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**OSTRACODA FROM THE ORDOVICIAN UHAKU
AND KUKRUSE FORMATIONS OF ESTONIA**

BY

A. ÖPIK

WITH 15 PLATES AND 8 FIG. IN THE TEXT

REPRINTED FROM:
ANNALES ETC. OF THE NATURALISTS SOCIETY OF TARTU UNIVERSITY
XLIII (1-2)

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OSTRACODA FROM THE ORDOVICIAN UNAKU
AND KURUSSE FORMATIONS OF ESTONIA

A. MATTIES

WITH 12 PLATES AND 10 FIGURES

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UNIVERSITY OF TARTU, ESTONIA

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Ostracoda from the Ordovician Uhaku and Kukruse formations of Estonia

Introduction.

Some Ordovician ostracoda from Estonia are described or mentioned by Fr. Schmidt (18), Eichwald and Krause (15, 16, 19, 20). But these descriptions are of a somewhat casual character.

The first systematic research into Estonian Ordovician ostracoda was made by Bonnem a (13); his paper is of a permanent paleozoological, taxonomical, and stratigrafical value.

In view of the importance of the continuation of the investigation of the ostracod faunas of the Estonian paleozoic strata, Dr. J. H. Bonnem a has recently donated to the Geological Institution and Museum of the University of Tartu all his ostracod collections from Estonia and Gotland. In the present paper the author has made use of this unselfish and generous donation.

The works of Krause, Steusloff and recently of Kummerow are also important from the taxonomical point of view. The stratigraphical distribution given by these authors for the ostracoda of the glacial drift boulders does not correspond to their distribution in the bedrock.

Ostracoda appear in the Ordovician of Estonia in the middle *Megalaspis*-limestone in great abundance (*Tetradella grewingki*, *T. primaria* and *Ceratopsis bocki*). This old fauna of Beyrichiidae is described by A. Öpik (1). It may be added that in the upper part of the *Megalaspis*-limestone there occur a true *Ulrichia*, and a new *Eurychilina*. The overlying *expansus*-limestone is not developed in Estonia, and its ostracod fauna is not yet known. In Norway *Isochilina ? socialis* Broegger appears in these beds.

In the Kunda formation or *vaginatum*-limestone, ostracoda occur only in the western area, — in the Rogö formation (lime-bearing sandstone and bituminous marl). *Ceratopsis*, *Steusloffia*, *Primitia* and *Conchoprimitia* are the genera of this part of the Baltic Asaphide series, but the description of the species must be given later.

In the upper part of the Asaphide series, — in the Aseri, and the Tallinna formations, ostracoda have not been found, although many exposures of all the zones of this “*Echinospaerites*-limestone” sensu lato—have been studied by the author.

The ostracoda appear anew suddenly in the upper half of the *Caryocystites*-limestone and occur more or less abundantly in all Ordovician beds from this formation upward.

The *Caryocystites*-limestone (or Uhaku beds) cannot distinctly be separated from the base of the Kukruse formation; it is at present being studied by Orviku (2), (3). Fr. Schmidt (4) and G. Holm (5) regard these beds as the upper part of the *Echinospaerites*-limestone. According to A. Öpik (6) the zone containing *Diplograptus linnarsoni*, corresponds approximately to the *Caryocystites*-limestone, and probably to a part of the zone of “building limestone” with *Asaphus devereux* and *A. ornatus*. The ostracod-bearing upper half of the *Caryocystites*-limestone has a fauna more related to the Kukruse formation, and contains a variety of the *Chasmops odini* closely related to the typical form of the Kukruse formation.

The typical locality of *Caryocystites* limestone is the exposures on the river Uhaku. Orviku has proposed to name these beds the Uhaku formation.

The boundary between the Uhaku limestone and the Kukruse formation is more or less definite in the western part of Estonia; in the east it is more indefinite.

The Uhaku ostracod fauna, or *Caryocystites* limestone, is well distinguished from the fauna of the Kukruse stage. In the *Caryocystites* limestone there occur fifteen to sixteen species restricted only to this formation, among them *Tallinnella dimorpha*, *Steusloffia rigida* and *Drepanella europaea*, which occur in all exposures and which may be regarded as the characteristic species of this stratigraphical unit.

The ostracod fauna of the *Caryocystites* limestone was first observed by the author in the quarries near the South Lighthouse at Tallinn. At the author's request mag. Orviku has kindly provided many rock specimens of the *Caryocystites* beds from the rivers Purtsejõgi and Uhaku. These rock specimens have been collected according to the profile in fig. 1 in the text.

In the quarries near the South Lighthouse at Tallinn the most common ostracoda are *Steusloffia rigida*, *Drepanella europaea*, and *Conchoprimitia tolli integra*; but all other species of the Uhaku form.

are represented here also. However, the Uhaku form. of this locality is distinguished by the appearance of a few small intercalations of kukersite-bearing marl layers with *Tetradella calkeri* Bonnemai, which species evidently appears to be a characteristic fossil of the kukersite facies. The first kukersite-bearing layer with ostracoda

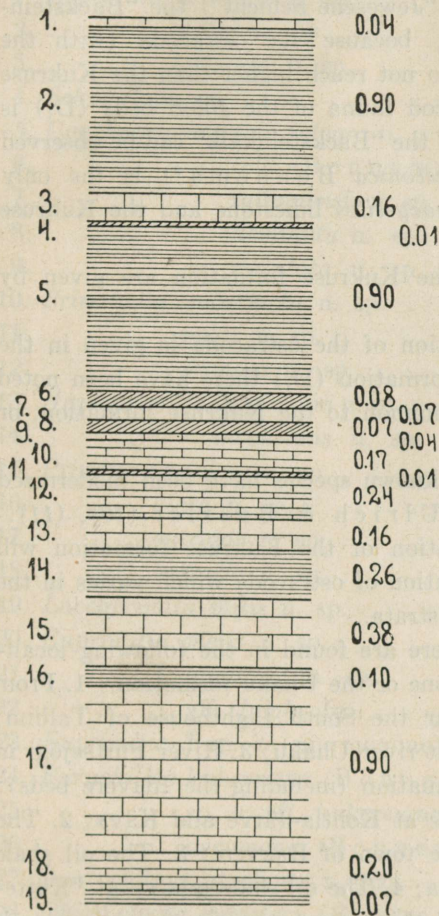


Fig. 1. The profile of *Caryocystites* limestone (Uhaku formation) from the rivers Uhaku and Purtsejõgi, according to Orviku (2, p. 17, fig. 5.). Quarried: limestone; horizontal lineate: marl; diagonal: clay. Below bed 14 the ostracoda are missing. In bed 14 six species only, *Steusloffia rigida* n.sp., *Tallinnella dimorpha* n. sp., *Uhakiella coelodesma* n. sp., *Ceratopsis obliquejugata*, *Ctenobolbina obliqua kukersiana* and *Conchoprimitia tolli integra* were found. In bed no. 8 *Leperditella semen* and *Drepanella europaea* come up; more abundant are the ostracoda in bed no. 5 and upward. Here appear many forms which have been found in Kukruse formation also, such as *Eurychilina kukersiana*, *E. decumana* etc. Cf. also the list of the stratigraphical distribution of species.

in the exposures at Tallinn was observed at ca 2 m below the top of the Uhaku beds. Evidently a hiatus consists between the Uhaku form. and its substratum in this locality. A part of the lower half of the Uhaku beds is not developed here.

The "Backsteinkalk" — boulders of the German glacial drift — are also of same age as the Estonian Uhaku formation or *Caryocystites*-beds. Kummerow (7, p. 440—442) has named from

these boulders ten species which occur also in our *Caryocystites*-limestone and in the Kukruse formation. His *Steusloffia linnarssoni* is the true *S. rigida*¹⁾, the *Bollia granulosa* or *Berychia granulifera* [in Kummerow (8) p. 49, fig. 8, this species is named *Eurychilina kukersiana*] corresponds to *Uhakiella coelodesma*. With the Jõhvi formation (Schmidt's "Jewesche Schicht") the "Backsteinkalk" cannot be synchronized, because its ostracoda (with the exception of a single species) do not reach higher than the Kukruse formation. The bedrock ostracod fauna of the Jõhvi beds (D_1) is very abundant, but no species of the "Backsteinkalk" can be observed here. Lastly *Eurychilina* ?? *estonica* Bonnemaa²⁾ is the only species reaching from the *Caryocystites* limestone and the Kukruse formation into the Jõhvi beds.

The geological data for the Kukruse formation are given by A. Õpik (6) and (9).

The stratigraphical distribution of the ostracoda is given in the following list. For the Jõhvi formation (D_1) there have been noted only those species which are common to the Kukruse formation, or the *Caryocystites* limestone.

The generic names of the known species have been modernized according to the researches of Ulrich & Bassler (10), (11).

A more detailed investigation of the Kukruse formation will most probably reveal a distribution of ostracoda which varies in the various zones of these peculiar strata.

The ostracoda described here are found in the following localities: the *Caryocystites*-limestone or the Uhaku formation. 1. From the buildingstone quarries near the South Lighthouse of Tallinn; 2. Natural exposures on the east river Uhaku; 3. River Purtsejõgi in Eastern Estonia. Kukruse formation (including the Idavere beds): 1. The State Oil Shale Quarries at Kohtla-Järve and Käva; 2. The Ubja oil shale quarry near the town of Rakvere; 3. The oil shale quarry, "Eesti Kiviõli", at Salla; 4. The oil shale quarry at "Küttejõud" near the river Purtse; 5. Limestone quarries near the South Lighthouse at Tallinn; 6. Exposures near Kukruse, coll. Bonnemaa.

¹⁾ Dr. E. Kummerow had the kindness to send to the author of this paper some specimens of this ostracoda for comparison with the specimens from the *Caryocystites*-limestone.

²⁾ *E. estonica* B. is described below as the type of the new genus *Hesperidella*.

List of Ostracoda known from the Ordovician *Caryocystites*-limestone and from the Kukruse formation of Estonia.

	C ₁ δ Uhaku form.	C ₂ -C ₃ Kuk- ruse form.	Jõhvi (D ₁) form.
1. <i>Leprereditella semen</i> n. sp.	×	—	—
2. „ <i>gutta</i> n. sp.	×	—	—
3. „ <i>lenticula</i> n. sp.	—	×	—
4. <i>Schmidtella</i> sp.	×	—	—
5. <i>Conchoprimitia tolli integra</i> n.	×	×	—
6. „ <i>toll</i> i (B o n n e m a)	—	×	—
7. „ <i>tallinnensis</i> n. sp.	×	—	—
8. „ <i>deminuta</i> n. sp.	—	×	—
9. „ <i>inuitata</i> n. sp.	—	×	—
10. <i>Primitiella indistincta</i> n. sp.	—	×	—
11. „ <i>pulex</i> n. sp.	—	×	—
12. „ <i>granosa</i> n. sp.	—	×	—
13. <i>Haploprimitia kogermani</i> n. sp.	—	×	—
14. „ <i>inconstans</i> n. sp.	×	—	—
15. <i>Primitia undulosa</i> n. sp.	—	×	—
16. „ <i>alata</i> n. sp.	×	—	—
17. „ <i>eutropis</i> n. sp.	×	—	—
18. „ <i>extraria</i> n. sp.	—	×	—
19. <i>Laccoprimita mitis</i> n. sp.	—	×	—
20. <i>Euprimitia plena</i> n. sp.	—	×	—
21. „ <i>bilabrata</i> n. sp.	—	×	—
22. „ aff. <i>bilabrata</i>	—	×	—
23. <i>Euprimitia</i> ? sp. <i>a</i> (sine nomine)	×	—	—
24. <i>Eurychilina kukersiana</i> (B o n n e m a)	×	×	—
25. „ sp. <i>a</i> , aff. <i>kukersiana</i>	—	×	—
26. „ <i>decumana</i> (B o n n e m a)	×	×	—
27. <i>Apatochilina ubjaënsis</i> n. sp.	—	×	—
28. <i>Chilobolbina dentifera</i> (B o n n e m a)	—	×	—
29. <i>Macronotella bonnemai</i> n. sp.	—	×	—
30. „ sp. <i>a</i> . (sine nom.)	—	×	—
31. <i>Tallinnella dimorpha</i> n. sp.	×	—	—
32. <i>Ceratopsis obliquejugata</i> (F r. S e h m.)	×	×	—
33. „ <i>platyceras</i> n. sp.	×	×	—
34. „ <i>rostrata cornuta</i> (K r a u s e)	—	×	—
35. „ <i>perpunctata</i> n. sp.	×	—	—

36.	<i>Ceratopsis perpunctata prominens</i> nov.	×	—	—
37.	„ <i>perpunctata</i> var. <i>a</i> (sine nom.)	—	×	—
38.	„ sp. aff. <i>rostrata cornuta</i> (Krause)	—	×	—
39.	<i>Tetradella perornata</i> n. sp.	×	×	—
40.	„ ? <i>pectinata</i> n. sp.	—	×	—
41.	„ aff. <i>pectinata</i>	—	×	—
42.	„ <i>dubitabilis</i> n. sp.	×	×	—
43.	<i>Beyrichia</i> sp.	—	×	—
44.	<i>Kiesowia pernodosa</i> n. sp.	×	—	—
45.	„ <i>margaritata</i> n. sp.	—	×	—
46.	<i>Ctenobolbina duhmbergi</i> n. sp.	—	×	—
47.	„ <i>polytropis</i> n. sp.	×	—	—
48.	„ <i>ctenolopha</i> n. sp.	—	×	—
49.	„ <i>carinata estona</i> nov. var.	—	×	—
50.	„ <i>aspera</i> n. sp.	—	×	—
51.	„ <i>variolaris</i> (Bonnema)	—	×	—
52.	„ ? <i>minor mitis</i> n. var.	—	×	—
53.	„ ? <i>octispina</i> n. sp.	—	×	—
54.	„ ? aff. <i>obliqua</i> (Krause)	—	×	—
55.	<i>Polyceratella tetraceras</i> n. sp.	×	—	—
56.	<i>Ctenonotella elongata</i> n. sp.	—	×	—
57.	<i>Biflabellum tenerum</i> A. Ö.	—	×	?
58.	„ <i>reticulatum</i> n. sp.	—	×	—
59.	„ <i>crista</i> n. sp.	—	×	—
60.	„ <i>acutum</i> n. sp.	—	×	—
61.	<i>Uhakiella coelodesma</i> n. sp.	×	—	—
62.	„ <i>pumila</i> n. sp.	×	—	—
63.	„ <i>kohtlensis</i> n. sp.	×	×	—
64.	<i>Rakverella bonnema</i> n. sp.	—	×	—
65.	<i>Piretella margaritata</i> n. sp.	×	×	—
66.	<i>Hesperidella estonica</i> (Bonnema)	×	×	×
67.	<i>Steusloffia rigida</i> n. sp.	×	×	?
68.	„ <i>humilis</i> n. sp.	×	—	—
69.	„ <i>multimarginata</i> n. sp.	—	×	—
70.	<i>Pseudostrepula cristata</i> n. sp.	—	×	—
71.	<i>Drepanella europaea</i> n. sp.	×	×	—
72.	<i>Pulvillites triangulum</i> n. gen. n. sp.	—	×	—
73.	<i>Bairdia</i> (sensu lato) <i>micra</i> n. sp.	—	×	—
74.	<i>Ostracodorum</i> ? sp. indet.	—	×	—

Species not described in this paper:

75.	<i>Macronotella</i> ? <i>kukersiana</i> Bonnem a	—	×	—
76.	<i>Primitiella kukersiana</i> B on.	—	×	—
77.	<i>Haploprimitia molli</i> (B.)	×	×	—
78.	<i>Eurychilina kapteyni</i> (B.)	—	×	—
79.	<i>Tetradella calkeri</i> B.	×	×	—
80.	<i>Polyceratella kukersiana</i> (B.)	—	×	×
81.	<i>Ctenobolbina rossica</i> (B.)	—	×	—
82.	„ <i>kukersiana</i> B.	×	×	—
83.	„ <i>obliqua kukersiana</i> (B.)	×	×	—
84.	„ <i>oblonga kukersiana</i> (B.)	×	×	—
85.	„ <i>minor kukersiana</i> (B.)	×	×	—
86.	„ <i>minor robusta</i> (B.)	—	×	—
87.	„ <i>ornata</i> (Krause)	—	×	—
88.	„ <i>ornata latimarginata</i> (B.)	×	×	?
89.	<i>Pseudostrepula kukersiana</i> (B.)	—	×	×
90.	„ <i>kukersiana acuta</i> (B.)	—	×	?
91.	<i>Cytherellina ulrichi</i> B.	×	×	?
92.	<i>Cytherellina jonesi</i> B.	×	×	—
93.	„ <i>krausei</i> B.	—	×	—
94.	„ <i>ruedemanni</i> B.	—	×	—

Total number of ostracod species in C1δ 38

Number of species restricted to the Uhaku
beds only 17

Total number of ostrakoda in the Kukruse
form. 77

Number of species passing from the Uhaku bed
into the Kukruse form. 21

Described in this paper, but not occurring in the Uhaku beds or the
Kukruse formation:

Rakverella spinosa n. gen. n. sp., in the Jõhvi and Keila
formations.

Piretella acmaea n. gen. n. sp., in the lower part of the Lyck-
holm limestone.

Gen. *Rigidella* n. gen., lower part of the Asaphide series.

Description of the genera and species.

Gen. *Leperditella* Ulrich.

1. *Leperditella semen*. n. sp.

Pl. I, Fig. 11—14.

This species corresponds in all its features to the gen. *Leperditella* Ulrich (11, 12). The outline is leperditoid, the larger left valve overlaps the right one along the ventral border (Pl. I, Fig. 11a.) and has a concentric groove (I, Fig. 14) to fit the ventral border of the right valve. *Primitia mundula* Jones and *Conchoprimitia* A. Ö. has the same structure of the ventral closure [A. Ö. (1) p. , 7], but the sulcus of *Primitia*, and the concentric grooves of *Conchoprimitia* are missing in *Leperditella semen*.

The specimen on Pl. I, fig. 11a—11b from the *Caryocystites*-limestone of Uhaku is the holotype.

The outline is leperditoid, with rounded posterior and well-expressed anterior dorsal angle (135°), short hinge-line and oval horizontal section (Pl. I, fig. 11b). The carapace appears more inflate in its posterior half. No depression, no sulcus, no node-like elevation appear on the surface of the valves. The dorsal border of the right valve has a groove (Pl. I, fig. 12—13) (analogue to the groove of the ventral border of the left valve) for the joint with the left valve; but in the left valve the ridge which corresponds to this groove is not clearly developed. A similar structure of the junction of the valves in the dorsal border is described by Bonnem a (13) in many Paleozoic ostracoda and can be observed clearly in *Primitia tolli* Bonnem a. The posterior part of the right valve is slightly swollen.

Measurements of the holotype: length 2 mm; height 1,5 mm; thickness 1,1 mm; length of the hinge line 1 mm.

Closely related to *L. semen* are the American *Leperditella inflata* Ulrich and the Europaen *L. vandalica* Kummerow (7), in having a similar leperditoid form. But both species appear relatively more oblong, and the *L. inflata* is more inflate than the *L. semen*; *L. vandalica* differs, however, in being more oblique [Kummerow (7), Pl. 20, fig. 9] than *L. semen*.

L. semen is a rare fossil of the Ordovician *Caryocystites*-limestone of Estonia and is found in the exposures at Uhaku only.

2. *Leperditella gutta* n. sp.

Pl. XIII, fig. 15—17.

The specimen pictured is the holotype. This species resembles *Leperditella semen* n. sp., but *L. gutta* is smaller, has a straight dorsal margin in both valves, and is inflat in the anterior half (*L. semen* has the maximum thickness on the posterior half of the carapace).

The outline of *L. gutta* is ovate to leperditoid, with a developed posterior dorsal angle and a smooth surface. It is inequivalve, the left valve overlaps the right one along the free margin. The holotype is 1 mm. long, 0,85 mm high, and 0,7 mm thick.

Occurrence. *L. gutta* appears rarely in the *Caryocystites*-beds. In the *Caryocystites* beds of the quarries near Tallinn this species is more abundant.

3. *Leperditella lenticula* n. sp.

Pl. XIII, fig. 18—19.

The pictured specimen is the holotype, 1 mm long, 0,75 mm high, 0,55 mm thick, with a 0,4 mm long hinge. It differs from other *Leperditellae* in being elliptical in the horizontal section and in having the widest swelling in the middle of the carapace. In some specimens the central rounded muscle-spot is visible. The outline is slightly oblique (leperditoid), and only the posterior dorsal angle is developed. Surface smooth. Very constant in shape, size, and other features.

Occurrence: not uncommon, and restricted to the Kukuruse form.

Gen. *Schmidtella* Ulrich.

4. *Schmidtella* sp.

Pl. XIII, fig. 24.

One isolated valve was found only in the *Caryocystites*-beds at Tallinn. It suggests *Schmidtella crassimarginata* Ulrich, but has a shorter hinge line.

Gen. *Conchoprimitia* A. Ö. (1).

