UPPER ORDOVICIAN OSTRACODS FROM THE OSLO REGION, NORWAY

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CONTENTS

A b s t r a c t. 22 paleocop ostracods are described from the Upper Ordovician of the Oslo Region in Norway. A chart shows their stratigraphical and geographical distribution (p. 101). The following species are new: *Bolbina tuberculata, Öpikium porkuniensis, Primitia osloensis, Platybolbina tiara, Laccochilina tarda, Bollia accentuata, Pseudulrichia norvegica,* and *Monoceratella bos.* The Calcareous Sandstone (5b) is included in the Ordovician,

and is placed together with the Gastropod Limestone (5a) in a new division of the Upper Ordovician of the Oslo Region, called the Dalmanitina Series. The underlying Tretaspis Series is restricted to 4c and 4d. Many of the ostracods of the Dalmanitina Series were first described from glacial drift boulders in N. Germany. The fauna resembles that of the Swedish Leptaena Limestone and of the Esthonian Porkuni (Borkholm) Limestone. Some of the drift species are recorded for the first time from in situ material.

Introduction.

The Upper Ordovician is here understood to embrace the Tretaspis Series (4c, 4d) and an overlying series which is here called the Dalmanitina Series (5a, 5b).

Only ostracods belonging to the suborder Paleocopa are described.

The present study is based partly on old collections preserved in the Paleontological Museum, Oslo. These samples were collected primarily because of their macrofossils, and this may explain why ostracods are reported from only two districts in the Oslo Region, and mainly from 5a and 5b. No doubt a systematic searching for ostracods would show that they had a wider geographical distribution and sometimes probably also a greater vertical range than appears from this paper. Most probably also additional forms may be expected to occur. Only in 5b on the Island of Hovedøya, Oslo, have the ostracods been collected for their own sake, namely by the Swedish paleontologist G. HOLM in 1877 and by the writer during the present investigation.

The writer would like to express his gratitude to Prof., Dr. E. STENSIÖ at the Paleozoological Department of the State Museum of Natural History, Stockholm, for placing at his disposal G. HOLM's valuable material.

The writer also wishes to thank Prof., Dr. L. STØRMER (Paleont. Inst., Oslo) for facilitating this work, and for his interest in it, and cand. real. N. SPJELDNÆS for the discussion of certain problems. Furthermore his thanks are due to the Faculty Photographer, Miss B. MAURITZ, for photographing the ostracods.

Remarks on the Faunas and the Stratigraphy.

Strangely enough, not a single ostracod has been observed in material from the Tretaspis Beds (4c) and only one species in material

from the Isotelus Beds (4d) preserved at the Paleontological Museum. A rich ostracod fauna was, however, found in material of the Gastropod Limestone (5a) and of the Calcareous Sandstone (5b).

The Gastropod Limestone and the Calcareous Sandstone are close to the Ordovician-Silurian boundary, and there is some uncertainty as to where this boundary should be drawn in the Oslo Region. In a paper giving the divisions of stage 4, BRÖGGER (1887) gave the Gastropod Limestone the symbol 4dδ, and included it in the «Lower Silurian» (=Ordovician), whereas the Calcareous Sandstone (referred to as stage 5) was regarded as transitional to the «Upper Silurian» (=Silurian s.s.). In a special paper on these beds, KIÆR (1897, p. 43) changed the symbol of the Gastropod Limestone to 5a, and denoted the Calcareous Sandstone as 5b, the two together forming the stage 5. This was segregated by him (1901, p. 111) as «Middle Silurian» — a separate division between the «Lower Silurian» and «Upper Silurian». In 1934 STØRMER assigned 5a to the Ordovician and 5b to the Silurian, a practice which has been followed by him and other authors in later papers.

The ostracod faunas of 5a and 5b are of an Ordovician type. Many forms are related to those in the Middle Ordovician, but, on the other hand, they contain no members of the Beyrichiidae, so characteristic in the Silurian. The faunas in 5a and 5b are very similar, so, as far as the ostracods are concerned, it would at least be practical to include 5b in the Upper Ordovician.

Cand.real. N. SPJELDNÆS has kindly furnished the writer with some unpublished information on the Ordovician-Silurian boundary sections in the Oslo—Asker district, and this, too, points towards an Ordovician age for 5b.

5b may probably correspond more or less to the Dalmanitina Beds in Sweden. These beds were placed in the Lower Llandovery by WÆRN (1948, p. 465), but O. T. J(ONES) (1949, p. 200) is of the opinion «that in comparison with the British sections the Ordovician-Silurian boundary should be drawn above the Dalmanitina Beds».

For the above-mentioned reasons the writer is inclined to include 5b in the Ordovician.

STØRMER (1953, p. 45) included the Tretaspis Beds (4c), the Isotelus Beds (4d), and the Gastropod Limestone (5a) in the Tretaspis

Series. This series would then correspond to the whole of the Upper Ordovician. When 5b is also placed in the Upper Ordovician, it may be better to divide the Upper Ordovician of the Oslo Region into a lower Tretaspis Series and an upper Dalmanitina Series. It is here suggested that the Dalmanitina Series should embrace 5a and 5b (both containing species of *Dalmanitina*), and to restrict the Tretaspis Series to 4c and 4d.

			SILURIAN
UPPER ORDOVICIAN	Dalmanitina Series	5b	Calcareous Sandstone
		5a	Gastropod Limestone
	Tretaspis Series	4d	Isotelus Beds
		4c	Tretaspis Beds
			MIDDLE ORDOVICIAN

5a was correlated with the Staurocephalus zone in Sweden by TROEDSSON (1918, p. 87). This zone has sometimes been classed with the Dalmanitina Beds and sometimes included in the Tretaspis Series (as has been the practice in later years, cf. WÆRN, 1948, p. 460). If the Dalmanitina Beds are included in the Ordovician, as suggested by JONES (cf. above), the Staurocephalus zone and the Dalmanitina Beds might again be united in a division, which would correspond to the Dalmanitina Series in the Oslo Region.

The ostracod fauna of the Dalmanitina Series (stage 5) has many genera in common with Middle Ordovician ostracod faunas in the Oslo Region (cf. HENNINGSMOEN, 1953b). It is interesting to note that two N. American genera, not earlier known from Europe, occur in the Dalmanitina Series, namely *Tetradella* (s.s.) known from the Middle Ordovician and the Richmond of the United States, and *Monoceratella*, known from Middle Ordovician rocks in Arctic Canada and N. Greenland.

None of the ostracod species found in the stage 5 fauna seem to have been found outside the Scando-Baltic area, except in Scando-Baltic drift boulders in N. Germany.

Contemporaneous Scando-Baltic Ostracod Faunas.

(Cf. chart p. 101).

BRÖGGER (1887, p. 33) stated that 4bδ (=5a) partly corresponds to the Leptaena Limestone of Sweden and the Lyckholm and Borkholm (=Porkuni) beds of Esthonia. KIÆR (1897, p. 52) correlated 5a and 5b with the Lyckholm and Borkholm formation, respectively, Unfortunately the ostracod faunas of the Swedish Leptaena Limestone and the Esthonian Lyckholm and Borkholm formations have not been described from in situ material. Many species have, however. been described from glacial drift boulders in N. Germany, which are claimed to come from these formations. Some of these ostracods have been recognized in the Norwegian material from stage 5.

Sweden.

Two Upper Ordovician ostracod faunas have been described in detail, one from the Tretaspis Beds at Kinnekulle in Vestergötland (HENNINGSMOEN, 1948), and one from the Brachiopod Beds in Scania (TROEDSSON, 1918). No ostracod fauna contemporaneous with that from the Swedish Tretaspis Beds has been found in Norway. The Brachiopod Beds were correlated with 5b by TROEDSSON (1918, p. 87). Only one of its 12 ostracod species, *Primitiella? rara* (TROEDSSON, 1918), may occur in 5b in the Oslo Region. The difference in the ostracod faunas may be due to a difference in facies; the Brachiopod Beds are developed as shale while 5b is developed as calcareous sandstone, sandy limestone or conglomerate.

Several of the N. German drift boulder species have been specially stated to occur in boulders of Leptaena Limestone, namely four forms described by STEUSLOFF (1894); *Leperditia krausei* (?=*Macronotella praelonga*), *Leperditia? kiesowii* (?= *Macronotella praelonga*), *Isochilina frequens* (here = *Öpikella frequens*), *Primitia elongata semicircularis* (?= *Platybolbina plana*), and several additional forms described or listed by KUMMEROW (1924); *Leperditia phaseolus praecursor* KUMMEROW, 1924, *Primitiella* (?) *kuckersiana* BONNEMA, 1909 (the occurrence of this Middle Ordovician species in Leptaena Limestone appears doubtful), *Primitia*(?) *bursa* KRAUSE, 1889, *Primitia distans* KRAUSE, 1889 (?= *Platybolbina plana*), *Primitia parva* KUMMEROW, 1924 (probably not a *Primitia* species), *Primitia plana*

KRAUSE, 1889 (here = *Platybolbina plana*), *Craspedobolbina dietrichi* KUMMEROW, 1924, *Kloedenia globosa* KRAUSE, 1889 (probably not a *Kloedenia* species), *Bollia granulosa* KRAUSE, 1889 (possibly a *Primitia* species), and *Macronotella lenticularis* KUMMEROW, 1924.

Some of these forms have been recognized in the Norwegian material from stage 5. If the above-mentioned drift species really come from Leptaena Limestone, this agrees with the general view that the stage 5 is more or less contemporaneous with a part of the Leptaena Limestone.

Scando-baltic drift boulders in N. Germany.

Besides the above-mentioned drift species, assumed to occur in Leptaena Limestone and Porkuni (Borkholm) Limestone, or recognized in in situ material of Porkuni Limestone, there are others which have been observed in the stage 5 fauna, and thus for the first time recorded from material collected in situ. The age of these forms has hitherto been uncertain, but it may now be regarded as late Upper Ordovician. These species are: *Bollia duplex* KRAUSE, 1892 and (described from the same boulder) *Primitia* (*Ulrichia?*) *umbonata* KRAUSE, 1892 (here = *Platybolbina umbonata*). In addition, *Primitia elongata* KRAUSE, 1891 (here = *Platybolbina elongata*) and *Primitiella umbilicata* KUMMEROW, 1924 (here = *Öpikella umbilicata*) may probably be present in the Norwegian material.

