

REVIEW OF UPPERMOST FURONGIAN TRILOBITES FROM SCANIA, SOUTHERN SWEDEN, BASED ON TYPE MATERIAL

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Abstract: The Scandinavian trilobites described in the classical papers by Moberg and Möller (1898) and Moberg (1898) are reviewed, based on the original type collections. The ten species and subspecies originally described are here considered to represent 12 species and subspecies, ranging in age from the latest Furongian (late Cambrian) through the Tremadocian (Early Ordovician). Lectotypes are selected for *Parabolina* (*Parabolina*) *acanthura* (Angelin), *Acerocare* *ecorne*

Angelin and *Westergaardia lata* (Matthew). *Leptoplastus claudicans* (Moberg and Möller) is regarded as a junior subjective synonym of *L. stenotus* Angelin. These, and lectotypes formerly only figured by hand-drawings, are illustrated by high-resolution photographs.

Key words: Trilobita, *Acerocare* Zone, Furongian, Cambrian, Scandinavia.

THE principle of name-bearing types constitutes the basis for our organization of the Animal Kingdom. Virtually all palaeontological generalizations rely on sound taxonomy and a stable nomenclature. A misuse of the name-bearing type concept undermines the taxonomic work that, in turn, could lead to erroneous theories. In this context, reviewing and improving older taxonomic descriptions are of fundamental importance, and a task that would be difficult without existing type material. Useful presentations of species put great demands upon not only the written descriptions but also the illustrations. A common practice during the nineteenth and the beginning of the twentieth century was to make hand-drawings of the specimens and to retouch photographs in order to enhance their appearance. This, of course, expresses the artists' or scientists' subjective appreciation of the specimens, and not necessarily the actual specimens. An example of this is the two papers reviewed herein (Moberg and Möller 1898; Moberg 1898), in which ten species and subspecies of Furongian (Peng *et al.* 2004) trilobites from Scandinavia were originally illustrated by drawings, several of which are shown to be slightly imperfect or inaccurate. These drawings were later copied by Westergård (1909, 1922) and Poulsen (1923). The original specimens were restudied in order to determine their currently valid taxonomic affinity. Discrepancies between these specimens and the illustrations are discussed and lectotypes are selected where necessary. High-resolution digital images

were produced of lectotypes, discussed specimens and additional characteristic representatives of selected taxa. I hope that this paper will provide a good basis for future work on the uppermost Furongian in Scandinavia and elsewhere.

GEOLOGICAL SETTING AND HISTORICAL BACKGROUND

The Furongian of Scandinavia consists of a condensed succession of kerogen-rich shale (alum shale) with lenses and beds of dark grey limestone (anthraconite or orsten). The thickest and stratigraphically most complete successions are in the Oslo Region of Norway, and in Scania, the southernmost province of Sweden, where the Furongian is up to approximately 50 m thick (Westergård 1944; Henningsmoen 1957). In Scania, Furongian outcrops are confined to a few localities along the length of a fault-bounded, graben-like structure, the Colonus Shale Trough, running diagonally (north-west–south-east) through Scania (e.g. Bergström *et al.* 1982; Norling and Bergström 1987; Erlström *et al.* 1997). Furongian strata have also been recorded from drill cores in Scania (Westergård 1942, 1944; Terfelt *et al.* 2005).

In most parts of Scandinavia, strata of late Furongian age (the *Acerocare* Zone) are absent or poorly exposed; consequently, this is an inadequately known stratigraphical

interval. However, late Furongian strata are exposed at a few localities in the Oslo Region, Norway (Henningsmoen 1957; Bruton *et al.* 1982, 1988), Bornholm, Denmark (Poulsen 1923), and in three areas in southern Sweden: southern Öland, Kinnekulle in Västergötland, and Scania (Westergård 1947), of which the last has the most complete successions.

The Scanian outcrops are exposed at four localities: Åkarpsmölla, Södra Sandby, Andrarum and Järrestad (Text-fig. 1B). The greatest thickness of the *Acerocare* Zone is found at Andrarum, where it reaches 8.7 m (Westergård 1944). The fauna of the *Acerocare* Zone is dominated by olenid trilobites, although brachiopods (e.g. *Orusia* sp.; Moberg and Möller 1898) and conodonts (e.g. Bruton *et al.* 1988) have also been recorded.

The first work on the uppermost Furongian of Scandinavia was carried out by Angelin (1854) who described two species of trilobites (*Acerocare ecorne* and *Parabolina acanthura*) from Södra Sandby. A few years later, Nathorst (1869) concluded that strata with *Acerocare* Angelin, 1854 form the top of the Cambrian based on the succession at Andrarum. In 1875 Linnarsson described another trilobite species, *Cyclognathus micropygus* (= *Acerocarina micropyga*), from Åkarpsmölla and in 1882 Brøgger described the trilobite *Parabolina heres* from the Oslo area. Towards the end of the nineteenth century the stratigraphical position and ranges of these trilobites were uncertain; as a result, the famous Swedish geologist Johan Christian Moberg, together with botanist Hjalmar Möller, initiated a thorough investigation of the upper Furongian strata of Scania in 1894. Their efforts resulted in two papers published in 1898 (Moberg and Möller 1898; Moberg 1898). These comprise detailed stratigraphical and lithological descriptions of the uppermost Furongian at Åkarpsmölla, Södra Sandby and Andrarum (Text-fig. 1C–E), as well as descriptions of six new trilobite species. Even to this day these papers represent the most important and meticulous work on trilobites from the uppermost Furongian in Scandinavia.

Moberg and Möller (1898) concluded that the presence of *Acerocare ecorne* defines the base of the *Acerocare* Zone. Studying a borehole core from Södra Sandby, however, Westergård (1942, 1944) showed that this species actually occurs at the top of this zone. Furthermore, Moberg and Möller (1898) included the subzone with *Parabolina megalops* and *Peltura paradoxa* in the *Acerocare* Zone. By contrast, Westergård (1942) regarded that same subzone as the uppermost part of the zone with *Peltura*, *Sphaerophthalmus* and *Ctenopyge* (the *Peltura scarabaeoides* Zone). The zonation applied in this paper is that of Henningsmoen (1957) who subdivided the *Acerocare* Zone into four subzones (Text-fig. 2) based on pelturines, as they are more common and easier to identify than species

of *Parabolina*. In ascending order these are: the *Peltura transiens*, the *Peltura costata*, the *Westergaardia* and the *Acerocare ecorne* subzones.

MATERIAL AND METHODS

The bulk of the material studied derives from the uppermost Furongian of Scania. Moberg and Möller's (1898) specimens were collected at Södra Sandby, Åkarpsmölla and Andrarum in Scania (Text-fig. 1). Angelin's (1854) specimens were collected at Södra Sandby. Brøgger's (1882) specimens were collected from Vekkerø, in the Oslo Region, and Matthew's (1891) specimens were collected from Navy Island, St. John Harbour, New Brunswick, Canada. Figured specimens were coated with ammonium chloride prior to photographing with a digital camera. Multiple images of each specimen were combined (using the CombineZ software) in order to enhance focal depth. Moberg and Möller's (1898) and Moberg's (1898) material is housed in the type collection of the Department of Geology, Lund University (LO); Brøgger's (1882) is in the type collection of the Palaeontological Museum, University of Oslo (PMO); Angelin's (1854) is in the type collection of the Swedish Museum of Natural History, Stockholm (RM); and Matthew's (1891) is in the type collection of the Royal Ontario Museum, Canada (ROM).

SYSTEMATIC PALAEOLOGY

The descriptive terminology applied herein follows that of Whittington and Kelly (in Kaesler 1997). The subheadings 'Material' and 'Other material' refer to figured specimens from the Moberg and Möller (1898) type collection, unless stated otherwise.

