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The Ordovician ostracodes established by Aurel Krause, Part I

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Abstract

The lack of a revision of the ostracodes described by Aurel Krause at the end of the 19th century from glacial erratic boulders from Berlin and the Mark Brandenburg (Northern Germany) has led to taxonomic confusion in the corresponding literature of the 20th century. To attain stability in names, some of Krause's ostracode species have been revised based on the types stored in the Museum für Naturkunde Berlin, namely *Primitia plana*, *P. plana tuberculata*, *P. intermedia*, *P. globifera*, *Entomis sigma antiquata*, *Bollia v-scripta*, *B. granulosa, B. duplex*, *Strepula lineata*, *Isochilina canaliculata*, *Beyrichia dissecta*, *B. mamillosa*, *B. signata*, and *B. bidens*. Most species have up to four younger synonyms among species described later from outcrops or borings in Baltoscandia or glacial erratic boulders of Northern Germany and Sweden. Three of Krause's species, which have been considered as *nomina dubia* by Jaanusson are in fact valid species. Some of Krause's species or of their synonyms are type species.

Introduction

Systematic descriptions of Ordovician ostracodes from Baltoscandia have been started by the end of the 19th century with Aurel Krause. Between 1889 and 1897 he described in several papers new ostracodes from glacial erratic boulders from Berlin and the Mark Brandenburg. Before him, only few ostracode species were sporadically established by Eichwald (1854, 1860), F. Schmidt (1858), Bock (1867), Linnarsson (1869), and Brögger (1882). Apart from Bonnema's (1909) and Öpik's (1937) monographs on the ostracodes of the Uhaku and Kukruse stages of Estonia and few other but small papers, the main investigations on Ordovician ostracodes from Baltoscandia took place not before the end of the war (Henningsmoen 1948, 1953a, 1954a, 1954b; Neckaja 1952, 1953, 1958, 1966, 1973; Stumbur 1956; Jaanusson 1957, 1966; Sarv 1959, 1962, 1963; Thorslund 1940, 1948). However, these papers clearly document the utmost necessity of a modern revision of the ostracodes described by Krause at the end of the 19th century.

It has been generally assumed that the types of the species described by Krause formerly belonging to the Geologisch-Paläontologisches Museum of the Friedrich Wilhelm-Universität Berlin were lost during the war (Jaanusson 1962, 412). However, in 1958 the material was returned from the former Soviet Union to Berlin and has been housed in the Paläontologisches Museum der Humboldt Universität (Diebel 1960), now Museum für Naturkunde Berlin.

Enabled by a loan of Krause's types to Uppsala, Valdar Jaanusson started a revision of Krause's Ordovician ostracods at the beginning of the sixties. In 1962 Jaanusson published a short note on these ostracodes in which he cited nine species with their younger synonyms described from the Baltoscandian Ordovician and four species of Krause which he considered as *nomina dubia* (Tab. 1). Two of these species were refigured by Jaanusson in his 1966 paper. Further revisions were never published by Jaanusson and by the end of the nineties the unrevised material came back to Berlin. Only some photos taken by Jaanusson have been made availabe to some colleagues.

Therefore, a new attempt for part of Krause's material was made by the present authors (Schallreuter & Hinz-Schallreuter 2005) in order to attain stability in taxonomic determinations since many species have up to several younger synonyms. In the frame of their revisions the authors also revealed wrong interpretations of some of Krause's species.

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Table 1. The species of Krause studied by Jaanusson (1962) and their synonyms. **G** – no. of Krause's glacial erratic boulders with the type specimen; **H** – Hessland; ** – valid as subspecies. **[1]** – Jaanusson (1962); **[2]** – Jaanusson (1966); **[3]** – Jaanusson (1957); **[4]** – Schallreuter (1993); **[5]** – Schallreuter (1985).

Krause's species	year	G	actual combination	synonyms (*no more, see Table 2)	reference
Primitia bursa	1889	292	*Euprimites b.*	*Euprimites bursellus* Jaanusson, 1957	[1] p. 412
P. sulcata	1889	315	*Conchoprimitia s.*	*Primitia tolli* Bonnema, 1909	[1] p. 412
Beyrichia digitata	1889	303	*Glossomorphites d.*	*Glossopsis clavata* H., 1949 *Glossopsis lingua* H., 1949 ***Entomis impressa* Steusloff, 1895	[1] p. 412 [1] p. 412 [4] p. 89
B. marchica angustata	1891	150	*Tallinnella a.*	*Tallinnella dimorpha* Öpik, 1937	[1] p. 413
B. erratica acuta	1891	479	*Asteusloffia a.*	*Steusloffia polynodulifera* Hessland, 1949	[1] p. 413
Isochilina ? erratica	1891	400	*Conchoprimitia e.*	*Conchoides circumstriatus* Hessland, 1949	[1] p. 412
Primitia labrosa	1892	497	*Uhakiella l.*	*Uhakiella aequigranosa* Jaanusson, 1957	[1] p. 413
Entomis auricularis	1892	587	*Disulcinoides a.*	*Sigmobolbina quanta* Sarv, 1959	[1] p. 413
Bollia major	1892	670	*Bolbina m.*	*Bolbina lehtmetsaensis* Sarv, 1959 *Bollia minor* Krause, 1892 *Bolbina major calva* Schallreuter, 1987	[1] p. 413 [5] p. 104
Beyrichia carinata	1892	670	*Carinobolbina c.*	*Carinobolbina estona magnifera* Sarv, 1959	[1] p. 413 [2] p. 29
Beyrichia rostrata	1892	587	*Sigmoopsis r.*	*Sigmoopsis lamina* Sarv, 1959	[1] p. 413 [2] p. 29
Primitia cincta	1889		*Eobromidella c.*	*Eobromidella* sp. indet. nom. dub.	[1] p. 413
Primitia intermedia	1889	339	*Euprimites i.*	*Euprimites* sp. indet. nom. dub.*	[1] p. 413
Strepula lineata	1889	106	*Steusloffia l.*	*Steusloffia* sp. indet. nom. dub.*	[1] p. 413
Primitia globifera	1892	666	*Hesperidella g.*	*Hesperidella* sp. indet. nom. dub.*	[3] p. 329 [1] p. 413

Material

Krause's material came from glacial erratic boulders of both Berlin region and Mark Brandenburg. Most of the samples were collected in the former sand and gravel pits near Müggelheim at the Müggel Isle (Berlin) (Krause 1889: 22). They came from different glacial erratic boulders which Krause (1889: 24) called "Untersilurischer Beyrichienkalk" (Ordovician *Beyrichia* Limestone) – an unsuitable name because the term refers to many types of Middle and Upper Ordovician limestone glacial erratic boulders of Baltoscandia (Kummerow 1924: 409; Schallreuter 1993: 13–14). A second group of ostracode-bearing glacial erratic boulders Krause (1892: 399) called "Geschiebe mit *Beyrichia rostrata*" (glacial erratic boulders with *Sigmoopsis rostrata*). From this group he described a complete ostracode fauna so that this type is better characterized faunistically. This fauna was found several years ago in a boulder from Münsterland which allowed its revision (Schallreuter 1985). However, for political reasons the types had not been available for the author at that time.

Most of the species revised herein came from different boulders (Tab. 2). Only three of these species orginate from one boulder (no. 670) of the so-called "*rostrata*" type group. Stratigraphically, the boulder was referred to as the Keila Stage (D2) (Schallreuter 1976: 164). Later, the group to which this boulder belongs was called "Harpakalk" (Schallreuter 1985: 101). It is assumed to originate from the northern Middle Baltic Sea (Schallreuter 1985: 102). The age of the other glacial erratic boulders could be gained from the stratigraphical occurrences of the synonyms of the respective species.

Many of the figured specimens of Krause's ostracodes were stored in small glass tubes together with a small label inside the tube. The tubes were kept together with some labels in open boxes.

Some of the ostracodes were glued on the cork of the tube. This fact combined with the coating with MgO for previous photography badly affected the respective specimens.

The oldest labels seem to be those inside the glass tubes. However, they could not be from Krause himself, because such tubes and labels are used also for few of Kummerow's (1924) species in the museum's collection. The label without an institutional assignment (only: Inv. Geol. S.) were probably labels of the former Märkisches Museum or Geologisches Landesmuseum Berlin. The 3rd labels are from the "Geol.-Paläont. Mus. Berlin". Many types have a 4th label from Jaanusson – but mostly without further information.

If not stated otherwise the glacial erratic boulders with the types of the Krause's species came from the type locality, the former gravel/sand pits near Müggelheim on Müggel Isle (Berlin), 52°25′ N, 31°19′ E.

Palaeontological dating of glacial erratic boulders is generally only possible if their fossil content is also known from Baltoscandian out-

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Table 2. The species of Krause revised in this paper and their synonyms. Type species are set in bold face. G = no. of Krause's glacial erratic boulders with the type specimen; **T.** – Thorslund; **Ö** – Öpik 1937; **[1]** – Schallreuter & Hinz-Schallreuter 2008; **[2]** – Bassler & Kellett 1934; **[3]** – Schallreuter 1995; **[4]** – Henningsmoen 1954; **[5]** – Sarv in Kaljo et al. 1956; **[6]** – Sarv 1959; **[7]** – Schallreuter 1973; **[8]** – Schallreuter 1968.

Krause's species	year	G	actual comb.	synonyms (*valid as subspecies)	reference
Primitia plana	1889	301	*Tvaerenella plana*	*Primitiella umbilicata* Kummerow, 1924	this paper
				Tvaerenella expedita Sarv, 1959	[1] p. 809
Beyrichia signata	1892	648	*Signakiella signata*	*Strepula signata* Steusloff, 1895	[2] p. 476
				Signakiella steusloffi Schallreuter, 1988	Schallreuter 1988, p. 40
				Steusloffia wandae Sztejn, 1989	[3] p. 128
				Piretella ? paczerensis Sidaravičienė, 1992	Sidaravičienė 1996, p. 16
Beyrichia dissecta	1892	616	***Kiesowia dissecta***	*Beyrichia mamillosa* Krause, 1892	[4] p. 79 (?)
					Meidla 1996, p. 57
				Kiesowia septenaria Stumbur, 1956	Sarv 1962, p. 109
				**Hithis leviconvexus* Schallreuter, 1967	Meidla 1996, p. 57
Bollia v-scripta	1889	112	***Vauscripta v-scripta***	*Piretella tridactyla* Jaanusson, 1957	this paper
				Mojczella jaanussoni Olempska, 1989	Sidaravičienė 1992, p. 147
Primitia intermedia	1889	339	*Euprimites intermedius*	*Euprimites locknensis* Thorslund, 1940	this paper
Primitia plana tuberculata	1892	670	*Tvaerenella tuberculata*	*Primitiella indistincta* Öpik, 1937	[5] p. 51, [6] p. 30
				Primitiella granosa Öpik, 1937	this paper
				Primitiella carinata T., 1940	[7] p. 104
Isochilina canaliculata	1892	670	*Oepikella canaliculata*	*Macronotella bonnemai* Ö., 1937	this paper
				Oepikella tvaerensis T., 1940	this paper
				Oepikella asklundi T., 1940	[7] p. 271
				Tvaerenella stossmeisteri Schallreuter, 1985	this paper
Entomis sigma antiquata	1891	187	*Oepikium antiquatum*		
Strepula lineata	1889	106	*Asteusloffia lineata*	*Strepula lineata granulosa* Steusloff, 1895	this paper
Bollia granulosa	1889	339	*Uhakiella granulosa*	*Beyrichia granulifera* Ulrich & Bassler, 1908	Ulrich & Bassler 1908, p. 285
				? ****Uhakiella coelodesma*** Ö.	this paper
Beyrichia bidens	1892	670	*Bilobatia bidens*	****Bilobatia serralobata*** Schallreuter, 1976	Schallreuter 1982, p. 9,15
Bollia duplex	1892	640	***Duplexi bollia d.***		
Primitia globifera	1892	666	*Balticella globifera*	*Primitia binodis* Krause, 1897	this paper
				Balticella oblonga T., 1940	[8] p. 135

crops or borings. When Krause described his new species the knowledge of Ordovician ostracode faunas from Baltoscandian outcrops was still very limited, and apart from the types none of Krause's glacial erratic boulders material has been preserved. Therefore, dating of Krause's stratigraphically unassigned ostracode types results from synonymous species of outcrops. Some of Krause's newly established ostracodes lacking later synonyms may be datable by associated ostracodes mentioned already by Krause and whose occurrence is meanwhile known from outcrops. A third possibility for dating is the use of comparative material from exactly dated glacial erratic boulders.

Abbreviations. **C1**, **C2**, **C3**, **C4** – cristae (on or originating from corresponding lobes); **GG** – Institut für Geographie und Geologie, Ernst Moritz Arndt-Universität Greifswald; **H** – height; **IGT** – Institute of Geology, University Tartu; **L** – length; **L1**, **L2**, **L3**, **L4** – lobes 1–4; **MB.** – Museum für Naturkunde Berlin; **OD** – original designation; **PAN** – preadductorial node; SD = subsequent designation; **SGU** – Sveriges Geologiska Undersökning Stockholm; **syn.** (in the lists of synonyms) – q.v. for further synonymy.

Definition of size. <0.50 mm very small; 0.50–1.00 small; 1.00–2.00 median-sized; 2.00–5.00 large.

Since the scales of the plates based on SEM data may deviate a little, the absolute size is given in the explanations. Because of the fixed position of the SE-detector in the SEM (which corresponds to the lamp in light photography) two views orientated perpendicularly to each other have been figured from the specimen in Figure 3A.

Systematic Palaeontology

Order **Palaeocopa** Henningsmoen, 1953
Suborder **Beyrichiomorpha** Henningsmoen, 1965
Superfamily **Eurychilinoidea** Ulrich & Bassler, 1923
Family **Oepikellidae** Jaanusson, 1957
Subfamily **Oepikellinae** Jaanusson, 1957

Oepikella Thorslund, 1940

Type species. *Öpikella tvaerensis* Thorslund, 1940; by original designation.

= *Isochilina canaliculata* Krause, 1889 = *Macronotella bonnemai* Öpik, 1937 = *Oepikella asklundi* Thorslund, 1940 = *Tvaerenella stossmeisteri* Schallreuter, 1985.

Definition. Jaanusson 1957: 270.

