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Aalenian – Lower Bajocian (Middle Jurassic) ostracods from the Geisingen clay pit (SW Germany)

Matthias Franz, Martin Ebert & Ruta Stulpinaite

Abstract

This study of ostracods from 26 samples from the Aalenian and Lower Bajocian of Geisingen (Baden-Württemberg, southern Germany) has yielded five faunal assemblages. The assemblages from the Lower Aalenian are dominated by small-sized ostracod species and are in general less diverse than those assemblages recorded from the Middle and Upper Aalenian. First order microfaunal changes occur at the base of the Lower Aalenian "Comptum" Subzone, at the Bradfordensis/Gigantea Subzonal boundary and at the Bradfordensis/Concavum Zonal boundary. A second order microfaunal change is also noted at the Aalenian/Bajocian boundary (Concavum/Discites Zones). The following new species are described: *Polycope circulosa*, *Cardobairdia tesakovae*, *Cytheropterina alacostata*, *Cytheropterina bicuneata*, *Infracytheropteron bisulcatum*, *Procytheropteron catena*, *Aphelocythere dilgeri*, *Praeschuleridea concentrica*, *Pleurocythere ohmerti*, *Progonocythere scutula*, and *Kinkelinella* (*K.*) *geisingensis*. 13 presumably new species of Cytherurids, 1 "*Monoceratina*" sp. and 1 *Kinkelinella* sp. as well as 6 specimens 'incertae sedis'are figured, but left in open nomenclature. The holotype and a paratype of *Polycope pelta* Fischer, 1961 are figured for the first time in SEM photographs.

K e y w o r d s : Ostracods, stratigraphy, faunal assemblages, Aalenian, Bajocian.

1. Introduction

Since the 1970's Middle Jurassic clays have been exploited for cement production at the foot of the Wartenberg hill, close to the village of Geisingen (south-western Swabian Alb, Fig. 1). The now abandoned clay pit exposed a lithological section ranging from the "Oberer Opalinuston" (Lower Aalenian) up to the "Unterer Wedelsandstein" (Lower Bajocian). A unique feature of this exposure is the occurrence of a chamosite-oolitic bed (0.6–0.8 m) representing parts of the Middle Aalenian Gigantea Subzone of the Bradfordensis Zone. A detailed description of the section and its ammonite fauna has been given by Dietze et al. 2014. Gastropods of the Geisingen section have been described by Gründel et al. (2011).

Our knowledge on the Aalenian ostracod fauna in Germany is based mainly on the early studies from the 1930's to 1960's (Brand & Fahrion 1962, Buck 1954, Dilger 1963, Fahrion 1935, Kobler 1972, Malz 1966, Plumhoff 1963, Stoermer & Wienholz 1967, Triebel 1950, Triebel & Bartenstein 1938, and Ziegler 1959). Brand & Mönnig (2009), Ernst (1989), Franz et al. (2009) and Ohmert (1996, 2004) comprise the more recent contributions.

Publications on Aalenian ostracods from the other areas in Europe include Ainsworth (1986, 1990, 1991), Ainsworth et al. (1989), Bate (1963a, b, 1968, 1978), Kochhann et al. (2015), Morris (1983), Sheppard (1981), Whittaker & Hart (2009) [Great Britain, Ireland], Bodergat (1997), Dépêche (1985) [France], Arias et al. (2009) [Spain], Reisdorf et al. (2016), Tesakova (2017) and Tröster (1987), [Switzerland]. Aalenian ostracods have also been described from Argentina (Ballent & Whatley 2000, 2009).

2. Material

2.1. Sampling

The ostracods were collected in the clay pit at the Wartenberg Hill near Geisingen (SW Germany). Drill core samples were taken from the exploration well Geisingen 1/1993 by M. Franz (samples G01Fr–G13Fr). The samples of the section exposed in the quarry were taken and processed by M. Ebert over the last 20 years (samples G14Eb–G26Eb); the Comptumbank has been sampled by ME and MF (carbonaceous marl and clay facies).

The sediments occurring within the clay pit comprises seven ammonite faunal horizons ranging from the Comptum Subzone (Opalinum Zone, Lower Aalenian) to the Discites Zone (Lower Bajocian, Dietze et al. 2014). The 117 m deep drill profile commenced just below the "Comptum-Bank" and did not reach the lower boundary of the Opalinuston Formation. The Opalinum Zone could be proven by the single specimens of *Leioceras opalinum* between 22.80 m and 76.42 m depth.

The samples from the lower, main part of the quarry (G14Eb–G22Eb, Fig. 2) comprise a black to grayish clay. About 40 % of the ostracods described here are recovered from the chamosite-oolitic bed (Geisingen Oolith, sample G20Eb) within the Gigantea Subzone of the Bradfordensis Zone (Middle Aalenian). This bed is rich in well-preserved

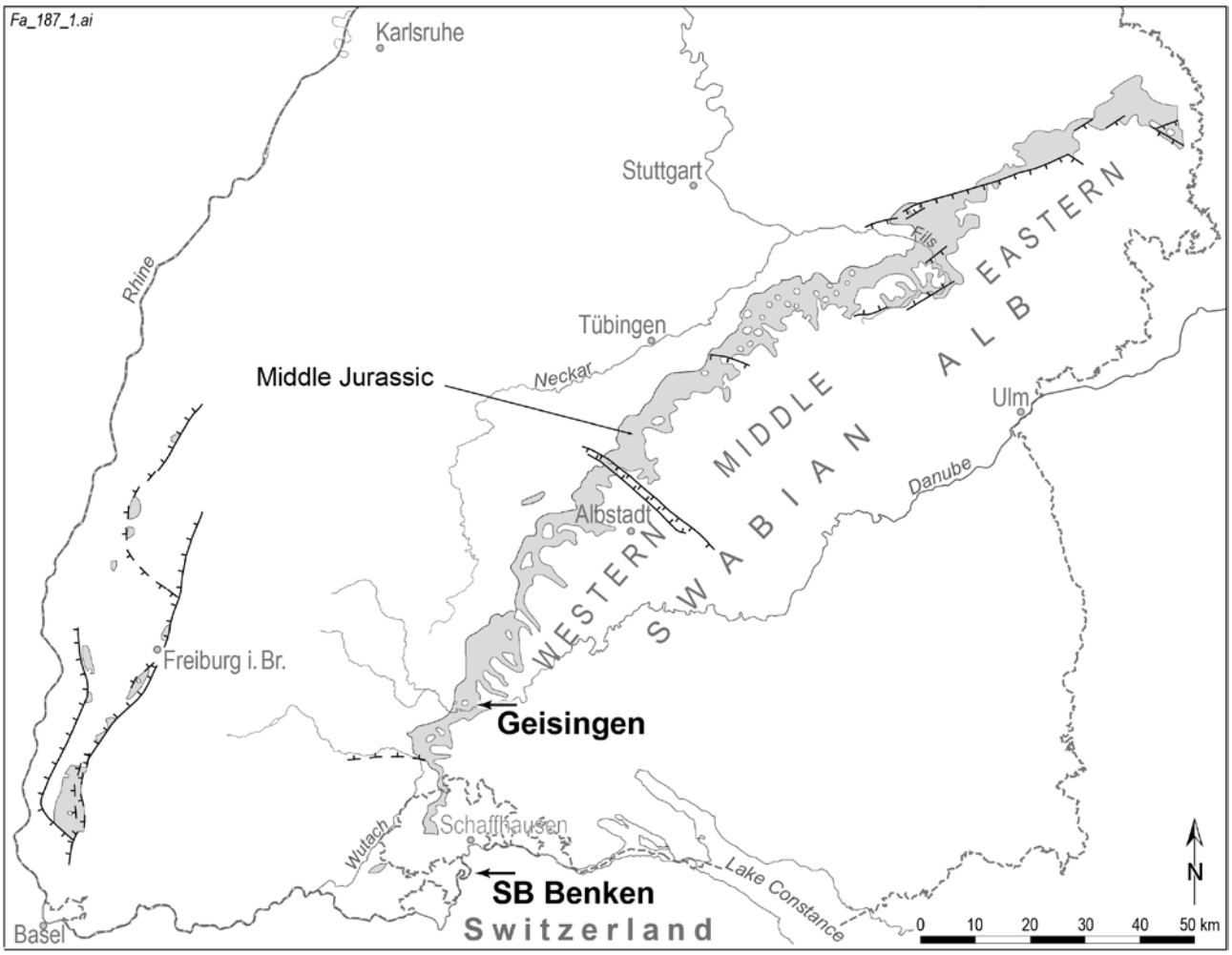

Fig. 1. Location of the section studied in the Swabian Middle Jurassic.

invertebrates, especially ammonites and bivalves. The samples G23Eb–G26Eb from the upper part of the quarry comprise fine-grained clayey sands (mostly quartz) to fine sandy clays from the Lower Bajocian Wedelsandstein Formation.

The sampling was completed by 13 samples from the drill core, the main part of which consists of dark grey to black silty clays, poor in macrofossils. A single sample was taken 76,45 m below the base of the quarry (G01Fr), the upper part of the drill core (5–20 m below surface) was sampled by the metre (G02Fr–G13Fr). The ostracods are housed in the collection of the Staatliches Museum für Naturkunde Stuttgart (SMNS).

2.2. Methods

Microfossils have been extracted from clay-rich rock by first drying the sample (0.5–1kg) and then sieving it under water. More resilient samples were additionally broken down with the aid of hydrogen peroxide (3% solution of H_2O_2). These simple methods are unsuitable for the strongly cemented ferrugineous Geisingen Oolith. This rock is divided by fissures into blocks. Some of these blocks are weathered in situ on the outside, bearing a hard iron-oxide crust. Inside this cementation zone rests a layer of weathered weakly cemented rock, a few millimeters thick, severely depleted in iron followed by the unweathered chamosite oolith. Microfossils have been extracted from the weakly cemented weathered zone in the same manner as described above.

The residues from the drillcore samples were completely examined, except for the finest fraction (0.15–0.2 mm), from which we picked 3 trays. In order to obtain the ostracod fauna of the important Geisingen Oolith as completely as possible, a much greater volume of residue has been inspected (an estimated 50–100 trays).

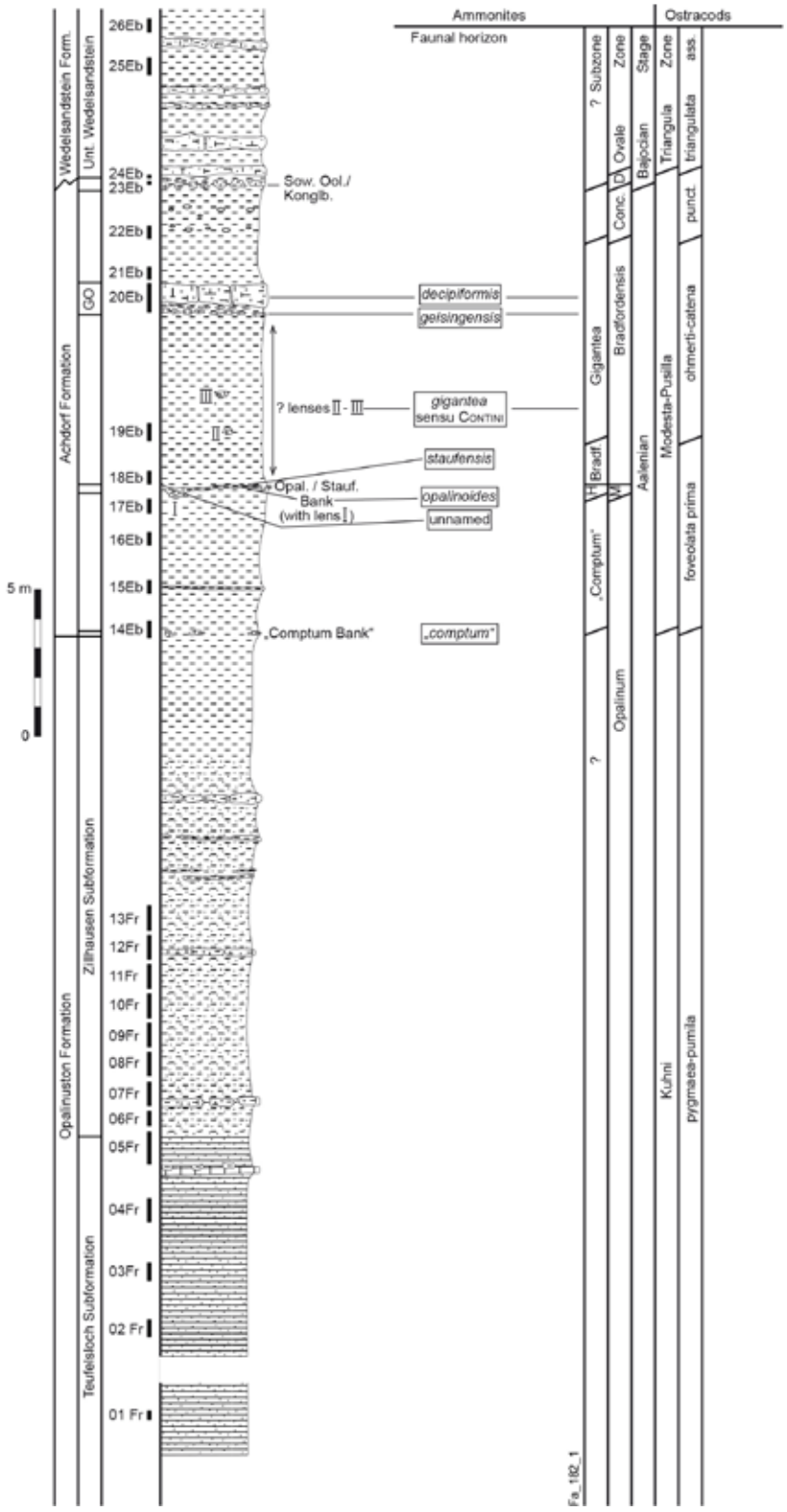

Fig. 2. Section of the Aalenian and Lower Bajocian in the Geisingen clay pit with correlation of the ammonite biostratigraphy and the ostracod faunal assemblages. Abbreviations: GO = Geisingen Oolith, Sow. Ool. = Sowerbyi Oolith, Kongl.b. = Konglomeratbank, Opal. / Stauf. Bank = Opalinoides /Staufensis Bank, H = Haugi, Bradf. = Bradfordensis, M = Murchisonae, Conc. = Concavum, D = Discites, punct. = punctulata, ass. = assemblage. Diagonal lines: boundary not exactly known.

Pictures were taken using SEM in Freiburg (Institute for Cristallography), Moscow (Geological Institute of Lomonossow University) and Stuttgart (SMNS).

3. Geisingen section

3.1. Core drilling KB 1/1993

In 1993 the former cement plant Geisingen explored the raw material reserves in the clay pit with a cored borehole. The drilling commenced at the base of the pit and reached 117 m in total depth. In 1996 the first author (MF) redescribed the core and sampled the top section in order to compare the microfauna to the research well Wittnau (Ohmert 1996). Description from bottom to top.

Opalinuston Formation

Teufelsloch Member

95.80 m dark grey, sandy laminated mudstone with iron-rich carbonate concretions and thin lenses of fine sandstone; at the top and 4.35 m below top two layers of carbonate concretions (0.05 m); 1.60 m and 55.20 m below top *Leioceras opalinum*; sample G01Fr (55.2 m below top).

2.20 m dark grey, weakly sandy, laminated mudstone; sample G02Fr (top)

1.65 m dark grey (sandy) mudstone, at the base irregularly bedded; sample G03Fr (top)

3.05 m dark grey sandy, laminated mudstone with a layer of phosphoritic nodules (0.2 m below top); sample G04Fr (middle).

0.30 m grey sandy carbonaceous mudstone with limestone nodules on top

1.20 m dark grey, weakly sandy, laminated mudstone; sample G05Fr

0.80 m grey sandy, marly, laminated mudstone; sample G06Fr

0.30 m grey sandy carbonaceous, weakly bioturbated mudstone

0.70 m dark brownish grey, weakly sandy laminated mudstone; sample G07Fr

1.30 m dark grey, weakly sandy laminated mudstone; sample G08Fr (base)

Zillhausen Member:

2.85 m sandy, finely biodetritic mudstone with Muscovite; samples G09Fr (base), G10Fr (middle) and G11Fr (top)

0.10 m grey sandy marly limestone

1.50 m grey sandy, marly laminated mudstone; samples G12Fr (base) and G13Fr (middle)

4.25 m alternation of grey, sandy marly mudstone (as above) and four, 0.1–0.4 m thick beds of grey, hard, sandy limestone.

1.00 m grey laminated sandy, muscovite-bearing mudstone

3.2. The Wartenberg clay pit

The section is compiled from several descriptions and has been described in detail in Dietze et al. (2014). In the following section the present authors have given an abridged version. The lithostratigraphical terminology follows Franz & Nitsch (2009).

Opalinuston Formation

ca. 4.00 m grey laminated mudstones with four horizons of septarian nodules; a band of calcareous nodules (0.03 m) at the top.

Achdorf Formation

0.05–0.2 m Marls, sometimes with pebbles and locally cemented, forming a hard limestone bed, laterally merging into rubble-bearing claystones ["Comptum" Bank]; G14Eb.

1.35–1.7 m Mudstones with horizons of argillaceous ironstone concretions.

0.03–0.07 m Limestone, sometimes containing muddy pebbles, their surfaces partly encrusted with pyrite.

3.0–3.5 m Mudstone with some layers of septarian nodules; G15Eb (base), G16Eb (middle) and G17Eb (top).

0.05–0.20 m pyritic, sparsely oolitic, nodular blue limestone (locally up to 0.6 m thick). In the lower part fine-grained septarian like limestones with ammonites, which are often corroded and reworked. The upper level contains muddy pebbles, abundant pyrite and is sparsely chamosite-oolitic. Bivalves, gastropods, serpulids belemnites and ammonites are common. Stromatolite layers and small areas of serpulid-encrusted hardgrounds within the Bank provide evidence for hiatuses.

At a few locations within the clay pit this bed appears as the breccia fill of small troughs ranging in depth up to 0.6 m (pers. observ. W. Auer) over an area of about 1.5 m² ("lens I" in Fig. 2). [Opalinoides/Staufensis Bank].

5.6–6.1 m Finely laminated mudstone with argillaceous ironstone concretions at different levels and lenses II and III. At ca. 3.8 m above the base, a sandy limestone bed occurs (0.05–0.08 m); samples G18Eb (base) and G19Eb (1.5 m above base).

0.6–0.8 m A chamosite oolitic limestone bed, unweathered grey to green in color, weathering to a rusty brown. At its base a hard, sparsely chamosite-oolitic limestone bed (0.15 m) is intermittently developed. A few centimeters of mudstone are succeeded by a nodular, fairly soft chamosite-oolitic limestone bed. Above is a massive chamosite-oolitic bed (0.4–0.6 m) with abundant ammonites, belemnites and bivalves (mainly *Astarte* and *Cucullaea*) in its lower part; sample G20Eb. [Geisingen Oolite].

2.6–3.1 m mudstones with several levels of argillaceous ironstone concretions; samples G21Eb (base) and G22Eb (middle)

0.2–0.35 m In the northern part of the clay pit Dietl & Rieber (1980), Rieter (pers. comm.) and Franz (1986) descibed two layers of chamosite-oolitic, calcareous nodules (each 0.1–0.2 m) separated by 0.15–0.2 m of mudstone. In the southern

part of the pit these two layers of nodules were replaced by a 0.2–0.3 m thick, hard, conglomeratic limestone bed (Franz & Reimer 1996, unpubl.). It is pale grey to beige in color, slightly oolitic and conglomeratic, containing bivalves and belemnites. The muddy pebbles within this bed are coated with microbial crusts, subsequently bored by bivalves and encrusted by oysters and serpulids. In contrast to the surrounding matrix these pebbles are not oolitic. ["Konglomeratbank/Sowerbyi Oolith"]; sample G23Eb.

Although the boundary between the Achdorf and Wedelsandstein formations cannot be placed precisely, it must lie within these strata. From the north to the south of the clay pit the mudstones separating the two nodule layers within the "Konglomeratbank/Sowerbyi-Oolith" and between the "Konglomeratbank/Sowerbyi-Oolith" and the "Unterer Wedelsandstein", wedge out.

Wedelsandstein Formation

Unterer Wedelsandstein

0.05 m	sandy mudstone, grey; sample G24Eb
0.40 m	sandy limestone, grey
0.50 m	sandy, micaceous mudstone, grey
0.60 m	sandy limestone, grey, *Zoophycos*
1.00 m	sandy mudstone, grey
0.20 m	sandy limestone, grey, *Zoophycos*
0.40 m	sandy mudstone, grey
0.20 m	sandy limestone, grey, *Zoophycos*
1.30 m	sandy mudstone, grey; sample G25Eb
0.30 m	sandy limestone, grey, *Zoophycos*
> 0.05 m	sandy mudstone, grey; sample G26Eb

4. Ostracod fauna

The 26 samples yielded a total of 4400 specimens, with the outstanding maximum of 1843 specimens in sample G20Eb (Geisingen Oolith). For semi-quantitative analysis of the composition of the ostracod faunal assemblages the greater numbers of single (right or left) valves were counted as 1, resulting in a total of 3400 individuals. In the Wedelsandstein Formation and in the sandy samples of the Opalinuston and Achdorf formations the ostracods are partly covered by remnants of sediment (mainly quartz grains) and/or fragmentary preserved. For this reason a number of individuals could only be determined on the generic level or had to be left indeterminate.

Remark: The description of all new species of Cytherurids (*Eucytherura* sp. 1–7, *Procytherura* sp. 1–4) in our material would have exceeded the scope of this work. They will be described in a later work.

Abbreviations: GPIT: Geologisch-Paläontologisches Institut Tübingen, Germany; LGRB = Landesamt für Geologie, Rohstoffe und Bergbau im Regierungspräsidium Freiburg, Germany; SMNS = Staatliches Museum für Naturkunde Stuttgart, Germany. C = carapace, RV = right valve, LV = left valve, HT = Holotype.

4.1. Systematic descriptions

Order Myodocopida Sars, 1866

Family Polycopidae Sars, 1866

Genus *Polycope* Sars, 1866

Polycope circulosa n. sp.
Pl. 1, Fig. 1

Etymology: From *circulus* (lat.) = circle, ring, after six anteroventral oval to ellipsoidal costae.

Holotype: Right valve, figured on Pl. 1, Fig. 1, SMNS no. 70423-1.

Type locality: Clay pit at the Wartenberg hill near Geisingen (SW Germany).

Type horizon: Bed GO (Geisingen Oolith), Bradfordensis Zone, Gigantea Subzone.

Material: 1 RV in sample G20Eb.

Diagnosis: Strong reticulation with six ovally arranged, oval to ellipsoidal costae and two semicircular ribs in the periphery.

Description: The shell is small, moderately convex, round, similar to lentils. The posterior is slightly higher than the anterior, widely rounded, both margins passing gradually into the dorsal and ventral margins. Dorsal margin very short and straight, ventral margin strongly convex. The lateral surface of the valve is ornamented with well-developed concentric ribs. The two longest concentric ribs are parallel to each other, surround the valve almost completely, and are located along the anterior, ventral and posterior margins. Five large ellipsoidal ribs are developed in the central part of the valve; two small round ribs are located closer to the dorsal margin. The entire intercostal surface, as well as the inner side of the ellipsoidal ribs is covered with intersecting small ribs, forming a reticulate ornament. Inside the cells of this grid there are even finer ribs forming a smaller second-order network. Round simple pores are present both on the ribs and on the intercostal surface; on the ribs they are larger. No internal details observed.

Dimensions: Length: 0.26 mm, Height: 0.25 mm

Comparisons: The peripheral ornamentation of the holotype is similar to that of *Polycope cincinnata* Apostolescu, 1959 (p. 801, pl. 1, fig. 2) from the Pliensbachian in the Paris Basin; however, the ornamentation of the latter species consists entirely of U-shaped ribs.The coarsely ribbed *Polycope* 4197 Michelsen, 1975 differs in the absence of the oval costae in the central area of the valve.

Occurrence: Middle Aalenian (Bradfordensis Zone, Gigantea Subzone).

Remark: Despite the fact, that we have only the single valve figured in Pl. 1, Fig. 1, we described it as a new species because of its extraordinary sculpture which differs to all previously described species.

