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NORSK POLARINSTITUTT

# SKRIFTER

Nr. 117

## THE DOWNTONIAN AND DEVONIAN VERTEBRATES OF SPITSBERGEN. X.

TWO NEW SPECIES OF THE GENUS PTERASPIS FROM  
THE WOOD BAY SERIES IN SPITSBERGEN

BY  
NATASCHA HEINTZ



OSLO 1960

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## **Summary.**

Two new species *Pteraspis* ? *lykensis* sp. nov. and *Pteraspis* ? *minor* sp. nov. from the Wood Bay Series in Spitsbergen are described and depicted. Their relation to other Pteraspids is discussed, and it is pointed out, that the lack of dorsal spine, the development of very coarse ornamentation (dentine ridges) and small size, make it fairly presumable that they must be considered to belong to a new subgenus.

## **Introduction.**

Norwegian expeditions to Spitsbergen have in the course of many years collected an extensive material of fossil agnathes and fishes from the Downtonian and Devonian deposits. Especially the expeditions of 1925, 28 and 39 brought back very valuable collections, among which were great numbers of different Heterostraci.

As early as about 1910 Professor JOHAN KIÆR started to work on the different Heterostraci from Spitsbergen, but at his death only the manuscript dealing with the suborder Cyathaspida was more or less finished. As to the suborder Pteraspida, KIÆR had made a preliminary systematic division of this group. But unfortunately the definition of the different species was not sufficient to make it possible to identify them.

The only paper dealing especially with *Pteraspis* from Spitsbergen, is KIÆR's work (1928) "The Structure of the Mouth of Pteraspids and Cephalaspid", where he gives a preliminary description of the two species: *Pt. primaeva* and *Pt. vogti*, both from the Red Bay Series.

FØYN and HEINTZ (1943) in their paper on the geology of the Downtonian—Devonian deposits of the northern part of Vestspitsbergen mention, that the two genera *Doryaspis* and *Giganthaspis*, both belonging to the fam. Pteraspidae, are very good guide-fossils for the Lyktan- and Kapp Kjeldsen Division, respectively, whereas — on the other hand — no species of the genus *Pteraspis* so far seems to have been recorded from these deposits.

During my work on the *Doryaspis*-fauna from the Wood-Bay Series, I have, however, found dorsal and ventral disks of two new species, which

I believe may perhaps belong to the genus *Pteraspis*. If this is the case, they are the youngest hitherto known representatives of this genus from Spitsbergen. Another point of interest is the fact that they are extremely small, a feature that is more typical of the elder members of this group. I therefore feel that it would be of some interest to give a more detailed description of these two new species.

### Description.

#### *Pteraspis? lyktensis sp. nov.*

Pl. I, A, B, C, D, E, and Pl. II, A. Fig. 1 and 2.

#### Diagnosis.

A small *Pteraspis* with coarse dentine ridges numbering from 40—50 ridges to each cm. The dorsal disk more or less rectangular, about 18—20 mm along the median line, 12—14 mm in width and quite flat. No distinct dorsal spine seems to be developed.

The ventral disk more or less oval, about 20 mm along the median line, about 15 mm in width and quite strongly arched.

The sensory canal system on the dorsal disk is distinguished by the fact that the median longitudinal canals coalesce with an oval loop of the pineal canal, which extends down about one fourth of the length of the disk. The sensory canals are about 0.2 mm in width.

#### Holotype.

As holotype is chosen specimen No. A 27840 Pal. Mus. Oslo, (Pl. I, D).

#### Occurrence and material.

Hitherto only one slab has been found, which has yielded three more or less complete dorsal and four more or less complete ventral disks and several fragments of both dorsal and ventral disks.

The piece was collected by the E-N-S-expedition in 1939 on the SE-slope of Lykta, Nathorstdalen in Dicksonfjorden. According to FØYN and HEINTZ (1943) these layers belong to the Lyktan Division of the Wood Bay Series.