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Oepikella canaliculata (Krause, 1892)

Figure 1A

1892 *Isochilina canaliculata* Krause: 385, 399, pl. 21, figs 1a–b.
non 1897 *Isochilina* cf. *canaliculata*. – Krause: 932, 938, pl. 25, fig. 15 (= *Tvaerenella* ? sp.).
1934 *Aparchites canaliculatus*. – Bassler & Kellett: 55, 157, 338.
1937 *Macronotella bonnemai* Öpik: 5, 23, 60, 69, 87, 124, pl. 1, figs 7–8.
1940 *Öpikella tvaerensis* Thorslund: 181–182, 187, pl. 2, figs 1–7.
1940 *Öpikella canaliculata*. – Thorslund: 181, 182.
1940 *Öpikella bonnemai*. – Thorslund: 181.
1940 *Öpikella asklundi* Thorslund: 182, 187, pl. 1, figs 3–5.
1957 *Oepikella tvaerensis*. – Jaanusson: 270, 271–275, tabs 11, 40, figs 8, 19–20, pl. 4, figs 9–19, pl. 13, figs 1–13 (syn.).
1959 *Oepikella bonnemai*. – Sarv: 15–16, tab. 2, pl. 2, figs 12–13 (= Öpik 1937, pl. 1, figs 7a–b).
1979 *Oepikella bonnemai*. – Ivanova: 73, 187, pl. 5, fig. 3.
1985 *Oepikella canaliculata*. – Schallreuter: 102, 134, tab. 1, pl. 3, fig. 5, pl. 8, fig. 1.
1985 *Tvaerenella stossmeisteri* Schallreuter: 107–108, 124, tab. 1, pl. 3, fig. 4a–b.
1990 *Oepikella tvaerensis*. – Ivanova in Abushik et al.: 56, 232, pl. 6, fig. 2.
1990 *Oepikella? canaliculata*. – Hints et al. in Aru et al.: 138, fig. 30 (cf.; faunal log).

Lectotype (designated here). Juvenile left tecnomorphic valve, MB. HS 2010-9, Figure 1A, Krause 1892, pl. 21, fig. 1.

Type locality and horizon. Müggelheim; Krause's glacial erratic boulder no. 670, age Keila (D2).

Dimensions. Lectotype L 1.98 mm, H 1.32 mm. The largest specimen measured by Jaanusson (1957, tab. 11) reaches 3.61 mm, i.e. the lectotype is not adult.

Definition. At least up to 3.61 mm length. Posterior cardinal angle distinctly > 90°. Cardinal corners separated from lateral surface by short bulge-like swellings in prolongation of the more indistinct tecnomorphic bulge-like velum. Dolon extending from anterocentral region to centroventral region. Outer shell surface finely punctate.

Comparisons. According to Jaanusson (1957: 275) *Oepikella bonnemai* Öpik, 1937 differs from the type species only by the ornamention ("widely punctate", Öpik 1937: 87 or 23). Also for *O. tvaerensis* Jaanusson (1957 : 272, fig. 20a) mentioned "scattered pits", over the whole lateral surface and Thorslund (1940: 181) described the outer surface as "finely punctate". Both species are considered here as synonyms. This all the more, as Jaanusson (1957: 275) recorded both species also from a boulder of Tvären.

Oepikella tvaerensis and *O. asklundi* were considered already by Henningsmoen (1953b: 228) as "most probably one dimorphic species", i.e., as synonyms which was acknowledged by Jaanusson (1957: 271), and *O. tvaerensis* is a younger synonym of *O. canaliculata* (see also Schallreuter 1985: 102).

Another synonym of *O. canaliculata* is *Tvaerenella stossmeisteri*. The holotype of that species (Schallreuter 1985, pl. 3, figs 4a–b) resembles the tecnomophic valves of *O. canaliculata* figured in the same paper (Schallreuter 1985, pl. 3, figs 5a–b, pl. 8, fig. 1). The holotype is a ♀ valve with the velar frill broken away close to the domicilium but it seems that the frill has been tubulose like that of *O. asklundi*. The specimen is smaller than the largest ♀ valves of *O. tvaerensis*, but Jaanusson (1957: 273) already recognized a great size difference within the ♀ of that species (Jaanusson 1957, tab. 11, fig. 8), i.e. from 2.34–3.99 mm (5 specimens). These females fall by their size "within the limits of the last but one moult stage, or into an even earlier moult stage" (Jaanusson 1957: 208) and thus, represent some sort of precocious sexual dimorphism (premature fertility). Wether or not more than one species is represented is morphologically indistinguishable. By contrast, females of *Tetrada memorabilis* (Neckaja, 1953), *Brezelina palmata* (Krause, 1889), and *Ahla bocki* (Öpik, 1935) are known already from the A^{-3} stage onward (Schallreuter 1976: 169; Tinn & Meidla 2003, fig. 4). However, the preadult females are not fertile. The smallest specimen of *O. asklundi* Thorslund (1940: 182) recognized as females of *O. tvaerensis* are only 2.00 mm long. The holotype of *Tvaerenella stossmeisteri* measures 1.85 mm (without frill). With regard to the convexity of the domicilium (greatest convexity in the posterior ventral quarter) it very much resembles *O. tvaerensis* (compare Schallreuter 1985, pl. 3, figs 4a–b and Jaanusson 1957, pl. 13, figs 11–13). *Tvaerenella stossmeisteri* is therefore considered here also as a synonym of the associated *O. canaliculata* (Schallreuter 1985, pl. 3, figs 4–5).

Oepikella luminosa Sarv, 1959 (Oandu to Porkuni stages, holotype from Pirgu stage; Meidla 1996: 21) is smaller (♀ 1.62–2.00 mm; Sarv 1959: 17; Sidaravičienė 1992: 244) but has a longer dolon and may be distinctly reticulate (compare Jaanusson 1957, pl. 13, figs 1, 9 and Sarv 1959, pl. 2, fig. 14; see also Sidara-

▶

Figure 1. A. *Oepikella canaliculata* (Krause, 1892), lectotype, juvenile left valve (MB. HS 2010-9), dorsal, lateral, and ventral views, L 1.98 mm, Müggelheim (Berlin), Krause's glacial erratic boulder no. 670, age: Keila stage (D2); **B.** *Oepikium antiquatum* (Krause, 1889), holotype, tecnomorphic right valve (MB. HS 2010-10), frill posteroventrally broken away, lateral view, L 2.32 mm, Rixdorf (Berlin), Krause's glacial erratic boulder no. 187, exact age unknown, presumably lower Viruan; **C.** *Duplexibollia duplex* (Krause, 1892), holotype, anteriorly incomplete left valve (MB. HS 2010-15), lateral view, L 2.75 mm, Müggelheim (Berlin), Krause's glacial erratic boulder no. 640, age: Pirgu stage or Porkuni stage (F1c or F2); **D.** *Signakiella signata* (Krause, 1892), lectotype, right valve (MB. HS 2010-2), lateral view, L 2.54 mm, Müggelheim (Berlin), Krause's glacial erratic boulder 648, age presumably Keila stage (D2); **E.** *Signakiella signata* (Steusloff, 1895) = *S. asteusloffi* Schallreuter, 1988, lectotype, left valve (GG 114-59), lateral view, L 2.00 mm, Neubrandenburg, glacial erratic boulder, age presumably Keila stage (D2); **F.** *Uhakiella granulosa* (Krause,1889), lectotype, right male valve (MB. HS 2010-12), lateral view, L 2.08 mm; Müggelheim (Berlin), Krause's glacial erratic boulder no. 339, age Viruan; **G.** *Vauscripta v-scripta* (Krause, 1889), lectotype, right tecnomorphic valve (MB. HS 2010-5), lateral view, L 1.78 mm; Berlin or Mark Brandenburg, Krause's glacial erratic boulder no. 112, age presumably Aseri (C1a). All stereo-pairs.

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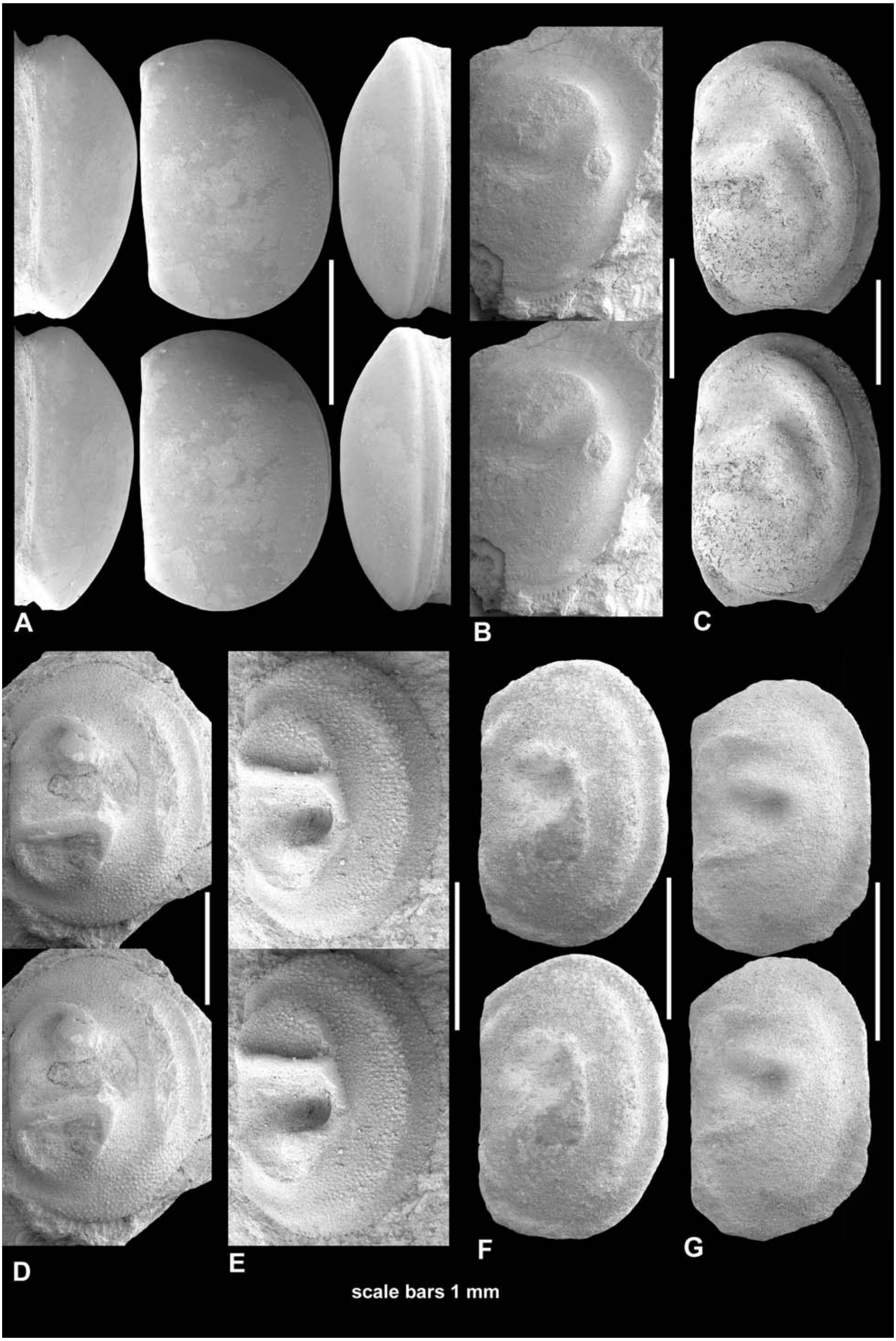
A
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vičienė 1992, pl. 36, fig. 10). According to Sarv (1959: 17), only the anterior of the bulge-like swellings ("diagonal lobes") of the cardinal corners is developed. The posterior end of the valve is less convex.

Oepikella ? *alta* Schallreuter, 1984 reaches only 1.25 mm and has a long dolon extending from the anteroventral region to the posterocentral region (Schallreuter 1984a, fig. 1.1). Tecnomorphic valves of that species are unknown (designation therefore only with "?").

Remarks. Since *O. canaliculata* is the most common ostracode species in the glacial erratic boulder (age: D2) described by Krause (1892: 385), Andersson (1893: 125) called this association "*Isochilina canaliculata*-Fauna" and considered it (Andersson 1893: 219) as an equivalent of the *Chasmops macrourus* zone (Keila stage, ? Oandu stage) of Öland. In the boulders of the Tvären area (age: Kukruse to Jõhvi stages, C2–D1, Schallreuter 1970: 301) *O. canaliculata* is "... one of the commonest species" (Jaanusson 1957: 275).

Occurrence. Glacial erratic boulder of Keila stage (age: D2): Krause's glacial erratic boulder no. 670 (*Harpa* Limestone); glacial erratic boulder no. STEU-4a (*Macrourus* Limestone; Steusloff 1895: 779), glacial erratic boulder Ahl-1001 (*Harpa* Limestone, Schallreuter 1985: 102). Estonia: Uhaku and Kukruse stages (C1c–C2α), Sweden (Tvären): boulders of lowermost *Ludibundus* limestone (Kukruse stage; Jaanusson 1960, tab. 1).

Family **Oepikiidae** Jaanusson, 1957

***Oepikium* Agnew, 1942**

Synonym. *Biflabellum* Öpik, 1935 non Döderlein, 1913.

Type species. *Biflabellum tenerum* Öpik, 1935; by original designation.

Definition. Schallreuter 1975: 175.

***Oepikium antiquatum* (Krause, 1889)**

Figure 1B

1889 *Entomis sigma* var. – Krause: 13, 23, pl. 1, fig. 13.
1891 *Entomis sigma* v. *antiquata* Krause: 509, 518.
1934 *Ctenobolbina antiquata*. – Bassler & Kellett: 55, 254, 306.
? 1992 *Oepikium* sp. – Sidaravičienė: 151, 244, tab. 2, pl. 38, fig. 2.
? 1993 *Vittella* ? aff. *antiquata*. – Schallreuter: 36, 244, pl. 48b, fig. 1.

Holotype (monotypy). Right valve, frill posteroventrally incomplete, MB. HS 2010-10, Figure 1B, Krause 1889, pl. 1, fig. 13.