Order PTYCHOPARIIDA Swinnerton, 1915

Family OLENIDAE Burmeister, 1843

Subfamily OLENINAE Burmeister, 1843

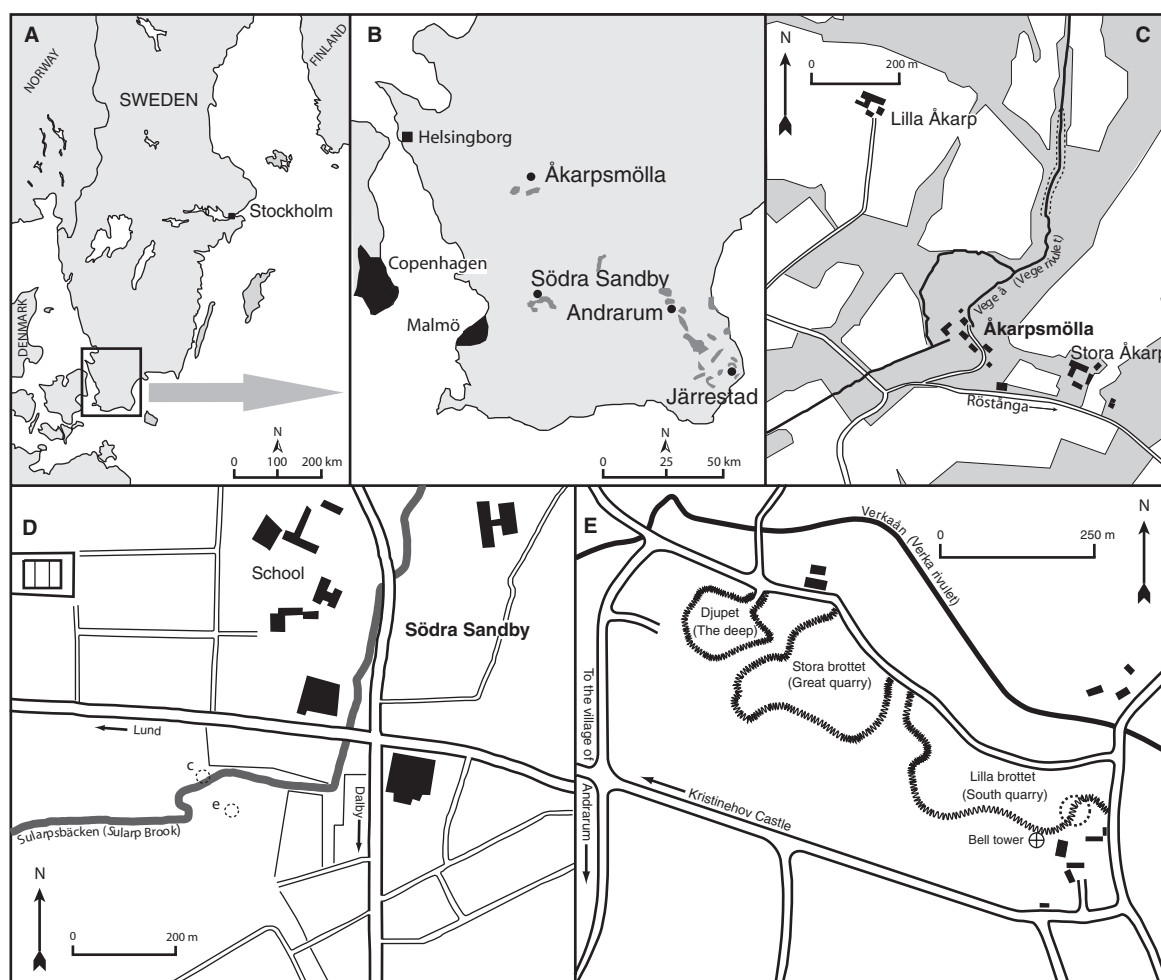
Genus PARABOLINA Salter, 1849

Type species. *Entomostracites spinulosus* Wahlenberg, 1818, by monotypy.

Subgenus PARABOLINA (PARABOLINA) Salter, 1849

Type species. As for genus.

Remarks. For discussion of this subgenus, see Nikolaisen and Henningsmoen (1985, p. 4).



TEXT-FIG. 1. A, orientation map of southern Scandinavia. B, map of Scania, the southernmost province of Sweden, showing the location of Åkarpsmälla, Södra Sandby, Andrarum, and Järrestad. Middle Cambrian–lower Ordovician outcrops are marked in dark grey. C, detailed map of the Åkarpsmälla area, showing Moberg and Möller’s (1898) collecting site (encircled by a dashed line) along the Vege rivulet. D, detailed map of the Södra Sandby area, showing Moberg and Möller’s (1898) localities c and e (encircled by dashed lines) along the Sularp brook. E, detailed map of the Andrarum quarries showing Moberg and Möller’s collecting site (encircled by a dashed line) in the South Quarry.

Parabolina (Parabolina) acanthura (Angelin, 1854)

Plate 1, figures 1–7

- 1854 *Olenus? acanthurus* Angelin, p. 44, pl. 25, fig. 7.
 v.1898 *Parabolina acanthura* (Angelin); Moberg and Möller, p. 259, pl. 12, figs 1–7; pl. 14, figs 15–16.
 1957 *Parabolina acanthura* (Angelin); Henningsmoen, p. 116, pl. 10, figs 1–6.
 1985 *Parabolina (Parabolina) acanthura* (Angelin); Nikolaisen and Henningsmoen, p. 4, fig. 11A (with full synonymy).
 v.1992 *Parabolina acanthura* (Angelin); Ahlberg, p. 33, fig. 8E–H.

Type specimen. A cranium (RM 1655a; Pl. 1, fig. 4) from Angelin’s (1854) syntypes is herein selected as lectotype.

Other material. One fairly complete specimen, one cranium, one librigena, three pygidia, one hypostome and one incomplete thorax with the pygidium attached; all preserved in limestone (anthraconite).

Remarks. Pygidium LO 1350t (Pl. 1, fig. 2; Moberg and Möller 1898, pl. 14, fig. 15): Moberg and Möller (1898) described a variant with two pairs of pygidial spines only. However, part of the pleural field on the lower left side is missing, thus obscuring the presence of a third spine. Moreover, in the counterpart on the right side, the specimen appears to have been damaged during preparation, features not shown in their drawing. In the cranium LO 1344t (Pl. 1, fig. 3; Moberg and Möller 1898, pl. 12, fig. 1) the anterior margin is

ZONES		SUBZONES
Acerocare		<i>Acerocare ecorne</i>
		<i>Westergaardia</i>
		<i>Peltura costata</i>
		<i>Peltura transiens</i>
Peltura Zones	Peltura scarabaeoides	<i>Peltura paradoxa</i>
		<i>Parabolina lobata</i>
		<i>Ctenopyge linnarssoni</i>
		<i>Ctenopyge bisulcata</i>
	Peltura minor	<i>Ctenopyge affinis</i>
		<i>Ctenopyge tumida</i>
		<i>Ctenopyge spectabilis</i>
		<i>Ctenopyge similis</i>
	Protopeltura praecursor	<i>Ctenopyge flagellifera</i>
		<i>Ctenopyge postcurrens</i>
		<i>Leptoplastus neglectus</i>
	Leptoplastus	
<i>Leptoplastus angustatus</i>		
<i>Leptoplastus ovatus</i>		
<i>Leptoplastus crassicornis</i>		
<i>Leptoplastus raphidophorus</i>		
<i>Leptoplastus paucisegmentatus</i>		
Parabolina spinulosa		<i>Parabolina spinulosa</i>
		<i>Parabolina brevispina</i>
Olenus Zones	Agnostus (Homagnostus) obesus	<i>Olenus scanicus</i>
		<i>Olenus dentatus</i>
		<i>Olenus attenuatus</i>
		<i>Olenus wahlenbergi</i>
		<i>Olenus truncatus</i>
		<i>Olenus gibbosus</i>

TEXT-FIG. 2. Zonation of the Furongian Series in Scandinavia modified from Ahlberg (2003).

slightly convex rather than straight. In the thoracic segments LO 1346t (Moberg and Möller 1898, pl. 12, fig. 3) only one thoracic segment is shown in their drawing. The original specimen consists, however, of six articulated thoracic tergites attached to an almost complete pygidium (Pl. 1, fig. 6). In the hypostome LO 1348t (Pl. 1, fig. 5; Moberg and Möller 1898, pl. 12, fig. 5) the posterior lobe of the middle body is broader and more rounded than shown in their drawing.

Occurrence. The species is restricted to the *Acerocare ecorne* Subzone of the *Acerocare* Zone, except in Norway where it ranges up to the basal part of the Tremadocian (Henningsmoen 1957; Bruton *et al.* 1988). It has been recorded from Sweden (Westergård 1922), Norway (Henningsmoen 1957), Denmark (Poulsen 1923) and Great Britain (Rushton 1982).

Parabolina (Parabolina) heres heres Brøgger, 1882

- 1882 *Parabolina heres* Brøgger, p. 101, pl. 1, fig. 13a–d.
v.1898 *Parabolina heres* Brøgger, Moberg and Möller, p. 267, pl. 12, figs 8–15; pl. 14, figs 13, ?14.

- 1957 *Parabolina heres heres* Brøgger; Henningsmoen, p. 119 (with full synonymy).
1982 *Parabolina heres heres* Brøgger; Rushton, p. 47, pl. 1, figs 1–19.
1982 *Parabolina acanthura* (Angelin); Bruton *et al.*, p. 66, pl. 1, figs 1–3, 17, 19.
1985 *Parabolina (Parabolina) heres* Brøgger; Nikolaisen and Henningsmoen, pp. 4, 8.
1996 *Parabolina heres*; Bilz, p. 60, fig. 13.
2003 *Parabolina heres heres* Brøgger; Buchholz, p. 47, pl. 3, figs 5–8.
2004 *Parabolina (Parabolina) heres heres* Brøgger; Buchholz, p. 9, pl. 4, figs 3–7.
v.2005 *Parabolina (Parabolina) heres heres* Brøgger; Terfelt *et al.*, p. 199, fig. 4J–K.