#### General description.

##### *Dorsal shield.*

The dorsal shield has definitely been composed of several plates, but so far only the dorsal disk has been found.

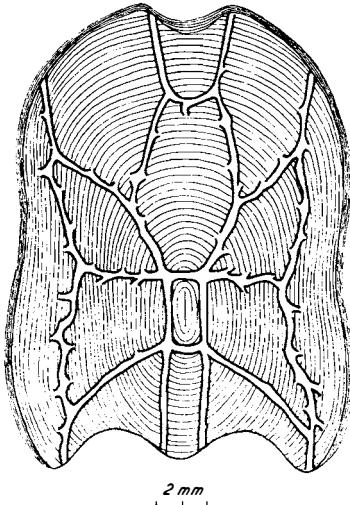


Fig. 1.

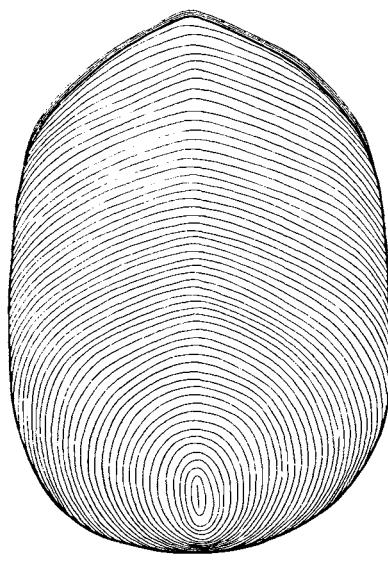


Fig. 2.

Fig. 1. *Pteraspis? lyktensis* sp. nov. Dorsal disk, partly restored, showing the sensory canals, the coarse dentine ridges and the fine lateral rim.

Fig. 2. *Pteraspis? lyktensis* sp. nov. Ventral disk, partly restored, showing the coarse dentine ridges and the fine anterior rim.

#### Dorsal disk.

(Pl. I, A, B, C, D, E. Fig. 1.)

The dorsal disk is more or less flat, slightly curved transversally near the anterior corners. The posterior corners bend slightly inwards near the lateral sides. The lateral sides slightly concave, the posterior corners distinct (Fig. 1) and almost form a right angle. The posterior margin undulated, no distinct dorsal spine seems to have been developed. The anterior corners rounded, forming a blunt angle with the lateral sides, the anterior margin oblique with an oval indentation near the median line. The borders along the lateral and anterior sides are thin and covered with fine dentine ridges (Pl. I, B. Fig. 1) clearly differing from the rest of the disk, which is covered with coarse dentine ridges. These ridges, numbering from 40—50 to each cm, are of more or less the same width on the whole disk, only narrowing slightly towards the lateral and posterior margin. The focus of the ridges is situated about  $\frac{1}{3}$  of the way from the posterior margin. No growthlines have been recorded. The cancellous layer is well developed, the alveole being quite small in the anterior part of the disk, increasing in size further back, especially towards the posterior, median part of the disk. (Pl. I, C, D, E.) The

development of the sensory canals follow the usual pattern found in *Pteraspis*, but a few peculiarities have been recorded. On the dorsal disk there are two pairs of longitudinal canals, the lateral being connected with the median pair by three transverse canals. The posterior transverse canals join the lateral longitudinal canals near the posterior corners of the disk, and the lateral canals obviously continue on to the carapace (Pl. I, A, D. Fig. 1). Both the posterior and the median transverse canals continue medially to join the inner longitudinal canals, the latter near the focus of the shield, the other a little further back. The anterior transverse canals join the lateral longitudinal canals about quarter of the way from the anterior corners. The lateral longitudinal canals obviously continue forwards to the orbital plates. Typical of *Pt. ? lyktenensis* is the fact that the median longitudinal canals anteriorly join an oval loop of the pineal canal which extends down about  $\frac{1}{4}$  of the length of the dorsal disk. (Pl. I, B, D. Fig. 1). The median longitudinal canals thus do not reach the anterior border of the disk, and they are further away from each other in front of the focus, while they further back are quite close together, and leave the dorsal disk on each side of the little, posterior median thickening of the disk. The lateral longitudinal canals run nearly parallel to the lateral sides of the disk, only with an inward curve at the point where the median transverse canals join them. The tubuli connecting the sensory canals with the outer pores branch off at different intervals on both sides of all the sensory canals (Pl. I, C. D. Fig. 1). The tubuli are most numerous at the lateral longitudinal canals between the places where posterior and median canals join them. All sensory canals are coarse, about 0.2 mm in diameter, while the tubuli are finer.