Polycope discus Fischer, 1961
Pl. 1, Fig. 2

1961 *Polycope discus* n. sp. – Fischer, p. 497, fig. 1.
1975 *Polycope* sp. 4044. – Michelsen, p. 263, pl. 40, fig. 564.

1983 *Polycope discus* Fischer, 1961. – Knitter, p. 217, pl. 34, figs. 1, 2.
1986 *Polycope transversicostata* sp. nov. – Ainsworth, p. 289, pl. 1, figs. 2–4.
? 1986 *Polycope* sp. A. – Ainsworth, p. 290, pl. 1, fig. 5.
1987 *Polycope discus* Fischer, 1961. – Tröster, p. 444, fig. 1.
1999 *Polycope discus* Fischer, 1961. – Arias & Lord, p. 78, pls. 1–3.

M a t e r i a l : 1 V in sample G20Eb.

D i s t r i b u t i o n : Lower Sinemurian to Middle Aalenian (Denmark, SW Germany, Ireland, Spain).

Polycope minor Michelsen, 1975
Pl. 1, Fig. 3

1968 *Polycope* sp. 851. – Christensen, pl. 23, fig. 6.
1970 *Polycope* No. 4065. – Michelsen, p. 49, pl. 12, fig. 6a, b.
1975 *Polycope minor* n. sp. – Michelsen, p. 261, pl. 38, figs. 546–547, pl. 39, figs. 555–562.
1990 *Polycope minor* Michelsen 1975. – Brand, p. 143, pl. 1, figs. 2, 3.

M a t e r i a l : 1 C, 2 V in sample G20Eb.

D i s t r i b u t i o n : Hettangian to Upper Bathonian (Denmark, Germany).

R e m a r k s on *Polycope pelta* Fischer, 1961: At first sight we thought that our material from Geisingen comprises *Polycope pelta*, which was cited by a number of authors. But when compared to the literature the determination of this species seemed to be very questionable. Therefore we tried to find out what *Polycope pelta* was originally supposed to be.

Polycope pelta was erected by Fischer (1961) with the following diagnosis: "A species of the genus *Polycope* with the following characteristics: Rostral incision absent, the sculpture reduced to a peripheral zone provided with delicate, radial ribs. Marginal teeth are absent. … The valves are often without ornamentation, the sculpture can be blurred by dissolution."

Unfortunately his figure of the holotype (Fischer 1961: Fig. 1 center, refigured from Fischer 1957: pl. 1, fig. 2) is out of focus and does not show the ornamentation, which lead to misinterpretations as many authors have already stated (Dilger 1963: 6; Michelsen 1975: 263; NAinsworth 1986: 289; Brand 1990: 143, Arias & Lord 1999: 78). To improve the situation E. Kristan-Tollmann (cit. in Brand 1990: 143) had planned to publish SEM-photographs of the type material, but unfortunately could not finish her publication.

The Working Group Micropaleontology of the GPIT kindly provided copies of the above mentioned SEM-pictures, which allowed the present authors to refigure the holotype and a paratype of *Polycope pelta* (Pl. 1, Figs. 4a–c) and to add some details to the description.

Polycope pelta Fischer, 1961
Pl. 1, Figs. 4a–c

non 1938 Ostracode (227). – Wicher, pl. 27, fig. 4.
1961 *Polycope pelta* n. sp. – Fischer, p. 499, fig. 1.
non 1963 *Polycope* cf. *maculata* G. W. Müller 1894. – Plumhoff, p. 18, pl. 1, figs. 3a–c.
non 1963 *Polycope pelta* Fischer 1961. – Plumhoff, p. 17, pl. 1, figs. 1, 2.
non 1970 *Polycope pelta* Fischer 1961. – Whatley, p. 311, pl. 1, figs. 1–4.
non 1975 *Polycope pelta* Fischer 1961. – Michelsen, p. 262, pl. 40, figs. 570–573.
non 1979 *Polycope pelta* Fischer. – Exton, p. 65, pl. 11, fig. 4.
1981a *Polycope pelta* Fischer 1961. – Herrig, p. 679, pl. 2, figs. 1–5.
non 1983 *Polycope pelta* Fischer, 1961. – Knitter, p. 217, pl. 34, fig. 3.
non 1984 *Polycope* cf. *pelta* Fischer, 1961. – Dépêche, p. 188, pl. 1, fig. 4.
non 1984 *Polycope pelta* Fischer. – Exton & Gradstein, p. 27, pl. 2, fig. 13.
v 1985 *Polycope pelta* Fischer, 1961. – Riegraf, p. 71, pl. 1, fig. 4.
v 1985 *Polycope plumhoffi* Bate & Coleman, 1975. – Riegraf, p. 71, pl. 1, fig. 5.
non 1986 *Polycope pelta* Fischer, 1961. – Ainsworth, p. 289, pl. 1, fig. 1.
non 1987 *Polycope pelta* Fischer, 1961 – Tröster, pl. 4, fig. 2.
1990 *Polycope pelta* Fischer 1961. – Brand, p. 142, pl. 1, figs. 1, 2.
non 1992 *Polycope pelta* Fischer, 1961. – Arias & Comas-Rengifo, p. 432, pl. 1, fig. 1.
non 1999 *Polycope pelta* Fischer, 1961. – Arias & Lord, p. 78, pls. 1–4.
non 2009 *Polycope pelta* Fischer, 1961a. – Arias et al., p. 213, pl. 1, fig. 2.
non 2009 *Polycope pelta* Fischer, 1961. – Wilkinson & Whatley, pl. 1, fig. 2.
non 2014 *Polycope pelta* Fischer, 1961. – Franz et al., fig. 13Bo.
non 2017 *Polycope pelta* Fischer, 1961. – Tesakova, p. 32, pl. 1, figs. 1, 2, pl. 5, figs. 3, 4.

D i a g n o s i s : Central part of the valve smooth. Anteroventrally delicate, weakly curved crests which extend towards the margin at an acute angle. In the posterior half small linked crests, more or less parallel to the margin.

D e s c r i p t i o n : The central part of the valve is smooth; the lateral delicate sculpture confined to a narrow marginal zone. The anterior marginal zone is covered with fine, weakly curved and flexed crests which join at the anteroventral margin at a 35°–45° angle. Anterodorsally these crests pass into more or less subparallel to the margin, moderately curved fine ribs. As the paratype Ar 1110/5 shows these may continue along the dorsal margin (the carapace of the holotype is overgrown by ? calcite in the dorsal region). In the posterior half a narrow marginal zone is covered by very fine, irregularly linked, margin-subparallel ribs, which at their posterodorsal und posteroventral ends join the margin at an acute angle.

C o m p a r i s o n s : The marginal zone of Ostracode (227) Wicher, 1938 (pl. 27, Fig. 4) from the Upper Pliensbachian in N Germany is more densely ribbed with slightly diverging ribs, spread very regularly along the ventral marginal zone and reaching the margin at an acute angle. However, the dorsal marginal zone cannot be seen clearly. In *Polycope* cf. *maculata* Müller as figured by Plumhoff (1963: 18, pl. 1, figs. 3a–c) the marginal ribs do not extend to the margin but seem to be parallel to it. *Polycope* cf. *pelta* Fischer, 1961 in Dépêche (1984: 188, pl. 1, fig. 4) from the French Lower Bathonian is significantly coarser ribbed; the ornamentation covering about 80 % of the lateral surface. In the anterior part the ribs – commencing at the dorsal margin – are semicircular and more or less concentric, sub-

parallel to the anterior and ventral margins. In the posterodorsal region a few ribs follow the margin and bend towards the valves center at about mid height.

Polycope cf. "*pelta*" Fischer, 1961
Pl. 1, Fig. 5

1963 *Polycope pelta* Fischer 1961. – Plumhoff, p. 17, pl. 1, figs. 1, 2.
1970 *Polycope pelta* Fischer 1961. – Whatley, p. 311, pl. 1, figs. 1–4.
non 1975 *Polycope pelta* Fischer 1961. – Michelsen, p. 262, pl. 40, figs. 570–573.
1979 *Polycope pelta* Fischer. – Exton, p. 65, pl. 11, fig. 4.
1983 *Polycope pelta* Fischer, 1961. – Knitter, p. 217, pl. 34, fig. 3.
1984 *Polycope* cf. *pelta* Fischer, 1961. – Dépêche, p. 188, pl. 1, fig. 4.
1984 *Polycope pelta* Fischer. – Exton & Gradstein, p. 27, pl. 2, fig. 13.
non 1985 *Polycope pelta* Fischer, 1961. – Riegraf, p. 71, pl. 1, fig. 4.
v 1986 *Polycope pelta* Fischer, 1961. – Ainsworth, p. 289, pl. 1, fig. 1.
1999 *Polycope pelta* Fischer, 1961. – Arias & Lord, p. 78, pls. 1–4.
2009 *Polycope pelta* Fischer, 1961. – Wilkinson & Whatley, pl. 1, fig. 2.
2014 *Polycope pelta* Fischer, 1961. – Franz et al., fig. 13Bo.
non 2017 *Polycope pelta* Fischer, 1961. – Tesakova, p. 32, pl. 1, figs. 1, 2, pl. 5, figs. 3, 4.

M a t e r i a l : 2 C, 1 V in samples G11Fr and G20Eb.

R e m a r k : We have set *P.* cf. "*pelta*" in quotation marks because it differs significantly from *Polycope pelta* Fischer. We recommend a revision of the *Polycope minor – pelta –* cf. *pelta* group on the base of the herewith refigured type specimens of *Polycope pelta* Fischer.

Polycope sp.
Pl. 1, Fig. 6

M a t e r i a l : 30 C and 246 V in samples G11Fr–G21Eb.

R e m a r k s : The material comprises predominantly very small, smooth carapaces and valves with no visible ornamentation and therefore is not determinable to a species level under the microscope. It can not be excluded that they belong to different species.

Order Podocopida Müller, 1894

Family Bairdiidae Sars, 1888

Genus *Bairdia* McCoy, 1844

Bairdia aff. *ohmerti* Knitter, 1984
Pl. 1, Fig. 7

1979 *Bairdia* sp. 3. – Exton, p. 54, pl. 11, figs. 1, 2.
1984 *Bairdia inflata* n. sp. – Knitter, p. 217, pl. 35, figs. 1, 2.
1984 *Bairdia ohmerti* nom. nov. – Knitter, p. 50, pl. 1, fig. 1.
1985 *Bairdia inflata* n. sp. – Riegraf, p. 76, pl. 2, fig. 3.
1986 *Bairdia ohmerti* Knitter, 1983. – Ainsworth, p. 294, pl. 2, figs. 19, 20.
2009 *Bairdia ohmerti* Knitter, 1983. – Boomer & Ainsworth, p. 188, pl. 1, fig. 7.
2017 *Bairdia* sp. – Tesakova, p. 34, pl. 1, fig. 13.

M a t e r i a l : 5 RV, 6 LV in sample G20Eb.

D i s t r i b u t i o n : Lower Toarcian to Middle Aalenian (SW Germany, Ireland, Portugal, N Switzerland).

R e m a r k s : The material referred to this species is overgrown by calcite and/or pyrite on the outer surface and therefore it has not been possible to see the characteristic punctate valve ornamentation.

Genus *Bairdiacypris* Bradfield, 1935

Bairdiacypris triangularis Ainsworth, 1986
(not figured)

1986 *Bairdiacypris triangularis* n. sp. – Ainsworth, p. 296, pl. 3, figs. 3–6, 8.
2009 *Bairdiacypris triangularis* Ainsworth, 1986. – Boomer & Ainsworth, p. 187, pl. 1, fig. 3.

M a t e r i a l : 1C, 1 RV, 1 LV in sample G24Eb.

D i s t r i b u t i o n : Upper Toarcian to Lower Bajocian (SW Germany, Ireland).

Cytherella apostolescui Ainsworth, 1986
Pl. 1, Figs. 8, 9

1954 Ostracode 1099 b. – Buck, Ostracodentabelle [unpublished].
1958 *Cytherella callosa ampla* n. ssp. – Braun, p. 5, pl. 1, fig. 2 [unpublished].
1963 *Cytherella callosa ampla* n. ssp. Braun. – Dilger, p. 8, pl. 1, figs. 5–9.
1986 *Cytherella apostolescui* sp. nov. – Ainsworth, p. 290, pl. 1, figs. 6–13.
2009 *Cytherella callosa ampla* Braun in Dilger, 1963. – Franz et al., p. 130, pl. 1, fig. 1.
2017 *Cytherella callosa ampla* Braun in Dilger, 1963. – Tesakova, p. 44, pl. 1, figs. 3–5.

M a t e r i a l : 15 C, 107 RV, 88 LV in samples G14Eb–G25Eb.

D i s t r i b u t i o n : Upper Toarcian to Lower Oxfordian (SW Germany, Ireland).

R e m a r k s : According to the today rules of the ICZN – unlike Kempf (1980) – the thesis Dilger (1963) can not be regarded as a valid publication. The new species established by Dilger (1963) have therefore to be regarded as *nomina nuda*.

After the examination of more material from the uppermost Aalenian and Lower Bajocian, we consider *C. callosa callosa* and *C. callosa ampla* sensu Dilger (1963) as (ecological) variants of the same species. In our material there are 9 RV and 4 LV of *Cytherella* sp. (some of them juveniles), which could not be assigned to this species with certainty.

Cytherelloidea cf. catenulata (Jones & Sherborn, 1888)
Pl. 1, Fig. 10

1888 *Cytherella catenulata*. – Jones & Sherborn, p. 274, pl. 5, fig. 6a–c.
1948 ? *Cytherelloidea catenulata* (Jones & Sherborn). – Sylvester-Bradley, p. 200, pl. 14, fig. 11.
1963a *Cytherelloidea catenulata* (Jones & Sherborn). – Bate, p. 184, pl. 1, figs. 3–6.
1963 *Cytherelloidea catenulata* (Jones & Sherborn 1888). – Oertli, pl. 27, fig. h, pl. 29, fig. p.
1969 *Cytherelloidea catenulata* (Jones & Sherborn). – Bate, p. 396, pl. 6, figs. 2, 3.
1984 *Cytherelloidea catenulata* (Jones & Sherborn, 1888). – Dépêche, pl. 1, figs. 6, 7, 9.

Material: 1 RV, 1 LV in sample G20Eb.

Distribution: Middle Aalenian to Bathonian (England, France, SW Germany).

Cytherelloidea cadomensis Bizon, 1960
(not figured)

1960 *Cytherelloidea cadomensis* n. sp. – Bizon, p. 204, pl. 1, fig. 6, pl. 2, fig. 4.
1978 *Cytherelloidea cadomensis* Bizon. – Lord, pl. 2, fig. 6.
1984 *Cytherelloidea cadomensis* Bizon, 1960. – Knitter & Riegraf, p. 67, pl. 4, fig. 1.
1987 *Cytherelloidea cadomensis* Bizon, 1960. – Tröster, pl. 4, fig. 5.
2009 *Cytherelloidea cadomensis* Bizon, 1960. – Franz et al., p. 131, pl. 1, fig. 2.
2017 *Cytherelloidea cadomensis* Bizon, 1960. – Tesakova, p. 33, pl. 1, figs. 8–10, pl. 5, fig. 9.
2017 *Cytherelloidea cadomensis* Bizon, 1960. – Dietze et al., pl. 9, fig. l.

Material: 2 C, 54 RV, 43 LV in samples G14Eb–G24Eb.

Distribution: Upper Toarcian to Lower Bajocian (SW Germany).

Remarks: Some further, partly juvenile specimens of *Cytherelloidea* sp. could not be assigned to a species due to their poor preservation.

Cytherelloidea lordi Ainsworth, 1986
Pl. 1, Figs. 11, 12

1963 *Cytherelloidea curva cincta* Fischer. – Dilger, p. 12, pl. 1, fig. 13.
1986 *Cytherelloidea lordi* sp. nov. – Ainsworth, p. 292, pl. 1, figs. 20–22, pl. 2, figs. 1–5.

Material: 20 RV, 36 LV in samples G17Eb, G20Eb, G24Eb and G25Eb

Distribution: Toarcian to Lower Bajocian (SW Germany, Great Britain).

Remark: Dilger (1963) redescribed and figured the species, originally described by Fischer (1957) in his unpublished thesis.

Family Healdiidae Harlton, 1933

Genus *Cardobairdia* van den Bold, 1960

Cardobairdia tesakovae n. sp.
Pl. 1, Figs. 13–16

? 1986 Indet. Gen. 4 sp. A. – Ainsworth, 1986, pl. 6, figs. 9, 10, 12.
2017 *Cardobairdia* sp. 1. – Tesakova, p. 45, pl. 1, figs. 14, 15.

Etymology: In honour of the Russian micropalaeontologist Ekaterina M. Tesakova, who first figured this species.

Holotype: Left valve, figured on Pl. 1, Fig. 13, SMNS no. 70423-12.

Paratypes: Two carapaces, one left valve, figured on Pl. 1, Figs. 14–16, SMNS nos. 70423-13–15.

Type locality: Drillcore KB 1/93 Geisingen (SW Germany).

Type horizon: Beds G12Fr–G13Fr, Zillhausen Subformation, Opalinum Zone.

Material: 12 C, 7 RV and 11 LV in samples G05Fr, G12Fr, G13Fr; further 3 C from the core drilling SB Benken (Switzerland).

Diagnosis: Carapace of medium size, subovate. Posterior margin of the left valve bluntly rounded with the greatest extension of curvature above mid-height with an obtuse cardinal angle. Posterior margin of the right valve acuminate. Valve surface smooth in anterior half, with very fine, subparallel longitudinal ribs in the posterior area.

Description: Carapace of medium size, subovate. Left valve: Anterior margin symmetrically rounded. Posterior margin valve bluntly rounded with the greatest extension of curvature above mid-height. Dorsal margin in the anterior half arched, highest point in front of mid-length, tapers straight to slightly concave towards posterior, ending in an obtuse cardinal angle. Ventral margin convex, strongly tapering towards posterior in postero-ventral region. Right valve: anterior margin slightly asymmetrically rounded with the greatest extension of curvature below mid-height. Posterior margin acuminate. Dorsal margin arched, highest point in front of mid-length, with a slight cardinal angle tapering towards the anterior. Ventral margin convex, towards the posterior slightly concave. Dorsal view subovate, maximum width medianly, right valve ends slightly concave at anterior and posterior. Left valve much larger than right, strongly overlapping along periphery, except for the posterodorsal section. Valve surface smooth in anterior half, with very fine, subparallel longitudinal ribs in the posterior area. Hinge antimerodont; left valve with dentate terminal grooves separated by a median bar. Other internal details not observed.

Dimensions:	Length	Height	Width
Holotype	0.61 mm	0.26 mm	
Paratypes	0.61 mm	0.26 mm	
	0.62 mm		0.26 mm
	0.49 mm	0.25 mm	

Comparisons: *Cardobairdia tesakovae* differs from Ostracod Nr. 103 Klingler, 1962 (p. 96, pl. 13, fig. 29) from the Pliensbachian and Toarcian in Germany, *Krausella* ? sp. 101 Oertli & Grosdidier, 1961 (p. 460, table 6) from the Toarcian in France and *Cardobairdia fastnetensis* Ainsworth, 1986 (p. 299,

pl. 3, figs. 15, 19, 20) from the Toarcian and Aalenian in Ireland in the lack of a posterior spine in the right valve. *Cardobairdia toarcensis* Ainsworth, 1986 (p. 300. pl. 3, figs. 16, 21, 22) from the Toarcian and Aalenian in Ireland has a more rounded outline with an entirely convex dorsal margin and a more bluntly rounded posterior end of the right valve.

D i s t r i b u t i o n : Lower Aalenian, Opalinum Zone (SW Germany, N Switzerland).

Family Bythocyprididae Maddon, 1969

Genus *Bythocypris* Brady, 1880

Bythocypris dorisae Knitter, 1984
Pl. 2, Figs. 1, 2

non 1932 *Bythocypris faba* n. sp. – Coryell & Osorio, p. 36, pl. 5, fig. 4.
1983 *Bythocypris faba* n. sp. – Knitter, p. 217, pl. 35, figs. 6, 7.
1984 *Bythocypris dorisae* nom. nov. – Knitter, p. 51, pl. 1, fig. 2.
2009 *Bairdiacypris dorisae* (Knitter, 1983). – Arias et al., p. 217, pl. 1, figs. 11, 12.
2017 *Bythocypris dorisae* Knitter, 1984. – Tesakova, p. 34, pl. 2, fig. 1.

M a t e r i a l : 10 C, 53 RV, 33 LV in samples G19Eb–G24Eb.

D i s t r i b u t i o n : Upper Toarcian to Lower Bajocian (SW Germany, Spain, N Switzerland).

Genus *Isobythocypris* Apostolescu, 1959

? *Isobythocypris* sp.
Pl. 2, Fig. 3

M a t e r i a l : 2 LV in sample G20Eb

O c c u r r e n c e : Middle Aalenian.

R e m a r k : Due to their poor, incomplete preservation the two specimens could not be assigned to species level.

Family Paracyprididae Sars, 1923

Genus *Paracypris* Sars, 1866

Paracypris sp.
(not figured)

M a t e r i a l : 49 C, 10 RV, 3 LV in samples G01Fr–G25Eb

O c c u r r e n c e : Lower Aalenian to Lower Bajocian.

R e m a r k : The specimens are predominantly small and/or preserved in pyrite (partly internal casts) and could therefore not be assigned with certainty to any species.

Family Macrocyprididae Mueller, 1912

Genus *Macrocypris* Brady, 1868

Macrocypris aequabilis Oertli, 1959
Pl. 2, Fig. 4

1959 *Macrocypris* (*Macrocypris*)? *aequabilis* n. sp. – Oertli, p. 24, pl. 3, figs. 74–82.
1962 *Macrocypris* (*Macrocypris*)? *aequabilis* Oertli 1959. – Plumhoff, p. 18, pl. 1, figs. 4–8.
1970 *Macrocypris aequabilis* Oertli 1959. – Whatley, pl. 1, figs. 17, 19, 21, 26.
2009 *Macrocypris aequabilis* Oertli, 1959. – Wilkinson & Whatley, p. 262, pl. 1, figs. 7–8.
2013 *Macrocypris aequabilis* Oertli, 1959. – Tesakova, pl. 5, fig. 3.
2017 *Macrocypris* (*Macrocypris*)? *aequabilis* Oertli, 1959. – Tesakova, p. 34, pl. 1, fig. 16, pl. 5, fig. 13.

M a t e r i a l : 10 C, 1 RV in G04FR–G15Eb.

D i s t r i b u t i o n : Lower Aalenian to Lower Oxfordian (Germany, Scotland, N Switzerland, Russia).

Macrocypris ? *liassica* Bate & Coleman, 1975
Pl. 2, Figs. 5–6

1975 *Macrocypris* ? *liassica* n. sp. – Bate & Coleman, p. 6, pl. 9, figs. 3, 6, 7.
1990 *Macrocypris* ? *liassica* Bate & Coleman 1975. – Brand, p. 150, pl. 1, fig. 16.

M a t e r i a l : 7 C, 19 RV, 15 LV in sample G20Eb.

D i s t r i b u t i o n : Toarcian to Middle Aalenian (England, SW Germany); Upper Bathonian (N Germany).

R e m a r k : Some further, partly juvenile specimens of *Macrocypris* sp. could not be assigned to a species due to their poor preservation.

Family Bythocytheridae Sars, 1926

Genus *Bythoceratina* Hornibrook, 1952

Bythoceratina (*Praebythoceratina*) *scrobiculata* (Triebel & Bartenstein, 1938)
Pl. 2, Fig. 7

1938 *Monoceratina scrobiculata* n. sp. – Triebel & Bartenstein, p. 508, pl. 1, fig. 5, pl. 2, fig. 6.
1949 *Bythocythere calloveica* n. sp. – Mandelstam, p. 262, pl. 85, fig. 9.
1955 *Bythocythere calloveica* Mandelstam n. sp. - Ljubimova, p. 30, pl. 1, fig. 10.
1959 Monoceratina scrobiculata Triebel & Bartenstein. – Ziegler, Beilage 2, fig. 1.
1959 Monoceratina scrobiculata Triebel & Bartenstein 1938. – Oertli, p. 26, pl. 4, figs. 92–95.
1960 *Monoceratina* cf. *scrobiculata* Triebel & Bartenstein 1938. – Lutze, p. 433, pl. 37, fig. 7.
1962 *Monoceratina scrobiculata* Triebel & Bartenstein 1938. – Fischer, p. 335, pl. 19, figs. 10–12.