Lectotype. Pygidium PMO 19948, figured by Brøgger (1882, pl. 1, fig. 13d) and Rushton (1982, pl. 1, fig. 4); subsequently designated by Henningsmoen (1957, p. 119).

Material. One cranidium, one cranidium with an incomplete thorax, four pygidia, one librigena, one hypostome and eight articulated thoracic tergites; all preserved in limestone (anthraconite).

Remarks. This subspecies was thoroughly discussed by Rushton (1982, p. 47).

Occurrence. The subspecies generally is restricted to the lowermost two subzones (the *Peltura transiens* and *P. costata* subzones) in the *Acerocare* Zone of Scandinavia (Henningsmoen 1957). In the Nærnes section of the Oslo Region, however, it ranges through the remaining two subzones (the *Westergaardia* and *Acerocare ecorne* subzones) of the *Acerocare* Zone (Bruton *et al.* 1988). In New Brunswick it possibly extends into the *Westergaardia* Subzone (Rushton 1982). *Parabolina (P.) heres heres* has been recorded from Sweden (Moberg and Möller 1898; Westergård 1922, 1947; Terfelt *et al.* 2005), Norway (Henningsmoen 1957; Nikolaisen and Henningsmoen 1985), North Wales (Rushton 1982), and with doubt from New Brunswick, Canada (Rushton 1982) and the Holy Cross Mountains, Poland (Żylińska 2001, 2002).

Parabolina (Parabolina) heres megalops Moberg and Möller, 1898

Plate 1, figure 11

- v?p1898 *Parabolina megalops* Moberg and Möller, p. 275, pl. 13, figs 2, ?3, ?6, ?8 [non figs 1, 4, 7, 10 (= *P. (N.) lobata lobata*), fig. 9 (= *P. scarabaeoides westergaardi*)].
v?p1922 *Parabolina megalops* Moberg and Möller; Westergård, p. 137, pl. 7, figs 17, ?21, ?22 [non figs 18–20, 23 (= *P. (N.) lobata lobata*)] [copy Moberg and Möller 1898].
1929 *Parabolina* sp.; Strand, p. 357.
1942 *Parabolina megalops* Moberg and Möller; Westergård, p. 14.

- 1944 *Parabolina megalops* Moberg and Möller; Westergård, p. 39, pl. 1, figs 12–17, ?18, 19.
 1947 *Parabolina megalops* Moberg and Möller; Westergård, p. 24.
 1957 *Parabolina megalops* Moberg and Möller; Henningsmoen, p. 124.
 1982 *Parabolina heres megalops* Moberg and Möller; Rushton, p. 47, pl. 1, figs 20–21.
 1985 *Parabolina megalops* Moberg and Möller; Nikolaisen and Henningsmoen, pp. 4, 7–8.
 2003 *Parabolina megalops* Moberg and Möller; Buchholz, p. 47, pl. 3, figs 3–4.
 2004 *Parabolina (Parabolina) megalops* Moberg and Möller; Buchholz, p. 11, pl. 7, figs 9–10.
 v?2005 *Parabolina (Parabolina) heres* cf. *megalops* Moberg and Möller; Terfelt *et al.*, p. 199.

Lectotype. Cranidium LO 1365t (Pl. 1, fig. 11) figured by Moberg and Möller (1898, pl. 13, fig. 2) and Westergård (1922, pl. 7, fig. 17 [copy Moberg and Möller 1898]; 1944, pl. 1, fig. 12); subsequently designated by Westergård (1944, p. 40).

Other material. One hypostome and two pygidia; all preserved in shale.

Remarks. The material at hand is very poorly preserved and the only specimen that can be assigned to the subspecies with certainty is the lectotype. The poor state of preservation most probably is due to storage under unfavourable conditions in the Department of Geology in Lund for more than 100 years. Since the specimens have not been photographed (except for the lectotype), the drawings by Moberg and Möller (1898) cannot be properly compared with the original specimens and consequently it cannot be firmly established that they all belong to *P. (P.) heres megalops*.

Occurrence. The subspecies is restricted to the *Peltura paradoxa* Subzone of the *P. scarabaeoides* Zone and has been recorded from Sweden (Moberg and Möller 1898; Westergård 1922, 1944) and Norway (Henningsmoen 1957).

Parabolina (Parabolina) heres lata Matthew, 1892

- 1892 *Parabolina heres* Brøgger var. *lata* n. var.; Matthew, p. 51, pl. 13, fig. 6a–f.
 1898 *Parabolina heres* Brøgger var.; Moberg and Möller, p. 274, pl. 14, figs 10–12.
 1898 *Parabolina heres* Brøgger var.; Moberg, p. 315, pl. 16, figs 7–8.
 1957 *Parabolina heres lata* Matthew; Henningsmoen, p. 120 (with full synonymy).
 1982 *Parabolina heres lata* Matthew; Rushton, p. 48, pl. 2, figs 1–11, ?12, ?13, ?16 (= transitional to *P. acanthura*).

- 1985 *Parabolina (Parabolina) heres* cf. *lata* Matthew; Nikolaisen and Henningsmoen, p. 5, fig. 11B.
 1988 *Parabolina heres lata* Matthew; Bruton *et al.*, p. 453.

Lectotype. Pygidium ROM 41462 figured by Matthew (1892, pl. 13, fig. 6e) and refigured by Rushton (1982, pl. 2, fig. 5). Subsequently designated by Henningsmoen (1957, p. 120; note that Henningsmoen incorrectly referred to Matthew's pl. 13, fig. 6b, which is a cranidium).

Material. One nearly complete specimen, one pygidium and one pygidium with the thorax preserved in shale; two pygidia preserved in limestone (anthraconite).

Remarks. This subspecies was thoroughly discussed by Rushton (1982, p. 48).

Occurrence. The subspecies is restricted to the *Westergaardia* Subzone of the *Acerocare* Zone and has been recorded from Sweden (Westergård 1943, 1947), Norway (Henningsmoen 1957) and eastern Canada (Matthew 1892).

Subfamily LEPTOPLASTINAE Angelin, 1854

Genus LEPTOPLASTUS Angelin, 1854

Type species. *Leptoplastus stenotus* Angelin, 1854; designated by Vogdes (1890).

Leptoplastus stenotus Angelin, 1854 Plate 1, figures 8–10; Text-figure 3A–G

- 1854 *Leptoplastus stenotus* Angelin, p. 47, pl. 26, fig. 1.
 v.1898 *Acerocare claudicans* Moberg and Möller, p. 257.
 v.1898 *Acerocare claudicans* Moberg and Möller; Moberg, p. 314, pl. 16, figs 1–5.
 1908 *Acerocare claudicans* Moberg and Möller; Raw, p. 513.
 1917 *Acerocare claudicans* Moberg and Möller; Westergård, p. 640.
 1922 *Leptoplastus claudicans* (Moberg and Möller); Westergård, p. 147, pl. 8, figs 8–12 [copy Moberg 1898].
 1925 *Leptoplastus claudicans* (Moberg and Möller); Raw, pp. 252, 263.
 1940 *Leptoplastus claudicans* (Moberg and Möller); Westergård, p. 64.
 v.1957 *Leptoplastus claudicans* (Moberg and Möller); Henningsmoen, pp. 165–166, pl. 13, figs 11–13.
 1957 *Leptoplastus stenotus* Angelin; Henningsmoen, p. 177 (with full synonymy).
 1973 *Leptoplastus stenotus* Angelin; Schrank, p. 819, pl. 5, figs 5–11.

Type data. Angelin's (1854) syntypes from Andrarum cannot be found.

Material. Two cranidia, one librigena, one thoracic tergite and one pygidium; all preserved in shale. Additional specimens have been recovered from the same slab of shale that yielded Moberg and Möller's figured types: one nearly complete cephalon with incomplete thorax, one pygidium with incomplete thorax, one librigena, two pygidia and two cranidia; again, all preserved in shale.

