

THE MIDDLE ORDOVICIAN OF THE OSLO REGION, NORWAY

7. Trilobites of the suborder Cheirurina

By

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Abstract. Sixteen cheirurid trilobites are described from the Middle Ordovician Ogygiocaris and Chasmops series of the Oslo Region of Norway. The genus *Cyrtometopella*, and also the species *Paraceraurus helgoeyensis*, *Cyrtometopella tumula*, *C. askerensis*, *Nieszkowskia norvegica*, *Hemisphaerocoryphe inflatus*, and *Atractopyge gracilis* are new. The species *Cybele brevicauda*, *C. coronata*, *C. dentata*, *C. kutorgae*, *C. revaliensis*, *C. rex*, and *C. woerthi* are transferred to the genus *Atractopyge*. The species *C. grewingki* (SCHMIDT, 1881) is regarded as a synonym of *Atractopyge dentata* (ESMARK, 1833). The species *Hemisphaerocoryphe? rosenthali* (SCHMIDT, 1881) is transferred to the genus *Cyrtometopella* n. gen.

A chart shows the stratigraphic occurrence of the described species.

CONTENTS

Page

Abstract	279
Introduction	281
Acknowledgements	282
Abbreviations	282
Names used by previous authors	283
Family Cheiruridae	283
Subfamily Cheirurinae	283
<i>Paraceraurus helgoeyensis</i> n. sp.	283
— <i>perlongus</i> (BRØGGER)	286
Subfamily Cyrtometopinae	287
Genus <i>Cyrtometopella</i> n. gen.	287
<i>Cyrtometopella tumula</i> n. gen., n. sp.	288
— <i>askerensis</i> n. gen., n. sp.	289

Subfamily Acanthoparyphinae	291
<i>Nieszkowskia norvegica</i> n. sp.	291
Subfamily Deiphoninae	292
<i>Hemisphaerocoryphe inflatus</i> n. sp.	292
— <i>sphaericus</i> (ESMARK)	293
Family Pliomeridae	295
Subfamily Pliomerinae	295
<i>Pliomerops</i> sp.	295
Family Encrinuridae	296
Subfamily Encrinurinae	296
<i>Encrinurus</i> sp.	296
Subfamily Cybelinae	296
<i>Atractopyge brevicauda</i> (ANGELIN)	296
— <i>dentata</i> (ESMARK)	298
— <i>gracilis</i> n. sp.	302
— <i>kutorgae</i> (SCHMIDT)	304
— aff. <i>kutorgae</i> (SCHMIDT)	305
— sp.	306
Subfamily Staurocephalinae	306
<i>Staurocephalus</i> sp.	306
References	307
Middle Ordovician cheirurid trilobites found in Norway and their known stratigraphic and geographic occurrence (chart)	309
Plates 1—4 and explanation of plates.	

Introduction

The present paper appears as no. 7 in a series dealing with the Middle Ordovician stratigraphy and fossils of the Oslo region. Team work on this subject was initiated by Professor Leif Størmer in 1950, and is supported by grants from the Norwegian Research Council for Science and Humanities.

The term Middle Ordovician is taken in the sense defined by STØRMER (1953), *i.e.* from and including the Llandvirnian zone of *Didymograptus bifidus* to and including the Caradocian zone of *Dicranograptus clingani*. The Cambro-Silurian of the Oslo region is divided into several districts, cf. STØRMER (1953, p. 51; map p. 53).

The first description of cheirurid trilobites based on Norwegian material was the two Middle Ordovician species *Trilobites sphaericus* (now *Hemisphaerocoryphe sphaericus*), and *Trilobites dentatus* (now *Atractopyge dentata*) described by ESMARK in 1833.

Since then only two species of cheirurid trilobites have been described from the Middle Ordovician of Norway, namely *Cheirurus perlongus* (now *Paraceraurus perlongus*), described by BRØGGER in 1882, and *Staurocephalus* sp., described by KIELAN in 1957.

Only one species previously described from other countries has so far merely been recorded from the Middle Ordovician of the Oslo region (namely *Atractopyge brevicauda*), *e.g.* KLÆR (1897), and HOLTEDAHL (1909).

In 1881 SCHMIDT published his paper «Revision der ostbaltischen silurischen Trilobiten», which contains descriptions of the Baltic species of the three trilobite families Phacopidae, Cheiruridae, and Encrinuridae. This paper has been valuable in determining the Norwegian species of the suborder Cheirurina.

The Norwegian species do not resemble closely any British or North American species except that *Paraceraurus helgoeyensis* n. sp. recalls *Ceraurinus craigensis* (TRIPP, 1954) from the Caradocian mudstones at Craighead Quarry near Girvan, Scotland.

Unfortunately most of the present material consists of detached parts of the shield, whereas complete dorsal shields are rare. Only two nearly complete dorsal shields have been found, and they belong to the same species. For this reason, and because the preservation is not always too good, there are some specimens in the collections

which I have not been able to determine. Some of these specimens may belong to other species than those described in this paper. It is regrettable that stratigraphic data are inadequate or even missing for some of the specimens in the collections.

The species *Pliomerops* sp. comes from Redalen in Biri, and thus it should not have been dealt with in this paper, but as this species is the only known Middle Ordovician cheirurid trilobite that occurs in Norway outside the Oslo region, I have decided to include it here.

The stratigraphy used in this paper was published by STØRMER in 1953. For abbreviations in this connection see below.

I mainly use the descriptive terms published in the Treatise on Invertebrate Paleontology, Volume O. The terms S1, S2, and S3 used for the lateral glabeller furrows were suggested by JAANUSSON in 1956, and HENNINGSMOEN in 1957.

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I wish to express my sincere thank to Miss. B. Mauritz for her interest in taking good photographs, and to Dr. Frank Vokes for reading the English of the manuscript.

ABBREVIATIONS

The following abbreviations are used in the text:

- P.M.O. = Paleontological Museum, University of Oslo, Norway.
- Ceph. = Cephalopod Shale (4a β ?).
- Ech. = Echinospaerites Beds (4ba?).
- Coel. = Coelosphaeridium Beds (4b β ?).
- Cycl. = Cyclocrinus Beds (4by?).
- Sphaer. = Sphaeronid Limestone (4b δ ?).

Names used by previous authors

Names used by ESMARK, 1833:

Revised names:

Trilobites sphaericus *Hemisphaerocoryphe sphaericus*
 — *dentatus* *Atractopyge dentata*

Names used by BRØGGER, 1882 and 1887:

1882 *Cheirurus perlongus* *Paraceraurus perlongus*
 1887 *Sphaerocoryphe* cf. *Hübneri* ... *Hemisphaerocoryphe inflatus*
 1887 *Cybele* sp. (4ba) *Atractopyge dentata*
 1887 — sp. (4bδ) — *gracilis*

Names used by KIÆR, 1897:

Cybele brevicauda *Atractopyge brevicauda*

Names used by HOLTEDAHL, 1909:

Cybele brevicauda *Atractopyge brevicauda*
 — *Grewingkii* — *dentata*

Suborder Cheirurina HARRINGTON & LEANZA, 1957

[Erroneously ascribed to ÖPIK, 1937, by HARRINGTON & LEANZA, 1957].
 [Superfamily Cheiruracea ÖPIK, 1937; Cheiruroidae HUPÉ, 1953 (attributed to ÖPIK, 1937)] [Type — *Cheirurus* BEYRICH, 1845]

Family Cheiruridae SALTER, 1864

[= Chirurides HAWLE & CORDA, 1847; Chiruridae ANGELIN, 1854, suppression of both pend. ICZN; = Cerauridae MILLER, 1889]

SUBFAMILY CHEIRURINAE SALTER, 1864

[*nom. transl.* RAYMOND, 1913 (*ex* Cheiruridae SALTER, 1864)]

Genus *Paraceraurus* MÄNNIL, 1958

Type species: — *Ceraurus aculeatus* EICHWALD, 1860

Paraceraurus helgoeyensis n. sp.

Pl. 1, figs. 1–3, text fig. 1.

Name: — From the island of Helgøy in Lake Mjøsa in the Nes—Hamar district.

Type data: — Holotype (here selected) is a cranidium (P.M.O. no. 67937), from the Mjøsa Limestone (4bδ) at Bergevika, Helgøya.

Material: — In addition to the holotype, 3 more or less fragmentary cranidia (P.M.O. nos. 67915, 67926, 67977 and counterpiece 67978). Furthermore 1 hypostoma (P.M.O. no. 68010), and 3 more or less incomplete pygidia (P.M.O. nos. 67914, 67981 and 69634).

Diagnosis: — Cranidium more than twice as wide as long, glabella with subparallel sides, smooth, and subtrapezoidal in front. Fixigenae wide, pitted, reticulate, and with flattened genal spines pointing obliquely backwards.

Hypostoma with a granulated middle body, and a pair of distinct furrows. Posterior part of the brim wide (long.).

Thorax unknown.

Pygidium flattened, with 2 pairs of pleural spines, the anterior pair much stronger than the posterior pair, and the axial piece with 2 small spines.

P. helgoeyensis n. sp. differs from the type species in having the eyes closer to the glabella, and a wider and more parallel-sided glabella.

