ORDOVICIAN PROETIDAE (TRILOBITA) FROM SCANDINAVIA

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Twenty-five species of proetid trilobites are distinguished in the Ordovician of Scandinavia. They are distributed among the established genera *Proetus* Steininger, 1831, *Decoroproetus* Přibyl, 1946, *Eremiproetus* R. & E. Richter, 1919, and *Cyphoproetus* Kegel, 1927 and the new genera *Ascetopeltis* (type species *A. bockeliei* sp. nov.), *Stenoblepharum* (type species *Paraproetus warburgae* Přibyl, 1964), and *Xenocybe* (type species *X. micrommata* sp. nov.). Nine new species are defined: *Ascetopeltis bockeliei, A. lepta, Decoroproetus bodae, D. campanulatus, D. evexus, Stenoblepharum norvegicum, S.? striatum, Eremiproetus agellus* and *Xenocybe micrommata.* The new genus *Parvigena* (type species *Proetus parvigena* Warburg, 1925), of unknown affinities, is placed in family uncertain.

The greatest diversity of species is found in late Ordovician reef or reef-like deposits, and species from such horizons are comparable with those occurring in the Kildare Limestone, Ireland, and in the Whitehead Formation, Quebec. Species found in non-reef deposits are mostly distinct from those of the reefs, but are the same as, or comparable with those found in similar strata in Britain and Poland.

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Localities in the Oslo region of Norway and in central Sweden, particularly those exposing the Boda reef limestone in Dalarne, north central Sweden, have proved to be some of the richest known sources of Ordovician proetid trilobites, and the material is commonly abundant and well preserved. Over the past 140 years some twenty species have been described and figured, in the works of Esmark (1833), Angelin (1854), Linnarsson (1869), Törnquist (1884), Olin (1906), Wiman (1907), Sjöberg (1918), Warburg (1925), Størmer (1940) and Owens (1970). Of these a large proportion originate from the Boda Limestone and were described by Warburg (1925) in her monumental monograph. Warburg's descriptions are for the most part adequate but she did not describe all the material available to her, so they can in some cases be amplified.

Much of the material which forms the basis for this paper is in various Norwegian and Swedish museum collections, and this has been augmented with extra material collected by the author in Dalarne in the autumn of 1969. Proetids from the Middle Ordovician of the Oslo region have been treated separately by Owens (1970).

The following abbreviations are employed for institutions in which specimens are lodged: PMO-Palaeontologisk Museum, Oslo; RM-Naturhistoriska Riksmuseet, Stockholm; SGU-Sveriges Geologiska Undersökning (Museum

of the Swedish Geological Survey), Stockholm; SU-Stockholm University Collections; UM-Museum of the Palaeontological Institute, Lund; GSM-Institute of Geological Sciences, Geological Survey Museum, London; NMP-National Museum, Prague.

Before photographing, each specimen was given a light coating of ammonium chloride sublimate, some having previously received a coating of dilute black 'opaque'. All of the photographs were made by the author using a Leitz aristophot apparatus equipped with a fluorescent ring light. Drawings were made for the most part from the photographs.

The terminology employed herein follows that of Harrington, Moore & Stubblefield (Moore 1959, pp. 0117–0126), but also includes a few additional terms used previously by the author (Owens 1970, pp. 309–311).

Measurements, given in millimetres, are given for figured specimens where possible. Those used are the same as given in Owens (1970, p. 311, fig. 2), except that L_2 refers to the sagittal length of the preglabellar field plus the anterior border. In addition, SO refers to the sagittal length of the occipital ring. Paramaters given in brackets are estimated. E and I indicate that the measurements are made on the external surface or internal moulds respectively. E/I refers to partially exfoliated specimens.

Stratigraphy

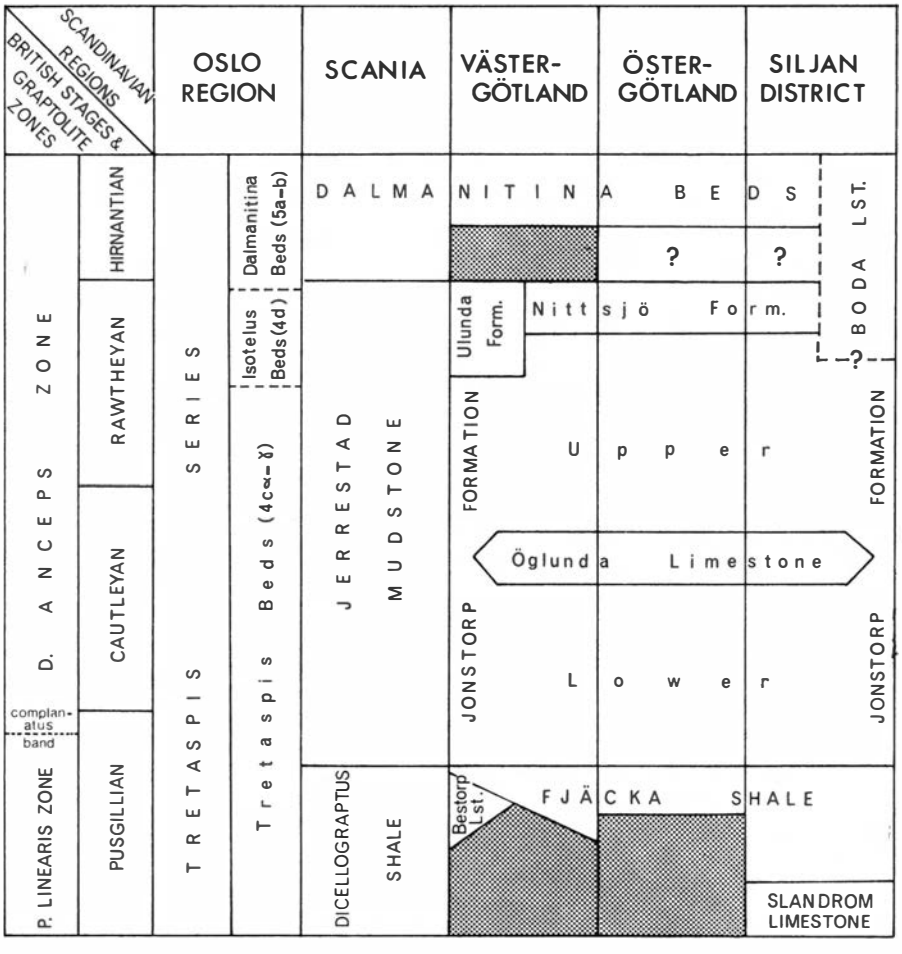
Instead of using the rather vague terms 'Middle' and 'Upper' Ordovician, it is preferred to use the series names Viruan and Harjuan, as used by Jaanusson (e.g. 1960, 1960a, 1963) in central Sweden. The terms Caradoc and Ashgill are avoided, except when referring to British material, because their exact correlation with the Scandinavian sequences is still somewhat conjectural. However, some general remarks can be made in their approximate equivalents in Scandinavian successions. Ingham & Wright (1970) have revised the British Ashgill Series, dividing it into four stages; their inclusion of the Pusgillian in the Ashgill makes the latter approximately equivalent to the Harjuan.

Both the Pugsillian stage and the Fjäcka Shale are equivalent, at least in part, to the zone of *Pleurograptus linearis*. Dr. J. K. Ingham (pers. comm. 1970) considers Stage 5a of the Tretaspis Series in Norway to be approximately the same age as the Upper Drummuck Group at Girvan, which he considers to belong to zone 7 of the Rawtheyan stage. The Red Jonstorp Formation is also about the same age. On proetid evidence, the Boda Limestone, whose age is uncertain, would seem to be more or less contemporaneous with Stage 5a and the Upper Drummuck Group.

Distribution and comparison with non-Scandinavian proetid faunas

The stratigraphical and geographical distribution of the proetid species in Scandinavia discussed in this paper is shown on the accompanying table. For

Table 1. Harjuan formations in Scandinavia and their correlation with the standard British Ashgill. [Correlation of Swedish successions after Jaanusson 1963; correlation of British Ashgill Stages and graptolitic succession after Ingham & Wright 1970].



the purpose of comparison with other regions, the Ordovician proetids from Scandinavia may be conveniently divided into four groups based on facies and on stratigraphy: –

Non-reef facies of the Viru Series

Non-reef facies of the Harju Series

Reef facies of the Viru Series

Reef and Palaeoporella facies of the Harju Series.

On the whole, species in the reef and non-reef facies are distinct, although some occur in both facies, but while common in one tend to be rare in the other.

Non-reef facies of the Viru Series

In the Oslo district of southern Norway the non-reef Viruan is essentially a series of impure limestones alternating with shales and mudstones, while in

Table 2. Stratigraphical and geographical distribution of Proetidae in the Ordovician of Norway and Sweden. [+ indicates present; * indicates abundant].

Species	NORWAY: Oslo Region: Stage 5a	NORWAY: Oslo Region: Stage 4cα	NORWAY: Oslo Region: Chasmops Series	SWEDEN: Scania: Jerrestad Mudstones	SWEDEN: Västergötland: Dalmanitina Beds	SWEDEN: Västergötland: Jonstorp Formation	SWEDEN: Östergötland: Dalmanitina Beds	SWEDEN: Östergötland: Jonstorp Formation	SWEDEN: Östergötland: Fjäcka Shale	SWEDEN: Dalarne: Boda Limestone (reef)	SWEDEN: Dalarne: Boda Limestone (off-reef)	SWEDEN: Dalarne: Fjäcka Shale	SWEDEN: Dalarne: Kullsberg Limestone	SWEDEN: Öland: Macrourus Limestone	Remarks
Proetus ainae										+					
Ascetopeltis bockeliei	*							+			+				Occurs in Porkuni Stage, Estonia?
A. lepta	+														
A. sp. 1	+														
A. ? sp. 2										+					
Decoroproetus asellus		+								*					Occurs in Ashgill, of Girvan district
D. bodae										+					
D. brevifrons						+									
D. campanulatus										+					
D. evexus	+				+		+								
D. furubergensis			+											+	
D. gyratus			+												
D. papyraceus									+			*			Occurs in Ashgill, of Poland & N. England
D. solenotus			+												
D. sp. A			+												
D. sp. 1													+		
D. sp. 2										+					
D. ? *scanicus*				+											
Stenoblepharum warburgae										*	+				
S. norvegicum	*									+					
S. kullsbergense													+		
S. pentagonoides										+					Occurs in Kildare Limestone, Eire?
S. ? *striatum*										+					
E. agellus	+									+					
Cyphoproetus sp. 1										+					
C. sp. 2	+														
C. sp. 3	+														
Parvigena parvigena										+					
Xenocybe micrommata	+														

parts of central Sweden (Östergötland, Öland and Dalarne) it is represented mainly by a series of limestones. In Västergötland the sequence is transitional between the graptolitic shales found in Skåne on the one hand and the mixed mudstone-carbonate sequence of the Oslo region on the other. Four species of *Decoroproetus* have been recorded from the Viruan in the Oslo region (Owens 1970) and one of these *(D. fururbegensis* Owens 1970) has since been identified from Macrourus Limestone erratics from Öland. Some of the species *(D. furubergensis* and *D. solenotus)* are comparable with contemporaneous ones from the Girvan district (e.g. *D. jamesoni* (Reed 1914) and east North America (e.g. *D. matutinus* Ruedemann 1901)).

Non-reef facies of the Harju Series

This is essentially a shale sequence in which dark calcilutites (e.g. the Bestorp Limestone) are locally developed. In this facies of the Harjuan *Decoroproetus* is the common proetid genus, represented by such species as *D. asellus* (Esmark 1833), *D. brevifrons* (Angelin 1854) and *D. papyraceus* (Törnquist 1884). *D. asellus* occurs in the Boda Limestone, and also in the Upper Drummuck Group (late Rawtheyan) of the Girvan district. *D. paypraceus* is found both in Poland and in northern England, but in both cases occurs in later beds than in Sweden. *Ascetopeltis bockeliei* occurs rarely in the Red Jonstorp Formation of Östergötland and in the reef flank deposits of the Boda Limestone, but occurs more commonly in the *Palaeporella* facies of Stage 5a in the Oslo region. *Stenoblepharum warburgae* is also found rarely in the reef flank deposits of the Boda Limestone, but is much more common in the reef proper.

Reef facies of the Viru Series

Viruan reefs are developed in Dalarne as the Kullsberg Limestone, which occurs in close association with the overlying Harjuan Boda Limestone reefs. In this facies of the Viruan only one proetid species is common – *Stenoblepharum kullsbergense,* accompanied by a rare *Decoroproetus*. No contemporaneous comparable species are known from elsewhere and the closest affinities lie with species in the Harjuan Boda reef limestone.

Reef and Palaeoporella facies of the Harju Series

Harjuan reefs are developed in Dalarne, Sweden, as the Boda Limestone, while corresponding beds of Stage 5a in the Oslo region are bedded limestones containing a similar shelly fauna and biostromes of the calcareous green alga *Palaeoporella*. In the Harjuan reef or *Palaeoporella* facies, certain genera are found which are rare or unknown in the non-reef facies, such as *Stenoblepharum, Eremiproetus,* and *Xenocybe*. Of these, *Stenoblepharum* is the most characteristic and abundant proetid genus of Scandinavian Harjuan reefs. The dominant proetid species of the Boda Limestone are *Stenoblepharum warburgae* and *Decoroproetus asellus,* whilst in Stage 5a *Stenoblepharum norvegicum* (closely related to *S. warburgae* and also oc-

curring rarely in the Boda Limestone) and *Ascetopeltis bockeliei* are dominant. Os a rule the proetid faunas of the Boda Limestone and Stage 5a are distinct and the former is far richer in species (Table 2), and in individuals. Outside Scandinavia, comparable species to those of the Boda Limestone and Stage 5a are found in the Ashgill Kildare Limestone of Ireland and in the Ashgill Whitehead Formation of Quebec. In both of these formations, *Stenoblepharum* species are found.

Systematic descriptions

Family PROETIDAE Salter, 1864, *Subfamily* PROETINAE Salter, 1864.

Genus *Proetus* Steininger, 1831

Type species: *Calymmene concinna* Dalman, 1827.

Proetus ainae Warburg, 1925.

Fig. 1, A–F, H–L.

□ 1925 *Proetus Ainae;* Warburg, p. 178, pl. 5, figs. 26–31. □ 1964 *Paraproetus ainae* (Warburg); Přibyl, p. 44.

Lectotype (here selected). – A partially exfoliated cranidium (Stockholm University Collection), figured Warburg 1925, pl. 5, fig. 26 and refigured herein as Fig. 1, H.

Fig. 1.

A–F, H–L. *Proetus ainae* Warburg, 1925.

A–D. Cranidium: A-dorsal, B-anterior oblique, C-lateral and D-anterior views, × 7. Note lateral glabellar furrows and small auxiliary impressions on A. Specimen the original of Warburg 1925, pl. 5, fig. 29. Boda Limestone, Lissberg, Lake Siljan district, Dalarne, Sweden. (S.G.U. Collection, unnumbered.)

E. Cranidium: dorsal view, × 5½. Probably Boda Limestone, Gulleråsen, Lake Siljan district, Dalarne, Sweden. (RM Ar 11482.)

F. Free cheek: dorsal view, × 5½. Note pitted surface. Specimen the original of Warburg 1925, pl. 5, fig. 27. Horizon and locality as A. (S.G.U. Collection, unnumbered.)

H. *LECTOTYPE* cranidium: dorsal view, × 6. Specimen the original of Warburg 1925, pl. 5, fig. 26. Horizon and locality as A. (Geologiska Institutet, Stockholm collection, unnumbered.)

I–K. Pygidium: I-dorsal, J-posterior and K-lateral views, × 6. Horizon and locality as A. RM Ar 11480.

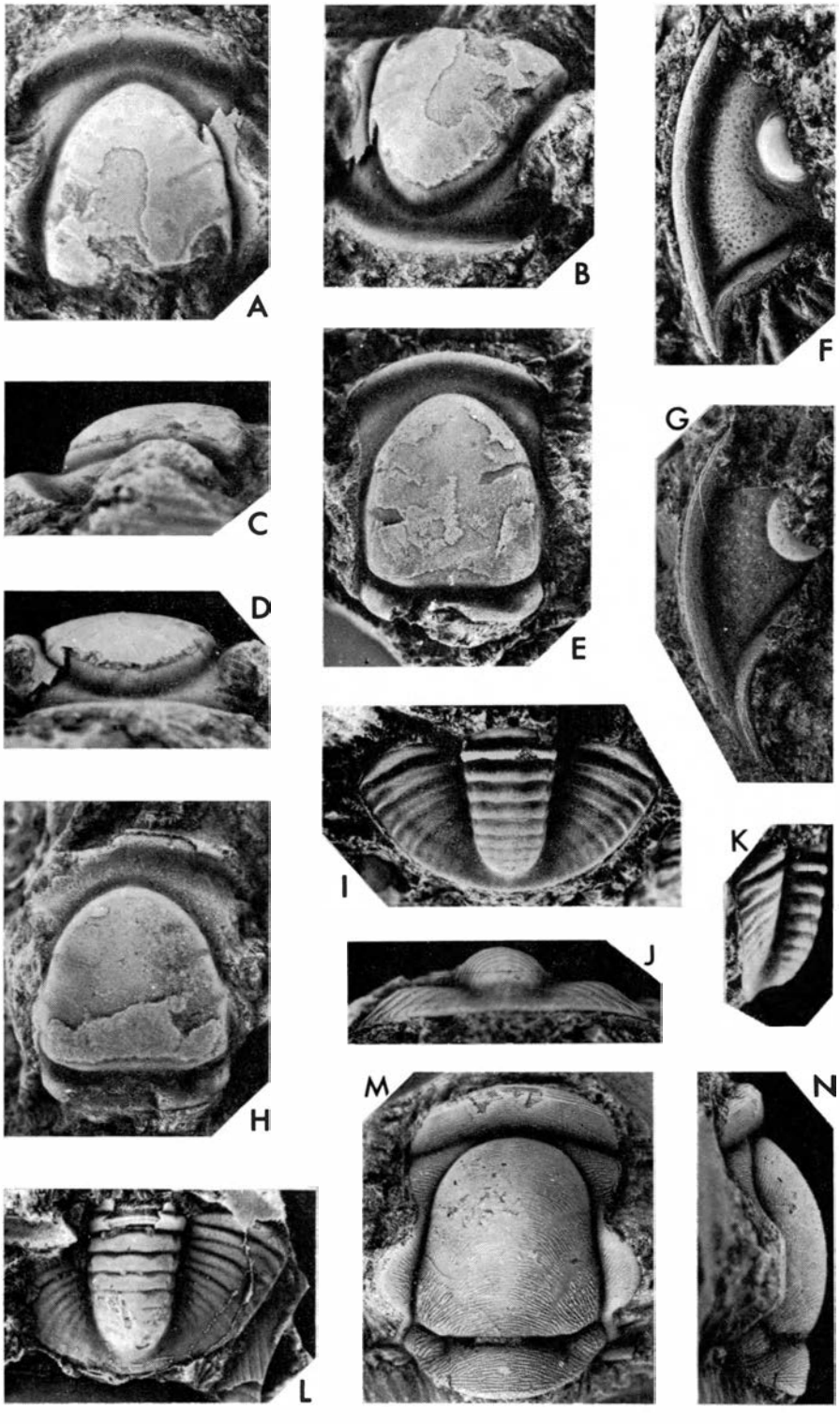
L. Pygidium: dorsal view, silicone rubber cast of external mould, × 5. Horizon and locality as A. (RM Ar 11480.)

G. *Proetus* sp. cf. *ainae* Warburg, 1925.

Free cheek: dorsal view, × 7½. Ashgill, Kildare Limestone, Chair of Kildare, Ireland. (GSM 35656.)

M, N. *Ascetopeltis bockeliei* gen. et sp. nov.

Cranidium: M-dorsal and N-lateral views, × 6. Tretaspis Series, Stage 5a, Jongskollen, Oslo district, Norway. (PMO 8814, coll. J. F. Bockelie 1966.)


A
B
F
C
E
G
D
I
K
J
H
M
N
L

Material. – Many detached exoskeletal parts, mostly internal moulds.

Type stratum and type locality. – Harjuan, Boda Limestone, Lissberg, Lake Siljan district, Sweden.

Occurrence. – Only known from the type locality.

Diagnosis. – Glabella broadly coniform, weakly inflated and steeply declined at its perimeter to the axial and preglabellar furrows; three pairs of non-incised lateral glabellar furrows; very short (sag.) preglabellar field; eye small, on narrow, poorly defined eye socle; anterior branches of facial sutures weakly divergent, posterior branches with epsilon and zeta separate angles; field of free cheek pitted; genal spine short; occipital ring with lateral lobes, pygidium without border; axis rather narrow with 7–8 axial rings clearly defined; pleural areas with 5 pairs of ribs.

Description. – See Warburg, p. 178.

Discussion. – The generic name *Proetus* Steininger, 1831 has been widely and somewhat indiscriminately used for proetids ranging in age from the Ordovician to the Devonian. The type species, *Proetus concinnus* (Dalman 1827), which is Silurian, has recently been refigured by Whittington & Campbell (1967, pl. 3, figs. 4, 5, 9, 11, 12). Few Ordovician species can be referred to *Proetus*. One of these, the earliest so far recorded, is *Proetus berwynensis* (Whittington 1966), referred by its author to the genus *Astroproetus* Begg 1939. *Proetus berwynensis* has, as Whittington (1966, p. 83) notes, the preannulus. Other characters of this species include the short, bluntly terminating pygidial axis, pygidial pleural and interpleural furrows running more or less parallel, coniform glabella, weakly divergent anterior branches of the facial sutures, very short (sag.) preglabellar field and triangular rostral plate. By virtue of these characters, and particularly the preannulus and the pygidial morphology, *berwynensis* can be assigned to *Proetus*. No known species of *Astroproetus* has the preannulus, and the structure of the pygidial axis and pleural ribs is different.