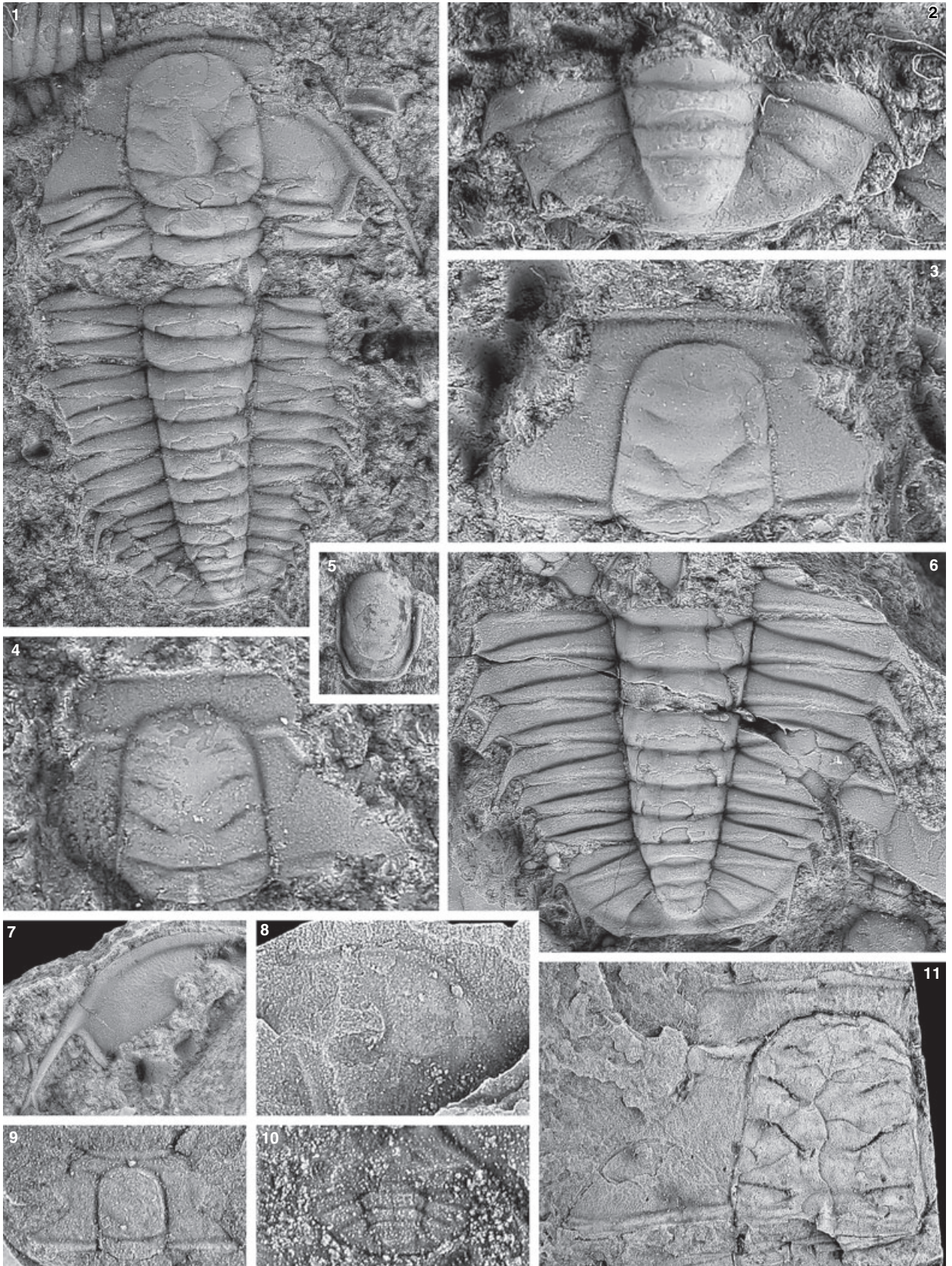
Remarks. Moberg and Möller's (1898) specimens of *L. stenotus* were identified in a loose slab of shale found close to the bell tower at Andrarum (Moberg and Möller 1898). Hence, the stratigraphical horizon of these specimens is unclear. Both Westergård (1922) and Henningsmoen (1957) noted the inaccuracy of the drawings of Moberg (1898). The illustration of the cranidium LO 1377t (Pl. 1, fig. 9; Moberg 1898, pl. 16, fig. 1) is inaccurate in the following respects. The anterior margin is concave rather than straight. The preocular facial sutures are longer and not as strongly converging. The palpebral lobes are considerably larger and situated further back, thus the ε -point of the palpebral suture is on a level at approximately the mid-length (sag.) of the glabella and not two-thirds of the glabellar length as shown in the drawing. His illustration of the librigena LO 1380t (Pl. 1, fig. 8; Moberg 1898, pl. 16, fig. 4) is inaccurate in the following respects: the genal field is wider than shown in the drawing and the genal spine is not visible in the specimen.

Moberg and Möller (1898) believed that the specimens belonged to the genus *Acerocare* and came from the *Acerocare* Zone. They assigned them to the new species *A. claudicans*. However, Westergård (1922) later assigned it to the genus *Leptoplastus*, suggested that it came from the

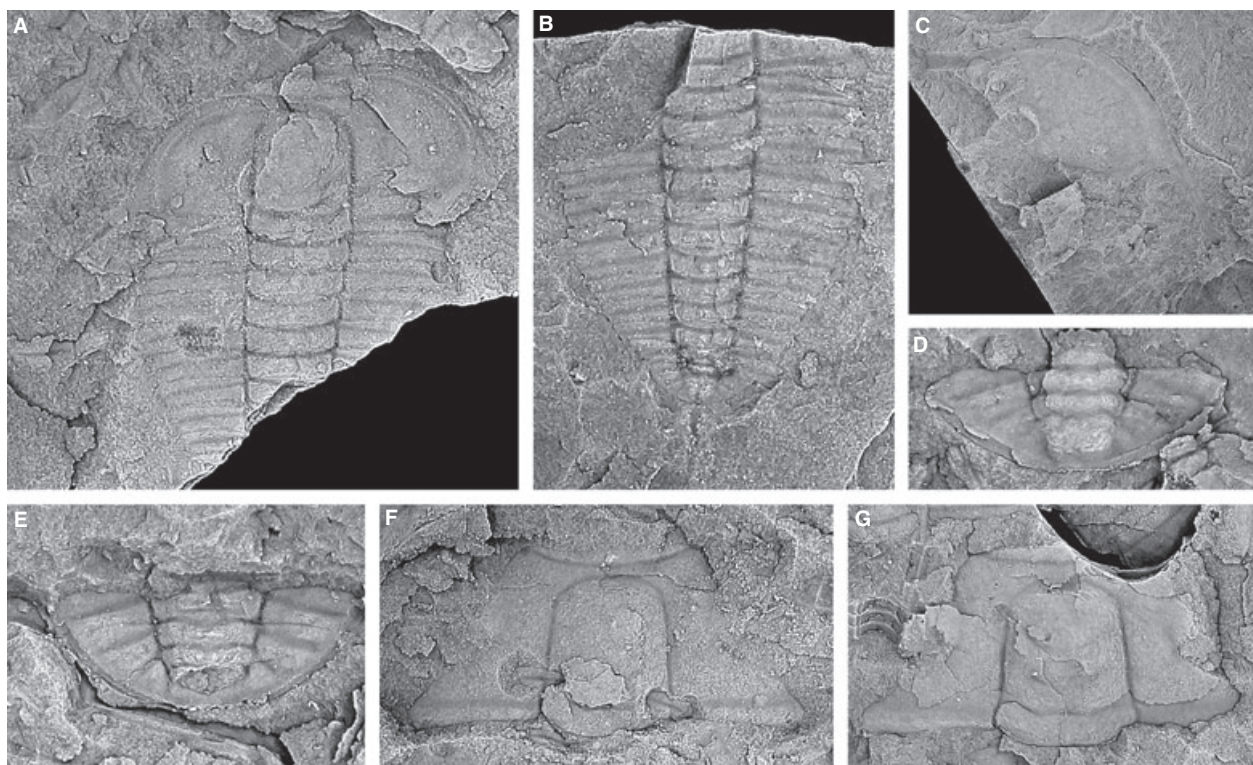
Leptoplastus Zone, and pointed out its resemblance to both *L. stenotus* and *L. raphidophorus*. In 1940 (p. 64, footnote 1) Westergård found it likely that *L. claudicans* came from the Tremadocian or some late Cambrian strata not exposed at Andrarum. Henningsmoen (1957) re-examined the type material of *L. claudicans*, emphasized its similarities to *L. stenotus*, and suggested that *L. claudicans* and *L. stenotus* might be conspecific. However, he found it difficult to compare them, as the available material was fragmentary and not very well preserved. Re-examination of the original slab of shale, from which Moberg and Möller's (1898) type material derives, yielded new and better preserved specimens that greatly facilitate the comparison between *L. claudicans* and *L. stenotus*. The cranidia (Text-fig. 3F–G) show characteristics corresponding to that of *L. stenotus*, with a short (sag.) preglabellar field, a palpebral area about half as wide (tr.) as the glabella, and a posterior border as wide (tr.) as the occipital ring. The librigenae (Text-fig. 3A, C) are likewise strikingly similar to those of *L. stenotus*, with a slender spine, an obtuse corner angle and a straight posterior margin. The pygidia (Text-fig. 3D–E) are identical to those of *L. stenotus*, with an evenly rounded margin lacking spines, and 3–4 axial rings. The thorax (Text-fig. 3A–B) consists of 12 segments. The axis is as wide (tr.) as, or slightly narrower than, the pleural fields, and a long axial spine is present in the eleventh segment. In these respects the thorax is similar to that of *L. stenotus*. Thus it is evident that *L. claudicans* shares all essential features with *L. stenotus* and I regard it as a junior synonym of *L. stenotus*.