Description: — Cephalon subsemicircular in outline, moderately convex transversely. Cranidium only slightly less than 2.3 times as wide as long. Glabella with subparallel sides, and subtrapezoidal in front. Three pairs of strong and distinct lateral glabellar furrows. S1 geniculate, oblique backwards and reaching the occipital furrow. S2 and S3 slightly convex, slightly oblique backwards, reaching one-third across the glabella. S2 slightly less convex than S3. Glabella appears to be smooth, but the test is missing. Occipital furrow deep and distinct, simple and convex. Preoccipital glabellar lobe subrectangular. Occipital ring as wide (tr.) as glabella, mesial tubercle not developed. Axial furrow deep and distinct. Postocular fixigenae slightly less than 1.5 times as wide (tr.) as occipital ring, pitted faint near the glabella, but stronger at the sides. Relatively long, curved and flattened genal spines, pointing obliquely backwards. Posterior border furrow deep and well defined. Posterior border broad (long.). Eyes located at transverse mid-line of the cranidium. Palpebral lobes strong and protuberance-like. Eye ridges slightly oblique backwards, broad (long.) and short (tr.). Width of interocular fixigenae about one-third of that of glabella at eye-line. Preglabellar field narrow (long.). Preocular part of facial suture converging slightly, postocular part running slightly obliquely forwards until reaching the lateral border furrow, and then obliquely backwards. Librigenae small and with

Fig. 1.

Pygidium of *Paraceraurus helgoeyensis* n. sp., from the lower part of the Mjøsa Limestone (4b δ_1), Bergevika, Helgøya, Nes-Hamar. P.M.O. no. 69634. Coll.: F. Nikolaisen, 1961. x 4.0.



well rounded outer margin, lateral border broad (tr.), lateral border furrow deep and distinct.

Hypostoma with a rather convex and granulated middle body. A pair of deep and distinct furrows separates the anterior lobe from the posterior lobe, each furrow reaching about one-third across the middle body. Lateral parts of the brim narrow (tr.), posterior part wide (long.), and with a well rounded posterior margin.

Thorax unknown.

Pygidium flattened, with 2 pairs of pleural spines. The axis is short, occupying about one-fourth of total width. Anterior pair of pleural spines long and broad (tr.), slightly curved, posterior pair about half as long, and half as wide. The endlobe is slightly convex, and provided with 2 pit-like impressions near the base, and a pair of small spines, which seem to be convex in the longitudinal direction, and to be hollow.

Dimensions: — The holotype is 12.1 mm long and 27.5 mm wide. The largest cranidium is 16 mm long and 36.5 mm wide. Largest pygidium is about 7.3 mm long and 22 mm wide (spines not included).

Occurrence: — Mjøsa Limestone (4b δ), NES—HAMAR (Helgøya).

Affinities: — *P. helgoeyensis* n. sp. is closely related to the two Baltic species *P. exsul* (BEYRICH, 1846) and *P. gladiator* (EICHWALD, 1857). It differs from *P. exsul* in having a wider and apparently smooth glabella. Furthermore the eyes are located further forwards. It differs from *P. gladiator* in having the eyes further forwards and closer to

the glabella. The pygidium differs from both species in having only 2 pairs of pleural spines.

Furthermore it seems to be related to the species *Ceraurinus craigensis* (TRIPP, 1954), which may be a species of the genus *Paraceraurus*. *P. helgoeyensis* n. sp. differs from this species in having a shorter and wider glabella. The pygidium differs in being narrower.

Paraceraurus perlongus (BRØGGER, 1882)

Pl. 1, fig. 4.

1882 *Cheirurus perlongus* n. sp. — BRØGGER, p. 134, pl. V, fig. 14.
(Short diagn. and fig. of glabella).

Type data: — Holotype (by monotypy) is a fragmentary cranium (P.M.O. no. 2636) probably from the Upper Chasmops Shale (4by) from Oslo. (Figured by Brøgger, 1882).

Material: — The holotype is the only known specimen.

Diagnosis: — A *Paraceraurus* species with subparallel-sided glabella, and 3 pairs of lateral glabellar furrows, all oblique backwards. Occipital ring as wide as glabella. Glabella granulated.

P. perlongus differs from the type species in having a more parallel-sided and narrower (tr.) glabella.

Description: — Glabella only slightly more than 1.6 times as long as wide, with subparallel sides, and subtrapezoidal in front, but not as markedly as the front of the glabella of *P. helgoeyensis* n.sp. Three pairs of lateral glabellar furrows. S1 geniculate, oblique backwards, and reaching the occipital furrow. S2 and S3 convex, S3 more convex than S2, oblique backwards, deepest near the axial furrow, and reaching about one-fourth across the glabella. Glabella covered with relatively small nodes. Occipital furrow distinct, simple and straight. Occipital ring as wide as glabella. Axial furrow well defined.

Other parts of the trilobite unknown.

Dimensions: — The holotype is 13 mm long and 7.8 mm wide (occipital ring not included).

Occurrence: — Probably the Upper Chasmops Shale (4by), OSLO—ASKER (Oslo).

Affinities: — *P. perlongus* (BRØGGER) is probably closely related to both *P. exsul* (BEYRICH, 1846) and *P. gladiator* (EICHWALD, 1857), and may morphologically occupy an intermediate position between

these. *P. perlongus* differs from *P. exsul* in having narrower glabella, and it differs from *P. gladiator* in having the glabella possessed with relatively large and conspicuous nodes.

SUBFAMILY CYRTOMETOPINAE ÖPIK, 1937

Remarks: — With the inclusion of *Cyrtometopella* n. gen. in the subfamily the diagnosis as given in the Treatise on Invertebrate Paleontology, Volume 0 may be changed to state that eye ridges are present or not (if present partly coalesced with the sutural ridges), and that the pygidium has 2 to 4 (instead of 3 to 4) pairs of pleural spines, the posterior pair being more or less reduced.

Genus *Cyrtometopella* n. gen.

Name: — Referring to the great likeness to the genus *Cyrtometopus*, I prefer to call this genus *Cyrtometopella*.

Type species: — *Cyrtometopella tumula* n. gen., n. sp.

Diagnosis: — A genus of the subfamily Cyrtometopinae with the cranidium subsemicircular in outline, glabella oval in outline, with three pairs of lateral glabellar furrows, reaching or nearly reaching the occipital furrow. Eyes located opposite or slightly behind S2. Eye ridges present or not (if present partly coalesced with sutural ridges).

Hypostome and thorax unknown.

Pygidium with two pairs of pleural spines, posterior pair reduced.

Affinities: — Cranidium resembling that of *Cyrtometopus*, but with the eyes opposite or slightly behind S2. The postocular fixigenae are narrower (tr.) and more convex transversely than those of *Cyrtometopus*. Glabella resembles that of *Cyrtometopus* in having convex sides, but the convexity is stronger both in the longitudinal and the transversal direction. Sutural ridges, if present, differs from those of *Cyrtometopus* in being partly coalesced with the eye ridges.

The pygidium differs distinctly from that of *Cyrtometopus* in having only two pairs of pleural spines.

The cranidium of *Cyrtometopella* thus resembles that of *Cyrtometopus* so much that it can hardly be doubted that the two genera are closely related. For this reason I place the genus *Cyrtometopella* in the subfamily Cyrtometopinae.

Remarks: — The species *Hemisphaerocoryphe? rosenthali* (SCHMIDT, 1881) shows a very close relationship to the two species *Cyrtometopella tumula* n. sp. and *C. askerensis* n. sp.. For this reason I propose to include *H.? rosenthali* in the genus *Cyrtometopella*.

Cyrtometopella tumula n. gen., n. sp.

Pl. 1, figs. 7–10.

Name: — From Latin *tumulus* (barrow, hillock), referring to the shape of the glabella.

Type data: — Holotype (here selected) is a cranidium (P.M.O. no. 72146) from the transitional beds between the Ampyx Limestone (4a β) and the Lower Chasmops Shale (4ba) at Ildjernet in the Oslo—Asker district.

Material: — In addition to the holotype 4 more or less fragmentary cranidia (P.M.O. nos. 72147 (2 specimens), 72148, and 72149), and 2 pygidia (P.M.O. nos. 18910 and 72149).

Diagnosis: — A *Cyrtometopella* species with the cranidium about 3 times as wide as long, rather convex transversely. Glabella bulbous, and with three pairs of lateral glabellar furrows; S1 oblique backwards, S2 transverse, S3 oblique forwards. Occipital ring as wide as posterior end of glabella. Fixigenae about twice as wide as occipital ring, and with long genal spines. Eyes located slightly behind S2.

Librigenae, hypostome and thorax unknown.

Pygidium with 2 pairs of pleural spines, anterior pair strong, posterior pair reduced.

