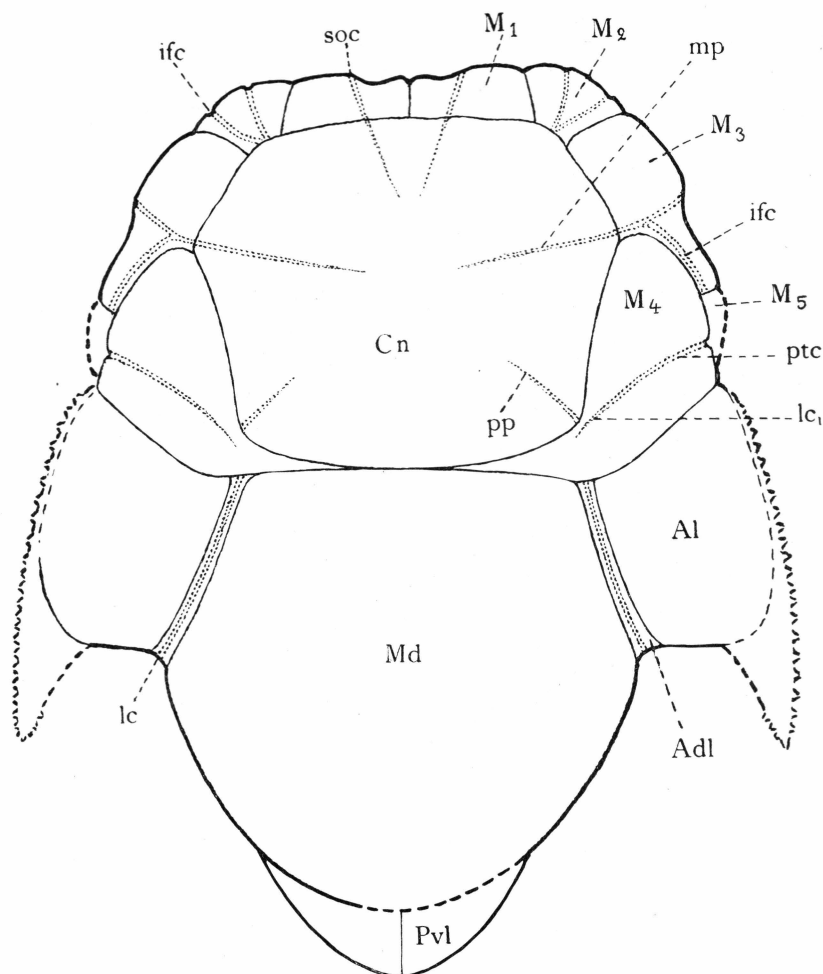
species may show a fairly wide range of variation in regard to their proportions. However, as is seen from the accompanying table on p. 7, the anterior ventro-lateral plate from Clashbennie is in most of its proportions so different from the corresponding plate not only in the Dura Den specimen, but also in *Ph. undulata*, *Ph. orvini* and *Ph. nielseni* that, unless its shape is due to distortion, which is unlikely, it can impossibly belong to any of these species. One is, therefore, led to the conclusion that it represents a species of its own.

As the Clashbennie plate under consideration and the Dura Den specimen thus in all probability belong to different species I find it most appropriate to choose the Clashbennie plate as a neotype of *Ph. concentrica* and thus to retain this species name for that plate. For the Dura Den specimen I propose the new species name of *Ph. woodwardi* in honour of Sir ARTHUR SMITH WOODWARD, who has contributed so much to our knowledge of it.

Before leaving *Ph. woodwardi* we shall also give a brief account of its other characters. The cephalic division of its armour (measured from the anterior margin of the medial part of the marginal plate 1 to the posterior margin of the median cephalic plate) is relatively long, its length corresponding to 86 % approximately of the length of the median dorsal plate (text-fig. 3). The median cephalic plate is of a fairly long and narrow type, the length amounting to 86 % of the maximum breadth. The part of this plate situated in front of the pit-line (*mp*) interpreted as the middle one is fairly large, at any rate larger than in *Ph. orvini* (cf. STENSIÖ 1936, text-figs. 2, 16, 23); and its anterior margin taken as a whole is somewhat more convex than in that species. The median dorsal plate (text-fig. 3) is a little broader than long, and it is therefore decidedly of a short type. Its maximum breadth is 107 % approximately of the length. In regard to the relative proportions of its breadth and length the median dorsal plate is suggestive of the corresponding plate of the shortest type found in *Ph. orvini*. Its antero-lateral margin (the margin attached to the anterior dorso-lateral plate) is only slightly forward directed and also in regard to this character the plate is thus of a similar type to that in *Ph. orvini* (cf. STENSIÖ 1934, pl. 11). The anterior lateral plate is short and broad. The posterior ventro-lateral plate (text-figs. 2, 3) is imperfectly exposed, but it is evident that it is relatively broad and robust with a rather pointed posterior end and a convex lateral margin. In the whole it is, therefore, as in *Ph. orvini* (cf. STENSIÖ 1934, text-figs. 24, 26; and pl. 12; pl. 16, fig. 2; pl. 17, figs. 1, 2; 1936, text-figs. 4, 24 and pls. 23, 24, 27). The ornament of the armour seems also in the whole to be of a similar type to that in *Ph. orvini*.

As may be gathered from the brief description just given of it *Ph. woodwardi* agrees in several of its characters with *Ph. orvini*, and

it cannot be doubted that it must be closely akin to this species. However, it is clearly distinguished from that by the considerably greater length of its head armour both in proportion to the median dorsal



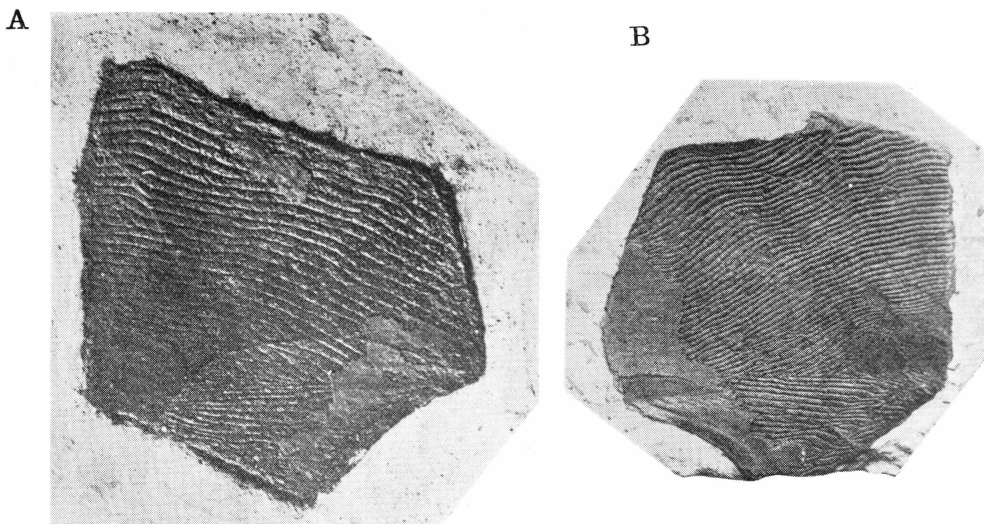
Text-fig. 3. *Phyllolepis woodwardi*. n. sp. Attempted restoration of the armour in dorsal view. Almost natural size.

Adl, anterior dorso-lateral plate; *Al*, anterior lateral plate; *Cn*, median cephalic plate; *M₁-M₅*, marginal plates; *Md*, median dorsal plate; *ifc*, infraorbital sensory groove; *ifc.b*, probably a posterior division of the supraorbital groove; *mp*, probably middle pit-line; *lc*, main lateral line; *lc₁*, cephalic division of the lateral line; *soc*, supraorbital groove.

plate and to the dorsal wall of the armour as a whole (cf. *Ph. orvini* below on p. 16).

Ph. undulata LOHEST was erected by LOHEST, in a paper published in 1888 (p. 157), for a few detached small median dorsal plates. In the

same paper LOHEST also described a few median cephalic plates under the name of *Ph. corneti*, and some anterior ventro-lateral plates also belonging to *Phyllolepis* under the new genus name and species name of *Pentagonolepis konincki* LOHEST (LOHEST 1888, pp. 157—167). LERICHE united in 1931 (pp. 9—14) *Ph. undulata*, *Ph. corneti* and *Ph. konincki* into a single species, for which he retained the species name of *Ph. undulata*. As a lectotype for the species so defined he choose (LERICHE 1931,



Text-fig. 4. Anterior ventro-lateral plate. A, of *Ph. undulata*; $\times 4$ diam.; B, of *Ph. konincki*. Lectotype. Natural size. From LERICHE 1931.

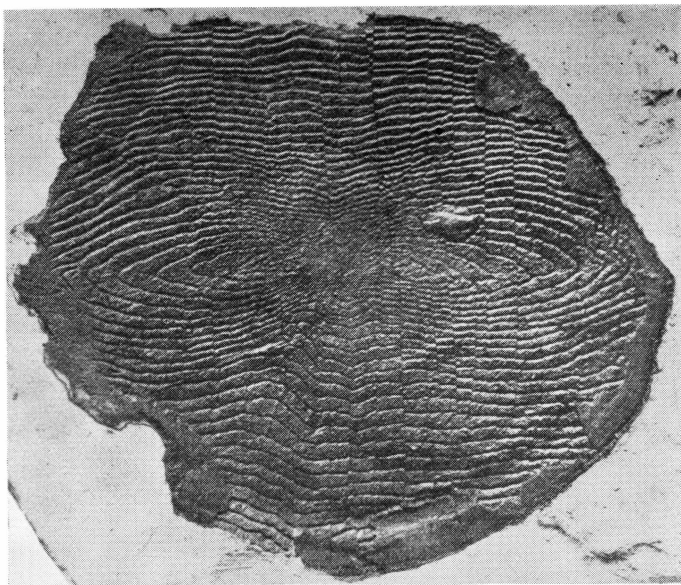
explanation of pl. 1, figs. 3 and 3a) the median dorsal plate figured by LOHEST (1888) in pl. 10, fig. 5.

The present writer has not had the opportunity of studying the material of *Phyllolepis* treated by LOHEST and LERICHE, but, judging from the figures published by them, it is probable that this material comprises two species: *Ph. undulata* LOHEST and *Ph. konincki* (LOHEST).

