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NON-AGNOSTIDEAN TRILOBITES OF THE MIDDLE CAMBRIAN OF SWEDEN

II

BY

A. H. WESTERGÅRD

With Eight Plates

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STOCKHOLM 1950
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A b s t r a c t. — The following genera are dealt with: *Centropleura*, *Clarella*, *Acontheus*, *Ellipsocephalus*, *Anomocare*, *Anomocarina*, *Anomocarioides*, *Bailiella*, *Bailiaspis*, *Ctenocephalus*, *Elyx*, and *Dasometopus*. *Acontheus* is placed in the family Corynexochidae, subfamily Acontheinae nov.

The present paper is a continuation of No. 498 of this Series.

Paradoxididae EMMRICH, 1839.

Centropleurinae (ANGELIN, 1854) HOWELL, 1933.

Grönwall (1902) and most subsequent authors regarded *Anopolenus* SALTER (1864) as synonymous with *Centropleura* ANGELIN (1854). On the other hand, Howell retained the former and distinguished the new genus *Clarella*. The genera, constituting the subfamily Centropleurinae, were defined thus (Howell, 1933, p. 218):

Centropleura ANGELIN. — "Palpebral lobes curving in an uneven arc and not reaching all the way back to the rear corners of the cranidium. Genotype, *Centropleura lovéni* ANGELIN."

Anopolenus SALTER. — "Palpebral lobes curving in an even arc and reaching all the way back to the rear corners of the cranidium. Genotype, *Anopolenus henrici* SALTER."

Clarella HOWELL. — "Palpebral lobes having a sinuous curvature and reaching almost or quite to the rear corners of the cranidium. Genotype, *Clarella venusta* (BILLINGS)."

This taxonomy is based on a single criterion, the curvature and length of the palpebral lobe. However, *C. angelini* to be described agrees with *Centropleura* in the curvature and with *Anopolenus* in the length of the lobe, the difference in the cephalon between these genera thus being confined to the curvature of the lobe, which, moreover, is less pronounced in young than in full-grown specimens. Another dissimilarity is to be found in the pygidium, which has a definite border in *A. henrici* but none in *C. lovéni*. Besides the genotype Howell included in *Anopolenus* also *A. salteri* HICKS, which Lake (1934) stated to be identical with the former; no other form hitherto described is referable to *Anopolenus;* whether this genus is valid or a synonym for *Centropleura* may for the present be left undecided.

The Centropleurinae should be compared with the Australian genus *Xystridura* WHITEHOUSE (1936) occurring at a lower level of the Middle Cambrian. It is to some extent intermediate between the Paradoxidinae and Centropleurinae, the cephalon being of the same form as in the former but the pygidium like the type of the latter group. Whitehouse (1939, p. 197) did not regard *Xystridura* as a member of a lineage leading from Paradoxidinae to Centropleurinae but rather as a separate offshoot and placed it in an independent subfamily, Xystridurinae.

If the Australian genus mentioned is excluded from Centropleurinae, the subfamily is confined to the upper half part of the Middle Cambrian in the

Acado-Baltic Province (Scandinavia, England and Wales, Newfoundland, and north-western Vermont) and Siberia inclusive of Bennett Island.

Centropleura ANGELIN, 1854.

Genotype: *Paradoxides lovéni* ANGELIN, 1851.

In addition to the type the following species referable to this genus are known: *C. vermontensis* HOWELL (1932), *C. siberica* LERMONTOVA (1940), *C. angelini* nov. (and the form from Bennett Island tentatively identified as this species), *C. angustata* nov., and, probably, *C. pugnax* ILLING (1916).

Centropleura lovéni (ANGELIN, 1851). Pl. 1, figs. 1—3 (4; pl. 2, fig. 1?).

1851. *Paradoxides lovéni* ANGELIN, Palaeont. Svec., fasc. I, p. 2, pl. 3, figs. 1—3. (Indifferent diagnosis and figs. of cephalon, hypothetical thorax, pygidium, and hypostoma. Andrarum limestone. Andrarum, Scania.)

1854. *Centropleura lovéni* (ANGELIN), Palaeont. Scand., fasc. II, p. 87. (Species assigned as the type of *Centropleura;* diagnosis of Centropleuridae.)

1878. *Centropleura lovéni* (ANGELIN), Palaeont. Scand., 2nd ed., appendix, p. 95, pl. 3 (emended), figs. 1, 1a, 4a, 4b.

1902. *Centropleura lovéni* (ANGELIN), Grönwall, D. G. U., II. Række, no. 13, p. 124. (Comments on species recorded from Bornholm; no fig.)

1930. *Centropleura lovéni* (ANGELIN), partim, Holm & Westergård, Mém. Acad. Sci. URSS., sér. 8, vol. 21, no. 8, p. 16, pl. 4, figs. 24a, b (and 25?). (Figs. of cranidium and pygidium from Andrarum, Scania. Not the form from Bennett Island, pl. 3, figs. 13—16.)

1940. *Centropleura lovéni* (ANGELIN), partim, Lermontova, in Vologdin: Atlas ... of the fossil faunas of the USSR, vol. 1, p. 135, pl. 41, figs. 2, 3, 3 a? (which are copies from Angelin, 1878, and Holm & Westergård, 1930; not the form from Bennett Island, figs. 4, 4 a—b, copies from the latter paper).

Remarks. — The specimens depicted by Angelin cannot be identified; the figures are certainly restored and the rear thoracic segments are probably incorrect, which is true also of the emended figure published in 1878. Angelin's specimens found prove that he included in *C. lovéni* two forms clearly different in the cranidium. In one the palpebral lobes do not extend to the posterior marginal furrow and the furrow and posterior margin are bent forwards in their extremities, whereas in the other the palpebral lobes are longer, extending all the way to the furrow, and the margin and furrow are almost straight. This dissimilarity appears irrespective of the stage of growth and indicates a specific distinction. The form with shorter palpebral lobes agrees better with Angelin's figures (the rejected as well as the emended) than does that with longer lobes and retains the specific name *lovéni;* that with longer lobes is named *Centropleura angelini* sp. n. The anterior margin is angulate in the adult of both; only in young specimens does it form an even arc as in Angelin's figure. Both display a pair of small intergenal spines, which are quite definite also in the largest specimens of *angelini* but apparently evanescent in *lovéni* of the same size.

No complete specimen has been found either of *lovéni* or *angelini*, and it cannot be stated whether there exist any dissimilarities also in the thorax, pygidium, and hypostoma. The largest and most complete specimen beyond doubt belonging to one of the two, unfortunately poorly preserved, shows part of the free cheek, hypostoma in situ, and 13 thoracic segments; the genal spine is

very long and more slender than in Angelin's figure; the thorax is subequal in breadth throughout, about 80 mm, the axis is prominent and slightly tapering (24 mm broad in the fourth and 19 mm in the eleventh segment) and the pleura are not geniculate, deeply furrowed, and terminate in broad and short recurved spines. The part of the thorax preserved agrees fairly well with Angelin's figure, but an associated specimen (pl. 2, fig. 1) shows parts of the pygidium and the two rear thoracic segments with long pleural spines, particularly in the last but one segment very long and slender. However, as the specimen is associated with cranidia of *lovéni* and *angelini* it is uncertain to which of them it belongs; for reasons stated below it is tentatively referred to the former.

A long and a broad form of the associated pygidia and hypostomata seem to exist, but as also the cranidia of both species vary in the ratio of length and breadth this feature in itself may have no specific value. In the pygidium there are other characteristics possibly implying specific distinction, in one form the lateral margin being convex and the marginal spines tending to become directed inwards (pl. 1, fig. 4; pl. 2, fig. 1), whereas in the other the lateral margin is straighter and the spines are directed backwards (pl. 1, fig. 10). Since there is a slab (RM. No. Ar. 1617) with a pygidium of the latter type associated with the holotype (pl. 1, fig. 6) and two more cranidia of *C. angelini* and two imperfect segments (one illustrated on pl. 1, fig. 7), all on one bedding plane which yielded no other species, it seems probable that this pygidium belongs to *angelini*, from which we conclude that the former type may be referable to *lovéni*. Obviously this suggestion must be corroborated by more complete material than that now available.

The test of the cranidium is smooth to the naked eye but under a lens it sometimes displays a faint net-work of very weak ridges resembling that in some forms of Olenellidae, and a similar ornamentation is more pronounced on the pygidium; also the thoracic pleura bear fine ridges forming a somewhat different pattern.

The largest cranidium of *lovéni* available is 64 mm broad across the palpebral lobes and about 49 mm long.

A form from Bennett Island, N of Siberia, of which only a few small and defective cranidia were found and which the present writer (Holm & Westergård, 1930) included in *C. lovéni*, is too imperfectly known for a safe specific identification; it is distinct from the latter, but as far as a comparison is possible it agrees with *angelini*.

Horizon and Localities. — Zone of *Solenopleura brachymetopa* (Andrarum limestone and the immediately underlying shale bed). — Andrarum (type locality) and Järrestad (boulder), 5 km SW of Simrishamn, Scania. — Pygidia possibly belonging to this species have been found at Kiviks-Esperöd, Scania; Byklev, at Hunneberg, Västergötland; Siljeåsen, Jämtland. — Not infrequent at Andrarum, in the regions north of Scania very rare.

According to Grönwall (1902) common in the Andrarum limestone on Bornholm. Not recorded from Norway.

Centropleura angelini sp. n. — Pl. 1, figs. 5—10.

Diagnosis. — Distinct from the genotype by longer palpebral lobes extending to the posterior marginal furrow and nearly straight posterior margin and marginal furrow.

For reasons stated above the pygidium fig. 10 is probably referable to this species.

The form is apparently closely allied to the genotype, in which it was included by Angelin; it also attains the same size, the largest cranidium found being 43 mm long and 60 mm broad across the palpebral lobes.

Occurs associated with *C. lovéni* in the Andrarum limestone at Andrarum (type locality) and Järrestad (boulder), Scania. Not infrequent at Andrarum.

A form from Bennett Island, N of Siberia, is possibly referable to this species.

Centropleura angustata sp. n. — Pl. 2, figs. 4, 5.

Diagnosis. — Distinct from the genotype by proportionately narrower cranidium, the thorax narrower than the cranidium, and the thoracic pleura narrower than the axis.

Description. — The ratio of length and breadth of the cranidium is 1 : 1.18 (about 1: 1.3 in specimens of *C. lovéni* subequal in size). The posterior margin and marginal furrow are bent forwards as in the genotype.

The thorax, of which nine segments are preserved, tapers very slowly. The axis is fairly convex. The pleura are but slightly more than half as broad as the axis, truncate, and terminate in minute spines; the pleural furrows are oblique, narrow, and nearly straight, and the inner portion of the posterior pleural band is greatly swollen. The associated fragment fig. 5 may represent one of the rear thoracic segments of this form; it is apparently proportionately broader than the anterior and middle segments and terminates in a long straight pleural spine.

Size. — The cranidium of the holotype is 19.5 mm long and 23 mm broad; the first thoracic segment is 19 mm broad, of which the axial ring occupies 8.0 mm.

Remarks. — Only the specimens illutrated and an imperfect cranidium, all on one bedding plane of a limestone slab, have been found. As the rear portion of the incomplete left-hand palpebral lobe is curved slightly inwards (a feature more pronounced in the specimen not figured) the form is included in *Centropleura*.

C. angustata may be closely allied to the English *C. pugnax* Illing, 1916 (re-described and re-illustrated by Lake, 1934),[1] the holotype of which is a small immature specimen from the top of the *Paradoxides hicksii* zone. Unfortunately it is too imperfect for a close comparison with our form, but it does not seem to be identical with the latter.

[1] Howell (1933) included *C. pugnax* in *Clarella;* the present writer considers it more likely to belong to *Centropleura*.

Horizon and Locality. — The zone is not known for certain. Besides the specimens described the slab has yielded but a few poor fragments of a *Paradoxides* with granulate surface and may belong either to *forchhammeri* or to *davidis*. According to the label it was collected from the Andrarum limestone, but the lithologic character of the slab seems to speak in favour of the zone of *Ptychagnostus punctuosus*. — Andrarum, Scania.

Clarella Howell, 1933.

Genotype: *Anopolenus venustus* Billings, 1874.

The following other forms belong to this genus: *Anopolenus impar* Hicks (1872) inclusive of the Scanian form to be described, *Centropleura steenstrupi* Angelin (1878), and *Cl. grönwalli* Howell & Poulsen (1933).

Clarella cf. *impar* (Hicks, 1872). — Pl. 2, fig. 6.

Remarks. — A flattened poorly preserved internal cast of the cranidium in shale is the only specimen existing. Its most significant criterion would appear to be the shape of the palpebral lobes, which are almost straight and broad, tapering at the anterior end, but otherwise equal in breadth and extending to the posterior corners of the cranidium.

Of the species hitherto described, *Cl. impar* from the Menevian of Wales displays particularly close resemblance to our form (cf. Lake's figs. of the former). Small differences in the curvature of the palpebral lobes and the relative breadth of the glabella possibly exist but may be adventitious; thus it seems probable that better preserved material will prove the forms to be conspecific. The Bornholm species *Cl. grönwalli*, contemporaneous with our form, is distinct by pronouncedly sinous and posteriorly tapering palpebral lobes. A detailed comparison with *Cl. steenstrupi* from the Andrarum limestone on Bornholm cannot be carried out since Angelin's specimens are lost and no more material has been found (except a fragment of the pygidium mentioned by Grönwall); however, if Angelin's figure of the cephalon is correct the forms do not seem to be identical and, moreover, they occur in different zones. Finally, judging from the original description and figure of *Cl. venusta* from the uppermost part of the *Paradoxides hicksii* zone on Newfoundland (Howell, 1925), this form differs from the Scanian in the glabella being separated from the border by a narrow space (only an immature feature?), the anterior branch of the facial suture curving slightly forwards, and the palpebral lobes being less straight.

Horizon and Locality. — Zone of *Ptychagnostus punctuosus*, lower part. Andrarum (Tullberg's loc. 10), Scania.

Corynexochidae Angelin, 1854.

Acontheinae nov.

Diagnosis: Corynexochidae wanting eyes and facial suture, otherwise resembling Corynexochinae.

Acontheus ANGELIN, 1851.

Genotype and only known species: *A. acutangulus* ANGELIN, 1851.

Original diagnosis. — Corpus ... crusta laevissima, irregulariter striolata. — Caput semilunare, anguste marginatum, sulcoque intramarginali; anguli postico exterioris acuti; sutura facialis ignota. Oculi nulli. Frons antrorsum dilatata, marginem attingens. — Thorax ... — Abdomen rotundatum, immarginatum: rachis distincta: costae laterales, depressae, marginem attingunt.

The above generic name was published in Palaeontologia Svecica, fasc. I, but was amended by Angelin himself to *Aneucanthus* in Palaeontologia Scandinavica, fasc. II (1854, pp. X and 63), no doubt because in an abstract of fasc. I in Neues Jahrbuch für Mineralogie, etc., 1852, p. 242, it was stated that *Aconthias* had earlier been used as the generic name of a serpent. Later Barrande (1856, p. 20) amended it to *Aneuacanthus*, which was accepted by Lindström in his explanation of the plates in the second edition of Palaeontologia Scandinavica (1878). However, the names *Acontheus* and *Aconthias* are so distinct that a confusion is excluded and, thus, Angelin's original name of the genus is valid.

Angelin (1854, p. X) included *Acontheus* in Corynexochidae although that disagrees with his diagnosis of the family, and because of its wanting eyes Beecher (1897) placed it in Conocoryphidae, which he regarded as the most primitive family of Opisthoparia. The prevailing opinion of to-day is, however, that the blind trilobites arose from forms with eyes and facial suture but otherwise similar in characters not depending on the loss of eyes. Thus, as *Acontheus* in shape and length of the glabella is quite distinct from *Conocoryphe* and the genera around the latter, it is phyletically remote from Conocoryphidae. On the other hand, the resemblance between *Acontheus* and *Corynexochus* is striking, indicating that these genera may have common ancestors, which apparently was Angelin's opinion. If we imagine that *Cor. spinulosus*, the genotype, lost the eyes and that the facial suture was closed or migrated to the margin, we should get a form in all essential features like *Acontheus* in the cephalon; the differences in the pygidium are not very significant, and the size of the cephalon as well as that of the pygidium seems to be about the same in both. No form known to the present writer displays closer resemblance to *Acontheus*. *Tonkinella* MANSUY[1] (cf. pl. 8, figs. 8—10) might be considered, mainly because of its pygidium; it has the long clavate glabella distinctive of *Acontheus* though less expanded in front, and in the pygidium it is more like the latter than is *Corynexochus*. However, as the characters of the cephalon in other groups have proved to be of higher taxonomic value than have those of the pygidium and as *Acontheus* and *Corynexochus* occur associated, whereas *Tonkinella* has not been recorded from the Acado-Baltic province, it seems likely that *Acontheus* arose from *Corynexochus* (or a closely related genus).

[1] The Middle Cambrian genus *Tonkinella* was described by Mansuy (1916) from French Indo-China, and representatives of it have subsequently been made known from various regions of Asia and North America (British Columbia, Montana, and Alabama).

Corynexochus, which was known of old from the Middle Cambrian of the Acado-Baltic province, was later recorded from Siberia and Australia.

Accordingly, the genus is placed in the new subfamily Acontheinae under the family Corynexochidae.[1]

Acontheus acutangulus ANGELIN, 1851. — Pl. 8. figs. 4—6.

