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The post-cephalic morphology of the middle Ordovician trilobite *Prionocheilus narinosus* from the central Oslo Region, Norway

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The thorax and pygidium of the rare middle Ordovician (*clingani* graptolite zone) trilobite *Prionocheilus narinosus* (Siveter, 1977) are described from a nearly complete specimen found at Ringåsen, Norderhov, Ringerike District, Oslo Region. This is the first known association of cranidium, thorax and pygidium of this species and this new record also extends its geographic distribution. It may be a junior synonym of *P. foveolatum* (Törnquist, 1884).

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Introduction

The rare trilobite *Prionocheilus narinosus* (Siveter, 1977) was previously known only from three cranidia from the Oslo-Asker District. Although a fourth cranidium was figured by Owen & Bruton 1980, I consider this to belong to *P. foveolatum* (Törnquist, 1884) (see below for further discussion). In the collections of the Swedish Museum of Natural History, Stockholm, I discovered a dorsal exoskeleton belonging to *P. narinosus,* that lacks only free cheeks and the posterior extremity of the pygidium. This specimen is illustrated and described here to provide a more complete image of this species. The specimen was collected by Gerhard Holm from the Ringerike District in 1879.

The new specimen was found on Ringåsen, Ringerike, close to Norderhov church, 5 km SE of Hønefoss. A map indicating the location of Norderhov church can be found in Owen (1978, p. 246). The precise stratigraphical horizon of the specimen is unknown. According to Kiær's map (1908, map I), this area is Upper Ordovician, and no more detailed maps have been published. The other three known specimens are all from the uppermost part of the Solvang Formation (of latest Caradoc age; see Owen et al. 1990, p. 24) at Raudskjer and Kalvøya in the Oslo-Asker District. There is no reason to believe that the present specimen came from a different horizon. The Solvang Formation, which is one of the most fossiliferous units in the Oslo Region, is a transgressive sequence and the uppermost part was probably deposited in relatively shallow water. In Oslo-Asker, the top of the formation becomes younger towards the west and thinner towards the east (Bruton & Owen 1979). The lithology consists of bedded and irregularly nodular limestone in the lower parts, but on Raudskjer and Kalvøya in the west, the uppermost 1 metre consists of planar limestone beds. Two of the specimens of *P. narinosum* were found at the lower boundary of these planar beds at Kalvøya (Siveter 1977, p. 347), while the exact level of the holotype is unknown. The species is not known from further east. This indicates that the species may have a very short time-range and that it occurs only in relatively high-energy environments.

Systematic Palaeontology

Abbreviations used. – PMO – Natural History Museum, University of Oslo, Section for Geology; NRM – Swedish Museum of Natural History, Stockholm.

Family PHAROSTOMATIDAE Hupé, 1953
Genus *Prionocheilus* Rouault, 1847

Type species. – By original designation: *Prionocheilus verneuili* Rouault, 1847, p. 32, pl. 3: 3, 31, from Upper Ordovician strata at Poligné, Brittany, France.

Remarks – As noted by Dean (1964), *Prionocheilus* Rouault, 1847, is the senior synonym of *Pharostoma* Hawle & Corda, 1847, while Whittington (1965) made the case that *Prionocheilus* should be considered a *nomen oblitum*. Siveter (1977) agreed with Whittington, but Ingham (1977) followed Dean's proposal, arguing that the generic name actually had been in use by some authors of primary zoological literature during the past fifty

years. At the time of the publication of Owen & Bruton´s paper (1980), the case for suppression of *Prionocheilus* had not been put before the Commission of Zoological Nomenclature, and I have not been able to find any later discussion of this question. All authors subsequent to Ingham (1977) have used *Prionocheilus,* so it now seems appropriate to continue with this name.

*Prionocheilus narinosus (*Siveter, 1977)

1977 *Pharostoma narinosum* n. sp.; Siveter, p. 344, fig. 3.
non 1980 *Prionocheilus narinosus* (Siveter); Owen & Bruton, p. 32, pl. 9, fig. 12.

Holotype – Incomplete cranidium PMO 81266, from the upper Solvang Formation at Raudskjær, Oslo-Asker District. Figured by Siveter (1977, fig. 3A-D).

Other material – Incomplete cranidia PMO 91448, 91449; almost complete carapace NRM Ar38163 (described herein).