1963 "*Monoceratina*" *scrobiculata* Triebel & Bartenstein 1938. – Oertli, pl. 35, fig. 2l, pl. 36, fig. l.
1969 *Monoceratina* cf. *scrobiculata* Triebel, 1951. – Dépêche, pl. 2, fig. 9.
1970 *Monoceratina scrobiculata* Triebel & Bartenstein 1938. – Whatley, p. 318, pl. 3, figs. 1–7, 9, 10.
1976 *Monoceratina scrobiculata* Triebel & Bartenstein 1938. – Kaever, p. 51, pl. 6, fig. 9.
1979 *Monoceratina scrobiculata* Triebel & Bartenstein. – Sheppard, p. 113, pl. 1, figs. 1–3; pl. 2, figs. 1–5.
1979 *Monoceratina scrobiculata* Triebel & Bartenstein. – Exton, p. 56, pl. 11, fig. 6.
1980 *Monoceratina scrobiculata* Triebel & Bartenstein. – Bielecka et al., p. 247, pl. 73, fig. 4.
1981b *Bythoceratina* (*Praebythoceratina*) *scrobiculata* (Triebel & Bartenstein, 1938). – Herrig, p. 873, pl. 1, fig. 3.
1983 *Monoceratina scrobiculata* Triebel & Bartenstein 1938. – Herngreen et al., p. 106, pl. 5, fig. 12.
1983 *Monoceratina scrobiculata* Triebel & Bartenstein, 1938. – Knitter, p. 219, pl. 36, fig. 2.
1983 *Monoceratina scrobiculata* Triebel & Bartenstein 1938. – Morris, pl. 5, figs. 10–11.
non 1984 *Monoceratina scrobiculata* Triebel & Bartenstein. – Bate et al., pl. 2, fig. 4.
1987 *Monoceratina scrobiculata* Triebel & Bartenstein, 1938. – Tröster, pl. 5, fig. 18.
1988 *Monoceratina scrobiculata* Triebel & Bartenstein. – Bielecka et al., p. 178, pl. 73, fig. 4.
1990 *Bythoceratina* (*Praebythoceratina*) *scrobiculata* (Triebel & Bartenstein 1938). – Brand, p. 154, pl. 2, fig. 10.
2001 *Bythoceratina* (*Praebythoceratina*) *scrobiculata* (Triebel & Bartenstein, 1938). – Olempska & Blaszyk, p. 573, fig. 13 A–D.
2001 *Monoceratina scrobiculata* Triebel & Bartenstein, 1938. – Whatley et al., p. 137, pl. 1, fig. 3.
2008 *Patellacythere calloveica* (Mandelstam, 1949). – Tesakova, figs. 2.8, 2.11.
2009 *Bythoceratina* (*Praebythoceratina*) *scrobiculata* (Triebel & Bartenstein, 1938). – Franz et al., p. 133, pl. 1, fig. 11.
2009 *Monoceratina scrobiculata* Triebel & Bartenstein, 1938. – Wilkinson & Whatley, pl. 1, figs. 13–14.
2009 *Monoceratina scrobiculata* Triebel and Bartenstein, 1938. – Arias et al., p. 217, pl. 1, figs. 13–15.
2013 *Bythoceratina scrobiculata* (Triebel et Bartenstein, 1938). – Tesakova, pl. 5, fig. 7.

Material: 1 C, 9 RV, 9 LV in samples G18Eb and G20Eb.

Distribution: Upper Toarcian to Callovian (England, France, Germany, Netherlands, Poland, Russia, Scotland, Spain).

Bythoceratina (*Praebythoceratina*) sp.
Pl. 2, Fig. 8

Material: 1 C, 7 RV, 11 LV in samples G13Fr–G20Eb.

Distribution: Lower Aalenian (SW Germany).

Remark: The specimens are close to *Bythoceratina* (*Praebythoceratina*) sp. 3 Dépêche, 1984 from the Lower Callovian of France.

Genus "*Monoceratina*" Roth, 1928

"*Monoceratina*" *ungulina* Triebel & Bartenstein, 1938
Pl. 2, Fig. 9

1938 *Monoceratina ungulina* n. sp. – Triebel & Bartenstein, p. 506, pl. 1, figs. 3, 4.
1963 *Monoceratina ungulina* Triebel & Bartenstein 1938. – Plumhoff, p. 48, pl. 11, fig. 166.
1999 *Monoceratina ungulina* Triebel & Bartenstein, 1938. – Arias & Lord, p. 92, pl. 4, fig. 6.
2009 *Monoceratina ungulina* Triebel & Bartenstein, 1938. – Arias et al., p. 218, pl. 2, fig. 3.
2017 *Monoceratina ungulina* Triebel & Bartenstein, 1938. – Tesakova, p. 35, pl. 2, fig. 2.

Material: 3 C, 11 RV, 26 LV in samples G01Fr–G24Eb.

Distribution: Upper Toarcian to Lower Bajocian (Germany, Spain, N Switzerland).

"*Monoceratina*" sp. 1
Pl. 2, Fig. 10

Material: 1 C, 1 RV, 2 LV in samples G20Eb–G24Eb

Occurrence: Middle Aalenian (Bradfordensis Zone) to Lower Bajocian (Discites Zone).

Remark: The very small, presumably juvenile specimens could not be assigned to a known species.

Family Cytheruridae Müller, 1894

Genus *Cytheropterina* Mandelstam, 1956

Cytheropterina alacostata n. sp.
Pl. 2, Figs. 11–14

Etymology: *ala* (lat.)= wing and *costatus* (lat.)= ribbed; referring to two sharp medioventral ribs, which continue onto the underside of the alate extension.

Holotype: Left valve, figured on Pl. 2, Fig. 11, SMNS no. 70423-26.

Paratypes: One right valve, two left valves, figured on Pl. 2, Figs. 12–14, SMNS nos. 70423-27–29.

Type locality: Clay pit at the Wartenberg hill near Geisingen (SW Germany).

Type horizon: Bed GO (Geisingen Oolith), Bradfordensis Zone, Gigantea Subzone.

Material: 1C, 11 RV, 13 LV in sample G20Eb, further 3 RV and 1 LV from Bisingen-Thanheim.

Diagnosis: Small. Subtriangular outline, with two sharp, curved medioventral ribs, which continue onto the underside of the alate extension.

Description: Carapace small, subtriangular. Right and left valve (identical in outline and ornamentation): Anterior margin symmetrically rounded. The dorsal margin is straight, medianly slightly concave. The ventral margin converges, partly straight or in a slight curve, to the acuminate posterior end. The ventral margin is obscured by a broad triangular wing. The orna-

mentation of the valve is very variable. In most of the specimens the lateral surface possesses subvertical, sometimes irregularly curved ribs, which bend dorsally and ventrally towards the mid-borders, surrounding some irregular depressions with varying depths in the median area. In some specimens the coarse ribbing is replaced by a dense reticulation. The common and most prominent feature is a pair of ribs: one anterodorsal–anteroventral and secondly an anteromedian–mid-ventral rib, both of which continue onto the underside of the wing. Hinge antimerodont; left valve with dentate terminal grooves separated by a median bar. Other internal details not observed.

Dimensions:	Length	Height
Holotype	0.24 mm	0.14 mm
Paratypes	0.40 mm	0.21 mm
	0.39 mm	0.22 mm
	0.45 mm	0.26 mm

Comparisons: *Cytheropterina alacostata* resembles in outline and ornamentation *Cytheropterina bicuneata* (Braun) n. sp. from the Aalenian and Lower Bajocian in SW Germany, and *Cytheropterina cribra* Fischer, 1962 (p. 339, pl. 20, figs. 8–11) from the Toarcian to Bajocian. The main difference consists in the two anteromedian ribs that continue onto the underside of the wing.

Occurrence: Achdorf Formation, Middle Aalenian (Bradfordensis Zone).

Remark: Unfortunately, the four best preserved specimens were destroyed during the transport to the SEM.

Cytheropterina alafastigata (Fischer, 1962)
Pl. 2, Fig. 15

1961 *Monoceratina* aff. *stimulea* (Schwager, 1866). – Magné et al., p. 391, pl. 12, fig. 3.
1962 *Cytheropteron* (*Cytheropteron*) *alafastigatum* n. sp. – Fischer, p. 336, pl. 20, figs. 1–6.
1975 *Cytheropteron* (*Cytheropteron*) *alafastigatum* Fischer, 1962. – Bate & Coleman, p. 28, pl. 11, figs. 1–6.
1981c *Cytheropterina alafastigata* (Fischer, 1962). – Herrig, p. 1017, pl. 1, fig. 1.
1985 *Cytheropteron alafastigatum* Fischer, 1962. – Ainsworth, p. 301, pl. 4, fig. 4.
1988 *Cytheropteron alafastigatum* Fischer. – Bodergat & Donze, pl. 1, fig. 11.
2009 *Cytheropteron alafastigatum* Fischer, 1962. – Arias et al., p. 218, pl. 2, fig. 4.

Material: 1 C in sample G01Fr.

Distribution: Lower Toarcian to Lower Aalenian (England, France, Germany, Ireland, Spain).

Cytheropterina bicuneata (Braun) n. sp.
Pl. 2, Figs. 16–19

1954 Ostracode 1379. – Buck, Ostracodentabelle [unpublished].
1958 *Cytheropteron* (*Cytheropteron*) *bicuneata* n. sp. – Braun, p. 20, pl. 2, fig. 1 [unpublished].
2004 *Cytheropteron* (*Cytheropteron*) *bicuneata* (Braun) in Dilger. – Ohmert, p. 89, pl. 18, fig. 2.
2009 *Cytheropteron* (*Cytheropteron*) *bicuneata* (Braun) in Dilger. – Franz et al., p. 135, pl. 2, fig. 1.

Etymology: *bis* (lat.) = twice and *cuneatus* (lat.) = cuneiform; referring to the form of the valves and the wings.

Holotype: Left valve, Ar 1134/29, refigured on Pl. 2, Fig. 16.

Paratypes: Two left valves, one carapace, figured on Pl. 2, Figs. 17–19, SMNS nos. 70423-31–33.

Type locality: Owen/Teck

Type horizon: "Sonninien-Schichten" [= Wedelsandstein Formation]

Material: 1 C, 120 RV, 148 LV in samples G10Fr–G24Eb.

Diagnosis: A species of the genus *Cytheropterina* with the following characteristics: Subtriangular carapace with broad, acuminate wings. Lateral surfaces reticulate with subvertical furrows in the anterior half.

Description: Right valve: Anterior margin dorsally skewed, marginal zone offset, moderately rounded. The dorsal margin is straight, the ventral margin converges, partly straight or slightly convex, to the acuminate posterior end. The ventral margin is obscured by a broad triangular wing, which starts close to the ventral border in the anteroventral and posteroventral corners. The lateral surface and the ventral side of the wing is covered by strong reticulation with several subvertical furrows in the anterior half of the valve. One of the major furrows starts at the anterior cardinal angle and reaches midheight or the ventral margin. A second furrow starts mid-dorsally and runs slightly irregularly undulating to the anterior leg of the wing.

Left valve: The dorsal margin is slightly convex and the anterior margin broader rounded. The sculpture is the same as in the RV.

At the dorsal margin the left valve slightly overlaps the right valve. In dorsal view the anterior margin is slightly offset. The tip of the wing lies just behind midlength of the carapace.

Hinge antimerodont; left valve with crenulate terminal sockets separated by a smooth median bar. The anterior socket is divided into six, the posterior socket into seven locules. According to the description by Dilger (1963) the muscle scars are situated on a central ridge, which corresponds to the median furrow of the outer surface: 4 adductor scars with a single anterodorsal antennal scar and a single anteroventral mandibular scar.

Dimensions:	Length	Height	Width
Holotype	0.62 mm	0.32 mm	0.30 mm
Paratypes	0.56 mm	0.37 mm	0.30 mm
	0.52 mm	0.30 mm	
	0.54 mm		0.38 mm

Comparisons: The very similar *Cytheropterina cribra* (Fischer, 1962) from the Toarcian to Bajocian in SW Germany differs in a broader carapace, a broader anterior margin, a smaller wing and the weaker modeled ribs. The main difference to *Cytheropterina alacostata* n. sp. consists in the reticulation that continues on the underside of the wing.

Distribution: Lower Aalenian to Lower Bajocian (SW Germany).

Cytheropterina cribra (Fischer, 1962)
(not figured)

1959 Ostracod Z 2061 Ziegler. – Ziegler, Beilage 2, fig. 2.
1962 Ostracod N 96 Klingler. – Klingler, p. 112, pl. 14, fig. 58.
1962 *Cytheropteron* (*Cytheropteron*) *bispinosum cribrum* n. ssp. – Fischer, p. 339, pl. 20, figs. 8–11.

1963 *Cytheropteron* (*Cytheropteron*) *bispinosum cribrum* Fischer, 1962. – Plumhoff, p. 39, pl. 8, figs. 117–119.
1981c *Cytheropterina cribra ziegleri* Stoermer & Wienholz, 1967. – Herrig, p.1018, pl. 1, figs. 2, 3.
1983 *Cytheropterina cribra* (Fischer, 1962). – Knitter, p. 221, pl. 37, fig. 2.
1983 *Cytheropterina cribra* (Fischer, 1962). – Knitter & Ohmert, pl. 5, fig. 1.
1986 *Cytheropteron bispinosum cribrum* Fischer, 1962. – Ainsworth, p. 301, pl. 4, fig. 6.
1987 *Cytheropterina cribra* (Fischer, 1962). – Tröster, pl. 5, fig. 17.
1988 *Cytheropterina cribra* (Fischer). – Bodergat & Donze, pl. 1, figs. 14, 18.
2009 *Cytheropteron cribrum* (Fischer, 1962). – Arias et al., p. 220, pl. 2, figs. 5, 6.
2009 *Cytheropterina cribra* (Fischer, 1962). – Franz et al., p. 134, pl. 1, fig. 18.
2017 *Cytheropterina cribra* (Fischer, 1962). – Tesakova, p. 35, pl. 2, figs. 4–7.
2017 *Cytheropterina cribra* (Fischer, 1962). – Dietze et al., pl. 9, fig. f.

Material: 9 C, 34 RV, 35 LV in samples G01Fr–G24Eb.

Distribution: Lower Toarcian to Upper Bajocian (France, Germany, Ireland, Spain, N Switzerland).

Remark: Some further specimens of *Cytheropterina* sp. could not be assigned to a species due to their poor preservation.

Genus *Procytherura* Whatley, 1970

Procytherura aff. *bispinata* Ballent, 1991
Pl. 2, Fig. 18

1991 *Procytherura bispinata* n. sp. – Ballent, p. 37, pl. 2, figs. 8–11.
2009 *Procytherura bispinata* Ballent, 1991. – Ballent & Whatley, p. 206, pl. 2, figs. 18–19.

Material: 1 RV in sample G02Fr.

Distribution: Lower Aalenian to Lower Bajocian (Argentina, Germany).

Remark: We name this species *P.* aff. *bispinata*, since the identity with the species previously known only from Argentina is not proven.

Procytherura celtica Ainsworth, 1986
Pl. 3, Fig. 1

1986 *Procytherura celtica* sp. nov. – Ainsworth, p. 303, pl. 4, figs. 8–11.
non 1991 *Procytherura* cf. *celtica* Ainsworth, 1986. – Ballent, p. 36, pl. 2, fig. 7.
? 2000 *Procytherura celtica* Ainsworth, 1986. – Ballent & Whatley, p. 231, fig. 2H.
non 2009 *Procytherura celtica* Ainsworth, 1986. – Ballent & Whatley, p. 207, pl. 3, fig. 1.

Material: 1 RV in sample G13Fr.

Distribution: Upper Toarcian to Lower Bajocian (Germany, Ireland).

Procytherura aff. *didictyon* Whatley et al., 2001
Pl. 3, Fig. 2

2001 *Procytherura didictyon* n. sp. – Whatley et al., p. 146, pl. 3, figs. 3–8, 10.
2013 *Procytherura didiction* Whatley, Ballent & Armitage, 2001. – Tesakova, pl. 5, fig. 15.

Material: 1 RV in sample G20Eb.

Distribution: Middle Aalenian, Bradfordensis Zone (SW Germany), Callovian (England, Russia).

Remark: Whatley et al. (2001) described this species from the Callovian of England. Our specimen from the Middle Aalenian is very similar. Because of the difference in age, we leave this specimen as *P.* aff. *didictyon*.

Procytherura euglyphea Ainsworth, 1986
Pl. 3, Fig. 3

1986 *Procytherura euglyphea* n. sp. – Ainsworth, p. 303, pl. 4, figs. 12–15.
v 1991 *Procytherura euglyphea* Ainsworth, 1986. – Ballent, p. 35, pl. 2, fig. 6.
2009 *Procytherura euglyphea* Ainsworth, 1986. – Ballent & Whatley, p. 233, fig. 2I.
2009 *Procytherura euglyphea* Ainsworth, 1986. – Ballent & Whatley, p. 207, pl. 3, fig. 2.
2009 *Procytherura euglyphea* Ainsworth, 1986. – Boomer & Ainsworth, p. 196, pl. 4, fig. 7.

Material: 4 RV, 1 LV in samples G10FR–G20Eb.

Distribution: Upper Toarcian to Lower Bajocian (Argentina, SW Germany, Ireland).

Procytherura multicostata Ainsworth, 1986
Pl. 3, Fig. 4

1986 *Procytherura multicostata* n. sp. – Ainsworth, p. 304, Text-fig. 1, pl. 4, figs. 16–18, 23, 24.
2009 *Procytherura multicostata* Ainsworth, 1986. – Boomer & Ainsworth, p. 195, pl. 4, fig. 3.

Material: 3 RV, 1 LV in samples G20Eb and G24Eb.

Distribution: Upper Toarcian to Lower Bajocian (SW Germany, Ireland).

Procytherura aff. *pleuraperiousis* Whatley et al., 2001
Pl. 3, Fig. 5

1963 Gen. et sp. inc. 4 – Plumhoff, p. 52, pl. 12, figs. 183–185.
2001 *Procytherura pleuraperiousis* sp. nov. – Whatley et al., p. 145, pl. 2, figs. 15–18, pl. 3, figs. 1, 2.
2013 *Procytherura pleuraperiousios* Whatley, Ballent & Armitage, 2001. – Tesakova, pl. 5, fig. 14.

Material: 1 RV, 3 LV in G20Eb.

Distribution: Middle Aalenian, Bradfordensis Zone (Germany); Callovian (S England, Russia).

Remark: Whatley et al. described this species from the Callovian of England. Our specimens from the Middle Aalenian

are very similar. Because of the difference in age, we leave these as *P.* aff. *pleuraperiousis*.

Procytherura aff. *serangodes* Ballent & Whatley, 2000
Pl. 3, Fig. 6

1991 *Procytherura*? sp. – Ballent, p. 38, pl. 2, fig. 12.
2000 *Procytherura serangodes* n. sp. – Ballent & Whatley, p. 230, figs. 2A–F.
2004 *Procytherura serangodes* Ballent & Whatley. – Ballent, fig. 6 P.

M a t e r i a l : 3 C in samples G01Fr–G05Fr.

D i s t r i b u t i o n : Lower Aalenian to Lower Bajocian (SW Germany); Mid Callovian (Argentina).

R e m a r k : We name this species *P.* aff. *serangodes*, since the identity with the species previously known only from the Callovian of Argentina is not proven.

Procytherura sp. 1
Pl. 3, Fig. 7

M a t e r i a l : 1 RV in sample G10Fr.

O c c u r r e n c e : Lower Aalenian (Opalinum Zone).

Procytherura sp. 2
Pl. 3, Fig. 8

M a t e r i a l : 1 C in sample G12Fr.

O c c u r r e n c e : Lower Aalenian (Opalinum Zone).

Procytherura sp. 3
Pl. 3, Fig. 9

M a t e r i a l : 2 LV in samples G14Eb and G20Eb.

O c c u r r e n c e : Lower to Middle Aalenian (Opalinum to Bradfordensis zones).

Procytherura sp. 4
Pl. 3, Fig. 10

M a t e r i a l : 1 RV in sample G20Eb.

O c c u r r e n c e : Middle Aalenian (Bradfordensis Zone).

Genus *Tethysia* Donze, 1975

Tethysia sp. 1 Tesakova, 2017
Pl. 3, Fig. 11

2017 *Tethysia* sp. 1. – Tesakova, p. 37, pl. 6, figs. 14, 15.

M a t e r i a l : 1 C, 5 RV, 2 LV in samples G11Fr, G13Fr and G20Eb.

D i s t r i b u t i o n : Lower Aalenian to Lower Bajocian (SW Germany, N Switzerland).

R e m a r k : A single right valve found in sample G04Fr could only be determined as *Tethysia* sp. due to its poor preservation.

Genus *Eucytherura* Müller, 1894

Eucytherura liassica Bate & Coleman, 1975
Pl. 3, Fig. 12

1975 *Eucytherura liassica* n. sp. - Bate & Coleman, p. 40, pl. 15, figs. 9–11,14.
non 1983 *Eucytherura liassica* Bate & Coleman, 1975. – Knitter, p. 224, pl. 38, figs. 5, 6.
?1986 *Rutlandella batei* sp. nov. – Ainsworth, p. 307, pl. 5, figs. 13, 14, 17, 18.
1999 *Eucytherura liassica* Bate & Coleman, 1975. – Arias & Lord, p. 224, pl. 1, fig. 6.

M a t e r i a l : 1C, 1 RV, 2 LV in samples G09FR and G20Eb.

D i s t r i b u t i o n : Toarcian to Middle Aalenian (England, SW Germany).

Eucytherura michelseni (Finger, 1983)
Pl. 3, Fig. 13

1975 *Acrocythere tricostata* n. sp. – Michelsen, p. 158, pl. 9, figs. 131–142, pl. 11, figs. 157, 158, text-fig. 26.
1983 *Acrocythere michelseni* nom. nov. – Finger, p. 110.
v 1991 *Eucytherura argentina* n. sp. – Ballent, p. 34, pl. 2, figs. 2, 3.
2009 Eucytherura michelseni (Finger, 1983). – Ballent & Whatley, p. 199, pl. 1, figs. 16, 17.
2009 *Acrocythere michelseni* (Finger, 1983). – Boomer & Ainsworth, p. 195, pl. 4, fig. 4.

M a t e r i a l : 1 LV in sample G20Eb.

D i s t r i b u t i o n : Upper Pliensbachian to Lower Bajocian (Denmark, England, Sweden, Germany, Argentina, ? Australia).

Eucytherura cf. *parairregularis* (Brand, 1990)
Pl. 3, Fig. 14

1990 *Renicytherura* (*Renicytherura*) *parairregularis* n. sp. – Brand, p. 172, pl. 6, figs. 1–6.
2017 *Renicytherura* cf. *parairregularis* Brand, 1990. – Dietze et al., pl. 10, fig. o.

M a t e r i a l : 1 C, 1 RV in sample G20Eb.

D i s t r i b u t i o n : Middle Aalenian to Late Bathonian (Germany).

R e m a r k s : We do not agree with Whatley & Boomer (2000), who regarded *Renicytherura* as congeneric with *Mockella* Bunza & Kozur (1971). According to the description both genera are very similar, but there are clear differences in the outline and sculpture of the carapace:

– *Renicytherura* posseses an eye tubercle (in the Lower Jurassic with an adjacent anterodorsal rib), a distinct anterior cardinal angle in the LV and a posterior caudal process, situated above mid-height. The hinge is merodont – peratodont.

– In *Mockella* the eye tubercles and the anterodorsal rib are absent, the anterior is symmetrically rounded with no clear cardinal angle, while the posterior end is flattened. The hinge is lophodont.

Instead of uniting *Mockella* from the Tethyan Alpine Triassic with *Renicytherura* from the epicontinental Jurassic, the

present authors assign the latter genus to *Eucytherura*. This is supported by numerous morphological transitions between species of *Eucytherura*, *Renicytherura* and *Vesticytherura* (E. Tesakova, pers. comm.).