As mentioned, before no other plates have yet been found, but the brim along the anterior and lateral sides of the dorsal disk, indicates that it has been surrounded by other plates.

*Ventral shield. Ventral disk.*

(Pl. II, A. Fig. 2.)

Four practically complete ventral disks and several fragments are known. They show that the ventral disk is about 18—20 mm along the median line, and about 14—16 mm in width at the middle of the disk. The ventral disk is quite strongly arched transversely, especially near the posterior border. The anterior side is oval, the lateral sides being roughly parallel, the posterior margin is transverse, almost forming a right angle with the lateral sides.

The focus of the disk is situated far back, about  $\frac{1}{5}$  of the total length from the posterior margin. The dentine ridges are coarse, numbering from 35—45 ridges to each cm, while the anterior borders are surrounded by a thin rim, with fine dentine ridges (Pl. II, A. Fig. 2). Fragments of the

sensory canals have been found only on two disks, showing that the longitudinal canals run along the lateral sides, sending off short transverse canals at intervals. The sensory canals are less coarse than those on the dorsal disk. No tubuli have yet been recorded.

Neither oral plates, nor scales or impressions of the carapace have so far been found.

*Remarks.*

The development of the sculpture, the sensory canals and the shape of the dorsal and ventral disks, all point towards the present specimens belonging to the genus *Pteraspis*. The fact that they are so small, is however, rather surprising, especially as according to FØYN and HEINTZ (1943) the Lyktan Division of the Wood Bay Series must be compared with lower to middle Lower Devonian layers, that in other places are characterized by rather large Pteraspids. The typical pteraspid of the Lyktan Division is undoubtedly the medium sized *Doryaspis*. The development of its sculpture has made it necessary to separate it as a new genus. But the sculpture in *Pt. ? lyktensis* in addition to the fully developed lateral longitudinal sensory canals make it quite certain that *Pt. ? lyktensis* is not a youth stage of *Doryaspis*.

***Pteraspis ? minor sp. nov.***

Pl. II, B, C. Fig. 3 and 4.

*Diagnosis.*

A very small pteraspid with a long more or less rectangular, nearly flat dorsal disk. The length of the dorsal disk is 14 mm along the median line, and the width is 8 mm. The dentine ridges are coarse, numbering from 45—55 per cm. The posterior median part of the disk is slightly valved, but no distinct dorsal spine seems to have been developed.

The ventral disk is almost oval. The length is 15 mm along the median line, the greatest width is about 10 mm. The anterior part of the disk is triangular.

The sensory canal system on the dorsal disk is distinguished by the fact that the median longitudinal canal coalesce with a rectangular-shaped loop of the pineal canal, which extends down on to the front part of the dorsal disk. The sensory canals are coarse.

*Holotype.*

As holotype is chosen specimen No. A 27842 Pal. Mus. Oslo, (Pl. II, B, C).

