SVERIGES GEOLOGISKA UNDERSÖKNING

SER. C. Avhandlingar och uppsatser. N:o 526.

ÅRSBOK 46 (1952) N:o 2.

NON-AGNOSTIDEAN TRILOBITES OF THE MIDDLE CAMBRIAN OF SWEDEN

III

BY

A. H. WESTERGÅRD

WITH EIGHT PLATES

Pris 4 kronor

STOCKHOLM 1953
KUNGL. BOKTRYCKERIET. P. A. NORSTEDT & SÖNER
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A b s t r a c t. — The following genera are dealt with: *Agraulos* (inclusive of *Proampyx*), *Solenopleura*, *Parasolenopleura* nom. nov. (= *Liostracus* ANGELIN, partim), and *Grönwallia*. — The type specimen of *Paradoxides paradoxissimus* (WAHLENBERG, 1821) is illustrated.

The present paper is a continuation of Nos. 498 and 511 of this Series.

Agraulidae HOWELL, 1937.

Agraulos CORDA, 1847.

Genotype: *Arion ceticephalus* BARRANDE, 1846.

The Scandinavian forms of this group — *difformis*, *aculeatus*, and *acuminatus* — described by Angelin and originally (1851), with a note of interrogation, placed in *Proetus* but later (1854) removed into his genus *Anomocare*, were included by Barrande (1856, p. 20) in *Arionellus* (= *Agraulos*), to which most subsequent authors have agreed. The differences distinguishing them from the genotype of the latter seem to be mainly confined to their having somewhat larger eyes and the thoracic pleura (at least in *aculeatus*) terminating in very short spines instead of being rounded; furthermore, each of them has a greatly variable brim in which they seem to merge into each other. This feature induced Angelin originally to consider *aculeatus* and *acuminatus* varieties of *difformis*, an opinion which he soon abandoned but which was later revived by Brögger (1878) and Grönwall (1902). On the other hand, Frech (1897, p. 66) regarded *acuminatus*, in which the brim (not the glabella as stated by Frech) is prolonged into a cusp, as a forerunner of *Ampyx* and as the type of an independent genus, *Proampyx*. This suggestion has been accepted by some subsequent authors, e. g. Kobayashi (1935) and Lermontova (1940). However, it can hardly be doubted but that *difformis* and *acuminatus* are very closely allied, and in the present writer's opinion the greatly variable brim is an aberrant feature, which in itself should not be regarded as a generic criterion. The difference between the form of *difformis* with a triangular brim and the form of *acuminatus* with a very short cusp is rather inconsiderable and, moreover, two cranidia in hand — unfortunately not very well preserved — seem to bridge the gap. Thus, Angelin's forms under consideration should be regarded as congeneric. In this the present writer agrees with Kobayashi but, for the reasons mentioned above, he prefers to retain them in *Agraulos*.

Agraulos occurs in the Middle Cambrian in various regions in Europe, in the American basin of the Acado-Baltic province, and in Siberia inclusive of Bennett Island.

Agraulos difformis (ANGELIN, 1851). — Pl. 1, figs. 1—8.

1851. *Proetus? difformis* ANGELIN (partim), Pal. Svec., fasc. I, p. 22, pl. 18, fig. 5. (Brief diagnosis of cephalon of species including var. *aculeatus* and var. *acuminatus;* cephalon, hypothetical thorax, and pygidium illustrated, the latter of which belongs to *Grönwallia* ("*Liostracus*") *microphthalma.* Andrarum limestone. Andrarum, Scania.)

1854. *Anomocare difforme* (ANGELIN) (partim), Pal. Scand., fasc. II, p. 25, pl. 18, fig. 5. (Amended diagnosis.)

1878. *Arionellus difformis* (ANGELIN) sensu stricto, Brögger, Nyt Mag. Naturv., vol. 24, pt. 1, p. 58 (42), pl. 3, fig. 16. (Species discussed; cranidium of a young individual illustrated. *Paradoxides forchhammeri* beds. Krekling, Norway.)

1902. *Agraulos difformis* (ANGELIN), Grönwall, D. G. U., II. Række, no. 13, p. 161. (Remarks on species from the Andrarum limestone on Bornholm.)

Description. — Only the cranidium is known for certain. It is moderately arched; dorsal furrows shallow, particularly on specimens retaining the test. Glabella subrectangular, slightly narrower in front than at the rear, tending to become keeled. Three pairs of glabellar furrows faintly marked to imperceptible on the test, fairly distinct on internal casts. Occipital furrow shallow, sometimes effaced at the axial line, straight or curving slightly forwards in the middle. Occipital ring widened to the axial line, bearing a small median node. Brim gently arched, varying in length and outline — semicircular, parabolic, or subtriangular — usually showing a transverse shallow groove touching, or slightly distant from, the glabella and almost straight or curving gently backward in the middle. Fixed cheek in a section across the palpebral lobes about three-fourths as broad as the glabella. Palpebral lobes fairly large, in middle-sized and full-grown specimens about half as long as the glabella. Ocular ridges almost imperceptible on the test, distinct though faint on internal casts, oblique. Posterior limb about three-fourths as wide as the occipital ring. Anterior branches of the facial suture diverging from the eyes, then curving forwards and inwards; posterior branches fairly straight, running backwards—outwards. Free cheek probably belonging to this form narrow, terminating in a stout genal spine. — Test fairly thick, closely punctate, the punctiform impressions being sometimes almost discernible to the naked eye and sometimes visible only at a high magnification; internal cast smooth or very faintly shagreened.

Size. — One of the largest cranidia found is 19 mm long and 21 mm broad across the palpebral lobes.

Remarks. — With respect to the variability of the brim three main forms can be distinguished: the one has a relatively short brim, about half as long as the glabella, and a nearly semicircular outline; the two others have a longer brim, but slightly shorter than the glabella, and the outline is either parabolic (pl. 1, fig. 6) or triangular (fig. 8). As all three merge into each other by intermediate links and occur associated they are beyond doubt conspecific. The one with a short brim evenly rounded in front predominates at the type locality and agrees with Angelin's figure of *difformis;* it is selected as lectotype (fig. 4).

Horizon and Localities. — Zone of *Solenopleura brachymetopa* (Andrarum limestone and the underlying so-called *Hyolithes* limestone). —

Scania: Andrarum (type locality); Kiviks-Esperöd; Gislövshammar (boring); S. Sandby (boring). — Västergötland: Råbäck, Kinnekulle. — Jämtland: Brunflo. — Common in Scania.

Bornholm. — Various districts in Norway.

Agraulos aculeatus (ANGELIN, 1851). — Pl. 1, figs. 9—10.

1851. *Proetus? difformis* var. *aculeatus* ANGELIN, Pal. Svec., fasc. I, p. 22, pl. 18, fig. 6. (Cranidium illustrated. Andrarum limestone. Andrarum, Scania.)
1854. *Anomocare aculeatum* (ANGELIN), Pal. Scand., fasc. II, p. 26, pl. 18, fig. 6. (Brief diagnosis of cranidium.)
1878. *Arionellus difformis* var. *aculeata* (ANGELIN), Brögger, Nyt Mag. Naturv., vol. 24, p. 58 (42), pl. 4, figs. 1—6 (7, 8?). (Species discussed and figs. of almost complete specimens. Zones of *Paradoxides rugulosus* and *P. forchhammeri*. Krekling, Norway.)
1902. *Agraulos difformis* var. *aculeata* (ANGELIN), Grönwall, D. G. U., II. Række, no. 13, p. 161. (Remarks on species from the Andrarum limestone on Bornholm.)

Remarks. — This form is clearly distinct from *A. difformis* by having a stout and long occipital spine instead of a faint node; otherwise it agrees with the latter in the cranidium. Most specimens from the type locality have a relatively long parabolic or subtriangular brim and specimens with a short brim and evenly curved outline are rare; thus, in the shape of the brim *aculeatus* varies in the same manner as does *difformis*. Internal casts have four pairs of glabellar furrows, the anterior pair being very short and faint. The state of preservation of the tests of the specimens in hand is so poor that it has not been possible to corroborate Angelin's statement that the test is punctate (porous) as in *difformis*. In exfoliated specimens the surface is sometimes very faintly punctate.

The lectotype (fig. 10) is 14 mm long exclusive of the occipital spine, and 13 mm broad across the palpebral lobes; the largest specimen measures 26 mm across the palpebral lobes.

Having studied a large Norwegian material, Brögger materially supplemented our knowledge of this species, which appears earlier at Krekling — in the upper part of the *Paradoxides rugulosus* zone — than at Andrarum. The form predominant in the lower zone has a short brim with an evenly curved outline (Brögger's figs. 3 and 5), while that from the upper zone has a longer parabolic brim (figs. 1 and 4). The genal spine is stated to be comparatively short and straight in the former, longer and curving slightly inwards in the latter form. In large specimens the thorax has 12 or 13 segments, the pleura terminating in very short spines, and the axial rings of the middle segments at least bearing long spines. The pygidium is small with two segments in the axis.

Horizon and Localities. — As far as known this form is in Sweden confined to the zone of *Solenopleura brachymetopa* (Andrarum limestone and the so-called *Hyolithes* limestone). — Scania: Andrarum (type locality); Gislövshammar (boulder). — Öland: Degerhamn. — Västergötland: Munkesten, at Hunneberg; Hällekis, at Kinnekulle. — Jämtland: Siljeåsen. — Ångermanland: Aborrfallet. — Infrequent at the type locality.

Bornholm. — Krekling, Norway.

Agraulos acuminatus (ANGELIN, 1851). — Pl. 1, figs. 11—15.

1851. *Proetus? difformis* var. *acuminatus* ANGELIN, Pal. Svec., fasc. I, p. 22, pl. 18, fig. 7. (Cranidium illustrated. Andrarum limestone. Andrarum, Scania.)
1854. *Anomocare acuminatum* (ANGELIN), Pal. Scand., fasc. II, p. 26, pl. 18, fig. 7. (Brief diagnosis of cranidium.)
1897. *Proampyx acuminatus* (ANG.), Frech, Leth. geogn., 1, Leth. palaeoz., vol. 2, pt. 1, p. 66. (Species selected as the type of an independent genus.)
1902. *Agraulos difformis* var. *acuminata* (ANG.), Grönwall, D. G. U., II. Række, no. 13, p. 161. (Comments on species from the Andrarum limestone on Bornholm.)

Remarks. — Only the cranidium is known. The brim is prolonged into a coarse cusp of variable length and, accordingly, the lateral outlines of the anterior portion of the cranidium are concave. In a side view the brim inclusive of the cusp is usually horizontal, sometimes curving slightly upwards. No specimen in hand definitely referable to this species has the cusp markedly longer than seen in the lectotype (fig. 13); the termination of the cusp is more or less blunt. Otherwise the species, so far as it is known, agrees with *A. difformis;* thus, the occipital ring bears a small node and the test is punctate. The largest specimen unhesitatingly identifiable as *acuminatus* is 16 mm long inclusive of the cusp, and 14 mm broad across the palpebral lobes.

The reasons for retaining *acuminatus* in *Agraulos* are stated above (p. 3).

Horizon and Localities. — Zone of *Solenopleura brachymetopa* (Andrarum limestone). — Scania: Andrarum (type locality); Kiviks-Esperöd; Baskemölla; Gislövshammar (boring). — Västergötland: Hällekis, at Kinnekulle. — Jämtland: Fånån. — Ångermanland: Aborrfallet. — Fairly common in Scania.

Bornholm. — Krekling, Norway. — An imperfect cranidium from Bennett Island may belong to this or an allied form (Holm & Westergaard, 1930) and a similar form is known also from the Siberian mainland (Lermontova, 1940).

Agraulos anceps sp. n. — Pl. 2, figs. 1—3.

1930. *Agraulos acuminatus* (ANGELIN), Holm & Westergaard, Mém. Acad. Sci. URSS, sér. 8, cl. phys.-mat., vol. 21, no. 8, pl. 4, fig. 15. (Cranidium illustrated. Andrarum limestone, Scania.)

Diagnosis. — Brim prolonged into a long cusp, in its distal portion slender and curving upwards; occipital ring bearing a stout spine; test (under the microscope) smooth and apparently compact.

Only the cranidium is known. The form has earlier been identified as *acuminatus* though it is clearly distinct by having a strong occipital spine instead of a faint node, smooth instead of punctate test, and, probably, a longer and more slender frontal cusp. Otherwise *anceps* seems to agree with the preceding forms; it attains about the same size as does *aculeatus*. Pending additional and more complete material, it is provisionally placed in *Agraulos*.

Associated with the three preceding species at Andrarum, Scania; fairly infrequent. A defective cranidium from Aborrfallet, Ångermanland, probably belongs to this species.

Solenopleuridae ANGELIN, 1854.

Synonym: Liostracidae ANGELIN, 1854, partim.

Solenopleura ANGELIN, 1854.

Genotype: *Calymene canaliculata* ANGELIN, 1851[1], (selected by S. A. Miller, 1889).

Unfortunately Miller's selection of type has been overlooked by subsequent authors, who, following Vogdes, 1890, regard *S. holometopa* as the type. These species are distinct in several features, the differences being mainly as follows: compared with *holometopa*, *canaliculata* has the axial lobe of the dorsal shield pronouncedly narrower than the pleural lobes; the glabella is shorter and its furrows are well impressed; in front of the glabella the brim is slightly depressed and flat, the border is widened backwards, and, accordingly, the marginal furrow makes a backward curve; the palpebral lobes are somewhat smaller and the ocular ridges are stronger and more transverse; the pygidium is larger with seven axial segments and five pairs of pleural ribs.

At first sight the dissimilarities enumerated seem to indicate that the forms should be regarded as generically distinct, an opinion voiced by Whitehouse (1939, p. 213). This author erected the new genus *Asthenopsis* (whose type is *A. levior* from the Australian *Papyriaspis* stage, approximately contemporaneous with the European zone of *Paradoxides davidis*) to receive those forms hitherto included in *Solenopleura* which differ from *S. holometopa* in having "a small, conical glabella, wider fixed cheeks and prominent preglabellar field". Among European species referable to *Asthenopsis* were recorded *S. brachymetopa*, *S. canaliculata*, and the British *S. applanata* (SALTER). However, the length of the glabella is a variable character, and specimens of *brachymetopa* and *canaliculata* exist in which the glabella is proportionately subequal in length to, or even slightly longer than, the glabella in occasional specimens of forms which, in general aspect, are more similar to *S. holometopa*, e. g. *S. bucculenta* (pl. 3, fig. 3), nor is the brim shorter in the latter than in the two former. The glabella in the species included by Whitehouse in *Asthenopsis* is not more conical than in several species around *holometopa* and its breadth in relation to the breadth of the fixed cheeks is variable and in itself a poor generic criterion in this as well as in several other groups of trilobites.

Other differences were not discussed by Whitehouse and no statement was made regarding the convexity of the dorsal shield of *A. levior* (except that the fixed cheeks are inflated and the thoracic pleura are markedly geniculate). Judging from the illustrations, the Australian form seems to be fairly flat. If this is true, it is in this feature distinct from *Solenopleura* (*canaliculata* as well as *holometopa*), the dorsal shield of which is highly convex and strongly arched down in front.

[1] Professor Chr. Poulsen of Copenhagen has courteously called the present writer's attention to Miller's selection of genotype.

Of the dissimilarities between *canaliculata* and *holometopa* mentioned above the backward expansion of the border in front of the glabella seems to be a rare feature in *Solenopleura* (in *A. levior* the border is of uniform thickness). In at least one other form, *S. spissa* HOWELL (1937) (though known for certain only from the cranidium probably a true *Solenopleura*) it is quite definite. This form differs from *canaliculata*, however, in its longer glabella extending to the marginal furrow, in which respect it agrees better with *holometopa*. Thus, the widened border — in Conocoryphidae believed to indicate generic significance (*Bailiaspis* RESSER) — seems to be of little taxonomic value in *Solenopleura*.

From what has been said above it may be gathered that the two genera in which Whitehouse proposed to break up *Solenopleura*, merge into each other in such a manner that they should be considered congeneric, though, possibly, the forms displaying a closer resemblance to *holometopa* than to *canaliculata* may be placed in a subgenus under *Solenopleura*. Not having had an opportunity to examine specimens of the genotype of *Asthenopsis*, it is difficult for the present writer to form a safe opinion of its taxonomic position; it seems to represent an independent genus in close proximity to *Ptychoparia* and *Solenopleura*.

The very close resemblance of *Solenopleura* to the genera *Ptychoparia* CORDA and *Liostracus* ANGELIN (i. e. *L. aculeatus;* cf. p. 21) was early recognized and later discussed at considerable length by Lake (1931) and Thoral (1948), who also reviewed older opinions on this subject. Additional material from Sweden, increasing our knowledge of earlier known species or belonging to hitherto undescribed forms, enables the present writer to contribute to the solving of the problem. In particular two forms of *Solenopleura* are of interest in this connection. Thus, *S. holometopa humilis*, to be described below, is of moderate convexity and has very shallow, scarcely impressed, dorsal furrows; and the free cheek of *S. munsteri* STRAND, hitherto unknown, has a strong genal spine the outer margin of which is a direct continuation of the outer margin of the cheek, as in *Ptychoparia*. Except in the features mentioned, the former agrees so well with *S. holometopa* that it is awarded but subspecific rank; the cranidium of the latter is definitely of *Solenopleura* type and it is thus excluded from *Ptychoparia;* the great variability of the genal angles in *Solenopleura* indicates, too, that this character, at any rate in this group, is of very little taxonomic significance.[1] If the generic reference of these forms is accepted, a revision of some details of the generic diagnosis of *Solenopleura* is necessary.