The new species of *Conchoprimitia*, *C. tallinnensis* is doubtless closely related to *Primitia tolli* Bonnema. *Primitia tolli* has

developed the characteristic concentric grooves of *Conchoprimitia* on the posterior margin only; in the variety *integra* the relict short concentric grooves near the posterior edge of both valves of the typical *tolli* are entirely lacking. Further, but for the different development of these concentric grooves, *Conchoprimitia tolli*, *Conchoprimitia tolli integra* and *Conchoprimitia tallinnensis* differ only in some relatively unimportant features. Evidently *Conchoprimitia tolli integra* with the concentric grooves missing forms an extreme form in the development of the *Conchoprimitia*. The resemblance of "*Primitia*" *tolli integra* to *Primitia* sensu stricto and *Haploprimitia* must be ascribed to a convergence of two related but separate branches. The haploprimitioid or primitioid exterior is in this case of a diphyletic origin. The species of *Conchoprimitia* differ from *Haploprimitia* also in the more anterior position of the sulcus and node (if such are present) and resemble in this feature *Leperditia*. But in *Leperditia* the right valve is the larger one, in *Conchoprimitia* it is the smaller one.

Conchoprimitia is a widely variable genus: sulcus and node, the concentric grooves, and the punctation are in some cases well developed, in other cases these appear undefined or lacking. The internal structure of the carapace can be observed in the specimens in pl. XV, fig. 1 and 2. The first internal cast of a left valve of *C. tolli* (Bonnema) shows the vascular impressions described by Bonnema (13), p. 18; the second specimen, a left valve also, shows the fitting grooves along the dorsal and the ventral borders, and indistinct vascular impressions.

The following species are *Conchoprimitia*: 1. *C. gammae* A. Ö., — without node and sulcus, smooth, and well developed concentric grooves; 2. *C. glauconitica* Kummerow, with an undefined node, minutely punctate and with imperfect concentric grooves; 3. *Conchoprimitia conchoides* (Hadding), with a sulcus; impunctate; 4. *Conchoprimitia tallinnensis* n. sp., widely punctate, with well developed concentric grooves, sulcus, and a more or less undefined node; 5. *Conchoprimitia tolli* (Bonnema) — like *C. tallinnensis*, but with imperfect concentric grooves; 6. *C. tolli integra* like *C. tallinnensis* or *C. tolli* but without concentric markings. 7. *C. diminuta* n. sp., related to *tallinnensis*, but smaller. Probably, the *Conchoprimitia inusitata* is also a member of this genus.

5. *Conchoprimitia tolli integra* n. var.

Pl. IX, fig. 1; pl. XV, fig. 2.

Bonnema (13), partim; A. Öpik (1).

The pictured specimen is the holotype of this subspecies. From the typical *C. tolli* (Bonnema) the new variety is distinguished by the total absence of the concentric grooves, and in being slightly more inflate in the region near the sulcus.

6. *Conchoprimitia tolli* (Bonnema).

Pl. IX, fig. 2a, 2b, 2c; Pl. XII, fig. 1, Pl. XV, fig. 1.

Primitia tolli Bonnema (13) partim; *P. tolli* Bonnema (26), (27).

The holotype (lectotype) is the complete carapace, pictured in pl. X fig. 1. It is Bonnema's original specimen, published in his dissertation (13) pl. I, fig. 1—5. In Bonnema's photographs which were prepared without NH_4Cl , whitening, the concentric groove near the posterior margin is not visible. In our photograph the NH_4Cl has reproduced this important feature of the type specimen. Bonnema's specimens (13). pl. I, fig. 6 and 7 which represent the same species show the well-developed characteristic incomplete grooves of the holotype. These grooves are developed in specimens of different age, both in young and old.

Occurrence: common in the Kukruse formation.

7. *Conchoprimitia tallinnensis* n. sp.

Pl. IX, fig. 3a, 3b, 3c.

The holotype is the pictured specimen. It is 2,3 mm. long, 1,5 mm high, 1,1 mm thick. It is distinguished from other species of *Conchoprimitia* by a well-developed concentric groove on each valve, and by a slightly curved sulcus. *C. tallinnensis* is closely related to *C. tolli* and *C. tolli integra* by the shape and size of the carapace, and by the mode of ornamentation. The sulcus of *toll*i and *toll*i *integra* is straighter and longer than that of *tallinnensis*. The *tallinnensis* is more inflate also and has an angulate anterior extremity (compare pl. IX fig. 3b with fig. 2b). The inner part of the exterior surface of the valve of *C. tallinnensis* inside the concentric groove corresponds completely to the valve of *C. toll*i

integra. This inner part forms a step-like elevated border along the concentric groove.

Occurrence; rare in the *Caryocystites* beds in the quarries near the South Lighthouse of Tallinn.

8. *Conchoprimitia deminuta* n. sp.

Pl. XI, fig. 8, pl. XV, fig. 3—5 and 9.

Holotype is the pictured specimen, a right valve, 1,3 mm long and 0,8 mm high. It resembles *C. tallinnensis* in the development of the concentric grooves and sulcus. But in the *C. deminuta* the sulcus is placed more toward the middle of the valve and the shape of the carapace is elliptical, not leperditoid as in *tallinnensis*. Few impressed punctae appear on the posterior half near the sulcus. Most of the specimens of this species are smaller than the holotype. The complete specimen pl. XV, fig. 3—5 and 9, from Kukruse, coll. J. H. Bonnema, resembles in its outline *C. tolli*, but differs distinctly from it in being smaller and in having a well-developed concentric marking, one on each valve. Fig. 4. shows the partly exfoliated left exterior which corresponds to the second layer of the valve; fig. 9 shows the primary layer. The valve of *Conchoprimitia deminuta* consists of two layers, and the concentric step-like marking can be regarded in this case probably as the true though single marking of growth.

Occurrence: rare in the Kukruse formation.

9. *Conchoprimitia ? inusitata* n. sp.

Pl. XIII, fig. 10—12.

Holotype is the specimen in pl. XIII, fig. 10—11, 0,7 mm long, 0,45 mm high, with a 0,4 mm long hinge.

C. ? inusitata is an unusual primitioid species. The male (Pl. XIII, fig. 12.) is without lateral carinae which appear sharply developed in the females (Pl. XIII, fig. 10—11). These relations suggest more a *Ctenobolbina* than a member of the Primitiidae. But it seems the carinae of *Conchoprimitia ? inusitata* correspond probably to the concentric grooves of other species of the genus *Conchoprimitia*. It is possible, that the concentric groove is connected in this case with the wide, fimbriate border of the interior part of the valve. The coarse punctation on the posterior sur-

face of the valves of *inuitata* is *Conchoprimitia*-like. The sulcus is long, slightly curved and relatively deep. On each side of it the carapace forms a large, undefined node-like swelling. The outline is leperditoid.

The strict generic position of this species is not yet certain. The form of the sulcus and the undefined nodes suggest also *Primitia mundula* or *Haploprimitia*, but the sexual dimorphism and the lateral carinae represent a rather uncommon feature.

Occurrence: not rare in the Kukruse formation.

Gen. *Primitiella* Ulrich.

10. *Primitiella indistincta* n. sp.

Pl. I, fig. 4.

Small, sub-elliptical in outline, equally convex on the anterior and on the posterior edges; without surface markings; smooth. Along the ventral border can be observed on each valve a very narrow undefined false border. The absence of nodes and of the sulcus and the symmetrical construction do not allow one to distinguish between the anterior and the posterior end of the carapace.

This species is distinguished from all other species by its symmetrical outline, a smooth surface and by the absence of the sulcus and nodes.

Holotype is the pictured carapace. Length: 0,8 mm; high: 0,35 mm; thickness: 0,4 mm;

Occurrence: very rare in the Kukruse formation at Salla (oil shale quarries of "Eesti Kiviõli").

11. *Primitiella pulex* n. sp.

Pl. XIII, fig. 3—5.

Holotype is the specimen in pl. XII, fig. 3, 4; 0,75 mm height: 0,35 mm; thickness: 0,4 mm;

In the lateral view *Primitella pulex* suggests the larger *Primitiella kukersiana* Bonnemai. But the latter species has an undefined sulcus and no prominent carinae on the ventral margin, differing in these features from our new species.

Primitiella pulex has a leperditoid shape, appears widest inflated on the posterior third, and has a smooth surface, without nodes,

sulcus, or ornaments. The ventral margin is provided with two pairs of carinae, of which the carinae of the interior pair, forming the true ventral margin, are closely approached one to the other and form a prominent ridge. The dorsal margin is flattened and forms a low depression.

Occurrence: common in the Kukruse formation.

12. *Primitiella granosa* n. sp.

Pl. XIII, fig. 6—9.

Holotype is the specimen in pl. XIII, fig. 6. a right valve, 1,3 mm long, 0,8 mm high. It differs from other *Primitiellae* by a symmetrical outline, and granulous surface. The sulcus is missing, and an undefined rounded node is developed on the posterior third near the dorsal part of the valve. The dorsal margin is flattened and forms a lip-like thickening on each valve (Pl. XIII, fig. 7; the same structure appears in *Primitella pulex*, pl. XIII, fig. 5.). The ventral border is of an usual structure: here appear two moderately developed exterior carinae (false border) and a thickening along the true margin of each valve. *Primitella granosa* is evidently an instable species. The complete carapace, Pl. XIII, fig. 8—9, is shorter than the type specimen and has an elliptical horizontal section (fig. 9). The smaller complete carapace, pl. XIII, fig. 7, which corresponds more to the type specimen, has an oval horizontal section with the widest swelling on the posterior half. These differences in the shape and swelling of the valves are probably a kind of sexual dimorphism.

Occurrence: rare in the Kukruse formation of the oil shale quarries at Kohtla-Järve.

Gen. *Haploprimitia* Ulrich & Bassler.

"Distinguished from *Primitia* by the absence of a border along the free edge of valves and occurrence of a simple slit-like furrow in the dorsal half" (according to U. & B. (11), p. 297). In the Estonian Ordovician *Haploprimitia kogermani*, *H. inconstans* and *Primitia molli* Bonnem a can be placed under this genus.

13. *Haploprimitia kogermani* n. sp.

Pl. I, fig. 2a, 2b, and 3; Pl. XIII, fig. 30.

This species has a very short hinge line restricted to the anterior half of the carapace, and differs in this feature very much from other primitioid ostracod species. The anterior extremity is more convex than the posterior. Only the posterior dorsal angle is developed. The narrow, short sulcus is placed in the middle of the dorsal half, and it ends below the anterior end of the short dorsal hinge line. At the base of the sulcus can be seen an obscure muscle spot-like swelling. In the posterior part the carapace is more inflated and higher than the anterior part. Dimensions of the holotype (the pictured specimen): height; length; 0,9 mm; length of the hinge: 0,4 mm; height 0,6 mm; thickness 0,4 mm.

The surface is smooth. The small specimen in Pl. X fig. 30 differs from the type in having a larger hinge line.

Derivatio nominis: in honour of professor P. Kogerman, investigator of the chemistry of the Kukersite.

Occurrence: very rare in the Kukruse beds.

14. *Haploprimitia inconstans*. n. sp.

Pl. XIII, fig. 20—21 and fig. 22—23.

Two specimens only of this form are found in the *Caryocystites*-beds at Tallinn. Oblique in outline, with a deep sulcus, without nodes, and without clearly developed ventral carinae, these carapaces must be placed under *Haploprimitia*.

H. inconstans is distinguished from other related ostracoda by the large, nearly median sulcus and a smooth surface.

The type is the specimen in pl. XIII, fig. 22—23; 0,9 mm long, 0,5 mm high, 0,45 mm thick. The second pictured specimen differs from the type in having different relative dimensions: it is shorter and thicker than the type. Probably it is also a case of a sexual dimorphism.

Gen. *Primitia* Jones.

This genus is based on the *Primitia mundula* Jones as the genotype. The typical specimen of this species is described by T. R. Jones in No. 1 of the "Notes on Paleozoic Bivalved Entomostraca" as *Beyrichia mundula* (14, p. 90. and Pl. V, fig. 23).

The "narrow marginal depressed rim" of *B. mundula* is an important feature of the genus *Primitia* s. str., but it is not clear whether this narrow rim is a ridge-like border, or a marginal depression only. This circumstance is overlooked by the later authors. Krause (15), pl. XXX, fig. 5—7 describes as *P. mundula* specimens without a free border or marginal depression; Kummerow (8) follows him. Therefore the nature of true *Primitia mundula* does not appear clearly enough, and likewise the differences of the genera *Primitia* Jones and *Haploprimitia* Ulrich & Bassler (11) must be revised. For *Primitia mundula* it is probable that the border, or rim, is an attribute of the female specimens whereas the males are without it.

15. *Primitia undulosa* n. sp.

Pl. I, fig. 1a, 1b; Pl. VI, fig. 1a, 1b.

The node and sulcus and depressed marginal border of this species are characteristic of a *Primitia* s. str. From other species of *Primitia* the *P. undulosa* is distinguished by a sub-circular shape, a well developed acuminate node, a short hinge line, the central position of the deep sulcus, and a fine wave-like lineate sculpture.

Holotype is the pictured specimen. Measurements: length 0,9 mm, height 0,7 mm; length of the hinge line 0,4 mm; thickness (of both valves in junction) 0,8 mm.

Primitia undulosa is related to *Euprimitia compta* Kummerow (7) from the German glacial drift. But *E. compta* is lineate and punctate, *P. undulosa* however is lineate only: furthermore *E. compta* has a longer hinge line, its sulcus is more posterior in position than in *P. undulosa*, and the node is not developed.

P. undulosa appears rarely in the Kukruse-formation of Kohtla, Käva and Salla.

16. *Primitia alata* n. sp.

Pl. VIII, fig. 12 and fig. 1 in the text.

This small new species is probably related to American *Primitia tumidula* Ulrich (12). But in *P. alata* the hinge is shorter, the frill is more developed than in *tumidula* and the sulcus is undefined. The node is wide but low, rounded and placed behind the

middle. Along the dorsal border the valve forms a fold overtopping the hinge line. The surface is minutely granulated.

Holotype is the pictured valve, 0,75 mm long.

Occurrence: rare in the *Caryocystites* beds in the quarries near the South Lighthouse at Tallinn.

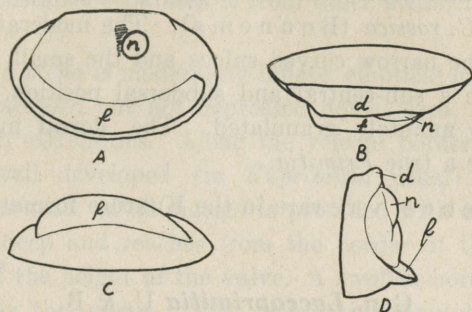


Fig. 2. *Primitia alata* n. sp., same specimen pl. VIII, fig. 12. A — lateral, B — dorsal, C — ventral, and D — anterior view; n — node, d — dorsal fold, f — marginal frill.

17. *Primitia eutropis* n. sp.

Pl. XIII, fig. 1—2.

Holotype is the specimen in pl. XIII, fig. 2, 1,4 mm long. This species is distinguished by a broad sulcus placed a little behind the middle of the valve, by an asymmetrical false border having the largest width near the posterior third or quarter part, and by a coarsely granulated surface.

Primitia eutropis resembles only *Primitia bursa* Krause [(16), pl. I, fig. 7—8, not 9] in which the same construction of the sulcus and of the false border appears. In both species there appears an equally developed, undefined node near the upper posterior margin of the sulcus. But *Primitia bursa* is pictured by Krause with a smooth, non-granulated surface, *Primitia eutropis* on the contrary is granulated.

Primitia eutropis is a variable species, as shown in both the pictured specimens. Pl. XIII, fig. 1 is relatively shorter and higher than the type.

Occurrence: not very common in the *Caryocystites* beds, but is found in all exposures.

18. *Primitia* ? *extraria* n. sp.

Pl. X, fig. 19.

Holotype is the pictured specimen, 0,9 mm long and 0,5 mm high.

This species is very different from other primitioid species. The oblique shape and acute anterior extremity suggest those of a *Ctenobolbina*, as *C. rossica* (Bonnem a). The moderately developed false border, the narrow curved sulcus and the small, rounded node behind it have a sub-central and subdorsal position. The surface is lineate and minutely granulated. The dorsal margin appears rather long for a true *Primitia*.

Occurrence: very rare in the Kukruse formation of Kohtla-Järve.

Gen. *Laccoprimitia* U. & B.19. *Laccoprimitia* ? *mitis* n. sp.

Pl. XI, fig. 12, 13.

Holotype is the pictured specimen, 0,7 mm long, 0,4 mm high. It differs from all other species of gen. *Laccoprimitia* in having a distinct rounded node behind the central pit. Although Ulrich and Bassler (11), in the original diagnosis of this genus assert that *Laccoprimitia* is "without surface nodes", our species must be placed in this genus because of the sub-central pit and the narrow false border.

Laccoprimitia mitis is slightly oblique in outlines, has a rounded posterior and a right anterior dorsal angle. The surface is coarsely punctate or reticulate and suggests in this case a *Halliella* or *Primitiopsis*.

Occurrence: very rare in the Kukruse-formation of Kohtla-Järve.

Gen. *Euprimitia* Ulrich & Bassler.20. *Euprimitia plena* n. sp.

Pl. XIII, fig. 13—14.

Holotype is the pictured specimen, 1,4 mm long, 0,8 mm high, 0,65 mm thick.

In most of the Primitiidae the sulcus and the greatest

height are both placed on the same part of the valve which can be regarded as the posterior. Few species of the diverse genera of the Primitiidae, such as *Primitia molli* Bonnem a the species of *Conchoprimitia*, and some other species, show an inverse distribution of these features. *Euprimitia plena* also has the sulcus on one side, the greatest height on the other side with respect to the middle line, and this circumstance separates it from other members of the genus *Euprimitia*.

Euprimitia plena is moderately inflate, elliptical in the horizontal view, has a flattened but not depressed dorsal area, and is equally convex on both extremities. Along the ventral border of each valve extends the well developed (in *Euprimitia* usual) carina (false border) and the true valval margin is provided with elevated ridges. The sulcus is deep and reaches from the border of the dorsal area over a third of the height of the valve. A swollen horse-shoe shaped ridge surrounds the sulcus. The surface is minutely lineate and shows few disperse granules. The structure of the sulcus and of the swollen ridge surrounding it suggest relations to *Primitia intermedia* Krause (16, Pl. I, fig. 16.), but this species has a larger sulcus in the sub-central position.

Occurrence: rare in the Kukruse formation.

21. *Euprimitia bilabrata* n. sp.

Pl. I, fig. 5a, 5b, 5c.

The features of the gen. *Euprimitia* are here the bicanaliculate ventral margin and the sulcus without nodes. The surface of *E. bilabrata* is smooth and this new species differs from the true reticulate *Euprimitiae* by the sculpture.

E. bilabrata is elliptical in the lateral view, moderately inflate, and strongly elliptical in its horizontal section: the low sulcus is placed in the middle of the dorsal half. The ventral edges of the valves have each a marginal ridge, and a narrow crescent shaped false border.

Holotype is the pictured specimen. Measurements: length 1 mm, height 0, thickness 0,5 mm, length of the hinge 0,8 mm.

Occurrence: few specimens are found in the Kukruse beds of Kohtla-Järve.

22. *Euprimitia* sp. aff. *bilabrata*

Pl. I, fig. 6.

The pictured specimen differs from *E. bilabrata* in having a deeper sulcus, and an undefined node beside it.

Occurrence: one specimen from the Kukruse beds of Kohtla-Järve.

23. *Euprimitia* ? sp. *a.* (sine nomine)

Pl. XII, fig. 10, 11.

Of this species the pictured specimen only is found. It is distinguished by the long narrow sulcus with an undefined node, bicarinate margin, and by the greatest height on the anterior third. The preservation of the surface is bad and the sculpture is unknown.

Occurrence: *Caryocystites* bed at river Uhaku.

Gen. *Eurychilina* Ulrich.24. *Eurychilina kukersiana* (Bonnema) (13).

Pl. I, fig. 9; Pl. XI, fig. 1—6.

Ulrich and Bassler (11), p. 516 place the *Primitia kukersiana* Bonnema in their new genus *Chilobolbina*. But *Primitia kukersiana* has no differentiated brood-pouch, and the frill or false border, especially in the female individuals, is "curved on its under side so as to form a concave area around the true contact edges of the valves". This structure of the false border of the females of the *Primitia kukersiana* corresponds to the structure of *Eurychilina ventrosa* Ulrich [(12), pl. XLV, fig. 1—3.] and suggests from the exterior (Pl. XI, fig. 1) a sausage-like body. Doubtless it corresponds also to the brood-pouch of *Chilobolbina*.

