

Molasse cénozoïque

Micropaléontologie

Claudius Pirkenseer



CPPJ – A16

Catalogues du patrimoine
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DÉPARTEMENT DE LA FORMATION, DE LA CULTURE ET DES SPORTS
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SECTION D'ARCHÉOLOGIE ET PALÉONTOLOGIE
PALÉONTOLOGIE A16

Basée à Porrentruy, la Paléontologie A16 est financée par l'Office fédéral des routes (OFROU) et par la République et Canton du Jura. Sa mission se concentre sur le tracé A16 de 24,675 km de long, comprenant les sections autoroutières situées entre Boncourt et Porrentruy, ainsi qu'entre Delémont et Choindez. Sa mission principale consiste à documenter les nombreuses découvertes mises au jour et l'exploitation scientifique des données, la gestion de la documentation et des collections ainsi que la transmission de l'ensemble de cet héritage à la République et Canton du Jura.

Charophyte: *Rantzieniella nitida*

Foraminifère: *Protelphidium nonioninoides*

Ostracode: *Hemicypriideis helvetica*

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Claudius Pirkenseer

Avec des contributions de
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Sous la direction de
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Office de la culture
Paléontologie A16
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La Collection des Catalogues du patrimoine paléontologique jurassien–A16 est publiée sous les auspices de l'Office de la culture de la République et Canton du Jura. La Collection documente les nombreuses découvertes en provenance de l'A16 et leur exploitation scientifique.

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Avant-propos

Basée à Porrentruy, la Paléontologie A16 est un projet pilote de paléontologie autoroutière, financé à hauteur de 95% par l'Office fédéral des routes et de 5% par la République et Canton du Jura. Sa mission, de 2000 à 2018, se concentre sur le tracé de la route nationale A16 Transjurane, long de 24,675 km. La Paléontologie A16 a prospecté et fouillé 64 sites des sections autoroutières 1, 2, 3, 7 et 8 entre Boncourt et Porrentruy – principalement sur le plateau de Courtedoux – ainsi qu'entre Delémont et Choindez. Les découvertes paléontologiques sont le fruit de cette activité de terrain de grande envergure, avec des fouilles contrôlées menées de 2005 à 2011, grâce au soutien financier conséquent de l'Office fédéral des routes. La mission principale de la Paléontologie A16 consiste à sauvegarder ces nombreuses découvertes, à les documenter, les gérer en collection, les exploiter scientifiquement et, finalement, transmettre l'ensemble de cet héritage à la République et Canton du Jura.

Dans ce cadre, les *Catalogues du patrimoine paléontologique jurassien–A16* ont été créés sur une idée originale de Wolfgang A. Hug, responsable de l'équipe Paléontologie A16 de 2002 à 2016. Ils sont réalisés par la Paléontologie A16 et publiés sous les auspices de l'Office de la culture de la République et Canton du Jura.

Le but de ces catalogues est de présenter les principales découvertes paléontologiques A16 et leur documentation exhaustive et inédite, en particulier pour les sites à traces de dinosaures. Ils accompagnent ainsi l'inventaire de la collection physique de la Paléontologie A16 et ses quelque 65 000 objets répertoriés (fossiles, sédiments, minéraux, etc.). De plus, en facilitant l'accès à une sélection d'objets phares, ces catalogues sont une porte d'entrée vers les découvertes paléontologiques A16 pour la communauté scientifique. La diffusion de la série complète des catalogues en format papier est limitée, mais une version électronique est disponible en ligne et en libre accès.

Les thèmes couverts par les catalogues correspondent aux principales études menées par la Paléontologie A16. Les couches géologiques de trois grandes périodes traversées par l'A16 ont déterminé la nature des découvertes et donc des études. Pour le Mésozoïque, il s'agit en particulier des traces de dinosaures, des vertébrés et des invertébrés marins mis au jour dans les calcaires et les marnes du Jurassique supérieur (Oxfordien et Kimméridgien). Pour le Cénozoïque, il s'agit essentiellement des faunes de mammifères et de microfossiles de la Molasse (Éocène, Oligocène et Miocène) et des faunes de mammifères des dolines à la fin du Cénozoïque (Pléistocène).

Les données cataloguées sont présentées de manière synthétique, synoptique et richement illustrée (fossiles, localités, coupes géologiques, méthodologie de fouille, etc.). Les coordonnées spatiale et temporelle de chaque objet sont précisément indiquées; la détermination de chaque fossile reste fonction de l'état actuel des connaissances. Les catalogues documentent aussi certaines analyses menées, sous forme de mandats, par des instituts externes.

Les *Catalogues du patrimoine paléontologique jurassien–A16* sont le reflet de la devise de la Paléontologie A16: Sauvegarder, Étudier, Transmettre. Qu'ils soient utiles pour la mémoire de cette activité unique, pour de futures études scientifiques et pour la gestion pérenne de ce patrimoine – d'importance nationale –, dont la responsabilité incombe à la République et Canton du Jura.

Merci à toutes les collaboratrices et à tous les collaborateurs de l'équipe de la Paléontologie A16: ces catalogues constituent un bel aboutissement de votre engagement.

Porrentruy, le 31 mai 2017

Jean-Paul Billon-Bruyat
Responsable de la Paléontologie A16

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1 Introduction

This catalogue documents the three most common groups of microfossils from the Cainozoic sediments of the Canton of Jura exposed by the construction of Highway A16. Microfossils represent remains of biota generally smaller than 1 mm. Accordingly the catalogue is organized in three parts, illustrating 10 species of Charophyta, 48 taxa of Foraminifera and 30 taxa of Ostracoda on 78 plates and 29 text-figures. Information on ostracod taxa is supplemented by spatiotemporal distribution maps and measurement tables.

The occurrences of not individually described taxa of Charophyta, reworked benthic Foraminifera and planktonic Foraminifera are grouped cumulatively in tables. The results of small mammal teeth have been published separately (Prieto et al. 2018; Maridet et al., in prep.).

Taxonomy of ostracods, foraminifers and charophytes follows the literature respectively outlined in Pirkenseer & Berger (2011), Pippèrr (2015) and Mojon et al. (2018).

Charophyta

Charophyta are an extant group of multicellular green algae generally living in carbonate-rich, oligotrophic ponds and lakes as well as less frequently in brackish waters (e.g. Zeneli & Kashta 2016). The fossil record of charophytes reaches back into the Palaeozoic Era (e.g. Kelman et al. 2007). The most commonly preserved parts of charophytes are calcified stems and oogonia. Oogonia represent female reproductive organs of stoneworts, which are commonly found in lacustrine marls and siltstones of the Swiss Molasse Basin. Due to a comparatively rapid morphological evolution of charophyte oogonia a biostratigraphic framework based on assemblages zones complements the standard Cainozoic mammal biozonation (ELMMZ) for European non-marine sediments (Berger 1999; Mojon et al. 2018).

In the Canton of Jura charophyte oogonia have been mainly documented from late Rupelian to Aquitanian fluviatile and lacustrine sediments of the “Molasse alsacienne” and the “Calcaires delémontiens”.

The most common occurrence of oogonia adheres to the lower part of the “Molasse alsacienne”, denoting the middle to late Rupelian non-basal *Rhabdochara major*-zone (for details on assemblage zones see Mojon et al. 2018) for the localities POI / PRC / VEG / PCA / BIR / BEU / BEE / EPN, CLU, LGR, CLM / VRG / RIN / CTR in the Delémont Basin and ETA in the Ajoie. The cumulative regional charophyte assemblage includes the taxa *Rhabdochara* gr. *stockmansi-major*, *Rhabdochara* gr. *praelangeri-major*, *Nitellopsis* (*Tectochara*) gr. *meriani*, *Gyrogona medicaginula*, *Gyrogona wrighti*, *Gyrogona caelata*, *Sphaerochara* gr. *hirmeri* and *Chara minutissima*.

The subsequent *Chara microcera*-zone attributes part of the Molasse alsacienne at the locality EPN to the late Rupelian to early Chattian stages.

The youngest charophyte assemblage from the “Calcaires delémontiens” including *Rantzieniella nitida*, *Stephanochara* gr. *praerberdotensis*, *Nitellopsis* (*Tectochara*) gr. *meriani*, *Chara* gr. *molassica-notata*, *Sphaerochara* gr. *hirmeri* pertaining to the *Rantzieniella nitida*-zone correlates the locality MCX in the central Delémont Basin to the Aquitanian stage.

Foraminifera

Foraminifera form an extant, extremely diverse group of unicellular Eukaryotes that – with only few exceptions – build shells (“tests”) and live in marine environments. The fossil record reaches at least back into the early Cambrian (earliest Palaeozoic Era) (e.g. Culver 1991; Pawlowski et al. 2003). Foraminifera are characterized by two basic test morphologies, either built of CaCO₃ (plate 7-37) or agglutinated detrital grains (see plate 1-6, 38/fig. 1-5) of various origins. Foraminifera adhere to two modes of life, either living on or in the sea floor (“benthic”) or drifting in the upper part of the water column (“planktonic”).

Planktonic Foraminifera are instrumental for the biostratigraphy (relative age of sediment strata) of Cretaceous and Cainozoic

(e.g. P-O zones in Berggren & Pearson 2009) marine sediments due to their high rates of evolution and global distribution. Benthic Foraminifera assemblages and key species are characteristic for discrete marine habitats and incorporate related chemical properties of the surrounding seawater. Fossil benthic Foraminifera and the chemical composition of their tests thus allow reconstructions of past environmental conditions (e.g. water depth, oxygenation and salinity amongst many others).

The Foraminifera from Rupelian marine deposits (“Septarienton”) of the Canton of Jura mainly consist of benthic species. Planktonic Foraminifera are rare and generally poorly preserved, which is to be expected in nearshore environments experiencing increased influx of coarser clastic sediments.

Autochthonous inner neritic or lagoonal low-diversity benthic Foraminifera assemblages from localities closest to the palaeo-coast (OIS, ETA, BEE) are dominated by taxa like *Quinqueloculina* spp., *Pararotalia canui*, *Aubignyna kiliani* and *Buccella* spp. Assemblages including *Cancris subconicus*, *Cibicidoides* spp., *Melonis* spp., *Bolivina* spp. are documented for the localities RNA and CHM, indicating slightly more offshore, well-oxygenated inner to outer neritic palaeoenvironments.