Type locality and horizon. Rixdorf, Mark Brandenburg (now part of Berlin); Krause's glacial erratic boulder no. 187, a greenish-grey marly limestone with *Primitia bursa* Krause, 1889, *Entomis sigma* Krause, 1889, *Ampyx* sp. and *Cheirurus* sp., age presumably Middle Ordovician.

Dimensions. Holotype: L with frill anteriorly but without posterior spines 2.32 mm, H with frill 1.45 mm.

Definition. At least up to 2.32 mm. Long sigmoidal S2, being deep also in its ventral part, lobes strongest in ventral part, top of posteroventral lobe node- or spine-like, ventral ends of lobes connected by an indistinct ridge.

Remarks. The top of the posteroventral lobe is broken away so that it is unclear whether it terminates in a node or spine (Stachel = lobal spine). Velar flange broad and plane, radially striated and with very fine ridges parallel to the border.

Comparisons. O. antiquatum differs from all other Baltoscandian species of the genus [*O. flabelliferum* (Krause, 1892) = *Biflabellum reticulatum* Öpik, 1937 = *B. crista* Öpik, 1937; *O. tenerum* (Öpik, 1935), *O. porkuniensis* Henningsmoen, 1954, *O. novum* Sarv, 1959] mainly by the more distinct S2 and the ventrally stronger developed lobes (Öpik 1937, pl. 5, figs 1–8; Schallreuter 1975, pl. 8, figs 2–3; Schallreuter 1993, pl. 61b, fig. 4; Schallreuter & Hinz-Schallreuter 2007, fig. 4).

Oepikium sp. A Jaanusson, 1957 from the South Bothnian glacial erratic boulder Erken no. 10 (*Crassicauda* limestone = Uhaku stage, C1c) has a similar S2 but differs also by the ventrally weaker lobes (Jaanusson 1957, pl. 14, fig. 5). The specimen figured by Jaanusson is smaller (L 1.79 mm) and probably a female. The sausage-shaped elevation of the frill (Jaanusson 1957: 408) seems to be an antrum restricted to the inner part of the frill because it has the width of the presumed diameter of the eggs stored in similar constructions of other species and genera (*O. tenerum*, Öpik 1937, pl. 5, fig. 2; *Tallinnellina divelata,* Sarv 1963, pl. 2, figs 4–5; *Snaidar radians*, Schallreuter 1976, pl. 8, figs 4–5; *Femerensia gealbertii*, Schallreuter 1983c, pl. 94, fig. 2).

Occurrence. Despite its large size (L 2.32 mm) the species has not been found in Baltoscandian outcrops. Sidaravičienė (1992, pl. 38, fig. 2) figured an incomplete and compressed specimen of *Oepikium* from the Lasnamägi stage (C1b) of Lithuania (L 1.65 mm without velar frill), which may be conspecific to *O. antiquatum*.

The incomplete left valve figured by Schallreuter (1993, pl. 48b, fig. 1; L 2.34 mm) may also belong to that species. Unfortunately the portion ventral to the center of S2 is broken away. The boulder has been referred to the middle and upper Kunda stage (B3β–γ).

Superfamily **Hollinoidea** Swartz, 1936
Family **Tvaerenellidae** Jaanusson, 1957
Subfamily **Tvaerenellinae** Jaanusson, 1957

***Uhakiella* Öpik, 1937**

Type species. *Uhakiella coelodesma* Öpik, 1937; by original designation.

Remarks. Henningsmoen (1953b: 226) considered *Uhakiella* as a younger synonym of *Primitia* Jones & Holl, 1865 with *Beyrichia strangulata* as type species. Jaanusson also studied the type material of *Beyrichia strangulata* and according to his observations there hardly remains any doubt of this species belonging to

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Uhakiella (Jaanusson 1957: 288). Although Miller (1889: 561) had already cited *Beyrichia strangulata* McCoy, 1951 as type species for *Primitia* his designation was long time neglected in favour of *Beyrichia mundula* Jones, 1855 as the respective type species (Ulrich & Bassler 1923: 300; Bassler & Kellett 1934: 438; Swartz 1936: 549) until Henningsmoen (1953b: 225) argued against this wrong use and re-established *Beyrichia strangulata*. Because of the great nomenclatorical consequences an application to the International Commission on Zoological Nomenclature was submitted to suppress Miller's designation of *Beyrichia strangulata* in order to maintain the accustomed usage of *Primitia mundula* as type species of *Primitia* (Jaanusson 1957: 217, 288). However, *Primitia* is still a bag genus for unisulcate species of uncertain relationships and best considered as a *nomen dubium*.

Schmidt (1941: 33, 96, pl. 5, figs 43a–d) considered *Uhakiella* Öpik, 1937 to be synonymous with the North American genus *Bromidella*. The latter was erected by Harris in 1931 in a paper not cited by Öpik. Thorslund (1948: 344, 350, 359) and Henningsmoen (1948: 416) agreed with this opinion. However, after having re-examined the type material of *Beyrichia strangulata* Henningsmoen (1953b: 226) found that the strong dorsal ridge of *Bromidella* is rather unique so that Henningsmoen "concluded that it may be better to retain *Bromidella* as a separate genus" (Jaanusson 1957: 288).

The type-species of *Bromidella* differs from *Uhakiella*, not only by the very strong dorsal plica but also by the missing ventral bulge and the development of the tecnomorphic velum as a row of spines which is most distinct on the posterior part of the brood pouch (Williams & Siveter 1989, pls 4, 16, figs 1–4).

The Baltoscandian *Bromidella sarvi* Schallreuter, 1964, which occurs together with *Uhakiella*, not only has a strong dorsal plica but also a distinct ventral bulge like *Uhakiella*. On the other hand, juveniles of *B. sarvi* have their tecnomorphic velum developed as a narrow flange and in the posterior part also as a row of spines (Schallreuter 1973, pl. 20, figs 4–5; 1983b, pl. 10, 28, figs 1–2).

Despite the differences between *Bromidella* and *Uhakiella* some Baltoscandian authors have not agreed with the assignment of *B. sarvi* and related species to *Bromidella* and still consider them as species of *Uhakiella* (Gailīte 1973; Jaanusson 1976; Sidaravičienė 1992). Nevertheless, Sidaravičienė (1996: 55, fig. 13) noted that these species represent at least a separate branch within *Uhakiella*. Therefore, we consider it as a possible new genus or subgenus of *Uhakiella.*

Uhakiella granulosa (Krause, 1889)

Figure 1F

1889 *Bollia granulosa* Krause: 14–15, 22–24, pl. 2, figs 1–2.
1908 *Beyrichia granulifera* Ulrich & Bassler: 285, 294, 328, fig. 32, pl. 38, fig. 7 (after Krause 1889, pl. 2, fig. 2).
non 1909 *Bollia granulosa*. – Bonnema: 63–65, 78, 84, pl. 4, figs 12–18 (= *Uhakiella kohtlensis* Öpik, 1937: 108 or 44).
1933 *Ctenobolbina granulosa*. – Kummerow: 48–49.
1937 *Uhakiella granulosa* = *U. granulifera*. – Öpik: 4, 42–43, 68, 106–107.
1941 *Bromidella granulosa*. – Schmidt: 33, 80.
1954b *Primitia granulosa*. – Heningsmoen: 75.
1988b *Uhakiella granulosa*. – Schallreuter: 41, fig. 2.2.
1992 *Uhakiella granulosa*. – Sidaravičienė: 87–88, 237–238, tab. 2, pl. 22, fig. 10, pl. 23, figs 1–2.
1996 *Uhakiella granulosa*. – Sidaravičienė: 13, 16, 51, figs 2–3, 5–11, 13 (faunal logs); tabs 2–5.

Lectotype (designated by Öpik 1937: 106 or 42). Right ♂ valve, MB. HS 2010-12 – Figure 1F, Krause 1889, pl. 2, fig. 2; Ulrich & Bassler 1908, fig. 32, pl. 38, fig. 7; Schallreuter 1988b, fig. 2.2.

Type locality and horizon. Müggelheim (Berlin), Krause's glacial erratic boulder no. 339, age Viruan.

Dimensions (L – H in mm – L : H). Lectotype 2.08 – 1.30 – 1.60. Sidaravičienė 1992, pl. 22, fig. 10 (left ♀ valve, C3) 2.65 – 1.75 – 1.51, pl. 23, fig. 1 (left ♀ valve, C2) 2.55 – 1.65 – 1.55, pl. 23, fig. 2 (left ♂ valve, C3) 2.45 – 1.60 – 1.53.

Definition. Adults 2.08–2.65 mm. S2 as a distinct relatively broad pit, PAN weak, ± distinct zygal crista, dorsal plica and ventral bulge, tecnomorphic velum as an indistinct narrow bulge, in ♂ centroventrally reduced, ♀ with closed false brood pouch in the anteroventral region. Surface of domicilium and antrum with closely set spines.

Comparisons. *U. granulosa* resembles very much *U. coelodesma* which differs mainly by the weaker plica (compare Figure 1F and Öpik 1937, pl. 3, figs 1, 3; Sarv 1959, pl. 4, figs 6–7; Sztejn 1985, pl. 1, fig. 5; and Sidaravičienė 1992, pl. 22, fig. 10, pl. 23 figs 1–2).

In *U. jaanussoni* (especially in the nominate subspecies) the ornamental features are even weaker than in *U. granulosa*, so that there is no furrow between the lateral surfaces of domicilium and brood pouch (Schallreuter 1973, pl. 19, fig. 3; Sidaravičienė 1992, pl. 23, fig. 3). In the younger (Skagen, Keila stage) *U. jaanussoni skageni* ornamentation is more distinct.

A common feature of *U. granulosa*, *U. coelodesma*, and *U. jaanussoni* is the centroventral incisure of the ♂ velum (Öpik 1937, pl. 3, fig. 1; Sarv 1959, pl. 4, fig. 7; Sidaravičienė 1992, pl. 23, fig. 2; Schallreuter 1973, pl. 19, figs 1, 8). This feature has been observed in these three species only. Therefore, they may represent only one species with several subspecies (cf. Schallreuter 1973: 79) because transitions exist in other features. However, Jaanusson (1963: 25, 28) who studied the type of *U. granulosa* (Jaanusson 1962: 412; 1963: 5), considered *U. granulosa* and *U. coelodesma* as different species, and also Sidaravičienė 1992 cited *U. coelodesma*, *U. granulosa* and *U. jaanussoni* as different species of a phylogenetic lineage within *Uhakiella* (Sidaravičienė 1996: 55, fig. 13).

With up to 2.75 mm *Uhakiella jonesiana* (Schmidt, 1941) (= *Primitia jonesii* Krause, 1889 = *U. magnifica* Sarv,1959; Schallreuter 1973: 78) becomes larger (Sidaravičienė 1992: 238) and differs also by the narrower S2, the stronger plica, and the weaker ventral bulge, which is documented only by an accumulation of tubercles. Furthermore, the pouch exhibits a finer granulation than the lateral surface of the domicilium (Sarv 1959, pl. 3, fig. 10, pl. 4, fig. 16; Sidaravičienė 1992, pl. 24, fig. 3; Meidla 1996, pl. 4, figs 10–11). Whether or not the male velum has a ventral incisure is unknown.

Uhakiella labrosa (Krause, 1889) (= *U. aequigranosa* Jaanusson, 1957, uppermost *Crassicauda* limestone) is of about the same size (holotype of *U. aequigranosa* 2.10 mm) and differs from *U. granulosa* and other species of the genus by its ornamentation and the indistinct ornamental ridges (Jaanusson 1957: 291, pl. 5, fig. 10). Males seem to be unknown so that it is also not known whether a ventral incisure exists or not.

In *Uhakiella oanduensis* Sarv, 1963 the ventral incisure is apparently lacking. The plica is more distinct and the surface ornamentation consists of granules and few tubercles instead of spines (Meidla 1996, pl. 4, figs 12–13).

Remarks. For *Bollia granulosa* Ulrich & Bassler (1908: 294, 328) introduced the replacement name *Beyrichia granulifera* after assigning this species to the genus *Beyrichia* (secondary homonymy). Already Bonnema (1909: 84) considered the shifting of *Bollia granulosa* into *Beyrichia* only weakly founded, but it became irrelevant (Schmidt 1941: 33 footnote) when Öpik, on one hand and Schmidt, on the other hand, assigned this species to *Uhakiella* (Öpik 1937: 42–43, 106–107) or *Bromidella,* respectively (Schmidt 1941: 33).

In unawareness of this remark, the name *granulifera* has been further used, but mostly only in lists in the sense of ICZN art. 23.9.6. In the few papers contributing to the knowledge of the taxon the name *granulosa* has been prefered. This also applies to the present paper (in the sense of ICZN art. 59.29) despite the existence of a replacement name since its irrelevancy has been recognized already in 1941.

Kummerow (1933: 48–49, fig. 8) mentioned the external sausage-like brood pouch ("false" brood pouch) in *Eurychilina kuckersiana* and *Ctenobolbina* (= *Bollia*) *granulosa* from weathered Backsteinkalk glacial erratic boulders and figured a steinkern of *Eurychilina kuckersiana*, which Öpik (1937: 43) considered as *Uhakiella sp.*

Kummerow (1939: 89) disagreed and stated that both species occur together in the Backsteinkalk. For comparative reasons he reproduced his figure 8 (1939 as fig. 9) and refigured copies of both species from Bonnema (1909, pl. 7, figs 13–14).

However, the copy of *Bollia granulosa* in fact represents *Bromidella kohtlensis* Öpik, 1937 (= *Bollia granulosa*: Bonnema, 1909) with a distinct false brood pouch like *U. granulosa*.

The refigured *E. kuckersiana* on the other hand represents in reality *Severobolbina kuckersiana*, which lacks a false brood pouch contrary to *U. granulosa* but displays quite another kind of dimorphism. However, it seems that Kummerow erraneously figured (same species name!) the wrong figure of Bonnema. He probably meant *Laccochilina kuckersiana* which has a false brood pouch like *U. granulosa*. In accordance with this assumption Sarv (1959: 9) cited *Eurychilina kuckersiana* Kummerow, 1933 under *Laccochilina kuckersiana*.