The dissimilarities between *Solenopleura* and *Ptychoparia*[2] are not very conspicuous. In *Solenopleura* the cranidium is strongly arched down in front, in *Ptychoparia* it is flatter and scarcely arched down in front; in the former the glabellar furrows are very weak to moderately incised, in the latter they are

[1] In the present writer's opinion it is not reasonable to exclude e. g. *Ellipsocepholus germari* BARR. and *Asaphus platyurus* ANG. from the genera in which they were originally placed, only because they bear genal spines.

[2] *Ptychoparia* is poorly represented in Scandinavia, only two species, *P. johnstrupi* GRÖNWALL (1902) and *P. anderseni* HENNINGSMOEN (1952), being hitherto described.

strong. In both genera the anterior branches of the facial suture in reality have the same course, being, between the eyes and border, almost straight and about perpendicular to the margin, then curving abruptly inwards and cutting the border very obliquely; nevertheless, on a dorsal view of specimens retaining their original convexity the course is ostensibly distinct due to the differences in the arching down of the cranidium in front, in *Solenopleura* the branches being subparallel to the axial line or convergent, in *Ptychoparia* divergent. In *Solenopleura* the genal angles are strongly variable: angulate or rounded and with or without a short genal spine usually making an angle with the margin of the cheek, rarely strong and continuous with the margin; in *Ptychoparia* the genal angles are of the last-mentioned type. In *Solenopleura* the terminations of the pleura are rounded, at least in the anterior and middle thoracic segments, in *Ptychoparia* they are pointed. In the pygidium no safe differences exist; usually it is smaller in *Solenopleura* than in *Ptychoparia*, in the genotypes the pygidia are subequal in size, however, the number of segments in the axis being six or seven in *S. canaliculata* and six to eight in *P. striata*.

Lake considered the most important differences to be those in the genal angles and the pleural terminations; the former are of little value, however, since the free cheek of *S. munsteri* has proved to be of *Ptychoparia* type. The dissimilarities in the arching down of the cranidium in front and in the glabellar furrows seem to be more useful, though they may be more or less veiled in flattened specimens.

The dissimilarities between *Solenopleura* and *Liostracus* (as represented by *L. aculeatus*) are even less significant than those distinguishing the former from *Ptychoparia*.

Broadly speaking, the cephalon is more convex, the cranidium is more strongly arched down in front, the dorsal furrows are deeper, and, accordingly, the glabella is more strongly sunk between the cheeks, and the latter are more inflated in *Solenopleura* than in *Liostracus*. However, since forms congeneric with *L. aculeatus* exist which in these features agree fairly well with some forms of *Solenopleura*, none of the differences mentioned in itself is of decisive taxonomic value. Thus, Lake's statements that in *Liostracus* the glabella is not sunk between the cheeks and the latter not at all inflated but slope down from the glabella to the marginal furrow — which "is, perhaps, the most conspicuous difference of all" (p. 145) — apply to *S. holometopa humilis* as well as to some forms of *Liostracus*, but not very well to *L. aculeatus*, in which the glabella is slightly sunk between the faintly inflated cheeks. In *Solenopleura* the marginal furrow is deep, in *Liostracus* it is shallow, in the former the border is well convex, in the latter fairly flat, particularly in the free cheeks, and in *L. aculeatus* it is upturned in front of the glabella. The genal angles show the same tendency to variation in both genera except that in no form of *Liostracus* known is the genal spine continuous with the margin of the cheek. In the thorax no safe dissimilarities seem to exist; the number of segments, which varies somewhat in both groups, normally seems to be fourteen in *Solenopleura*, and this is the number in *L. aculeatus* too. In the pygidium there appears to be a slight dif-

ference, the interpleural grooves on the lateral lobes being less pronounced in *Solenopleura* than in *Liostracus*.

In *Solenopleura* the test is usually distinctly granulate, in *Liostracus* it is apparently smooth. In the former genus the grains are usually of various sizes, the larger ones scattered and visible to the naked eye and the smaller ones close-set and discernible only under a lens, but forms occur, e. g. *S. brachymetopa alutacea*, in which the granulation is imperceptible without magnification. In *Liostracus* the cephalon is sometimes smooth even under the microscope, but in all the congeneric species treated in the present paper of which thorax and pygidium are known, these parts of the shield prove to be granulate at a more or less strong magnification.

From the above statements it will appear that the dissimilarities between *Solenopleura* and *Liostracus* are fairly inconspicuous, as was emphasized also by Lake and Thoral and, evidently, the generic reference of several imperfectly known forms must be uncertain. Thoral (1948, p. 68) schematically defined *Liostracus* thus: "un *Solenopleura* à limbe plat, joues peu convexes et test lisse", which, broadly speaking, is correct but can scarcely be said to have general validity. In fact, the groups merge into each other in such a manner that it may even be questioned whether they should be considered generically distinct. At any rate, if *L. aculeatus* is maintained as the type of an independent genus, it is necessary, for reasons stated below, to give it a new generic name, here proposed to be *Parasolenopleura* (cf. p. 21).

Generic diagnosis of *Solenopleura*. — Dorsal shield ovate, of high convexity.

Cephalon about semicircular, strongly arched down in front. Glabella somewhat conical, fairly short, rarely extending to the border, with very weak to moderately incised furrows. Dorsal furrows usually deep, sometimes shallow. Occipital ring well-defined, bearing a faint to prominent node. Brim in the axial region usually gently convex, sometimes slightly depressed and flat. Marginal furrow definite; border convex. Cheeks more or less inflated. Palpebral lobes rather small, central or slightly approximated to the posterior margin; ocular ridges obsolete to definite. Anterior branches of the facial suture between the eyes and marginal furrow practically straight and about perpendicular to the margin, then curving forwards—inwards and cutting the border very obliquely (in a dorsal view of specimens retaining their original convexity subparallel to the axial line or converging); posterior branches gently sigmoid, cutting the posterior margin at a short distance within the genal angles. Genal angles rounded or quite angulate, with or without genal spines, which usually are short and make an angle with the outline of the cheek, exceptionally stout and continuous with the outline.

Thorax of 14 segments (in some species); pleura deeply furrowed, strongly geniculate, with rounded extremities at least in the anterior and middle segments.

Pygidium of variable size, with three to seven segments in the axis and one to five well-defined ribs on the pleural lobes, wanting a definite border.

Test granulate, usually with scattered larger grains visible to the naked eye and close-set very small grains discernible only at some magnification.

Solenopleura s. str. seems to be confined to the Middle Cambrian; in Scandinavia it appears in the zone of *Ptychagnostus* (*Triplagn.*) *gibbus* and ranges into the zone of *Solenopleura brachymetopa*, in which it attains its acme. Members of the genus are known from Europe, the American basin of the Acado-Baltic province, Siberia (and, possibly, Novaya Zemlya, NW Greenland, and N Newfoundland).

Solenopleura munsteri STRAND, 1929. — Pl. 2, figs. 6—10.

1879. *Solenopleura parva*(?) LINNARSSON, S. G. U., ser. C, no. 35, p. 15, pl. 1, fig. 20. (Only the pygidium.)

1929. *Solenopleura munsteri* STRAND, Norsk Geol. Tidsskr., vol. 10, p. 352, pl. 2, figs. 12, 13, 14?, 15—18. (Cranidium and pygidium described and illustrated. Zone of *Ctenocephalus exsulans* and immediately overlying strata. Mjösen and Oslo districts, Norway).

Description. — Cranidium highly convex, ratio of length of breadth about 1 : 1.5. Glabella broad, with gently convex sides, moderately tapering, rounded in front, sunk between and rising above the cheeks; three pairs of lateral furrows, the posterior pair well-defined, curving backwards, and extending almost to the occipital furrow, the anterior pair faint, short, nearly transverse. Dorsal furrows deep, fairly narrow. Occipital furrow pronounced, curving slightly forwards in the middle. Occipital ring somewhat expanded in the middle, with a small prominent node (damaged in the specimen fig. 6). Brim in front of the glabella slightly depressed, gently arched or nearly flat, at the axial line subequal in length to the border. Border thick, convex. Marginal furrow shallow in the middle, impressed at the sides. Fixed cheeks in a section across the palpebral lobes convex, a little more than half as broad as the glabella. Palpebral lobes of normal size for the genus, somewhat upturned, situated at subequal distance from the anterior and posterior margins of the cephalon. Ocular ridges faint (on specimens retaining the test). Posterior limb about four-fifths as wide as the occipital ring. Anterior branches of the facial suture between the eyes and marginal furrow almost straight and perpendicular to the margin, in a dorsal view of specimens retaining their original convexity subparallel to the axial line; posterior branches curving outwards—backwards, slightly sigmoid, cutting the posterior margin a short distance within the genal spine. Free cheek fairly arched, with a well-defined marginal furrow; ocular platform twice as broad as the convex border; genal angle prolonged into a stout spine whose outer margin is continuous with the margin of the cheek, about half as long as the cheek proper.

Thorax unknown.

Pygidium arched, somewhat less than twice as broad as long, with strongly curved anterior margin. Axis prominent, tapering, with five segments, terminating in a broad and low ridge abruptly sloping to the margin. Pleural lobes with three pairs of ribs not extending quite to the margin; interpleural grooves well-defined on the first pair of ribs. No definite border.

Test granulate, with scattered larger grains and close-set smaller grains (the latter visible under a low-power lens). The pygidium wants the larger grains.

S i z e. — The largest cranidium in hand is 18 mm long (the largest cranidium recorded by Strand is 4 mm longer).

R e m a r k s. — The above description is founded on two cranidia, two free cheeks, and one pygidium, all retaining the test and their original convexity, collected from a thin stratum of a greenish-gray glauconitic impure limestone at Oltorp, Västergötland, yielding no other form to which the free cheek and pygidium might be referable.

Thanks to the courtesy of Dr. Strand and Dr. Henningsmoen the present writer has had the opportunity of examining the specimens of *S. munsteri* illustrated by the former author. According to the original description the eyes are approximated to the posterior margin of the cranidium. However, as far as can be concluded from the defective specimens, the lobes seem to be placed about in the middle of the cheeks as in the Swedish form, which also in other features agrees so well with the holotype that it is identified with Strand's species.

S. munsteri is the only form with the free cheek of *Ptychoparia* type known to the present writer which may be referable to *Solenopleura* (cf. p. 8).

The pygidium (fig. 8) associated with the cranidium (fig. 6) is like the pygidium by Strand tentativily included in *munsteri* except in the number of segments in the axis — five in the former and six in the latter — a difference which in itself is of little significance. It is not distinguishable from the pygidium which Linnarsson with some hesitation referred to *S. parva* but which apparently belongs to *munsteri*.

S. munsteri seems to be most closely allied to *S. parva* (with which it is associated in the Scanian Exsulans limestone). In the cranidium no very significant dissimilarities exist. The differences in the free cheek are conspicuous, however, the cheek of the former being proportionately broader and the genal spine stouter and continuous instead of making an angle with the margin. Furthermore, *munsteri* attains a size twice as large as *parva*.

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 in Scania). — Scania: Brantevik; Gislövshammar (boulder). — Västergötland: Oltorp, 18 km E of Falköping; Byklev (lowest stinkstone bed), at Hunneberg. — Östergötland: Tornby (boring); Berg (boulder). — Infrequent in Sweden.

Mjösen and Oslo districts of Norway.

Solenopleura parva LINNARSSON, 1879. — Pl. 2, figs 11—13.

1879. *Solenopleura parva* LINNARSSON, S. G. U., ser. C, no. 35, p. 14, pl. 1, figs 16—19. Cranidium described and illustrated; the pygidium, fig. 20, tentatively included in this species, belongs to *S. munsteri*. Exsulans limestone. Gislöv (= on the shore 1 km S of Brantevik) and other localities in Scania.)

1902. *Solenopleura parva* LINNARSSON, Grönwall, D. G. U., II. Række, no. 13, p. 151. (Remarks on species from Bornholm; no illustration.)

1929. *Solenopleura parva* LINNARSSON, Strand, Norsk Geol. Tidsskr., vol. 10, p. 353, pl. 2, fig. 21. (Remarks on species, cranidium illustrated. Mjösen and Oslo districts.)

Description. — Cranidium highly arched, length about two-thirds of the breadth. Glabella somewhat tapering, evenly rounded in front, slightly sunk between and rising above the cheeks; glabellar furrows three pairs, faint, sometimes marked only as smooth interruptions in the ornamentation of the test. Dorsal furrows well impressed throughout, rarely deepening into a faint pit at the axial line. Occipital furrow well impressed, narrow, straight; occipital ring, more or less expanded in the middle, with a faint node usually visible also on internal casts. Brim in front of the glabella gently arched, at the axial line slightly depressed and subequal in length to or shorter than the border. Border fairly thick, convex. Marginal furrow definite throughout. Fixed cheeks inflated, in a section across the palpebral lobes about two-thirds as broad as the glabella. Palpebral lobes of normal size for the genus, upturned, inconsiderably approximated to the posterior margin; palpebral furrow definite. Ocular ridges imperceptible or weak, on internal casts sometimes quite definite. Posterior limb about three-fourths as wide as the occipital ring. Facial suture of the type characteristic of the genus, but the anterior branches directed slightly more forwards than is usually the case. — Free cheek narrow, moderately arched, with a convex border almost as broad as the ocular platform and a broad marginal furrow; genal spine coarse and short, forming a blunt angle with the lateral margin of the cheek.

Thorax and pygidium unknown.

Test with close-set very fine granules invisible to the naked eye and scattered somewhat larger grains, the latter of varying frequency, sometimes almost wanting.

Size. — A small form, the cranidium rarely attaining 12 mm in length; the holotype, fig. 11, is 6.6 mm long and 9.2 mm broad.

Remarks. — The size of the pygidium alone, which Linnarsson[1] tentatively referred to *S. parva*, is against its reference to this species; it agrees with the pygidium of the associated *S. munsteri*. Probably the pygidium of *parva* is very small, which may explain why it has been overlooked despite the cranidium being common.

S. parva displays close resemblance to *S. munsteri*, q.v.

Horizon and Localities. — Zone of *Ptychagnostus* (*Triplagn.*) *gibbus* (Exsulans limestone). — Scania: Gislövshammar (boring); Brantevik (type locality); Kiviks-Esperöd; Andrarum; S. Sandby. — Öland: on the shore 4.5 km S of Mörbylånga. — Jämtland: Prästnäset, NW of Sunne church; Vedjeön (boulder). — Common in the Exsulans limestone in Scania.

Bornholm. — Oslo and Mjösen districts of Norway.

Solenopleura bucculenta GRÖNWALL, 1902. — Pl. 3, figs 1—3.

1902. *Solenopleura bucculenta* GRÖNWALL, D. G. U., II Række, no. 13, p. 152, pl. 4, fig. 18. (Cranidium described and illustrated. Zones of *Paradoxides davidis* and *P. forchhammeri*. Bornholm.)

[1] Linnarsson's figure of the pygidium is not very good: the specimen proves that the third axial ring is shorter than the second and the terminal portion of the axis is longer than the third ring. A very faint transverse furrow on the terminal portion indicates five segments in the axis.

Description. — Only the cranidium is known for certain. It is greatly convex, ratio of length and breadth about 1 : 1.3 (in specimens apparently retaining their original convexity). Glabella comparatively short, half as long as the cranidium or inconsiderably longer, deeply sunk between and rising above the cheeks, gently constricted at the rear, slightly tapering, rounded in front. Two or three pairs of oblique lateral furrows, the posterior pair distinct, the anterior pairs faint to almost imperceptible even on internal casts. Dorsal furrows deep and broad at the sides, shallower and narrower in front of the glabella, at the axial line deepening into a pit usually visible on the test and distinct on internal casts. Occipital furrow well-defined, curving slightly forwards in the middle; occipital ring expanded in the middle, bearing a prominent blunt node. Brim in front of the glabella gently convex, at the axial line subequal in length to the border or somewhat longer. Border thick, highly convex; marginal furrow well-defined. Fixed cheeks strongly inflated, in a section across the palpebral lobes about three-fourths as broad as the glabella. Palpebral lobes of moderate size, upturned; palpebral furrow well impressed. Ocular ridges imperceptible on the test, rarely indicated on internal casts. Posterior limb subequal in width to the occipital ring, sloping gently to the dorsal furrow and almost vertically in its extremity. Facial suture running as in *S. holometopa*.

Test granulate, with the granules in various specimens somewhat varying in size and frequency, usually visible also on internal casts; under the microscope the space between them is very finely granulate or shagreened; the bottom of the furrows is smooth.

Size. — The largest cranidium in hand is 11.5 mm long (a specimen recorded by Grönwall from Bornholm is 2 mm longer).

Remarks and Affinities. — The above description is founded on 18 cranidia from Andrarum and Gislöv.

S. bucculenta has deeper and broader dorsal furrows and more strongly inflated fixed cheeks than any other Scandinavian congeneric form. In so far as it is known it is most like *S. holometopa*. Besides the dissimilarities just mentioned it differs in having shorter glabella, a thicker and more swollen border, a more expanded occipital ring, and a coarse prominent occipital node.

A cranidium from the Rushton area, Shropshire, determined as *S.* cf. *bucculenta* by Cobbold (1934), appears to be too imperfect for a safe specific identification. At any rate it does not seem to be identical with the Scandinavian form since the test is stated to lack the larger grains.

Horizon and Localities. — Zone of *Solenopleura brachymetopa* (the so-called *Hyolithes* limestone and Andrarum limestone). — Scania: Andrarum; Gislöv (boulder). Fairly infrequent.

Bornholm (zones of *Paradoxides davidis* and *P. forchhammeri*). — Czarnocki (1927, p. 9) recorded this species from St. Croix, Poland.

Solenopleura holometopa (Angelin, 1851). — Pl. 4, figs. 1—8.

1851. *Calymene holometopa* Angelin, Pal. Svec., fasc. I, p. 23, pl. 18, figs. 8, 8 a. (Indifferent diagnosis; cephalon, pygidium, and hypothetical thorax illustrated. Andrarum limestone. Andrarum, Scania.)