EXPLANATION OF PLATE 1

- Figs 1–7. *Parabolina (Parabolina) acanthura* (Angelin, 1854). All specimens from the *Acerocare ecorne* Subzone in Södra Sandby (locality c in Text-fig. 1D), preserved in limestone. 1, LO 1349t, nearly complete specimen; original of Moberg and Möller (1898, pl. 12, fig. 6), Westergård (1922, pl. 7, fig. 15), and Ahlberg (1992, fig. 8h); $\times 7$. 2, LO 1350t, pygidium; original of Moberg and Möller (1898, pl. 14, fig. 15) and Westergård (1922, pl. 7, fig. 13); $\times 13$. 3, LO 1344t, cranidium; original of Moberg and Möller (1898, pl. 12, fig. 1), Westergård (1922, pl. 7, fig. 9), Poulsen (1923, fig. 10), and Ahlberg (1992, fig. 8F); $\times 10$. 4, RM 1655a, lectotype, cranidium; original of Angelin (1854, pl. 25, fig. 7); $\times 15$. 5, LO 1348t, hypostome; original of Moberg and Möller (1898, pl. 12, fig. 5) and Westergård (1922, pl. 7, fig. 16); $\times 10$. 6, LO 1346t, incomplete thorax with pygidium; one segment is the original of Moberg and Möller (1898, pl. 12, fig. 3) and Westergård (1922, pl. 7, fig. 11); $\times 8$. 7, LO 1345t, librigena; original of Moberg and Möller (1898, pl. 12, fig. 2), Westergård (1922, pl. 7, fig. 10), Poulsen (1923, fig. 10), and Ahlberg (1992; fig. 8E); $\times 5$.
- Figs 8–10. *Leptoplastus stenotus* Angelin, 1854. All specimens from the *Leptoplastus stenotus* Subzone at Andrarum, preserved in shale. 8, LO 1380t, librigena; original of Moberg (1898, pl. 16, fig. 4), Westergård (1922, pl. 8, fig. 9), and Henningsmoen (1957, pl. 13, fig. 12); $\times 10$. 9, LO 1377t, cranidium; original of Moberg (1898, pl. 16, fig. 1), Westergård (1922, pl. 8, fig. 8), and Henningsmoen (1957, pl. 13, fig. 11); $\times 11$. 10, LO 1379t, pygidium, lectotype of *L. claudicans*; original of Moberg (1898, pl. 16, fig. 3), Westergård (1922, pl. 8, fig. 11), and Henningsmoen (1957, pl. 13, fig. 13); $\times 13$.
- Fig. 11. *Parabolina (Parabolina) heres megalops* Moberg and Möller, 1898, LO 1365t, lectotype; cranidium from the *Peltura paradoxa* Subzone at Åkarpmsölla (Text-fig. 1C); original of Moberg and Möller (1898, pl. 13, fig. 2) and Westergård (1922, pl. 7, fig. 17; 1944, pl. 1, fig. 12); $\times 5$.



TERFELT, *Leptoplastus*, *Parabolina*



TEXT-FIG. 3. A–G, *Leptoplastus stenotus* (Angelin, 1854). All specimens from the *Leptoplastus stenotus* Subzone at Andrarum and the same slab of shale from which Moberg and Möller retrieved their figured types. A, LO 9639, nearly complete cephalon with incomplete thorax; $\times 10$. B, LO 9640, pygidium with thorax; $\times 11$. C, LO 9641, librigena; $\times 4$. D, LO 9643, pygidium; $\times 9$. E, LO 9642, pygidium; $\times 10$. F, LO 9645, cranium; $\times 8$. G, LO 9644, cranium; $\times 6$.

Occurrence. The species is restricted to the *Leptoplastus stenotus* Subzone of the *Leptoplastus* Zone, and has been recorded from Sweden (Westergård 1922, 1947), Norway (Henningsmoen 1957) and Bornholm, Denmark (Poulsen 1923).

Subfamily PELTURINAE Hawle and Corda, 1847

Genus ACEROCARE Angelin, 1854

Type species. *Acerocare ecorne* Angelin, 1854; by monotypy.

Acerocare ecorne Angelin, 1854

Plate 2, figures 1–9

- 1854 *Acerocare ecorne* Angelin, p. 46, pl. 25, fig. 10.
 v.1898 *Acerocare ecorne* Angelin; Moberg and Möller, p. 231, pl. 10, figs 1–10.
 1957 *Acerocare ecorne* Angelin; Henningsmoen, p. 243, pl. 30, figs 1–8, pl. 31 (with full synonymy).
 1973 *Acerocare ecorne* Angelin; Henningsmoen, p. 193, text-fig. 10 [copy Henningsmoen 1957].
 1982 *Acerocare ecorne* Angelin, 1854; Bruton *et al.*, p. 64, pl. 1, figs 4–5, 7–9.

- 1988 *Acerocare ecorne* Angelin; Bruton *et al.*, p. 452.
 v.1992 *Acerocare ecorne* Angelin; Ahlberg, p. 32, fig. 8A–D.

Type specimen. A cranium (RM 1655 g; Pl. 2, Fig. 1) from Angelin's (1854) syntypes is herein selected as lectotype.

Other material. Two fairly complete specimens, four crania, one pygidium, one librigena and one hypostome; all preserved in limestone (anthraconite).

Remarks. The illustrations by Moberg and Möller (1898) are inaccurate in the following respects: in the cranium LO 1309t (Pl. 2, fig. 2) the posterior border of the fixigena is slightly longer (sag.) than shown in the drawing (Moberg and Möller 1898, pl. 10, fig. 2). In the hypostome LO 1310t (Pl. 2, fig. 8), the posterior lobe of the middle body is more pointed than shown in the drawing (Moberg and Möller 1898, pl. 10, fig. 3). In the juvenile cranium LO 1312t (Pl. 2, fig. 5), the preglabellar field is shorter (sag.) than shown in the drawing (Moberg and Möller 1898, pl. 10, fig. 5). In the cranium LO 1313t (Pl. 2, fig. 3), the palpebral lobes are situated a little further back and the posterolateral projections are longer (tr.) than shown in the drawing

(Moberg and Möller 1898, pl. 10, fig. 6). Furthermore, the two nodes present on the anterior border are not shown. In the nearly complete specimen LO 1314t (Pl. 2, fig. 6) only the seventh thoracic segment is shown (Moberg and Möller 1898, pl. 10, fig. 7). The nearly complete specimen LO 1316t (Pl. 2, fig. 7; Moberg and Möller 1898, pl. 10, fig. 9) is fractured but clearly belongs to *A. ecorne*.

Occurrence. The species is restricted to the *Acerocare ecorne* Subzone of the *Acerocare* Zone and has been recorded from Sweden (Westergård 1922) and Norway (Henningsmoen 1957).

***Acerocare tullbergi* Moberg and Möller, 1898**

Plate 2, figures 10–12

- v.1898 *Acerocare tullbergi* Moberg and Möller, p. 254, pl. 14, figs 6–7, ?8, 9.
 1957 *Acerocare tullbergi* (Moberg and Möller); Henningsmoen, p. 243, pl. 30, figs 9–11 (with full synonymy).
 1982 *Acerocare tullbergi* (Moberg and Möller); Bruton *et al.*, p. 64, pl. 1, fig. 11.
 1988 *Acerocare tullbergi* Moberg and Möller; Bruton *et al.*, p. 452.
 non 2000 *Acerocare tullbergi* Moberg and Miller [*sic*]; Pegel, fig. 15-9.

Lectotype. Cranidium LO 1341t (Pl. 2, fig. 10) figured by Moberg and Möller (1898, pl. 14, fig. 6) and Westergård (1922, pl. 16, fig. 15) [copy Moberg and Möller 1898]; subsequently designated by Henningsmoen (1957, p. 244).

Other material. One librigena, one hypostome and one pygidium with thorax attached; all preserved in limestone (anthraconite).

Remarks. An examination of the lectotype reveals that the specimen figured by Henningsmoen (1957, pl. 30, fig. 11) as lectotype actually is another specimen. Henningsmoen's figured specimen cannot be found in Moberg and Möller's material. The hypostome LO 1341t (Moberg and Möller 1898, pl. 14, fig. 8) is very poorly preserved and no characteristic features are visible.

The cranidium figured by Pegel (2000) from the lower slope trilobite biofacies of the Siberian Platform differs from that of *Acerocare tullbergi* in having a considerably narrower and more pointed glabella, in lacking lateral occipital lobes, and in having deeper axial furrows. Furthermore, the glabellar furrows are straight and oblique backwards in the cranidium from Siberia, whereas they are distinctly geniculate in *A. tullbergi*.

Occurrence. The species is restricted to the upper part of the *Acerocare* Zone (*A. ecorne* Subzone?) and has been recorded

from Sweden (Moberg and Möller 1898; Westergård 1922, 1944) and Norway (Bruton *et al.* 1982, 1988).

Genus ACEROCARINA Poulsen, 1952

Type species. *Cyclognathus micropygus* Linnarsson, 1875; by original designation.