Later investigations of Backsteinkalk ostracodes by the senior author evidenced, that Kummerow's *Ctenobolbina granulosa* is identical with *Bromidella sarvi* (Schallreuter 1973: 86). The latter is very similar to *Bromidella kohtlensis* according to the figure of that species reproduced by Kummerow. According to his short description (Kummerow 1939: 89) his *Eurychilina kuckersiana* seems to be identical with *Uhakiella jaanussoni* Schallreuter, 1964. Posthumously, one must agree Öpik (1937: 68) in placing *Eurychilina kuckersiana* sensu Kummerow (1933, 1939) in *Uhakiella*.

Occurrence. Lithuania: Sidaravičienė 1996 mentioned *U. granulosa* and *U. coelodesma* both from the Lasnamägi stage and Uhaku stage, *U. granulosa* also up to undivided Idavere/Johvi (= Haljala stage) but not from Jõhvi stage. In her figure 13 (stratigraphical and phylogenetical ranges) *U. coelodesma* is restricted to Lasnamägi stage and Uhaku stage, *U. granulosa* to the Kukruse stage and lower Idavere substage. Western Latvia: Kukruse and Haljala stages, eastern Latvia: Kukruse stage.

Signakiella Schallreuter, 1988

Type species. *Strepula signata* Steusloff, 1895 (= *Signakiella steusloffi* Schallreuter, 1988b); by original designation. = *Beyrichia signata* Krause, 1892 = *Steusloffia wandae* Sztejn, 1989 = *Piretella* ? *paezerensis* Sidaravičienė, 1992.

Definition. Large, amplete or slightly preplete, unisulcate, S2 as a distinct pit behind of a small but distinct PAN. Strong zygal ridge starting from PAN and continuing around S2 and as C3 until the dorsal plica. In front of the PAN the latter is followed by an anterior ridge (C1), which terminates ventrally at the zygal ridge. Posteroventrally of S2 at the zygal ridge C4 starts as a short ridge.

Comparisons. *Signakiella* is closely related to *Uhakiella* and very probably a descendent of the latter. Most important common features are the pit-like S2, PAN, dorsal plica, zygal ridge, and ventral bulge ("ventral lobe" of Öpik 1937, fig. 5). *Signakiella* differs from *Uhakiella* mainly by the much stronger rich-like ornamental sculptures, particularly by the much stronger ventral bulge and the development of a parable-like ridge around PAN and S2, which incorporates the zygal ridge.

There are several homeomorphic genera with a parable-like ridge (C1 + C3) around both PAN and S2 such as *Piretella*, *Vauscripta* (= *Mojczella*), *Pectidolon*, *Asteusloffia*, and *Steusloffia*, in which the species partly had been placed. From these genera *Signakiella* differs mainly by the ventral bulge.

Signakiella also resembles *Lennukella* Jaanusson, 1957 mainly in the dorsal plica, the PAN and the ventral bulge, but differs by the development of a short ridge, a node below and above the middle of the post-

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sulcal area as well as of a narrow velar flange (Öpik 1937, pl. 3, figs 11–12; Jaanusson 1957, fig. 34, pl. 10, fig. 1).

Signakiella signata (Krause, 1892)

Figure 1D–E

1892 *Beyrichia (Tetradella) signata* Krause: 395, 399, pl. 21, fig. 4.
1895 *Strepula signata* Steusloff: 784–785, pl. 58, fig. 25.
1908 *Beyrichia (Steusloffia) signata*. – Ulrich & Bassler: 295, 296.
1934 *Steusloffia signata*. – Bassler & Kellett: 55, 206, 476–477, 483.
1973 *Uhakiella signata*. – Schallreuter: 78.
1988b *Signakiella asteusloffi* Schallreuter: 40–41, fig. 2.1.
1989 *Steusloffia wandae* Sztejn: 4, 8–9, 18–19, 20, 22, 72, 76–77, 86–88, 90, tab. 1, pl. 2, fig. 1a–d.
1992 *Piretella* ? *paežerensis* Sidaravičienė: 145, 146, 244, tab. 2, pl. 37, figs 4–9.
1993 *Signakiella* cf. *asteusloffi*. – Schallreuter: 16, 72, 252, tab. 2, pl. 52b, fig. 4.
1995 *Signakiella steusloffi*. – Schallreuter: 127–128, tab. 2, fig. 1.
1996 *Piretella* ? *paežerensis*. – Sidaravičienė: 16, 51, 56, tabs 4, 6, figs 3–4 (faunal logs).

Lectotype (designated here). Right valve, MB. HS 2010-2, Fig. 1D; Krause 1892, pl. 21, fig. 4.

Type locality and horizon. Müggelheim (Berlin), Krause's glacial erratic boulder no. 648, a "graues, ziemlich festes, splittriges Geschiebe", presumably Keila Stage (D2).

Lectotype of *Strepula signata*. Left valve, GG-114-59 – Figure 1E; Steusloff 1895, pl. 58, fig. 25, Neubrandenburg, presumably Keila Stage (D2).

Material. From the several specimens of Krause (1892: 395) only the figured one had been at the authors disposal. From Steusloff's *Strepula signata* two left valves (lectotype and paratype) and an external mould of a left valve (Schallreuter 1988, fig. 2.1) had been available.

Dimensions and proportions (L – H in mm – L : H). Lectotype: 2.54 – 1.77 – 1.44. Lectotype of *Strepula signata* 2.00 – 1.37 – 1.46. Holotype of *Piretella* ? *paczerensis*: 3.25 – 2.00 – 1.63, specimen no. 13–249/2 of Sidaravičienė 1992, pl. 37, figs 6–7: 2.50 – 1.75 – 1.43. *S. wandae* (after Sztejn 1989: 76) holotype 2.63 – 1.83 – 1.44, paratype 8348/88/O 2.94 – 1.53 – 1.92 (measurements incorrect?, after figure pl. 2, fig. 1d and magnification L only 1.78 mm). Specimen of Schallreuter: 1995, fig. 1: 3.58 – 2.30 – 1.56.

Definition. As for the presently monotypic genus.

Remarks. Younger synonyms are *Strepula signata* Steusloff, 1895, *Signakiella asteusloffi* Schallreuter, 1988, *Steusloffia wandae* Sztejn, 1989 and *Signakiella paczerensis* (Sidaravičienė, 1992). Already Bassler & Kellett (1934: 476) considered *Strepula signata* Steusloff and *Beyrichia signata* Krause as synonyms.

Dimorphism. Until now, none of the available specimens shows dimorphic features. However, the largest known specimen does not exceed 3.58 mm (Schallreuter 1988b: 128) and the yet presented material is even smaller. Therefore, adult females seem to be absent rather than that dimorphic features are not developed. This all the more, as *Signakiella* is closely related to *Uhakiella* and thus, dimorphism with a strongly convex dolon ("false" brood pouch) in the anteroventral region is to be expected.

Occurrence. Lithuania: Haljala Stage (C3/D1); mid-eastern Poland: Kukruse – Keila; ? Östergotland. Glacial erratic boulders (D2 and perhaps older) of northern Germany.

Vauscripta Schallreuter, 1988

Synonym. *Mojczella* Olempska, 1989

Type species. *Bollia v-scripta* Krause, 1889; by original designation. Type species of *Mojczella*: *M. jaanussoni* Olempska, 1989; by original designation.

Definition. Medium-sized – large, S2 pit-like, distinct oval PAN, zygal ridge and C3 forming a v-shaped ridge, C1 isolated or connected anteroventrally with C3. C1 and C3 passing dorsally into the two branches of the plica. Velum anteriorly and ventrally as a ridge or more or less broad flange which may be undulate, in females weakly or strongly convex. Outer surface reticulate and tuberculate or smooth.

Dimorphism. The knowledge about mode and formation of the dolon/antrum in *Vauscripta* is rather limited since females are extremely rare. Olempska (1989a, pl. 17, figs 5–6; 1989b: 162) mentioned and figured few females with a slightly convex undulate dolon but mentioned also a fragmentary heteromorph with a strongly convex dolon. The female figured by Sidaravičienė (1992, pl. 36, fig. 12) seems to have such a strongly convex dolon forming a long false brood pouch. This specimen is rather large with 2.15 mm, and tecnomorphs may even reach 2.40 mm. This shows that the majority of the material described is juvenile.

Olempska (1989b: 162) mentioned a "very fine transversal striation (but without traces of fused spines)" at the heteromorphic velar flange. Such striation was also observed in tecnomorphs (Schallreuter 1993, pl. 39b, fig. 4), but mostly striation or undulation is rather indistinct for preservational reasons.

Comparisons. There are several genera characterized by a parable-like crista formed by C1 and C3 and enclosing both PAN and S2. This feature is, therefore, homeomorphic and complicates the systematic differentiation between *Vauscripta* and *Mojczella* as well as between *Uhakiella* and *Signakiella* (Tvaerenellidae), *Piretella* and *Lembitsarvella* (Piretellidae), *Asteusloffia* (Ctenentominae, Ctenonotellidae), and *Pectidolon* (Wehrliinae, Ctenonotellidae).

Before becoming the type-species of *Vauscripta*, *Bollia v-scripta* was assigned to *Uhakiella*, Tvaerenellidae (Öpik 1937; Schallreuter 1973). Olempska also referred *Mojczella* to the Tvaerenellidae, while Sidaravičienė (1992: 145, 147) assigned it to the Piretellinae. The taxonomic problems are also exemplified by species originally erected within the genus *Piretella*: *Vauscripta tridactyla* (Jaanusson, 1957),.

Features such as the pit-like S2, the PAN, the zygal ridge, and the plica indicate close relationships between

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Vauscripta, Uhakiella and *Signakiella*. Main differences between the three genera refer to the ventral bulge present in *Uhakiella* and *Signakiella* and the C3 and velar flange developed in *Vauscripta*. In lobation and cristation transitions exist between *Uhakiella* and *Vauscripta* as shown, e.g., by the two valves figured by Thorslund (1940, pl. 1, figs 6–7) as *Uhakiella coelodesma*.

Differences seem to exist in the construction of the tecnomorphic velum and perhaps the dimorphism. In *Uhakiella* the tecnomorphic velum is reduced to a narrow broad bulge and in typical species with a centroventral incisure in the males. By contrast, *Vauscripta* has a relatively broad velar flange which forms a weakly convex undulate dolon or strongly convex pouch in females.

More than typical *Uhakiella* species does *Vauscripta* very much resemble the Baltic species assigned to *Bromidella* in their ridge- or flange-like tecnomorphic (part of) velum. It is very likely that *Vauscripta* (Schallreuter 1988b: 42; 1993, pl. 50a, figs 2–3, pl. 52b, figs 1–3) originated from this *Bromidella* branch.

Vauscripta also resembles the two ctenentominine genera *Asteusloffia* and *Ctenentoma*. *Vauscripta* and *Asteusloffia* are very similar in the construction of the plica (compare Fig. 3C and Olempska 1989a, pl. 18, fig. 6) but in *Asteusloffia* the distance between PAN and C1/3 is larger and a connection between them is lacking. Furthermore, *Asteusloffia* exhibits a C4.

In the formation of an undulate velar flange as well as in the kind of dimorphism (weakly convex dolon) *Vauscripta* resembles very much *Ctenentoma* (Schallreuter 1994, pl. 17, fig. 3). Similarity exists also concerning S2, PAN and postsulcal ridge. *Vauscripta* has only more ridges on the lateral surface.

Comparable features to *Steusloffia* refer to S2, PAN, cristae and sometimes an undulate velar flange (Schallreuter 1993, pl. 39b, figs 3–4).

In the development of C1/3 *Mojczella* very much resemble *Signakiella* also showing the slight bending at the connection point beneath the PAN (Olempska 1989b: 164) (compare Fig. 1G and Olempska 1989a, pl. 19, figs 3–4, 8 – for the first time already at least in the samples MA-58 and MA-59, not MA-65 and MA-66).

Signakiella differs mainly by the ventral bulge, the short C4, and the missing velar flange. This fact clearly demonstrates the striking homeomorphic nature of the C1/3 character.

Piretella to which one synonym of the type-species was originally assigned has an uninterrupted C1/3 like adults of the type-species and *M. sanctacrucensis* (Olempska 1989a, pl. 19, figs 7–8; Sidaravičienė 1992, pl. 37, figs 1–2). The velum of *Piretella* consists of a frill with hollow tubules and long spines in both centroventral and posterior region of the valve. Spines may occur also in the posterior region of *Vauscripta,* but they are only short and restricted to that area because of the longer velar flange. The distance between C1/3 and the velum is shorter in *Piretella* (e.g. Sidaravičienė 1992, pl. 36, fig. 11, and pl. 37, figs 1–2). *Piretella* has a reticulate shell, while *Vauscripta* may have only a reticulogranulate outer surface (Olempska 1989a, pl. 18, figs 3–6). It is, however, mostly more or less granulate to smooth. Young *Piretella* instars may have C1 and C3 separated anteroventrally (Schallreuter 1975, pl. 5, fig. 2) like in the oldest species assigned to *Mojczella* and in larvae of *M. jaanussoni* (Olempska 1989a, pl. 17, figs 1–7, pl. 18, figs 1, 4–5).

Phylogeny. Olempska reconstructed an evolutionary lineage of *Mojczella* from the Ordovician Mójcza Limestone of the Holy Cross Mountains. The lineage consists of the three chronospecies (*M. polonica*, *M. jaanussoni*, *M. sanctacrucensis*) distinguished on the basis of morphologic differences and stratigraphical occurrence. They have been "... defined in such way that the two most significant gaps in the record separate them ... and it is clear that this way of discrimination of species is actually quite arbitral" (Olempska 1989b: 167).

M. jaanussoni has been defined by C1 "... ending below PAN", and *M. sanctacrucensis* by "... C1 and C3 united beneath PAN". The largest figured valve of *M. jaanussoni*, a female valve (Olempska 1989a, pl. 19, fig. 4; L 2.03 mm), which is older than the smaller holotype of that species, shows already a connected C1/3 like in the younger but smaller tecnomorphic holotype of *M. sanctacrucensis* (Olempska 1989a, pl. 19, fig. 8; L 1.80 mm) which is not adult. Sidaravičienė (1992, pl. 37, fig. 1) figured a female (?) valve of 2.40 mm length. The unification of C1 and C3 is therefore apparantly a matter of palingenesis.