Proetus ainae is comparable with *P. berwynensis,* especially in the coniform glabella, the very short (sag.) preglabellar field, and the nature of the pygidial pleural ribs, although the pygidial axis is narrower with more rings. The overall morphology of *ainae* indicates that it, like *berwynensis,* is an early member of *Proetus*. *P. ainae* has so far only been recorded from the Boda Limestone, from only one locality. A free cheek from the Ashgill Kildare Limestone of Eire (Fig. 2, G) is similar to that of *P. ainae,* and may belong to a closely related, hitherto undescribed species.

Of Warburg's original material, it has unfortunately been impossible to trace the hypostome (Warburg, pl. 5, fig. 28) which she supposed to belong to this species.

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
S.U. Coll. (I) (Fig. 1, H)	6.7	4.6	1.2	0.9	4.2	–	Lectotype
S.G.U. Coll. (E) (Fig. 1, A)	–	4.2	1.0	–	4.1	5.9	
RM Ar 11482 (I)	7.2	5.2	1.0	1.0	4.4	–	
Pygidia Specimen No.	A	A_1	X	Y			
S.G.U. Coll. (E) (Fig. 1, L)	4.8	4.3	(8.0)	2.6			
RM Ar 11480 (I)	3.9	3.1	6.3	2.0			
RM Ar 11483 (I)	1.8	1.3	(2.4)	0.8			

Genus *Ascetopeltis* gen. nov.

Type species: *Ascetopeltis bockeliei* gen. et sp. nov.

Derivation of name. – From Greek *asketos,* curiously wrought, and *pelte,* a small shield, alluding to the surface sculpture of the type species. Gender, feminine.

Diagnosis. – Preglabellar field, when present, is very short (sag.); palpebral lobe large to rather small; occipital ring may or may not narrow abaxially; small, ill-defined lateral occipital lobes present; panderian notch present on cephalic doublure at base of genal spine; thorax of ten segments, preannulus present; pygidium broadly triangulate, without border; broad, bluntly terminating axis with 4–5 rings, separated by very shallow interannular furrows; pleural areas with 3–4 pleural ribs, with pleural and interpleural furrows of about the same depth; sculpture smooth or striate, the striae often interspersed with sporadic granules.

Species. – *Ascetopeltis bockeliei* sp. nov.; *A. lepta* sp. nov.; *A.* sp. 1; *A.* ? sp. 2; *A.* ? *kertelensis* (Schmidt), at least one additional species from Estonia and an undescribed species from the British Isles.

Occurrence. – Harjuan, Tretaspis Series, Stage 5a, Oslo, Norway; Boda Limestone (off-reef facies) and Red Jonstorp Formation, Lake Siljan district and Östergötland, Sweden; Porkuni Stage, Estonia; Ashgill, N.W. Yorkshire, England.

Discussion. – *Ascetopeltis* is considered to be an early member of the Proetinae, closely related to *Proetus*. The principal differences between these two genera are to be found in the shape of the pygidium and the striated surface sculpture of the former. Important shared features of *Ascetopeltis* and *Proetus* include the cephalic panderian notch, the preannulus and incurved pygidial marginal terrace lines. Species of Proetus are already present in the later Ordovician (see above) and some pre-date the earliest known *Ascetopeltis*. *Ascetopeltis* does not, therefore, seem to be the direct ancestor of *Proetus,* but may be its descendant. The origins of *Ascetopeltis* and *Proetus* are uncertain, but may lie in *Cyphoproetus,* Kegel 1927, whose known range extends back into the Middle Ordovician. Its type species (*C. depressus* (Barrande 1846)) possesses the preannulus and a similar type of pygidium to *Proetus* and *Ascetopeltis*. It is proposed to discuss *Cyphoproetus* in greater detail in a forthcoming paper.

Ascetopeltis bockeliei sp. nov.

Fig. 1, M, N, Fig. 2, A–K.

Holotype. – A complete, partially exfoliated exoskeleton (PMO 8808) with incomplete counterpart (PMO 8807), Fig. 2, A, I.

Material. – Several cranidia, free cheeks and pygidia.

Fig. 2.

A–K. *Ascetopeltis bockeliei* gen. et sp. nov.

A, I. *HOLOTYPE:* Complete, partially exfoliated exoskeleton: A-dorsal view, × 3¾; note trapezoidal rostral plate in front of glabella; the small cranidium seen on the right hand side, just behind the eighth pleura, belongs to *Xenocybe micromnata* gen et sp. nov. (see also Fig. 14).

I-dorsal view of part of glabella, × 13, showing detail of the striated sculpture. Tretaspis Series, Stage 5a, Holmenskjæret, Oslo-Asker district, Norway. (PMO 8408, coll. J. F. Bockelie 1965.)

B. Silicone rubber cast of incomplete external mould: dorsal view, × 3½. Tretaspis Series, Stage 5a, Lindøya, Oslo district, Norway. (PMO 70467, coll. T. Faarlund 1962.)

C. Free cheek: dorsal view, × 5. Internal surface, showing panderian opening on doublure. Tretaspis Series, Stage 5a, Jongskollen, Oslo district, Norway. (PMO 8847, coll. J. F. Bockelie 1966.)

D. Cranidium: dorsal view, × 7. Partially exfoliated occipital ring shows transverse terrace lines of doublure. Tretaspis Series, probably Stage 5a, Nes terrasse 16, Nesbru, Oslo-Asker district, Norway. (PMO 8862, coll. J. F. Bockelie 1966.)

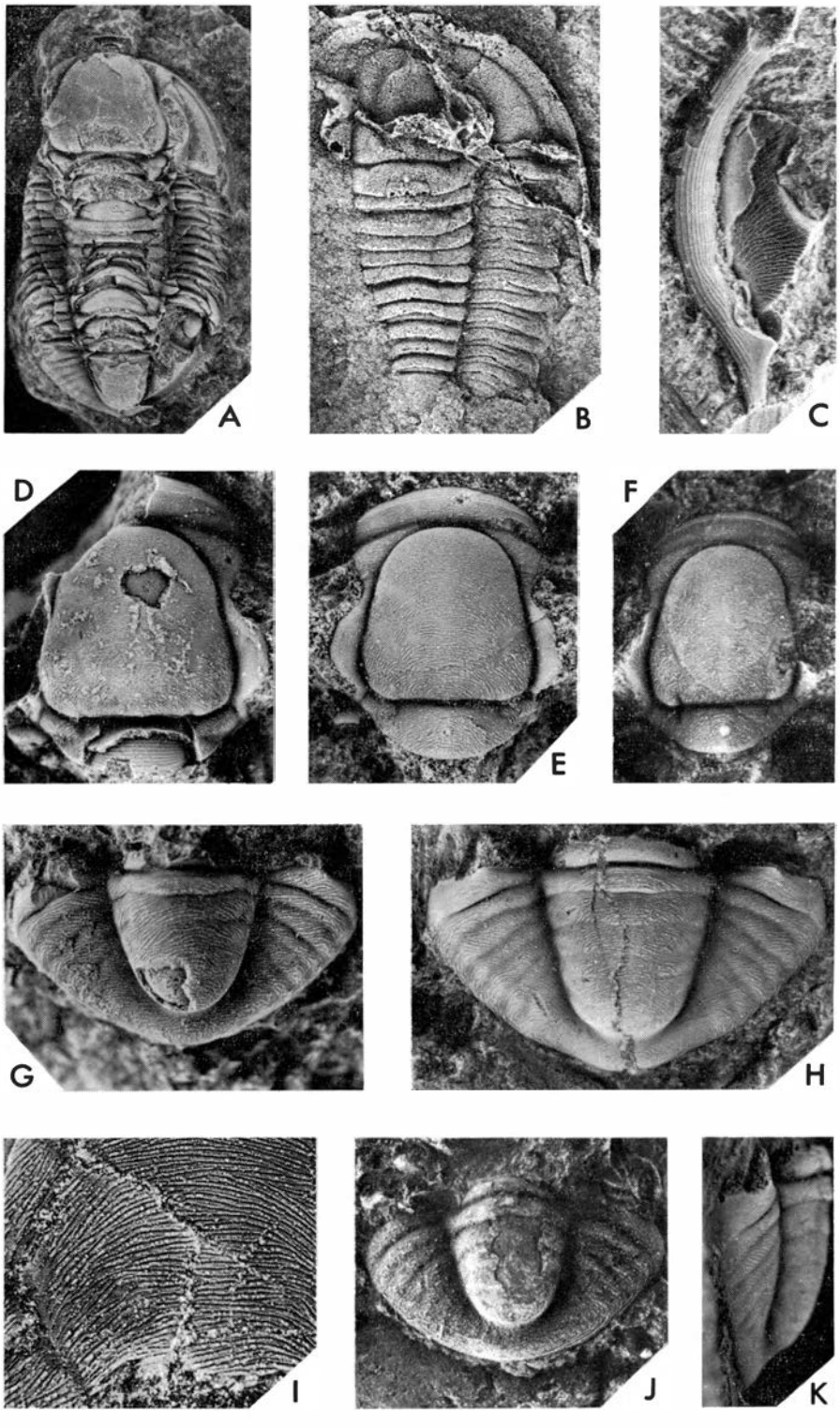
E. Cranidium: dorsal view, × 8. Horizon and locality as A. (PMO 8467, coll. J. F. Bockelie 1965.)

F. Small cranidium: dorsal view, × 11½. Horizon and locality as A. Note short longitudinal forrows on posterior edge of glabella. (PMO 70430, coll. F. Nikolaisen 1968.)

G. Pygidium: dorsal view, × 7. Boda Limestone, off-reef facies, erratic block no. 41, Hultersta, Öland. (RM Ar 23075, coll. G. Andersson 1893.)

H. K. Pygidium: H-dorsal and K-lateral views, × 6. Note incurving marginal terrace lines. Horizon and locality as A. (PMO 70469, coll. F. Nikolaisen 1968.)

J. Small pygidium: dorsal view, × 10. Red Jonstorp Formation, Rödbergsudden, Östergötland. (RM Ar 17830.)


A
B
C
D
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H
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Type stratum and type locality. – Harjuan, Tretaspis Series, Stage 5a, Holmenskjæret, Holmen, Oslo-Asker district, Norway.

Occurrence. – Harjuan, Tretaspis Series, Oslo-Asker district, Norway; Red Jonstorp Formation, Östergötland and Siljan, Sweden, Boda Limestone (off-reef facies), Siljan, Sweden.

Derivation of name. – After Mr. J. F. Bockelie (Oslo) who collected most of the material upon which this species is based.

Diagnosis. – Preglabellar field absent; anterior border rather wide; occipital ring narrows rapidly abaxially, and has small, ill-defined lateral lobes; sculpture of dense striations.

Description. – Cephalon semicircular in outline, with moderately wide, convex border. Glabella as wide or a little wider (trans.) than long (sag.), slightly constricted near anterior end of palpebral lobe, gently convex in lateral and longitudinal profiles. Three pairs of lateral glabellar furrows, represented by smooth areas interrupting striations on glabellar surface, although some striations cross anterior two pairs. 1p far more distinct than 2p and 3p opposite anterior part of palpebral lobe, backwardly directed and roughly lozenge-shaped, widest at mid-length. 2p, nearly opposite γ, is directed backwards at about 45° and widens slightly inwards. 3p inconspicuous ovate area a short distance in front of 2p, directed forwards and isolated from axial furrow.

Occipital furrow deep, transverse and flexed forwards at extreme lateral ends. Anterior slope nearly vertical, posterior slope inclined at about 45°. Occipital ring wide (sag.), narrowing strongly laterally, in lateral profile inclined at 45° from occipital furrow, flattening posteriorly, and at greatest width (trans.) marginally wider than glabella. Small median tubercle and small, rather ill-defined, ovate lateral lobes present.

Anterior branches of facial sutures diverge quite strongly, palpebral lobe crescentic, posteriorly placed and inclined quite steeply from axial furrow. flattening distally. Narrow band runs parallel with outer edge, interrupting striations. Eye large, crescentic, supported by indistinct eye socle. Posterior branch of facial suture with ε and ξ one angle, close to axial furrow.

Anterior border furrow distinct and confluent with preglabellar furrow in front of glabella. Anterior border weakly convex and somewhat flattened sagittally, where it widens very slightly.

Free cheek gently convex and quite steeply declined from eye. Lateral and posterior borders convex, but latter is slightly narrower than former. Genal spine rather short, with short median groove at anterior end. Cephalic doublure ventrally convex, with distinct panderian notch near base of genal spine (Fig. 2, C).

Thorax of ten segments, with axis narrowing gently backwards. Annulus

gently convex in lateral profile and rather narrow (sag.). Preannulus about two-thirds width (sag.) of annulus, not reaching axial furrow. Articulating half-ring wider than annulus (sag.). Doublure of annulus dorsally convex with strong transverse terrace lines. Pleura with deep pleural furrow, which extends about three-quarters of way towards distal end. Fulcrum situated about half way along the pleura. Posterolateral end of the pleura is pointed.

Pygidium subtriangular, without a border; axis occupies about one third the pygidial width at its anterior end, tapering backwards gradually, bluntly rounded posteriorly, not reaching the posterior border, and strongly arched in longitudinal profile. Five axial rings, of which first is narrow and elevated above remainder. In lateral profile each ring gently inclined towards posterior, and each is defined by very shallow interannular furrows. Articulating furrow deep. On all except the first ring is a small rounded impression near posterolateral angle, which interrupts striations. No postaxial ridge. Pleural areas with three pairs of distinct ribs, with a fourth pair weakly indicated. Pleural and interpleural furrows more or less the same strength, with exception of first pair of pleural furrows, which are much deeper and narrower than the remainder. Anterior pleural band a little wider than posterior, and both are of equal convexity and height. Pygidial doublue of comparable width to cephalic, and similarly ventrally convex and ornamented with strong, parallel terrace lines.

Entire exoskeleton covered with fine striations, on some parts, notably posterior part of the glabella, occipital ring an pygidial axis, interspersed with sporadic granules.

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
PMO 8408 (E)	(7.8)	6.0	–	–	7.2	–	Holotype
PMO 8814 (E)	7.1	4.5	1.2	1.4	4.0	5.8	
PMO 8467 (E)	4.7	3.0	0.7	1.0	2.8	4.0	
PMO 8862 (E)	–	4.0	–	(1.1)	4.0	(5.0)	
PMO 70430 (E)	3.0	2.0	0.4	0.6	1.8	(2.1)	
Pygidia Specimen No.	A	A_1	X	Y			
PMO 8408 (E/I)	5.2	4.7	8.3	3.1		Holotype	
PMO 70469 (E)	5.5	4.8	8.3	3.4			
RM Ar 23075 (E)	4.8	3.8	7.6	3.0			
RM Ar 17830 (E)	3.0	2.4	4.9	1.7			
PMO 8466 (E)	2.4	2.0	3.3	1.1			

Discussion. – *Ascetopeltis bockeliei* is quite common in Stage 5a in the Oslo region, and occurs rarely in the Red Jonstorp Formation and in the off-reef facies of the Boda Limestone in central Sweden. Comparable specimens

occur in the Porkuni Stage of Estonia (Fig. 3, A–D, H–I). One cephalon, with one free cheek preserved (Fig. 3, D) shares similar proportions to *A. bockeliei,* but apparently lacks striations on the surface. Another cranidium (Fig. 3, H, I), with a striated sculpture, differs from *A. bockeliei* in the shape of the glabella and in having a smaller palpebral lobe. A pygidium (Fig. 3, A–C) has the external surface devoid of striations, and bears a short anterior projection on the articulating facet of the pygidium (Fig. 3, B). One or more of these Estonian specimens may belong to Schmidt's (1894, p. 56, pl. 4, fig. 37) species *Proetus kertelensis,* which occurs in the Porkuni stage. His figure shows that the species in quite similar to *A. bockeliei,* and therefore probably belongs to *Ascetopeltis,* but I have been unable to see the original specimen.

Ascetopeltis lepta sp. nov.

Fig. 3, E–G, J.

Holotype. – A cranidium (PMO 70498), Fig. 3, E–G.

Material. – Two additional cranidia.

Type stratum and type locality. – Harjuan, Tretaspis Series, Stage 5a, Holmenskjæret, Holmen, Asker, Norway.

Fig. 3.

A–C. *Ascetopeltis* sp.
Pygidium: A-dorsal, B-lateral and C-posterior views, × 4½. Note projection on articulating facet on B. Porkuni Stage, Estonia. (RM Ar 34812, coll. G. Holm 1883.)

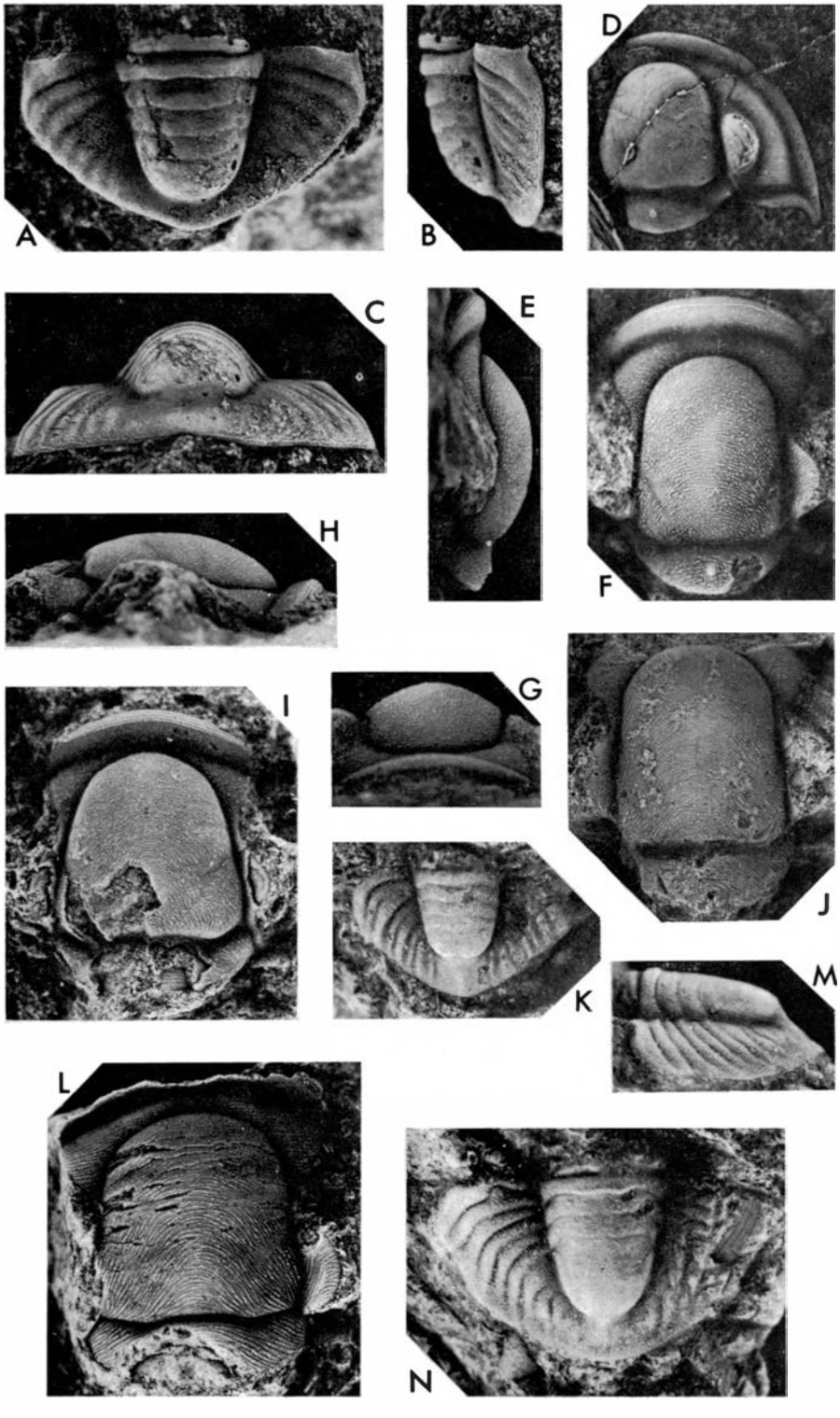
D. *Ascetopeltis* sp.
Silicone rubber cast of external mould of cranidium with one free cheek: dorsal view, × 4. Porkuni Stage, railway station, Nömküla, Estonia. (RM Ar 34414, coll. G. Holm 1883.)

E–G, J. *Ascetopeltis lepta* gen. et sp. nov.
E–G. *HOLOTYPE* cranidium: E-dorsal, F-lateral and G-anterior views, × 12½. Tretaspis Series, Stage 5a, Holmenskjæret, Oslo-Asker district, Norway. (PMO 70498, coll. J. F. Bockelie 1966.)
J. Incomplete cranidium: dorsal view, × 9. Horizon and locality as E. (PMO 70489, coll. J. F. Bockelie 1965.)

H, I. *Ascetopeltis* sp.
Cranidium: H-lateral and I-dorsal views, × 5. Porkuni Stage, Estonia. (RM Ar 34441, coll. G. Linnarsson 1872.)

K, M, N. *Ascetopeltis* ? sp. 2.
K. Pygidium: dorsal view, × 13½. Specimen the original of Warburg 1925, pl. 5, fig. 37, Boda Limestone, Klittberg, Lake Siljan district, Dalarne, Sweden. (UM D 64, coll. O. Isberg.)
M, N. Pygidium: M-lateral and N-dorsal views, × 8. Specimen the original of Warburg 1925, pl. 5, fig. 64, Boda Limestone, Östbjörka, Lake Siljan district, Dalarne, Sweden.

L. *Ascetopeltis* sp. 1.
Cranidium: dorsal view, × 6½. Horizon and locality as E. (PMO 8858, coll. J. F. Bockelie 1966.)


A
B
D
C
E
F
H
I
G
J
K
M
L
N

Occurrence. – At the type locality, and Nes terrasse 16, Nesbru, Asker.

Derivation of name. – From the Greek, *leptos,* slender, from the slender glabella.

Diagnosis. – Differs from *A. bockeliei* in the following ways: Glabella elongate, almost parallel sided, not constricted laterally and with greatest tranverse width about threequarters of the sagittal length; short (sag.) preglabellar field present.