1854. *Solenopleura holometopa* (ANGELIN), Pal. Scand., fasc. II, p. 26, pl. 18, figs. 8, 8 a. (New generic name and amended diagnosis.)
1878. *Solenopleura holometopa* (ANGELIN), Brögger, Nyt Mag. Naturvid., vol. 24, p. 53 (37), pl. 3, fig. 9. (Pygidium illustrated. *Paradoxides forchhammeri* beds. Krekling, Norway.)
1902. *Solenopleura holometopa* (ANGELIN), Grönwall, D. G. U., II. Række, no. 13, p. 155, pl. 4, figs. 20, 21, 23. (Description and figs. of cranidium. Andrarum limestone. Bornholm.)
1913. *Solenopleura holometopa* (ANGELIN), Walcott, Res. in China, p. 167, pl. 17, figs. 12, 12 a—c. (Figs. of cranidium and defective free cheek from the type locality.)

Description. — Dorsal shield elongated ovate, strongly convex.

Cranidium about one and a half times as broad as long, somewhat narrower in young than in full-grown specimens. Glabella long, not touching the marginal furrow, moderately tapering, rounded in front, sunk between, and rising high above, the cheeks; two or three pairs of faint oblique lateral furrows, often indicated only as smooth lines on the granulate test, sometimes almost indiscernible even on internal casts. Dorsal furrows deep at the sides, shallow in front of the glabella, rarely deepening into a small pit at the axial line. Occipital furrow straight or nearly so, deeper and narrower at the sides than in the middle; occipital ring slightly expanded in the middle, with a faint to obsolete node. Brim in front of the glabella slightly depressed, flat, varying in sag. length, being a little longer than, or less than half as long as, the border, at the sides arching strongly down. Border of moderate thickness, convex; marginal furrow well impressed. Fixed cheeks inflated, in a section across the palpebral lobes two-thirds to three-fourths as broad as the glabella. Palpebral lobes of moderate size, situated about at the middle of the cheeks, slightly upturned; palpebral furrow definite. Ocular ridges faint or almost effaced on specimens retaining the test, oblique. Posterior limb less wide than the occipital ring, in its extremity sloping almost vertically. Anterior branches of the facial suture between the eyes and marginal furrow nearly straight, gently curving forwards, almost perpendicular to the margin, cutting the border very obliquely, and reaching the margin a short distance from the axial line; posterior branches forming an evenly arcuate curve, cutting the posterior margin close to the genal angle. Free cheek broad, fairly convex, semicircular in outline; border convex, marginal furrow broad and deep; genal angle rounded, in young specimens displaying a small spine abruptly projecting from the margin, in full-grown specimens reduced to a diminutive point or atrophied. The free cheek in situ takes a nearly vertical position.

Number of thoracic segments unknown. Dorsal furrows definite though not impressed. Axis prominent, narrower than the occipital ring, slowly tapering, occupying nearly one-third the total breadth (in projection); axial rings wanting a median node or spine. Pleura straight, horizontal between the dorsal furrow and fulcrum, then bent down almost at right angles. Fulcrum situated at the middle of the pleuron in the anterior segments, approximated to the dorsal furrow in the posterior segments. Pleural furrow deep and fairly broad; terminations of pleura apparently blunt.

Pygidium small, strongly convex, about twice as broad as long. Axis prominent, occupying about one-third the total breadth, with three to four segments, not extending quite to the margin. Pleural lobes arched, with one pair of ribs;

interpleural grooves faint or obsolete. Border usually imperceptible, sometimes very faintly indicated, narrow; posterior margin evenly curved.

Test thick; surface granulate, with scattered larger grains — often discernible also on internal casts — and crowded microscopic grains.

Size. — The largest cranidium in hand is 21 mm long and 32 mm broad, the largest pygidium 10.5 mm long and 19 mm broad.

Remarks. — The above description is based on a large material from the type locality.

The species varies in the convexity of the cranidium and the depth of the furrows. The brim is sometimes very short at the axial line, but in no specimen present do the preglabellar and marginal furrows coincide, as stated by Grönwall and Lake.

In the thorax the pleural furrows in specimens retaining the test are narrow and shallow at the dorsal furrows and increase in depth and breadth to the fulcrum, in internal casts the furrows are deep and broad throughout.

The ornamentation of the test varies as regards the frequency of the larger granules in various specimens as well as in various parts of the dorsal shield of one specimen; as a rule the granules are fairly dense but sometimes sparse, on the glabella sometimes very sparse and on the pygidium usually absent.

Matthew's (1888, p. 153) surmise that Angelin may have referred the pygidium of *S. holometopa* to *S. brachymetopa* and vice versa is disproved by complete specimens of the latter form.

S. holometopa compares closely with *S. conifrons* sp. n. and *S. bucculenta*, q.v.

Horizon and Localities. — Zone of *Sol. brachymetopa* (Andrarum limestone). — Scania: Gislövshammar (boring); Kiviks-Esperöd; Andrarum (type locality); S. Sandby (boring). — (? Västergötland: Ödegården.) Common at the type locality.

Bornholm. — Krekling, Norway.

Solenopleura holometopa humilis subsp. n. — Pl. 4, figs. 9 a—c.

Diagnosis. — Distinct from *S. holometopa* by lower convexity of cranidium, very shallow dorsal furrows, cheeks in a transverse section across the palpebral lobes inconsiderably or not at all inflated and, accordingly, the glabella not sunk between the cheeks.

Only the cranidium is known. It cannot be doubted but that the characters mentioned are primary and not caused by adventitious agencies. Otherwise the form, so far it is known, agrees with *S. holometopa*. Although the latter varies in the convexity of the cranidium and the depth of the dorsal furrows there has not been observed a continuous series of intermediate links connecting the subspecies to the typical *holometopa*. — In its relatively low convexity and shallow dorsal furrows the form resembles *S. conifrons* sp. n. but it is clearly distinct by having a wider glabella and narrower fixed cheeks.

Associated with *S. holometopa* at Andrarum, Scania. Rare.

Solenopleura conifrons sp. n. — Pl. 4, figs. 10 a—d.

1902. *Solenopleura acadica* WHITEAVES MS. var. *elongata* MATTHEW, Grönwall, D. G. U., II. Række, no. 13, p. 156 pl. 4, fig. 19. (Cranidium described and illustrated. Andrarum limestone. Bornholm.)

?1934. *Solenopleura acadica* WHITEAVES MS. var. *elongata* MATTHEW, Cobbold & Pocock, Phil. Trans. Roy. Soc. London, ser. B, vol. 223, p, 362, pl. 42, fig. 17. (Cranidium described and illustrated. *Paradoxides bohemicus salopiensis* fauna. Rushton area, Shropshire.)

Diagnosis. — Cranidium arched in transverse as well as longitudinal direction. Glabella conical, slightly more than half as broad in front as at the base, rounded in front, of fairly low convexity, rising slightly above, and somewhat sunk between, the cheeks; two pairs of definite and one anterior pair of very weak oblique lateral furrows (on the internal cast). Dorsal furrows narrow and fairly shallow. Brim in front of the glabella slightly depressed, almost flat, longer than, or subequal in length to, the convex border. Fixed cheeks in a transverse section across the palpebral lobes subequal in breadth to the glabella and nearly horizontal or somewhat arched. Posterior limb as wide as the occipital ring. Test granulate, with scattered larger grains (barely visible to the naked eye) and close-set microscopic granules.

The largest cranidium in hand, holotype, is 14 mm long and about 24 mm broad.

Remarks and Affinities. — Four defective cranidia have been found. This Scanian form agrees with the specimen from Bornholm mentioned above except that a weak constriction of the glabella immediately in front of the posterior pair of glabellar furrows visible in the latter is scarcely perceptible in the former. None of the specimens shows any trace of an occipital node.

With some hesitation Grönwall identified this form with *S. acadica elongata.* Judging from Matthew's description and illustration of the latter they seem to be distinct: in the Canadian form the glabella is nearly parallel-sided and about one and a half times as long as it is wide, the posterior limb is markedly wider than the occipital ring, and "the surface of the test of the glabella, occipital ring, and anterior marginal fold has fine granulations; but on the fixed and movable cheek it has a strongly pitted surface" (p. 158). The English form, by Cobbold identified with the Canadian, is stated to agree more closely with Grönwall's description than with that given by Matthew. The form is said to differ from Grönwall's description in having a well-defined occipital node, and the ornamentation of the test is in agreement with Matthew's description. Thus, it does not seem to be identical with *conifrons*. Furthermore, the English as well as the Canadian form occurs at a lower horizon than does the Scandinavian.

S. conifrons compares fairly well with *S. holometopa,* in particular the subspecies *humilis,* q.v.

Horizon and Localities. — Associated with *S. holometopa,* Andrarum, Scania. Apparently rare.

Bornholm.

Solenopleura brachymetopa (ANGELIN, 1851). — Pl. 3, figs. 4—10.

1851. *Calymene brachymetopa* ANGELIN, Pal. Svec., fasc. I, p. 23, pl. 19, figs 1, 1 a (Indifferent diagnosis and rough figures of cephalon, pygidium, and hypothetical thorax. Andrarum limestone. Andrarum, Scania.)
1854. *Solenopleura brachymetopa* (ANGELIN), Pal. Scand., fasc. II, p. 27, pl. 19, figs. 1, 1 a (New generic name.)
1878. *Solenopleura brachymetopa* (ANGELIN) var. *alutacea* BRÖGGER, Nyt Mag. Naturvid., vol. 24, p. 51 (35), pl. 3, figs. 8, 8 a—b. (Description and figs. of cranidium with attached defective thorax, and detached pygidium. Oslo district, Norway.)
1902. *Solenopleura brachymetopa* (ANGELIN), Grönwall, D. G. U., II. Række, no. 13, p. 153, pl. 4, figs. 15, 22. (Description and figs. of cranidium. Bornholm.)

Description. — Dorsal shield ovate, strongly convex; breadth across the thorax slightly more than half the total length (in specimens apparently retaining their original convexity).

Cephalon semicircular in outline. Glabella rather short, slightly tapering, more or less rounded or, sometimes, truncate in front, deeply sunk between the cheeks, about as high as the latter or a little higher. Three pairs of oblique lateral furrows, the posterior pair well impressed, the anterior pair weak or imperceptible even on internal casts. Dorsal furrows very deep at the sides, shallower but quite definite in front of the glabella. Occipital furrow pronounced, straight; occipital ring almost equal in sag. length throughout, with a faint median node. Brim in front of the glabella moderately convex, at the axial line subequal in length to the border. Border fairly thick, strongly convex. Marginal furrow well-defined. Fixed cheeks in a section across the palpebral lobes inflated, nearly as broad as the glabella. Palpebral lobes small, slightly approximated to the posterior margin and situated opposite to the last but one pair of glabellar lobes, upturned or horizontal. Ocular ridges faint, oblique. Posterior limb a little wider than the occipital ring. Anterior branches of the facial suture straight between the eyes and marginal furrow, perpendicular to the margin, in a dorsal view of specimens retaining the original convexity subparallel to the axial line or slightly converging; posterior branches bent strongly outwards and cutting the posterior margin at the drawn out marginal furrow. Free cheek broad, moderately convex, with a prominent broad border which is truncate or faintly concave at the rear; genal angle strictly angular, sometimes pointed but wanting a spine.

Thorax of fourteen segments, like the thorax of *S. holometopa*.

Pygidium moderately convex, about twice as broad as long. Axis prominent, with three to five segments, tapering, not extending quite to the margin. Pleural lobes arched, with three pairs of well-defined ribs; interpleural grooves effaced. Border usually absent, sometimes very faintly indicated, particularly on internal casts.

Test granulate, with close-set minute granules visible under the microscope and scattered somewhat larger granules of varying frequency, sometimes very sparse, particularly on the pygidium. Surface of internal casts very finely punctate, often with the larger granules perceptible.

Size. — As a rule the cranidium is less than 15 mm long; the largest specimen in hand is 18 mm, indicating a total length of about 65 mm.

Remarks and Affinities. — The above description is based on a large material from the type locality. Specimens with the free cheeks in situ are present. Owing to the thickness of the test, specimens retaining it and internal casts look rather different, all furrows on the latter being markedly deeper and broader than on the former.

S. brachymetopa alutacea BRÖGGER differs from the typical *brachymetopa* in wanting the coarser granules on the test which, as stated above, is a variable character; otherwise no dissimilarities exist. The subspecies is fairly common at Andrarum and Grönwall recorded it from Bornholm. — (On the other hand, *S. brachymetopa nuntia* GRÖNWALL from the *Paradoxides davidis* zone on Bornholm deserves specific rank. It differs clearly from *brachymetopa* in the palpebral lobes being approximated to the anterior instead of to the posterior margin, and, accordingly, the ocular ridges are almost transverse, and the posterior branches of the facial suture curve more strongly backwards.)

S. brachymetopa differs from the genotype mainly in the following respects: the glabella is broader, the border does not expand backwards in front of the glabella, the palpebral lobes are approximated to the posterior margin of the cranidium and in consequence of this the ocular ridges are more oblique, the pygidium is smaller, and the granulation of the test is less coarse.

Whitehcuse included *S. brachymetopa* in his genus *Asthenopsis* (cf. p. 7).

Horizon and Localities. — Zone of *Solenopleura brachymetopa* (Andrarum limestone and Exporrecta conglomerate). — Scania: Gislövshammar (boring); Baskemölla; Kiviks-Esperöd; Andrarum (type locality); S. Sandby (boring). — Öland: on the shore NW of Ventlinge church; Degerhamn. — Västergötland: Ödegården; Djupadalen, 6 km E of Falköping; Torbjörntorp; Hällekis and other localities at Kinnekulle; Byklev and Munkesten, at Hunneberg. — Jämtland: Vedjeön; Hillsand; Siljeåsen. — Ångermanland: Brattbäcken; Karbäcken; Aborrfallet. — It is one of the most common species in the Andrarum limestone in Scania.

Bornholm. — Oslo and Mjösen districts, Norway. — Czarnocki (1927, p. 9) recorded this form from St. Croix, Poland. — According to Cobbold (1934, p. 365) the type form probably occurs in the Rushton area, Shropshire, England.

Solenopleura canaliculata (ANGELIN, 1851). — Pl. 5, figs. 1—5.

1851. *Calymene canaliculata* ANGELIN, Pal. Svec., fasc. I, p. 23, pl. 18, figs. 9, 9 a. (Indifferent diagnosis, figs. of cephalon, pygidium, and hypothetical thorax. Andrarum limestone. Andrarum Scania.)

1854. *Solenopleura canaliculata* (ANGELIN), Pal. Scand., fasc. II, p. 27, pl. 18, figs. 9, 9 a. (New generic name; unchanged specific diagnosis.)

1902. *Solenopleura canaliculata* (ANGELIN), Grönwall, D. G. U., II. Række, no. 13, p. 151, pl. 4, figs. 16, 17. (Remarks on species and figs. of cranidium from the Andrarum limestone on Bornholm.)

Description. — Cranidium convex, strongly arched down at the sides and in front, about half as long as broad; anterior outline faintly convex, in front of the glabella straight or, rarely, tending to become concave. Glabella rather short, slightly tapering, rounded to nearly truncate in front, sunk

between and subequal in height to the cheeks; two pairs of oblique lateral furrows quite definite on specimens retaining the test, a third anterior pair sometimes perceptible on internal casts. Dorsal furrows deep and broad at the sides, not impressed in front of the glabella. Occipital furrow well-defined, usually straight, sometimes curving forwards in the middle; occipital ring moderately expanded in the middle, bearing a small node. Brim in front of the glabella depressed and flat, at the axial line equal in length to the border or definitely shorter. Border convex, expanding backwards in the middle. Marginal furrow deep at the sides, not impressed in front of the glabella. Fixed cheeks in a section across the palpebral lobes gently arched or flat, somewhat broader than the glabella. Palpebral lobes small, upturned, situated in the middle of the cheeks. Ocular ridges well-defined, gently curved to straight, almost transverse. Posterior limb markedly broader than the occipital ring, in its exterior portion sloping strongly down. Anterior branches of the facial suture between the eyes and marginal furrow straight or nearly so and perpendicular to the margin, cutting the border very obliquely; posterior branches running in an almost straight line outwards to the border, then curving abruptly backwards. — Free cheek broad, arched, with a convex border one-third as broad as the ocular platform and a deep and broad marginal furrow. Genal angle unknown.

Thorax unknown.

Pygidium large, about half as long as broad, arched. Axis prominent, occupying about one-fourth of the total breadth, slightly tapering, extending almost to the margin, composed of six or seven segments. Pleural lobes with four or five pairs of ribs extending not quite to the margin; pleural furrows deep, interpleural grooves obsolete. No definite border; margin behind the axis gently indented or straight.

Test with large tubercles of varying sizes on all prominent parts, between the tubercles and in the furrows under the microscope finely and closely granulate. On internal casts the tubercles are quite definite and the surface is otherwise very faintly punctate.

S i z e. — The largest cranidium in hand is 30 mm long, the largest pygidium 12.5 mm long and 27 mm broad.

R e m a r k s. — Angelin's specimens left are very fragmentary; the defective cranidium fig. 1 — by Angelin himself marked as No. 1 (the largest) of his specimens of this species and equal in size to his illustration — is selected as lectotype.

In Angelin's restored figure the genal angle is blunt; however, judging from his material left it seems questionable whether he had the opportunity of studying the genal angle. In so far as the free cheek is known it resembles the cheek of *S. brachymetopa*.

In the backward expansion of the border in front of the glabella our species is like *S. spissa* HOWELL (1937) from the late Middle Cambrian of Vermont, which differs in having a long glabella extending all the way to the marginal furrow.

