

New Ostracodes from the Öjlemyr Chert (Late Ordovician) of Gotland and Northern Germany

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ABSTRACT - Twelve new ostracod species and five new ostracod genera are described from Öjlemyr Flint glacial erratic boulders of Late Ordovician age from the Isles of Gotland (Baltic Sea) and Sylt (North Sea) as well as from western Niedersachsen (North Germany). These taxa include some micro-ostracodes with adults <0.5 mm: *Laterophores ferrettii* sp. n., *Postceratia fossula* sp. n., *Sagittovum? glabrum* sp. n., *Sudon microporatus* sp. n., *Buckelopsis dyca* gen. et sp. n., *Epiclinia epiclinata* gen. et sp. n., *Immanisator punctatus* gen. et sp. n., *Longisyltherella erratica* gen. et sp. n., *Aviacypris planta* sp. n., *A. coartata* sp. n., *A. truncata* sp. n., and *Dornbuschia bospi* sp. n. The early occurrence of a typical platycopid with a limen, and of podocopes with duplicatures is noteworthy.

RIASSUNTO - [Una nuova fauna ad ostracodi dal Öjlemyr Chert (Ordoviciano Superiore) di Gotland e N Germania] - Vengono descritte dodici nuove specie e cinque nuovi generi di ostracodi dell'Ordoviciano Superiore, provenienti da blocchi glaciali erratici delle isole di Gotland (Mar Baltico) e Sylt (Mare del Nord) e dalla Bassa Sassonia occidentale (Germania): *Laterophores ferrettii* sp. n., *Postceratia fossula* sp. n., *Sagittovum? glabrum* sp. n., *Sudon microporatus* sp. n., *Buckelopsis dyca* gen. et sp. n., *Epiclinia epiclinata* gen. et sp. n., *Immanisator punctatus* gen. et sp. n., *Longisyltherella erratica* gen. et sp. n., *Aviacypris planta* sp. n., *A. coartata* sp. n., *A. truncata* sp. n., e *Dornbuschia bospi* sp. n. Alcune specie sono rappresentate da "micro-ostracodi" con adulti di dimensioni inferiori a 0.5 mm. Di particolare rilevanza nella fauna la comparsa precoce di un tipico platycopide con un limen e di podocopidi provvisti di duplicatura.

INTRODUCTION

From the Isle of Gotland (Baltic Sea) Wiman (1901) described "Silurian" limestones with graptolites together with many cherts ("Feuersteine", Flint), which he called "Öjlemyr-geschiebe" after the bog Öjle Myr. Based on the fauna, he compared the boulders with the Borkholmer Schicht (Porkuni Stage, FII) of Estonia, which was formerly placed into the Silurian by some authors.

In order to extract the graptolites, Wiman processed Öjlemyr limestones with hydrochloric acid and additionally gained secondarily silicified fossils, above all brachiopods, bryozoans, corals and sponges (Wiman, 1901, p. 166). Of trilobites, molluscs and ostracodes he received only indeterminate fragments.

Since 1961, the first author has been studying ostracodes from the early Late Ordovician Backsteinkalk geschiebes (glacial erratic boulders) of Northern Germany for ostracodes. In these silicified limestones the matrix is silicified but not the calcareous microfossils, which therefore could be gained by processing with hydrofluoric acid (HF). In the mid-sixties the author expanded his investigations on Öjlemyr cherts from old collections housed in the German Archive for Geschiebeforschung (glacial erratic boulder research), which were processed by the same method.

After 1975 the author collected himself Öjlemyr Flint boulders at the beaches of NW Gotland. In 1977

he found such rocks also among the "Lavendelblaue Hornsteine" (lavenderblue cherts) within the Kaolinsand (Plio-/Pleistocene) of the Isle of Sylt collected by Ulrich von Hacht, Hamburg. Contrary to the Gotland cherts, these cherts are completely secondarily silicified, i.e. the calcareous fossils are also silicified.

Another occurrence of Öjlemyr Flint was discovered in Western Niedersachsen/Eastern Netherlands (Wilsum, Wielen, Westerhaar) by Freek Rhebergen, Emmen, Netherlands in Pleistocene sediments. In the respective boulders the calcareous fossils are secondarily silicified too.

Wiman dated the Öjlemyr Flint as being of the same age as the Porkuni Stage (FII, Borkholmer Schicht, Hirnantian) of Estonia. Thorslund & Westergård (1938, p. 37-38) compared the rock with the Lyckholm Stage (FI). However, of the three stages of FI the respective ostracod association clearly indicates the Pirgu Stage (FIc, late Katian) (Schallreuter, 1981, p. 61). The Öjlemyr Flint may represent FIc and FII since some of the ostracodes are known in Estonia only from FII, yet (see Tab. 1). The Öjlemyr Flint boulders have most likely originated from the Hall banks NW of Gotland (Martinsson, 1958, pl. 18, fig. 2).

The microfossils gained from Öjlemyr cherts by HF are much better preserved than Wiman's silicified material. The ostracode fauna is not only excellently preserved but also very rich. Apart from ostracodes, the residues

contain trilobites, brachiopods, bryozoans, echinoderms, gastropods, bivalves, sponge spicules, machaeridians, cornulitides, algae, graptolites, scolecodonts, chitinozoans, melanosclerites and others. More than 150 ostracode species (120 are listed in Tab. 1) could have been described in several papers since 1967. Tab. 1 shows that the species frequency differs in a boulder very much, ranging between 1 and >1000 and also between the different boulders. The species described in the present paper are partly very rare or/and very small.

The boulders were treated with 40% hydrofluoric acid and the residues washed with a sieve set of the following diameters: 0.06 - 0.2 - 0.5 - 3.0 mm. A single boulder may yield >10.000 ostracode valves and carapaces. Our processing method guarantees material of excellent quality and the preservation of ostracodes <0.2 mm height. Additionally, isolated valves permit the study of the clausal sculptures (sculptures of the hinge and of the contact margin) and of internal features, such as duplicature, sulcaments, etc., which are hardly detectable on embedded material or closed carapaces.

The complete material is housed at the Institute of Geography and Geology, University of Greifswald under the numbers GG 375-1 - GG 375-46.

TERMINOLOGY

Dorsum - Term introduced by Jaanusson (1957, p. 186) for a “flattened area adjacent to the hinge-line and set off from the lateral surface”. “The dorsum may be epicline, protruding beyond the hinge-line, orthocline, or hypocline, not concealing the hinge-line in strictly lateral view” (Jaanusson, 1957, fig. 1). The terms epicline, etc. can be used likewise also for the marginal surface.

Duplicature (doublure) - Calcified parts of the inner lamella or/and infold of the outer lamella.

Lappet - Term introduced by Berdan (1976, fig. 3). It is identical with the terms “bow-shaped projection” of Cannon (1926) and “lip” of Sohn (1960, p. 6) (Adamczak, 1976, p. 300). German: Lappen (Schallreuter, 1968c, p. 141).

Limen - A rounded ridge forming a threshold to the posterior part of the carapace in females with kloedenellid type of domiciliary dimorphism (Adamczak, 1966, p. 10). Later Adamczak (1991, p. 263) extended the concept of the limen to include also the fold of the posterior sulcus

	species	1	2	3	4	5	Baltic stages*
1	<i>Fallaticella schaeferi</i> Sch., 1984	X	6				Flc
2	<i>Ampletochilina trapezoidea</i> Sch., 1969	C	X	L		L	Flb-c
3	<i>Ampletochilina? granifera</i> (Sarv, 1962)	L	X	X	1	5	Flb-FII
4	<i>Apatochilina? liptica</i> Sch., 1986			1			
5	<i>Platylolbina (P.) distans</i> (Krause, 1889) = <i>P. orbiculata</i> Sarv, 1959	C	C	L	5	L	DIII?,E-FII
6	<i>P. (P.) anguliacuta</i> Sch., 1971	X	5	X		1	
7	<i>P. (Reticulobolbina) integra</i> Sch., 1969	X	X	X			
8	<i>P. (R.) tenuivelata</i> Sch., 1987	5		2		3	
9	<i>P. (R.) spongiosoreticulata</i> Sch., 1972		1	3		7	
10	<i>P. (Abruptobolbina) maslovi</i> Sarv, 1959	1	1				Flc
11	<i>Swantina pseudobliqua</i> Sch., 1986	X		5			
12	<i>Swantina serrata</i> Sch., 1986	X	3	X	5	X	
13	<i>Levisulculus obliquus</i> (Steusloff, 1895)	X	X			X	
14	<i>Moeckowia harena</i> Sch., 1987			2			
15	<i>Gellensia nodoreticulata</i> Sch., 1982	L	X	1	1	X	
16	<i>Gotula gotlandica</i> (Sch., 1967)	1	4				
17	<i>Oepikella luminosa</i> Sarv, 1959		2				Fla-FII
18	<i>Oepikium porkuniense</i> Henningsmoen, 1954	2	2				FII
19	<i>Gryphiswaldensia wilnoensis</i> (Neckaja, 1952)	C	L	L	2	X	Flb-FII
20	<i>Gryphiswaldensia visbya</i> Sch., 1969	3	C	C	X	2	Flc
21	<i>Gryphiswaldensia plicata</i> Sch., 1969	X	X	X		X	FII
22	<i>Caprabolbina capra</i> Sch., 1972		3				Flc
23	<i>Bolbina saxbya</i> Meidla, 1983	1					E-FII
24	<i>Bolbina valensis</i> Sch., 1984	?					? Flc
25	<i>Bolbihithis abdominalis</i> Sch., 1981					6	
26	<i>Brevibolbina pontificans</i> Sch., 1981		1				Flc
27	<i>Uhakiella osloensis</i> (Henningsmoen, 1954)		6			2	
28	<i>Piretia rugosa</i> (Steusloff, 1895)	C	C	L	1	X	Flc
29	<i>Tvaerenella umbilicata</i> (Kummerow, 1924) = <i>T. expedita</i> Sarv, 1959	4	1	2		6	Flb-FII
30	<i>Eoaquapulex frequens</i> (Steusloff, 1895)	X	9			1	Flb-FII
31	<i>Quadrilia (Krutatia) iunior</i> Sch., 1981		1				F1a
32	<i>Tetradella egorowi</i> Neckaja, 1952	4	X	X	6		E-FII
33	<i>Tetradella separata</i> Sidaravičienė, 1971	5	X	4	5	X	Flc
34	<i>Pleurodella pentaloculata</i> (Sch., 1978)	X	X	X	3	6	Flc-FII
35	<i>Kiesowia dissecta</i> (Krause, 1892)	3		3	1	3	Fla-FII
36	<i>Deefgella dajsiveteri</i> Sch., 1981	X	?			8	
37	<i>Deefgella? semikolon</i> Sch., 1984		2	1			
38	<i>Foramenella parkis</i> (Neckaja, 1952) (incl. <i>F. porkuniensis</i> Sarv, 1962)	9	X	X	5	X	Flb-FII
39	<i>Naevhithis pictis</i> (Neckaja, 1958) = <i>N. naevus</i> Sch., 1981		X	X			Flc-FII
40	<i>Pseudohippula pseudopokornina</i> Sch., 1975		1	1			

Tab. 1 - Ostracodes of the Öjlemyrflint boulders studied herein. Abbreviations: X=10-49, L=50-99, C=100-499, D=500-999, M≥1000 specimens (mostly single valves); 1:Val-34, 2:G-287, 3:Val-144, 4:Sy-97, 5:Wie-1; Sch. = Schallreuter. * Mainly after Meidla (1993, 1996), Sarv (1962), and Sidaravičienė (1992).