***Acerocarina granulata* (Moberg and Möller, 1898)**

Plate 3, figures 1–6

- vp.1898 *Acerocare granulatum* Moberg and Möller, p. 244, pl. 11, figs 1–9 [non pl. 14, figs 1–5 (= *Westergaardialata*)].
 v.1898 *Acerocare granulatum* Moberg and Möller var.; Moberg, p. 315, pl. 16, fig. 6.
 v.1922 *Cyclognathus granulatus* (Moberg and Möller); Westergård, p. 179, pl. 16, figs 26–31 [copy Moberg 1898], 32.
 1957 *Acerocarina granulata* (Moberg and Möller); Henningsmoen, p. 252.
 2003 *Acerocarina granulata* (Moberg and Möller); Buchholz, p. 44, pl. 2, figs 8–15 (with full synonymy).
 2003 *Acerocarina cf. micropyga* (Linnarsson); Buchholz, p. 45, pl. 2, figs 16–17.
 v.2005 *Acerocarina granulata* (Moberg and Möller); Terfelt *et al.*, p. 202, fig. 4A–F.

Lectotype. Fairly complete specimen LO 1323t (Pl. 3, fig. 1) figured by Moberg and Möller (1898, pl. 11, fig. 1); subsequently designated by Henningsmoen (1957, p. 252).

Other material. One complete specimen, one librigena, two cranidia, one hypostome, four articulated thoracic tergites and one pygidium preserved in stinkstone. One nearly complete specimen preserved in shale.

Remarks. Moberg and Möller's (1898) drawings of *A. granulata* are inaccurate in the following respects: in the lectotype (Pl. 3, fig. 1; Moberg and Möller 1898, pl. 11, fig. 1), the sagittal length of the glabella is exaggerated, whereas the transverse length of the fixigena is understated. The anterior right part of the pygidium has been broken off and is lost, most probably owing to unfavourable storage conditions. Specimen LO 1329t (Pl. 3, fig. 4) consists of four articulated thoracic segments whereas only one thoracic segment is shown in the drawing (Moberg and Möller 1898, pl. 11, fig. 7). In the pygidium LO 1330t (Pl. 3, fig. 5; Moberg and Möller 1898, pl. 11, fig. 8), the pygidial border is damaged; hence, the length (sag.) of the notch at the posterior margin is exaggerated (Terfelt *et al.* 2005).

Occurrence. The species is restricted to the two lowermost subzones (the *Peltura transiens* and *P. costata* subzones) in the *Acerocare* Zone and has been recorded from Sweden (Moberg and Möller 1898; Westergård 1922; Terfelt *et al.* 2005) and Norway (Henningsmoen 1957). In his chart 2, Henningsmoen (1957, p. 299) incorrectly placed the species in the stratigraphically older *P. paradoxa* Subzone (Terfelt *et al.* 2005).

Acerocarina micropyga (Linnarsson, 1875)

Plate 3, figures 7–9; Plate 4, figure 1

1875 *Cyclognathus micropygus* Linnarsson, p. 500, pl. 22, figs 8–10.

v.1898 *Acerocare micropygum* (Linnarsson); Moberg and Möller, p. 237, pl. 10, figs 11–18.

1957 *Acerocarina micropyga* (Linnarsson); Henningsmoen, p. 252, pl. 28, fig. 5 (with full synonymy).

non 2003 *Acerocarina cf. micropyga* (Linnarsson); Buchholz, p. 45, pl. 2, figs 16–17 (= *A. granulata*).

Lectotype. A nearly complete specimen figured by Linnarsson (1875, pl. 22, fig. 8); subsequently designated by Henningsmoen (1957, p. 253).

Material. One nearly complete specimen, one librigena, one hypostome, one cranium, three articulated thoracic tergites and one pygidium with thorax attached; all preserved in limestone (anthraconite). The juvenile cranium (Moberg and Möller 1898, pl. 10, fig. 15) seems to be lost.

Remarks. The illustrations of Moberg and Möller (1898) are inaccurate in several respects. In the nearly complete specimen LO 1317t (Pl. 3, fig. 7) there are ten thoracic segments and not 12 as shown in the drawing (Moberg

and Möller 1898, pl. 10, fig. 11). Moreover, the occipital node is less distinct and situated closer to the occipital furrow than shown in the drawing. In the cranium LO 1320t (Pl. 3, fig. 9) the occipital node is situated closer to the occipital furrow than shown in the drawing (Moberg and Möller 1898, pl. 10, fig. 14). The specimen LO 1322t (Pl. 4, fig. 1) consists of a pygidium attached to a nearly complete thorax, whereas only the pygidium is shown in the drawing (Moberg and Möller 1898, pl. 10, fig. 17). Furthermore, the sagittal length of the postaxial pleural field is exaggerated. The lectotype belongs to the Geological Survey of Sweden (SGU) collection in Uppsala. However, the specimen was last seen in 1979 and cannot be located at present (L. Wickström, pers. comm. 2005).

Occurrence. The species is restricted to the *Peltura costata* Subzone of the *Acerocare* Zone and has been recorded from Sweden (Moberg and Möller 1898; Westergård 1922) and Norway (Henningsmoen 1957).

Genus WESTERGAARDIA Raymond, 1924

Type species. *Boeckia scanica* Westergård, 1909; by original designation.

Westergardia lata (Matthew, 1891)

Plate 4, figures 5–10

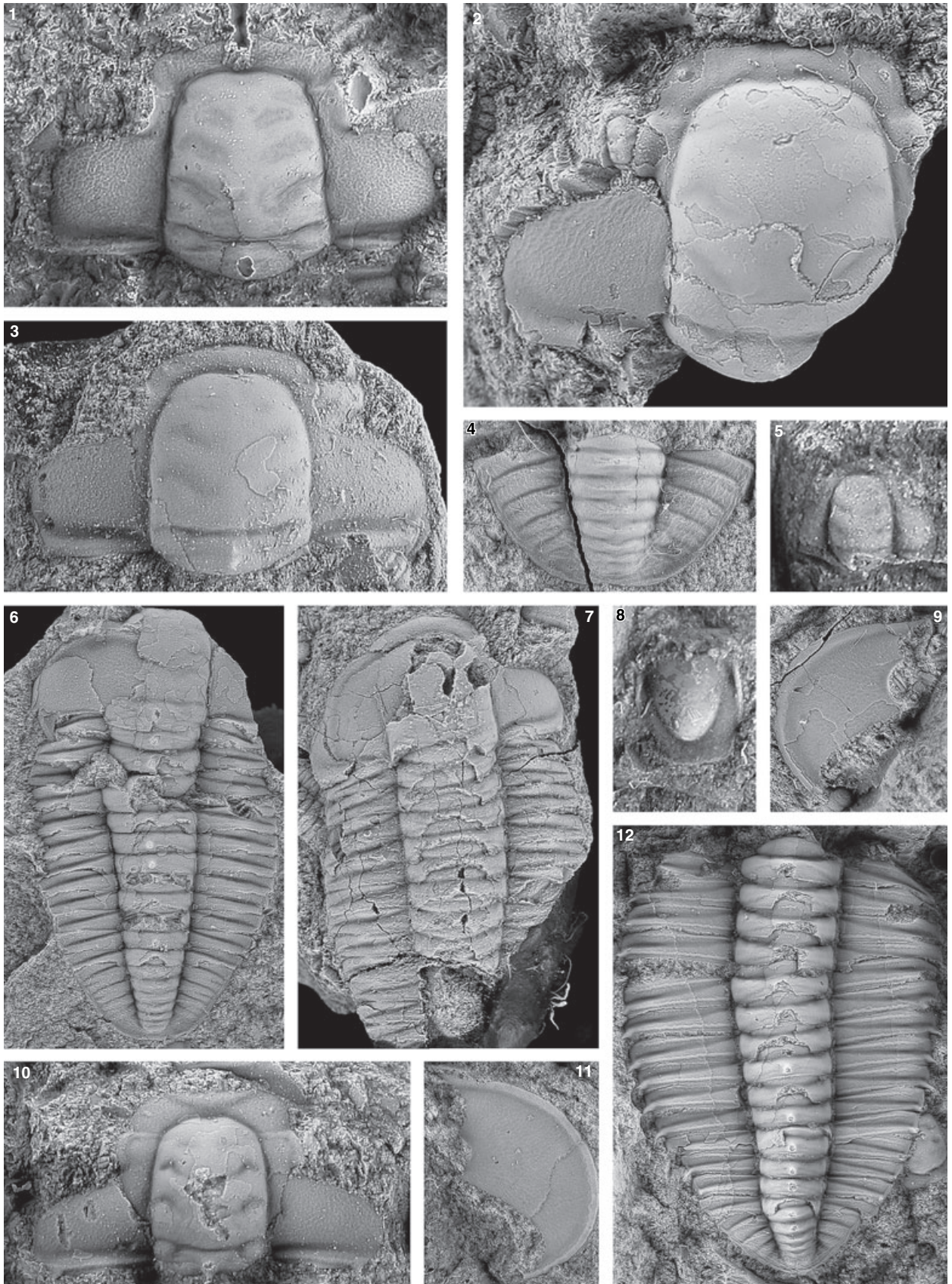
v.1891 *Leptoplastus latus* Matthew, p. 462, text figs 1–3.

v.1898 *Acerocare granulatum* Moberg and Möller, p. 248, pl. 14, figs ?1, 2–5.