Eucytherura plumhoffi Tesakova, 2017
Pl. 3, Fig. 15

2017 *Eucytherura plumhoffi* n. sp. – Tesakova, p. 36, pl. 2, figs. 12, 13, pl. 7, fig. 3.

Material: 30 C, 4 RV, 7 LV in samples G02Fr–G20Eb.

Distribution: Lower to Middle Aalenian (SW Germany, N Switzerland).

Eucytherura cf. *plumhoffi* Tesakova, 2017
Pl. 3, Fig. 16

2017 Gen. et sp. 9 – Tesakova, pl. 4, fig. 16.

Material: 18 C, 1 RV in samples G04Fr–G20Eb.

Occurrence: Lower to Middle Aalenian (SW Germany, N Switzerland).

Eucytherura aff. *scottia* (Whatley, 1970)
Pl. 3, Fig. 17

1970 *Eucytherura* (*Vesticytherura*) *scottia* n. sp. – Whatley, p. 328, pl. 7, figs. 7–13.
1994 *Eucytherura* (*Vesticytherura*) *scottia* Whatley, 1970. – Witte & Lissenberg, p. 32, pl. 9, figs. 21, 22.
2003 *Vesticytherura scottia* (Whatley, 1970). – Tesakova, p. 171, pl. 4, fig. 15.
2009 *Eucytherura* (*Vesticytherura*) *scottia* Whatley, 1970. – Wilkinson & Whatley, p. 270, pl. 5, figs. 3, 4.

Material: 1 RV, 3 LV in samples G03Fr, G17Eb and G20Eb.

Distribution: Middle Aalenian (Bradfordensis Zone) to Lower Oxfordian (England, Germany, Netherlands, Scotland, Russia).

Remark: Whatley described this species from the Callovian and Oxfordian in Scotland. Our specimens from the Middle Aalenian are very similar. Because of the difference in age, we leave these as *E.* aff. *scottia*.

Eucytherura transversiplicata (Bate & Coleman,1975)
Pl. 3, Fig. 18

1975 *Rutlandella transversiplicata* n. sp.- Bate & Coleman, p. 34, pl. 13, figs. 7–10, 12; figs. 14a, b, 15, 16.
1986 *Rutlandella transversiplicata* Bate & Coleman, 1975. – Ainsworth, pl. 5, fig. 15.
v 1987 *Rutlandella*? sp. A. – Ballent, p. 108, pl. 5, fig. 11; pl. 6, fig. 1.
v 1991 *Rutlandella* cf. *transversiplicata* Bate and Coleman, 1975. – Ballent, p. 38, pl. 2, figs. 1, 2.
v 1991 *Rutlandella* sp. A. – Ballent, p. 39, pl. 3, figs. 3, 4.
v 1996 *Eucytherura transversiplicata* (Bate and Coleman, 1975). – Ballent & Whatley, p. 148, pl. 1, fig. 15.
2009 *Eucytherura transversiplicata* (Bate & Coleman, 1975). – Ballent & Whatley, pl. 2, figs. 1, 2.
2009 *Rutlandella transversiplicata* Bate & Coleman, 1975. – Boomer & Ainsworth, p. 195, pl. 4, fig. 6.
2017 *Rutlandella transversiplicata* Bate et Coleman, 1975. – Tesakova, pl. 2, fig. 15.
2017 *Rutlandella transversiplicata* Bate & Coleman, 1975. – Dietze et al., pl. 10, fig. l.

Material: 2 C, 1 RV in G20Eb.

Distribution: Pliensbachian to Bajocian (Argentina, Egypt, England, Germany, Ireland, North Africa, Wales).

Eucytherura sp. 1
Pl. 3, Fig. 19

2017 Gen. et sp. 14 – Tesakova, pl. 4, fig. 21.

Material: 17 C, 1 RV in samples G02Fr–G13Fr.

Occurrence: Lower Aalenian, Opalinum Zone (SW Germany, N Switzerland).

Eucytherura sp. 2
Pl. 3, Fig. 20

Material: 5 C, 1 RV in samples G02Fr–G10Fr.

Occurrence: Lower Aalenian (Opalinum Zone).

Eucytherura sp. 3
Pl. 3, Fig. 21

Material: 21 RV, 2 RV, 2 LV in samples G04Fr–G20Eb.

Occurrence: Lower to Middle Aalenian, (Opalinum Zone to Bradfordensis Zone).

Eucytherura sp. 4
Pl. 3, Fig. 22

Material: 19 C, 1 LV in samples G04Fr–G13Fr.

Occurrence: Lower Aalenian (Opalinum Zone).

Eucytherura sp. 5
Pl. 3, Fig. 23

Material: 5 RV, 1 LV in samples G11Fr, G15Eb and G20Eb.

Occurrence: Lower to Middle Aalenian (Opalinum Zone to Bradfordensis Zone).

Eucytherura sp. 6
Pl. 3, Fig. 24

Material: 1 LV in sample G11Fr.

Occurrence: Lower Aalenian (Opalinum Zone).

Eucytherura sp. 7
Pl. 3, Fig. 25

2004 *Rutlandella* sp. – OHMERT, p. 98, pl. 17, Fig. 8

Material: 1 LV in G20Eb.

Distribution: Middle Aalenian (Bradfordensis Zone) to Lower Bajocian (Ovale Zone); SW Germany.

Genus *Infracytheropteron* KAYE, 1964

? *Infracytheropteron bisulcatum* n. sp.
Pl. 4, Figs. 1, 2

Etymology: From *bis* (lat.) = double and *sulcus* (lat.) = furrow; after the two vertical furrows in the anterior half of the valve, close to midlength.

Holotype: One carapace, figured in Pl. 4, Fig. 1, SMNS no. 70423-60.

Paratype: One carapace, figured in Pl. 4, Fig. 2, SMNS no. 70423-61.

Type locality: Drillcore KB 1/93 Geisingen (SW Germany).

Type horizon: Zillhausen Subformation, sample G08Fr, Lower Aalenian.

Material: 4 C in samples G08Fr–G13Fr.

Diagnosis: A small-sized species of the genus *Infracytheropteron* with two vertical furrows situated in the anterior half of the lateral area and with a curved midventral rib that terminates posteroventrally in a short, rounded alar process.

Description: Carapace in lateral view converging to the posterior, the caudal process broken off in all specimens. Anterior margin broad symmetrically rounded. Dorsal margin slightly convex, anterior dorsal angle rounded. Ventral margin convex, right valve overlaps left valve slightly along the dorsal margin. Greatest length slightly below the dorsal margin, greatest height at the anterior dorsal angle. Lateral surface divided by two vertical furrows in the ratio 1 : 2. At the ventral margin a broad, curved rib, which terminates posteriorly in a roundish button-like stub wing. Maximum width of the wings = 1/2 length of the carapace, dorsal margin straight. Ventral margin straight, obscured by alar projection, ventral surface slightly depressed. Lateral surface smooth at the anterior and posterior ends, indistinctly coarsely reticulate on both sides of the vertical double furrow. Internal details not observed.

Dimensions:	Length	Height
Holotype:	0.26 mm	0.15 mm
Paratype:	0.26 mm	0.15 mm

Comparisons: *Infracytheropteron pseudoelegans* BRAND, 1990 (p. 181, pl. 7, figs. 10–16), as well as *Infracytheropteron* sp. 1, I. sp. 2 and I. sp. 4 BRAND, 1990 (p. 179 f., pl. 8, figs. 1–7) from the Bathonian in northern Germany are all distinguished by reticulate surfaces.

Occurrence: Lower Aalenian (Opalinum Zone), SW Germany.

? *Infracytheropteron* sp. 1
Pl. 4, Fig. 3

Material: 1 LV in sample G11Fr.

Occurrence: Lower Aalenian (Opalinum Zone).

Remark: The assignment of the fragmentarily preserved specimen to the genus *Infracytheropteron* is uncertain.

Genus *Procytheropteron* LJUBIMOVA, 1955

Procytheropteron catena n. sp.
Pl. 4, Figs. 4–6

Etymology: From *catena* (lat.) = chain, after the mediodorsal to medioventral semicircular, chainlike row of round pits.

Holotype: Right valve, figured in Pl. 4, Fig. 4, SMNS no. 70423-63.

Paratypes: Two left valves, figured in Pl. 4, Figs. 5–6, SMNS nos. 70423-64–65.

Type locality: Clay pit at the Wartenberg hill near Geisingen (SW Germany).

Type horizon: Bed GO (Geisingen Oolith), Bradfordensis Zone, Gigantea Subzone.

Material: 27 RV, 21 LV in samples G19Eb and G20Eb.

Diagnosis: Small. A coarsely reticulated species of the genus *Procytheropteron*, whose irregular meshes are irregularly arranged around the muscle field. The outermost, semicircular row of pits on the wing-like overhang is characterized by uniform meshes decreasing from medio-ventral towards the antero- and posterodorsal areas.

Description: Small. Dorsal margin very slightly convex to convex, extending into the asymmetrically rounded anterior margin with a distinct cardinal angle. Posterior margin ending in a narrow, rounded tip, postero-dorsally concave, postero-ventrally slightly convex extending into the convex ventral margin. Valves ventrolaterally swollen and overhanging, towards the anterior bounded by a steep drop to the flat, narrow marginal zone. The anterior end of the carapace therefore looks dull in dorsal view. A curved, dorsoventral depression situated in front of the muscle field. Two strong, curved vertical ribs surround the muscle attachment field on the valve surface. The muscle field is surrounded by a semicircular row of circular meshes, decreasing from the wing-like overhang (medio-ventrally) towards the antero- and posterodorsal areas. Posterior part of the valve coarsely reticulated.

Hinge: Merodont. Left valve with a smooth or weakly crenulate hinge bar, terminated by fusiform crenulate sockets. Posterior socket as far as recognizable with seven vallums, anterior socket with six vallums. Other internal details not observed.

Dimensions:	Length	Height
Holotype	0.36 mm	0.21 mm
Paratypes	0.41 mm	0.22 mm
	0.35 mm	0.23 mm

Comparison: *Procytheropteron stephanodes* OHMERT, 2004 (p. 94, text-fig. 24, pl. 17, fig. 6) from the Discites Zone in SW Germany has irregular meshes, surrounding the muscle field in high-oval, concentric rows, which are ventrally bounded by strong ribs.

Occurrence: Middle Aalenian, Bradfordensis Zone, Gigantea Subzone (southwest Germany).

Procytheropteron sp. 1
Pl. 4, Fig. 7

Material: 1 LV in sample G20Eb.

Distribution: Middle Aalenian (Bradfordensis Zone).

Genus *Metacytheropteron* Oertli, 1957

Metacytheropteron opalinum Plumhoff, 1963
Pl. 4, Fig. 8

1963 *Metacytheropteron opalinum* n. sp. – Plumhoff, p. 39, pl. 8, figs. 120–124.

Material: 15 C, 8 RV, 6 LV in samples G07Fr–G13Fr.

Distribution: Late Toarcian to Middle Aalenian (Germany).

Aphelocythere dilgeri n. sp.
Pl. 4, Fig. 9

1954 Ostracode 1496. – Buck, Ostracodentabelle [unpublished].
1963 *Pleurocythere kanonica* n. sp. – Dilger, p. 41, pl. 3, figs. 63–65.
1996 *Aphelocythere kanonika* (Dilger). – Ohmert, fig. 30f.
2009 *Aphelocythere kanonica* (Dilger, 1963). – Franz et al., p. 135, pl. 2, fig. 3.

Etymology: After the German micropalaeontogist Harald Dilger, who first described this species.

Holotype: Left valve, Ar 1186/72, Pl. 4, Fig. 9.

Paratypes: Two left valves, Ar 1186/72, 74, two right valves, Ar 1186/73, 75.

Type locality: Clay pit at the Wartenberg hill near Geisingen (SW Germany).

Type horizon: Upper Opalinuston Formation, sample G11Fr

Material: 10 RV, 6 LV in samples G03Fr–G18Eb.

Diagnosis: A species of the genus *Aphelocythere* with the following special features: Irregular reticulation strongly developed. One rib along the ventral margin, turning at a 90° angle into a subvertical direction close to the anterior margin, ending in an eye tubercle. Second rib along the dorsal margin, starting behind the eye tubercle, turning close to the posterior cardinal angle with a semicircular curve into a subhorizontal median rib.

Description: Carapace of medium to large size, elongate subrectangular. Anterior margin bluntly rounded. Posterior margin acuminate at about mid height. Dorsal margin concave, cardinal angles rounded. In the posterior part the dorsal rib forms a keel-like outline.

On the lateral surface well developed irregular reticulation, except for a small unornamented zone at the posterior margin. The subvertical ribs of the reticulation more prominent in the posterior part of the valve. The slightly convex ventral margin is hidden by the ventral rib which bends in a subvertical direction shortly before the anterior margin at a wide rounded right angle. It ends anterodorsally with the eye tubercle. It is paralleled by a minor rib along the anterior margin. A second rib starts just behind the eye tubercle. Shortly before the posterior cardinal angle it bends semicircularly downwards and runs subhorizontally to the middle of the valve and from there with a slight bend diagonally to the anteroventral corner.

Hinge (description after Dilger 1963): Antimerodont: Terminal sockets in the left valve loculate, the anterior terminal socket possessing 4 locules, the posterior socket possessing 5 locules; narrow median bar, weakly grooved. Broad marginal zone, other internal details not observed.

Dimensions:	Length	Height	Width
Holotype	0.53 mm	0.32 mm	
Paratypes	0.65 mm	0.32 mm	0.15 mm
	0.57 mm	0.30 mm	0.17 mm
	0.54 mm	0.32 mm	0.14 mm
	0.52 mm	0.30 mm	0.16 mm

Comparison: *Aphelocythere recta* Ohmert, 2004 from the Lower Bajocian possesses a strictly horizontal median rib; the other Middle Jurassic representatives of the genus are only weakly ornamented.

Distribution: Lower Aalenian to Lower Bajocian (SW Germany).

Genus *Aphelocythere* Triebel & Klingler, 1959

Aphelocythere hamata Plumhoff, 1963
Pl. 4, Fig. 10

1963 *Aphelocythere hamata* n. sp. – Plumhoff, p. 21, pl. 2, figs. 25–28.

Material: 8 C, 2 LV in samples G01Fr–G12Fr.

Distribution: Lower to Middle Aalenian (Germany).

Aphelocythere kuhni Triebel & Klingler, 1959
Pl. 4, Figs. 11, 12

1959 *Aphelocythere kuhni* n. sp. - Triebel & Klingler, p. 341, pl. 6, figs. 11–19; pl. 7, figs. 20, 21; pl. 12, figs. 59–61.
1962 *Aphelocythere kuhni* Triebel & Klingler 1959. – Klingler, p. 112, pl. 14, fig. 55.
1962 *Aphelocythere kuhni* Triebel & Klingler 1959. – Brand & Fahrion, p. 139, pl. 20, fig. 2.
1963 *Aphelocythere kuhni* Triebel & Klingler, 1959. – Plumhoff, p. 21, pl. 2, figs. 23, 24.
1967 *Aphelocythere kuhni* Triebel & Klingler, 1959. – Plumhoff, p. 553, pl. 1, figs. 10–14.
1981c *Aphelocythere kuhni* Triebel & Klingler, 1959. – Herrig, p. 1023, pl. 2, fig. 7.
1983 *Aphelocythere kuhni* Triebel & Klingler, 1959. – Knitter, p. 220, pl. 36, figs. 5, 6.
1983 *Aphelocythere kuhni* Triebel & Klingler, 1959. – Knitter & Ohmert, pl. 5, fig. 8.
1987 *Aphelocythere kuhni* Triebel & Klingler, 1959. – Tröster, pl. 5, fig. 8.
1994 *Aphelocythere kuhni* Triebel & Klingler. – Ohmert, fig. 30e.
1999 *Aphelocythere kuhni* Triebel & Klingler, 1959. – Arias & Lord, p. 226, pl. 2, fig. 6.
2009 *Aphelocythere kuhni* Triebel & Klingler, 1959. – Franz et al., p. 135, pl. 2, fig. 4, 5.

2017 *Aphelocythere kuhni* Triebel & Klingler, 1959. – Tesakova, p. 50, pl. 3, fig. 1.

Material: 14 C, 23 RV, 33 LV in samples G02Fr–G20Eb.

Distribution: Toarcian to Middle Aalenian (Germany, Spain, Switzerland). *Aphelocythere kuhni* is the index species of the Kuhni ostracod Zone (Ohmert 2004).

Aphelocythere pygmaea Plumhoff, 1963
Pl. 4, Figs. 13, 14

1963 *Aphelocythere* ? *pygmaea* n. sp. – Plumhoff, p. 24, pl. 2, fig. 43; pl. 3, figs. 44–46.
2017 Gen. et sp. 3. – Tesakova, p. 46, pl. 4, figs. 8, 9.

Material: 228 C, 2 RV, 4 LV in samples G01Fr–G13Fr

Distribution: Lower to Middle Aalenian (Germany, Switzerland).

Aphelocythere ? sp. 1 Plumhoff, 1963
Pl. 4, Figs. 15, 16

1963 *Aphelocythere* ? sp. 1. – Plumhoff, p. 25, pl. 3, figs. 47, 48.
2017 Gen. et sp. 7 – Tesakova, p. 60, pl. 4, fig. 14.

Material: 28 C, 3 RV, 1 LV in samples G01Fr–G17Eb.

Distribution: Lower to Middle Aalenian, Germany, N Switzerland.

Family Schulerideidae Mandelstam, 1959

Genus *Asciocythere* Swain, 1952

"*Asciocythere*" sp.
Pl. 4, Figs. 17, 18

1963 *Asciocythere mystron* n. sp. – Dilger, p. 32, pl. 3, figs. 50–54.

Material: 8 C, 85 RV, 109 LV in samples G01Fr–G24Eb.

Distribution: Lower Aalenian to Lower Bajocian (Opalinum Zone to Discites Zone), SW Germany.

Remark: We have set *Asciocythere* in question marks because the assignment of this species to the genus *Asciocythere* is doubtful. *Asciocythere mystron* is a *nomen nudum* according to the rules of the ICZN.

Genus *Praeschuleridea* Bate, 1963

Praeschuleridea concentrica n. sp.
Pl. 5, Figs. 1–4

Etymology: After the concentrically arranged pits, gradually reduced in size towards the margins.

Holotype: Left valve figured on Pl. 5, Fig. 1, SMNS no. 70423-78.

Paratypes: One right valve, one left valve, one carapace, figured on plate 5, Figs. 2–4, SMNS nos. 70423-79–81.

Type locality: Clay pit at the Wartenberg hill near Geisingen (SW Germany).

Type horizon: Bed GO (Geisingen Oolith), Bradfordensis Zone, Gigantea Subzone.

Material: 1 C, 10 RV, 15 LV in sample G20Eb.

Diagnosis: A medium-sized species of the genus *Praeschuleridea*, in lateral view triangular-oval. Medium-sized pits irregularly distributed over the valve surface, surrounded by three rows of essentially smaller pits that run parallel to the margin.

Description: Medium-sized. Left valve: Dorsal outline strongly convex, behind the posterior hinge sloping slightly concave to the blunt tip of the posterior margin. Ventral margin convex. Right valve: Dorsal outline slightly to moderately convex, with two cardinal angles sloping straight to the anterior and posterior margin, the latter ending in a short, blunt tip. Valve ventrolaterally swollen and mid-ventrally overhanging the convex margin, towards the anterior sloping gently to the flattened marginal zone. Medium-sized pits irregularly distributed over the valve surface, anteroventral to mid-dorsal surrounded by three rows of essentially smaller pits that run parallel to the margin in the posterior half of the carapace.

Hinge paleohemimerodont, with terminal indented sockets and a smooth median groove upon a finely serrated median bar in the left valve.

Dimensions:	Length	Height	Width
Holotype	0.57 mm	0.35 mm	
Paratypes	0.47 mm	0.29 mm	
	0.53 mm	0.35 mm	
	0.53 mm		0.25 mm

Comparisons: The main differences to the similar isochronous species *Praeschuleridea ventriosa ventriosa* (Plumhoff, 1963: 36, pl. 6, figs. 95–98), *P. punctulata* (Plumhoff, 1963: 33, pl. 5, figs. 83–87, pl. 6, fig. 88) from the Toarcian to Bajocian and *P. ornata* (Bate, 1963b: 37, pl. 9, figs. 9–12, pl. 10, figs. 1–3) from the Aalenian and Bajocian are the short caudal process in the posterior margin and the absence of vertically arranged pits, which are separated by vertical ribs. *Praeschuleridea angulata* (Plumhoff, 1963: 36, pl. 6, figs. 99, 100) from the Toarcian to Aalenian has the same outline but differs in the irregular gross reticulation.

Occurrence: Middle Aalenian (Bradfordensis Zone, Gigantea Subzone), southwest Germany.

Praeschuleridea ornata (Bate, 1963)
Pl. 5, Fig. 5

1954 Ostracode 875. – Buck, Ostracodentabelle [unpublished].
v 1963b *Paraschuleridea ornata* sp. nov. – Bate, p. 37, pl. 9, figs. 9–12; pl. 10, figs. 1–3; fig. 2.
v 1963b *Praeschuleridea ventriosa ventriosa* (Plumhoff). – Bate, p. 39, pl. 10, figs. 8–13; pl. 11, figs. 1–9; pl. 12, figs. 1–3, 7, 8.
1968 *Praeschuleridea decorata* sp. nov. – Bate, p. 211, figs. 1, 3 (1–5), 4 (1–3).
2009 *Praeschuleridea decorata* Bate, 1968. – Bate, p. 214, pl. 1, figs. 7, 8.

Material: 140 C, 150 RV, 344 LV in samples G11FR–G26Eb.

Distribution: Lower Aalenian to Lower Bajocian (England, Germany).

Remark: We cannot see clearly the distinction between *Praeschuleridea ornata* (Bate, 1963b) and *P. decorata* Bate, 1968. In our opinion the specimens shown in Malz (1966: pl. 49, 26, 27) and Bate (2009: pls. 1, 7, 8) belong to the same species.

Praeschuleridea punctulata (Plumhoff, 1963)
Pl. 5, Fig. 6

1963 *Procytheridea*? *punctulata* n. sp. – Plumhoff, p. 33, pl. 5, figs. 83–87; pl. 6, fig. 88.
1983 *Praeschuleridea punctulata* (Plumhoff, 1963). – Knitter, p. 228, pl. 40, figs. 3, 4.
2009 *Praeschuleridea punctulata* (Plumhoff, 1963). – Arias et al., p. 224, pl. 3, fig. 4.
2017 *Praeschuleridea punctulata* (Plumhoff, 1963). – Tesakova, p. 51, pl. 3, fig. 11.

Material: 13 C, 37 RV, 40 LV in samples G01Fr–G22Eb.

Distribution: Upper Toarcian to Lower Bajocian (Germany, Spain, Switzerland).

Praeschuleridea ventriosa (Fischer in Plumhoff, 1963)
Pl. 5, Fig. 7

v part. 1935 *Cytheridea* aff. *subperforata* J. – Fahrion, 10-25, table 1.
1962 Ostracode Nr. 101 Klingler. – Brand & Fahrion, p. 127, pl. 16 (Fauna 1), fig. 2; (Fauna 6) fig. 6; [non pl. 17 (Fauna 9), fig. 7].
1962 Ostracode Nr. 101 Klingler. – Klingler, p. 78, tab. 7; pl. 11a, fig. 3; pl. 14, fig. 57.
1963 *Procytheridea*? *ventriosa ventriosa* n. sp. Fischer 1963. – Plumhoff, p. 36, pl. 6, figs. 95–98.
1966 *Praeschuleridea ventriosa* (Plumhoff 1963). – Malz, p. 394, pl. 49, figs. 21–23.
1983 *Praeschuleridea ventriosa* (Fischer in Plumhoff, 1963). – Knitter, p. 229, pl. 40, figs. 7, 8.
2009 *Praeschuleridea ventriosa* (Plumhoff, 1963). – Arias et al., p. 225, pl. 3, figs. 5–8.
2017 *Praeschuleridea ventriosa ventriosa* (Fischer in Plumhoff, 1963). – Tesakova, p. 50, pl. 3, figs. 2–7.

Material: 55 C, 30 RV, 41 LV in samples G02Fr–G20Eb.

Distribution: Upper Toarcian to Lower Bajocian (Germany, Spain, Switzerland).