41	<i>Vitteplana stipula</i> (Sch., 1971)		5				
42	<i>Airina cornuta</i> (Neckaja, 1958) = <i>Hallatia mezciemensis</i> Gailite, 1975	1					E-FII
43	<i>Distobolbina tuberculata</i> (Henningsmoen, 1954)	C	M	D	9	X	FII-FII
44	<i>Distobolbina bispinata</i> Sch., 1977			C			
45	<i>Semibolbina ordoviciana</i> Sch., 1977			6			
46	<i>Laterophores longiposteronodus</i> Sch., 1971			1		1	E-Fla, ? Flc
47	<i>Laterophores ferrettii</i> sp. n.			1			
48	<i>Reginea reginae</i> Sch., 1983	L	8	2	X	X	
49	<i>Bullaferum granodus</i> Sch. & al., 2006	X	X	X		1	Flc(?)
50	<i>Ritatia ritae</i> Sch., 1987	4		3	2	9	
51	<i>Pseudulrichia ullehmanni</i> Sch., 1981 = <i>P. inarguta</i> (Neckaja, 1966)			1		7	DIII-Flc
52	<i>Postceratia fossula</i> sp. n.		5	2	2		
53	<i>Antiaechmina groenwalli</i> (Troedsson, 1918)		1				FII
54	<i>Kinnekullea herrigi</i> Sch., 1971	1	4			1	
55	<i>Duplexibollia duplex</i> (Krause, 1892)		2				Flc
56	<i>Baltonotella</i> sp.			4			
57	<i>Hyperchilarina</i> sp. A Sch., 1973 = <i>Brevidorsa limbata</i> (Sidaravičienė, 1975)	?	?	9		1	DIII-Flc
58	<i>Aparchites brachynotos</i> (Schmidt, 1858) = <i>Leperditella globosa</i> Sarv, 1959		3	2			E-FII
59	<i>Pygoconcha trilamellae</i> Sch., 1968		X	L			
60	<i>Cryptophyllus gutta</i> Sch., 1968		C	C			E-Flc
61	<i>Milleratia</i> ? <i>westerlandensis</i> Sch., 1986			X	5	X	
62	<i>Neoprimitiella bisulcata</i> Sch., 1969		9	X	1	X	Flc
63	<i>Jaanussonia unicerata</i> Sch., 1971	X	L	L	1	1	
64	<i>Hemeaschmidtella exula</i> Sch., 1971	9	C	C			DIII-FII
65	<i>Hemiaechminoides excentricus</i> Sch., 1971	L	X	X		X	Flc
66	<i>Sagittovum ingwersae</i> Sch., 1984	1	2				
67	<i>Sagittovum</i> ? <i>glabrum</i> sp. n.		2				
68	<i>Sudon microporatus</i> sp. n.	L		X	1		
69	<i>Buckelopsis dyca</i> sp. n.	C		X	6		
70	<i>Epiclinia epiclinata</i> sp. n.	L		X			Flc-FII
71	<i>Oblisylthys kampensis</i> Sch., 1987	X			1	X	
72	<i>Oejlemyra oejlemyrensis</i> Sch., 1968	X	C	C	1	2	
73	<i>Ningulella alta</i> (Sch., 1972)	2	X	L	4	2	
74	<i>Conodomyra reticulata</i> Sch., 1968	L	C	C	X	C	FIIb-c
75	<i>Martinssonozona ordoviciana</i> Sch., 1968	C	L	X	8	L	
76	<i>Gotlandina erratica</i> Sch., 1968	3	L	X		3	
77	<i>Ordovizona sulcata</i> Sch., 1969	1	X	X	1	3	DIII-Fla
78	<i>Immanisator punctatus</i> sp. n.					1	
79	<i>Spinopleura</i> ? <i>porkuniensis</i> (Stumbur, 1956)	1	2				FII
80	<i>Foveaprimitiella dactyloscopia</i> Sch., 1972		X	5			
81	<i>Sulcraphiolus sulcatus</i> Sch., 1975				1	1	
82	<i>Estonaceratella estona</i> (Sarv, 1962)	1	1	6	3	5	FIIb-FII
83	<i>Nonsulcozona praepleta</i> Sch., 1972	2	X				Flc
84	<i>Steusloffina cuneata</i> (Steusloff, 1895)	D	D	L	5	L	E-FII
85	<i>Steusloffina lintra</i> Sch., 1972	C	X	3		X	Flc
86	<i>Steusloffina dilatata</i> Meidla, 1983	3				2	E-FII
87	<i>Kroemmelbeinia valensis</i> Sch., 1985	X	X	C	2		
88	<i>Spinobairdia spina</i> (Sch., 1969)	C	?	X	3	X	Fla-FII
89	<i>Oejlemyra</i> ? <i>angustoduplicata</i> Sch., 1986	2					
90	<i>Rectella carinaspinata</i> Sch., 1972	L	X	L		X	E-FII
91	<i>Trapezysylthere divisa</i> Sch., 1986 = <i>Pseudorayella admirebilis</i> Neckaja, 1966					3	FIIb-c
92	<i>Medianella</i> ? n. sp. ? = ? <i>Longiscula praelonga</i> (Steusloff, 1895) (= <i>L. porrecta</i> Meidla, 1993)	X				1	FII, ? FIIb-c
93	<i>Bairdia</i> ? <i>iocus</i> Sch., 1987	X		1		6	FIIb?, FIIc-FII
94	<i>Revisylthere breviclastrum</i> (Sch., 1968)	X	5	2	3	X	FIIb-FII
95	<i>Rempesgrinella lubrica</i> (Stumbur, 1956)	C	?	L	1	5	E-FII
96	<i>Crucicornina ahemuelleri</i> Sch., 1984			1		1	
97	<i>Medianella longa</i> (Stumbur, 1956)	X		9		3	DIII?, E-F2
98	<i>Medianella robusta</i> (Kummerow, 1924) = <i>Bythocypris intacta</i> Stumbur, 1956	L	L				E-FII
99	<i>Uthoernia lunata</i> Sch., 1986	L	1	X		X	Flc
100	<i>Bulbosclerites unicornis</i> (Neckaja, 1952)			2	7	C	Flc?, FII
101	<i>Brevantia</i> sp.	L		X			
102	<i>Rectella romboformis</i> Neckaja, 1966	L	C	C	6	X	DIII?, E-FII
103	<i>Medianella</i> ? sp. n.	C					
104	<i>Longisyltherella erratica</i> sp. n.	9					
105	<i>Pseudorayella</i> ? <i>kaufmanni</i> Sch., 1975	6	3	X	3	X	Flc-FII
106	<i>Revisylthere</i> ? <i>bucheckeri</i> (Sch., 1968)	4	1	3	1	3	
107	<i>Duplicristatia asymmetrica</i> Sch., 1978			1		1	FII
108	<i>Dagoerayella elongata</i> (Meidla, 1983)	L				7	Fla-FII
109	<i>Dornbuschia ostseensis</i> Sch., 1968	X	2	X	5	X	
110	<i>Dornbuschia bospi</i> sp. n.	8		3			
111	<i>Aviacypris avia</i> Sch., 1977					X	
112	<i>Aviacypris planta</i> sp. n.	4					
113	<i>Aviacypris coartata</i> sp. n.	6					
114	<i>Aviacypris truncata</i> sp. n.	2		2			
115	<i>Beecherella listensis</i> Sch., 1987	2					
116	<i>Syltherella ingeae</i> Sch., 1978				2		
117	<i>Syltherella risca</i> Sch., 1978		1		1		
118	<i>Inisylthere minimus</i> (Sch., 1968)	X		2		1	
119	<i>Sylthere vonhachti</i> Sch., 1978				1		
120	<i>Velapezoides angulatus</i> Sch., 1968	X	2	X		X	

Tab. 1 - continue

(S3). The room separated from the domicilium was called domatium by Jaanusson (1985, p. 80).

Stop-pegs (Berdan, 1976, p. 44 = stop-ridges: Adamczak, 1967, p. 462 = “balkonartige Kontaktvorsprünge” Schallreuter, 1969a, p. 211) - Two (or more) tubercles or short ridges on the contact margin of the larger valve blocking excessive thrusting of the two valves. The term stop-ridge was used by Berdan for another feature, a ridge bordering the overlap platform of the smaller overlapped valve in leperditicopes (Berdan, 1976, fig. 3). The stop-pegs may result in stop pits on the outer side of the valve.

Adamczak (1976, p. 317) considered the stop-ridges as being part of the outer lamella but there are examples where the stop-pegs are placed on the inner lamella, for example in *Dagoerayella elongata* (Meidla, 1993), *Rempesgrinella lubrica* (Stumbur, 1956) or gen. n. sp. n.: Schallreuter, 1979 (pl. 1, figs 6, 9).

Sulcament - Term introduced by Schallreuter (1967, p. 626) for thickenings on the inner side of the valve. They are hardly visible on the outside, but sometimes their existence is indicated by a brighter colour of the shell in that region, e.g., the median internal ridge in *Medianella robusta* (Schallreuter & Hinz-Schallreuter, 2008, figs 21, r), or by a weak depression.