Description: — Cranidium subtriangular in outline, strongly convex transversely, only slightly more than 3 times as wide as long. Glabella oval in outline and very bulbous. Three pairs of lateral glabellar furrows. S1 convex, oblique backwards, reaching one-third across the glabella, and nearly reaching the occipital furrow. S2 almost straight, transverse, reaching only one-eighth across the glabella. S3 straight, oblique forwards, less distinct. Glabella with numerous small nodes. Occipital furrow simple, straight, deep and distinct. Occipital ring about as wide as posterior part of glabella, covered with small and less distinct nodes. Mesial tubercle not developed. Preoccipital glabellar lobes suboval in outline. Axial furrow deep and well defined. Postocular fixigenae about twice as wide as occipital ring, with rela-

tively long genal spines, and covered with nodes. The genal spines are round and slightly curved, oblique backwards. Posterior border furrow narrow (long.) near the axial furrow, but widening laterally. Posterior border narrow (long.). Width of interocular fixigenae about one-fourth of that of glabella at eye-line. Eyes located at transverse mid-line of the cranidium. Palpebral lobes convex and relatively small. Eye ridges not developed on present material. Preglabellar field narrow (long.). Preocular part of facial suture converging forwards, postocular part transverse.

Librigenae, hypostome and thorax unknown.

Pygidium about twice as wide as long, axis occupying about one-third of total width. Two pairs of pleural spines, anterior pair about 3 times as long as the pygidium proper. Posterior pair of pleural spines much shorter, only about one-fourth as long as the pygidium proper.

Dimensions: — The holotype is 7.1 mm long and 22 mm wide. The largest pygidium is 8 mm long and 15.5 mm wide (spines not included).

Occurrence: — Ampyx Limestone (4a β) and Lower Chasmops Shale (4ba). OSLO—ASKER: Ildjernet (4a β), Slependen (4ba), Vassholmen (4a β).

Affinities: — *C. tumula* n. sp. is closely related to *C. rosenthali* (SCHMIDT, 1881) (here transferred to this genus), but differs from it in having a wider cranidium and a more bulbous glabella.

Cyrtometopella askerensis n. gen., n. sp.

Pl. 1, figs. 5–6.

Name: — From the district of Asker.

Type data: — Holotype (here selected) is a cephalon (P.M.O. no. 72226) from the Ampyx Limestone (4a β) at Terneskjær, Asker.

Material: — In addition to the holotype only one fragmentary cranidium (P.M.O. no. 72224).

Diagnosis: — A *Cyrtometopella* species with cephalon subsemicircular in outline. Cranidium more than twice as wide as long. Glabella with convex sides and 3 pairs of lateral glabellar furrows. Fixigenae pitted, and provided with relatively long genal spines. Eyes located at transverse mid-line of the cranidium.

Other parts of the trilobite unknown.

C. askerensis n. sp. differs from the type species in having a well rounded convexity of the glabella and narrower and more convex fixigenae.

Description: — Cephalon subsemicircular in outline, rather convex transversely. Cranium more than twice as wide as long. Glabella oval in outline, well rounded in front, and covered with numerous small nodes. Three pairs of lateral glabellar furrows, all deepest near the axial furrow. S1 convex, oblique backwards, and nearly reaching the occipital furrow. S2 slightly convex, transverse, and reaching about one-fifth across the glabella. S3 almost straight, oblique slightly forwards, and reaching about one-fifth across the glabella. Preoccipital glabellar lobe oval in outline. Occipital furrow broad (long.), deepest at the axial furrow, simple and straight. Occipital ring about as wide as posterior part of glabella, and covered with numerous small nodes. Mesial tubercle not developed. Axial furrow deep and distinct. Fixigenae about 1.5 times as wide as occipital ring, pitted only faintly near the glabella, but more strongly at the sides, and provided with relatively long genal spines. The genal spines are flattened and slightly curved, pointing obliquely backwards. Posterior border furrow deep and broad (long). Posterior border narrow (long.), but somewhat wider near the postero-lateral corner. Width of interocular fixigenae about one-third of that of glabella at eye-line. Eyes seem to be stalked, located at the transverse mid-line of the cranium. Eye ridges partly coalesced with the sutural ridges, pointing obliquely backwards. Preglabellar field appears to be only a narrow (long.) brim. Pre-ocular part of facial suture converging forwards, postocular part transverse.

Librigenae small, and with well rounded outer margin. Lateral border furrow deep and broad (tr.). Lateral border smooth and well defined.

Other parts of the trilobite are unknown.

Dimensions: — The holotype, which is the largest specimen present, is 7.7 mm long and 18 mm wide.

Occurrence: — Ampyx Limestone (4a β). OSLO—ASKER: Terneskjær.

Affinities: — *C. askerensis* n. sp. is closely related to both *C. tumula* n. sp. and *C. rosenthali* (SCHMIDT, 1881) (here transferred to this genus). The cranium differs from that of *C. tumula* in being

narrower (tr.) and in having a better rounded glabella in lateral view. It differs from that of *C. rosenthali* in having the eyes further forwards and closer to the glabella.

SUBFAMILY ACANTHOPARYPHINAE WHITTINGTON & EVITT, 1953

Genus *Nieszkowskia* SCHMIDT, 1881

Type species: — *Sphaerexochus cephaloceros* NIESZKOWSKI, 1857

Nieszkowskia norvegica n. sp.

Pl. 2, figs. 1–2.

Name: — From Latin *norvegicus* (from Norway).

Type data: — Holotype (here selected) is a fragmentary cranium (P.M.O. no. 8675) from the Echinospaerites Beds (4ba?) at Skjellbukta, Frierfjord, Skien—Langesund.

Material: — In addition to the holotype only one fragmentary cranium (P.M.O. no. 20333).

Diagnosis: — A *Nieszkowskia* species with a broad and strong glabella, and strong glabellar spine. The whole cranium is covered with both larger and smaller nodes. Glabella tapering forwards.

No other parts of the trilobite are known.

N. norvegica n. sp. differs from the type species in having a wider glabella and a stouter glabellar spine.

Description: — Glabella about 1.4 times as long as wide, with straight sides converging forwards, and bluntly rounded in front. Three pairs of lateral glabellar furrows. S1 strongly convex, oblique backwards, and not reaching the occipital furrow. S2 and S3 convex, oblique backwards, and reaching about one-fourth across the glabella. Between the preoccipital glabellar lobes there is a long and strong spine, gently curved and pointing backwards. Occipital furrow simple, straight and well developed. Occipital ring only slightly narrower than posterior part of the glabella, broad (long.) at the axial line, but tapering to the sides. Mesial tubercle less distinct. Axial furrow distinct, but not very deep. Fixigenae not completely preserved on present material. Posterior border furrow narrow (long.), deep and distinct. Posterior border broad (long.). Preglabellar field narrow (long.). The whole cranium (glabellar spine included) densely covered with both small and large nodes.

Other parts of the trilobite are unknown.

Dimensions: — The glabella of the holotype, which is the largest specimen present, is 34 mm long and 24.2 mm wide.

Occurrence: — Ampyx Limestone (4a β) and Echinospaerites Beds (4ba?). OSLO—ASKER: Søndre Kojatangen (4a β), SKIEN—LANGE-SUND: Skjellbukta (Ech.).

Affinities: — *N. norvegica* n. sp. is closely related to *N. variolaris* (LINNARSSON, 1869), but differs from it in having the glabella less tapering forwards, more bluntly rounded in front, and in having a longer and stronger glabellar spine.

Furthermore it seems to be related to *N. cephaloceros* (NIESZKOWSKI, 1857), but differs from it in the characters mentioned in the diagnosis.

SUBFAMILY DEIPHONINAE RAYMOND, 1913

Genus *Hemisphaerocoryphe* REED, 1896

Type species: — *Sphaerexochus pseudohemicranium* NIESZKOWSKI, 1859.

Hemisphaerocoryphe inflatus n.sp.

Pl. 1, figs. 11–12.

Name: — From Latin *inflatus* (puffed up, swollen).

Type data: — Holotype (here selected) is a small but well preserved cranidium (P.M.O. no. 67357) from the Coelosphaeridium Beds (4b β ?) at Eina, Toten.

Material: — In addition to the holotype 5 more or less fragmentary cranidia (P.M.O. nos. 5352, 63386, 72222, 72223, and 72254).

Diagnosis: — A *Hemisphaerocoryphe* species with a cranidium more than twice as wide as long. Glabella bulbous, nearly spherical, 3 pairs of lateral glabellar furrows, all oblique backwards. Fixigenae relatively wide, probably with genal spines. Eyes located at transverse mid-line of the cranidium.

Other parts of the trilobite are not known.

H. inflatus differs from the type species in having a more bulbous glabella, narrower occipital ring, and the eyes located further backwards.

Description: — Cranidium only slightly less than 2.4 times as wide as long. Glabella very bulbous, nearly spherical, leaning somewhat forward, and faintly granulated. Three pairs of lateral glabellar fur-

rows. S1 convex, oblique backwards, deep, distinct, and reaching the occipital furrow. S2 convex, oblique backwards, short, deepest a short distance from the axial furrow. S3 pit-like, less distinct. Pre-occipital glabellar lobe subellipsoidal in outline. Occipital furrow deep and distinct, simple and convex, deepest near the axial furrow. Occipital ring narrow (long.), width about that of glabella between the pre-occipital glabellar lobes, and probably granulated. Mesial tubercle not developed. Axial furrow deep and distinct. Postocular fixigenae slightly wider (tr.) than the occipital ring, pitted less distinct near the axial furrow, but stronger laterally, and probably provided with genal spines. Posterior border furrow broad (long.), deep and well defined. Posterior border narrow (long.) and distinct. Eyes located at transverse mid-line of the cranium. Palpebral lobes medium-sized, convex and protuberance-like. Width of interocular fixigenae about one-fourth of that of glabella at eye-line. Eye ridges straight and distinct, oblique backwards, narrow (long.) near the glabella, but widening laterally. Preglabellar field reduced to be only a narrow (long.) brim on glabella. Preocular part of facial suture converging forwards, postocular part transverse.