Remark: Some additional specimens of *Praeschuleridea* sp. in samples G21Eb – G26Eb could not be determined to the species level due to attached sediment (mostly quartz grains) and/or their fragmentary preservation.

Family Protocytheridae Ljubimova, 1955

Genus *Pleurocythere* Triebel, 1951

Pleurocythere kirtonensis Bate, 1963
Pl. 5, Fig. 8

1963a *Pleurocythere kirtonensis* sp.nov. – Bate, p. 203, pl. 10, figs. 14–18, pl. 11, figs. 1–5.
non 2004 *Pleurocythere* cf. *kirtonensis* Bate. – Ohmert, p. 93, pl. 17, fig. 17; pl. 18. fig. 3.

Material: 1 RV, 2 LV in samples G20Eb–G24Eb.

Distribution: Middle Aalenian to Lower Bajocian (England, southwest Germany).

Pleurocythere ohmerti n. sp.
Pl. 5, Figs. 9–12

2004 *Pleurocythere* cf. *kirtonensis* Bate. – Ohmert, p. 93, pl. 17, fig. 17; pl. 18. fig. 3.

Etymology: In honour of the German micropalaeontologist Wolf Ohmert†, who first described the species as *Pleurocythere* cf. *kirtonensis*.

Holotype: Right valve, figured on Pl. 5, Fig. 9, SMNS no. 70423-86.

Paratypes: Two left valves, one carapace, figured on Pl. 5, Figs. 10–12, SMNS nos. 70423-87–89.

Type locality: Clay pit at the Wartenberg hill near Geisingen (SW Germany).

Type horizon: Bed GO (Geisingen Oolith), Bradfordensis Zone, Gigantea Subzone.

Material: 2 C, 12 RV, 17 LV in samples G19Eb and G20Eb; further material from the sections Balingen-Zillhausen, Bisingen-Thanheim, Breitenbach near Reutlingen and Ringsheim.

Diagnosis: Medium-sized. A species of the genus *Pleurocythere* with the following characteristics: Dorsal rib present on both valves, at its posterior end connected with the middle rib. The middle rib does not extend down to the ventral rib, the ventral rib extends to the anterior but not the posterior margin. The anterior rib commences at the eye tubercle and extends to the anterior margin below mid-height. Intercostal areas intensely reticulated.

Description: Medium-sized. Carapace elongate, rounded anteriorly, posteriorly in the right valve triangular, in the left valve bluntly rounded. Dorsal margin in both valves straight, in the right valve with two cardinal angles. Dorsal, posterior and ventral marginal zone keel-like. A dorsal rib is present on both valves, in the left valve terminating before mid-length. The middle rib is connected at its posterior end with the dorsal rib, in the right valve in a tight curve, in the left at an acute angle. Its downward sloping anterior end does not reach the ventral rib. The slightly undulating ventral rib commences in front of the posterior margin and extends to the anterior margin. The anterior rib commences behind the anterior cardinal angle with an eye tubercle and terminates below the mid-height at the anterior margin. A small transverse rib extends from the middle rib obliquely towards the anterior rib, but does not extend to it. Intercostal areas strongly reticulated.

Hinge merodont, consisting in the right valve of six terminal teeth at each end and a median bar. Further internal details not observed.

Dimensions:	Length	Height	Width
Holotype	0.52 mm	0.25 mm	
Paratypes	0.50 mm	0.29 mm	
	0.40 mm	0.21 mm	
	0.58 mm		0.28 mm

C o m p a r i s o n s : *Pleurocythere kirtonensis* Bate, 1963a (p. 203, pl. 10, figs. 14–18, pl. 11, figs. 1–5) from the Ovale Zone in England differs in having a convex dorsal outline, an anterior marginal ridge and the weakly developed or absent dorsal rib in the left valve. *Pleurocythere laticosta* Braun, 1958 (p. 41, pl. 3, figs. 1a–c) from the Bajocian in Germany has broader ribs and a significant bulge above the anterior hinge element; the latter is absent in *P. ohmerti* as Ohmert (2004) stated. The younger (Upper Bajocian and Bathonian) representatives of the genus normally possess more rounded posterior margins, while the middle rib is connected with the frontal rib.

D i s t r i b u t i o n : Middle Aalenian (Bradfordensis Zone) to Lower Bajocian (Laeviuscula Zone), southwest Germany.

? *Pleurocythere* sp.
Pl. 5, Fig. 13

M a t e r i a l : 1 RV in sample G13Fr.

O c c u r r e n c e : Lower Aalenian (Opalinum Zone).

Family Progonocytheridae Sylvester-Bradley, 1848

Genus *Acrocythere* (Neale, 1960)

Acrocythere pumila Plumhoff, 1963
Pl. 5, Figs. 14–15

1963 *Acrocythere pumila* n. sp. – Plumhoff, p. 20, pl. 1, figs. 13–16.
2017 *Acrocythere pumila* Plumhoff, 1963. – Tesakova, p. 46, pl. 2, fig. 14.

M a t e r i a l : 15 C, 5 RV, 12 LV in samples G04Fr–G13Fr.

D i s t r i b u t i o n : Lower to Middle Aalenian (Germany, Switzerland).

Genus *Homocytheridea* Bate, 1963

? *Homocytheridea* cf. *punctulata* (Plumhoff, 1963)
Pl. 5, Figs. 16–20

v 1958 *Clithrocytheridea biconcava* n. sp. – Braun, p. 37, pl. 2, fig. 8c.
1963 *Procytheridea apion* n. sp. – Dilger, p. 50, pl. 4, figs. 79–82.
1963 *Homocytheridea* ? *punctulata* n. sp. – Plumhoff, p. 33, pl. 5, figs. 83–87, pl. 6, fig. 88

M a t e r i a l : 83 internal casts in sample G21Eb, 11 C, 18 RV,18 LV in sample G22Eb.

O c c u r r e n c e : Middle Aalenian to ? Bajocian (southwest Germany).

R e m a r k s : We assign this species tentatively to the genus *Homocytheridea* because of the similarity in outline and hinge structure. The broad anterior marginal zone as well as the characteristic medial indentation, which corresponds with a curvature on the inside of the shell, seem to be the same as in *Procytheridea* ? *punctulata* Plumhoff, 1963. The majority of our specimens differs in a greater length of the valves.

A further left valve of a ? *Homocytheridea*" sp. in sample G20Eb could not be determined to the specific level.

Genus *Camptocythere* Triebel, 1950

Camptocythere foveolata prima Plumhoff, 1963
Pl. 5, Fig. 21

1963 *Camptocythere foveolata prima* n. ssp. – Plumhoff, p. 44, pl. 9, figs. 138–140.

M a t e r i a l : 14 C, 31 RV, 17 LV in samples G14Eb–G18Eb.

D i s t r i b u t i o n : Lower to Middle Aalenian (Germany).

Genus *Aaleniella* Plumhoff, 1963

Aaleniella compressa Plumhoff, 1963
Pl. 5, Fig. 22

1963 *Aaleniella compressa* n. sp. – Plumhoff, p. 38, pl. 7, figs. 107–114.

M a t e r i a l : 5 RV, 7 LV in sample G20Eb.

D i s t r i b u t i o n : Aalenian to Lower Bajocian (Germany).

R e m a r k : A single carapace from the Opalinuston (sample G09Fr, Pl. 5, Fig. 23) was tentatively assigned to the genus *Aaleniella* because of the similarity of the outline.

Genus *Supratoarcina* Knitter & Riegraf, 1984

Supratoarcina supratoarcensis Knitter & Riegraf, 1984
Pl. 5, Figs. 24, 25

1954 Ostracode 1083. – Buck, Ostracodentabelle [unpublished].
1957 *Cytheropteron* (*Cytheropteron*) *falcatum* n. sp. – Fischer, p. 70, pl. 11, figs. 3–7 [unpublished].
1962 Ostracod N 86 Klingler. – Klingler, p. 106, pl. 14, fig. 47.
1963 *Procytheridea falcata* (Fischer). – Dilger, p. 57, pl. 5, figs. 93–95.
1983 Gen. et sp. indet. 1. – Knitter, p. 230, pl. 34, figs. 8, 9.
1983 Gen. et sp. indet. 1 *sensu* Knitter. – Knitter & Ohmert, pl. 5, fig. 2.
1984 *Supratoarcina supratoarcensis* n. gen. n. sp. – Knitter & Riegraf, p. 70, pl. 5, figs. 1–3.
1987 *Supratoarcina supratoarcensis* Knitter & Riegraf, 1984. – Tröster, pl. 4, fig. 12.
2009 *Supratoarcina supratoarcensis* Knitter & Riegraf, 1984. – Franz et al., p. 138, pl. 3, fig. 9.

M a t e r i a l : 9 C, 110 RV, 104 LV in samples G14Eb–G23Eb.

D i s t r i b u t i o n : Upper Toarcian to Upper Aalenian (southwest Germany, Switzerland).

R e m a r k s : The comparison of holotypes showed that *Supratoarcina supratoarcensis* Knitter is identical to *Cytheropteron* (*C.*) *falcatum* (Fischer, 1957). As Fischer's holotype has never been published, *Cytheropteron* (*C.*) *falcatum* and *Procytheridea falcata* (Fischer) are both *nomina nuda*.

Genus *Progonocythere* Sylvester-Bradley, 1948

Progonocythere scutula n. sp.
Pl. 6, Figs. 1, 2

Etymology: *scutula* (lat.)= rhomb, referring to the rhomboidal arrangement of the ribs.

Holotype: Right valve, figured on Pl. 6, Fig. 1, SMNS no. 70423-103.

Paratype: One left valve, figured on Pl. 6, Fig. 2, SMNS no. 70423-104.

Type locality: Clay pit at the Wartenberg hill near Geisingen (SW Germany).

Type horizon: Bed GO (Geisingen Oolith), Bradfordensis Zone, Gigantea Subzone.

Material: 1 RV, 5 LV in sample G20Eb.

Diagnosis: A medium-sized species of the genus *Progonocythere* with fine rhomboidally arranged ribs. Valve surface covered by small pits decreasing in size from the valve center to the margins. Parallel to the anterior margin a prominent dorso-ventral arcuate rib.

Description: Left valve: Anterior margin symmetrically rounded, gradually passing into the convex dorsal and ventral margins. Greatest height immediately in front of mid-length, the straight to slightly convex dorsal margin gently sloping towards the posterior. The posterior margin asymmetrically rounded, with the greatest extension of curvature below mid-height. Valve ventrolaterally swollen and mid-ventrally slightly overhanging the convex margin. Right valve: Anterior and posterior margins asymmetrically rounded, with the greatest extension of curvature below mid-height. Dorsal margin strongly convex around the anterior hinge, gently and straight sloping towards the posterior. The anterodorsal margin straight, relatively steeply sloping towards the anterior. Valve ventrolaterally swollen and mid-ventrally slightly overhanging the convex margin. The sculpture is dominated by a four-sided, asymmetrically diamond-shaped field and consists of a pattern of low, relatively fine ribs. Between the ribs the valve surface is covered by pits decreasing in size from the valve center to the margins of the valve. The anterior margin is paralleled by an arcuate rib which traverses the ribs of the main sculpture at an acute angle. No internal details observed.

Dimensions:	Length	Height
Holotype	0.61 mm	0.36 mm
Paratype	0.65 mm	0.36 mm

Comparison: *Progonocythere triangulata* Braun in Ohmert, 2004 (p. 96, pl. 16, figs. 13–14, pl. 18, fig. 1) from the Lower Bajocian shows a triangular arrangement of the main sculpture.

Occurrence: Middle Aalenian (Bradfordensis Zone), southwest Germany.

Progonocythere triangulata Braun in Ohmert, 2004
Pl. 6, Fig. 3

1958 *Progonocythere triangulata* n. sp. – Braun, p. 60, pl. 3, figs. 8a, b.
2004 *Progonocythere triangulata* Braun n. sp. – Ohmert, p. 96, pl. 16, figs. 13, 14; pl. 18, fig. 1.

Material: 28 C, 77 RV, 110 LV in samples G24Eb–G26Eb.

Distribution: Lower Bajocian (southwest Germany). *Progonocythere triangulata* is the index species of the Triangulata ostracod Subzone (Ohmert 2004).

Remark: In sample G24Eb (Lower Bajocian) we found three right and one left valves without any ornamentation (under the microscope) which we assign also to *Progonocythere*. It cannot be excluded that their smoothness is the result of weathering or some other destructive process.

Genus *Kinkelinella* Martin, 1960

Kinkelinella (*Ektyphocythere*) *bucki* (Bizon, 1960)
Pl. 6, Fig. 4

1960 *Procytheridea bucki* n. sp. – Bizon, p. 205, pl. 1, figs. 2a–e.
1975 *Kinkelinella* (*E.*) *bucki* (Bizon). – Bate & Coleman, fig. 11a.
1983 *Kinkelinella* (*Ektyphocythere*) *debilis* Bate & Coleman, 1975. – Knitter, p. 226, pl. 39/1.
1983 *Ektyphocythere debilis* Bate & Coleman, 1975. – Knitter in Knitter & Ohmert, pl. 4, fig. 8.
1984 *Kinkelinella* (*Ektyphocythere*) *bucki* (Bizon, 1960). – Knitter, p. 52, pl. 1, fig. 4.
1985 *Kinkelinella* (*Ektyphocythere*) *bucki* (Bizon, 1960). – Riegraf, p. 81, pl. 3, fig. 18.
1986 *Ektyphocythere* cf. *E. intrepida* (Bate & Coleman, 1975). – Ainsworth, p. 316, pl. 8, figs. 5, 6, 9.
1992 *Ektyphocythere anterocosta* Boomer. – Arias et al., pl. 2, fig. 16.
1992 *Ektyphocythere ambo* n. sp. – Boomer, p. 56, pl. 2, figs. 1–3.
1999 *Ektyphocythere bucki* (Bizon, 1960). – Arias & Lord, p. 228, pl. 3, fig. 1.

Material: 1 RV in sample G01Fr

Distribution: Upper Toarcian to Lower Aalenian (England, France, Germany, Ireland, Portugal, Spain).

Remark: A further specimen of *Ektyphocythere* sp. in sample G14Eb could not be assigned with certainty to a known species.

Kinkelinella (*Kinkelinella*) *adunca* Malz, 1966
Pl. 6, Fig. 5

v 1963 *Procytheridea adunca* Fischer. – Plumhoff, p. 30, pl. 4, figs. 64, 65.
non 1963 *Procytheridea adunca* n. sp. – Fischer, p. 296, fig. 1.
1966 *Kinkelinella adunca* (Plumhoff 1963). – Malz, p. 386, pl. 48, figs. 1–3.

Material: 43 RV, 23 LV in samples G18Eb to G20Eb.

Distribution: Middle Aalenian (Bradfordensis Zone) to Lower Bajocian (Discites Zone).

Remark: A number of specimens in sample G20Eb have a very delicate sculpture, so that they have only tentatively been assigned to this species.

Kinkelinella (*Kinkelinella*) *fischeri* Malz, 1966 (not figured)

1954 Ostracode 1709a. – Buck, Ostracodentabelle [unpublished].
1962 Ostracod N 94 Klingler. – Klingler, p. 110, pl. 11, fig. 6; pl. 14, fig. 53.
1966 *Kinkelinella fischeri* n. sp. – Malz, p. 389, pl. 48, figs. 4–14.
1978 *Kinkelinella fischeri* Malz. – Pyatkova & Permyakova, p. 152, pl. 67, fig. 5.
1982 *Kinkelinella* (*Kinkelinella*) *fischeri* Malz, 1966. – Herrig, p. 1450, pl. 1, figs. 1, 2.
1983 *Kinkelinella* (*Kinkelinella*) *fischeri* Malz, 1966. – Knitter, p. 225, pl. 39, figs. 3, 4.
1983 *Kinkelinella* (*Kinkelinella*) *fischeri* Malz, 1966. – Knitter & Ohmert, pl. 5, fig. 4.
1984 *Kinkelinella fischeri* Malz, 1966. – Dépêche, pl. 27, fig. 9.
1987 *Kinkelinella fischeri* Malz, 1966. – Tröster, pl. 4, figs. 16, 17.
1992 *Kinkelinella fischeri* Malz, 1966. – Arias et al., p. 14, pl. 2, fig. 15.
2009 *Kinkelinella fischeri* Malz, 1966. – Arias et al., p. 222, pl. 2, figs. 14, 15.
2009 *Kinkelinella* (*Kinkelinella*) *fischeri* Malz, 1966. – Franz et al., p. 141, pl. 4, fig. 8.
2017 *Kinkelinella* (*Kinkelinella*) *fischeri* Malz, 1966. – Tesakova, p. 40, pl. 3, fig. 14; pl. 4, fig. 1.

Material: 2 C, 63 RV, 39 LV in samples G11Eb–G20Eb.

Distribution: Upper Toarcian to Middle Aalenian (France, Germany, Russia, Spain, Switzerland).

Kinkelinella (*Kinkelinella*) *geisingensis* n. sp. Pl. 6, Figs. 6–8

Etymology: After the town of Geisingen.

Holotype: Left valve, figured on Pl. 6, Fig. 6, SMNS no. 70423-108.

Paratype: Two right valves, figured on Pl. 6, Figs. 7, 8, SMNS nos. 70423-109–110.

Type locality: Clay pit at the Wartenberg hill near Geisingen (SW Germany).

Type horizon: Bed GO (Geisingen Oolith), Bradfordensis Zone, Gigantea Subzone.

Material: 6 RV, 6 LV in sample G20Eb

Diagnosis: A small- to medium-sized species of the genus *Kinkelinella*. A leaf-like ornament in the area of the central muscle field, surrounded by a club-shaped rib. Three concentric subvertical ribs on the anterior half, six slightly curved, subvertical ribs on the posterior half of the valve.

Description: A small- to medium-sized species of the genus *Kinkelinella*; lateral outline subtriangular. Dorsal margin convex, almost straight in the area of the hinge. Anterior margin broadly rounded with the greatest extension of curvature below mid-height. Posterior margin narrowly rounded with the greatest extension of curvature above mid-height. Both margins accompanied by broad, smooth flanges. Both valves ventrolaterally swollen and overhanging about half the length of the carapace. Left valve: In the area of the central muscle field six partly merged, flat elongated elevations, which together form a leaf-like ornament. From its left side a curved rib extends vertically upwards, terminating before the dorsal margin. This feature is surrounded by a club-shaped, dorsally open rib. In front of it, there are three slightly curved, concentric subvertical ribs on the anterior half of the valve, and on the posterior half of the valve another six subvertical concentric ribs. A curved ventral rib runs parallel to the ventral margin. Mid-ventrally it subdivides into two parallel ribs, which are then divided by two transverse ribs into three oblong segments. Right valve: In some specimens fine transverse ribs between the main ribs produce a regular rectangular reticulation. The ventral rib subdivides below the muscle field; the upper rib bends strongly upwards and falls from the club-shaped rib undulating towards the posterior. The lower rib continues parallel to the ventral edge; the intercostal area is irregularly reticulated. Two longitudinal ribs on the ventral side of both valves. The hinge is merodont, further details not observed because of poor preservation.

Dimensions:	Length	Height
Holotype	0.36 mm	0.20 mm
Paratypes	0.44 mm	0.25 mm
	0.42 mm	

Comparisons: *Kinkelinella costata* Knitter, 1983 (p. 224, pl. 39, figs. 7–10) has a subquadrate outline and straight vertical ribs all over the valve surface. *Kinkelinella fischeri* Malz, 1966 (p. 389, pl. 48, figs. 4–14) from the Upper Toarcian to Middle Aalenian in Germany has a quadrate to rhombic, partially reticulate ornamentation with overlying V-shaped parallel ribs. *Kinkelinella levata* Ohmert, 2004 (p. 90, text-fig. 23, pl. 17, fig. 1) from the Discites Zone in SW-Germany has a strictly reduced ornamentation and a strong, ventro-lateral, wing-like overhang. *Kinkelinella persica* Bate & Coleman, 1975 (text-fig. 9c, p. 18, figs. 5.1–5.12, 6.1–6.5) from the Lower Toarcian in England differs in the sub-rectangular outline, more or less straight vertical ribs and the absence of the central club-shaped ornament. *Kinkelinella sermoisensis* (Apostolescu, 1959: 812, pl. 3, figs. 37–38) from the Toarcian to Bajocian has a reticulate ornament, and *Kinkelinella* (*Ektyphocythere*) *triangula* (Brand in Brand & Malz, 1961: 161, pl. 1, figs. 11–14) from the Lower Toarcian in Germany possesses a more triangular ornamentation.

Distribution: Middle Aalenian (Bradfordensis Zone).

Kinkelinella (*Kinkelinella*) *levata* Ohmert, 2004 Pl. 6, Fig. 9

1988 *Kinkelinella* sp. A. – Ohmert, p. 266, figs. 2, 3.
2004 *Kinkelinella* (*Kinkelinella*) *levata* n. sp. – Ohmert, p. 90, text-fig. 23, pl. 17, fig. 1.

Material: 34 RV, 44 LV in sample G20Eb–G26Eb.

Occurrence: Middle Aalenian (Bradfordensis Zone) to Lower Bajocian (Discites Zone), southwest Germany.

Kinkelinella (*Kinkelinella*) *sermoisensis* (Apostolescu, 1959) Pl. 6, Fig. 10

1959 *Procytheridea sermoisensis* n. sp. – Apostolescu, p. 812, pl. 3, figs. 37, 38.

1960 *Procytheridea sermoisensis* Apostolescu 1959. – Bizon, p. 210, pl. 1, fig. 7a, c, d; pl. 3, figs. 1a, 2a.
1961 *Procytheridea sermoisensis* Apostolescu 1959. – Cousin et al., table 4 bis.
1962 Ostracod N 81 Klingler. – Klingler, p. 108, pl. 14, fig. 50.
1963 *Procytheridea sermoisensis* Apostolescu 1959. – Oertli, pl. 20, fig. B; pl. 21, figs. 1a, 2b; pl. 22, fig. F.
1974 *Kinkelinella sermoisensis* (Apostolescu). – Lord, pl. 90, figs. 6–9.
1975 *Kinkelinella* (*Kinkelinella*) *sermoisensis* (Apostolescu, 1959). – Bate & Coleman, p. 16, pl. 4, figs. 1–11.
1978 *Kinkelinella sermoisensis* (Apostolescu). – Lord, p. 202, pl. 3, figs. 7, 8.
1978 *Kinkelinella sermoisensis* (Apostolescu). – Pyatkova & Permykova, p. 152, pl. 67, fig. 6.
1979 *Kinkelinella sermoisensis* (Apostolescu). – Exton, p. 59, pl. 12, figs. 1–4.
1983 *Kinkelinella sermoisensis* (Apostolescu, 1959). – Knitter, p. 225, pl. 39, figs. 5, 6.
1983 *Kinkelinella sermoisensis* (Apostolescu 1959). – Morris, pl. 9, figs. 10, 12–15.
1984 *Kinkelinella sermoisensis* (Apostolescu). – Exton & Gradstein, pl. 2, figs. 7, 8.
1985 *Kinkelinella sermoisensis* (Apostolescu). – Dépêche, pl. 27, figs. 12, 13 (non fig. 6).
1985 *Kinkelinella* (*Kinkelinella*) *sermoisensis* (Apostolescu, 1959). – Riegraf, p. 79, pl. 3, figs. 7–10.
1986 *Kinkelinella sermoisensis* (Apostolescu, 1959). – Ainsworth, p. 314, pl. 7, figs. 9–12, 16.
1987 *Kinkelinella sermoisensis* (Apostolescu, 1959). – Tröster, pl. 4, figs. 18, 19.
1991 *Kinkelinella sermoisensis* (Apostolescu, 1959). – Arias et al., p. 14, pl. 2, fig. 17.
1999 *Kinkelinella sermoisensis* (Apostolescu, 1959). – Arias & Lord, p. 232, pl. 3, fig. 6.
2009 Kinkelinella sermoisensis (Apostolescu, 1959). – Arias et al., p. 222, pl. 2, fig. 13.
2009 Kinkelinella (*Kinkelinella*) *sermoisensis* (Apostolescu, 1959). – Franz et al., p. 141, pl. 4, fig. 10.
2009 *Kinkelinella sermiosensis* (Apostolescu, 1959). – Boomer & Ainsworth, p. 196, pl. 4, fig. 13.
2017 *Kinkelinella* (*Kinkelinella*) *sermoisensis* (Apostolescu, 1959). – Tesakova, p. 41, pl. 4, fig. 2;

M a t e r i a l : 2 C, 19 RV, 28 LV in samples G13Fr–G24Eb.

