

SVERIGES GEOLOGISKA UNDERSÖKNING

SER. C.

Avhandlingar och uppsatser.

N:o 421.

ÅRSBOK 33 (1939) N:o 1.

ON SWEDISH
CAMBRIAN ASAPHIDAE

BY

A. H. WESTERGÅRD

WITH THREE PLATES

Pris 1.00 kr.

STOCKHOLM 1939
KUNGL. BOKTRYCKERIET. P. A. NORSTEDT & SÖNER
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Abstract. — Three new asaphids, one referable to *Niobella* REED and two placed in the new genus *Promegalaspides*, are described, discussed, and illustrated. All originate from the Upper Cambrian, zone of *Peltura scarabaeoides* (WAHLENBERG), at Råbäck, Kinnekulle, Västergötland.

Representatives of different asaphidian genera occurring sporadically in the Upper Cambrian¹ of Sweden have been known for a long time past. As the first described and at the same time the oldest we should possibly mention *Liostracus* (?) *superstes* LINNARSSON (1875) from the zone of *Orusia lenticularis* (subzone of *Parabolina brevispina* and *Protopeltura aciculata*) at Andrarum, Scania, which Kobayashi in 1936 included in the Asaphidae and designated as the type of the new genus *Eoasaphus* (= *Anorina* WHITEHOUSE, 1936). The relegation of this species to the family mentioned may be right though our knowledge of it is imperfect. Thus we are ignorant of the ventral behaviour of the facial sutures and also of the hypostoma, and it may further be noted that the forwardly tapering glabella is a characteristic alien to the typical asaphids.² The following Cambrian specimens doubtlessly referable to some genus or other of the Asaphidae have so far been recorded from Sweden.

Megalaspis cf. *planilimbata* ANGELIN, hypostoma, zone of *Peltura scarabaeoides*, Andrarum, Scania (Persson, 1904, p. 513, pl. 9, fig. 27).

Niobe sp., abundant fragments in an orsten (black bituminous limestone) lens within the *Acerocare* zone at Järrestad, Scania (Fearnsides, 1907, p. 262. Mentioned, not described or depicted).

Niobe primaeva WESTERGÅRD, cranidium (and pygidium?), zone of *Acerocare*, Sandby, Scania (mentioned by Moberg, 1900, p. 532; described and figured by Westergård, 1909, p. 52, pl. 1, figs. 23, 24).

Megalaspis n. sp., pygidium, associated with the preceding species (mentioned by Moberg in Moberg & Möller, 1898, p. 215; described and figured by Westergård, 1909, p. 53, pl. 1, fig. 25).

Megalaspis (?) sp., pygidium, zone of *Acerocare*, Sandby, Scania (Westergård, 1909, p. 54, pl. 1, fig. 27).

Megalaspis (?) sp., two associated pygidia, zone of *Acerocare*, Järrestad, Scania (Westergård, 1909, p. 54, pl. 1, fig. 26).

Niobe primaeva WESTERGÅRD (?), cranidium and pygidium, upper part of the *Peltura* zone — the cranidium at least from the subzone of *Parabolina longicornis* — at Råbäck, Västergötland (Westergård, 1922, p. 180, pl. 2, figs. 25, 26).

¹ According to the current opinion of modern Scandinavian geologists the boundary between the Cambrian and Ordovician Systems is drawn at the base of the Dictyonema Shale.

² *Eoasaphus superstes* is still known only from the holotype, a rather complete dorsal shield (except for the free cheeks). It was refigured by Westergård, 1922, pl. II, fig. 20.

Megalapsis sp., hypostoma, associated with the preceding cranidium (Westergård, 1922, p. 180, pl. 2, fig. 28).

Megalaspis (?) spp., two different pygidia, upper part of the *Peltura* zone, Råbäck, Västergötland (Westergård, 1922, p. 180, pl. 2, figs. 30, 31).