The median “subvertical ridge” (Swain et al., 1961, p. 371) was named “adductorial ridge” by Adamczak because “Its ventral part is generally occupied by the adductor muscle spot” (Adamczak, 1968, p. 25). As found by Lundin et al. (1995, p. 893) and also indicated by *Longisyltherella* gen. n., this seems not to be the case in any event.

Vecon - Short term introduced by Schallreuter et al. (2006, p. 299, fig. 5) for the “inward curvature” (Swain et al., 1961, p. 370), “konkave Außenlinie des Ventralrandes” (Hartmann 1963, p. 53), and “ventricular concavity” (Henningsmoen, 1965, p. 385). Occurs often

in podocopes, also in other groups, but very rarely in palaeocopes. It is assumed to be connected with life-style.

The line connecting both ventral projections of the vecon is called *basis-line*. It is used for orientation mainly in podocopes, comparable to the straight hinge-line in beyrichiocopes (Hinz-Schallreuter & Schallreuter, 1998, fig. 15; Schallreuter et al., 2006, fig. 5).

ABBREVIATIONS

C = carapace, LV, RV = left, right valve(s), tec. = tecnomorph, L = length, H = height (without sculptures dorsal of hinge-line), Hm = height with sculptures above of hinge-line; LD, HD = length, height of domicilium (measured from the inner borders of the contact margin), measurements given in mm.

Definition of size - < 0.5 mm = very small, 0.5 - 1.0 mm small, 1.0 - 2.0 median-sized.

Definition of shape - L:H < 1.45 very high, 1.45 - 1.55 high, 1.55 - 1.65 rather high, 1.65 - 1.75 moderately high, 1.75 - 1.85 moderately long, 1.85 - 1.95 rather long, 1.95 - 2.05 long, > 2.05 very long.

SYSTEMATIC DESCRIPTIONS

Order BEYRICHIOCOPA

Suborder BINODICOPA

Family BOLLIIDAE Bouček, 1936

Genus *Laterophores* Schallreuter, 1968

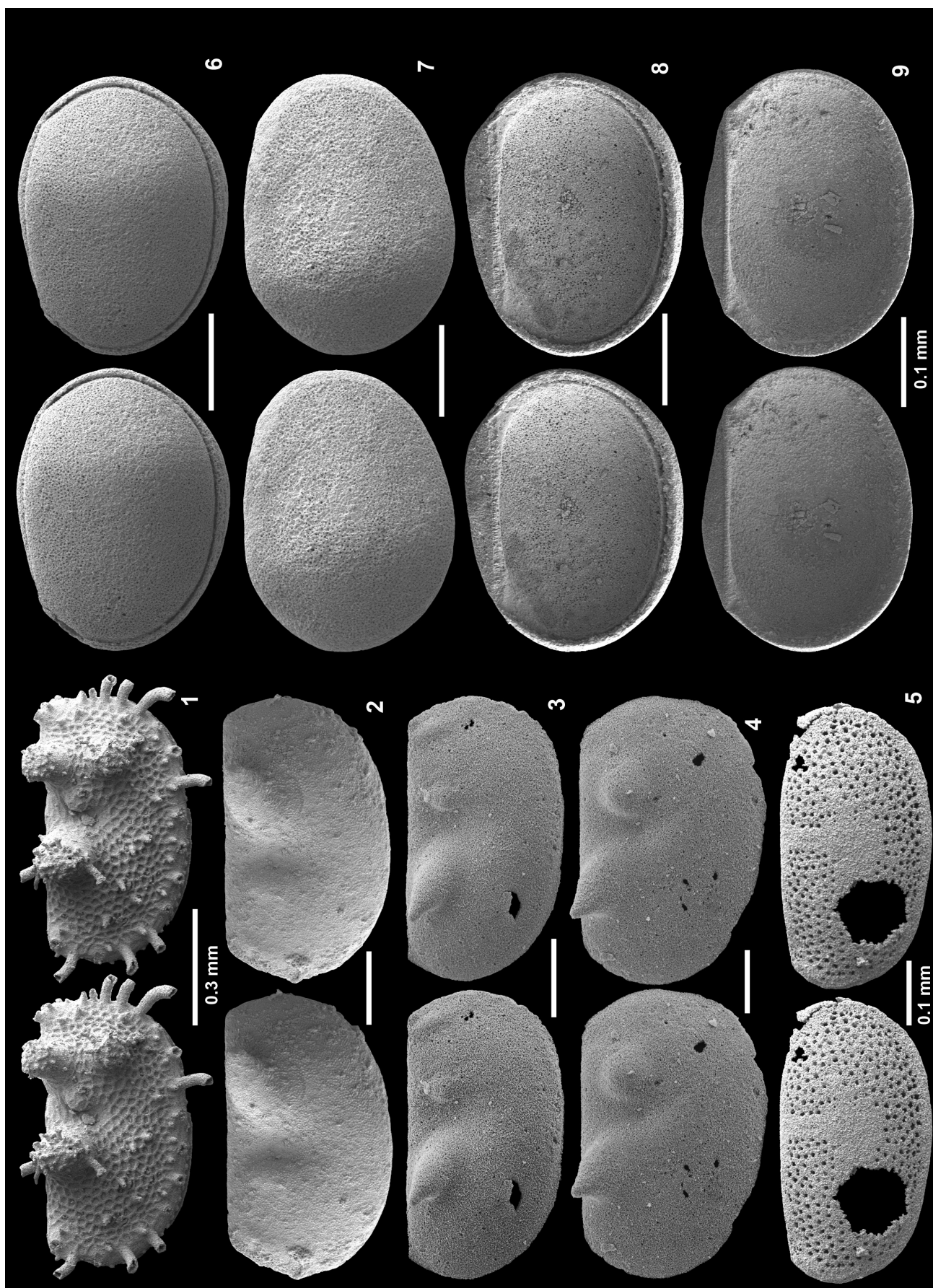
Type species - *Laterophores lateris* Schallreuter, 1968b (original designation).

Remarks - Olempska (1994, p. 190) considered *Laterophores* only as a subgenus of *Klimphores*

EXPLANATION OF PLATE 1

- Fig. 1 - *Laterophores ferrettii* sp. n.
1) Holotype, right valve, GG 375-1, L 1.27 mm, Isle of Gotland (boulder Val-144).
- Figs 2-3 - *Postceratia fossula* sp. n.
2) Holotype, LV, GG 375-3, L 0.37 mm, boulder (no. Sy-97) from the kaolin sand, Plio-/Pleistocene, Isle of Sylt.
3) RV, GG 375-4, L 0.37 mm, Isle of Gotland (boulder Val-144).
- Fig. 4 - *Pseudulrichia ullehmanni* Schallreuter, 1981 (= ?*Parulrichia inarguta* Neckaja, 1966), juvenile RV, GG 375-2, L 0.39 mm; Isle of Gotland (boulder Val-144).
- Fig. 5 - *Immanisator punctatus* gen. et sp. n. Holotype, RV, GG 375-5, L 0.42 mm; Wielen, western Lower Saxony, glacial erratic boulder (no. Wie-1).
- Figs 6-9 - *Buckelopsis dyca* gen. et sp. n.
6) Holotype, carapace from right, GG 375-6, L 0.29 mm.
7) Paratype, LV, GG 375-7, L 0.30 mm.
8) Paratype, LV, GG 375-8, interior view, L 0.32 mm.
9) Paratype, RV, GG 375-9, L 0.32; interior view; Isle of Gotland (boulder Val-34).

All SEM-stereo-pairs.



Schallreuter, 1966. However, the anterior nodes of *Laterophores* are distinctly separated from each other, which is not the case in typical *Klimphores* species. Concerning the *K. vannieri* (Olempska, 1994, pl. 45, figs 9-11) with distinctly separated nodes, it may be debatable whether it represents the beginning of a phylogenetically nodal separation (*Laterophores*) or of their amalgamation to one node (*Klimphores*). However, stratigraphically younger species clearly evidence the existence of two different phylogenetic lines.

Laterophores ferrettii sp. n.

Derivation of name - In honour of Annalisa Ferretti, University of Modena and Reggio Emilia.

Holotype - RV, GG 375-1 (Pl. 1, fig. 1).

Type locality - Boulder (no. Val-144) from the beach of Vale, NW Gotland.

Material - Holotype.

Dimensions and proportion - L 0.66 mm, H 0.37 mm, L:H 1.81.

Definition - Largest valve known 0.66 mm. Shape moderately long. Nodes rounded with anterodorsal and posterior node reaching beyond the hinge-line. Nodes with spines, but without reticulation. Pseudovelum developed as a row of long spines. Surface reticulate and with few short spines.

Comparison - The species is mainly characterized by the strong spinosity and the non-reticulated nodes. Furthermore, in the contemporaneous *L. longiposteronodus* Schallreuter, 1971 the posterior node is obliquely elongate and not rounded (Schallreuter, 1971b, fig. 1.4; Sidaravičienė, 1992, pl. 41, fig. 4). In the older *L. hystrix* Schallreuter, 1972 the pseudovelum also consists of a row of spines but the spines are shorter than in the new species, and represent the only spines in that species (Schallreuter, 1972b, pl. 1, fig. 1).

Remarks - Only the holotype is available but its features are so characteristic that it unquestionably represents a new species.

Family AECHMINIDAE Bouček, 1936

Genus *Postceratia* Schallreuter & Hinz-Schallreuter, 1998

Type species - *Pseudulrichia posterocerata* Blumenstengel, 1965 (original designation).

Postceratia fossula sp. n.

Derivation of name - “fossa”, Lat. - ditch, after the distinct sulcus.

Holotype - LV, GG 375-3 (Pl. 1, fig. 2).

Type locality - Glacial erratic boulder (no. Sy-97) from the Kaolinsand, Plio-/Pleistocene, Isle of Sylt.

Material - 9 valves from three boulders (Sy-97, G-287, Val-144).

Dimensions and proportions -

GG	valve	type	boulder	L	H	L:H	Pl. 1
375-3	LV	holotype	Sy-97	0.37	0.22	1.67	fig. 2
375-4	RV		Val-144	0.37	0.22	1.69	fig. 3

Definition - Maximal length 0.37 mm. Shape moderately high to high. Outline slightly preplete. Distinct broad sulcus. N1 flat and indistinct. N2 as a posteriorly directed spine, which does not rise above the dorsal margin.