D i s t r i b u t i o n : Lower Toarcian to Lower Bajocian (England, France, Germany, Ireland,
Portugal, Russia, Spain, N Switzerland).

Kinkelinella (*Kinkelinella*) sp. 1
Pl. 6, Fig. 11

M a t e r i a l : 9 RV, 19 LV in samples G17Eb–G20Eb.

O c c u r r e n c e : Middle Aalenian (Bradfordensis Zone).

Family Neurocytheridae Gründel, 1975

Genus *Fuhrbergiella* Brand & Malz, 1962

Fuhrbergiella (*Praefuhrbergiella*) ? *favosa* Plumhoff, 1963
(not figured)

1963 *Fuhrbergiella* (*Praefuhrbergiella*) ? *favosa* n. sp. – Plumhoff, p. 26, pl. 3, figs. 52–55.
2017 *Fuhrbergiella* (*Praefuhrbergiella*) *favosa* Plumhoff, 1963. – Tesakova, p. 56, pl. 3, fig. 3.

M a t e r i a l : 2 LV in sample G11Fr.

D i s t r i b u t i o n : Lower Aalenian (Opalinum Zone) to Lower Bajocian (Discites Zone), Germany.

Family Cytheridae Baird, 1850

Genus *Plumhofficythere* Luppold, 2003

Plumhofficythere clavatoides Luppold, 2003
Pl. 6, Fig. 12

1963 Cytheridae, n. gen. n. sp. 1. – Plumhoff, p. 50, pl. 12, figs. 176–178.
1963b *Pleurocythere* sp. – Bate, p. 31, pl. 4, figs. 1, 2.
2003 *Plumhofficythere clavatoides* n. sp. – Luppold, p. 23, pl. 5, figs. 1–3.

M a t e r i a l : 1 C, 1 LV in sample G20Eb.

D i s t r i b u t i o n : Middle Aalenian to ? Lower Bajocian (England, France, Germany, Luxembourg).

R e m a r k s : Contrary to the holotype and the figures in Plumhoff (1963), the characteristic club-shaped rib is anteriorly not closed in our specimen. Since otherwise all features - especially the hinge - match, we assign our specimen to the same species.

Ostracoda incertae sedis

Gen. et sp. 10 Tesakova, 2017
Pl. 6, Fig. 14

2017 Gen. et sp. 10. – Tesakova, p. 60, pl. 4, fig. 17.

M a t e r i a l : 1 RV in sample G04Fr.

D i s t r i b u t i o n : Lower Aalenian, Opalinum Zone (SW Germany, N Switzerland).

Gen. et sp. indet. 1
Pl. 6, Fig. 13

M a t e r i a l : 2 C in samples G03Fr and G05Fr.

O c c u r r e n c e : Lower Aalenian (Opalinum Zone).

Gen. et sp. indet. 2
Pl. 6, Fig. 15

M a t e r i a l : 1 LV in sample G02Fr.

O c c u r r e n c e : Lower Aalenian (Opalinum Zone).

Gen. et sp. indet. 3
Pl. 6, Fig. 16

M a t e r i a l : 2 LV in samples G04Fr and G13Fr.

O c c u r r e n c e : Lower Aalenian (Opalinum Zone).

Gen. et sp. indet. 4
Pl. 6, Fig. 17

M a t e r i a l : 2 C, 1 RV in samples G08Fr, G12Fr and G13 Fr.

O c c u r r e n c e : Lower Aalenian (Opalinum Zone).

Gen. et sp. indet. 5
Pl. 6, Fig. 18

M a t e r i a l : 1 LV in sample G10Fr.

D i s t r i b u t i o n : Lower Aalenian, Opalinum Zone (SW Germany, N Switzerland).

Gen. et sp. indet. 6
Pl. 6, Fig. 19

M a t e r i a l : 1 RV in sample G12Fr.

D i s t r i b u t i o n : Lower Aalenian (Opalinum Zone).

4.2. Characterization of the faunal assemblages

The ostracod faunas from the Middle and Upper Aalenian of Geisingen have a special characteristic, due to the fauna from the Geisingen Oolith, which also bears a specific ammonite fauna (Dietze et al. 2014). The Geisingen Oolith as Middle Jurassic iron oolites in general (Franz 1986) represents a long time interval of (at least) two ammonite subzones. Condensation or reworking cannot be excluded (Dietze et al. 2014).

The Geisingen Oolith as a whole was sampled as one layer, therefore sample G20Eb does not reflect the then unknown biostratigraphical subdivision. The high number of ostracod species, half of which are only present in the Geisingen Oolith can be explained by a low sedimentation rate under favorable living conditions.

But even without this horizon the Aalenian ostracod fauna of Geisingen differs significantly from the previously described studies. Thus, of the 35 species described by Dilger (1963) only 16 have also reported from Geisingen. When compared to Plumhoff (1963), there are only 18 of 56 species in common, which partly is due to the limited marine connection between North and SW Germany. In contrast, there is a closer connection at least to the Opalinuston of northern Switzerland with 30 common species from a total of 42 (Tesakova 2017).

The absence in other section of some of the species listed here, proven in Geisingen by only single specimens, may be due to their rarity. In addition, differing facies and thus other palaeoenvironmental conditions have lead to differing faunal compositions.

5. Bio- and Chronostratigraphy

While the ostracod faunas of the Lower Aalenian and Lower Bajocian correspond well with the standard ostracod zones (section 6 below), this is not possible for the Middle and Upper Aalenian. In the following, we name faunal assemblages referring to the dominant and/or characteristic species. In Fig. 2 these are correlated with the ammonite zonation of the section according to Dietze et al. (2014).

Surprisingly, but in accordance with Dilger (1963), the faunal assemblages of the "Comptum" and Bradfordensis subzones are very similar, though the extremely reduced Murchisonae Zone indicates a gap. This is why we assigned samples G14Eb–G18Eb to one faunal assemblage. In the opposite, the significant faunal change between samples G18Eb and G19Eb does not correspond with any change in lithology. The exact position of lenses II and III, which by their richness in ammonites indicate smaller time gaps, is unknown. If we assume one of them laying beneath sample G19Eb, this could explain it.

A range chart of the stratigraphically important species is shown in Table 1; the vertical distribution of all species is shown in Table 3 (appendix); taxa which may include different species have been omitted.

5.1. Aphelocythere kuhni ostracod Zone of Ohmert (2004)

The single sample G01Fr is not interpreted because of its sparse ostracod fauna. A second reason lies in the great vertical distance (55 m) to sample G02Fr. Of note are the single occurrences of *Kinkelinella* (*Ektyphocythere*) *bucki*, *Cytheropterina alafastigata* and *Procytherura* aff. *serangodes* (also present in samples G04Fr and G05Fr).

Pygmaea-pumila faunal assemblage (this work)
(Opalinum Zone, Opalinum Subzone, samples G01Fr–G13r)

The ostracod assemblage consists of 897 individuals representing 63 species. The assemblage is dominated

by *Aphelocythere pygmaea*, *Praeschuleridea ventriosa*, *Acrocythere pumila*, *Eucytherura plumhoffi*, *Metacytheropteron opalinum*, *Eucytherura* sp. 3, and *Eucytherura* sp. 4, while in the upper part addition taxa include *Praeschuleridea punctulata*, *P. ornata* and *Cardobairdia tesakovae*. The stratigraphic value of the newly described, rare species *Infracytheropteron* ? *bisulcatum* and *Polycope* cf. "*pelta*" can only be assessed after further investigations have been undertaken.

In this faunal assemblage some of the cytherurids are the first known occurrences in Germany, but mostly as individual specimens: *Procytherura* aff. *bispinata*, *Eucytherura liassica*, *Procytherura euglyphea* and *Procytherura celtica*. In samples G12Fr and G13Fr (= 9 m below the upper boundary of the Opalinuston Formation) 16 species have their last occurrences in this faunal assemblage, comprising among others *Aphelocythere pygmaea*, *A. hamata*, *Eucytherura* sp. 1, *Acrocythere pumila*, *Eucytherura* sp. 4, *Cardobairdia tesakovae*, and *Metacytheropteron opalinum*.

5.2. Camptocythere modesta – Camptocythere pusilla ostracod zones of Ohmert (2004)

None of the index species could be proven in our material, the only representative of the genus *Camptocythere* in our material is *Camptocythere foveolata prima*. Whereas there is no significant change in the ostracod fauna at the Haugi/Bradfordensis Subzonal boundary, the base of the Gigantea Subzone can be defined by the last occurrences of *Camptocythere foveolata prima* and *Aphelocythere dilgeri*, in association with the first appearances of a great number of species. At the base of the Concavum Zone the majority of the species of the Gigantea Subzone disappear, with only 2 new appearing species.

Foveolata prima faunal assemblage (this work) (Opalinum Zone, "Comptum" Subzone to Bradfordensis Zone, Bradfordensis Subzone; samples G14Eb–G18Eb)

The faunal assemblage in this part of the section (27 species, 352 individuals) shows only slight differences to the underlying one. *Cytherella apostolescui*, *Cytherelloidea lordi*, *Supratoarcina supratoarcensis*, *Procytherura* sp. 3, *Camptocythere foveolata prima*, *Kinkelinella* (*K.*) *adunca*, *Kinkelinella* sp. 1 and *Eucytherura* aff. *scottia* have their first appearances.

Dominant species include "*Asciocythere*" sp., *Kinkelinella* (*K.*) *fischeri*, *Cytherella apostolescui*, *Supratoarcina supratoarcensis*, and *Camptocythere foveolata prima*. *Supratoarcina supratoarcensis* was first described by Knitter (1983) from the Upper Toarcian and may be absent in the Geisingen section prior to appearing in this assemblage due to the unfavourable facies.

From the dominant species *Camptocythere foveolata prima* is the only species which is restricted to this assemblage, all other species extend up into the Gigantea Subzone, except for the very rare *Progonocythere reticulata* and an undetermined ? *Procytherura* sp.

Ohmerti-catena faunal assemblage (Bradfordensis Zone, Gigantea Subzone; samples G19Eb–G21Eb)

The ostracod fauna of the Geisingen Oolith (sample G20Eb) is very extraordinary, similar as is the ammonite fauna. From a total of 68 species, 30 are only recorded in this interval and 27 of which are rare (< 10 specimens). Five species are reported for the first time in Germany: *Pleurocythere kirtonensis*, *Procytherura multicostata*, *P.* aff. *didicytyon*, *P.* aff. *pleuraperiousis*, and *Eucytherura michelseni*. To date, 11 new species have been recovered: *Pleurocythere ohmerti*, *Procytheropteron catena*, "*Monoceratina*" sp. 1, *Cytheropterina alacostata*, *Eucytherura* sp. 7, *Procytherura* sp. 4, *Progonocythere scutula, Kinkelinella geisingensis*, *Polycope circulosa*, *Praeschuleridea concentrica*, and *Procytheropteron* sp. 1.

The dominant species are *Praeschuleridea ornata*, *Polycope* sp., *Cytheropterina bicuneata*, *Bythocypris dorisae* and *Supratoarcina supratoarcensis*, representing 61 % of a total of 1336 individuals.

Punctulata faunal assemblage (this work) (Concavum to ? Discites zones; samples G22Eb–G24Eb)

The ostracod faunal assemblage above the Geisingen Oolith is characterized by a sharp decline in the number of species (11) and individuals (244); only eight species from the underlying assemblage are noted. ? *Homocytheridea* ? *punctulata* and an undetermined species of *Praeschuleridea* appear, while *Supratoarcina supratoarcensis* and *Praeschuleridea punctulata* have their last appearances in this assemblage. ? *Homocytheridea* cf. *punctulata*, *Praeschuleridea ornata* and to a lesser extent "*Asciocythere*" sp. are dominant. It is noteworthy that *Homocytheridea* ? cf. *punctulata* occurs exclusively as internal casts in sample G21Eb. Therefore, unfavorable preservation conditions may partly have caused the reduction of diversity.

5.3. Kinkelinella triangula ostracod Zone of Ohmert (2004) Progonocythere triangulata ostracod Subzone of Ohmert (2004) (Ovale Zone)

The main difference to the underlying assemblage is the first appearance of *Progonocythere triangulata*, the

index fossil of the Triangulata ostracod zone. In addition, another smooth-shelled *Progonocythere* sp. and *Bairdiacypris triangularis* appear, both of which are very rare. All other species encountered here already occur in the Punctulata faunal assemblage.

Among the 24 species *Progonocythere triangulata*, *Cytherelloidea lordi*, *Praeschuleridea ornata* and *Cytherella apostolescui* are dominant in this assemblage, representing 72 % of a total of 315 individuals.

6. Correlation

The Ostracod zonation of the European Aalenian to Lower Bajocian (Bodergat 1997: tables 25, 26) is based on Plumhoff (1963) and has been slightly modified for SW Germany by Ohmert (2004). Brand & Mönnig (2009: Fig. 1) introduced the Metacytheropteron opalinum Zone for the Lower Aalenian in northern Germany. This species also occurs in SW-Germany and northern Switzerland, but is not common. A major problem with the correlation in northern and southern Germany lies in the differing abundances of the index species, due to a reduced connection between the two sedimentary basins (Brand & Ohmert 1992, Brand & Mönnig 2009). For example, the zonation of the Middle and Upper Aalenian refers to several species of the genus *Camptocythere*, which are very rare in SW Germany (Dilger 1963: 85, Ohmert 2004: 83), so that the ostracod zones of the Middle and Upper Aalenian cannot always be proven nor confined safely (Tab. 2). The (little more frequent) occurrences of *Camptocythere* in the middle Swabian Alb (Ohmert 2004) and in the Franconian Alb (Ziegler 1959) may indicate that *Camptocythere* preferred more sandy substrates.

Additionally, the ostracod fauna presented here can only partially be compared with the previously published data since not all authors worked on the smaller ostracod taxa. Furthermore, the distinction of species in the widespread genera *Kinkelinella* and *Praeschuleridea* was not finally clarified yet.

6.1. Germany – N Switzerland

The facies of the Opalinuston Formation is largely similar throughout Germany and the neighbouring northern Switzerland. Therefore, the dominant ostracod species as known so far are recovered virtually everywhere in the distribution area of the formation. *Aphelocythere kuhni*, *Aphelocythere pygmaea*, *Acrocythere pumila*, *Praeschuleridea ventriosa* and *Metacytheropteron opalinum* are recorded in the Swabian Alb (Dilger 1963; Kobler 1972), in the Wutach area (Buck, unpubl. data), in the drillcore Benken in northern Switzerland (Tesakova 2017) and in the Gifhorn Trough (Plumhoff 1963). According to Plumhoff (1963: 55) *Acrocythere pumila* is the index species for the Lower/Middle Aalenian boundary. Besides *Aphelocythere kuhni* Ziegler (1959) reported from the Franconian Alb "*Monoceratina*" *ungulina*, *Bythoceratina scrobiculata* and *Cytheropterina cribra*, which are present in our material too. Additional parallels to northern Switzerland exist in the common occurrence of *Kinkelinella fischeri*, *Praeschuleridea punctulata*, *Cardobairdia tesakovae*, and *Eucytherura plumhoffi*.

Due to facies variations the differences in the faunal composition in the Middle and Upper Aalenian increase. The clay/sand ratio and the carbonate content widely fluctuate, due to palaeorelief and differential subsidence. From the dominant species in the Foveolata prima assemblage "*Asciocythere*" sp. and *Cytherella apostolescui* are present in this part of section throughout the Swabian Alb (Dilger 1963), the latter species being very frequent. Vice versa, from the dominant species in the "Dogger beta 2" (Dilger 1963: 87) only *Cytheropterina bicuneata* was found in our material. In the drillcore Pottenstein II, 20 km south of Bayreuth, Ziegler (1959) reported *Camptocythere foveolata* and *C. media*. In the Gifhorn trough *Camptocythere foveolata prima* and *Praeschuleridea ventriosa* have been recognised in this level (Plumhoff 1963).

Because of the special stratigraphical position of the Geisingen Oolith we summarize the Ohmerti-Catena and the Punctulata assemblages for the comparison with the "Dogger beta 3" assemblage (Dilger 1963: 88 f.) and the "Obtusa" and "Concava" subzones.

From the dominant species in Geisingen, *Cytheropterina bicuneata*, ? *Homocytheridea* cf. *punctulata* and "*Asciocythere*" sp. were also described by Dilger (1963), whereas from his dominant species *Cytherella apostolescui* is present in our material, though not frequent. From the Franconian Alb only single specimens of *Camptocythere pusilla* were reported (Ziegler 1959). The similarities with northern Switzerland and the Gifhorn Trough are confined to the occurrence of *Praeschuleridea ventriosa* and – only in Gifhorn – *Praeschuleridea punctulata* (Plumhoff 1963; Tesakova 2017).

The first sample above the Sowerbyi Oolith (G24Eb) yielded numerous *Progonocythere triangulata*. According to Ohmert (2004) this indicates that the Discites Zone is confined to the Sowerbyi Oolith. Surprisingly Dilger (1963) did not mention *Progonocythere triangulata*, whereas we could not find any of his predominant species except for *Cytherella apostolescui*, which persists from the Upper Toarcian to the Upper Bathonian (Franz et al. 2009) and therefore is of restricted stratigraphical value.

6.2. Western Europe, Argentina

Table 2 shows the correlation of the faunal assemblages presented here with the ostracod zonations for

SW and N Germany, France and Great Britain according to OHMERT (2004), BRAND & MÖNNIG (2009), BODERGAT (1997) and BATE (2009). Again, there are good matches in the Lower Aalenian and Lower Bajocian. The faunal composition in the Lower Aalenian in Spain (ARIAS et al. 2009) is also very similar; however, the index species from Western Europe seem to be absent.

Noteworthy are the first known occurrences of *Bairdiacypris triangularis*, *Procytherura celtica*, *P. euglyphea* and *P. multicostata*, which were first described from the Celtic Sea (AINSWORTH 1986) and of *Procytherura* aff. *bispinata* and *P.* aff. *serangodes*, which were first described from the Neuquén Basin in Argentina (BALLENT & WHATLEY 2000). Even assuming an already open connection across the "Hispanic Corridor" it remains uncertain whether the latter two species are really identical with the Argentinian ones. Therefore we assigned them only tentatively to the southamerican species.

7. Conclusions

The ostracod fauna of the Geisingen clay pit can be subdivided in five faunal assemblages. Because of the absence of the index species in the Middle and Upper Aalenian these can only partly be correlated with the standard ostracod zonation. This might be due to stratigraphic gaps (DIETZE et al. 2014: 79) and particular facies conditions.

11 new species, in addition to 15 new species left in open nomenclature, help to complete our knowledge about the Aalenian ostracod fauna. A great number of small ostracod species, which have been found for the first time in SW Germany, show relationships with Aalenian deposits both in Western Europe and South America.

The ostracod assemblage in the upper Opalinuston Formation is very similar to the fauna from the Wutach area (BUCK, unpublished data) – except for the small forms that were not studied in the 1950's – and from Northern Switzerland (TESAKOVA 2017). The common occurrence of new species such as *Eucytherura plumhoffi* TESAKOVA and *Cardobairdia tesakovae* n. sp. could indicate that these parts of the section are isochronous.

The ostracod fauna of the Geisingen Oolith is highly diverse and consists of many, partly new species, which are only present in this horizon. Currently, their stratigraphical value can not be assessed. This requires the examination of further profiles.

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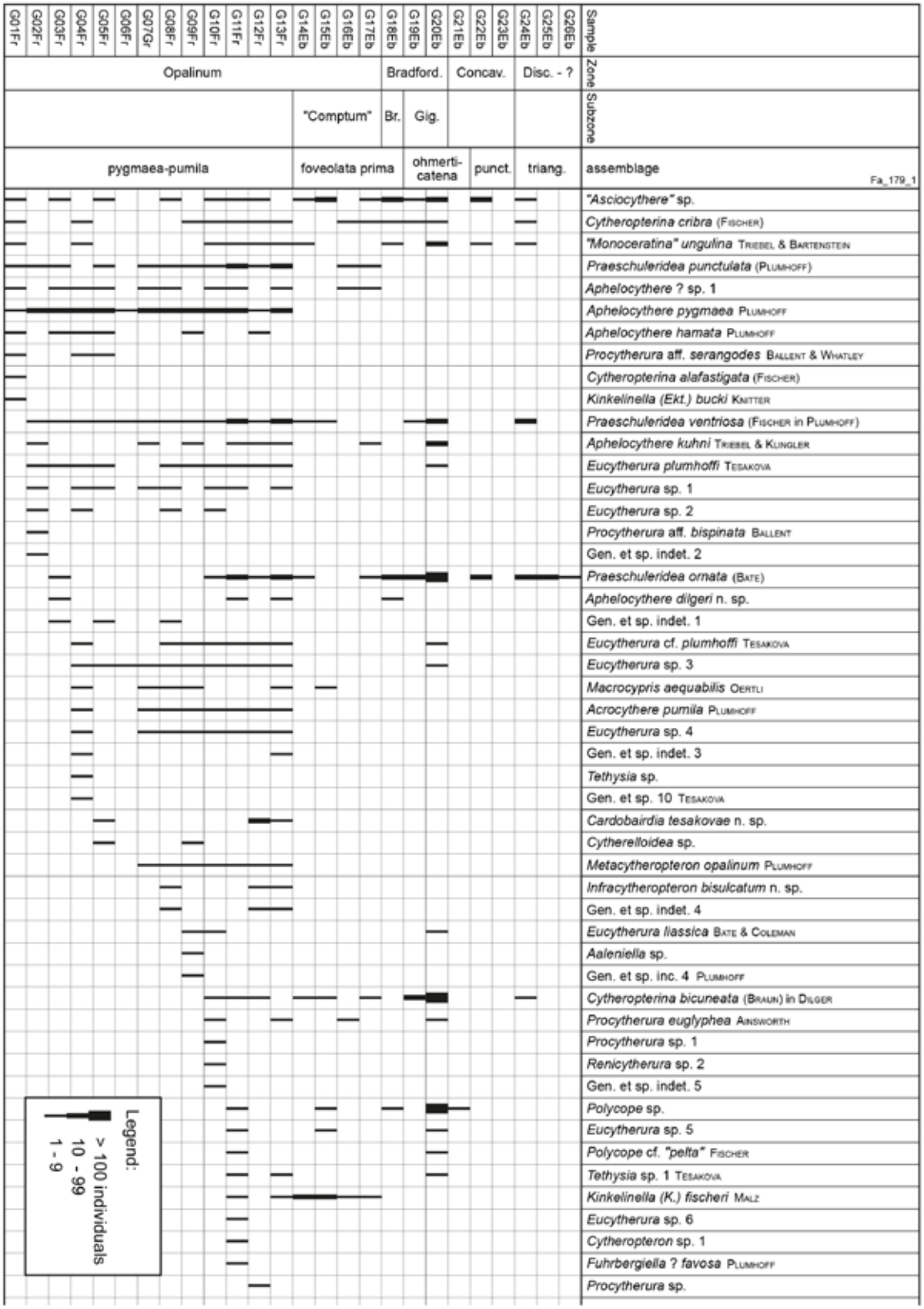
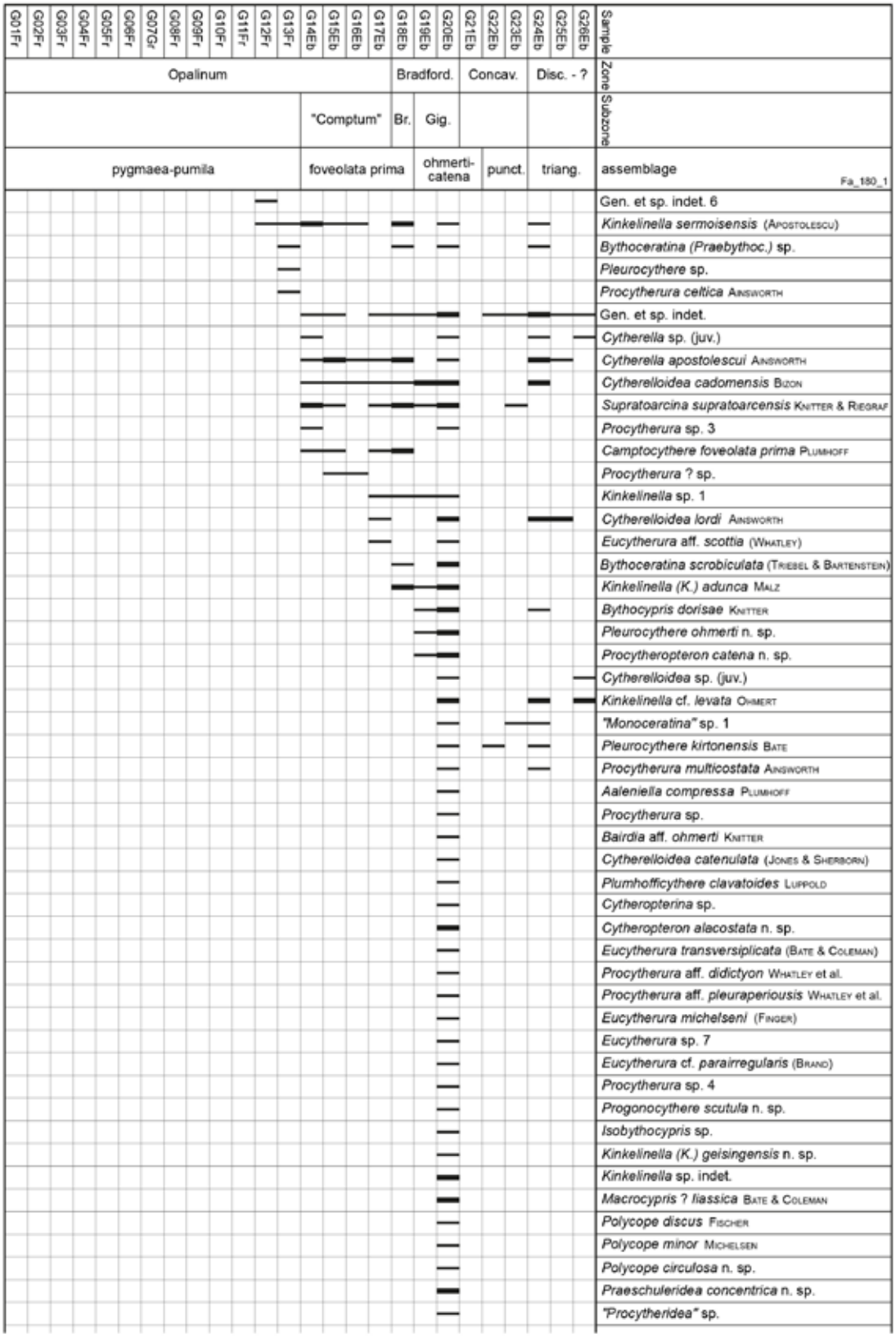
Table 1. Vertical distribution of stratigraphically valuable ostracods in the Geisingen section. Abbreviations: Bradford./Br. = Bradfordensis, Concav. = Concavum, Disc. = Discites, Gig. = Gigantea.