Primitia kukersiana differs from the members of the genus *Eurychilina* in having a sub-central pit in place of the sulcus, and shows an additional small node (Pl. XI, fig. 1) near the posterior dorsal angle. This node is connected with the undefined node beside the sub-central pit by a straight, swollen ridge. On the anterior edge a marginal narrow thickening is separated from the other body by a furrow. These peculiar features appear also in the type specimen of this species [Bonnema (13), Pl. V, fig. 19], and in all other specimens (pl. I, fig. 8, pl. XI, fig. 2—6). The differences between the true *Eurychilinae*, and the *Primitia kukersiana* are of equal value

as those between *Laccoprimitia* and *Euprimitia*. *Primitia kukersiana* can be regarded consequently as a representative of a new genus, closely related to *Eurychilina*, and is placed here provisionally in this latter genus.

The specimen in pl. I, fig. 1 and pl. XI, fig. 1 shows the pitted and granulated ornamentation of this species. The marginal part of the frill is granulate, the other part appears more or less radiate. The specimen in Pl. XI, fig. 2 has an unusually wide sub-central pit.

Occurrence: *Eurichilina kukersiana* is a rare ostracod of the Kukruse formation and *Caryocystites* beds.

25. *Eurychilina* sp., aff. *kukersiana*.

Pl. XI, fig. 7.

As in *Eurichilina kukersiana*, a small oval node is developed on the posterior dorsal angle and the outline of the body of the carapace corresponds to the *E. kukersiana*. But in this specimen the central pit is small and low, the surface is unequally and coarsely granulated and shows irregular wave lines without punctae. The characteristic false border of *Eurychilinae* is not present; evidently it is broken, as in the specimen of *E. kukersiana*, in pl. XI, fig. 4—6.

Occurrence: one specimen only in the Kukruse formation, Kohtla-Järve.

26. *Eurychilina decumana* (Bonnema).

Pl. XII, fig. 8.

This species occurs equally in the Kukruse formation and in the *Caryocystites* beds. It is of the same group as *E. kukersiana*, but has the sulcus curved, narrow and more oblong. The surface appears minutely granulate and non-punctate. No lobe is found on the posterior dorsal angle.

Gen. *Apatochilina* Ulrich & Bassler.

27. *Apatochilina ubjaënsis* n. sp.

Pl. I, fig. 10. Pl. XV, fig. 7 and 8 (?).

This species differs from other *Apatochilinae* in having a swelling along the dorsal margin. The frill is non-striated, the surface is smooth. *Apatochilina simplex* Kummerow (17), from the glacial

drift of North Germany is more inflates and without a single depression on the surface. In *A. ubjaënsis* there can be seen an undefined mesial depression with an obscure node beside it. The marginal border of *A. ubjaënsis* is smooth and not striated. *Primitia plana* Krause (16) is without a marginal swelling along the dorsal edge. The same swelling appears in *P. cincta* Krause (16), but this species is granulated, has a defined node and a pit, and it is more an *Eurychilina* than an *Apatochilina*. Measurements: length 1,1 mm, height 0,75 mm. The specimen from Bonnema's collection in Pl. XV, fig. 7 corresponds to the type, but appears entirely without superficial depressions. The specimen in pl. XV, fig. 8 differs from the other in the absence of the marginal dorsal swelling: the frill is shorter and more convex. Probably this valve is from a female carapace of the *Apatochilina ubjaënsis*, or from a related species.

Occurrence: Only in the Kukruse formation, and very rare.

Gen. *Chilobolbina* Ulrich & Bassler.

28. *Chilobolbina dentifera* (Bonnema).

Pl. VII, fig. 1—3.

1909. *Primitia dentifera* Bonnema (13).

1923. *Chilobolbina dentifera* (Bonnema) Ulrich & Bassler (11).

Ulrich and Bassler (11) have written on the structure of the brood-pouch of *Chilobolbina dentifera* as follows: "in this species the inner third of the pouch lies on the ventral slope of the valve proper. Unfortunately it is not known whether it opens on the inner or outer side of the contact edge."

Fig. 3 in our pl. VII shows that the brood-pouch is separated from the inner cavity of the carapace and represents an enlargement of the marginal frill only. In the upper part of the pouch the radial sculpture of the frill is still preserved. The same construction of the pouch appears in *Uhakiella*, *Piretella* and (more undefined) in some species of *Eurychilina*.

Chilobolbina dentifera is the single representative of this genus in the paleozoic of Estonia. *Primitia kukersiana* Bonnema is evidently an *Eurychilina*. *Primitia kapteyni* Bonnema in having an *Eurychilina*-like frill but missing a central pit or sulcus corresponds to *Platyichilina* Kummerow (8), nomen nudum.

Occurrence: only in the Kukruse formation.

Gen. *Macronotella* Ulrich.29. *Macronotella bonnemai* n. sp.

Pl. I, fig. 7a, 7b, and 8.

This is a true *Macronotella*, closely related to *M. scofieldi* Ulrich. The hinge is long, the valve is without nodes or sulci, with a dark oval muscle spot near the centre. The surface is widely punctate with the exception of the canaliculate ventral margin, the muscle spot and the small triangular parts on the anterior and posterior dorsal angles. On the angles the valve appears slightly compressed laterally.

From *M. scofieldi* the new species is distinguished by minute punctation, by an undefined depression of the muscle spot (Pl. I, fig. 7b), and by the inequality of the angles: the anterior angle is nearly a right one, the posterior more obtuse (nearly 130°). A dark spot-like stripe can be observed between the central muscle spot and the dorsal margin.

The holotype is the specimen in Pl. I, fig. 7a, 7b.

This species occurs rarely in the Kukruse stage at Kohtla, Käva, Ubja and Salla. Measurements: length 2 mm, height 1,3 mm, length of the hinge 1,7 mm.

The gen. *Macronotella* is probably a member of the fam. *Primitiidae*. *M. bonnemai* resembles the "*Primitia*" kapteyni Bonnema and "*Primitia*" distans Krause, but misses the frill.

M. bonnemai is evidently closely related to *Aparchites* (?) *obliquatus* Ulrich & Bassler [(11), p. 503, Pl. XXXVI, fig. 25], but this last species is more oblique in outline and the punctation appears to be coarser. This species is compared by the authors with "*Kirkbya* and certain species of *Primitia*", but *Macronotella* is a Kirkbyide genus also.

30. *Macronotella* ? sp. a.

Pl. XV, fig. 6.

The generic affinity of this ostracod is not clear enough. As in *Leperditella*, or *Aparchites*, the outline is obovate to elliptical and a central muscle-spot is present. As in *Leperditella* on the dorsal margin there appears an undefined, low sulcus-like depression. The surface is provided with a minute punctation. The punctae are distri-

buted in a nearly concentric arrangement surrounding the central muscle spot. From *Macronotella kukersiana* Bonnem a this species is distinguished by a more oblong shape and minute punctation.

Occurrence: rare in the Kukruse formation.

Fam. Beyrichidae Jones.

Gen. *Tallinnella* nov. gen.

The lobation of this genus is closely related to *Ceratopsis* and *Tetradella*. But in the female the brood-pouch is of *Primitiopsis*-like structure. It is formed by the enlargement of the marginal border in the posterior part of the valves. As in *Primitiopsis* [cf. Bonnem a (17)] this brood-pouch is open along the posterior margin of the carapace.

The genotype is *Tallinnella dimorpha* n. gen. n. sp.

Beyrichia marchica Krause is likewise a *Tallinnella*.

Occurrence: middle Ordovician of Estonia.

31. *Tallinnella dimorpha* n. sp.

Pl. II, fig. 1a—2b, pl. X, fig. 1—2.

Beyrichia marchica Krause [(16), Pl. II, fig. 10, 11] is closely related to the *Tallinnella dimorpha*. But *B. marchica* has a minutely densipunctate surface, whereas in *Tallinnella dimorpha* the reticulation-like punctation is restricted only to the lower part of the posterior and middle lobe. The lobes of *B. marchica* appear more bulbous than those of *T. dimorpha*. The variety of *Beyrichia marchica* in Krause (16), pl. II, fig. 9 called by Krause (15) var. *angustata* has narrow lobes, but differs from *T. dimorpha* in the sculpture also.

Holotype is the right valve of a female individual in Pl. II, fig. 2a—2b. The measurements of the holotype are: length 2,9 mm, height 1,6 mm, length of the hinge 2,1 mm. The measurements of a male specimen in Pl. II, fig. 1a—1b are: length 2,5 mm, height 1,55 mm, length of the hinge 2,0 mm. The female specimen consequently appears relatively longer than the male.

The lobes in the male and female are of the same size and shape. The posterior lobe is flat and punctate in the lower half; the short

median lobe appears bulbous; of the two anterior lobes the first is sigmoidal and bulbous in the upper part. The ventral margin is provided with a convex border, which is separated from the lobes by a wide and deep concentric groove. The ventral margin appears to be denticulate. In the male (Pl. II, fig. 1b) the interior border of the ventral margin forms an undulate line. The specimen in pl. X, fig. 1—2, a large complete female carapace, shows very prominent dorsal extremities of the lobes; the brood-pouch appears broken on the thin-walled posterior margin.

Occurrence: *Tallinnella dimorpha* is a common microfossil of the *Caryocystites* limestone (C₁δ) of Tallinn, Uhaku and Purtse.

Gen. *Ceratopsis* Ulrich.

The Estonian species of *Ceratopsis* differ from the American forms by an indefinitely developed anterior lobe and by a well-pronounced sexual dimorphism. The females of Estonian species of *Ceratopsis* are distinguished by a well developed marginal ridge or false border for sheltering the brood.

32. *Ceratopsis obliquejugata* Fr. Schmidt [(18), p. 193].

1909. *Ceratopsis schmidtii* Bonnem a (13), p. 39, pl. VI, fig. 1—6.

Our specimen in Pl. II, fig. 3, is the original of the *Beyrichia obliquejugata* Fr. Schmidt and must be selected for the type of this species. Although the preservation is bad, this type specimen appears to be identical with Bonnem a's species. In both ostracoda the horn-like process is separated from the short sigmoidal median lobe by a narrow, deep furrow; the marginal border reaches to the top of this horn. These conditions can be observed in the type-specimen of *C. schmidtii* Bonnem a (13) in pl. VI fig. 1—6, in the lectotype of *B. obliquejugata* (our Pl. II, fig. 3) and in an additional female specimen in Pl. II, fig. 4.

The female specimen in pl. XIV, fig. 6, has a short flattened horn-like process, like *C. perpunctata*, but the lobation and smooth surface correspond to *C. obliquejugata*.

Occurrence: very common in all exposures of *Caryocystites*-limestone and Kukruse formation.

33. *Ceratopsis platyceras* n. sp.

Pl. II, fig. 6, 7; pl. X, fig. 12—14, pl. XIV, fig. 5.

This species differs from the *Ceratopsis obliquejugata* (Schmidt) and other species by the flat and short horn-like process, triangular in form, which is not separated from the short median lobe. The marginal border reaches to the base of this horn only. The surface is smooth. Probably *Ceratopsis platyceras* is related to *Beyrichia rostrata* Krause (19), pl. XXI, fig. 2. But in this species the sulci are nearly straight; in *platyceras*, on the contrary, the anterior furrow is curved and the deep middle sulcus is sigmoidal. On the well preserved specimens of *Ceratopsis platyceras* the top of the horn-like process and the short posterior lobe possess each a small separated and rounded point (visible in pl. II, fig. 7).

The specimen in pl. X, fig. 12—14, a complete male carapace, shows the multicarinate ventral side, the deep posterior and the indistinct anterior furrow, and the sharp elliptical horizontal view (fig. 13—14). The specimen in pl. XIV, fig. 5, a female right valve from Bonnema's collection, shows an indistinct granulation on the surface.

The Holotype is the female specimen in Pl. II, fig. 6. In the male (Pl. II, fig. 7) the marginal ridge is smaller than in the female.

Measurements: the female, fig. 6, is: 1,6 mm long and 0,8 mm high, the male, fig. 7, is 1,7 mm long, and 0,9 mm high.

Occurrence: in the Kukruse formation and *Caryocystites* limestone, but not very abundant.

34. *Ceratopsis rostrata cornuta* (Krause).

Pl. II, fig. 5.

1896. *Ctenobolbina rostrata* var. *cornuta* Krause (20), p. 937. Pl. XXV, fig. 3.

1909. *Ceratopsis cornuta* (Krause). Bonnema (13), p. 41, pl. VI, fig. 9.

Bonnema has seen the original specimen of *Ctenobolbina rostrata* var. *cornuta* Krause and found that this species occurs in the Kukruse formation of Estonia. Our specimen (Pl. II, fig. 5.) of this is a complete female left valve showing the spine-like horn,

separated by a low furrow from the posterior part of the median lobe. The marginal border, characteristic of female individuals, is separated here by a low concentric furrow from the lobes. The lateral surface, especially on the base of the posterior lobes, appears minutely punctate.

Occurrence: only in the Kukruse formation, and not very abundant.

35. *Ceratopsis perpunctata* n. sp.

Pl. X, fig. 3—6. and 7.

Holotype is the specimen in pl. X, fig. 3, and 4; 1,2 mm long, 0,75 mm high.

This species is very different from other members of this genus. It is distinguished by the coarse punctation of the surface, by smooth crests on the borders of the lobes, and by the flattened horn-like process. The short sigmoidal median lobe is separated from the posterior "horn-shaped process" by a deep furrow, the posterior branch of the divided anterior lobe appears narrower on the central, and dilatate on the lower and upper part.

Occurrence: common in the *Caryocystites* bed, in all Estonian exposures.

36. *Ceratopsis perpunctata prominens* n. var.

Pl. X, fig. 8—10.

Holotype is the pictured complete carapace, 1,1 mm long, 0,6 mm high, 0,55 mm thick. It differs from the main variety in having a more prominent rounded "horn-shaped" process, and a very prominent (on the lower and upper part bulbous) posterior branch of the divided anterior lobe. The furrows are deep and narrower than on *C. perpunctata* sensu stricto. The crests along the borders of the lobes are not developed in this variety. Moreover the ventral side is broad and hexacarinata; as a rule the right valve seems a little greater than the left and has a more prominent and thicker ridge along the true margin.

Occurrence: rare in association with *C. perpunctata* in the *Caryocystites* beds.

37. *Ceratopsis perpunctata* var. *a* (sine nomine).

Pl. X, fig. 7.

In the bituminous limestone beds of the Kukruse formation very small valves with the characteristic punctation and flattened posterior "horn-shaped" process appear. But they differ from the main variety in being smaller in size, in having a slightly different outline and no crests; from the variety *prominens* these ostracods differ in their equally convex lobes.

38. *Ceratopsis* sp. aff. *rostrata cornuta* Bonnemai.

Pl. X, fig. 11.

Small, very thin, punctate, with a prominent pointed horn process, this form suggests a young stage of *Ceratopsis rostrata cornuta*, but it shows a different development of the short median lobe.

Occurrence: not rare in the Kukruse formation.

Gen. *Tetradella* Ulrich.

39. *Tetradella perornata* n. sp.

Pl. II, fig. 8—11; fig. 3 in the text.

This new species differs from all *Tetradellae* in lobation and ornamentation to a very considerable degree. The anterior lobe is

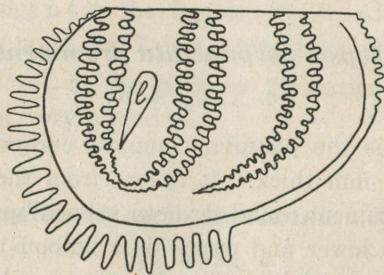


Fig. 3. *Tetradella perornata* n. sp., reconstruction. 1 — is the median lobe producing a *Tetradella*-like habitus of this beyrichioid ostracod.

detached; two other lobes form a u-shaped ridge; a small bulbous elongated elevation between the u-shaped ridge represents a relict of the median lobe of other *Tetradellae* or *Ceratopsis*. This mode of lobation suggests a similarity to the ostracoda of the *Beyrichia buchiana* group and to some species of *Bollia*.

Holotype is the specimen in pl. II, fig. 11. Length 1,3 mm, height 0,9 mm.

The free edge of the valves with a false border is provided on the posterior and ventral part with numerous spines. The lobes are adorned with tooth-like granules in opposite arrangement.

Occurrence: very rare in the Kukruse formation of Kohtla, Käva and Salla.

40. *Tetradella* ? *pectinata* n. sp.

Pl. IV, fig. 9. Pl. VII, fig. 4 and 5. Pl. X, fig. 16. Pl. XV, fig. 12.

Evidently this species is a member of a new genus related to *Tetradella* or *Ceratopsis*. The most important difference from *Ceratopsis* is the absence of a distinct horn-shaped process in the *T. ? pectinata*. The lobation of this species can be seen in Pl. VII, fig. 4. The anterior (aa) lobe is not well defined; the posterior branch (a) of the anterior lobe forms a prominent, oblique, narrow ridge; the median lobe (m) is small and short as in all species of *Ceratopsis*. The posterior lobe is without the horn-shaped process. Although the "horn" is missing the lobation suggests more a *Ceratopsis* than *Tetradella*. Probably it may be a separate branch of *Ceratopsis*, derived from more ancient forms with a short "horn", like *Ceratopsis bocki* A. Ö. (1), or from the not yet known common ancestor of *Ceratopsis* and *Tetradella*. On the other hand *T. ? pectinata* suggests a *Ctenobolbina*, like the *Ctenobolbina obliqua* Ulrich. Related species are *Berychia marchita lata* Krause [(15), Pl. XXXI, fig. 14, 15], *Berychia palmata* Krause [(16), Pl. II, fig. 13], *B. digitata* [ibid., fig. 12], and *Ctenobolbina rostrata* Krause [(20), Pl. XXV, fig. 1, 2]. From all these ostracoda the *Tetradella ? pectinata* is clearly different in having many long spines along the ventral false border of the male valves and in being coarsely granulated. Many of the granules are stelliform. Ulrich (12), and Ulrich & Bassler (10) place most of the named species in the genus *Tetradella*. The specimen in pl. XV, fig. 12, shows the interior of a left valve with a dark muscle spot. In pl. X, fig. 16 is given a left valve, probably a female of the same species. Its lobation and surface are identical with those of both the other specimens (Pl. VII, fig. 4, 5); but in the posterior two-thirds along the ventral and posterior margin appears a frill with a granulated and radiated surface, exteriorly not clearly separated from the body of the valve. This other, ante-

rior part of the margin is provided with spines. Compare also the following species (*T. ? aff. pectinata*).

The holotype is the left valve in pl. VII, fig. 4. It is 1,4 mm long and 0,6 mm high.

Occurrence: rare in the Kukruse formation.

41. *Tetradella ? sp. aff. pectinata*.

Pl. IX, fig. 5; pl. XV, fig. 15.

Of this species few fragments only have been found. The lobation, the sculpture of the surface, and the construction of the marginal border correspond to those of *T. ? pectinata*. From this it differs in having a long spine forming the prolongation of the top of the posterior lobe. Some fragments might be mistaken for a *Rakverella* (cf. Pl. IX, fig. 4 and 5).

Occurrence: only in the Kukruse formation.

42. *Tetradella ? dubitabilis* n. sp.

Pl. X, fig. 15, pl. XV, fig. 13—14.

Holotype is the specimen in pl. X, fig. 15, 20 mm long and 1,0 mm high. This species suggests a *Tallinnella*, but it has the surface granulated, and a granulated and striate frill not separated from the body of the valve. The brood-pouch is unknown. This species is distinguished from other *Tetradellae* especially in having a pointed (mucronate) posterior lobe; from *Tetradella ? pectinata* it differs also in the broad anterior furrow and more curved lobes. The complete specimen in pl. XIV, fig. 13—14, evidently the same species, shows the anterior edge sharp, as in *Ceratopsis platyceras*. A similar, undescribed species with mucronate posterior lobe and reticulate surface occurs in the Jõhvi and Keila formation.

Occurrence: very rare in the Kukruse formation and probably present in the *Caryocystites* limestone.

43. *Berychia ? sp.*

Pl. XIV, fig. 4.

This small ostracod is known in fragments only. The valve is thin and has a reticulate surface. Three lobes only are developed and fused on the ventral part. No lobe can be observed on the anterior third of the valve. Long spines adorn the margin. It is

possible that this badly preserved species is a reticulate member of our *Tetradella* ? *pectinata* group.

Occurrence: very rare in the Kukruse formation.

Gen. *Kiesowia* Ulrich & Bassler (10), (11).

Kiesowia has been known hitherto only in the Ordovician boulders of the glacial drift of Germany. These species are *Kiesowia mammosa* (Krause), *K. dissecta* (Krause) and *K. radians* (Krause). In the following are described two new species from the bedrocks of the Kukruse and Uhaku formations. *K. mammosa* and *dissecta* and some new species occur also in the Ordovician of Estonia, and one or two species in the lower Silurian Porkuni formation (Borkholm f. of Raymond); The specimen of *Kiesowia* unfortunately appears to be rare in the bedrocks although they seem to possess a good stratigraphical value.

44. ***Kiesowia pernodosa* n. sp.**

Pl. XIV, fig. 2—3.

Holotype is the pictured specimen from the upper part of the Uhaku-bed (*Caryocystites* b. 1.) at Tallinn (South Lighthouse). Measurements: 1,4 mm long, 0,8 mm high.