Remarks. Beside of *V. v-scripta* (= *V. tridactyla* = *V. jaanussoni), V. polonica*, and *V. sanctacrucensis*, *Piretella pontis* Schallreuter & Krůta, 1984 and *Rigidella dubia* Olemspka, 1994 may belong in *Vauscripta*.

Vauscripta v-scripta **(Krause, 1889)**

Figure 1G

1889 *Bollia v-scripta* Krause: 13–14, 23, 24, pl. 1, fig. 18 (non fig. 17).
1896 *Bollia V-scripta*. – Koken: 39, 383, fig. 26d (after Krause 1889, pl. 1, fig. 18).
1908 *Beyrichia v-scripta*. – Ulrich & Bassler: 299, fig. 48 (= Krause 1889, pl. 1, fig. 18), pl. 38, fig. 8.
1934 *Zygobolba v-scripta*. – Bassler & Kellett: 55, 221, 498.
1937 *Uhakiella* ? *V-scripta*. – Öpik: 42, 106.
1957 *Piretella tridactyla* Jaanusson: 279, 280–281, tab. 40, pl. 5, figs 1–5.
1960 *Piretella tridactyla*. – Jaanusson: 238, 270, figs 6, 23 (faunal logs), tab. 5.
1973 *Uhakiella v-scripta*. – Schallreuter: 78.
1976 *Piretella tridactyla*. – Sidaravičienė: 52, tabs 1–2.
1982 *Piretella tridactyla*. – Gailīte in Ul'st et al.: 117, 127–128, 179–180, 183, figs 23 (cf.), 28 (faunal logs), tabs 8–11.
1984 *Piretella tridactyla*. – Laškov et al.: 82.
1985 *Piretella tridactyla*. – Sztejn: 61 (partim); non 61 (partim), 86, tab. 1, pl. 1, figs 2a–b = *Mojczella sanctacrucensis*, Sidaravičienė 1992: 147.

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1988b *Vauscripta v-scripta*. – Schallreuter: 40–42, figs 2.3–4.
1989a *Mojczella jaanussoni* Olempska: 135, 138, 140–141, 143–144, pl. 17, figs 7–8, pl. 18, figs 1–7, pl. 19, figs 1–4.
1989a *Mojczella ? tridactyla*. – Olempska: 138–139.
1989b *Mojczella jaanussoni*. – Olempska: 159, figs 2–5.
1992 *Mojczella tridactyla*. – Sidaravičienė: 147, 244, tab. 2, pl. 36, fig. 12.
1993 *Vauscripta tridactyla*. – Schallreuter: 38, 226, pl. 39b, fig. 4.
1994 *Mojczella jaanussoni*. – Olempska: 147–148, 153–154, 175–176, figs 8, 11, tab. 2, pl. 38, figs 1, 4–10, pl. 40, figs 1–2.
1996 *Mojczella tridactyla*. – Sidaravičienė: 10, 52, tab. 2, figs 7, 10, 12 (faunal logs).

Lectotype. Right valve (MB. HS 2010-5), Figure 1G; Krause 1889, pl. 1, fig. 18; Schallreuter 1988b, fig. 2.3.

Type locality and horizon. Berlin or Mark Brandenburg, Krause's glacial erratic boulder no. 112, age: presumably Aseri Stage (C1a).

Dimensions. Lectotype L 1.78 mm, H 1.07 mm, Hm 1.10 mm; L : H 1.66.

Comparisons. *Vauscripta v-scripta* is considered here as an older synonym of *Piretella tridactyla* Jaanusson, 1957 which Sidaravičienė (1992: 147) had recognized as an older synonym of *Mojczella jaanussoni* Olempska, 1989.

Olempska (1989a: 138) placed *Piretella tridactyla* only tentatively in *Mojczella* because its entire velum is longer than in the latter genus. This seems to apply also to Jaanusson's (1957) specimen figured on plate 5, figure 1, but not to the holotype of *Piretella tridactyla*. The latter agrees with *jaanussoni* (Jaanusson 1957, pl. 5, fig. 2) in having posteriorly a row of tubercles including the characteristical posterodorsal spine (Olempska 1989b: 162) like *Mojczella*. With a domiciliary length of about 1.40 mm the holotype of *Piretella tridactyla* represents only a larval stage. The smaller female valve figured by Jaanusson (1957, pl. 5, fig. 5) represents a different species (*Piretia* ? sp.). Sidaravičienė (1992, pl. 37, fig. 1) figured a female valve of *Piretella tridactyla* with L 2.15 mm in accordance with the largest known specimen (2.03 mm) of *Mojczella jaanussoni*.

The holotype of *P. tridactyla* agrees in most features with the lectotype of *Vauscripta v-scripta* except for the anterior branch of the plica. Dorsocentrally, the latter seems to be connected with the posterior branch (Jaanusson 1957, pl. 5, fig. 2) – like in some species of *Piretella* (Sarv 1959, pl. 3, figs 4, 7; Sidaravičienė 1992, pl. 36, fig. 11). This feature may be a matter of variation or perhaps of subspecific importance – like in *Asteusloffia acuta*.

From the succession of the Mojcza limestone in the Holy Cross Mountains, Olempska (1989b, fig. 2) reconstructed a phylogenetic lineage of the *Mojczella* species, which is characterized by the prolongation of both C1 and C3 and their unification in the youngest species. Based on these specific features *Vauscripta v-scripta*, *Piretella tridactyla*, and *Mojczella jaanussoni* must be considered as synonyms. This the more, as they come from about the same stratigraphical level (Upper Llanvirnian).

Remarks. The second specimen (MB. HS 2010–6) figured by Krause (1889, pl. 1, fig. 17) which came from another boulder (glacial erratic boulder no. 311) represents another species (*Bromidella* cf. *kohtlensis*) because the zygal crista is not connected with the posterior plical bow.

Occurrence. Öland: Segerstad Lst. (*Platyurus* Lst., Aseri Stage) (Jaanusson 1960); Latvia: Upper Ziemel'skaja (C1a) (Gailīte in Ulst et al. 1982); Lithuania: *M. tridactyla* Zone, Rokiškis Fm., Aseri Stage (Laškov et al. 1984; Sidaravičienė 1976, 1992, 1996); Holy Cross Mountains: *Pygodus anserinus* zone (Olempska 1989a, 1989b). Glacial erratic boulders: Upper Gray and Upper Red *Orthoceras* Lst. (Kummerow 1924; Schallreuter 1993).

Euprimites Hessland, 1949

Type species. Euprimites reticulogranulatus Hessland, 1949; by original designation.

Euprimites intermedius (Krause, 1889)

Figure 2F

1889 *Primitia intermedia* Krause: 11, 23, pl. 1, fig. 16.
1934 *Eurychilina intermedia*. – Bassler & Kellett: 55, 315, 446.
1962 *Primitia intermedia* = *Euprimites* sp. indet. – Jaanusson: 413.
1973 *Euprimites locknensis*. – Schallreuter: 92–94, 96, 98, 111, tab. 13, pl. 21, figs 4–11 (syn.).
1983a *Euprimites locknensis*. – Schallreuter: 174 (syn.).
1984b *Euprimites locknensis*. – Schallreuter: 93, 95–96, tab.1, figs 1a–b, 2b.
1992 *Euprimites locknensis*. – Sidaravičienė: 97–98, 239, tab. 2, pl. 25, fig. 12.
1993 *Euprimites (Euprimites) locknensis*. – Schallreuter: 44, 116–117, 172, pl. 12b, fig. 3 (syn.).
1996 *Euprimites locknensis*. – Sidaravičienė: 13, 16, tabs 2–4, figs 3, 4 (*Suprimites l.*), 6–7, 10.

Lectotype (designated by Jaanusson 1962: 413). Left female valve, MB. HS 2010-7, Figure 2F; Krause 1889, pl. 1, fig. 16.

Type locality and horizon. Müggelheim; Krause's glacial erratic boulder no. 339, a grey, marly limestone, age presumably like *Ludibundus* limestone of Sweden.

Dimensions. L of lectotype 1.46 mm, holotype of *E. locknensis* 1.46 mm.

Definition. Females between 1.30 and 1.70 mm and mostly moderately high. Outline more or less amplete. Domicilium rather weakly convex. Sulcus very broad and relatively long, in its central part somewhat constricted, anteroventral depression present. Velum in tecnomorphs as flange-like keel, in females as a flange. Anterocentral part of flange extending perpendicular, centroventral part parallel to straight dorsal margin. End of dolon anteriorly indistinct, antrum not very deep, anteriorly open and posteriorly indistinctly closed. Lateral surface reticulate.

Remarks. After investigation and designation of the lectotype Jaanusson (1962: 413) considered *P. intermedia* as a *nomen dubium*. However, new SEM stereopairs clearly evidence that it is a senior synonym of *E. locknensis*. The broad S2 is a very characteristic feature.

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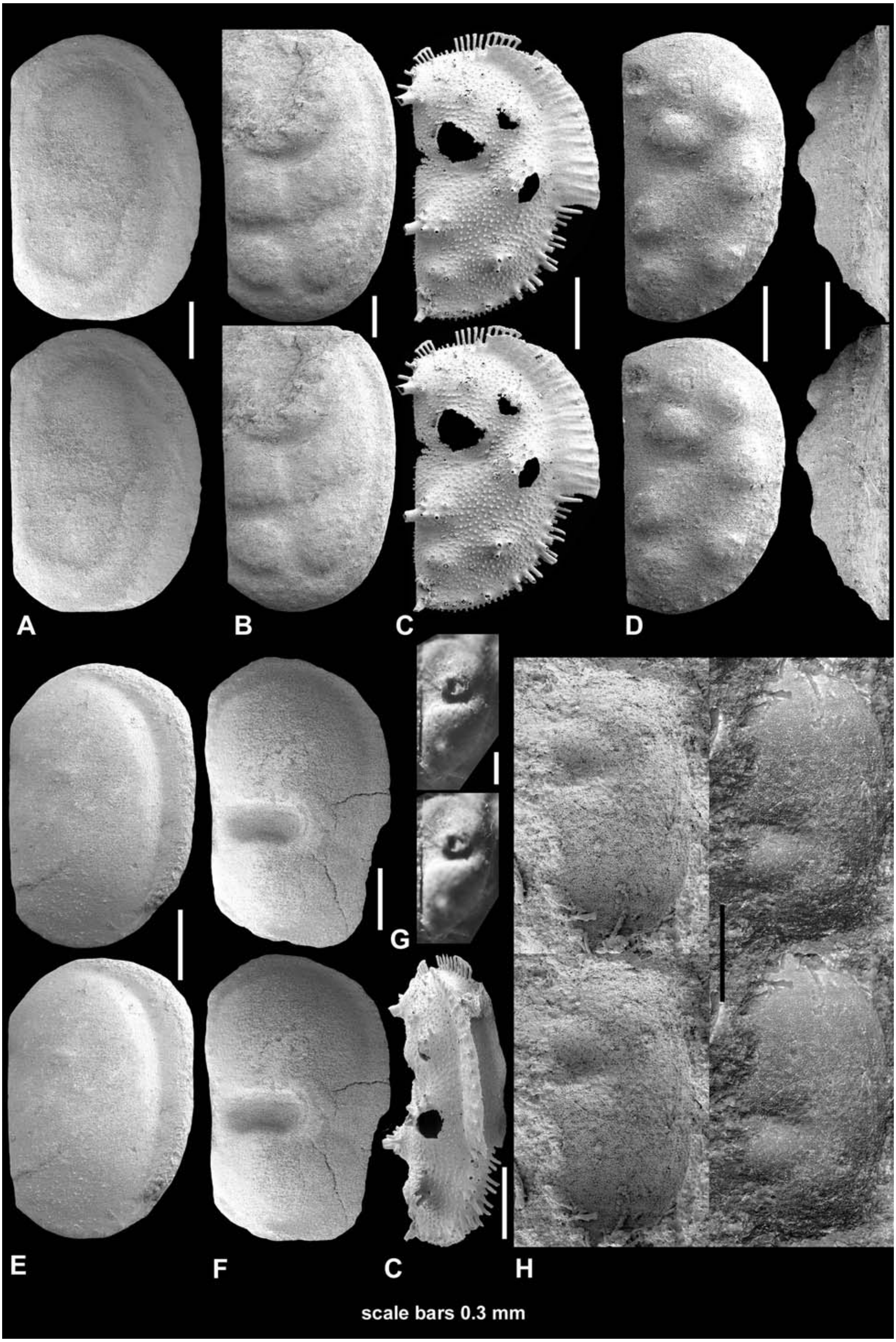

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Occurrence. *E. locknensis* is reported from outcrops and borings of the Central Baltoscandian confacies belt (Sweden, SE Estonia, Latvia, Lithuania, Belorussia, former East Prussia) from the Aseri stage (C1a) up to the Keila stage (D2) (Schallreuter 1993: 117). From Swedish outcrops, the probable origin of the respective glacial erratic boulder, the species is recorded exclusively from the *Ludibundus* Limestone (= Kukruse – Haljala stages) where it is one of the commonest species (Jaanusson 1957: 310).

Tvaerenella Jaanusson, 1957

Type species. *Primitiella carinata* Thorslund, 1940 (OD); by original designation. = *Primitia plana tuberculata* Krause, 1892 = *Primitiella indistincta* Öpik, 1937 = *Primitiella granosa* Öpik, 1937.

Definition. Schallreuter 1973: 102.

Tvaerenella tuberculata (Krause, 1892)

Figure 2E

1892 *Primitia plana* Krause var. *tuberculata* Krause: 385, 399, pl. 21, fig. 8.
1934 *Apatochilina plana tuberculata*. – Bassler & Kellett: 55, 163, 452.
1937 *Primitiella indistincta* Öpik: 5, 13, 60, 69, 77, 124, pl. 1, fig. 4.
1937 *Primitiella granosa* Öpik: 5, 14, 72, 69, 78, 136, pl. 13, figs 6–9.
1940 *Primitiella* (?) *carinata* Thorslund: 163, 186, pl. 4, fig. 8.
1959 *Tvaerenella granosa*. – Sarv: 30–31, pl. 5, figs 4–7 (= Öpik 1937, pl. 13, figs 6–9) non figs 8–9 (= Öpik 1937, pl. 15, figs 7–8), tab. 2.
1973 *Tvaerenella* ? *tuberculata*. – Schallreuter: 102, 104.
1973 *Tvaerenella granosa*. – Schallreuter: 103–104, 106, 111, pl. 25, figs 1–5 (syn.).
1983a *Tvaerenella granosa*. – Schallreuter: 165, 175–176, 191, tab. 16 (12/7), pl. 12, fig. 7 (syn.).
1985 *Tvaerenella tuberculata*. – Schallreuter: 107–108, 130, tab. 1, pl. 6, fig. 7 (syn.).
1993 *Tvaerenella tuberculata*. – Schallreuter: 14, 117–118, 260, pl. 56a, figs 1–3.

