THE MIDDLE ORDOVICIAN OF THE OSLO REGION, NORWAY

4. Ostracoda.

ВY

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CONTENTS. Page 36 Abstract Preface 36 Description of species 37 Paleocopa 37 Bevrichiacea 37 Tetradellidae 37 Tetradellinae 37 Tallinnella Öpik 37 T. trident sp. n. 37 T. tumida sp. n. 38 T. mjoesensis sp. n. 39 T. kiaeri sp. n. 40 Swollen forms in Tallinnella 41 Ceratopsis Ulrich..... 42 *C*.? sp. 42 C.? stoermeri sp. n. 42 Piretellinae 43 Piretopsis gen. n. 43 *P. donsi* gen. & sp. n. 43 Bassleratiinae 43 Steusloffia Ulrich & Bassler 43 S. costata (LINNARSSON) 43 Familiae incertae 45

Ullerella Henningsmoen

45

U. triplicata sp. n	46
U. ventroplicata sp. n	47
$U. \ ulli \ (Dons) \dots$	48
U. holtedahli (Dons)	48
Sigmoopsiidae	48
Sigmoopsiinae	48
Bolbina Henningsmoen	49
B. variolaris (BONNEMA)	49
Primitiidae	49
Primitia Jones & Holl	49
P. suecica (THORSLUND)	49
Eurychilinidae	50
Eurychilininae	50
Platybolbina ThorsLund	50
P. kapteyni (BONNEMA)	50
?Euprimitiinae	51
Euprimites Hessland	51
E.? suecica (Thorslund)	51
Leperditiacea	52
Leperditiidae	52
Leperditiinae	52
Eoleperditia SWARTZ	52
<i>E. skjesethi</i> sp. n	52
Other ostracods	53
Remarks on the faunas	54
References	54
Stratigraphical and geographical distribution (chart).	55
Explanation of plates; plates	57

Abstract. 18 paleocop ostracods are described from the Middle Ordovician Ogygiocaris and Chasmops Series of the Oslo Region in Norway. The genus Piretopsis is new, and also the species Ullerella triplicata, U. ventroplicata, Tallinnella trident, T. tumida, T. mjoesensis, T. kiaeri, Ceratopsis? stoermeri, Piretopsis donsi, and Eoleperditia skjesethi. Forms of Tallinnella with swollen features are regarded as examples of neoteny as compared with forms with accentuated relief.

Preface.

The present paper is one of several being published by different authors on the Middle Ordovician of the Oslo Region. This team work was initiated by Prof. L. Størmer (Paleontological Institute, Oslo). The writer expresses his gratitude to him for the inspiring way this work has been organized, and for friendly and helpful suggestions during the work. Furthermore the writer wishes to thank him and the other fellow workers, especially cand. real. N. Spjeldnæs and cand. real. S. Skjeseth, for collecting ostracods in the different districts covered by them. It is with pleasure that the writer thanks Miss B. Mauritz for the often troublesome task of photographing the ostracods.

Description of species.

Suborder PALEOCOPA HENNINGSMOEN, 1953

Superfamily Beyrichiacea ULRICH & BASSLER, 1923 Family Tetradellidae SWARTZ, 1936 Subfamily Tetradellinae SWARTZ, 1936 Genus Tallinnella ÖPIK, 1937

Type species: — Tallinnella dimorpha Öрік, 1937.

The genus *Tallinnella* is employed here in the wide sense proposed by HENNINGSMOEN (1953, p. 214), who restricts *Tetradella* to the *Tetradella quadrilirata* group (developing submarginal loculi) and transfers the *subquadrans* group to *Tallinnella*.

Tallinnella trident sp.n.

(Pl. 1, fig. 1, Pl. 2 figs. 1-2.)

Name: — The name *trident* is alluding to the 3-branched pattern of the lobal ridges.

Type data: — Holotype (P.M.O. 66420) is an external impression of a left valve from 4a α_2 , collected at Muggerudkleiva, Sandsvær by L. STORMER, 1925.

Material: — A great number of external and internal impressions of separated valves preserved in shale.

Diagnosis: — *Tallinnella* species with L1, L3, and L4 rather narrow and forming a 3-branched pattern. L4 does not reach the dorsal border. L2 is small and node-like.

Description: — Adult values are up to 2,5 mm long and 1.5 mm high. Outline with slight forward swing. Surface with high relief. L1, L2, and L3 are narrow, almost ridge-like, and form a 3-forked pattern. L1 and L3 project slightly above the dorsal margin, whereas L4 fades away well below the dorsal margin. L2 is small and node-

like and gives the impression of being situated on the inner slope of L1. S2 and S3 deep and wide, S1 faint and narrow. The lobes are separated from the velate frill by a well defined groove. Velate frill not very wide but convex; raising rather steeply up from the carapace wall and bending rather abruptly down again; most convex along the anterior margin. The frill is restricted, and does not reach more than half way up along the posterior margin. The material is not too well preserved and no dimorphism has been detected in the frill.

Relationships: — Tallinnella trident sp.n. may be a close relative of species like T. marchica (KRAUSE, 1889) and T. dimorpha (ÖPIK, 1937) but differs from these in the almost ridge-like appearance of L1, L3, and L4 and the weak development of L2. In this respect T. trident sp.n. resembles T. scripta (HARPER, 1947), which differs, however, i.a. in the long L4 (reaching the dorsal border) and in having a ridge between the ventral end of L3 and the velate ridge. T. tumida sp.n. may be closely related to T. trident sp.n.

Occurrence: — Associations of numerous specimens in $4a a_1$ — $4a a_3$. Eiker-Sandsvær (Muggerudkleiva, Ravalsjø-elva, etc.), Modum (Melåen).

Tallinnella tumida sp.n. (Pl. 1, fig. 2, Pl. 2 figs. 3-4).

Name: — The name *tumida* is given due to the somewhat swollen appearance of this species.