The poorly preserved, abundant benthic Foraminifera from the basal fluviatile “Molasse alsacienne” represent reworked specimens from older regional, characteristic “Meeressand” assemblages (e.g. in Pirkenseer et al. 2010), indicated by the exclusive occurrence of well-sorted, large and thick-shelled calcitic or massive agglutinated forms bearing imprints and abrasions from quartz grains. Rare large, reworked planktonic Foraminifera and some specimens of allochthonous larger benthic Foraminifera (LBF) of Cretaceous and Eocene age co-occur. Their highly abraded and fragmented state indicates a protracted fluviatile transport from alpine source sediments (e.g. Pirkenseer et al. 2011).

The scarcity of the material, the poor preservation and the absence of index taxa of planktonic Foraminifera unfortunately hampers a biostratigraphic interpretation of the marine sediments.

Ostracoda

Ostracods, commonly called mussel or seed shrimps represent a class within the subphylum of Crustacea (e.g. crabs, shrimps, woodlice). Ostracods typically are crustaceans smaller than 1 mm, their body being protected by a bivalved, hinged carapace (hence the common name). The oldest true ostracods date back to the early Ordovician period (e.g. Williams et al. 2008).

Ostracods live in deep-sea to freshwater habitats and even in moist soils (Harding 1953). During their life cycle ostracods develop nine consecutive moult stages (eight juvenile, one adult) of increasing size. Ostracods live mainly on or in the sediment, while pelagic planktonic taxa are rare. Ostracods, with few exceptions, do not tolerate reduced oxygenation levels, hence they are not recorded from dysoxic sediments. Individual ostracod taxa are sensible towards environmental changes, especially salinity

gradients, water temperature or depth. Distinct shifts in ostracod assemblage composition can accordingly be assigned to changes in e.g. palaeosalinity.

Ostracods occur in the fossil record either as closed carapaces, or as individual valves (more common). A predominance of closed carapaces and the presence of many moults stages hint towards an autochthonous assemblage, whereas a majority of valves (often sorted by size) indicate at least local post-mortem transport. Separate valves however are easier to determine, since internal features of the shell (e.g. hinge structure, muscle scars) are often taxonomically distinct.

The Ostracoda of the Canton of Jura are mainly recorded from Rupelian marine (“Septarienton”) to deltaic (“Marnes à Cyrènes”) sediments. Freshwater ostracods from the subsequent fluvatile “Molasse alsacienne” are exceedingly rare. The quick shift from (e.g. localities COM, RNA) or the co-occurrence of (e.g. localities BEE, ETA) shallow marine to coastal assemblages (e.g. *Legumino-cythereis sorneana*, *Loxoconcha* spp., *Cytheridea sandbergeri* and *Cytheretta* spp.) to /and brackish, deltaic assemblages dominated by *Hemicyprideis helvetica* indicate a rapid desalination of the shallow Delémont Basin and the Ajoie region in the late Rupelian as well as repeated short-term shifts of palaeoenvironments in the context of a prograding river delta system (e.g. Pirkenseer et al. 2018).

Material and sample numbering system

The material is stocked following a consecutive numbering scheme based on the year of sampling and the sample locality (and **not** section and sample depth), partly grouping lots of microfossils, partly discerning individually figured specimens. Closely related specimen or lot sample numbers **do not** necessarily represent the same sample level and /or the same section.

Several discrete, sometimes strongly diverging numbers are due to non-consecutive preparation, selection or grouping of picked specimens and different sampling years and may be derived from an individual **initial sediment sample** (or several from a same sample depth at a given section, see example below). Accordingly these numbers are grouped for each described taxon under their initial sediment sample(s) and referenced to the relevant locality, unit (= individual section) and layer (= sampling depth) for the convenience of the reader.

Example (under “Occurrences”, *Cytheridea sandbergeri*, p. 148): Picking cell numbers BEE006-34 / BEE004-165 to 167 / BEE003-557, 860 to 861, 970 (note different sampling years!) pertain to the initial respective sample numbers 1/260/767, all derived from the same layer 1800 of unit (section) 19 of the locality BEE.

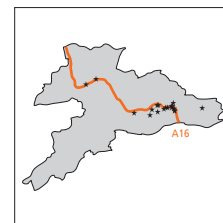
Abbreviations: D = diameter, H = height, L = length, W = Width

2 Fiches

Charophyta

CHAROPHYTA

diverse taxa



Taxonomy

Phylum	Order	Family	Genus	Species
Charophyta	Charales	various	various	various

Determination (name/date): Pierre-Olivier Mojon/11.04.2016

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
various	–	Oligocene-Miocene

Occurrences (localities)

Name	Coordinates CH
Bassecourt - Longues Royes (BAS-LGR)	584 600/242 870
Corban - Chaudron (COB-CHD)	602 890/244 310
Courfaivre - Epenattes (CFV-EPN)	588 890/242 350
Courrendlin - Birse (CRD-BIR)	594 765/244 510
Courrendlin - Pécas (CRD-PCA)	595 690/243 390
Courrendlin - Poillat (CRD-POI)	594 650/244 600
Courrendlin - Pré Chevalier (CRD-PRC)	594 700/243 560
Courrendlin - Solé (CRD-SOL)	595 700/243 560
Courrendlin - Vieille Église (CRD-VEG)	595 395/244 270
Courroux - Centre (CRX-CTR)	595 185/245 585
Courtételle - Courtemelon (CTT-CLM)	591 200/245 025
Courtételle - Métairie de Chaux (CTT-MCX)	589 410/243 820
Courtételle - Rintche (CTT-RIN)	590 800/245 000
Courtételle - Verger (CTT-VRG)	590 960/243 140
Delémont - Beuchille (DEL-BEU)	593 125/244 580
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Porrentruy - Étang (POR-ETA)	571 474/251 036
Porrentruy - Roche de Mars (POR-RMA)	574 350/252 025
Rossemaison - Clos Leuchu (ROS-CLU)	592 630/243 770

Samples L = Locality Y = sampling year N = cell number U = Unit La = Layer

L	Y	N	U	La	Taxa (number)
BEE	2002	56	2	7	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. praelangeri-major</i>
BEE	2003	603	13	1	<i>Chara minutissima</i>
BEE	2003	779	8	100	<i>Rhabdochara gr. stockmansi-major</i>
BEU	2001	345	20	200	cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
BEU	2001	348	20	700	cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
BEU	2001	596	20		cf. <i>Gyrogona medicaginula</i>
BEU	2001	609	20	100	<i>Nitellopsis (Tectochara) gr. meriani</i>
BEU	2001	1066	20		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
BEU	2002	45	11	8	cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
BIR	2004	40	4	3	<i>Rhabdochara gr. stockmansi-major</i>
CHD	2007	79	1	6	<i>Nitellopsis (Tectochara) gr. meriani</i>
CLM	2012	31	3		<i>Rhabdochara gr. stockmansi-major</i> , <i>Rhabdochara gr. praelangeri-major</i>
CLM	2012	33	3		<i>Rhabdochara gr. praelangeri-major</i>
CLM	2012	35	1		<i>Rhabdochara gr. stockmansi-major</i>
CLM	2012	36	1		<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. stockmansi-major</i> , <i>Rhabdochara gr. praelangeri-major</i>
CLU	2007	192	1	8	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. praelangeri-major</i>
CLU	2007	193	1	8	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Sphaerochara gr. hirmeri</i>
CLU	2007	194	1	8	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. praelangeri-major</i>
CLU	2007	195	1	9	cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
CTR	2006	77	1		<i>Sphaerochara gr. hirmeri</i> , <i>Chara minutissima</i>
EPN	2007	98	1	1	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. stockmansi-major</i>
EPN	2007	99	1	8	<i>Nitellopsis (Tectochara) gr. meriani</i>
EPN	2007	100	1	8	<i>Nitellopsis (Tectochara) gr. meriani</i>
EPN	2007	101	1	8	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Sphaerochara gr. hirmeri</i>
EPN	2007	102	1	8	<i>Nitellopsis (Tectochara) gr. meriani</i>
EPN	2007	103	1	8	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. stockmansi-major</i> , <i>Chara praemicrocera</i>
ETA	2004	148	3	1	<i>Chara minutissima</i>
ETA	2004	156	3	6	<i>Sphaerochara gr. hirmeri</i>
HCR	2004	22	1	1	<i>Chara gr. molassica-notata</i>
HCR	2004	31	1	2	<i>Chara gr. molassica-notata</i>
HCR	2004	43	1	4	<i>Chara gr. molassica-notata</i> , cf. <i>Lychnothamnus</i> sp.
LCT	2003	7	1	1	<i>Nitellopsis (Tectochara) gr. meriani</i>
LCT	2003	13	1	1	cf. <i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. praelangeri-major</i>
LCT	2003	34	1	1	cf. <i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Sphaerochara gr. hirmeri</i>
LGR	2007	81	1	7	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. praelangeri-major</i> , <i>Sphaerochara gr. hirmeri</i> , <i>Chara minutissima</i>
LGR	2007	82	1	7	cf. <i>Rhabdochara gr. stockmansi-major</i> , <i>Sphaerochara gr. hirmeri</i> , <i>Chara minutissima</i>
LGR	2007	83	1	7	cf. <i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Sphaerochara gr. hirmeri</i>
LGR	2007	84	1	8	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. stockmansi-major</i> , <i>Sphaerochara gr. hirmeri</i>
LGR	2007	85	1	8	<i>Sphaerochara gr. hirmeri</i>
LGR	2007	86	1	8	<i>Nitellopsis (Tectochara) gr. meriani</i>
LGR	2007	88	1	8	<i>Nitellopsis (Tectochara) gr. meriani</i>
LGR	2007	90	1	8	cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
LGR	2007	93	1	9	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. praelangeri-major</i> , <i>Sphaerochara gr. hirmeri</i>
LGR	2007	94	1	9	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. praelangeri-major</i> , <i>Sphaerochara gr. hirmeri</i> , <i>Chara minutissima</i>
LGR	2007	95	1	10	<i>Rhabdochara gr. praelangeri-major</i>
MCX	2008	16	1	3	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rantzieniella nitida</i> , <i>Stephanochara gr. praerberdotensis</i>
MCX	2008	20	1	3	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rantzieniella nitida</i> , <i>Stephanochara gr. praerberdotensis</i>
MCX	2008	28	1	3	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rantzieniella nitida</i> , <i>Stephanochara gr. praerberdotensis</i>
MCX	2008	33	1	3	<i>Chara gr. molassica-notata</i> , <i>Sphaerochara gr. hirmeri</i>
MCX	2008	34	1	3	<i>Rantzieniella nitida</i> , <i>Stephanochara gr. praerberdotensis</i>
MCX	2008	59	1	3	<i>Chara gr. molassica-notata</i>
MCX	2008	63	1	3	<i>Nitellopsis (Tectochara) gr. meriani</i>
MCX	2008	84	1	1	<i>Chara gr. molassica-notata</i>