Other parts of the trilobite are unknown.

Dimensions: — The holotype is 6.5 mm long and 15.5 mm wide. The largest fragmentary cranium is about twice as large as the holotype.

Occurrence: — Lower Chasmops Shale (4ba) and Coelosphaeridium Beds (4bβ?). TOTEN: Eina (Coel.), OSLO—ASKER: Gåsøya (4ba).

Affinities: — *H. inflatus* n. sp. is closely related to *H. granulatus* (ANGELIN, 1854), and may possibly be a subspecies of this. It differs from *H. granulatus* in having broader (long.) fixigenae.

Hemisphaerocoryphe sphaericus (ESMARK, 1833)

Pl. 2, fig. 3.

1833 *Trilobites sphaericus* n. sp. — ESMARK, p. 269, pl. VII, fig. 8. (Descr. and figs. of cranium).

1940 *Hemisphaerocoryphe sphaericus* (ESMARK) — STØRMER, p. 124, text figs. 2–3, pl. 1, figs. 6–7. (Remarks and figs. of cranium).

Type data: — Neotype is the cranium (P.M.O. no. 61747) figured by Størmer (1940), from the Ampyx Limestone (4aβ) or the Lower Chasmops Shale (4ba) at Løken, Bygdøy in Oslo.

Material: — In addition to the neotype 4 incomplete cranidia are preserved at Paleontological Museum in Oslo (P.M.O. nos. 3688, 18862, 20425, and 56174).

Diagnosis: — A *Hemisphaerocoryphe* species with cephalon subsemicircular in outline, cranium more than twice as wide as long. Three pairs of lateral glabellar furrows, S1 and S2 oblique backwards, S3 oblique forwards. Fixigenae as wide as occipital ring, pitted. Eyes located slightly in front of the transverse mid-line of the cranium.

Other parts of the trilobite are unknown.

H. sphaericus (ESMARK) differs from the type species in having a more bulbous glabella, well defined preoccipital glabellar lobes, and the eyes farther from the glabella.

Description: — Cephalon subsemicircular in outline, strongly convex transversely. Cranium triangular in outline, and about 2.2 times as wide as long. Glabella strongly convex, about 1.5 times as long as high, well rounded in front, and covered with relatively small nodes all over. Three pairs of lateral glabellar furrows. S1 deep and distinct, convex, oblique backwards, and reaching the occipital furrow. S2 deep, but not as deep as S1, convex, oblique backwards, reaching one-sixth across the glabella. S3 slightly convex, nearly straight, oblique forwards, less distinct. Preoccipital glabellar lobe suboval in outline. Occipital furrow deep and distinct, simple and convex. Occipital ring narrow (long.), and as wide as glabella between the preoccipital glabellar lobes, probably granulated. Mesial tubercle not developed. Axial furrow deep and well defined. Postocular fixigenae pitted, and as wide as occipital ring, genal spines appear to be present. Posterior border furrow deep and broad (long.). Posterior border narrow (long.). Eyes located slightly in front of the transverse mid-line of the cranium. Palpebral lobes medium-sized, well defined. Eye ridges not present, or probably coalesced with the sutural ridges. Width of interocular fixigenae about one-third of that of glabella at eye-line. Preglabellar field reduced to a narrow brim on the glabella. Preocular part of facial suture converging forwards, postocular part transverse.

Other parts of the trilobite unknown.

Dimensions: — The neotype, which is the largest specimen present, is 8.9 mm long and 22.3 mm wide (occipital ring and genal spines missing).

Occurrence: — Ampyx Limestone (4a β) and Lower Chasmops Shale (4ba). Oslo—Asker: Royal Castle, Bygdøy, Bjerkøy, Ostøya.

Affinities: — *H. sphaericus* (ESMARK) is closely related to *H. pseudohemicranium* (NIESZKOWSKI, 1859), but differs from it in the characters mentioned in the diagnosis.

Family Pliomeridae RAYMOND, 1913

[*nom. transl.* ÖPIK, 1937 (*ex* Pliomerinae RAYMOND, 1913)]
[= Amphionidae PICTET, 1854]

SUBFAMILY PLIOMERINAE RAYMOND, 1913

Genus *Pliomerops* RAYMOND, 1905

Type species: — *Amphion canadensis* BILLINGS, 1859

Pliomerops sp.

Pl. 2, fig. 4.

Material: — Only one fragmentary cranidium (P.M.O. no. 36600) and counterpiece (P.M.O. no. 36599) from the Ogygiocaris Shale (4aa) at Redalen in Biri (outside the Oslo region).

Description: — Cranidium about 2.5 times as wide as long. Glabella wide in front, but tapering backwards. S1 slightly convex, oblique slightly backwards. S2 and S3 straight, transverse, deepest nearest to the axial line, and reaching more than one-third across the glabella. Preoccipital glabellar lobes small and narrow (long.). Occipital ring poorly preserved, but seems to show a strong mesial tubercle. Postocular fixigenae wide (tr.) and broad (long.), and strongly reticulate pitted. Posterior border furrow deep and distinct. Posterior border well defined. Eyes seem to be located far forwards, opposite S3. Postocular part of facial suture gently curved, directed transverse.

Other parts of the trilobite are unknown.

Dimensions: — The only known cranidium is 12 mm long and 30.4 mm wide.

Occurrence: — Ogygiocaris Shale (4aa). Redalen in Biri (North of the Oslo region).

Family Encrinuridae ANGELIN, 1854

SUBFAMILY ENCRINURINAE ANGELIN, 1854

[*nom. transl.* HUPÉ, 1955 (*ex* Encrinuridae ANGELIN, 1854)]

Genus *Encrinurus* EMMRICH, 1844

Type species: — *Entomostracites punctatus* WAHLENBERG, 1821

Encrinurus sp.

Pl. 2, fig. 5.

Material: — Only one fragmentary pygidium (P.M.O. no. 72150) from the Mjøsa Limestone (4bδ₂) at Bergevika, Helgøya.

Description: — Pygidium about 1.3 times as long as wide, with at least 10 pairs of pleural lobes. Axis occupying about one-third of total width. The pleural lobes are provided with short spines. Pleural region strongly convex. Posterior spine lacking. Axis with at least 24 small axial rings.

Other parts of the trilobite unknown.

Dimensions: — The pygidium is 6 mm long and 4.5 mm wide.

Occurrence: — Mjøsa Limestone (4bδ₂). NES—HAMAR: Helgøya.

Affinities: — *E.* sp. seems to be closely related to *E. ? moë* (MÄNNIL, 1958), but differs from it in having narrower pygidium.

Remarks: — *E.* sp. is undoubtedly a new species, but there is no reason to name it until better material is available.

SUBFAMILY CYBELINAE HOLLIDAY, 1942

[*nom. transl.* HUPÉ, 1955 (by error as "sous-famille de Cybelidae") (*ex* Cybelidae HOLLIDAY, 1942)] [*emend.* HUPÉ, 1955]

Genus *Atractopyge* HAWLE & CORDA, 1847

Type species: — *Calymene verrucosa* DALMAN, 1827

Atractopyge brevicauda (ANGELIN, 1854)

Pl. 2, fig. 6—7.

1854 *Cybele brevicauda* n. sp. — ANGELIN, p. 89, pl. XLI, fig. 14. (Short diagn. and fig. of pygidium).

?1857 *Zethus brevicauda* n. sp. — NIESZKOWSKI, p. 617.

?1857 *Zethus bellatulus* n. sp. — NIESZKOWSKI, p. 613.

?1857 *Zethus attractopyge* n. sp. — NIESZKOWSKI, p. 616.

?1857 *Encrinurus sexcostatus* n. sp. — NIESZKOWSKI, p. 610.

- 1881 *Cybele brevicauda* ANGELIN? — SCHMIDT, p. 219, pl. XI, fig. 23, pl. XIV, figs. 7—10, pl. XV, figs. 15—17. (Descr. and figs. of cranidia and pygidia).
1884 *Cybele brevicauda* ANGELIN — TÖRNQUIST, p. 26. (Recorded).
1897 *Cybele brevicauda* ANGELIN — KLÆR, p. 13. (Recorded).
1909 *Cybele brevicauda* ANGELIN — HOLTEDAHL, pp. 20, 31, 32, 40. (Recorded).
1925 *Cybele brevicauda* ANGELIN — WARBURG, p. 337, pl. XI, fig. 38. (Remarks and fig. of holotype).

Type data: — As holotype (by monotypy) I select the pygidium described by ANGELIN (1854, pl. XLI, fig. 14) from Osmundsberg, Sweden, and preserved in Naturhistoriska Riksmuseet, Stockholm.