1851. *Acontheus acutangulus* ANGELIN, Pal. Svec., fasc. I, p. 5, pl. 5, figs. 4,5. (Diagnosis of cephalon and pygidium, the former illustrated. Andrarum limestone. Andrarum, Scania.)
1854. *Aneucanthus acutangulus* (ANGELIN), Pal. Scand., fasc. II, pp. X, 63, pl. 33, fig. 19. (Fig. of pygidium.)

Description. — Cephalon fairly convex, about semicircular with the length somewhat greater than half the breadth. Dorsal furrows well impressed, narrow. Glabella rising high above the cheeks, extending to the margin, expanded in front and there twice as broad as at the rear, with three pairs of very weak lateral furrows, the posterior pair meeting across the glabella and the anterior pairs short or sometimes effaced. Occipital furrow well-defined, narrow; occipital ring somewhat expanded towards the middle, with a faint node. Border flat, fading out to the axial line, narrow in front of the anterolateral corners of the glabella, outside the latter abruptly widening, narrowing backwards; marginal furrow shallow and narrow. Cheeks swollen. Occipital segment well-defined. Genal angles terminating in a pair of broad short acute spines. Eyes and (dorsal) facial suture absent; it has not been possible to prove whether or not a marginal suture is developed.

Thorax unknown.

Pygidium semicircular in outline, less convex than the cephalon, apparently almost as large as the latter. Axis occupying about one-fourth the total breadth, moderately prominent, conical, extending to the border, with two well-defined smooth rings and a long blunt end-lobe that rarely is divided by a weak transverse furrow. Pleural lobes slightly arched, with three pairs of flat-topped ribs separated by well-defined pleural furrows which at the marginal furrow turn abruptly backwards and extend to the margin; interpleural grooves as a rule effaced, sometimes discernible on the first pair of ribs. Border broad, slightly convex; marginal furrow shallow. A narrow and weak median ridge behind the axis usually discernible.

Test of cephalon and pygidium smooth, under the microscope slightly rough due to very small granules and irregular ridges.

Size. — Largest cephalon, the lectotype fig. 4, 4.4 mm and largest pygidium 4.0 mm long.

Remarks. — Eight cephala and eight pygidia, some of them Angelin's specimens, are present. The exact similarity in the character of the test of

[1] Kobayashi's (1935, p. 214) statement "During my visit to Stockholm Westergård suggested me that *Toxotis* might be an immature form of *Acrocephalites* and *Aneucanthus* [*Acontheus*] that of *Conocoryphe*" is in part a misunderstanding and requires the following comment. It is true that, since I had realized that the shield interpreted by Wallerius as the pygidium of *Toxotis* is a transitory pygidium of *Proceratopyge conifrons*, I was inclined to regard the cranidium of *Toxotis* as an immature form of *Acrocephalites stenometopus* although intermediate links had not been found, which I told Kobayashi. (This presumption was corrected by myself in 1948.) On the other hand, I have never held the opinion that *Acontheus* and *Conocoryphe* might be closely allied, and the size alone of *Acontheus* contradicts the assumption that it is an immature form.

phalon and pygidium as well as the manner in which they have been found sociated indicates that they are conspecific.

In the original diagnosis the pygidium is stated to be "immarginatum", probably because the ribs and pleural furrows extend to the margin, nor is the border indicated in Angelin's figure. However, all pygidia present display a definite border though the marginal furrow is faint.

Horizon and Localities. — Zone of *Solenopleura brachymetopa* (Andrarum limestone proper). Andrarum, Scania. Rare.

Ellipsocephalidae MATTHEW, 1887.

Ellipsocephalus ZENKER, 1833.

Genotype: *Trilobites hoffii* SCHLOTHEIM, 1823.

Kiaer (1916) discussed the genus at considerable length, emphasizing its close affinity to *Strenuella* MATTHEW (inclusive of *Strenuaeva* R. & E. RICHTER, 1940, 1941 b), and a revised diagnosis was presented by Lake (1940), in which the genal angles were claimed to be rounded and not prolonged into spines, as earlier suggested by Kobayashi (1935). Kiaer and Lake excluded *E. circulus* BRÖGGER, with which the present writer agrees.[1] Lake excluded also *E. germari* BARRANDE, which was stated to differ in having large free cheeks with strong genal spines, smaller eyes, and both branches of the facial suture running more strongly outwards from the eye. However, in most of these characters Barrande's species is not distinct from e. g. *E. lejostracus*, beyond doubt a true *Ellipsocephalus*, the only pronounced dissimilarity being the genal spines, a feature which in itself is no generic criterion, at least not in this genus. Thus, *germari* should be retained in *Ellipsocephalus* (cf. R. & E. Richter, 1940, p. 39).

Members of the genus are known from the late Lower and the Middle Cambrian of the Acado-Baltic Province — Scandinavia, Poland (Czarnocki, 1927), Bohemia, Spain, New Brunswick, and probably England (Lake, 1940). According to Whitehouse (1939) *Ellipsocephalus* possibly occurs also in Australia.

Ellipsocephalus polytomus LINNARSSON, 1877. — Pl. 8, fig. 7.

1936. *Ellipsocephalus polytomus* LINNARSSON, Westergård, S. G. U., ser. C, no. 394, p. 56, pl. 11, figs. 5—17. (List of synonyms; notes on species and its ontogeny; figs. of complete specimens at various stages of growth. *Paradoxides oelandicus* beds. Öland, Gothland, Östergötland, Närke, Jämtland.)

Remarks. — A 19 mm long and 11 mm broad complete dorsal shield from Borgholm, Öland, RM. No. Ar. 1514h, may be the holotype; it is preserved in shale and wants the test.

Horizon and Localities. — Appears early in the *Paradoxides oelandicus* beds, zone of *P. insularis*, and ranges into the conglomerate with *Acrothele granulata* forming the basal stratum of the *Par. paradoxissimus* beds on Öland, in which it may appear secondarily, however. It is one of the

[1] Kiaer was inclined to include *E. circulus*, a member of the *Paradoxides forchhammeri* fauna, in *Agraulos* and to regard it "as a remarkable differentiation of the richly varying *Agraulos difformis* series" (p. 51).

most common species in the *oelandicus* beds on Öland, in Östergötland, Närke, southern Jämtland, and under Gothland, but has not been recorded from either Ångermanland-Lapland or Norway.[1]

Ellipsocephalus lejostracus (ANGELIN, 1851). — Pl. 2, figs. 7—14.

1851. *Calymene lejostraca* ANGELIN, Pal. Svec., fasc. I, p. 24, pl. 19, fig. 3. (Inexpressive diagnosis; fig. of cranidium; *Paradoxides paradoxissimus* beds; Öland.)
1854. *Liostracus muticus* ANGELIN, Pal. Scand., fasc. II, p. 27, pl. 19, fig. 3. (Generic and specific names and diagnosis amended.)
1875. *Ellipsocephalus muticus* (ANGELIN), Linnarsson, Vet.-Ak. Övers., Årg. 32, p. 40, pl. 5, figs. 4—7. (Description and figs. of cranidium and part of thorax; *Par. paradoxissimus* beds; Vinala, Närke.)
1877. *Ellipsocephalus muticus* (ANGELIN), Linnarsson, G. F. F., vol. 3, pp. 364—366. (A form from Öland was identified as *E. muticus* and the form from Närke in 1875 described under that name was considered specifically distinct and named *E. granulatus*.)
1877. *Ellipsocephalus granulatus* LINNARSSON, ibid., pp. 365—366. (See the preceding note.)
1906. *Ellipsocephalus muticus* (ANGELIN), Wiman, Bull. Geol. Inst. Upsala, vol. 7, p. 289, pl. 29, figs. 11, 12. (Description and fig. of cranidium; associated with *Ctenocephalus exsulans* in a boulder of calcareous sandstone S of Borgholm, Öland.)
1929. *Ellipsocephalus lejostracus* (ANGELIN), Westergård, S. G. U., ser. C, no. 355, p. 18, foot-note. (Note on the nomenclature.)

Description. — Dorsal shield ovate, ratio of legnth and breadth across the thorax about 1 : 0.6, of high convexity; dorsal furrows well impressed. Glabella convex, parallel-sided to inconsiderably tapering, angulate to rounded in front. Glabellar furrows as a rule effaced on specimens retaining the test, more or less distinct on internal casts, three or even four pairs, the rear pair relatively well defined. Occipital furrow deep; occipital ring inconsiderably expanded towards the axial line, smooth. Brim about one-fourth as long as the glabella, slightly convex, sloping downwards. Border and marginal furrow usually quite effaced in front of the glabella but faintly marked at the antero-lateral corners of the cranidium on specimens retaining the test, sometimes faintly discernible throughout, in particular on internal casts of various sizes. Fixed cheek across the palpebral lobe about three-fourths as broad as the glabella, gently arched. Ocular ridge faint, oblique, sometimes replaced by an edge bounding the cheek against the brim; palpebral lobe fairly long, does not extend to the posterior marginal furrow in full-grown specimens. Posterior limb somewhat narrower than the occipital ring. Free cheek almost as broad as the fixed cheek, with a well-defined broad border, in young holaspid specimens still displaying the remnant of the genal spine (pl. 2, fig. 13) which in later stages of growth by degrees becomes quite atrophied. Anterior branch of the facial suture running from the eye forwards, then curving outwards and on the border inwards; posterior branch directed outwards-backwards.

Thorax of 14 segments. Axis convex, in the anterior segments slightly broader than the pleuron, continuously tapering; axial rings smooth. Pleura strongly geniculate, deeply furrowed, even in full-grown specimens terminating in short slender spines in the anterior segments directed outwards and slightly backwards and in the posterior segments straight backwards.

[1] Czarnocki (1927) recorded *E. polytomus* from a formation in Poland (St. Croix), which for stratigraphical reasons was concluded to be late Middle Cambrian in age and was tentatively correlated with the *Paradoxides forchhammeri* beds of Scandinavia. If the statement regarding the horizon is correct, it does not seem very probable that the form is referable to Linnarsson's species.

Pygidium small, almost three times as broad as long, subtriangular, non-segmented; axis broad, does not extend quite to the margin.

Test thick, finely punctate, occasionally finely granulate, striated on the anterior portion of the border of the cephalon, the extremities of the pleura, and the pygidium, the striae generally meeting across the rear thoracic segments and pygidium. In case of granulation only parts of the specimen are granulate, while other parts are quite smooth and punctate; as the granules under a lens show a central pit, the granulation implies a form of punctation.

Size. — A complete specimen a little less than middle-sized is 28.5 mm long (cephalon 10.0, thorax 16.5, pygidium 2.0) and 18 mm broad across the thorax. The largest cranidium is 18 mm long, indicating a total length of about 50 mm.

Remarks. — In the old collections of the Paleozool. Dept. of the Swedish Museum of Nat. Hist. there is a small sample (Ar. 1503 a) of a gray calcareous sandstone from the *Paradoxides paradoxissimus* beds of Öland with an impression of an imperfect cranidium which is exactly the size of Angelin's figure of *Calymene lejostraca* and broadly speaking agrees with the figure so well that it is certainly the holotype. The glabella, which shows the interior surface of the test, has three pairs of very weak furrows (easily overlooked as they appear only on an artificial cast), part of the fixed cheek is preserved as external mould proving that the test is finely punctate, and the palpebral lobe is practically invisible. Although the specimen is very poor there is no doubt but that it represents the form which Linnarsson and Wiman identified as *E. muticus*.

About a hundred specimens — four fairly complete — referable to *E. lejostracus* are present. As stated in the above description it is in several features somewhat variable due to the varying state of preservation and stage of growth, which induced Linnarsson to distinguish two independent species, *muticus* (= *lejostracus*) and *granulatus*. The latter was stated to differ from the former in having granulate test, well-defined glabellar furrows, and more strictly parallel-sided glabella. However, the difference in sculpture does not seem to indicate specific distinction; in e.g. one of Linnarsson's specimens of *granulatus*, pl. 2, fig. 12, the test on the glabella, occipital ring, and thoracic axis is quite smooth and punctate and it is very faintly granulate-punctate only on the fixed cheek and the ridges of the pleura; it should also be noted that specimens with smooth and with partly granulate test occur associated. The cranidia (typoids) of *granulatus* are comparatively small (6.5 to 8 mm in length) with the greater part of the glabella wanting the test and on account of that they display well-defined glabellar furrows; moreover, in the shape of the glabella *granulatus* agrees perfectly with many specimens from Öland belonging beyond doubt to Angelin's species. Thus, the present writer does not hesitate to regard *granulatus* as a synonym of *lejostracus*.

Compared with *E. polytomus*, *E. lejostracus* is distinguished by having angulate anterior corners of the cranidium, deeply impressed occipital furrow, broader free cheek, and the thoracic pleura terminating in short spines also in full-

grown specimens. In the pronounced occipital furrow, more distinct glabellar furrows (on internal casts), and the pleural spines *lejostracus* is more primitive than is *polytomus*, though it appears later than does the latter.

E. lejostracus differs from the Lower Cambrian *E. nordenskiöldi* LINNARSSON (1883) and *E. latus* WIMAN (1903) only in some not very significant details; in *nordenskiöldi* the anterior corners of the cranidium are less angulate, the cranidium is proportionately narrower at its posterior margin, and in the thorax the pleura are narrower than the axis and terminate in somewhat stronger spines; in *latus*, which is known but from the cranidium (a number of internal casts), the glabellar furrows are wanting and the occipital furrow is faint and shallow.

Horizon and Localities. — Zone of *Ptychagnostus* (*Triplagn.*) *gibbus*, on Öland probably ranging into overlying strata. — Öland: Albrunna, 3 km S of Degerhamn; Borgholm and neighbouring localities; Äleklinta. — Småland: Humlenäs (boulder). — Östergötland: Berg (boulders); Grankulla (boring); Tornby (boring). — Närke: Julsta, 7 km NW of Hallsberg junction; Viby, 14 km W of Hallsberg junction; Vinala; Vrana; in several boring cores. — Not infrequent in the *gibbus* zone.

An imperfect cranidium associated with *Hypagnostus parvifrons* in the matrix of a sandstone conglomerate at the top of the *Par. paradoxissimus* sandstone on the shore WSW of Mörbylilla, Öland, possibly belongs to *E. lejostracus*.

Anomocaridae POULSEN, 1927.

The genus *Anomocare* was for a long time used in a very wide sense and a great number of forms from Europe, Asia — in particular eastern Asia — and North America were included in it. The greater part of them have later been removed into various new genera by recent authors, which, broadly speaking, is justifiable. It should be said, however, that a few of these Asiatic forms, e. g. *Anomocare ephori* WALCOTT,[1] which Resser & Endo placed in their genus *Proasaphiscus*, seem to be so similar to *A. laeve* that, if found in Scandinavia, they would have been referred to *Anomocare*. Unfortunately, these Asiatic forms as well as *A. laeve* are still imperfectly known and, consequently, a detailed comparison cannot be carried out. Thus the writer for the present leaves unsettled whether representatives of Angelin's genus are or are not to be found in the hitherto known Cambrian faunas of eastern Asia. — Three species from the *Centropleura* fauna of north-western Vermont included in *Anomocare* by Howell (1937) are poorly preserved and seem to be too imperfectly known for a safe generic reference.

The Swedish forms of *Anomocare*[2] were divided by Lermontova (1940) into

[1] *A. ephori* differs from *A. laeve* in having proportionately slightly shorter glabella. The length of the palpebral lobes in relation to the length of the glabella is practically the same in both and the pygidium of *A. ephori* resembles that of *A. longifrons* sp. n.

[2] *Anomocare(?) magnum* BRÖGGER (1878) from the *Paradoxides forchhammeri* beds at Krekling, Norway, which is very imperfectly known, is probably distinct from this genus. *A. balticum* HEDSTRÖM (1923) from the *Par. oelandicus* beds under Gothland was based on a cranidium of *Ellipsocephalus polytomus* at a stage of the meraspid period (Westergård, 1936, p. 56).

three genera: *Anomocare* sensu stricto, *Anomocarina* nov., and *Anomocarioides* nov. They may be distinguished as follows.

Anomocare ANGELIN sensu stricto. — Border well defined in cephalon and pygidium; brim flat or nearly so. Here belong the Scandinavian forms *A. laeve* (ANG.), genotype, and *A. longifrons* to be described, the Siberian *A. salairensis* LERM., and the Australian *A. confertum* WHITEH., all recorded from the late Middle Cambrian. Possibly *A. ephori* WALC. and some other imperfectly known Asiatic forms originally placed in *Anomocare* but by subsequent writers removed into other genera are referable to this genus.

Anomocarina LERMONTOVA. — Cranidium and free cheeks want a well-defined border; brim strongly concave; pygidium surrounded with a broad almost flat limb indistinctly set off from the pleural platform, with the pleural furrows extending quite or almost to the margin. This genus comprises the Scandinavian *A. excavata* (ANG.), genotype, *A. excavata dentata* (GRÖNW.), and *A. extornata* (WGÅRD), and the Siberian *A. siberica* (WGÅRD) and *A. splendens* LERM., all occurring in the late Middle Cambrian. Furthermore, *Anomocare angelini* GRÖNW. from the *Ptychagnostus punctuosus* zone on Bornholm is tentatively included in this genus (see below).

Anomocarioides LERMONTOVA. — Border absent in cranidium and free cheeks; brim inconsiderably convex, flat, or slightly concave; pygidium with a well-defined moderately broad flat and smooth border. *A. limbatus* (ANG.), genotype, and *A. limbataeformis* LERM. are referable to this genus. Both occur in the late Middle Cambrian; the former is recorded from Scandinavia and Siberia and the latter from Siberia.