Samples L = Locality Y = sampling year N = cell number U = Unit La = Layer					
L	Y	N	U	La	Taxa (number)
MCX	2008	95	1	1	<i>Stephanochara gr. praeberdotensis</i>
MCX	2008	109	1	1	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Stephanochara gr. praeberdotensis</i>
MCX	2008	115	1	1	cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
MCX	2008	121	1	2	<i>Nitellopsis (Tectochara) gr. meriani</i>
RIN	2009	21	12		cf. <i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. praelangeri-major</i>
RMA	2006	12	1		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
TIL	2004	48	1	2700	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rantzieniella nitida</i> , <i>Stephanochara gr. praeberdotensis</i>
POI	2005	75	15	200	<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2005	82	16	260	<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2005	92	17	320	<i>Sphaerochara sp.</i>
POI	2005	99	19	200	<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2005	103	19	310	<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2005	143	13	220	<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	527	69		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	710	98		<i>Gyrogona medicaginula</i>
POI	2007	716	98		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	742	68		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	753	47		cf. <i>Rhabdochara gr. stockmansi-major</i>
POI	2007	769	47		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	825	117		cf. <i>Gyrogona medicaginula</i>
POI	2007	969	57		<i>Gyrogona medicaginula</i>
POI	2007	1029	57		<i>Gyrogona caelata</i>
POI	2007	1090	98		cf. <i>Gyrogona medicaginula</i> , cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	1165	101		cf. <i>Gyrogona medicaginula</i>
POI	2007	1170	46		<i>Rhabdochara gr. stockmansi-major</i>
POI	2007	1324	98		cf. <i>Gyrogona medicaginula</i>
POI	2007	1348	57		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	1357	48		<i>Gyrogona caelata</i>
POI	2007	1361	98		<i>Gyrogona medicaginula</i>
POI	2007	1365	98		cf. <i>Gyrogona medicaginula</i> , <i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. stockmansi-major</i>
POI	2007	1384	57		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	1660	47		<i>Gyrogona medicaginula</i>
POI	2007	1668	58		cf. <i>Gyrogona medicaginula</i> , cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	1706	47		cf. <i>Nitellopsis (Tectochara) gr. meriani</i> , cf. <i>Gyrogona medicaginula</i>
POI	2007	1730	47		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	1751	47		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	1817	89		cf. <i>Nitellopsis (Tectochara) gr. meriani</i> , cf. <i>Gyrogona medicaginula</i>
POI	2007	1874	47		cf. <i>Gyrogona medicaginula</i>
POI	2007	1877	59		cf. <i>Gyrogona medicaginula</i>
POI	2007	1892	69		cf. <i>Gyrogona medicaginula</i>
POI	2007	1895	69		<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Gyrogona medicaginula</i>
POI	2007	1911	57		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	1929	68		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	1953	57		<i>Psilochara sp.</i> , <i>Gyrogona wrighti</i>
POI	2007	1962	57		<i>Rhabdochara gr. stockmansi-major</i>
POI	2007	1976	118		<i>Gyrogona medicaginula</i> , cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	1983	120		<i>Gyrogona medicaginula</i> , <i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. stockmansi-major</i>
POI	2007	1994	56		<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. stockmansi-major</i>
POI	2007	2004	67	0-50	<i>Gyrogona medicaginula</i>
POI	2007	2014	67	0-50	<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2039	55		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2067	25		<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. stockmansi-major</i>
POI	2007	2110	45		<i>Gyrogona medicaginula</i>
POI	2007	2149	59		cf. <i>Gyrogona medicaginula</i> , <i>Rhabdochara gr. stockmansi-major</i>
POI	2007	2154	65		<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Gyrogona wrighti</i>
POI	2007	2175	47		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2194	36		<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Gyrogona medicaginula</i>
POI	2007	2200	36		cf. <i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. stockmansi-major</i>
POI	2007	2209	47		cf. <i>Gyrogona medicaginula</i>
POI	2007	2219	57		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2230	57		cf. <i>Rhabdochara gr. stockmansi-major</i>

Samples L = Locality Y = sampling year N = cell number U = Unit La = Layer					
L	Y	N	U	La	Taxa (number)
POI	2007	2240	47		<i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	2293	37		<i>Nitellopsis (Tectochara) gr. meriani, Gyrogona medicaginula</i>
POI	2007	2317	46		<i>Gyrogona medicaginula</i>
POI	2007	2333	90		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2340	47		cf. <i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	2358	118		<i>Nitellopsis (Tectochara) gr. meriani, Gyrogona medicaginula</i>
POI	2007	2379	47		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2391	47		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2405	47		cf. <i>Nitellopsis (Tectochara) gr. meriani, Gyrogona caelata</i>
POI	2007	2430	57		<i>Nitellopsis (Tectochara) gr. meriani, Gyrogona medicaginula</i>
POI	2007	2446	57		<i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major, Gyrogona wrighti</i>
POI	2007	2465	117		cf. <i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	2478	65		<i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	2492	58		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2503	57		<i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	2517	57		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2534	47		<i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. praelangeri-major, Gyrogona wrighti</i>
POI	2007	2548	47		cf. <i>Nitellopsis (Tectochara) gr. meriani, Gyrogona medicaginula</i>
POI	2007	2615	47		<i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2626	69		cf. <i>Nitellopsis (Tectochara) gr. meriani, Gyrogona medicaginula</i>
POI	2007	2630	47		<i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. praelangeri-major</i>
POI	2007	2660	47		<i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major, Rhabdochara gr. praelangeri-major</i>
POI	2007	2670	45		<i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	2699	21		<i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. praelangeri-major</i>
POI	2007	2701	25		<i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	2707	47		cf. <i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	2716	65		<i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. praelangeri-major</i>
POI	2007	2727	47		<i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. praelangeri-major</i>
POI	2007	2745	58		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2765	104		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2775	47		<i>Gyrogona medicaginula, Rhabdochara gr. praelangeri-major</i>
POI	2007	2787	47		<i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	2799	59		<i>Gyrogona medicaginula</i>
POI	2007	2808	97		cf. <i>Nitellopsis (Tectochara) gr. meriani, Gyrogona medicaginula</i>
POI	2007	2817	117		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2835	47		<i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	2842	47		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2864	47		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2933	47		cf. <i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	2940	47		<i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	2942	47		<i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	2946	57		cf. <i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	3023	47		<i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	3071	47		cf. <i>Nitellopsis (Tectochara) gr. meriani, Gyrogona medicaginula</i>
POI	2007	3074	47		<i>Gyrogona medicaginula</i>
POI	2007	3080	47		cf. <i>Nitellopsis (Tectochara) gr. meriani, Gyrogona medicaginula</i>
POI	2007	3084	47		<i>Rhabdochara gr. stockmansi-major</i>
POI	2007	3096	47		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	3099	55		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	3110	21		cf. <i>Gyrogona medicaginula</i>
POI	2007	3116	58		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	3117	68		cf. <i>Nitellopsis (Tectochara) gr. meriani, Gyrogona medicaginula</i>
POI	2007	3121	57		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2007	3228	100		<i>Rhabdochara gr. stockmansi-major</i>
POI	2007	3243	45		<i>Rhabdochara gr. stockmansi-major</i>
POI	2007	3259	45		<i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2007	3260	21		<i>Nitellopsis (Tectochara) gr. meriani, Gyrogona medicaginula</i>
POI	2010	160	201		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2010	165	192		cf. <i>Nitellopsis (Tectochara) gr. meriani, Gyrogona medicaginula</i>
POI	2010	206	191		<i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2010	216	191		<i>Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2010	264	261		<i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2010	278	192		<i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2010	285	261		<i>Gyrogona medicaginula, Nitellopsis (Tectochara) gr. meriani, Rhabdochara gr. stockmansi-major</i>
POI	2010	300	142		<i>Nitellopsis (Tectochara) gr. meriani, Gyrogona medicaginula</i>