Several of the ostracods in the stage 5 fauna were listed by KUMMEROW (1924) as occurring also in drift boulders of a type referred to as «Algenkalk». This may thus be of late Upper Ordovician age. Some species listed from this by KUMMEROW were not recognized in the stage 5 fauna, but may be expected in beds of this age, namely *Aparchites marchicus* KUMMEROW, 1924, *A. cuneatus* KUMMEROW, 1924, *Primitia corrugata* KRAUSE, 1892 (not a *Primitia* species), and *Macronotella lenticularis* KUMMEROW, 1924.

Esthonia.

In his paper on ostracods from the Middle Ordovician Uhaku and Kukruse formations, ÖPIK (1937) described or mentioned also a few species from Upper Ordovician formations, namely *Piretella acmaea* ÖPIK, 1937 and an unnamed *Uhakiella* species (l.c., p. 42)

(perhaps *Primitia osloensis* sp. n.) from the Lyckholm formation, and *Biflabellum flabelliferum* (KRAUSE, 1892) (here = *Öpikium porkuniensis* sp. n.) from the Porkuni (=Borkholm) formation. KRAUSE (1892, p. 398, foot-note) recorded the following species from the Porkuni formation at Porkuni: *Beyrichia dissecta* KRAUSE, 1892 (here = *Kiesowia dissecta*), *Beyrichia plicata* (error for *plicatula*) KRAUSE, 1892 (here = *Tetradella plicatula*), *Primitia elongata* KRAUSE, 1892 (here = *Platybolbina elongata*), *Primitia distans* KRAUSE, 1889 (here = *Platybolbina distans*), and an *Isochilina* species (=*Öpikella frequens*, cf. STEUSLOFF, 1894, p. 783). The following three forms are present in material from the Porkuni formation at Porkuni, preserved at the Paleontological Museum in Oslo: *Kiesowia dissecta*, *Platybolbina elongata*, and *Platybolbina distans*.

STEUSLOFF (1894) mentioned the following ostracods from a sample, which, on lithological and faunal (ostracods) evidence, he believed to be the Borkholm Limestone: *Primitia jonesii* KRAUSE, 1889 (here = *Chilobolbina? jonesiana* (SCHMIDT, 1941)), *Primitia plana* (here = *Platybolbina plana*), *Primitia distans* (? = *Platybolbina plana*), and described the following ostracods: *Leperditia praelonga* (here = *Macronotella praelonga*), *Primitia cuneata* (= *Steusloffina cuneata*, a bairdiid), *Primitia rugosa* (probably not a *Primitia*), *Primitia canaliculata* (probably not a *Primitia*), and *Primitia elongata obliqua* (? = *Platybolbina plana*).

The Porkuni fauna thus agrees rather well with that cf stage 5 in the Oslo Region.

Systematic descriptions.

Only paleocop ostracods are described in the present paper. Non-paleocop ostracods also occur in the Upper Ordovician of the Oslo Region, e.g. *Steusloffina cuneata* (STEUSLOFF, 1894), which has been met with in 5b. No doubt even more paleocop ostracods will be found later. A few defective valves, not belonging to any of the species described below, were observed in 5b.

An interrogation mark in front of the name of a systematic unit indicates that it is uncertain whether it really belongs to the next higher taxonomic unit.

Suborder PALEOCOPA HENNINGSMOEN, 1953
Superfamily Beyrichiacea ULRICH & BASSLER, 1923
Family Sigmoopsiidae HENNINGSMOEN, 1953
Subfamily Sigmoopsiinae HENNINGSMOEN, 1953
Genus *Sigmobolbina* HENNINGSMOEN, 1953

Type species: — By original designation, *Entomis oblonga* var. *Kuckersiana*, BONNEMA, 1909.

Sigmobolbina? sp.
(Pl. 1, figs. 1—2; text fig. 1.)

Material: — A few valves, preserved in limestone.

Description: — The valves reach a size of about 0.9 × 0.5 mm. Slight forward swing. Unisulcate; sulcus somewhat sigmoidal, deep behind faint presulcate node, rather shallow and faint ventrally. No flanges, but a submarginal bend separates the lateral and marginal surface anteriorly and ventrally. A short, broad-based, spurlike spine is developed postero-ventrally. The lateral surface slightly overhangs the free margin ventrally. Surface smooth.

Fig. 1. *Sigmobolbina*? sp. Lateral and ventral view of left valve (reconstruction). x 20.

Remarks: — This form resembles *Sigmobolbina obliqua* (KRAUSE, 1892), and may possibly belong to the same genus. No dimorphism was observed in the present form, but this may be due to lack of sufficient material. It probably represents a new species, but more material is needed to give an adequate description.

Occurrence: — Oslo—Asker (5b, Hovedøya).

Genus *Bolbina* HENNINGSMOEN, 1953

Type species: — By original designation, *Bollia ornata* KRAUSE, 1892.

Bolbina aff. *minor* (KRAUSE, 1892)
(Pl. 1, fig. 13.)

Remarks: — One single valve, 0.7 mm long and 0.4 mm high,

resembles the Middle Ordovician species *Bolbina minor*. The valve is, however, not too well preserved.

Occurrence: — Oslo—Asker (5b, Hovedøya).

Bolbina tuberculata sp.n.

(Pl. 1, figs. 3—5; text fig. 2.)

Name: — The name *tuberculata* alludes to the tuberculate surface.

Type data: — Holotype (P.M.O. — 66428a) is a left valve from 5b at Hovedøya in Oslo.

Material: — 10 separate valves, all preserved in limestone.

Fig. 2. *Bolbina tuberculata* sp. n. Left valve (reconstruction). x 20.

Diagnosis: — A small *Bolbina* species with a presulcal node and a postero-ventral lobe-like node. The nodes are separated by the sulcus, not united as usual in *Bolbina*. Surface tuberculate.

Description: — The valves reach a size of about 0.7 × 0.4 mm. Slight forward swing. Unisulcate; sulcus poorly developed dorsally, forms a deep, characteristic pit just behind the round presulcate node, and is fairly well developed ventrally. Behind the ventral part of the sulcus there is an elongate, oblique lobe-like node. A narrow velate frill is developed parallel to the ventral and lower half of the anterior border. Surface ornamented with comparatively large tubercles.

Remarks: — *Bolbina tuberculata* resembles species like *B. ornata* (KRAUSE, 1896), but differs in being tuberculate, and in having the sulcus prolonged ventrally, thus separating the presulcal node and the postero-ventral lobe-like node. Nevertheless, it seems reasonable to include the present species in *Bolbina*. No dimorphism was observed in *B. tuberculata*.

Occurrence: — Oslo—Asker (5b, Hovedøya).

?Genus *Kiesowia* ULRICH & BASSLER, 1908.

Type species: — By original designation, *Beyrichia dissecta* KRAUSE, 1892.

Kiesowia dissecta (KRAUSE, 1892)

(Pl. 2, figs. 1—3, 5.)

1892 *Beyrichia dissecta* n.sp. — KRAUSE, p. 392, pl. XXI, fig. 3.

?1892 *Beyrichia mamillosa* n.sp. — KRAUSE, p. 393, pl. XXII, fig. 14.
1894 *Tetradella*? *dissecta* (KRAUSE) — ULRICH, p. 679.
?1894 *Tetradella*? *mamillosa* (KRAUSE) — ULRICH, p. 679.
1908 *Tetradella* (*Kiesowia*) *dissecta* (KRAUSE) — ULRICH, p. 306, pl. 39, fig. 10.
?1908 *Tetradella* (*Kiesowia*) *mamillosa* (KRAUSE) — ULRICH, p. 305, pl. 39, fig. 11.
1923 *Kiesowia dissecta* (KRAUSE) — ULRICH & BASSLER, pp. 310, 311, text fig. 20 (fig. 6).
1934 *Kiesowia dissecta* (KRAUSE) — BASSLER & KELLETT, p. 349.
?1934 *Kiesowia mamillosa* (KRAUSE) — BASSLER & KELLETT, p. 349.
1937 *Kiesowia dissecta* (KRAUSE) — ÖPIK, p. 31.
?1937 *Kiesowia mammilosa* (KRAUSE) — ÖPIK, p. 31.
1951 *Kiesowia dissecta* (KRAUSE) — KESLING, p. 158, pl. V, fig. 3.
?1951 *Kiesowia mamillosa* (KRAUSE) — KESLING, p. 157, pl. IV, fig. 3.
1953 *Kiesowia dissecta* (KRAUSE) — HENNINGSMOEN, p. 210.
?1953 *Kiesowia mammilosa* (KRAUSE) — HENNINGSMOEN, p. 210.

Type data: — As lectotype is here chosen the right valve figured by KRAUSE (1892, pl. XXI, fig. 3) from a glacial drift boulder at Müggelheim, N. Germany.

Present material: — About 10 valves and internal moulds of valves, preserved in limestone.

Description of present material: — Adult valves about 1.9 mm long and 1.1 mm high. Elongate, with slight forward swing. Tetralobate. L2 developed as a rather round node. L1, L3, and L4 are all divided into two nodes. L1 tends, however, to split into three nodes. This is especially seen in larval valves. The dorsal node(s) of L1 is (are) round and rather small; its ventral node is also round, but larger. The dorsal nodes of L3 and L4 are round, whereas their ventral nodes are elongate. S1 is short, S2 and S3 long. S2 is best developed; it is deepest just behind L2. A fairly well developed velate frill is preserved in two specimens. It is restricted to the anterior and ventral border areas and appears to be replaced by a row of spines posteriorly. The frill is radially striate, as if composed of fused spines. The frill is very faintly convex in both specimens. It narrows upwards along the anterior border, and dies out before it reaches the dorsal border, whereas it ends rather abruptly posteriorly. The surface of the valve between the lobes is reticulate (or granuloreticulate), whereas the surface of the nodes, especially L2, L3, and L4, appears smoother. The nodes are, however, covered by scattered, relatively large tubercles.

Remarks: — No frill was described by KRAUSE; instead his figure of the lectotype shows a submarginal row of tubercles. The same feature is seen in internal moulds of the present material. It is thus possible that his specimen is an internal mould, or it may represent the male type, if the two present specimens with velate frill represent the female type. *Kiesowia mamillosa* (KRAUSE, 1892) agrees rather well with larval forms of *K. dissecta* and may probably be a synonym.