Comparison - The species is characterized by its small size, the distinct relatively broad sulcus, the flat N1 being never developed as a spine and not projecting beyond hinge-line.

Postceratia posterocerata from a Lederschiefer clast of Saalfeld (Thuringia) and its synonym, *Parulrichia tubulata* Neckaja, 1966 from the Baltic region is larger (1.00 mm), has a stronger posterior spine (Schallreuter, 2005, pl. 5, figs 1-4; Schallreuter et al., 2006, pl. 1, figs 5-7, pl. 6, figs 1-3; Schallreuter et al., 2007, pl. 5, figs 1-2; Hinz-Schallreuter & Schallreuter, 2007, pl. 6, figs 6C-D) and a ± strong anterior bulb.

Pseudulrichia inarguta (Neckaja, 1966) (*nomen dubium*, Schallreuter, 2005, p. 293) and its possible synonym *P. ullehmanni* Schallreuter, 1981, which may occur together with the new species in the same boulder (Val-144) differs mainly by its larger size and semicircular outline, shape (L:H ratio), the smaller sulcus, and the distinct N1 (Schallreuter, 1981, fig. 9). For comparative reason, a larva of *P. ullehmanni* of the same size (L 0.39 mm, H 0.25 mm, L:H 1.56) as the *P. fossula* from boulder Val-144 is illustrated (Pl. 1, fig. 4).

?Family SAGITTOVIDAE Schallreuter, 1984

Genus *Sagittovum* Schallreuter, 1984

Type species - *Sagittovum ingwersae* Schallreuter, 1984 (original designation).

Sagittovum? glabrum sp. n.

Derivation of name - “glaber”, Lat. without hairs.

Holotype - Carapace, GG 375-25 (Pl. 3, fig. 11).

Type locality - Isle of Gotland, glacial erratic boulder as beach boulder, no. G-287.

Dimensions and proportions -

GG	valve	type	L	H	L:H	Pl. 3
375-24	RV	paratype	0.37	0.23	1.63	fig. 10
375-25	C	holotype	0.37	0.23	1.62	fig. 11

Definition - Largest specimen 0.37 mm long, amplete and with R/L overlap. Both valves with a narrow epicline dorsum characterized by spine-like nodes posterodorsally. Anteriorly very weak inflation parallel to anterior margin. Surface smooth or very finely granulate and with minute pores.

Comparison - *Sagittovum ingwersae* differs from *S.?* *glabrum* mainly in having stronger posterodorsal spines and spine-like tubercles of the lateral surface (Schallreuter, 1984, figs 4.5-4.6) The main spines are more closely set to the posterior cardinal corner in *S.?* *glabrum*.

S.? *glabrum* resembles *Kayina* Harris, 1957, which has a posterodorsal knob on the LV only (Harris, 1957, p. 159, pl. 3, figs 11a-d; Williams & Vannier, 1995, fig. 6). This genus had been placed within the Jaanussoniidae by Schallreuter (1971a). Because "the LV overlaps the RV in typical leperditellid fashion", Williams & Vannier (1995, p. 18) consider *Kayina* "closely related to the palaeocope *Leperditella*". Lundin et al. (1995, p. 894) tentatively assigned *Leperditella* to platycopes (as was already done by Schallreuter, 1968c, p. 129).

Suborder LEIOCOPA

Superfamily APARCHITOIDEA Jones in Chapman, 1901

Family SCHMIDTELLIDAE Neckaja, 1966

Remarks - To her Schmidtellidae, Neckaja referred three subfamilies, the Schmidtellinae Neckaja, 1966, Circulininae Neckaja, 1966, and Aechmininae Bouček, 1936. However, the Circulininae, Aechmininae, and some of the species described as schmidtellines by Neckaja were later placed into the Binodicopa. Except for *Schmidtella*, also other genera assigned to Schmidtellinae by Neckaja have been assigned to other families. Therefore, the original diagnosis (definition, according to ICZN Art. 12,13.1) given by Neckaja (1966, p. 7) and stating that "...representatives are almost equivalved (left valve slightly larger) or equivalved" refers to taxa, which do not belong to the family any more. Already Warshauer & Berdan (1982, p. 55) wrote in their remarks to the genus *Schmidtella*: "The validity of the family Schmidtellidae Neckaja, 1966, must depend on further study of the genera composing this family". Meanwhile, such studies evidenced a L/R overlap for typical schmidtellids (Berdan, 1988, p. 287-289; Williams & Vannier, 1995, p. 7). Concerning their orientation, the following three species are problematical because the adductor muscle scar field is located in the centre (Pl. 1, fig. 8; Pl. 2, figs 5, 8; Pl. 3, fig. 4). Directed processes (= gerichtete Fortsätze sensu Triebel, 1941, p. 334) like in *Hemiaechminoides* are missing.

The specimen of *Sudon microporatus* figured on Pl. 2, fig. 7 seems to be a RV because the posterior epicline projection is broader than the anterior projection. Therefore, the higher lobe-like elevation is regarded anterior and the valves show L/R overlap (Pl. 2, figs 9-10) and a preplete outline.

In the specimen of *Buckelopsis dyca* figured on Pl. 1, fig. 8 the muscle scars are situated in the centre maybe as a result of the high anterior elevation. In that position the length of the adductor muscle would be shorter. If the

strong elevation is considered anterior the outline would be also preplete.

If *Epiclinia epiclinata* is considered to have also L/R overlap the outline varies between preplete (Pl. 3, fig. 4) and postplete (Pl. 3, fig. 2).

The three genera mentioned above resemble certain Schmidtellidae in several features but in typical schmidtellids the marginal surface (not the free margin which is a line) may be compressed (Berdan, 1988, p. 287) like in the holotype of the type-species of *Schmidtella* Ulrich, 1892, *S. crassimarginata* Ulrich, 1892 (Warshauer & Berdan, 1982, pl. 12, fig. 19). The compressed marginal surface was formerly the reason for placing *Schmidtella* into the Eridostraca.

On the other side the three genera resemble *Hemiaechminoides* Morris & Hill, 1952 and may be closely related. *Hemiaechminoides* was assigned to Jaanussoniidae, Paraparchitacea (Schallreuter, 1971a) because of the R/L overlap and asymmetric carapace. If the three species were closely related to *Hemiaechminoides* their orientation had to be changed.

Neckaja (1966, p. 7) included *Hemiaechminoides* as well as *Kayina* Harris, 1957 in her subfamily Schmidtellinae (Neckaja inclosed in the Schmidtellidae also the subfamily Aechmininae Bouček, 1936; therefore the correct name for the family would have been Aechminidae). Berdan (1988, p. 287) did not enclose these two genera within the Schmidtellidae.

Similarity also exists to *Sagittovum?* *glabrum* and, therefore, possibly to the Sagittovinae. Further studies are necessary to clear the relations between these three families. Presently the genera are tentatively referred to Schmidtellidae.

Genus *Sudon* Schallreuter, 1990

Type species - *Sudon nussi* Schallreuter, 1990 (original designation).

Sudon microporatus sp. n.

Derivation of name - After the very fine pores (Pl. 2, fig. 6).

Holotype - Carapace, GG 375-16 (Pl. 2, figs 9-10).

Type locality - Isle of Gotland, glacial erratic boulder as beach boulder, no. Val-34.

Material - 2 carapaces, > 70 valves from boulders Val-34, Val-144 and Sy-97.

Dimensions and proportions -

GG	valve	type	L	H	L:H	Pl. 2
375-13	LV	paratype	0.37	0.24	1.56	fig. 5
375-15	RV	paratype	0.37	0.24	1.56	fig. 8
375-12	LV	paratype	0.37	0.22	1.68	fig. 4
375-14	RV	paratype	0.35	0.23	1.54	figs 6 - 7
375-16	C	holotype	0.35	0.22	1.58	figs 9 - 10

Definition - Largest valves 0.37 mm. Shape high to moderately high. Outline slightly preplete. Hinge-line straight. Unisulcate, with broad and flat sulcus between two broad lobes. Anterior lobe slightly higher and closer to anterior end than posterior lobe to posterior end. Dorsally to lobes, two plica-like thickenings form an epicline dorsum and a sinus-like dorsal margin, anterior plical bow may be slightly shorter than posterior. Ventrally an epicline elevation is developed. Shell very finely and densely punctate. L/R overlap, LV with a contact list which is separated from the marginal surface by a faint furrow, and an inner contact furrow. RV with an inner contact list and an outer semi-furrow forming a narrow ridge separated from the marginal surface by a weak furrow.

Comparison - The older *Sudon nussi* Schallreuter, 1990 differs from *S. microporatus* by the lack of ventral epicline projections and a coarse punctation (Schallreuter, 1990, pl. 7, figs 4-5).

Occurrence - See tab. 1.

Genus *Buckelopsis* gen. n.

Derivation of name - "Buckel", Germ. - hump, after the strong lobe in the anterior half of the valve.

Type species - *Buckelopsis dyca* sp. n.

Definition - Very small. Amplete to weakly preplete. L/R overlap. Dorsal portion of either valve with an epicline umbo being broadest in anterior half. Overlapping valve also centroventrally umbonate and epicline. Domicilium strongly inflated anteriorly, resulting in a conical outline in dorsal and ventral views. Overlapped valve with a high contact list, which fits into a corresponding semi-furrow of the larger overlapping valve.

Comparison - *Obliquisylthis* Schallreuter, 1987 has an umbo in the posterior two thirds of the LV and a similar inflation in the ventral part of the RV (Schallreuter, 1987, fig. 6).

Buckelopsis dyca sp. n.

Derivation of name - Artificially formed from *dynamica* (dy-nami-ca).

Holotype - Carapace, GG 375-6 (Pl. 1, fig. 6; Pl. 2, fig. 1).

Type locality - Isle of Gotland, glacial erratic boulder as beach boulder, no. Val-34.

Material - >300 valves and carapaces from boulders Val-34, Val-144 and Sy-97.