*Occurrence and material.*

So far only one nearly complete and one doubtful dorsal disk and two fragmentary ventral disks are known. All four disks of *Pt. ? minor*

have been found on one slab, collected by the E-N-S-expedition in 1939 at the talus on south side of Stjørdalen in Woodfjorden. Unfortunately the information about the place where the piece was found, is not sufficient. But, according to the geological map of this area, (FØYN and HEINTZ (1943)) the layers where the piece was found, either belong to the Lyktan- or Stjørdalen Division of the Wood Bay Series. The piece yields a few other fragments, but they are very difficult to determine. Nevertheless, the one fragment definitely is a part of a ventral disk of a pteraspidian form, though it can hardly belong to the genus *Doryaspis*. As mentioned, *Doryaspis* is a very good guide-fossil for the Lyktan Division. Therefore it is impossible at this stage to determine with certainty to which division these layers belong.

#### General description.

##### *Dorsal shield.*

The dorsal shield of *Pt. ? minor* has definitely been composed of several plates, but so far only the dorsal disk has been found.

##### *Dorsal disk.*

(Pl. III, B. Fig. 3.)

The very small dorsal disk is nearly of a rectangular shape. The disk is more or less flat, only slightly curved transversally and longitudinally. The lateral sides of the disk are parallel. The anterior margin is oval shaped, probably with no sharp anterior corners or inmargination. The posterior margin and corners are rounded. But as parts of the anterior margin are damaged, it is at present impossible to give a full description of this part of the disk. No distinct dorsal spine seems to have been developed, but the posterior, median part of the disk, from the focus to the posterior border, is slightly valved.

The coarse dentine ridges number from 45—55 ridges to each cm. The dentine ridges are only preserved on the central  $\frac{2}{3}$  of the disk, but the ridges seem to have been more or less of the same width all over the disk. The focus of the ridges is situated about  $\frac{1}{3}$  of the way from the posterior border, and in front of the focus the ridges between the two median longitudinal sensory canals form a slight curve (Pl. II, B. Fig. 3.)

The development of the sensory canals is so far only known from the dorsal disk. On this disk two pairs of longitudinal canals are found, the lateral pair being connected with the median by three transverse canals. The posterior transverse canals join the lateral longitudinal canals near the rounded posterior corners, and it may be assumed that the lateral longitudinal canals have continued on to the carapace. Both the posterior and the median transverse canals continue medianly and join the two

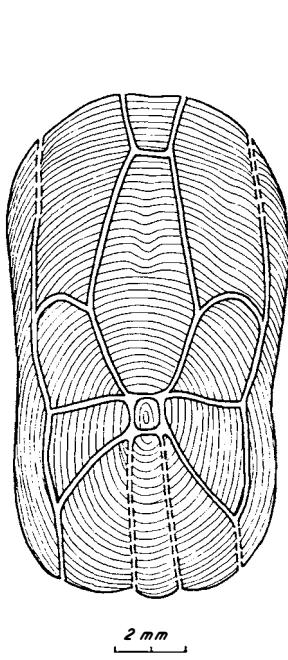


Fig. 3.

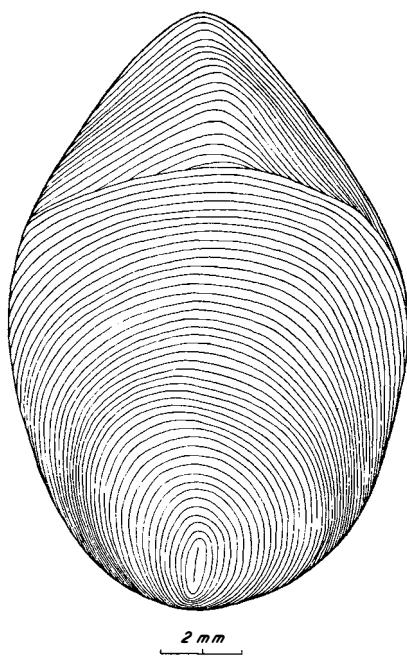


Fig. 4.

Fig. 3. *Pteraspis ? minor* sp. nov. Dorsal disk. Partly restored, showing the sensory canals and the coarse dentine ridges. These parts of the sensory canals, indicated by a dotted line, are not known.