H o r i z o n a n d L o c a l i t i e s. — Zone of *Solenopleura brachymetopa*

(Andrarum limestone). — Scania: Andrarum (type locality). — Jämtland: Kläppe, parish of Marby (teste Thorslund). — Infrequent.

Bornholm.

Parasolenopleura nom. nov.

Synonym: *Liostracus* ANGELIN, 1854, partim.

Genotype: *Calymene aculeata* ANGELIN, 1851.

In the genus *Liostracus* Angelin included *L. aculeatus* (ANG.), *L. muticus* ANG. [= *Ellipsocephalus lejostracus* (ANG.)], and *L. costatus* ANG., all three of them based on poor fragments and for a long time imperfectly known. The genotype is *L. costatus*, definitively selected by Linnarsson in 1873. Unfortunately, on account of the erroneous presumption that *L. costatus* at that time was not recognized as a valid species by the Scandinavian authors, Matthew (1888, p. 135) rejected Linnarsson's designation and assigned *L. aculeatus* as the type, which has been accepted by practically all subsequent extra-Scandinavian authors. Furthermore, *Liostracus* ANGELIN is a younger homonym, since *Leiostracus* was used by Albers in 1850 as the generic name for a gastropod. Because of that Raymond (1937, p. 1106) proposed the new name *Andrarina* "vice *Liostracus* ANGELIN", hence it follows that the genotype of *Andrarina* is *L. costatus*, not *L. aculeatus* as stated by Raymond.[1] These species are generically distinct, which was recognized long ago and is quite clear since the entire dorsal shield of both is now known. Thus, if *L. aculeatus* is regarded as the type of an independent genus (or a subgenus under *Solenopleura*), it must receive a new generic (or subgeneric) name. The writer proposes the new name *Parasolenopleura* and the species should be called *Parasolenopleura aculeata* (ANGELIN, 1851).

As stated above, *Parasolenopleura* is very similar to *Solenopleura*. Broadly speaking, the differences are as follows: in *Parasolenopleura* the dorsal shield is less convex and less arched down in front, the cheeks are less inflated, the dorsal and marginal furrows are shallower, the border is less convex and especially in the cheeks flat or nearly so, in the pygidium the interpleural grooves on the pleural lobes seem to be somewhat more pronounced, and the test is smooth to the naked eye but under the microscope, in particular on thorax and pygidium, finely granulate. These characters vary in both groups, however, and none of them alone is a reliable distinctive criterion, but in various combinations they seem to be useful to keep the groups apart. Thus *Parasolenopleura* is awarded generic rank.

Representatives of the genus occur in the early and mediaeval Middle Cambrian in Europe and the American basin of the Acado-Baltic province.

[1] As regards this question cf. Westergård, S. G. U., ser. C, no. 437 (1940), p. 62, foot-note 2; no. 498 (1948), p. 13; Rud. Richter, Neues Jahrb. Min., etc., Jahrg. 1940, Referate III, p. 1032.

Lake's (1931, p. 143) statement that *L. costatus* was included in *Liostracus* "at a later date" than were *aculeatus* and *muticus* may cause a misunderstanding. Even though the two latter species in the text follow immediately after the generic diagnosis while *costatus* was described on a later page and illustrated on a later plate in fasc. II of Palaeontologica Scandinavica, as members of *Liostracus* they were published contemporaneously.

Recent authors — e. g. Kobayaski, 1935, and Thoral, 1948 — retain "Liostracidae" as a valid family. In the present writer's opinion the group does not even deserve to be regarded as a subfamily under Solenopleuridae.

Parasolenopleura cristata (LINNARSSON, 1877). — Pl. 2, figs. 4, 5.

1877. *Solenopleura cristata* LINNARSSON, G. F. F., vol. 3, p. 370, pl. 15, figs. 5, 6 (also as S. G. U., ser. C, no. 22). (Description of cephalon and part of thorax, the former illustrated. *Paradoxides oelandicus* beds. Borgholm, Öland.)

1936. *Solenopleura cristata* LINNARSSON, Westergård, S. G. U., ser. C, no. 394, p. 59, pl. 12, figs. 1—7. (Species described and discussed, the complete dorsal shield illustrated. Zone of *Paradoxides insularis*. Borgholm and other localities, Öland.)

R e m a r k s. — A complete dorsal shield in shale from Borgholm (RM. No. Ar. 1462) with 14 thoracic segments, in which the axial rings of the three anterior and two posterior segments are intact, want a median node or spine on these rings and the rings of the segments lying between them are damaged. Other specimens from Öland show that at least the sixth to the twelfth segment bear a prominent axial node or spine.

The pygidium is small, about two and a half times as broad as long, and is poorly segmented; the axis seems to have three or four segments and there is one pair of faint ribs on the pleural lobes.

Since the complete dorsal shield of *P. aculeata* has been found, it can scarcely be doubted but that this species is more closely allied to *P. cristata* than to any other Scandinavian form hitherto described. The differences seem to be mainly confined to the cranidium, the glabella being slightly broader and longer in *cristata* than in *aculeata*, the former having a small occipital node which in the latter is replaced by a stout spine, and the ocular ridges being faint to obsolete in the former but definite in the latter. The similarities in the cephalon are significant: in the convexity of the shield and the depth of all furrows the forms agree; the border is upturned in front of the glabella, lowers to the sides, and is flat in the posterior part of the free cheeks, the marginal furrow is shallow, not impressed in front of the glabella, and fades away backwards in the free cheeks; the latter are narrow and fairly flat and the genal angles are angulate in both even if in *cristata* they sometimes appear to be rounded. — The number of thoracic segments is 14 in both species; in *cristata* the axial rings have a prominent node or spine except on a few anterior segments and the last two, and in *aculeata* a similar node or spine occurs on the eight or nine anterior segments; the terminations of the pleura of the anterior and middle segments are blunt in both, but it is unsettled whether or not they are truncate and pointed in the rear segments of *cristata* as in *aculeata*. — In the pygidium there is some difference: it is shorter and less distinctly segmented in *cristata* than in *aculeata*. Finally, the granulation of the test is less faint in the former than in the latter. In fact, the similarities are close enough to cause us to surmise that *P. cristata* may be a forerunner of *P. aculeata*.

A form from the *Paradoxides oelandicus* beds in the Mjösen district, known only from the cranidium, which Strand (1929, p. 353, pl. 2, fig. 19) identified

as *Solenopleura cristata*, has a markedly narrower glabella than the latter and seems to be specifically distinct.

Horizon and Localities. — *Paradoxides oelandicus* beds; on Öland the form seems to be confined to the zone of *Par. insularis*, but in Närke it occurs associated with *Par. pinus*. — Öland: Borgholm (type locality) and other localities where the lower zone is or has been accessible. — Östergötland: Vågforsen, 10 km NE of Skänninge (teste S. Rosén, 1922). — Närke: Övre Åkerby, 5 km E of Yxhult (boring). — (? Southern Jämtland: Bingsta, parish of Berg.)

Parasolenopleura aculeata (ANGELIN, 1851). — Pl. 5, figs. 6—10; pl. 6, figs. 1—4.

1851. *Calymene aculeata* ANGELIN, Pal. Svec., fasc. I, p. 23, pl. 19, fig. 2. (Indifferent diagnosis and fig. of cranidium; it is questionable whether the pygidium illustrated belongs to this species. Basal stratum of the *Paradoxides paradoxissimus* beds. Borgholm, Öland.)
1854. *Liostracus aculeatus* (ANGELIN), Pal. Scand., fasc. II, p. 27, pl. 19, fig. 2. (New generic name and amended diagnosis.)
1879. *Liostracus aculeatus* (ANGELIN), Linnarsson, S. G. U.; ser. C, no. 35, p. 11, pl. 1, figs. 12—15. (Description and figs. of cranidium; species compared with *L. linnarssoni* BRÖGGER. Exsulans limestone of Scania.)
1883. *Liostracus aculeatus* (ANGELIN), Linnarsson, S. G. U., ser. C, no. 54 (1882), p. 22. (Diagnosis in Latin; no fig.)
1913. *Liostracus aculeatus* (ANGELIN), Walcott, Res. in China, p. 137, pl. 13, figs. 6, 6 a—b. (Remarks on species and figs. of cranidium from the type locality.)
1929. *Liostracus aculeatus* (ANGELIN), Strand, Norsk Geol. Tidsskr., vol. 10, p. 351, pl. 2, figs. 5 a—b. (Description and figs. of cranidium. Zone of *Ctenocephalus exsulans*. Mjösen district, Norway.)

Non:

1878. *Liostracus aculeatus* (ANGELIN?), Brögger, Nyt Mag. Naturvid., vol. 24, pp. 46 (30), pl. 3, fig. 3. (Cf. *Parasolenopleura spinigera* sp. n.)

Description. — Dorsal shield ovate, the breadth across the thorax a little more than half the total length, moderately convex, slightly arched down in front.

Glabella rather short, occupying about three-fifths of the length of the cranidium (exclusive of the occipital spine), tapering, more or less truncate in front, slightly sunk between and rising superior to the cheeks, with three pairs of weak to obsolete furrows. Dorsal furrows well impressed at the sides, shallow in front of the glabella. Occipital furrow definite, straight; occipital ring bearing a stout spine. Brim abruptly sloping from the ocular ridges to the marginal furrow, depressed and flat or gently concave in front of the glabella, at the axial line equal in length to, or shorter than, the border. Marginal furrow in the middle definite though not impressed. Border upturned, posteriorly flat but in the marginal region arched. Fixed cheeks in a section across the palpebral lobes about three-fourths as broad as the glabella and faintly arched. Palpebral lobes small, slightly approximated to the anterior margin. Ocular ridges well-defined, oblique. Posterior limb less wide than the occipital ring, in its distal portion arched strongly down. Anterior branches of the facial suture between the eyes and marginal furrow straight, making a slightly obtuse angle with the margin, on a dorsal view of the cranidium retaining its original convexity converging, cutting the border very obliquely; posterior branches forming an almost even curve, cutting the posterior margin at the drawn out lateral marginal furrow.

Free cheek narrow, fairly flat, truncate at the rear; marginal furrow shallow and broad anteriorly, fading away backwards; border almost as broad as the ocular platform, slightly convex anteriorly, flat posteriorly, faintly striated along the margin; genal angle strictly angulate; genal spine wanting.

Thorax of fourteen segments. Axis convex, narrower than the pleura, very slowly tapering; axial rings of the eight or nine anterior segments bearing a prominent node or spine directed upwards, rings of the succeeding segments smooth. Pleura geniculate; fulcrum in the anterior and middle segments situated about at the middle of the pleuron, in the posterior segments approximated to the dorsal furrows; pleural furrows fairly shallow and narrow (in specimens retaining the test); terminations of pleura rounded in the anterior and middle segments, truncate and pointed or bearing diminutive spines on the rear segments.

Pygidium subtriangular in outline, slightly more than twice as broad as long. Axis fairly convex, with three or four segments, extending to the margin or nearly so. Pleural lobes slightly arched, with two pairs of ribs bisected by faint interpleural grooves. No definite border.

Ornamentation of the test variable, smooth to the naked eye, under the microscope smooth to faintly shagreened or thinly punctate on parts of the cephalon, usually finely granulate on the border and still more so on the prominent parts of the thoracic segments and pygidium.

Size. — Cranidium rarely exceeding 10 mm in length, the occipital spine omitted. The largest cranidium in hand is 13.5 mm long, indicating a total length of about 40 mm.

Remarks and Affinities. — Angelin's statement regarding the type locality "Œlandiae prope Borgholm" probably refers to a place on a brooklet immediately SE of the town, where the basal stratum of the *Paradoxides paradoxissimus* beds, a thin calcareous conglomerate with *Acrothele* (*Redlichella*) *granulata*, is accessible. His specimens left, five poorly preserved crushed cranidia, one of which is illustrated in pl. 5, fig. 10, occur in a rock lithologically agreeing with this conglomerate.

The pygidium by Angelin included in *P. aculeata*, which Linnarsson (1879) had the opportunity to examine but which now cannot be identified, was stated to have a granulate test, and on account of that it was excluded from this species. However, specimens of the pygidium exist which under the microscope are closely granulate.

The ornamentation of the test varies on various parts of one specimen; in e. g. the specimen fig. 2 in pl. 6 the cranidium under the microscope is smooth while the thorax is closely granulate, in particular on the posterior segments. Usually the cranidium is smooth, sometimes shagreened or more or less thinly granulate on parts of the shield. Besides cranidia of these types there occurs in the Scanian Exsulans limestone a form which is closely granulate throughout (pl. 6, fig. 3) and quite the same ornamentation appears on the associated pygidia (pl. 6, fig. 4).

P. aculeata is apparently closely akin to *P. cristata*, q.v. It differs from other congeneric Swedish forms in the anterior part of the cranidium, the brim in

front of the ocular ridges sloping abruptly instead of arching down to the marginal furrow and in the middle being flat or concave instead of gently convex, and the border being upturned and almost flat instead of more evenly convex.

The Norwegian form identified as *P. aculeata* by Strand is stated to have rounded free cheeks. According to a personal communication by Dr. Strand, no complete free cheek was found in his material and the statement was possibly founded on a fragment.

Among foreign forms *Liostracus ouangondianus* (HARTT), as described and illustrated by Matthew (1888) from New Brunswick, displays a close resemblance to *P. aculeata* in the cranidium and, judging from Matthew's illustrations, the forms may be congeneric but not conspecific: the free cheek of the former differs from that of the latter in having a much narrower border in relation to the ocular platform and rounded instead of angular genal angle. The thorax and pygidium of the Canadian form seem to be unknown.

Horizon and Localities. — Zone of *Ptychagnostus* (*Triplagn.*) *gibbus* (inclusive of the Exsulans layer and the conglomerate of *Acrothele* (*Redlichella*) *granulata*). — Scania: Brantevik and Gislövshammar; Kiviks-Esperöd; Andrarum; Fågelsång. — Öland: on the shore 4.5 km S of Mörbylånga; Borgholm (type locality) and other localities in the neighbourhood of the town; on the shore 1 km N of Lundegård. — Östergötland: Berg (boulders); Grankulla, parish of Flistad (boring). — Västergötland: Oltorp. — Närke: Vrana; Vinala; in several boring cores from the western and south-eastern areas of the province. — Northern Jämtland: Vedjeön (boulders). — Common in the Exsulans limestone of Scania; not infrequent in other areas.

Mjösen district of Norway.

Parasolenopleura scanica sp. n. — Pl. 6, figs. 5—8.

Diagnosis. — Glabella fairly narrow, inconsiderably tapering, evenly rounded in front; occipital ring bearing a faint node; brim in front of the glabella slightly arched; border convex; genal angle prolonged into a very short spine making an obtuse angle with the lateral margin of the cheek.

Description. — Cranidium moderately convex; dorsal furrows narrow, well impressed throughout. Glabella occupying three-fifths of the length of the cranidium, slightly sunk between and rising a little above the cheeks, with three pairs of weak to obsolete lateral furrows. Occipital furrow well-defined, narrow, straight. Occipital ring somewhat widening to the middle, with a small node. Brim at the axial line slightly longer than the border. Marginal furrow definite, shallow; border moderately convex. Fixed cheeks in a section across the palpebral lobes nearly as broad as the glabella, faintly arched. Palpebral lobes small, slightly approximated to the anterior margin. Ocular ridges faint to obsolete, fairly transverse. Posterior limb subequal in width to the occipital ring. Course of the facial suture as in the genotype. Free cheek fairly narrow, slightly arched; marginal furrow well impressed; border moderately convex, about half as broad as the ocular platform; genal spine short, making an angle with the lateral margin.

Thorax unknown.

Associated pygidium lenticular, fully two and a half times as broad as long, moderately arched. Axis subequal in breadth to the pleural lobe, with three or four segments, not extending quite to the margin. Lateral lobes with one or two pairs of ribs; interpleural grooves fairly distinct. No definite border.

Test smooth to the naked eye, under the microscope granulate, with varying frequency of the granules: close-set or scattered, sometimes almost wanting. Internal casts finely punctate to smooth.

Size. — The cranidium, holotype fig. 5, is 8.0 mm long; the largest cranidium found measures 12 mm in length.

Remarks and Affinities. — Several cranidia, free cheeks, and a pygidium have been observed on one bedding plane yielding no other congeneric form.

P. scanica is readily distinguished from *P. aculeata* by the characters given in the diagnosis. It displays closer resemblance to the group of *P. linnarssoni*, from which it mainly differs in having the palpebral lobes approximated to the anterior instead of the posterior margin of the cephalon, less oblique ocular ridges, less tapering glabella, and shorter pygidium.

Compared with the associated *Solenopleura parva* (with which it seems to have been confounded) the cranidium of *P. scania* is less convex from side to side and less strongly arched down in front, the glabella is proportionately narrower, the dorsal furrows are less deep, the palpebral lobes situated farther forward, the border of the free cheek is narrower, and the ornamentation of the test weaker.

Horizon and Localities. — Lower portion of the zone of *Ptychagnostus* (*Triplagn.*) *gibbus* (Exsulans limestone). Andrarum (type locality) and Brantevik, Scania. Not infrequent.

Parasolenopleura linnarssoni (Brögger, 1878). — Pl. 6, figs. 9—12 (? Pl. 7, figs. 1—5).