Dimensions and proportions -

GG	valve	type	L	Hm	L:H	Pl.
375-10	C	paratype	0.29			2, fig. 2
375-11	C	paratype	0.30			2, fig. 3
375-6	C	holotype	0.29	0.21	1.34	1, fig. 6; 2, fig. 1
375-9	RV	paratype	0.32	0.23	1.38	1, fig. 9
375-8	LV	paratype	0.32	0.23	1.36	1, fig. 8
375-7	LV	paratype	0.30	0.22	1.35	1, fig. 7

Definition - Largest specimen 0.37 mm. Shape very high. Other features as for the genus.

Ontogeny and variation - All respective carapaces and single valves on hand are of about the same size with the smallest ones measuring around 0.24 mm. Generally, the specimens show little variation. Ontogenetical changes refer to the extremely weak umbo in small instars, having also a weaker anterior inflation than adult stages.

Genus *Epiclinia* gen. n.

Derivation of name - After the epicline umbos.

Type species - *Epiclinia epiclinata* sp. n.

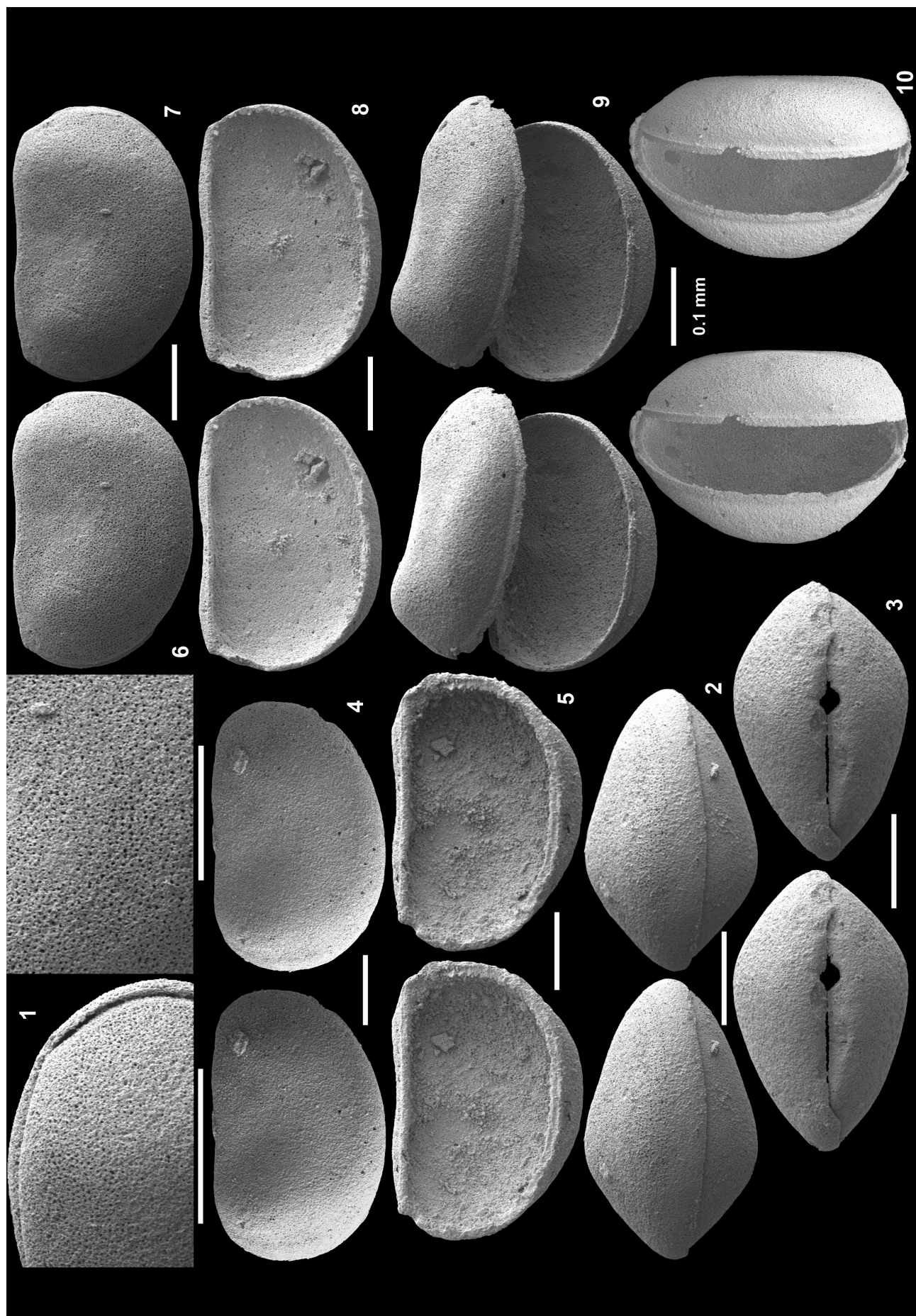
Definition - Small, outline preplete to postplete, L/R overlap. Carapace symmetrical except of overlap.

EXPLANATION OF PLATE 2

- Figs 1-3 - *Buckelopsis dyca* gen. et sp. n.
 1) Holotype, detail of Pl. 1, fig. 6.
 2) Paratype, GG 375-10, carapace, ventral view, L 0.29 mm.
 3) Paratype, GG 375-11, carapace, dorsal view, L 0.30 mm.

- Figs 4-10 - *Sudon microporatus* sp. n.
 4) Paratype, GG 375-12, LV, lateral view, L 0.37 mm.
 5) Paratype, GG 375-13, LV, interior view, L 0.37 mm.
 6-7) Paratype, GG 375-14, RV, lateral view, L 0.35 mm.
 8) Paratype, GG 375-15, RV, interior view, L 0.37 mm.
 9-10) Holotype, opened carapace, GG 375-16, ventrolateral and ventral views, L 0.35 mm.

All: Beach of Vale, Isle of Gotland (boulder Val-34).
 All SEM-stereo-pairs except of figs 1 and 6.



Domicilium of equal convexity throughout. Both valves with a dorsal epicline umbo, and an epicline, keel-like ridge ventrally. The latter displays fine ridges parallel to border.

Comparison - *Obliquisylthis* is distinct by its asymmetry (only LV with dorsal umbo, and only RV with ventral umbo). *Buckelopsis* has a longitudinal unequally convex domicilium and lacks ventral ridges.

Epiclinia epiclinata sp. n.

1996 *Hemeaschmidtella*? sp. 1 - Meidla: p. 101, fig. 24 (faunal log), tab. 9 (p. 209), pl. 20, figs 3-5.

Holotype - Carapace GG 375-23 (Pl. 3, fig. 7).

Type locality - Beach of Vale, Isle of Gotland, glacial erratic boulder (beach boulder) no. Val-34.

Material - >60 valves and carapaces from boulders Val-34 and Val-144.

Dimensions and proportions - (Hm = H with umbo)

GG	valve	type	L	Hm	L:Hm	Pl. 3
375-17a	LV	paratype	0.57	0.37	1.57	fig. 1
375-22	RV	paratype	0.54	0.37	1.47	fig. 6
375-21	C	paratype	0.54	0.37	1.47	fig. 5
375-17b	RV	paratype	0.53	0.35	1.51	---
375-18	LV	paratype	0.52	0.32	1.60	fig. 2
375-20	RV	paratype	0.49	0.30	1.66	fig. 4
375-19	RV	paratype	0.48	0.32	1.50	fig. 3
375-23	C	holotype	0.45	0.31	1.46	fig. 7

Definition - Largest valve 0.57 mm. Shape (including of umbo) high to rather high. In other features as for genus, which is presently monotypic.

Remarks - Contrary to both species described above, *Epiclinia epiclinata* has quite a variable morphology

concerning outline, length of the straight hinge-line as well as concerning width and length of the dorsal umbo.

The RV of *Obliquisylthis kampensis* which may occur together with *Epiclinia* also show a similar ventral swelling but no dorsal umbo (Schallreuter, 1967, fig. 6b).

The specimens from Pirgu and Porkuni stages of Estonia figured as *Hemeaschmidtella*? sp. 1 by Meidla (1996, pl. 20, figs 3-5) (size 0.50 - 0.56 mm) seem to be conspecific with *Epiclinia epiclinata*. The carapace no. 3484 is very similar to the specimen figured here on Pl. 3, fig. 6. The carapace no. 3486 figured in ventral view is very similar to the carapace figured here on Pl. 3, fig. 7; it also shows a fine ridge close to the free margin.

Occurrence - See Tab.1.

Order PLATYCOPA (PLATYCOPIDA)

Next to the suborder Platycopina of the order Platycopida Schallreuter (1968c) included some taxa, which did not fit into the concept of both orders Podocopa (Podocopida) and Beyrichiocopa (Palaeocopida) at that time.

This was heavily criticized by Adamczak (1976, p. 315) as a “dramatic attitude”. However, Hessland & Adamczak (1974, p. 62) united the suborders Platycopa and Palaeocopa within the order Palaeocopida (recte Platycopida, because this is the older name) which is considered an even more “dramatic attitude”.

Suborder PUNCIOCOPA (= KIRKBYOCOPA)

Family ORDOVIZONIDAE Becker, 1997a

Genus *Immanisator* gen. n.

Derivation of name - Artificially formed from “immanis”, Lat. huge; after the very large adductor muscle spot.

Type species - *Immanisator punctatus* sp. n.