EXPLANATION OF PLATE 2

Figs 1–9. *Acerocare ecorne* Angelin, 1854. All specimens from the *Acerocare ecorne* Subzone in Södra Sandby (locality c in Text-fig. 1D), preserved in limestone. 1, RM 1655g, lectotype, cranium; original of Angelin (1854, pl. 25, fig. 10); × 13. 2, LO 1309t, cranium; original of Moberg and Möller (1898, pl. 10, fig. 2), Westergård (1922, pl. 16, fig. 6), and Ahlberg (1992, fig. 8B); × 8. 3, LO 1313t, cranium; original of Moberg and Möller (1898, pl. 10, fig. 6), Westergård (1922, pl. 16, fig. 12), and Ahlberg (1992, fig. 8C); × 9. 4, LO 1315t, pygidium; original of Moberg and Möller (1898, pl. 10, fig. 8), Westergård (1922, pl. 16, fig. 9), and Ahlberg (1992, fig. 8D); × 5. 5, LO 1312t, juvenile cranium; original of Moberg and Möller (1898, pl. 10, fig. 5) and Westergård (1922, pl. 16, fig. 13); × 15. 6, LO 1314t, nearly complete specimen; original of Moberg and Möller (1898, pl. 10, fig. 7) and Westergård (1922, pl. 16, fig. 8); × 3. 7, LO 1316t, fairly complete specimen; one thoracic segment is original of Moberg and Möller (1898, pl. 10, fig. 9); × 4. 8, LO 1310t, hypostome; original of Moberg and Möller (1898, pl. 10, fig. 3) and Westergård (1922, pl. 16, fig. 11); × 16. 9, LO 1308t, librigena; original of Moberg and Möller (1898, pl. 10, fig. 1), Westergård (1922, pl. 16, fig. 7) and Ahlberg (1992, fig. 8A); × 6.

Figs 10–12. *Acerocare tullbergi* Moberg and Möller, 1898. All specimens from the upper part of the *Acerocare* Zone (*Acerocare ecorne* Subzone?) at Andrarum (Text-fig. 1E), preserved in limestone. 10, LO 1341t, lectotype, cranium; original of Moberg and Möller (1898, pl. 14, fig. 6) and Westergård (1922, pl. 16, fig. 15); × 9. 11, LO 1342t, librigena; original of Moberg and Möller (1898, pl. 14, fig. 7) and Westergård (1922, pl. 16, fig. 16); × 4. 12, LO 1343t, pygidium with thorax; original of Moberg and Möller (1898, pl. 14, fig. 9); × 3.



TERFELT, *Acerocare*

- v.1909 *Boeckia? illaenopsis* Westergård, p. 49, pl. 1, figs 14–17, 20 [copy Moberg and Möller 1898], 18–19.
 1952 *Sphaerophthalmoides latus* (Matthew); Hutchinson, pp. 90, 92.
 1957 *Westergaardia lata* (Matthew); Henningsmoen, p. 254, pl. 28, figs 7–10 (with full synonymy).

Type specimen. A cranidium (ROM 57581; Pl. 4, fig. 8) from Matthew's (1891) syntypes is herein selected as lectotype.

Other material. One cranidium with thorax attached, two cranidia and two pygidia preserved in shale. One cranidium; original of Matthew (1891), preserved in limestone (anthraconite).

Remarks. In the drawing of the pygidium LO 1334t by Moberg and Möller (1898, pl. 14, fig. 4) the shape of the terminal area resembles that of *Acerocarina granulata*. However, in the original specimen the posterior margin is concave, giving the pygidium the trapezoidal shape characteristic of *Westergaardia lata* (Pl. 4, fig. 10). In the cranidium LO 1331t (Pl. 4, fig. 7; Moberg and Möller 1898, pl. 14, fig. 1), the shape of the glabella resembles that of *W. intermedia* Westergård, 1944, while the position of the palpebral lobes corresponds to that of *W. lata*, suggesting that this specimen is intermediate between these two species.

Occurrence. This species is restricted to the *Westergaardia* Subzone of the *Acerocare* Zone and has been recorded from Sweden, Norway and eastern Canada (e.g. see Henningsmoen 1957).

Genus PELTURA Milne Edwards, 1840

Type species. *Entomostracites scarabaeoides* Wahlenberg, 1818; subsequently designated by Hawle and Corda (1847, p. 119).

Peltura paradoxa (Moberg and Möller, 1898)

Plate 4, figures 2–4

- v.1898 *Acerocare paradoxum* Moberg and Möller, p. 251, pl. 11, figs 10–13, ?14.
 1957 *Peltura paradoxa* (Moberg and Möller); Henningsmoen, p. 236, pl. 26, figs 3–6 (with full synonymy).
 p.1997 *Peltura transiens* (Brøgger); Weidner, p. 88, pl. 21, fig. 1 [non fig. 2 (= *P. transiens*)].
 2003 *Peltura paradoxa* (Moberg and Möller); Buchholz, p. 39, pl. 1, figs 1–6.
 v?2005 *Peltura cf. paradoxa* (Moberg and Möller); Terfelt *et al.*, p. 201.

Lectotype. Pygidium LO 1339t (Pl. 4, fig. 4) figured by Moberg and Möller (1898, pl. 11, fig. 13) and Westergård (1922, pl. 16, fig. 3) [copy Moberg and Möller 1898]; subsequently designated by Henningsmoen (1957, p. 236).

Other material. Two librigenae, one pygidium with thorax attached and one hypostome; all preserved in limestone (anthraconite).

Remarks. Because the circumocular suture of the librigena LO 1336t (Pl. 4, fig. 2) is not visible in the specimen due to breakage, its position in the drawing (Moberg and Möller 1898, pl. 11, fig. 10) is speculative.

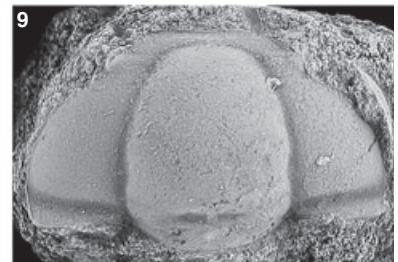
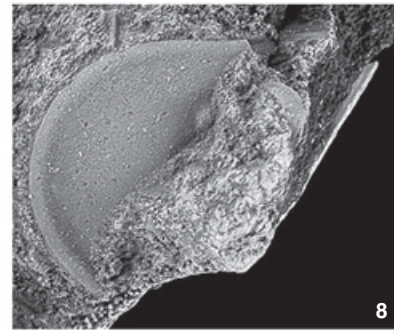
Occurrence. The species is restricted to the *P. paradoxa* Subzone in the *Acerocare* Zone and has been recorded from Sweden (Moberg and Möller 1898; Westergård 1922, 1944) and Norway (Henningsmoen 1957).

Genus PELTOCARE Henningsmoen, 1957

Type species. *Acerocare norvegicum* Moberg and Möller, 1898; by original designation.

EXPLANATION OF PLATE 3

Figs 1–6. *Acerocarina granulata* (Moberg and Möller, 1898). All specimens except 2 from the *P. transiens* and *P. costata* subzones in Södra Sandby (locality e in Text-fig. 1D). 1, LO 1323t, lectotype, nearly complete specimen preserved in shale; original of Moberg and Möller (1898, pl. 11, fig. 1); × 9. 2, LO 1381t, complete specimen from Andrarum (Text-fig. 1E), preserved in limestone; original of Moberg (1898, pl. 16, fig. 6); × 11. 3, LO 1326t, cranidium preserved in limestone; original of Moberg and Möller (1898, pl. 11, fig. 4) and Westergård (1922, pl. 16, fig. 26); × 7. 4, LO 1329t, four articulated thoracic tergites, preserved in limestone; original of Moberg and Möller (1898, pl. 11, fig. 7) and Westergård (1922, pl. 16, fig. 28); × 8. 5, LO 1330t, pygidium preserved in limestone; original of Moberg and Möller (1898, pl. 11, fig. 8) and Westergård (1922, pl. 16, fig. 29); × 22. 6, LO 1324t, external mould of a nearly complete specimen preserved in shale; original of Moberg and Möller (1898, pl. 11, fig. 2); × 6.
 Figs 7–9. *Acerocarina micropyga* (Linnarsson, 1875). All specimens from the *Peltura costata* Subzone at Åkarpsmölla (Text-fig. 1C), preserved in limestone. 7, LO 1317t, nearly complete specimen; original of Moberg and Möller (1898, pl. 10, fig. 11); × 9. 8, LO 1318t, librigena; original of Moberg and Möller (1898, pl. 10, fig. 12) and Westergård (1922, pl. 16, fig. 20); × 10. 9, LO 1320t, cranidium; original of Moberg and Möller (1898, pl. 10, fig. 14) and Westergård (1922, pl. 16, fig. 19); × 7.