1878. *Liostracus linnarssoni* Brögger (partim), Nyt Mag. Naturvid., vol. 24, pp. 47, 50 (31, 34), ? pl. 3, figs. 4, 4 a—c. (Only the form with an occipital node. Description and illustrations of cephalon and pygidium. *Paradoxides paradoxissimus* beds, lower and middle portions. Krekling, Norway.)
1879. *Liostracus linnarssoni* Brögger, Linnarsson, S. G. U., ser. C, no. 35, p. 12. (Species discussed.)
1883. *Liostracus linnarssoni* Brögger (partim), Linnarsson, S. G. U., ser. C, no. 54, p. 23. (Only the form with an occipital node. The cranidium and pygidium pl. 4, figs. 8, 11, from the zone of *Tomagnostus fissus* probably belong to this form. Andrarum, Scania.)
1902. *Liostracus linnarssoni* Brögger, Grönwall, D. G. U., II. Række, no. 13, p. 144. (Species recorded from Bornholm.)
1929. *Liostracus linnarssoni* Brögger (partim), Strand, Norsk Geol. Tidsskr., vol. 10, p. 351. (Only the form with an occipital node. The cranidium illustrated on pl. 2, fig. 6, possibly belongs here. Mjösen district, Norway.)
Non:
1888. *Ptychoparia linnarssoni* (Brögger), Matthew, Trans. Roy. Soc. Canada, vol. 5, p. 143, pl. 2, figs. 1 a—m. (Brögger's and Linnarsson's accounts of *L. linnarssoni* published in English translation. *Cf. Paras. spinigera* sp. n.)

Remarks. — In *Liostracus linnarssoni* earlier authors included two or more forms which occur associated at various localities. Unfortunately, the material accessible is insufficient to clear them up properly and, thus, the taxonomy given below must be provisional.

Of the specimens illustrated by Brögger only the cranidium (his fig. 4), an internal cast in limestone retaining very small remnants of the test, has been found. For the present this must be regarded as the lectotype; it is re-illustrated in pl. 7, figs. 1 a—c. From the type locality no other specimen in limestone but numerous detached parts of the dorsal shield in shale collected and identified by Brögger as this species have been available to the present writer thanks to the courtesy of Dr. Henningsmoen.

According to the original diagnosis and the more complete description, the occipital ring has a small median node. Unfortunately, the occipital ring of the lectotype is damaged and does not verify this statement; in most of the cranidia in shale the ring is poorly preserved, in a few specimens it has a node while in others it bears a definite spine. Thus, we seem to have two forms which as regards the cranidium differ in the ornamentation of the occipital ring but otherwise appear to be alike, an observation earlier made by Strand (1929). Only the form with an occipital node is here identified as *linnarssoni* in a restricted sense.

Detached thoracic segments in Brögger's shale material seem to want a spine on the axial ring, and the terminations of the pleura are sometimes pointed and sometimes apparently blunt. The number of segments is not known for certain.

Associated pygidia have four or five, rarely six, segments in the axis, which does not extend quite to the margin; the last segment displays two small nodes separated by a longitudinal depression or narrow furrow. On the pleural lobes there are two pairs of ribs with well-defined interpleural grooves. A definite border (marked off on Brögger's illustration) is wanting.

Brögger stated that the test is punctate. The cranidium (his fig. 4) proves, however, that the internal cast has close-set punctiform impressions (visible under a lens), and as regards the character of the outer surface of the test no safe conclusion can be drawn from the poor remnants of the test left. Of Brögger's shale specimens, the test of which is always dissolved, the cranidia and free cheeks are smooth while many thoracic segments are faintly granulate on the axial rings and pleural ridges.

Linnarsson, who discussed this species at considerable length, stated that the occipital spine is a constant character and, if it appears to be lacking, its absence is ostensible owing to imperfect preservation. It is well known that Linnarsson was a keen-eyed and careful observer; in this case he was mistaken, however. Several cranidia, excellently preserved in limestone from Swedish localities, have a small blunt node, whereas others, often associated with the former, have the node replaced by a definite spine. Linnarsson further noted that in some detached thoracic segments[1] the axial ring had a median spine which in other specimens seemed to be wanting. In the material present this spine has not been observed for certain, which obviously does not disprove

[1] It should be noted that the strata with the forms under consideration usually yield no other trilobites than agnostids. In such a case there may be no doubt but that the detached thoracic segments and pygidia belong to the one or other of these forms.

Linnarsson's statement. Granting that Linnarsson is right on this point, it seems reasonable to conclude that the form with an occipital node has a spineless thorax and the one bearing an occipital spine has a row of spines on the thoracic axis, as in the genotype. However, an external mould in shale from the type locality (Paleont. Museum of Oslo, Nos. 28516/17) showing the cephalon with ten attached thoracic segments has a distinct occipital spine but no traces of a spine on any of the faintly granulate thoracic axial rings. In the cranidium the latter specimen agrees with the form here called *P. spinigera*, which thus apparently has a spine-less thorax, and *P. vestgothica* to be described remains as the only form found which can be supposed to have a spinous thoracic axis.

The ornamentation of the test, which can be closely studied only on well preserved specimens in limestone, is fairly variable. On cranidium and free cheeks the test is smooth to the naked eye and under the microscope either smooth or showing more or less thinly scattered granules. At a magnification of 50 times some specimens have the occipital ring closely granulate and are otherwise either smooth or display sparse granules and, sometimes, an indistinct punctation. The thoracic segments usually have a slightly more pronounced granulation, at least on the pleura, with the grains arranged in a row on the anterior and posterior pleural ridges. The pygidium is finely and closely granulate.

The size is small, the cranidium rarely attaining 12 mm in length.

The forms are readily distinguished from the genctype by the glabella being evenly rounded in front instead of truncate, the brim in front of the glabella faintly arched instead of flat and less abruptly sloping from the ocular ridges, and the border being convex instead of upturned and fairly flat.

Horizon and Localities. — *P. linnarssoni* appears in the lower portion of the zone of *Tomagnostus fissus* and *Ptychognostus atavus* and ranges at least to the upper limit ot the zone of *Hypagnostus parvifrons*. — Scania; Brantevik; Gislövshammar (boulders); Andrarum. — Öland: Degerhamn. — Västergötland: Oltorp; Ödegården; Djupadalen; St. Stolan; (? Byklev and Munkesten, Hunneberg. — Jämtland: Vedjeön; Kopparrökhällarna). — Ångermanland: Nybränna; Aborrfallet. — Not infrequent in Scania and the Falbygden area in Västergötland.

Bornholm. — Oslo and Mjösen districts, Norway. — Czarnocki (1927, p. 9) recorded *Liostracus linnarssoni* from St. Croix, Poland.

Parasolenopleura linnarssoni brevicauda subsp. n. — Pl. 6, fig. 13, (14?).

Diagnosis. — Pygidium short, nearly three times as broad as long, with but two definite segments in the axis and one pair of ribs on the pleural lobes.

The counterpart of the specimen illustrated proves that the occipital and thoracic axial rings want spines. The number of thoracic segments is probably 13 (minimum); in those best preserved the terminations of the pleura appear to be pointed. The granulation of the test is somewhat more pronounced than is usually the case in this group.

Linnarsson (1883, p. 24) referred to this specimen and identified it as *Liostracus linnarssoni*. It is certainly very closely allied to this species; in view of the differences apparently existing in the pygidium and our present imperfect knowledge of *linnarssoni* it seems advisable, however, to regard the form as subspecifically distinct.

Only the holotype is known for certain. It was collected from the lowest portion of the zone of *Hypagnostus parvifrons* at Andrarum, Scania.

Parasolenopleura cf. *linnarssoni* (BRÖGGER, 1878). — Pl. 7, figs 6—8.

The specimens illustrated represent a form similar to *P. linnarssoni* and its subspecies except in the much narrower glabella. Whether this difference may indicate specific (or subspecific) distinction must be left undecided until more complete material has been found.

Zone of *Ptychagnostus atavus*, uppermost portion, at Andrarum, Scania. — Zone of *Hypagnostus parvifrons*, at Byklev and Munkesten, Hunneberg, Västergötland.

Parasolenopleura spinigera sp. n. — Pl. 6, figs. 15 a—c; (? Pl. 7, figs. 1—5).

1878. *Liostracus aculeatus* (ANGELIN?), Brögger, Nyt Mag. Naturvid., vol. 24, p. 46 (30), pl. 3, fig. 3. (Cranidium illustrated. Öxna, Norway.)

This form is characterized by having an occipital spine instead of a node. Otherwise it seems to agree with *P. linnarssoni*, also in wanting spines on the axial rings of the thorax. The difference is rather insignificant; however, as intermediate links have not been observed and as it does not seem very probable that the dissimilarity might imply sexual distinction, the form is tentatively regarded as specifically distinct from *linnarssoni*.

Of the cranidia illustrated by Linnarsson, 1883, fig. 5 in pl. 4 may belong to this form. Unfortunately, the specimen seems to be lost; it was collected from the zone of *Ptychagnostus punctuosus* at Andrarum.

The Canadian form determined as *Ptychoparia linnarssoni* (BRÖGGER) by Matthew (1888, p. 143) resembles our form in essential features. A re-examination of Matthew's material is required for a more definite statement regarding their relations.

P. spinigera seems to have about the same range as has *P. linnarssoni* and has been found associated with the latter at various localities in Scandinavia.

Parasolenopleura vestgothica sp. n. — Pl. 6, figs. 16 a—c.

Diagnosis. — Glabella with three pairs of lateral furrows, the two posterior pairs well impressed; occipital ring strongly widened in the middle, bearing a median spine; (? thoracic axis with a row of median spines).

Only the cranidium is known. For reasons stated above (p. 28) the form is supposed to have axial spines on the thorax. Under the microscope the test is smooth, with sparse granules, and the part of the glabella wanting the test is very finely and closely punctate.

The form is like *P. spinigera* except in the characters mentioned. Only additional, more complete material can give a definite answer to the question whether it should be included in the latter or regarded as an independent species.

Horizon and Locality. — Zone of *Ptychagnostus atavus*. Oltorp, Västergötland. Associated with *P. linnarssoni* and *P. spinigera*.

Parasolenopleura? *peregrina* (WALLERIUS, 1930). — Pl. 7, figs. 9—12.

1930. *Lonchocephalus peregrinus* WALLERIUS, G. F. F., vol. 52, pp. 51—52, text-fig. 2. (Description of cranidium, free cheek, and pygidium; restored fig. of cranidium. Zone of *Paradoxides davidis*. Byklev, Hunneberg, Västergötland.)

Description. — Cranidium of moderate convexity. Glabella slightly tapering, evenly rounded in front, rising above the cheeks, with two or three pairs of very weak furrows or quite smooth. Dorsal furrows shallow, definite also in front of the glabella, sometimes depressed into a faint pit at the axial line. Occipital furrow shallow, straight; occipital ring prolonged into a stout spine attaining about the length of the cranidium proper. Brim faintly arched, at the axial line slightly longer than the border. Marginal furrow definite, faintly or not at all impressed. Border fairly flat. Fixed cheeks in a section across the palpebral lobes inconsiderably inflated, more than half as broad as the glabella. Ocular ridges faint, oblique. Posterior limb slightly narrower than the occipital ring. Facial suture as in *P. aculeata*. Free cheek slightly arched, broad; ocular platform more than twice as broad as the border; marginal furrow shallow; border thick nearly flat; genal angle prolonged into a short spine forming an angle with the lateral margin.

Thorax unknown.

Associated pygidium almost three times as broad as long. Axis prominent, subequal in breadth to the pleural lobes, not extending to the margin, with three segments, the rear bearing a pair of low nodes separated by a shallow depression. Pleural lobes fairly flat, with one pair of faintly marked ribs; no definite border. Posterior margin straight in the middle.

Test of cranidium and free cheek smooth to the naked eye; under the microscope (magnification 50 times) it is practically smooth while exfoliated parts have a closely punctate surface. The surface of the pygidium is roughened apparently due to imperfect preservation or adventitious agencies.

Size. — A small form, the largest cranidium in hand being 7 mm long exclusive of the occipital spine.

Remarks. — In the text Wallerius stated that he was going to present the material of this and associated species from the type locality to the Geol.-Min. Institution of Lund, where it has been sought in vain, however. — The specimens collected by the present writer are poorly preserved fragments.

Wallerius apparently included the species in the American genus *Lonchocephalus* OWEN, 1852, because of its resemblance to *L. appalachia* WALC. in the cranidium. Walcott, who revised and restricted *Lonchocephalus*, emphasized its close similarity to *Liostracus* ANG. (i. e. *L. aculeatus*): "With only the

cranidia for comparison, the difference between them is in the frontal limb and rim, and the absence of well-defined glabellar furrows in *Liostracus*" (Walcott, 1916, p. 189). However, as stated above these characters are variable in *Parasolenopleura* and have little taxonomic value. In other criteria the genera may be distinct; according to Walcott *Lonchocephalus* has six or seven thoracic segments while in *P. aculeata* the number is fourteen, and the pygidium is relatively large and has a definite border in the former, whereas it is small and lacks a border in the latter. As regards the cephalon the only conspicuous dissimilarities between *peregrina* and *aculeata* seem to be those in the length of the occipital spine and the breadth of the free cheek, and the pygidium probably belonging to the former is more like *Parasolenopleura* than *Lonchocephalus*. Furthermore, the range and geographical distribution are against the reference of the Swedish form to the American genus, the latter being confined to the early Upper Cambrian and occurring in a province whose Middle and Upper Cambrian faunas have very little in common with the faunas of the Acado-Baltic province. Thus, pending additional better preserved material of Wallerius' species it is provisionally included in *Parasolenopleura*.

Horizon and Locality. — Zone of *Ptychagnostus punctuosus*. Not infrequent in a thin stratum forming the middle portion of the uppermost stinkstone (orsten) layer at Byklev, Hunneberg, Västergötland.

? **Andrarinidae** RAYMOND, 1937.

Synonym: Liostracidae ANGELIN, 1854, partim.

Grönwallia KOBAYASHI, 1935.

Genotype: *Liostracus platyrrhinus* GRÖNWALL, 1902.

Kobayashi, who erroneously regarded *Parasolenopleura aculeata* as the type of *"Liostracus"*, placed this species and *G. platyrrhina* in his subfamily Liostracinae under Liostracidae ANGELIN. In the present writer's opinion these species belong to distinct families, however. The former is here placed in Solenopleuridae and the latter displays so close resemblance to *Andrarina costata* (ANG.), the true type of *"Liostracus"* (cf. p. 21), that it is tentatively referred to Andrarinidae.

Grönwallia platyrrhina (GRÖNWALL, 1902). — Pl. 7, figs. 18—20.

1902. *Liostracus platyrrhinus* GRÖNWALL, D. G. U., II. Række, no. 13, pp. 147, 218, pl. 4, fig. 11 (Description and fig. of cranidium. Andrarum limestone, Bornholm.)

Description. — Cranidium moderately arched, length (exclusive of the occipital spine) subequal to the breadth at the posterior margin and slightly shorter than the breadth across the brim. Glabella short, slightly conical, evenly rounded or tending to become truncate in front, with two or three pairs of short very weak furrows sometimes quite effaced on specimens retaining the test. Dorsal furrows narrow and shallow. Occipital furrow effaced or faintly marked at least at the sides; occipital ring bearing a stout spine. Brim half as

long as the glabella, usually gently convex in its posterior portion, rarely flat throughout. Marginal furrow definite, shallow. Border flat, slightly upturned. Palpebral lobes rather small, at a distance from the dorsal furrows subequal to half the breadth of the glabella in front, approximated to the posterior margin. Ocular ridges weak, oblique. Posterior limb about half as wide as the occipital ring. Anterior branches of the facial suture strongly diverging from the eyes, then curving forwards and inwards, reaching the margin at a fairly great distance from the axial line; posterior branches cutting the posterior margin midway between the dorsal furrow and genal spine. Free cheek broader than the fixed cheek across the palpebral lobe; marginal furrow very shallow, border flat or nearly so; genal angle prolonged into a spine continuous with the margin of the cheek.

Of the thorax only the fragments seen in fig. 20 have been found. — Pygidium unknown.

Test thin, under the microscope smooth, sometimes very finely granulate on the border.

Size. — A small form, the largest cranidium found (fig. 19) being 8.5 mm long (exclusive of the occipital spine), 9.2 mm broad across the brim and 8.4 mm at the posterior margin.

A dozen cranidia are present. The Scanian form agrees with the holotype except that the occipital furrow is still weaker in the former than in the latter.

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

In the same zone on Bornholm.

Grönwallia microphthalma (Angelin, 1851). — Pl. 7, figs. 13—17.

1851. *Proetus? microphthalmus* Angelin, Pal. Svec., fasc. I, p. 22, pl. 18, fig. 4. (Indifferent diagnosis; fig. of cephalon. Andrarum limestone. Andrarum, Scania.)
1851. *Proetus? difformis* Angelin (partim), ibid., pl. 18, fig. 5 (pygidium only).
1854. *Anomocare microphthalmum* (Angelin), Pal. Scand., fasc. II, p. 25, pl. 18, fig. 4. (Emended diagnosis, new generic name.)
1873. *Liostracus microphthalmus* (Angelin), Linnarsson, G. F. F., vol. 1, p. 244. (*L. costatus* was selected as the type of *Liostracus*, with which *A. microphthalmum* was considered congeneric. The pygidium by Angelin referred to *Proetus? difformis* was proved to belong to *L. microphthalmus*.)
1876. *Liostracus microphthalmus* (Angelin). Brögger, G. F. F., vol. 3, p. 195, pl. 8, figs. 4, 4 a—b. (Comments on the ornamentation of the brim; a fragmentary cranidium illustrated. Breidengen, Valdres, Norway.)
1878. *Liostracus microphthalmus* (Angelin), Brögger, Nyt Mag. Naturvid., vol. 24, pp. 48 (32), 50 (34), pl. 3, figs. 1—2. (Supplementary notes on species; figs. of cephalon and a fairly complete specimen. Krekling, Norway.)
1929. *Loganellus microphthalmus* (Angelin), Strand, Norsk Geol. Tidsskr., vol. 10, p. 354. (This species and *Liostracus costatus* Ang. were included in the American genus *Loganellus* Devine, 1863.)

Description. — Dorsal shield ovate, fairly flat.