Fig. 4. *Pteraspis ? minor* sp. nov. Ventral disk, partly restored. Showing the characteristic development of the dentine ridges in the triangular front part of the disk.

median longitudinal canals. In this way the sensory canals form a square that just surrounds the focus of the disk. The anterior transverse canals coalesce the lateral and median longitudinal canals about half way between the focus and the point where the median longitudinal canals join the pineal canal which extends from the anterior plates.

The lateral longitudinal canals are nearly parallel to the lateral sides of the disk. They definitely continue forwards to the orbital plates. The median longitudinal canals are slightly curved, with an outward curve where the anterior transverse canals leave the longitudinal canals. On the present dorsal disk no continuation of the median longitudinal canals behind the place where these and the posterior transverse canals join, is found, as this part of the disk is partly damaged. This may, however, be expected to be found on other well preserved specimens. The loop of the pineal canal, which extends down on to the dorsal disk from the rostral (pineal) plates, is of a rectangular shape, and goes down about  $\frac{1}{6}$  of the

length of the disk. The sensory canals are coarse, about 0.15—0.20 mm in diameter. No tubuli are found, but, as previously mentioned, the state of preservation is rather poor, and the finer structures have not been preserved.

*Ventral shield. Ventral disk.*

(Pl. II, C. Fig. 4.)

Two fragmentary ventral disks are known showing that the disk is quite flat, only slightly arched posteriorly which may be due to the crushing. The posterior corners are rounded, whereas the lateral sides are nearly parallel, diverging slightly forwards. The anterior part of the disk is triangular, the two anterior margins forming a sharp angle. The focus is situated very far back, close to the posterior margin. The dentine ridges in the front part of the disk follow the anterior margin, thus being of a triangular shape, a feature which is not found in other Pteraspids (Fig. 4). The dentine ridges are coarse, numbering from 45—55 to each cm. No traces of the sensory canals have as yet been found on the ventral disk.

*Remarks.*

The present species is surprisingly small, but our specimen of *Pt. ? minor* is obviously adult because of the presence of the lateral longitudinal canals. The shape of the dorsal disk and the development of the sensory canals point towards this species belonging to the genus *Pteraspis*. On the other hand, the development of the dentine ridges on the ventral disk is quite unusual, and, when the coarseness of the dentine ridges also is taken into account, it seems rather doubtful that this species can be referred to the genus *Pteraspis*.

### Discussion.

In his diagnosis of the genus *Pteraspis*, WHITE (1935) among other things says: "Pteraspids with dorsal shield moderately broad, depressed anteriorly, but arched behind . . . Dorsal spine prominent and usually large. Ridges of superficial "ornamentation" entire and crenulated. All three layers of plates and scales well developed. Outer and inner longitudinal sensory canals of dorsal disk complete, transversing length of plate and connected by three transverse canals radiating from focus of "ornamentation"."

The most marked difference between this diagnosis and the two new species *Pt. ? lyktenensis* and *Pt. ? minor* is the fact that both the latter forms do not have a distinct dorsal spine, and that the dentine ridges of the superficial "ornamentation" is not crenulated. All hitherto known

members of the genus *Pteraspis* have a larger or smaller spine, perhaps with the exception of *Pt. gosseleti*. LERICHE (1906) asserts that in this species the spine is lacking, but nevertheless from his figures (particularly Fig. 9) it seems that a socket for the spine is developed. This marked difference from all other *Pteraspis*-forms may justify considering *Pt. ? lyktensis* and *Pt. ? minor* as belonging to a separate subgenus. But until more material is available, this question cannot be definitely answered.

If the two new species are placed in the same subgenus, this will not only be due to the fact that both lack a dorsal spine and crenulated superficial "ornamentation". The great resemblance when it comes to the "ornamentation" (dentine ridges) and the development of the sensory canals also seem to indicate a close relationship. The peculiar coarse ornamentation is unknown in other *Pteraspis*-species, whereas it is very much the same in *Pt. ? lyktensis* and *Pt. ? minor*.