Samples L = Locality Y = sampling year N = cell number U = Unit La = Layer					
L	Y	N	U	La	Taxa (number)
POI	2010	310	142		cf. <i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Gyrogona medicaginula</i>
POI	2010	318	142		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2010	325	142		<i>Gyrogona medicaginula</i>
POI	2010	334	260		cf. <i>Nitellopsis (Tectochara) gr. meriani</i> , cf. <i>Rhabdochara gr. stockmansi-major</i>
POI	2010	377	242		<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Gyrogona medicaginula</i>
POI	2010	418	242		cf. <i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. stockmansi-major</i>
POI	2010	424	192		<i>Gyrogona medicaginula</i> , <i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2010	448	260		<i>Gyrogona medicaginula</i> , cf. <i>Rhabdochara gr. stockmansi-major</i>
POI	2010	453	260		<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Gyrogona medicaginula</i>
POI	2010	460	189		<i>Nitellopsis (Tectochara) gr. meriani</i>
POI	2010	465	201		<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. stockmansi-major</i>
POI	2010	482	242		<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. stockmansi-major</i>
POI	2010	601	201		<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. stockmansi-major</i>
PCA	2008	284	123	500	<i>Nitellopsis (Tectochara) gr. meriani</i>
PCA	2008	382	115	1200	<i>Rhabdochara gr. praelangeri-major</i>
PCA	2008	407	109	600	cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
PCA	2008	483	138	500	<i>Nitellopsis (Tectochara) gr. meriani</i>
PCA	2008	504	140	1100	<i>Gyrogona medicaginula</i> , cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
PCA	2008	528	124	600	<i>Nitellopsis (Tectochara) gr. meriani</i>
PCA	2008	541	124	600	<i>Nitellopsis (Tectochara) gr. meriani</i>
PCA	2008	565	170	1300	cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
PCA	2008	597	119	500	cf. <i>Rhabdochara gr. stockmansi-major</i> , <i>Nitellopsis (Tectochara) gr. meriani</i>
PRC	2004	222	14	600	<i>Gyrogona wrighti</i> , <i>Rhabdochara gr. praelangeri-major</i>
PRC	2004	246	14	600	<i>Gyrogona wrighti</i> , <i>Nitellopsis (Tectochara) gr. meriani</i>
PRC	2004	255	2	300	<i>Gyrogona wrighti</i> , <i>Nitellopsis (Tectochara) gr. meriani</i>
PRC	2004	256	8		<i>Gyrogona medicaginula</i>
PRC	2004	281	13	700	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Gyrogona medicaginula</i>
PRC	2004	287	13	700	<i>Nitellopsis (Tectochara) gr. meriani</i>
PRC	2004	297	13	700	cf. <i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Gyrogona caelata</i>
PRC	2004	300	13	700	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Gyrogona medicaginula</i>
PRC	2004	307	13	700	<i>Gyrogona wrighti</i> , <i>Gyrogona medicaginula</i>
VRG	2007	241	2	15	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Rhabdochara gr. praelangeri-major</i>
VRG	2007	243	2	21	<i>Rhabdochara gr. praelangeri-major</i>
VRG	2007	244	2	25	<i>Sphaerochara gr. hirmeri</i>
VRN	2004	3	1		<i>Stephanochara gr. ungeri</i>
VRN	2004	4	1		<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Stephanochara gr. ungeri</i>
PRA	2005	12	5	200	<i>Rantzieniella nitida</i> , <i>Stephanochara gr. praeberdotensis</i>
PRA	2005	14	6	100	<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Sphaerochara gr. hirmeri</i>
VEG	2006	252	25		<i>Rhabdochara gr. stockmansi-major</i> , <i>Rhabdochara gr. praelangeri-major</i>
VEG	2006	405	36		<i>Nitellopsis (Tectochara) gr. meriani</i>
VEG	2006	475	33		<i>Rhabdochara gr. stockmansi-major</i> , cf. <i>Gyrogona medicaginula</i>
VEG	2006	583	39		<i>Nitellopsis (Tectochara) gr. meriani</i>
VEG	2006	646	18		<i>Nitellopsis (Tectochara) gr. meriani</i> , cf. <i>Gyrogona medicaginula</i>
VEG	2006	750	35		<i>Rhabdochara gr. praelangeri-major</i> , cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
VEG	2006	826	35		<i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Gyrogona medicaginula</i>
SOL	2004	70	2	700	<i>Chara minutissima</i> , <i>Sphaerochara gr. hirmeri</i>
SOL	2005	127	11	200	<i>Rhabdochara gr. stockmansi-major</i>
SOL	2006	89	16		<i>Nitellopsis (Tectochara) gr. meriani</i>
SOL	2006	139	17		cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
SOL	2006	160	21	700	<i>Nitellopsis (Tectochara) gr. meriani</i>
SOL	2006	171	21	700	cf. <i>Nitellopsis (Tectochara) gr. meriani</i> , <i>Sphaerochara gr. hirmeri</i>
SOL	2008	10	27	700	<i>Nitellopsis (Tectochara) gr. meriani</i>
SOL	2008	23	27	750	<i>Nitellopsis (Tectochara) gr. meriani</i>
SOL	2008	44	27	700	<i>Sphaerochara gr. hirmeri</i>
SOL	2008	59	27	750	cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
SOL	2008	76	27	750	cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
SOL	2008	99	27	700	cf. <i>Nitellopsis (Tectochara) gr. meriani</i>
SOL	2008	120	27	750	cf. <i>Nitellopsis (Tectochara) gr. meriani</i>

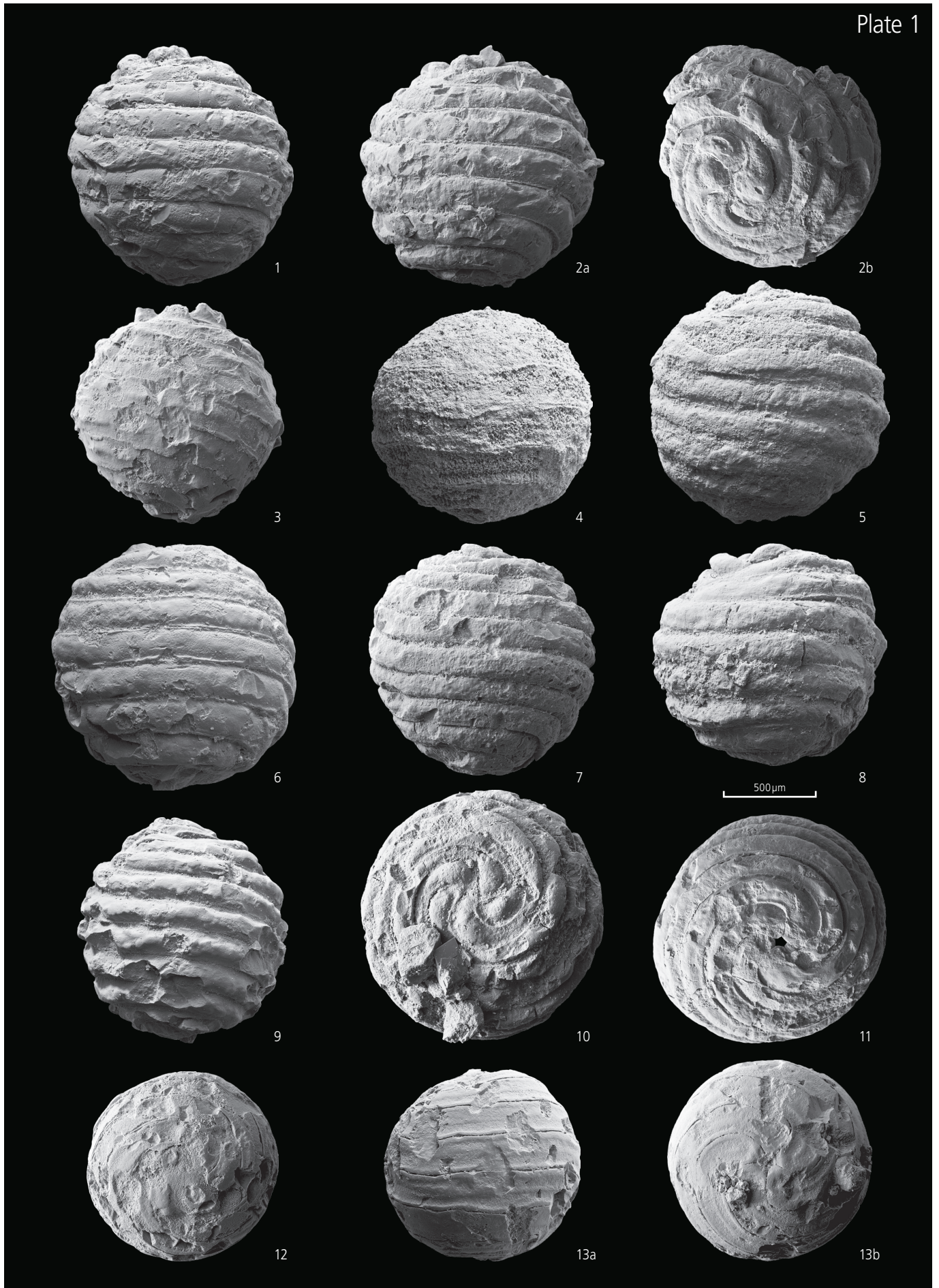
Charophyta

Plate 1

Gyrogona gr. *wrighti* (Salter ex Reid & Groves, 1921)
Pia, 1927 -*medicaginula* Lamarck, 1804

1. POI010-645
Late Rupelian, Courrendlin-Poillat
D 1203 × H 1283 μm
lateral view (image POI010_482.psd)
2. POI010-642
Late Rupelian, Courrendlin-Poillat
D 1255 × H 1291 μm
a) lateral view (image POI010_377.psd)
b) apical view (image POI010_377B.psd)
3. POI010-638
Late Rupelian, Courrendlin-Poillat
D 1137 × H 1176 μm
lateral view (image POI010_285.psd)
4. POI007-3343
Late Rupelian, Courrendlin-Poillat
D 1178 × H 1156 μm
lateral view (image POI007_1953b.psd)
5. POI007-3350
Late Rupelian, Courrendlin-Poillat
D 1277 × H 1294 μm
lateral view (image POI007_2775.psd)
6. POI007-3345
Late Rupelian, Courrendlin-Poillat
D 1305 × H 1319 μm
lateral view (image POI007_2293.psd)
7. POI007-3340
Late Rupelian, Courrendlin-Poillat
D 1209 × H 1236 μm
lateral view (image POI007_969.psd)
8. POI007-3352
Late Rupelian, Courrendlin-Poillat
D 1250 × H 1187 μm
lateral view (image POI007_2942.psd)
9. POI007-3347
Late Rupelian, Courrendlin-Poillat
D 1121 × H 1200 μm
lateral view (image POI007_2430.psd)
10. POI007-3351
Late Rupelian, Courrendlin-Poillat
D 1346 μm
apical view (image POI007_2808.psd)
11. POI007-3348
Late Rupelian, Courrendlin-Poillat
D 1242 μm
basal view (image POI007_2503.psd)
12. PRC004-335
Late Rupelian, Courrendlin-Pré Chevalier
D 1019 × H 1011 μm
lateral view (image PRC004_255.psd)
13. PRC004-331
Late Rupelian, Courrendlin-Pré Chevalier
D 1091 × H 1025 μm
a) lateral view (image PRC004_246.psd)
b) basal view (image PRC004_246B.psd)