 $Type \ data:$ — Holotype (P.M.O. 66421) is a left valve from 4a a_3 , collected from the section Bjerkås—Djuptrekkodden, Røyken, by N. Spjeldnæs, 1951.

Diagnosis: — A *Tallinnella* species with rather swollen lobes, confluent with the extralobal area. L2 small and node-like, giving the impression of being situated on the posterior slope of L1. Frill narrow and restricted.

Description: — Adult valves are up to about 2.5 mm long and 1.5 mm high. Outline with slight forward swing. Surface rather convex, with swollen relief. The lobal area is confluent with the extralobal area. L1 and L3 project slightly above the hinge line and bound a semi-elliptical depressed area, consisting of S1, L2, and S2. L2 is small and node-like and situated, as it appears, on the posterior slope of L1, and is not as high as L1 and L3. L3 rises well above L4, S3 being developed almost as a semisulcus. A narrow groove is formed where the velate frill rises from the valve wall. The frill is narrow, somewhat convex, and restricted to the anterior and ventral margin. Surface (including frill) appears smooth.

Relationships: — Tallinnella tumida sp.n. may be compared with T. marchica lata (KRAUSE, 1891). The figures of the latter show several differences in details from T. tumida sp.n., but it is not impossible that a better knowledge of T. marchica lata may prove that these forms are synonyms. T. tumida sp.n. agrees with T. trident sp.n. in several features as type and position of L2, restricted frill, etc. and differs mainly in having more swollen features. It is probale that T. tumida sp.n. has developed from T. trident sp.n.

Material: — A few separated valves preserved in limestone.

 $\mathit{Occurrence:}$ — In 4
a a_3 of the section Bjerkås—Djuptrekkodden, Røyken.

Tallinnella mjoesensis sp.n. (Pl. 1, fig. 3, Pl. 3 figs. 1—5).

Name: — From Lake Mjøsa, as this ostracod occurs in the Mjøsa districts.

Type data: — Holotype (P.M.O. 66422) is a right valve from the Cyclocrinus Beds at Furuberget, Nes—Hamar district, collected by S. Skjeseth, 1950.

Material: — About 50 valves and impressions of these, including larval instars.

Diagnosis: — A *Tallinnella* species with narrow, ridge-like lobes. The ventral connecting ridge is, however, poorly developed. Velate structure ridge-like, not quite reaching the dorsal margin in either end.

Description: — Adult valves about 2.5 mm long and 1.5 mm high. Ends subequal, anterior end slightly more pointed than posterior end. Surface with very high relief. The lobes are developed as long, high and narrow ridges. They are connected ventrally, but the connecting ridge is poorly developed. L2 and L3 are higher than L1 and L4, L3 being the higher. L1 is curved parallel to the anterior margin and is somewhat overhanging outwards. L2 is almost straight, with the dorsal end only slightly bulbous, and shorter than L1 and L3. L1 is slightly oblique and reaches farther up dorsally than the other ridges; but does not quite reach the dorsal border. L4 is curved

parallel to the posterior border. The sulci are rather flat, as is the groove between the lobal area and the velate ridge. The latter is ridge-like, high and narrow as are the lobes. It is set off from the valve wall at a rather high angle. The posterior end is the highest part of the velate ridge. The velate ridge does not reach the dorsal border at either end; the posterior end reaching slightly farther up than the anterior end. Surface of the valve (including velate ridge) appears smooth. Left valve with a fine ridge along the dorsal contact margin, fitting into a corresponding fine groove in the right valve. Free border of the left valve slightly overlaps the right valve.

Larval instars. Small valves (1.5 mm long and less) have a more or less even convex surface, only L2 and L3 being set off as two not very well defined small nodes. In a valve 1.75 mm long the two other ridges are developed as well, and the lobal area separated from the velate ridge, which is swollen. The posterior lobes are ridge-like, whereas the anterior lobe (L1) is still swollen, and hardly separated from the velate ridge. In larger valves the anterior lobe and velate ridge assume the shape of the adult.

Relationships: — The long L2 reminds one of the poorly known T. digitata separata ((STEUSLOFF, 1894) and also early Tallinnella species as T. grewingki (BOCK, 1867). T. mjoesensis is probably close to T. kiaeri sp.n. (cf. p. 41).

Occurrence: — Rather common in the Cyclocrinus Beds and Mjøsa Limestone at Furuberget (Hamar district).

Tallinnella kiaeri sp.n.

(Pl. 1, fig. 4, Pl. 4 figs. 1-6).

- 1897 Beyrichia cf. Marchica KRAUSE-KLER, p. 39 (Listed from "5a", i.e. Mjøsa Limestone).
- 1909 Beyrichia aff. Marchica KRAUSE--HOLTEDAHL, p. 32 (Listed from Cyclocrinus Beds).

 Name: — This species is named after its finder, Johan Kiær. Type data: — Holotype (P.M.O. 66432) is a left valve from the Mjøsa Limestone at Furuberget (Hamar district), collected by S. Skjeseth, 1950.

Material: — More than hundred separated valves, including larval instars.

Diagnosis: — A *Tallinnella* species with L1 and L4 more or less completely fused with the swollen velate ridge. L2 and L3 are developed

as swollen lobes, hardly connected ventrally and not connected with the velate ridge.

Description: — Adult valves are up to 3.9 mm long and 2.1 mm high. Ends subequal or with slight forward swing. Surface not very convex but with swollen structures. L1 and L4 swollen and more or less completely fused with the swollen velate ridge (see Pl. 4, fig. 1). The submarginal ridge thus formed is subparallel to the free border, except for its posterior end which turns round and points forwards. L2 and L3 form swollen lobes, not connected ventrally with the velate ridge. There is considerable variation in the outline of this species, as in the form of the lobes. L2 and L3 may be short or almost reach the velate ridge and sometimes they are indistinctly united ventrally to form a U-shaped loop.