Norwegian material: — Only two fragmentary cranidia (P.M.O. nos. 67922 and 72255) and two incomplete pygidia P.(M.O. nos. 7384 and 35426) are present in the Middle Ordovician, but cranidia, pygidia and thoracic shields are also known from the Upper Ordovician of the Oslo region.

Diagnosis (based on Norwegian material): — An *Atractopyge* species with the glabella strongly expanding forwards, concave sides, and covered with large nodes. Three pairs of lateral glabellar furrows, all oblique backwards. Fixigenae rather convex. Eyes located in posterior part of the cranidium.

Pygidium about as long as wide. Axis strongly arched down in lateral view.

A. brevicauda (ANGELIN) differs from the type species in having larger eyes, located in the posterior half part of the cranidium, glabella stronger convex, and narrower (long.) fixigenae. The pygidium differs in having small pleural spines, and a smoother axis.

Description of Norwegian material: — The description is based on the Norwegian Middle Ordovician material.

Cranidium subtriangular in outline. Glabella with slightly concave sides, strongly expanding forwards, and well rounded and provided with a row of relatively large and well defined tubercles in front. Three pairs of lateral glabellar furrows. S1 convex, oblique backwards, nearly reaching the occipital furrow, and deepest a short distance from the axial furrow. S2 and S3 slightly convex, oblique backwards, deepest a short distance from the axial furrow, and reaching one-third across the glabella. Preoccipital glabellar lobe small and less distinct. Occipital furrow faint and poorly defined. Occipital ring as wide as posterior part of glabella. Mesial tubercle not preserved on present

material. Postocular fixigenae strongly convex, width about that of occipital ring. Eyes located in posterior half of the cranidium. Eye ridges not developed. Width of interocular fixigenae about one-half of that of glabella at eye-line. A deep pit-like impression is observed posterior to the antero-lateral corner of the glabella. The whole cranidium is covered with large nodes.

Librigenae, hypostome and thorax not present in the Middle Ordovician material.

Pygidium about as wide as long. Pleural region strongly convex. The ribs are provided with short spines, which are broad-based, but taper rapidly. Axis occupying about one-third of total width, strongly arched down in lateral view, and with 5 more or less distinct nodes.

Dimensions: — The cranidium is 10.7 mm long and 14.2 mm wide. The largest pygidium is 11.8 mm wide and 11.2 mm long.

Occurrence in Norway: — Upper Chasmops Limestone (4bδ), Gagnum Shale (4bδ?), and Mjøsa Limestone (4bδ). NES—HAMAR: Helgøya (Mjøsa Lmst.), HADELAND: Sølvsberget (4bδ), Grimsrud (Gagnum Sh.), RINGERIKE: Røysetangen (4bδ).

Affinities: — *A. brevicauda* (ANGELIN) is closely related to *A. kutorgae* (SCHMIDT, 1881), but differs from it in having the glabella less expanding forwards.

The pygidium differs in being narrower (tr.).

Atractopyge dentata (ESMARK, 1833)

Pl. 3, figs. 1—2, pl. 4, figs. 1—4.

- 1833 *Trilobites dentatus* n. sp. — ESMARK, p. 269, pl. VII, fig. 13. (Descr. and fig. of pygidium).
- 1854 *Cybele dentata* ESMARK — ANGELIN, p. 89, pl. XLI, fig. 12. (Short diagn. and fig. of pygidium).
- 1881 *Cybele Grewingki* n. sp. — SCHMIDT, p. 211, text fig. 11, pl. XIV, figs. 1—2. (Descr. and figs. of cranidium and thorax. Non fig. of pygidium).
- 1887 *Cybele* sp. — BRØGGER, p. 19. (Recorded).
- 1888 *Cybele Grewingki* SCHMIDT — WIGAND, p. 89, pl. X, fig. 17. (Descr. and fig. of cranidium).
- 1907 *Cybele Grewingki* SCHMIDT — SCHMIDT, p. 20. (Mentioned).
- 1909 *Cybele Grewingki* SCHMIDT — HOLTEDAHL, pp. 16, 30, 40. (Recorded).
- 1937 *Cybele (Cybelella) grewingki* SCHMIDT — ÖFIK, p. 123, text fig. 36. (Discussion and fig. of "holotype").
- 1940 *Cybele dentata* (ESMARK) — STØRMER, p. 125, text fig. 2, pl. 1, fig. 5. (Remarks and fig. of lectotype).

1940 *Cybele dentata* (ESMARK) — GRORUD, p. 160, pl. 2, fig. a. (Recorded and fig. of pygidium).

1953 *Cybele* sp. — STØRMER, pp. 62, 64, 91. (Recorded).

Type data: — Lectotype is the pygidium (P.M.O. no. 56161), figured by STØRMER (1940, pl. 1, fig. 5) from the Ogygiocaris Shale (4aa) or the Ampyx Limestone (4aa) at the Royal Palace in Oslo.

Norwegian material: — Two nearly complete specimens (P.M.O. nos. 61609 and 72151), one specimen with cranidium and thorax preserved (P.M.O. no. 18831 and counterpiece no. 18832), 13 cranidia (P.M.O. nos. 1940, 1946, 1980, 2120, 18833, 20366, 20626, 56509, 63187, 63253, 63255, 72184, 72204), 6 librigenae (P.M.O. nos. 7383, 34610, 34611, 5277, 55975, 72211), and 20 pygidia (P.M.O. nos. 6346, 6347, 6898, 7377, 7382, 7519, 20625, 33473, 36979, 56042, 56065, 56089, 56161 a, 56259, 56315, 56440, 56508, 62111, 72162, 72170) are preserved at the Paleontological Museum in Oslo.

Diagnosis: — An *Atractopyge* species with cephalon subsemi-circular in outline, rather convex transversely. Cranidium about 2.5 times as wide as long. Glabella with subparallel sides, only slightly wider and with 5 distinct tubercles or short spines in front, 4 pairs of more or less distinct nodes are observed along the axial line. Three pairs of lateral glabellar furrows, all oblique backwards. Occipital ring as wide as posterior part of glabella. Fixigenae about twice as wide as occipital ring. Genal spines lacking. Eyes stalked, located slightly behind the transverse mid-line of the cranidium.

Librigenae pitted, lateral margin well rounded.

Thorax with 12 segments. Pleurae with long spines. The spines on the 6. segment are as long as the total length of the dorsal shield, and parallel to the axis.

Pygidium with 4 pairs of ribs, provided with short spines. Axis occupying about one-third of total width, and only slightly arched down in lateral view.

A. dentata (ESMARK) differs from the type species in having narrower (tr.) fixigenae, wider (tr.) librigenae, and stalked eyes, located further backwards and closer to the glabella.

The pygidium differs in being narrower, and in having small pleural spines.

Description: — The description is based on the Norwegian material.

Dorsal shield suboval in outline, somewhat narrower (tr.) in the pygidial region. Cephalon subsemicircular in outline, rather convex transversely. Cranidium about 2.5 times as wide as long. Glabella with subparallel sides, only slightly wider in front, and bearing 8 more or less distinct nodes located in 2 longitudinal lines. Five distinct tubercles or short spines in front of glabella. The spines are gently flattened and broad-based, but taper rapidly. Three pairs of lateral glabellar furrows. S1 geniculate, oblique backwards, deep and short, and not reaching the occipital furrow or the axial furrow. S2 pit-like, nearly oval, oblique backwards. S3 straight, more oblique backwards than S2, not reaching the axial furrow. Occipital furrow well defined, simple and convex. Occipital ring as wide as posterior part of the glabella, with a distinct mesial tubercle. Furthermore 2 small more or less distinct nodes on each side of the mesial tubercle. Axial furrow faint. Postocular fixigenae pitted, faint near the glabella, but stronger laterally, width only slightly less than twice the width of the occipital ring. Behind the eyes some more or less distinct nodes are to be observed. Posterior border furrow relatively faint and narrow (long.) near the axial furrow, but widening and deep laterally. Posterior border narrow (long.) and well defined. Genal spines lacking. Eyes stalked (maximum length 8 mm), located slightly behind the transverse mid-line of the cranidium. Eye ridges straight and well defined, directed obliquely backwards. Width of interocular fixigenae about one-half of that of glabella at eye-line. Anterior pits deep, slightly elongate, situated ahead of the most anterior lateral glabellar furrows. One large node is located outside the antero-lateral corner of the glabella. Preglabellar field narrow (long.). Preocular part of facial suture converging forwards, postocular part transverse.

Librigenae reticulate pitted, strongly arched, provided with some distinct nodes located near to the eyes. Lateral margin well rounded. Lateral border broad (tr.) and with a row of large nodes. Lateral border furrows faint.

Hypostome unknown.

Thorax with 12 segments. Axis strongly convex transversely. Pleurae bearing transverse furrows and long spines. The spines on the 1.—5. segments are directed straight outwards or slightly oblique backwards. The spines on the 6. segment are nearly parallel to the axis, gently curved, and about as long as the total length of the dorsal

shield. The spines on the 7.—12. segments are parallel to the spines on the 6. segment, and about one-fourth as long as these.