Both species are also very small, and are, as far as I can see from the literature, the smallest hitherto known Pteraspids. It is surprising that these small forms first appear in the Lykton Division, as the general trend of *Pteraspis* seems to be that the younger forms — geologically speaking — usually are larger than the elder ones. The large form *Pt. dunensis*, for instance, is known from the middle Under Devonian layers in the Rhine-district, from Podolien we have among others *Pt. longirostra*, *Pt. elongata* and *Pt. magnipinealis* and from U.S.A. *Pt. gigantea*, all from the same time.

*Pt. ? lyktensis* and *Pt. ? minor* can hardly be considered as stunted forms owing to extremely poor living conditions, as they are found together with the medium-sized pteraspid *Doryaspis* and a number of Cephalaspids and Arthrodires, none of which are particularly small, rather quite the contrary. Generally speaking, however, the fauna of the Lykton Division is fairly poor, and less favourable living conditions may have contributed to this.

The fact that our two new species are so small, may also indicate that they actually are elder forms which ought rather to be considered as relicts from earlier periods, and which for some reason have managed to live on in this special area. If, however, we study the two other hitherto described *Pteraspis*-forms from Spitsbergen, i. e. *Pt. vogti* and *Pt. primavea*, both from the Red Bay Series, they are both considerably larger than *Pt. ? lyktensis* and *Pt. ? minor*. But among other, not yet described Pteraspids, both from the Red Bay Series and Kapp Kjeldsen Division of Wood Bay Series, are found several quite small forms. KIÆR in his manuscript mentions 3 small new species, none of them, however, being so small as *Pt. ? lyktensis* and *Pt. ? minor*.

Both *Pt. vogti* and *Pt. primavea* have well developed dorsal spines, while the development of the sensory canals is more primitive, as the two

median longitudinal canals do not reach to the front part of the dorsal disk and do not join the pineal canal which forms a V-shaped loop on the dorsal disk. This connection, however, is found in *Pt. ? lyktenensis* and *Pt. ? minor*, and makes it reasonable to assume that, in spite of their small size, they must be considered as fairly highly developed forms and hardly as relic forms.

Apart from the small material, also the lack of other plates, as for instance orbital, rostral, branchial, pineal and cornual plates, at present makes it impossible to learn any more about the relationship between the two newly described species and the other *Pteraspis*-forms. Another obstacle is the insufficient knowledge of the *Pteraspis* fauna of Spitsbergen. I would therefore suggest that the two new species for the time being be included in the genus *Pteraspis*, with reservation being made that when more extensive material is available, it may prove necessary to place them in another subgenus or even genus.