All these specimens are obviously too fragmentary to allow of safe generic references. However, subsequent to the present writer's memoir »Sveriges Olenidskiffer» being published in 1922, a beautifully preserved material of three asaphids belonging to the genera *Niobella* REED and *Promegalaspides* gen. n. has been collected from the *Peltura* beds at Råbäck — the bulk by workmen at the alum shale quarry — and with the aid of this material some of the earlier finds can be more definitely determined. These species, described below, are possibly the oldest true Asaphidae so far made known, if we omit forms whose reference to this family is uncertain or disputed, such as the imperfectly known *Eoasaphus* and the fairly remote Middle Cambrian *Ogygopsis* (cf. Walcott, 1916, p. 377, pl. 66, figs. 1, 1 a—b, and Warburg, 1925, p. 65).

Family **Asaphidae** BURMEISTER.

Subfamily **Asaphinae** RAYMOND.

Genus **Promegalaspides** nov.

Genotype: *Promegalaspides kinnekullensis* sp. n.

D i a g n o s i s. — Asaphinae with well-defined narrow axial lobe, depressed narrow border on cephalon and pygidium, niobiform facial sutures (i. e. marginal in front), long glabella, genal spines, pygidium with furrowed pleural ribs, and hypostoma with well developed forks.

C o m p a r i s o n s. — *Promegalaspides kinnekullensis* displays characteristics appearing in various combinations in several of the early Ordovician asaphidian genera, especially in *Megalaspides*, *Niobe*, *Niobella*, and *Megalaspis*. In the cephalon it is of the same type as *Niobe* and *Niobella*, save that the genal angles are elongated into spines. In this feature it resembles *Megalaspis* and *Megalaspides* which on the other hand are distinguished by isoteliform facial sutures (intramarginal in front) an shorter and faintly outlined glabella. As regards the furrowed pleural ribs of the pygidium, *Promegalaspides* recalls the two latter genera, but in the depressed border and well-defined and prominent axis it is distinct from *Megalaspides*. In the hypostoma it stands especially close to *Megalaspides* and approaches *Niobe (pars)* but is radically distinct from *Megalaspis* and *Niobella*.

The long pleural spines of the last thoracic segment is a characteristic which does not seem to be known from any other asaphid. It should be remarked, however, that the present writer has observed detached segments with long pleural spines — in all probability belonging to some asaphid, but certainly

not to *Megalaspides dalecarlicus* (HOLM) — in the zone of *Megalaspis planilimbata* at several localities in Sweden.

The general aspect of *Promegalaspides* differs rather strongly from that of *Megalaspides*, nevertheless the former probably descended from the same stem as the latter. *Promegalaspides* is more primitive than *Megalaspides* in the well-defined axial furrows and prominent axial lobe, the long glabella, the niobiform facial sutures, and the distinctly ribbed lateral lobes of the pygidium. It is the only Cambrian genus of the Asaphinae so far described, and, as is the case of *Basilicus* (in the restricted sense by Raymond and Reed), it differs from other genera of the subfamily in having niobiform instead of isoteliform facial sutures.

In addition to the genotype but one more form, *P. pelturae* sp. n., can at present be included in *Promegalaspides*. Both originate from the zone of *Peltura scarabaeoides*.

Promegalaspides kinnekullensis sp. n.

Pl. I, figs. 1—3.

?1922. *Megalaspis* (?) sp., Westergård, Sver. Geol. Unders., Ser. Ca, No. 18, p. 180, pl. 2, fig. 31.
(Fig. of pygidium from the Peltura beds at Råbäck, Västergötland).

Description. — Dorsal shield subovate in outline, moderately arched; axial furrows well-defined; pleural lobes broad.