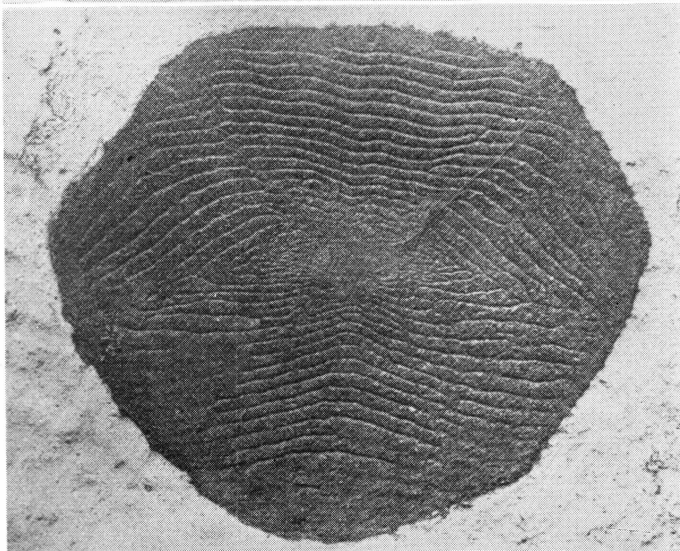
In addition to the lectotype chosen by LERICHE (1931, pl. 1, fig. 3 and 3a; text-fig. 5A in the present paper) I assigne to *Ph. undulata* the following specimens: the median dorsal plate figured by LOHEST in pl. 11, fig. 9, the median dorsal plates figured by LERICHE in pl. 1, fig. 2 and 2a, and pl. 2, fig. 1 and 1a, and the anterior ventro-lateral plate figured by LERICHE in pl. 2, fig. 1 and 1b (cf. also text-figs. 4A, 5 B, C in the present paper). Judging from the short anterior margin of the median dorsal plates known thus far it is more likely that *Ph. undulata* had a long and narrow than a short and a broad median

Text-fig. 5. A, B, C, median dorsal plates of *Ph. undulata*. A, lectotype. $\times 2$ diam.; B, C $\times 3$ diam. From LERICHE 1931.

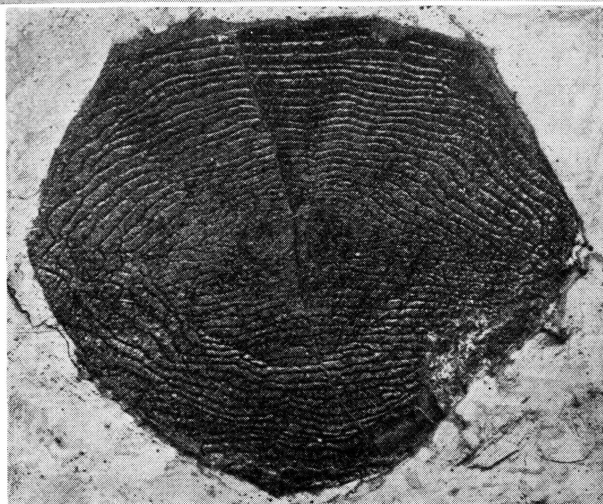
A



B



C



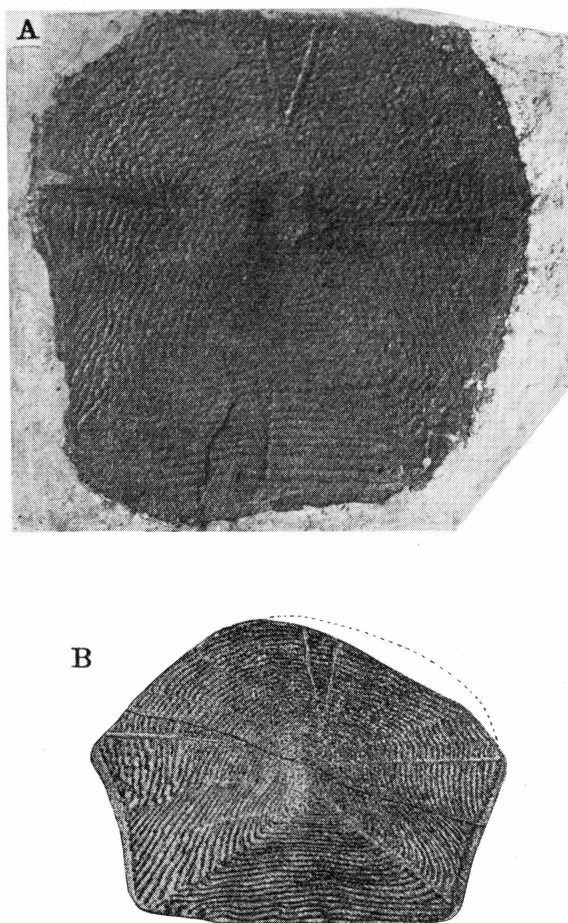
cephalic plate. Because of this the median cephalic plate figured by LERICHE in pl. 1, fig. 1 and 1a (cf. text-fig. 6A in the present paper) is also referred here to *Ph. undulata*.

As a lectotype of *Ph. konincki* (LOHEST) is hereby chosen the anterior ventro-lateral plate figured by LERICHE in pl. 2, fig. 3 (cf. text-fig. 4B in the present paper). The other plates which in my opinion seem to belong to this species are as follows: the anterior ventro-lateral plates figured by LOHEST in pl. 11, figs. 1, 2, 5, the anterior ventro-lateral plate and the median dorsal plate figured by LERICHE in pl. 3, fig. 1A, possibly the median cephalic plate figured by LOHEST in pl. 10, fig. 6 (cf. text-fig. 6B in the present paper), and possibly also certain of the median dorsal plates figured by LOHEST in pl. 10.

Ph. undulata and *Ph. konincki* seem generally to have been smaller than the holotype of *Ph. woodwardi*, but in certain cases they are said to have attained a similar size to that or even to have been a little larger. For a more detailed account of the characters of these two species we shall first turn to *Ph. undulata*.

As has already been pointed out above I assign to *Ph. undulata* the median cephalic plate figured by LERICHE in pl. 1, figs. 1 and 1A (cf. text-fig. 6A in the present paper). This plate is as long as it is broad approximately; its anterior part, situated in front of the supposed middle pit-line (*mp*), is large in proportion to the one situated behind the said pit-line; and its anterior margin, taken as a whole is very strongly convex. The median dorsal plate of *Ph. undulata* (text-fig. 5) is broader than long, its length constituting only 83—85 % of the maximum breadth. Its antero-lateral margin (the margin attached to the anterior dorso-lateral plate) is short and clearly more forward directed than in *Ph. woodwardi*, *Ph. konincki* and *Ph. orvini*; and, owing to this, the lateral angle (the angle between the margin just referred to and the free postero-lateral margin) is more acute and less rounded than in the other species in which it is known. The anterior ventro-lateral plate of the species has a very characteristic shape (text-fig. 4A). Taken as a whole it is short in proportion to its breadth, shorter than in any of the other species known. Its anterior broad division is also shorter than in the other species, the length of this corresponding only to 57 % of the total length of the plate from the anterior margin to the postero-lateral corner parallel with the medial margin (cf. the table on p. 7). The length of the lateral margin of the anterior, broad division of the plate is only 62 % approximately of the length of the medial margin, whereas, in the other species it may amount to 81—90 % or more (cf. table on p. 7, and the description of *Ph. nielsenii* below p. 24). The medial margin is relatively long, its length corresponding to 86 % of the maximum breadth of the plate. The posterior margin is longer than the lateral margin of

the anterior, broad division of the plate, but much shorter than the medial margin (for this and further proportions see the table on p. 7); the postero-medial angle is approximately 120° . All the plates known of *Ph. undulata* bear an ornament of narrow ridges, mostly situated



Text-fig. 6. *A*, median cephalic plate, probably of *Ph. undulata*; *B*, median cephalic plate, probably of *Ph. konincki* (Lohest). *A* $\times 2\frac{1}{2}$ diam. *B*, nat. size; *A*, from LERICHE 1931; *B*, from LOHEST 1888.

further apart than in *Ph. konincki* and most other species (cf. text-figs. 4A, 5A—C, 6A).

Ph. konincki as defined by the writer (p. 12) may be supposed to have had a considerably shorter and broader median cephalic plate than *Ph. undulata*, and, because of this, it is likely that the median cephalic plate figured by LOHEST in pl. 10, fig. 6 (cf. text-fig. 6B in the present paper) belongs to it. This plate is much shorter than broad,

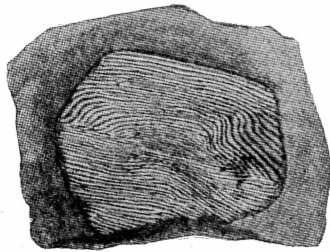
the length presumably being only 74—75 % of the maximum breadth; and in this character it is thus almost as the corresponding plate of the short-armoured individuals of *Ph. orvini*. The median dorsal plate is imperfectly known, but, judging from LERICHE's pl. 3, fig. 1d it seems in its characters known to be fundamentally as in *Ph. woodwardi* and *Ph. orvini*. Thus, as in these species, its antero-lateral margin connected to the anterior dorso-lateral plate is only slightly forward directed and its lateral angle is rather slightly pronounced and much rounded. The anterior ventro-lateral plate (text-fig. 4B; cf. also LERICHE 1931, pl. 2, fig. 3 and pl. 3 fig. 1c) is characterized particularly by the fact that its anterior broad division is longer than in *Ph. undulata*, the length of this division amounting to almost three fourths (71 % approximately) of the total length of the plate from the anterior margin to the postero-lateral angle (parallel with the medial margin), and in regard to this division the plate is thus also fundamentally as in *Ph. woodwardi* and *Ph. orvini* (cf. the table on p. 7). The anterior margin of the plate is imperfectly preserved, but in spite of this it is evident, that it must have been somewhat concave. The lateral margin of the broad anterior part of the plate is much longer than in *Ph. undulata*, probably almost as long as the medial margin, and unlike in *Ph. undulata* it is not straight, but convex. The length of the medial margin can not be fully ascertained, but it is clear that it must be smaller than the maximum breadth of the plate. The posterior margin is shorter than the medial margin, its length probably being between 70—80 % of that of the latter. Finally the posterior angle of the plate seems to be 120°—125°. The ornament of *Ph. konincki* consists as that in *Ph. concentrica*, *Ph. woodwardi*, *Ph. delicatula*, *Ph. orvini* and *Ph. nielsenii* of numerous ridges, situated fairly close to each other, at any rate closer than in *Ph. undulata*.