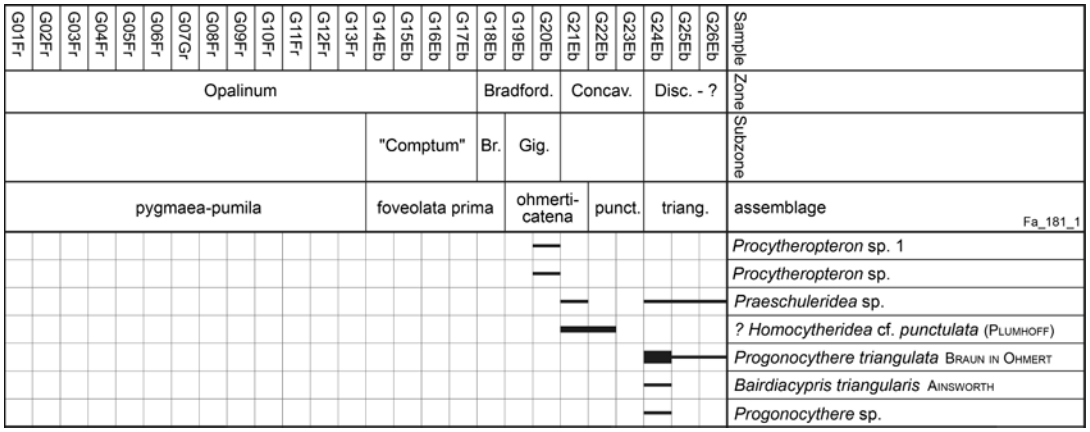


Table 2. NW European standard ammonite zonation and ostracod zonations from Germany, France and Great Britain in the Aalenian and Early Bajocian and the herewith presented faunal assemblages.

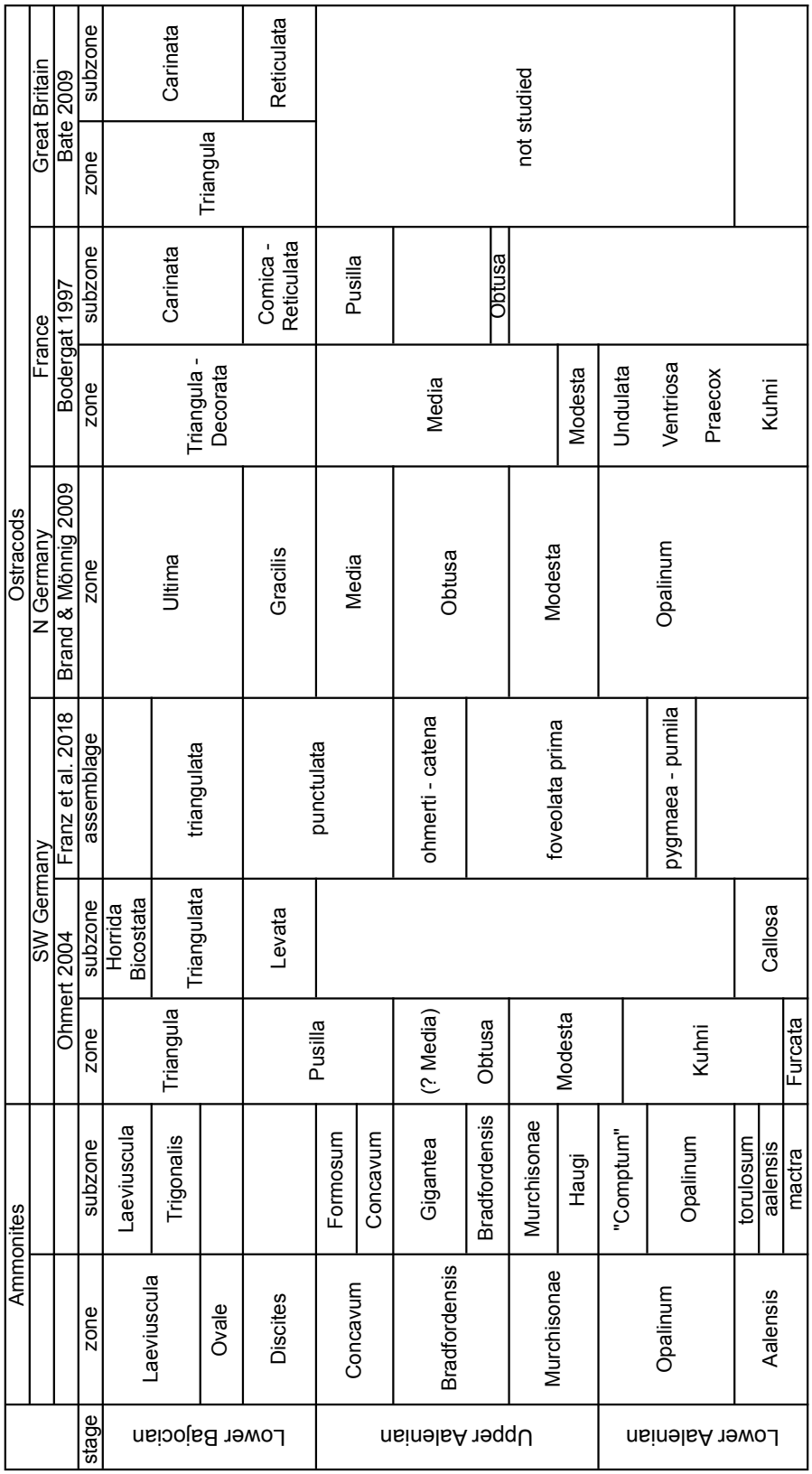


Table 3. Range chart of all taxa determined to the specific level. Single representatives of a genus are also listed, even when the species is unknown. Abbreviations: Same as for Table 1; punct. = punctulata, triang. = triangulata

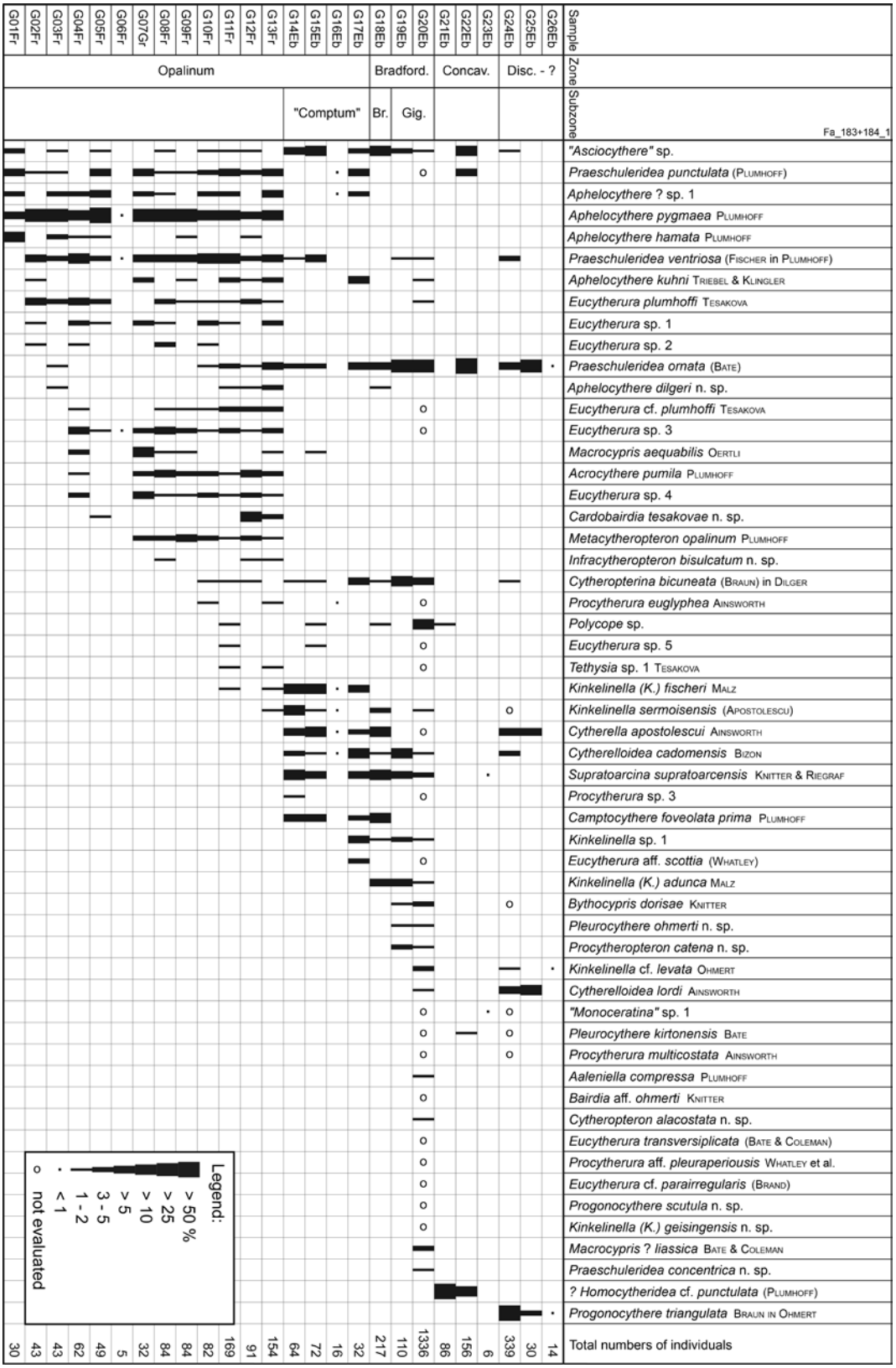


Plate 1

1. *Polycope circulosa* n. sp.; holotype, SMNS 70423-1; RV, sample G20Eb, Gigantea Subzone. – Scale: 0.05 mm.
2. *Polycope discus* Fischer, 1961; SMNS 70423-2; RV, sample G20Eb, Gigantea Subzone. – Scale: 0.05 mm.
3. *Polycope minor* Michelsen, 1975; SMNS 70423-3; C, right view, sample G20Eb, Gigantea Subzone. – Scale: 0.05 mm.
4. *Polycope pelta* Fischer, 1961; **a**: holotype, C, right view; Weilheim, sample 40, Upper Toarcian, GPIT AR 1110/4; Scale: 0.05 mm; **b**: holotype, detail; Scale: 0.02 mm; **c**: paratype, C, left view, Weilheim, sample 40, Upper Toarcian, GPIT AR 1110/5. – Scale: 0.05 mm.
5. *Polycope* cf. "*pelta*" Fischer, 1961; SMNS 70423-4; C, left view, sample G11Fr, Opalinum Zone. – Scale: 0.05 mm.
6. *Polycope* sp.; SMNS 70423-5; C, right view, sample G20Eb, Gigantea Subzone. – Scale: 0.05 mm.
7. *Bairdia* aff. *ohmerti* Knitter, 1983; SMNS 70423-6; LV, internal view, sample G20Eb, Gigantea Subzone. – Scale: 0.05 mm.
8, 9. *Cytherella apostolescui* Ainsworth, 1963; **8**: LV, sample G14Eb, "Comptum" Subzone, SMNS 70423-7. **9**: RV, internal view, sample G20Eb, Gigantea Subzone, SMNS 70423-8. – Scale: 0.1 mm.
10. *Cytherelloidea* cf. *catenulata* (Jones & Sherborn, 1888); SMNS 70423-9; RV, sample G20Eb, Gigantea Subzone. – Scale: 0.1 mm.
11, 12. *Cytherelloidea lordi* Ainsworth, 1986; **11:** RV, sample G17Eb, "Comptum" Subzone, SMNS 70423-10. **12:** LV, internal view, sample G20Eb, Gigantea Subzone, SMNS 70423-11. – Scale: 0.1 mm.
13–16. *Cardobairdia tesakovae* n. sp.; **13**: holotype, SMNS 70423-12; LV, sample G12Fr, Opalinum Zone, **14**: paratype, SMNS 70423-13; C, right view, sample G12Fr, Opalinum Zone, **15**: paratype, SMNS 70423-14; C, dorsal view, sample G12Fr, Opalinum Zone, **16**: paratype, SMNS 70423-15; LV, internal view, sample G13Fr, Opalinum Zone. – Scale: 0.1 mm.

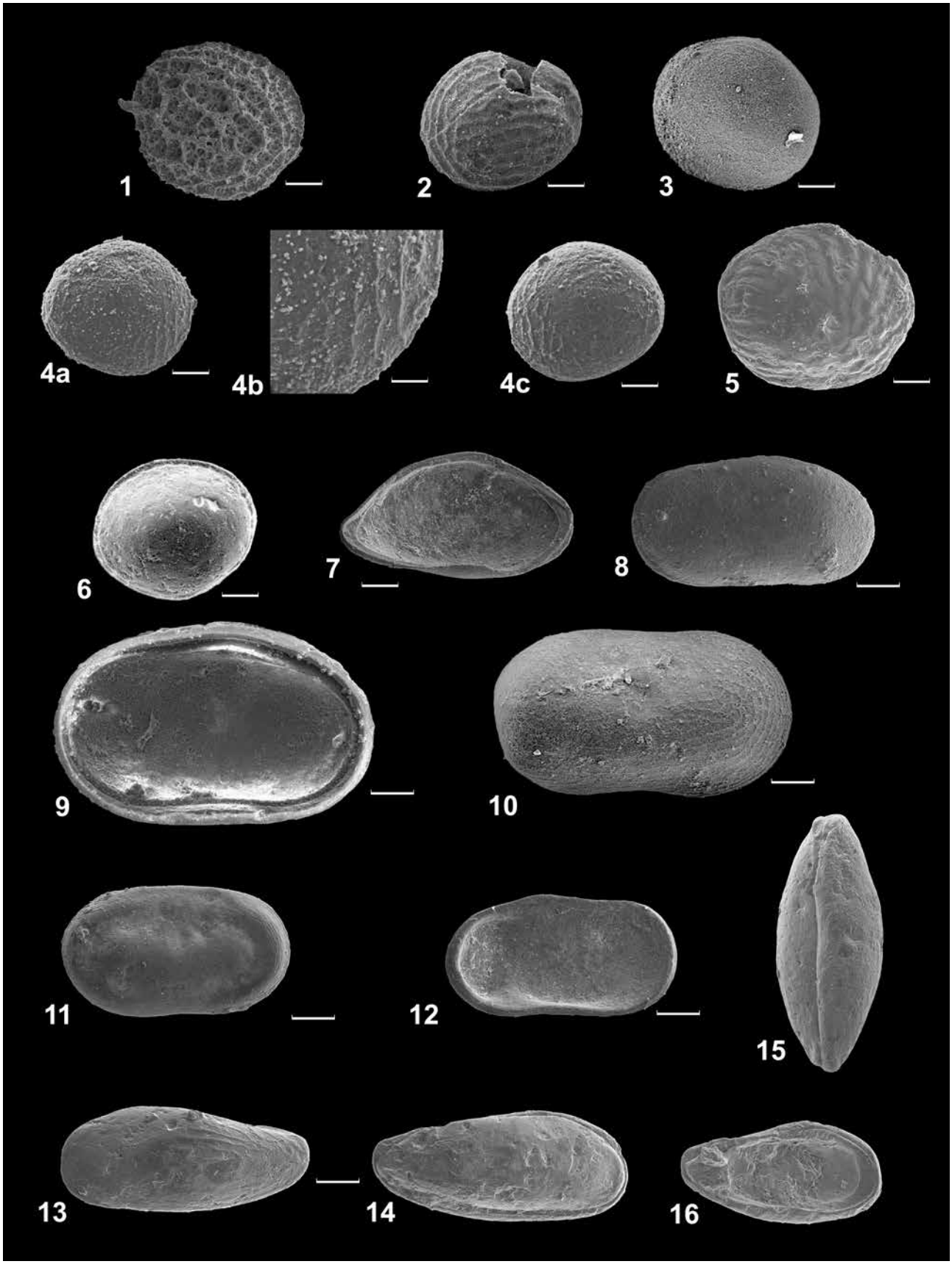


Plate 2

1, 2. *Bythocypris dorisae* Knitter, 1984; **1**: C, right view, sample G19Eb, Gigantea Subzone, SMNS 70423-16; **2**: RV, internal view, sample G20EB, Gigantea Subzone, SMNS 70423-17. – Scale: 0.1 mm.
3. *Isobythocypris* sp.; SMNS 70423-18; LV, sample G20Eb, Gigantea Subzone. – Scale: 0.1 mm.
4. *Macrocypris aequabilis* Oertli, 1959; SMNS 70423-19; C, right view, sample G08Fr, Opalinum Zone. – Scale: 0.05 mm.
5, 6. *Macrocypris* ? *liassica* Bate & Coleman, 1975; **5**: LV, sample G20EB, Gigantea Subzone, SMNS 70423-20; **6**: LV, internal view, sample G20Eb, Gigantea Subzone, SMNS 70423-21. – Scale: 0.1 mm.
7. *Bythoceratina* (*Praebythoceratina*) *scrobiculata* (Triebel & Bartenstein, 1938); SMNS 70423-22; LV, sample G20Eb, Gigantea Subzone. – Scale: 0.05 mm.
8. *Bythoceratina* (*Praebythoceratina*) sp.; SMNS 70423-23; LV, sample G20Eb, Gigantea Subzone. – Scale: 0.05 mm.
9. "*Monoceratina*" *ungulina* Triebel & Bartenstein, 1938; SMNS 70423-24; LV, sample G20Eb, Gigantea Subzone. – Scale: 0.05 mm.
10. "*Monoceratina*" sp. 1; SMNS 70423-25; LV, sample G20Eb, Gigantea Subzone. – Scale: 0.05 mm.
11–14. *Cytheropterina alacostata* n. sp.; sample 20Eb, Gigantea Subzone; **11**: holotype, SMNS 70423-26; LV, **12**: paratype, SMNS 70423-27; RV, **13**: paratype, SMNS 70423-28; LV, internal view, **14**: paratype, SMNS 70423-29; LV,ventral view. – Scale: 0.05 mm.
15. *Cytheropterina alafastigata* (Fischer, 1962); SMNS 70423-30; C, left view, sample G01Fr, Opalinum Zone. – Scale: 0.05 mm.
16–19. *Cytheropterina bicuneata* (Braun) n. sp.; **16**: holotype, Ar 1134/29; LV, Wedelsandstein Formation, Owen/Teck, **17.** paratype, SMNS 70423-31; LV, sample G20Eb, Gigantea Subzone, **18.** paratype, SMNS 70423-32; LV, inner view, sample G16Eb, "Comptum" Subzone, **19**. paratype, SMNS 70423-33; C, dorsal view, sample G20Eb, Gigantea Subzone.