Description – The cranidium of this species was described by Siveter (1977, p. 344), who also figured the three previously known specimens, all cranidia. The cranidium of the new specimen does not differ much from these specimens, except in having a more medially projecting outline of the anterior cranidial margin, and in that the anterior border apparently narrows (exsag.) more quickly abaxially, but I suspect both of these differences are caused by incomplete preservation of the anterior border. The size of the cranidium of the present specimen is almost equal to that of the holotype (2 cm long). The cranidial length is estimated to be about 1/3 of the total carapace length, while the pygidium occupies an estimated 17% of carapace length. The whole carapace is covered with small tubercles without any specific pattern, except that they seem to be arranged in radial rows along the periphery of the cranidium. The tubercles also seem to be more closely spaced on the axial part of the animal than on its lateral parts.

The thorax consists of 13 segments; the axis occupies 32% of the total width just behind the cranidium, narrowing to 29% anterior to the pygidium. The articulating half-rings are as long (sag.) as the length of the axial ring (as seen below broken parts of the axial rings), indicating the possibility of a large degree of ventral flexure, facilitating at least a large degree of enrollment. The posterior edge of the axial ring overlaps the articulating half-ring almost

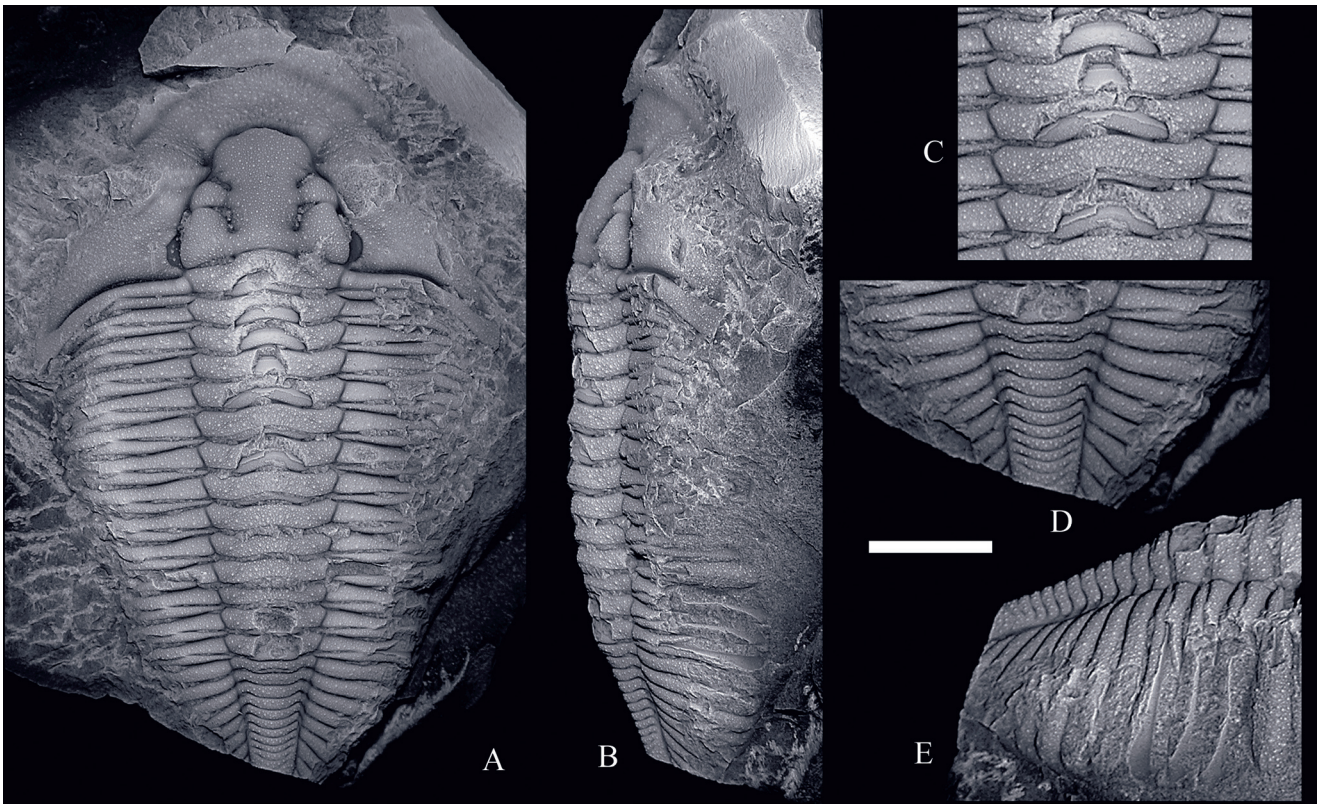

Fig. 1. Prionocheilus narinosum (Siveter, 1977). Dorsal exoskeleton lacking free cheeks and posterior margin (NRM Ar 38163) from Ringsåsen, Ringerike, probably from the uppermost Solvang Formation. Scale bar (figs. A-B) = 1 cm, (figs. C-E) = 0,75 cm. A: Dorsal view. B: Lateral view, slightly tilted towards the camera. C: Enlarged view of thoracic segments 3-8. Note the sagittal length and the smooth surfaces of the articulating half-rings. D: Enlarged dorsal view of pygidium. Note the non-functional half-ring centrally on the anterior axial ring, and also, faintly, on the second axial ring. E: Enlarged lateral view of pygidium. Note the molds of the doublure on the posteriorly rounded pleural tips.

completely, but there is room for a small amount of dorsal flexure, probably only about 1° in each thoracic segment, adding up to about 10-20° altogether. The pleural region has an almost even width (transv.) along the whole thorax, and is only slightly wider at its mid-length. The inner half of each pleura is horizontal, the outer half descends steeply. The pleural furrows slope backwards at an angle of about 10°, while the pleurae themselves are more or less transverse to the axis. The pleurae are only weakly fulcrate and have an even width (exsag.) down to their tips, and though their distal parts are not well preserved, the postero-distal margins of some appear to be rounded. The doublure of the posterior thoracic pleurae is observable as a mould, its inner boundary being positioned about the point where the pleurae turn downwards.