As may be gathered from the brief account just given *Ph. undulata* and *Ph. konincki* are of rather different types. The former must be assumed to have had a relatively long and narrow head armour, and a trunk armour which rapidly increased in breadth posteriorly to the transverse plane through the lateral angle of the median dorsal plate; the latter must obviously have had its head and trunk armour shaped fundamentally as in *Ph. woodwardi* and *Ph. orvini*. In this connection it should also be mentioned that *Ph. konincki* is so imperfectly known that for the present it cannot be fully defined from *Ph. woodwardi*, and that the possibility, therefore, must be taken into account that it will turn out to be identical with this.

Ph. delicatula NEWBERRY was named and described by NEWBERRY in 1889 (pp. 97—98). Only the holotype, a small median dorsal plate missing a large posterior part (text-fig. 7), is known of it. Both NEWBERRY

(1889) and LERICHE (1931, pp. 13—14) have pointed out that this plate (text-fig. 7) is of a fairly similar type to that in *Ph. undulata* (cf. text-fig. 5), and both these writers have, therefore, suspected *Ph. delicatula* to be identical with *Ph. undulata*. Judging from the figure published by NEWBERRY (1889, pl. 19, fig. 11) and reproduced in text-fig. 7 in the present paper, however, the plate is ornamented with thicker and more closely set ridges than in *Ph. undulata*. As this is the only character known, distinguishing it from *Ph. undulata*, *Ph. delicatula* cannot for the present be properly defined.

In their catalogue of the fossil fishes in the Buffalo museum HUSSAKOFF & BRYANT described in 1918 (pp. 21—22, pl. 32, fig. 2) four plates



Text-fig. 7. *Phyllolepis delicatula* NEWBERRY.

Imperfect median dorsal plate. Holotype. From NEWBERRY 1889. Natural size.

ornamented with concentric “lines”. They considered these plates to belong to *Phyllolepis* and to represent a new species which they named *Ph. elegans*. From their description and from their figure of the holotype I find it impossible to decide whether in this case we are really concerned with *Phyllolepis*. At any rate their description and figure are not convincing that this is so. However, if their material really would reveal itself as belonging to *Phyllolepis* the plate chosen as a holotype could hardly be anything but the marginal plate 4.

Before leaving *Ph. elegans*, the true nature of which thus is doubtful, it should be pointed out that this species is from the Rhinestreet shale, and accordingly from the Portage stage (HUSSAKOFF & BRYANT 1918, pp. 9, 21), whereas the undoubted *Phyllolepis*-remains known as yet all come from deposits equivalent to or perhaps in part even somewhat younger than the Chemung stage.

Phyllolepis orvini HEINTZ, named and first described by HEINTZ in 1930 (HEINTZ 1930, pp. 38—42), is at present the best known species of its genus (HEINTZ 1932 a, pp. 5—14; STENSIÖ 1934; 1936). In this species the general plan of organization of the genus could for the first time be analyzed. In addition in this species it could also for the first time be proved that the armour in the *Phyllolepis*-species may vary

considerably both in its proportions as a whole and in the proportions of its various bone plates, and that the determination of detached *Phyllolepis*-plates as to species, therefore, often may be difficult.

Ph. orvini is the largest species known of the genus, its armour attaining a total length of 40 cm. or more and a maximum breadth of 32—35 cm. The marginal plate 1 and median cephalic plate are together shorter proportionally than in *Ph. woodwardi*, their lengths put together, in both the short-armoured and long-armoured varieties, amounting only to 70 % approximately of the length of the median dorsal plate (84 % in *Ph. woodwardi*). The median cephalic plate varies from a rather short and broad type with the length corresponding only to 73 % approximately of the maximum breadth to a rather long and narrow type with the length amounting to 83 % approximately of the maximum breadth. The anterior part of the median cephalic plate, in front of the probable middle pit-line (*mp*), is not particularly large and in the short-armoured individuals it is fairly short. The anterior margin of the plate under consideration is as a whole convex, though less so than in *Ph. woodwardi* (text-fig. 3) and *Ph. undulata* (text-fig. 6A). The marginal plate 1 is shorter in proportion to its breadth than in *Ph. woodwardi*, and, unlike in this species, it seems not to have been in contact medially with its fellow of the other side (cf. text-fig. 3). The marginal plate 4 is relatively narrow anteriorly, at any rate narrower than in *Ph. woodwardi* (text-fig. 3). The median dorsal plate varies much in its proportions. In the most long-armoured individuals it is somewhat narrower than long, in other individuals it is as broad as it is long, and, finally, in the most short-armoured ones it is even broader than long. More precisely its breadth varies from 90—119 % of the length. Its antero-lateral margin (the margin attached to the anterior dorso-lateral plate) is generally relatively long and only slightly forward directed, and its lateral angle is obtuse and well rounded off. The anterior dorso-lateral and the anterior lateral plates are shorter in proportion to their breadth in the short-armoured specimens than in the long-armoured ones. The anterior ventro-lateral plate (cf. the table on p. 7) is of a fundamentally similar type to that in *Ph. woodwardi* and *Ph. konincki*, i. e. its anterior broad division is so long as to correspond almost to three fourths (67—74 %) of the total length of the plate from the anterior margin to the postero-lateral angle, parallel with the medial margin. The anterior margin of this plate is straight or slightly concave; the lateral margin of the anterior broad division of the plate, thus the margin attached to the spinal plate, is convex and long, its length corresponding to 81—86 % of the length of the medial margin; and, finally the posterior margin of the plate is shorter both than the lateral margin just referred to and the medial margin (cf. the table on p. 7); the postero-medial

angle is 120° approximately. The posterior ventro-lateral plate narrows rapidly backwards, ending with a rather pointed posterior corner; its lateral margin is convex throughout. All the plates of the armour are ornamented with relatively coarse ridges, generally closely set. On the posterior ventro-lateral plates the ridges are, however, at least in several cases, situated more apart from each other than on the other plates. The superficial laminated layer of the dermal plates seems to be distinctly developed only on the lateral and ventro-lateral parts of the armour.

The *Phyllolepis*-remains recorded from Western Russia and Timan (HECKER, PHILIPOVA and BARKHATOVA 1932, p. 66; ROHON 1900, pp. 48—49) and from Australia (HILLS 1931, pp. 212—213; 1932, p. 852; 1936, p. 164) have not been determined as to species, and they are too imperfectly known to be discussed in this connection.

As may be gathered from the revision here carried out the previously described material of the genus *Phyllolepis* would for the present comprise at least six species: *Ph. concentrica* AGASSIZ, *Ph. woodwardi* n. sp., *Ph. undulata* LOHEST, *Ph. konincki* (LOHEST), *Ph. delicatula* NEWBERRY, *Ph. orvini* HEINTZ. Whether *Ph. elegans* HUSSAKOFF & BRYANT really belongs to *Phyllolepis* is, as we have seen (p. 15), very doubtful. At any rate no certain diagnosis can for the present be given of this species. The diagnoses that can be given of the other six species are as follows.

Ph. concentrica.—Species attaining a fairly large size. Only the anterior ventro-lateral plate known. This plate of a type possessing a long anterior, broad division with a long convex lateral margin; its maximum breadth probably equallying the length from the anterior margin to the postero-lateral corner (parallel with the medial margin); its anterior margin slightly concave; its medial margin relatively short, corresponding to something like 70 % of the maximum breadth; its posterior margin probably of almost the same length as the medial one; its postero-medial angle 130° . Ornament consisting of numerous, closely set ridges.

Ph. woodwardi.—Species of a moderate or somewhat large size. Length of marginal plate 1 + length of median dorsal plate corresponding to 84 % approximately of the length of the median dorsal plate. Marginal plates relatively strongly developed; marginal plate 4 comparatively broad anteriorly. Marginal plate 1 in contact with its antimere medially. Median cephalic plate relatively long and narrow, its length corresponding to 85 % of the maximum breadth; its anterior part, in front of the middle pit-line, rather large; its anterior margin as a whole rather strongly

convex. Median dorsal plate relatively short, slightly broader than long; its antero-lateral margin only rather slightly forward directed; lateral angle of the plate obtuse, rounded and not particularly conspicuous. Anterior dorso-lateral and anterior lateral plates relatively short. Anterior ventro-lateral plate of a type possessing a long anterior broad division with a convex lateral margin; this lateral margin probably shorter than the medial margin of the plate. Maximum breadth of the plate smaller than the length of the plate from the anterior margin to the postero-lateral corner (parallel with the medial margin), probably corresponding only to 85% of that length. Anterior margin of the plate probably slightly concave; medial margin long its length probably about 90% of maximum breadth of the plate; posterior margin much shorter than the medial one, its length being only 70% of that of the latter; postero-medial angle 120° . Posterior ventro-lateral plate relatively broad with a pointed posterior end and a convex lateral margin. Ornament of armour consisting of numerous, mostly fairly closely set ridges.

Ph. undulata.—Species generally of a small or moderate size. Median cephalic plate probably of a long type, practically as long as broad; its anterior part, situated in front of the middle pit-line, large; anterior margin as a whole very strongly convex. Median dorsal plate short and broad, its length constituting only 83—85% of the maximum breadth; antero-lateral margin strikingly short and much forward directed; lateral angle rather acute, generally slightly or not rounded off. Anterior ventro-lateral plate of a type with a short anterior, broad division, the length of that division being only slightly more than one half (57%) of the length of the plate from the anterior margin to the postero-lateral corner (parallel with the medial margin); the lateral margin of the division just mentioned straight, fairly much forward directed and short, corresponding only to 62% of the length of the medial margin of the plate. Maximum breadth of the plate longer than the length from the anterior margin to the postero-lateral corner (parallel with the medial margin); the medial margin long, corresponding to 86% of the maximum breadth of the plate; the posterior margin longer than the lateral margin of the broad anterior division, but shorter than the medial margin; postero-medial angle 120° approx-

imately. Ornament of armour consisting of narrow ridges situated rather far apart.