Lectotype (designated by Schallreuter 1985: 107). Right ♀ valve, MB. HS 2010-8 – Figure 2E; Krause 1892, pl. 21, fig. 8.

Type locality and horizon. Müggelheim, Krause's glacial erratic boulder no. 670.

Dimensions (L, H in mm, L : H. Lectotype 1.23 – 0.75 – 1.64. Holotype of *P. granosa* (tecnomorphic carapace) 1.30 – 0.80 – 1.63 (Öpik 1937), 1.20 – 0.88 – 1.36 (Sarv 1959). Holotype of *P. carinata* (left ♀ valve) 1.16 – 0.68 – 1.71, of *P. indistincta* 0.80 – 0.45 – 1.77.

Definition. Females 1.10 – 1.30 mm long and rather high to moderately high. Domicilium with indistinct sulcal depression. PAN very small and flat, situated anterodorsally of an oval, more or less distinct muscle spot with a weak interior sulcament. Tecnomorphic velum developed as keel, rounded bend or completely lacking. Dolon posteriorly extending up to the posterocentral region. Surface smooth or reticulate and more or less covered with tubercles.

Remarks. *Apatochilina ubjaënsis* Öpik, 1937 has been tentatively considered as a synonym of *T. granosa* (Sarv 1959: 30–31; Schallreuter 1973: 103–104) but the presence of a dorsal plica (Öpik 1937, pl. 1, fig. 10, pl. 15, figs 7–?8) clearly distinguishes this species from typical *Tvaerenella* species. Together with *Tvaerenella caesura* Schallreuter, 1993 this species possibly represents a new genus.

Occurrence. Sweden (Brunflo-Lockne area, Jämtland; Fjäcka, Siljan District): *Ludibundus* beds. Estonia: Uhaku and Kukruse. Glacial erratic boulders: Ringsö, Tvären; Backsteinkalk types 1B2 (Dalby), 1B3 (Skagen), 14B2 and 1B13 (Haljala Stage); Harpa Limestone (D2).

Tvaerenella plana (Krause, 1889)

Figure 2A

1889 *Primitia plana* Krause: 5–7, 22, 24, pl. 1, fig. 1a–b.
1896 *Primitia plana*. – Koken: 381, fig. 26c (after Krause).
1924 *Primitiella umbilicata*, *Primitia u.* – Kummerow: 420–421, 440, 447, pl. 20, fig. 14.
1934 *Apatochilina plana*. – Bassler & Kellett: 55, 162, 452.
1954b *Platybolbina plana*. – Henningsmoen: 74–76, 89, 97.
1954b *Öpikella* cf. *umbilicata*. – Henningsmoen: 94–95, 101, pl. 5, figs 1–6.
1959 *Tvaerenella expedita* Sarv: 34–35, 185, 195, pl. 5, figs 23–28.
1993 *Euprimites* ? *umbilicata*. – Schallreuter: tab. 3.

◄

Figure 2. **A.** *Tvaerenella plana* (Krause, 1889), holo- or lectotype, left ♀ valve (MB. HS 2010-1), lateral view, L 1.51 mm; Müggelheim (Berlin), Krause's glacial erratic boulder no. 310, Harjuan; **B.** *Kiesowia dissecta* (Krause, 1892), holotype, anterior incomplete right tecnomorphic valve (MB. HS 2010-3), lateral view, L > 2.05 mm, Müggelheim (Berlin), Krause's glacial erratic boulder no. 616, age Pirgu or Porkuni stage (F1c or F2); **C.** *Kiesowia dissecta leviconvexa* (Schallreuter, 1967), holotype, right female valve (GG 25-3), lateral view, and ventrolateral views, L 1.20 mm, Isle of Gotland, Öjlemyr flint, glacial erratic boulder (no. 794), age Pirgu or Porkuni stage (F1c or F2); **D.** *Kiesowia dissecta* (Krause, 1892), holotype of *K. mamillosa* (Krause, 1892), right tecnomorphic valve (MB. HS 2010-4), lateral, and ventral views, L > 2.05 mm, Müggelheim (Berlin), Krause's geschiebe no. 667, age Pirgu or Porkuni stage (F1c or F2); **E.** *Tvaerenella tuberculata* (Krause, 1892), lectotype, right female valve (MB. HS 2010-8), lateral view, L 1.23 mm, Müggelheim (Berlin), Krause's glacial erratic boulder no. 670, age: Keila (D2); **F.** *Euprimites intermedius* (Krause, 1889), lectotype, left female valve (MB. HS 2010-7), L 1.46 mm, Müggelheim (Berlin), Krause's geschiebe no. 339, age presumably like *Ludibundus* limestone of Sweden; **G.** *Balticella globifera* (Krause, 1892), holotype of *Balticella binodis* (Krause, 1897), steinkern of a right valve (Rijksmuseum van Geologie en Mineralogie Leiden no. 34116), lateral view in two focus levels, L 1.28 mm, glacial erratic boulder from Zwiep hill near Lochem (Staring no. 11068), age Haljala stage (C3/D1); **H.** *Balticella globifera* (Krause, 1892), dorsally incomplete external mould of lost holotype (steinkern), left valve, (MB. HS 2010–16), internal lateral view, and photographical cast, L 0.85 mm, Müggelheim (Berlin), Krause's glacial erratic boulder no. 666, age presumably Haljala stage (C3/D1). All stereo-pairs except of C (ventrolateral view), and G.

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2008 *Tvaerenella umbilicata*. – Schallreuter & Hinz-Schallreuter: 809–812, fig. 1.1–4. (syn.).

Holo- or lectotype. Left ♀ valve, MB. HS 2010-1 – Figure 2A, Krause 1889, pl. 1, fig. 1.

Krause wrote that he found the species only once in a bright-grey glacial erratic boulder. It is not clear whether he meant only one specimen or several specimens in one boulder.

Type locality and horizon. Müggelheim (Berlin), Krause's glacial erratic boulder no. 310, together with *Platybolbina distans*. The latter seems to be a junior synonym of *P. orbiculata*, which occurs in Estonia from the Oandu (?) to Porkuni Stages (Meidla 1996: 23). *Tvaerenella expedita* is reported from Vormsi to Porkuni Stages of Estonia (Meidla 1996: 39), the age of the boulder is therefore, Vormsi Pirgu or Porkuni Stage.

Dimensions (L – H in mm – L : H). Lectotype 1.51 – 0.98 – 1.54.

Definition. At least up to 1.63 mm. Cardinal angles almost equal-sized. Dolon relatively short, terminating posteriorly already in the centroventral region.

Comparisons. *T. plana* differs from *T. tuberculata* mainly by the smaller anterodorsal cardinal angle and the shorter dolon.

Remarks. *P. plana* is a senior synonym of *Tvaerenella umbilicata* and *Tvaerenella expedita*.

Twenty years after Bassler & Kellett (1934) had assigned *Primitia plana* to the genus *Apatochilina* Henningsmoen (1953a) established the new genus *Platybolbina* for Krause's *P. distans*. Henningsmoen (1954b) considered *Primitia plana* as a possible synonym of *P. distans*. Reinvestigation of the type specimen of *P. plana* revealed, however, that it in fact belongs to the genus *Tvaerenella*. Accordingly, most citations in the literature concerning *Platybolbina plana* or *Platybolbina* cf. *plana* refer to *Platybolbina distans*.

In 1959 Sarv introduced the new species *Platybolbina orbiculata,* but Meidla (1996: 23) stated that "... until the type specimen of *P. plana* is redescribed the relationship between *P. plana* and *P. orbiculata* remains uncertain". There does not exist any relationship between *Tvaerenella plana* and *Platybolbina orbiculata*.

Occurrence. Oslo region: 4d–5b. Estonia: Vormsi Stage – Porkuni Stage. Russia (Pskov district), Latvia: Pirgu Stage. Lithuania, NW' Belorussia: Vormsi Stage – Pirgu Stage. Glacial erratic boulders: Öjlemyrflint: Isles of Gotland and of Sylt. Brandenburg: upper Ordovician limestones.

Superfamily **Tetradelloidea** Swartz, 1936
Family **Ctenonotellidae** Schmidt, 1941
Subfamily **Ctenentominae** Schmidt, 1941

Asteusloffia **Schallreuter, 1993**

Type species. *Strepula lineata separata* Steusloff, 1895; by original designation = *Beyrichia erratica acuta* Krause, 1891.

Definition. Medium-sized. Unisulcate, with distinct S2 and PAN. Dorsal plica complete or only partially developed. Three generally vertically arranged cristae: C2 missing, C1/C3 parable-like with C4 branching off from its posteroventral part C4 may or may not reach the dorsal margin.

Comparisons. From other genera with a parable-like crista around PAN and S2 (e.g., *Steusloffia*, Jaanusson 1957, fig. 38) *Asteusloffia* is distinguished mainly by the development of a C4. The similar *Steusloffia* in which adults and larger larvae are also characterized by a C4, has a C2 developed. Further, the C3 is centrally interrupted and terminates on the spine-like posteroventral lobe (Schallreuter 1993, pl. 54a, fig. 1). Although being stratigraphically older, *Asteusloffia* cannot be regarded as predecessor of *Steusloffia* because of the already lacking C2, which is in that lineage an advanced character.

Already Henningsmoen (1953b: 223) assumed that *Steusloffia* developed from forms with "normal" tetradellid arrangement of the cristae like *Tallinnellina lanceolata* and *Rigidella mitis*.

Also *Steusloffia* displays these four cristae, but has the C2 separated from the other cristae. The C2 is still present in the youngest species of *Steusloffia*, *S. levis* Sarv, 1959 from the Rakvere stage (E) of Estonia (Sarv 1959, pl. 15, fig. 7). By contrast, *Asteusloffia acuta* (= *Steusloffia polynodulifera* Hessland, 1949) lacks a C2 and therefore, is regarded as member of another lineage characterized by an early reduction of the C2.

Asteusloffia lineata **(Krause, 1889)**

Figure 3B

1889 *Strepula lineata* Krause: 15, 23, pl. 2, fig. 3.
1934 *Steusloffia lineata*. – Bassler & Kellett: 55, 475, 477.
1962 *Steusloffia lineata* = *Steusloffia sp.* indet. – Jaanusson: 413.

Lectotype (designated by Jaanusson 1962: 413). Right valve (MB. HS 2010-11), Fig. 3B, Krause 1889, pl. 2, fig. 3.

Type locality and horizon. ? Müggelheim (not mentioned on labels), Krause's glacial erratic boulder no. 106, exact age unknown.

▶

Figure 3. A. *Asteusloffia acuta separata* (Steusloff, 1895), lectotype, left valve (GG 114-51), lateral views in different positions to the SEM detector, L 0.98 mm, Neubrandenburg, glacial erratic boulder, age B3, lower Darriwillian; **B.** *Asteusloffia lineata* (Krause, 1889), lectotype, right valve (MB. HS 2010-11), lateral, and oblique dorsal views, L 1.05 mm, ? Müggelheim (Berlin), Krause's glacial erratic boulder no. 106, age unknown; **C.** *Asteusloffia acuta acuta* (Krause, 1891), right valve (GG 400-G123-18), lateral view, L 1.23 mm. Black Orthoceras limestone (B3β), local glacial erratic boulder (no. Gis-84) from Gislövshammar, Scania; **D.** *Asteusloffia acuta acuta* (Krause, 1891), left valve (GG 400–2539), lateral view, L 1.22 mm. Same boulder as fig. 3; **E.** *Asteusloffia acuta separata* (Steusloff, 1895), paratype, external mould of right valve (GG 114-50A), internal lateral view, and photographical cast, L 1.22 mm, same glacial erratic boulder as fig. 1; **F.** *Bilobatia bidens* (Krause, 1892), lectotype, female right valve (MB. HS 2010-14), lateral view, L 0.98 mm, Müggelheim (Berlin), Krause's glacial erratic boulder no. 670, age Keila stage (D2). All stereo-pairs.