Larval instars. Larval values are more tunid and with less well developed lobation. In the smallest values only L2 and L3 can be distinguished from the general convex surface.

Relationships: — As discussed below, T. mjoesensis may be a rather closely related species. T. kiaeri sp.n. differs rather much in general appearance from other *Tallinnella* species, recalling such genera as *Drepanella* and *Bollia*. If T. kiaeri is related to *Drepanella*, with which it also agrees in attaining a large size, this would mean that *Drepanella* had developed from *Tallinnella*. It is, however, possible that the pattern of T. kiaeri, *Drepanella bigeneris* ULRICH, 1894, and *Bollia* may have developed in different stocks.

Occurence: — Rather common in Mjøsa Limestone at Nes (Helgøya) and Toten (Einavatnet).

Swollen forms versus forms with accentuated relief in Tallinnella.

The differences between *Tallinnella trident* and *T. tumida* may be ascribed to the latter being more convex and having swollen lobes. There is a similar difference between *T. marchica marchica* and *T. marchica lata*. It is interesting that forms with accentuated relief have larval instars with swollen features. Swollen adult forms may be regarded as examples of neoteny as compared with forms with accentuated relief. It is possible that this is due to environmental conditions or mode of habitat and that the swollen forms need not be genetically distinct from those with accentuated relief. *T. kiaeri* sp.n. is probably specifically distinct from *T. mjoesensis*, but they are probably closely related. T. kiaeri corresponds well to larval instars of T. mjoesensis and may be regarded as a neotenous species.

Genus Ceratopsis Ulrich, 1894 Type species: — Beyrichia chambersi Miller, 1874

Ceratopsis? sp. (Pl. 1, fig. 5, Pl. 2, fig. 5).

Material: — A right valve and a left valve with the test missing except for marginal parts. Preserved in limestone.

Description: — The two valves are about 2.5 and 1.5 mm high (including frill). Well developed relief. Outline with almost subequal ends. L1 broken off in both specimens but apparently forming a horn, whose base is round. L2 forms a small isolated node. L4 ard especially L3 are well developed and long, reaching the velate frill. The frill is wide and restricted to the anterior and ventral margin and is radially striated. The test is granulated where it is preserved (along the frill).

Occurrence: — Rare in Coelosphaeridium Beds at Ringsaker (Skjønsby).

Ceratopsis? stoermeri sp.n. (Pl. 1, fig. 6, Pl. 2, fig. 6).

Name: — This species is named in honour of Prof. Leif Størmer, who collected it, and who initiated the detailed study of the Middle Ordovician of the Oslo Region.

Type data: — Holotype (P.M.O. 60402) is an external impression of a right valve from $4a a_2$, collected by L. Størmer in 1925 at Muggerud-kleiva, Sandsvær.

Material: — External impressions of two left and two right valves, all more or less damaged and preserved in shale.

Diagnosis: — A tetradellid species with *Ceratopsis*-like horn formed by L1 and probably also L2. The ventral connecting ridge of the lobes does not quite reach the horn. Velate frill wide and apparently restricted.

Description: — The four values are rather small, c. 1.3 mm long and 0.8 mm high (including frill). Outline with forward swing. Well developed relief. L1, possibly with the incorporated L2, forms a

comparatively large horn with round base. It points out from the valve wall. L3 and L4 are connected ventrally, and the connecting ridge continues forwards subparallel to the free border but does not quite unite with the horn. Frill rather wide, radially striated and apparently restricted to the anterior and ventral margin.

Relationships: — The horn of Ceratopsis? stoermeri sp.n. has a slightly more posterior position than is usual in Ceratopsis and may include L2. Otherwise the general appearance of the lobes recalls C. oculifera (HALL, 1871), where L2 also seems to be more or less incorporated in the horn. Young forms of C. oculifera are rather like the Norwegian form. C. oculifera and other American species of the genus seem to differ from C.? stoermeri sp.n. in having a narrow and entire velate frill. C.? stoermeri sp.n. may possibly be related to Piretopsis donsi gen. & sp.n.

Occurrence: — Rare in 4a α_2 at Sandsvær (Muggerudkleiva).

Subfamily Piretellinae Öрік, 1937 *Piretopsis* gen.n.

Name: — The name suggests the likeness to Piretella ÖPIK, 1937 Type species: — Piretopsis donsi gen. & sp.n.

Diagnosis: — See diagnosis of the type species (only known species). Relationships: - Piretopsis gen.n. shares the U-shaped ridge of L1 and L3 with Piretella ÖPIK, 1937 and Rakverella ÖPIK, 1937 (included in the Piretellinae by HENNINGSMOEN, 1953). Furthermore the velate frill is restricted and curved as in some individuals (female type) of the Piretellinae. On the other hand *Piretopsis* is undoubtedly close to the Tetradellinae, from which the Piretellinae may have developed (HENNINGSMOEN, 1953). Middle Ordovician members of the Tetradellinae often have a restricted frill and thus agree with the Piretellinae, in contrast to Lower Ordovician Tetradellinae, whose velate structure is entire. Piretopsis has a Ceratopsis-like horn. This does not necessarily involve it having developed from Ceratopsis, as this type of horn may have developed in different stocks (cf. HENNINGSMOEN, 1953, p.216). Ceratopsis? stoermeri sp.n. may be related to Piretopsis. Piretella ÖPIK, 1937 may have developed from Piretopsis or similar forms through effacement of lobation and loss of C4. Morphologically, at least, *Piretopsis* is intermediately between the Tetradellinae and *Piretella*.

Piretopsis donsi gen. & sp.n. (Pl. 1, fig. 7, Pl. 2 figs. 7-8).

Name: — This species is named after its finder, Curator J. A. Dons. $Type \ data:$ — Holotype is the external impression (P.M.O. 66424) and internal mould (66425) of a right valve, collected in 4a β at Ullern, Oslo by J. Dons, 1948. It is the only specimen known and is

preserved in weathered limestone.
Diagnosis: — A tetralobate species with a U-formed crest formed
by C1 and C3. Another crest (C4) is not united with this. L1 is horn-like. Velate frill restricted and curved in the only specimen known (probably dimorphic).