Ph. konincki.—Species generally of a small or moderate size. Median cephalic plate probably of a rather short and broad type. Median dorsal plate with its lateral margin presumably only rather slightly forward directed. Anterior ventro-lateral plate of a type with a long anterior broad division, the length of this division corresponding almost to three fourths (71 % approximately) of the length of the plate from the anterior margin to the postero-lateral angle (parallel with the medial margin); maximum breadth smaller (94 %) than the distance just mentioned from the anterior margin to the postero-lateral corner; anterior margin of the plate probably almost as long as the medial margin and convex; medial margin not fully preserved, but clearly shorter than the maximum breadth, and longer than the posterior margin; postero-medial angle 120° — 125° approximately. Ornament of armour consisting of numerous ridges situated fairly close to each other.

Ph. delicatula.—(Only a fragmentary median dorsal plate known). Species, probably of a small size. Median dorsal plate broader than long; its antero-lateral margin short and rather much forward directed; lateral angle of the plate rather sharply marked; ornament of the plate consisting of presumably rather thick and closely set ridges.

Ph. orvini.—Species of a large size, its sarmour attaining a length of 40 cm or more and a maximum breadth of 32—35 cm. Length of marginal plate 1 + length of median cephalic plate corresponding to 70 % approximately of the length of the median dorsal plate. Marginal plate 1 relatively short in proportion to its breadth and probably not in contact with its fellow of the other side medially. Marginal plate 4 rather narrow anteriorly. Median cephalic plate varying between a short and broad type, with length 73 % of maximum breadth, and a rather long and narrow type, with length 83 % approximately of maximum breadth; anterior part of the plate in front of the middle pit-line, not so very large; anterior margin as a whole convex, though not particularly strongly so. Median dorsal plate varying in its proportions; in short-armoured individuals somewhat broader than long, in other individuals practically as broad as long, and in the most long-armoured ones somewhat longer than broad; its antero-lateral mar-

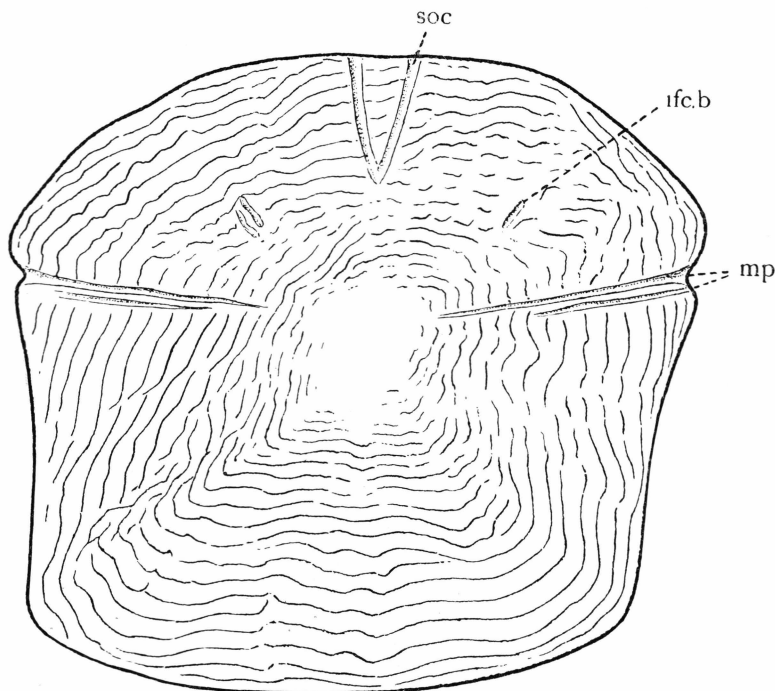
gin relatively long, only slightly forward directed; its lateral angle obtuse and much rounded. Anterior dorso-lateral and anterior lateral plates shorter and broader in short-armoured than in long-armoured individuals. Anterior ventro-lateral plate of a type with a long anterior broad division, the length of this division corresponding almost to three fourths (66—74 %) of the total length of the plate from the anterior margin to the postero-lateral angle (parallel with the medial margin); the lateral margin of this division convex and of a length corresponding to 81—86 % of the length of the medial margin of the plate. Maximum breadth of the plate smaller (86—97 %) than the length from the anterior margin to the postero-lateral corner (parallel with the medial margin). Anterior margin of the plate straight or slightly concave; medial margin relatively long, its length corresponding to 80—90 % of the maximum breadth of the plate; posterior margin shorter than the medial margin, its length corresponding only to 70—78 % of the length of the latter margin; postero-medial angle 120° approximately. Posterior ventro-lateral plate relatively broad with a pointed posterior end and a convex lateral margin. Ornament of armour consisting of numerous, not seldom rather coarse ridges, mostly situated close or somewhat close to each other. Superficial laminated layer of dermal bones probably present only in certain lateral and ventro-lateral parts of the armour.

***Phyllolepis nielseni* n. sp.**

(Text-figs. 8—11; pls. 1—3; pl. 4, figs. 2, 3).

Diagnosis.—Species of a moderate size. Marginal plate 4 rather broad anteriorly. Median cephalic plate relatively long, the length corresponding to 86—90 % of the breadth; the part of the plate in front of the supposed middle pit-line rather large with the anterior margin rather strongly convex. Median dorsal plate with a short, somewhat forward directed antero-lateral margin and slightly pronounced, obtuse lateral angle. Anterior lateral plate short and relatively broad. Anterior ventro-lateral plate of a type with a somewhat long anterior broad division, the length of this division corresponding to two thirds (64—66 %) approximately of the length of the plate from the anterior margin to the postero-lateral angle (parallel with the medial

margin); the lateral margin of this anterior broad division convex, somewhat forward directed and of a length corresponding to 80 % or even a little more of the length of the medial margin of the plate. Maximum breadth of the plate approximately equal to the length from the anterior



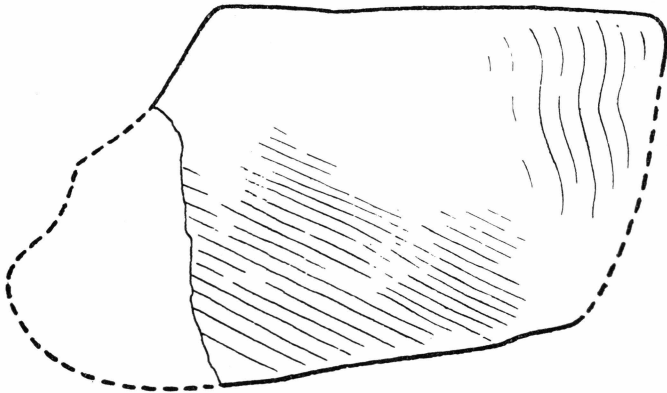
Text-fig. 8. *Phyllolepis nielsenii* n. sp. Median cephalic plate in dorsal view. Restoration made after the holotype (pl. 1, fig. 1). $\times 1\frac{1}{2}$ diam.

ifc.b, pieces of a sensory groove, possibly representing an anterior part of the supra-orbital groove; *mp*, groove, probably representing the middle head-line of pit-organs; *soc*, supraorbital groove.

margin to the postero-lateral corner (parallel with the medial margin). Anterior margin of the plate slightly concave; medial margin long, its length corresponding to 74—78 % of the maximum breadth of the plate; posterior margin rather much shorter than the medial margin, but only slightly shorter than the lateral margin of the broad, anterior division of the plate; postero-medial angle 120° — 125° approximately. Posterior ventro-lateral plate with its posterior end obtuse and rounded and its lateral margin with a distinct concavity in the anterior part. Ornament of armour consisting of ridges situated rather close to each

other on the plates of the head, but less close on the plates of the trunk, particularly the median dorsal plate and the posterior ventro-lateral plate.

Material.—The Material at hand is small, comprising only a few detached plates (nos. P 985—990), several of which are imperfect. More precisely the material includes one imperfect marginal plate 4 (no. P 988a), one complete (no. P 985) and two fragmentary median cephalic plates (nos. P 987a, 989), parts of two median dorsal plates (nos. P 987b, 988b), a fragment of an anterior dorso-lateral plate (no. P 988c), one imperfect anterior lateral plate (no. P 987c), one complete (no. P 986)



Text-fig. 9. *Phyllolepis nielseni* n. sp. Attempted restoration of a left anterior lateral plate. $\times 1\frac{1}{2}$ diam.

and three imperfect anterior ventro-lateral plates (nos. P 988d, e; 990), and one complete posterior ventro-lateral plate (no. P 987d).

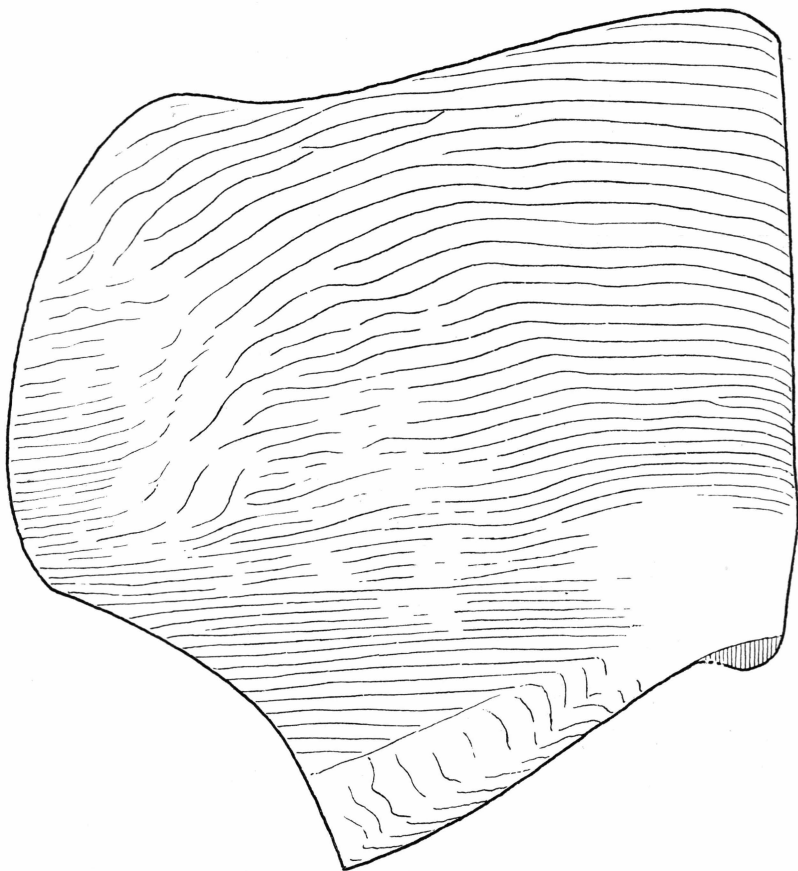
As a holotype is herewith chosen the complete median cephalic plate (no. P 985; text-fig. 8; pl. 1, fig. 1).