Cephalon of the same length as the pygidium, broader than the latter, semicircular in outline with the genal angles produced into fairly strong spines. Facial sutures niobiform, meeting at the frontal margin in a very blunt, almost imperceptible angle indicating that the sutures are not strictly marginal but almost so (as in several species of *Niobe*), continuing into the median suture across the doublure. Outer border moderate in breadth, gently convex in front of the glabella and gently concave in the anterior portion of the free cheeks; posterior border well-defined. Glabella large, reaching to the border, subrectangular with rounded anterior corners, inconsiderably contracted between the palpebral lobes, marked by four pairs of short and very faint furrows, bearing a small median tubercle between the posterior pair of furrows. Occipital furrow distinct but shallow in the centre, almost obliterated and turning slightly forward at the sides. Occipital ring smooth, with a pair of weak oblique furrows at the sides delimiting a pair of triangular lobes. Palpebral lobes rather small, at about an equal distance from the outer and posterior margins of the cephalon and close to the axial furrows; postero-lateral limbs of the fixed cheeks about three-fourths as wide as the occipital ring. Free cheeks broad.

Thorax with eight segments; axis narrow, prominent; pleural lobes markedly broader than the axis with a pronounced fulcrum a little outside their midst, horizontal within the fulcrum; pleural furrows strong, extending across from the anterior inner side of the pleuron to the posterior outer side; pleural terminations in the anterior segments pointed, in the middle and posterior form.

ing short, slightly falcate spines, and in the last segment prolonged into slender backwardly curved spines extending far behind the pygidium.

Pygidium semi-elliptical in outline, with a depressed narrow border and a well-defined annulated axial lobe; seven or eight axial rings are discernible of which only the three anterior are distinctly separated by shallow furrows; lateral lobes with six ribs separated by well-marked pleural furrows; rib-furrows weak on the outer surface of the test. Doublure narrow, of uniform breadth.

Hypostoma elongate, nearly parallel-sided, bifurcated, with the posterior limbs broad and rounded; central body somewhat pyriform, with a large convex anterior lobe separated from the very short posterior lobe by a shallow furrow.

Test smooth and glossy, striated on the genal spines, doublure, and hypostoma, under a strong lens extremely finely punctate throughout the dorsal shield.

D i m e n s i o n s. — The holotype, a complete almost full-grown specimen retaining the natural convexity, is 49 mm long (cranium 16, thorax 18, pygidium 15 mm) and 29 mm across the thorax. The largest cranium found is 20 mm long, indicating a total length of about 60 mm.

H o r i z o n a n d L o c a l i t y. — The holotype is associated with *Peltura scarabaeoides* alone which is in accordance with a statement by the collector that it was taken from a layer 4—5 m above the »thick stinkstone layer» (zone of *Olenus* and adjacent zones), i. e. within the subzone of *Peltura scarabaeoides* and *Sphaerophthalmus alatus*. The pygidium mentioned above was recorded by the present writer in 1922 from the subzone of *Parabolina longicornis*. It seems more likely, however, that this statement is wrong due to vague information of the collector and that also this specimen was in reality found in a layer within the subjacent subzone (cf. Westergård, 1922, pp. 53 and 77). — Råbäck, Kinnekulle, Västergötland.

Promegalaspides pelturae sp. n.

Pl. II, figs. 3—6.

R e m a r k s. — Two cranidia of young individuals, a pygidium with a small part of the thorax attached, and an imperfect hypostoma are present. They were all found in one small slab, and in all probability they belong to one species congeneric with the one just described but specifically distinct. The following differences may be noted. In *P. pelturae* the preglabellar area is broader and gently concave instead of convex, and the anterior margin is slightly more angulate, the palpebral lobes are larger, and the fixed cheeks slightly broader, dissimilarities which may be actual and not due to different stages of growth. The last thoracic segment has the same peculiar shape as in the genotype but the two preceding segments differ in having blunt pleural terminations instead of short spines — in the last but one segment the posterior corner projects into a very weak point and in the one next in order the end

is evenly rounded. In the pygidium the rib furrows are more strongly marked. The hypostoma displays no essential difference from that of the genotype so far as a comparison is possible.

The pygidium, probably of a full-grown specimen, is the holotype; it measures 17.5 mm in length and 24 mm in breadth.