Occurrence: — Oslo—Asker (5a-b, Nedre Ås in Bærum; 5b, Hovedøya), Ringerike (5a, Stavnestangen). — Esthonia (Porkuni Limestone, Porkuni), N. Germany (glacial drift boulders).

Family Tetradellidae SWARTZ, 1936
Subfamily Tetradellinae SWARTZ, 1936
Genus *Tetradella* ULRICH, 1890.

Type species: — *Beyrichia quadrilirata* HALL & WHITFIELD, 1875, by subsequent designation of ULRICH (1894, p. 677).

Remarks: — The genus *Tetradella* was restricted by HENNINGSMOEN (1953, p. 213) to the *Tetradella quadrilirata* group only, i.e. to those species which develop submarginal loculi.

Tetradella plicatula (KRAUSE, 1892)

(Pl. 1, figs. 8—11; text fig. 3.)

1892 *Beyrichia plicatula* sp.n. — KRAUSE, pp. 394, 399, pl. XXII, fig. 13.
1892 *B(eyrichia) plicata* sp.n. [error for *B. plicatula* sp.n.:] — KRAUSE, p. 398.
1934 *Bollia? plicatula* (KRAUSE) — BASSLER & KELLETT, p. 218.

Type data: — Holotype is the left valve figured by KRAUSE (1892). It was stated to come from a drift boulder of uncertain age in N. Germany. In a list KRAUSE (p. 399) tentatively assigned it to the Upper Silurian (=Silurian s.s.). BASSLER & KELLETT (1934) stated that the drift is a *Ceratopsis rostrata* limestone (Lower Ordovician). This appears to be a mistake, probably due to the fact that many of the other species described in the same paper (KRAUSE, 1892) came from drift of this limestone. The lithological character of the

boulder (according to KRAUSE's description) suggests that it may be Porkuni Limestone. Furthermore KRAUSE (p. 398) reported it (by mistake as *B. plicata*) from a sample of Borkholm (=Porkuni) Limestone from Esthonia. It thus appears rather probable that the holotype also came from beds of this age.

Present material: — 8 more or less damaged valves, all preserved in limestone.

Fig. 3. *Tetradella plicatula* (KRAUSE). Left valve of female type (reconstruction) x 16.

Description of present material: — The valves are up to about 1.1 mm long and 0.7 mm high. Slight forward swing. Surface traversed by several ridges. Disregarding these, the main surface of the valve is trilobate. The anterior lobe (L1) carries two longitudinal ridges. The median lobe (L2) is developed as a round node, continuing ventrally in a ridge which after a short distance unites with the inner ridge of L1. Whereas S1 is short, S2 is long and well developed. The posterior lobe (L3 + L4) carries three longitudinal ridges. The two outer ones are ventrally connected with the outer ridge of L1, thus forming a carinal ridge. The remaining ridges unite ventrally with the carinal ridge. An entire velate ridge is also present. A row of loculi are developed between the velate and the carinal ridge in some specimens (female type). The material is not good enough to show exactly how many loculi are developed, but there appear to be five. The surface appears smooth.

Remarks: — The present specimens agree well with *T. plicatula* in the number and arrangement of ridges, and may be considered conspecific. No subventral loculi are described in the holotype, which apparently is of the male type. *T. plicatula* appears to be the only known European form referable to *Tetradella* (s.s.). It comes rather close to *T. ulrichi* described by KAY (1934, p. 339) from the Middle Ordovician Hull, Decorah, and Sherman Fall formations in U. S. A., but this differs from *T. plicatula* inter alia in that the inner anterior ridge and the ridges below the median node do not unite ventrally.

Occurrence: — Oslo—Asker (5a-b, Nedre Ås in Bærum; 5a, Hovedøya) — N. Germany (drift boulders), Esthonia (Porkuni Limestone, Porkuni).

?Subfamily Piretellinaė Öpik, 1937
?Genus *Öpikium* Agnew, 1942

Type species: — *Biflabellum tenerum* Öpik, 1935a (probably a synonym of *Entomis flabellifera* Krause, 1892, cf. below).

Öpikium porkuniensis sp. n.
(Pl. 2, fig. 4.)

1937 *Biflabellum flabelliferum* Krause (partim) — Öpik, p. 39, pl. V, fig. 8.

Name: — From Porkuni (=Borkholm) in Esthonia.

Type data: — As holotype is chosen the specimen figured by Öpik (1937, pl. V, fig. 8) as *Biflabellum flabelliferum* from the Porkuni (=Borkholm) formation at Porkuni in Esthonia.

Remarks: — Öpik (1937, p. 39) identified an Upper Ordovician (Porkuni formation) species as *Öpikium* (=*Biflabellum*) *flabelliferum*, a species described from a glacial drift boulder in N. Germany by Krause (1892, p. 388) as *Entomis* (*Primitia*?) *flabellifera*. The drift species is, however, a Middle Ordovician form, as can be ascertained by the associated fauna, an *Öpikella* («*Isochilina*«) *canaliculata* fauna (cf. Andersson, 1893). Its very wide frill makes it probable that *Öpikium tenerum* (Öpik, 1935a) from the Middle Ordovician Kukruse formation is a junior synonym. Some specimens described by Bonnema (1909, p. 70) were, probably correctly, referred by him to *Entomis flabellifera*. They were, however, transferred to *Biflabellum tenerum* by Öpik (1937, p. 40).

The form from the Porkuni formation is not *Ö. flabelliferum*. It is described below as a new species, *Ö. porkuniensis*.

Diagnosis: — An *Öpikium* species with very wide velate frill. The frill may be as wide as the valve proper is high, whereas in the also wide-frilled *Ö. biflabellum* (and *Ö. tenerum*) the frill may be markedly wider than the valve proper is high. The frill is finely radially striate in *Ö. porkunensis* sp.n., whereas it is coarsely radially striate in *Ö. biflabellum* (and *Ö. tenerum*).

Description of holotype, based on figure given by Öpik (1937, pl. V, fig. 8): — Ends subequal. Unisulcate; sulcus (S2) long, with geniculum. Just in front of the bend of the sulcus there is a small node-like inflation, corresponding to L2. A velate frill is developed

in the anterior and ventral border areas. It does not reach the dorsal border anteriorly. It widens posteriorly and ends abruptly. Its maximum width is about as great as the height of the valve proper (excluding frill). The frill is finelly radially striate, and shows also very fine concentric structures. The frill is somewhat incurved, especially along the border. The specimen is thus of the female type. The specimen (including frill) is about 2.9 mm long and 1.8 mm high.

Present material: — A right valve (female type, 3.3 × 2.0 mm) and a few impressions (male type), preserved in limestone. The female type agrees very well with the holotype. The impressions of male type valves are not good, and do no allow a detailed description. The frill is apparently not as wide as in the female type, and not incurved.

Occurrence: — Oslo—Asker (5b, Hovedøya), Ringerike (5a, Stavnestangen) — Esthonia (Porkuni).

Family Primitiidae Ulrich & Bassler, 1923.
Genus *Primitia* Jones & Holl, 1923

Type species: — *Beyrichia strangulata* McCoy, 1851 (designated by Miller, 1889).

Primitia osloensis sp. n.
(Pl. 1, figs. 6—7.)

Type data: — Holotype is a left valve (P.M.O. — 55 081a) from 5a, Stavnestangen, Ringerike.

Material: — A few valves of the female type, preserved in limestone.

Diagnosis: — A small *Primitia* species with short velate pouch (about 3/5 length of valve) and granulate surface.

Description: — Adult valves about 1.1 mm long and 0.7 mm high, disregarding velate pouch. Slight forward swing. Sulcus rather faint; presulcal node small. The velate pouch has an antero-ventral position, and is rather short, about 3/5 the length of the valve. It is faintly and irregularly striate. Surface of valve is granulate.

Remarks: — In size this species recalls *Primitia* («*Uhakiella*») *pumila* (Öpik, 1937) from the Middle Ordovician of Esthonia, which,

however, has the pouch situated more anteriorly. *P. osloensis* sp.n. also reminds one of *P. strangulata*, which is larger and has a longer pouch. ÖPIK (1937, p. 42) mentions an undescribed *Uhakiella* species from the Lyckholm formation in Esthonia. It may possibly be *P. osloensis*.

Occurrence: — Oslo—Asker (5b, Hovedøya), Ringerike (5a, Stavnestangen).

Genus *Chilobolbina* ULRICH & BASSLER, 1923

Type species: — By original designation, *Primitia dentifera* BONNEMA, 1909.

Chilobolbina? cf. *jonesiana* (SCHMIDT, 1941)

(Pl. 6, fig. 5; text fig. 4.)

cf. 1889 *Primitia Jonesii* n.sp. — KRAUSE, p. 8, pl. I, fig. 6.
cf. 1934 *Primitia jonesii* (KRAUSE) — BASSLER & KELLETT, p. 446.
cf. 1941 *Mirochilina jonesiana* n. nom. — SCHMIDT, p. 29 (not pl. 3, figs. 20—23.)

Type data: — Holotype (by monotypy) is the left valve figured by KRAUSE (1889) from a drift boulder of unknown age in N. Germany.

Present material: — Some 25 valves, preserved in limestone.

Description of present material: — Adult valves about 2.0 mm long and 1.4 mm high. Ends subequal, cardinal angles obtuse. Moderately and rather evenly convex save for the one sulcus (S2). The sulcus is short, and almost as well defined dorsally as ventrally; thus having a sausage-like outline. The valve is very faintly swollen around the sulcus. A dorsal plica (ridge) is developed both in front of and behind the sulcal area. A slightly oblique row of spines is developed behind the sulcus, and is connected with the anterior end of the posterior dorsal plica. A submarginal row of spines appears to represent the velate structure. Inside this row, there is another subparallel row of spines. The surface of the valve is densely covered with granules; in between there are a few larger ones (probably spine bases).

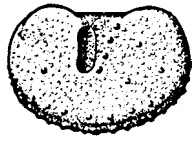

Fig. 4. *Chilobolbina*? cf. *jonesiana* (SCHMIDT). Left valve (reconstruction). x 12.