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
PMO 70498 (E)	3.4	2.1	0.8	0.5	1.8	(2.2)	Holotype
PMO 8863 (E)	3.9	2.4	0.8	0.7	1.8	(2.5)	
PMO 70489 (E)	–	3.1	–	0.9	2.6	(3.9)	

Discussion. – It is quite conceivable that *A. lepta* and *A. bockeliei* are sexual dimorphs, as both are found at the same horizon and locality, have similarly shaped occipital rings and anterior borders, and also have the same type of surface sculpture.

Ascetopeltis sp. 1.

Fig. 3, L.

Material. – One cranidium (PMO 8858).

Horizon and locality. – Harjuan, Tretaspis Series, Stage 5a, Holmenskjæret, Holmen, Asker, Norway.

Dimensions (in millimetres)

Cranidium Specimen No.	L	L_1	L_2	SO	W	δ–δ
PMO 8858 (E)	(6.5)	4.2	(1.0)	1.3	4.1	(5.4)

Discussion. – A single cranidium referable to *Ascetopeltis* and originating from the same horizon and locality as *A. bockeliei* and *A. lepta* is distinguished from the first of these species in having a preglabellar field and a narrow anterior border, and from the second in having a broader, laterally constricted glabella. It differs from both in the non-laterally narrowed occipital ring and in the different kind of striated surface sculpture (cf. Fig. 3, L, F and Fig. 2, E), and evidently represents a third species.

Ascetopeltis? sp. 2.

Fig. 3, K, M, N.

□ 1925 *Proetus* sp. ind. c; Warburg 1925, p. 182, pl. 5, fig. 64. □ 1925 *Proetus* sp. ind. e; Warburg 1925, p. 183, pl. 5, fig. 37.

Material. – Two pygidia.

Horizon and localities. – Harjuan, Boda Limestone, Östbjörka and Klittberg, Lake Siljan district, Sweden.

Dimensions (in millimetres)

Pygidia Specimen No.	A	A_1	X	Y
UM D 79 (E)	3.8	2.9	2.4	(6.3)
UM D 64 (E)	1.4	1.1	0.9	2.3

Discussion. – Two pygidia, described by Warburg as *Proetus* sp. ind. c and *Proetus* sp. ind. e are not dissimilar to those of species of *Ascetopeltis,* although the pleural and interpleural furrows are distinctly deeper than in any of these. Although the outlines of the two pygidia differ slightly from one another, there is a size difference (Fig. 3, K is the smaller), and the overall rib pattern and shape of the axis are comparable. Until more material is forthcoming, these specimens are considered as representing one species, referred with doubt to *Ascetopeltis.*

Subfamily TROPIDOCORYPHINAE Přibyl, 1946.

Genus *Decoroproetus* Přibyl, 1946.

(Synonyms *Proetidella* Bancroft, 1949, *Ogmocnemis* Kielan, 1960, *Warburgaspis* Přibyl, 1946). Type species. – *Proetus decorus* Barrande, 1846.

Diagnosis. – Lateral glabellar furrows commonly weak or absent; preglabellar field typically sigmoidal, but may be concave or straight; tropidium absent; lateral occipital lobes commonly absent, but weakly developed ones occur in some species. Eye socle commonly distinct, with lower margin in some cases defined by incised furrow; thorax of 10 segments; pygidial axis with 5–10 rings, pleural areas with 4–6 pairs of ribs whose pleural furrows deepen and curve more strongly backwards abaxially; postaxial ridge commonly present; sculpture of continuous or discontinuous striations, covering entire dorsal exoskeleton, or localised.

Occurrence. – The genus has been recorded from the Ordovician (Llandeilo) to the Lower Devonian, from Europe, north Africa, Russia and north America.

Discussion. – Examination and comparison of the type species of *Decoroproetus* Přibyl, 1946 (*Proetus decorus* Barrande, 1846), *Warburgaspis* Přibyl, 1946 (*Proetus modestus* Törnquist, 1884), *Proetidella* (*Proetidella fearnsidesi* Bancroft, 1949), and *Ogmocnemis* Kielan, 1960 (*Ogmocnemis irregularis* Kielan, 1960), has shown that none bears characters by which it can be distinguished generically from any of the others. All share characters given in the diagnosis above, which is for *Decoroproetus,* the senior synonym. The type species of *Decoroproetus* and *Warburgaspis* are refigured herein (Fig. 4, C and I respectively), and those of *Proetidella* and *Ogmocnemis* have been recently figured by Dean (1963, pl. 45, figs. 3–8) and by Kielan (1960, pl. 3, figs. 6–9, pl. 4, figs. 8–9, pl. 26, fig. 1 and text-fig. 17, p. 71) respectively.

Whittington (1966, p. 81) considered *Proetidella, Ogmocnemis* and probably *Warburgaspis* to be congeneric with *Astroproetus* Begg 1939, Ingham 1970, p. 28) also suspected *Proetidella* and *Ogmocnemis* to be congeneric, and with some reservation followed Whittington in considering them junior synonyms of *Astroproetus,* also including in the latter *Decoroproetus* which he believed to be congeneric with the others. The type species of *Astroproetus (Astroproetus reedi* Begg, 1939) has recently been refigured by Whittington (1966, pl. 25, figs. 7, 10, 11), but he only had knowledge of a single specimen (1966, p. 82), the holotype, which is an internal mould. Several additional specimens have since been found in museum collections, mostly labelled as *Proetus girvanensis* Nicholson & Etheridge, 1879, and among these are external moulds. With these specimens it is now possible to obtain a better understanding of the species, and a number of salient characters can be listed (e.g. the coniform glabella, distinct lateral occipital lobes, shallow pygidial pleural furrows which do not deepen markedly abaxially and the smooth dorsal surface of the exoskeleton). These characters serve to distinguish *A. reedi* and other *Astroproetus* species from all the species mentioned above, and hence I prefer to retain *Astroproetus* and *Decoroproetus* as distinct (though presumably closely related) genera.

Richter, Richter & Struve (*in* Moore 1959, p. 0398) included *Decoroproetus* in the subfamily Tropidocoryphinae Přibyl, 1946, with question, while Erben (1966, p. 170) preferred to propose a new subfamily, the Decoroproetinae, to accommodate it and two other genera. Alberti (1969, p. 348), however, rejected Erben's proposal and followed the earlier classification of Richter, Richter & Struve. Since *Decoroproetus* shares the same pygidial pleural rib structure as tropidocoryphines, a feature which I consider to be of primary importance in proetid classification, I see no reason to separate it at subfamily level from the Tropidocoryphinae. Moreover, most of the other Tropidocoryphinae probably have their origins in *Decoroproetus.*

Decoroproetus is a conservative genus throughout its long history, and its general morphology changes little (cf. *D. fearnsidesi* (Dean 1963, pl. 45, figs. 3–8) from the Caradoc, *D. asellus* (Fig. 4, A, herein) from the Harjuan,

and *D. decorus* (Fig. 4, C, herein) from the Wenlock). It appears to have been a root stock from which several other proetid lines (e.g. the later tropidocoryphines and the Eremiproetinae) arose. While *Decoroproetus* is widespread in terms of facies and spatial distribution in Ordovician times, known occurrences in the Silurian suggest that it became far more restricted. *Decoroproetus* species are quite common in the late Wenlock of Bohemia, in dark, fine grained limestones and shales. In Britain and Scandinavia *Decoroproetus* occurs in similar facies, in association with other faunal elements more characteristic of Bohemia than the Anglo-Baltic area. It is absent in the typical shelf sequence of the Welsh Borderland and Gotland.

Decoroproetus asellus (Esmark, 1833).

Fig. 4, A, B, D–I.

□ 1833 *Trilobites asellus;* Esmark, pl. 7, fig. 5. □ 1884 *Proetus modestus* n. sp.; Törnquist, p. 46, pl. 2, fig. 3. □ 1907 *Dicellocephalus? leptaenarum* sp. nov.; Wiman, p. 5, pl. 2, figs. 1–3. □ 1925 *Proetus modestus* Törnquist; Warburg, p. 167, pl. 5, figs. 15, 16, 18. □ 1925 *Proetus remotus* n. sp.; Warburg, p. 170, pl. 5, fig. 7. □ 1940 *Proetus asellus* (Esmark); Størmer, p. 122, pl. 1, fig. 1 and text-fig. 2. □ 1946 *Proetus mactaggarti* sp. nov.; Begg, p. 40, pl. 3, figs. 1–2. □ 1946 *Proetus (Warburgaspis) modestus* Törnquist; Přibyl, p. 5. □ 1960 *Proetus modestus* Törnquist; Kielan, p. 69. □ 1960 *Ogmocnemis asellus* (Esmark); Kielan, p. 71. □ *Proetus asellus* (Esmark); Dean, p. 345. □ *Warburgaspis modestus* (Törnquist, 1884); Pillet, pl. 3, fig. 8, p. 81; pl. 6, fig. 22, p. 84.

Holotype. – Internal mould preserved in pyrrhotite, of an almost complete specimen, but with much of the pygidium missing (PMO 56442). Fig. 4, A.

Material. – About 30 specimens from the Boda Limestone, some almost complete; 4 complete specimens from Girvan.

Type stratum and type locality. – Harjuan, Tretaspis Series, Stage 4cα, Trosviken, Brevik, Norway.

Occurrence. – Harjuan, Tretaspis Series, southern Norway; Boda Limestone, Kallholn, Osmundsberget, Boda, Unskarsheden, Lissberg, Östbjörka, Lake Siljan district, Sweden; Ashgill, late Rawtheyan, Upper Drummuck Group, Girvan district, Scotland.

Diagnosis. – Glabella not constricted laterally, frontal lobe well rounded, lateral glabellar furrows weak, not always seen; occipital ring characteristically a little wider (trans.) than glabella; cephalic border narrow, brim-like; eye small, eye socle with incised lower marginal furrow which diverges markedly from the upper at either end, ε and ξ independent angles; pygidial axis strongly arched longitudinally, with 6 ill-defined rings, pleural areas with 5 pairs of ribs, on which interpleural furrows are inconspicuous.

Table 3. Summary of diagnostic characters of Scandinavian Ordovician *Decoroproetus* species.

CHARACTER / SPECIES	GLABELLA		LATERAL GLABELLAR FURROWS		LOWER MARGIN OF EYE SOCLE		LATERAL PROFILE OF PREGLAB. FLD.		€ AND §		PYGIDIAL AXIS		PYGIDIUM		SCULPTURE
											interannular furrs.		axial rings	pleural ribs	
	constricted	non constricted	incised	non incised	incised	non incised	sigmoidal (s) or (c) concave	straight	1 angle	2 angles	deep	shallow			
asellus		x		x	x		c			x		x	6	5	continuous striations
bodae	x		x			x	s		x						" and granules
brevifrons	x			x		x	s			x					
campanulatus	x		x			x	c		x			x	7	4	continuous striations
evexus	x			x		x	c			x	x		7	6	"
furubergensis	x			x		x	s			x	x		6	4–5	discontinuous striations
gyratus	x			x				x							continuous striations
papyraceus	x			x	x		s		x		x		6–8	5–7	"
solenotus	x			x	x				x			x	5	4	discontinuous striations
sp. 1												x	10	6	continuous striations
sp. 2					x										" and granules
sp. A (Owens '70)	x			x			s			x					continuous striations

Description. – See Warburg (1925, p. 187), for description for *Proetus modestus,* here considered conspecific with *D. asellus.*

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
PMO 56442 (I)	4.0	2.7	0.8	0.5	2.7	(3.0)	Holotype
S.G.U. Coll. (E) (Fig. 4, I)	5.2	3.3	1.0	0.9	3.2	3.5	
RM Ar 47497a (E)	3.3	2.0	0.9	0.4	1.9	(2.1)	
RM Ar 47497b (E)	2.4	1.6	0.4	0.4	1.4	(1.7)	
UM D 1358 (E)	2.2	1.6	0.3	0.3	1.1	–	
Pygidia Specimen No.	A	A_1	X	Y			
UM D 1356 A (E)	4.5	3.7	5.9	2.2			
UM D 1356 C (E)	1.5	1.2	1.0	3.0			

Discussion. – Comparison of the type specimens of the species *asellus* (Fig. 4, A), *modestus* (Fig. 4, I), *remotus* (Fig. 4, D, E, H) and *mactaggarti* (Begg 1946, pl. 3, figs. 1–2) has shown that there is little reason for retaining them as separate species, and all can be readily incorporated in the diagnosis given above. The holotype of *asellus,* the senior synonym, is the only specimen known from the type locality, and although rather poorly preserved, it does show enough to enable comparison with *modestus,* from the Boda Limestone of which there is well preserved material which shows the external surface.

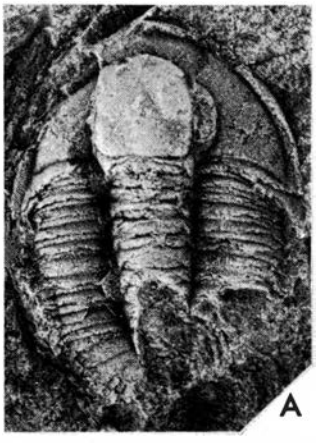
Decoroproetus asellus belongs to a group of species which bear a prominent incised lower margin to the eye socle, which also includes *Decoroproetus papyraceus* (Törnquist 1884), described below (Fig. 8, E, L, M). The type species of *Decoroproetus, D. decorus* (Fig. 4, C) from the late Wenlock of Bohemia is very similar to *D. asellus,* differing principally in the larger eye, less deeply incised lower marginal furrow of the eye socle, the weakly incised 1p lateral glabellar furrows and greater number of pygidial axial rings and pleural ribs.

Dean (1963, p. 245) was misled by a misprint on Størmer's (1940, pl. 1, fig. 1) plate explanation which read 4a α rather than 4c α, and consequently stated that *D. asellus* came from beds of probable Llanvirn age, assuming this species to occur considerably earlier than it really does.

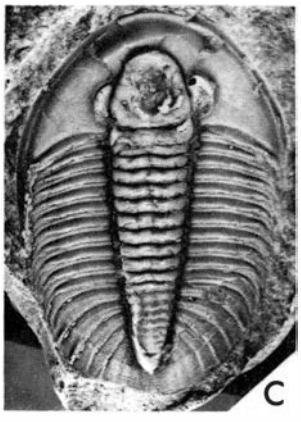
Decoroproetus bodae sp. nov.

Fig. 4, J–L.

Holotype. – A cranidium, retaining the external surface (RM Ar 10896); Fig. 4, J, L.


A


B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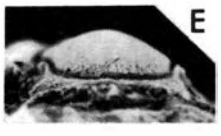
D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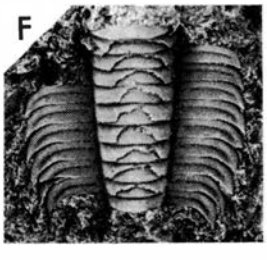
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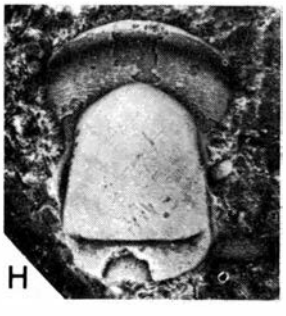
G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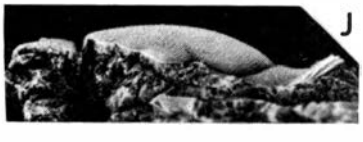
I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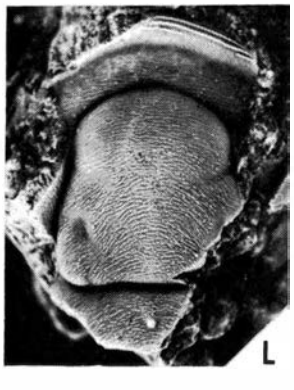
K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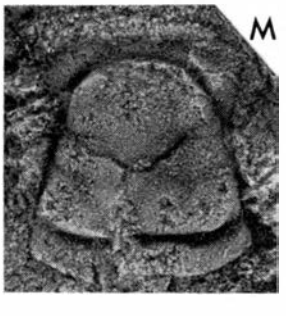

M

Material. – Besides the type, one free cheek.

Type stratum and type locality. – Harjuan, Boda Limestone, Boda, Lake Siljan district, Sweden.

Occurrence. – Only known from the type locality.

Diagnosis. – Glabella distinctly constricted; adaxial part of 1p impressed, pit like; occipital ring as wide (sag.) as preglabellar area; preglabellar field weakly sigmoidal, a little longer (sag.) than anterior border, and about a fifth of the sagittal length of glabella; eye large, crescentic, eye socle with non-incised lower margin, running parallel to upper margin; sculpture striated, with sporadic granules on preglabellar field and field of free cheek.

Dimensions (in millimetres)

Cranidium Specimen No.	L	L_1	L_2	SO	W	δ–δ
RM Ar 10896 (E)	4.3	2.7	0.9	0.7	(2.5)	(3.0)

Fig. 4.

A–B, D–I. *Decoroproetus asellus* (Esmark, 1833).

A. *HOLOTYPE,* incomplete internal mould: dorsal view, × 4½. Specimen the original of Esmark 1833, pl. 7, fig. 5 and Størmer 1940, pl. 1, fig. 1. Tretaspis Series, Stage 4cα, Trosviken ved Brevik, southern Norway. (PMO 56442.)

B. Small cranidium: dorsal view, × 10. Boda Limestone, Kallholn, Lake Siljan district, Dalarne, Sweden. (RM Ar 47497b, coll. O. Isberg.)

D, E, G. Cranidium: D-lateral, E-anterior and G-dorsal views, × 7. Specimen the original of Warburg 1925, pl. 5, fig. 7, holotype of *Proetus remotus* Warburg. Horizon and locality as B. (UM D 52, coll, O. Isberg.)

F. Incomplete thorax: dorsal view, × 4. Boda Limestone, Osmundsberget, Lake Siljan district, Dalarne, Sweden. (RM Ar 10859.)

H. Cranidium: dorsal view, × 10. Horizon and locality as B. (RM Ar 47497a, coll. O. Isberg.)

I. A most complete specimen: dorsal view, × 3. Specimen the original of Törnquist 1884, pl. 2, fig. 3, and Warburg 1925, pl. 5, fig. 16, holotype of *Proetus modestus* Törnquist. Horizon and locality as B. (S.G.U. collection, unnumbered.)

C. *Decoroproetus decorus* (Barrande, 1846).

Plaster cast of complete specimen: dorsal view, × 1⅔. Specimen the original of Prantl and Vaněk 1958, pl. 2, fig. 1. Silurian, Wenlock Series, Liteň Beds, Loděnice, Prague district, Czechoslovakia. (NMP Br 241.)

J–L. *Decoroproetus bodae* sp. nov.

J. L. *HOLOTYPE* cranidium: J-lateral and L-dorsal views, × 10. Boda Limestone, Boda, Lake Siljan district, Dalarne, Sweden. (RM Ar 10896, coll. G. Holm 1880.)

K. Free cheek: dorsal view, × 10. Boda Limestone, Boda Church (RM Ar 43433, coll. O. Isberg 1912.)

M. *Decoroproetus brevifrons* (Angelin, 1854).

LECTOTYPE cranidium: internal mould, dorsal view, × 5. Specimen probable original of Angelin 1854, pl. 33, fig. 18. Jonstorp Formation (Öglunda Limestone?), Ålleberg, Västergötland, Sweden. (RM Ar 15254, coll. J. W. Dalman 1827.)

Discussion. – The features listed above characterise *D. bodae.* The species most similar to it is *D. campanulatus* sp. nov. (see below), which is distinguished by its deeper 1p furrow, broader, flatter lateral border, finer striations without interspersed granules, and smaller eye. *D. brevifrons* (Angelin, 1854) differs in similar ways to *D. campanulatus,* although 1p is not impressed in this species. The distinctly constricted glabella and non-incised lower margin of the eye socle distinguish *D. bodae, D. brevifrons* and *D. campanulatus* from such species as *D. asellus, D. papyraceus* and *D. solenotus,* which all have very weakly or non-constricted glabellas and a distinct, deep incised lower margin to the eye socle.

Decoroproetus brevifrons (Angelin 1854).

Fig. 4, M, Fig. 5, A–C.

□ 1854 *Forbesia? brevifrons;* Angelin, p. 63, pl. 33, fig. 18, 18a. □ 1869 *Proetus brevifrons* (Angelin); Linnarsson, pl. 2, fig. 29. □ 1884 *Proetus brevifrons* Ang; Törnquist, p. 47. □ 1960 *Ogmocnemis brevifrons* (Angelin); Kielan, p. 28.

Lectotype (here selected). – Internal mould of cranidium (RM Ar 15254), Fig. 4, M.

Type stratum and type locality. – Harjuan? Öglunda Limestone, Ålleberg, Bestorp, Västergötland.

Material. – 4 cranidia, 1 imperfect cephalon, and 1 cephalon with 9 attached thoracic segments, 1 incomplete pygidium.

Occurrence. – Harjuan, Jonstorp Formation, and ?Öglunda Limestone, Ålleberg and Mösseberg, Bestorp, Västergötland.

Diagnosis. – Glabella tapering rapidly forwards, distinctly laterally constricted; lateral glabellar furrows non-incised, anterior border rather narrow, lateral border broadens and flattens towards broad based genal spine; eye small.

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
RM Ar 15254 (I)	6.5	4.0	1.2	1.3	4.9	5.8	Lectotype
RM Ar 15257 (I)	7.0	4.1	1.8	1.1	4.0	–	
RM Ar 15258 (I)	4.3	2.4	1.2	0.7	(2.3)	–	
S.G.U. Coll. (I) (Fig. 5, C)	8.0	5.0	2.0	1.0	5.5	7.1	

Discussion. – Angelin (1854, pl. 33, figs. 18, 18a) figured a cranidium and a pygidium as *Forbesia? brevifrons* from Ålleberg. In the collections of the Naturhistoriska Riksmuseet, Stockholm, two cranidia (Nos. Ar 15254 and Ar 15255), both from Ålleberg, are labelled as Angelin's original. The morphology of these (cf. Fig. 4, M and Fig. 7, L) indicates that each is a separate species, and the matrix in which each is preserved is different – Ar 15254 in a dark calcareous shale (Öglunda Limestone?), Ar 15255 in a drab shale (Dalmanitina Beds?). Linnarsson (1869, pl. 2, fig. 29) later figured a further specimen, a cephalon with nine attached thoracic segments from the Red Jonstorp Formation as *Proetus brevifrons*. The cranidium of this specimen is like Ar 15254.