Horizon and Locality. — The species is associated with *Peltura scarabaeoides* and *Sphaerophthalmus alatus*; no other species has been observed in the slab. Thus we may conclude that the slab originates from a layer within the subzone characterized by these two species, i. e. from about the same level as the genotype. — Råbäck, Kinnekulle, Västergötland.

Subfamily **Ogygiocarinae** RAYMOND.

Genus **Niobella** REED, 1931.

Genotype: *Niobe homfrayi* SALTER, 1866.

»The chief reason for the separation of this species [*Niobe homfrayi*] from *Niobe*, sens. str., and for its relegation to a distinct new genus is the shape of the hypostome, for instead of being broad and subquadrate or expanded posteriorly, and with an emargination in the posterior margin, that of *Niobella* is more like that of *Ogyginus*» [RAYMOND, with *Asaphus corndensis* MURCHISON as genotype] (Reed, 1931, p. 463).

In addition to the genotype Reed included *N. selwynii* (SALTER, 1852) in this genus, and in 1933 Stubblefield added *N. homfrayi smithi* STUBBLEFIELD. All these forms originate from the Tremadoc of Great Britain. The species described below occurs in the *Peltura* zone and is thus rather much older. Whether also *Niobe primaeva* WESTERGÅRD (1909) — known only from a cranidium (and a pygidium?), both fragmentary, from the *Acerocare* zone at Sandby, Scania — possibly is congeneric with *Niobella*, must at present be left undecided.

Niobella aurora sp. n.

Pl. II, figs. 1—2; pl. III.

- ? 1904. *Megalaspis* cfr. *planilimbata* ANGELIN, Persson, Geol. Fören. Förh., Bd. 26, p. 513, pl. 9, fig. 27. (Fig. of a hypostoma from the *Peltura* zone at Andrarum, Scania).
1922. *Niobe primaeva* WESTERGÅRD (?), Westergård, Sver. Geol. Unders., Ser. Ca, No. 18, p. 180, pl. 2, figs. 25, 26. (Figs. of fragmentary cranidium and pygidium from the *Peltura* zone at Råbäck, Kinnekulle, Västergötland).
1922. *Megalaspis* sp., Westergård, *ibid.*, p. 180, pl. 2, fig. 28. (Fig. of hypostoma associated with the above-mentioned cranidium from Råbäck).

Description. — Dorsal shield subelliptical in outline, tapering considerably backwards, almost twice as long as broad, moderately convex. Cephalon slightly broader and longer than the pygidium, semicircular in outline, with rounded genal angles. Facial sutures niobiform, meeting on the front

margin in an almost imperceptible angle. Glabella occupies almost half the breadth of the cranidium at the posterior border, subcylindrical, slightly widened posteriorly and inconsiderably constricted between the eye lobes, with rounded anterior corners and truncate front, extends to the frontal border; glabellar furrows four pairs, very weak, marked mainly as linear interruptions in the sculpture of the test, radiating from the palpebral lobes. Occipital furrow faint, obliterated at the sides. Palpebral lobes of moderate size, at an equal distance from the anterior and posterior margins of the cephalon and close to the glabella.

Thorax with eight segments. Axis convex, bounded by straight axial furrows, occupies in the first segment one-third, in the last segment a little more than one-fourth the total breadth. Pleura horizontal interiorly, sloping rather strongly exteriorly, deeply furrowed, with well-developed articulation facets; fulcrum in the first segment a very short distance from the dorsal furrow, in the last segment approaching the middle of the pleuron; pleural extremities evenly rounded in the anterior segments, truncated in the rear segments.

Pygidium semicircular, with well-defined axis and broad flat border of uniform width. Axis with 6 or 7 rings of which only the two anterior are well-defined, extends to the middle of the border. Furrows and ribs of the lateral lobes weak. Doublure somewhat broader than the flat border, uniform in breadth.