Glabella short, about half as long as the cranidium, somewhat conical, rounded in front, with three pairs of faint lateral furrows sometimes almost imperceptible on specimens retaining the test. Dorsal furrows shallow, weak in front of the glabella. Occipital furrow straight, narrow, impressed at the sides, shallow in the middle; occipital ring subequal in sag. length throughout,

with a faint to obsolete node. Brim half as long as the glabella, flat or very slightly arched. Marginal furrow definite; border flat. Fixed cheeks in a section across the palpebral lobes about seven-tenths as broad as the glabella; posterior limb wider than the occipital ring. Palpebral lobes of moderate size, approximated to the posterior margin. Ocular ridges faint, oblique. Anterior branches of the facial suture strongly diverging, almost straight between the eyes and the marginal furrow, then curving forwards and inwards, reaching the margin at a fairly great distance from the axial line; posterior branches curving strongly outwards, cutting the posterior margin a little within the genal spine. Free cheek broader than the fixed cheek across the palpebral lobe; marginal furrow definite, border flat; genal angle prolonged into a stout spine, somewhat shorter than the cheek proper, continuous with the margin.

Thorax of 13(?) segments. Axis fairly convex, narrow, in the middle segments less than half as broad as the pleura. Pleura geniculate, deeply furrowed, terminating in spines that are quite short in the anterior and increase in length in the succeeding segments. The fifth segment from behind is coarser than the adjacent and terminates in stout and very long spines.

Pygidium more than twice as broad as long. Axis occupying scarcely one-fifth of the total breadth, with five or six, rarely seven segments, at the rear abruptly constricted to a lower tapering portion sloping to the border. Pleural lobes gently arched, with three or four pairs of flat ribs; interpleural grooves weak. Border flat, widened to the sides; margin behind the axis straight or faintly indented.

Test thin, on the entire dorsal shield, even in the furrows, closely punctate. Besides this feature the brim sometimes displays a very faint net-work of anastomozing ridges perpendicular to the marginal furrow.

S i z e. — The largest cranidium in hand is 25 mm long and the largest pygidium 12 mm long indicating a total length of about 80 mm.

R e m a r k s. — One of the specimens in hand is enrolled, showing the form of enrolment by Barrande called "form discoide".

This species was for a long time included by Scandinavian paleontologists in *Liostracus*, which cannot be understood if we do not keep in mind the fact that Linnarsson had definitely selected *L. costatus* as the genotype.

The form differs from *G. platyrrhina* in having a faint occipital node instead of a stout spine, the posterior branches of the facial suture cutting the posterior margin farther out from the dorsal furrows, and a punctate instead of smooth test. These dissimilarities do not necessarily imply generic distinction. Pending more complete material of the genotype, *microphthalma* is for the present included in *Grönwallia*.

Brögger emphasized the close resemblance between *G. microphthalma* and the American Middle Cambrian *Conocoryphe* (*Conocephalites*) *kingii* MEEK, 1870, i. e. the genotype of *Elrathia* WALCOTT, 1924. The most conspicuous differences are the stronger divergence of the anterior branches of the facial suture in the Scandinavian form, in which the transverse breadth of the brim markedly exceeds the breadth of the cranidium across the palpebral lobes instead of

being subequal or even shorter than the latter, the very long pleural spines of the fifth thoracic segment counted from behind, and the punctate test.

Horizon and Localities. — Zone of *Solenopleura brachymetopa* (Andrarum limestone and Exporrecta conglomerate). — Scania: Gislövshammar (boring); Baskemölla; Kiviks-Esperöd; Andrarum (type locality). — Öland: on the shore NW of Ventlinge church; Degerhamn. — Västergötland: Ödegården; Djupadalen; Hällekis, at Kinnekulle; Byklev and Munkesten, at Hunneberg. — Jämtland: Brunflo; Vedjeön; Siljeåsen. — Ångermanland: Aborrfallet. — Common in Scania.

Bornholm. — Various districts in Norway.

Grönwallia? angermanensis sp. n. — Pl. 8, fig. 1.

Diagnosis. — Glabella short, subquadrangular, moderately convex, apparently smooth. Dorsal furrows definite though not impressed. Occipital furrow obsolete; occipital ring bearing a very long spine. Brim large, about half as long as the cranidium (exclusive of the occipital spine), semicircular in outline, slightly inflated in front of the glabella, otherwise concave. No definite border. Fixed cheeks in a section across the palpebral lobes less than half as broad as the glabella. Palpebral lobes fairly large, strongly approximated to the posterior margin. Posterior limb short (sag.), less wide than the occipital ring. Test smooth(?).

Length of cranidium (exclusive of the spine) 7 mm.

Only the specimen illustrated — poorly preserved (and possibly representing an immature form) — is present.

The absence of a definite border seems to be the most significant difference between this species and *G. platyrrhina* and may indicate generic distinction. Until additional material is forthcoming the form is tentatively included in *Grönwallia*.

Horizon and Locality. — *Paradoxides forchhammeri* beds. Aborrfallet, Ångermanland.

With the present paper the writer has finished his revision of the Middle Cambrian trilobites of Sweden, embracing hitherto found forms except the Paradoxidinae. For several reasons he is necessitated to desist from performing the revision of this group too; here will only be given a photographic illustration of the type of *Paradoxides paradoxissimus* (WAHLENBERG, 1821) = *P. tessini* BRONGNIART, 1822.

As stated by Holm (1887), Wahlenberg's figure of *Entomostracites paradoxissimus* was drawn from a specimen in the old collections of the Paleozoological Department of the Swedish Museum of Natural History, Stockholm (No. Ar. 46147). It is the left-hand specimen illustrated in pl. 8, fig. 2, a strongly flattened impression in alum shale, whose length between the margins of cephalon and pygidium is 117 mm (120 mm in Wahlenberg's figure). Obviously this specimen was available also to Angelin when his figure of *P. tessini* var

wahlenbergi was drawn (Pal. Scand., edit. of 1878, pl. 1 a, fig. 1). It was collected from the lowest portion of the *P. paradoxissimus* beds, probably the zone of *Ptychagnostus* (*Triplagn.*) *gibbus*, at Oltorp, 18 km E of Falköping, Västergötland.

The thorax is composed of 21 segments; at all events, this is the number in the right-hand imperfect specimen in fig. 2, a plaster cast of which proves that it originally was complete, had a length of 132 mm (measured as above), and all parts of the dorsal shield in undisturbed order. Furthermore, the same number is found in at least three other complete specimens of various sizes from the type locality. Thus, in this character *P. paradoxissimus* differs from the very similar *P. bohemicus* BARR., in which according to Barrande the number is constantly 20. — In another, smaller, very closely allied species, *P. jemtlandicus* WIMAN (1903), the thoracic segments are 19 in specimens of various sizes. This form appears at least in Jämtland slightly earlier than does *P. paradoxissimus*, at the boundary between the *oelandicus* and *paradoxissimus* beds. It is hitherto known for certain only from southern Jämtland (Brunflo and other localities) and Närke (Julsta; not Vinala as stated by Linnarsson, 1875, p. 40).

Tabular summary of the range and geographical distribution of

A1, zone of *Paradoxides insularis*
A2, » » » *pinus*
B1, » » *Ptychagnostus (Triplagn.) gibbus*
B2, » » *Tomagn. fissus and Ptychagn. atavus*
B3, » » *Hypagnostus parvifrons*

	Zones								
	A1	A2	B1	B2	B3	B4	C1	C2	C3
Paradoxides (*groomi* LAPW.?)	+	.	.	.	.	.	.	.	.
» *insularis* WGÅRD	+	.	.	.	.	.	.	.	.
» *sjögreni* LINRS.	+	+	.	.	.	.	.	.	.
» cf. *sjögreni* LINRS.	.	+	.	.	.	.	.	.	.
» *oelandicus* SJÖGR.	+	+	.	.	.	.	.	.	.
» aff. *oelandicus* SJÖGR.?	.	.	+	.	.	.	.	.	.
» *quadrimucronatus* WGÅRD	+	+	.	.	.	.	.	.	.
» *bidentatus* WGÅRD	?	+	.	.	.	.	.	.	.
» *pinus* WGÅRD	.	+	.	.	.	.	.	.	.
» *torelli* WGÅRD	.	+	.	.	.	.	.	.	.
» *jemtlandicus* WIM.	.	.	+	.	.	.	.	.	.
» *paradoxus* (LINNÉ)	.	.	?	.	.	.	.	.	.
» *paradoxissimus* (WAHL.)	.	.	+	+	+	?	.	.	.
» aff. *paradoxissimus* (WAHL.)?	.	.	.	.	.	?	.	+	.
» *palpebrosus* LINRS.	.	.	+	.	.	.	.	.	.
» *hicksii* SALT.	.	.	.	+	.	.	.	.	.
» *brachyrhachis* LINRS.	.	.	.	.	.	+	.	?	.
» *davidis* SALT.	.	.	.	.	.	+	.	.	.
» *forchhammeri* ANG.	.	.	.	.	.	.	.	+	?
Clarella cf. *impar* (HICKS)	.	.	.	.	.	+	.	.	.
Centropleura angustata WGÅRD	.	.	.	.	.	?	.	?	.
» *lovéni* (ANG.)	.	.	.	.	.	.	.	+	.
» *angelini* WGÅRD	.	.	.	.	.	.	.	+	.
Kootenia westergårdi THORSL.	.	+	.	.	.	.	.	.	.
Dorypyge aenigma (LINRS.)	.	.	.	.	.	.	.	+	.
Corynexochus spinulosus ANG.	.	.	.	.	.	.	.	+	+
» cf. *spinulosus* ANG.	.	.	.	.	.	.	.	.	+
Acontheus acutangulus ANG.	.	.	.	.	.	.	.	+	.
Dolichometopus suecicus ANG.	.	.	.	.	.	.	.	+	.
Proceratopyge conifrons WALL.	.	.	.	.	.	.	.	.	+
» *magnicauda* WGÅRD	.	.	.	.	.	.	.	.	+

the Middle Cambrian Non-Agnostidean Trilobites of Sweden.

B4, zone of *Ptychagnostus punctuosus*
C1, » » *Piychagn. (Triplagn.) lundgreni and Goniagn. nathorsti*
C2, » » *Solenopleura brachymetopa* (Andrarum limestone)
C3, » » *Lejopyge laevigata*

Scania	Öland	Gothland	Östergötl.	Västergötl.	Närke	S. Jämtland	N. Jämtland Ångermanl.	S. Lapland	Bornholm	Norway	
.	+										
.	+										
.	+	.	.	.	.	.	.	?			
.	+										
.	+	?	+	.	?	+	?	?	.	+	
+	+	.	+	+							
.	+										
.	+	.	.	.	+	+					
.	+	.	.	.	+	+	.	.	.	+	
.	+	.	+	.	.	+	+	+	.	+	
.	.	.	.	?	+	+					
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+	+	.	+	+	+	+	+	+	+	+	England?
+											
+	.	.	.	.	.	.	.	.	+		
+	.	.	.	.	.	.	.	.	+	.	England and Wales. Newfoundland
+	.	.	.	.	.	.	.	.	+	?	
+	.	.	.	?	.	.	.	.	+	.	England and Wales. Newfoundland. E. Canada
+	+	.	+	+	?	+	+	?	+	+	E. Canada?
+											
+											
+	.	.	.	?	.	.	?	.	+		
+	.	.	.	.	.	.	.	.	.	.	Bennett Isl.?
.	.	.	.	.	.	+					
+	.	.	.	+							
+	.	.	.	+	+						
+											
+											
+	+	.	.	+	.	+	.	.	.	+	
.	.	.	.	+							
+											

	Zones								
	A1	A2	B1	B2	B3	B4	C1	C2	C3
Ellipsocephalus polytomus LINRS.	+	+	.	.	.	.	.	.	.
» *lejostracus* (ANG.)	.	.	+	?	?	.	.	.	.
Agraulos difformis (ANG.)	.	.	.	.	.	.	.	+	.
» *aculeatus* (ANG.)	.	.	.	.	.	.	.	+	.
» *acuminatus* (ANG.)	.	.	.	.	.	.	.	+	.
» *anceps* WGÅRD	.	.	.	.	.	.	.	+	.
Anomocare laeve (ANG.)	.	.	.	.	.	.	.	+	.
» *longifrons* WGÅRD	.	.	.	.	.	.	.	+	.
» cf. *longifrons* WGÅRD	.	.	.	.	.	.	.	+	.
Anomocarina excavata (ANG.)	.	.	.	.	.	.	.	+	.
» cf. *excavata* (ANG.)	.	.	.	.	.	.	.	+	.
» *extornata* (WGÅRD)	.	.	.	.	.	.	.	+	.
Anomocarioides limbatus (ANG.)	.	.	.	.	.	.	.	+	.
Grönwallia platyrrhina (GRÖNW.)	.	.	.	.	.	.	.	+	.
» *microphthalma* (ANG.)	.	.	.	.	.	.	.	+	.
» ?*angermanensis* WGÅRD	.	.	.	.	.	.	.	+	.
Andrarina costata (ANG.)	.	.	.	.	.	.	.	.	+
Nericia quinquedentata WGÅRD	.	.	.	.	.	.	.	.	+
» *septemdentata* WGÅRD	.	.	.	.	.	.	.	.	+
Conokephalina ornata (BRÖGG.)	.	.	.	.	.	+	.	.	.
» *suecica* (WALL.)	.	.	.	.	.	.	.	.	+
Ullaspis conifrons WGÅRD	.	.	.	.	.	.	.	.	+
Bailiella emarginata (LINRS.)	+	.	.	.	.	.	.	.	.
» *fröensis* WGÅRD	+	.	.	.	.	.	.	.	.
» *tenuicincta* (LINRS.)	.	.	+	.	.	.	.	.	.
» *impressa* (LINRS.)	.	.	+	.	.	.	.	.	.
» *aequalis* (LINRS.)	.	.	.	.	.	+	.	.	.
Bailiaspis dalmani (ANG.)	.	.	+	.	.	.	.	.	.
» *glabrata* (ANG.)	.	.	.	.	.	.	.	+	.
Ctenocephalus exsulans (LINRS.)	.	.	+	.	.	.	.	.	.
Elyx laticeps (ANG.)	.	.	.	.	.	.	.	+	.
Dasometopus breviceps (ANG.)	.	.	.	.	.	+	.	+	.
» ?*incertus* WGÅRD	.	.	.	.	.	.	.	+	.
Parasolenopleura cristata (LINRS.)	+	+	.	.	.	.	.	.	.
» *aculeata* (ANG.)	.	.	+	.	.	.	.	.	.
» *scanica* WGÅRD	.	.	+	.	.	.	.	.	.
» *linnarssoni* (BRÖGG.)	.	.	.	+	+	?	.	.	.
» » *brevicauda* WGÅRD	.	.	.	.	+	.	.	.	.
» cf. *linnarssoni* (BRÖGG.)	.	.	.	+	+	.	.	.	.

Scania	Öland	Gothland	Östergötl.	Västergötl.	Närke	S. Jämtland	N. Jämtland Ångermanl.	S. Lapland	Bornholm	Norway	
.	+	+	+	.	+	+					
.	+	.	+	.	+						
+	.	.	.	.	.	+	.	.	+	+	
+	+	.	.	+	.	.	+	.	+	+	
+	.	.	.	+	.	.	+	.	+	+	
+	.	.	.	.	.	.	?				
+	.	.	.	.	.	.	.	.	+		
+											
+											
+	.	.	.	.	.	.	.	.	+	+	Siberia. Bennett Isl.
+											
+	.	.	.	.	.	.	.	.	+	+	
+	.	.	.	.	.	.	.	.	+	.	Siberia
+	.	.	.	.	.	.	.	.	+		
+	+	.	.	+	.	+	+	.	+	+	
.	.	.	.	.	.	.	+				
.	.	.	+	+	+	.	.	.	.	+	
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.	.	.	.	.	.	.	+	.	+	+	
.	.	.	.	+							
.	.	.	.	.	+						
.	+										
.	+										
+	+	.	.	.	.	.	.	.	+		
+	.	.	.	.	.	.	?	.	+		
+	.	.	.	.	.	.	.	.	+	.	Newfoundland
+	.	.	.	.	.	.	.	.	+		England and Wales
+	.	.	.	.	.	.	.	.	+		
+	+	.	.	.	.	.	+	.	+	+	
+	.	.	.	.	.	.	.	.	+	+	
+	.	.	.	.	.	.	.		+		
+											
.	+	.	+	.	+	?	.	.	.	?	
+	+	.	+	.	+	.	+	.	.	+	
+											
+	+	.	.	+	.	.	+	?	+	+	
+	.	.	.	.	.	.	?				
+	.	.	.	+							

	Zones								
	A1	A2	B1	B2	B3	B4	C1	C2	C3
Parasolenopleura spinigera WGÅRD	.	.	.	+	+	+	.	.	.
» *vestgothica* WGÅRD	.	.	.	+	.	.	.	.	.
» ? *peregrina* (WALL.)	.	.	.	.	.	+	.	.	.
Solenopleura munsteri STRAND	.	.	+	.	.	.	.	.	.
» *parva* LINRS.	.	.	+	.	.	.	.	.	.
» *bucculenta* GRÖNW.	.	.	.	.	.	.	.	+	.
» *holometopa* (ANG.)	.	.	.	.	.	.	.	+	.
» » *humilis* WGÅRD	.	.	.	.	.	.	.	+	.
» *conifrons* WGÅRD	.	.	.	.	.	.	.	+	.
» *brachymetopa* (ANG.)	.	.	.	.	.	.	.	+	.
» » *alutacea* BRÖGG.	.	.	.	.	.	.	.	+	.
» *canaliculata* (ANG.)	.	.	.	.	.	.	.	+	.
Acrocephalites stenometopus (ANG.)	.	.	.	.	.	.	.	.	+
Toxotis pusilla WALL.	.	.	.	.	.	.	.	.	+
Burlingia laevis WGÅRD	.	+	.	.	.	.	.	.	.
Schmalenseeia acutangula WGÅRD	.	.	.	+	+	+	.	.	.