Complete specimens of the genotypes of *Anomocarina* and *Anomocarioides* are known; in both the number of thoracic segments is ten and the terminations of the pleura are pointed (not spined). The thorax of *Anomocare* does not seem to be known for certain.

Lermontova distinguished one more new genus in the group under consideration, *Metanomocare*, based on *M. petaloides* LERM. from the late Middle Cambrian of eastern Siberia. It differs from the three former genera *inter alia* in having medium-sized palpebral lobes, and judging from the imperfect cranidium illustrated its reference to Anomocaridae seems to be questionable. In this genus Lermontova included *Anomocare angelini* GRÖNW., though it displays closer resemblance to *Anomocarina*. At any rate, *angelini* is not referable to *Metanomocare*; if it should prove to be distinct from *Anomocarina* it is the genotype of *Macrotoxus* LORENZ (cf. Resser, 1937 a, p. 6).

Anomocare ANGELIN, 1854.

Genotype: *Proetus laevis* ANGELIN, 1851.

Anomocare laeve (ANGELIN, 1851). — Pl. 3, figs. 1—8.

1851. *Proetus laevis* ANGELIN, Pal. Svec., fasc. I, p. 21, pl. 18, figs. 1, 1a. (Indifferent diagnosis and rough figure of cephalon with ten attached thoracic segments. Andrarum limestone. Andrarum, Scania.)

1854. *Anomocare laeve* (ANGELIN), Pal. Scand., fasc. II. p. 25. (New generic name and amended diagnosis.)

1902. *Anomocare laeve* (ANGELIN), partim, Grönwall, D. G. U., II. Række, no. 13, pp. 141, 217, pl. 4, fig. 8 only. (Description and figure of cranidium. The pygidium, fig. 9, belongs to *Anomocarina extornata*. Andrarum limestone. Bornholm.)

1911. *Anomocare laeve* (ANGELIN), partim, Walcott, Cambr. Geol. and Paleont., vol. 2, no. 4, p. 87, pl. 17, figs. 1, 1a—b only. (Figures of cranidium and free cheek from the type locality. The pygidium, fig. 1c, belongs to *Anomocarina extornata*. — Same figs. in Walcott's work of 1913, Res. in China, vol. 3, p. 187, pl. 18, figs. 1, 1a.)

1930. *Anomocare laeve* (ANGELIN), Holm & Westergård, Mém. Acad. Sci. L'URSS, 8. sér., vol. 21, no. 8, p. 17, pl. 4, figs. 16—18. (Cranidium and pygidium from the type locality illustrated.)

1940. *Anomocare laeve* (ANGELIN), Lermontova, in Vologdin: Atlas ... of the fossil faunas of the USSR, vol. 1, p. 155, pl. 47; figs. 1, 1 a—b. (Copies of two cranidia and a pygidium from Holm & Westergård, 1930, pl. 4, figs. 16—18).

Description. — Cranidium moderately convex; dorsal furrows narrow and shallow. Glabella a little more than half as long as the cranidium, slightly tapering, fairly rounded in front, tending to become keeled; glabellar furrows pronounced, discontinuous, three pairs, a fourth pair sometimes faintly indicated. Occipital furrow well-defined throughout, straight, deep at the sides, shallower at the middle. Occipital ring slightly widened to the middle, with a fairly slender spine at least as long as the glabella. Brim at the axial line somewhat shorter than the breadth of the glabella in front, flat to faintly convex, with weak ridges perpendicular to the border. Border well-defined, at the axial line markedly shorter than the brim, flat to gently convex, upturned. Marginal furrow shallow. Fixed cheeks subequal in width to the glabella in front, flat or nearly so. Palpebral lobes very long, crescent-shaped, with the anterior and posterior ends situated opposite to the anterior pair of glabellar furrows and the occipital furrow respectively; palebral furrow well-defined. Ocular ridges distinct, oblique, reaching the dorsal furrows slightly in front of the anterior pair of glabellar furrows. Anterior branches of the facial suture cutting the border obliquely, curving backwards and converging to the palpebral lobes; posterior branches almost perpendicular to the axial line. Posterior limb very narrow (sag.), almost as wide as the occipital ring. Free cheek inconsiderably arched, somewhat narrower than the fixed cheek, with faint anastomosing ridges radiating from the eye; border well-defined, almost flat; genal spine strong, longer than the cheek proper, forming an obtuse angle with the posterior margin.

In Angelin's figure of the holotype, which has been sought in vain, the thorax is like that of *Anomocarina excavata* and the number of segments is ten (+ x?). See below.

Pygidium about semicircular in outline, gently indented to almost straight behind the axis. Axis a little narrower than the pleural lobe, convex, inconsiderably tapering, terminating in a short narrow keel extending into the border, with four or five smooth rings besides the end-lobe, separated by shallow furrows. Pleural platform faintly arched, marked with four shallow pleural furrows; interpleural grooves usually effaced, sometimes indicated on the first pair of ribs. Marginal furrow indefinite. A weak ridge sometimes separates the platform from the fairly broad, faintly concave or flat, smooth border.

Test of cephalon and pygidium smooth to the naked eye, under the microscope very finely granulate.

Size. — A large cranidium is 16 mm long and 16.7 mm broad across the

palpebral lobes. The largest pygidium present is 7.5 mm long and 12.0 mm broad. Cf. p. 21.

Remarks. — As mentioned above the holotype has not been found and probably Angelin's figure is restored; the cranidium fig. 3, probably one of his specimens, is chosen as the lectotype. In the figure the thoracic pleura are falcate, but as cranidia, free cheeks, and pygidia are usually associated with detached thoracic segments of a different type, the pleura terminating in slender straight spines directed backwards and slightly outwards, it seems more likely that this type belongs to the species. — It is rather surprising that the pygidium described above was overlooked for a long time; at the type locality it is not rare and most of the specimens found occur associated with cranidia and free cheeks of *A. laeve*. Furthermore, as cranidium and pygidium agree in the ornamention of the test it can hardly be doubted but that they are conspecific. The pygidium, which Grönwall and following him Walcott referred to *laeve*, belongs to *Anomocarina extornata*, q. v.

Horizon and Localities. — Zone of *Solenopleura brachymetopa* (Andrarum limestone). Scania: Andrarum (type locality); Kiviks-Esperöd; Baskemölla. Not infrequent at the type locality.

In the same zone on Bornholm.

Anomocare longifrons sp. n. — Pl. 3, figs. 9, 10.

Diagnosis. — Distinct from the genotype by proportionately longer glabella, brim at the axial line shorter than the border, narrower fixed cheeks, and more strictly semicircular pygidium with the pleural furrows extending into the border.

Description. — Cranidium moderately convex; dorsal furrows narrow and shallow. Glabella occupying about two-thirds the total length, slightly conical, rounded in front; three pairs of discontinuous glabellar furrows, the posterior pair well impressed and oblique, the anterior pairs faint and almost transverse. Occipital furrow deep at the sides, shallow at the middle, straight; occipital ring not widened to the middle, apparently wanting a median spine. Brim flat; marginal furrow definite though not impressed; border convex, at the axial line twice as long as the brim. Fixed cheek about half as broad as the glabella at the rear, fairly flat. Palpebral lobes and facial sutures as in the genotype except that they come closer to the dorsal furrows. Ocular ridges practically wanting. Posterior limb about three-fourths as wide as the occipital ring.

Free cheeks and thorax unknown.

Pygidium semicircular. Axis convex, occupying about one-fourth the total width, slightly conical, with five smooth rings besides the end-lobe, terminating in a narrow ridge extending almost to the margin; ring furrows shallow. Pleural lobes gently arched, with five pairs of shallow pleural furrows extending into, and curving backwards on, the interior half part of the border; interpleural grooves faintly marked on the anterior pairs of ribs. Marginal furrow weak. Border almost as wide as the axis, inconsiderably widening anteriorly, flat.

Test of cranidium and pygidium covered with close-set fine granules clearly visible under a low-power lens.

Size. — Cranidum, holotype, 9.3 mm long; largest pygidium 7.4 mm long. Cf. p. 21.

Remarks. — One cranidium and three pygidia have been found. As the shields agree in the ornamentation of the test and as no other pygidium which might be taken into account has been met with, they may confidently be considered conspecific.

A. longifrons should be compared with *Eymekops similis* RESSER & ENDO, 1937, (= *Anomocarella hermias* WALCOTT, 1913, partim) from eastern Asia. In the cranidium, the only part of the dorsal shield known, the latter differs from our form in having a less clearly defined marginal furrow and almost effaced glabellar furrows. In the pygidium the Swedish species is like *Anomocare ephori* WALCOTT (1911, pl. 15, fig. 8a).

Horizon and Localities. — Zone of *Solenopleura brachymetopa* (Andrarum limestone). Baskemölla (type locality) and Gislövshammar (boulder 106), Scania. — Rare.

Anomocare sp. indet. — Pl. 3, fig. 11.

This small pygidium differs so strongly from *A. longifrons* in its porportionately greater breadth and broader border that it may represent a distinct species. It was collected from the Andrarum limestone at Kiviks-Esperöd, Scania.

Anomocarina LERMONTOVA, 1940.

Genotype: *Proetus? excavatus* ANGELIN, 1851.

Anomocarina excavata (ANGELIN, 1851). — Pl. 3, figs. 12—19.

1851. *Proetus? excavatus* ANGELIN, Pal. Svec., fasc. I, p. 22, pl. 18, fig. 3. (Brief diagnosis and figure of complete specimen with hypothetical thorax. Andrarum limestone. Andrarum, Scania.)
1854. *Anomocare excavatum* (ANGELIN), Pal. Scand., fasc. II, p. 25. (Generic name and diagnosis amended.)
?1878. *Anomocare excavatum* (ANGELIN), partim. Brögger, Nyt Mag. Naturvid., vol. 24, p. 55 (39), pl. 3, fig. 14a only. (The pygidium illustrated may belong here; the cranidium, fig. 14, belongs to *Anomocarina extornata. Paradoxides forchhammeri* beds. Krekling, Norway.)
1902. *Anomocare excavatum* (ANGELIN), partim, Grönwall, D. G. U., II. Række, no. 13, p. 140. (The cranidium, pl. 4, fig. 6, belongs to *A. extornata*. Andrarum limestone. Bornholm.)
1906. *Anomocare excavatum* (ANGELIN), Wiman, Bull. Geol. Inst. Upsala, vol. 7, p. 295, pl. 29, fig. 23. (Fig. of an almost complete dorsal shield from unknown locality, re-illustrated in the present paper.)
1930. *Anomocare excavatum* (ANGELIN), Holm & Westergård, Mém. Acad. Sci. URSS, 8 sér., vol. 21, no. 8, p. 16, pl. 2, figs. 1—14; pl. 4, figs. 19—21. (Comments on species; figs. of cranidium, free cheek, detached thoracic segments, pygidium, and hypostoma from Bennett Island, N of Siberia, and Andrarum, Scania.)
1940. *Anomocarina excavata* (ANGELIN), Lermontova, in Vologdin: Atlas ... of the fossil faunas of the USSR, vol. 1, p. 156, pl. 48, figs. 3, 3 a—m. (Copies of the following figs. in Holm & Westergård, 1930: pl. 2, figs. 1, 2, 5—8, 10, 12, 14; pl. 4, figs. 19—21).

Description. — Dorsal shield moderately arched, ovate, the length almost twice the breadth across the thorax.

Glabella bounded by narrow and shallow dorsal furrows, slightly tapering, evenly rounded in front; glabellar furrows three pairs, the posterior pair well impressed, the anterior pairs faint to almost imperceptible; a very weak

median tubercle situated at the base of the glabella (discernible only on well-preserved young and middle-sized specimens). Occipital furrow deep at the sides, quite effaced at the middle; occipital ring equal in length (sag.) throughout, with a faint slightly curved transverse furrow in its posterior portion. Brim at the axial line half as long as the glabella or nearly so, strongly concave, the margin rising almost to the height of the glabella, with a faint curved transverse ridge touching the glabella (in young specimens separated by a narrow space from the latter). Fixed cheek subequal in width to the glabella in front, flat or nearly so, with a pair of fairly prominent bosses opposite to the posterior pair of glabellar lobes and close to the dorsal furrows. Palpebral lobes almost as long as the glabella, semicircular in outline, not extending to the dorsal furrows, fairly narrow. Ocular ridges short, oblique. Posterior limb very small. Anterior branches of the facial suture running from the eyes straight outwards and then curving forwards and inwards, the space between them being nearly as broad as the breadth of the cranidium across the palpebral lobes. Free cheek fairly narrow, anteriorly somewhat upturned in its marginal portion, otherwise flat; genal angle prolonged into a stout short spine.

Associated hypostoma greatly convex; anterior border fairly long (sag.), gently concave; lateral furrows deep, middle furrow faint; lateral borders prominent; maculae imperceptible.

Thorax of ten segments. Axis arched, continuously tapering, in the anterior segments occupying about one-fourth and in the posterior segments less than one-fifth of the total breadth. Pleura faintly geniculate, with the knee a short distance from the dorsal furrows, falcate, pointed; pleural furrows in their proximal portion fairly deep and broad; anterior pleural band raised into a prominent ridge lowering outwards.

Pygidium semicircular, with the anterior outline convex. Axis convex, slightly tapering, occupying about two-thirds the total length and one-fifth to one-fourth the total breadth, terminating bluntly, sometimes prolonged into a weak narrow ridge extending almost to the margin (marked as a furrow on the doublure); with four well-defined smooth rings besides the end-lobe. Pleural lobes arched in their inner portion, merging outwards into a broad gently concave limb, with five pairs of well impressed pleural furrows fading out a little within the margin; interpleural grooves effaced.

Test smooth and minutely punctate on the cranidium, with faint ridges on the pleural lobes of the pygidium.

Size. — The largest cranidia and pygidia indicate a total length of 65 mm. Cf. p. 21.

Remarks. — Angelin's figure of the cephalon is apparently restored. The location of the transverse ridge on the brim immediately in front of the glabella proves that the figure was drawn after a specimen belonging to *excavata* despite the anterior branches of the facial suture having quite another course and agreeing better with that in *A. extornata*. This discrepancy may be explained by the fact that in *excavata* (when preserved in limestone and retaining the original convexity) the exterior portions of the brim, due to their

being turned down, are always concealed in the rock, the facial sutures thus becoming visible only after preparation. As the pygidium seen in our fig. 15 on the attached label is stated to be the one depicted by Angelin, it is chosen as the lectotype.

A. excavata in the whole of the dorsal shield displays closer resemblance to *A. siberica* than to any other hitherto known form (cf. Holm & Westergård, 1930).

Horizon and Localities. — Zone of *Solenopleura brachymetopa* (Andrarum limestone). — Scania: Andrarum (type locality); Kiviks-Esperöd; Baskemölla; Gislövshammar (boring); S. Sandby (boring). — Common.

Bornholm. — Krekling, Norway. — Siberia: Anabar and Aldan regions, the upper course of the Lena, and Bennett Island.

Anomocarina cf. *excavata* (Angelin, 1851). — Pl. 3, fig. 20.

The small pygidium illustrated, which is associated with *A. excavata*, differs from specimens of the latter equal in size in proportionately greater breadth and narrower, more tapering, and longer axis, dissimilarities indicating that it may represent a distinct form.

Andrarum limestone. Andrarum, Scania.

Anomocarina extornata (Westergård, 1930). — Pl. 4, figs. 1—5.

1878. *Anomocare excavatum* (Angelin), partim, Brögger, Nyt Mag. Naturvid., vol. 24, p. 55 (39), pl. 3, fig. 14. (Only the cranidium. *Paradoxides forchhammeri* beds. Krekling, Norway.)
1902. *Anomocare excavatum* (Angelin), partim, Grönwall, D. G. U., II. Række, no. 13, pl. 4, fig. 6. (Cranidium illustrated. Andrarum limestone. Bornholm.)
1902. *Anomocare laeve* (Angelin), partim, Grönwall, ibid., pp. 141, 217; pl. 4, fig. 9. (Only the pygidium described and illustrated. Andrarum limestone. Bornholm.)
1911. *Anomocare laeve* (Angelin), partim, Walcott, Cambr. Geol. and Paleont., vol. 2, no. 4, p. 87, pl. 17, fig. 1c. (Only the pygidium illustrated. Andrarum limestone. Andrarum, Scania. — Same fig. in Walcott's work of 1913, Res. in China, vol. 3, p. 187, pl. 18, fig. 1b.)
1930. *Anomocare extornatum* Westergård, Holm & Westergård, Mém. Acad. Sci. L'URSS, 8. sér., vol. 21, no. 8, p. 17, pl. 4, figs. 22, 23. (Species distinguished from *A. excavatum;* cranidium and pygidium illustrated. Andrarum limestone. Andrarum, Scania.)

Remarks. — The cranidium of *A. extornata* was for a long time confounded with that of *excavata* apparently owing to Angelin's misleading illustration of the latter as stated above. In reality the differences are conspicuous in several features. Thus, the anterior branches of the facial suture are curved less strongly outwards in *extornata* than in *excavata* and, accordingly, the brim between the sutures is much narrower than the breadth of the cranidium across the palpebral lobes in the former but almost as broad as the cranidium in the latter, the faintly arched ridge on the brim runs some distance from the glabella instead of touching it, and the median node on the boundary between the occipital ring and the glabella is well-defined in the former but weak to imperceptible in the latter. Otherwise the above description of *excavata* also applies to *extornata* as far as the cranidium is concerned.

Free cheek and thorax unknown.