This species is related to *Kiesowia mammosa* (Krause) in outline, granulate surface, and in having an elevated border along the free margin. The differences consist in the grade of development and arrangement of the nodes. 1) In *mammosa* the anterior lobe is divided into two nodes, — in *pernodosa* n. sp. these lobes are fused, 2) the nodes of the posterior branch of the anterior lobe are smaller than in *mammosa*, 3) in *K. pernodosa* the lower nodes of both the middle lobes are enormously developed, as can be seen in pl. XIV, fig. 2.

Occurrence: very rare in the upper part of the Uhaku beds.

45. ***Kiesowia margaritata* n. sp.**

Pl. XIV, fig. 7—8.

Holotype is the pictured specimen. Measurements: 0,75 mm long, 0,4 mm high.

K. margaritata is the smallest species of the genus. Coarse nodules adorn the free border, whence the name of the species (*mar-*

garitata). Similar ornamentation is developed also in *K. mammosa*, but in the latter species the nodules are smaller. *Margaritata* differs from all other species in having ten nodes on the surface (*mammilosa* has eight, *dissecta* — seven, and *pernodosa* six elevated and two low nodes). Further, the lobation is clearly developed here, and a sigmoidal median sulcus passes from the dorsal margin to the ventral edge. As in a true *Tetradella*, the posterior lobe is divided into two branches, and the middle and anterior lobes are separated from one another by a low furrow. The posterior edge is convex, the anterior one acute, acuter than in the other species. Surface smooth.

Occurrence: only in the Kukruse formation, very rare and badly preserved.

Gen. *Ctenobolbina* Ulrich.

46. *Ctenobolbina duhmbergi* n. sp.

Pl. IV, fig. 10, 11, pl. VI, fig. 5.

Holotype is the specimen in Pl. IV, fig. 11 and pl. VI, fig. 5. It is 1,3 mm long and 0,7 mm high.

This species of the unisulcate group of *Ctenobolbina* is distinguished by being densipunctate on the surface, and by having a spinous anterior false marginal border. The posterior part of the fals border is formed by a striate frill. The sulcus is deep and the outline of the carapace is leperditoid.

Ctenobolbina duhmbergi is a rare species of the Kukruse formation.

Derivatio nominis: in memory of K. Duhmberg, late assistant of the Mineralogical Institution of the University of Tartu.

47. *Ctenobolbina polytropis* n. sp.

Pl. VIII, fig. 7. and fig. 4 in the text.

This new unisulcate *Ctenobolbina* differs from other species in having in the female carapaces three carinae or false borders (frill) on each valve along the ventral margin. Both the grooves between these carinae are divided into two rows of small cells or loculi. By this peculiarity *C. polytropis* is distinguished from other forms with

loculi (cf. *Ctenobolbina fulcrata* Ulrich, *C. loculata* Ulrich etc.) in which the loculi form a single row on each valve. The surface of *C. polytropis* is smooth, the long curved sulcus is bifurcate near the dorsal margin, as in *Ctenobolbina diensti* Kummerow (7, 8). The latter species has a simple frill. *Entomis sigma* Krause [(16), Pl. I, fig. 11, 12] is closely related to *C. polytropis*, but it is monocarinate, and rectangular on the anterior and posterior dorsal angles. In *C. polytropis* the anterior and posterior extremities are rounded and convex.

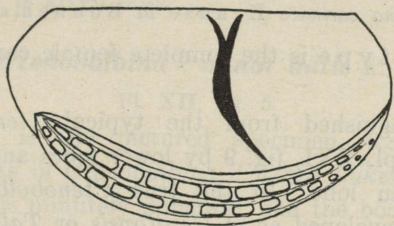


Fig. 4. *Ctenobolbina polytropis* n. sp., schematic diagram of the holotype, shows two rows of loculi between the carinae.

Holotype is the pictured specimen. It is 1,5 mm long and 0,9 mm high. This is a complete carapace with slightly distorted opposite valves.

Occurrence: rare in the *Caryocystites*-beds in the quarries near the South Lighthouse of Tallinn.

48. *Ctenobolbina ctenolopha* n. sp.

Pl. X, fig. 17—18.

Holotype is the pictured specimen, 1,05 mm long and 0,55 mm high.

This new species differs from other *Ctenobolbinae* in having a detached node on the upper part of the sulcus, long slightly curved bristles along the ventral margin, and a triple frill with two rows of loculi. It suggests *Ctenobolbina polytropis* in the construction of the frill and loculi, but differs in having the node more developed and a different outline. The surface of *C. ctenolopha* is smooth. The node behind the sulcus is well developed, and a dark rounded central muscle-spot is visible on the bottom of the sulcus. The peculiar feature of this *Ctenobolbina* is the prominent node formed by the

bifurcation of the dorsal end of the sulcus. A similar bifurcation appears in *Ctenobolbina polytropis* n. sp. and *C. diensti* Kummel but without the prominent node.

This species suggests a relation with *Beyrichia salteriana* or *Kloedenaia*.

Occurrence: rare in the Kukruse formation.

49. *Ctenobolbina carinata estona* n. var.

Pl. VIII, fig. 8, 9.

Ctenobolbina carinata Krause in Bonnemaa (13), 1909.

The Holotype is the complete female carapace in pl. VIII, fig. 8.

It is distinguished from the typical *Ctenobolbina carinata* Krause (19), pl. XXI, fig. 9 by lower lobes and sulci, and by an undefined median lobe. In the true *Ctenobolbina carinata* this median lobe is developed as in *Ceratopsis* or *Tallinnella*, forming a short node fused in its ventral ends with the posterior lobe. Further, *Ctenobolbina carinata estona* has an additional small lobe on the posterior angle which is surrounded by a low curved furrow. The surface of *C. carinata estona* appears minutely granulated.

An exact description of this ostracod is given by Bonnemaa (13).

Occurrence: very abundant in the Kukruse formation.

50. *Ctenobolbina aspera* n. sp.

Pl. VIII, fig. 4, 5. Pl. XI, fig. 10.

Holotype is the specimen in pl. VIII, fig. 5., 1.3 mm. long. This is related to *Ctenobolbina variolaris* (Bonnemaa), *C. oblonga kukersiana* (Bonnemaa), *C. obliqua kukersiana* (Bonnemaa) etc., but differs from all the other members of this natural group in having a very coarse granulation, and an enormously developed subcentral node. This node is connected on the base with the anterior lobe of the valve. The sulcus is long, sigmoidal, and extends from the dorsal margin to the false border or frill. This frill is placed in the same manner as in the other members of this group, but it appears to be indistinctly striated radially. On the bottom of the sulcus a narrow ridge extends from the node toward the ventral end, visible in the specimen in pl. VIII, fig. 4.

For comparison in pl. XI, fig. 11 is given the type specimen of *Ctenobolbina variolaris* Bonnem a [same specimen in Bonnem a (13), pl. V fig. 10], which shows a broad sulcus and a smaller node.

Occurrence: not common in the Kukruse formation.

51. *Ctenobolbina variolaris* (Bonnem a).

Pl. XI, fig. 11.

For comparison with *C. aspera* a picture of type specimen of *C. variolaris* (Bonnem a), prepared by the procedure of whitening with NH_4Cl is given here.

52. *Ctenobolbina* ? *minor mitis* n. var.

Pl. XII, fig. 5.

Holotype is the pictured specimen, 0,85 mm long and 0,45 mm high. As in *Ctenobolbina* ? *minor kukersiana* (Bonnem a), the surface is minutely punctate, and the body of the valve is surrounded along the free margin by a concentric furrow. *C. minor mitis* differs from the var. *kukersiana* Bonnem a and minor Krause in having a smaller horse-shoe shaped swelling, and a narrower sulcus.

Bonnem a (13) placed these forms in the genus *Bollia*, and did not agree (ibig. p. 84) with Ulrich & Bassler, who regard *Bollia minor* and allied forms as members of the genus *Ctenobolbina*. Indeed, the ostracoda of the *Bollia minor* group are non-carinate and differ in this case to a considerable extent from the true *Ctenobolbinae*: in *Ctenobolbina* the ventral margin is bicarinate or multicarinate, and the females are provided with one or more additional carinae on each valve. Evidently, the *Bollia minor* group forms a non-carinate branch of the genus *Ctenobolbina*, or may be regarded, probably, as a separate genus of Beyrichidae, without carinae and without exterior arrangements for the sheltering of the brood.

Occurrence: not common in the Kukruse formation.

53. *Ctenobolbina* ? *octispina* n. sp.

Pl. VIII, fig. 6, pl. XI, fig. 16, 17.

Entomis quadrispina Krause (19), Bonnem a (13), p. 71, pl. V, fig. 17—18.

Holotype is the specimen in pl. XI, fig. 16—17, this is Bonnem a's specimen, in (13), pl. V, fig. 17, prepared subsequently by the writer.

The new species differs from *Entomis quadrispina* Krause in being bisulcate, and in having on each valve two nodes near the dorsal margin. These nodes correspond in the position of both median marginal spines.

The surface is smooth, the posterior sulcus deeper than the anterior. The arrangement and the number (four on each valve) of the marginal spines is the same in both species.

Entomis quadrispina Krause occurs also in Estonia in the Oandu formation, which is the eastern representative of Vasalemma (D₃) limestone [cf. A. Öpik (9), p. 6]. As in Krause's picture these specimens are monosulcate. Doubtless, both species, *Entomis quadrispina* Krause, and *Ctenobolbina ? octispina* n. sp. are closely related forms; the bisulcate *octispina* is older than the monosulcate *quadrispina*. Further, both species are non-carinate. These circumstances suggest that the questionable ostracoda form a separate genus, probably not related, but only convergent with the *Ctenobolbina*. In *Ctenobolbina* the monosulcate and bisulcate species are two independent branches; the *quadrispina*, on the contrary, can be regarded as a derivate from the monosulcate *octispina*.

Occurrence: rare in the Kukruse formation.

54. *Ctenobolbina* ? aff. *obliqua* (Krause).

Pl. XIV, fig. 9.

Only a single specimen (the one pictured, from Bonnema's collection) of this very small ostracod is known. It is distinctly shorter than the *Entomis obliqua kukersiana* Bonnema, and not so acute on the anterior extremity. The lateral spine appears shorter also. The true *Entomis obliqua* Krause [(19), pl. XXII, fig. 10] is evidently larger and has a more developed sulcus. Our specimen appears moderately carinate.

The North European *Ctenobolbinae* with one lateral spine on each valve probably form a separate genus. According to Ulrich and Bassler (11), p. 311, "*Entomis sigma* and *E. obliqua* are so completely bilobed as to suggest *Dilobella*". This opinion, however, is not accepted by Bonnema (13), p. 84. It seems a certain resemblance does exist between *Entomis obliqua* group and *Acronotella* U. & B (12), but *Acronotella* appears to be non-carinate, whereas the *Entomis obliqua* and related forms are carinate, especially the female individuals.

Occurrence: Kukruse formation, Kukruse.

Gen. *Polyceratella* n. gen.

Genotype is *Ulrichia kukersiana* Bonnem a, (13), in pl. VI, fig. 10—15, p. 51—5.

The primitioid true *Ulrichia* has two prominent nodes, one on each side of the sulcus and "occasionally other nodes are present on the ventral valve half of the surface" (U. & B. (11), p. 301). Therefore in *Ulrichia kukersiana* appear two well developed lobes divided by a curved sigmoidal sulcus passing from the dorsal edge to the ventral border. This is a distinct beyrichiid structure which suggests some species of *Ctenobolbina* and *Biflabellum*. Another distinctive feature of *Polyceratella* is the prominent ridge along the free border of each valve, forming on the dorsal margin two pairs of short spine-like processes, placed on the anterior and posterior dorsal angles.

The species of *Polyceratella* are 1) *Ulrichia kukersiana* Bonnem a; 2) *Polyceratella tetraceras* n. sp. from the *Caryocystites* limestone, and some new species in the Ordovician formations above the Kukruse formation of Estonia.

55. *Polyceratella tetraceras* n. sp.

Pl. V, fig. 9.

This species differs from the coarsely granulated *Ulrichia kukersiana* Bonnem a in having a smooth surface, and in being more oblong in shape. An undefined node appears behind the sulcus also in *P. tetraceras*.

Holotype is the pictured specimen in pl. V, fig. 9. It is 1,9 mm long and 0,8 mm high.

Occurrence: it is a rare species of the *Caryocystites* limestone of Tallinn, Purtse and Uhaku.

Gen. *Ctenonotella* n. gen.

Ulrichia (partim) in Krause (19) et Bonnem a (13).

Genotype: *Ctenonotella elongata* n. sp.

Ctenonotella differs from other Beyrichidae in having two prominent nodes on the lateral surface of each valve. These nodes (pl. VIII, fig. 18) correspond to the median lobe and posterior branch of the divided anterior lobe of a *Tetradella* or *Ceratopsis*. *Ctenonotella* can be regarded as a *Tetradella* with reduced posterior

lobe and anterior branch of the anterior lobe. The sulci appear as depressions in front of the posterior branch (a) of the anterior lobe and in front of the median lobe (m). On the bottom of this last depression appears the dark rounded sub-central muscle-sport. The surface appears granulated. The free margin is provided by narrow carinae. A broad striated false border is developed and reaches from the posterior angle to the lower end of the anterior margin.

The species of this genus are *Ctenotella elongata* n. sp., *Ulrichia bidens* Krause, and, probably, a new species in the Ordovician Jõhvi formation of Estonia. *Ulrichia bidens* Krause is known from the Ordovician boulders in the glacial drift of Germany, and appears in many specimens in the Estonian Ordovician Jõhvi formation.

The resemblance of these species to the Primitiide *Ulrichia* is a superficial coincidence only, not indicative of a true intimate relationship.

56. *Ctenonotella elongata* n. sp.

Pl. VIII, fig. 1—3.

Ulrichia cf. *bidens* Krause in Bonnema (13), p. 54, pl. VI, fig. 27.

Holotype is the specimen in pl. VIII, fig. 2. 1,5 mm long, and 0,8 mm high. *Ctenonotella elongata* differs from *Ctenonotella bidens* (Krause) in being more elongate, and in having both nodes placed on the posterior half of the valve. In *C. bidens* the nodes have a more central position. Further, the dorsal margin of *C. elongata* is provided with long spines.

Occurrence: not common in the Kukruse formation.

Gen. *Biflabellum* A. Ö.

Genotyp: *Biflabellum tenerum* A. Ö. (24).

This genus is closely related to *Dibolbina* Ulrich & Bassler (11), p. 658. The female of *Dibolbina* has a globular brood pouch as an enlargement of the false border or frill. *Biflabellum* is distinguished from *Dibolbina* by the absence of this brood pouch. The female *Biflabellum* has a curved, convex false border.

All species of *Biflabellum* are provided with a broad radially striated frill, with a curved median sulcus, and a node behind it. The other differences from *Dibolbina* can be seen also in *Biflabellum*

reticulatum (Pl. V, fig. 5 and Pl. VI, fig. 4, other species, pl. V, fig. 5, 6, 7,) which has in the posterior dorsal angle a short vertical ridge, and no ridges in the anterior half.

The following species can be placed in this new genus: 1.) *Biflabellum tenerum* A. Ö.; 2.) *Biflabellum reticulatum* n. sp.; 3.) *Biflabellum crista* n. sp.; 4.) *Biflabellum acutum*, all from the Kukruse formation; and 5.) *Biflabellum flabelliferum* Krause from the Porkuni formation of Estonia (Borkholm form. of former authors), and from glacial boulders of North Germany.

Ulrich and Bassler (11), p. 656—657 have written the following on the *Dibolbina*: „Their genetic relations to other ostracoda are somewhat obscure, because they remind in one or another respect of several widely differing generic types. The general aspect, with particular reference to the wide frill elongate form and simple lobation, suggests *Eurychilina*. The body of the valves reminds on its curved furrow of the unisulcate species of *Ctenobolbina* and also of species now referred to *Entomis*. But these seem to be more resemblances and not, we are convinced, indicative of truly close relationships.“ All these statements are valid for the new genus *Biflabellum* also; further the type of this genus, *B. tenerum* is placed by Bonnemai under the genus *Entomis* (cf. likewise *Entomis flabellifera* Krause), and the relationship of *Biflabellum* and *Ctenobolbina*, as it seems exists nevertheless in reality.

The ordovician *Biflabellum* and the upper silurian *Dibolbina* are two closely related genera, and *Biflabellum* appears as an immediate ancestor of *Dibolbina*. In this case the derivation of *Dibolbina* and *Biflabellum* immediately from the true *Beyrichia* is impossible, since *Beyrichia* has well developed brood pouch, whereas *Biflabellum* is without it and in the more advanced *Dibolbina* this branch of *Beyrichiaceae* has independently developed a *Chilobolbina*-like brood pouch. The beyrichioid branch of *Biflabellum*, — *Dibolbina* appears as moreless slow in its evolution and can be placed under the *Beyrichiaceae*, in the vicinity of the genera as *Ctenobolbina*, *Ceratopsis*, *Tallinnella*, *Tetradella*, in which a brood' pouch is missing as part of the carapace body, and appears only in the form of diverse modifications of the frill. Similar relations exist also in *Hollina*, *Uhakiella* and the *Eurychiliniinae*. And lastly, it is not a coincidence only that in *Ctenobolbina* there appear lateral crests as in *Dibolbina* [cf. *Ctenobolbina carinata* Krause and other species

in Bonnema (13) pl. II, fig. 23, 24.], and that the sulcus and node of *Dibolbina* and *Biflabellum* are closely similar to those of many unisulcate *Ctenobolbinae* [cf. *Primitia rossica* Bonnema (13), pl. VI, fig. 28, 29, which is a true unisulcate *Ctenobolbina* with node and sulcus as in *Dibolbina* and *Biflabellum*].

57. *Biflabellum tenerum* A. Ö.

Pl. V, fig. 1, 2, 3, 4, pl. XIV, fig. 12. textfig.

1909. *Entomis flabellifera* Krause in Bonnema (13), p. 70. Pl. V, fig. 1—5, [non Krause (19)].

1935. *Biflabellum tenerum* A. Ö. (24), p. 86, fig. 40.

This species is distinguished from *Entomis flabellifera* Krause by a more developed frill with coarse radiate sculpture. The true *Entomis flabellifera* with more inflate lobes has not so wide a frill as *B. tenerum*. *Entomis flabellifera* Krause occurs in the Porkuni formation (Borkholm of Schmidt) only; in pl. V, fig. 8 is given a left valve of this species for comparison with the closely related *B. tenerum*.

The body of the carapace of *B. tenerum* is more or less oblong, flat, has a long hinge, a curved furrow behind the middle of the valve, and a slightly prominent node on its posterior border. The fan-shaped very wide frill has a concentric sculpture also. On the posterior edge the frill reaches to the posterior dorsal angle, on the anterior the frill ends a little below the angle. The anterior edge, free from the frill, appears to be denticulate (Pl. V, fig. 2). The ventral side of the carapace is flat and the true ventral border of the valves is denticulate (Pl. V, fig. 4). In females (Pl. V, fig. 3, pl. XIV, fig. 12), the frill is curved, not so long on the anterior edge as in the male specimen, and the terminal radius of the fan forms a rigid thickening. The hinge line is shorter than the body.

Measurements of the Holotype: length of body 1,9 mm, length of the hinge-line: 1,6 mm; total length: 3,4 mm; height of the body: 0,8; height of the frill: 1,0 mm.

Occurrence: not common in the Kukruse formation of Estonia.

58. *Biflabellum reticulatum* n. sp.

Pl. V, fig. 5; pl. VI, fig. 4; pl. XI, fig. 9; pl. XIV, fig. 13, 14.

Holotype is the pictured specimen. Measurements: length of body 1,1 mm, length of the hinge 1,1 mm, height of the body 0,6 mm.

This small species differs from the *B. flabelliferum* (Krause) and *B. tenerum* A. Ö. in having a reticulate sculpture, with few granules, a deeper and more curved sulcus and a very minutely radiate frill. The node behind the sulcus is fused with the posterior lobe. Before the median sulcus near the dorsal margin a low rounded node ("n" in pl. XIV, fig. 14), formed by an indistinct bifurcation of the median sulcus is also developed. This feature suggests a comparison with *Ctenobolbina ctenolopha* n. sp. (pl. X, fig. 17—18.). The carapace appears more inflate than in the other species of *Biflabellum*. The posterior edge is provided with a narrow ridge forming a short spine-like process slightly elevated above the posterior dorsal angle. This process appears in both the following species of *Biflabellum* also. The hinge-line is as long as the body of the carapace. In Pl. XI, fig. 9 is given a female valve of *B. reticulatum* showing the convex frill and coarse disperse granulation. The reticulation is of the same structure as in the holotype. Same features are well developed in Bonnem's specimen in pl. XIV, fig. 13—14.

Occurrence: rarely in the Kukruse formation of Kohtla, Käva and Ubja.

59. *Biflabellum crista* n. sp.

Pl. V, fig. 6.

Holotype is the specimen (a right valve) in pl. V, fig. 6.

Measurements: length of the hinge 0,8 mm, length of the body 0,85 mm, height of the body 0,75 mm.