Plate 1



Charophyta

Plate 2

Psilochara cf. conspicua casselensis Feist & Riveline ex Riveline, 1986

1. POI007-3344
Late Rupelian, Courrendlin-Poillat
D 502 × H 799 µm
lateral view (image POI007_1953C.psd)

Gyrogona gr. wrighti (Salter ex Reid & Groves, 1921); Pia, 1927 -*medicaginula* Lamarck, 1804

2. POI010-642
Late Rupelian, Courrendlin-Poillat
D 857 × H 850 µm
lateral view (image POI010_377.psd)

Gyrogona caelata (Reid & Groves, 1921); Grambast, 1956

3. PRC004-336
Late Rupelian, Courrendlin-Pré Chevalier
D 499 × H 507 µm
lateral view (image PRC004_297.psd)

4. POI007-3341
Late Rupelian, Courrendlin-Poillat
D 501 × H 514 µm
lateral view (image POI007_1357.psd)

Nitellopsis (Tectochara) gr. meriani (Braun ex Unger, 1850); Grambast & Soulié-Märsche 1972

5. MCX008-132
Aquitanian, Courtételle-Métairie de Chaux
D 612 × H 700 µm
lateral view (image MCX8_16D.psd)

6. MCX008-131
Aquitanian, Courtételle-Métairie de Chaux
D 596 µm
apical view (image MCX8_16D.psd)

Chara minutissima (Mädler, 1955); Schwarz, 1984

7. LGR007-163
middle Miocene, Bassecourt-Longues Royes
D 144 × H 181 µm
lateral view (image LGR007_81C.psd)

8. LGR007-161
middle Miocene, Bassecourt-Longues Royes
D 158 × H 195 µm
lateral view (image LGR007_81A.psd)

9. LGR007-162
middle Miocene, Bassecourt-Longues Royes
D 150 × H 171 µm
lateral view (image LGR007_81B.psd)

Sphaerochara gr. hirmeri (Rasky, 1945); Mädler, 1952

10. PRA005-16
Miocene, Marin
D 341 × H 377 µm
lateral view (image PRA5_14H.psd)

11. PRA005-17
Miocene, Marin
D 326 µm
apical view (image PRA5_14G.psd)

Rantzieniella nitida Grambast, 1962

12. MCX008-129
Aquitanian, Courtételle-Métairie de Chaux
D 380 × H 523 µm
lateral view (image MCX8_16A.psd)

13. MCX008-130
Aquitanian, Courtételle-Métairie de Chaux
D 380 µm
apical view (image MCX8_16B.psd)

Stephanochara gr. ungeri Feist-Castel, 1977

14. VRN004-7
Late Chattian, Bevaix-Les Vernes
D 415 × H 550 µm
lateral view (image VRN4_4O.psd)

15. VRN004-8
Late Chattian, Bevaix-Les Vernes
D 404 µm
apical view (image VRN4_4P.psd)

Rhabdochara gr. stockmansi Grambast, 1957 -*major* Grambast & Paul, 1965

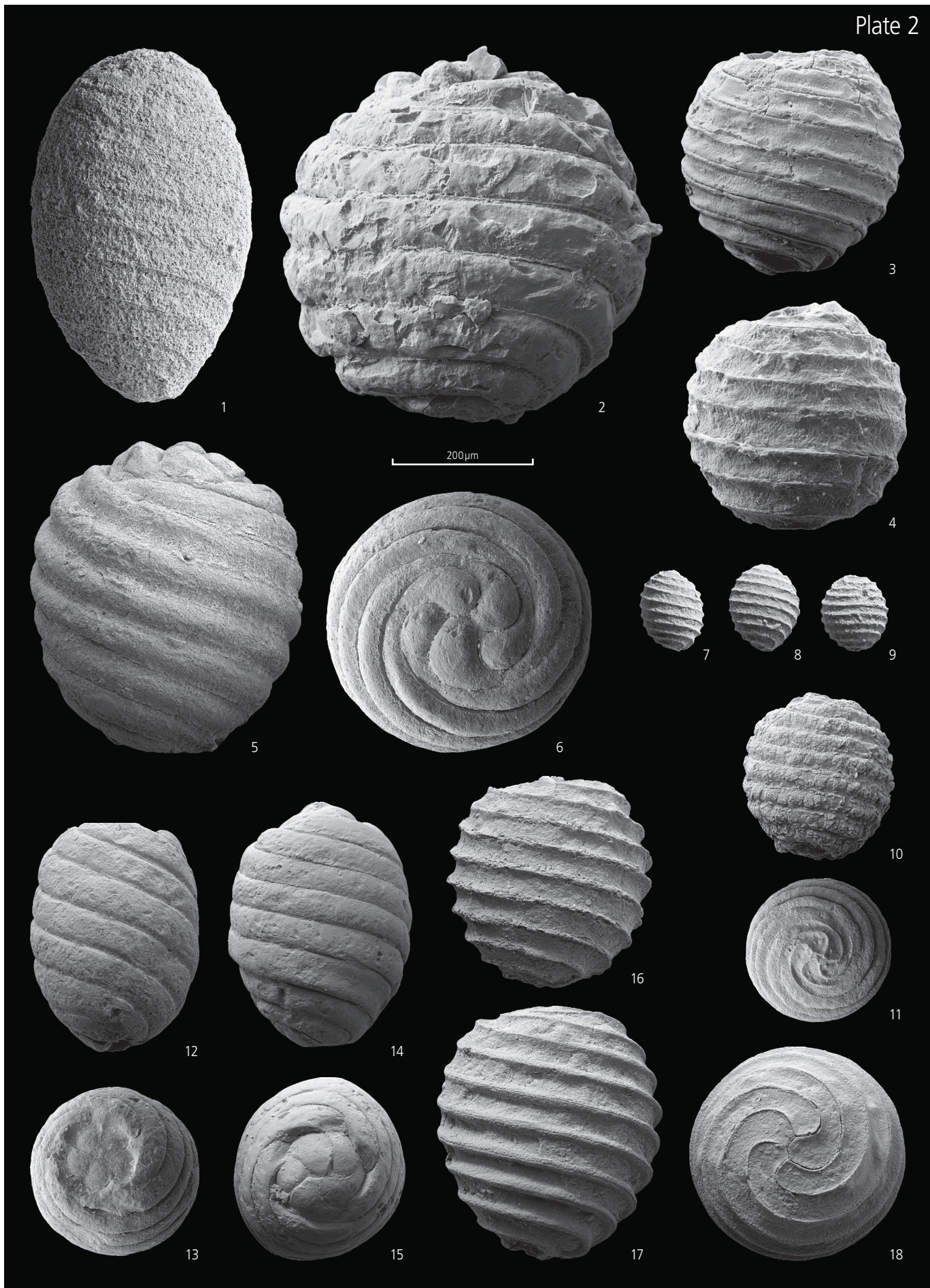
16. CLM012-56
Late Rupelian, Courtételle-Courtemelon
D 462 × H 474 µm
lateral view (image CLM01236L.psd)

Rhabdochara gr. praelangeri Castel, 1967 -*major* Grambast & Paul, 1965

17. CLM012-57
Late Rupelian, Courtételle-Courtemelon
D 506 × H 572 µm
lateral view (image CLM01236M.psd)

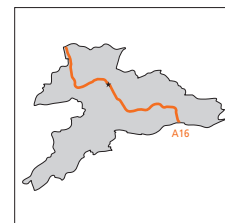
18. CLM012-58
Late Rupelian, Courtételle-Courtemelon
D 485 µm
apical view (image CLM01236N.psd)

Plate 2



Foraminifera

ASTRORHIZIDA
Ammodiscus sp.



Taxonomy

Phylum	Order	Family	Genus	Species
Foraminifera	Astrorhizida	Ammodiscidae	<i>Ammodiscus</i>	–
Determination (name/date): Claudius Pirkenseer/17.03.2016				

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	1	-25.0 m	1	RNA987-5, 59

Material

1 specimen



Foraminifera

Plate 3

Ammodiscus sp.

1. RNA987-59

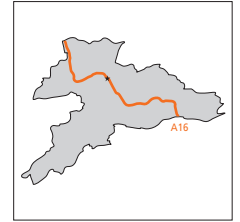
Late Rupelian, Cornol-Route Nationale

max. D 401 × H 57 μm

a) umbilical view (image Ammodiscus 69_01SID.psd)

b) apertural view (image Ammodiscus 69_01SID2.psd)

LITUOLIDA

Spiroplectinella deperdita (Andreae, 1884)**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Lituolida	Spiroplectamminidae	<i>Spiroplectinella</i>	<i>deperdita</i>

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/07.12.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol-Route Nationale (COR-RNA)	577 713/250 616

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	1	-37.7 m	53	RNA987-29, 98-99