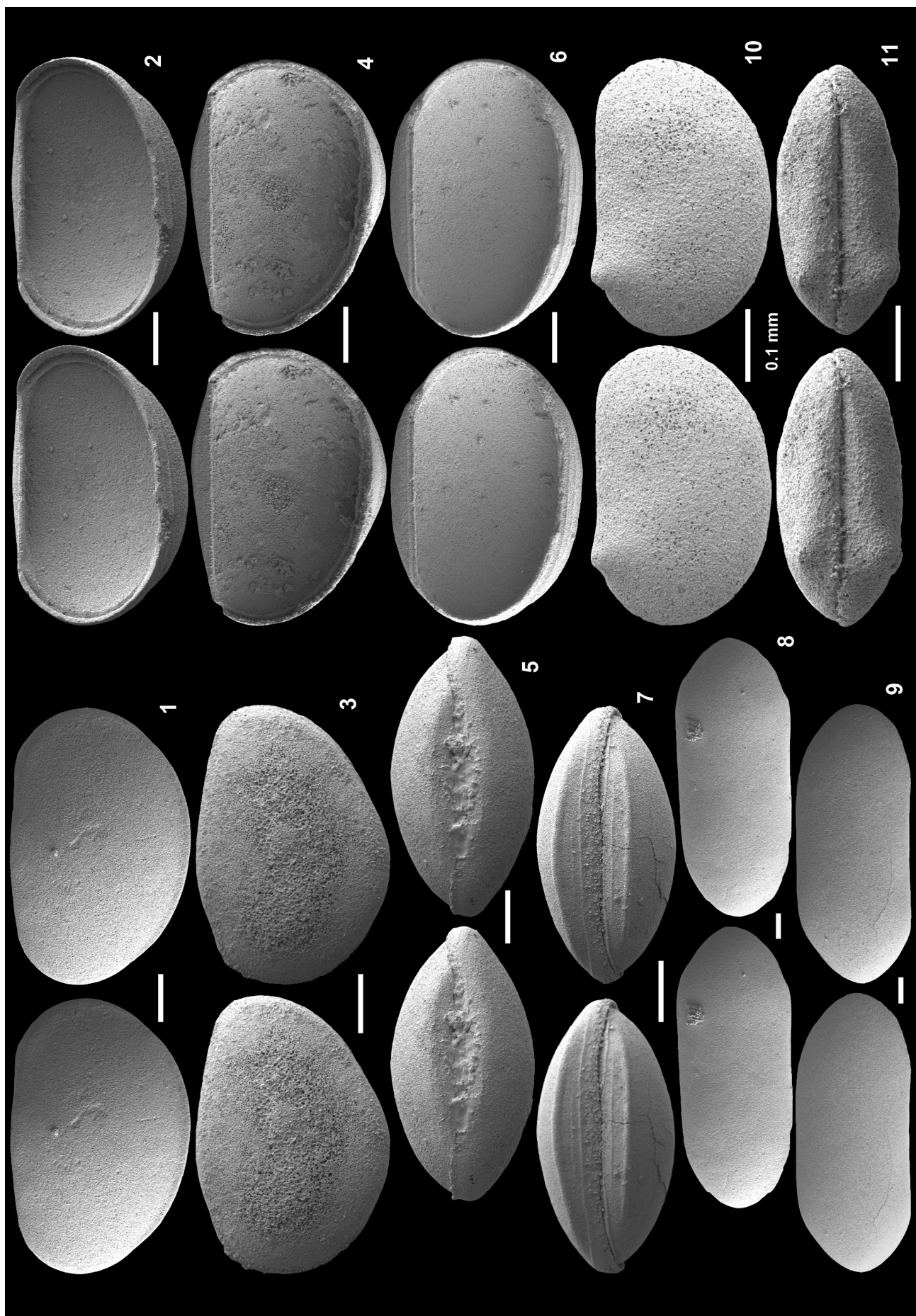
EXPLANATION OF PLATE 3

- Figs 1-7 - *Epiclinia epiclinata* gen. et sp. n.
 1) Paratype, LV, GG 375-17a, lateral view, L 0.57 mm.
 2) Paratype, LV, GG 375-18, interior view, L 0.32 mm.
 3) Paratype, RV, GG 375-19, lateral view, L 0.48 mm.
 4) Paratype, RV, GG 375-20, interior view, L 0.49 mm.
 5) Paratype, carapace GG 375-21, dorsal view, L 0.54 mm.
 6) Paratype, RV, GG 375-22, interior view, L 0.54 mm.
 7) Holotype, carapace, GG 375-23, ventral view, L 0.45 mm, LV above; Isle of Gotland (boulder Val-34).

- Figs 8-9 - *Longisyltherella erratica* gen. et sp. n.
 8) Paratype, LV, GG 375-26, lateral view, L 1.10 mm.
 9) Paratype, RV, GG 375-27, lateral view, L 1.05 mm; Isle of Gotland (boulder Val-34).

- Figs 10-11 - *Sagittovum? glabrum* sp. n.
 10) Paratype, RV, GG 375-24, lateral view, L 0.37 mm.
 11) Holotype, carapace, GG 375-25, dorsal view, L 0.37 mm; Isle of Gotland (boulder G-287).

All SEM-stereo-pairs.



Definition - Very small (< 0.5 mm), rather long and sub-amplete. Very large central non-reticulate spot slightly anterior and below mid-lines. Lateral surface punctate except adductor spot, a very small comarginal zone and a small bridge between adductor spot and dorsal margin.

Comparison - The new genus resembles *Nonsulcozona* Schallreuter, 1972a in being nonsulcate but the muscle spot in that genus is in more dorsal position, the outline is preplete and the lateral surface reticulate.

The new genus is characterized by the very large non-reticulate central spot and its position closer to the ventral than dorsal margin. It is very likely to represent a muscle-spot, at least with its central part. The distance factor (Adamczak, 1976, p. 308) is rather high (46). The ventral position below mid-height is typical for the Kirkbyoidea (Becker, 1997b, p. 114). But among other groups there are also examples with a ventral position of the muscle spot (*Kiltsiella cometica* Schallreuter, 1995, Silurian, Schallreuter, 1995, pl. 9A, fig. 1; *Platybolbina ventroreticulata* Schallreuter, 2000, Silurian, Schallreuter, 2000, pl. 7A, fig. 3r).

According to Kesling (1951, p. 137) the term muscle-spot is synonymous to the term muscle scar, which was defined by him (Kesling, 1951, p. 120) as "... an area marking the former position of a muscle". Since the ostracode adductor consists of several scars, Adamczak used the term adductor muscle scar field (= AMF, Adamczak, 1976, p. 306), which we regard herein as synonym to muscle-spot. In Ordovician ostracodes, muscle scars have been very rarely observed, but the muscle-spot is often indicated, especially in reticulated species, by a smooth area. In these cases it is unknown, whether the entire smooth field was taken by the individual muscle scars as, e.g., in *Platybolbina* (*Reticulobolbina*) *integra* Schallreuter, 1969b (o.c. fig. 1) or not.

Comparable to other related taxa, *Immanisator punctatus* does not exhibit muscle scars. However, with a value 18.0 according to the adductor muscle index AMI (Adamczak, 1976, p. 306) the whole unreticulated area does not significantly exceed the AMI of *P. integra* (12.7 - 16.4). Therefore, it can be assumed that most of the unreticulated area in *Immanisator punctatus* had been taken by the muscle scars themselves.

Immanisator punctatus gen. et sp. n.

Derivation of name - After the punctate lateral surface.

Holotype - RV, GG 375-5 (Pl. 1, fig. 5).

Type locality - Wielen, western Lower Saxony, glacial erratic boulder (no. Wie-1).

Dimensions and proportion - L 0.42 mm, H 0.22 mm, L:H 1.91.

Definition - As for genus which is monotypic.

Suborder CYTHERELLIFORMES
Superfamily CYTHERELLOIDEA Sars, 1866
Fam. inc.

Genus *Longisyltherella* gen. n.

Derivation of name - After the long shape and genus name *Syltherella*.

Type species - *Longisyltherella erratica* sp. n. At present the genus is monotypic.

Definition - Medium-sized. Shape very long. Cigar-like, with straight hinge line parallel to ventral margin, which lacks a distinct vecon. Posteriorly slightly narrower rounded than anteriorly. Interior with a muscle spot slightly above centre and a bipartite vertical sulcament behind the muscle spot in both dorsal half and in the posteroventral region of the valve.

Remarks - The interpretation of the interior sculptures of the type-species delivers some problems. The round central sulcament certainly represents an adductor muscle spot and the posteroventral sulcament is considered as a limen. The centrodorsal sulcament therefore cannot be an adductorial ridge. Since the posteroventral limen is restricted to the ventral part, the centrodorsal sulcament could be only interpreted also as a limen. The latter would be constructed of two parts in this case - like in the female specimen of *Cavellina* from the Pennsylvanian of Oklahoma figured by Jaanusson (1985, fig. 7 = Hinz-Schallreuter & Schallreuter, 1998, fig. 47A). Contrary to *Longisyltherella*, this *Cavellina* species is characterized by a holosolenic furrow. The elongate shape combined with both a divided limen and the missing holosolenic furrow seems to be a unique within the Cytherelloidea and probably justified the erection of a new family.

Adamczak (1991, p. 264) considered the limen as a typical feature of the Cytherellidae and Kloedenellidae of the Kloedenellacea (= Kloedenelloidea; recte: Cytherelloidea). He treated the Kloedenelloidea as the only taxon of the platycopes firstly occurring in the Llandovery/Wenlock. Lundin et al. (1995) described domatidial dimorphism also in Ordovician leperditellid and monotiolepid ostracodes. The inclusion of all taxa having domatidial dimorphism within the Platycopoda was considered as a possible classification by Lundin et al. (1995, comp. Schallreuter 1968c).

Since *Longisyltherella* resembles more Silurian platycopes (Kloedenellidae and Cytherellidae, Adamczak, 1966) than *Loculocavata* Lundin et al., 1995 (Leperditellidae), the genus is therefore assigned to Platycopoda inc. fam. Here the great similarity with Ordovician podocopes contradicts Adamczak's (1991, p. 264) statement that "the platycopes are distinctly separate from the podocopides".

Longisyltherella erratica gen. et sp. n.

Derivation of name - After the occurrence in a glacial erratic boulder.

Holotype - LV, GG 375-28 (Pl. 4, fig. 15).

Type locality - Beach of Vale, Isle of Gotland, glacial erratic boulder (beach boulder, no. Val-34).

Material - 9 valves from glacial erratic boulder Val-34.

Dimensions and proportions -

GG	valve	type	L	H	L:H	Pl.
375-28	LV	holotype	1.12	0.45	2.51	4, fig. 15
375-26	LV	paratype	1.10	0.43	2.57	3, fig. 8
375-27	RV	paratype	1.05	0.42	2.53	3, fig. 9
375-29	RV	paratype	1.05	0.40	2.66	4, fig. 16

Definition - As for genus.

Remarks - *Longisyltherella erratica* strongly resembles *Rectella? proposita* Abushik & Sarv, 1963 (Molodovo Stage, Podolia) in size, shape and outline (comp. Abushik & Sarv, 1963, pl. 6, figs 5-6). Therefore, it is very likely conspecific if not only homeomorphic. However, the interior features of the species are unknown. Abushik & Sarv compared *Rectella? proposita* with the morphologically similar but smaller *Bulbosclerites unicornis* (Neckaja, 1952), which is characterized by two inner stop-pegs (Schallreuter, 1980, pl. 78, fig. 2), and thus, belongs to quite another family (Balticellidae, Schallreuter & Hinz-Schallreuter, 1999, p. 234) and suborder (Cypridocopa).