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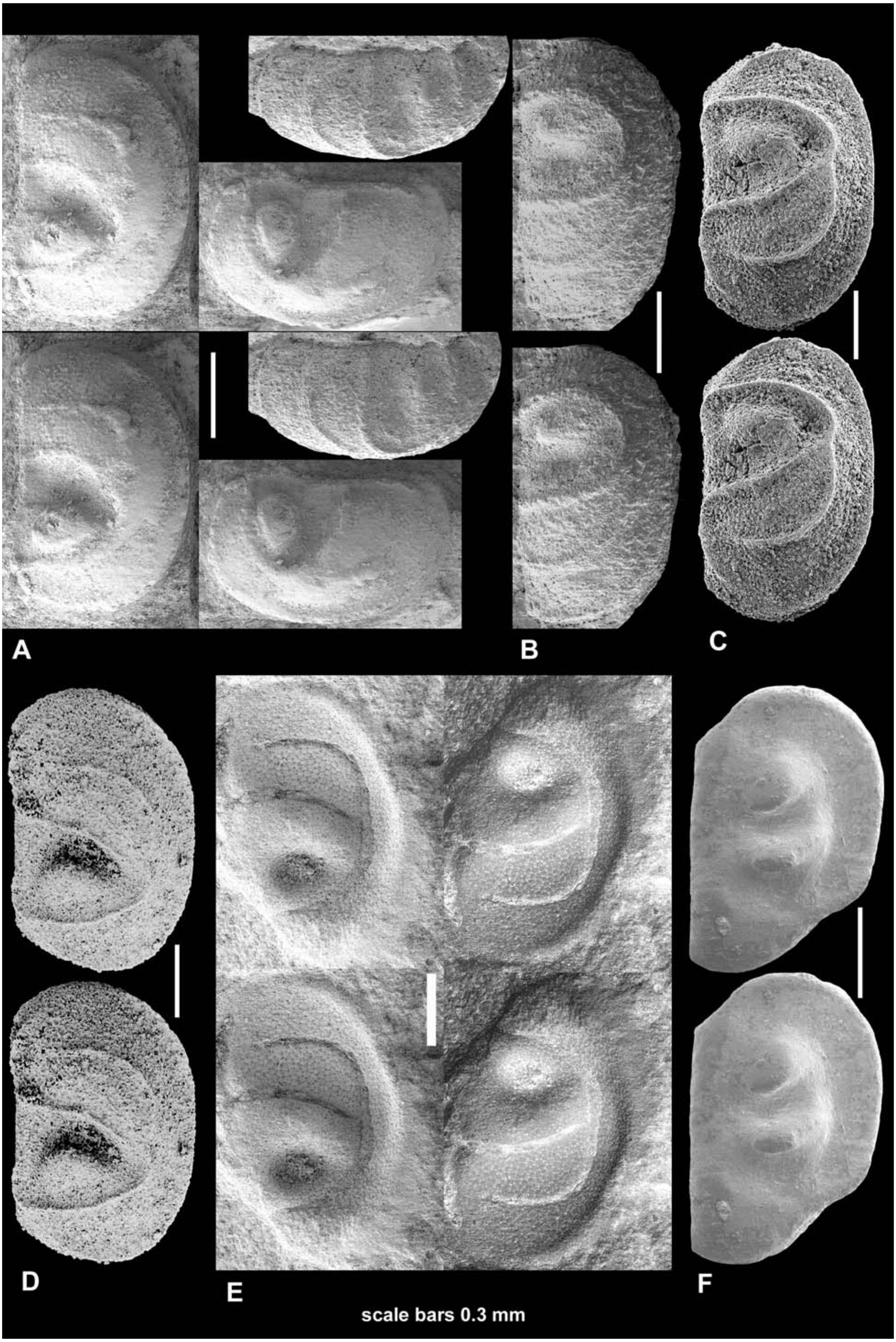
A
B
C
D
E
F
scale bars 0.3 mm

Dimensions. Lectotype L 1.05 mm, H 0.61 mm.

Definition. At least up to 1.05 mm. Plica nearly complety missing. C1 and C3 forming a U-shaped crista around small PAN and relatively narrow S2. C4 bow-shaped, both ends directed anteriorly; dorsal end may be connected with the dorsal end of C3. Plica nearly completely missing, only represented by the short dorsal portion of C4.

Comparisons. The missing plica distinguishes *A. lineata* from all other species of the genus. Differences exist also in the cristal arrangement: C1 plus C3 are U-shaped in *A. lineata* and V-shaped in *A. acuta*. In *A. lineata* both C3 and C4 reach the dorsal margin, C3 extends perpendicularly to the latter. C4 forms a slight bow with its ends anteriorly directed; its dorsal part represents a short plica. In *A. acuta*, the C3 passes dorsally into the posterior part of the plica, C4 terminates blindly in the dorsal half of the valve (Fig. 3C-D). *A. acuta* has a larger PAN and a broader S2 than *A. lineata.* Consequently, C3 is located directly at the posterior border of S2.

A. separata (Steusloff, 1895) has been originally described as a subspecies (var.) of *A. lineata*. Öpik (1937: 117 or 53) considered this taxon as a species of *Rigidella*, Jaanusson (1957: 359) referred it to *Steusloffia*, and Schallreuter (1993: 68) regarded it as the type-species of *Asteusloffia*. However, *A. separata* is more similar to *A. acuta* (Krause, 1891). Both differ only in their plicae which is present in all parts in *A. acuta separata* (Fig. 3A, E; Schallreuter 1993, pl. 33b, fig. 3, pl. 34a, figs 1l, 2l, 3, pl. 34b, fig. 4), while the centrodorsal part is lacking in *A. acuta acuta* (Figure 3C–D; Schallreuter 1993, pl. 31b, fig. 1r, pl. 36a, fig. 4, pl. 39a, figs 1l, 2). Therefore, *A. acuta separata* is considered here as a subspecies of *A. acuta*, and not as a variety because of the constantness of this feature in all investigated samples.

Although the lectotype of *A. lineata* is smaller (1.05 mm) than the largest known specimens of both *A. acuta separata* (1.25 mm) and *A. acuta acuta* (1.56 mm) the lack of the plica is not an ontogenetical feature in this case. The plica is present in the species mentioned above already in specimens of about the same size (Schallreuter 1993, pl. 33b, fig. 3) or even smaller ones (Schallreuter 1993, pl. 39a, fig. 3). As demonstrated by species of the related genus *Steusloffia* the plica appears already in the A-3 stage with the C4 still not developed (Schallreuter 1976: 189, pl. 5, fig. 5; Hinz-Schallreuter & Schallreuter 1998, fig. 81).

Occurrence. Known only from type locality.

Subfamily **Wehrliinae** Schallreuter, 1965

***Bilobatia* Schallreuter, 1976**

Type species. *Bilobatia serralobata* Schallreuter, 1976; by original designation. = *Beyrichia* (*Ulrichia*?) *bidens* Krause, 1892.

Definition. Schallreuter 1976: 205.

***Bilobatia bidens* (Krause, 1892)**

Figure 3F

1892 *Beyrichia (Ulrichia?) bidens* Krause: 396, 399, pl. 22, fig. 12.
1909 *Ulrichia bidens*. – Bonnema: 54, 81; non 54, 77, 81–82, pl. 6, fig. 27 = *Ctenonotella elongata* Öpik, 1937.
1937 *Ctenonotella bidens*. – Öpik: 38, 102.
1959 *Ctenonotella bidens*. – Sarv: 72–73, tab. 2, pl. 11, figs 17–18.
1976 *Bilobatia serralobata* Schallreuter: 205–207, 215, tab. 12; fig. 14, pl. 8, figs 1–2 (syn.).
1982 *Bilobatia serralobata.* – Schallreuter: 9–15, pl. 10, figs 1–2, pl. 12, figs 1–3, pl. 14, figs 1–2, pl. 16, figs 1–2.
1985 *Bilobatia bidens*. – Schallreuter: 110–111, 120, tab. 1, pl. 1, figs 5–6 (syn.).
1990 *Bilobatia bidens serralobata* – Schallreuter: 255, 268, tabs 2–4, pl. 2, figs 9–10.
1997 *Bilobatia bidens serralobata* – Schallreuter: figs 18a–e.
1998 *Bilobatia bidens serralobata* – Hinz-Schallreuter & Schallreuter: fig. 96a–e (= Schallreuter 1997: fig. 18).
1999 *Bilobatia bidens serralobata* – Schallreuter et al.: pl. 1, fig. 4.

Lectotype (designated by Sarv 1959: 73, not by monotypy as mentioned by Sarv). Right ♀ valve, MB. HS 2010-14, Figure 3F, Krause 1892, pl. 22, fig. 12.

Type locality and horizon. Müggelheim (Berlin); Krause's glacial erratic boulder no. 670.

Dimensions. Lectotype L 0.98 mm, H 0.66 mm, L : H 1.48.

Definition. As for the genus which is presently monotypic.

Remarks. In the population of the glacial erratic boulder Sy-108 described by Schallreuter (1982) yielded females that are much smaller (0.90–0.96 mm) than the holotype of the nominal type-species *B. serralobata* (1.25 mm). They were therefore considered (Schallreuter 1982: 13) as a possibly smaller subspecies, which the lectotype of *B. bidens* with a size of 0.98 mm is referred to.

Occurrence. Estonia: Haljala Stage (C3/D1) and Keila Stage (D2). Glacial erratic boulders: Harpa Lst. (D2; Krause's glacial erratic boulder no. 670, Ahl-1001); Baltic Backsteinkalk = Sandöflint (14B2 type, glacial erratic boulder 14B2, 1B341, Ho-2); Rollsteinkalk (glacial erratic boulder Ro-2 (D2); Lavenderblue Cherts (Hornsteine) of Sylt, types Sy-154 (D1), Sy-167 (C3/D1), Sy-108 (*Cyclocrinus* Lst., D2).

Family **Tetradellidae** Swartz, 1936
Subfamily **Sigmoopsinae** Henningsmoen, 1953

***Kiesowia* Ulrich & Bassler, 1908**

Type species. *Beyrichia dissecta* Krause, 1892; by original designation.

Definition. Quadrilobate, lobes disintegrated into single nodes. Each node is composed of two nodes. Females anteriorly and ventrally with an undulate velar flange. A shorter histial ridge may branch off from the velar flange anterocentrally and may extend to the centroventral region. Marginal sculpture developed as a row of spines. Surface with spines and granules.

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***Kiesowia dissecta* (Krause, 1892)**
Figure 2B–D

1892 *Beyrichia dissecta* Krause: 391–393, 398–399, pl. 21, fig. 3.
1892 *Beyrichia mamilosa* Krause: 386, 393, 399, pl. 22, fig. 14.
1894 *Tetradella* ? *dissecta*, *Tetradella* ? *mamillosa*. – Ulrich: 679.
1908 *Tetradella (Kiesowia) dissecta*, *T. (K.) mamillosa*. – Ulrich & Bassler: 306–307, pl. 39, figs 10–11 (after Krause).
1923 *Kiesowia (Beyrichia) dissecta*. – Ulrich & Bassler: 311, fig. 20.6 (presumably after Krause 1892: pl. 21, fig. 3).
1934 *Kiesowia mamillosa*. – Bassler & Kellett: 349–350 (partim), 481.
1951 *Kiesowia mamillosa*, *Kiesowia dissecta*. – Kesling: 157–158, pl. 4, fig. 3, pl. 5, fig. 3.
1954b *Kiesowia dissecta* = ? *Kiesowia mamillosa*. – Henningsmoen: 76, 78–80, 101, pl. 2, figs 1–3, 5.
1956 *Kiesowia septenaria* Stumbur: 188–189, 194, pl. 2, fig. 1.
1958 *Kiesowia dissecta*. – Pokorný: 138, fig. 667 (after Krause).
1962 *Kiesowia dissecta*. – Sarv: 95, 97–98, 103, 109–111, 127, tab. 1, pl. 4, fig. 9.
1965 *Kiesowia dissecta*. – Pokorný: 145.
1967 *Hithis leviconvexus* Schallreuter: 619–621, fig. 3.
non 1970 *Kiesowia mamillosa*. – Schallreuter: 288 (= ? *Homeokiesowia frigida*, Schallreuter 1976: 178).
1977 *Kiesowia dissecta*. – Helmdach: fig. 18.
1979 *Kiesowia (Kiesowia) dissecta*. – Schallreuter: 79, 81, 83, 85, pl. 6, 80, figs 1–4, pl. 6, 82, figs 1–4, pl. 6, 84, figs 1–5, pl. 6, 86, figs 1–6.
1982 *Hithis ? mamillosa*. – Schallreuter & Siveter: 87.
1986 *Kiesowia (Kiesowia) dissecta*. – Schallreuter: 7, 22, pl. 4, fig. 4.
1987b *Kiesowia (Kiesowia) dissecta*. – Schallreuter: 207, 222.
1988a *Kiesowia (Kiesowia) dissecta*. – Schallreuter: 1042, 1045, pl. 1, fig. 7.
1990 *Kiesowia dissecta*. – Abushik in Abushik et al.: 61, 233, pl. 7, fig. 10.
1992 *Kiesowia mamillosa* = *K. septenaria*. – Sidaravičienė: 52–54, 233, tab. 2, (non pl. 12, fig. 3, see below).
1996 *Kiesowia dissecta*. – Meidla: 56–57, tabs 5, 9, figs 9–10, 20 (faunal logs), pl. 10, fig. 3.
1998 *Kiesowia dissecta*. – Hinz-Schallreuter & Schallreuter: fig. 85b.

Synonyms. *K. mamillosa* and *K. septenaria* Stumbur, 1956 have been considered as (possible) synonyms of *K. dissecta* (Henningsmoen 1954b: 79–80; Sarv 1962: 109–110; Meidla 1996: 57). Meidla (1996: 57) regarded also *Hithis leviconvexus* as a synonym of *Kiesowia dissecta*. Schallreuter (1979: 85) had already assumed that *K. mamillosa* is a senior synonym of *H. leviconvexus*.

Lectotype of *Beyrichia dissecta*: tecnomorphic right valve, MB. HS 2010-3 – Figure 2B; Krause 1892, pl. 21, fig. 3.
The part of the valve anteriorly of the fine crack seen at Krause's figure is broken away later (Meidla 1996: 57). The valve was still complete when Heidrich prepared a drawing of the valve (Helmdach 1977, fig. 18).

Type locality and horizon. Müggelheim; Krause's glacial erratic boulder no. 616, age: upper Upper Ordovician, presumably Porkuni (F2).

Holotype of *Beyrichia mamillosa* (monotypy). right tecnomorphic valve, MB. HS 2010-4 – Figure 2D; Krause 1892, pl. 22, fig. 14. Müggelheim, Berlin; Krause's glacial erratic boulder no. 667, a yellowish crystallinic glacial erratic boulder with *Primitia elongata* Krause, 1891.

Holotype of *Kiesowia septenaria*. left tecnomorphic valve, Tartu Os 5005 – Stumbur 1956, pl. 2, fig. 1, Sarv 1962, pl. 4, fig. 9. Porkuni, F2.

Holotype of *Hithis leviconvexus*. right female valve, GG 25-3 – Schallreuter 1967, fig. 3. Isle of Gotland (Baltic Sea), Öjlemyrflint (glacial erratic boulder no. 794), F1c/F2.

Dimensions. Holotype of *K. dissecta* L > 2.05 mm, H 1.22 mm; holotype of *K. mamillosa* L 1.15 mm, H 0.61 mm; holotype of *K. septenaria* L 2.40 mm (Stumbur 1956: 188) or 1.70 mm (Sarv 1962: 109); holotype of *Hithis leviconvexus* L 1.20 mm, H 0.79 (incl. velar flange).

Definition. Females 1.20–2.15 mm (Sarv 1962: 109), ? 2.40 mm. Histium short or completely missing.

Comparison. *K. prussica* Schallreuter, 1987 (1.66–2.35 mm) has a histial ridge which extends further posteriorly than in *K. dissecta* and may reach the ventral end of L3 (Schallreuter 1987b, pl. 1b, fig. 1; Sarv 1959, pl. 21, fig. 17; Sidaravičienė 1992, pl. 12, figs 3–5).