Remarks: – The drawing given by KRAUSE (1889) of the holotype

differs from the present material in having the sulcus more centrally placed. Apart from this the present material agrees very well with KRAUSE's figure and description of *Primitia Jonesii*, and may well be conspecific. Two specimens described by KRAUSE (1891, p. 493, pl. XXXI figs. 6, 7) as *Primitia* aff. *Jonesii* differ from this species in many features (also in developing a dimorphic pouch?) and does not seem to be closely related. Probably these specimens belong to a *Primitia* species. SCHMIDT (1941, p. 29) pointed out that *Primitia Jonesii* KRAUSE, 1889 is a synonym of *P. Jonesii* KONINCK, 1876, and gives the new name *jonesiana* to KRAUSE's form. At the same time SCHMIDT changes the generic reference to *Mirochilina*. This genus (with two species) was described from the Ludlow in Bohemia by BOUČEK (1936). However, it seems rather questionable if *jonesiana* should be assigned to *Mirochilina*. On the other hand *jonesiana* agrees rather well with some forms assigned to *Chilobolbina*, cf. for example *Chilobolbina decumana* (BONNEMA) as figured by BONNEMA (1909, pl. II, fig. 12). This specimen has a similar sulcus, dorsal plicae, and type of ornamentation, but differs inter alia in having a velate frill. Quite possibly *jonesiana* represents an offshoot which does not develop a dimorphic frill. SCHMIDT further assigns some Caradoc specimens from Bohemia to *jonesiana*. These seem to differ from *jonesiana* inter alia in developing a velate frill (at least in some specimens), and it is possible that they represent another species congeneric with *jonesiana*.

Occurrence: — Oslo—Asker (5b, Hovedøya; 5a-b, Nedre Ås in Bærum) — N. Germany (drift).

Family Eurychilinidae ULRICH & BASSLER, 1923
Subfamily Eurychilininae ULRICH & BASSLER, 1923
Genus *Platybolbina* HENNINGSMOEN, 1953b

Type species: — By original designation, *Primitia distans* KRAUSE, 1889.

Remarks on the generic name: — *Primitia distans* was referred to as *Platychilina distans* by KUMMEROW (1933). He gave, however, no definition of the genus, and designated no type species. This was later done by THORSLUND (1940 p. 169), who selected *Primitia distans*

KRAUSE, 1889 as type species. Meanwhile, KUMMEROW (1939, p. 19) had already given a definition of the genus, and designated *Primitia elongata* KRAUSE, 1891 as type species. As pointed out by AGNEW (1944, p. 219) the ostracod genus *Platychilina* is a junior homonym of the gastropod genus *Platychilina* KOKEN, 1892. The new name *Platybolbina* was suggested for the ostracod genus by HENNINGSMOEN (1953b, p. 50), who unfortunately was not aware of KUMMEROW's erection of the genus in 1939[1].

Platybolbina was therefore proposed as a new name for *Platychilina* THORSLUND, 1940, with *P. distans* as type. For this reason it may be correct to regard *P. distans* as type species of *Platybolbina*, and not *P. elongata*. Fortunately *P. distans* and *P. elongata* appear to be congeneric.

Remarks on the type species: — *Primitia distans* was first described by KRAUSE (1889, p. 6) from a N. German glacial drift boulder, which was listed by KUMMEROW (1924) as Leptaena Limestone. In 1892 KRAUSE (p. 386, pl. XXI, fig. 16) assigned another drift boulder specimen to *P. distans*. The age of this boulder can now safely be regarded as late Upper Ordovician, since *Bollia duplex* and *Platybolbina umbonata* occur in it, and these two characteristic species are recorded from the late Upper Ordovician in Norway.

In 1896 KRAUSE (p. 933, pl. XXV, figs. 7—8) reported *P. distans* from a Middle Ordovician glacial drift boulder from Holland. BONNEMA (1909, p. 29) erected a new species, *P. kapteyni*, for the Middle Ordovician form, which he also described from Esthonian material from the Middle Ordovician Kukruse (Kuckers) beds. According to BONNEMA the difference between the Middle Ordovician *Primitia kapteyni* and the Upper Ordovician *P. distans* should be that whereas *P. kapteyni* showed a reticulate surface pattern (save for a smooth muscle spot, a smooth triangular area at the anterior cardinal angles, and a smaller smooth triangular area at the posterior cardinal angle), *P. distans* had a granulated surface (save for the muscle spot). He had, at hand, material of *P. distans* from the Upper Ordovician of Esthonia, and could not find any specimens with reticulate pattern in it. He therefore confidently assigned the specimen of *P. distans* (showing a

[1]) The writer wishes to thank Prof., Dr. HENRY V. HOWE (Louisiania State University) for bringing this paper to his attention.

reticulate pattern) described by KRAUSE (1892) to *P. kapteyni*. It is now known that this specimen is of Upper Ordovician age. Furthermore the writer has observed specimens of *P. distans* with reticulate surface pattern in material of the late Upper Ordovician Porkuni (Borkholm) formation in Esthonia. It therefore seems that the reticulation cannot be used to distinguish these two species. The problem is further complicated by the description of quite smooth specimens of *P. kapteyni* from the Middle Ordovician of Sweden by THORSLUND (1940, p. 169) — only in one specimen a distinct but minute reticulation was observed.

It is possible that *P. kapteyni* should be regarded as a synonym of *P. distans*, but the rather great difference of age between them seems to make this less probable. Both species sometimes appear to show a reticulate pattern. The type specimen of *P. distans* was stated by KRAUSE to be granulate. However, internal moulds of *P. kapteyni* (described by KRAUSE, 1896 as *P. distans*) are also granulate, and it is thus possible that the type specimen of *P. distans* is also an internal mould. As suggested by KRAUSE (1896, p. 933) the reticulate pattern is probably due to the prismatic layer of the shell. It is important, as pointed out by KUMMEROW (1933, p. 44), that the reticulate pattern may be seen *through* the exterior shell layer in favourably preserved specimens, whereas otherwise this pattern is first seen when the exterior shell layer has weathered away. It is possible that *P. distans* differs from *P. kapteyni* in having a more acute posterior end. Better material is, however, needed to ascertain possible differences between these two species.

Primitia elongata semicircularis STEUSLOFF (1894) is probably a synonym of *P. distans*. It is possible that *Platybolbina distans* is a synonym of *P. plana*, as discussed below.

Platybolbina cf. *plana* (KRAUSE, 1889)

(Pl. 3, figs. 1—8.)

cf. 1889 *Primitia plana* n.sp. — KRAUSE, p. 5, pl. I, figs. 1a—b.
?1889 *Primitia distans* n.sp. — KRAUSE, p. 6, pl. I, figs. 3a-b.
?1892 *Primitia distans* KRAUSE — KRAUSE, pp. 386,398, pl. XXI, fig. 16.
?1894 *Primitia elongata* var. *obliqua* n. v. — STEUSLOFF, p. 783, pl. LVIII, fig. 12.

?1894 *Primitia elongata* var. *semicircularis* n.v. — STEUSLOFF, p. 784, pl. LVIII, fig. 13.
?1909 *Primitia distans* KRAUSE — BONNEMA, p. 30.
cf. 1923 *Apatochilina plana* (KRAUSE) — ULRICH & BASSLER, p. 521.
?1923 *Ccelochilina distans* (KRAUSE) — ULRICH & BASSLER, p. 521.
cf. 1924 *Primitia plana* KR. — KUMMEROV, p. 440.
?1924 *Primitia distans* KR. — KUMMEROW, p. 440.
?1933 *Platychilina* (=*Primitia*) *distans* (KR.) — KUMMEROW, p. 44.
cf. 1934 *Apatochilina plana* (KRAUSE) — BASSLER & KELLETT, p. 162.
?1934 *Coelochilina distans* (KRAUSE) — BASSLER & KELLETT, p. 246.
?1934 *Primitia? elongata semicircularis* STEUSLOFF — BASSLER & KELLETT, p. 443.
?1934 *Primitia* (?*Eurychilina*) *elongata obliqua* STEUSLOFF — BASSLER & KELLETT, p. 443.
?1940 *Platychilina distans* (KRAUSE) — THORSLUND, p. 169.
?1953b *Platybolbina distans* (KRAUSE) — HENNINGSMOEN, p. 50.

Type data: — *Platybolbina plana* was founded upon a single specimen (holotype), which was described from a glacial drift boulder in N. Germany. It was associated with the holotype of *Platybolbina distans*. The boulder was stated by KUMMEROW (1924, p. 440) to be of Upper Ordovician (Leptaena Limestone) age.

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

Description of present material: — Adult valves up to about 2.0 mm long and 1.1 mm high. Moderately convex; convexity somewhat varying. Faint forward swing. Anterior cardinal angle slightly obtuse or slightly acute. Posterior cardinal angle slightly acute. Each cardinal angle may protrude into a spinelike point, especially in larval valves. Non-sulcate, but a very faint and diffuse sulcoid depression may occasionally be distinguished. An elliptical subcentral muscle spot is often discernible, especially on internal moulds. Velate structure developed as a frill in the ventral and greater part of the anterior border area. It is widest anteroventrally, and tapers towards both ends, from where it continues in a velate ridge, reaching the dorsal margin at both ends. In larval moults and in adult valves of the male type the frill is flat, and rises up from the sagittal plane of the carapace. It is radially striate, but the striae do not always quite reach the edge of the frill. In valves of the female type the frill is more or less convex, and often twice as wide as in

the male type. The radial striae are sometimes not discernible in the valves of female valves.

The surface ornamentation is variable. In larval moults the surface is usually pitted (save for the muscle scar), but is often smooth or finely granulate. In valves of the female type the surface is usually smooth but may be finely granulate, or, rarely, pitted. A reticulate pattern described by KRAUSE (1892) in *P. distans* and seen by the author in Esthonian material of the same species, has not been observed in the Norwegian material. This is perhaps because the Norwegian material is preserved in dark, unweathered limestone. Such reticulation is usually seen when the valves are translucent (as sometimes in light-coloured limestones) or when the valve is weathered (cf. above).

Remarks: — This appears to be a rather variable species, both in outline and surface ornamentation. Some of the valves in the Norwegian material agree rather well with the holotype of *Platybolbina plana*, and others with the holotype of *P. distans*. As intermediate types occur as well, it appears possible that both forms belong to one species. The writer has not had the opportunity to examine the type material but it may be recalled, however, that the two holotypes occur in the same glacial drift boulder. It also appears probable that *Primitia elongata obliqua* STEUSLOFF, 1894 and *P. elongata semicircularis* STEUSLOFF, 1894 belong to the same species. They were stated to come from boulders of Porkuni Limestone and Leptaena Limestone, respectively.