The pygidium seems to be triangular in outline and has a length/width ratio estimated at 3/5. The axis occupies about 1/3 of the total width, tapers evenly and has 11 preserved transaxial furrows, which become very short (transv.) and shallow in the posterior part. The first axial ring has a small, transaxial furrow apparently delimiting a non-functional articulating half-ring, and the second ring also shows extremely faint traces of such a furrow. The pleural furrows bend slightly anteriorly half-way across the horizontal part of the pleural region. The outer lateral part of the pleural region slopes steeply downwards. There is no clear inner boundary of the doublure. The posterior part of the pygidium is not preserved.

Remarks – P. narinosum (from the upper *clingani* graptolite zone) belongs to a group of Middle Ordovician species which also comprises *P. foveolatum* (Törnquist, 1884) (upper *clingani* zone) *P. nieszkowskii* (Schmidt, 1894) from the Kukruse Stage (*gracilis* zone) of Estonia and *P. simile* (Thorslund, 1940) from the *gracilis* or *multidens* zones of Jämtland, Sweden. The species within the group seem to be quite closely related to each other, mainly differing in the length and convexity of the preglabellar field and anterior border (long and low in *P. narinosum*, short and convex in *P. nieszkowskii*, and both long and convex in the others) as well as the pygidial Length/Width ratio (largest in *P. nieszkowskii,* large in *P. foveolatum* and *P. simile*, small in *P. narinosum*). *P. narinosum* is most closely related to *P. foveolatus*, but has a relatively wider pygidium, much shorter than in *P. foveolatus* and slightly shorter than in *P. simile* (Thorslund, 1940), both of which have a similar number of transaxial furrows (10-12). The number of pleural furrows (8 or 9) is less than that of *P. foveolatus* (10) and more than that of *P. simile* (6 or 7).

Apart from the cranidia of Siveter (1977), the only other specimen that has been assigned to *P. narinosum* is the cranidium figured by Owen & Bruton (1980, pl. 9, fig. 12) from the Solvang Formation of Snarøya, Oslo-Asker District. However, it has a shorter (sag.) preglabellar field than the present cranidium as is also the case in Siveter's (1977) specimens, and seems to be more similar to *P. simile.* It should therefore more reasonably be assigned to that species. The specimens figured by Siveter (1977, fig. 2F-G) as *P.* cf. *foveolatum* (Törnquist, 1884) from an equivalent horizon at Helgøya, Nes-Hamar District are here considered to be *P. foveolatum*. The large cranidium of *P. foveolatum* figured by Warburg (1925, pl. 4, fig. 13) is overall quite similar to both the specimen described herein and the holotype of *P. narinosum*, although apparently having a more convex preglabellar field and a shorter (sag.) anterior border. The large pygidium figured by Warburg (1925, pl. 4, fig. 20) is less similar to *P. narinosum* in being relatively longer (L/W ratio about 3/4) and having an apparently less accentuated axial furrow, though the latter may be due to simplification of the drawn illustration in Warburg (1925).

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