Hypostoma suboval, with subparallel sides and continuously rounded posterior margin, and small anterior wings.

Test of the dorsal shield displays very faint and closely set dichotomous and anastomosing ridges on the anterior portion of the glabella, posterior portion of the free cheeks, axial rings, and exterior parts of the pleura; otherwise smooth, under a strong lens finely punctate.

D i m e n s i o n s . — The holotype, a full-grown complete specimen in full relief, is 59 mm long (cephalon 20, thorax 21, pygidium 18 mm) and 33 mm broad across the first thoracic segment. The largest specimen found is 60 mm long.

R e m a r k s a n d C o m p a r i s o n s . — An almost complete specimen displays the hypostoma *in situ*.

Originally this form was tentatively identified as *Niobe* [*Niobella?*] *primaeva* WESTERGÅRD, the identification being based on a few fragments only. Since then a better material of the former — twelve wholly or almost complete specimens in addition to a number of fragments — has been collected at the type locality, which seems to indicate that it should be considered an independent species. Thus the anterior margin of the cranidium is less angulate in *Niobella aurora* than in *N. (?) primaeva*, the network of fine ridges — a constant characteristic in the former — is absent in the latter (and the pygidium is slightly less convex in the latter than in the former). As moreover the forms originate from different zones they may be considered specifically distinct at least with our present imperfect knowledge of *N. (?) primaeva*.

The hypostoma in shale from the Peltura zone at Andrarum, identified by

Persson (1904) as *Megalaspis* cf. *planilimbata*, possibly belongs to *N. aurora*, the small dissimilarities being apparent and due merely to different modes of preservation.

N. aurora differs from *N. homfrayi*, the genotype, mainly in the following characteristics: in the former the glabella is less constricted between the palpebral lobes, the occipital furrow is fainter, the segmentation of the pygidium is less pronounced, and the posterior margin of the hypostoma is rounded instead of angulate. — In several characteristics *N. aurora* compares fairly well also with the Tremadocian *Hemigyraspis affinis* (M'COY) as described and depicted by Salter (cf. Salter, 1864—1883, p. 164, pl. 24, figs. 13, 14).

H O R I Z O N a n d L o c a l i t y . — The present writer has collected *N. aurora* from the topmost layer of the zone of *Peltura scarabaeoides*, i. e. the subzone of *Parabolinella longicornis*, in the alum shale quarry at Råbäck, Kinnekulle, Västergötland. In most of the material present *Peltura scarabaeoides* is the only associated species which may indicate that the species appears already in the underlying subzone.

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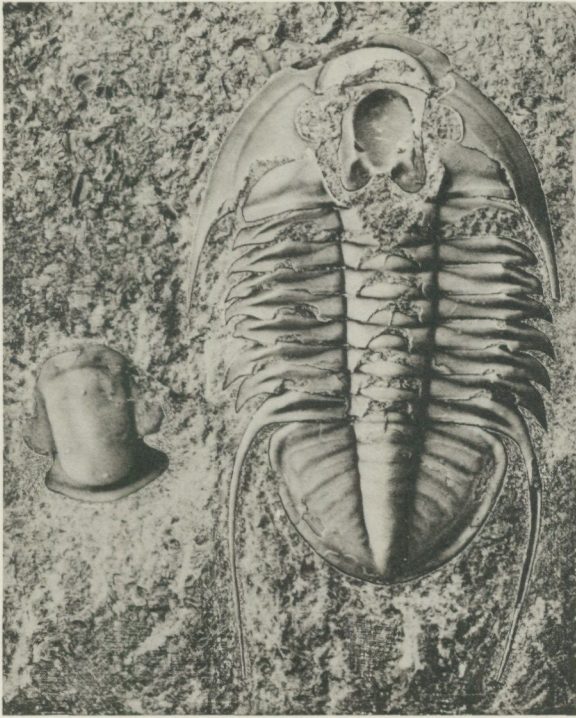
Explanation of Plates.