Occurrence: — Oslo—Asker (5a, Bærum; 5a, Asker; 5b, Hovedøya; 5b, Sandviksåsen), Ringerike (5a, Stavnestangen; 5a Frognøy) — Esthonia (Porkuni Limestone, Porkuni), N. Germany (glacial drift boulders).

Platybolbina tiara sp.n.

(Pl. 4, figs. 4—9.)

Name: — The name alludes to the rather fine, tiara-like frill of this species.

Type data: — The holotype (P. O. M. — 66434) is a left valve from 5b at Hovedøya, Oslo.

Diagnosis: — A *Platybolbina* species with entire, rather coarsely

striate, velate frill (showing dimorphism), a short sulcus, and a poorly defined node in front of it. Surface pitted and granulate.

Description: -- Adult valves reach a length of about 1.9 mm and height of about 1.2 mm. Moderately convex; rather slight forward swing. Unisulcate. The sulcus is short, and not well defined dorsally. It is deepest in its ventral end, just behind and below a poorly defined node. Velate frill entire, i.e. reaching from anterior to posterior dorsal angle. The frill has coarse, radially arranged striae, and shows also some very fine concentric wrinkles. The frill is flat and narrow or wide in valves of the male type, and convex and wide in valves of the female type. The surface is rather coarsely pitted and granulate.

Affinities: — This characteristic species recalls *P. umbonata*, but differs in not having such a large node, in showing velate dimorphism and in attaining a greater size. *P. tiara* sp.n. differs from *P. plana* inter alia in having an entire frill.

Occurrence: — Oslo—Asker (5b, Hovedøya).

Platybolbina cf. *elongata* (KRAUSE, 1891)

(Pl. 1, fig. 14.)

cf. 1891 *Primitia elongata* n.sp. — KRAUSE, p. 494, pl. XXX, figs. 4a-b.
1892 *Primitia elongata* KRAUSE — KRAUSE, p. 386, pl. XXII, fig. 2.
cf. 1924 *Primitia elongata* KR. — KUMMEROW, pp. 409, 440.
cf. 1934 *Primitiella elongata* (KRAUSE) — BASSLER & KELLETT, p. 461.
cf. 1939 *Platychilina elongata* (KRAUSE) — KRAUSE, p. 19.
1948 *Platychilina* (=*Primitia*) *elongata* (KR.) — KUMMEROW, p. 20, text fig. 5.
(non 1896 *Primitia elongata* KRAUSE — KRAUSE, p. 933, pl. 25, fig. 9.)

Type data: — Holotype (by monotypy) is the left valve figured by KRAUSE (1891) from a glacial drift boulder in N. Germany.

Present material: — About 15 valves preserved in limestone.

Description of present material: — Elongate, largest valve about 1.4 mm long and 0.7 mm high. Slight forward swing. In some specimens a short, narrow and poorly defined sulcus is present, in front of which is then a small, not well defined node. In other specimens the sulcus and node are missing or are only faintly visible. An elliptical muscle scar is usually seen ventral to the sulcus. The scar is smooth, whereas the surface of the valve is elsewhere rather coarsely

granulate. The velate frill is entire, flat and radially striate. It is rather narrow (male type) or rather wide (female type).

Remarks: — The present material agrees very well with the specimen (female type) described by KRAUSE in 1892. It is, however, uncertain whether the holotype is conspecific with this form or with the Middle Ordovician form assigned to *P. elongata* by KRAUSE in 1896. For this reason it appears best to refer to the present material as *P.* cf. *elongata*.

Occurence: — Oslo—Asker (5a, Bærum; 5b, Hovedøya), Ringerike (5a, Frognøy) — Esthonia (Porkuni Limestone, Porkuni), N. Germany (glacial drift boulders).

Platybolbina umbonata (KRAUSE, 1892)

(Pl. 4, figs. 1—3.)

1892 *Primitia* (*Ulrichia*?) *umbonata* n.sp. — KRAUSE, p. 389, pl. XXI, figs. 10—11.
1933 *Platychilina* (=*Primitia*) *umbonata* (KRAUSE) — KUMMEROW, p. 45.
1934 *Platychilina* (=*Primitia*) *umbonata* (KRAUSE) — KUMMEROW, p. 502,
1934 *Eurychilina* (*Coelochilina*) *umbonata* (KRAUSE) — BASSLER & KELLETT. p. 317.
1941 *Eurychilina* (*Platychilina*) *umbonata* (KRAUSE) — TRIEBEL, p. 314, pl. 4, fig. 42.

Type data: — As lectotype is here chosen one of the specimens figured by KRAUSE (1892), namely the left valve of which was later given a photograph by TRIEBEL (1941). It was described from an Ordovician drift boulder in N. Germany.

Present material: — Some 30 valves and impressions of valves, all preserved in limestone.

Remarks: — This rather small species (reaching a size of about 1.5 × 1.0 mm) is easily recognisable by its unusually large node and its very wide entire frill, rising up from the sagittal plane and thus giving a collar-like impression. The Norwegian material agrees quite well with the German drift specimens. KUMMEROW (1933, p. 45; 1934, p. 502) believed that the node takes the place of the muscle scar in *P. distans*. As shown by TRIEBEL (1941, p. 314, pl. 4, fig. 42) there is, however, a small pit behind the node, indicating that the muscle scar is situated behind the node, as usual. No dimorphism

has been observed. Nevertheless, *P. umbonata* appears to be rather close to other species assigned to *Platybolbina*.

Occurrence: — Ringerike (5a, Frognøy, associated with *Bollia duplex* and *Platybolbina* cf. *plana*) — N. Germany (glacial drift boulder).

Genus *Laccochilina* HESSLAND, 1949

Type species: — By original designation, *Eurychilina estonula* ÖPIK, 1935b.

Laccochilina tarda sp.n.

(Pl. 6, figs. 8—9.)

Name: — The name *tarda* alludes to the late appearance of this species of *Laccochilina*.

Type data: — Holotype (P.M.O. — 66436) is a right valve (female type) from 5b at Hovedøya, Oslo.

Material: — About 15 valves and impressions of valves preserved in limestone.

Diagnosis: — A *Laccochilina* species with comparatively large node, well developed sulcal slit, well developed dorsal plica (ridge) and densely granulate surface. Anterior end narrower than posterior end.

Description: — Adult valves reach a length of about 2.4 mm and a height of about 1.4 mm. Ends subequal, but the anterior end is somewhat narrower than the posterior end. A short, slit-like, slightly curved sulcus is developed behind a comparatively large, round node. Dorsal plica well developed. It turns round at the ends to run subparallel with the free borders for a short distance; slightly further down ventrally at the anterior end than at the posterior end. Velate frill entire, rather narrow, faintly radially striate. It is slightly incurved in some specimens (female type). Surface (including frill) densely granulate.

Affinities: — This species resembles the Lower Ordovician species of *Laccochilina* described by HESSLAND (1949). It differs inter alia in having a much larger node.

Occurrence: — Oslo—Asker (5b, Hovedøya; 5a, Asker; 5a, Bærum) Ringerike (5a, Frognøy).

Genus *Öpikella* THORSLUND, 1940

Type species. — By original designation, *Öpikella tvaerensis* THORSLUND, 1940. As suggested by HENNINGSMOEN (1953, p. 228) this species may be based on valves of the male type, whereas *Ö. asklundi* THORSLUND, 1940 apparently represents valves of the female type of the same species, and should be considered a synonym of *Ö. tvaerensis*. The description of the following two species, both showing similar dimorphism, supports this assumption.

Öpikella frequens (STEUSLOFF, 1894)

(Pl. 5, figs. 7—9.)

1892 *Isochilina* (= ? *Leperditia brachynotus* FR. SCHMIDT) — KRAUSE, p. 398.
1894 *Isochilina frequens* n.sp. (*Leperditia brachynotus* FR. SCHMIDT?) — STEUSLOFF, p. 784, pl. LVIII, fig. 4.
1924 *Aparchites* (?) *frequens* STEUSL. sp. — KUMMEROW, p. 415, pl. 20, (=21) fig. 4.
1934 *Isochilina frequens* STEUSLOFF — BASSLER & KELLETT, p. 339.

Type data: — Lectotype (here chosen) is the valve (female type) figured by STEUSLOFF (1894). It comes from a glacial drift boulder (Leptaena Limestone) in N. Germany.

Present material: — A great number of valves and impressions of valves, preserved in limestone.

Description of present material: — Adult valves up to about 2.4 mm long and 1.5 mm high. Rather convex. Posterior end lower and more pointed than anterior end. Greatest height slightly in front of median line. Cardinal angles rather obtuse. Hinge line comparatively short, about 1/2 the length of the valve, depressed, bordered on both sides (in complete carapace) by a dorsal plica (ridge), which conceals the true dorsal border in lateral view, giving a slightly convex dorsal outline. Non-sulcate, but a subcentral, elliptical muscle scar is sometimes faintly visible, especially in wetted specimens. Velate frill dimorphic. Male type: — velate frill flat and very narrow; dorsally (at both ends) replaced by a bend between the lateral and the narrow marginal surface. This velate bend appears to be confluent with the dorsal plica. Female type: — Velate frill slightly incurved, narrow, but markedly wider than in valves of the male type. The frill reaches from about the anterior extremity of the valve

to just below the most posterior point. It ends rather abruptly at both ends. Dorsal to the frill (at both ends) it is replaced by a velate bend as in valves of male type. Surface of valve smooth.

Remarks: — The present material agrees very well with the two specimens figured by STEUSLOFF (1894) and KUMMEROW (1924) — both of the female type. For discussion of affinities, see next species.

Occurrence: — Oslo—Asker (5b, Hovedøya; 5b, Sandviksåsen), Ringerike (5a, Stavnestangen) — N. Germany (drift, Leptaena Limestone, Algal Limestone), Esthonia (Porkuni Limestone, Porkuni).