Pygidium tending to become subquadrate, moderately convex. Axis tapering, with four smooth rings besides the end-lobe, terminating in a faint pointed

ridge; transverse furrows shallow. Pleural lobes in their interior portion slightly arched, merging into a broad faintly concave to flat limb, with four to five pairs of pleural furrows extending almost to the margin, the first pair well impressed, the remainder shallow. Interpleural grooves as a rule quite effaced. A faint ridge on the test marking the boundary of the doublure is sometimes visible. A pair of weak marginal spines appear at the postero-lateral corners.

Test of cranidium and pygidium smooth to the naked eye, under the microscope finely punctate and showing scattered minute granules (in both shields somewhat better defined on the axial than on the lateral lobes).

Size. — The largest cranidium is 16 mm and the largest pygidium 14 mm long. Cf. p. 21.

A. extornata should be compared with *Glyphaspis perconcava* POULSEN (1927) from the middle Cambrian of north-west Greenland. In the cranidium the latter seems to differ from our form mainly in its shorter palpebral lobes; the pygidium resembles that of *A. excavata*.

Horizon and Localities. — Zone of *Solenopleura brachymetopa* (Andrarum limestone). Andrarum (type locality), and Baskemölla, Scania. Fairly infrequent.

At the corresponding level on Bornholm and at Krekling, Norway.

Anomocarioides LERMONTOVA, 1940.

Genotype: *Proetus? limbatus* ANGELIN, 1851.

Anomocarioides limbatus (ANGELIN, 1851). — Pl. 4, figs. 6—14.

1851. *Proetus? limbatus* ANGELIN, Pal. Svec., fasc. I, p. 22, pl. 18, fig. 2. (Indifferent diagnosis; figure of complete dorsal shield with hypothetical thorax. Andrarum limestone, Andrarum.)
1854. *Anomocare limbatum* (ANGELIN), Pal. Scand., fasc., II, p. 25. (New generic name and emended diagnosis.)
1902. *Anomocare limbatum* (ANGELIN), Grönwall, D. G. U., II. Række, no. 13, p. 140, pl. 4, fig. 5. (Cranidium illustrated. Andrarum limestone. Bornholm.)
1911. *Coosia (?) limbata* (ANGELIN), Walcott, Cambr. Geol. Paleont., vol. 2, no. 4, pp. 70, 91, 96. (Species discussed.)
1913. *Coosia (?) limbata* (ANGELIN), Walcott, Res. in China, vol. 3, p. 214, pl. 21, figs. 12, 12a. (Cranidium and pygidium from the type locality illustrated.)
1940. *Anomocarioides limbatum* (ANGELIN), Lermontova, in Vologdin: Atlas . . . of the fossil faunas of the USSR, vol. 1, p. 155, pl. 47, figs. 3, 3 a—c. (An almost complete dorsal shield from Siberia illustrated).

Description. — Cranidium of low convexity. Dorsal furrows weak, not impressed. Glabella slightly tapering, gently rounded in front, occupying about three-fifths the total length. Glabellar furrows discontinuous, three pairs, posterior pair well-defined though shallow, anterior pairs weak to imperceptible. A very weak median tubercle usually visible at the base of the glabella. Occipital furrow well impressed at the sides, quite effaced at the middle. Occipital ring smooth, with straight posterior margin. Brim flat to gently convex, with a low ridge usually almost touching the glabella but sometimes running a short distance from the latter; in its marginal portion often displaying very weak ridges parallel to the margin, otherwise smooth. Fixed cheeks about three-fourths as wide as the glabella in front, flat or nearly so;

Dimensions of the species of Anomocaridae described.

The specimens apparently retain their original convexity.

	Anomocare				*Anomocarina*						*Anomocarioides*		
	laeve			*longi-frons*	*excavata*			*extornata*			*limbatus*		
	Pl. 3, f. 4	Pl. 3, f. 3	Pl. 3, f. 1	Pl. 3, f. 9	RM. Ar.1414c	Pl. 3, f. 13	Pl. 3, f. 14	RM. Ar.32381	Pl. 4, f. 1	Pl. 4, f. 2	Pl. 4, f. 8	Pl. 4, f. 7	Pl. 4, f. 6
Cranidium													
Length (exclusive of the occipital spine)	10.0 (1)	13.7 (1)	16.3 (1)	9.2 (1)	7.4 (1)	11.3 (1)	13.2 (1)	9.3 (1)	15.0 (1)	16.2 (1)	11.1 (1)	15.4 (1)	21.3 mm (1)
Breadth across the palpebral lobes	c. 10.5 (1.05)	c. 14.0 (1.02)	17.2 (1.06)	9.4 (1.02)	8.6 (1.16)	13.6 (1.20)	15.7 (1.19)	c. 11.3 (1.22)	18.6 (1.24)	19.0 (1.17)	13.0 (1.17)	c. 17.5 (1.14)	23.5 (1.10)
Length of glabella + occipital ring	7.2 (0.72)	10.3 (0.75)	11.9 (0.73)	7.3 (0.79)	5.5 (0.74)	8.4 (0.74)	9.5 (0.72)	6.8 (0.72)	10.9 (0.73)	12.0 (0.74)	8.3 (0.75)	11.3 (0.73)	14.6 (0.69)
Breadth of glabella at the rear	4.2 (0.42)	5.8 (0.42)	6.8 (0.42)	4.8 (0.52)	3.4 (0.46)	5.8 (0.51)	6.6 (0.50)	4.5 (0.48)	7.6 (0.51)	7.7 (0.48)	5.4 (0.49)	7.5 (0.49)	12.3 (0.58)
Breadth of brim between the facial sutures	7.0 (0.70)	11.8 (0.86)	13.0 (0.80)	6.9 (0.75)	8.0 (1.08)	12.6 (1.12)	14.2 (1.08)	7.5 (0.81)	11.7 (0.78)	13.0 (0.80)	10.0 (0.90)	13.4 (0.87)	20.4 (0.96)
	Pl. 3, f. 7	RM. Ar.32361	Pl. 3, f. 8	Pl. 3, f. 10	Pl. 3, f. 17	Pl. 3, f. 16	S. G. U. 2424	RM. Ar.1431a	Pl. 4, f. 3	Pl. 4, f. 5	Pl. 4, f. 11	Pl. 4, f. 13	Pl. 4, f. 12
Pygidium													
Length	5.0 (1)	5.2 (1)	7.5 (1)	5.5 (1)	6.2 (1)	8.2 (1)	14.0 (1)	6.2 (1)	9.4 (1)	12.5 (1)	10.5 (1)	13.0 (1)	14.2 (1)
Breadth	8.3 (1.65)	8.4 (1.62)	12.0 (1.60)	8.9 (1.62)	10.6 (1.71)	12.7 (1.55)	21.4 (1.53)	9.8 (1.58)	13.2 (1.40)	17.7 (1.42)	20.6 (1.96)	23.8 (1.83)	25.5 (1.80)
Breadth of axis	2.4 (0.48)	2.4 (0.46)	3.5 (0.47)	2.2 (0.40)	2.1 (0.34)	3.0 (0.37)	4.6 (0.33)	2.5 (0.40)	3.8 (0.40)	5.0 (0.40)	3.8 (0.36)	4.6 (0.35)	4.8 (0.34)

a pair of bosses opposite to the posterior pair of the lateral glabellar lobes and close to the dorsal furrows usually present, sometimes practically indiscernible or coalesced with the glabella. Palpebral lobes but a little shorter than the glabella, extending backwards to the marginal furrow, crescent-shaped, fairly narrow, defined by faint palpebral furrows; ocular ridges oblique, reaching the dorsal furrows opposite to the anterior pair of glabellar furrows. Anterior branches of the facial suture cutting the brim in an evenly convex arc, the width of the brim between them being slightly shorter than the width across the palpebral lobes; posterior branches coinciding with the posterior marginal furrow. Posterior limb about three-fourths as wide as the occipital ring. Free cheeks almost flat; genal angles prolonged into stout fairly short spines.

Associated hypostoma resembles that of *Anomocarina excavata*.

Thorax of ten segments; pleura like those of *Anomocarina* (Siberian specimens).

Pygidium moderately convex, semicircular in outline. Axis prominent, narrow, occupying one-fifth the total breadth at the anterior margin, continuously tapering, extending to the border, with five or six smooth rings besides the pointed end-lobe; ring furrows shallow. Pleural lobes gently arched, with five pairs of shallow pleural furrows and weak interpleural grooves (or ridges) on the anterior pairs of ribs. Border nearly as wide as the axis in front, subequal in width throughout, gently concave, smooth.

Test of cephalon and pygidium smooth and compact.

Size. — A fairly large form, the largest cranidium in hand being 22 mm and the largest pygidium 24 mm long. Cf. p. 21.

Remarks. — The cephalon illustrated by Angelin cannot be identified and probably his figure is restored. According to the attached label the pygidium in our fig. 12 is the one depicted by Angelin and is chosen as the lectotype.

Horizon and Localities. — Zone of *Solenopleura brachymetopa* (Andrarum limestone). Scania: Andrarum; Kiviks-Esperöd; Baskemölla; Gislövshammar. — Common.

At the same horizon on Bornholm. — Siberia: Anabar and Aldan regions.

Conocoryphidae Angelin, 1854.

Conocoryphinae (Angelin, 1854) Matthew, 1887.

Mainly because of divergent conceptions of the blindness of the trilobites as a primitive or a degenerative character and different interpretations of the cephalic sutures, greatly divergent opinions have been advanced on the position in a natural system and on the mutual relations of the members of the group now under consideration.

It is well known that Barrande (1852) in the genus *Conocephalites* included eye-bearing (*Ptychoparia* Corda, 1847) as well as blind forms (*Conocoryphe* and *Ctenocephalus* Corda, 1847). This assemblage was placed by Matthew

(1887) in the family Ptychopari[i]dae, in which he distinguished two subfamilies, Conocoryphinae (= Conocoryphidae ANGELIN) and Ptychopari[i]nae, the former of which was believed to be the primitive group. Of subsequent authors Beecher (1897), Swinnerton (1915), Poulsen (1927), Whitehouse (1939), and others did not recognize any close affinity between Matthew's subfamilies mentioned, which were given the rank of families and by the two latter writers even placed in different orders or suborders. On the other hand, Warburg (1925), Raw (1925), Rud. Richter (1932), and others deduced that the Conocoryphidae may be secondarily blind Ptychopariidae, in which the loss of the eyes was accompanied by a straightening and marginal migration of the facial suture. This idea was further developed by R. & E. Richter (1941), who founded their argumentation on zoological facts and the knowledge acquired from the Phacopidae and Proetidae; the groups were retained as subfamilies as suggested also by Raw, and the family name was emended to Conocoryphidae according to the International Rules.

In 1936 Resser reviewed the Conocoryphidae (= Conocoryphinae in this paper), in which he included the following genera: *Conocoryphe* CORDA, *Bailiella* MATTHEW (inclusive of *Erinnys* SALTER = *Menevia* LAKE), *Bailiaspis* nov., *Ctenocephalus* CORDA (including *Elyx* ANGELIN), *Holocephalina* SALTER, *Dasometopus* nov. (based on *Harpides breviceps* ANGELIN), and *Hartshillia* ILLING. Some authors, e. g. Kobayashi (1935), give the family a still wider sense. On the other hand, in his studies on the British forms Lake (1940) stated that the group is rather heterogeneous as regards the thorax and pygidium, and on account of that he retained as true Conocoryphidae only the four former of the genera mentioned. In fact, it is easily conceived that these four may have arisen from *Ptychoparia* and closely allied genera, while it seems more difficult to trace the ancestors of some genera among the others; thus, the assemblage in the wider sense used by most authors may be polyphyletic.

In a memoir by Thoral (1946) on the Conocoryphidae of Languedoc, France, founded on a large material with a great many more or less complete specimens, the author accepts broadly speaking Resser's taxonomy. The course of the facial suture is given a high taxonomic value and, thus, two new genera are erected: *Parabailiella* which may be characterized as a *Conocoryphe* with the facial suture of *Bailiella*, and *Couloumania*, which resembles *Bailiella* in wanting the grooves across the brim and has the facial suture distinctive of *Conocoryphe*, i. e., running on the border or on its outer surface.

The following genera referable to Conocoryphinae with the reservation stated above have been found in Sweden: *Bailiella*, *Bailiaspis*, *Ctenocephalus*, *Elyx*, and *Dasometopus*, and three more have been recorded from neighbouring Scandinavian regions, *Conocoryphe* from Norway and Bornholm, *Menevia* and *Holocephalina* from Bornholm. Although a large material of the Swedish forms has been collected, it has yielded almost exclusively cranidia, some fragmentary free cheeks and pygidia too imperfectly preserved for a safe specific identification. Of one form alone, *Bailiella emarginata*, the entire dorsal shield is known.

The group is fairly common in the Middle Cambrian of the Acado-Baltic

province (including Prussia (boring at Dobrilugk), Bavaria, Poland, Bohemia, southern France, Spain, and Sardinia), and a few forms have been recorded from south-eastern, eastern and inner Asia.

Bailiella MATTHEW, 1884.

Genotype: *Conocephalites baileyi* HARTT (Dawson, 1868).

Bailiella is readily distinguished from *Conocoryphe* by the absence of a pair of diverging grooves crossing the brim and separating a transverse low-lying lobe in front of the glabella; furthermore, the facial suture in the holotype cuts the cheek slightly inside instead of outside the lateral marginal furrow. In thorax and pygidium no significant dissimilarities exist and the number of thoracic segments is 14 in the respective genotypes but varies slightly in *Bailiella*;[1] the terminations of the pleura are pointed (not spined) in both.

The dissimilarities between *Bailiella* and *Bailiaspis* were stated by Resser to be less distinct. In the former the anterior border of the cranidium is not thickened, or but slightly so, whereas in the latter it expands backwards, and, in consequence, the marginal furrow is evenly convex in the former but curves backwards at the axial line in the latter. Nevertheless Resser included in *Bailiella* also forms with moderately thickened border but evenly convex marginal furrow. It should be borne in mind, however, that the broadening of the border in the cranidium, if not expanding backwards, at least to some extent depends on the course of the facial suture, in so far as it becomes more pronounced if the suture reaches the margin close to the axial line than if it cuts the margin farther outward; and judging from fig. 3 on pl. 5 of *Bailiella emarginata* compared with complete cranidia of the same size the border is subequal in breadth in the cephalon though considerably thickened in the cranidium. According to Lake an equally important difference is the depression of the brim in front of the glabella in *Bailiaspis*, so that the fixed cheeks are separated from each other instead of continuous as in *Bailiella*. This criterion is somewhat variable, however; in *Bailiaspis dalmani*, which seems to be very like the genotype, the depression of the brim is markedly deeper than in *B. glabrata*, and in the present writer's opinion some forms referable to *Bailiella*, e. g. *B. emarginata*, have the brim slightly depressed. Thus, the most conspicuous and most reliable differences between the genera under consideration will be those in the border and the marginal furrow: in *Bailiella* the border does not extend backward even though it increases in breadth towards the axial line in the cranidium, and the marginal furrow is convex, whereas in *Bailiaspis* the border expands backward and is followed by a backward curve of the furrow.

In *Bailiella* Resser included also *Erinnys venulosa* SALTER. However, as this form is clearly distinct in thorax and pygidium, the thoracic segments numbering 25 or more and the pleura terminating in stout recurved spines, Lake

[1] In his description of *B. baileyi* Matthew (1890) states that the number of thoracic segments is 14, but in the restored figure it is 17. In *B. lyelli* (HICKS) and *B. emarginata*, the latter of which Resser placed in *Bailiaspis*, the number is 15.

excluded rightly it from *Bailiella*. He considered it the type of an independent genus and, since *Erinnys* as well as *Salteria* proposed by Walcott was preoccupied, it was given the new generic name *Menevia*.

Bailiella emarginata (LINNARSSON, 1877). — Pl. 5, figs. 1—4.

1872. *Conocoryphe dalmanni* ANGELIN?, Sjögren, G. F. F., vol. 1, p. 75. (Cranidium briefly characterized; no figure. *Paradoxides oelandicus* beds. Stora Frö, Öland.)
1877. *Conocoryphe emarginata* LINNARSSON, G. F. F., vol. 3, p. 366, pl. 15, figs. 2—4. (Also as S. G. U., ser. C, no. 22, p. 15, pl. 2, figs. 2—4.) (Description and figs. of cranidium and part of thorax with attached pygidium. Horizon and locality as above.)
1936. *Bailiella emarginata* (LINNARSSON), Westergård, S. G. U., ser. C, no. 394, p. 58, pl. 11, figs. 1—3. (Described and discussed; a fairly complete dorsal shield illustrated. Zone of *Paradoxides insularis*. Öland.)
1936. *Bailiaspis emarginata* (LINNARSSON), Resser, Smiths. Misc. Coll., vol. 95, no. 4, p. 19. (Species placed in *Bailiaspis*.)

Remarks and Affinities. — The cranidium fig. 2 on pl. 5 is probably one of the specimens on which the original description was based, and is chosen as lectotype. The largest cranidium found is 20 mm long, indicating a total length of about 60 mm; see also the table on p. 36.

The reasons for including this form in *Bailiella* and not in *Bailiaspis* as suggested by Resser are adduced above.

In the thickness of the border and proportionately large glabella *B. emarginata* resembles the associated *fröensis* to be described, but is distinct in other characters as stated under the latter. Compared with *B. tenuicincta*, *emarginata* differs in having slightly thicker border, the marginal furrow decreasing in depth towards the middle line instead of subequal in depth throughout, the brim being flat, slightly depressed, and in sagittal length subequal to the border instead of convex and longer than the border, and in the quite distinct ornamentation of the test.