As specimen Ar 15254 is labelled as having been collected by Dalman in 1827, Angelin would have had access to it, but there is no evidence to show when or by whom Ar 15255 was collected, and it is consequently impossible to know whether or not Angelin could have seen it. Ar 15254 has the external mould of an incomplete proetid pygidium on the reverse side, the only pygidium identified as *brevifrons,* and therefore possibly the original of Angelin's fig. 18a. Because Ar 15254 can be demonstrated as having been available to Angelin, because it contains the only pygidium labelled as *brevifrons* and because it is the same species as interpreted by Linnarsson as *brevifrons,* I consider it the best course to select this cranidium as lectotype for *brevifrons*. Ar 15255 is probably conspecific with *D. evexus* (Fig. 7). Outside Scandinavian species, *D. brevifrons* shows some resemblance to *D. piriceps* (Ingham 1970, p. 28, pl. 4, figs. 20–26, 28, 30–32) from the Cautleyan Stage of the Ashgill Series of northern England. Both species share the distinctly constricted glabella tapering rapidly forwards, although *D. piriceps* differs in possessing small, indistinct lateral occipital lobes, a distinct lower marginal furrow of the eye socle and a narrower lateral border.

Decoroproetus campanulatus sp. nov.

Fig. 6 and Fig. 5, D–K.

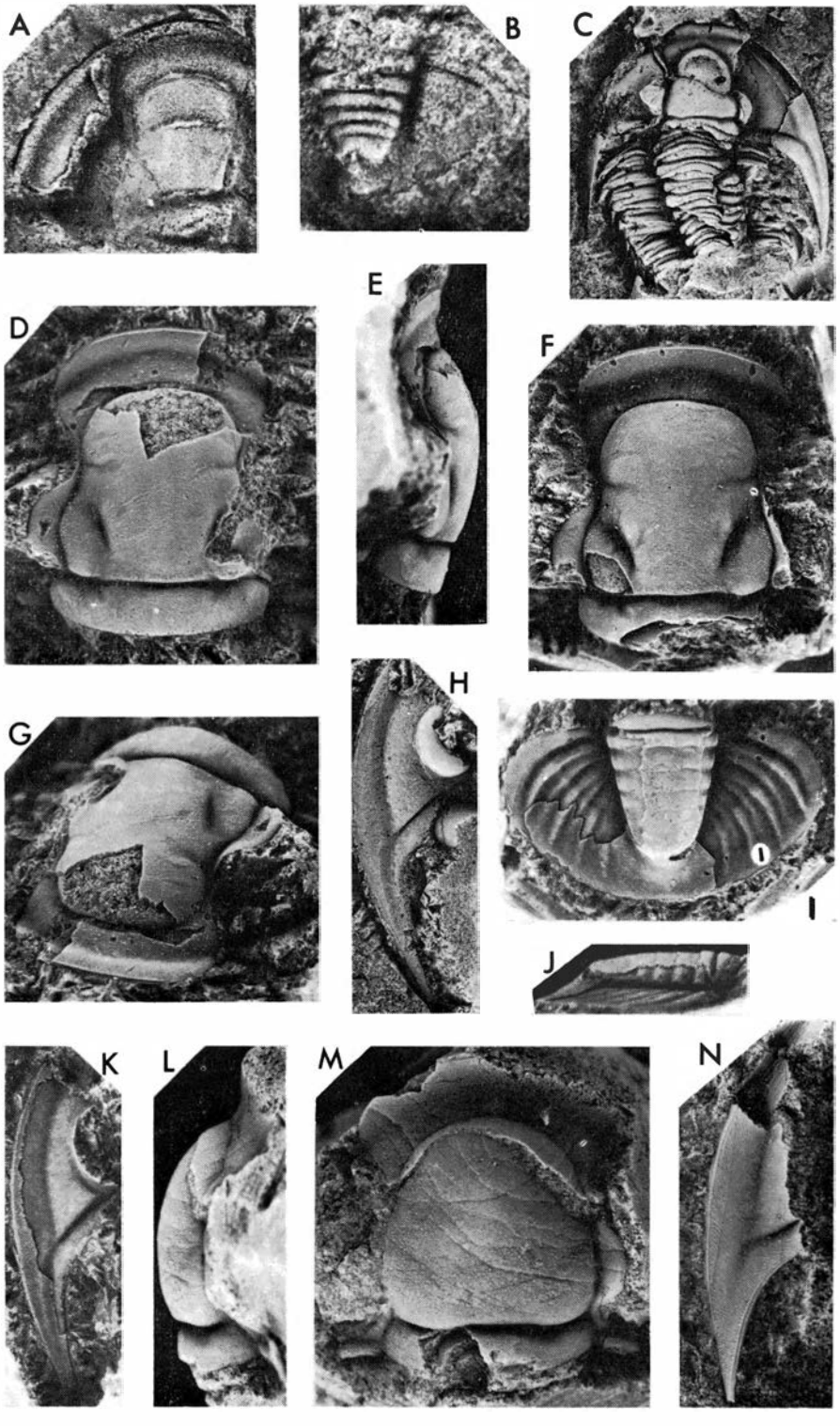
Holotype. – A cranidium with most of external surface preserved. (PMO A 34422) Fig. 5, F.

Material. – Besides the type, 5 cranidia, 3 free cheeks, one pygidium.

Type stratum and type locality. – Harjuan, Boda Limestone, Osmundsberget, Lake Siljan district, Dalarne, Sweden.

Occurrence. – Only known from the type locality.

Derivation of name. – From Latin, *campanula,* a little bell – the glabella is more or less bellshaped.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Diagnosis. – Glabella distinctly laterally constricted, frontal margin almost transverse; 1p deeply incised, partially isolating ovoid 1p lobe; preglabellar field as wide (sag.) as the anterior border; occipital ring distinctly wider (trans.) than glabella, maintaining the same width laterally; very poorly defined lateral occipital lobes; free cheek with lateral border broadening towards base of genal spine; pygidial axis with 7 rings, separated by very shallow undulating interannular furrows; 4 pairs of pleural ribs with pleural and interpleural furrows of nearly equal strength.

Description. – Cranidium with sagittal length a little greater than palpebral width, and rather weakly vaulted. Glabella as long (sag.) as wide (trans.), broadly campamulate, defined by narrow axial and preglabellar furrows. From bluntly angular posterolateral corner glabella expands forwards as far as a position in line with δ–δ, after which it narrows rapidly forwards as far as a position just behind γ. From here, lateral margin of glabella very slightly bowed abaxially in a weakly convex curve until anterolateral corner is reached. Frontal margin almost transverse. 1p shallow where it joins axial furrow, but rapidly deepens backwards, abruptly terminating some distance in front of occipital furrow. It is directed backwards at about 35° to an exsagittal line and partially isolates ovate 1p lobe. Associated with 1p is small auxiliary impression, seen as a darkened area, not interrupting striated sculpture. 2p opposite γ, shallow, weakly impressed, interrupting striated sculpture, running into axial furrow, extending about halfway towards sagit-

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Fig. 5.

A–C. *Decoroproetus brevifrons* (Angelin, 1854).

A. Cranidium with incomplete free cheek: internal mould, dorsal view, × 7. Red Jonstorp Formation, Mösseberg, Bestorp, Västergötland, Sweden. (RM Ar 15258.)

B. Silicone rubber cast of incomplete external mould of pygidium: dorsal view, × 4. Specimen possible original of Angelin 1854, pl. 33, fig. 18a. Jonstorp Formation (Öglunda Limestone ?), Ålleberg, Västergötland, Sweden. (RM Ar 15254 [on reverse of slab containing Fig. 4, M], coll. J. W. Dalman 1827.)

D. Cephalon with parts of nine thoracic segments: dorsal view, × 2. Specimen the original of Linnarsson 1869, pl. 2, fig. 29. Red Jonstorp Formation, Bestorp, Västergötland, Sweden. (S.G.U. Collection, unnumbered, coll. G. Linnarsson.)

D–K. *Decoroproetus campanulatus* sp. nov.

D, E, G. Damaged cranidium: D-dorsal, E-lateral and G-anterior oblique views, × 4½. Boda Limestone, Unskarsheden, Lake Siljan district, Dalarne, Sweden. (PMO A 34423, coll. D. L. Bruton 1966.)

F. *HOLOTYPE* cranidium: dorsal view, × 6. Horizon and locality as D. (PMO A 34422, coll. D. L. Bruton 1966.)

H. Free cheek: dorsal view, × 6. Horizon and locality as D. (PMO A 34424, coll. D. L. Bruton 1966.)

I, J. Pygidium: I-dorsal and J-lateral views, × 4. Horizon and locality as D. (PMO A 34426, coll. D. L. Bruton 1966.)

K. Free cheek: dorsal view, × 5¼. Horizon and locality as D. (PMO A 34425, coll. D. L. Bruton 1966.)

L–N. *Decoroproetus evexus* sp. nov.

L, M. Cranidium: L-lateral and M-dorsal views, × 7. Tretaspis Series, Stage 5a, Nes terasse 10, Oslo-Asker district, Norway. (PMO 70479, coll. J. F. Bockelie 1966.)

N. Free cheek: dorsal view, × 5. Tretaspis Series, Stage 5a, Holmenskjæret, Oslo-Asker district, Norway. (PMO 8428.)

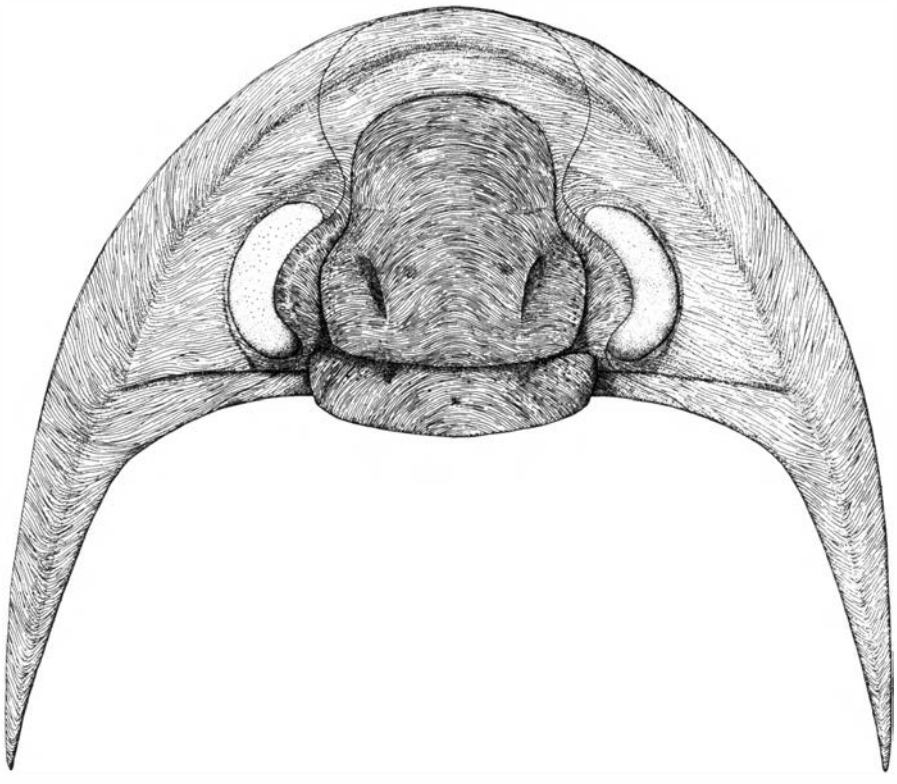


Fig. 6. Reconstruction of the cephalon of *Decoroproetus campanulatus* sp. nov.

tal line, and is directed weakly backwards. Abaxial end of 3p short distance in front of 2p, not running into axial furrow. 3p is about same length as 2p and runs inwards and distinctly forwards.

Occipital furrow narrow and deeper than axial and preglabellar furrows, with a nearly vertical anterior slope; posterior slope inclined at about 30°. Median portion of occipital ring between adaxial ends of 1p furrows almost transverse, arched very weakly backwards. Behind 1p lobes it curves very gently forwards. Directly behind (exsag.) posterior ends of 1p, or a little abaxially from them, is a pair of weak depressions running into occipital furrow. Occipital ring a little narrower (sag.) than preglabellar area, maintains same width laterally and is distinctly wider (trans.) than glabella. In lateral profile (Fig. 5, E) gently inclined backwards and nearly flat. Minute median tubercle present. Behind (exsag.) depressions on posterior edge of glabella is a corresponding pair of more distinct, though weakly impressed depressions on anterior edge of occipital ring. These partially define rather large, transversely elongated lateral occipital lobes.

Preglabellar field about same width (sag.) as anterior border, quite steeply declined from preglabellar furrow and is sigmoidal in profile. Anterior border furrow wide and shallow, anterior border flattened. Anterior branches of facial sutures are moderately divergent, a rather wide, abaxially convex

curve. γ close to axial furrow. Palpebral lobe large, almost half the sagittal length of glabella. ε and ξ a single angle, close to axial furrow at postero-lateral corner of glabella. Posterior branch of facial suture cuts posterior margin about half way between lateral margin and axial furrow.

Eye large and crescentic, eye socle narrow, with lower margin non-incised, diverging slightly from upper margin at either end. Field of free cheek rather narrow and gently convex. Lateral border furrow, like anterior, weak. Lateral border flattened, and widens distinctly backwards towards genal spine. Posterior border furrow narrow and sharply defined, abruptly truncated at base of genal spine where it meets lateral border furrow. Posterior border widens slightly abaxially, is flattened and gently inclined towards posterior. Genal spine broad based, long and blade-like, with median groove off set abaxially from lateral border furrow at anterior end. Median groove shallow, running close to inner margin of genal spine, dying out before reaching its posterior end. Thorax unknown.

Pygidium of subparabolic outline, without border. Anteriorly axis is about a third of total pygidial width (trans.) and is nearly three quarters of its length (sag.). It is rather gently convex longitudinally. No distinct postaxial ridge present. Axis consists of 7 rings of which last two are very poorly defined. First is narrower and elevated above remainder, and as wide (sag.) as articulating half ring from which it is divided by deep interannular furrow, which curves forwards weakly sagittally and laterally. Remainder of rings nearly flat in lateral profile and divided by very shallow interannular furrows which are gently undulating. Axial furrows shallow, but distinct. Four pairs of pleural ribs, which bend rather strongly and evenly backwards. Both pleural and interpleural furrows wide and shallow, but distinct and converging abaxially, with abaxial end of interpeural furrow deeper than that of the pleural furrow. Neither pleural nor interpleural furrows reach margin, and, except in first rib, interpleural is longer than pleural. Anterior and posterior pleural bands are of approximately equal width (exsag.), except in first rib where anterior is considerably wider (exsag.). On each band anterior slope gently inclined, posterior slope is steeply inclined. Sculpture of very fine, dense striations, arranged in a Bertillon pattern on cranidium. On palpebral lobe striations interrupted by smooth band running parallel with its margin. On cephalic margin are two or three strong continuous raised striations.

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
PMO A 34422 (E)	–	4.7	1.3	–	4.5	(5.8)	Holotype
PMO A 34423 (E)	7.5	6.0	1.5	1.2	(5.0)	(5.9)	
Pygidia Specimen No.	A	A_1	X	Y			
PMO A 34426 (E/I)	6.3	5.8	9.8	3.2			

Discussion. – *D. campanulatus* is compared with other *Decoroproetus* species under *D. bodae*. Outside *Decoroproetus,* the cranidium of *D. campanulatus* is not dissimilar to those of species of the Silurian genus *Prionopeltis* Hawle & Corda, 1847. Two subspecies of *P. striatus* Hawle & Corda, 1847 have recently been refigured by Chlupáč (1971, pl. 22, figs. 1–8, pl. 23, figs. 7–10). The cranidia of these have similar deep 1p furrows, disposition of 2p and 3p and flattened anterior border to *D. campanulatus*. The pygidium of *Prionopeltis* has a spinose margin, but the shallow interannular furrows and the pleural and interpleural furrows of similar strength are comparable with *D. campanulatus*. *D. campanulatus* shows characters which could be regarded as being transitional between *Decoroproetus* and *Prionopeltis,* and is possibly related to the ancestral stock of the latter.

Decoroproetus evexus sp. nov.

Fig. 4, L–N, Fig. 7, A–I, L.

Holotype. – A cranidium retaining the external surface (PMO 70439), Fig. 7, B.

Material. – 8 cranidia, 4 free cheeks, 10 pygidia.

Type stratum and type locality. – Harjuan, Tretaspis Series, Stage 5a, Øvre Nes badestrand, Asker, Norway.

Fig. 7.

A–I, L. *Decoroproetus evexus* sp. nov.

A, C. Pygidium: A-dorsal and C-lateral views, × 7. Tretaspis Series, Stage 5a, Nes Terrasse 10, Nesbru, Oslo-Asker district, Norway. (PMO 70475 coll. J. F. Bockelie 1966.)

B. *HOLOTYPE* cranidium: dorsal view, × 7. Tretaspis Series, Stage 5a, Øvre Nes badestrand, Oslo-Asker district, Norway. (PMO 70439 coll. J. F. Bockelie 1966.)

D, E. Cranidium: D-lateral and E-dorsal views, × 6. Dalmanitina Beds? Borenshult, Östergötland, Sweden. (RM Ar 18622.)

F. Small pygidium: dorsal view, × 12. Horizon and locality as D. (RM Ar 18620.)

G. Pygidium: Dorsal view, × 8½. Horizon and locality as D. (RM Ar 18615.)

H. Free cheek: dorsal view, × 5½. Horizon and locality as A. (PMO 8849, coll. J. F. Bockelie 1966.)

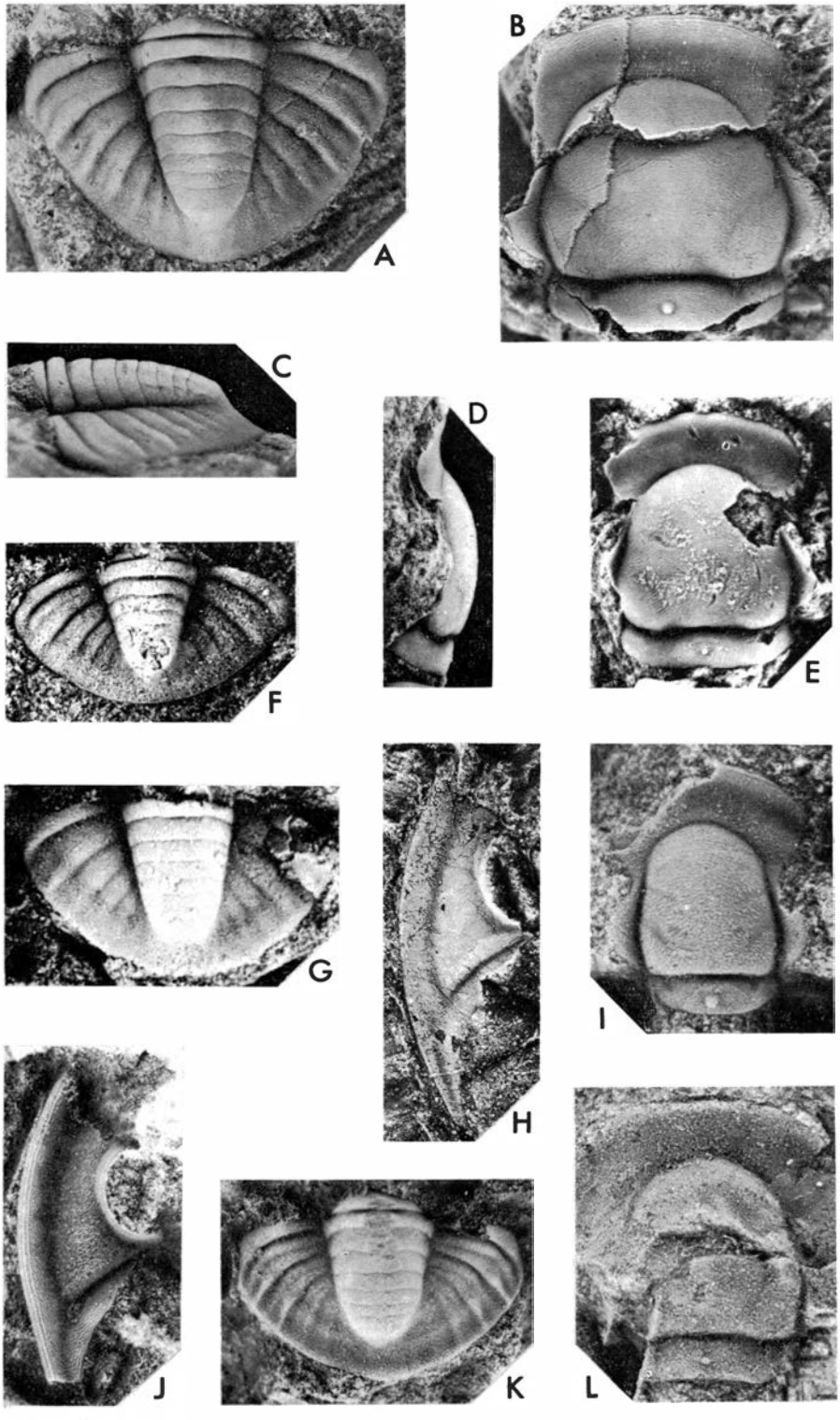
I. Small cranidium: dorsal view, × 14. Horizon and locality as A. (PMO 70476, coll. J. F. Bockelie 1966.)

L. Damaged cranidium, probably referable to *D. evexus:* dorsal view, × 8. Labelled 'orig.' of Angelin 1854, pl. 33, fig. 18. Dalmanitina Beds? Ålleberg, Västergötland, Sweden. (RM Ar 15255.)

J, K. *Decoroproetus furubergensis* Owens, 1970.