Material

2 specimens

Synonymy

Genus *Spiroplectinella* Kisel'man, 1972

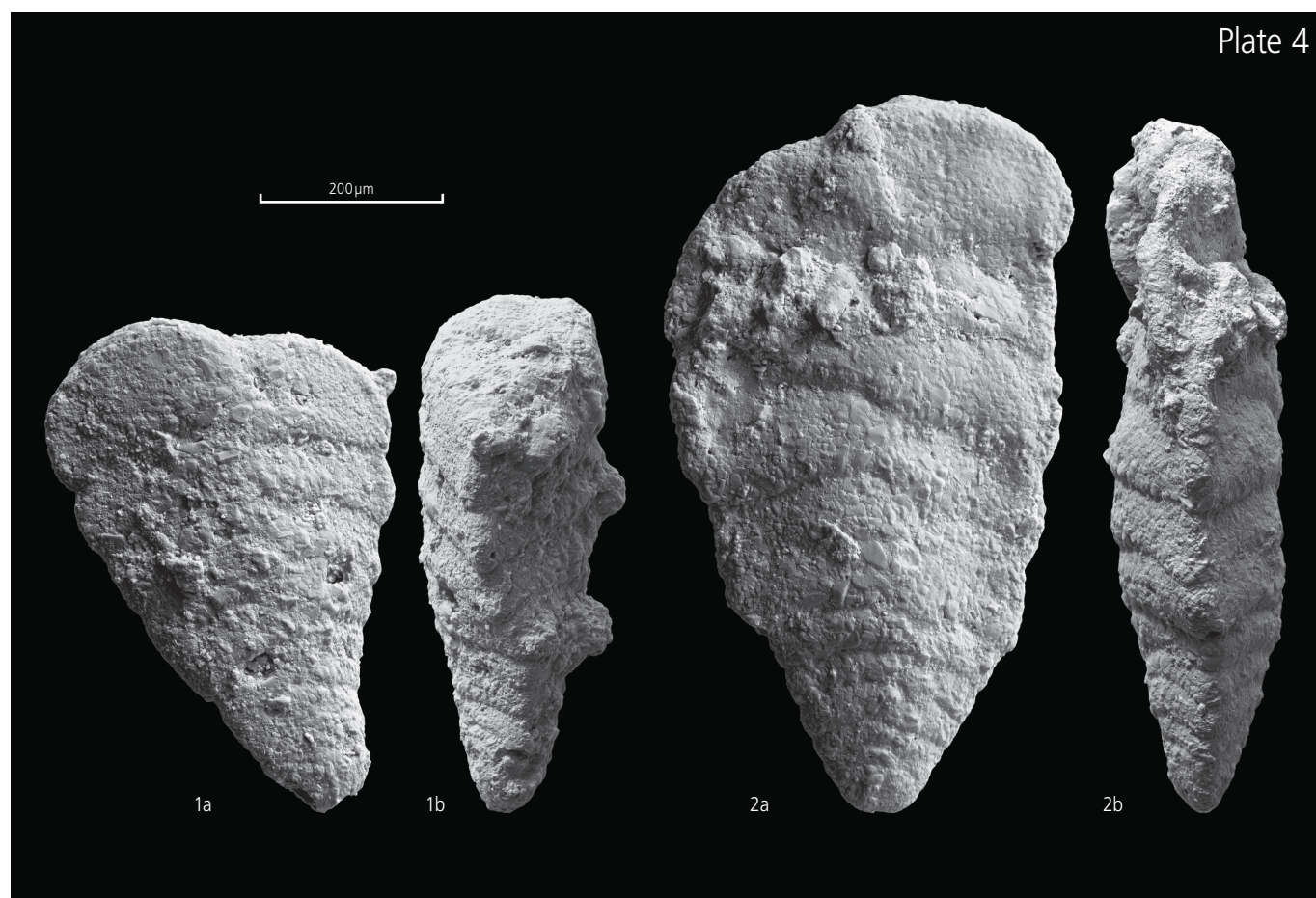
Type species: *Spiroplecta wightii* Silvestri, 1903, 1913

Spiroplectinella deperdita (d'Orbigny, 1846)

*	1846	<i>Textularia deperdita</i> – d'Orbigny, p. 244, pl. 14, fig. 23-35
partim	1958	<i>Spiroplectammina carinata</i> – Batjes, p. 98, pl. 1, fig. 3, [non 2]
	1974	<i>Spiroplectammina deperdita</i> – Doehl & Sonne, p. 15, pl. 1, fig. 1
	1987	<i>Textularia deperdita</i> – Reiser, p. 59, pl. 2, fig. 4-5
	1994	<i>Spiroplectinella deperdita</i> – Grimm, pl. 1, fig. 11, pl. 2, fig. 4
	1998	<i>Semivulvulina deperdita</i> – Cicha et al., p. 126, pl. 5, fig. 11
	2003	<i>Spiroplectinella deperdita</i> – Becker, pl. 8, fig. f
	2004	<i>Spirorutilus deperditus</i> – Schudack & Nuglisch, p. 74, pl. 6, fig. 103-104
	2006	<i>Spirorutilus deperditus</i> – De Man, p. 260, pl. 1, fig. 11-13
	2010	<i>Spiroplectinella carinata</i> – Pirkenseer et al., pl. 2, fig. 12
	2011	<i>Semivulvulina deperdita</i> – Havran, pl. 8, fig. 1

Remarks

Batjes (1958) mentions the occurrence of transitional morphs leading to a *Spiroplectinella carinata* habitus. In general *Spiroplectinella deperdita* is much thicker (e.g. specimen in Doehl & Sonne 1974) in peripheral view, smaller on average with nearly horizontal sutures and lacks carinae. While initially both species show a fast increase in width (in microspheric forms), mature *Spiroplectinella carinata* specimens develop nearly parallel carinae (see specimens figured in Pirkenseer et al. 2010). We follow Grimm (1993, 1994) in the generic assignment of the species (presence of pseudopores, rhombical cross section, planispiral initial whorl).



Foraminifera

Plate 4

Spiroplectinella deperdita (d'Orbigny, 1846)

1. RNA987-98

Late Rupelian, Cornol-Route Nationale

L 547 × W 386 μm

a) apical view (image Spiroplectammina 68_47SID.psd)

b) umbilical view (image Spiroplectammina 68_47SI2.psd)

2. RNA987-99

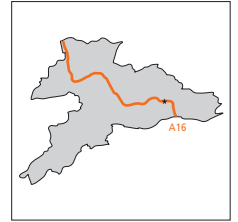
Late Rupelian, Cornol-Route Nationale

L 778 × W 447 μm

a) apical view (image Spiroplectammina 68_48SID.psd)

b) umbilical view (image Spiroplectammina 68_48SI2.psd)

LITUOLIDA

? *Trochammina* sp.**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Lituolida	Trochamminidae	? <i>Trochammina</i>	–

Determination (name/date): Claudius Pirkenseer/17.12.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

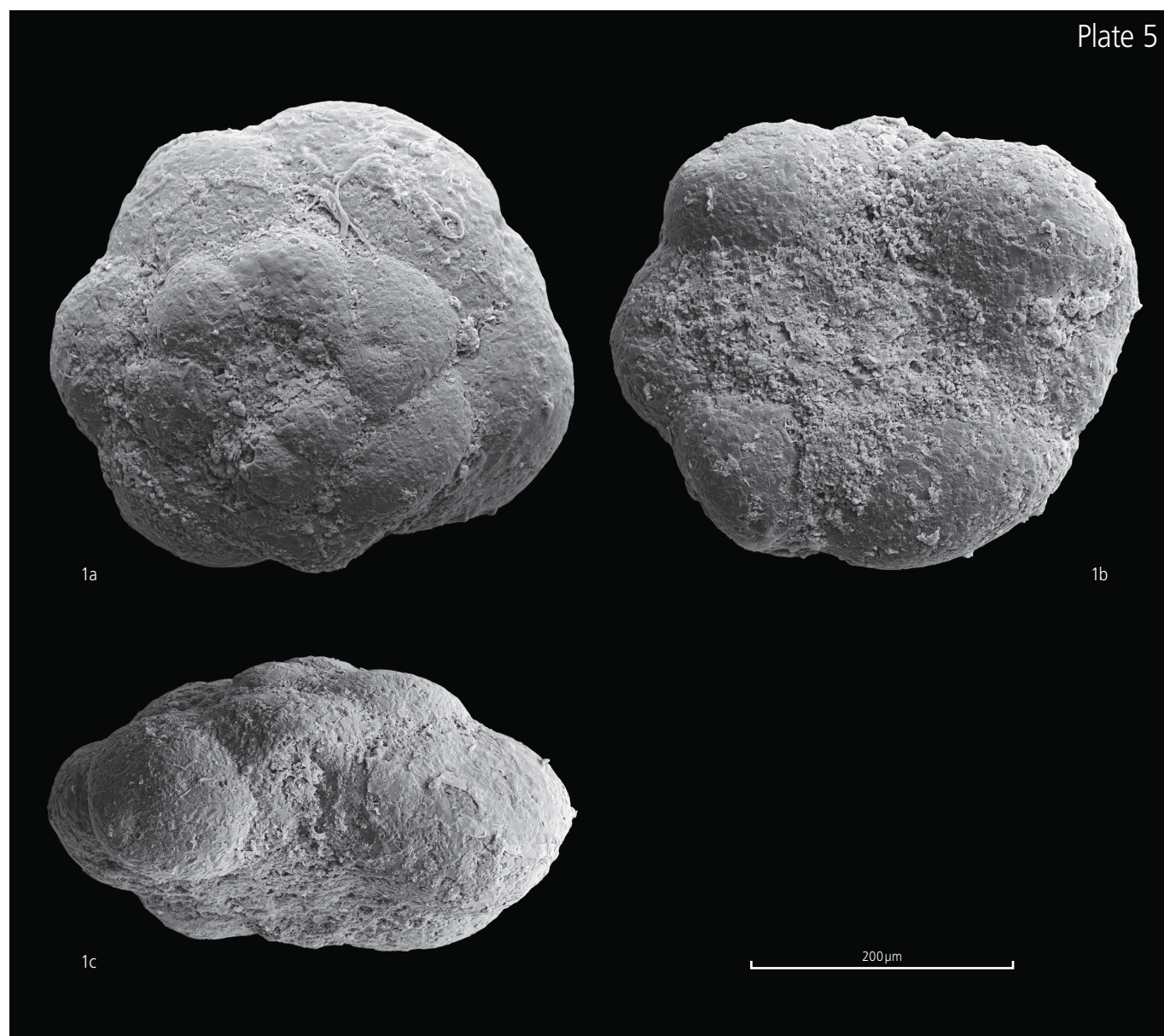
Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
DEL-BEE	9	201	213	BEE003-273, 949

Material

at least 6 specimens



Foraminifera

Plate 5

?*Trochammina* sp.

1. BEE003-949

Late Rupelian, Delémont - Beuchille Est

max. D 400 × H 185 μm

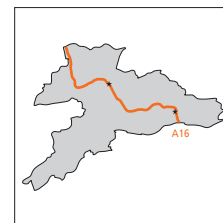
a) apical view (image TROC13A.psd)

b) umbilical view (image TROC13B.psd)

c) lateral view (image Troc13C.psd)

LITUOLIDA

? Trochamminidae indet.