The English form *B. longifrons* (*Conocoryphe emarginata longifrons* COBBOLD, 1911) from the early Middle Cambrian *Paradoxides groomi* fauna was originally described as a variety of Linnarsson's species, though Cobbold recognized that the differences are considerable. Beyond doubt it is specifically distinct from *emarginata* as stated by Resser (1936) and Lake (1940). Judging from Lake's description and illustrations it compares with *B. fröensis* sp. n. in the outline of the cranidium, and in general aspect it seems to be fairly like *B. impressa*.

B. emarginata should also be compared with *B. lyelli* (HICKS), of which the entire dorsal shield is known. In the cranidium our form is distinct by proportionately thicker border, shorter brim, and more tapering glabella, but as regards the free cheeks, thorax, and pygidium the forms agree except that the pygidium of *lyelli* has one more segment and a faint narrow border (cf. Lake, 1940, pl. 40, figs. 1—6). Broadly speaking, our form is also fairly like the French *B. levyi* (MUNIER-CHALMAS & BERGERON) as stated by Thoral (1946, p. 31).

Horizon and Localities. — *Paradoxides oelandicus* beds, zone of *P. insularis*. Öland: Stora Frö (type locality); Mörbylånga (boulders); Mossberga (boring). Fairly infrequent.

Bailiella fröensis sp. n. — Pl. 5, figs. 5a—c.

Diagnosis. — Cranidium one and a half times as broad as long; glabella broad, tapering; brim slightly depressed, flat, at the axial line subequal in lenght to the border; border convex, in the cranidium considerably widening to the middle; marginal furrow evenly convex; occipital furrow curving forwards in the middle; test granulate, with scattered larger grains and close-set very small grains, the latter invisible to the naked eye.

Remarks. — Only the specimen illustrated has been found; it is preserved in an impure limestone and retains the test on the right-hand fixed cheek. The glabella (internal cast) displays three pairs of faint oblique furrows, the anterior pair almost imperceptible. Ocular ridges defined though short. The facial suture cuts the cheek in a slightly curved line, which is inconsiderably inclined to the axial line. The forward curve of the occipital furrow is more pronounced than in any other Scandinavian species referable to *Bailiella* or *Bailiaspis* and, thus, the occipital ring widens considerably to the middle; it bears a small median node. — The cranidium is 10.7 mm long; cf. p. 36.

B. fröensis resembles the associated *emarginata* in the glabella, brim, and border but is distinct in other features: in the former the facial sutures are less inclined to the axial line and, accordingly, the cranidium and posterior limb narrower in proportion, the occipital furrow is convex instead of straight, and the ornamentation of the test differs distinctly from that in *emarginata*. In the latter character *fröensis* resembles *tenuicincta*, but differs in the features common to *fröensis* and *emarginata*.

Horizon and Locality. — *Paradoxides oelandicus* beds, zone of *P. insularis*. Stora Frö, Öland. Apparently very rare.

Bailiella tenuicincta (Linnarsson, 1879). — Pl. 5, figs. 6—8, (9?).

1879. *Conocoryphe tenuicincta* Linnarsson, S. G. U., ser. C, no. 35, p. 18, pl. 2, figs. 23—25. (Description and figs. of cranidium. Exsulans limestone. Gislöv = on the shore 1 km S of Brantevik, Scania.)

1936. *Bailiella tenuicincta* (Linnarsson), Resser, Smiths. Misc. Coll., vol. 95, no. 4, p. 16. (Species included in *Bailiella*.)

Remarks. — New illustrations of the holotype are presented in figs. 6a—d. There is nothing to add to the original description of the cranidium. The pygidium, fig. 9, preserved in shale and retaining the test except in a narrow strip along the posterior margin of the left-hand pleural lobe, agrees with the cranidium in ornamentation and may belong to this species. Large cranidia are about 20 mm long; cf. p. 36.

B. tenuicincta should be compared with *emarginata*, q. v. A re-examination of the Canadian *Conocoryphe* (*Bailiella*) *baileyi arcuata* Matthew, 1884, will probably prove this form to be very closely allied to *tenuicincta*.

Horizon and Localities. — Zone of *Ptychagnostus* (*Triplagn.*) *gibbus* (Exsulans limestone). — Scania: Brantevik and Gislövshammar; Kiviks-Esperöd; Andrarum; Fågelsång. — Öland: on the shore 4.5 km S of Mörby-

långa (in dark-gray calcareous sandstone). — Fairly common at the Scanian localities.

In the same zone on Bornholm.

Bailiella impressa (LINNARSSON, 1879). — Pl. 5, figs. 10—12.

1879. *Conocoryphe impressa* LINNARSSON, S. G. U., ser. C, no. 35, p. 20, pl. 2, figs. 29, 30. (Description and figs. of cranidium. Exsulans limestone. Kiviks-Esperöd, Scania.)
1883. *Conocoryphe impressa* LINNARSSON, ibidem, no. 54, p. 27. (Species compared with *C. lyelli* HICKS.)
1902. *Conocoryphe* (*Liocephalus*) *impressa* LINNARSSON, Grönwall, D. G. U., II. Række, no. 13, pp. 84—88, 101, 213, pl. 1, fig. 25. (Species discussed and assigned as the type of *Liocephalus;* fig. of cranidium. Exsulans limestone. Bornholm.)
1936. *Bailiella impressa* (LINNARSSON), Resser, Smiths. Misc. Coll., vol. 95, no. 4, p. 17. (Species included in *Bailiella.*)

Non:

1913. *Conocoryphe* (*Liocephalus*) *impressa* LINNARSSON, Cobbold, Quart. Journ. Geol. Soc., vol. 69, p. 33, pl. 3, figs. 16a—c (= *Bailiella cobboldi* RESSER, 1936).

R e m a r k s. — Only the cranidium is known; new illustrations of the holotype are presented on pl. 5, figs. 10a—c.

The cranidium is characterized by its almost even convexity, all furrows being shallow and narrow, and by a flat border. The furrows are somewhat more pronounced in young than in full-grown specimens and better defined on internal casts than on the test; on specimens retaining the test the furrow bounding the glabella in front is sometimes practically effaced. In the features mentioned *impressa* differs from the remainder of the Swedish members of the group, and in the character of the test — smooth to the naked eye but finely punctate under a lens — it is like *Bailiaspis glabrata.* It is a comparatively small form, the largest cranidium found, the holotype, being 13.4 mm long; cf. p. 36.

Linnarsson considered *impressa* probably generically distinct from *Conocoryphe* sensu lato, but pending more complete material he postponed to place it in a new genus. Grönwall assigned it as the type of his *Liocephalus,* one of the four subgenera in which he broke up *Conocoryphe. Liocephalus* is a fairly heterogeneous group, however, in which Grönwall included *Conocoryphe lyelli* HICKS, as mentioned above a true *Bailiella,* and two new forms from Bornholm which may belong in *Holocephalina* SALTER. Resser placed *impressa* in *Bailiella,* and Lake, who originally (1938, p. 263) was inclined to consider *Liocephalus* possibly identical with *Holocephalina,* later (1940, p. 283) accepted Resser's suggestion regarding the generic reference of *impressa.* As the criteria particularly distinctive of *impressa* in themselves do not seem to be of generic value and as but the cranidium is known, it is for the present justifiable to include the form in *Bailiella.*

The English form identified as *impressa* by Cobbold is specifically distinct as stated by Resser and Lake. On the other hand, Lake (1940, p. 281) suggested that an imperfect specimen of *Conocoryphe emarginata longifrons* COBBOLD (1911, pl. 24, fig. 8) might be referable to *impressa.*

H o r i z o n a n d L o c a l i t i e s. — Zone of *Ptychagnostus* (*Triplagn.*)

gibbus (Exsulans limestone). Scania: Brantevik and Gislövshammar; Kiviks-Esperöd (type locality); Andrarum; Fågelsång. Fairly common.

In the same zone on Bornholm.

Bailiella aequalis (LINNARSSON, 1883). — Pl. 5, fig. 13; pl. 6, figs. 1, (2?), 3.

1883. *Conocoryphe aequalis* LINNARSSON, S. G. U., ser. C, no. 54, p. 25, pl. 4, figs. 12—15. (Description and figs. of cranidium. Zone of *Ptychagnostus punctuosus*, lower part. Andrarum (Tullberg's loc. 10), Scania.)

?1902. *Conocoryphe aequalis* LINNARSSON, Grönwall, D. G. U., II. Række, no. 13, p. 92, pl. 1, fig. 22. (Comments on species and fig. of cranidium from Bornholm.)

1936. *Bailiella aequalis* (LINNARSSON), Resser, Smiths. Misc. Coll., vol. 95, no. 4, p. 16. (Species included in *Bailiella*.)

Non:

1913. *Conocoryphe aequalis* LINNARSSON, Cobbold, Quart. Journ. Geol. Soc., vol. 69, p. 32, pl. 3, figs. 18a—c (= *Bailiella comleyensis* RESSER, 1936).

Remarks. — *B. aequalis* was based on some poorly preserved cranidia in shale — internal casts and external moulds — and since then no additional material has been found at any Swedish locality.

Of the four specimens depicted by Linnarsson and re-illustrated in this paper, his fig. 12 — here chosen as lectotype — and fig. 15 (our figs. 13 and 1) agree and differ somewhat from figs. 13 and 14 (2 and 3). Linnarsson stated that the glabellar furrows are not discernible for certain on internal casts though faintly indicated on some external moulds (which is contrary to what is usually the case in these and other trilobites), and his fig. 13 of a mould does not even display any traces of glabellar furrows despite three pairs being quite definite, as seen from our fig. 2 of the same specimen. As this specimen otherwise agrees exactly with the lectotype as far as a comparison is possible it is tentatively included in *aequalis*. In the small specimen, fig. 3, no granulation is visible, a probably ostensible difference depending on imperfect preservation.

The ocular ridges are as a rule obsolete or, sometimes, reduced to a pair of weak elongate knobs. The surface of the moulds as well as the casts is ornamented with close-set fairly coarse grains subequal in size, on the former with a minute pit at the top. The largest specimen is 22.5 mm long; cf. p. 36.

The course of the facial suture is not distinctly traceable; it seems to cut the cheek slightly inside, or to coincide with, the lateral marginal furrow. On the other hand, on the cranidium from Bornholm illustrated by Grönwall the suture runs on the lateral border slightly outside the furrow, in which the specimen agrees with *Couloumania* THORAL, and it is proportionately broader than the type of *aequalis*, the ratio of length and breadth being exactly 1 : 2. Thus, it possibly represents a form distinct from the latter, a question which requires additional and better preserved material from the type locality before it can be answered.

B. aequalis is readily distinguished from congeneric forms by the combination of the following criteria: the great breadth of the cranidium, the border not being thickened in front of the glabella, and the ornamentation of the test.

Horizon and Localities. — Zone of *Ptychagnostus punctuosus*, lower part. Andrarum, Scania. Apparently fairly infrequent.

Bornholm(?). — South-eastern Newfoundland (Howell, 1925). — *B.* cf. *aequalis* is recorded from a boring at Dobrilugk, 100 km S of Berlin, Germany.

Bailiaspis Resser, 1936.

Genotype: *Conocephalites elegans* Hartt (in Dawson, 1868).

The genus is distinguished from allied genera by the border expanding backwards, the marginal furrow curving backwards, and the brim being more or less depressed in front of the glabella.

Bailiaspis dalmani (Angelin, 1854). — Pl. 6, figs. 4, 5a—d.

1827. *Asaphus? sulzeri* (Schlotheim), Dalman, Vet.-Akad. Handl. (for the year 1826), pp. 260, 284, 294, pl. 6, fig. 2. (Cranidium illustrated. Southern Öland [?].)
1837. *Asaphus? sulzeri* (Schlotheim), Hisinger, Leth. Suec., p. 15, pl. 3, fig. 2. (Brief diagnosis; copy of Dalman's fig.)
1854 *Conocoryphe dalmani* Angelin, Pal. Scand., fasc. II, p. 63, pl. 33, figs. 16, 16a. (Brief diagnosis; Dalman's specimen re-illustrated. Regio Conocorypharum, Scania.)
1869. *Conocoryphe bufo* Hicks, Quart. Journ. Geol. Soc., vol. 25, p. 52, pl. 2, fig. 8. (Description and. fig. of cranidium with six attached thoracic segments. Basal beds of the "Menevian Group". St. Davids, Wales.)
1879. *Conocoryphe dalmani* Angelin, Linnarsson, S. G. U., ser. C, no. 35, p. 19, pl. 2, figs. 26—28. (Detailed description and figs. of cranidium. Exsulans limestone. Andrarum and other localities in Scania.)
1902. *Conocoryphe dalmanni* Angelin, Grönwall, D. G. U., II. Række, no. 13, p. 94. (Remarks on species, recorded from Bornholm.)
1936. *Bailiaspis dalmani* (Angelin), Resser, Smiths. Misc. Coll., vol. 95, no. 4, p. 19. (Species included in *Bailiaspis*.)
1940. *Bailiaspis dalmani* (Angelin), Lake, Pal. Soc., Brit. Cambr. Trilob., p. 283, pl. 40, figs. 15, 16. (Hick's specimen of *Conocoryphe bufo* redescribed, discussed, and re-illustrated.)

Remarks. — The holotype is re-illustrated on pl. 6, fig. 4.[1]

Linnarsson's description may be supplemented in some details. The brim in front of the glabella is depressed though slightly convex; rarely the area is bounded to the sides by a pair of extremely weak furrows (cf. fig. 5) corresponding to those much more pronounced in *Conocoryphe* and *Ctenocephalus*. The occipital node is pointed and at least in some specimens forms a short spine, as stated by Grönwall. The ornamentation — crowded small grains and scattered larger tubercles — is practically as pronounced on exfoliated specimens as

[1] This specimen, which belongs to the Geol.-Min. Instit. of Lund, was stated by Linnarsson (1877, p. 368) to be beyond doubt the original of Angelin's fig. and in all probalility also of Dalman's fig. of *Asaphus? sulzeri*. Dalman stated that the specimen is preserved in a dark-gray limestone and, according to Professor Sven Nilsson, it was collected on southern Öland. There is every probability that Linnarsson's statement is true; the size of the figure is almost exactly that of the specimen and the label tells that it belonged to Sven Nilsson's collections. On the other hand, the lithological character of the small slab, a nearly black dense limestone, contradicts it having been found on Öland and, if that is so, it cannot have been collected from the solid rock. At the only locality on southern Öland where the Exsulans layer has hitherto been found uncovered, on the shore 4.5 km S of Mörbylånga, the rock is a dark-gray calcareous sandstone. Angelin recorded the specimen from Scania (without giving the locality), which is more probable; his mistake in including the species in Regio Conocorypharum, i. e. the Andrarum limestone, may be explained by the fact that the Exsulans limestone was unknown to him at the time when Palaeontologia Scandinavica was published.

In this connection it may be mentioned that the Exsulans limestone is better exposed on the shore 1 km S of Brantevik, Scania, than at any other Swedish locality, and most of its fauna described by Linnarsson in 1879 was collected at that locality (by Linnarsson called Gislöv). Earlier the solid rock at the place was covered with a thick bed of gravel and sand, which was washed away by an exceptionally violent storm in November, 1873 (personal commnunication by an old farmer at Gislöv).

on the outer surface of the test, but the ocular ridges are better defined on the former. The largest cranidium present is 25 mm long; cf. p. 36.

Affinities. — Linnarsson suggested that *B. bufo* (HICKS) from the *Paradoxides aurora* zone of Wales may be identical with *dalmani* and, after a re-examination of Hicks's type specimen, Lake stated that "it is certainly impossible to give any character to distinguish between them". *B. elegans* (HARTT) from the *Par. eteminicus* zone in New Brunswick, Canada, redescribed and illustrated by Matthew (1884), is apparently very like Angelin's species; since according to Matthew the test of the Canadian form consists of two layers and the ornamentation of the inner layer is quite different from that of the outer, it does not seem to be identical with our form, however. *B. prominens* RESSER from south-eastern Newfoundland is distinct by a slightly narrower glabella extending to the marginal furrow, in which it resembles the English *B. tuberculata* LAKE.

Horizon and Localities. — Zone of *Ptychagnostus* (*Triplagn.*) *gibbus* (Exsulans limestone and immediately adjacent shale layers). Scania: Brantevik and Gislövshammar; Kiviks-Esperöd; Andrarum; Fågelsång. Common in the Exsulans limestone, infrequent in the immediately adjacent shale layers.

At the same horizon on Bornholm.

Bailiaspis glabrata (ANGELIN, 1854). — Pl. 6, figs. 6—8.

1854. *Conocoryphe? glabrata* ANGELIN, Pal. Scand., fasc. II, p. 72, pl. 37, figs. 8, 8a. (Inexpressive diagnosis and rough figs. of cranidium. Andrarum limestone. Andrarum, Scania.)
1902. *Conocoryphe glabrata* ANGELIN, Grönwall, D. G. U., II. Række, no. 13, p. 93. (Remarks on species; recorded from Bornholm. No fig.)
1936. *Bailiaspis glabrata* (ANGELIN), Resser, Smiths. Misc. Coll., vol. 95, no. 4, p. 19. (Species included in *Bailiaspis*.)