J. Free cheek, dorsal view, × 9½. Macrourus Limestone (erratic), Kråketorp, Öland, Sweden. (RM Ar 23741.)

K. Pygidium: dorsal view, × 8½. Macrourus Limestone (erratic), Eriksöre, Öland, Sweden. (RM Ar 23656.)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Occurrence. – Harjuan, Tretaspis Series, Stage 5a, at the type locality and at Nes terrasse 10, Nesbru, Asker, Norway; Harjuan, Dalmanitina Beds, Bestorp, Västergötland, Dalmanitina Beds?, Borenshult, Östergötland, Sweden.

Derivation of name. – From Latin *evexus,* rounded at the top – alluding to the rounded frontal margin of the glabella.

Diagnosis. – Small cranidia and pygidia (e.g. Fig. 7, F, I) are of similar proportions to similarly sized specimens of *D. furubergensis* (cf. Owens 1970, Figs. 5, F and 6, G and Fig. 9, K and Fig. 10, A, herein), but larger specimens are markedly different – the glabella of *D. evexus* is proportionately much wider than in *D. furubergensis* (cf. Owens 1970, Fig. 5, E and Fig. 9, B, herein), and the pygidium is proportionately longer in *evexus* (cf. Owens 1970, Fig. 6, J and Fig. 7, A, herein). Other features distinguishing *evexus* from *furubergensis* are the profile of the preglabellar field (concave as opposed to sigmoidal), the flatter cephalic border and the weakly developed occipital lobes of the former and the greater number of pygidial axial rings (7) and pleural ribs (6). The type of surface sculpture of the two species also differs – fine continuous striations in *evexus,* coarser discontinuous striations in *furubergensis.*

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
PMO 70439 (E)	6.6	4.0	1.4	1.2	5.1	6.5	Holotype
PMO 70479 (E)	6.5	4.0	1.3	1.2	4.4	(5.1)	
RM Ar 18622 (E)	6.1	4.0	1.1	1.0	4.4	5.0	
PMO 70476 (E)	2.2	1.4	0.5	0.3	1.3	1.6	
Pygidia Specimen No.	A	A_1	X	Y			
PMO 70475 (E)	4.8	4.0	6.7	2.3			
PMO 70473 (E)	(4.4)	(3.6)	(6.0)	2.3			
RM Ar 18615 (E)	3.0	2.1	(4.2)	2.5			
PMO 70472 (E)	2.4	1.8	3.3	1.0			
RM Ar 18620 (E)	1.8	1.3	3.2	1.0			

Discussion. – The pygidium of *D. evexus* closely resembles pygidia figured by Temple (1969, pl. 4, figs. 13, 20) as 'Proetidae, pygidium type 1'. Temple's specimens originate from a limestone overlying the Keisley Limestone at Keisley, Westmorland, which he considered to be of earliest Llandovery age. The Keisley pygidia and that of *D. evexus* share a similar outline and a strongly longitudinally convex axis with a similar number of rings (7). Of the proetid cranidia from Keisley, the ones figured as 'Proetidae, cranidium type 1' (Temple 1969, pl. 4, figs. 1–4) most closely resemble *D.*

evexus. The similarity between Temple's cranidium type 1 and pygidium type 1 and the corresponding parts of *D. evexus* suggests that Temple's specimens might be conspecific.

Decoroproetus furubergensis Owens, 1970.

Fig. 7, J, L, Fig. 8, A, B.

□ 1970 *Decoroproetus furubergensis* sp. nov.; Owens, p. 312, fig. 5, A–K, fig. 6, G–M. fig. 7, L.

Type data. – Owens 1970, p. 312.

Swedish material. – 8 cranidia, 1 free cheek, 10 pygidia.

Occurrence in Sweden. – Viruan, Macrourus Limestone, erratic blocks from Eriksöre, Kråketorp and Hulterstad, Öland.

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ
RM Ar 23074 (E)	3.7	2.0	0.9	0.8	2.0	(2.5)
RM Ar 23670 (E)	–	2.8	–	0.9	2.7	(3.4)

Pygidium Specimen No.	A	A_1	X	Y
RM Ar 23656 (E)	3.4	3.0	1.8	5.0

Discussion. – The identification of specimens from Öland as *Decoroproetus furubergensis* extends the geographical range of this species to Sweden. One of the Öland cranidia (Fig. 8, B) shows poorly isolated lateral occipital lobes, and on the posterior margin of the glabella opposite their inner ends are small depressions running a short distance forwards. The cranidium is otherwise like the others, but whether this feature is of any significance must await more material.

Decoroproetus papyraceus (Törnquist, 1884).

Fig. 8, C–H, J, L, M.

□ 1884 *Proetus papyraceus* n. sp.; Törnquist, p. 48, pl. 2, figs. 4–6. □ 1918 *Niobe cunctatrix;* Sjöberg, p. 458, pl. 7, figs. 1–2. □ 1960 *Ogmocnemis irregularis* n. sp.; Kielan, p. 70, pl. 3, figs. 6–9, pl. 4, figs. 8–9, pl. 26, fig. 1, text-fig. 17, p. 71. □? 1966 *Decoroproetus (Ogmocnemis)* cf. *irregularis* (Kielan); Ingham, pp. 473, 487, 501. □ 1965 *Astroproetus irregularis* (Kielan); Whittington, p. 81. □? 1970 *Astroproetus?* cf. *irregularis* (Kielan); Ingham, p. 30, pl. 4, figs. 34–38.

Lectotype (here selected). – A cranidium with some of the external surface preserved (LO 597 T), figured Törnquist, 1884, pl. 2, fig. 2 and refigured herein as Fig. 8, D.

Swedish material. – One almost complete exoskeleton (internal mould with counterpart external mould) and numerous detached cranidia, free cheeks and pygidia, mostly internal moulds.

Type stratum and type locality. – Harjuan, Fjäcka Shale, Fjäcka, Lake Siljan district, Sweden.

Occurrence. – Harjuan, Fjäcka Shale, Fjäcka, Draggån, Gulleråsen-Sanden, Lake Siljan district; Örberga, Östergötland, Sweden; Ashgill, Rawtheyan Stage, *Staurocephalus clavifrons* zone, Brzezinki, Holy Cross Mountains,

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Fig. 8.

A–B. *Decoroproetus furubergensis* Owens, 1970.

A. Cranidium: dorsal view, × 12½. Macrourus Limestone (erratic) Eriksöre, Öland, Sweden. (RM Ar 23074.)

B. Cranidium: dorsal view, × 8½. Note shallow longitudinal furrows on posterior edge of glabella. Horizon and locality as A. (RM Ar 23670.)

C–H, J, L, M. *Decoroproetus papyraceus* (Törnquist, 1884).

C. Cranidium, internal mould, dorsal view, × 10. Note shallow lp furrows. Fjäcka Shale, road section north of Gulleråsen–Sanden, Lake Siljan district, Dalarne, Sweden. (RM Ar 47559, coll. R. M. Owens 1969.)

D. *LECTOTYPE* cranidium, showing striated sculpture: dorsal view, × 9. Specimen the original of Törnquist 1884, pl. 2, fig. 4. Fjäcka Shale, Fjäcka, Lake Siljan district, Dalarne, Sweden. (LO 597 T.)

E. Free cheek: dorsal view, × 7. Specimen the original of Törnquist 1884, pl. 2, fig. 5. Fjäcka Shale, Draggån, Lake Siljan district, Dalarne, Sweden. (LO 599 t.)

F. Pygidium: dorsal view, × 6. Specimen the original of Törnquist 1884, pl. 2, fig. 6. Horizon and locality as E. (LO 598 t.)

G. Pygidium: dorsal view, × 4. Fjäcka Shale, Vikarbyn, Lake Siljan district, Dalarne, Sweden. (RM Ar 10890.)

H. Partially exfoliated, almost complete specimen: dorsal view, × 2½. Specimen the original of Sjöberg 1918, pl. 7, fig. 1, figured as *Niobe cunctatrix* Sjöberg. Fjäcka Shale, Ullnäs, Örberga, Östergötland, Sweden. (LO 2859 T.)

L, M. Almost complete external mould, counterpart of H: L-dorsal view, × 2½. M-enlargement of part of cephalon, showing striated sculpture and individual facets of eye. Specimen the original of Sjöberg 1918, pl. 7, fig. 2, figured as *Niobe cunctatrix* Sjöberg. Horizon and locality as H. (LO 2860 t.)

J. Small pygidium: dorsal view, × 24. Fjäcka Shale, Dalarne, Sweden. (RM Ar 11582.)

I. *Decoroproetus? scanicus* Olin, 1906.

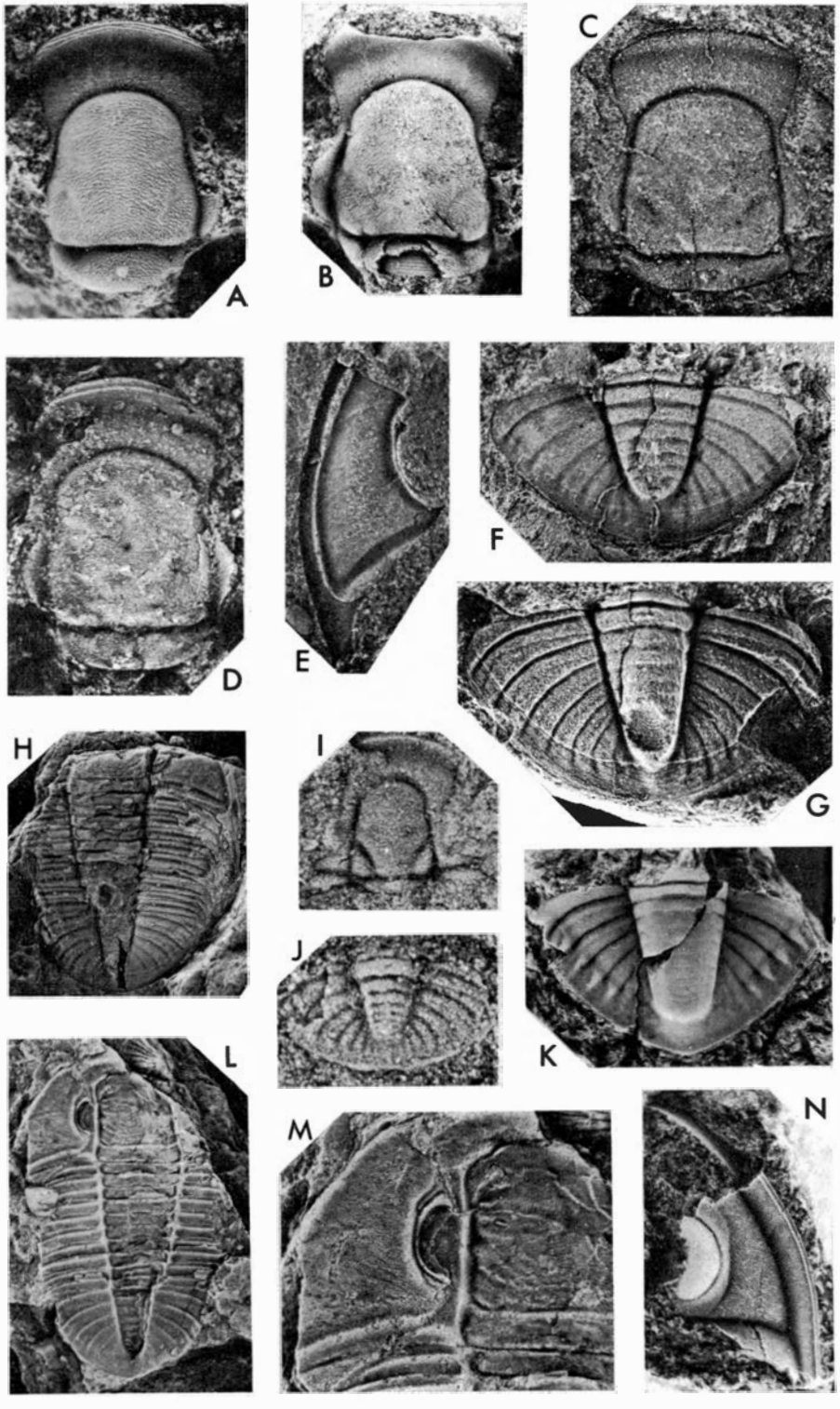
HOLOTYPE. Cast of external mould of cranidium: dorsal view, × 14½. Specimen the original of Olin 1906, pl. 2, fig. 17. Jerrestad Mudstone, Röstånga, Scania, Sweden. (LO 1940 T.)

K. *Decoroproetus* sp. 1.

Pygidium: dorsal view, × 5. Specimen the original of Warburg 1925, pl. 5, fig. 63. Kullsberg Limestone, Kullsberg, Lake Siljan district, Dalarne, Sweden. (LO 3118 t.)

N. *Decoroproetus* sp. 2.

Free cheek: dorsal view, × 8. Boda Limestone, Klittberget, Lake Siljan district, Dalarne, Sweden. (RM Ar 43797.)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Poland; Ashgill, Rawtheyan Stage, Austwick district, Yorkshire and ?Cautley district, Westmorland.

Diagnosis. – Glabella tapering gently forwards, very weakly laterally constricted; weakly impressed 1p furrows seen on some specimens, otherwise lateral glabellar furrows non-impressed; lower margin of eye socle incised, diverging from upper at either end; pygidial axis with 6–8 rings, pleural areas with 5–7 pairs of ribs; sculpture of fine, continuous striations.

Description. – Kielan (1960, pp. 70–71) has presented a full description of *Ogmocnemis irregularis,* here considered to be conspecific with *D. papyraceus.* Additional information from Swedish specimens provides the following amplification of a few points: Kielan mentions only one pair of lateral glabellar furrows, but three pairs are present, although all are commonly inconspicuous. The eye socle, not mentioned by Kielan, is distinct, with the lower marginal furrow incised, and diverging from the upper at either end. The eye socle can be seen on Kielan's figure (pl. 3, fig. 8) of the holotype of *O. irregularis.* Although Kielan states that the number of axial rings is 7 and the number of pleural ribs 5, additional specimens have shown that the former range from 6 to 8 and the latter from 5–7.

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
LO 597 T (E)	4.5	3.3	1.2	0.6	2.5	3.0	Lectotype
RM Ar 47558 (I)	4.7	2.9	1.0	0.8	2.5	3.0	
RM Ar 47559 (I)	3.7	2.3	0.9	0.5	2.1	2.8	
LO 2859 T (E)	–	4.0	–	0.8	4.3	(5.4)	
Pygidia Specimen No.	A	A_1	X	Y			
RM Ar 10890 (I)	7.7	6.3	12.5	3.5			
RM Ar 10873 (I)	6.0	4.7	10.4	3.0			
RM Ar 10874 (E)	4.0	3.1	7.3	2.3			
RM Ar 10875 (E)	3.6	2.8	–	–			
LO 2860 T (E)	5.0	4.7	8.8	2.2			
LO 598 t (I)	4.0	3.0	6.8	2.1			
RM Ar 47560 (I)	2.7	2.0	5.0	1.6			
RM Ar 11582 (E)	0.7	0.6	1.3	0.3			

Discussion. – *Decoroproetus papyraceus* is common in the Fjäcka Shale of the Lake Siljan district, and at some localities (e.g. Gulleråsen-Sanden) it is the most common trilobite. Comparison between specimens of *D. papyraceus* (e.g. Fig. 8, C, D, M) and the type and additional material of *Ogmocnemis irregularis* Kielan (see Kielan 1960, pl. 3, figs. 6–9; pl. 4, figs. 8–9; pl. 26, fig. 1) shows that there is little to distinguish these two species, and hence I

synonymise *irregularis* with *papyraceus*. The type stratum for *irregularis* is the *Staurocephalus clavifrons* zone of the Holy Cross Mountains, Poland. Ingham (1970, p. 30, pl. 4, figs. 34–38) describes and figures *Astroproetus?* cf. *irregularis* (Kielan) from a similar horizon (Ashgill, Rawtheyan Stage, Zone 6) at Cautley, Westmorland, and I have also seen specimens identical with the Polish and Swedish from Rawtheyan, zone 6 strata from near Austwick, Yorkshire. Other remarks on *D. papyraceus* are given under *D. asellus*.

Decoroproetus sp. 1.

Fig. 8, K.

1925 *Proetus* sp. ind. b; Warburg, p. 181, pl. 5, fig. 63.

Material. – One pygidium (LO 3118).

Horizon and locality. – Viruan, Kullsberg Limestone, Kullsberg, Lake Siljan district, Sweden.

Description. – Warburg 1925, p. 181.

Dimensions (in millimetres)

Specimen No	A	A_1	X	Y
LO 3118 (E)	5.5	4.5	7.8	2.4

Discussion. – This pygidium is the only proetid occurring in the Kullsberg Limestone apart from *Stenoblepharum kullsbergense* (Warburg) and Warburg's specimen remains the only one available. It is particularly distinctive in the large number of pleural ribs (6) and axial rings (10), and shows some resemblance to the later Harjuan species, *D. evexus*. As Warburg suggests, a new species is probably represented.

Decoroproetus sp. 2.

Fig. 8, N.

Material. – One free cheek (RM Ar 43797).

Horizon and locality. – Harjuan, Boda Limestone, Klittberget, Lake Siljan district, Sweden.

Discussion. – A single, incomplete free cheek belonging to *Decoroproetus* has a distinct eye socle, a sculpture of fine striations, and two prominent terrace lines on the lateral margin. Its morphology precludes assignment to any of the *Decoroproetus* species described here, and a new species is probably represented. The shape of the eye socle invites comparison with *D. papyraceus* (Fig. 8, M).

Decoroproetus? scanicus (Olin, 1906).

Fig. 8, I.

□ 1906 *Proetus scanicus;* Olin, p. 59, pl. 2, fig. 17. □ 1960 *'Proetus' scanicus* Olin; Kielan, p. 28.

Holotype. – External mould of a small cranidium (LO 1940T) figured Olin pl. 2, fig. 17, a cast of which is refigured herein as Fig. 8, I, the only specimen known.

Type stratum and type locality. – Harjuan, Jerrestad Mudstone, Röstånga, Scania.

Dimensions (in millimetres)

Specimen No.	L	L_1	L_2	SO	W	δ–δ
LO 1840 T (E)	1.3	0.9	0.4	0.2	0.7	1.0

Discussion. – The only specimen known of this species has the following characters: elongate glabella with deep 1p furrows which partially isolate triangulate 1p lobes; 2 p and 3p furrows shallow, inconspicuous; palpebral lobe well out from glabella; posterior branch of facial suture runs obliquely abaxially and backwards from ε, the stretch ε-ω almost straight. Early holaspid cranidia of a Silurian species of *Decoroproetus* from northern England have similar characters – hence it is likely that *D.? scanicus* is an early holspid stage of some *Decoroproetus* whose adult stage is as yet unknown. This is further supported by the small size of the specimen – 1.3 mm sagittal length.

Genus *Stenoblepharum* gen. nov.

Type species: *Paraproetus warburgae* Přibyl, 1964.

Derivation of the name. – From the Greek *stenos,* narrow and *blepharon,* an eyelid, pertaining to the narrow palpebral lobe. Gender: neuter.

Diagnosis. – Preglabellar field short (sag.); never wider than anterior border; lateral glabellar furrows non-impressed; occipital ring laterally narrowed, without lobes; eye socle commonly well-developed; thorax of 10 segments; pygidium without border and with short, bluntly terminating axis with 4–5 poorly defined axial rings; pleural areas with 3–4 pairs of pleural ribs, with deep pleural furrows and indistinct interpleural furrows, anterior pleural band forming crest-like ridge; no postaxial ridge; rostral plate trapezoidal, tapering backwards with adaxially convex connective sutures; sculpture of fine continuous or discontinuous striations, locally interspersed with minute granules.

Species. – *S. warburgae* (Přibyl, 1964), *S. pentagonoides* (Warburg, 1925), *S. norvegicum* sp. nov., *S. kullsbergense* (Warburg, 1925), *S. strasburgense* (Cooper, 1953); doubtfully included: *S? zalesskyi* (Öpik, 1937), *S? striatum* sp. nov.

Occurrence. – Middle Ordovician Edinburg formation, Virginia, U.S.A.: Viruan, Kullsberg Limestone, Lake Siljan district, Sweden; ?Kukruse Stage, Estonia; Harjuan, Boda Limestone, Lake Siljan district, Sweden; Tretaspis series, Stage 5a, Oslo region, Norway; Ashgill Series, Kildare limestone, Ireland; Whitehead Formation, Quebec.