**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Lituolida	? Trochamminidae	–	–

Determination (name/date): Claudius Pirkenseer/17.03.2016

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Courendlin - Hauts Rochets (CRD-HRT)	595 640/243 145

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	1	-25.0 m	1	RNA987-5, 60
CRD-HRT	15	-34.0 m	47	HRT988-21, 65-67

Material

11 specimens

Foraminifera

Plate 6

Trochamminidae indet.

1. RNA987-60

Late Rupelian, Cornol-Route Nationale

small specimen, max. D 399 × H 112 μm

a) apical view (image Trochammina 69_02UMB.psd)

b) lateral view (image Trochammina 69_02SID.psd)

2. HRT988-65

Late Rupelian, Courrendlin-Hauts Rochets

max. D 547 × H 157 μm

a) apical view (image Trochammina 68_76API.psd)

b) umbilical view (image Trochammina 68_76UMB.psd)

c) lateral view (image Trochammina 68_76SID.psd)

3. HRT988-67

Late Rupelian, Courrendlin-Hauts Rochets

max. D 476 μm

a) apical view (image Trochammina 68_78API.psd)

b) umbilical view (image Trochammina 68_78UMB.psd)

4. HRT988-66

Late Rupelian, Courrendlin-Hauts Rochets

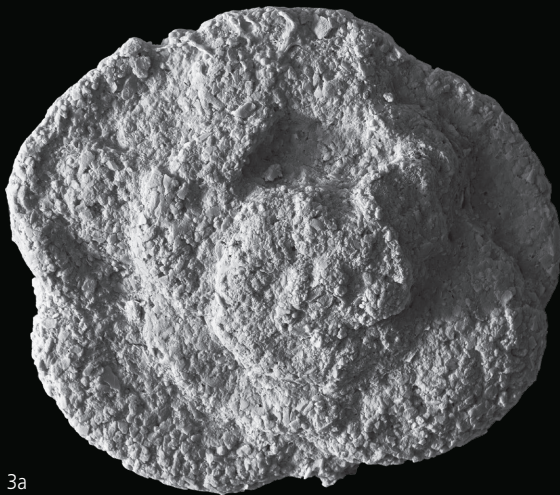
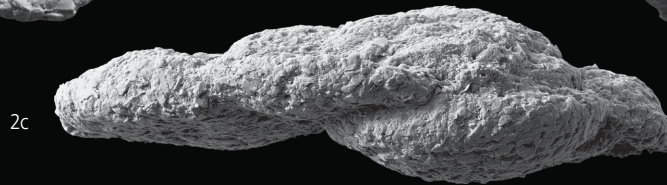
max. D 507 μm

a) apical view (image Trochammina 68_77API.psd)

b) umbilical view (image Trochammina 68_77UMB.psd)

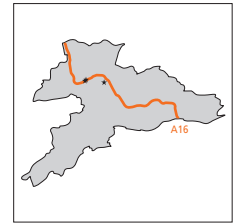


Plate 6



200 μ m

MILIOLIDA

Quinqueloculina seminula (Linnaeus, 1758)**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Miliolida	Hauerinidae	<i>Quinqueloculina</i>	<i>seminula</i>

Determination (name/date): Martina Pippèr/27.10.2015; Claudius Pirkenseer/06.12.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035
Porrentruy - Étang (POR-ETA)	571 474/251 036
Porrentruy - Oiselier (POR-OIS)	571 900/250 500

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
? CGN-CLJ	1	-6.0 m	3	CLJ007-42
POR-ETA	2	-5.0 m	5	ETA004-138
POR-ETA	2	-6.0 m	6	ETA004-93
POR-ETA	2	-7.0 m	7	ETA004-94
POR-ETA	2	-8.0 m	8	ETA004-95
POR-ETA	2	-13.0 m	13	ETA004-117
POR-ETA	3	-9.0 m	29	ETA004-166
POR-ETA	3	-10.0 m	30	ETA004-173
? POR-ETA	3	-11.0 m	31	ETA004-176
POR-ETA	3	-12.0 m	32	ETA004-178
? POR-ETA	3	-13.0 m	33	ETA004-181
POR-ETA	3	-15.0 m	35	ETA004-192, 250-251
? POR-ETA	3	-16.0 m	36	ETA004-198
? POR-ETA	3	-17.0 m	37	ETA004-201
? POR-ETA	3	-20.0 m	40	ETA004-215
POR-OIS	2	–	6	OIS000-8, 30-32

Material

at least 138 specimens, 16 specimens uncertain
potential specimens present in site Beuchille-Est (see Miliolidae spp.)

Synonymy

Genus *Quinqueloculina* d'Orbigny, 1826
Type species: *Serpula seminulum* Linnaeus, 1758
Quinqueloculina seminula (Linnaeus, 1758)

- * 1758 *Serpula seminulum* – Linnaeus, p. 786
- 1958 *Quinqueloculina seminula* – Batjes, p. 102, pl. 1, fig. 15
- 2004 *Quinqueloculina laevigata* – Gebhardt, p. 261, fig. 14/6-7
- 2005 *Quinqueloculina seminula* – Grimm et al., pl. 1, fig. 3
- 2006 *Quinqueloculina seminula* – De Man, p. 265, pl. 3, fig. 6
- 2010 *Quinqueloculina seminula* – Margreth, p. 101, pl. 7, fig. 8

Foraminifera

Plate 7

Quinqueloculina seminula (Linnaeus, 1758)

1. OIS000-30

Late Rupelian, Porrentruy - Oiselier

L 1415 × W 897 × T 563 μm

- a) lateral view (image Quinqueloculina 68_42SID.psd)
- b) peripheral view (image Quinqueloculina 68_42SI2.psd)
- c) top view (image Quinqueloculina 68_42TOP.psd)

2. OIS000-32

Late Rupelian, Porrentruy - Oiselier

L 1330 × W 736 × T 494 μm

- a) lateral view (image Quinqueloculina 68_44SID.psd)
- b) peripheral view (image Quinqueloculina 68_44SI2.psd)
- c) top view (image Quinqueloculina 68_44TOP.psd)

3. OIS000-31

Late Rupelian, Porrentruy - Oiselier

L 1388 × W 830 × T 545 μm

- a) lateral view (image Quinqueloculina 68_43SID.psd)
- b) peripheral view (image Quinqueloculina 68_43SI2.psd)
- c) top view (image Quinqueloculina 68_43TOP.psd)

4. ETA004-250

Late Rupelian, Porrentruy - Étang

L 1077 × W 659 × T 430 μm

- a) lateral view (image Quinqueloculina 68_40SID.psd)
- b) peripheral view (image Quinqueloculina 68_40SI2.psd)
- c) top view (image Quinqueloculina 68_40 TOP.psd)

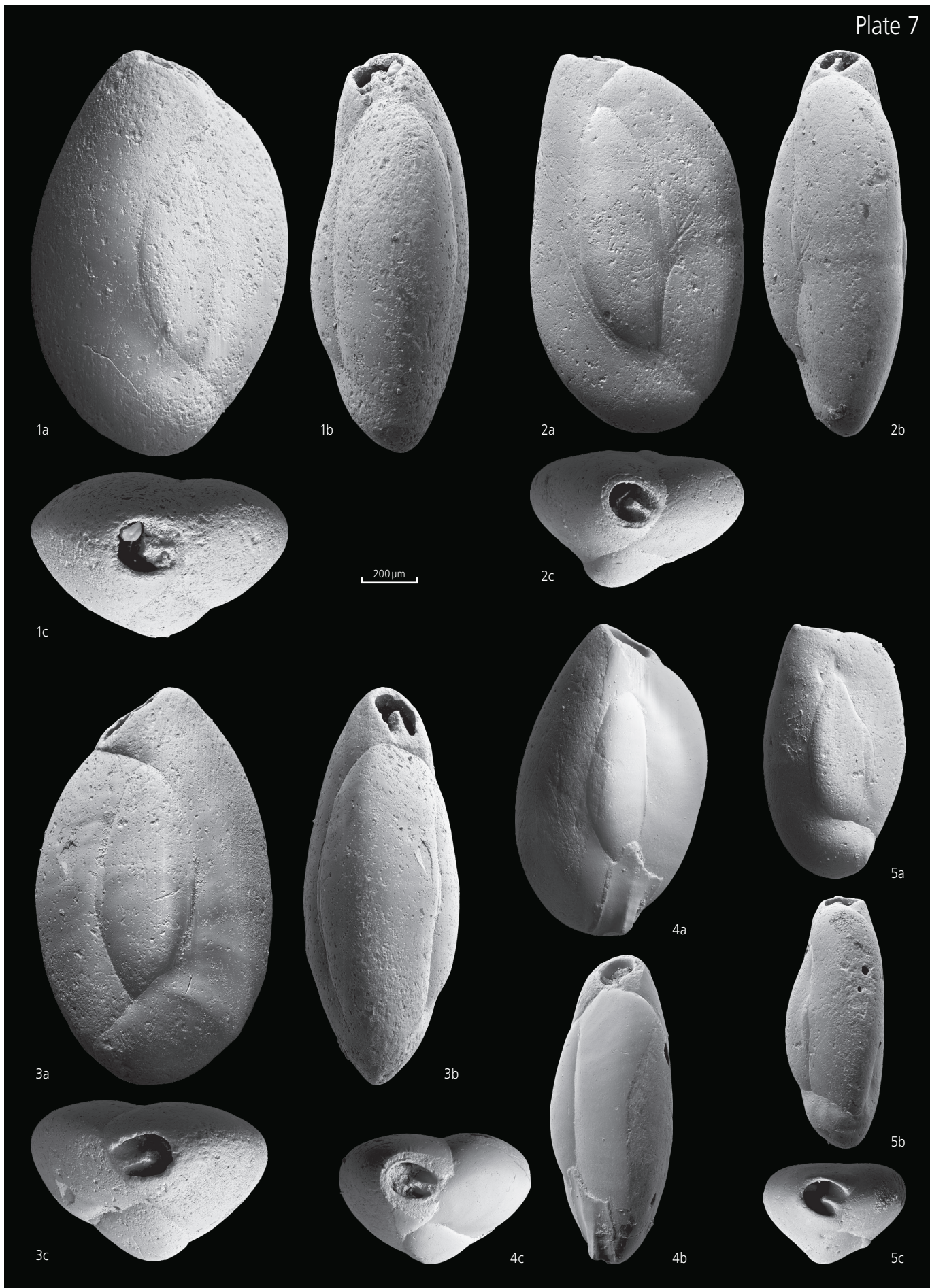
5. ETA004-251

Late Rupelian, Porrentruy - Étang

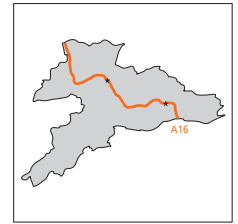
L 880 × W 457 × T 347 μm

- a) lateral view (image Quinqueloculina 68_41SID.psd)
- b) peripheral view (image Quinqueloculina 68_41SI2.psd)
- c) top view (image Quinqueloculina 68_41TOP.psd)