Pygidium with 4 pairs of ribs, which are provided with short spines. The spines are round and broad-based, but taper rapidly. Axial ring not well defined. Postero-lateral corners shoulder-like, lateral margin slightly convex, and converging backwards. Axis occupying about one-third of total width, only slightly arched down in lateral view, and with at least 14 pairs of small furrows. Ribs with few more or less distinct nodes.

Dimensions: — The largest complete specimen is 62 mm long and 38 mm wide (spines on the 6. segment not included). The largest cranidium has an axial length of 23 mm and a width of 61 mm.

The largest pygidium, which belongs to the largest complete specimen, is 16 mm long and 15 mm wide.

Occurrence: — Ogygiocaris Shale (4aa), Ampyx Limestone (4aβ), Cephalopod Shale (4aβ?), Lower Chasmops Shale (4ba), Echinospaerites Beds (4ba?), and Lower Chasmops Limestone (4bβ). NES—HAMAR: Hovindsholm, HADELAND: Gran, RINGERIKE Bratterud, Ringsås, Røysetangen, OSLO—ASKER: Bygdøy, Sinsen, Skarpsno, Slottsbakken, Smestad, Tørtberg, Billingstad, Delebukta, Nakkholmen, Nesøya, Ostøya, Slependen, LANGESUND—SKIEN: Frierfjorden.

Affinities: — *A. dentata* (ESMARK) is closely related to *A. coronata* (SCHMIDT, 1881), but differs from it in having shorter spines in front of the glabella, narrower fixigenae, and the eyes located in the posterior half of the cranidium.

The pygidium differs in being narrower and in having shorter spines.

Remarks: — I believe that the species *A. grewinkii* (SCHMIDT, 1881) is a synonym of *A. dentata*. The holotype (selected by ÖPIK) described by SCHMIDT as *Cybele Grewinkii* n. sp. is a specimen with cephalon and thorax preserved. This specimen shows the spines on the 6. segment that are so typical of *A. dentata*. The diagnosis and description he gives for the cephalon and thorax agrees well with the diagnosis and description of *A. dentata*. He also mentions that *C. Grewinkii* is larger than any others of the Baltic *Cybele* species. The dimensions he gives agree well with the Norwegian material of *A. dentata*. The pygidium, which he describes as *C. Grewinkii*, seems to belong to *A. kurtorgae* (SCHMIDT, 1881).

A. dentata also resembles the species *A. revaliensis* (SCHMIDT, 1881) so much that I cannot find any differing characters between them. Therefore I believe that *A. revaliensis* is a synonym of *A. dentata*.

Atractopyge gracilis n.sp.

Pl. 4, figs. 5–9.

1887 *Cybele* sp. — BRØGGER, p. 23. (Recorded).

Name: — From Latin *gracilis*, (slender, thin).

Type data: — Holotype (here selected) is a cranidium (P.M.O. no. 6531) from the Upper Chasmops Limestone (4bδ) at Terneholmen, Asker.

Material: — In addition to the holotype 9 cranidia (P.M.O. nos. 5600, 5615, 5917, 5937, 5944, 6523, 20443, 65146, 72192), 2 librigenae (P.M.O. nos. 5818, 72145), and 11 pygidia (P.M.O. nos. H 227, 5575, 5638, 5818, 5926 (2 specimens), 5927, 9095, 72190 (2 specimens), 72191), are preserved at the Paleontological Museum in Oslo.

Diagnosis: — An *Atractopyge* species with the cranidium about 3 times as wide as long, subparallel-sided glabella, and 3 pairs of lateral glabellar furrows, all oblique backwards. Occipital ring as wide as glabella. Fixigenae relatively wide, strongly granulated. Eyes stalked, located slightly behind the transverse mid-line of the cranidium. Genal spines relatively long, broad (tr.) and flattened.

Librigenae granulated.

Hypostome and thorax are unknown.

Pygidium slightly longer than wide, axis occupying about one-third of total width, and strongly arched down in lateral view.

A. gracilis n. sp. differs from the type species in having a subparallel-sided glabella, long genal spines, and the eyes further backwards and closer to the glabella.

The pygidium differs in being narrower, and in having small pleural spines.

Description: — Cranidium subtriangular in outline, about 3 times as wide as long, rather convex transversely. Glabella with subparallel sides, strongly granulated. Three pairs of lateral glabellar furrows, all reaching about one-third across the glabella. S1 geniculate, oblique backwards, deepest a short distance from the axial furrow, and reaching the occipital furrow. S2 elongate, nearly pit-like, oblique

backwards, and not reaching the axial furrow. S3 almost straight, more oblique backwards than S2, and deepest a short distance from the axial furrow. Preoccipital glabellar lobes elongate in outline. Occipital furrow composite, deep and well defined, and with a deep and pit-like impression a short distance from the axial furrow. Occipital ring as wide as glabella, and with a well developed and keel-like mesial tubercle. Furthermore some small nodes on each side of the mesial tubercle. Axial furrow deep and broad (tr.). Postocular fixigenae about twice as wide as occipital ring, and strongly granulated. Genal spines relatively long, flattened and broad-based. Inner half of posterior border narrow (long.), outer half broad. Posterior border furrow deep and narrow (long.) near the axial furrow, but broader and fainter laterally. Eyes stalked, located slightly behind the transverse mid-line of the cranidium. Eye ridges well developed, straight, directed obliquely backwards. Width of interocular fixigenae about one-half of that of glabella at eye-line. Anterior pits deep, situated ahead of the most anterior lateral glabellar furrows. Preglabellar field possibly with long spines in front because the anterior margin is broken on all specimens. Preocular part of facial suture converging forwards, postocular part running convex transversely.

Librigenae faintly granulated and strongly arched. Lateral margin well rounded. Lateral border relatively broad (tr.) and smooth. Lateral border furrow broad (tr.) and deep.

Hypostome and thorax unknown.

Pygidium only slightly less than 1.3 times as long as wide, straight in front, and with the lateral margins convex, converging backwards. Four pairs of ribs provided with short and broad-based round spines. Axis occupying about one-third of the total width, strongly arched down in lateral view, and with a large number of small transverse furrows. Both axis and pleurae with few small nodes.

Dimensions: — The holotype, which is the largest specimen present, is 27.6 mm wide and 9.1 mm long. The genal spines are 12 mm long.

The largest pygidium is 7.5 mm long and 6.0 mm wide.

Occurrence: — Upper Chasmops Limestone (4dδ) and Sphaeronid Limestone (4bδ?). HADELAND: S. Gran (Sphaer.), OSLO—ASKER: Ostøya, Terneholmen (4bδ).

Affinities: — *A. gracilis* n. sp. is closely related to *A. rex* (NIE-

szkowski, 1857), but differs from it in having long genal spines and the eyes more posteriorly situated.

The pygidium differs in being narrower and more arched down in lateral view.

A. gracilis n. sp. also seems to be related to *A. coronata* (SCHMIDT, 1881), but differs from this in having the eyes further backwards and closer to the glabella, eye ridges directed obliquely backwards, and long genal spines.

The pygidium differs in being narrower.

Atractopyge kutorgae (SCHMIDT, 1881)

Pl. 2, figs. 8–9.

- 1881 *Cybele Kutorgae* n. sp. — SCHMIDT, p. 217, pl. XV, figs. 11–14, pl. XVI, figs. 39a-b. Text figs. 12 a-b. (Descr. and figs. of cranidia and pygidia).
1907 *Cybele Kutorgae* SCHMIDT — SCHMIDT, p. 21, pl. I, figs. 16–18. (Remarks and figs. of cranidia).

Type data: — As lectotype should be selected one of the specimens described and figured by SCHMIDT, 1881.

Norwegian material: — Two fragmentary cranidia (P.M.O. nos. 34241 and 72153 with counterpiece 72152) are preserved at the Paleontological Museum in Oslo.

Diagnosis (based on Norwegian material): — An *Atractopyge* species with cranidium slightly more than 2.5 times as wide as long, rather convex transversely, and strongly granulated. Glabella strongly expanding forwards, and with a row of tubercles in front. Three pairs of short lateral glabellar furrows. Occipital ring wider than posterior part of glabella. Fixigenae slightly wider than occipital ring. Genal spines probably present.

Other parts unknown in the Norwegian material.

A. kutorgae (SCHMIDT) differs from the type species in having the glabella more expanding forwards, and the eyes closer to the glabella.

Description of Norwegian material: — Cranidium subtriangular in outline, only slightly more than 2.5 times as wide as long, rather convex transversely, and covered with large nodes all over. The nodes proper carry smaller nodes. Glabella strongly expanding forwards, and with a row of tubercles in front. One large node outside the antero-lateral corners of the glabella. Three pairs of short lateral glabellar

furrows, but they are longer and deeper on exfoliated cranidia. S1 slightly convex, oblique backwards, deepest at the axial furrow, and not reaching the occipital furrow. S2 almost straight, transverse, reaching one-fourth across the glabella. S3 stronger than S2, almost straight, oblique forwards, and deepest a short distance from the axial furrow. Occipital furrow well defined, simple and convex, and deepest at the axial furrow. Occipital ring slightly wider than posterior part of glabella. Mesial tubercle appears to be lacking. Axial furrow well defined. Postocular fixigenae only slightly wider than occipital ring. Posterior border furrow deep and narrow (long.) near the axial furrow, but wider and fainter laterally. Posterior border relatively broad (long.). Genal spines appear to be present. Eyes stalked, situated slightly behind the transverse mid-line of the cranium. Eye ridges relatively distinct, straight, directed obliquely backwards. Width of interocular fixigenae about one-half of that of glabella at eye-line. Anterior pits deep, situated ahead of the most anterior glabellar furrows. Preglabellar field narrow (long.). Preocular part of facial suture converging forwards, postocular part transverse.