From *Biflabellum tenerum* and *flabelliferum* this species is distinguished by having a spine-like process on the posterior angle (as in *B. reticulatum*); from *B. reticulatum* *B. crista* differs in the smooth, non-reticulate surface and straighter sulcus continued on the frill also.

Occurrence: only in the Kukruse formation, and rarely.

60. *Biflabellum acutum.* n. sp.

Pl. V, fig. 7.

Holotype is the specimen in pl. V, fig. 7. Measurements: length (on the hinge) 1,2 mm, height of the body 0,6 mm.

This new species is distinguished from all the other species of *Biflabellum* by the acute anterior and posterior dorsal angles, by the elongate form and by the oblique shape of the carapace. On

the posterior angle appears an elevated process as in *B. reticulatum* and *tenerum*. The frill reaches on the anterior edge immediately to the dorsal angle (in other species it ends at some distance from this angle).

Occurrence: very rare in the Kukruse formation of Kohtla-Järve.

Gen. *Uhakiella* n. gen.

Bollia Jones in Krause (16) 1889 (partim); *Bollia* J. in Bonnema (13) 1909 (partim); *Primitia* J. & H. in Krause (15) 1891, (partim); *Beyrichia* in Ulrich and Bassler (10) 1909, (partim).

This new genus contains ostracoda related to *Bollia granulosa* Krause, which species is called *Beyrichia granulifera* by Ulrich and Bassler. The ostracoda of this group have a more or less undefined lobation which resembles the lobation of *Beyrichia clavata* Kolmodin and, in some cases, of *Primitia* also. But the species of *Beyrichia* with *B. kloedeni* as a type have a brood-pouch "arising from the ventral part of the posterior lobe, hence located wholly or mostly behind the middle of the valve" [according to Ulrich and Bassler (11), p. 285]. On the contrary, in *Uhakiella* n. gen. the brood-pouch is formed by the enlargement of the posterior part of the marginal border, as in *Hollina* [cf. *Hollina insolens* in Ulrich and Bassler (10), pl. XLII, fig. 10 and 11.]

The males have a false border in the posterior and ventral margin; the anterior margin is usually more or less denticulate, the surface is granulated.

The genotype of *Uhakiella* is *U. coelodesma* from the *Caryocystites* beds. Other species are *Uhakiella pumila* n. sp. (*Caryocystites* limestone), *U. kohtlensis* n. sp. (= *Bollia granulosa* Krause in Bonnema), *Bollia granulosa* Krause [Krause (16), pl. II, fig. 2 as a type, which specimen appears as a type also for the *Beyrichia granulifera* Ulrich & Bassler (11) pl. XXXVIII, fig. 7], and an unnamed new species from the Lyckholm formation of Estonia. In the genus *Uhakiella* must be placed also *Primitia* aff. *jonesi* Krause (15), pl. XXXI, fig. 6, a female individual with the typical brood-pouch; likewise probably *Primitia jonesi* Krause (16), in pl. I, fig. 14—15, and lastly, but with a great reservation, *Bollia V-scripta*.

The brood-pouch as an enlargement of the marginal border appears also in *Chilobolbina*. In *Chilobolbina dentifera* (Bonne-

ma) in Pl. VII, fig. 1 in the upper part of the brood-pouch even the primary radiate ornamentation of the marginal frill is preserved. In *Eurichilina kukersiana* (pl. I. fig. 9) the upper part of the frill is radially striated, the lower part, however, granulate like the brood-pouch of *Chilobolbina dentifera* (Bonnenma). This construction of the brood-pouch has been observed by Kummerow (8), p. 48. 49 also. However Kummerow's fig. 8, p. 49 is not *Eurichilina kukersiana* but the carapace of an *Uhakiella*. In Ulrich & Bassler (11) p. 278 is given a summary of the construction of the brood-pouches of the paleozoic ostracoda.

61. *Uhakiella coelodesma* n. sp.

Pl. III, fig. 1—3.

1889. *Bollia granulosa* Krause (16), p. 131, tab. II, fig. 1, (non pl. II, fig. 2).

1891. *Primitia* aff. *jonesii* Krause (15), pl. XXXI, fig. 6.

The difference between *Bollia granulosa* Krause and the new species (*Uhakiella coelodesma*) can be seen from Krause's paper (16). The selected type-specimen of *B. granulosa* [Pl. II, fig. 2 in

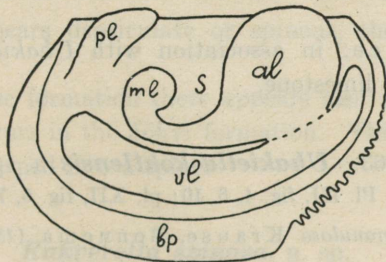


Fig. 5. Diagram of a right valve of *Uhakiella*. Pl. — posterior lobe; ml — node-like middle lobe; al — anterior lobe; s — deep median sulcus; vl — ventral lobe; bp — brood-pouch.

(16)] which is reproduced by Ulrich & Bassler (10), Pl. XXXVIII, fig. 7, as *Beyrichia granulifera*, appears more oblique (leperditoid) in outline, is shorter and taller than the other specimen of *B. granulosa* Krause [(16), pl. II, fig. 1], and than our valves from the *Caryocystites* limestone.

The holotype of *Uhakiella coelodesma* is the left valve in Pl. III, fig. 3, from a gerontic female specimen. It is 2 mm long, 1,25 mm high, the hinge-line is 1,3 mm long and is hidden by the

dorsal swelling of the anterior and posterior lobes; the sulcus is deep and open toward the hinge; the median lobe is connected with the anterior by a swelling which surrounds the lower part of the sulcus. The concentric ventral lobe is not separated from the anterior lobe, but on the ventral side it is surrounded by a low concentric groove. The brood-pouch is long and reaches to the middle of the anterior half of the valve. The surface is coarsely granulated.

In the male specimens in Pl. III, fig. 1—2 the concentric ventral lobe appears slightly separated from the anterior lobe, and the median node-like lobe is more developed.

Occurrence: not rare in the *Caryocystites* limestone ($C_1\delta$) of Estonia in all exposures.

62. *Uhakiella pumila* n. sp.

Pl. III, fig. 5.

The holotype is the reproduced specimen, 1 mm long, 0,65 mm high, with a 0,7 mm long hinge-line.

This small species is distinguished by the indistinct lobation, minute granulation, and especially by the short brood-pouch reaching to the median sulcus only. The anterior edge appears denticulate.

Occurrence: in association with *Uhakiella coelodesma* in the *Caryocystites* limestone.

63. *Uhakiella kohtlensis* n. sp.

Pl. III, fig. 4, 6, 10; pl. XII, fig. 6, 7.

1909. *Bollia granulosa* Krause, Bonnema (13) p. 63, pl. IV, fig. 12—18.

The description of this species by Bonnema is very exhaustive. *U. kohtlensis* differs from the other species by a moderately granulous surface, well developed dorsal swellings of the lobes, which form a saddle-like dorsal margin, straight or slightly concave ventral edge in the males, and a very large brood-pouch in the females. In pl. XII, fig. 6 is given a complete carapace showing the flattened ventral side, and in pl. XII, fig. 7 — a complete carapace also in dorsal view. The type is the female specimen in pl. III, fig. 9. It is 1,6 mm long, 10 mm high, has a 1,3 mm long hinge-line.

Occurrence: this species appears in the *Caryocystites* limestone and is common in the Kukruse formation.

Gen. *Rakverella* n. gen.

The genotype is *Rakverella spinosa* n. sp. from the upper Keila formation, town Rakvere, Estonia. This new genus is related to *Beyrichia* in being trilobate, but the lobes are reduced and are represented by narrow ridges only. Sulci are not developed, the

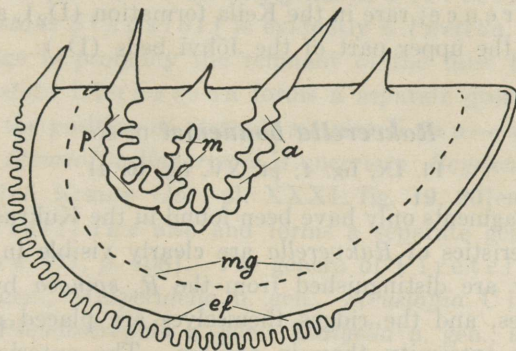


Fig. 6. *Rakverella spinosa* n. gen. n. sp. p — posterior, m — middle, and a — anterior ridge, corresponding to the lobes of a *Beyrichia*; ef — exterior denticulate part of the frill; mg — position of the ventral border of the carapace.

dorsal margin appears denticulate or spinous, the brood-pouch is missing.

In the Kukruse formation there appears also a *Rakverella*, and another species occurs in the Jõhvi formation. This last species has the middle ridge turned into a spine.

***Rakverella spinosa* n. sp.**

Pl. IX, fig. 6 and fig. 6 in the text.

The Holotype is the pictured specimen, 1,8 mm long and 1,0 mm high. The posterior edge is rounded, the anterior angle is acute, the outline appears oblique. The denticulated exterior part of the frill forms an incurved narrow band on the posterior and ventral edge. The true frill is larger (2,5 mm) but not differentiated exteriorly from the rest of the body of the valve. On the interior side the frill is well defined as a prominent ventral border. The surface of the body and most of the frill are exteriorly granulated. The exterior band of the frill, separated from the other part by a low concentric groove, appears smooth. The ridges are placed

behind the middle of the valve. On the connection of the anterior, posterior and median ridges a small sinus appears developed on the lower side. The ridges are denticulated. The posterior and anterior ridges are prolonged into the long acute main spines. Other spines are placed on the posterior dorsal angle between the main spines, and between the anterior main spine and the anterior angle.

Occurrence: rare in the Keila formation (D_2), and probably occurring in the upper part of the Jõhvi beds (D_1).

***Rakverella bonnemai* n. sp.**

Pl. IX, fig. 4; pl. XV, fig. 10, 11.

Three fragments only have been found in the Kukruse formation. The characteristics of *Rakverella* are clearly visible in these specimens. They are distinguished from the *R. spinosa* by non-denticulated ridges, and the ridges themselves are placed more toward the posterior extremity than in *spinosa*. The anterior branch of the horse-shoe shaped ridge is placed on a swelling of the valve. This swelling extends toward the anterior extremity in a more or less definite form. Other features as in *spinosa*.

Holotype is the specimen in pl. XV, fig. 11.

Occurrence: rare in the Kukruse formation.

***Piretellidae* nov. fam.**

The type of this new family of the Beyrichiacea is the new genus *Piretella* described below. Other genera are *Steusloffia* Ulrich & Bassler (10), *Rigidella* n. gen., *Pseudostrepula* n. gen. The species of all these genera Ulrich and Bassler place in the single genus *Steusloffia* (subfam. Kloedeninae, fam. Zygodolbidae). But *Steusloffia* sensu lato has not a brood-pouch (in the Zygodolbidae "brood-pouch present as an added lobe or undefined swelling along the posterior edge or on the post-ventral slope"), and in the new gen. *Piretella* appears a brood-pouch formed by the enlargement of the false border. Further all *Piretellidae* are provided with more or less developed crests in the lateral surface, have a deep median sulcus and a rounded middle node. In view of these features the *Piretella* are more related to Primitiidae than to Zygodolbidae and may be regarded as a separate branch of the Beyrichiacea.

Probably the true *Strepula* is a more advanced piretellide genus also with a very undefined lobation. A specimen of *Strepula irregularis* Jones & Holl (21), pl. VIII, fig. 7, shows a median lobe of the piretellida type.

Some species Piretellidae with the crests cannot (cf. *Pseudostrepula* n. gen.) be placed in a distinct genus of Piretellidae. The *Strepula constans* Steusloff is evidently a *Piretella*, and its submarginal ridge is probably the remnant of the false border. The *Beyrichia costata* Linnarson forms a separate group of Piretellidae; the position of *Strepula simplex* Krause which resembles a young *Steusloffia linnarssoni* is uncertain; *Beyrichia spingifera* Boll (22) [cf. Krause (15), pl. XXXI, fig. 19, 20] can be placed in the Piretellidae also and forms a separate genus [cf. also Kummerow (7), p. 408]. The genera of Piretellidae are: *Piretella* n. gen., *Hesperidella* n. gen., *Steusloffia* Ulrich and Bassler; *Pseudostrepula* n. gen.; *Ridigella* n. gen., and *Strepula* Jones et Holl.

A separate genus (*Hesperidella*) of Piretellidae is represented also in *Primitia estonica* Bonnemai. It is doubtless related to *Piretella* in having a reticulate surface, similar crests and the same position of the node and sulcus. But it is without the characteristic brood-pouch and the node is enormously developed. "*Primitia*" *estonica* is very rare in the Kukruse formation but occurs frequently in the Jõhvi stage. These species of the new genus will be described in a following paper on the ostracoda of the Jõhvi and Keila formations.

In part the crests are not only a privilege of Piretellidae and *Steusloffia*. In the upper Ordovician Jõhvi and Keila formations occurs a new ostracod with the lobation of *Tetradella* and with crests on the anterior lobe; *Ceratopsis perpunctata* n. sp. also has crests.

Gen. *Piretella* nov. gen.

The carapace appears trilobate, the anterior and posterior lobes undefined, the median lobe forms a rounded node; the sulcus is large. The crest surrounds the node and sulcus like a single curved elevated ridge. The brood-pouch is formed by the swelling of the false border, as in *Chilobolbina* and *Uhakiella*. The surface appears reti-

culate or punctate. Three species are known: 1) *Piretella acmaea* n. sp. the genotype, from the lower part of the Ordovician Lyckholm limestone of Estonia; 2) *Piretella margaritata* n. sp. from *Caryocystites* limestone and Kukruse formation; and 3) *Strepula reticulata* Krause (15) (in text p. 498 it is called *Strepula limbata* by Krause), an Ordovician species also from the glacial drift of Germany.

E. Kummerow [(8), p. 48, fig. 7.] draws a specimen of *Piretella* as a female *Steusloffia reticulata* (Krause) from the Backsteinkalk. Evidently it is a left male valve of *Piretella margaritata* and in this case the impressios of the frill regarded by him as the brood are sculpture markings only. The female is provided with a brood-pouch.

***Piretella acmaea* n. sp.**

Pl. IV, fig. 6a, 6b. and 7; pl. VII, fig. 6—9.

Holotype is the specimen in pl. VII, fig. 6—9, a female carapace. It is distinguished from the *Piretella reticulata* (Krause) [Krause (15), *Strepula reticulata* or *limbata*], by the more minute punctation, by the coarsely radiate or spinous false border, and by the spines of the anterior margin forming the continuation of the false border. Again the crest is developed along the dorsal margin also, surrounds the node and sulcus, and forms a short branch near the anterior dorsal angle of the valve. The median node is free from the crest. The true border of the valve is denticulate. In the female specimen (Pl. IV, fig. 6a, 6b, and pl. VII, fig. 6—9) the brood-pouch is formed by the swelling of the frill, appears nodulous in the lower part, and reaches toward the middle of the valve. In the male the frill appears in the posterior two-thirds of the valve; on the anterior part it is developed in the form of coarse spines (pl. IV, fig. 7).

Measurements of the holotype: length 2,5 mm, height 1,5 mm, thickness 1,1 mm; of the male pl. IV, fig. 7: l.: 2,1 mm; h.: 1,2 mm.

Occurrence: only in the lower part of the Lyckholm formation, abundant in the quarry of Moe in middle Estonia.

Derivatio nominis: from Piret, a female person in Estonian mythology; and from ἀζμαῖος abundant.

***Piretella margaritata* n. sp.**

Pl. IV, fig. 5, pl. XIV, fig. 10—11.

The holotype is the right valve in pl. IV, fig. 5. It differs from both the other species of *Piretella* in having six or seven rounded prominent granules along the dorsal border inside the area formed by the U-shaped crest. The node is in contact with the crest, and the node, sulcus and crest are placed more toward the centre of the valve than in *P. acmaea*. The sulcus is low. The specimen in pl. XIV, fig. 10 is a male and fig. 11 — a female specimen of same species. The brood-pouch is not so well developed as in *P. acmaea*.

Length 2 mm, height 1,2 mm.

Occurrence: Few specimens were found in the Kukruse formation of Kohtla, Käva and Kukruse one valve in the middle part of the *Caryocystites* limestone by the river Purtse.

Gen. *Hesperidella* n. gen.***Hesperidella estonica* (Bonnema).**

Pl. XI, fig. 14—15.

The genotype is *Primitia estonica* Bonnema (13). This genus is closely related to *Piretella*, but differs from it by the absence of the brood-pouch.

Hesperidella estonica is rare in the Kukruse formation and common in the upper Ordovician Jõhvi and Keila formations. Probably in these beds one or two other species of this genus occur.

Gen. *Steusloffia* Ulrich & Bassler.

Strepula auctorum; *Steusloffia* (as sub-genus of *Beyrichia*) Ulrich & Bassler (10); *Steusloffia* (as separate genus of *Kloedeninae*) U. & B. (11).

The type is *Strepula linarssoni* Krause (16), Pl. II, fig. 4, and 5. The most important generic features are 1) the well developed anterior and median lobes, 2) a small posterior lobe in the posterior dorsal angle, 3) one or more concentric crests and 4) a very conspicuous tubercle on the anterior lobe. The surface is coarsely granulated and a false border is present. On the internal cast the crests are not developed and the lobation suggests a relationship with *Ctenobolbina*.

The species of this genus *Steusloffia* (sensu stricto) are: 1. *Steusloffia linnarssoni* Krause in the Ordovician boulders of the drift of Germany; 2. *Steusloffia rigida* n. sp.; 3. *Steusloffia humilis* n. sp., Caryocystites-limestone; 4. *S. multimarginata* n. sp. Kukruse formation and probably *Strepula simplex* Krause.

The other species of *Steusloffia* s. lato are placed in the genus *Rigidella* nov.

Steusloffia rigida n. sp.

Pl. IV, fig. 1, 2. Pl. VII, fig. 9, 10. Pl. XII, fig. 9; fig. 7. in the text.

Holotype is the right valve in Pl. IV, fig. 1. From *Steusloffia linnarssoni* (Krause) it differs in the mode of development

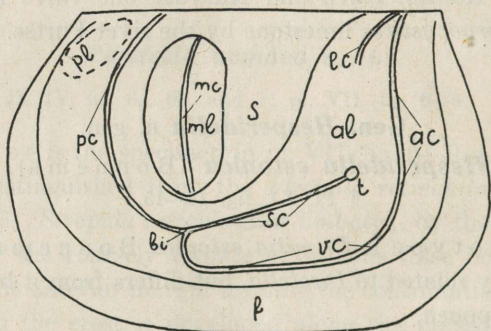


Fig. 7. *Steusloffia linnarssoni* Krause, diagram of the type specimen [Krause(16) pl. II, fig. 4.], after Krause x 20. Prof. O. Schwindewolf was so kind as to revise the original specimen which is kept in the Preussische Geologische Landesanstalt in Berlin. He compared both forms and found that *Strepula linnarssoni* differs clearly from our ostracod, especially in the position of the bifurcation of the crests (bi) and in having the node (pl) in the posterior dorsal angle more undefined; pl — posterior node; ml — median lobe or node; al — anterior lobe; s — sulcus; f — marginal frill; pc — posterior branch of the concentric crest; bi — bifurcation of the crest; vc — ventral branch of the concentric crest; ac — anterior branch of the concentric crest; sc — subcentral crest; t — spine-like tubercle as anterior end of the sub-central crest on the anterior lobe; c — median crest; lc — anterior dorsal crest.

and position of the crests. Measurements: length 2,4 mm; height 1,6 mm; the specimen in pl. VII, fig. 10 is 1,2 mm long, 0,9 mm thick.

Steusloffia rigida is related to *Steusl. linnarssoni*, but the differences of both can be seen in fig. 4 and 5 on, and in the following comparison:

Steusloffia linnarssoni

(Krause).

The bifurcation of the crest is placed below the median node.

The sub-central crest appears straight.

Dorsal marginal crest is missing.

Posterior node (pl) undefined.

St. rigida n. sp.

The bifurcation is placed more toward the posterior margin.

The sub-central crest is broken (k) and curved in its posterior part.

The dorsal marginal crest is well developed and connected with the median crest.

Posterior node well developed.

The peculiar form of *Steusloffia rigida* is given also in Pl. VII, fig. 10. This is the first known complete specimen of a *Steusloffia*. In Pl. XII, fig. 9 a valve of *Steusloffia rigida* is pictured from the ventral side. The true free margin is surrounded by a double narrow ridge; the well developed frill appears double also.

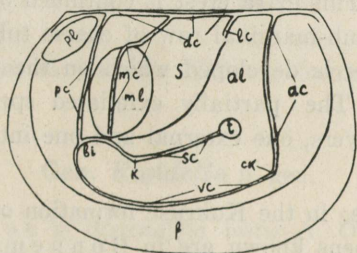


Fig. 8. *Steusloffia rigida* n. sp., diagram of the lateral face of the holo-type. k. — crack on the sub-central crest; ck — crack in the concentric crest; dc — dorsal marginal crest; rest of legend as in Fig. 7.