All specimens are preserved in limestone (orsten) and retain their natural convexity. They originate from the zone of *Peltura scarabaeoides* at Råbäck, Kinnekulle, Västergötland, and belong to the Geological Survey of Sweden.

PLATE I.

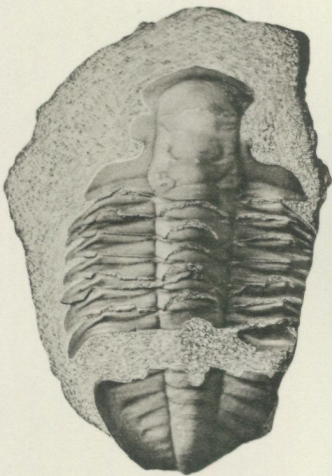
Promegaspides kinnekullensis gen. et sp. n.

- Fig. 1. Complete specimen, with the hypostoma *in situ*, and a detached fragmentary cranium. The former is the H o l o t y p e. — $\times 1.5$.
- Fig. 2. Free cheek with the eye attached. Associated with the holotype. — $\times 2$.
- Figs. 3 a, b. Rather complete specimen in different aspects. Presented by Mr. Albert Karlsson Ygger to the Geological Survey. — Nat. size.



1

x1.5



3 a



3 b



2

x2

C. Larsson photo.

PLATE II.

Niobella aurora sp. n.

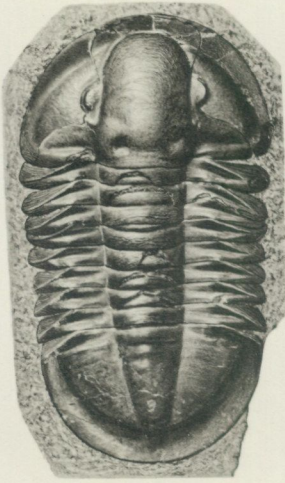
- Figs. 1 a, b. Complete specimen in different aspects. H o l o t y p e, nat. size.
— Fig. 1 c, part of cephalon and thorax enlarged four times to show the sculpture of the test.
- Fig. 2. Hypostoma, associated with the specimens on Pl. III. — $\times 3$.

Promegalaspides pelturae gen. et sp. n.

- Figs. 3, 4. Cranidia of young individuals. — $\times 4$.
- Fig. 5. Pygidium with parts of the three posterior thoracic segments attached. H o l o t y p e. — $\times 1.5$.
- Fig. 6. Hypostoma. — $\times 4$.

Figs. 3—6 were collected from one slab.

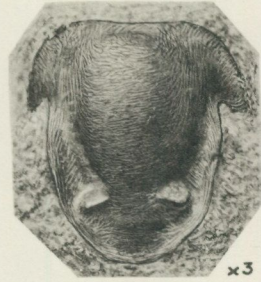
All the specimens were presented by Dr. Nils Ahlström, Borås, to the Geological Survey.



1 a



1 b

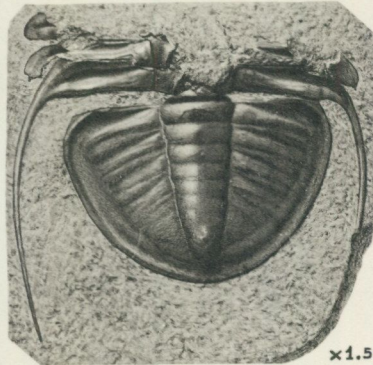


2



1 c

x4



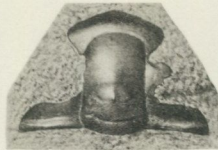
5

x1.5



3

x4



4

x4



6

x4

J. W. Englund photo & ret.

A.-B. Kartografiska Institutet
Esselte ab. Stockholm

PLATE III.

Niobella aurora sp. n.

Several complete specimens. Presented by Dr. Nils Ahlström, Borås,
to the Geological Survey. — Nat. size.



C. Larsson photo.

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