Dimensions: — The largest cranidium is 11 mm long and 28 mm wide.

Occurrence: — Lower Chasmops Shale (4ba) and Cyclocrinus Beds (4by?). OSLO—ASKER: Bernhard Herres vei (4ba), HADELAND: Røykenvik (Cycl.).

Affinities: — As pointed out by SCHMIDT, 1881, *A. kutorgae* closely resembles *A. brevicauda* (ANGELIN, 1854), and seems to be a fore-runner of this. This agrees well with the Norwegian material, but the two species have so few and so small differing characters that they may be only subspecies of the same species.

A. kutorgae also seems to be related to *A. woerthi* (EICHWALD, 1840), but differs from it in having a wider cranidium and the eyes located further backwards.

Atractopyge aff. *kutorgae* (SCHMIDT, 1881)

Pl. 2, figs. 10.

Material: — Only one large pygidium (P.M.O. no. 21961) is preserved at the Paleontological Museum in Oslo.

Affinities: — The pygidium closely resembles that of *A. kutorgae* (SCHMIDT, 1881), but differs in some characters. The pygidium of

A. kutorgae is slightly wider than long, maximum length (cf. SCHMIDT, 1881) 10.5 mm. The Norwegian pygidium is 26 mm long, and slightly longer than wide. It also differs in converging more rapidly backwards.

Occurrence: — Coelosphaeridium Beds (4b β ?). NES—HAMAR: Furuberget.

Atractopyge sp.

Material: — Only one fragmentary cranidium (P.M.O. no. 72252) and one librigena (P.M.O. no. 72251).

Description: — Cranidium more than twice as wide as long. Glabella with subparallel sides, probably with spines in front. Three pairs of deep and distinct lateral glabellar furrows. S1 slightly convex, oblique backwards. S2 almost straight, oblique backwards. S3 slightly convex, oblique backwards. S1, S2 and S3 deepest near the axial furrow. Occipital furrow deep and distinct, simple and straight. Occipital ring not present. Postocular fixigenae about twice as wide as glabella. Posterior border furrow broad (long.). Posterior border relatively narrow (long.). Eyes possibly stalked. Eye ridges not preserved. Width of interocular fixigenae about two-thirds of that of glabella at eye-line. Cranidium granulated all over.

Librigenae strongly granulated. Lateral margin well rounded.

Other parts of the trilobite are unknown.

Dimensions: — The cranidium is 4 mm long and 8.9 mm wide.

Occurrence: — Ampyx Limestone (4a β). OSLO—ASKER: Bygdøy.

Affinities: — *A.* sp. is closely related to *A. rex* (NIESZKOWSKI, 1857), but differs from it in having a more parallel-sided glabella, and in having more and larger nodes all over the cranidium.

Subfamily Staurocephalinae PRANTL & PŘIBYL, 1947

Genus *Staurocephalus* BARRANDE, 1846

Type species: — *Staurocephalus murchisoni* BARRANDE, 1846

Staurocephalus sp.

1957 *Staurocephalus* sp. — KIELAN, p. 167, text fig. 4, pl. IV, fig. 3. (Descr. and fig. of cranidium).

Material: — Only one fragmentary cranidium (P.M.O. no. 67044).

Description and Dimensions: — See Kielan, 1957.

Occurrence: — Upper Chasmops Limestone (4b δ). OSLO—ASKER: Terneholmen.

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MIDDLE ORDOVICIAN CHEIRURID TRILOBITES FOUND IN NORWAY AND THEIR KNOWN STRATIGRA- PHIC AND GEOGRAPHIC OCCURRENCE.	Horizon										Districts											
	? = horizon uncertain																					
	4 aa	4 ab	Ceph.	4 ba	Ech.	4 bβ	Coel.	4 bγ	Cycl.	4 bδ	Sphaer.	Gagnum Sh.	Mjøsa Lmst.	Skien-Langesund	Oslo-Åsker	Ringerike	Hadeland	Toten	Nes-Hamar	Ringsaker	Biri	
CHEIRURIDAE																						
<i>Paraceraurus helgoeyensis</i> *	+
— <i>perlongus</i>
<i>Cyrtometopella tumula</i> *
— <i>askerensis</i> *
<i>Nieszkowskia norvegica</i> *
<i>Hemisphaerocoryphe inflatus</i> *
— <i>sphaericus</i>
PLIOMERIDAE																						
<i>Plomerops</i> sp.	+	+
ENCINURIDAE																						
<i>Encrinurus</i> sp.*	+
<i>Atractopyge brevicauda</i>	+
— <i>dentata</i>	+	+	+	+	+	+	+	.	+	+	+	.	+	+	+	+	+	+	+	+	+	.
— <i>gracilis</i> *
— <i>kutorgae</i> *
— aff. <i>kutorgae</i> *
— sp.
<i>Staurocephalus</i> sp.....

Ceph. = Cephalopod Shale (4a β ?) Ech. = Echinospaerites Beds (4ba?). Coel. = Coelosphaeridium Beds (4b β ?). Cycl. = Cyclocrinus Beds (4by?). Sphaer. = Sphaerionid Limestone (4b δ ?)

* = not previously recorded from Norway

PLATE 1

The photographs are not retouched, but the specimens were whitened with ammonium chloride before photographing.

Paraceraurus helgoeyensis n. sp. — p. 283.

- Fig. 1. x 2.0. Holotype cranidium. P.M.O. no. 67937. Mjøsa Limestone (4bδ). Bergevika, Helgøya. Coll.: G. Henningsmoen, 1954.
Fig. 2. x 1.9. Pygidium. P.M.O. no. 67981. Mjøsa Limestone (4bδ). Bergevika, Helgøya. Coll.: G. Henningsmoen, 1954.
Fig. 3. x 2.0. Hypostome. P.M.O. no. 68010. Mjøsa Limestone (4bδ). Bergevika, Helgøya. Coll.: G. Henningsmoen, 1954.

Paraceraurus perlongus (BRØGGER, 1882) — p. 286.

- Fig. 4. x 2.0. Holotype (by monotypy) cranidium. P.M.O. no. H 2636. Probably 4by. Oslo. Coll.: ?

Cyrtometopella askerensis n. gen., n. sp. — p. 289.

- Fig. 5. x 3.5. Holotype cephalon. P.M.O. no. 72226. 4aβ. Terneskjær, Asker. Coll.: N. Spjeldnæs, 1953.
Fig. 6. x 4.0. Right side view of cranidium, showing the convexity of the glabella. P.M.O. no. 72224. 4aβ. Terneskjær, Asker. Coll.: N. Spjeldnæs, 1953.

Cyrtometopella tumula n. gen., n. sp. — p. 288.

- Fig. 7. x 4.35. Holotype cranidium. P.M.O. no. 72146. Transitional beds between 4aβ and 4ba. SW side of Ildjernet, Asker. Coll.: N. Spjeldnæs, 1957.
Fig. 8. x 4.0. Right side view of the specimen in fig. 7.
Fig. 9. x 2.0. Dorso-ventrally pressed pygidium. P.M.O. no. 18910. 4ba. Drammensveien at Slependsen, Asker. Coll.: A. Heintz, 1933–34.
Fig. 10. x 2.0. Laterally compressed pygidium showing the long pleural spines. P.M.O. no. 72149. Transitional beds between 4aβ and 4ba. SW-side of Ildjernet, Asker. Coll.: N. Spjeldnæs, 1957.

Hemisphaerocoryphe inflatus n. sp. — p. 292.

- Fig. 11. x 2.0. Holotype cranidium. P.M.O. no. 67357. Coel. (4bβ?). Sund, Eina, Toten. Coll.: S. Skjeseth, 1951.
Fig. 12. x 2.0. Left side view of the specimen in fig. 10.

PLATE 1.

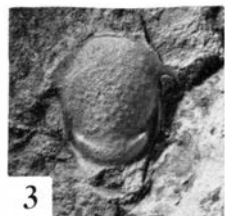
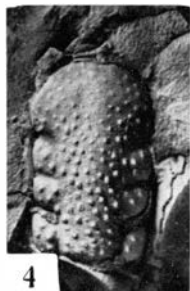


PLATE 2

The photographs are not retouched, but the specimens were whitened with ammonium chloride before photographing.

Nieszkowskia norvegica n. sp. — p. 291.

Fig. 1. x 2.0. Holotype cranidium. P.M.O. no. 8675. Ech. (4ba?). Skjellbukta, Frierfjord. Coll.: W. C. Brøgger, 1881.

Fig. 2. x 2.0. Right side view of the specimen in fig. 1.

Hemisphaerocoryphe sphaericus (ESMARK, 1883) — p. 293.