Scania	Öland	Gothland	Östergötl.	Västergötl.	Närke	S. Jämtland	N. Jämtland Ångermanl.	S. Lapland	Bornholm	Norway	
+	.	.	.	+	.	.	?	.	?	+	
.	.	.	.	+							
.	.	.	.	+							
+	.	.	+	+	.	.	.	.	.	+	
+	+	.	.	.	.	+	+	.	+	+	
+	.	.	.	.	.	.	.	.	+		
+	.	.	.	?	.	.	.	.	+	+	
+											
+	.	.	.	.	.	.	.	.	+		
+	+	.	.	+	.	.	+	.	+	+	
+	.	.	.	.	.	.	.	.	+	+	
+	.	.	.	.	.	+	.	.	+		
+	+	.	.	+	+						
.	.	.	.	+							
.	+										
+	.	.	.	.	.	.	+				

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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.

Plate 1.

All specimens illustrated in this plate are from the Andrarum limestone, Andrarum, Scania.

Agraulos difformis (ANGELIN). — Page 4.

Fig. 1. Cranidium of young individual, retaining the test.

Figs. 2—4. Three cranidia, exfoliated. Fig. 4 is the lectotype. — Figs. 3 and 4, RM. Nos. Ar. 42825 and 42824.

Figs. 5 a—b. Cranidium, retaining small parts of the test; one of the largest specimens found. — RM. No. Ar. 1813 a.

Figs. 6 a—b. Cranidium, retaining most of the test, with parabolic frontal outline. — RM. No. Ar. 42826.

Figs. 7, 8. Two cranidia retaining parts of the test, with subtriangular frontal outline. — Fig. 7, G.-M. I. Lund; fig 8, RM. No. Ar. 1820 b.

Agraulos aculeatus (ANGELIN). — Page 5.

Figs. 9, 10. Two cranidia, exfoliated; the latter is the lectotype. — RM. Nos. Ar. 1823 and 42828.

Agraulos acuminatus (ANGELIN). — Page 6.

Figs. 11—15. Five cranidia, exfoliated; fig. 13 is the lectotype. — Figs. 11 and 13, RM. Nos. Ar. 1818 a and 42830. Figs. 14 and 15, G.-M. I. Lund.

Agraulos sp.

Figs. 16, 17. Two free cheeks, exfoliated; probably belonging to either *A. difformis* or *A. aculeatus*. — Fig. 16, RM. No. Ar. 42827.

Figs. 1—3, 7—9, 10 a, 12, 14—17 photographed and retouched by J. W. Englund.
Figs. 4—6, 10 b, 11, 13 photographed by C. Larsson.

1 x4

2 x2

3 x2

x2 a 4

b

b

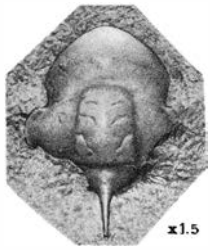
5 a x1.5

7 x2

8 x2

x2 a 6

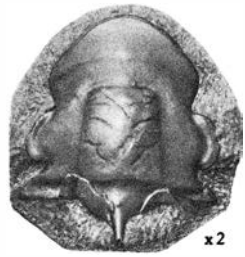
b



x1.5

9

b



x2

10 a

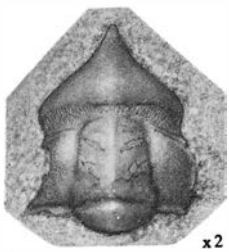
11 x2

b

12 a x2

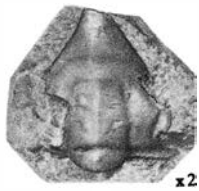
b

13 a x2



x2

14

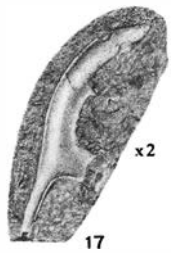


x2

15

x2

16



x2

17

Plate 2.

Agraulos anceps sp. n. — Page 6.

Figs. 1—3. Three cranidia, retaining parts of the test; fig. 2, holotype, copy from Holm & Westergaard, 1930, pl. 4, fig. 15. Andrarum limestone. Andrarum, Scania. — Figs. 2 and 3, RM. Nos. Ar. 42829 and 1810 a.

Parasolenopleura cristata (LINNARSSON). — Page 22.

Figs. 4—5. Dorsal shield wanting the free cheeks, and cephalon; 5, holotype. *Paradoxides oelandicus* beds, zone of *P. insularis*. Borgholm, Öland. Figs. 4 a and 5 copies from Westergård, 1936, pl. 12, figs. 1 and 3. — Fig. 5, RM. No. Ar. 1456 b.

Solenopleura munsteri STRAND. — Page 11.

Figs. 6 a—d. Cranidium; d, part of the left-hand fixed cheek showing the ornamentation of the test.

Figs. 7—8. Free cheek and pygidium, retaining the test; associated with the cranidium, fig. 6, in a greenish gray glauconitic limestone. Zone of *Ptychagnostus* (*Triplagn.*) *gibbus*. Oltorp, 18 km E of Falköping, Västergötland. Figs. 6—8, Geological Institution of the University of Stockholm.

Figs. 9—10. Defective cranidium (natural size), partly exfoliated; and pygidium retaining the test. Exsulans limestone. Brantevik, Scania.

Solenopleura parva LINNARSSON. — Page 12.

Figs. 11 a—c. New figs. of the holotype cranidium, retaining the test. Brantevik (= Linnarsson's locality Gislöv), Scania.

Fig. 12. Cranidium, retaining the test. Andrarum, Scania.

Fig. 13. Free cheek, retaining the test. Kiviks-Esperöd, Scania.

Figs. 11—13 from the Exsulans limestone.

Figs. 1, 2 b, 4 b, 6 c, 6 d, 8 b, 9, 11 c photographed by C. Larsson.
Figs. 2 a, 3, 4 a, 5—6 b, 7, 8 a, 10—11 b, 12, 13 photographed and retouched by J. W. Englund.

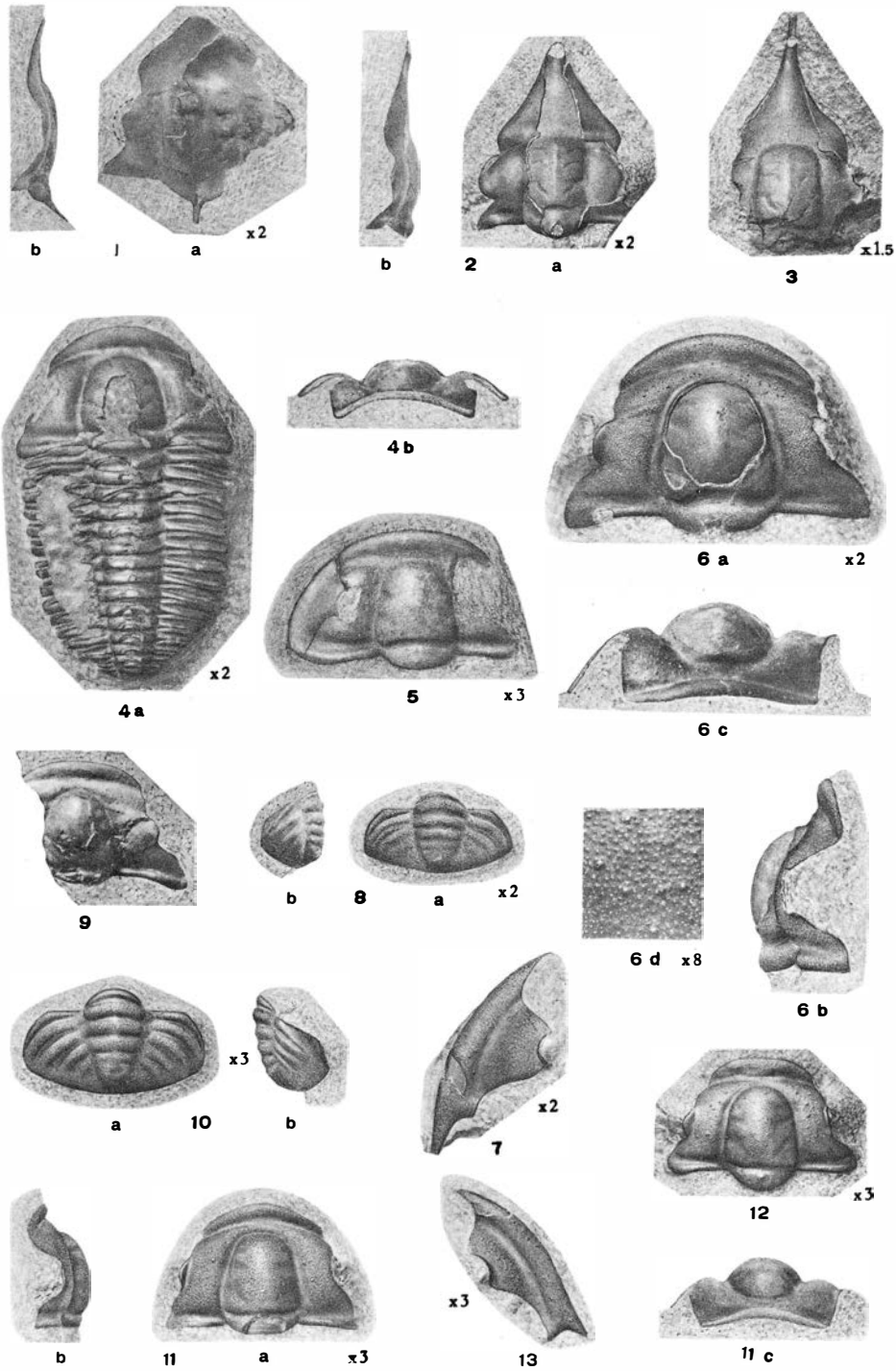

b
1
a
x2
b
2
a
x2
3
x1.5
4a
x2
4b
5
x3
6a
x2
6c
9
b
8
a
x2
6d
x8
6b
a
10
x3
b
7
x2
12
x3
b
11
a
x3
x3
13
11c

Plate 3.

Solenopleura bucculenta GRÖNWALL. — Page 13.

Figs. 1 a—b. Cranidium, exfoliated. The so-called *Hyolithes* limestone, ca. 0.4 m below the Andrarum limestone. Andrarum, Scania.

Figs. 2 a—c. Cranidium, retaining the test. Andrarum limestone, Andrarum, Scania.

Figs. 3 a—c. Cranidium, exfoliated. Andrarum limestone. Gislöv (boulder), Scania. — Geological Institution of the University of Stockholm.

Solenopleura brachymetopa (ANGELIN). — Page 18.

Figs. 4 a—c. Cranidium, retaining parts of the test; lectotype. — RM. No. Ar. 1773 g.

Figs. 5—7. Cranidium, free cheek, and pygidium from a weathered boulder.

Figs. 8 a—b. A fairly complete dorsal shield wanting the free cheeks; b, transverse section across the thorax. Natural size. — G.-M. I. Lund.

Fig. 9. Cranidium with part of attached thorax and displaced right-hand free cheek. — RM. No. Ar. 42835.

Figs. 10 a—b. Defective cephalon. — RM. No. Ar. 1780.

Figs. 4—10 from the Andrarum limestone. Andrarum, Scania.

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

1b

1a x3

3a x3

3b

2c

4c

2a x3

2b

3c

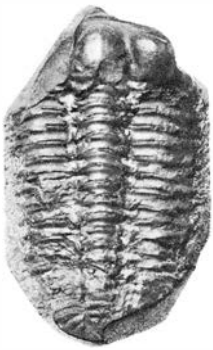
7 x2

4a x1.5

4b

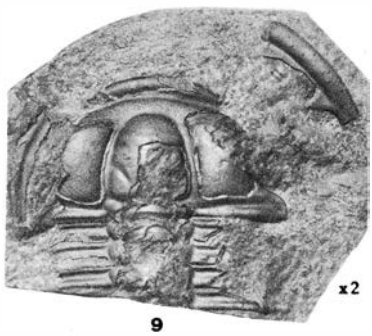
5a x2

5b

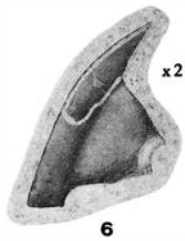


8a

8b



9 x2



6 x2

10a x1.5

10b

Plate 4.

All specimens illustrated in this plate are from the Andrarum limestone. Andrarum, Scania.

Solenopleura holometopa (ANGELIN). — Page 14.

Figs. 1 a—b. Cranidium, exfoliated. Lectotype, natural size. — RM. No. Ar. 46650.
Figs. 2—4. Three cranidia of various sizes, retaining the test. — Fig. 3, RM. No. Ar. 46651.
Fig. 5. Cranidium, with the left-hand free cheek in situ. — RM. No. Ar. 2057 b.
Fig. 6. Free cheek, retaining the test. — RM. No. Ar. 42834.
Figs. 7 a—b. Cranidium, with eleven thoracic segments attached; b, transverse section across the thorax. Natural size. — G.-M. I. Lund.
Figs. 8 a—b. Pygidium, retaining the test. — RM. No. Ar. 42837.

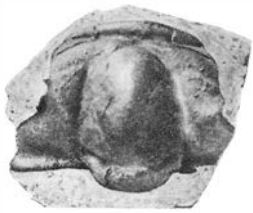
Solenopleura holometopa humilis subsp. n. — Page 16.

Figs. 9 a—c. Cranidium, retaining parts of the test; natural size. — RM. No. Ar. 1900.

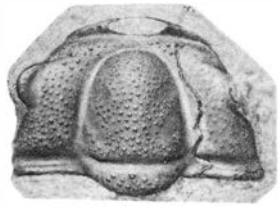
Solenopleura conifrons sp. n. — Page 17.

Figs. 10 a—d. Cranidium, retaining parts of the test; d, part of the left-hand fixed cheek showing the ornamentation of the test. — RM. No. Ar. 42836.

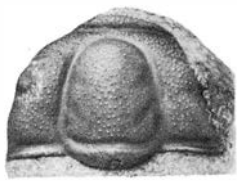
Figs. 1, 8 b, 9, 10 c photographed by C. Larsson.
Figs. 2—8 a, 10 a, 10 b, 10 d photographed and retouched by J. W. Englund.


1a

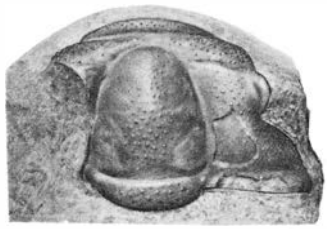

1b


2a x3


2b

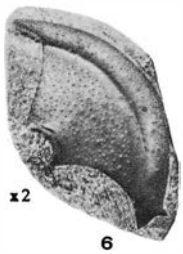

3a x2


3b


4a x1.5


4b


7a


x2 6

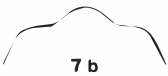

5 x2


4c


9c

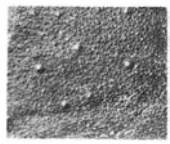

x2 8a

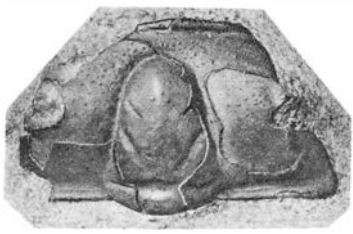

8b


7b


9a


9b


10d x6


10a x2


10b


10c

Plate 5.

Solenopleura canaliculata (ANGELIN). — Page 19.

Figs. 1 a—b. Defective cranidium, retaining small parts of the test. One of the specimens from which Angelin's restored figure was drawn; lectotype. Natural size. Andrarum, Scania. — RM. No. Ar. 46145.

Figs. 2 a—c. Cranidium, retaining parts of the test. Natural size. Järrestad (boulder), Scania. — RM. No. Ar. 1630.

Figs. 3 a—b. Cranidium, retaining the test. Andrarum, Scania.

Fig. 4. Defective free cheek, retaining the test on the border. Natural size. Andrarum, Scania. — G.-M. I. Lund.

Figs. 5 a—b. Pygidium, exfoliated. Andrarum, Scania. — RM. No. Ar. 1785 g.

Figs. 1—5 from the Andrarum limestone.

Parasolenopleura aculeata (ANGELIN). — Page 23.

Figs. 6 a—b. Cranidium and attached thorax, in shale, somewhat flattened; b, counterpart of a, photographed in reverse light, showing the impressions of the axial nodes on the eight anterior thoracic segments. Zone of *Ptychagnostus* (*Triplagn.*) *gibbus*. Boring at Övre Åkerby, Närke; level 23.5 m (Westergård 1941).

Fig. 7. Dorsal shield wanting the free cheeks, in shale, somewhat flattened. Zone as above. Boring at Berga, parish of Knista, Närke; level 14.23 m.

Figs. 8—9. Cranidium and free cheek, retaining the test. Zone as above. Berg (boulder 4), Östergötland.

Fig. 10. Cranidium, retaining the test, somewhat crushed. Lectotype. *Acrothele* (*Redlichella*) *granulata* conglomerate. Borgholm, Öland. — RM. No. Ar. 46143 a.