Description.—The median cephalic plate chosen as a holotype is 2.9 cm long and 3.2 cm broad at its broadest place. The two other median cephalic plates are both larger, the best preserved being 4 cm long approximately. The complete anterior ventro-lateral plate is 4.3 cm long, measured from the anterior margin to the postero-lateral corner parallel with the medial margin, and 4.2 cm broad at its broadest place. The two other anterior ventro-lateral plates are of a somewhat similar size to the one already referred to. Finally the posterior ventro-lateral plate is 3.4 cm long and 1.9 cm broad at its broadest place.

As may be seen from the measurements given of them the bone-plates here under description are from individuals of a rather small size.

The marginal plates 1, 2, 3 and 5 are unknown. The marginal plate 4 (pl. 3, fig. 2) is broader anteriorly than in *Ph. Orvini* and is therefore suggestive of that in *Ph. woodwardi* (cf. text-fig. 3).

The median cephalic plate (text-fig. 8; pl. 1, figs. 1, 2) is longer in proportion to its maximum breadth than in *Ph. woodwardi* and *Ph. orvini*, but not fully as long as in *Ph. undulata*. More precisely its length amounts to 90 % approximately of its maximum breadth, whereas in *Ph. woodwardi* and *Ph. orvini* the corresponding figures are



Text-fig. 10. *Phyllolepis nielseni* n. sp. Restoration of a right anterior ventro-lateral plate. Ventral view. After the specimen in pl. 3, fig. 3. $\times 1\frac{1}{2}$ diam.

85 % and 73—83 % respectively. The part situated in front of the groove *mp*, supposed to represent the middle pit-line, is rather large, as in *Ph. woodwardi* approximately (cf. text-fig. 3), and is bounded anteriorly by an as a whole strongly convex anterior margin.

The median dorsal plate (pl. 2, figs. 1, 2) is so imperfectly preserved that our knowledge of it is very unsatisfactory. However, it is fully evident that its antero-lateral margin is shorter than in *Ph. woodwardi* and *Ph. orvini* and in addition more forward directed than in

these, though not so much so as in *Ph. undulata*. The lateral angle of the plate is obtuse and not particularly pronounced.

Of the anterior dorso-lateral plate (pl. 4, fig. 2) only a small piece is preserved. This piece gives no certain idea of the proportions of the plate.

The anterior lateral plate (text-fig. 9; pl. 3, fig. 1) is short and relatively broad and seems to be in the whole suggestive of the one in the short-armoured individuals of *Ph. orvini* (cf. STENSIÖ 1936, pl. 15, fig. 1).

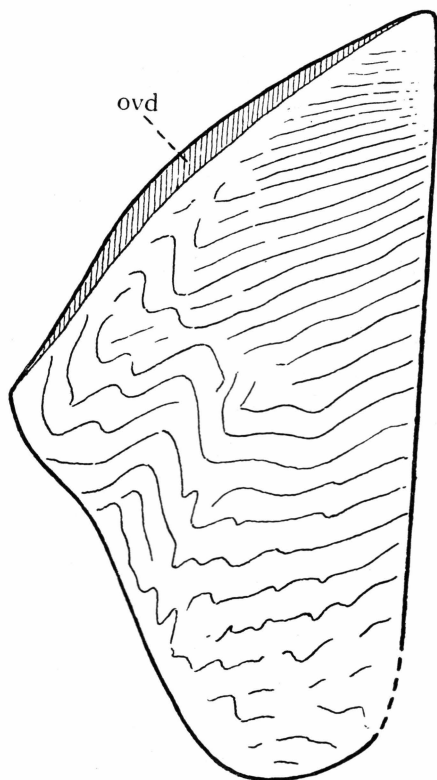
The anterior ventro-lateral plate (text-fig. 10; pl. 3, fig. 3; cf. the table on p. 7) is somewhat shorter in its anterior broad division than in *Ph. woodwardi* and *Ph. orvini*, the length of that division corresponding only to two thirds (64 %) approximately of the distance from the anterior margin to the postero-lateral angle, parallel with the medial margin. The last-mentioned distance is equal to the maximum breadth of the plate, and in this character, therefore, the plate resembles more the one in *Ph. concentrica* (cf. text-fig. 1, cf. the table on p. 7) than the one in *Ph. woodwardi* and *Ph. orvini*. The anterior margin is somewhat concave in its lateral half. The lateral margin of the anterior, broad division is convex, a little more forward directed than in *Ph. orvini* and of a length corresponding to 80 % or perhaps 82 % of the length of the medial margin. The medial margin is somewhat long, its length amounting to 74–98 % of the maximum breadth of the plate. The posterior margin is shorter than the medial margin, its length corresponding to 78 % approximately of that of the latter margin, but almost as long as the lateral margin of the broad anterior division. For the proportions of the plate otherwise see the table on p. 7. The postero-medial angle is (in the three plates in which it could be studied) 120° or slightly more. Judging from the posterior ventro-lateral plate (cf. text-fig. 11) it is probable, however, that in certain individuals it was 125° or even almost 130°.

The single posterior ventro-lateral plate found preserved as yet (text-fig. 11; pl. 4, fig. 3) is as a whole narrower in proportion to its length than in *Ph. woodwardi* and *Ph. orvini*. Unlike in the said two species its posterior end is not pointed, but broad and rounded off, and its lateral margin not convex throughout, but exhibits a distinct concavity in its anterior part. The anterior margin is distinctly convex, and more laterally directed than in *Ph. woodwardi* and *Ph. orvini*.

The ornament is of a similar type to that in the other species (pls. 1–3; pl. 4, figs. 2, 3). However, on the median dorsal plate it may in certain cases (pl. 2, fig. 1) consist of strikingly narrow ridges, situated far apart.

The sensory canal system agrees in all essentials with that in *Ph. orvini* (cf. STENSIÖ 1936, pp. 20–27). Thus the supraorbital groove

(*soc*, text-fig. 8; pl. 1, fig. 1) may in certain specimens be well developed on the median cephalic plate, whereas in other specimens (pl. 1, fig. 2) it was in all probability situated too superficially to the median cephalic plate to cause any distinct grooves or markings on this. The groove *ifc.b* (text-fig. 8; pl. 1, figs. 1, 2) is represented by one or more short pieces.



Text-fig. 11. *Phyllolepis nielseni* n. sp. A right posterior ventro-lateral plate. Ventral view. Restoration made after the specimen shown in pl. 4, fig. 3. $\times 1\frac{1}{2}$ diam.
ovd, overlapped area.

The groove *mp* (text-figs. 8; pl. 1, figs. 1, 2) supposed to represent the middle pit-line is well developed. Both it and the groove *ifc.b* may on the median cephalic plate be double for some distance or throughout their length. The groove which probably corresponds to the posterior pit-line (*pp*, pl. 1, fig. 2) is, as in the previously described species, occasionally developed. In the marginal plate 4 a large part of the postotic groove (*ptc*, pl. 3, fig. 1) is seen.

Remarks.—*Ph. nielseni* is in certain of its characters somewhat suggestive of *Ph. undulata*, whereas in others it approaches more *Ph. woodwardi* and *Ph. orvini*. As far as may be judged from the material

known for the present it is well distinguished from all the species previously described that are known in any detail.

The species is named in honour of Mag. EIGIL NIELSEN, Copenhagen.

Geological horizon and locality.—One of the lowermost horizons of the lowermost red division of the *Remigolepis*-series. Mt. Sederholm on Gauss Peninsula.

Order **Eurthrodira.**

Genus **Groenlandaspis** HEINTZ.

On the basis of the new material described below the diagnosis of the genus *Groenlandaspis* can be completed to some extent and is now as follows: Anterior halves of central plates widely separated from each other presumably by the pineal plate. Nuchal (median nuchal) plate relatively long and narrow and somewhat thickened. Paranuchal plate large, with a large fossa condyli situated fairly close to the corresponding fossa of the opposite side; in addition paranuchal plate with a pronounced oblique ridge on its lower face in front of the fossa condyli. Median dorsal plate very narrow with a slightly developed median ridge. Anterior dorso-lateral plate with a well developed condyle, but destitute of any pronounced ridges or thickenings. Anterior lateral plate strikingly long, with a long, probably free posterior margin. Posterior dorso-lateral plate high, almost twice as high as long. Posterior lateral plate present, presumably rather small and probably not descending to the ventral wall of the trunk armour. Only three sensory grooves developed on the central plates, these three grooves probably corresponding respectively to a posterior part of the supraorbital groove, to the middle pit-line and to the posterior pit-line. Lateral line groove on the posterior dorso-lateral plate forming a pronounced angle in passing first postero-dorsally in the posterior half of the plate, and then postero-ventrally.

Finally, it should be especially pointed out here that, judging from the stratigraphical conditions of the series in which it is found (cf. SÄVE-SÖDERBERGH 1934, pp. 49—50), *Groenlandaspis* is the latest representative of the Euarthrodirea that is known at present. In such circumstances it is highly interesting that in several of its characters known it seems to be mostly akin not to the *Brachythoraci* (cf. GROSS 1932, pp. 51—52; STENSIÖ 1936, pp. 29—30) which played such an important

part during the Upper Devonian, but to the *Acanthaspida* (cf. also HEINTZ 1932, pp. 19—24) which were predominant during the Lower Devonian.

Groenlandaspis mirabilis HEINTZ.

(Text-figs. 12, 13A, B; pl. 4, fig. 4; pls. 5, 6).

Syn. *Groenlandaspis mirabilis* HEINTZ 1932 a, pp. 18—24, pl. 5, pl. 6, fig. 1. ?*Groenlandaspis mirabilis*? STENSIÖ 1934, p. 55, pl. 8, fig. 4.