TERFELT, *Acerocarina*

Peltocare norvegicum (Moberg and Möller, 1898)

Plate 4, figures 11–13

- 1898 *Acerocare norvegicum* Moberg and Möller, p. 243.
 1957 *Peltocare norvegicum* (Moberg and Möller); Henningsmoen, p. 247, pl. 27, figs 6, 8, 10–14 (with full synonymy).
 1968 *Peltocare norvegicum* (Moberg and Möller); Robison and Pantoja-Alor, p. 793, pl. 103, figs 14–23.
 2005 *Peltocare norvegicum* (Moberg and Möller); Zeballo and Tortello, p. 136, fig. 5A–D.

Lectotype. Cranidium PMO H2619 (Pl. 4, fig. 12) figured by Brøgger (1882, pl. 1, fig. 3); subsequently designated by Henningsmoen (1957, p. 247).

Other material. One fairly complete specimen and one pygidium; both originals of Brøgger (1882), and preserved in limestone (anthraconite).

Remarks. Brøgger (1882) included this form in the species concept of *Cyclognathus micropygus* (= *Acerocarina micropyga*). However, Moberg and Möller (1898, p. 243) identified several features that differ from *C. micropygus* and erected the new species *Acerocare norvegicum*. Henningsmoen (1957, p. 246) subsequently placed it in the genus *Peltocare*. The hypostome and the librigena figured by Brøgger (1882, pl. 1, fig. 3a–b) are registered in the database at the Geological Museum, University of Oslo. However, these specimens cannot be located at present (F.-J. Lindemann, pers. comm. 2005).

Occurrence. Tremadocian in Norway (Henningsmoen 1957), Sweden (Wiman 1905), Argentina (Zeballo and Tortello 2005) and Mexico (Robison and Pantoja-Alor 1968).

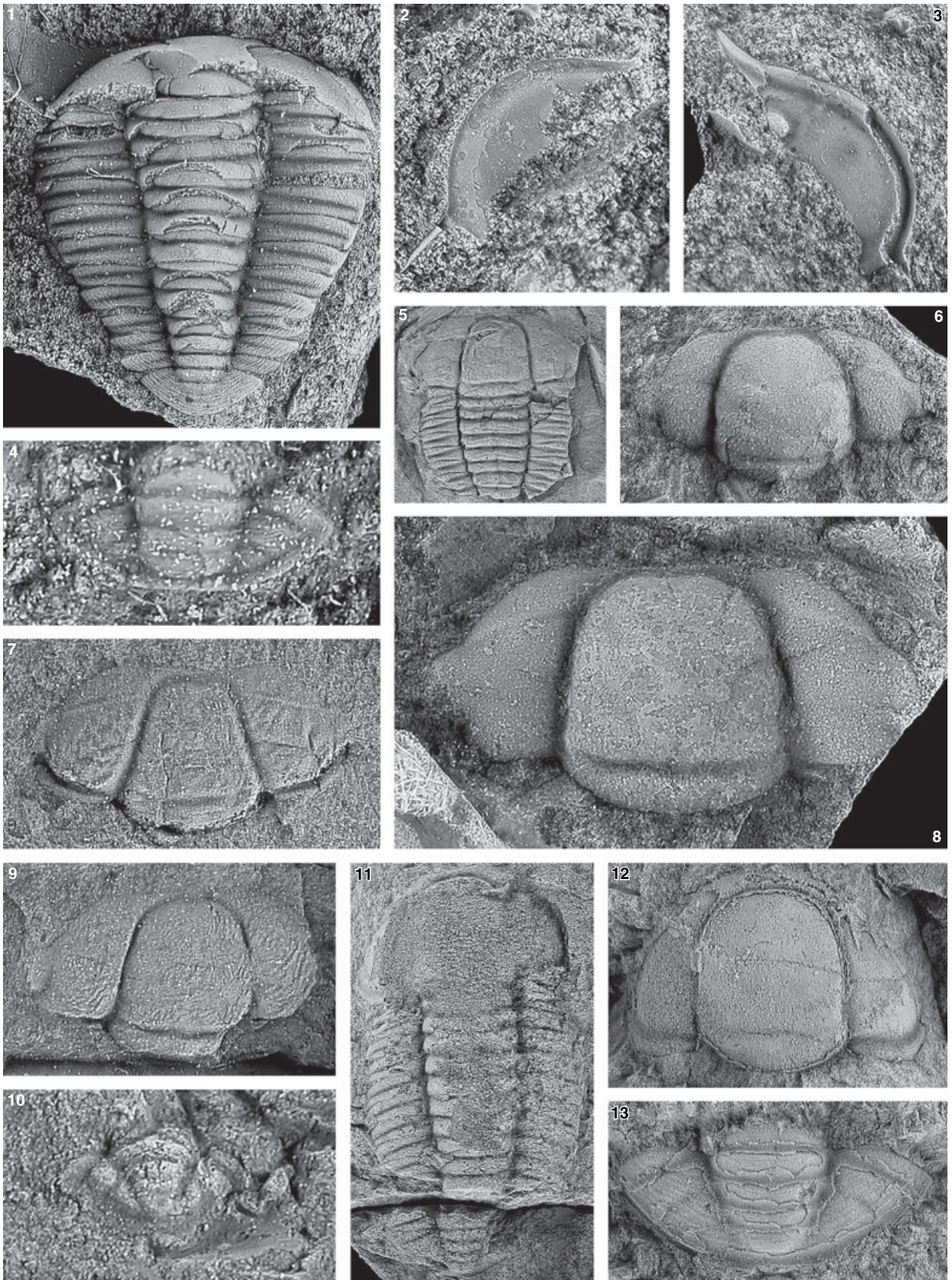
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EXPLANATION OF PLATE 4

- Fig. 1. *Acerocarina micropyga* LO 1322t, pygidium with thorax from the *Peltura costata* Subzone at Åkarpsmölla (Text-fig. 1C), preserved in limestone; the pygidium is original of Moberg and Möller (1898, pl. 10, fig. 17) and Westergård (1922, pl. 16, fig. 22); × 11.
 Figs 2–4. *Peltura paradoxa* (Moberg and Möller, 1898). All specimens from the *P. paradoxa* Subzone at Åkarpsmölla (Text-fig. 1C), preserved in limestone. 2, LO 1336t, librigena; original of Moberg and Möller (1898, pl. 11, fig. 10) and Westergård (1922, pl. 16, fig. 1); × 14. 3, LO 1337t, librigena; original of Moberg and Möller (1898, pl. 11, fig. 11) and Westergård (1922, pl. 16, fig. 2); × 12. 4, LO 1339t, lectotype, pygidium; original of Moberg and Möller (1898, pl. 11, fig. 13) and Westergård (1922, pl. 16, fig. 3); × 33.
 Figs 5–10. *Westergaardia lata* (Matthew, 1891). All specimens except 6 and 8 from the *Westergaardia* Subzone at Andrarum (Text-fig. 1E), preserved in shale. 5, LO 1333t, cranidium with thorax; original of Moberg and Möller (1898, pl. 14, fig. 3) and Westergård (1909, pl. 1, fig. 20; 1922, pl. 16, fig. 37); × 10. 6, ROM 57582, cranidium from Navy Island, St. John Harbour, New Brunswick, Canada, preserved in limestone; one of Matthew's (1891) syntypes; × 7. 7, *W. lata?*, LO 1331t, cranidium; original of Moberg and Möller (1898, pl. 14, fig. 1) and Westergård (1909, pl. 1, fig. 14; 1922, pl. 16, fig. 36); × 10. 8, ROM 57581, lectotype, cranidium from Navy Island, St. John Harbour, New Brunswick, Canada, preserved in limestone; one of Matthew's (1891) syntypes; × 10. 9, LO 1332t, cranidium; original of Moberg and Möller (1898, pl. 14, fig. 2); × 12. 10, LO 1334t, pygidium; original of Moberg and Möller (1898, pl. 14, fig. 4) and Westergård (1909, pl. 1, fig. 17; 1922, pl. 16, fig. 38); × 30.
 Figs 11–13. *Peltocare norvegicum* (Moberg and Möller, 1898). All specimens from the Tremadoc in Vekkerø, Oslo Region, Norway, preserved in limestone. 11, PMO H2694, fairly complete specimen; original of Brøgger (1882, pl. 1, fig. 4); × 2. 12, PMO H2619, lectotype, cranidium; original of Brøgger (1882, pl. 1, fig. 3); × 4. 13, PMO H2613, pygidium; original of Brøgger (1882, pl. 1, fig. 3c); × 5.



TERFELT, Furongian trilobites

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