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

1a

1b

2a

2b

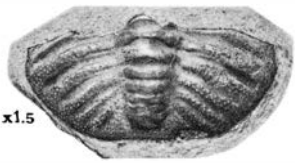
2c

4

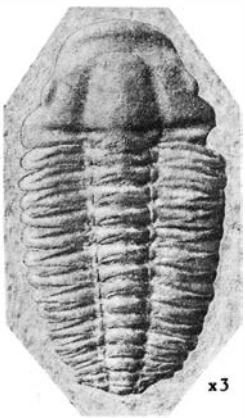
3a x2

3b

5b

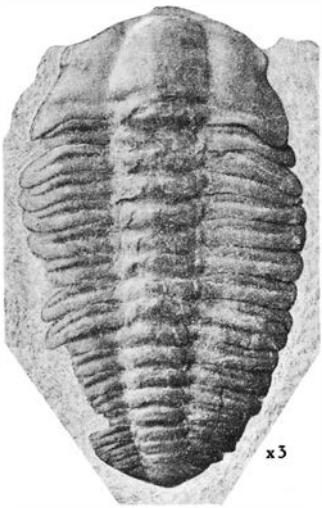


x1.5 5a



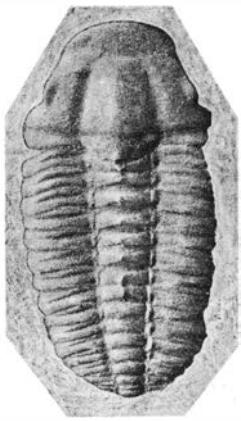
x3

6a

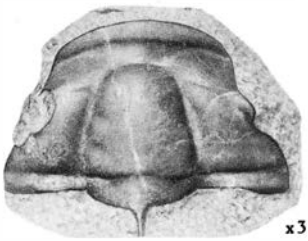


x3

7

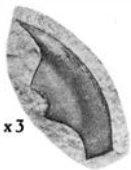


6b



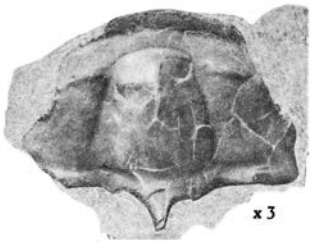
x3

8



x3

9



x3

10

Plate 6.

Parasolenopleura aculeata (ANGELIN). — Page 23.

Figs. 1 a—c. Cranidium, retaining the test. *Acrothele* (*Redlichella*) *granulata* conglomerate. Borgholm, Öland. — RM. No. Ar. 1464 b.

Fig. 2. Cranidium with attached thorax, retaining parts of the test. Under the microscope (magnification 25 times) the cranidium is quite smooth and the thorax — in particular the posterior segments — closely granulate. Associated with *Ctenocepahlus exsulans* in a thin stratum immediately covering the conglomerate mentioned above. On the shore 2 km E of Borgholm, Öland.

Figs. 3 a—c. Cranidium. Under the microscope (magn. 25 times) the test is closely granulate. Exsulans limestone, Andrarum, Scania.

Fig. 4. Pygidium. Test granulate as in fig. 3. Exsulans limestone. Gislövshammar (boulder 2), Scania.

Parasolenopleura scanica sp. n. — Page 25.

Figs. 5—6. Two cranidia; the former is the holotype. Under the microscope the test is fairly closely granulate.

Figs. 7—8. Free cheek and pygidium. Test as in figs. 5 and 6.
Figs. 5—8: Exsulans limestone; Andrarum, Scania.

Parasolenopleura linnarssoni (BRÖGGER). — Page 26.

Figs. 9—10. Two cranidia of different sizes. Zone of *Ptychagnostus atavus*. Oltorp, 18 km E of Falköping, Västergötland.

Figs. 11—12. Cranidium and pygidium, in shale, flattened; probably this species. New figs. of the specimens illustrated by Linnarsson, 1883, pl. 4, figs. 8 and 11. Zone of *Tomagnostus fissus*. Andrarum, Scania.

Parasolenopleura linnarssoni brevicauda subsp. n. — Page 28.

Fig. 13. Dorsal shield, almost complete, in shale, somewhat flattened, retaining the test; holotype. Zone of *Hypagnostus parvifrons*, lower portion. Andrarum, Scania. — G.-M. I. Lund.

Fig. 14. Cranidium of young individual, tentatively referred to this form. Zone of *Hypagnostus parvifrons*. Aborrfallet, the river Sjougdälven, Ångermanland.

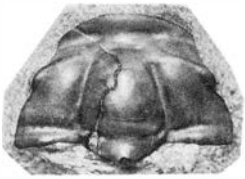
Parasolenopleura spinigera sp. n. — Page 29.

Figs. 15 a—c. Cranidium, holotype, retaining the test. Zone of *Ptychagnostus atavus*. Oltorp, 18 km E of Falköping, Västergötland.

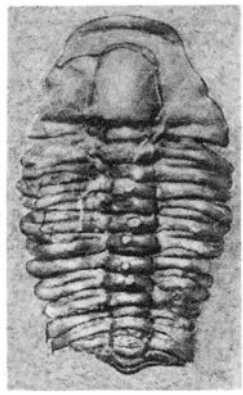
Parasolenopleura vestgothica sp. n. — Page. 29.

Figs. 16 a—c. Cranidium, holotype, retaining the test except on part of the glabella. Horizon and locality as in fig. 15.

Figs. 1 a—b, 3 a—b, 5 a—b, 6—9 a, 13, 14, 16 a—b photographed and retouched by J. W. Englund.
Figs. 1 c, 2, 3 c, 4, 5 c, 9 b—12, 15 a—c, 16 c photographed by C. Larsson.


1a x3


1b

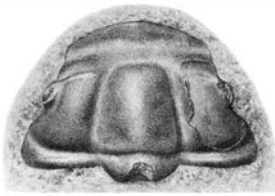

2 x3


1c

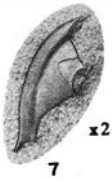

3c


4 x3


3b x3


3a

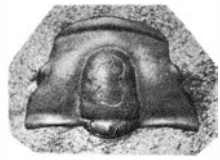

5c


7 x2


5a x2


5b


8 x3

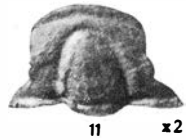

6 x3


b

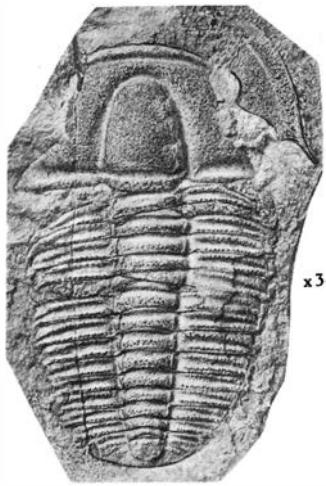

10 a x2


9 x3

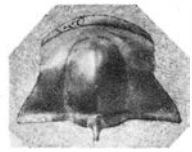

12 x2


11 x2


14 x4

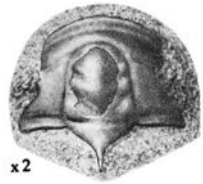

13 x3


b


15 a x2


15c


16c


x2 a 16


b

Plate 7.

Parasolenopleura linnarssoni (BRÖGGER) or *P. spinigera* sp. n.

Figs. 1 a—c. Cranidium, exfoliated but retaining very small remnants of the test. New figs. of the specimen depicted by Brögger, 1878, pl. 3, fig. 4.

Figs. 2—3. Free cheek and pygidium, in shale; test dissolved; collected by Brögger. Figs. 1—3 from Krekling, Norway. — Paleontological Museum of the University of Oslo.

Figs. 4—5. Free cheek and pygidium, retaining the test. Associated with the specimens figs. 10, 15, and 16 in pl. 6. Zone of *Ptychagnostus atavus*. Oltorp, 18 km E of Falköping, Västergötland.

Parasolenopleura cf. *linnarssoni* (BRÖGGER). — Page 29.

Figs. 6—7. Cranidium and associated free cheek, exfoliated. Zone of *Hypagnostus parvifrons*. Byklev (lowest portion of the third limestone bed from below), Hunneberg, Västergötland.

Fig. 8. Cranidium, in shale, flattened, retaining the test. Zone of *Ptychagnostus atavus*, uppermost portion. Andrarum (Tullberg's loc. 9), Scania. — RM. No. Ar. 46144.

Parasolenopleura? peregrina (WALLERIUS). — Page 30.

Figs. 9—10. Two cranidia, the former exfoliated, the latter retaining parts of the test.

Figs. 11—12. Associated free cheek and pygidium, retaining part of the test. Zone of *Ptychagnostus punctuosus*. Byklev (middle portion of the third limestone layer from below), Hunneberg, Västergötland.

Grönwallia microphthalma (ANGELIN). — Page 32.

Fig. 13. Defective cranidium, retaining the test except on the glabella. Lectotype. — RM. No. Ar. 46146.

Figs. 14—15. Cranidium and free cheek, the former partly exfoliated, the latter retaining the test. — RM. Nos. Ar. 1766 and 42832.

Fig. 16. Thorax with attached pygidium, retaining most of the test. The right-hand pleura of the tenth and eleventh thoracic segments counted from behind were broken and cicatriced while the animal lived.

Fig. 17. Pygidium, retaining parts of the test. — RM. No. Ar. 42833.
Figs. 13—17: Andrarum limestone, Andrarum, Scania.

Grönwallia platyrrhina (GRÖNWALL). — Page 31.

Figs. 18—19. Two cranidia, retaining most of the test. — Fig. 19, RM. No. Ar. 42831.

Fig. 20. Cephalon and the four anterior thoracic segments. — G.-M. I. Lund.
Figs. 18—20: Andrarum limestone, Andrarum, Scania.

Figs. 1—3, 9—13 photographed by C. Larsson.
Figs. 4—8, 14—20 photographed and retouched by J. W. Englund.

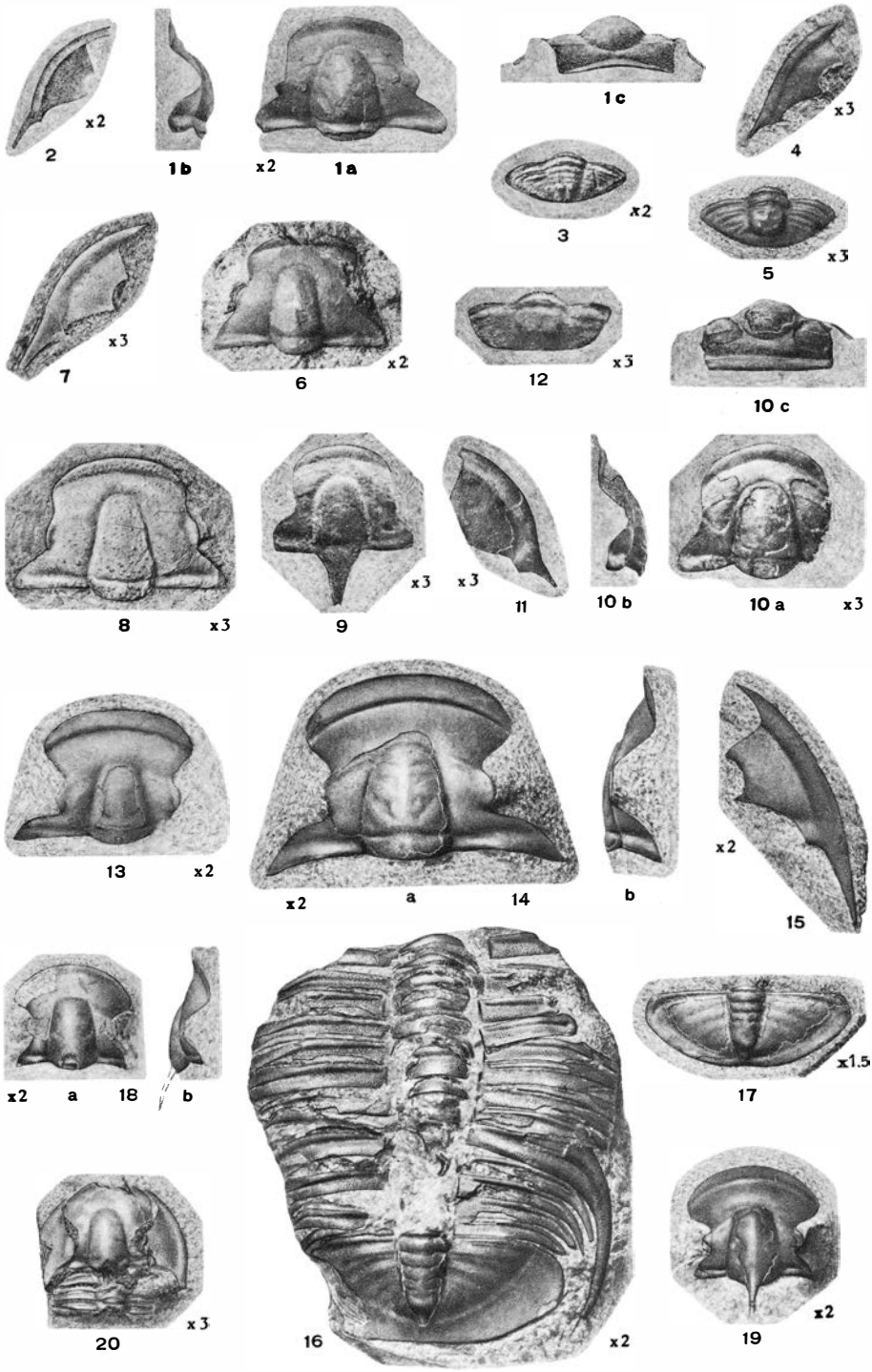

x2
2
1b
x2
1a
1c
x3
4
x2
3
x3
5
7
x3
x2
6
12
x3
10 c
8
x3
x3
9
x3
11
10 b
10 a
x3
13
x2
x2
a
14
b
x2
15
x2
a
18
b
x1.5
17
x3
20
16
x2
x2
19

Plate 8.

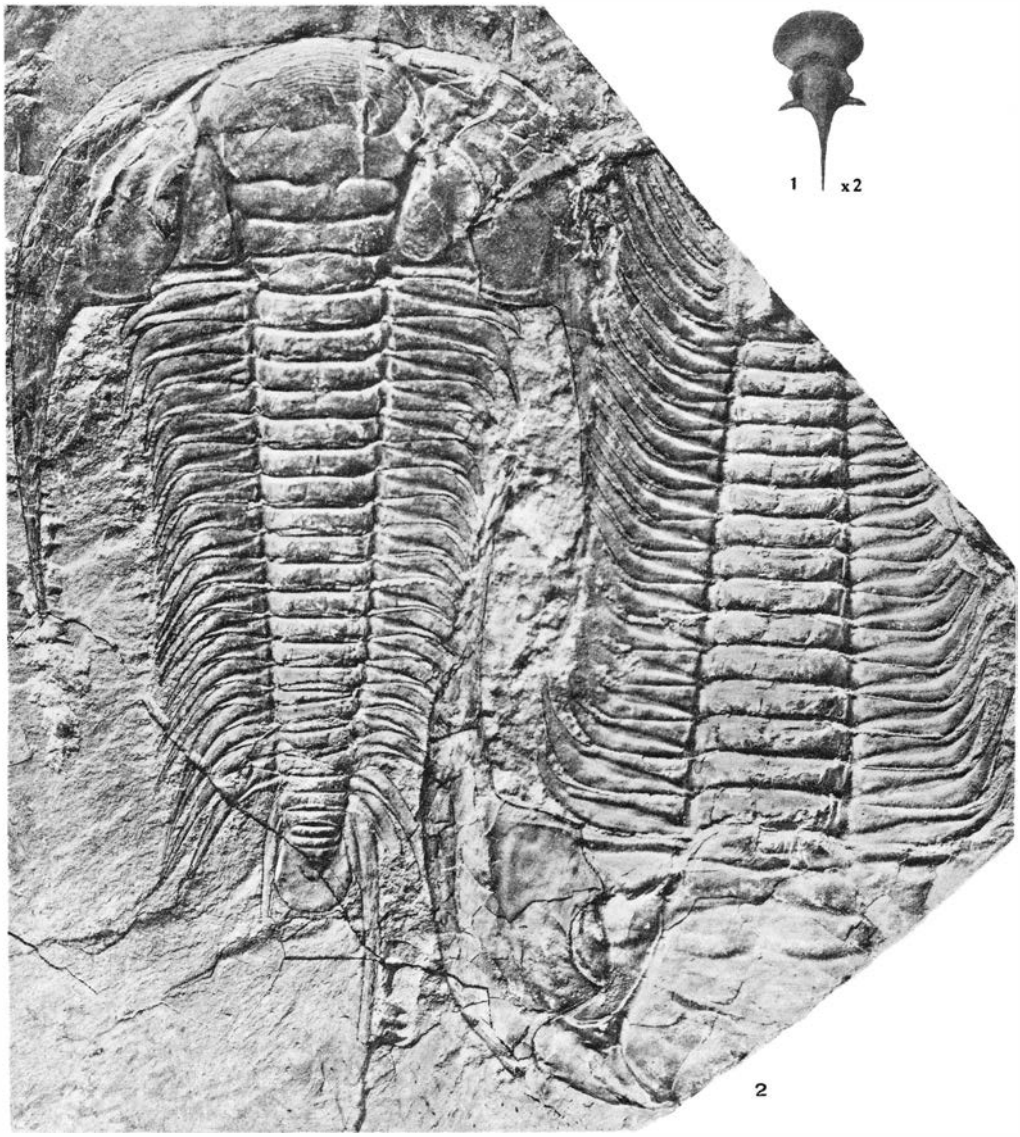
Grönwallia? *angermanensis* sp. n. — Page 34.

Fig. 1. Cranidium, wanting the test, poorly preserved. *Paradoxides forchhammeri* beds. Aborrfallet, the river Sjougdälven, Ångermanland. Collected by Professor P. Thorslund.

Paradoxides paradoxissimus (WAHLENBERG, 1821). — Page 34.

Fig. 2. Two specimens, the left-hand of which is the original of Wahlenberg's restored illustration of *Entomostracites paradoxissimus*. Strongly flattened impressions in alum shale; natural size. Lower portion of the alum shale, probably the zone of *Ptychagnostus* (*Triplagn.*) *gibbus*. Oltorp, 18 km E of Falköping, Västergötland. — RM. No. Ar. 46147.

Figs. 1 and 2 photographed by C. Larsson.


1 x2
2

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