Euarthrodie gen. et spec. indet. STENSIÖ 1936, pp. 47—49, textfig. 25, 26 and pl. 1, fig. 7, pl. 14, fig. 1, pl. 18, fig. 1.

Diagnosis.—The diagnosis will be as for the genus (cf. p. 26 above).

Material.—The new material of *G. mirabilis* now at hand comprises only the following detached plates: one imperfect plate (no. P 991) presumably from the head, one plate which probably is a central plate (no. P 992), two posterior dorso-lateral plates (nos. P 993, a, b) and a narrow spine-like plate (no. P 994). This new material shows that all or, at any rate, the main part of the previously described Euarthrodire material brought home by the Danish Expeditions to East Greenland (STENSIÖ 1934, p. 55; 1936, pp. 47—49) may belong to *G. mirabilis*.

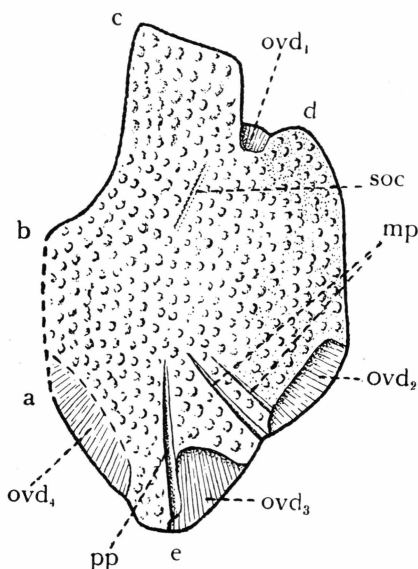
Description.—As is evident both from the holotype described by HEINTZ and from the detached plates available to the writer *G. mirabilis* attained a somewhat large size.

The plate (no. P 991) shown in pl. 5, fig. 3 seems to have belonged to the dermal cranical roof. Owing to its imperfect state of preservation it cannot be identified with certainty. Judging from the sensory groove crossing it throughout its length and from the position of its overlapped areas preserved it is not, however, quite impossible that it may be a preorbital plate.

The presumed central plate (text-fig. 12; pl. 5, figs. 1, 2) at hand is probably a right one. As generally in the Euarthrodires it is longer than broad. Medially it was in contact with its antimere only with a fairly short margin (*a—b*). In front of this margin it has a rather long concave margin (*b—c*) with which it seems to have overlapped a median element, most probably the pineal plate. With its front end (*c—d*) it seems mainly to have overlapped the preorbital plate, though for a short distance, in a deep fairly narrow emargination, it was somewhat (*ovd₁*) overlapped by the last-mentioned plate. The anterior part of the lateral margin (*d—e*) overlapped anteriorly the adjoining plate, which probably was the postorbital plate; the remaining part of the same margin was at two places (*ovd₂*, *ovd₃*) overlapped by one or two

adjoining plates. The posterior end of the plate bears an overlapping area. Finally the postero-medial margin ($e-a$) is imperfect, but it is most probable that it was overlapped (ovd_4) by the nuchal plate.

As is evident the central plate here under description seems in its relations to the neighbouring plates to differ somewhat from the one in the ideal type of the *Brachythoraci* (cf. HEINTZ 1932b, text-fig. 9). Whether in this respect, it differs also from the one in the *Acanthaspida* is impos-



Text-fig. 12. *Groenlandaspis mirabilis* HEINTZ. Central plate, probably from the right side. Dorsal view. $\times 1\frac{1}{2}$ diam.

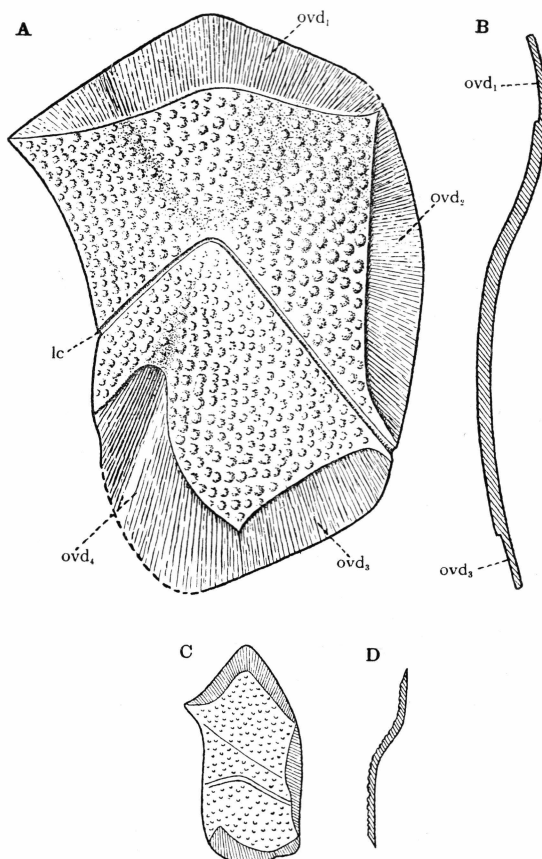
mp, grooves, probably representing the middle pit-line of fishes in general; *ovd₁-ovd₄*, overlapped areas; *pp*, groove, probably corresponding to the posterior pit-line of fishes in general; *soc*, groove, probably representing a posterior part of the supra-orbital groove.

ible to say as yet, as in these the mode of suturing of the bones of the dermal cranial roof are practically unknown.

The presumed central plate exhibits three sensory grooves. The most anterior one of these (*soc*, text-fig. 12, pl. 5, figs. 1, 2) is short and shallow and does not by far reach forward to the anterior margin. As far as may be judged this groove represents a posterior part of the supraorbital groove. The two other sensory grooves (*mp*, *pp*, text-fig. 12; pl. 5, figs. 1, 2) begin fairly close to each other but diverge fairly rapidly during their passage backward. They increase in depth and width backwards, and both of them reach the margin of the plate from which they certainly continued on to the postorbital and paranuchal plates respectively. According to their position and relations the anterior (*mp*)

of the lastmentioned two grooves seems to correspond to the middle, and the posterior one (*pp*) to the posterior pit-line of the head in *Brachythoraci* (cf. STENSIÖ 1934, pp. 29—31 and text-fig. 10).

Finally it should be mentioned that the opinion advanced here concerning the orientation of the central plate to some extent is based on the above interpretation of the sensory grooves.



Text-fig. 13. Posterior dorso-lateral plate. *A*, of *Groenlandaspis mirabilis* in lateral view. *B*, of *Groenlandaspis mirabilis* in transverse section. Nat. size. *C*, of *Acanthaspis subtilis* GROSS in lateral view. *D*, of *Acanthaspis subtilis* GROSS in transverse section. Figs. *C* and *D* from GROSS 1932.

lc, main lateral line groove; *ovd*₁, area overlapped by the median dorsal plate; *ovd*₂, area overlapped by the anterior dorso-lateral plate; *ovd*₃, area probably overlapped by the anterior lateral plate; *ovd*₄, area overlapped by the posterior lateral plate.

The posterior dorso-lateral plate (text-figs. 13A, B; pl. 5, fig. 4; pl. 6, figs. 1, 2) is much higher than long. In order to fit in with the narrow median dorsal plate (cf. HEINTZ 1932 a, p. 20) its dorsal part is not in a level directly continuous with that of the ventral part, but

it is bent so as to be situated at a lower or more precisely a more medial plane (text-fig. 13B). The postero-dorsal corner is slightly produced. The dorsal margin is characterized by the presence of a fairly pronounced angle, and along this margin a broad area (*ovd*₁) is found, which was overlapped by the median dorsal plate. The anterior margin is slightly convex, and along its upper and by far longer part there is an area (*ovd*₂), which was overlapped by the anterior dorso-lateral plate. The ventral margin is of a somewhat similar angular shape to the dorsal one. Along this margin two overlapped areas are to be seen, an anterior (*ovd*₃), which presumably was overlapped by the anterior lateral plate, and a posterior (*ovd*₄) which beyond question was developed for the posterior lateral plate. The posterior margin is concave and, as normally in the group, it was free. The outside of the plate is crossed by the main lateral line groove (*lc*), which there makes a very marked bend, passing first backward and upward and then backward and downward.

In all its characters known the posterior dorso-lateral plate is very similar to that in certain Acanthaspids, but particularly to that in *Acanthapis subtilis* Gross (cf. text-fig. 13C, D; cf. also Gross 1933, p. 61 and text-fig. 9).

In this connection it should be pointed out that, according to our present knowledge of the trunk armour, the plate described by the writer in 1936 as a possible paranuchal plate (STENSIÖ 1936, p. 48, text-fig. 25, pl. 18, fig. 1) in fact seems to be a dorsal part of a posterior dorso-lateral plate, and that the plate considered by the writer at the same occasion as an anterior median ventral plate + a part of an anterior ventro-lateral plate (STENSIÖ 1936, pp. 48—49, pl. 14, fig. 1) possibly is a ventral part of a posterior dorso-lateral plate.

From the development of the overlapped areas along the lower margin of the posterior dorso-lateral plate it is fully evident that a posterior lateral plate was present, although it cannot have been particularly large. As pointed out by HEINTZ (1932a, p. 22) it is unlikely that the posterior lateral plate descended to the ventral wall of the trunk armour but that it ended as far dorsally as to leave a considerable part of the posterior margin of the anterior lateral plate free.

Finally the spine-like plate (pl. 4, fig. 4) is so imperfectly preserved that its exact shape cannot be ascertained. At least in its present state of preservation it is slightly assymmetric, one of its sides being more flat than the other. At the rounded edge between its two sides it exhibits for a rather long distance a groove, exactly resembling a sensory canal groove (*ssg*) and on the more convex side a similar though much narrower groove (*ssg*) is to be noticed. The whole outside of the plate found preserved is ornamented with fairly low, round tubercles arranged in longitudinal rows. Judging from its characters known the plate just

under consideration might perhaps be taken for a spinal. If this is correct the spinal would lack denticles, but would on the other hand perhaps have been provided with sensory canal grooves.

The circumstance that sensory canal-like grooves are found on the possible spinal is of much interest, for, as is well known, sensory canals may be developed also on the pectoral fins of several recent *Rajiformes*. A trend for such an excessive development of the sensory canal system would thus perhaps be met with in widely different groupings of *Elasmobranchii* (cf. STENSIÖ 1936, p. 31)¹⁾.