Order PODOCOPA (PODOCOPIDA)
Suborder CYPRIDOCOPA
Family LONGISGULIDAE Neckaja, 1966

Remarks - The systematics of the Longisculidae suffer on the problem that a complete description does not only require the description of the carapace but also of the internal features. "The carapaces are generally closed, and it is difficult to open them in order to study internal structures" (Hessland & Adamczak, 1974, p. 59). Therefore single valves are necessary for the study of the internal sculptures. Only "certain internal features" enabled Hessland & Adamczak (1974, p. 59) to interpret *Steusloffina* as podocope.

Another possibility to study internal carapace features are successive transverse peels of a sectioned specimen - as, e.g. made by Hessland & Adamczak (1974, pl. 2) - and their digitalization for stereo-views in different levels as was shown by several spectacular examples by Siveter et al. (2003, 2007).

The internal features are particularly important for podocopes which have smooth or only weakly sculptured surface. Only outline, overlap conditions, and symmetry serve as diagnostic features. Furthermore, the persistent joker of homeomorphy (McKenzie, 1982) prevents the exact determination.

This is exemplified by species, originally placed in *Platyrhomboides*, which differ by the development of a broad duplicature in one species and two stop-pegs without duplicature in the other species (Schallreuter, 1979). Therefore, they represent different genera

(Schallreuter, 1979, p. 27-28; 1986, p. 11-12 or 211-212) of two different higher taxa.

Genus *Medianella* Neckaja, 1966

Type species - *Cytherella robusta* Kummerow, 1924 (subsequent designation Schallreuter & Hinz-Schallreuter, 2008, p. 813) = *Bythocypris intacta* Stumbur, 1956.

Remarks - Together with *Steusloffina* Teichert, 1937, Neckaja (1966, p. 55) assigned her genus *Medianella* in her family Longisculidae, while Meidla (1996, p. 124) referred the genus to the Steusloffinidae Schallreuter, 1984. Due to the unsulptured lateral surface, Schallreuter & Hinz-Schallreuter (1999, p. 234) agreed with Neckaja in placing *Medianella* within the Longisculidae. Steusloffinidae are characterized by their tricorinid outline and the development of lateral spines or ridges (l.c.). Similar to Balticellidae the Steusloffinidae have two interior stop-pegs in the LV. Stop-pegs had been also observed in genera assigned to Longisculidae (o.c., p. 234, and table 1), although this feature has not been identified in the type species of *Longiscula* Neckaja, 1958, *L. arcuaris* Neckaja, 1958. However, a similar species displays the respective character, as is outlined below.

If orientated after the straight hinge-line, *Medianella* somewhat resembles typical steusloffinids but differs by the relatively short hinge-line (Hinz-Schallreuter & Schallreuter, 1998, figs 31A-B). Typical longisculids, like *Longiscula*, *Pullvillites* (= *Arcuaris*, Meidla, 1996, p. 116), also have a short hinge-line, but are more symmetrical. These features may be transitional between the several species assigned to these genera making taxonomy even more difficult. Therefore, the species described below is only tentatively assigned to *Medianella*.

Medianella? sp. n.?

Material - >40 valves from the boulder Val-34.

Definition - Largest valve 2.15 mm. Shape of larger valves mostly long. Outline elongate-elliptical, dorsal and ventral margin about parallel to each other; anterior end less rounded than posterior one. Greatest length slightly below mid-length, posterior half somewhat higher than anterior one. Median sulcament slightly anterior to centre. Weak vecon in anterior half. Behind sulcament at ventral margin a short stop-peg. Anterior stop-peg missing or very weak. Lappet asymmetrical, broadest somewhat in front of centre, decreasing in width anteriorly more rapidly than posteriorly.

Remarks - Morphologically, the sulcament is not always distinctly developed but often indicated by the brighter colour. Few valves display a very weak anterior tubercle-like stop-peg. On RV and larvae the vecon is more distinct and the dorsal margin more strongly convex.

Dimensions and proportions -

GG	valve	L	H	L:H	Pl. 4
375-30	LV	2.15	1.08	1.99	fig. 3
375-31	LV	1.95	1.00	1.96	fig. 4
375-34	LV	1.67	0.85	1.98	fig. 1
375-32	LV	1.62	0.83	1.95	fig. 5
375-35	RV	1.56	0.80	1.96	fig. 2
375-33	RV	1.06	0.58	1.85	fig. 6

Comparison - Due to the distinct sulcament and the unequal stop-pegs the species is referred to *Medianella*. The type-species of *Medianella* also has a median sulcament (adductor ridge?) and two stop-pegs of which the posterior is distinctly stronger. *M. robusta* is distinctly different in having an egg-shaped outline, a higher shape (L:H ratio) and a more narrowly rounded posterior end (Schallreuter & Hinz-Schallreuter, 2008, fig. 2). Other species of *Medianella*, such as *M. aequa* Stumbur, 1956 and *M. longa* Stumbur, 1956, are more similar and differ mainly by the unequal valve ends (Meidla, 1996, pl. 26, figs 5, 7).

On the other hand the species shows a great similarity with some species assigned to *Longiscula* Neckaja, 1958. Meidla (1993) revised the genus *Longiscula* in redescribing several known and describing two new species. The descriptions are mainly based on carapaces, but some species display a sulcament (Meidla, 1993, figs 3.4, 4.1). Stop-pegs have been documented for *Longiscula* sp. by Schallreuter (1979, pl. 2, fig. 5), but Meidla (1993,

p. 291) referred this species to *Longiscula* only with question-mark.

The type-species, *L. arcuaris* Neckaja, 1958, differs from *Medianella*? sp. n.? distinctly in its heart-shaped outline, but *L. porrecta* Meidla, 1993 (= *Leperditia praelonga* Steusloff, 1895; Schallreuter & Hinz-Schallreuter, 2005, p. 604) and *L. perfecta* Meidla, 1993 resemble *Medianella*? sp. n.? in the longer hinge-line and the only weakly rounded dorsal margin (Meidla, 1993, figs 1-5, 1996, pl. 24, figs 1, 4). In *L. perfecta* a sulcament is present, but stop-pegs are unknown. The largest specimen of *Medianella*? sp. n.? is larger than the holotype of *L. perfecta* (1.60 mm) which may not be an adult specimen. Furthermore, it is distinctly higher in the posterior half. But despite these differences both taxa may be conspecific.

Genus *Aviacypris* Schallreuter, 1977

Type species - *Aviacypris avia* Schallreuter, 1977 (original designation).

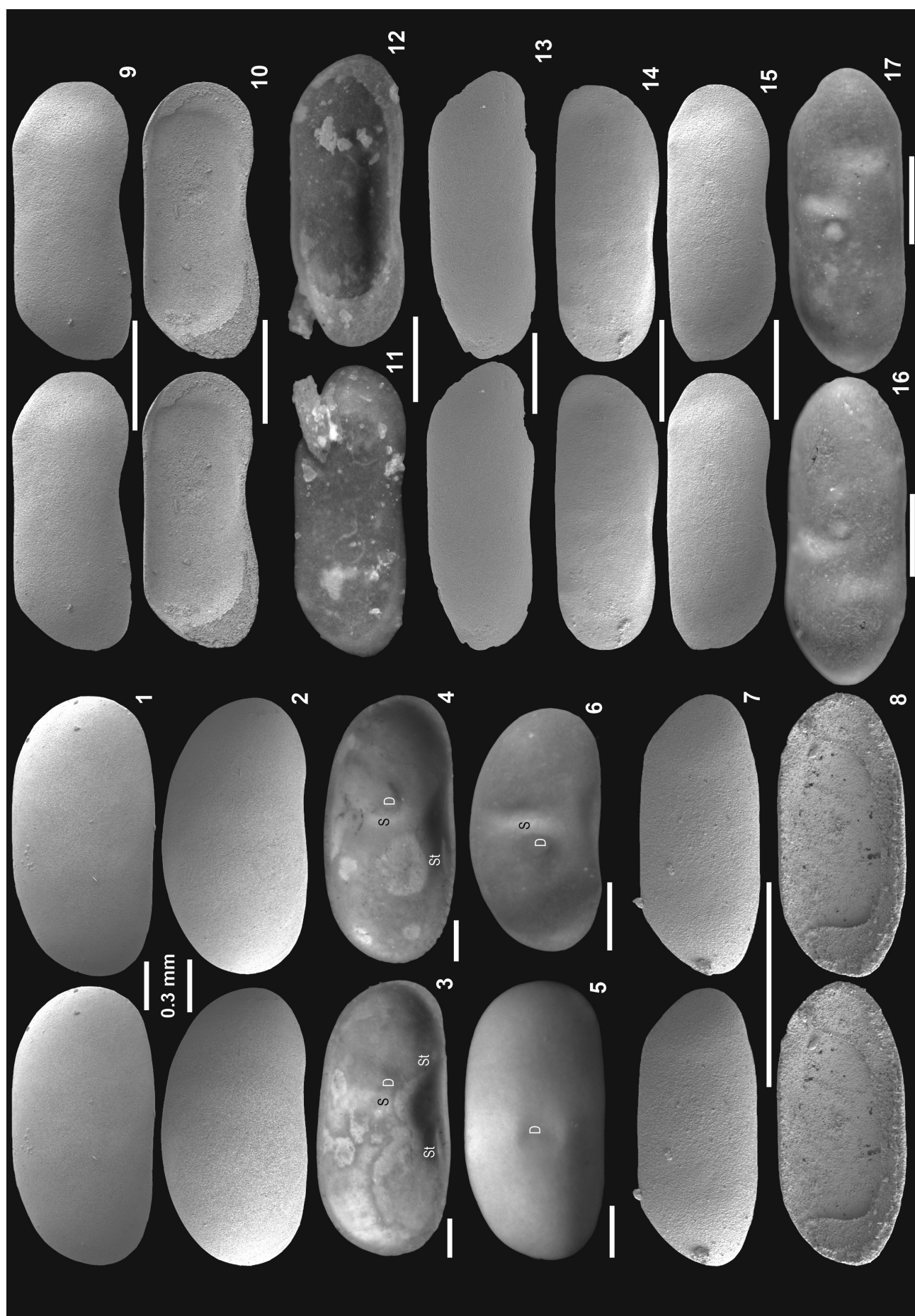
Remarks - This genus belongs to the few Ordovician genera characterized by a duplicature. Until now it was monotypical, i.e. the original diagnosis (Schallreuter 1977, p. 723) was exclusively based on features of the type-species. Since the new species described below do not agree completely with the original definition the latter has been somewhat changed in order to avoid the establishment of a new genus at present.