Öpikella cf. *umbilicata* (KUMMEROW, 1924)

(Pl. 5, figs. 1—6.)

cf. 1924 *Primitiella umbilicata* n.sp. — KUMMEROW, p. 420, pl. 20 (=21), fig. 14.

cf. 1934 *Primitiella umbilicata* KUMMEROW — BASSLER & KELLETT, p. 464.

Type data: — Lectotype (here selected) of *Öpikella umbilicata* is the left valve figured by KUMMEROW (1924). It comes from a glacial drift boulder of late Upper Ordovician age in N. Germany.

Present material: — Three carapaces and a great number of separate valves and moulds of valves, preserved in limestone.

Description of present material: — Adult valves up to about 1.8 mm long and 1.2 mm high. Moderately convex. Ends subequal. Cardinal angles obtuse. Hinge line about 3/4 the length of the valve, depressed, bordered on both sides (in a complete carapace) by a dorsal plica, which conceals the true dorsal border in lateral view, The dorsal plica is straight. Non-sulcate, but a subcentral, elliptical muscle scar may break the even convexity of the valve. Sometimes the edges of the scar are very faintly swollen (posteriorly sometimes forming a small post-sulcal node), and in some specimens the scar itself is slightly elevated above the general surface. In its dorsal end the scar may be extended into a faint stripe towards the dorsal border. Velate structure dimorphic. In valves of the male type it is developed as an extremely narrow frill (ridge) along the ventral border area. In valves of the female type the frill is comparatively wide, tapering evenly at both ends. The frill is smooth or somewhat irregularly striate. Anteriorly it reaches further up dorsally than

in the valves of the male type. The female type of frill is slightly convex and deviates only slightly from the lateral surface of the valve. Marginal structure tuberculate. Surface of valve smooth, or finely granulose, especially in the border areas. A few larger granules may also be developed.

Remarks: — Valves of the male type agree with the lectotype in size and outline, in the presence of a dorsal plica, and in the type of muscle scar. The lectotype seems, however, to have a somewhat wider frill, and for this reason the present material may be referred to as *Ö.* cf. *umbilicata*.

Ö. cf. *umbilicata* resembles *Ö. frequens*, but the latter differs in having a shorter hinge line (about ½ length of valve as compared to about ¾ length of valve in *Ö.* cf. *umbilicata*), and in having a convex dorsal outline of the dorsal plica (straight in *Ö.* cf. *umbilicata*). Furthermore the velate frills in the female type of valves are rather different. Both forms appear to be closely related to the type species, *Ö. tvaerensis*, where, however, the valves of the male type have no velate frill, only a velate ridge. As suggested by THORSLUND (1940, p. 181) *Isochilina canaliculata* KRAUSE (1892, p. 385, pl. 21, fig. 1) is probably also congeneric. Only valves of the male type of this species have been described.

Occurrence: — Oslo—Asker (4dα—γ, Kråkeholmen, Asker; 5b, Hovedøya; 5b, Sandviksåsen; 5a, Bondibråten), Ringerike (5a, Stavnestangen) — N. Germany (drift, Upper Ordovician limestone).

?Subfamily Euprimitiinae HESSLAND, 1949

? Genus *Primitiella* ULRICH, 1894

Type species: — By original designation, *Primitiella constricta* ULRICH, 1894.

Primitiella? cf. *rara* (TROEDSSON, 1918)

(Pl. 1, fig. 12.)

1918 *Ctenobolbina rara* n.sp. — TROEDSSON, p. 54, pl. II, fig. 18.
1934 *Ctenobolbina rara* TROEDSSON — BASSLER & KELLETT, p. 254.

Type data: — Holotype (by monotypy) is the right valve figured by TROEDSSON (1918), from the Brachiopod Shale in Scania (Sweden).

Present material: — A few separate valves, preserved in limestone.

Remarks: — The present material agrees rather well with the holotype in outline, and in type and position of the presulcal node, sulcus, and postero-ventral node (spine). No faint depression is, however, developed in front of the postero-ventral node, as in the holotype. This depression may be accidental, as the holotype is preserved in shale, and is thus compressed (whereas the present material is preserved in limestone). *Primitiella? rara* is probably not related to *Ctenobolbina*, which has a distinct velate frill and a long median sulcus (cf. HENNINGSMOEN, 1953, p. 211). *Laccoprimitia? nodosa* HENNINGSMOEN, 1948 is closely related, but appears to have smaller nodes. Both species may tentatively be included in *Primitiella*, but they differ from this genus in having a well developed sulcus, and should perhaps later be removed from this genus.

Occurrence: — Oslo—Asker (5b, Hovedøya) — *P.? rara:* Brachiopod Shale, Scania (Sweden).

Family Aparchitidae JONES, 1901

?Genus *Macronotella* ULRICH, 1894

Type species: — By original designation, *Macronotella scofieldi* ULRICH, 1894.

Macronotella cf. *praelonga* (STEUSLOFF, 1894)

(Pl. 6, figs. 1—2.)

cf. 1894 *Leperditia praelonga* n.sp. — STEUSLOFF, p. 781, pl. LVIII, fig. 3.
?1894 *Leperditia Krausei* n.sp. — STEUSLOFF, p. 783, pl. LVIII, fig. 1.
?1894 *Leperditia* (?) *Kiesowii* n.sp. — STEUSLOFF, p. 784, pl. LVIII, fig. 2.
1901 *Leperditia* sp. — KIÆR, p. 79.
cf. 1924 *Leperditia praelonga* STEUSL. — KUMMEROW, p. 407.
?1924 *Leperditia Krausei* STEUSL. — KUMMEROW, p. 408.
?1924 *Leperditia Kiesowi* STEUSL. — KUMMEROW, p. 407.
cf. 1934 *Macronotella praelonga* (STEUSLOFF) — BASSLER & KELLETT, p. 407.
?1934 *Macronotella krausei* (STEUSLOFF) — BASSLER & KELLETT, p. 407.
?1934 *Macronotella kiesowii* (STEUSLOFF) — BASSLER & KELLETT, p. 407.

Type data: — Holotype (by monotypy) of *M. praelonga* is the valve figured by STEUSLOFF (1894) from a drift boulder (Borkholm = Porkuni Limestone) in N. Germany.

Material: — Two valves, preserved in limestone.

Description of present material: — The larger specimen is about 3.9 mm long and 2.8 mm high; the other specimen (crushed) is 2.2 mm high. Ends subequal, with obtuse cardinal angles. Moderately and evenly convex, except for the subcentral, elliptical muscle scar which is faintly depressed. In the larger specimen there is a probably more or less accidental pit in the muscle scar. Surface rather densely covered with granules, except in the muscle scar. The granules appear to have been hollow, as they are replaced by deep pits where the valve is worn, especially in the dorsal half of the crushed specimen.

Remarks: — According to KUMMEROW (1924) the holotypes of *Macronotella kiesowii* and *M. krausei* are badly preserved, and the hinge line in STEUSLOFF's figure of *M. praelonga* is quite illusory. The outlines of all three species, as figured by STEUSLOFF, appear rather questionable. Possibly the specimens are either damaged or not quite cleaned of matrix. According to STEUSLOFF, *M. praelonga* is covered by fine granules, whereas *M. krausei* and *M. kiesowii* have deep pits instead. This may possibly be due to whether or not the valves were worn (cf. above). All three agree in their unusual large size, and in coming from drift boulders of late Upper Ordovician age; *M. praelonga* was described from a drift boulder of Borkholm (=Porkuni) Limestone associated with «*Primitia*» *jonesii* (=*jonesiana*), «*P.*» *distans*, «*P.*» *plana*, «*P.*» *cuneata*, «*P.*» *rugosa*, «*P.*» *canaliculata*, and «*P.*» *elongata obliqua*, whereas *M. krausei* and *M. kiesowii* occurred together in a drift boulder of Leptaena Limestone associated with «*Isochilina*» *frequens* and «*Primitia*» *elongata semicircularis*. To the writer, it seems possible that *M. praelonga*, *M. krausei*, and *M. kiesowii* are conspecific. It should, however, be checked, if possible, in the type material.

The Norwegian material agrees with these three species in the large size, types of surface ornamentation, and in coming from beds of the same age.

Occurrence: — Oslo—Asker (5a, Holtebråten in Asker), Ringerike (5a, Stavnestangen) — N. Germany (glacial drift boulders).

Associated with: — (the larger specimen): *Öpikium porkuniensis* sp.n., (the crushed specimen): *Kiesowia dissecta*, *Öpikium porkuniensis* sp.n., *Platybolbina* cf. *plana*, *Öpikella frequens*, *Bollia duplex*, *Primitia norvegica* sp.n., *Bolbina tuberculata* sp.n., *Macronotella* sp.

Macronotella spp.

Remarks: — Valves of *Macronotella* species are commonly met with. They vary in size, convexity, and outline. Some may possibly be larval moults of *M.* cf. *praelonga*. «*Leperditia brachynota*» listed by KIÆR (1901, p. 79) from 5b at Nyborg in Asker appears to be a *Macronotella* species.

Occurrence: — Oslo—Asker (5a, Nedre Ås in Bærum; 5a, Bondibråten; 5b, Sandviksåsen; 5b, Nyborg in Asker), Ringerike (5a, Stavnestangen).

Family Drepanellidae ULRICH & BASSLER, 1923
?Subfamily Bolliinae BOUČEK, 1936
Genus *Bollia* JONES & HOLL, 1886

Type species: — *Bollia uniflexa* JONES & HOLL, 1886 (designated by MILLER, 1892, p. 706).

Bollia duplex KRAUSE, 1892.

(Pl. 2, figs. 6—7.)

1892 *Bollia duplex* n.sp. — KRAUSE, p. 392, pl. XXI, fig. 7.
1934 *Bollia duplex* KRAUSE — BASSLER & KELLETT, p. 217.

Type data: — Lectotype (here selected) is the left valve figured by KRAUSE (1892) and described by him from a glacial drift boulder in N. Germany. It is associated with *Platybolbina distans* and *P. umbonata*, and may safely be regarded as of late Upper Ordovician age.

Present material: — 12 partly damaged valves and internal moulds of valves, all preserved in limestone.