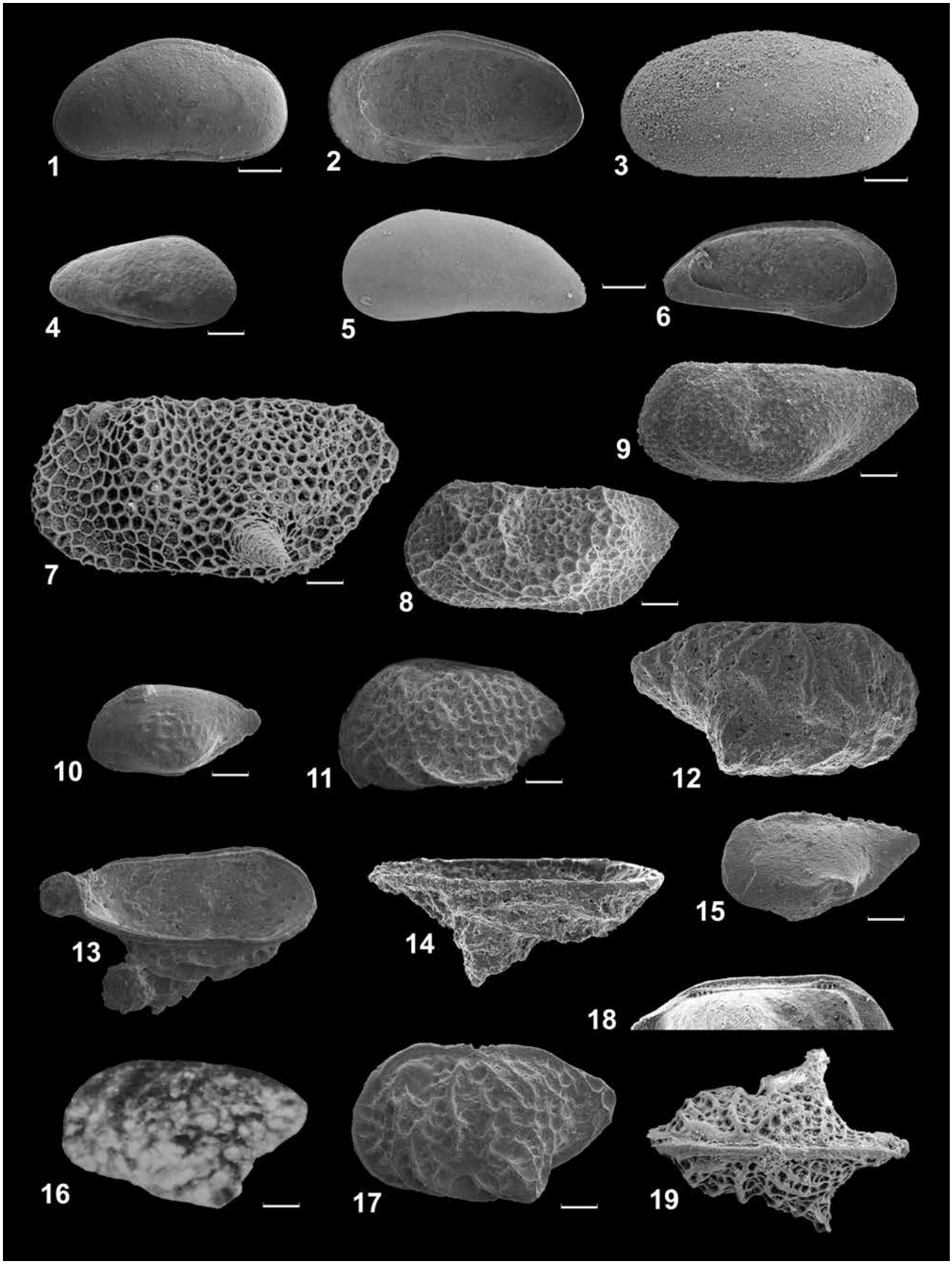


Plate 3

1. *Proytherura* aff. *bispinata* Ballent, 1991; SMNS 70423-34; RV, sample G02Fr, Opalinum Zone. – Scale: 0.05 mm.
2. *Procytherura celtica* Ainsworth, 1986; RV, sample G13Fr, Opalinum Zone, SMNS 70423-35.
3. *Procytherura* aff. *didictyon* Whatley et al., 2001; RV, sample G20Eb, Gigantea Subzone, SMNS 70423-36.
4. *Procytherura euglyphea* Ainsworth, 1986; RV, sample G16EB, "Comptum" Subzone, SMNS 70423-37.
5. *Procytherura multicostata* Ainsworth, 1986; RV, sample G20Eb, Gigantea Subzone, SMNS 70423-38.
6. *Procytherura* aff. *pleuraperiousis* Whatley et al., 2001; RV, sample G20Eb, Gigantea Subzone, SMNS 70423-39.
7. *Procytherura* aff. *serangodes* Ballent & Whatley, 2000; C, left view, sample G05Fr, Opalinum Zone, SMNS 70423-40.
8. *Procytherura* sp. 1; RV, sample G10Fr, Opalinum Zone, SMNS 70423-41.
9. *Procytherura* sp. 2; C, right view, sample G12Fr, Opalinum Zone, SMNS 70423-42.
10. *Procytherura* sp. 3; LV, sample G14Eb, "Comptum" Subzone, SMNS 70423-43.
11. *Procytherura* sp. 4; RV, sample G20Eb, Gigantea Subzone, SMNS 70423-44.
12. *Tethysia* sp. 1 Tesakova; C, right view, sample G20Eb, Gigantea Subzone, SMNS 70423-45.
13. *Eucytherura liassica* Bate & Coleman, 1975; C, left view, sample G09Fr, Opalinum Zone, SMNS 70423-46.
14. *Eucytherura michelseni* (Finger, 1983); LV, sample G20Eb, Gigantea Subzone, SMNS 70423-47.
15. *Eucytherura* cf. *parairregularis* (Brand, 1990); RV, sample G20Eb, Gigantea Subzone, SMNS 70423-48.
16. *Eucytherura plumhoffi* Tesakova; C, left view, sample G08Fr, Opalinum Zone, 70423-49.
17. *Eucytherura* cf. *plumhoffi* Tesakova; C, left view, sample G12Fr, Opalinum Zone, 70423-50.
18. *Eucytherura* aff. *scottia* (Whatley, 1970); LV, sample G20Eb, Gigantea Subzone, SMNS 70423-51.
19. *Eucytherura transversiplicata* (Bate & Coleman, 1975); C, right view, sample G20Eb, Gigantea Subzone, SMNS 70423-52.
20. *Eucytherura* sp. 1; C, left view, sample G10Fr, Opalinum Zone, SMNS 70423-53.
21. *Eucytherura* sp. 2; C, left view, sample G08Fr, Opalinum Zone, SMNS 70423-54.
22. *Eucytherura* sp. 3; C, right view, sample G12Fr, Opalinum Zone, SMNS 70423-55.
23. *Eucytherura* sp. 4; C, left view, sample G10Fr, Opalinum Zone, SMNS 70423-56.
24. *Eucytherura* sp. 5; RV, sample G20Eb, Gigantea Subzone, SMNS 70423-57.
25. *Eucytherura* sp. 6; LV, sample G11Fr, Opalinum Zone, SMNS 70423-58.
26. *Eucytherura* sp. 7; LV, sample G20Eb, Gigantea Subzone, SMNS 70423-59.
Scale for all figures: 0.05 mm.

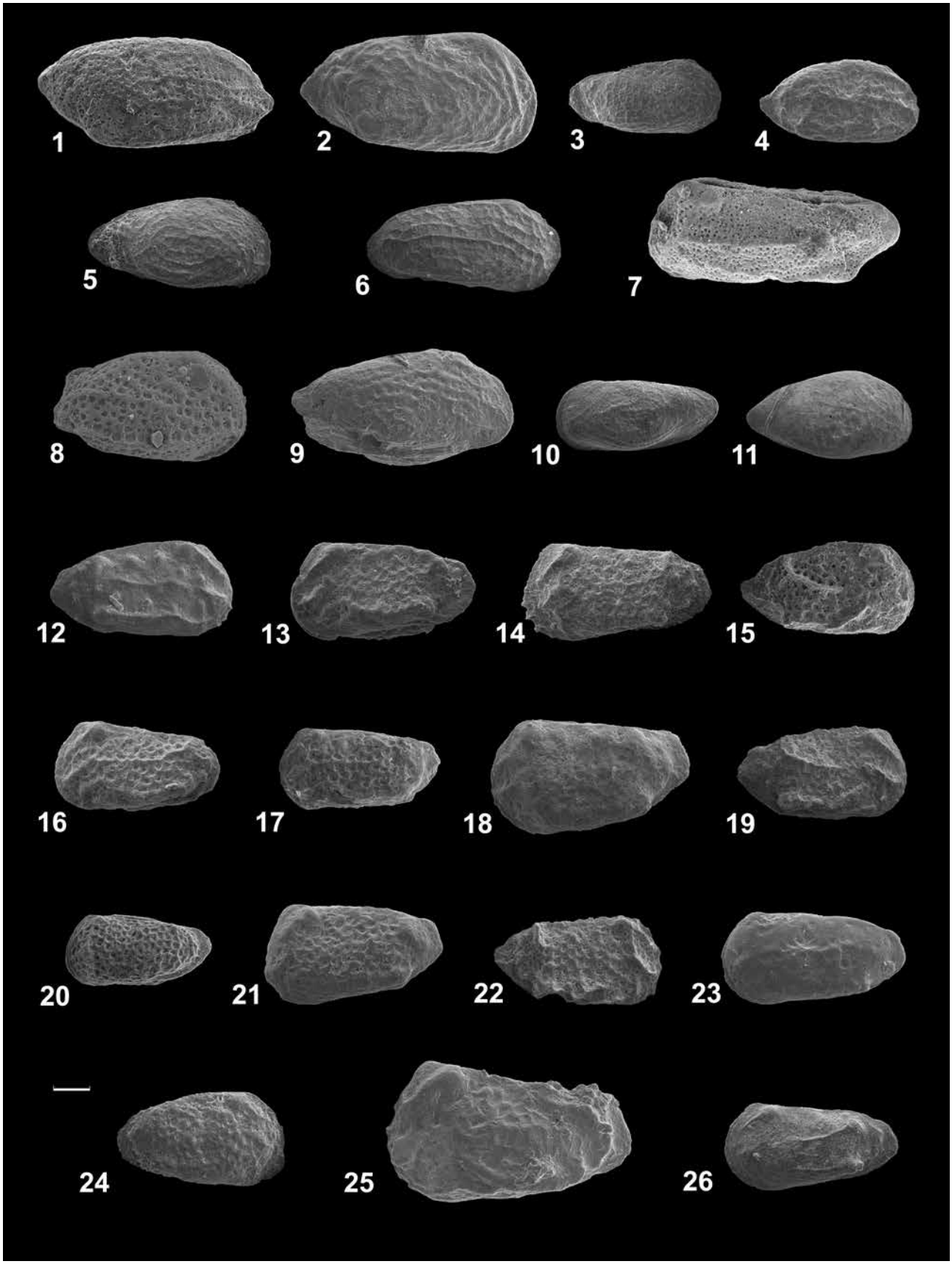


Plate 4

1, 2. *Infracytheropteron bisulcatum* n. sp.; **1**: holotype, SMNS 70423-60; C, left view, sample G08Fr, Opalinum Zone. **2**: paratype, SMNS 70423-61; C, left view, sample G13Fr, Opalinum Zone. – Scale: 0.05 mm.
3. *Infracytheropteron* sp. 1; SMNS 70423-62; LV, sample G11Fr, Opalinum Zone. – Scale: 0.05 mm.
4–6. *Procytheropteron catena* n. sp; sample G20Eb, Gigantea Subzone; **4**: holotype, SMNS 70423-63; RV, **5**: paratype, SMNS 70423-64; LV, **6**: paratype, SMNS 70423-65; LV, internal view. – Scale: 0.05 mm.
7. *Procytheropteron* sp. 1; SMNS 70423-66; LV, sample G20Eb, Gigantea Subzone. – Scale: 0.05 mm.
8. *Metacytheropteron opalinum* Plumhoff, 1963; 70423-67; C, left view, sample G08Fr, Opalinum Zone. – Scale: 0.05 mm.
9. *Aphelocythere dilgeri* n. sp., holotype; SMNS 70423-68; LV, sample G11Fr, Opalinum Zone. – Scale: 0.1 mm.
10. *Aphelocythere hamata* Plumhoff, 1963; SMNS 70423-69; C, left view, sample G01Fr, Opalinum Zone. – Scale: 0.05 mm.
11, 12. *Aphelocythere kuhni* Triebel & Klingler, 1959; **11**: C, right view, sample G09Fr, Opalinum Zone, 70423-70; **12**: LV, internal view, sample G20Eb, Gigantea Subzone, SMNS 70423-71. – Scale: 0.05 mm.
13, 14. *Aphelocythere pygmaea* Plumhoff, 1963; sample G08Fr, Opalinum Zone, **13**: C, right view, SMNS 70423-72; **14**: C, left view, SMNS 70423-73. – Scale: 0.05 mm.
15, 16. *Aphelocythere* ? sp. 1 Plumhoff, 1963; **15**: C, left view, sample G02Fr, Opalinum Zone, SMNS 70423-74; **16**: LV, internal view, sample G01Fr, Opalinum Zone, 70423-75. – Scale: 0.05 mm.
17, 18. *"Asciocythere"* sp., 1963; **17**: C, left view, sample G08Fr, Opalinum Zone, SMNS 70423-76; **18**: C, right view, sample G05Fr, Opalinum Zone, SMNS 70423-77. – Scale: 0.1 mm.

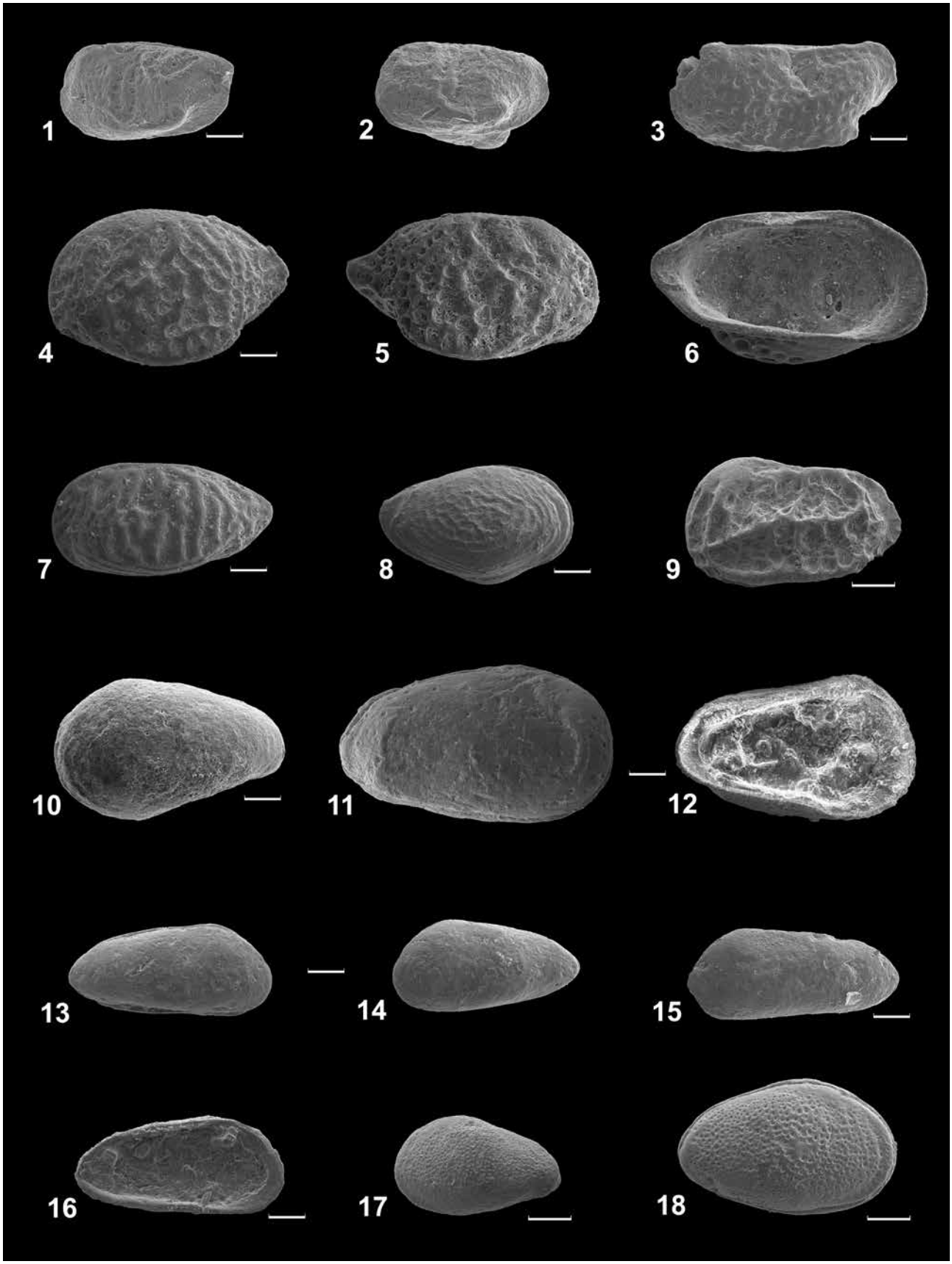


Plate 5

1–4. *Praeschuleridea concentrica* n. sp.; sample G20Eb, Gigantea Subzone; **1**: holotype, SMNS 70423-78; LV, **2**: paratype, SMNS 70423-79; RV, **3**: paratype, SMNS 70423-80; LV, internal view, **4**: paratype, 70423-81; C, dorsal view. – Scale: 0.1 mm.
5. *Praeschuleridea ornata* (Bate, 1963); SMNS 70423-82; C, right view, sample G07Fr, Opalinum Zone. – Scale: 0.1 mm.
6. *Praeschuleridea punctulata* (Plumhoff, 1963); SMNS 70423-83; C, right view, sample G09Fr, Opalinum Zone. – Scale: 0.1 mm.
7. *Praeschuleridea ventriosa* (Fischer in Plumhoff, 1963); SMNS 70423-84; C, right view, G03Fr, Opalinum Zone. – Scale: 0.1 mm.
8. *Pleurocythere kirtonensis* Bate, 1963; SMNS 70423-85; LV, sample G20Eb, Gigantea Subzone. – Scale: 0.05 mm.
9–12. *Pleurocythere ohmerti* n. sp.; sample G20Eb, Gigantea Subzone, **9**: holotype, SMNS 70423-86; RV, **10**: paratype, SMNS 70423-87; LV, **11**: paratype, SMNS 70423-88; RV, internal view, **12**: paratype, SMNS 70423-89; C, dorsal view. – Scale: 0.1 mm.
13. ? *Pleurocythere* sp.; SMNS 70423-90; RV, sample G13Fr, Opalinum Zone. – Scale: 0.05 mm.
14, 15. *Acrocythere pumila* Plumhoff, 1963; **14**: C, left view, sample G07Fr, Opalinum Zone, SMNS 70423-91; **15**: C, right view, sample G08Fr, Opalinum Zone, SMNS 70423-92. – Scale: 0.05 mm.
16–20. ? *Homocytheridea punctulata* (Plumhoff, 1963); sample G22Eb, Concavum Zone. **16**: C, left view, SMNS 70423-93; **17**: RV, internal view, SMNS 70423-94; **18**: LV, internal view, SMNS 70423-95; **19**: RV, SMNS 70423-96; **20**: RV, internal view, SMNS 70423-97. – Scale: 0.1 mm.
21. *Camptocythere foveolata prima* Plumhoff, 1963; SMNS 70423-98; RV, sample G14Eb, "Comptum" Subzone. – Scale: 0.1 mm.
22. *Aaleniella compressa* Plumhoff, 1963; SMNS 70423-99; LV, sample G20Eb, Gigantea Subzone. – Scale: 0.05 mm.
23. *Aaleniella* sp.; SMNS 70423-100; C, left view, G09Fr, Opalinum Zone. – Scale: 0.05 mm.
24, 25. *Supratoarcina supratoarcensis* Knitter & Riegraf, 1984; sample G20Eb, Gigantea Subzone. **24**: RV, SMNS 70423-101; **25**: RV, internal view, SMNS 70423-102. – Scale: 0.1 mm.

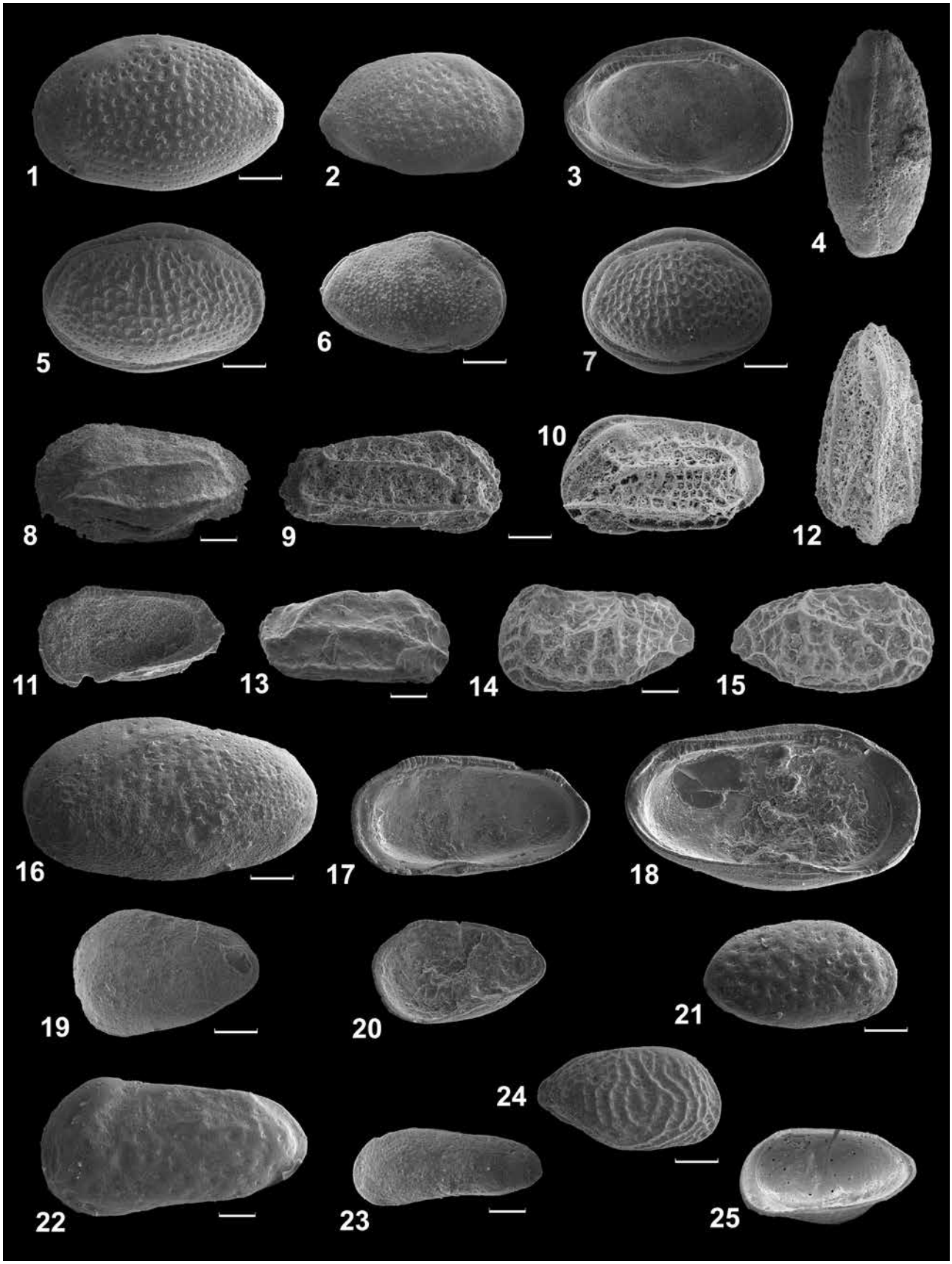


Plate 6

1, 2. *Progonocythere scutula* n. sp.; sample G20Eb, Gigantea Subzone. **1**: holotype, SMNS 70423-103; RV, **2**: paratype, SMNS 70423-104; LV. – Scale: 0.1 mm.
3. *Progonocythere triangulata* Braun in Ohmert, 2004; SMNS 70423-105; LV, sample G24Eb, ? Ovale Zone. – Scale: 0.1 mm.
4. *Kinkelinella* (*Ektyphocythere*) *bucki* Knitter, 1984; SMNS 70423-106; RV, sample G01Fr, Opalinum Zone. – Scale: 0.05 mm.
5. *Kinkelinella* (*Kinkelinella*) *adunca* Malz, 1966; SMNS 70423-107; RV, sample G20Eb, Gigantea Subzone. – Scale: 0.1 mm.
6–8. *Kinkelinella* (*Kinkelinella*) *geisingensis* n. sp.; sample G20Eb, Gigantea Subzone. **6**: holotype, SMNS 70423-108; LV, **7**: paratype, SMNS 70423-109; RV, **8**: paratype, SMNS 70423-110; RV, internal view. – Scale: 0.05 mm.
9. *Kinkelinella* (*Kinkelinella*) *levata* Ohmert, 2004; SMNS 70423-111; LV, sample G20Eb, Gigantea Subzone. – Scale: 0.1 mm.
10. *Kinkelinella* (*Kinkelinella*) *sermoisensis* (Apostolescu, 1959); SMNS 70423-112; LV, sample G14Eb, „Comptum“ Subzone. – Scale: 0.1 mm.
11. *Kinkelinella* sp. 1; SMNS 70423-113; LV, sample G19Eb, Gigantea Subzone. – Scale: 0.1 mm.
12. *Plumhofficythere clavatoides* Luppold, 2003; SMNS 70423-114; C, left view, sample G20EB, Gigantea Subzone. – Scale: 0.05 mm.
13. Gen. et sp. indet. 1; SMNS 70423-115; C, left view, sample G03Fr, Opalinum Zone. – Scale: 0.05 mm.
14. Gen. et sp. 10 Tesakova; SMNS 70423-116; RV, sample G04Fr, Opalinum Zone. – Scale: 0.05 mm.
15. Gen. et sp. indet. 2; SMNS 70423-117; LV, sample G03Fr, Opalinum Zone. – Scale: 0.05 mm.
16. Gen. et sp. indet. 3; SMNS 70423-118; LV, sample G04Fr, Opalinum Zone. – Scale: 0.05 mm.
17. Gen. et sp. indet. 4; SMNS 70423-119; C, right view, sample G08Fr, Opalinum Zone. – Scale: 0.05 mm.
18. Gen. et sp. indet. 5; SMNS 70423-120; LV, sample G10Fr, Opalinum Zone. – Scale: 0.05 mm.
19. Gen. et sp. indet. 6; SMNS 70423-121; RV, sample G12Fr, Opalinum Zone. – Scale: 0.05 mm.