EXPLANATION OF PLATE 4

- Figs 1-6 - *Medianella*? sp. n.?
 1) LV, GG 375-34, lateral view, L 1.67 mm.
 2) RV, GG 375-35, lateral view, L 1.56 mm.
 3) LV, GG 375-30, interior view, L 2.15 mm.
 4) RV, GG 375-31, interior view L 1.95 mm.
 5) LV, GG 375-32, lateral view, L 1.62 mm.
 6) RV, GG 375-33, interior view, L 1.06 mm. Note the distinct, short, posterior stop-ridge (St) in 3 and 4, the hardly visible, anterior stop-peg (St) in 3, the sulcament (S) in 3, 4 and 6, and in front of the sulcament the anteroventral depression (D) in 3-6.
- Figs 7-8 - *Dornbuschia bospi* sp. n.
 7) Paratype, RV, GG 375-37, lateral view, L 0.42 mm.
 8) Holotype, LV, GG 375-36, interior view, L 0.42 mm.
- Figs 9-10 - *Aviacypris coartata* sp. n.
 9) Holotype, RV, GG 375-38, lateral view, L 0.75 mm.
 10) LV, GG 375-39, interior view, L 0.78 mm.
- Figs 11-13 - *Aviacypris truncata* sp. n.
 11-12) Holotype, RV, GG 375-40, lateral and interior views, L 1.00 mm.
 13) Paratype, LV, GG 375-41, lateral view, L 1.01 mm.
- Figs 14-15 - *Aviacypris planta* sp. n.
 14) Paratype, LV, GG 375-45, lateral view, L 0.80 mm.
 15) Holotype, RV, GG 375-44, lateral view, L 0.82 mm.
- Figs 16-17 - *Longisyltherella erratica* gen. et sp. n.
 16) Holotype, LV, GG 375-28, interior view, L 1.12 mm.
 17) Paratype, RV, GG 375-29, interior view, L 1.05 mm.

All: Beach of Vale, Isle of Gotland (boulder Val-34).

All SEM-stereo-pairs except of figs 3-6, 11-12, and 15-16 (light photos).



Definition - Small to medium-sized. Shape very long (mostly L:H >2.05). Outline elongate-elliptical but with distinct vecon. Posterior half of valve higher than anterior one. Straight hinge-line rather long to long, but not corresponding to greatest length of valve. Epicline dorsum lacking or only very weak. Duplicature mesostene, with marginal surface more or less flattened in the respective region.

Occurrence - Late Ordovician of Baltica. Until now known from Öjlemyr Flint boulders only.

Aviacypris planta sp. n.

Derivation of name - From Latin “planta”, after the similarity with the sole of the foot.

Holotype - RV, GG 375-44 (Pl. 4, fig. 14).

Type locality - Isle of Gotland, glacial erratic boulder as beach boulder, no. Val-34.

Material - 2 RV, 2 LV from boulder Val-34.

Dimensions and proportions -

GG	valve	type	L	H	L:H	Pl. 4
375-46	LV	paratype	0.84	0.31	2.74	
375-44	RV	holotype	0.82	0.31	2.66	fig. 14
375-45	LV	paratype	0.80	0.29	2.74	fig. 13

Definition - At least up to 0.84 mm. Shape very long (L:H a. 2.66 - 2.74). Long straight hinge-line. Cardinal corners rounded. Anterior margin equally rounded and broadest antero-centrally. Posterior margin unequally rounded with the posterior end located in the posterodorsal region. Posterior half of valve distinctly higher than anterior one. Vecon very distinct.

Remarks - The very weak node in the anterodorsal corner (Pl. 4, fig. 13) may represent an eye tubercle.

Comparison - The species differs from the other species of the genus mainly by its very long shape and the posterior end located close to dorsal margin.

Oejlemyra? angustoduplicata Schallreuter, 1986 is superficially similar but differs in having a long straight hinge-line with distinct cardinal corners, and mainly by the narrow marginal ridge and the narrow duplicature (Schallreuter, 1986, pl. 8, fig. 12). The specimens are adult as probably also applies to *Oejlemyra? angustoduplicata*. The duplicature is fully developed, which - in recent ostracodes - is usually not complete before the adult stage. *A. planta* has a broad mesostene duplicature (broadest antero- and posteroventrally), whereas the narrow and equally wide (isoplate) duplicature of *O.? angustoduplicata* is more a “calcified internal rim” sensu Olempska (comp. Becker & Adamczak, 2001, p. 154) rather than a preadult feature.

Aviacypris coartata sp. n.

Derivation of name - From Latin “coartare”, narrow, after the narrowing in height in mid-length.

Holotype - RV, GG 375-38 (Pl. 4, fig. 9).

Type locality - Isle of Gotland, glacial erratic boulder as beach boulder, no. Val-34.

Material - 4 LV, 2 RV from boulder Val-34.

Dimensions and proportions -

GG	valve	type	L	H	L:H	Pl. 4
375-39	LV	paratype	0.78	0.32	2.41	fig. 10
375-38	RV	holotype	0.75	0.31	2.44	fig. 9

Definition - Length at least up to 0.78 mm. Shape very long (L:H a. 2.41 - 2.44) and highest in posterior half. Anterior end equally rounded and broadest antero-centrally, posterior end unequally rounded with the posterior end located in the posteroventral region. Both valves with very distinct vecon. Marginal surface anteriorly and posteroventrally slightly flattened.

Comparison - The species is characterized by extremely pronounced vecon in both valves.

The older *Bulbosclerites* sp. n. Meidla, 1996 (pl. 23, figs 7-8, Rakvere Stage) may be related if it also possessed a duplicature (instead of two stop-pegs in the LV). The vecon is placed in that species more centrally than in *A. coartata*.

Aviacypris truncata sp. n.

Derivation of name - After the truncate anterodorsal region.

Holotype - RV, GG 375-40 (Pl. 4, fig. 11).

Type locality - Isle of Gotland, glacial erratic boulder as beach boulder, no. Val-144.

Material - 1 RV, 1 LV from boulder Val-144 and 1 RV and 1 LV from boulder Val-34.

Dimensions and proportions -

GG	boulder	valve	type	L	H	L:H	Pl. 4
375-41	Val-144	LV	paratype	1.01	0.39	2.58	13
375-40	Val-144	RV	holotype	1.00	0.40	2.53	11-12
375-42	Val-34	LV		0.85	0.42	2.06	
375-43	Val-34	RV		0.85	0.41	2.10	

Definition - Length at least up to 1.01 mm. Shape of adults very long (L:H a. 2.5 - 2.6). Straight hinge-line relatively short and parallel to basis-line. Posterior half of valve only slightly higher than anterior one. Anterior end more narrowly rounded than posterior one, anterodorsally truncated. Both ends located at/or slightly below mid-length. Dorsal umbo weak, vecon distinct.

Comparison - The species is characterized by the relatively short and straight hinge-line as well by the truncate anterodorsal margin. The latter is a common feature of both *A. truncata* and the type-species, from which it differs by the anteriorly and posteroventrally flattened marginal surface (Schallreuter, 1977, figs 2-3).

Variation - The specimens from boulder Val-34 are smaller and not so elongate like the typical (adult) specimens (L:H 2.06 - 2.20) and the anterodorsal shoulder is shorter. Due to the weak and incompletely developed duplicature, they are considered as larval stages, which might, however, also turn out to represent a new subspecies. Since the duplicature is fully developed in both holo- and paratype they represent adult stages.

Genus *Dornbuschia* Schallreuter, 1968

Type species - *Dornbuschia hiddenseensis* Schallreuter, 1968a (original designation).

Dornbuschia bospi sp. n.

Derivation of name - After the "Bollettino della Società Paleontologica Italiana" (BoSPI).

Holotype - LV, GG 375-36 (Pl. 4, fig. 8).

Type locality - Isle of Gotland, glacial erratic boulder as beach boulder, no. Val-34.

Material - 11 valves from boulders Val-34 and Val-144.

Dimensions and proportions -

GG	valve	type	L	H	L:H	Pl. 4
375-36	LV	holotype	0.42	0.20	2.13	fig. 8
375-37	RV	paratype	0.42	0.17	2.43	fig. 7

Definition - Length at least up to 0.42 mm. Outline trapezoid-elliptical. Greatest height in the middle. Ends nearly equally rounded. Posteroventral margin rounded.

Comparison - The other Öjlemyr Flint species such as *Dornbuschia ostseensis* Schallreuter, 1968a, and the older type-species, *D. hiddenseensis* Schallreuter, 1968a, differ mainly by the longer or shorter straight dorsal margin and the unequally rounded ends, of which the posterior one is angulate (Schallreuter, 1968a, pl. 9, figs 1.2, 5-6).

Ontogeny and variation - All specimens on hand are of about the same size and show little variation only.

CONCLUSIONS

1. From the Upper Ordovician Öjlemyr Flint (chert) of the Isle of Gotland and Northern Germany a total of 12 new non-palaeocene ostracode species are described.

2. Three species placed within the Schmidtellidae are problematical concerning orientation and thus, in

their relations to Schmidtellidae, Jaanussoniidae and Sagittovinae, respectively.

3. A species resembling some *Longiscula* species (not the type-species) is tentatively assigned to *Medianella* based on internal characters. It documents the taxonomic problems of the family Longisculidae.

4. *Longisyltherella erratica* gen. et sp. n. is the first Ordovician and thus, the oldest representative of typical platycopids, which - according to Adamczak - are the only group being characterized by a limen.

5. With three new species of *Aviacypris* and *Dornbuschia bospi* sp. n. further representatives of the rare Ordovician podocopes with a mesostene duplicature are documented.

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