Description of present material: — Rather large; adult valves up to about 2.3 mm long and 1.5 mm high. Ends subequal; both cardinal angles markedly obtuse. Its pattern is characterized by two rather wide and concentric ridges. The inner loop is probably formed by L2 and parts of L3. Its anterior branch (L2) is rather straight (but somewhat swollen dorsally), whereas its posterior branch has a characteristic, angular course. Beneath this branch there is a node-like swelling, which, together with the ridge, probably represents L3. The swelling is best seen in the corner formed by the posterior branch of the inner loop. A well defined sulcus is developed between L2

and L3. The outer, submarginal ridge of the valve is partly formed by L1 and L4, and thus represents a carinal ridge (or, possibly, a fused carinal and velate ridge). A thin, marginal ridge runs along the free borders. The surface of the valve appears smooth.

There is some variation in the development of the ridges. Especially in larval valves they tend to be more swollen. This is similar to the conditions in the rather *Bollia*-like *Tallinnella mjoesensis* HENNINGSMOEN (1953b, p. 39).

Occurrence: — Oslo—Asker (5b, Hovedøya), Ringerike (5a, Frognøy, 5a, Stavnestangen).

Bollia accentuata sp.n.

(Pl. 2, figs. 8—9.)

Name: — The name *accentuata* alludes to the accentuated relief of this species.

Type data: — Holotype (P.M.O. — 66423) is a left valve from 5b at Hovedøya, Oslo.

Material: — A few separate valves, preserved in limestone.

Diagnosis: — A *Bollia* species with high U-shaped ridges. The inner ridge which is separated from the outer ridge by a narrow groove has both dorsal ends swollen into large nodes. There is also a faint swelling in the postero-ventral part of this ridge. The outer ridge is close to the margin.

Description: — Valves about 1.2 × 1.0 mm. Subequal ends. The outer U-shaped ridge is subparallel to the free borders, but does not quite reach the dorsal margin posteriorly. The inner U-shaped ridge is separated from the outer ridge by a narrow groove. Both its dorsal ends are swollen into large nodes, the anterior node being somewhat larger than the posterior node. A faint swelling of the ridge is developed postero-ventrally. The relief is high. Surface seems smooth.

Remarks: — The present species may be compared with *Bollia biplicata* (TROEDSSON, 1918) from the Brachiopod Shale in Scania (Sweden), but the latter form has not such a well-defined outer ridge, and the inner ridge is more even.

Occurrence: — Oslo—Asker (5b, Hovedøya).

Genus *Pseudulrichia* SCHMIDT, 1941

Type species: — By original designation, *Leperditia bivertex* ULRICH, 1879.

Pseudulrichia norvegica sp.n.
(Pl. 6, figs. 6—7.)

Type data: — Holotype (R.M. — Ar. 36426) is a right valve from 5b at Hovedøya, Oslo.

Material: — Some 25, usually more or less damaged valves, preserved in limestone.

Diagnosis: — A *Pseudulrichia* species with two rather large horns; anterior horn with blunt end, posterior horn drawn out into a spine.

Description: — Adult valves about 1.8 mm long and 1.2 mm high, excluding horns. Ends subequal, both cardinal angles obtuse. Surface evenly convex, except for the two rather dominating horn-like processes in the dorsal half, and a sulcus between them. The anterior horn (L2) has a round base, is somewhat bulbous and ends bluntly. It is about as high as it is wide at its base. The posterior horn (L3) has a round base of the same size as the anterior horn, but is drawn out into a spine, about twice as high (long) as the anterior horn. No submarginal structures are present. No dimorphism was observed. The surface is smooth.

Remarks: — *P. norvegica* resembles the type species, which, however, has two nodes instead of two horns. Some Bohemian species assigned to *Parulrichia* SCHMIDT, 1941 by SCHMIDT (1941) have such horns, and may be congeneric. The type species of *Parulrichia*, *Primitia diversa* JONES & HOLL, 1886, appears to belong to another family.

Occurrence: — Oslo—Asker (5b, Hovedøya).

Family Acronotellidae SWARTZ, 1936

?Genus *Monoceratella* TEICHERT, 1937a

Type species: — By original designation, *Monoceratella teres* TEICHERT, 1937a.

Known Stratigraphical and Geographical Distribution of the Upper Ordovician Paleocop Ostracods found in the Oslo Region	Oslo Region, Norway						Scando-Baltic Drift Boulders in N. Germany			Esthonia
	Oslo—Asker				Ringerike					
	Tretaspis Series		Dalmanitina Series		Dalmanitina Series		Leptaena Lst.	Unspecified	Porkuni Lst.	Porkuni Lst.
	4c	4d	5a	5b	5a	5b				
1. *Sigmobolbina*? sp.				1						
2. *Bolbina* aff. *minor* (KRAUSE)				2						
3. *Bolbina tuberculata* sp.n.				3						
4. *Kiesowia dissecta* (KRAUSE)			4?	4	4					4
5. *Tetradella plicatula* (KRAUSE)			5?	5						5
6. *Öpikium porkuniensis* sp.n.				6	6					6
7. *Primitia osloensis* sp.n.				7	7					
8. *Chilobolbina*? cf. *jonesiana* (SCHMIDT)			8?	8					8	
9. *Platybolbina* cf. *plana* (KRAUSE)			9	9	9		9		9	
10. *Platybolbina tiara* sp.n.				10						
11. *Platybolbina* cf. *clongata* (KRAUSE)			11	11	11			11		11
12. *Platybolbina umbonata* (KRAUSE)					12			12		
13. *Laccochilina tarda* sp.n.			13	13						
14. *Öpikella frequens* (STEUSLOFF)				14	14		14			14
15. *Öpikella* cf. *umbilicata* (KUMMEROW)		15	15	15	15			15		
16. *Primitiella* cf. *rara* (TROEDSSON)				16						
17. *Macronotella* cf. *praelonga* (STEUSLOFF)			17		17		17?		17	
18. *Macronotella* spp.			18	18	18					
19. *Bollia duplex* (KRAUSE)				19	19			19		
20. *Bollia accentuata* sp.n.				20						
21. *Pseudulrichia norvegica* sp.n.				21						
22. *Monoceratella bos* sp.n.				22						

NB. The «cf.»s apply only to the material from the Oslo Region.

Monoceratella bos sp.n.
(Pl. 6, figs. 3—4.)

Name: — The name *bos* (bull) alludes to the bull-like horns of this species.

Material: — Two valves, preserved in limestone.

Diagnosis: — A small *Monoceratella* species with long, slightly dorsal spines.

Description: — The two valves present are 1.2 × 0.7 and 0.8 × 0.5 mm. Valve elongate, slightly triangular in outline. A long, slender spine is developed in each of the dorsal corners. The spines are oblique, and slightly curved. The postero-ventral spine is broken off in both specimens. Surface smooth. Since both valves are right valves, the overlap features are not known.

Remarks: — Three species of *Monoceratella* have been described from the Middle Ordovician of Arctic Canada and N. Greenland by TEICHERT (1937a, 1937b). TEICHERT (1937b, p. 54) included in this genus also *Isochilina armata* var. *pygmaea* RUEDEMANN, 1901 from the Rysedorph conglomerate of New York. None of these species have dorsal spines as long as *M. bos*.

The taxonomic position of *Monoceratella* is rather uncertain (cf. HENNINGSMOEN, 1953, p. 234).

Occurrence: — Oslo—Asker (5b, Hovedøya).

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PLATES 1–6

All specimens were whitened before photographing. Photographer: Miss B. Mauritz.

P.M.O. = Paleontological Museum of the University in Oslo.

R.M. = Paleozoological Department of the State Museum of Natural History, Stockholm.

PLATE 1.

The background has been blackened in figs. 3—5, 7, and 10, and the sulcus slightly retouched in fig. 7. Otherwise no retouching.

Sigmobolbina? sp. 77

Fig. 1. Left valve. P.M.O. — 66437. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. × 20.

Fig. 2. Left valve. P.M.O. — 66438. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. x 20.

Bolbina tuberculata sp.n. .....p. 78

Fig. 3. Left valve. P.M.O. — 66428 b. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. x 20.

Fig. 4. Left valve. R.M. — Ar 36454. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 20.

Fig. 5. Left valve. Holotype. P.M.O. — 66428 a. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. x 20.

Primitia osloensis sp.n. .....p. 83

Fig. 6. Left valve, female type. Holotype. P.M.O. — 55081 a. 5a, Stavnestangen, Ringerike. Coll.: J. Kiær, 1919. x 20.

Fig. 7. Left valve, female type. R.M. — Ar. 36452 b. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 22.

Tetradella plicatula (KRAUSE) .....p. 80

Fig. 8. Badly preserved left valve. P.M.O. — 12511 a. 5a (-b), Nedre Ås, Bærum. Coll.: J. Kiær, 1905. x 20.

Fig. 9. Impression of left valve. P.M.O. — 12511 b. Counterpiece of specimen in fig. 8. x 16.

Fig. 10. Badly preserved right valve, showing, however, some of the subventral loculi. P.M.O. — 12511d. 5a(-b), Nedre Ås, Bærum. Coll.: J. Kiær, 1905. x 20.

Fig. 11. Anterior part of left valve. R.M. — Ar. 36463. 5b, Hovedøya, Oslo, Oslo. Coll.: G. Holm, 1877. x 20.

Primitiella? cf. *rara* (TROEDSSON) .....p. 95

Fig. 12. Right valve. P.M.O. — 66430. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. x 17.

Bolbina aff. *minor* (KRAUSE) .....p. 77

Fig. 13. Right valve. P.M.O. — 12510b. 5a(-b), Nedre Ås, Bærum. Coll.: J. Kiær, 1905. x 20.

Platybolbina cf. *elongata* (KRAUSE) .....p. 90

Fig. 14. Left valve, clearly showing the muscle scar. Male type. P.M.O. — 14469d. 5a, Frognøy, Ringerike. Coll.: J. Kiær, 1909. x 22.


1

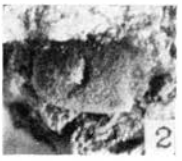
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PLATE 2.

The background has been blackened in figs. 5 and 8. Otherwise no retouching.

Kiesowia dissecta (KRAUSE) ..... p. 78

Fig. 1. Internal mould of left valve, with parts of test preserved dorsally. P.M.O. — 18722. 5a, Stavnestangen, Ringerike. Coll. J. Kiær, 1914. x 23.

Fig. 2. Right valve. Test partly missing, but frill present. P.M.O. — 15721. 5a, Stavnestangen, Ringerike. J. Kiær, 1915. x 22.