The ornament of all the plates described here consists of rounded tubercles, often fairly pointed. These tubercles seem mostly to be coarser on the trunk armour than on the head armour.

Geological horizon and locality.—The new material described here comes from a horizon of local talus 1348 m above the sea level in the Arthrodire Sandstone Series. The find place is on Remigolepis Ridge, Kerstin valley, Gauss Peninsula.

¹⁾ It would be of importance to know whether sensory grooves are present on the spinal plate in the earlier *Acanthaspida* and in the *Brachythoraci*.

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EXPLANATION OF PLATES

Plate 1.

Phyllolepis nielseni n. sp.

Fig. 1. Impression of the external face of a small median cephalic plate. $\times 3$ diam. Specimen no. P 995.

Fig. 2. Impression of a part of the external face of a larger median cephalic plate. $\times 3$ diam. Specimen no. P 987a.

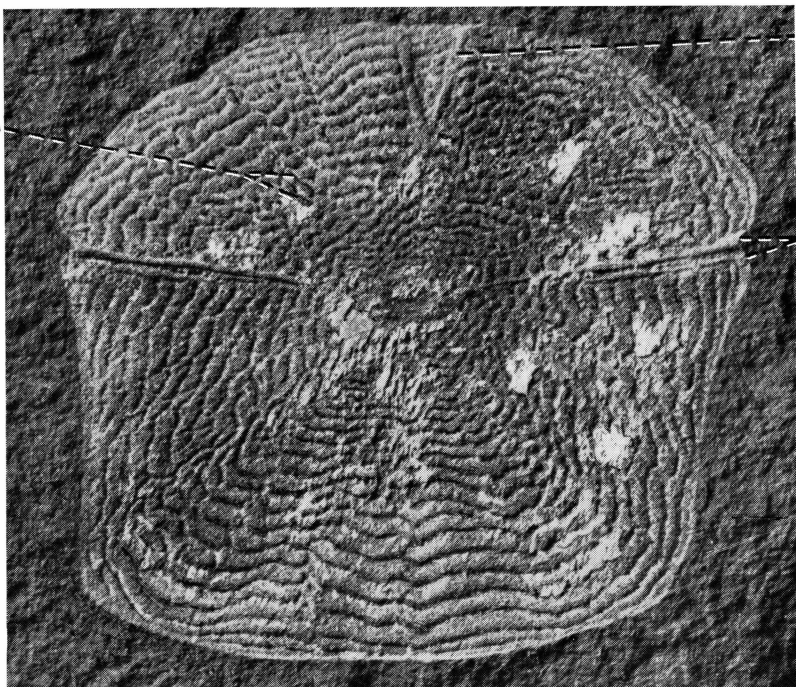
ifc.b, postero-medial branch of infraorbital groove or more probably a posterior branch of the supraorbital groove; *mp*, groove, probably representing the middle pit-line; *pp*, groove, probably representing the posterior pit-line; *soc*, supraorbital groove.

1

ifc.b

soc

mp



2

ifc b

mp

pp

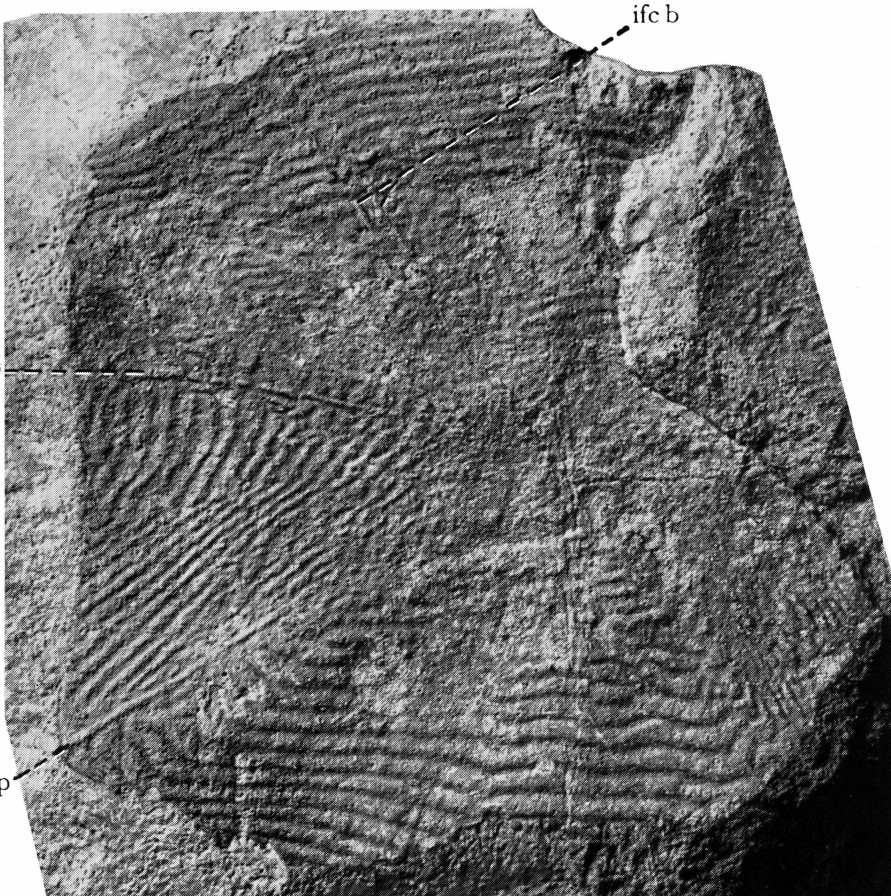


Plate 2.

Phyllolepis nielseni n. sp.

Fig. 1. A left part of a median dorsal plate. $\times 3$ diam. Specimen no. P 988 b.

Fig. 2. Impression of an anterior part of a median dorsal plate. $\times 3$ diam. Specimen no. P 987b.

1



2



Plate 3.

Phyllolepis nielseni n. sp.

- Fig. 1. Imperfect right anterior lateral plate, preserved mainly as an impression of the external face. $\times 3$ diam. Specimen no. P 987c.
Fig. 2. Imperfect right marginal plate 4. $\times 3$ diam. Specimen no. P 988a.
Fig. 3. Impression of a right anterior ventro-lateral plate. $\times 3$ diam. Specimen no. P 986.

*lc*₁, groove representing a part of the cephalic division of the main lateral line; *ov*, area overlapping the anterior dorso-lateral plate; *ovd*, area overlapped by the median cephalic plate; *ptc*, part of the postotic sensory groove.

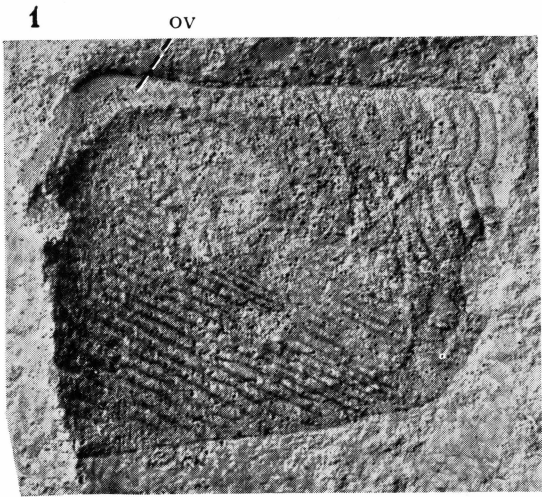
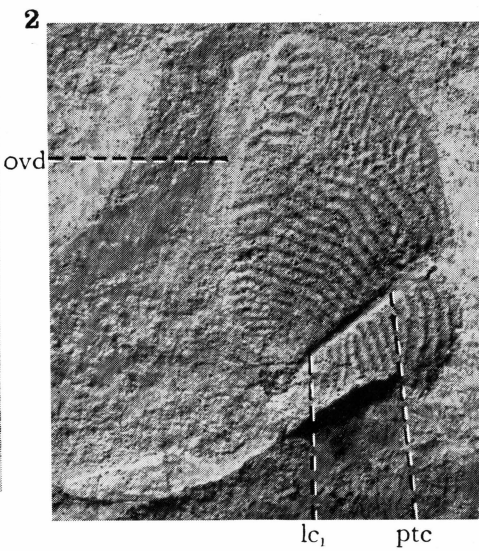
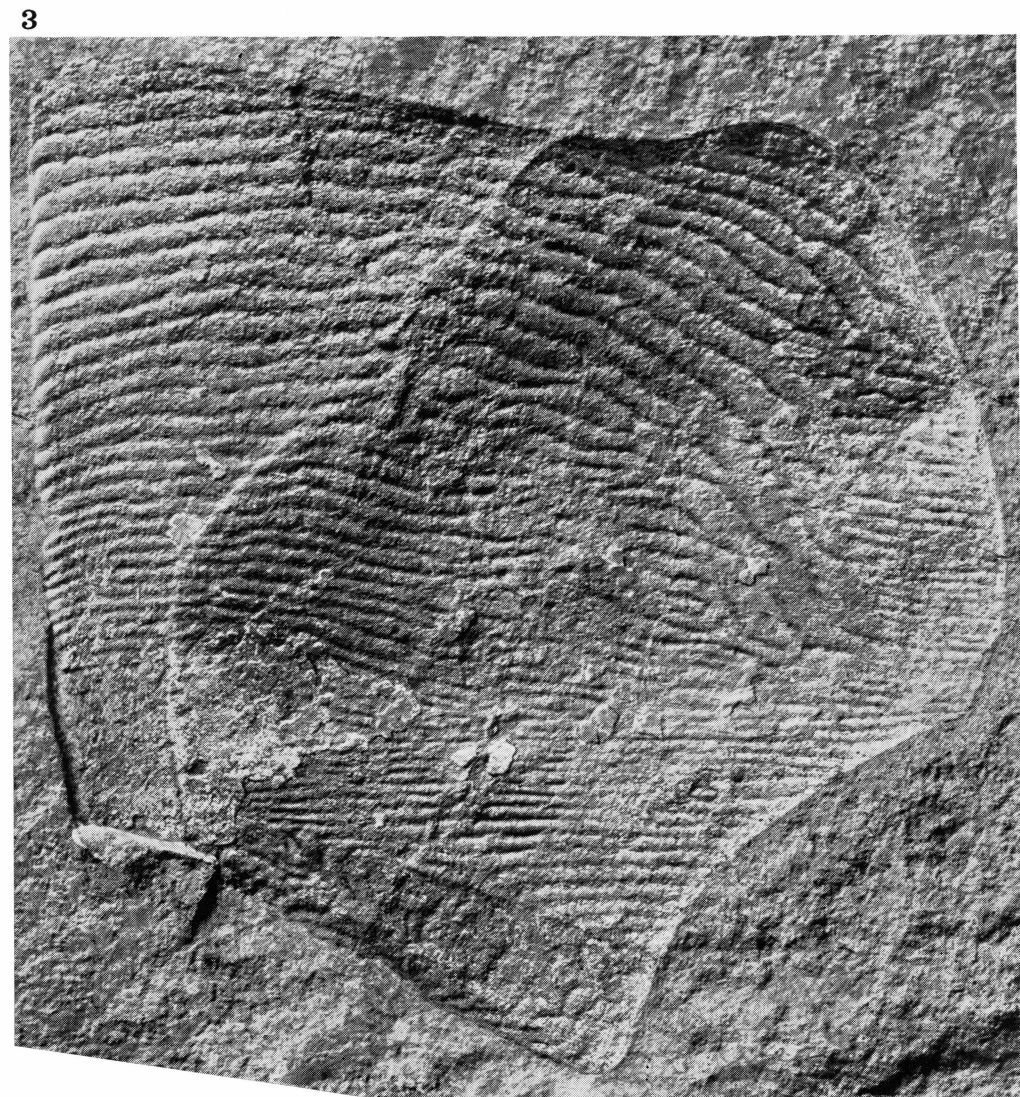