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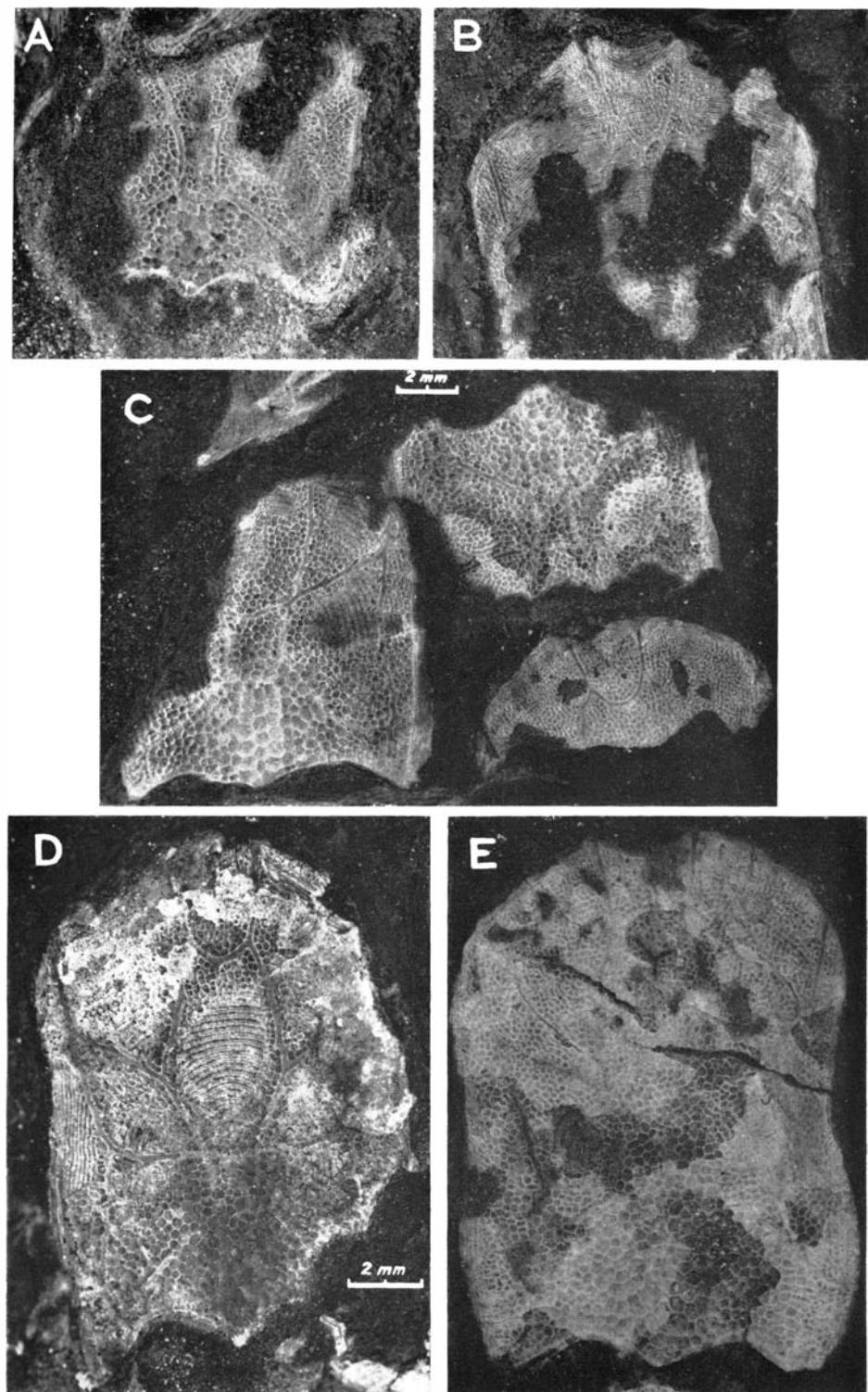
P L A T E S

Pl. I.

- A. *Pt. ?lyktensis* sp. nov. Posterior part of dorsal disk. The cancellous layer with the sensory canals is exposed.
- B. *Pt. ?lyktensis* sp. nov. Front part of dorsal disk.
- C. *Pt. ?lyktensis* sp. nov. Three fragments of dorsal disks, in all of which the cancellous layer is exposed.
- D. *Pt. ?lyktensis* sp. nov. Holotype. No. A 27840. Pal. Mus. Oslo. Dorsal disk with the cancellous layer and the sensory canals partly exposed.
- E. *Pt. ?lyktensis* sp. nov. Dorsal disk, with the cancellous layer exposed.

Pl. II.

- A. *Pt. ?lyktensis* sp. nov. Ventral disk. On the left side of the disk a small fragment of the sensory canal can be seen. (Marked with a cross.)
- B. *Pt. ?minor* sp. nov. Dorsal disk.
- C. *Pt. ?minor* sp. nov. Ventral disk, partly damaged.



Pl. II.

A



2 mm

B



2 mm

C



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