Description: — Length 2.3 mm, hight 1.6 mm. Outline with subequal ends. Moderate relief, except for the horn and crests. Tetralobate. L1 forms dorsally a horn-like projection, pointing outwards and slightly backwards. L2 very small and node-like. L3 well defined and higher than the less well defined L4. L1, L3, and L4 bear crests. C3 runs along the anterior edge of L3 and unites ventrally with C1 to form a U-shaped ridge. C4 runs along the anterior edge of L4 and continues forwards to below the median sulcus, but does not unite with the C1—C3-crest. The lobate area is confluent with the extralobal area. The velate frill is wide and restricted and apparently radially striated. It is rather convex and may represent the female type. Surface (excluding frill) is densely covered with small granules (possibly spine bases). Along the dorsal margin there is a row of coarser granules, probably corresponding to the dorsal crest in *Piretella*.

Occurrence: — The specimen was found in $4a\beta$ at Skogfaret, Ullern, Oslo.

Subfamily Bassleratiinae Schmidt, 1941. Genus Steusloffia Ulrich & Bassler, 1908. Type species: — Beyrichia costata LINNARSSON, 1869.

> Steusloțția costata (LINNARSSON, 1869). (Pl. 1, fig. 8).

1869 Beyrichia costata n.sp. - LINNARSSON, p. 85, pl. II, figs. 67-68.

- 1889 Strepula Linnarssoni n.sp. KRAUSE, p. 16, pl. II, figs. 4-5.
- 1908 Beyrichia (Steusloffia) linnarssoni (KRAUSE) ULRICH & BASSLER, pp. 282, 296, text figs. 8, 34, pl. 38, fig. 1.

- 1923 Steusloffia linnarssoni (KRAUSE) ULRICH & BASSLER, 1923, p. 308, text fig. 5.
- 1924 Steusloffia (Strepula) Linnarssoni Kr. KUMMEROW, p. 412, text fig. 1.
- 1934 Steusloffia linnarssoni (KRAUSE) BASSLER & KELLETT, p. 475, text fig. 9:5.
- 1937 Steusloffia linnarssoni (KRAUSE) Öрік, p. 50, text fig. 7 (Compared with S. rigida Öрік, 1937).
- ?1937 Steusloffia multimarginata n.sp. Öрік, 1937, р. 52, pl. IV, fig. 4.
- 1940 Steusloffia costata (LINRS.) THORSLUND, p. 176, pl. 2, figs. 10—12; pl. 3, fig. 5; text fig. 58. (Claims that S. linnarssoni is a synonym and S. multimarginata probably merely a variety. Describes larval instars.)
- 1948 Steusloffia costata (LINRS.) THORSLUND, p. 368, pl. XX, fig. 10.

Type data: — As lectotype is here chosen the specimen figured by LINNARSSON (1869, pl. II, fig. 67) from "Beyrichienkalk" in Västergötland, Sweden.

Remarks: — The Norwegian form is similar to the Swedish form as described and figured by THORSLUND (1940).

Horizon in Norway: — $4a \beta$ —4b a, thus probably not also 4a a as indicated by DONS & HENNINGSMOEN (1949, p. 30).

Localities: Oslo—Asker (Bygdøy, Gaustadskogen, Ullernåsen, Asker), Ringerike (Stubbdal) — Sweden, Germany (Scandinavian drift boulders), ?Esthonia.

Familiae incerta

Genus Ullerella HENNINGSMOEN, 1950 (= Ullia HENNINGSMOEN, 1949 non ROEWER, 1943)

Type species: — Ullia ulli Dons, 1949.

Remarks: — The taxonomic position of this genus is uncertain. The triangular cross section of the carapace is shared with many Sigmoopsiidae, and young instars of *Ullerella* recall *Bolbina* HEN-NINGSMOEN, 1953. *Ullerella* does not, however, show the sigmoidal median sulcus or the carinal dimorphism typical for this family and seems to have a better developed velate structure. In these features it corresponds better to the Tetradellidae, and it may be best for the present to regard the family reference as unsettled. The Silurian zygobolbids remind one of *Ullerella*. They differ i.a. in developing a

dimorphic pouch or swelling of the carapace wall. As the Zygobolbinae (and thus the Beyrichiidae, cf. HENNINGSMOEN, 1953, p. 236) no doubt have developed from Ordovician Beyrichiacea, which are not known to develop a similar pouch, it is not impossible that they have developed from *Ullerella* or related forms. In *Ullerella holtedahli* (Dons, 1949) and *U. triplicata* sp.n. the inner U-shaped ridge shows a characteristic widening in the ventral half of the posterior part of the ridge. It is interesting to note that a similar widening is seen in in the U-shaped ridge of some zygobolbids, especially in *Mastigobolbina*. As long as no intermediate forms are known between the Middle Ordovician *Ullerella* and the Silurian zygobolbids, the relationships between these may only be regarded as a suggestion.

Ullerella triplicata sp.n.

(Pl. 1, fig. 9, Pl. 5, figs. 5-6).

Name: — The name alludes to the three sets of ridges in this species. $Type \ data:$ — Holotype (P.M.O. 66426) is the external impression of a left valve, collected in 4a a_2 at Muggerudkleiva, Sandsvær by L. Størmer, 1925.

Material: — A large number of external impressions and internal moulds of separated valves, preserved in shale.

Diagnosis: — An *Ullerella* species with 3 concentric U-shaped ridges, reaching the dorsal margin in adult specimens.

Description: — Adult valves c. 1.6 mm long and 1.0 mm high. Outline with forward swing. Sulcus (S2) long and wide, bent slightly forwards ventrally. The sulcus is surrounded by an elevated area consisting of 3 concentric U-shaped ridges divided by two narrow grooves. The inner ridge is rather wide and lobe-like, except ventrally, where it narrows to the same width as the thin outer ridges. All ridges reach the dorsal border. The outermost ridge slightly overhangs the free border ventrally. The surface appears smooth.