Fig. 3. Left valve, showing frill (somewhat broken). R.M. — Ar. 36424. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 22.

Fig. 5. Right valve, larval form showing three nodes in L1 and the pitted surface. P.M.O. — 66439. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. x 20.

Öpikium porkuniensis sp. n. ..... p. 82

Fig. 4. Right valve, female type. R.M. — Ar. 36425. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 10.

Bollia duplex KRAUSE ..... p. 98

Fig. 6. Left valve (anterior and ventral border concealed by matrix). R.M. — Ar. 36426 d. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 21.

Fig. 7. Left valve with less pronounced relief. R.M. — Ar. 36426 a. 5b, Hovedøya, Oslo, Coll.: G. Holm 1877. x 23.

Bollia accentuata sp.n. ..... p. 99

Fig. 8. Right valve. P.M.O. — 66431. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. x 20.

Fig. 9. Left valve. Holotype. P.M.O. — 66432. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. x 20.


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PLATE 3.
No retouching.

Platybolbina cf. *plana* (KRAUSE) ..... p. 87

Fig. 1. Left valve with pitted surface and well developed muscle mark. Female type. P.M.O. — 66435. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. x 20.

Fig. 2. Left valve with typical outline; partly exfoliated. Female type. R.M. — Ar. 36472 a. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 20.

Fig. 3. Right valve, rather high. Male type. R.M. — Ar. 36458. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 22.

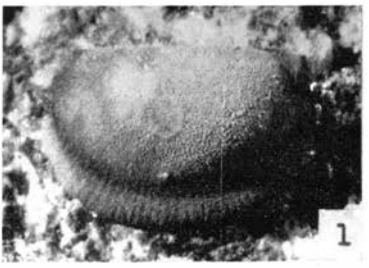
Fig. 4. Left valve with rather wide frill. Female type. P.M.O. — 18164 c. 5a, Stavnestangen, Ringerike. Coll.: J. Kiær, 1911. x 21.

Fig. 5. Left valve with typical outline; partly exfoliated. Male type. P.M.O. — 20582. 5a, Sandviksåsen, Bærum. Coll.: J. Kiær, 1894. x 22.

Fig. 6. Left valve, female type. R.M. — Ar. 36461 a. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 23.

Fig. 7. Left valve, female type. P.M.O. — 55084. 5a, Stavnestangen, Ringerike. Coll.: J. Kiær, 1919. x 22.

Fig. 8. Right valve, female type. R.M. — Ar. 36426 c. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 22.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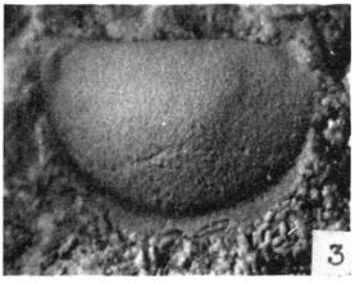
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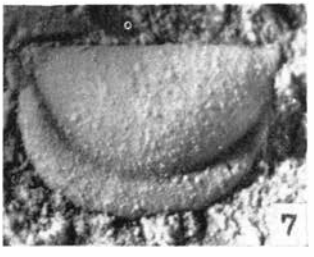
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PLATE 4.
No retouching.

Platybolbina umbonata (KRAUSE) ..... p. 91

Fig. 1. Right valve showing sulcal pit. P.M.O. — 14469 c. 5a, Frognøy, Ringerike. Coll.: J. Kiær, 1909. x 22.

Fig. 2. Right valve. P.M.O. — 14469 a. 5a, Frognøy, Ringerike. Coll: J. Kiær, 1909. x 22.

Fig. 3. Left valve, with presulcal node broken off. P.M.O. — 14469 b. 5a, Frognøy, Ringerike. Coll.: J. Kiær, 1909. x 22.

Platybolbina tiara sp. n. ..... p. 89

Fig. 4. Left valve, female type. R.M. — Ar. 36472. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 24.

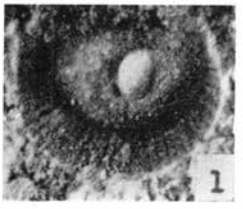
Fig. 5. Left valve, male type. Part of frill broken off posteroventrally. R.M. — Ar. 36464 b. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 20.

Fig. 6. Right valve, male type. Part of frill broken off posteroventrally. P.M.O. — 66428 c. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. x 20.

Fig. 7. Left valve, female type. R.M. — Ar. 36452 c. 5b, Hovedøya, Oslo. Coll.: G. Holm. 1877 .x 20.

Fig. 8. Left valve, female type. Holotype. P.M.O. — 66434. 5b, Hovedøya, Oslo. Goll.: G. Henningsmoen, 1953. x 20.

Fig. 9. Right valve, female type. R.M. — Ar. 36461 b. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 20.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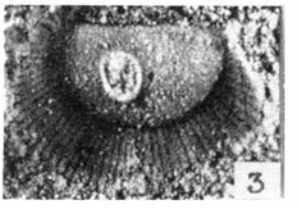
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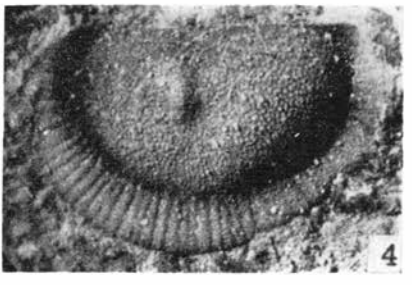
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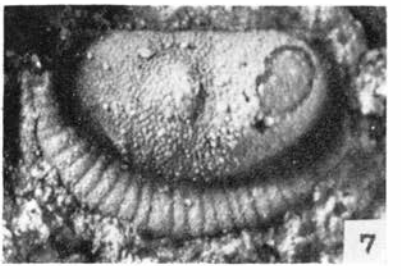
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PLATE 5.

No retouching.

Öpikella cf. *umbilicata* (KUMMEROW) .....p. 94

Fig. 1. Right valve, female type. P.M.O. — 18164 a. 5a, Stavnestangen, Ringerike. Coll.: J. Kiær, 1911. x 22.

Fig. 2. Right valve, male type. P.M.O. — 18164 b. 5a, Stavnestangen, Ringerike. Coll.: J. Kiær, 1911. x 22.

Figs. 3—5. Dorsal view (anterior end down), ventral view (anterior end down), and right side view of entire carapace. Male type. P.M.O. — 66420. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. x 20.

Fig. 6. Right valve with pitted surface. Female type. P.M.O. — 12303. 5a, N of Bondivatnet, Asker. Coll.: J. Kiær, 1897. x 20.

Öpikella frequens (STEUSLOFF) .....p. 93

Fig. 7. Right valve, male type. R.M. — Ar. 36464 a. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 20.

Fig. 8. Right valve, female type. P.M.O. — 55081 b. 5a, Stavnestangen, Ringerike. Coll.: J. Kiær, 1919. x 23.

Fig. 9. Left valve, female type. R.M. — Ar. 36451. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. x 20.


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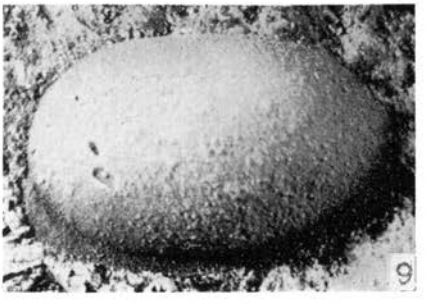
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PLATE 6.
No retouching.

Macronotella cf. *praelonga* (STEUSLOFF) .....p. 96

Fig. 1. Left valve, partly crushed, but showing pits (= broken tubercles) on the surface. P.M.O. — 55081 c. 5a, Stavnestangen, Ringerike. Coll.: J. Kiær, 1919. x 14.

Fig. 2. Right valve. The pit in the muscle scar is probably accidental. P.M.O. — 11099. 5a, S of Holtebråten, Asker. Coll.: J. Kiær, 1897. x 10.

Monoceratella bos sp.n. .....p. 102

Fig. 3. Right valve. Holotype. P.M.O. — 12511 c. 5a (-b), Nedre Ås, Bærum. Coll.: J. Kiær, 1905. x 20.

Fig. 4. Right valve. P.M.O. — 12510a. 5a (-b), Nedre Ås, Bærum. Coll.: J. Kiær, 1905. x 20.

Chilobolbina? cf. *jonesiana* (SCHMIDT).....p. 84

Fig. 5. Left valve. R.M. — Ar. 36452 a. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 24.

Pseudulrichia norvegica sp. n. .....p. 100

Fig. 6. Dorsal view of right valve, partly imbedded in matrix, showing bluntly pointed anterior horn and sharply pointed posterior horn. P.M.O. — 66433. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. x 20.

Fig. 7. Right valve, with broken horns. Holotype. R.M. — Ar. 36426 b. 5b, Hovedøya, Oslo. Coll.: G. Holm. 1877. x 22.

Laccochilina tarda sp. n. .....p. 92

Fig. 8. Left valve, male type. R.M. — Ar. 36462. 5b, Hovedøya, Oslo. Coll.: G. Holm, 1877. x 20.

Fig. 9. Right valve, female type. Holotype. P.M.O. — 66436. 5b, Hovedøya, Oslo. Coll.: G. Henningsmoen, 1953. x 20.


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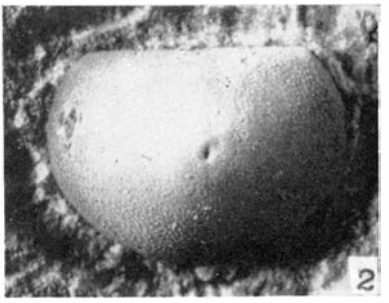
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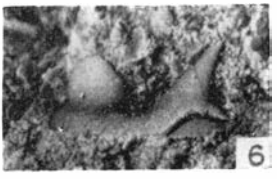
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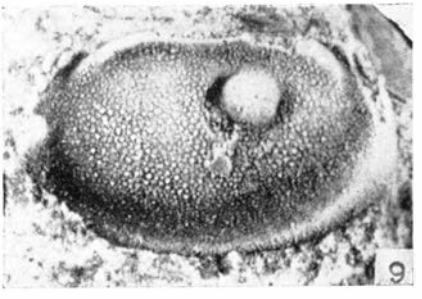
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