Remarks. *Kiesowia dissecta* is quadrilobate with the lobes split into single nodes with each being composed of two nodes. L1 is represented by the anterocentral node (L1m) and a less distinct, smaller anterodorsal node or spine (L1d). The anteroventral node has been often considered as the ventral node of L1 (L1v) but represents in fact the ventral node of L2 (L2v). L2 consists of L2m and L2v. Since L1m is usually fused with L2v, the latter has been often misinterpreted as anteroventral node of L1 (L1v) and made Henningsmoen (1954b: 79) state "… L1 tends to split into three nodes. This is especially seen in larval valves". However, as lobes in their dorsoventral extend are generally forwardly directed, the above interpretation would lead to a posteriorly directed extend of L1.

In palaeocopes, females are usually more important for taxonomic determinations than tecnomorphs. Specimens of *K. dissecta* with frill (= females) were firstly figured by Henningsmoen (1954b, pl. 2, figs 2–3, L 1,89 – 2.04, according to magnification). Additional and better preserved material was provided by Schallreuter (1979) in the Stereo-Atlas of Ostracod Shells. The figured females are smaller (1.43–1.58 mm) but all with fused L1m/L2v. In these specimens the frill has the same extent (posteriorly up to L4v) like in the valves figured by Henningsmoen. Therefore, they must be considered as adults and accordingly may represent a new, smaller (older ?) subspecies (Schallreuter 1979: 85).

By contrast, in *Hithis leviconvexus* the frill terminates posteriorly already ventrally of L3v. The smaller size and the development of three anterior nodes with L1m not being fused with L2v could be interpreted as larval feature. Also the shorter velar frill may be a larval character as, e.g, in tecnomorphs of *Piretella triebeli* and *Laccochilina lateris* (Schallreuter 1975: 165, 173, pl. 3, fig. 5, pl. 5, fig. 2). However, since the antrum is fully developed with a flange-like inner antral fence (Fig. 2C), which indicates that it is an adult and not a pre-adult female. In typical specimens of *K. dissecta* the inner antral fence is formed by a row of spines having their distal portion connected by a thin horizontal bar (Schallreuter 1979, pl. 6, 80, figs 2–3, pl. 6, 82, fig. 3). Taxonomically, *Hithis leviconvexus* is

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therefore, considered here as a subspecies of *K. dissecta* because of the differences not only in size.

Sidaravičienė (1992: 53–54) considered *K. mamillosa* as a separate species characterized by the distinct L1m. Her figured *K. mamillosa* (Sidaravičienė 1992, pl. 12, fig. 3) as well as her *K.* sp. A (Sidaravičienė 1992, fig. 4) both belong to *K. prussica*. The development or lack of L1m is merely a matter of variation (see above). *K. prussica* is characterized by its distinct histium, while in *K. dissecta* the histium is usually lacking; if present at all, it is only short (Schallreuter 1979, pl. 80, fig. 1). The specimens of *K. prussica* figured as *K. mamillosa*, *K.* sp. A and *K.* sp. B by Sidaravičienė (1992, pl. 12, figs 3–5) have differently long developed histia and represent the variation range of *K. prussica*. Already Sidaravičienė (1992: 55) assumed intraspecific variation concerning the very short histium in *K.* sp. B.

Occurrence. Oslo region: 5a–b. Estonia: Nabala Stage – Tamsalu Fm. (F1 – G2). Lithuania: ? Vormsi Stage – ? Pirgu Stage. Glacial erratic boulders: Öjlemyr flint and upper Ordovician limestones.

The occurrence in Lithuania is questionable. Meidla (1996: 57) mentioned the occurrence in Vormsi Stage and ? Pirgu Stage but Sidaravičienė (1992: 54) listed only one specimen of *K.* cf. *dissecta* from the Vormsi Stage. It seems that *K. dissecta* is in the Baltic region restricted to the North Estonian confacies belt. In size the lectotype is conform with the Estonian material. The smaller material considered as a possible subspecies (see above) occurs more westernly in the northern Middle Baltic Sea.

Suborder **Binodicopa** Schallreuter, 1972
Superfamily **Drepanelloidea** Ulrich & Bassler, 1923
Family **Drepanellidae** Ulrich & Bassler, 1923

Duplexibollia **Schallreuter, 1987**

Type species. *Bollia duplex* Krause, 1892; by original designation.

Remarks. The genus is presently monotypic. By contrast, Sidaravičienė (1992: 158) considered *Duplexibollia duplex* sensu Schallreuter (1987a) as a different species, which would be a case of "misidentified type species" according to ICZN art. 70.3. Only for this case *Duplexibollia duplex* sensu Schallreuter (1987a) should be suggested as type species instead of Krause's species (but see also "comparisons").

Definition. Large, outline amplete or subamplete. Quadricristate with two broad, lobe-like, u-shaped cristae parallel to free margin and separated from the latter by a u-shaped furrow. Inner crista ventrally of S2 reduced. Marginal border flattened and with short spines.

Duplexibollia duplex **(Krause, 1892)**

Figure 1C

1892 *Bollia duplex* Krause: 386, 389, 392, 399, pl. 21, fig. 7.
1954b *Bollia duplex*. – Henningsmoen: 75, 86, 97–99, 101, pl. 2, figs 6–7.
1987a *Duplexibollia duplex*. – Schallreuter: 39–40, fig. 3.3.
1990 *Duplexibollbia duplex*. – Meidla et al. in Aru et al.: fig. 28 (faunal log).
1992 *Duplexibollia duplex*. – Sidaravičienė: 157–158, 245, tab. 2, pl. 39, figs 7–8.
1996 *Duplexibollia duplex*. – Sidaravičienė: 41, 57, tab. 12, figs 5–6, 9 (faunal logs).

Holotype (monotypy, not lectotype as given by Henningsmoen 1954b: 98). Anteriorly incomplete left valve, MB. HS 2010-15, Figure 1C; Krause 1892, pl. 21, fig. 7.

Type locality and horizon. Müggelheim; Krause's glacial erratic boulder no. 640, a yellow-whitish glacial erratic boulder together with *Platybolbina distans* and *Cystomatochilina umbonata*, age Nabala, Vormsi or Pirgu Stage after the occurrences of *Cystomatochilina umbonata* and *Duplexibollia duplex* in Estonia and Lithuania (Meidla 1996: 25; Sidaravičienė 1992: 158; Sidaravičienė 1996, tab. 2).

Dimensions and proportions (L, H in mm, L : H). Holotype 2.75 – 1.59 – 1.73. Carapaces Sidaravičienė 1992, 245, pl. 39, figs 7–8) heteromorph 3.00 – 1.85 – 1.62, tecnomorph 2.75 – 1.60 – 1.72. Left valve (Schallreuter 1987a, fig. 3.3) 2.37 – 1.45 – 1.63 (domicilium 2.27 – 1.36 – 1.68). Henningsmoen 1954b, left valves pl. 2 figs 6–7: 2.33 – 1.33 – 1.75, 2.40 – 1.52 – 1.58 (according to magnification).

Definition. As for the genus.

Remarks. Sidaravičienė (1992: 157–158, pl. 39, figs 7–8) mentioned sexual dimorphism in *Duplexibollia duplex* which is expressed by the development of a narrow restricted velum extending from the anterior cardinal corner to the posteroventral region and not covering the free margin. However, what Sidaravičienė considered as velum seems to be merely the result of an ontogentically increasing development of the adjacent semifurrow. Therefore, *Duplexibollia* is not a dimorphic taxon. Her arguments are not convincing. The "velum" (pseudovelum) which is present in few large valves only seems to be more a function of the strength of development of the neighbouring furrow which seems to be dependant from the ontogeny.

Sidaravičienė (1992: 158) considered *D. duplex* Schallreuter, 1987 from the Öjlemyr flint boulder no. G287 from the Isle of Gotland as a possible new species, which is distinct from Krause's species by a small adductorial lobe, an interrupted inner connecting lobe, the occurrence of marginal tubercles, and the more distinct cardinal corners (cf. Schallreuter 1987a, fig. 3.3; Sidaravičienė 1992, pl. 39, figs 7–8). Since the above outlined differences are only a matter of ontogenesis, Sidaravičienė's respective interpretation is also declined.

Occurrence. Oslo region: Oslo–Asker (Hovedøva): 5b, Ringerike (Frognøy, Stavnestangen): 5a (Henningsmoen 1954b: 99); Estonia: Saunja Fm., Nabala Stage (Meidla et al. in Aru et al. 1990, fig. 28); Lithuania: Pirgu (F1c), Nadtaučionys [~ upper F2 (Sidaravičienė 1992: 158), or uppermost Pirgu or Tommarp (Sidaravičienė 1996, tab. 2)]. Glacial erratic boulders: Öjlemyr flint of the Isle of Gotland (Schallreuter 1987a), type locality.

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Order **Podocopa** Sars, 1866
Suborder **Metacopa** Sylvester-Bradley, 1961 emend. Adamczak, 1967
Superfamily **Bairdiocypridoidea** Shaver, 1961
Family **Balticellidae** Schallreuter, 1968

Balticella Thorslund, 1940

Type species. *Balticella oblonga* Thorslund, 1940; by original designation.
= *Primitia globifera* Krause, 1892 = *Primitia binodis* Krause, 1897

Definition. Schallreuter 1968: 135

Balticella globifera (Krause, 1892)

Figure 2G–H

1892 *Primitia (Ctenobolbina?) globifera* Krause: 389–390, 399, pl. 22, fig. 9.
1897 *Primitia binodis* Krause: 934, 938, pl. 25, fig. 16.
1934 *Kloedenia globifera*. – Bassler & Kellett: 70, 362, 444.
1940 *Hesperidella globifera*. – Thorslund: 179 (partim); non 179 (partim), 187, pl. 3, fig. 12, pl. 5, fig. 6 = *H. esthonica* (Bonnema, 1909).
1940 *Balticella oblonga* Thorslund: 49, 180, 187, pl. 1, figs 18–20.
1941 *Ctenentoma binodis*. – Schmidt: 35–37.
1962 *Hesperidella sp.* indet. – Jaanusson: 413.
1964 *Balticella binodis* = *B. oblonga*. – Schallreuter: 95.
1968 *Balticella binodis*. – Schallreuter: 135–137, fig. 10 (syn.).
1973 *Balticella binodis*. – Neben & Krueger: pl. 95, fig. 4 (= Schallreuter 1968, fig. 10.4).
1976 *Balticella binodis*. – Jaanusson: 312–313, fig. 9 (faunal log, no. 42).
1985 *Balticella binodis*. – Schallreuter & Siveter: pl. 69, fig. 4 (= Schallreuter 1968, fig. 10.4).
1990 *Balticella binodis*. – Schallreuter: 278, pl. 7, fig. 8.
1992 *Balticella binodis*. – Sidaravičienė: 195, 249, tab. 2, pl. 51, figs 1–2.

Holotype (monotypy). Steinkern and external mould of a juvenile right valve, MB. HS 2010-16, Krause 1892, pl. 22, fig. 9 (steinkern), Figure 2.8 (external mould).

Among the material, which came back from Uppsala to Berlin by the end of the 1990s, the respective slide with the holotype (steinkern) of *Balticella globifera* was empty due to the broken cover glass. However, the glass tube from which the steinkern had been removed in order to store it in a slide still contained the – dorsally incomplete – external mould of the specimen, which is now the holotype.

Type locality and horizon. Müggelheim, Krause's glacial erratic boulder no. 666, age presumably Haljala Stage (C3/D1) or Keila Stage (D2).

Dimension. Length of holotype 0.85 mm.

Definition. See definition of *Balticella binodis*, Schallreuter 1968: 135.

Comparisons. With the placement of *Primitia globifera* in *Kloedenia*, Bassler & Kellett (1934: 362) were closer to the truth than later Thorslund (1940) and Jaanusson (1957, 1962) with their determination as a species of *Hesperidella*.

Thorslund (1940: 179) considered *Primitia globifera* and *Primitia esthonica* as synonyms, which became, however, never accepted. Despite his assumption that "... these species may be identical...", Jaanusson (1957: 329) regarded *H. globifera* as a *nomen dubium*, also after having studied the holotype (not lectotype) (Jaanusson 1962: 413).

Reinvestigation of the holotype clearly shows that it belongs to *Balticella binodis* (= *B. oblonga*), which is characterized by both PAN and a posterior tubercle or spine. This species was erected by Krause 1897 who did not realize the synonymy with his previous *Primitia globifera* (Krause, 1892) (Fig. 2G). By contrast, in the external mould of the holotype of *B. globifera* a spine is not visible. It is uncertain whether the posterodorsal part including the spine or only the spine itself is primarily lacking. However, the spine proved to be variable in both strength and position (Schallreuter 1968, fig. 10). In the largest valve (L 1.65 mm) it is only tubercle-like and situated posterocentrally in height of the central portion of the PAN. In smaller specimens the spine is stronger and located in height of the dorsal part of the PAN. Thorslund (1940: 180, pl. 1, figs 18–20) neither described nor figured a spine in *B. oblonga* but mentioned "... small tubercles, sometimes with a larger one on the antero-dorsal slope" from his vice versa orientated valves.

The holotype is very weakly reticulogranulated. The surface ornamentation varies in this species between nearly smooth and granulated with some scattered tubercles (Schallreuter 1968, fig. 10; Schallreuter 1990, pl. 7, fig. 8).

Occurrence. *B. globifera* is known from outcrops in Sweden (Kinnekulle, Fjäcka, Central Lockne Area) from the *Ludibundus* beds and the Skagen Limestone and borings from Lithuania from the Jõhvi stage. The best material came from glacial erratic boulders of Tvären and Backsteinkalk glacial erratic boulders of Northern Central Europe (Swedish, Baltic and intermediate types).

Epilogue

In many cases Krause's drawings were considered of bad quality or "... somewhat diagrammatic" (Jaanusson 1962: 412). However, reinvestigation of his original material with SEM stereotechnique revealed, that Krause recognized almost all relevant characters of the respective taxa except for fine surface ornamentations. Apart from the latter, his illustrations are still informative and suitable for taxonomic work. Already assumed synonymy of many new taxa later described from outcrops, borings and also glacial erratic boulders based on Krause's illustrations could be verified by the present study.

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