Description. — Cranidium semi-elliptical, faintly angulate in front, of high convexity. Dorsal furrows shallow and broad. Glabella conical, about half as broad in front as at the rear, rounded to almost truncate in front, not extending to the border, tending to become gently keeled (less strongly than in Angelin's figure); three pairs of very faint lateral furrows usually discernible on internal casts. Occipital furrow shallow, in particular at the dorsal furrows, straight; occipital ring widened to the middle line, in some specimens bearing a minute node near the posterior margin. Brim in front of the glabella flat, slightly depressed, shorter than, or equal in length to, the border at the axial line. Border greatly expanded in front of the glabella, extending forwards and slightly backwards, rapidly narrowing to the sides, moderately convex. Marginal furrow shallow particularly at the axial line, curving backward or nearly straight in the middle. Fixed cheeks convex, sloping inconsiderably to the dorsal furrows and strongly to the marginal furrow. Ocular ridges of the shape common in this group, very faint, usually imperceptible on specimens retaining the test. Area in front of the ridges displaying a net-work of still weaker ridges visible only on internal casts. Facial suture running on the border, almost touching the lateral marginal furrow at the rear.

Test quite smooth to the naked eye, under the microscope very finely granu-

late and thinly punctate. Crushed specimens indicate that the test, though fairly thick, has been very flexible.[1]

Free cheek, thorax, and pygidium unknown.

Size. — The largest specimen found is 24 mm long; cf. p. 36.

Remarks. — The holotype has been sought in vain; one of Angelin's largest specimens is here chosen as lectotype (fig. 6).

B. glabrata differs from the genotype and other congeneric forms in the facial suture running slightly outside instead of slightly inside the lateral marginal furrow, a dissimilarity possibly indicating generic distinction (cf. Thoral, 1946). Since our form is known but from the cranidium, the writer for the present at least prefers to retain it in *Bailiaspis*.

An incomplete and somewhat distorted cranidium from the *Paradoxides davidis* zone in South Wales, identified as *Conocoryphe* cf. *dalmani* by Nicholas (1916) and later described and illustrated by Lake (1940) under the name of *Bailiaspis nicholasi* RESSER MS., seems to agree with *glabrata* (in particular our fig. 8) but according to Lake it has a granulate test.

Horizon and Locality. — Zone of *Solenopleura brachymetopa* (Andrarum limestone proper). Andrarum, Scania. Rare.

At the same horizon on Bornholm.

Ctenocephalus CORDA, 1847.

Genotype: *Cten. barrandii* CORDA, 1847 = *Conocephalus coronatus* BARRANDE, 1846.

The genus is characterized by a semicircular cranidium and a semiglobular prominent boss between the glabella and border, all round bounded by furrows.

Matthew (1884) distinguished two subgenera which he defined thus: *Ctenocephalus* sensu str. has "a wall-like front to the cheeks and frontal lobe", whereas *Harttella* subgen. n. (type *Conocephalites matthewi* HARTT) has "a sloping front to the cheeks and frontal lobe". However, Pompeckj (1895, p. 597) mentioned a Bohemian variety of *Cten. coronatus*, which "bildet einen typischen Übergang zwischen der böhmischen und der skandinavischen Art", indicating that the character in question may be of little taxonomic value. Thus, most subsequent authors do not recognize *Harttella* as distinct from *Ctenocephalus*, while Lake (1940) and Thoral (1946, p. 57) retained it as a subgenus, and Howell (1925; Hayes & Howell, 1937) raised it to generic rank.

On the other hand, *Elyx* ANGELIN, by several authors regarded as synonymous with *Ctenocephalus*, is a distinct genus for reasons stated below.

Ctenocephalus has been recorded from the Middle Cambrian of the Acado-Baltic province (Scandinavia, Bohemia, southern France, Spain, Britain, and eastern North America).

Ctenocephalus exsulans (LINNARSSON, 1879). — Pl. 6, figs. 9, 10.

1879. *Conocoryphe exsulans* LINNARSSON, S. G. U., ser. C, no. 35, p. 15, pl. 2, figs. 21, 22. (Cranidium described and illustrated. Exsulans limestone. Gislöv = on the shore 1 km S of Brantevik, Scania.)

[1] Cf. Cobbold, 1913, pp. 32, 33, pl. 3, fig. 17a.

1902. *Conocoryphe* (*Ctenocephalus*) *exsulans* LINNARSSON, Grönwall, D. G. U., II. Række, no. 13, pp. 84, 98. (Species discussed and recorded from Bornholm; no fig.)
1929. *Ctenocephalus exsulans* LINNARSSON, Strand, Norsk Geol. Tidsskr., vol. 10, p. 349. (Species recorded from the Mjösen district of Norway.)

Remarks. — The material available does not supplement Linnarsson's description of the cranidium, the only part of the dorsal shield hitherto found. The holotype, a large specimen, is 16.3 mm long; cf. p. 36.

C. exsulans should be compared with *C. matthewi* (HARTT) and certain forms described by Resser (1937), which seem to differ mainly in the ornamentation of the test. Also a form from Spain, originally identified as *C. coronatus*[1] but by Thoral (1946) included in his new species *C. antiquus*, is distinct from the former and more like *exsulans;* the French species differs from the Scandinavian *inter alia* in having a stout occipital spine.

Horizon and Localities. — Zone of *Ptychagnostus* (*Triplagn.*) *gibbus* (Exsulans limestone and immediately covering shale layer). — Scania: Brantevik and Gislövshammar; Kiviks-Esperöd; Andrarum; Fågelsång. — Öland: on the shore 4.5 km S of Mörbylånga; Borgholm and on the shore 2.5 km E of the town. — Jämtland: Vedjeön (boulder). — Common in Scania, otherwise rare.

Bornholm. — Mjösen district of Norway.

Elyx (ANGELIN, 1851).[2]

As stated above some recent writers recognize *Elyx* as a valid genus, while others regard it as a synonym for *Ctenocephalus*. The former differs from the latter in the following characters: the cephalon is subrectangular instead of semicircular in outline and on a front view its lower margin is straight instead of arched, the preglabellar boss is confluent with the border instead of being separated from it by the marginal furrow, the facial suture, if developed, is marginal instead of cutting off a narrow strip of the lateral border, and the thoracic pleura terminate in recurved spines instead of pointed. Because of these dissimilarities the present writer does not hesitate to consider *Elyx* distinct from *Ctenocephalus*.

The genus has been recorded from the late Middle Cambrian in Scandinavia and north-western Vermont, U. S. A.

Elyx laticeps (ANGELIN, 1851). — Pl. 7, figs. 1—5.

1851. *Eryx laticeps* ANGELIN, partim, Pal. Svec., fasc. I, p. 4, pl. 5, fig. 2; not fig. 3. (Brief diagnosis and fig. of cephalon. The shield interpreted as the pygidium of this species is the cranidium of *Dasometopus* (*"Harpides"*) *breviceps* as stated by Grönwall. Andrarum limestone. Andrarum, Scania.)
1901. *Elyx laticeps* (ANGELIN), Lindström, Sv. Vet.-Akad. Handl., vol. 34, no. 8, p. 19, pl. 6, fig. 43. (Function of facial ridge discussed; fig. of anterior part of cephalon. Andrarum, Scania.)
1902. *Conocoryphe* (*Ctenocephalus*) *laticeps* (ANGELIN), Grönwall, D. G. U., II. Række, no. 13, p. 101. (Comments on species; recorded from the Andrarum limestone on Bornholm.)

[1] Bull. Soc. Geol. France, sér. 2, tome 17, 1859—1860, p. 527.

[2] Angelin originally (Pal. Svec., fasc. I) called the genus *Eryx*, but since this name proved to be preoccupied (cf. Neues Jahrb. für Min., etc., 1852, p. 242), he later amended it to *Elyx* (Pal. Scand., fasc. II, p. X). He considered the genus distinct from Conocoryphidae and placed it tentatively in "Arraphidae" (invalid).

1929. *Ctenocephalus laticeps* (ANGELIN), Strand, Norsk Geol. Tidsskr. vol. 10, p. 349. (Species recorded from the *Paradoxides rugulosus* zone in the Mjösen district of Norway.)
1937. *Ctenocephalus angelini* RESSER, Journ. Pal., vol. 11, p. 42, pl. 7, figs. 9, 10. (Cephalon described and illustrated. Andrarum limestone. Andrarum, Scania.)

Description. — Cephalon arched; outline subrectangular, in front of the glabella slightly indented, straight, or even gently convex, the indentation usually being more pronounced in young than in full-grown specimens; antero-lateral corners angulate and more or less raised, postero-lateral corners rounded. Dorsal furrows deep. Glabella of high convexity, conical, truncate in front, with two pairs of oblique well-defined lateral furrows and an anterior pair faintly indicated. Occipital furrow deep at the sides, shallow and curving forwards in the middle. Occipital ring with a stout pointed node or spine directed upwards. A prominent boss between the glabella and border, bounded to the back and sides by broad grooves, confluent with the border. Border convex, fairly narrow, tending to become thickened at the corners of the cephalon. Marginal furrow deep and fairly broad, interrupted in front of the preglabellar boss. Cheek convex, sloping to the dorsal and marginal furrows. Ocular ridges short and faint to nearly indiscernible on the test, usually better defined and longer on internal casts, almost transverse.

The ornamentation of the cephalon is dissimilar on specimens retaining the test and on internal casts. The test on the cheek is covered with close-set very fine granules — on the postero-interior part usually also reticulate — and bears in addition irregularly scattered blunt of pointed larger grains, whereas internal casts want the finer granulation and the whole of the cheek is faintly reticulate, the reticulation being somewhat better defined and the meshes larger on the area in front of the ocular ridges than behind. On the border the coarse grains are sometimes fairly numerous and sometimes sparse. In all furrows the test is smooth.

A poor idea of the thorax is obtained from a figure of a cephalon with three attached thoracic segments on a plate prepared by Angelin for a contemplated third fasciculus of Palaeontologia Scandinavica (cf. pl. 7, fig. 5; unfortunately the specimen is not to be found). The axis occupies about one-fourth of the total breadth and bears a row of median nodes, and the pleura terminate in recurved spines of moderate length.

Pygidium unknown.

Size. — The largest cephalon present is 16 mm long; cf. p. 37.

Remarks. — The cephalon illustrated by Angelin cannot be identified; the largest of his specimens found is here chosen as lectotype, pl. 7, fig. 2.

It cannot be decided for certain whether the shield illustrated is the cephalon or the cranidium. The lateral border in its exterior portion dips abruptly downwards; neither the suture nor the free cheek has been observed. It does not seem unlikely that *Elyx* may represent a form of the Conocoryphinae, in which the suture has migrated to the very margin and the free cheeks are atrophied, as is the case in *Ductina ductifrons R. & E. Richter* of the Phacopidae.

Ctenocephalus angelini RESSER (1937, p. 42), based on an imperfect cephalon from the Andrarum limestone, was stated to differ from *Elyx laticeps* "in the

more forward position of the anterior angles of the cephalon and in the consequent straightness of the front margin and quadrate shape of the cephalon (in fact the front margin is indented at the middle); in the surface markings, which consist of a rather evenly distributed set of fine granules instead of the lines of *C. laticeps*, with the coarse granules also more prominent than on any specimen of *C. laticeps* in hand". However, as mentioned above the frontal outline in *laticeps* varies in specimens of various sizes and the differences in the ornamentation claimed to exist are those found on the surface of the test and on the internal cast. The specimen illustrated by Resser is equal in size to, and as far as a comparison is possible seems to agree with our fig. 3 of a specimen retaining the test. Thus, there is no doubt but that *angelini* is synonymous with *laticeps*.

E. latilimbatus BRÖGGER, a 3.5 mm long and 9 mm broad cephalon in shale from the *Paradoxides rugulosus* zone at Krekling, Norway, differs from *laticeps* chiefly in wanting the preglabellar boss and, judging from the illustration, in some other features. Strand (1929) suggested that *latilimbatus* is probably identical with *laticeps* as the boss is "too low in this species to be expected to appear in this little specimen". On the presumption that Brögger's specimen is poorly preserved and his illustration not very good, Strand's suggestion may be true, but it should be remarked that the smallest cephalon of *laticeps* in hand, 5.0 mm long, has a quite definite preglabellar boss.

E. americanus HOWELL (1932, 1937), a member of the *Centropleura* fauna in north-western Vermont, U. S. A., is too imperfectly known for a close comparison with the genotype.

Horizon and Localities. — Zone of *Solenopleura brachymetopa* (Andrarum limestone proper and immediately underlying strata inclusive of the so-called *Hyolithes* limestone). Andrarum and Baskemölla, Scania. Fairly infrequent.

At the same horizon on Bornholm. — In the zone of *Paradoxides rugulosus* of the Mjösen district, Norway (teste Strand).

Dasometopus RESSER, 1936.

Genotype: *Harpides breviceps* ANGELIN, 1854.

It is not yet definitely decided whether the only part of the dorsal shield of *H. breviceps* hitherto known is the cephalon or the cranidium. Linnarsson (1883) suggested that the species may have narrow free cheeks like those in *Conocoryphe*, but Resser speaks of the shield as the cephalon. Linnarsson's tentative interpretation of the shield as the cranidium gains in probability by the fact that the border is not bent down at the lateral margin and that the apparently allied *Menevia* (*"Erinnys"*) *venulosa* (SALTER) (cf. p. 24) has later been proved to have free cheeks.

The generic reference of *H. breviceps* has been much discussed. Linnarsson doubted that it belongs in *Harpides* since all forms except *breviceps* included in the genus occur in the Lower Ordovician, but as he could not find sufficient

difference to distinguish it, he provisionally retained it in *Harpides*. Linnarsson recognized the resemblance between *H. breviceps* and *M. venulosa;* in one character considered to have generic significance they were stated to differ, however: the former wants an actual border and marginal furrow in front and at the sides (in reality it has an upturned border bent slightly down at the frontal margin, but no definite furrow), whereas in the latter the border and marginal furrow are well-defined throughout. Another difference mentioned by Lake is that *H. breviceps* has a concave limb surrounding the elevated tract about the glabella, while in *M. venulosa* the cranidium is rather evenly convex and slopes down to the marginal furrow. Moreover, in the former there is a broad preglabellar depression separating the fixed cheeks from each other, which is absent (or faintly indicated?) in the latter. Disregarding these dissimilarities Grönwall (1902) included *breviceps* in *Menevia* (*"Erinnys"*), which he considered a subgenus of *Conocoryphe*. On the other hand, Lake (1938) hesitated to follow Grönwall and left the generic reference of Angelin's species unsettled. Resser (1936), who placed *M. venulosa* in *Bailiella*, erected the new genus *Dasometopus* to receive breviceps; he stated it to be similar to *Holocephalina* in many respects.

Until more complete material of *breviceps* has been found, its generic reference remains somewhat questionable. No doubt it is distinct from *Harpides*. Obviously it is very difficult to believe that a genus appearing in late Middle Cambrian times should have lived into the Lower Ordovician epoch, and that without having hitherto yielded a single Upper Cambrian species, a fact which by itself may be enough to exclude *breviceps* from *Harpides*. The difference regarding the eyes — absent in *breviceps* and apparently present in *Harpides* — in itself does not prove generic distinction, but indirectly it may have some significance: if *breviceps* were a member of *Harpides*, this species rather than the succeeding ones should be expected to have eyes, since it cannot be presumed that eye-bearing forms arose form blind ones.

Even though *breviceps* in many respects is similar to *M. venulosa* and seems to present closer resemblance to this form than to any other hitherto described, the differences are rather considerable. Therefore the present writer accepts Resser's suggestion to place it in an independent genus, yet with some hesitation for the following reason. A form to be described, believed to be congeneric with *breviceps*, has a quite definite border and is thus in some measure intermediate between *Dasometopus* and *Menevia*. Unfortunately it is too imperfectly known for any safe conclusions.

Only these two species are referable to *Dasometopus;* both occur in the Andrarum limestone.

Dasometopus breviceps (ANGELIN, 1854). — Pl. 8, figs. 1a—d, 2.

1851. *Eryx laticeps* ANGELIN, partim, Pal. Svec., fasc. I, p. 4, pl. 5, fig. 3 only. (The "pygidium" is the cranidium of *D. breviceps;* cf. Grönwall, 1902, p. 97.)

1854. *Harpides breviceps* ANGELIN, Pal. Scand., fasc. II, p. 87, pl. 41, figs. 8, 8a. (Inexpressive diagnosis and figs. of cranidium. Andrarum limestone. Andrarum, Scania.)

1883. *Harpides breviceps* ANGELIN, Linnarsson, S. G. U., ser. C, no. 54, p. 27, pl. 4, figs. 16a, b (Cranidium described, discussed, and illustrated. Zone of *Ptychagnostus punctuosus*, lower part. Andrarum, Scania.)

Dimensions of the species of Conocoryphinae described.

Specimens Nos. 1, 11 and 12 are preserved in shale and more or less flattened, the remainder in limestone and apparently retain their original convexity.