Larval instars. In small specimens the posterior halves of the U-shaped ridges do not reach more than half-way up between the ventral and dorsal border.

Occurrence: — In 4a a_1 , 4a a_2 , and 4a a_3 ? at Sandsvær (Muggerud-kleiva, Ravalsjøelva, etc.) and Modum.

Ullerella ventroplicata sp.n. (Text fig. 1, Pl. 1, fig. 10, Pl. 5, figs. 3—4).

Name: — The name indicates that the ridges are mainly restricted to the ventral half of the valve.

Type data: — Holotype (P.M.O. 4180 a) is a right valve, collected in 4a a_4 at Gomnes, Ringerike by J. Kiær, 1915.

Material: — Some 10 separated valves (including larval instars) preserved in limestone.

Diagnosis: — An *Ullerella* species with 3 concentric ridges. Only the inner ridge is U-shaped and reaches the dorsal margin (in adult specimens). A fourth ridge is developed anterior to the anterior branch of the outer ridge.

Description: — Adult valves c. 1.9 mm long and 1.2 mm high. Outline with forward swing. The sulcus (S2) is well developed, curving somewhat forwards ventrally. It is surrounded by a U-shaped ridge, reaching the dorsal border in both ends. Two more concentric ridges lie outside this ridge; they do not reach the dorsal border, but reach somewhat further up anteriorly than posteriorly. A fourth ridge is developed parallel to and outside the anterior branch of the third ridge. A faint lobe is de-

veloped beneath the anterior branch of the inner ridge. The two inner ridges are coallesced ventrally. Surface is finely granulated, except for the ridges which are smooth.

Early larval instars (text fig. 1). C. 0.5 mm long valves show the general form and lobation of adult valves, but the ridges are hardly traceable. In c. 1 mm long valves two ridges are clearly visible in the ventral half. The innermost ridge of the adults is not developed. *Later instars.* In up to 1.5 long valves the ridges are still confined solely to the ventral half of the valve. The innermost ridge is still present rather as lobes, but fused ventrally with the second ridge (from the sulcus) as in the adults. The anterior branches of the two ridges (in the adult ridge 2 and 3 from the sulcus) extend gradually further upwards into the dorsal half of the valve. The anterior branch of the outer ridge splits into two ridges.



larval and an adult

valve.

Occurrence: — In 4a a_4 at Oslo—Asker (Tøyen, Gamlebyen, Engervik) and Ringerike (Gomnes).

Ullerella ulli (Dons, 1949). (Pl. 1, fig. 11).

1949 Ullia ulli Dons sp.n. — Dons & Henningsmoen, p. 28, pl. 1, figs. 1—4.
1950 Ullerella ulli (Dons, 1949) — Henningsmoen, p. 244.

Type data: — Holotype (P.M.O. 65827) is an external impression of a right valve collected in $4a \beta$ at Abbediengkollen, Ullern, Oslo by J. Dons, 1943.

Diagnosis: — An *Ullerella* species with two concentric U-shaped ridges, both reaching the dorsal border in both ends.

Occurrence: — This species was originally stated to occur in beds believed to belong to $4a \ \alpha - \beta$. A closer study of these beds has revealed that they are restricted to $4a \ \beta$. Oslo—Asker (Oslo, Ullern, Bygdøy), Ringerike (the section $4a \ \beta$ —4b α at Kullerud, 50 m above the base), Gjerpen—Langesund (Frierfjorden).

Ullerella holtedahli (Dons, 1949). (Pl. 1, fig. 12).

1949 Ullia holtedahli Dons sp.n. — Dons & Henningsmoen, p. 29, pl. 1, figs. 5—8.

Type data: — Holotype (P.M.O. 65828) is an external impression of a left valve from 4b a at Øvre Ullern Terrasse, Ullern, Oslo and collected by J. Dons, 1943.

Diagnosis: — An *Ullerella* species with 2 concentric U-shaped ridges. Their ends reach the posterior border, except the posterior branch of the outer ridge, which fades away after a short distance.

Additional description: — A fine striation is sometimes seen on the ridges in their longitudinal direction.

Occurrence: — In 4b a (possibly also in 4b β); Oslo—Asker (Tøyen, Grefsen, Tørtberg, Bygdøy, Ullern, Asker) and Ringerike (Kullerud, Gomnes—Rud).

Family Sigmoopsiidae Henningsmoen, 1953 Subfamily Sigmoopsiinae Henningsmoen, 1953 Genus Bolbina HENNINGSMOEN, 1953 Type species: — Entomis variolaris BONNEMA, 1909.

> Bolbina variolaris (BONNEMA, 1909) (Pl. 1, fig. 13).

- 1909 Entomis variolaris n.sp. Воллема, 1909, р. 68, рl. 5, figs. 10—11.
- 1909 Entomis oblonga var. Kuckersiana n. var. (pars) Bonnema, p. 67, pl. 5, fig. 9.

1934 Ctenobolbina variolaris (Bonnema) — Bassler & Kellett, p. 255.

1937 Ctenobolbina variolaris (Воллема) — Öрik, pl. XI, fig. 11.

1940 Winchellatia variolaris (BONNEMA) — KAY, p. 254, pl. 32, fig. 12.

1940 Ctenobolbina variolaris (BONN.) — THORSLUND, p. 173, pl. 3, figs. 15-17.

1941 Winchellatia variolaris (Bonnema) — Schmidt, p. 36.

Type data: — As lectotype is here selected a right valve figured by BONNEMA (1909, pl. V, fig. 11) from the Kukruse formation in Esthonia.

Present material: — A number of separated valves preserved in limestone. The largest specimen reaches a length of 1.4 mm.