Plate 4.

- Fig. 1. Remain of a bone not nearer determinable as to genus or species. $\times 3$ diam. Specimen no. P 986.
- Fig. 2. *Phyllolepis nielseni*, fragment of an anterior dorso-lateral plate, preserved as an impression. $\times 3$ diam. Specimen no. P 988c.
- Fig. 3. *Phyllolepis nielseni*, a right posterior ventro-lateral plate showing its external face. $\times 3$ diam. Specimen no. P 987d.
- Fig. 4. *Groenlandaspis mirabilis?*, imperfect spine-like plate preserved as an impression. $\times 1,5$ diam. Specimen no. P 994.

lc, main lateral line groove; *ovd*, overlapped areas; *ssg*, *ssg*₁, grooves resembling sensory canal grooves.

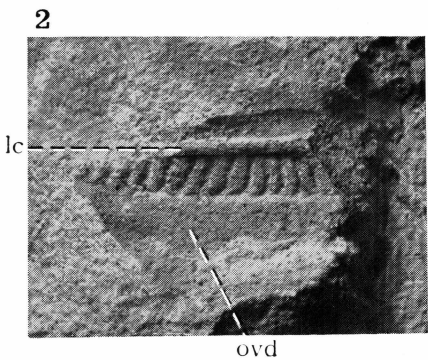
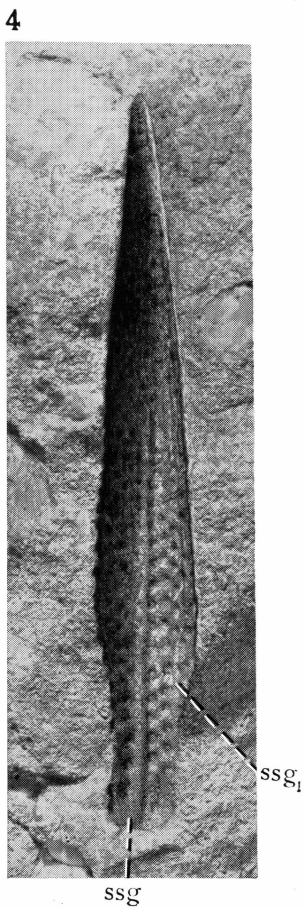
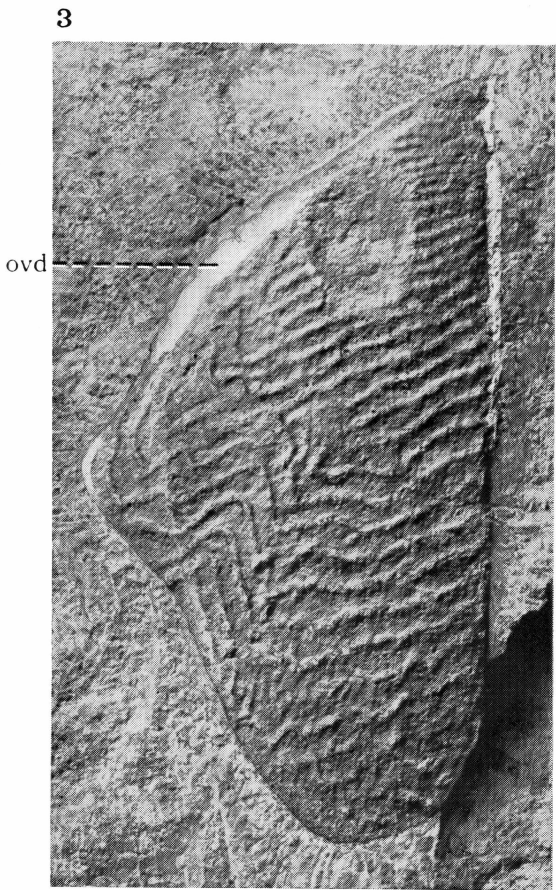


Plate 5.

Groenlandaspis mirabilis HEINTZ.

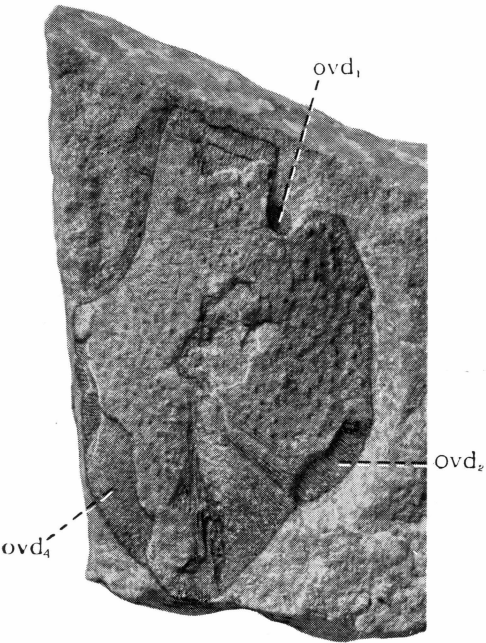
Figs. 1, 2. Presumed central plate, probably from the right side, in counterpart.
× 1,5 diam. Specimen no. P 992.

Fig. 3. Plate not nearer determinable. × 1,5 diam. Specimen no. P 991.

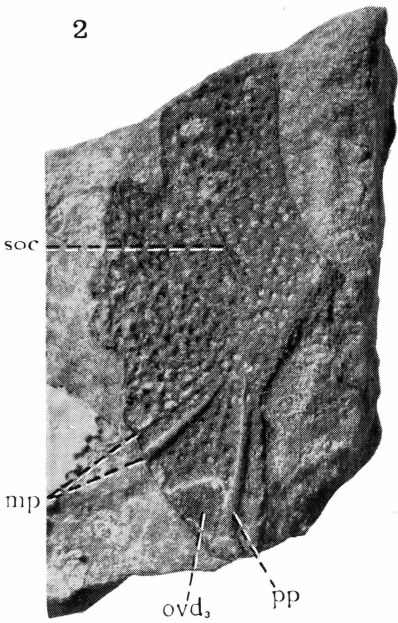
Fig. 4. Left posterior dorso-lateral plate, missing a postero-ventral part. The plate
is preserved as an impression of its outer face. 1,5 diam. Specimen no. 993b.

lc, main lateral line groove; *mp*, groove probably representing the middle pit-line;
note that this groove is double; *ovd₁-ovd₃*, overlapped areas; *pp*, groove, probably
representing the posterior pit-line; *soc*, probably a part of the supraorbital groove.

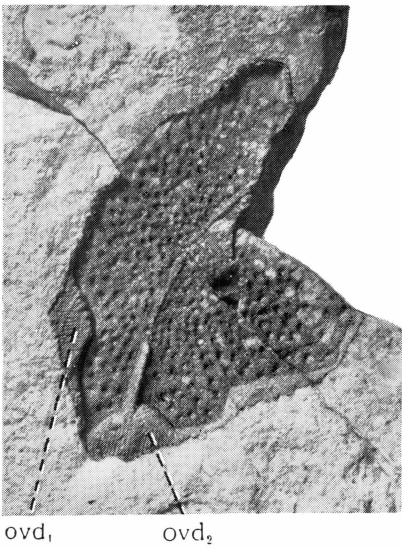
1



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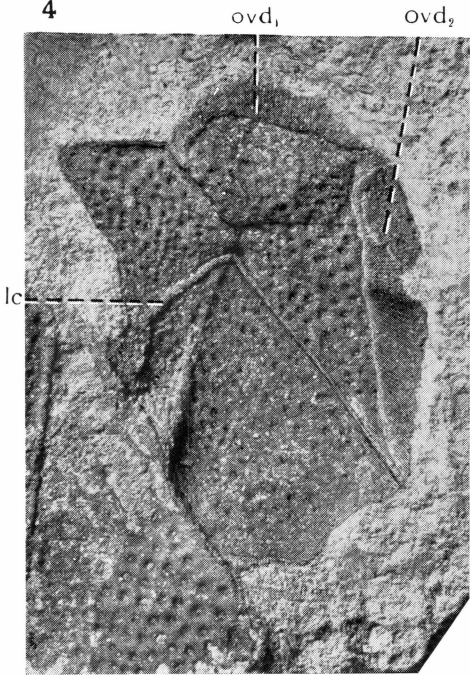


Plate 6.

Groenlandaspis mirabilis HEINTZ.

Figs. 1, 2. Somewhat imperfect right posterior dorso-lateral plate in counterpart.
× 1,5 diam. Specimen no. P 993a.

lc, main lateral line groove; *ovd*₁-*ovd*₄, overlapped areas.