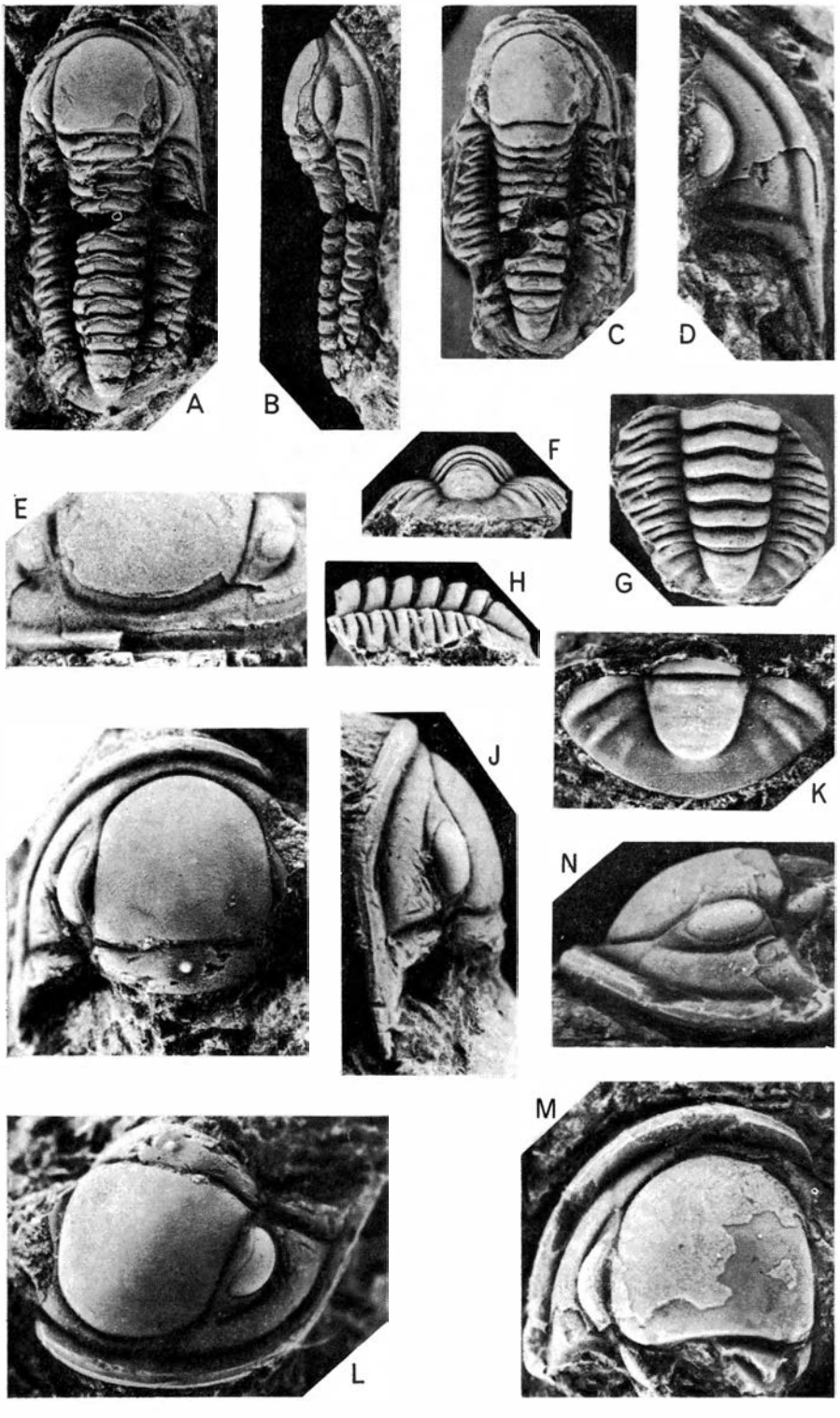
Discussion. – *Stenoblepharum* is restricted to a large degree to the algal reef facies, and it has only rarely been recorded from non-calcareous rocks. The genus is already present in the early Middle Ordovician, when the only abundant proetid genus is *Decoroproetus,* from which it is probably derived. *Decoroproetus* differs from *Stenoblepharum* in the more depressed exoskeleton, the longer preglabellar field, the longer pygidium with more sharply defined pleural ribs and in not having the connective sutures of the rostral plate adaxially convex.

Öpik (1937, p. 25, pl. 1, figs. 1–2, pl. 3, fig. 3) described and figured *Proetus (Prionopeltis?) zalesskyi* Öpik from the Kukruse Stage of Estonia and the cranidium of this species is remarkably similar to that of *Stenoblepharum strasburgense* (Cooper, 1953, p. 19, pl. 1, figs. 15–18) from the Edinburg formation of Virginia, U.S.A. The pygidium differs in possessing two short spines on the margin, but is otherwise similar. The species *zalesskyi* may be an early offshoot from the main *Stenoblepharum* stock.

Stenoblepharum warburgae (Přibyl, 1964).

Fig. 9, A–N.

□ 1925 *Proetus convexus;* Warburg, p. 170, pl. 5, figs. 8–13, 19–20 (*non* fig. 23).
□? 1936 *Proetus* cf. *convexus* Warburg; Cooper and Kindle, p. 365, pl. 53, fig. 19.
□ 1964 *Paraproetus warburgae* nom. nov. (*pro Proetus convexus* Warburg, 1925, *non* Hawle & Corda, 1847, p. 77); Přibyl, p. 45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Lectotype. – (Přibyl 1964, p. 45). A complete specimen (UM D53), figured Warburg, 1925, pl. 5, fig. 8, and refigured herein as Fig. 9, A, B, E.

Material. – One additional complete specimen, one pygidium with six attached thoracic segments, a few cephala and numerous detached exoskeletal parts.

Type stratum and type locality. – Harjuan, Boda Limestone, Kallholn, Lake Siljan district, Sweden.

Occurrence. – Harjuan, Boda Limestone, Kallholn, Boda, Unskarsheden, Lissberg, Östbjörka, and Arfvet, Lake Siljan district, Sweden.

Diagnosis. – Glabella almost parallel-sided, well rounded anteriorly, anterior branches of facial sutures nearly parallel; lateral glabellar furrows do not interrupt the surface sculpture, but are crossed by coarser striations than on the rest of the glabella; pygidial axis with three axial rings, pleural area with three pleural ribs; sculpture of very fine striations, interspersed with sporadic, minute granules on the cheeks, preglabellar field and inner part of the cephalic border; smaller inconspicuous granules occur on the glabella and occipital ring.

Description. Warburg 1925, p. 170.

Discussion. – Warburg's description can be emended and amplified in a few points. She (p. 171) states that on certain specimens the preglabellar field is almost obsolete, and figures one such specimen (pl. 5, fig. 23). These specimens do not belong to *S. warburgae* but to *S? striatum* (see below). On

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Fig. 9.

A–M. *Stenoblepharum warburgae* (Přibyl, 1964).

A, B, E. *LECTOTYPE* nearly complete, partially exfoliated exoskeleton: A-dorsal and B-lateral views, × 4¼. E-anterior view, × 8½, showing mould of rostral plate. Specimen the original of Warburg 1925, pl. 5, fig. 8, Boda Limestone, Kallholn, Lake Siljan district, Dalarne, Sweden. (UM D 53.)

C. Almost complete, partially exfoliated exoskeleton: dorsal view, × 4½. Specimen the original of Warburg 1925, pl. 5, figs. 9–10. Horizon and locality as A. (UM D 54.)

D. Free cheek: dorsal view, × 5½. Specimen the original of Warburg 1925, pl. 5, fig. 12. Horizon and locality as A. (UM D 55.)

F–H. Pygidium with six attached thoracic segments: F-posterior, G-dorsal and H-lateral views, × 4¼. Horizon and locality as A. (RM Ar 47505.)

I, J, L. Incomplete cephalon: I-dorsal, J-lateral and L-anterior oblique views, × 9. Specimen the original of Warburg 1925, pl. 5, fig. 11. Boda Limestone, Dalarne, Sweden. (RM Ar 10828.)

K. Pygidium: dorsal view, × 10. Horizon and locality as A. (RM Ar 45815.)

N, M. Incomplete cephalon: N-lateral and M-dorsal views, × 6½. Specimen the original of Warburg 1925, pl. 5, figs. 19–20. Boda Limestone, Östbjörka, Lake Siljan district, Dalarne, Sweden. (RM Ar 10825.)

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
UM D 53 (E)	4.9	3.5	0.6	0.8	3.8	4.6	Lectotype
UM D 54 (E)	4.2	2.9	0.4	0.9	3.1	–	
RM Ar 10825 (E/I)	–	4.0	1.2	–	4.3	4.9	
RM Ar 10828 (E)	4.7	3.0	0.7	1.0	3.2	3.4	
RM Ar 43225 (E)	6.1	4.2	0.7	1.2	4.2	5.0	
RM Ar 5219_1 (E)	5.2	3.4	0.7	1.1	3.3	3.9	
RM Ar 5219_2 (E)	4.3	2.6	0.8	0.9	2.8	–	
RM Ar 5219_3 (E)	3.9	2.5	0.7	0.7	2.3	–	
RM Ar 5219_4 (E)	3.3	2.2	0.5	0.6	(2.2)	(2.3)	
RM Ar 5219_5 (E)	2.4	1.8	0.3	0.3	1.4	–	
RM Ar 5219_6 (E)	2.0	1.6	0.2	0.2	1.3	1.5	
RM Ar 5219_7 (E)	2.0	1.5	0.2	0.3	1.1	(1.3)	
Pygidia Specimen No.	A	A_1	X	Y			
UM D 53 (E/I)	2.7	2.1	4.4	1.7		Lectotype	
RM Ar 45815 (E)	2.5	1.8	4.3	1.6			
RM Ar 47505 (E)	(2.1)	1.5	4.0	1.6			

the same page she describes the 'lower eyelid' – this is now called the eye socle (Shaw & Ormiston 1964, p. 1002). The ill-defined postaxial ridge that she states (p. 172) to be present has not been seen (Fig. 9, G, K).

A characteristic feature of *S. warburgae,* also shared by *S. norvegicum* is the presence of two parallel raised ridges on the outer part of the cephalic border. At the inner one there is a sharp change in slope in lateral profile (Fig. 9, B, J). The stretch between the inner and outer terrace lines is straight, and below the outer the border curves inwards and backwards towards the doublure. The lectotype (Fig. 9, E) has the anterior border damaged, and shows the small, trapezoidal rostral plate. The rostral suture is about five times the length (trans.) of the posterior margin, and the connective sutures converge backwards and are adaxially convex.

Stenoblepharum warburgae is the most widespread proetid in the Boda Limestone. The species most similar to *S. warburgae* is *S. norvegicum,* from the Harjuan of Norway, and the differences are indicated below. Cooper & Kindle (1936, p. 465, pl. 53, fig. 19) figure a cranidium from the Whitehead Formation of Quebec as *Proetus* cf. *convexus,* Warburg, 1925 [= *warburgae* Přibyl], and from the figure it seems likely that it is conspecific with the Swedish species.

Stenoblepharum norvegicum sp. nov.

Fig. 10, A–L.

Holotype. – A cranidium (PMO 70435) Fig. 10, A–C.

Material. – About 30 isolated cranidia, free cheeks and pygidia.

Type stratum and type locality. – Harjuan, Tretaspis series, Stage 5a, Holmenskjæret, Holmen, Asker, Oslo.

Occurrence. – The type locality and Gryssen, Lake Siljan district, Dalarne, Sweden.

Derivation of the name. – From the occurrence of this species in Norway.

Diagnosis. – *S. norvegicum* is very similar to *S. warburgae* from which it differs in the following ways: glabella tapering more strongly forwards and more strongly convex in lateral profile; posterior margin of occipital ring a more even curve; sculpture of short, rather coarse discontinuous striations, area of lateral glabellar furrow smooth.

Dimensions (in millimetres)

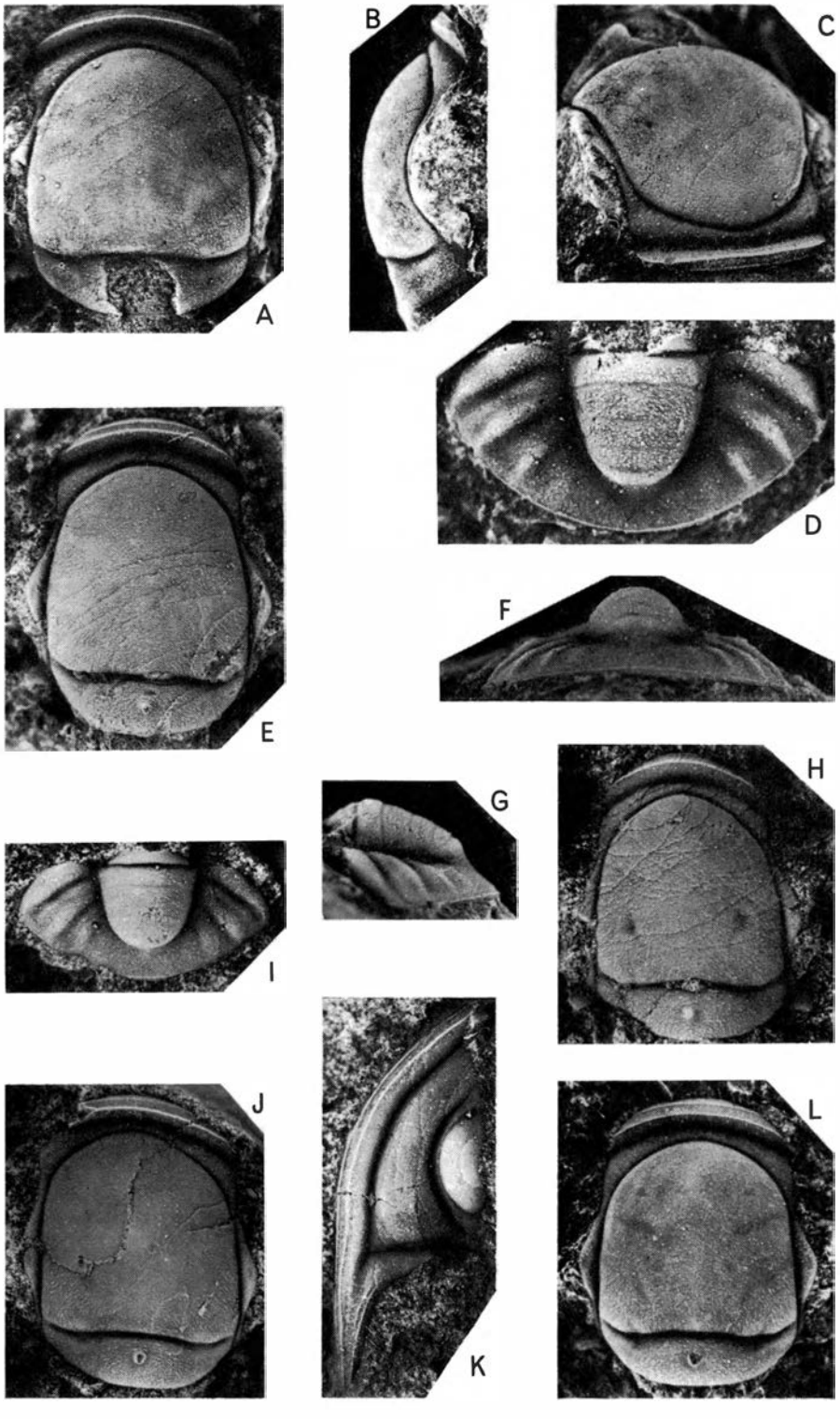
Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
PMO 70435 (E)	4.4	3.1	0.5	0.8	3.2	(3.6)	Holotype
PMO 8413 (E)	5.4	3.8	0.6	1.0	3.7	4.6	
PMO 70484 (E)	5.2	3.5	0.7	1.0	3.2	3.9	
RM Ar 10879 (E)	5.3	3.7	0.6	1.0	3.5	4.3	
PMO 8410 (E)	3.3	2.2	0.4	0.7	2.1	2.6	
Pygidia Specimen No.	A	A_1	X	Y			
PMO 70470 (E)	2.2	1.6	1.2	3.8			
PMO 8857 (E)	1.2	1.0	0.9	2.7			

Discussion. – Apart from the differences indicated in the diagnosis, *S. norvegicum* is very similar to *S. warburgae* (cf. Figs. 9 and 10) and the gross overall morphology is the same. The two species occur in slightly different environments – *S. warburgae* in the 'pure' reef facies of the Boda Limestone, and *S. norvegicum* in the *Palaeoporella* facies of the Tretaspis Series, Stage 5a. The great similarity between these species suggests that there can be no great age difference between the Boda Limestone and Stage 5a.

Stenoblepharum kullsbergense (Warburg, 1925).

Fig. 11, A–K, M.

□ 1925 *Proetus kullsbergènis;* Warburg, p. 173, pl. 5, figs. 24–25. □ *non* 1932 *Proetus* cf. *kullsbergenis* Warburg; King, p. 104.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Holotype. – (By original designation): an incomplete cranidium (UM D61), figured Warburg 1925 as pl. 5, fig. 21, and refigured herein as Fig. 11, A, B, F, H.

Material. – A small number of isolated cranidia and pygidia.

Type stratum and type locality. – Viruan, Kullsberg Limestone, Kullsberg.

Occurrence. – Viruan, Kullsberg Limestone, Kullsberg, Amtjärn, Skålberget, Lake Siljan district, Sweden.

Diagnosis. – Glabella with bluntly rounded frontal lobe, weakly constricted laterally, preglabellar field about one eighth the length of the glabella (sag.); eye socle with poorly defined lower margin; pygidial axis with 5 rings; pleural areas with 4 pairs of ribs, which turn rather strongly backwards abaxially; posterior end of axis plus the postaxial area are almost straight in lateral profile, and steeply declined. Sculpture of fine continuous striations, which cover the areas of the glabella furrows; sporadic granules on the preglabellar field and occipital ring.

Description. – Glabella marginally longer (sag.) than wide (trans.), weakly constricted laterally, bluntly rounded in anterior and moderately inflated. Three pairs of lateral glabellar furrows, which are generally inconspicuous and defined only as darker areas and are crossed by striations which cover remainder of glabellar surface. 1p is triangular, with long straight posterior margin directed backwards and inwards at about 45°, and anterior margin running almost straight (trans.) inwards, before turning sharply backwards to join posterior margin some distance in front of occipital furrow. 2p and 3p

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Fig. 10.

A–L. *Stenoblepharum norvegicum* gen. et sp. nov.

A–C. *HOLOTYPE* cranidium: A-dorsal, B-lateral and C-anterior oblique views. Tretaspis Series, Stage 5a, Holmenskjæret, Oslo-Asker district, Norway. (PMO 70435, coll. J. F. Bockelie 1965.)

D, F, G. Pygidium: D-dorsal, F-posterior and G-lateral views, × 14. Horizon and locality as A. (PMO 70470, coll. F. Nikolaisen 1968.)

E. Cranidium: dorsal view, × 9. Horizon and locality as A. (PMO 70484, coll. J. F. Bockelie 1965.)

H. Small cranidium: dorsal view, × 13½. Note impressed adaxial part of 1p glabellar furrow. Horizon and locality as A. (PMO 8410, coll. J. F. Bockelie 1966).

I. Pygidium: dorsal view, × 13½. Horizon and locality as A. (PMO 8857, coll. J. F. Bockelie 1966.)

J. Cranidium: dorsal view, × 8. Horizon and locality as A. (PMO 8413, coll. J. F. Bockelie 1966.)

K. Free cheek: dorsal view, × 10. Horizon and locality as A. (PMO 70428, coll. F. Nikolaisen 1968.)

L. Cranidium: dorsal view, × 8. Boda Limestone, Gryssen, Lake Siljan district, Dalarne, Sweden. (RM Ar 10879, coll. G. Holm 1880.)

inconspicuous, elongated; 2p opposite γ and directed weakly backwards, 3p a short distance in front of 2p and directed slightly forwards.

Occipital furrow more or less transverse median stretch, and turns weakly forwards abaxially. Occipital ring as wide, or sometimes a little wider (trans.) than glabella, gently convex in lateral profile and narrowing abaxially. Distinct median tubercle present.

Preglabellar field sigmoidal in profile, and an eighth the glabellar length (sag.). Anterior border furrow narrow and distinct, anterior border upturned and marginally longer (sag.) than preglabellar field. Prominent, raised terrace line present on margin. Anterior branches of facial sutures weakly divergent, γ close to anterolateral corner of glabella, and γ–β a distinct, abaxially convex curve. Posterior branch apparently with ε and ξ as independent angles. Palpebral lobe apparently subcrescentic, about half sagittal length of glabella. Eye reniform, eye socle with lower margin diverging weakly from upper, and not defined by incised furrow. Field of free cheek narrow, convex. Lateral border furrow shallower than anterior, lateral border widens slightly towards posterior. Posterior border furrow deep, narrow.

Pygidium subparabolic, about five eighths as long (sag.) as wide (trans.), with region of articulating facet turned strongly backwards. Axis anteriorly about two-fifths pygidial width, tapering backwards gradually to a bluntly rounded end, consisting of 5 rings and short end piece, in longitudinal profile strongly arched and semi-cylindrical, in lateral profile gently declined from anterior to posterior, with each ring weakly convex. Posterior end of axis and postaxial area steeply declined in an almost straight line, no postaxial ridge. First axial ring narrower (sag.) than remainder which gradually

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Fig. 11.

A–K, M. *Stenoblepharum kullsbergense* (Warburg, 1925).

A, B, F, H. *HOLOTYPE* cranidium: A-dorsal, B-lateral, F-anterior and H-anterior oblique views, × 9½. Specimen the original of Warburg 1925, pl. 5, fig. 24. Kullsberg Limestone, Kullsberg, Lake Siljan district, Dalarne, Sweden. (UM D 61.)

C–E. Pygidium: C-lateral, D-dorsal and E-posterior views, × 12. Specimen the original of Warburg 1925, pl. 5, fig. 25. Horizon and locality as A. (UM D 62.)