Remarks: — As remarked by BONNEMA (1909) and THORSLUND (1950) this species is dimorphic. It is a carinal dimorphism, typical of the Sigmoopsiidae (cf. HENNINGSMOEN, 1953, p. 201).

Occurrence: — In 4b δ of Oslo—Asker (Terneholmen, Sylling). Lower Chasmops limestone in Sweden, and Kukruse (Kuckers) formation in Esthonia.

Family Primitiidae Ulrich & BASSLER, 1923 Genus Primitia Jones & Holl, 1865 Type species: — Beyrichia strangulata McCoy, 1852.

> Primitia suecica (THORSLUND, 1948) (Pl. 1, fig. 14, Pl. 5, fig. 7).

1948 Eurychilina suecica sp.n — THORSLUND, 1948, p. 368, pl. XX, figs. 8—9.

 $Type \ data:$ — The type material is from a core through the Lower Chasmops Series at Kinnekulle, Vestergötland, Sweden.

Present material: — A few external impressions and internal moulds of separated valves, preserved in shale.

Description of present material: — Valves up to 1.5 mm long and 1.1 mm high. Outline with slight forward swing. Sulcus (S2)

4 — N.G.T. nr. 32

short, straight, almost normal to the hinge line and well defined, except dorsally where it widens out. Surface otherwise rather evenly convex. A velate frill is restricted to the anterior and ventral parts of the posterior margin. It is radially striated. A sausage-like velate pouch is developed in some specimens. The pouch appears to run along the ventral and half way up the anterior margin. Free border appears spinose, at least posteriorly. Surface granulated. A row of larger granules (spines?) near the dorsal margin. It may correspond to the dorsal ridge in some *Primilia* species.

Relationships: — This form may be closely related to the type species, *Primitia strangulata*, but the latter appears to have a shorter velate pouch and differs also in other minor details.

Occurrence: — 4b γ Oslo—Asker (Hvalstad). — Lower Chasmops Series in Sweden (Vestergötland).

Family Eurychilinidae Ulrich & Bassler, 1923 Subfamily Eurychilininae Ulrich & Bassler, 1923 Genus *Platybolbina* nomen nov.

Remarks: — This name is given here for *Platychilina* THORS-LUND, 1940, p. 169 (non KOKEN, 1892, as pointed out by AGNEW, 1944) *Platychilina* KUMMEROW, 1933, p. 45 is a nomen nudum (cf. HESSLAND, 1949, p. 253).

Type species: — Primitia distans KRAUSE, 1889 (Pl. 1, fig. 3). Diagnosis: — (According to THORSLUND, 1940, p. 169); Similar to Chilobolbina, but lacking a well-defined sulcus, instead having a conspicuous, subcentral muscle spot.

Platybolbina kapteyni (BONNEMA, 1909) (Pl. 1, fig. 15).

- 1896 Primitia distans KRAUSE KRAUSE, p. 933, pl. 25, figs. 7-8.
- 1909 Primitia Kapteyni n.sp. Воллема, р. 29, pl. 6, fig. 31.
- 1923 Chilobolbina kapteyni Ulrich & Bassler, p. 516.
- 1934 Chilobolbina kapteyni (Bonnema) Bassler & Kellett, p. 245.
- 1940 Platychilina kapteyni (BONN.) THORSLUND, p. 169, pl. 1, figs. 8—10; pl. 5, fig. 7.

Type data: — Holotype is the right valve figured by BONNEMA (1909, pl. 6, fig. 31) from the Kukruse (Kuckers) formation in Esthonia.

Present material: — A few separated valves preserved in limestone and external impressions and internal moulds preserved in shale.

Description of present material: — Length c. 1.6 mm, height c. 1.2 mm. A faint depression takes the place of the median sulcus. In front of this, at least in internal moulds, may be seen a small and faint lobe (L2). The velate frill runs along all of the free border, except for a short distance near the posterior dorsal corner. It is dimorphic; in some individuals the greater part of the frill is convex, forming a velate pouch. The frill is radially striated. The surface ornamentation of the valve gives a reticular appearance, with the exception of a subcentral spot and of the sulcoid depression. Furthermore the cardinal corners may be devoid of ornamentation in a triangular area, as described by KRAUSE (1896, p. 933) from the posterior cardinal angle and by BONNEMA (1909, p. 29).

Occurrence: $-4b \gamma$ (and $4b \delta$?) at Oslo-Asker (Hvalstad).

? Subfamily Euprimitiinae Hessland, 1949

As discussed by HENNINGSMOEN (1953, p. 228) this subfamily is only tentatively assigned to the Eurychilinidae.

Genus Euprimites HESSLAND, 1949 Type species: — Euprimites reticulogranulata HESSLAND, 1949.

Euprimites? suecica (THORSLUND, 1949).

(Pl. 1, fig., 16, Pl. 5, fig. 2).

1940 Ctenobolbina suecica n.sp. — THORSLUND, p. 172, pl. 2, figs. 13—14, pl. 3, fig. 14.

1940 Euprimitia minor n.sp. - THORSLUND, p. 164, pl. 1, figs. 11-12.

1949 Euprimites minor (THORSLUND, 1940) — HESSLAND, p. 250.

Type data: — The holotype is from Lower Chasmops Limestone in the Lockne area, Sweden, and was figured by THORSLUND (1940, pl. 2, fig. 14).

Present material: — A number of separated valves (including larval instars) preserved in limestone.

Remarks: — The Norwegian material shows the same type of velate dimorphism as the Swedish form; whereas some individuals have only a velate ridge (male type), others have a shelter-like frill

4* — N.G.T. nr. 32

along the anterior two thirds of the ventral border. In young specimens the velate ridge is less well developed and in the smallest specimens the velate structure appears to be absent. Small specimens with a slightly developed velate ridge agree quite well with *Euprimitia minor*, which are believed by the writer to be larval instars of *Euprimites*? suecica.