		Cranidium		Glabella + occip. ring		Fixed cheek breadth
		length	breadth	length	breadth	
1. *Bailiella emarginata*	Pl. 5, fig. 2	14.3 (1)	25.2 (1.76)	10.0 (0.70)	9.0 (0.63)	8.1 mm (0.57)
2. » »	Westergård, 1936, pl. 11, fig. 2	18.5 (1)	30.5 (1.65)	13.5 (0.73)	11.7 (0.63)	9.4 (0.51)
3. » »	Pl. 5, fig. 4	19.0 (1)	31.5 (1.66)	14.0 (0.74)	12.3 (0.65)	9.6 (0.51)
4. *Bailiella fröensis*	Pl. 5, fig. 5	10.7 (1)	15.7 (1.47)	8.1 (0.76)	6.3 (0.59)	4.7 (0.43)
5. *Bailiella tenuicincta*	Pl. 5, fig. 7	8.1 (1)	14.3 (1.77)	5.7 (0.70)	4.6 (0.57)	4.9 (0.60)
6. » »	Pl. 5, fig. 8	14.3 (1)	c. 23.3 (1.63)	10.1 (0.71)	7.9 (0.55)	7.7 (0.54)
7. » »	Pl. 5, fig. 6	19.3 (1)	c. 34.8 (1.80)	13.4 (0.69)	11.8 (0.61)	11.5 (0.60)
8. *Bailiella impressa*	Pl. 5, fig. 12	7.9 (1)	10.4 (1.32)	5.3 (0.67)	4.0 (0.51)	3.2 (0.41)
9. » »	Pl. 5, fig. 11	8.2 (1)	11.8 (1.44)	5.7 (0.70)	4.0 (0.49)	3.9 (0.48)
10. » »	Pl. 5, fig. 10	13.4 (1)	18.1 (1.35)	9.2 (0.69)	7.2 (0.54)	5.4 (0.40)
11. *Bailiella aequalis*	Pl. 6, fig. 3	7.7 (1)	14.2 (1.84)	5.7 (0.74)	4.8 (0.62)	4.7 0.61
12. » »	Pl. 5, fig. 13	22.5 (1)	c. 42.0 (1.87)	16.5 (0.73)	14.5 (0.64)	13.7 (0.61)
13. *Bailiaspis dalmani*	RM. Ar. 1787 b	16.8 (1)	30.0 (1.79)	12.3 (0.73)	10.0 (0.60)	10.0 (0.60)
14. » »	Pl. 6, fig. 5	17.0 (1)	29.5 (1.74)	12.4 (0.73)	10.3 (0.61)	9.8 (0.58)
15. » »	RM. Ar. 1787 a	19.0 (1)	35.4 (1.86)	13.6 (0.72)	11.0 (0.58)	12.2 (0.64)
16. *Bailiaspis glabrata*	Pl. 6, fig. 7	13.5 (1)	21.8 (1.61)	10.0 (0.74)	7.8 (0.58)	7.0 (0.52)
17. » »	Pl. 6, fig. 8	18.0 (1)	28.2 (1.57)	12.7 (0.71)	10.0 (0.56)	9.1 (0.51)
18. *Ctenocephalus exsulans*	Pl. 6, fig. 10	10.0 (1)	17.7 (1.77)	6.7 (0.67)	5.2 (0.52)	6.2 (0.62)
19. » »	Pl. 6, fig. 9	16.3 (1)	30.5 (1.87)	10.9 (0.67)	10.1 (0.62)	10.2 (0.63)

		Cranidium		Glabella + occip. ring		Fixed cheek breadth
		length	breadth	length	breadth	
20. *Elyx laticeps*	Pl. 7, fig. 3	9.7 (0.50)	19.3 (1)	7.2 (0.37)	6.3 (0.33)	6.5 (0.34)
21. » »	Pl. 7, fig. 4	13.0 (0.55)	23.5 (1)	9.1 (0.39)	7.4 (0.31)	8.1 (0.34)
22. » »	Pl. 7, fig. 2	14.0 (0.53)	26.3 (1)	10.4 (0.40)	8.4 (0.32)	9.0 (0.34)
23. *Dasometopus breviceps*	Pl. 8, fig. 2	5.8 (1)	13.2 (2.28)	3.2 (0.55)	2.7 (0.47)	5.2 (0.90)
24. » »	Pl. 8, fig. 1	7.6 (1)	17.0 (2.24)	4.3 (0.56)	3.7 (0.49)	6.6 (0.87)

1902. *Conocoryphe* (*Erinnys*) *breviceps* (ANGELIN), Grönwall, D. G. U., II. Række, no. 13, p. 97. (Species discussed; recorded from the Andrarum limestone on Bornholm.)
1936. *Dasometopus breviceps* (ANGELIN), Resser, Smiths. Misc. Coll., vol. 95, no. 4, p. 22. (Species assigned as the type of *Dasometopus;* generic diagnosis.)

Non:

1899. *Conocoryphe* (*Erinnys*) *breviceps* (ANGELIN), Matthew, Trans. Roy. Soc. Canada, 2nd ser., vol. 5, sect. 4, no. 3, p. 91, pl. 4, fig. 9. (The species from Newfoundland belongs to *Menevia* LAKE and is probably identical with *M. venulosa.*)

Remarks. — Angelin's specimens are preserved in limestone and apparently retain their original convexity (which certainly is exaggerated in his fig. 8a). In the convexity of the shield and the concavity of the exterior limb and preglabellar depression the specimens are somewhat variable, as stated by Linnarsson, shields of proportionately higher convexity having the concave parts more strongly depressed than shields of lower convexity. The specimen illustrated by Angelin is 18.7 mm long (provided that the figure agrees with the original); so large a specimen is not to be found in his collection, nor in any other collection from the Andrarum limestone available to the writer, the average size being about half of that size. As regards the dimensions of the cranidium see above.

The material present does not supplement Linnarsson's exhaustive description which, translated into English, was quoted by Matthew (1899, pp. 91—93). The cranidium illustrated by Linnarsson was collected from a considerably lower stratum than that yielding the type and it is poorly preserved in shale with the cheeks quite flattened; it is 14 mm long and 31 mm broad. As the dissimilarities distinguishing it from the type seem to be explained by the different modes of preservation, the forms may be identical.

Horizon and Localities. — Zones of *Ptychagnostus punctuosus*, lower part, and *Solenopleura brachymetopa* (Andrarum limestone). Andrarum and Gislövshammar (boulder), Scania. Rare in the lower and fairly infrequent in the upper zone.

In the Andrarum limestone on Bornholm.

Dasometopus? incertus sp. n. — Pl. 8, figs. 3a—c.

Diagnosis. — Distinct from *D. breviceps* by having a well-defined convex border, a pair of coarse ridges running parallel to the axial line across the brim and joining the border, and cheeks of higher convexity.

Description. — Only the fragmentary specimen illustrated has been found. The cheek is swollen, sloping gently to the dorsal furrows and more strongly forwards and outwards, merging into an exterior fairly broad concave zone. The ocular ridge forms a short node at the dorsal furrow and divides outwards into two subparallel faint branches which send out forwards a network of still fainter ridges. The location of the ocular ridge a little closer to the posterior than to the anterior margin indicates that the glabella is short as in *D. breviceps*. The border is moderately broad in front and tapers slightly backwards; despite a real marginal furrow being practically wanting the border is well-defined and high throughout, even at the postero-lateral corner. The ridges between the glabella and border are about half as broad as, and equal in height to, the latter; the space between them, forming part of the concave zone, is slightly more depressed than the zone outside the ridges.

The test, so far as it is preserved on the convex part of the cheek, is ornamented with close-set very fine grains and scattered larger grains (the latter in greater numbers than in *D. breviceps*), and on the concave zone it displays faint ridges perpendicular to the border. On the exfoliated inner part of the cheek the finer as well as the coarser granulation is discernible even on the faintly reticulate surface in front of the ocular ridge. The border is covered with fairly close-set coarse grains.

Size. — The specimen is 18 mm long.

Obviously the fragment is too imperfect for a safe generic determination. As it in general aspect agrees with *Dasometopus breviceps* it is tentatively included in this genus.

Horizon and Locality. — Zone of *Solenopleura brachymetopa* (Andrarum limestone). Kiviks-Esperöd, Scania.

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It should be noted that very little of the Russian literature on the Cambrian faunas published during the last decade has been available to the writer.

Geological Survey of Sweden, July, 1949.

Explanation of Plates.

If nothing is mentioned regarding the rock, the specimen is preserved in limestone.

If no other statement is made, the specimen belongs to the Geological Survey of Sweden.

Abbreviations:

RM. = Paleozoological Department of the Swedish Museum of Natural History, Stockholm.

G.-M. I. Lund = Geological-Mineralogical Institution of the University of Lund.

4—494268. S. G. U., Ser. C. N:o 511. Westergård.

Plate 1.

Centropleura lovéni (ANGELIN). — Page 4.

Fig. 1. Cranidium of young individual, one of Angelin's specimens. — RM. No. Ar. 32354.

Fig. 2. Cranidium, impression in shale photographed in reverse light; natural size. Probably from the layer immediately underlying the Andrarum limestone and overlying the so-called *Hyolithes* limestone. Andrarum, Scania. — RM. No. Ar. 1573a.

Figs. 3a, b. Cranidium; natural size; copies from Holm & Westergård, 1930, pl. 4, figs. 24a, b.

Fig. 4. Pygidium tentatively included in this species. — RM. No. Ar. 1613.

Figs. 1, 3, and 4 from the Andrarum limestone. Andrarum, Scania.

Centropleura angelini sp. n. — Page 6.

Fig. 5. Cranidium, one of Angelin's specimens of *C. lovéni;* natural size. — RM. No. Ar. 32355.

Figs. 6, 7. Cranidium and associated segment from the posterior portion of the thorax; natural size. Fig. 6 is the holotype. — RM. No. Ar. 1617.

Figs. 8a, b. Cranidium of full-grown specimen; natural size. Andrarum limestone. Boulder at Järrestad, 5 km SW of Simrishamn, Scania. — RM. No. Ar. 32356.

Fig. 9. Part of the frontal glabellar lobe, showing the ornamentation of the test — RM. No. Ar. 1611 d.

Figs. 10a, b. Pygidium probably referable to this species, and part of it magnified to show the ornamentation of the test. — RM. No. Ar. 1614.

Figs. 5—7, 9, and 10 from the Andrarum limestone. Andrarum, Scania.

Figs. 1, 2, 5, 8a, b photographed by C. Larsson.
Figs. 3a, b, 4, 6, 7, 9—10b photographed and retouched by J. W. Englund.

1 x 2

2

a 3

b

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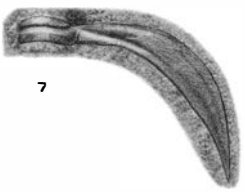
6



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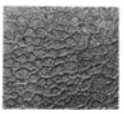
a 8

b



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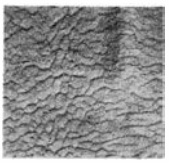


10b x 6

x 1,5 4

10a x 2

Plate 2.

Centropleura lovéni (ANGELIN). — Page 4.

Fig. 1. Parts of pygidium and the two last thoracic segments, tentatively included in this species. Natural size. Järrestad (boulder), Scania. — RM. No. Ar. 32357.

Figs. 2, 3. Two hypostomata, 2 proportionately broader than 3; belonging either to *C. lovéni* or to *C. angelini*. Andrarum, Scania. — RM. Nos. Ar. 1612 j and 1618.

Figs. 1—3 from the Andrarum limestone.

Centropleura angustata sp. n. — Page 6.

Figs. 4, 5. Cranidium with nine attached thoracic segments, and an associated defective segment from the rear part of the thorax. Natural size. Zone of *Ptychagnostus punctuosus* (?). Andrarum, Scania. — G.-M. I. Lund.

Clarella cf. *impar* (HICKS). — Page 7.

Fig. 6. Cranidium, flattened, in shale. Natural size. Zone of *Ptychagnostus punctuosus*, lower portion. Andrarum (Tullberg's loc. 10) Scania. — RM. No. Ar. 32358.

Ellipsocephalus lejostracus (ANGELIN). — Page 11.

Figs. 7a, b. Cranidium retaining the test; surface smooth, finely and closely punctate. — RM. No. Ar. 1504 c.

Fig. 8. Dorsal shield wanting the free cheeks, exfoliated; in shale. — RM. No. Ar. 32359.

Figs. 7 and 8 from the *Paradoxides paradoxissimus* beds. Äleklinta, Öland.

Figs. 9, 10. Two associated cranidia, the smaller retaining the test, which is finely and closely punctate; on the larger almost exfoliated specimen the border is faintly indicated throughout and the punctation on the parts of the test preserved is scattered. On the shore 2 km E of Borgholm, Öland.

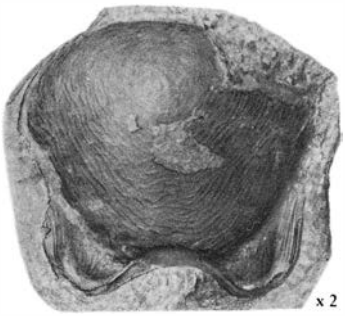
Figs. 11, 12. Cranidium, slightly flattened, and defective cranidium with part of the thorax. Two of Linnarsson's specimens, in 1875 identified (and the latter illustrated, pl. 5, fig. 6) as *E. muticus* but in 1877 distingusihed as *E. granulatus*. Vinala, Närke.

Fig. 13. Cranidium and the right-hand free cheek, showing a small remnant of the genal spine; the surface of the test is throughout smooth and finely punctate. Berg (boulder), Östergötland.

Fig. 14. Free cheek; the test is punctate and in part granulate. Another boulder at the same locality as fig. 13.

Figs. 9—14 from the zone of *Ptychagnostus* (*Triplagn.*) *gibbus*.

Figs. 1, 3b, 5, 9a—b photographed by C. Larsson.
Figs. 2, 3a, 4, 6—8, 10—14 photographed and retouched by J. W. Englund.



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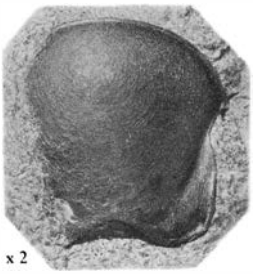

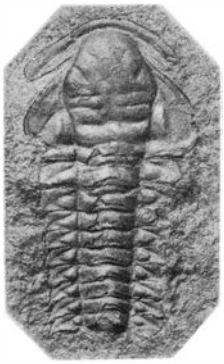

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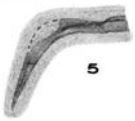

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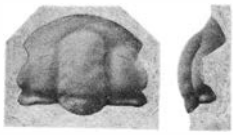
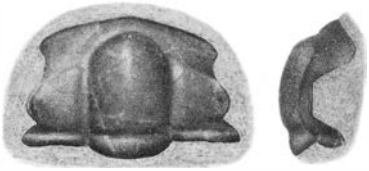
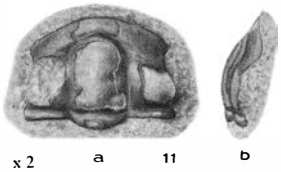
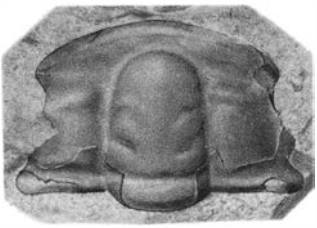
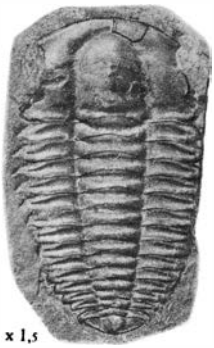
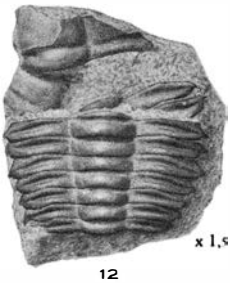












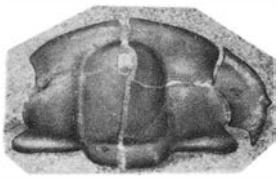


Plate 3.

Anomocare laeve (ANGELIN). — Page 14.

Fig. 1. Cranidium, artificial cast of impression in limestone. — RM. No. Ar. 32360.
Figs. 2—4. Three cranidia, fig. 3 is the lectotype. Figs 2 and 3a copies from Holm & Westergård, 1930, pl. 4, figs. 17 and 16. — RM. Nos. Ar. 1430, 1427b, and 1960a.
Figs. 5, 6. Cranidium showing the left-hand posterior limb, and free cheek.
Figs. 7, 8. Two pygidia of different sizes. — Fig. 7 RM. No. Ar. 32361.
Figs. 1—8 from the Andrarum limestone. Andrarum, Scania.

Anomocare longifrons sp. n. — Page 16.

Figs. 9, 10. Holotype cranidium and associated pygidium. Andrarum limestone. Baskemölla, Scania.

Anomocare sp. indet. — Page 17.

Fig. 11. Pygidium of young individual. Andrarum limestone. Kiviks-Esperöd, Scania.

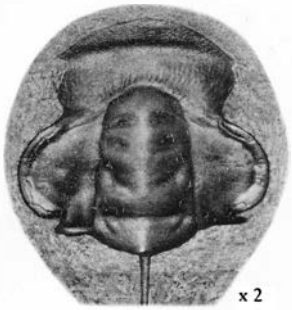
Anomocarina excavata (ANGELIN). — Page 17.

Fig. 12. New figure of a fairly complete specimen illustrated by C. Wiman, 1906, pl. 29, fig. 23. Locality unknown. — Paleont. Instit. of Uppsala.
Figs. 13, 14. Two cranidia, the latter copied from Holm & Westergård, 1930, pl. 4, fig. 19. — RM. Nos. Ar. 32362 and 1428b.
Fig. 15. Pygidium (natural size), according to the attached label the specimen illustrated by Angelin, 1851, pl. 18, fig. 3; lectotype. — RM. No. Ar. 1433.
Figs. 16, 17. Two pygidia, the former retaining the test and the latter showing the doublure. Copies from Holm & Westergård, 1930, pl. 4, figs. 20, 21.
Fig. 18. Pygidium of young individual. — RM. No. Ar. 1424.
Fig. 19. Associated hypostoma, probably this species. — RM. No. Ar. 1422 a.
Figs. 13—19 from the Andrarum limestone. Andrarum, Scania.

Anomocarina cf. *excavata* (ANGELIN). — Page 19.

Fig. 20. Pygidium of young individual. Andrarum limestone. Andrarum. Scania. — G.-M. I. Lund.