G. Cranidium: dorsal view, × 8. Horizon and locality as A. (RM Ar 10884, coll. O. Isberg.)

I. Cranidium: dorsal view, × 10. Horizon and locality as A. (RM Ar 43740, coll. O. Isberg.)

J. Free cheek: dorsal view, × 15. Horizon and locality as A. (RM Ar 47506, coll. O. Isberg 1913.)

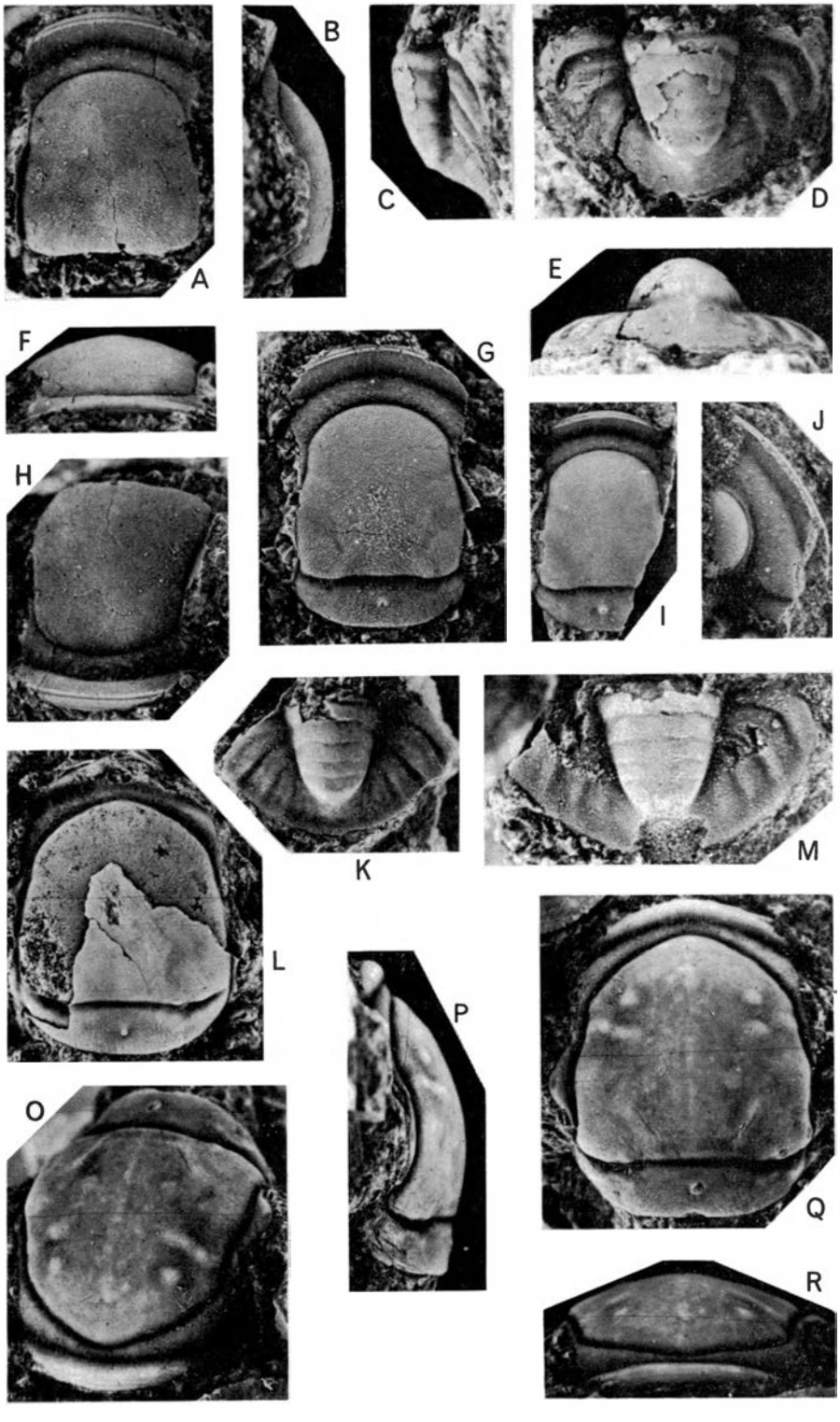
K. Pygidium: dorsal view, × 10. Kullsberg Limestone, Amtjärn, Lake Siljan district, Dalarne, Sweden. (RM Ar 43394, coll. O. Isberg.)

M. Pygidium: dorsal view, × 12½. Horizon and locality as A. (UM D 1376a, coll. E. Warburg.)

L, O–R. *Stenoblepharum pentagonoides* (Warburg, 1925).

L. Cranidium: dorsal view, × 3½. Boda Limestone, Osmundsberget, Lake Siljan district, Dalarne, Sweden. (RM Ar 10861.)

O–R. *HOLOTYPE* cranidium: O-anterior oblique, P-lateral, Q-dorsal and R-anterior views, × 5½. Specimen the original of Warburg 1925, pl. 5, fig. 22. Boda Limestone, Unskarsheden, Lake Siljan district, Dalarne, Sweden. (RM Ar 10838.)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decrease in width (sag.) towards posterior. Interannular furrows weak, arched backwards weakly sagitally and turn backwards abaxially. Articulating furrow narrow and distinct. Adaxial part of pleural field almost flat and horizontal, abaxial section bending gently downwards to margin. Three obvious pairs of pleural ribs with an ill-defined fourth pair. Pleural furrows deep, with steep anterior and shallow posterior slopes, turning backwards quite strongly distally. Interpleural furrows faint, running more or less parallel to pleural furrows, converging with the one behind slightly adaxially and abaxially. Neither pleural nor interpleural furrows reach margin.

Entire cephalon and pygidium covered with fine, continuous striations, arranged in a Bertillon pattern on glabella and occipital ring. On preglabellar field striations interspersed with sporadic granules, which are also found, but in a more irregular arrangement, on median part of occipital ring.

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
UM D 61 (E)	–	2.9	0.9	–	2.9	–	Holotype
RM Ar 10884 (E)	5.1	3.1	1.1	0.9	3.0	(3.2)	
RM Ar 10887 (E)	5.2	3.2	1.2	0.8	3.1	(3.8)	
RM Ar 43740 (E)	3.5	2.1	0.7	0.7	(2.0)	–	
Pygidia Specimen No.	A	A_1	X	Y			
UN D 62 (E/I)	2.3	1.7	1.5	3.6			
UM D 1376 a (E)	2.1	1.6	1.2	3.9			
RM Ar 43394 (E)	2.8	2.0	1.3	(3.7)			

Discussion. – Warburg (1925, p. 174) based her description of this species on two incomplete cranidia and pygidia. Now that more and better preserved material is available, a fuller description has been drawn up.

Like the later species *S. warburgae* and *S. norvegicum* (see above), *S. kullsbergense* possesses an abaxially narrowed occipital ring, a narrow elongated palpebral lobe and granules interspersing the striations on the preglabellar field. Like *S. warburgae, S. kullsbergense* has the striations which cover the glabella crossing over the areas of the lateral glabellar furrows. In this aspect, and in the striated sculpture consisting of continuous striations, *S. kullsbergense* is like *S. warburgae,* but unlike *S. norvegicum. S. kullsbergense* is distinct from both *S. warburgae* and *S. norvegicum* in the following features: – the laterally constricted glabella, the longer (sag.) preglabellar field, the diverging, abaxially convex anterior branches of the facial sutures, the proportionately longer pygidium, with one more axial ring and one more pleural rib. The pygidial morphology as well as the abaxially convex anterior branches of the facial sutures are common features of *S. kullsbergense* and the early Middle Ordovician species *S. strasburgense* (Cooper).

Stenoblepharum pentagonoides (Warburg, 1925).

Fig. 11, L, O–R.

□ 1925 *Proetus pentagonoides;* Warburg, p. 176, pl. 5, fig. 22. □ 1964 *Paraproetus pentagonoides* (Warburg): Přibyl, p. 44.

Holotype. – (By original designation): A cranidium (RM. Ar 10838) figured. Warburg 1925, as pl. 5, fig. 22, and refigured herein as Fig. 11, O–R.

Material. – Five cranidia.

Type stratum and type locality. – Harjuan, Boda Limestone, Unskarsheden, Lake Siljan district, Sweden.

Occurrence. – Harjuan, Boda Limestone, Unskarsheden, Osmundsberget, Kallholn, Lake Siljan district, Sweden; ?Kildare Limestone, Ireland.

Diagnosis. – Glabella with anterolateral corners and frontal lobe distinctly angular, producing a pentagonal outline of the glabella; margin of the glabella somewhat expanded opposite middle of palpebral lobe; palpebral lobe rather small, subtriangular; anterior branches of facial sutures slightly convergent; anterior border rounded in profile; sculpture of short, discontinuous striations.

Description. – Warburg, p. 176.

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
RM Ar 10838 (I)	8.0	5.8	0.9	1.3	5.7	(6.5)	Holotype
RM Ar 10861 (E/I)	–	5.0	–	1.3	5.0	–	
RM Ar 5219_8 (E/I)	–	3.5	–	1.0	3.7	–	

Discussion. – The distinctly angular outline of the glabella and the rounded anterior border serve to distinguish this from other *Stenoblepharum* species. From what remains of the external surface (e.g. Fig. 11, L), the surface sculpture seems to be like that of *S. norvegicum.*

Most of Warburg's description is based on the holotype, which is an internal mould. This specimen has the areas of the lateral glabellar furrows and auxiliary impressions as positive areas, which means that they must have originally been depressions on the inner surface of the exoskeleton. Other specimens of *S. pentagonoides* are not sufficiently preserved to show the appearance of the lateral glabellar furrows on the internal mould.

Stenoblepharum? striatum sp. nov.

Fig. 12, A–D.

□ 1925 *Proetus convexus* n. sp. *pars:* Warburg, pl. 5, fig. 23 (*non* figs. 8–13, 19–20).

Holotype. – A cranidium (RM Ar 47500), Fig. 12, A–C.

Material. – Besides the type, 5 cranidia.

Type stratum and locality. – Harjuan, Boda Limestone, Kallholn, Lake Siljan district, Sweden.

Occurrence. – Harjuan, Boda Limestone, Kallholn, Unskarsheden, Lake Siljan district, Sweden.

Derivation of the name. – From Latin *stria,* a line, due to the striated surface sculpture.

Diagnosis. – Glabella quadrate, lateral glabellar furrows non-incised, inconspicuous and crossed by striations which cover rest of glabella; occipital ring wider (trans.) than anterior border; sculpture of fine striations.

Description. – Cranidium rather weakly vaulted; glabella marginally wider (trans.) than long (sag.), roughly quadrate in outline with well rounded frontal lobe; three pairs of lateral glabellar furrows (not seen on all specimens), non-incised, inconspicuous and represented by darker areas on glabellar surface, crossed by striations which cover rest of glabella. Occipital furrow deep and narrow, arched weakly forwards sagittally and laterally. Occipital ring does not narrow laterally, is slightly wider (trans.) than glabella and has distinct median tubercle. Preglabellar field less than one fifth length (sag.) of anterior border, in profile (Fig. 12, C) making little impression on contour of cranidium. Anterior border rounded in profile, anterior border furrow narrow and shallow. Anterior branches of facial sutures very weakly divergent, γ close to axial furrow. Palpebral lobe narrow (trans.) and subcrescentic, about a quarter the glabellar sagittal length. Cranidium with sculpture of fine continuous striations, apparently lacking on the preglabellar field and anterior border.

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
RM Ar 47500 (E)	8.0	5.7	1.1	1.2	6.0	(6.5)	Holotype
UM D 60 (E/I)	(5.7)	4.1	0.6	(1.0)	4.2	–	
RM Ar 10822 (E)	6.4	4.4	0.9	1.1	4.5	–	
RM Ar 10820 (E/I)	5.2	3.4	0.9	0.9	3.8	–	
RM Ar 47495 (E/I)	4.3	2.6	0.7	1.0	3.0	–	

Discussion. – Six cranidia have the characters described above. The principal difference between them and *Stenoblepharum* species is the non-laterally narrowed occipital ring – a feature which would exclude them from this genus as presently diagnosed. Until other parts of the exoskeleton are known, these cranidia are doubtfully included in *Stenoblepharum,* and if the pygidium is like that of other members of this genus then the diagnosis can be modified to include *striatum.*

Subfamily EREMIPROETINAE Alberti, 1967.

Genus *Eremiproetus* R. & E. Richter, 1919.

Type species: *Proetus dufresnoyi* Hawle & Corda, 1847.

Eremiproetus agellus sp. nov.

Fig. 12, E, G–M.

□ 1925 *Proetus* sp. ind. a.; Warburg, p. 180, pl. 5, figs. 14, 17.

Holotype. – A cranidium (PMO 55817) Fig. 13, Fig. 12, G–H.

Material. – Numerous detached exoskeletal parts.

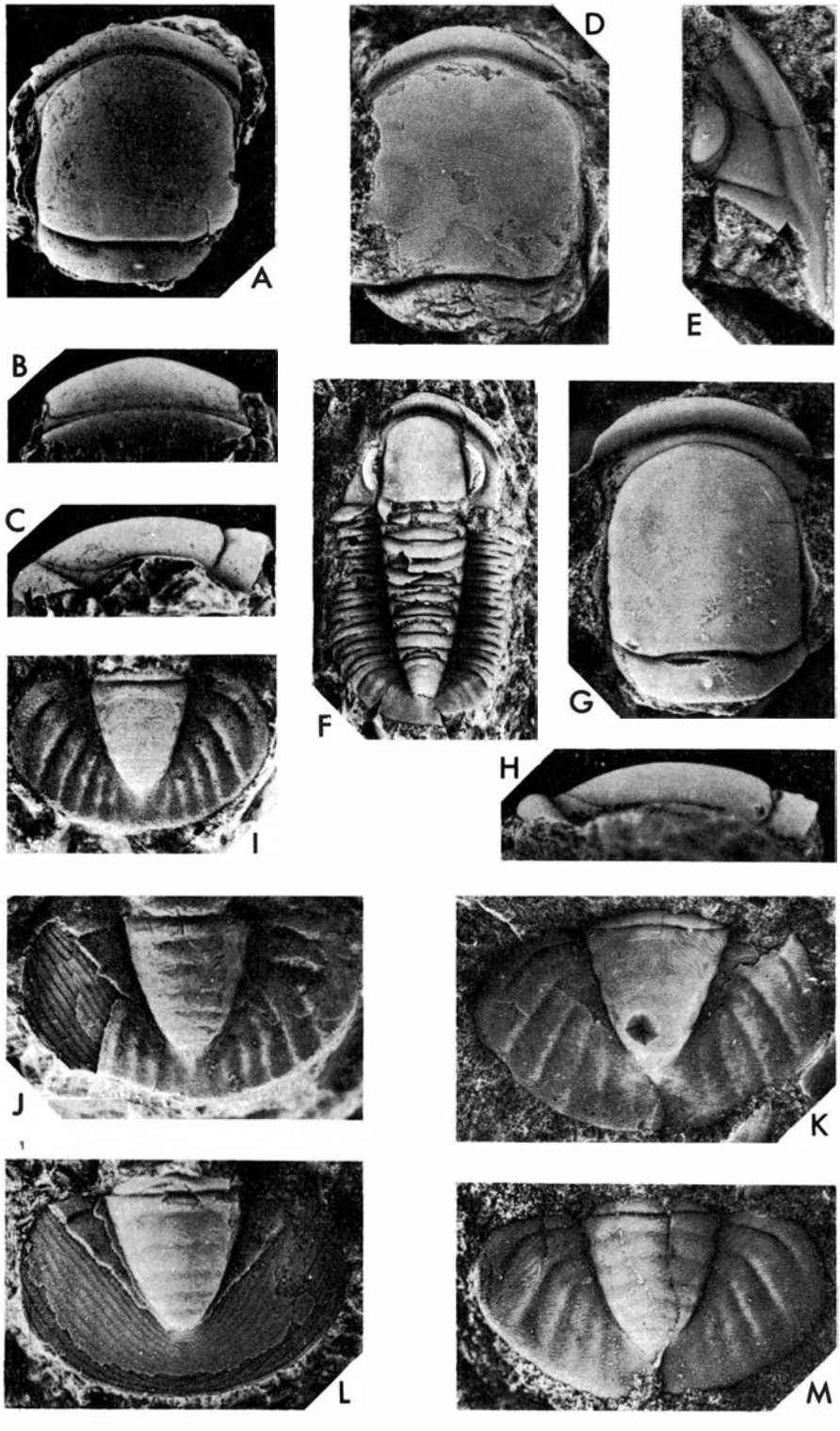
Type stratum and type locality. – Harjuan, Tretaspis Series, Stage 5a, Nøstest, Sælabon, Ringerike district, Norway.

Occurrence. – In Norway: Harjuan, Tretaspis Series, Stage 5a, Ringerike and Oslo-Asker districts; In Sweden: Harjuan, Boda Limestone, Osmundsberget Unskarsheden, Kallholn and Solberga, Lake Siljan district.

Derivation of the name. – From Latin *agellus,* a small field – from the short preglabellar field.

Diagnosis. – Glabella almost parallel-sided, with well-rounded frontal lobe; anterior branches of facial sutures weakly divergent; eye socle with incised lower marginal furrow, diverging from upper at either end; Occipital ring as wide (trans.) as glabella; pygidial axis conical, with 5–6 rather ill-defined rings, interannular furrows not noticeably arched backwards sagittally; 5–6 pairs of pleural ribs, turning strongly backwards; sculpture of fine, dense striations.

Description. – Cranidium rather weakly vaulted, distinctly longer (sag.) than wide (trans.) across δ–δ. Glabella as long as wide, nearly parallel-sided and with well-rounded frontal margin. Three pairs of weak, non-impressed lateral glabellar furrows, which are crossed by striated sculpture. Their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disposition is shown on Fig. 13. Occipital furrow narrow, deep with nearly transverse median section, laterally curving first weakly backwards, then weakly forwards to meet axial furrow. Occipital ring as wide (sag.) as preglabellar area, and as wide (trans.) as glabella. Does not narrow laterally and has prominent median tubercle. Preglabellar field about half sagittal length of anterior border, straight in profile where it forms a continuous declined slope with contour of glabella (Fig. 12, H). Anterior branches of facial sutures weakly divergent with γ close to axial furrow. Posterior branches with ε and ξ as independent angles.

Palpebral lobe narrow, subcrescentic, close to glabella and posteriorly situated, and about two-fifths the sagittal length of glabella. Eye rather small, reniform. Eye socle with incised lower marginal furrow with diverges from upper at either end. Field of free cheek narrow, weakly convex. Lateral border furrow distinct but shallow, like anterior. Lateral border broadens, becoming less convex, posteriorly. Posterior border furrow narrow, sharp, truncated at base of broad-based genal spine, whose median groove is offset abaxially from the lateral border furrow.

Pygidium subparabolic. From axial furrow anterior margin runs transversely for a short distance, then turns strongly backwards in a gentle, abaxially convex curve to meet posterior margin on transverse line running through fifth axial ring. Anteriorly axis about two fifths the total pygidial width, extending for about two thirds the pygidial length (sag.). Behind it is a weak postaxial ridge. Axis conical, tapering strongly backwards to a blunt point, and is gently longitudinally convex. It consists of 5–6 rings, separated by weak interannular furrows which are nearly transverse sagittally,

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Fig. 12.

A–D. *Stenoblepharum? striatum* gen. et sp. nov.

A–C. *HOLOTYPE* cranidium: A-dorsal, B-anterior and C-lateral views, × 4½. Boda Limestone, Kallholn, Lake Siljan district, Dalarne, Sweden. (RM Ar 47500.)

D. Cranidium: dorsal view, × 8. Note striated sculpture. Specimen the original of Warburg 1925, pl. 5, fig. 23. Horizon and locality as A. (UM D 60.)

E, G–M. *Eremiproetus agellus* sp. nov.

E. Free cheek: dorsal view, × 4. Tretaspis Series, Stage 5a, Stavnestangen, Ringerike, Norway. (PMO 20777, coll. J. Kiær 1894.)

G, H. *HOLOTYPE* cranidium: G-dorsal and H-lateral views, × 8. Tretaspis Series, Stage 5a, Nøstest, Saelabon, Ringerike, Norway. (PMO 55817, coll. J. Kiær 1916.)

I. Pygidium: dorsal view, × 7½. Horizon and locality as A. (S.G.U. Collection, unnumbered.)

J. Pygidium: dorsal view, × 9. Specimen the original of Warburg 1925, pl. 5, fig. 17. Horizon and locality as A. (UM D 58.)

K. Pygidium: dorsal view, × 4½. Horizon and locality as E. (PMO 20778, coll. J. Kiær 1894.)

L. Pygidium: dorsal view, × 7½. Specimen the original of Warburg 1925, pl. 5, fig. 14. Horizon and locality as A. (UM D 57.)

M. Pygidium: dorsal view, × 10. Tretaspis Series, Stage 5a, Holmenskjæret, Holmen, Oslo-Asker district, Norway. (PMO 70424, coll. D. L. Bruton, J. F. Bockelie and F. Nikolaisen 1966.)

F. *Eremiproetus senex* Alberti, 1967.

Plaster cast of almost complete specimen: dorsal view, × 3. Silurian, Ludlow Series, Kopanina Beds, Dlouhá Hora, Prague district, Czechoslovakia. (NMP Br 228.)

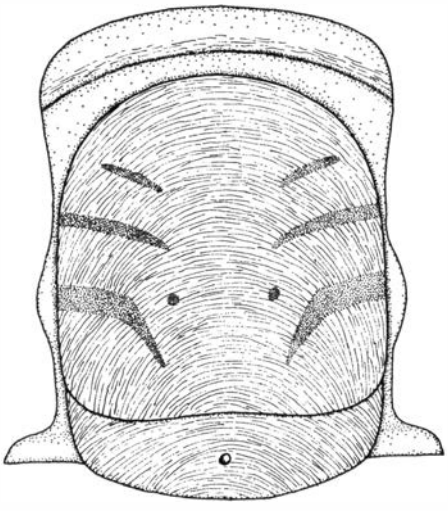


Fig. 13. Holotype cephalon (PMO 55817) of *Eremiproetus agellus* sp. nov., showing disposition of lateral glabellar furrows.

articulating furrow deep, narrow and transverse, first axial ring is distinctly narrower than second (sag.). Axis defined by narrow axial furrows, which shallow and become obsolete near posterior. Pleural areas gently convex, with 5–6 pairs of ribs which turn strongly backwards and widen a little abaxially. Pleural furrows deep, with steep anterior slope and shallow posterior slope. Abaxially they widen and become shallower, and die out before reaching margin. They turn backwards strongly as they cross above inner edge of doublure. Interpleural furrows weak and hardly apparent, but run close to and nearly parallel with succeeding pleural furrow (Fig. 12, K, on left hand side).

Pygidial doublure very broad and weakly ventrally convex, bearing 10–12 strong, parallel terrace lines, bunched together behind axis where doublure narrows considerably (Fig. 12, L).

Cephalon and pygidium covered with fine, dense, raised striations.

Dimensions (in millimetres)

Cranidia Specimen No.	L	L_1	L_2	SO	W	δ–δ	
PMO 55817 (E)	5.2	3.8	0.5	0.9	3.3	3.9	Holotype
PMO 20779 (E)	7.7	5.3	1.0	1.4	5.5	(5.9)	
RM Ar 10821 (E)	6.3	3.9	1.2	1.2	4.0	–	
Pygidia Specimen No.	A	A_1	X	Y			
PMO 20778 (E)	6.8	4.9	10.5	5.1			
UM D 57 (E/I)	4.3	3.1	6.6	2.7			
UM D 58 (E/I)	3.3	2.6	5.7	2.1			
PMO 70424 (E)	2.9	2.1	5.2	1.8			
S.G.U. Coll. (I) (Fig. 12, I)	3.0	2.2	5.2	1.8			

Discussion. – *Eremiproetus agellus* sp. nov. is the earliest known member of the genus, considerably pre-dating the next oldest species *E. senex* Alberti, 1967, which occurs in the early Ludlovian of Bohemia. *E. senex* is quite similar to *E. agellus* (cf. Fig. 12, E, G–M and Fig. 12, F), differing from it in the more tapering glabella, wider occipital ring, smaller number of pygidial axial rings and pleural ribs in having distinct interpleural furrows.