Relationships: - Euprimitia minor was transferred to Euprimites by HESSLAND (1949, p. 250). The Lower Ordovician type species of Euprimites shows no dimorphism as in E.? suecica. This may be due to the rather small material of the type species (2 carapaces and 2 valves). If more material will later prove that the type species shows no velate dimorphism, E.? suecica and allied species should probably not be included in this genus, and are here only tentatively assigned to it. E.? suecica is most probably not related to Ctenobolbina (cf. HENNINGSMOEN, 1953, p. 229). Euprimites? ("Euprimitia") plena (ÖPIK, 1937) appears to be a closely related species, and also Euprimites? ("Primitia") eutropis (ÖPIK, 1937). Haploprimitia inconstans Öрік, 1937 is probably based on larval instars of Euprimites ? eutropis. All the above mentioned species tentatively assigned to Euprimites may be related to Primitia. Further study is however needed, to trace the relationships between these species, the type species of Euprimites, and the genera Euprimitia and Primitia. If they are all closely related, the Euprimitiinae and probably also the Eurychilinae may again be included in the Primitiidae. As discussed by HENNINGS-MOEN (1953, p. 226), the *Primitia* and closely allied species may also possibly have developed from the Piretellinae. For this reason the family Primitiidae was restricted to Primitia and closely allied, and the Euprimitiinae and Eurychilininae included in a separate family Eurychilinidae.

Occurrence: — 4b δ in Oslo—Asker (Terneholmen, Sylling).

Superfamily Leperditiacea BASSLER & KELLETT, 1934 Family Leperditiidae Jones, 1856 Subfamily Leperditiinae Jones, 1856 Genus Eoleperditia SWARTZ, 1949 Type species: — Cytherina fabulites CONRAD, 1843. Eoleperditia skjesethi sp.n.

(Pl. 1, fig. 17, Pl. 5, fig. 1).

Name: — This species is named in honour of cand. real. Steinar Skjeseth, who has thoroughly studied the stratigraphy of the Mjøsa

districts and who has collected this, as well as several others of the ostracods described in this paper.

 $Type \ data:$ — Holotype (P.M.O. 66427) and only specimen known; a left valve preserved in limestone from the Mjøsa Limestone, and collected at Bergvika, Helgøya, Nes—Hamar district by S. Skjeseth.

Diagnosis: — A leperditiid about 1.6 times as long as wide, with no chevronmark but with subovoid adductor muscle scar with some 100 angular muscle spots.

Description: — The holotype is 6.5 mm long and 4.0 wide. Shell subovate in outline, truncated dorsally by straight hinge which extends for about four-sevenths of the greatest length. Anterior cardinal angle less obtuse than posterior cardinal angle. Surface of valve moderately convex with the greatest convexity just behind the muscle scar. Anterior corner slightly depressed, as well as posterior margin. The adductor scar is subovoid and with some 100 angular muscle spots. No other muscle spots or venose lines are seen. The eye tubercle is small and lies just in front of the upper end of the muscle scar.

Relationships: — As only an external left valve is known, it is uncertain whether this species shows any of the prongs described in the type species, *Eoleperditia fabulites* (CONRAD, 1843) (cf. SWARTZ, 1949, p. 317). *E. skjesethi* sp.n. has, however, no subocular chevron mark, and may rather confidently be plased in *Eoleperditia* and not in *Leperditia* ROUAULT, 1851 or *Hermannina* KEGEL, 1933, at present not known from pre-Silurian strata (cf. SWARTZ, 1949). *E. skjesethi* differs from *E. fabulites* i.a. in having a larger number of spots in the adductor muscle scar, and in having a shorter hinge line. The muscle scars of *E. groenlandica* (TEICHERT, 1937) and *E. catheyensis* (KIRK, 1928) are not known, but they differ from *E. skjesethi* at least in their outline.

Occurrence: — Mjøsa Limestone at Nes-Hamar (Helgøya).

Other Ostracods.

Further research will probably show that the above described species are only a part of the ostracod faunas in the Middle Ordovician series in the Oslo Region. Besides the paleocop ostracods described above, there is also a *Bythocypris*-like smooth ostracod in the Upper Chasmops beds. The material of this is, however, not very good.

Remarks on the Faunas.

The ostracod faunas of the Ogygiocaris Series (4a *a*) comprise forms which are not known from other areas. In the lower part of the Chasmops Series (4a β , 4b α — β) one species is also known from Sweden, where it is known to range throughout the Chasmops Series. The ostracods of the upper part of the Chasmops Series in the Mjøsa districts are all new, whereas those in the Oslo—Asker district, or at least closely related forms, are all known from Sweden and Esthonia. It is peculiar that they occur in the Lower Chasmops Series in Sweden and in the Kukruse (Kuckers) formation in Esthonia, which is believed to be of Lower Chasmops age.

Very little can thus be gained in the way of correlation from a comparision with other areas. With the exception of the Chasmops Series in Sweden and the Kukruse formation in Esthonia contemporaneous ostracod faunas have not been studied in detail in Europe (thus no ostracod faunas contemporaneous to those in the Ogygiocaris Series).

Several of the ostracod species described here, however, appear to be useful guide fossils within the Oslo Region.

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SPECIES				 Tallinnella trident sp.n. * tumida sp.n. * mijoesensis sp.n. * kiaeri sp.n. * stoermeri sp.n. 5 Ceratopsis ? sp 7 Piretopsis donsi gen. & sp.n. 8 Steusloffia costata (LINNARSSON) 9 Ullerella triplicata sp.n. 10 * ventroplicata sp.n. 11 * ulli (DONS) 12 holtedahli (DONS) 13 Bolbina variolaris (BONNEMA) 14 Primitia suecica (THORSLUND) 15 Platybolbina kapteyni (BONNEMA) 16 Euprimites ? suecica (THORSLUND) 17 Eoleperditia skjesethi sp.n. 	STRATIGRAPHICAL AND GEOGRAF

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PLATES 1-5

PLATE 1.