Figs. 1, 4—6, 9, 10, 12, 16a, 17, 20 photographed and retouched by J. W. Englund.
Figs. 2, 3a, 14, 15 photographed by G. Holm and retouched by G. Liljevall.
Figs. 3b, 7, 8, 11, 13, 16b, 18, 19 photographed by C. Larsson.

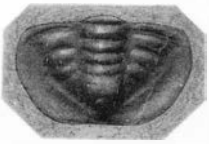

x 2
1


2


b 3 a x 2


7 x 2


5 x 3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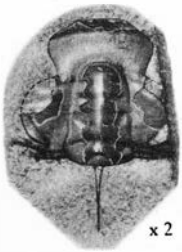

x 2
4


x 3
6

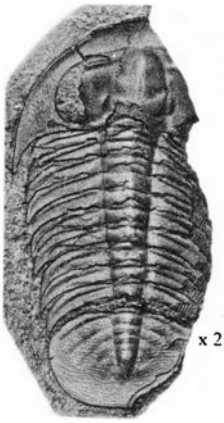

b 9 a x 2

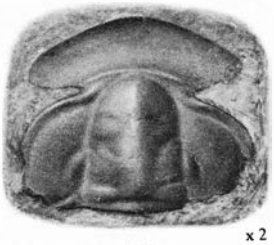

10 x 2


11 x 4


x 2 a 13


b


x 2
12


x 2
14


b 19 a x 4


b


16 a x 2


15


17 x 2


18 x 6


20 x 6

Plate 4.

Anomocarina extornata (WESTERGÅRD). — Page 19.

Fig. 1. Cranidium. — G.-M. I. Lund.
Figs. 2a, b. Cranidium, holotype. Copy from Holm & Westergård, 1930, pl. 4, fig. 22. — RM. No. Ar. 1974.
Figs. 3—5. Three pygidia. Fig. 3a copy from Holm & Westergård, 1930, pl. 4, fig. 23. — RM. Nos. Ar. 32363, 1431 b, and 32364.
Figs. 1—5 from the Andrarum limestone. Andrarum, Scania.

Anomocarioides limbatus (ANGELIN). — Page 20.

Figs. 6—8. Three cranidia, fig. 6 in natural size. — RM. Nos. 1429, 32365, and 1426.
Figs. 9—10. Two free cheeks, the former retaining the test and the latter displaying the doublure.
Figs. 11a, b. Pygidium, associated with fig. 6. — RM. No. Ar. 1429.
Figs. 12, 13. Two pygidia in natural size. The former is, according to the attached label, the original of Angelin's fig. 2 on pl. 18; lectotype. — RM. Nos. Ar. 1434 and 32380.
Figs. 14a, b. Associated hypostoma, probably this species.
Figs. 6—14 from the Andrarum limestone. Andrarum, Scania.

Figs. 1, 2a, 5, 7, 9, 10, 13, 14 photographed and retouched by J. W. Englund.
Figs. 2b, 3b, 8b, 11b photographed by C. Larsson.
Figs. 3a, 4, 6, 8a, 11a, 12 photographed by G. Holm and retouched by G. Liljevall.

1

a 2 b

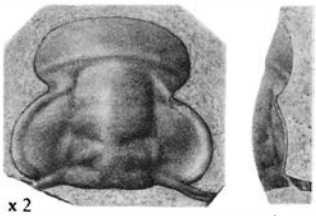
b 3 a

4

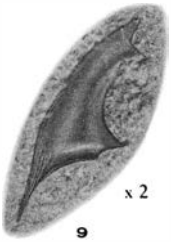
5

6

7 x 2



a 8 b



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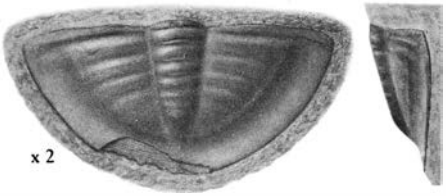


a 11 b

10

12

13

b 14 a x 2

Plate 5.

Bailiella emarginata (LINNARSSON). — Page 25.

Fig. 1. Cranidium of young individual.
Fig. 2. Crandium wanting the test and somewhat flattened, in shale; natural size. Lectotype. — RM. No. Ar. 1556 a.
Fig. 3. Almost complete specimen; copy from Westergård, 1936, pl. 11, fig. 1. — RM. No. Ar. 1557.
Fig. 4. Part of the fixed cheek of another specimen magnified to show the ornamentation of the test.
Figs. 1—4 from the *Paradoxides oelandicus* beds, zone of *P. insularis*. Stora Frö, parish of Vickelby, Öland.

Bailiella fröensis sp. n. — Page 26.

Figs. 5a—c. Imperfect cranidium, retaining the test on the right-hand fixed cheek, the ornamentation of which is seen in c. Zone of *Paradoxides insularis*. Stora Frö, Öland. — RM. No. Ar. 1558.

Bailiella tenuicincta (LINNARSSON). — Page 26.

Figs. 6a—d. New figs. of the holotype, partly exfoliated; a—c in natural size. Gislöv (on the shore 1 km S of Brantevik), Scania.
Figs. 7a, b. Cranidium retaining the test; b showing the ornamentation on the left-hand fixed cheek. Kiviks-Esperöd, Scania. — G.-M. I. Lund.
Figs. 8a, b. Imperfect cranidium, partly exfoliated. Associated with the holotype.
Figs. 6—8 from the Exsulans limestone = lower part of the zone of *Ptychagnostus* (*Triplagn.*) *gibbus*.
Fig. 9. Imperfect pygidium retaining the test except at the posterior margin of the left-hand pleural lobe; in shale. Probably this species. Zone of *Ptychagnostus* (*Triplagn.*) *gibbus*. — RM. No. Ar. 32366.

Bailiella impressa (LINNARSSON). — Page 27.

Figs. 10a—c. New figs. of the holotype; test retained. Kiviks-Esperöd, Scania.
Figs. 11a, b. Cranidium retaining the test. Gislöv (on the shore 1 km S of Brantevik), Scania.
Fig. 12. Cranidium, from the type locality.
Figs. 10—12 from the Exsulans limestone.

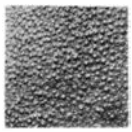
Bailiella aequalis (LINNARSSON). — Page 28.

Fig. 13. Cranidium, somewhat flattened and wanting the test, in shale; natural size. New fig. of Linnarsson's (1883) specimen 12 on pl. 14. Lectotype. Zone of *Ptychagnostus punctuosus*, lower portion. Andrarum, Scania.

Figs. 1, 2, 4—6, 7b, 9, 10 photographed by C. Larsson.
Figs. 3, 7a, 8, 11—13 photographed and retouched by J. W. Englund.

1 x 3

2



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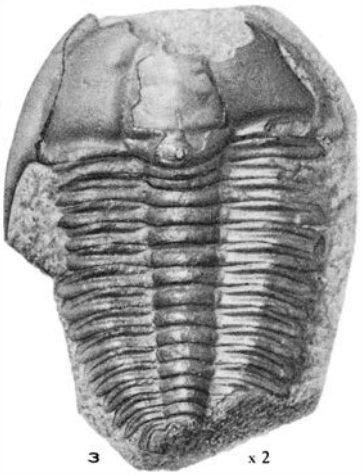

3 x 2

a x 2

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c x 6

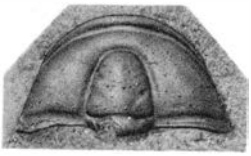
b

b

a 6

c

d x 6

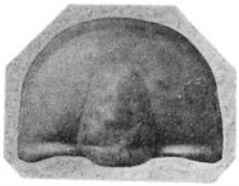


x 2 a 7

b x 6

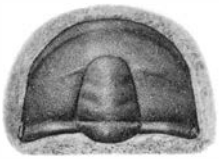
x 1,5 a 8

b



x 1,5 a

b



x 2 a 11

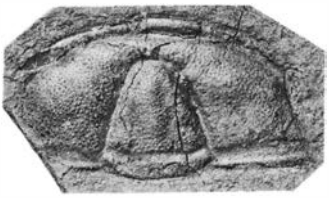
b

9 x 2

10

c

12 x 2



13

Plate 6.

Bailiella aequalis (LINNARSSON). — Page 28.

Figs. 1—3. New figures of three cranidia illustrated by Linnarsson, 1883, pl. 4 figs. 15, 13, and 14, all in shale; fig. 1 internal cast, natural size; 2 artificial cast of an external mould, with some hesitation included in this species; 3, internal cast. Zone of *Ptychagnostus punctuosus*, lower portion. Andrarum, Scania.

Bailiaspis dalmani (ANGELIN). — Page 29.

Fig. 4. Holotype cranidium re-illustrated. Locality unknown. — G.-M. I. Lund.

Figs. 5a—d. New figures of the cranidium illustrated by Linnarsson, 1879, pl. 2, figs. 26, 27; d, part of the left-hand fixed cheek showing the ornamentation. Exsulans limestone = lower part of the zone of *Ptychagnostus* (*Triplagn.*) *gibbus*. Andrarum, Scania.

Bailiaspis glabrata (ANGELIN). — Page 30.

Fig. 6. Cranidium retaining small parts of the test; natural size. Probably one of Angelin's specimens, chosen as the lectotype. — RM. No. Ar. 1893 b.

Figs. 7a—c. Cranidium. — RM. No. Ar. 1895.

Fig. 8. Cranidium. — G.-M. I. Lund.

Figs. 6—8 from the Andrarum limestone. Andrarum, Scania.

Ctenocephulus exsulans (LINNARSSON). — Page 31.

Figs. 9a—d. New figures of the holotype cranidium; d, part of the left-hand fixed cheek showing the ornamentation. Gislöv (on the shore 1 km S of Brantevik), Scania.

Fig. 10. Cranidium. Gislövshammar (boulder 5), Scania.

Figs. 9 and 10 from the Exsulans limestone = lower part of the zone of *Ptychagnostus* (*Triplagn.*) *gibbus*.

Figs. 1—3, 5a—b, 7a—b, 9a, c photographed and retouched by J. W. Englund.
Figs. 4, 5c—d, 6, 7c, 8, 9b, d, 10 photographed by C. Larsson.

1

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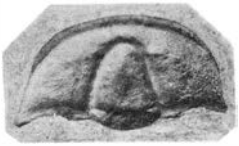
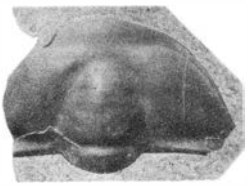


3 x 2

4 x 1,5

a x 1,5

b



6

5

c

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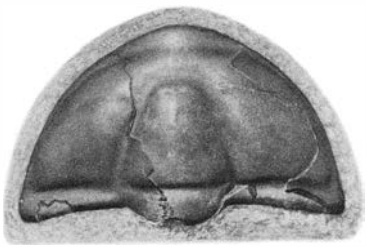

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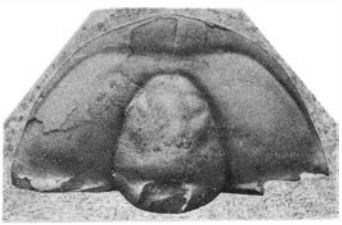

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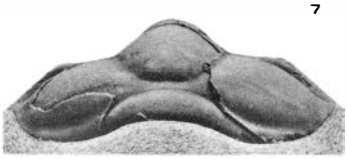
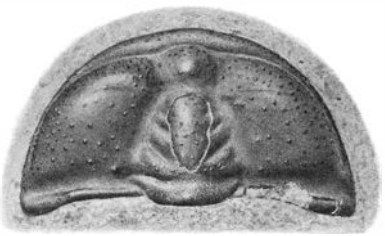


7

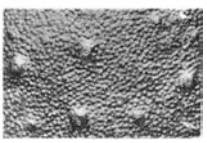
c

b

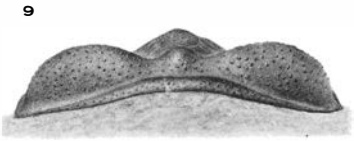


a x 1,5

10 x 2



d x 6



9

c

Plate 7.

Elyx laticeps (ANGELIN). — Pag. 32.

Fig. 1. Cranidium retaining minor parts of the test. Ocular ridges fairly well defined.

Figs. 2, 3a—d. Two cranidia of Angelin's specimens, the former wanting and the latter retaining the test. Fig. 2, which in outline and size agrees better with Angelin's illustration than does fig. 3, is chosen as the lectotype. — RM. Nos. Ar. 32367 and 32368.

Figs. 4a, b. Cranidium. The surface of the right-hand cheek retaining the test is finely granulate, that of the exfoliated left-hand cheek finely reticulate — RM. No. Ar. 32369.

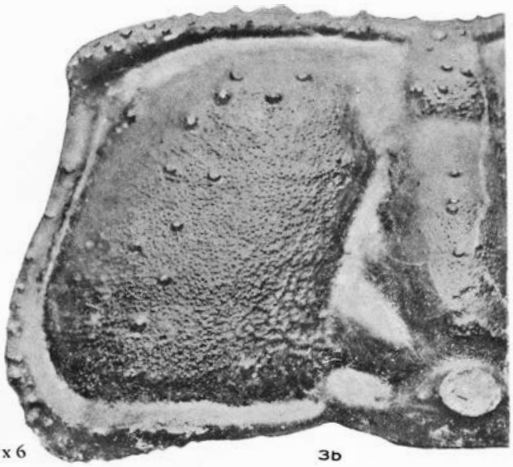
Fig. 5. Cranidium with three attached thoracic segments. Copy from a plate prepared by Angelin for a contemplated third fasciculus of Palaeontologia Scandinavica. The specimen cannot be found.

Figs. 1—4 (and 5?) from the Andrarum limestone. Andrarum, Scania.

Figs. 1 and 3a photographed and retouched by J. W. Englund.
Figs. 2, 3b—d, 4a—b photographed by C. Larsson.

1 x 3

2 x 2

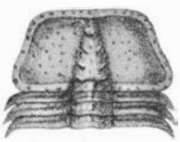


x 6 3b

3a x 2

3c

4a x 2



5

3d

4b x 6

Plate 8.

Dasometopus breviceps (ANGELIN). — Page 35.

Figs. 1a—d, 2. Two cranidia; the former is the lectotype. Andrarum limestone. Andrarum, Scania. — RM. Nos. Ar. 1913 b and 1909 g.

Dasometopus? incertus sp. n. — Page 38.

Figs. 3a—c. Fixed cheek. Andrarum limestone. Kiviks-Esperöd, Scania.

Acontheus acutangulus ANGELIN. — Page 9.

Figs. 4a—b, 5. Cephalon, lectotype, and pygidium. RM. No. Ar. 1930 c.
Figs. 6a—b. Pygidium. — RM. No. Ar. 1930 d.
Andrarum limestone. Andrarum, Scania.

Ellipsocephalus polytomus LINNARSSON. — Page 10.

Fig. 7. Complete dorsal shield. *Paradoxides oelandicus* beds. Borgholm, Öland. Copy from Westergård, 1936, pl. 11, fig. 11.

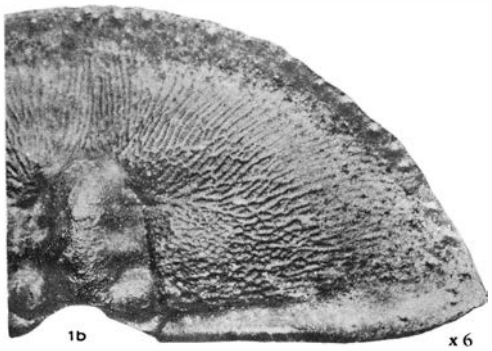
Tonkinella flabelliformis MANSUY.

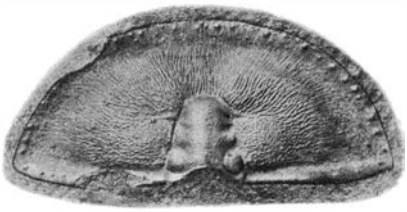
Fig. 8. Pygidium of the genotype. Middle Cambrian. Tong-King, Indo-China. Copy from Mansuy, 1916, pl. 7, fig. 10 d.

Tonkinella stephensis KOBAYASHI.

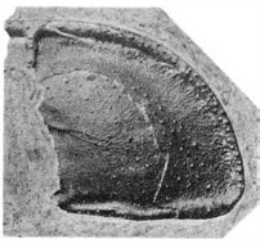
Figs. 9, 10. Cranidium and pygidium; magnified. Middle Cambrian Stephen formation. British Columbia, Canada. From photographs presented by the late Dr. C. E. Resser of Washington.
Figs. 8—10 illustrated for comparison of *Acontheus* with *Tonkinella*.

Figs. 1a, 2, 4, 5, 7 photographed and retouched by J. W. Englund.
Figs. 1b—d, 3, 6 photographed by C. Larsson.


1b x 6


1a x 3

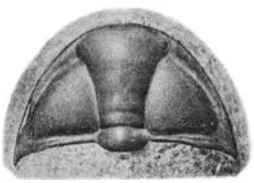

1c


3a x 1,5


3b

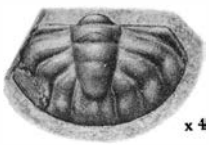

3c


1d


x 4 a 4


b

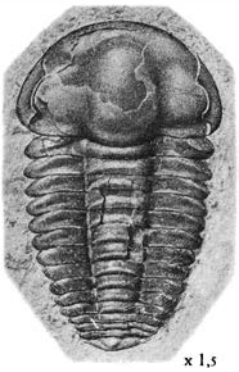

2 x 4


x 4

5


b


6 a x 4


x 1,5

7


x 5

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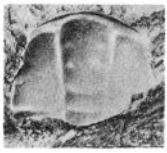
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