This species can be obtained in diverse stages of growth. The specimen in Pl. IV, fig. 2 is an ephebic valve, in which the anterior crest is not yet developed.

Steusloffia rigida occurs in the Estonian *Caryocystites* limestone and evidently in the "Backsteinkalk" of the glacial drift of North Germany. Some well preserved specimens from the "Backsteinkalk" were presented to the author by Dr. E. Kummerow.

***Steusloffia humilis* n. sp.**

Pl. IV, fig. 3.

The holotype (length 1,6 mm, height 1 mm), is the specimen in pl. IV, fig. 3. This specimen is distinguished by indistinctly developed crests, by a great median lobe in contact with the posterior curved crest, and by a prominent dorsal crest along the dorsal margin. The outline is nearly elliptical. It suggests *Strepula simplex* Krause (15), which species however has a single crest only and no spine on the anterior lobe.

Occurrence: rare in the *Caryocystites*-limestone.

***Steusloffia multimarginata* n. sp.**

Pl. IV, fig. 4; pl. XIV, fig. 1.

The specimen in Pl. IV, fig. 4 is the holotype. This species is related to *Steusloffia linnarssoni* (cf. position of the bifurcation of crests), but differs in being elliptical in outline (*S. linnarssoni* is oblique), and in having a dorsal marginal crest like *S. humilis* and *rigida*. Further, in *S. multimarginata* the node on the anterior lobe is very small, and it counts one sub-marginal crest more than the other species. This extra crest is continued on the anterior part of the valve by a sub-marginal row of coarse tubercles. A radially striated false border is developed which on the anterior part gives way to denticles. The partially exfoliated specimen in Pl. XIV, fig. 1 shows two layers, one external and one internal, of the valve substance.

Occurrence: in the Kukruse formation only, and very rare. Most of the specimens known are in Bonnema's collection from Kukruse.

Gen. *Pseudostrepula* n. gen.

Pl. IV, fig. 8, pl. VI, fig. 2, 3.

The genotype is *Strepula kukersiana* Bonnema (13), p. 48, pl. VI, fig. 16—23. From the true *Strepula* Jones & Holl this genus is distinguished by the presence of a rounded median node with a crescent-shaped sulcus in front of it. From other *Pireteliidae* *Pseudostrepula* differs in having an obscurer lobation and numerous crests beginning on the base of the sulcus. The true

Piretella-like crest around the sulcus and node is present also. A resemblance exists between *Pseudostrepula* and *Tetradella*, and Bassler (23), has placed the *Strepula kukersiana* Bonnem a in this last genus.

Strepula kukersiana Bonnem a and *Strepula kukersiana acuta* Bonnem a are the only known species of this genus. They occur in the Kukruse formation and probably in the overlying Jõhvi-formation of Estonia. Evidently a specimen of *Strepula irregularis* [Jones & Holl (21), p. 405, pl. XIII, fig. 7.] has the median lobe and crests nearly in the same position as *Pseudostrepula kukersiana*, and can be placed also in our new genus.

***Pseudostrepula cristata* n. sp.**

Pl. XII, fig. 4.

The holotype is the pictured specimen, 1,05 mm long and 0,5 mm high.

In shape and size this species is similar to *Pseudostrepula kukersiana* (Bonnem a), but differs in having a vertical crest on the node and the crests behind the node are replaced by rows of granules.

Occurrence: rare in the Kukruse formation.

Gen. *Rigidella* n. gen.

The genotype is *Steusloffia mitis* A. Ö. (1), p. 11, pl. I, fig. 5, from the lower Ordovician *Megalaspis* limestone of Estonia.

This genus consists of species with a beyrichioid trilobate valve without a spine on the anterior lobe and with well developed crests especially on the border of the anterior lobe. *Rigidella* is for the most part a lower Ordovician genus and is not represented in the *Caryocystites*-limestone and Kukruse formation. The species of *Rigidella* are: *Steusloffia mitis* A. Ö.; *Strepula lineata granulosa* Steusloff.; *Strepula lineata separata* Steusloff.; *Beyrichia erratica* Krause (16), (Pl. II, fig. 8 only); *Beyrichia erratica acuta* Krause; *Strepula beyrichioides* Jones & Holl; and, probably, *Strepula lineata* Krause (16), Pl. II, fig. 3.

Fam. **Zygobolbidae** Ulrich & Bassler.Subfam. **Drepanellinae** U. & B.Gen. **Drepanella** Ulrich.***Drepanella europaea*** n. sp.

Pl. III, fig. 11a—12d, pl. VIII, fig. 10a, 10b and 11, Pl. XII, fig. 2—3.

The holotype is the specimen in Pl. III, fig. 12a—12d from the *Caryocystites*-limestone of the South Lighthouse at Tallinn. The measurements of the holotype are: length 1,7 mm; height 1,1 mm; thickness 1,1 mm. The hinge is 0,1 mm long.

Drepanella europaea is evidently the first known species of this genus in the predevonian formation of Europe. It suggests some relation to *Drepanella crassinoda* Ulrich. But *Drepanella europaea* is more inflat, has a well developed false border, a very narrow and conspicuous sickle-shaped marginal ridge, and differs also in size, position and the form of the lateral nodes. The posterior lobe (cf. Pl. VIII, fig. 11) of *D. europaea* is crescent-like, the middle node is very conspicuous and rounded, the upper anterior node is very small. The lower anterior node, oblong in form and oblique in position, corresponds to the same node of *Drepanella crassinoda*. Near the anterior dorsal angle is placed also a small additional node, probably a prolongation of the concentric ridge. The ventral side of the *D. europaea* appears bicanaliculate, the margins of both valves are formed by lip-like crenelated thickenings, unequal in size. The outline is sub-elliptical-oblique, the horizontal section is piriform.

A young specimen is given in pl. VII, fig. 10a—10b. Its ventral side corresponds to the ventral side of the specimen in pl. III. On the lateral face only the concentric ridge and the rounded median lobe are developed. The other lobes are not yet developed. The median sulcus is present. This specimen suggests a *Primitia*, *Ctenobolbina* or a *Steusloffia* without crests.

Drepanella europaea is a species with no constant outlines. In Pl. XII, fig. 2 and 3, are given two specimens representing the limits of the variation of this species.

Occurrence: *Drepanella europaea* is a common fossil of the *Caryocystites* limestone. In the Kukruse-formation a single specimen only was found. (Pl. II, fig. 11a—11b.)

Superfam. **Cypridacea.**

In the *Caryocystites* beds and in the Kukruse formation the species of *Cytherellina* described by Bonnem a frequently occur. Several small *Cypridacea* of different structures are found in these strata also, but only the two following ostracoda show sufficient characteristics for a more or less exact determination. The first, described here as *Bairdia* (sensu lato) *micra*, is a more common species, and the second, *Pullvillites triangulum*, appears very rarely.

Bairdia (sensu lato) ***micra*** n. sp.

Pl. XIII, fig. 27—29.

H o l o t y p e is the specimen in pl. XIII, fig. 27, 1,8 mm long.

This specimen has a smooth surface and differs in the straight hinge-line, concave ventral margin, and in an indistinct overlap of the valves along the ventral margin.

The generic position cannot be determined; evidently it is a representative of a genus of *Bairdiidae* not yet described. Therefore this species is placed here provisionally under the genus *Bairdia*, from which it is nevertheless distinguished by rounded extremities and by the indistinct overlap of the valves.

O c c u r r e n c e: Kukruse formation.

Pullvillites triangulum n. gen. n. sp.

Pl. XIII, fig. 25, 26.

H o l o t y p e is the pictured specimen 0,7 mm long, 0,45 mm high, 0,3 mm thick.

This genus differs from other *Cypridacea* in the sub-triangular outline, long but slightly convex dorsal margin, acuminate ventral border, and in the symmetrical shape in lateral view. The valves overlap moderately along the dorsal margin and the middle ventral border.

Two species are known: 1) *P. triangulum* n. gen., the genotype, rare in the Kukruse formation and 2) *Bursulella rostrata* [Krause (15), pl. XXXIII, fig. 10]. This species differs from the *triangulum* in having a short ventral spine on the ventral extremity of the overlapping valve and in having a slightly concave

dorsal margin. The differences between a true *Bursulella* [genotype *Bursulella triangularis* Jones, selected by Ulrich and Bassler (11)], and the *B. rostrata* (Krause) are so great that a comparison of them appears to be unnecessary.

***Ostracodorum* ? sp.**

Pl. IV, fig. 12.

The small, bulbous, trilobate, bisulcate and smooth valves of this fossil occur in the Kukruse formation in all localities. It resembles the cranidium of a trilobite larva. The ostracod nature of this fossil is not certain, because a complete carapace with jointed valves has not been found hitherto.

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Explanation of the plates.

All the specimens are kept in the Geological Museum of the University of Tartu; and all except pl. II, fig. 3 were prepared by the author. The photographs, except Pl. VI, Pl. VII, fig. 4 and 5, pl. VIII, fig. 16, pl. X, fig. 3, 17, pl. XI, fig. 12, 15, 17, pl. XII, fig. 1, pl. XIII, fig. 10 and pl. XIV, fig. 8, 14 are magnified 20 diam.

I.

- 1a—1b. *Primitia undulosa* n. sp., lateral and dorsal view of the holotype. Same specimen pl. VI, fig. 1a—1b. State quarries of Kohtla-Järve, Kukruse formation.
- 2a—2b. and 3. *Haploprimitia kogermani* n. sp. 2a—2b holotype, a complete carapace from the oil shale quarries of "Eesti kiviõli A/S" at Salla. 3 — a complete specimen also from the State Oil Shale quarries at Kohtla-Järve. Kukruse formation.
4. *Primitiella indistincta* n. sp., holotype, a complete carapace from "Eesti Kiviõli" at Salla. Kukruse formation.
- 5a—5c. *Euprimitia bilabrata* n. sp. lateral, dorsal and ventral view of the holotype. Kohtla-Järve, Kukruse formation.
6. *Euprimitia* cf. *bilabrata*, from Kohtla Järve, Kukruse formation.
- 7a, 7b and 8. *Macronotella bonnemai* n. sp. 7a—7b. — Holotype. „Eesti Kiviõli“ Quarries at Salla. 7b shows the canaliculate ventral margin. 8 — a specimen (right valve) from the State quarries at Kohtla-Järve. The dark piriform muscle-spot, the dark stripe between this spot and the dorsal edge, and the punctation are visible. Kukruse formation.
9. *Eurychilina kukersiana* (Bonnema), from the *Caryocystites* beds by the river Uhaku, bed No. 6 in section Fig. 1 in text.
10. *Apatochilina ubjaënsis* n. sp., holotype, from the Oil Shale Quarries at Ubja. Kukruse formation.
- 11—14. *Leperditella semen* n. sp., *Caryocystites*-beds. 11a—11b — the holotype; all specimens from bed No. 8 at Uhaku (section in fig. 1, in text).

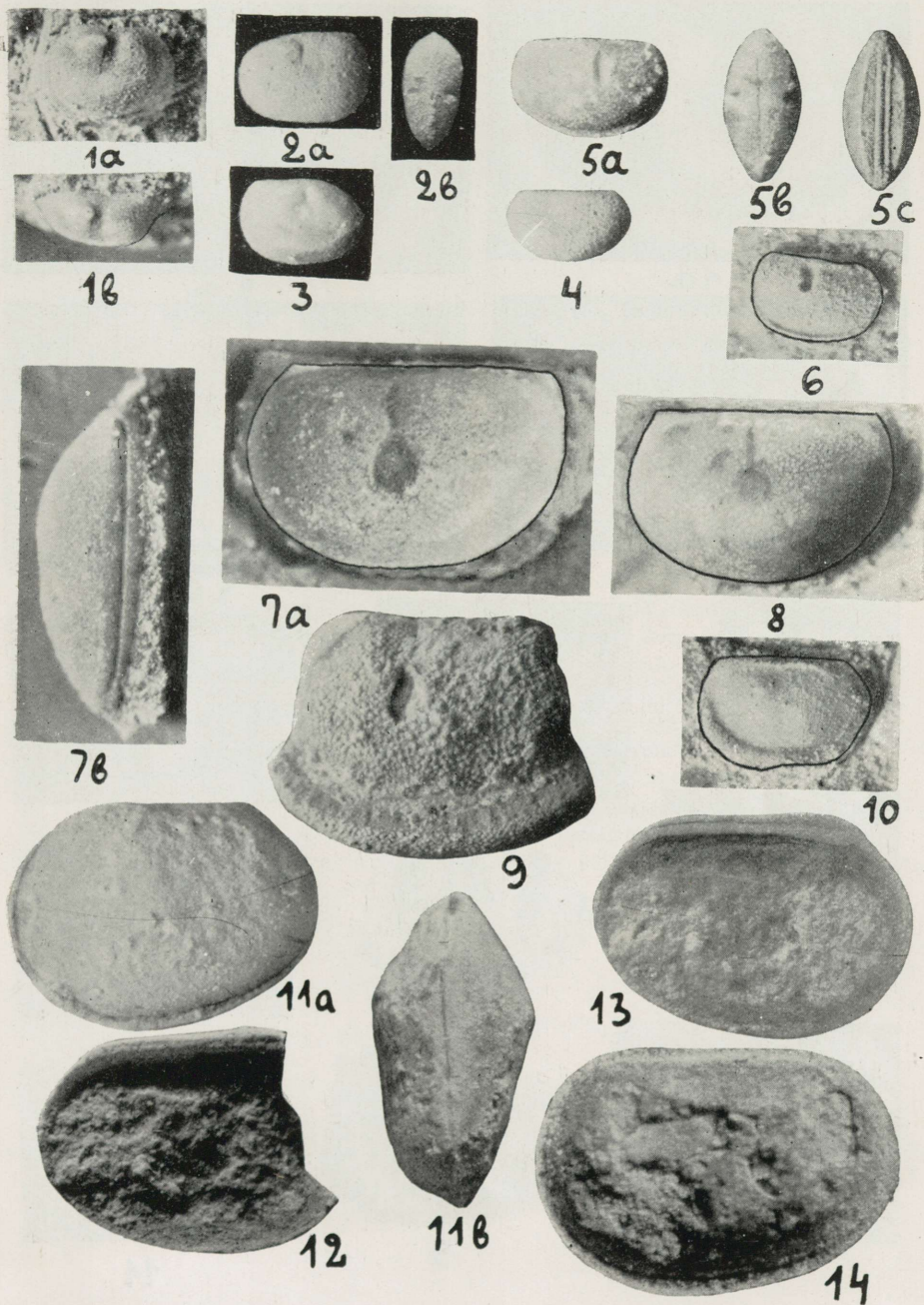
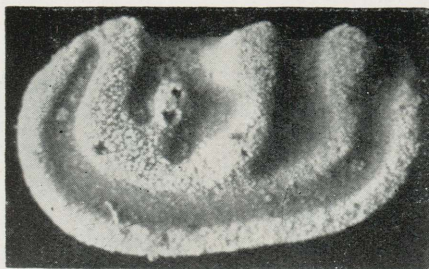
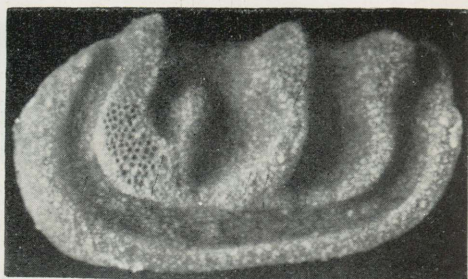


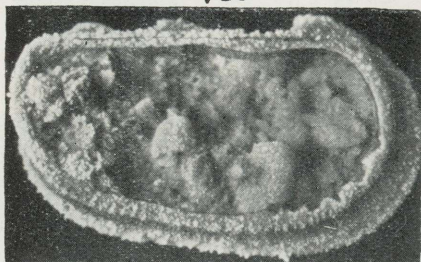
Plate II.



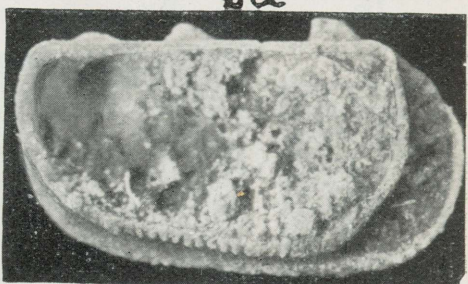
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2a



1b



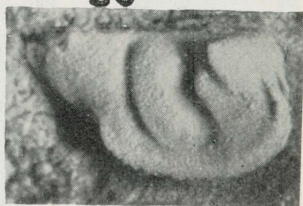
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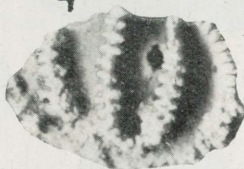
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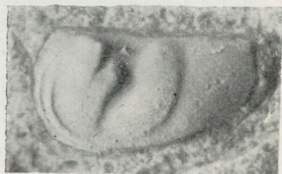
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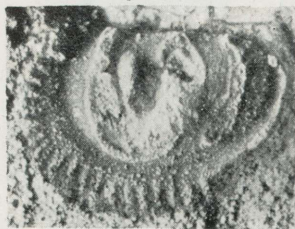
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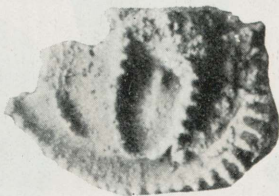
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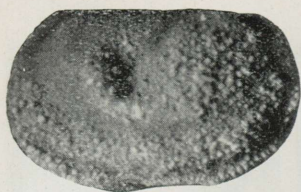
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II.

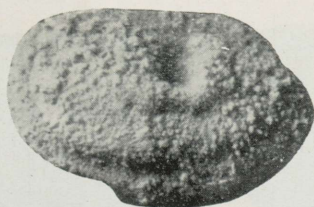
- 1a—1b, 2a—2b. *Tallinnella dimorpha*, n. gen. n. sp. *Caryocystites* beds. 1a, b. — right valve of a male specimen from bed C no. 6 (section fig. 1), at Uhaku. 2a—2b — holotype, a right female valve, bed No. 5, middle part (section fig. 1). The reticulation of the lower half of the posterior lobe is visible.
3. *Ceratopsis obliquejugata* (Fr. Schmidt), the lectotype. Kukruse formation, Vanamõisa. Coll. of the Naturalists' Society at the Univ. of Tartu.
4. *Ceratopsis obliquejugata* (Fr. Schmidt), an old female from the State Oil Shale Quarries at Kohtla-Järve. Kukruse formation.
5. *Ceratopsis rostrata cornuta* (Krause), a left female valve. Kohtla-Järve, Kukruse formation.
- 6—7. *Ceratopsis platyceras* n. sp. Holotype is the female specimen fig. 6. Fig. 7 — a male valve. Kohtla-Järve, Kukruse formation.
- 8—11. *Tetradella perornata* n. sp., Kukruse formation. 8 and 9 are two left valves with the ornamentation of the ridges preserved. Both from Kohtla-Järve. 10 — a complete, partially exfoliated right valve from Salla. Fig. 11 — the holotype, a right valve from State quarries at Käva.

III.

- 1—3. *Uhakiella coelodesma* n. gen. n. sp., *Caryocystites* beds from the river Purtse, bed No. 5 (cf. textfig. 1) 1. and 2—two male right valves; 3 — the holotype, a gerontic left female valve.
4. *Uhakiella kohtlensis* n. sp., a left female valve from the inner side showing the construction of the brood-pouch. *Caryocystites* beds from the river Purtse, bed No. 5.
5. *Uhakiella pumila* n. sp., the holotype, a left female valve. *Caryocystites* beds (bed No. 5) from the river Purtse.
- 6—10. *Uhakiella kohtlensis* n. sp. 6 — from *Caryocystites* beds (bed No. 5) from the river Purtse; the rest from the Kukruse formation. 7—9 from Kohtla-Järve; 9 — a female valve, the holotype; 10 — a female valve.
- 11a—11b. *Drepanella europaea*, a left valve from the Kukruse formation, Kohtla-Järve.
- 12a—12d *Drepanella europaea* n. sp., the holotype; *Caryocystites* beds from the quarries near the South Lighthouse of Tallinn. Lateral, ventral, dorsal and posterior view of a complete carapace.