Fig. 3. x 2.0. Neotype cranidium. P.M.O. no. 61747. 4aβ or 4ba. Løken, Bygdøy, Oslo. Coll.: ?.

Pliomerops sp. — p. 295.

Fig. 4. x 2.0. Incomplete cranidium. P.M.O. no. 36600. 4aa. North of Redalen, Biri. Coll.: T. Strand, 1926.

Encrinurus sp. — p. 296.

Fig. 5. x 4.0. Pygidium. P.M.O. no. 72150. Mjøsa Limestone (4bδ). Bergevika, Helgøya. Coll.: N. Spjeldnæs, 1959.

Atractopyge brevicauda (ANGELIN, 1854) — p. 296.

Fig. 6. x 2.0. Cranidium. P.M.O. no. 67922. Mjøsa Limestone (4bδ). Bergevika, Helgøya. Coll.: G. Henningsmoen, 1954.

Fig. 7. x 1.9. Pygidium. P.M.O. no. 7384. 4bδ. Røysetangen, Ringerike. Coll.: J. Kiær, 1913.

Atractopyge kutorgae (SCHMIDT, 1881) — p. 304.

Fig. 8. x 2.0. Latex cast of cranidium showing test surface. P.M.O. no. 72152. 4ba. Bernhard Herres vei, Oslo. Coll.: N. Spjeldnæs, 1950.

Fig. 9. x 2.0. Exfoliated cranidium. P.M.O. no. 34241. Cycl. (4bγ?). South of Røykenvik, Ringsaker. Coll.: O. Holtedahl, ?.

Atractopyge aff. *kutorgae* (SCHMIDT, 1881) — p. 305.

Fig. 10. x. 2.0. Pygidium. P.M.O. no. 2196. Coel. (4bβ?). Furuberget, Nes — Hamar. Coll.: O. Holtedahl, 1907.

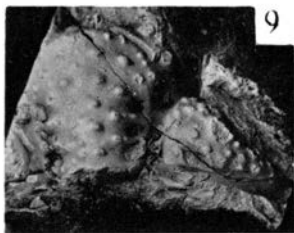
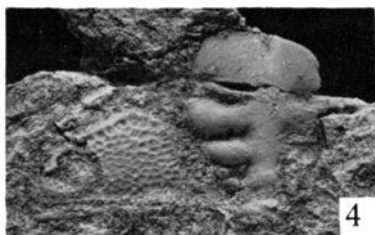
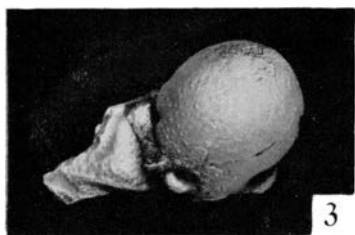
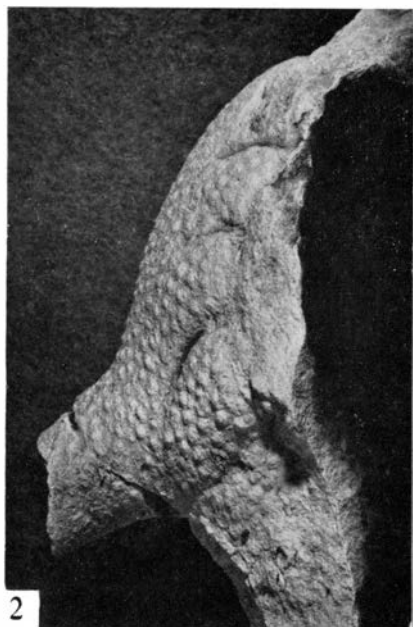
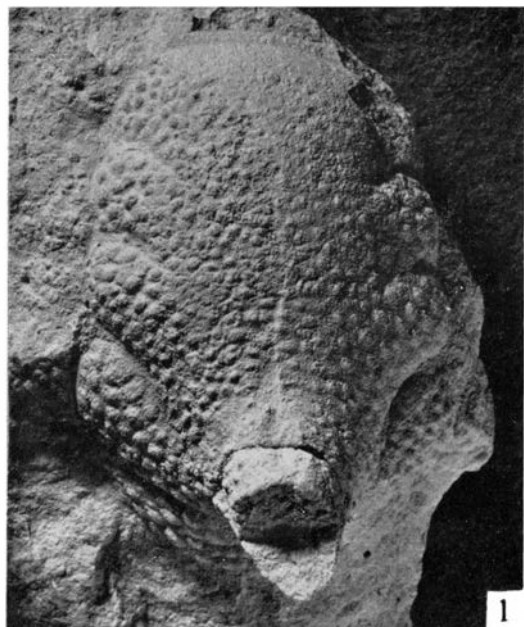


PLATE 3

The photographs are not retouched, but the specimens were whitened with ammonium chloride before photographing.

Atractopyge dentata (ESMARK, 1833) — p. 298.

Fig. 1. x 1.7. Nearly complete dorso-ventral pressed specimen showing the spine on the 6. segment. P.M.O. no. 72151. 4ba. Husebybakken, Oslo. Coll.: J. Mauritz and H. Bjerkholt, 1958.

Fig. 2. x 1.7. Nearly complete specimen. P.M.O. no. 61609. 4ba. Railway section at Sinsen, Oslo. Coll.: O. Johansen, 1900.

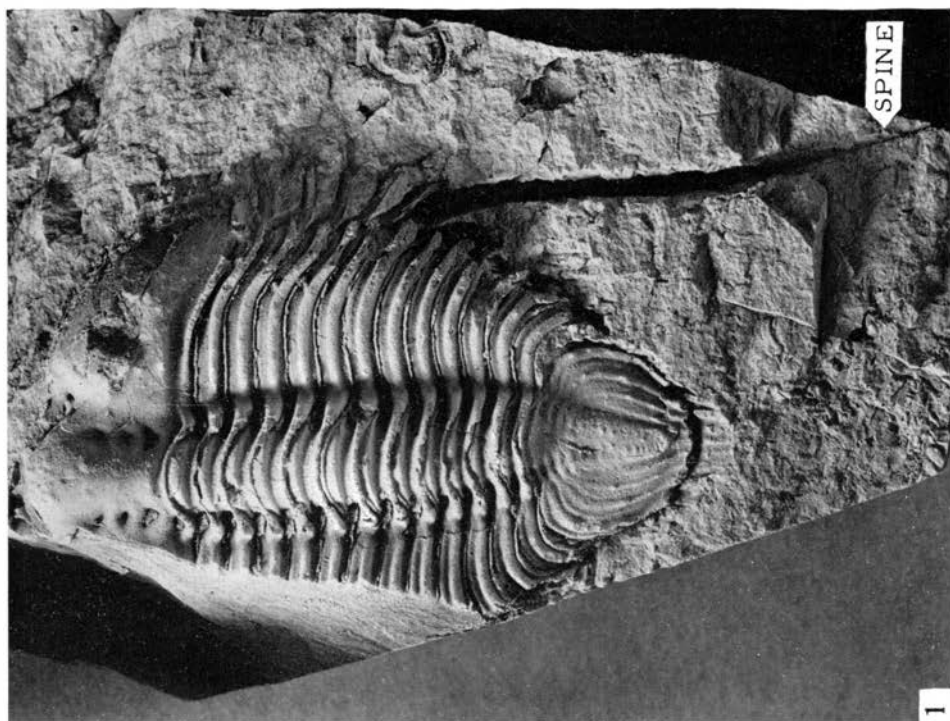


PLATE 4

The photographs are not retouched, but the specimens were whitened with ammonium chloride before photographing.

Atractopyge dentata (ESMARK, 1833) — p. 298.

- Fig. 1. x 2.0. Cranidium showing the eye ridges and the spines in front of the glabella. P.M.O. no. 20366. 4ba. Delebukta, Asker. Coll.: J. Kiær, 1898.
Fig. 2. x 2.0. Librigena showing the stalked eye. P.M.O. no. 5277. Probably 4ba. Royal Castle, Oslo. Coll.: B. Esmark, ?.
Fig. 3. x 2.0. Pygidium. P.M.O. no. 6346. 4ba. Bratterud, Ringerike. Coll.: J. Kiær, 1913.
Fig. 4. x 2.0. Latex cast of lectotype pygidium. P.M.O. no. 56161. Probably 4ba. Royal Castle, Oslo. Old coll.

Atractopyge gracilis n. sp. — p. 302.

- Fig. 5. x 2.0. Holotype cranidium. P.M.O. no. 6531. 4bδ. Terneholmen, Asker. Coll.: J. Kiær, exc., 1922.
Fig. 6. x 2.0. Cranidium. P.M.O. no. 5600. 4bδ. Terneholmen, Asker. Coll.: J. Kiær, 1921.
Fig. 7. x 2.0. Right side view of the specimen in fig. 6, showing the genal spines.
Fig. 8. x 2.0. Latex cast of librigena. P.M.O. no. 72145. 4bδ. Terneholmen, Asker. Coll.: N. Spjeldnæs, 1951.
Fig. 9. x 4.0. Pygidium. P.M.O. no. 9095. 4bδ. Terneholmen, Asker. Coll.: J. Kiær, 1921.

PLATE 4.