Reed (1940, p. 159, pl. 8, fig. 1) figured and described *Proetus vicinus* Reed from the Middle Ordovician Balclatchie Mudstones of the Girvan district. Přibyl (1947, p. 1, text-fig. 1), subsequently changed the species name to *reedi* (*vicinus* being a homonym of *Proetus vicinus* Barrande, 1872) and transferred the species, with doubt, to *Eremiproetus*. I have examined Reed's original cranidium and consider it to belong to *Decoroproetus* and to be conspecific with *D. jamesoni* (Reed, 1914).

The cranidium of *E. agellus* is not dissimilar to those of *Stenoblepharum warburgae* and *S. norvegicum,* although the pygidium is much different, and is more similar to that of *Decoroproetus.*

Subfamily UNCERTAIN.

Genus *Cyphoproetus* Kegel, 1927.

Type species: *Cyphaspis depressa* Barrande, 1846.

Discussion. – Three cranidia referable to *Cyphoproetus* have been obtained from the Ordovician of Scandinavia, two from Stage 5a of the Tretaspis Series and one from the Boda Limestone. Three species are possibly represented, but naming and full description are deferred until more complete material becomes available.

Cyphoproetus sp. 1.

Fig. 14, A.

□? 1925 *'Phaetonides'*, sp. ind.: Warburg, p. 184, pl. 5, fig. 36.

Material. – One incomplete external mould of a cranidium.

Horizon and locality. – Harjuan, Boda Limestone, Gulleråsen, Lake Siljan District, Sweden.

Dimensions (in millimetres)

Specimen No.	L	L_1	L_2	SO	W	δ–δ
RM Ar 10417 (E)	–	2.7	0.6	–	2.0	(3.0)

Discussion. – *Cyphoproetus* sp. 1 is characterised by: glabella longer (sag.) than wide (trans.), incompletely isolated 1p lobes, weak, non-incised 2p and 3p furrows, a short (sag.) preglabellar field and weakly divergent anterior branches of the facial sutures. The first character distinguishes it from both *C.* sp. 2 and *C.* sp. 3, and the last from *C.* sp. 3. Unfortunately the surface sculpture and occipital ring of *C.* sp. 1 are not preserved for further comparison. *C.* sp. 1 is similar to *Phaetonides* [= *Cyphoproetus*] *bellus* Cooper & Kindle, 1936 (pl. 53, fig. 15) from the Whitehead Formation of Quebec but the latter lacks the preglabellar field.

It has not been possible to trace the cranidium which Warburg (1925, p. 184, pl. 5, fig. 36) described and figured as '*Phaetonides*' sp. ind. From Warburg's figure and description it seems likely that her specimen belongs to *Cyphoproetus* sp. 1, which is the only representative of *Cyphoproetus* known from the Boda Limestone.

Cyphoproetus sp. 2.

Fig. 14, B.

Material. – One cranidium with most of the anterior border missing (PMO 35484).

Horizon and locality. – Harjuan, Tretaspis Series, Stage 5a, just above '*Armenoceras*' beds. At the beach, south of Gjøvik, Oslo region, Norway.

Dimensions (in millimetres)

Specimen No.	L	L_1	L_2	SO	W	δ–δ
PMO 35484 (E)	–	1.6	–	0.5	1.5	(2.0)

Discussion. – *C.* sp. 2 is like *C.* sp. 1, differing only in glabellar proportions and degree of constriction. It is particularly characterised by the striated sculpture with sporadic granules and the sagittally widened occipital ring with indistinct lateral lobes. *C.* sp. 1 is insufficiently preserved to show whether these characters in this species are comparable with *C.* sp. 2, so provisionally two distinct species are retained.

Cyphoproetus sp. 3.

Fig. 14, E.

Material. – One cranidium (PMO 54395).

Horizon and locality. – Harjuan, Tretaspis Series, Stage 5a, Korsrud, Lunner, Oslo region, Norway.

Dimensions (in millimetres)

Specimen No.	L	L_1	L_2	SO	W	δ–δ
PMO 64395	4.9	3.1	0.9	0.9	3.6	(4.5)

Discussion. – This species differs from both the above in having parallel anterior branches of the facial sutures, a character which invites comparison with *Cyphoproetus rotundatus* (Begg 1939, p. 378, pl. 6, fig. 6) described as *Warburgella rotundata* from the Ashgill Upper Drummuck Group of Girvan, Scotland. There is also some similarity to the earlier *C. facetus* (Tripp 1954, pl. 3, figs. 13–17) from the Caradoc Kiln Mudstones of the Girvan district.

Genus *Xenocybe* gen. nov.

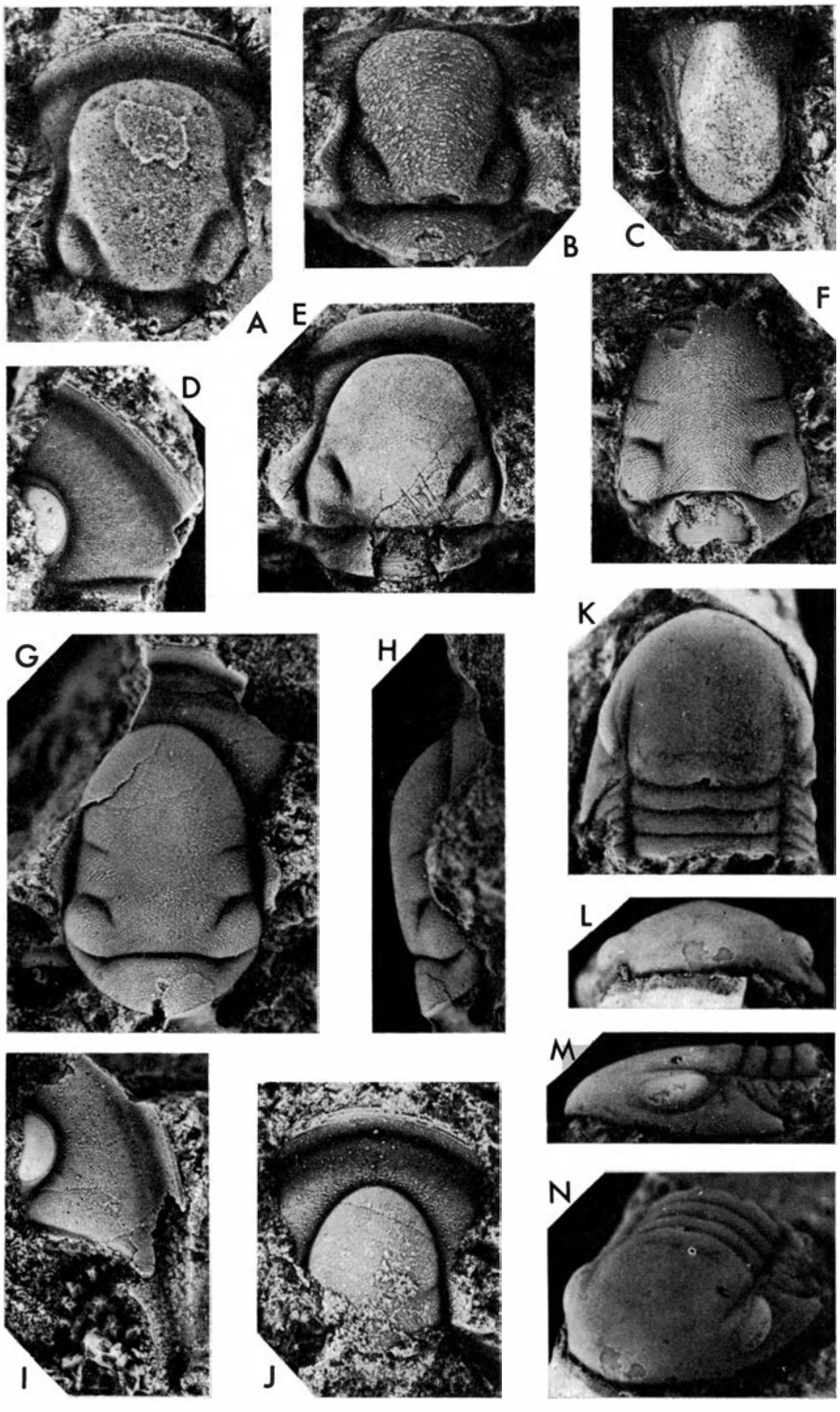
Type species: *Xenocybe micrommata* sp. nov.

Derivation of the name. – From the Greek *xenos,* stranger, and *kybe,* head, due to its distinctness from other proetids. Gender: feminine.

Diagnosis. – Glabella coniform, with 1p and 2p furrows deeply impressed; occipital ring without lobes, narrowing rapidly laterally. Preglabellar field rather long (sag.); eye small and backwardly placed.
Species: *Xenocybe micrommata* sp. nov.

Occurrence. – Harjuan, Tretaspis Series, Stage 5a, Oslo-Asker and Ringerike districts, Norway.

Discussion. – The deeply furrowed glabella distinguishes *Xenocybe micrommata* from all contemporaneous proetids. The only other Ordovician proetid with glabellar furrows of comparable depth is *Phaseolops sepositus* (Whittington 1963, p. 36, pl. 4, figs. 11–13, pl. 5, figs. 1–6) but its morphology is otherwise rather different from *Xenocybe micrommata,* although both species share the rather long, declined preglabellar field, strongly divergent anterior branches of the facial suture and small eyes. The direction of 2p is forwards in *Phaseolops sepositus,* but backwards in *Xenocybe micrommata,* and the position of 3p produces a short frontal lobe in the former, but a rather long one in the latter. It seems rather unlikely that *Xenocybe* and *Phaseolops* can be closely related, and the age difference is great, as *Phaseolops sepositus* comes from the Whiterock Stage of Llanvirn age. Only the cephalon of *Xenocybe micrommata* is known, and as this does not fit into any established proetid subfamily I am placing it in subfamily uncertain.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Xenocybe micrommata, sp. nov.

Fig. 14, D, F–J, Fig. 15.

Derivation of the name. – From the Greek, *micrommatos,* small eyed, because of the small size of the eyes.

Holotype. – Cranidium (PMO 8831) Fig. 14, G, H.

Material. – Five cranidia, and two free cheeks.

Type stratum and type locality. – Harjuan, Tretaspis Series, Stage 5a, Holmenskjæret, Holmen, Asker, Oslo.

Occurrence. – At the type locality and at Stavnestangen, Ringerike district, Norway.

Description. – Cephalon with narrow, upturned, convex border, cranidium with sagittal length much greater than palpebral width. Glabella a little longer than wide, conical and defined by deep, conjoined axial and preglabellar furrows; widest near posterolateral corners and tapering forwards moderately

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Fig. 14.

A. *Cyphoproetus* sp. 1.
Silicone rubber cast of external mould of incomplete cranidium: dorsal view, × 11. Boda Limestone, Gulleråsen, Lake Siljan district, Dalarne, Sweden. (RM Ar 10417.)

B. *Cyphoproetus* sp. 2.
Incomplete cranidium: dorsal view, × 15½. Tretaspis Series, Stage 5a, just above '*Armenoceras*' Beds, beach south of Gjøvik, Oslo district, Norway. (PMO 35484, coll. T. Münster 1892.)

C. Proetid hypostome indet.
Dorsal view, × 13. Specimen the original of Warburg 1925, pl. 5, fig. 21. Boda Limestone, Kallholn, Lake Siljan district, Dalarne, Sweden. (UM D 59, coll. O. Isberg.)

D, F–J. *Xenocybe micrommata* gen. et sp. nov.
D. Free cheek: dorsal view, × 8. Tretaspis Series Stage 5a, Holmenskjæret, Holmen, Oslo-Asker district, Norway. (PMO 8833, coll. J. F. Bockelie 1966.)
F. Incomplete cranidium: dorsal view, × 8. Tretaspis Series, Stage 5a, Stavnestangen, Ringerike, Norway. (PMO 13336, coll. J. Kiær 1894.)
G, H. *HOLOTYPE* cranidium: G-dorsal and H-lateral views, × 12. Horizon and locality as D. (PMO 8831, coll. J. F. Bockelie 1966.)
I. Free cheek: dorsal view, × 6. Horizon and locality as D. (PMO 8832, coll. J. F. Bockelie 1966.)
J. Incomplete cranidium: dorsal view, × 15. Horizon and locality as D. (PMO 8854, coll. J. F. Bockelie 1966.)

E. *Cyphoproetus* sp. 3.
Cranidium: dorsal view, × 8. Tretaspis Series, Stage 5a, Korsrud, Lunner, Oslo region, Norway. (PMO 64395.)

K–N. *Parvigena parvigena* (Warburg, 1925).
HOLOTYPE. Cephalon with three attached thoracic segments: K-dorsal, L-anterior, M-lateral and N-anterior oblique views, × 10. Specimen the original of Warburg 1925, pl. 5, figs. 32–33, Boda Limestone, Kallholn, Lake Siljan district, Sweden. (UM D 63, coll. O. Isberg.)

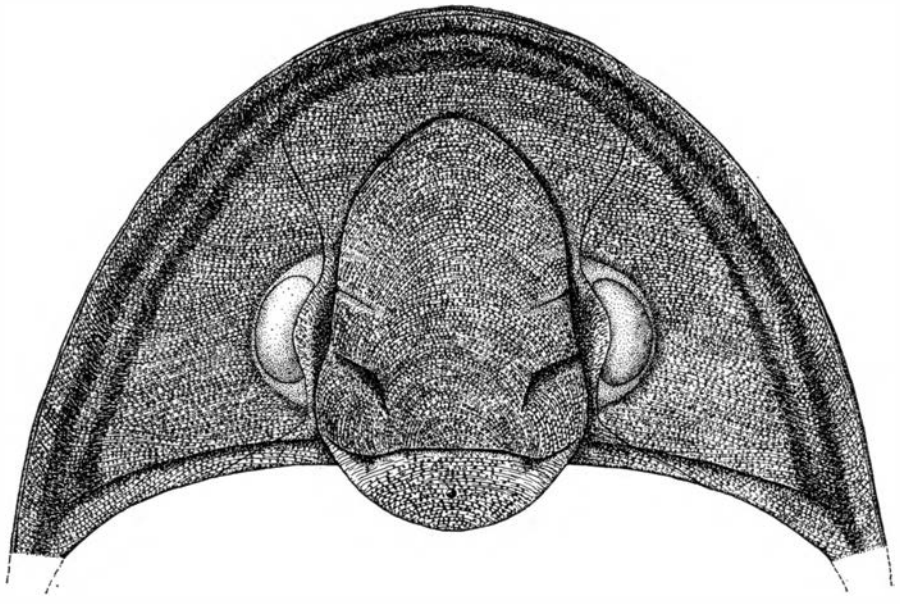

Fig. 15. Reconstruction of the cephalon of *Xenocybe micrommata* gen. et sp. nov.

rapidly as far as a position opposite γ, from which it tapers rapidly to bluntly pointed anterior lobe. In longitudiant profile glabella moderately convex, in lateral profile gently declined as far as frontal lobe, where it curves down steeply to preglabellar furrow. Three pairs of glabellar furrows, 1p and 2p deeply incised, 3p non-incised. 1p opposite posterior part of palpebral lobe, shallow proximally, quickly deepening inwards and directed slightly backwards. Distally it forks with anterior branch very shallow and directed slightly forwards, and posterior branch deep and bent strongly backwards. 1p partially isolates subquadrate 1p lobe, with independent convexity from rest of glabella. 2p opposite anterior part of palpebral lobe, about half way up glabella, unbranched, and directed backwards at slightly greater angle than proximal part of 1p. 3p a short distance in front of 2p, opposite γ, represented by an inconspicuous smooth area interrupting striated sculpture, and directed slightly backwards. 3p far back from anterior end of glabella, producing a long frontal lobe.

Occipital furrow narrow and deep, its middle section almost transverse, bending forwards at lateral ends. Anterior slope almost vertical. Occipital ring as wide (sag.) as preglabellar field, distinctly narrowed laterally, without lateral lobes and with distinct median tubercle. In lateral profile it is almost flat. One specimen (Fig. 14, F) shows doublure of occipital ring, which is weakly dorsally convex, with strong, parallel, transverse terrace lines.

Preglabellar field about a quarter the sagittal length of glabella, weakly concave in profile. Traversed by shallow depression, indicated by darker colouration, which runs close to and parallel with anterior border. It con-

tinues onto free cheek, where it extends to base of genal spine. Anterior and lateral border furrows rather wide and shallow, cephalic border rather narrow, upturned and weakly convex.

Anterior branches of facial sutures strongly divergent, γ close to axial furrow. Palpebral lobe narrow and subcrescentic, slightly under one third the sagittal length of the glabella. Eye small, bean-shaped. Eye socle with lower margin defined by shallow furrow which diverges from upper at either end. Posterior branch of facial suture with ε and ξ as separate angles, stretch between them close to axial furrow. From ξ posterior branches diverge strongly on posterior border.

Free cheek with broad, weakly convex field. Genal spine present, but ill-preserved on specimen seen. Posterior border furrow deep with nearly vertical anterior slope. Posterior border narrow and upturned.

Cephalon with sculpture of continuous striations interspersed with granules.

Thorax and pygidium unknown.

Dimensions (in millimetres)

Specimen No.	L	L_1	L_2	SO	W	δ–δ	
PMO 8831 (E)	4.3	2.7	1.0	0.6	3.1	2.6	Holotype
PMO 13336 (E)	–	3.2	–	0.9	3.1	–	
PMO 8426 (E)	5.5	3.3	1.2	1.0	3.1	–	

Proetid hypostome.

Fig. 14, C.

□ 1925 *Proetus* sp. ind. d; Warburg, p. 182, pl. 5, fig. 21.

Material. – Three hypostomes.

Horizon and localities. – Harjuan, Boda Limestone, Kallholn and Klittberg, Lake Siljan district, Sweden.

Discussion. – Warburg (1925, p. 182) described three proetid hypostomes, and figured one of them (pl. 5, fig. 21), which is refigured herein as Fig. 14, C. It is unknown to which, if any, of the proetid species described they belong.

Family UNCERTAIN.

Genus *Parvigena* gen. nov.

Type species: *Proetus parvigena* Warburg, 1925.

Derivation of name. – From Latin *parvus,* small, and *gena,* a cheek – the free cheek is very small. Gender – feminine.

Diagnosis. – Cephalic border furrows and anterior part of axial furrows obsolete; occipital furrow only apparent sagittally; eye close to margin; lower margin of eye socle incised; free cheek small and narrow, thorax with broad axis and very narrow pleurae.

Species. – *Parvigena parvigena* (Warburg, 1925).

Occurrence. – Harjuan, Boda Limestone, Lake Siljan district, Sweden.

Discussion. – The subdued cephalic furrows, broad thoracic axis and narrow pleurae of *P. parvigena* are suggestive of illaenids or certain nileids, e.g. *Symphysurus (Kodymaspis).* Whether this similarity is due to relationship or homeomorphy must await knowledge of the ventral cephalic sutures and the pygidium. Pending further information, *Parvigena* is classified as family uncertain and there are no features from which it could unequivocably be classified as a proetid.

Parvigena parvigena (Warburg, 1925).

Fig. 14, K–N.

□ 1925 *Proetus parvigena;* Warburg, p. 175, pl. 5, figs. 32–33. □ 1964 *Paraproetus parvigenus* (Warburg); Přibyl, p. 44.

Holotype. – (By monotypy): A small cephalon with three attached thoracic segments (UM D 53), figured Warburg, pl. 5, figs. 32–33 and refigured herein as Fig. 14, K–N.

Type stratum and type locality. – Harjuan, Boda Limestone, Kallholn, Lake Siljan District, Sweden.

Description. – Cranidium as long as wide. Glabella widest posteriorly, tapering gently forwards. Axial furrow clearly defined posteriorly, but becomes obsolete anteriorly; cephalic border furrows entirely obsolete. In lateral profile glabella very weakly convex, anteriorly declined in a continuous curve with anterior border, with no break in slope (Fig. 14, M). In longitudinal profile glabella more strongly convex. No lateral glabellar furrows, no preglabellar field. Occipital furrow weak, making scarcely any impression in lateral profile (Fig. 14, M), with median section more or less transverse, and becoming obsolete abaxially, so that lateral ends of occipital ring are fused with posterolateral corners of glabella. Occipital ring maintaining more or less constant width (exsag.) abaxially. In lateral profile it is gently inclined backwards. No indication of lateral occipital lobes, although Warburg (p.

175) states weakly defined ones to be present. No median tubercle. Anterior branches of facial sutures apparently weakly divergent, but exact course not clear. γ well out from axial furrow. ε close to axial furrow, posterior branch runs straight between it and base of genal spine.

Palpebral lobe subtriangular, narrow(trans.) about three eighths sagittal length of cranidium and posteriorly situated. Eye crescentic, about five twelfths length of cranidium. Eye socle with lower margin diverging from upper at either end and incised, running close to cephalic margin at mid length. Free cheek small, narrow and steeply declined, mostly taken up by the eye. Posterior border furrow shallow, but incised, abruptly terminated at base of genal spine. Genal spine triangulate, without median furrow, extending backwards as far as second thoracic segment.

Three thoracic segments preserved. Axial rings more or less transverse and equal in width (trans.). In lateral profile each ring weakly convex. Pleurae very narrow (trans.), the pleura about a quarter the width (trans.) of its corresponding axial ring. Fulcum close to axial furrow, and abaxially from its corresponding axial ring. Fulcrum close to axial furrow, and abaxially from it pleura is strongly declined. Distal end of pleura pointed. Pleural furrow transverse, and narrow, incised, dividing pleura into wider posterior band and narrower anterior band, becoming obsolete about half way along pleura, close to anterior edge.

Exoskeleton apparently smooth.

Dimensions (in millimetres)

Specimen No.	L	$L_1 + L_2$	SO	W	δ–δ
UM D 63 (E)	2.4	2.1	0.3	2.1	2.4

Discussion. – Only a single specimen of this species is known. Warburg (1925, p. 176) accounted for the subdued furrows on the cephalon by considering the specimen worn and damaged, but this does not seem to be so, and the subdued furrows are almost certainly primary.

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