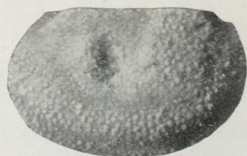
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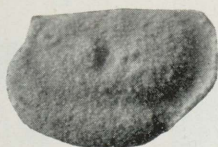
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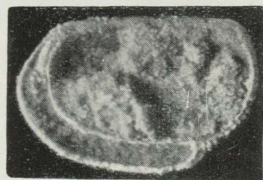
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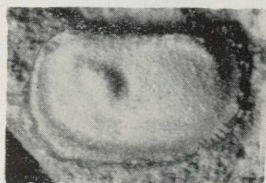
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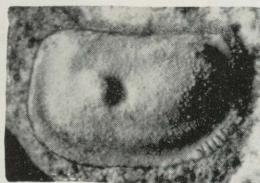
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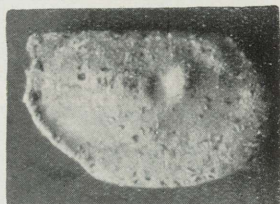
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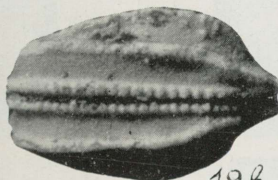
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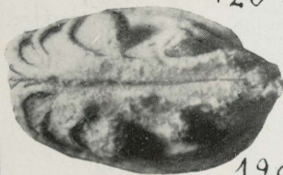
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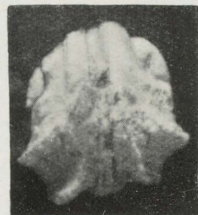
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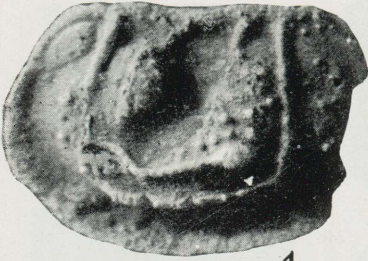
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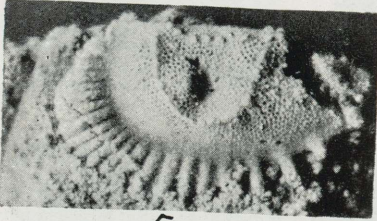
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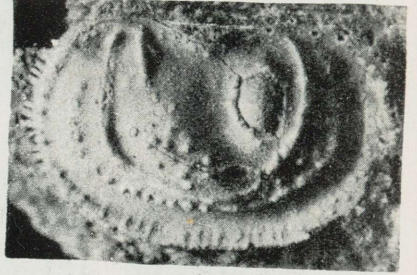
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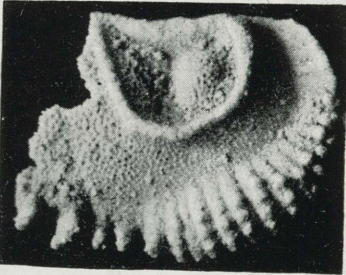
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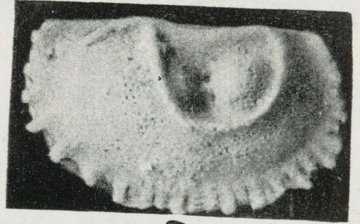
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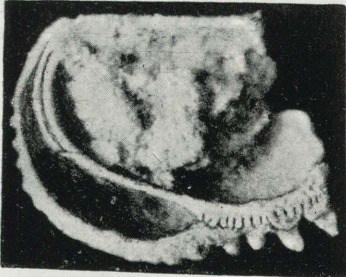
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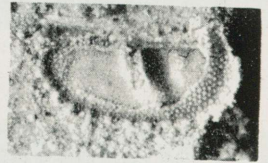
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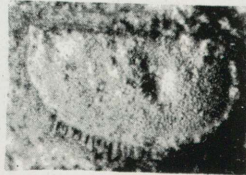
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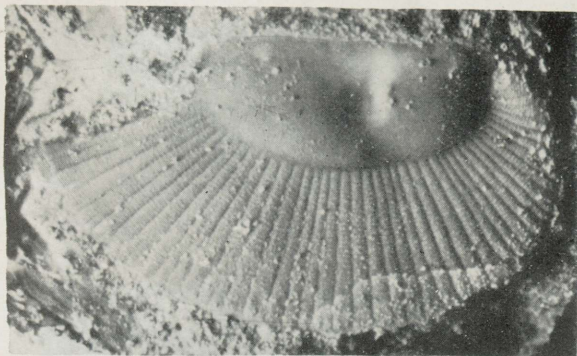
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IV.

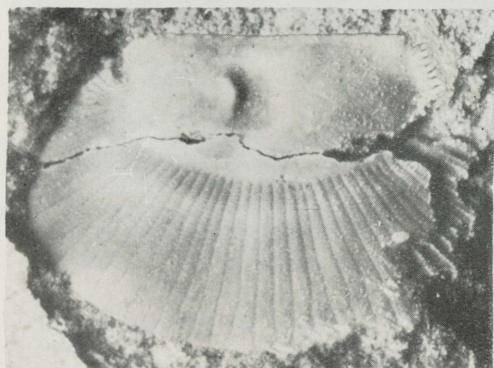
- 1—2. *Steusloffia rigida* n. sp. from the *Caryocystites* beds. 1 — the holotype, a right valve. Uhaku bed No. 6 (cf. fig. 1, in the text); 2 — a right valve from a young specimen, upper part of bed No. 2, by the river Purtsse. Same species in pl. VII, fig. 10. Cf. fig. 8 in the text also.
3. *Steusloffia humilis* n. sp., holotype, *Caryocystites* beds, No. 2 by the river Purtsse.
4. *Steusloffia multimarginata* n. sp., the holotype; Kukruse formation, Kohtla Järve.
5. *Piretella margaritata* n. sp., the holotype; Kukruse formation, Kohtla Järve.
- 6a, 6b, 7. *Piretella acmaea* n. sp., Lyckholm formation (upper Ordovician) of Moe. 6a, 6b — a female valve, 7 — a male. Same species in pl. VII, fig. 6—9. This species does not occur in the Kukruse formation or *Caryocystites* limestone, but occurs in the Lyckholm formation only. It is described here as the type of the new genus *Piretella*.
8. *Pseudostrepula kukersiana* (Bonnema), n. gen. Kukruse formation, Kohtla-Järve. Compare also Pl. VI, fig. 2.
9. *Tetradella* ? *pectinata* n. sp., Kukruse formation, Salla. Compare pl. VII, fig. 5 also.
- 10—11. *Ctenobolbina dukhbergi* n. sp., Kukruse formation. 11 — the holotype, from Kohtla Järve (same specimen in pl. VI, fig. 5); 10 — from Salla.
12. *Ostracodorum* ? sp. Kukruse formation, Kohtla Järve.

V.

- 1—4. *Biflabellum tenerum* A. Ö., Kukruse formation. 1 and 3 from Kohtla Järve, 2 and 4, from Salla, Fig. 1, is the holotype; 3 — a female valve (right); 4 — exfoliated complete specimen showing the ventral and lateral sides.
5. *Biflabellum reticulatum* n. sp., the holotype; Kukruse formation, Salla.
6. *Biflabellum crista* n. sp., the holotype. Kukruse formation, Kohtla Järve. Besides the middle node, the dark muscle spot is visible on the bottom of the sulcus.
7. *Biflabellum acutum* n. sp., the holotype. Kukruse formation, Kohtla Järve.
8. *Biflabellum flabelliferum* (Krause), a specimen from the Porkuni formation of Porkuni. Pictured for comparison with species of the Kukruse formation.
9. *Polyceratella tetraceras* n. sp., the holotype. *Caryocystites* beds of the quarries near the South Lighthouse of Tallinn.



1



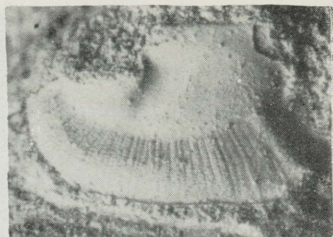
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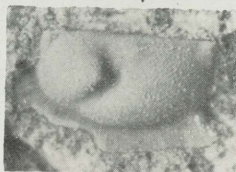
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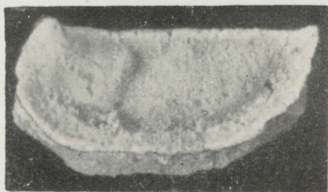
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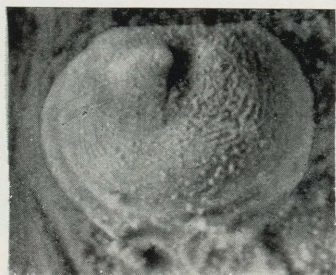
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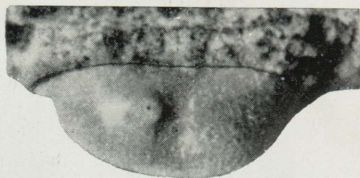
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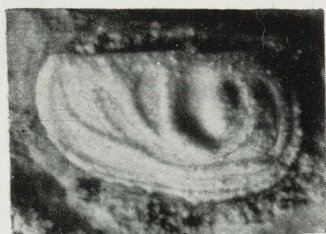
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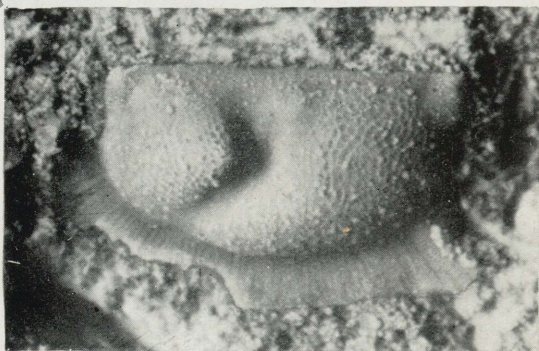
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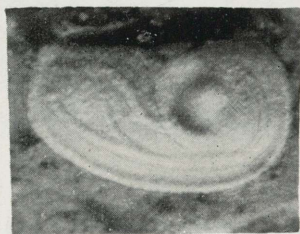
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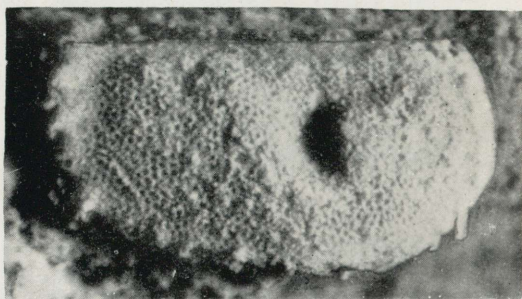
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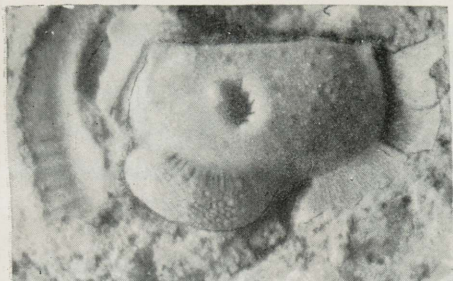
VI.

All magn. 40 diam.

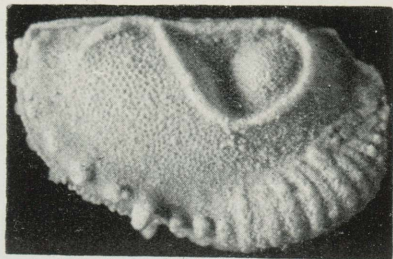
- 1a—1b. *Primitia undulosa* n. sp., same specimen in Pl. I, fig. 1a—1b.
- 2—3. *Pseudostrepula kukersiana* (Bonnema), from the Kukruse formation, Kohtla Järve. Same specimen as fig. 2 is given in Pl. IV, fig. 8.
4. *Biflabellum reticulatum* n. sp., same specimen as pl. V, fig. 5. The reticulate surface ornamentation is clearly visible.
5. *Ctenobolbina duhmbergi* n. sp., the same specimen as fig. 10, pl. IV.

VII.

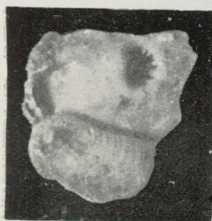
- 1—3. *Chilobolbina dentifera* (Bon n e m a), Kukruse formation; Kohtla Järve. The specimen in fig. 2 and 3 shows the construction of the brood-pouch. Magn. 20 diam.
- 4—5. *Tetradella ? pectinata* n. sp., magn. 37 diam., Kukruse formation. 4 — the holotype, from Kohtla Järve. 5 — same specimen as in pl. IV, fig. 9.
- 6—9. *Piretella acmaea* n. gen., n. sp., the holotype, left lateral, dorsal and ventral view. Upper ordovician Lyckholm formation at Moe. Same species in the pl. IV, Fig. 6a—7. $\times 20$.
10. *Steusloffia rigida* n. sp., a complete carapace, dorsal view. Magn. 20 diam. *Caryocystites* beds of the quarries near the South Lighthouse of Tallinn; compare also pl. IV, fig. 1—2.



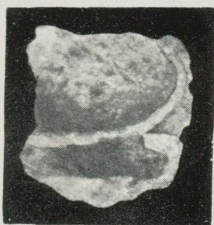
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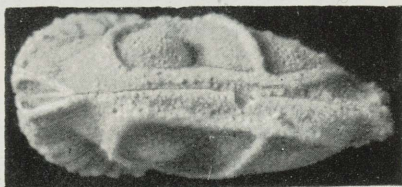
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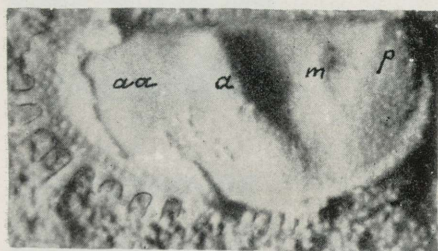
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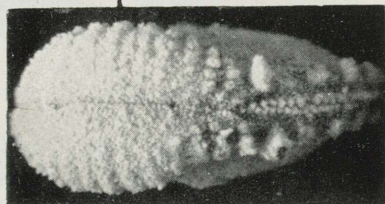
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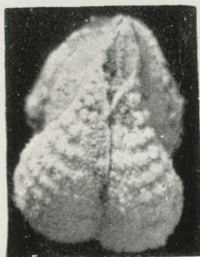
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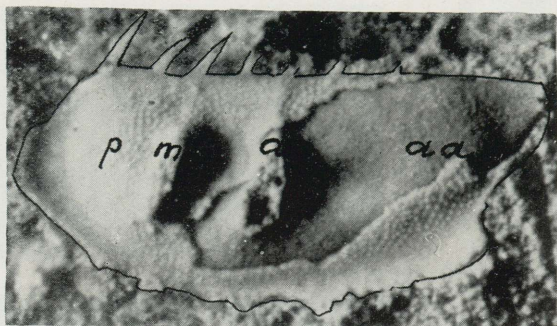
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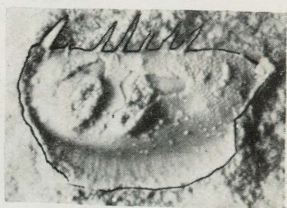
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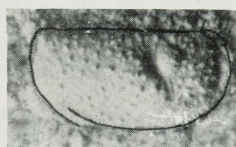
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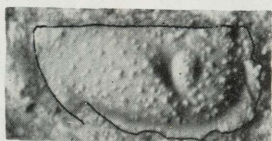
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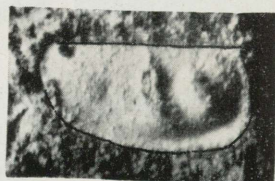
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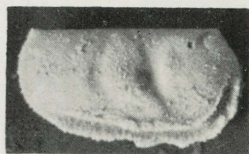
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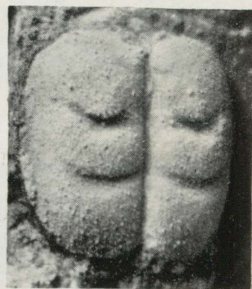
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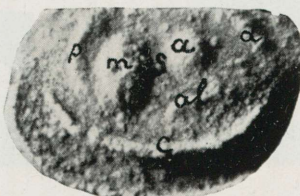
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10b



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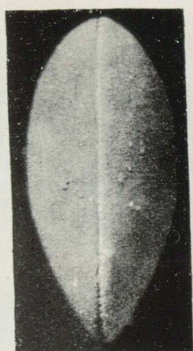
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VIII.

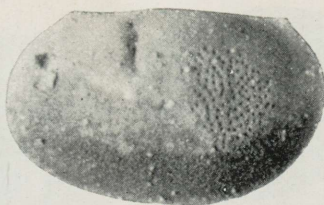
- 1a—3. *Ctenonotella elongata* n. gen. n. sp., fig. 1a—1b and 2 from the quarries of "Eesti Kiviõli" at Salla; fig. 3 — Kohtla Järve. Fig. 1b is magn. $\times 40$, it is the same specimen, as in fig. 1a. p — posterior, m — middle, a — and aa — anterior lobes [cf. Ulrich & Bassler (11), p. 184, fig. 12a (3, 7, 8)]. Fig. 2 is the holotype.
- 4—5. *Ctenobolbina aspera* n. sp., Kukruse formation, Kohtla Järve. Fig. 5, a female valve, is the holotype. Cf. also pl. XI, fig. 10. Fig. 4 shows a narrow ridge on the bottom of the sulcus.
6. *Ctenobolbina ? octispina* n. sp., from "E. Kiviõli", Salla. Cf. pl. XI, fig. 16, 17. Kukruse formation.
7. *Ctenobolbina polytropis* n. sp., holotype. Uhaku form, Tallinn, limestone quarry on the South Lighthouse. Cf. fig. 4 in the text.
- 8—9. *Ctenobolbina carinata estona* n. var., Kohtla-Järve. Fig. 8 — the holotype a complete female carapace; fig. 9 — a complete male.
- 11a—11b and 11. *Drepanella europaea* n. sp., two specimens from the Uhaku form. limestone quarries near the South Lighthouse at Tallinn. Fig. 10a—10b — a young specimen with less developed surface lobes. In fig. 11 p. — is the posterior, m — median, a — the anterior, d upper anterior al — lower anterior node, and c — marginal ridge; s — median sulcus. Cf. also pl. III, fig. 11—12, pl. XII, fig. 2—3.
12. *Primitia alata* n. sp., holotype, *Caryocystites* bed (= Uhaku form.), limestone quarry near the South Lighthouse at Tallinn; cf. fig. 2 in the text.

IX.

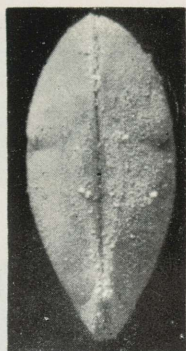
1. *Conchoprimitia tolli integra* n. var., holotype. Kukruse form., Kohtla-Järve.
- 2a—2c. *Conchoprimitia tolli* (Bönnema), a complete specimen. Kohtla-Järve, Kukruse formation. Cf. also pl. XII, fig. 1.
- 3a—3c. *Conchoprimitia tallinnensis* n. sp., holotype. *Caryocystites* — beds (= Uhaku form.), limestone quarry at the South Lighthouse near Tallinn.
4. *Rakverella* sp., a fragment from the Kukruse form., Kohtla-Järve.
5. *Tetradella* ? sp. aff. *pectinata*. a fragment from Kohtla-Järve C₂.
6. *Rakverella spinosa* n. gen. n. sp., the holotype. Keila form., town Rakvere.