Middle Ordovician ostracods from the Oslo Region. All enlarged approximately 10 times. Left valves only. (Reconstructions).

		Daga
1	Tallinnella trident so n	r uge
2	Talling la touide and	20
Ζ.	Tallinnella tumiaa sp.n.	38
3.	Tallinnella mjoesensis sp.n	39
4.	Tallinnella kiaeri sp.n	40
5.	Ceratopsis? sp	42
6.	Ceratopsis? stoermeri sp.n.	42
7.	Piretopsis donsi gen. & sp.n.	43
8.	Steusloffia costata (LINNARSSON)	43
9.	Ullerella triplicata sp.n.	46
10.	Ullerella ventroplicata sp.n.	47
11.	Ullerella ulli (Dons)	48
12.	Ullerella holtedahli sp.n.	48
13.	Bolbina variolaris (BONNEMA)	49
14.	Primitia suecica (THORSLUND)	49
15.	Platybolbina kapteyni (BONNEMA)	50
16.	Euprimites? suecica (THORSLUND)	51
17.	Eoleperditia skjesethi sp.n	52



PLATE 2.

The fossils have been whitened with ammonium chloride. The photographs are not retouched. Photographer: Miss B. Mauritz.

P.M.O. = Paleontological Museum, Oslo.

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Fig.	1.	Tallinnella trident sp.n. External impression of left valve. P.M.O.	
		66420 (Holotype). $4a\alpha_2$, Muggerudkleiva, Sandsvær. C. 21 x	37
Fig.	2.	Tallinnella trident sp.n. Internal mould of right valve. P.M.O.	
		66430. 4aa ₂ , Muggerudkleiva, Sandsvær. C. 22 x	37
Fig.	3.	Tallinnella tumida sp.n. Left valve. P.M.O. 66421 (Holotype).	
		Section Bjerkås-Djuptrekkodden, Røyken. C. 24 x	38
Fig.	4.	Tallinnella tumida sp. n. Left valve. P. M. C. 66428. Section Bjerkås-	
		Djuptrekkodden, Røyken. C. 24 x	38
Fig.	5.	Ceratopsis? sp. Right valve, test partly missing. P.M.O. 66440.	
		Coelosphaeridium Beds, Skjønsby, Ringsaker. C. 20 x	42
Fig.	6.	Ceratopsis? stoermeri sp.n. External impression of right valve.	
		P.M.O. 60402 (Holotype). $4a\alpha_2$, Muggerudkleiva, Sandsvær. C. 20x	42
Fig.	7.	Piretopsis donsi gen. & sp.n. Internal mould of right valve.	
		P.M.O. 66425. $4a\beta$, Ullern, Oslo. C. 22 x	43
Fig.	8.	Piretopsis donsi gen. & sp.n. External impression of same speci-	
		men as in fig. 7. P.M.O. 66424 (Holotype). C. 22 x	43

PLATE 2



PLATE 3.

The fossils have been whitened with ammonium chloride. The photographs are not retouched. Photographer: Miss B. Mauritz.

P.M.O. = Paleontological Museum, Oslo.

Tallinnella mjoesensis sp.n. (p. 39)

Cyclocrinus Beds. Furuberget, Nes-Hamar district.

Fig. 1. Right valve. P.M.O. 66422 (Holotype). C. 23 x

Figs. 2-4. Larval instars, right valves.

Fig. 2. P.M.O. 66433. C. 23 x

Fig. 3. P.M.O. 66432. C. 23 x

Fig. 4. P.M.O. 66431. C. 23 x

Fig. 5. Same as fig. 1 (Holotype). C. 40 x



PLATE 4.

The fossils have been whitened with ammonium chloride. The photographs are not retouched. Photographer: Miss B. Mauritz.

P.M.O. = Paleontological Museum, Oslo.

Tallinnella kiaeri sp.n. (p. 40).

Mjøsa Limestone, Furuberget, Nes-Hamar district.

- Fig. 1. Left valve. P.M.O. 66423 (Holotype). Shows faint furrows separating L1 and L4 from the velate ridge. C. 22 x.
- Fig. 2. Left valve. P.M.O. 66435. C. 13 x.
- Fig. 3. Right valve. P.M.O. 66438. C. 20 x.
- Fig. 4. Right valve. P.M.O. 66436. C. 13 x
- Fig. 5. Right valve. P.M.O. 66437. C. 13 x.
- Fig. 6. Left valve. P.M.O. 66434. C. 17 x.



PLATE 5.

The fossils have been whitened with ammonium chloride. The phot graphs are not retouched. Photographer: Miss B. Mauritz. P.M.O. = Paleontological Museum, Oslo.	ΰ Ο-
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Fig. 1. Eoleperditia skjesethi sp.n. Left valve. P.M.O. 66427 (Holotype). Mjøsa Limestone, Bergvika, Helgøya, Nes-Hamar district. C.	
13 x	50
Fig. 2. Euprimites? suecica (THORSLUND). Left valve. P.M.O. 66441. $4b\delta$,	
Terneholmen, Oslo—Asker district. C. 20 x	51
Figs. 3-4. Ullerella ventroplicata sp.n. Two left valves. P.M.O. 4180 a	
(Holotype, fig. 3) and 4180 b (fig. 4). $4a\alpha_1$, Gomnes, Ringerike.	
C. 17 x	47
Figs. 5-6. Ullerella triplicata sp.n. External impressions of left valves.	
$4aa_2$. Muggerudkleiva, Sandsvær	46
Fig. 5. Holotype, P.M.O. 66426. C. 22 x	
Fig. 6. Larval instar. The posterior parts of the ridges do not reach	
the dorsal border. P.M.O. 66442. C. 22 x	
Fig. 7. Primitia suecica (THORSLUND). Internal mould. P.M.O. 66443. 4by,	
Hvalstad, Oslo—Asker district. C. 30 x	49