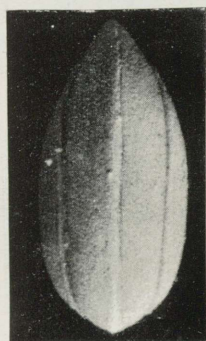
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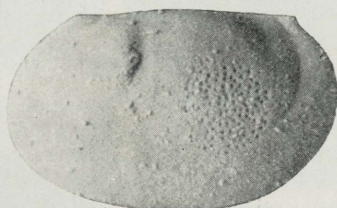
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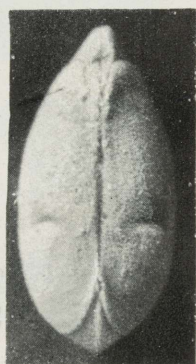
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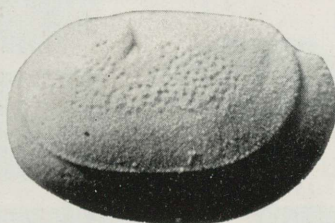
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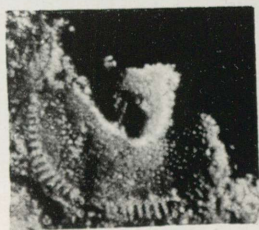
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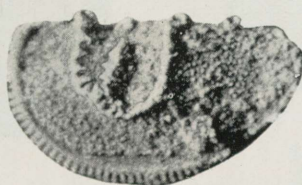
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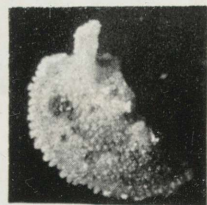
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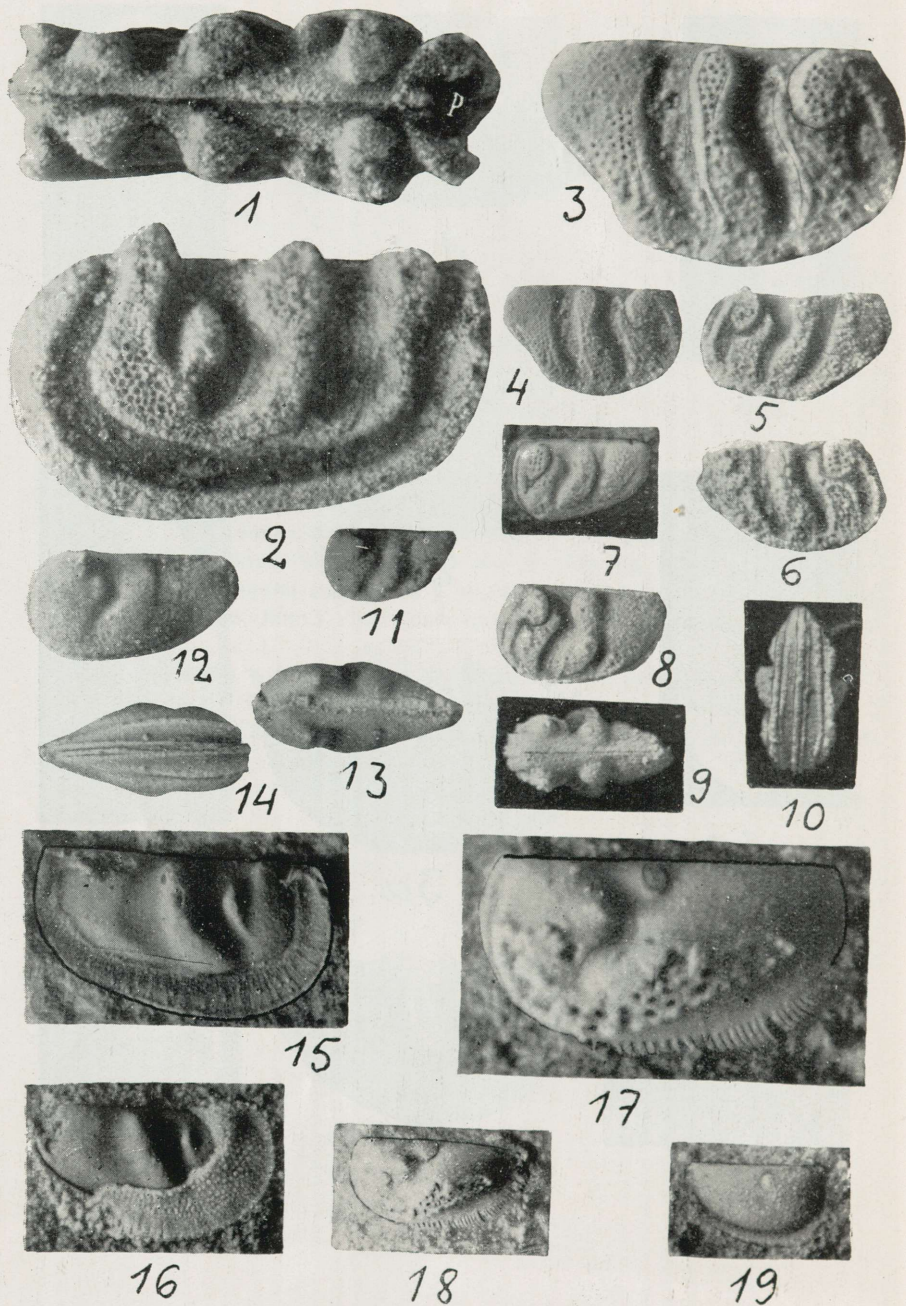


6



5

Plate X.

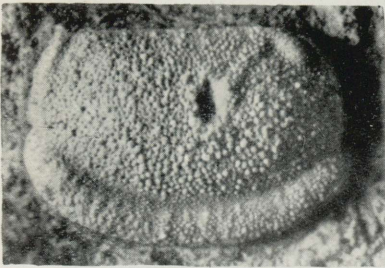


X.

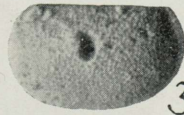
- 1—2. *Tallinnella dimorpha* n. gen. n. sp., a complete female specimen from the *Caryocystites* bed (Uhaku form.), river Purtse, bed 5. Fig. 1, dorsal view; fig. 2 at the left; the distorted brood-pouch („P“) is visible. Cf. also pl. II, fig. 1—2.
- 3—6. *Ceratopsis perpunctata* n. sp. Fig. 3—4, — the holotype (fig. 3 magn. $\times 40$), from Uhaku, Uhaku form. bed 5. Fig. 5 and 6. A right and left valve from the quarry at the South Lighthouse, Tallinn.
7. *Ceratopsis perpunctata* var. *a* (sine nomine), Kukruse form. Kohtla-Järve.
- 8—10. *Ceratopsis perpunctata prominens* n. var., holotype. Uhaku form. (= *Caryocystites* b.), Uhaku.
11. *Ceratopsis* sp. aff. *cornuta rostrata* Krause. Kukruse formation., Kohtla-Järve.
- 12.—14. *Ceratopsis platyceras* n. sp., complete specimen, Kukruse form., Kohtla-Järve. Cf. also pl. II, fig. 6—7.
15. *Tetradella* ? *dubitabilis* n. sp., holotype. Kukruse form., Kohtla-Järve.
16. *Tetradella pectinata* n. sp., Kukruse form., Kohtla-Järve. Cf. also pl. IV, fig. 9. and pl. VII, fig. 4—5.
- 17.—18. *Ctenobolbina ctenolopha* n. sp., holotype. Kukruse form., Kohtla-Järve. Fig. 17 is the same as fig. 18, but magn. $\times 40$.
19. *Primitia* ? *extraria*. n. sp., holotype. Kukruse form., Kohtla-Järve.

XI.

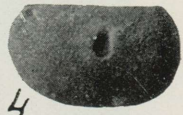
- 1—6. *Eurychilina kukersiana* (Bonnema). Fig. 1 — a well preserved female valve, Kukruse form., Kohtla; 2 — a valve with different position of the pit 3—6. A complete valve with the frill broken. Fig. 2—6 — two specimens from the *Caryocystites* bed (Uhaku-form), quarry near the South Lighthouse at Tallinn. Cf. also pl. I, fig. 9.
7. *Eurychilina* sp. a. aff. *kukersiana*; Kukruse form., Kohtla-Järve.
8. *Conchoprimitia deminuta* n. sp. holotype. Kukruse form., Kohtla-Järve.
9. *Biflabellum reticulatum* n. sp., a female valve. Kukruse form., Kohtla-Järve. Cf. also pl. V, fig. 5 and pl. VI, fig. 4.
10. *Ctenobolbina aspera* n. sp., Kukruse form., Kohtla-Järve. Cf. pl. VII, fig. 4—5.
11. *Ctenobolbina variolaris* (Bonnema), the type specimen, coll. Bonnema. Kukruse. form. Kukruse.
- 12—13. *Laccoprimitia mitis* n. sp., holotype (fig. 12 magn. $\times 40$). Kukruse form., Kohtla-Järve.
- 14—15. *Hesperidella estonica*, (Bonnema), n. gen. a specimen from the Kukruse form., Kohtla-Järve. Fig. 15 is magn. $\times 40$.
- 16—17. *Ctenobolbina* ? *octispina* n. sp., holotype. Kukruse form., Kukruse. This is the original specimen of the *Entomis quadrispina* Kr., of Bonnema. Cf. also pl. VIII, fig. 6.



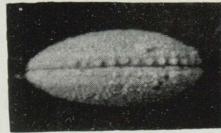
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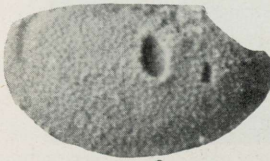
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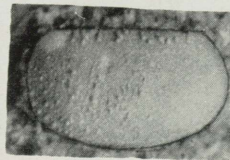
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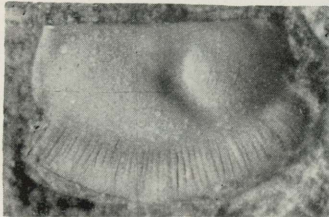
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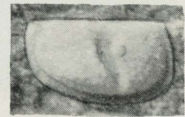
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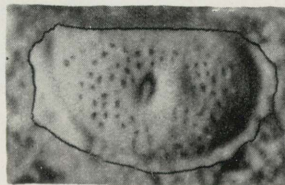
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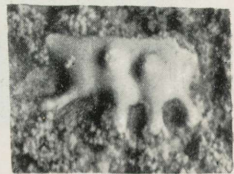
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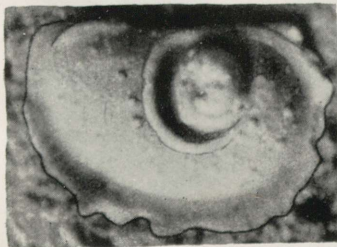
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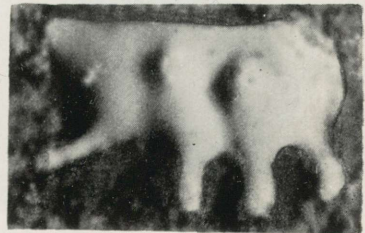
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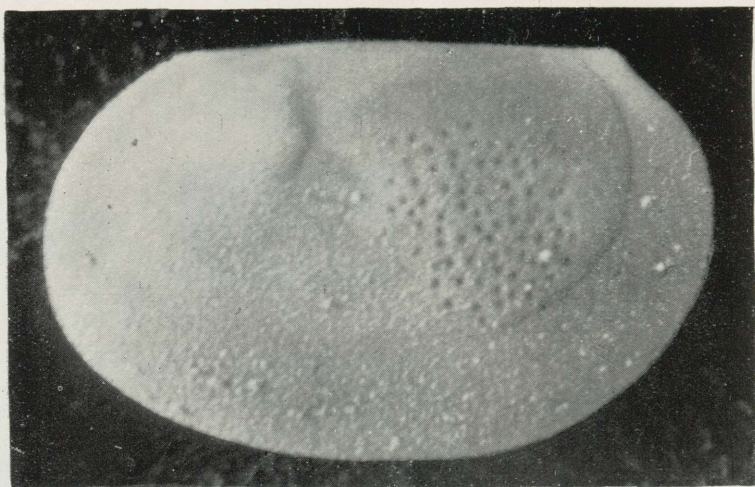
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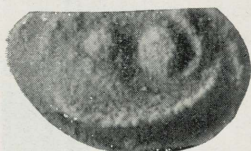
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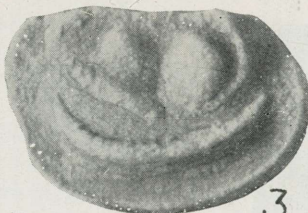
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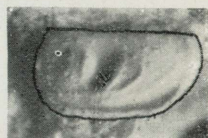
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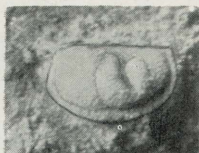
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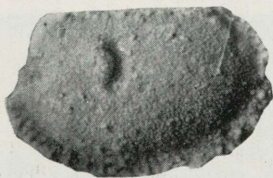
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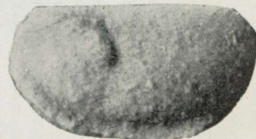
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9



10



11

XII.

1. *Conchoprimitia tolli* (Bonnema), the type specimen, coll. Bonnema. Indistinct waved sculpture appears at the left of the punctate field. Magn. x 41. Same specimen in pl. IX, fig. 2a.
- 2—3. *Drepanella europaea*, n. sp., river Purtse, *Caryocystites*-bed (Uhaku form., bed 6. Cf. also pl. III, fig. 11—12. and pl. VIII, 10—11.
4. *Pseudostrepula cristata* n. sp., holotype, Kukruse form., Kohtla-Järve.
5. *Ctenobolbina* ? *minor mitis* n. var., holotype. Kukruse form., Kohtla-Järve.
- 6—7. *Uhakiella kohtlensis* n. sp., two specimens, one from the ventral and another from the dorsal side. *Caryocystites* bed. Fig. 6 — from the river Purtse, bed 5, and fig. 7. — from Uhaku bed 6.
8. *Eurychilina decumana* (Bonnema). *Caryocystites* bed, limestone quarry near the South Lighthouse, Tallinn.
9. *Steusloffia rigida* n. sp., a right valve from the ventral side. *Caryocystites*-bed, river Purtse, bed 5. Cf. also pl. IV, fig. 1 and pl. VII, fig. 10.
- 10—11. *Euprimitia* ? sp. *a* (sine nomine). *Caryocystites* bed, Uhaku, bed. 5.

XIII.

- 1—2. *Primitia* ? *eutropis* n. sp., *Caryocystites* bed (Uhaku form.). Fig. 1 — river Uhaku, bed 8; fig. 2 — the holotype, river Purtse, bed. 5.
- 3—5. *Primitella pulex* n. sp., Kohtla-Järve, Kukruse form. The specimen fig. 3 and 4 is the holotype.
- 6—9. *Primitella granosa* n. sp., Kohtla-Järve. Holotype is the specimen fig. 6.
- 10—12. *Conchoprimitia* ? *inusitata* n. ap. The holotype is the specimen fig. 10—11. Fig. 10 is magn. near $\times 40$. The specimen fig. 10—11 is from the State Oil Shale quarry Käva, near Kohtla-Järve; specimen fig. 12 — from Kohtla-Järve Kukruse formation.
- 13—14. *Euprimitia plena* n. sp., the holotype Kukruse form., oil shale quarry. Eesti Kiviõli.
- 15—17. *Leperditella gutta* n. sp., holotype. *Caryocystites* bed, limestone quarry near the South Lighthouse at Tallinn.
- 18—19. *Leperditella lenticula* n. sp., the holotype. Kukruse form. Kohtla-Järve.
- 20—21. and 22—23. *Haploprimitia inconstans* n. sp., two specimens. Fig. 22—23, from river Purtse, bed 2 is the holotype. Fig. 20—21 -river Uhaku, bed 8. *Caryocystites* bed.
24. *Schmidtella* sp., *Caryocystites* bed, river Purtse.
- 25—26. *Pulvillites triangulum* n. gen. n. sp., holotype, Kukruse form., Kohtla Järve.
27. 29. *Bairdia* (sensu lato) *micra* n. sp. Kukruse form, Kohtla Järve. Specimen fig. 27 is the holotype. Fig. 28—29 is a second, smaller specimen.
30. *Haploprimitia kogermani* n. sp. a different specimen, Kohtla Järve. Cf. also pl. I, fig. 2—3.



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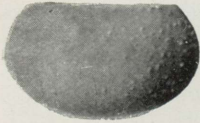
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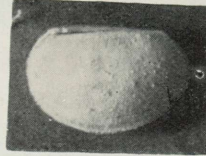
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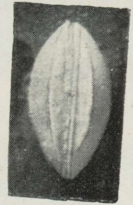
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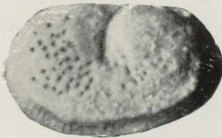
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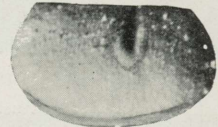
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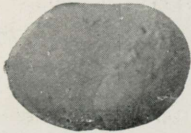
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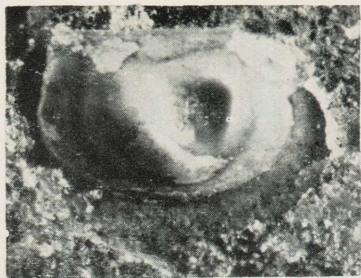


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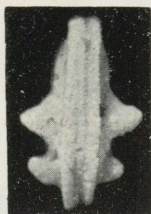


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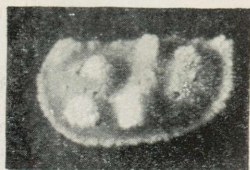
Plate XIV.



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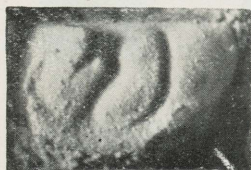
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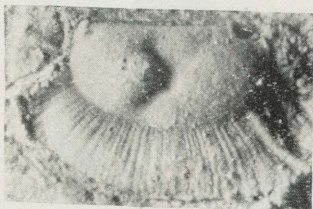
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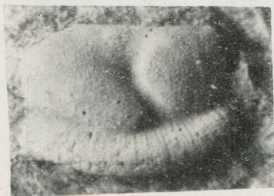
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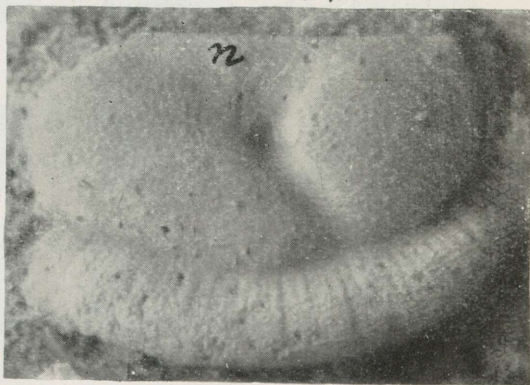
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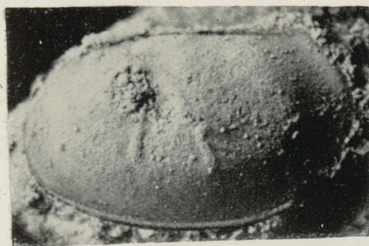
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XIV.

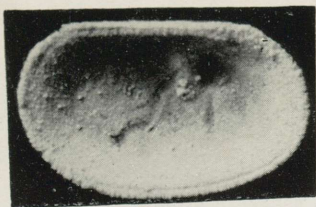
1. *Steusloffia multimarginata* n. sp. Kukruse form., Kukruse, coll. Bonnema. Partially exfoliated specimen showing two layers of the valve substance. Cf. pl. IV. fig. 4.
- 2—3. *Kiesowia pernodosa* n. sp., holotype. Complete specimen from the Uhaku beds, quarry near the Soth Lighthouse, Tallinn.
4. *Beyrichia* ? sp., Kukruse, coll. Bonnema.
5. *Ceratopsis platyceras* n. sp. A specimen (right valve of a female) with undefined granulation. Kukruse form., Kukruse, coll. Bonnema.
6. *Ceratopsis obliquejugata* (Fr. Schmidt). A left valve of a female specimen with an unusually flattened horn-shaped process. Kukruse form., coll. Bonnema.
- 7—8. *Kiesowia margaritata* n. sp. Fig. 8 magn. 50 diam. Holotype, a left valve. Kukruse form., Kukruse, coll. Bonnema.
9. *Ctenobolbina* aff. *obliqua* (Krause), a left valve. Kukruse form., Kukruse, coll. Bonnema.
- 10—11. *Piretella margaritata* n. sp., Kukruse; coll. Bonnema. Fig. 10 — a right female valve.
12. *Biflabellum tenerum* A. Ö., a female valve. Kukruse, coll. Bonnema.
- 13—14. *Biflabellum reticulatum*. Fig. 14 is magn. nearly 40 diam. n — a node formed by the bifurcation of the sulcus.

XV.

1. *Conchoprimitia tolli* (Bonnema), internal cast showing vascular impressions, Kukruse, coll. Bonnema.
2. *Conchoprimitia tolli integra* nov., internal face of an isolated valve showing vascular impressions and mutually fitting grooves on the ventral and dorsal margin. Kukruse, coll. Bonnema.
- 3—5 and 9. *Conchoprimitia diminuta* n. sp., a complete carapace in diverse positions. Kukruse, coll. Bonnema. Fig. 4 shows the secondary layer of the valve, without the primary layer which is preserved on the other side (fig. 5). The exfoliated secondary layer is preserved in the mould, fig. 9.
- 7—8. *Apatochilina ubjaensis* n. sp., both specimen from Kukruse, coll. Bonnema. Fig. 7 — a typical male specimen, fig. 8 — a female with the brood-pouch like a swelling of the marginal frill. Dorsal marginal swelling absent. Cf. pl. I, fig. 10.
- 10—11. *Rakverella bonnemai* n. sp., a left and a right valve from Kukruse, coll. Bonnema. In fig. 10 the posterior angular spine is preserved also. Cf. pl. IX, fig. 4.
12. *Tetradella* ? *pectinata* n. sp., interior of a left valve. Kukruse, coll. Bonnema. cf. Pl. IV, fig. 9, pl. VII, fig. 4—5, pl. X, fig. 16.
- 13—14. *Tetradella* ? *dubitabilis* n. sp. a complete carapace from the lower part of the Uhaku beds, South Lighthouse, Tallinn. Cf. pl. X, fig. 15.
15. *Tetradella* ? sp. aff. *pectinata*, a left valve, Kukruse, coll. Bonnema. Cf. pl. IX, fig. 5.



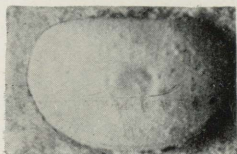
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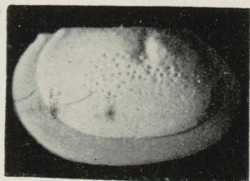
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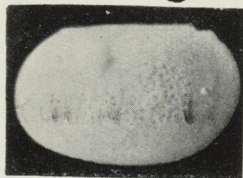
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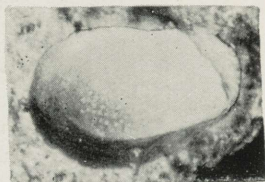
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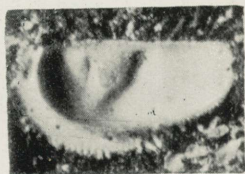
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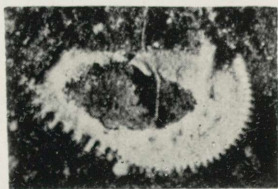
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15

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