Plate 7



MILIOLIDA

Cycloforina impressa (Reuss, 1851)

Taxonomy

Phylum	Order	Family	Genus	Species
Foraminifera	Miliolida	Hauerinidae	<i>Cycloforina</i>	<i>impressa</i>

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/06.12.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	1	-33.2 m	49	RNA987-13, 76-77
COR-RNA	1	-35.8 m	47	RNA987-17, 19, 86-88
DEL-BEE	9	100	110	BEE003-475
DEL-BEE	14	1	679	BEE003-833
DEL-BEE	16	1	112	BEE003-841
DEL-BEE	19	1800	3/260/767	BEE006- 39/BEE004-169/BEE003-859
DEL-BEE	19	1900	2/769	BEE006-79, 95/BEE003-463, 866

Material

at least 31 specimens (RNA987)

at least 574 specimens as *Cycloforina* spp. (due to poor preservation, locality BEE)

Synonymy

Genus *Cycloforina* Łuczowska, 1972

Type species: *Quinqueloculina contorta* d'Orbigny, 1846

Cycloforina impressa (Reuss, 1851)

*	1851	<i>Quinqueloculina impressa</i> – Reuss, p. 87, pl. 7, fig. 59
partim	1884	<i>Quinqueloculina impressa</i> – Andreae, p. 155, 225, pl. 10, fig. 25, 27, [non 26]
?	1958	<i>Quinqueloculina impressa</i> – Batjes, p. 103, pl. 1, fig. 13
	1974	<i>Quinqueloculina impressa subovalis</i> – Doehl & Sonne, p. 15, pl. 1, fig. 2
	2004	<i>Quinqueloculina laevigata</i> – Gebhardt, p. 261, fig. 14/6-7
	2004	<i>Quinqueloculina laevigata</i> – Grimm, p. 68, pl. 1, fig. 1
	2007	<i>Quinqueloculina akneriana</i> – Schudack & Nuglisch, p. 14, pl. 10, fig. 12
non	2008	<i>Cycloforina impressa</i> – Picot et al., pl. 1, fig. 6-7

Remarks

Schudack & Nuglisch (2007) discuss the synonymy of *Quinqueloculina akneriana* and *Q. impressa* and assign the latter to the former species, disregarding however the pronounced size difference (*Q. akneriana* is much larger) and the cycloforine aperture of *Q. impressa*. Accordingly we maintain the validity of *Q. impressa* and assign the species to the genus *Cycloforina* Łuczowska, 1972. Juveniles of other quinqueloculinid species may be confused with adult *Cycloforina impressa* (Łuczowska 1972).

The poorly preserved specimens from site Beuchille-Est (mainly moulds) may either belong to *Cycloforina hauerina* d'Orbigny, 1846, *C. ludwigi* Reuss, 1866 or *C. impressa*.

Foraminifera

Plate 8

Cycloforina impressa (Reuss, 1851)

1. RNA987-

Late Rupelian, Cornol-Route Nationale

L 409 × W 294 × T 209 μm

a) lateral view (image Miliolidae 68_68SID.psd)

b) peripheral view (image Miliolidae 68_68SI2.psd)

c) top view (image Miliolidae 68_68TOP.psd)

2. RNA987-

Late Rupelian, Cornol-Route Nationale

L 391 × W 279 × T 199 μm

a) lateral view (image Miliolidae 68_70SID.psd)

b) peripheral view (image Miliolidae 68_70SI2.psd)

c) top view (image Miliolidae 68_70TOP.psd)

3. RNA987-

Late Rupelian, Cornol-Route Nationale

L 375 × W 268 × T 211 μm

a) lateral view (image Miliolidae 68_69SID.psd)

b) peripheral view (image Miliolidae 68_69SI2.psd)

c) top view (image Miliolidae 68_69TOP.psd)

4. RNA987-

Late Rupelian, Cornol-Route Nationale

L 284 × W 197 × T 149 μm

a) lateral view (image Miliolidae 68_66SID.psd)

b) peripheral view (image Miliolidae 68_66SI2.psd)

c) top view (image Miliolidae 68_66TOP.psd)

5. RNA987-

Late Rupelian, Cornol-Route Nationale

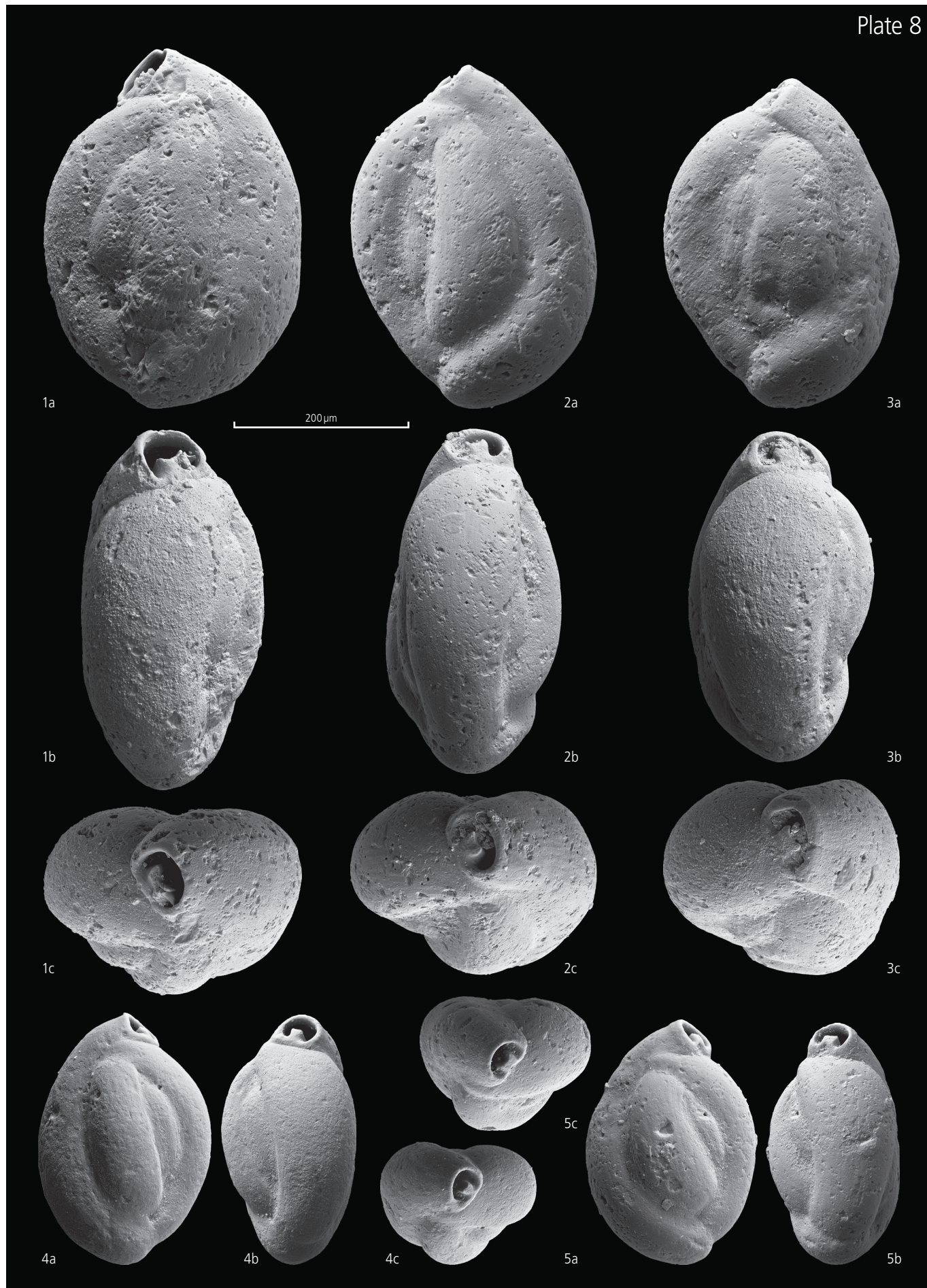
L 279 × W 192 × T 146 μm

a) lateral view (image Miliolidae 68_67SID.psd)

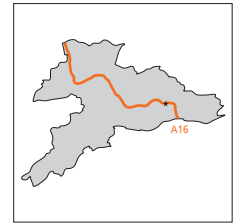
b) peripheral view (image Miliolidae 68_67SI2.psd)

c) top view (image Miliolidae 68_67TOP.psd)

Plate 8



MILIOLIDA
Miliolidae spp.



Taxonomy

Phylum	Order	Family	Genus	Species
Foraminifera	Miliolida	Hauerinidae	multiple	–

Determination (name/date): Martina Pippèr / 27.10.2015 ; Claudius Pirkenseer / 06.12.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610 / 244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
DEL-BEE	9100	110	BEE003-475	
DEL-BEE	14	1	679 BEE003-833	
DEL-BEE	16	1	112 BEE003-841	
DEL-BEE	19	1800	3/260/767	BEE006-39/BEE004-169/BEE003-859
DEL-BEE	19	1900	2/769BEE006-79, 95/BEE003-463, 866	

Material

at least 574 specimens as *Cycloforina* / *Quinqueloculina* spp. (due to poor preservation, locality BEE)

Remarks

The poorly preserved specimens from site Beuchille-Est (mainly moulds) may either belong to *Quinqueloculina seminula* (Linnaeus 1758), *Cycloforina hauerina* d'Orbigny, 1846, *C. ludwigi* Reuss, 1866 or *C. impressa*.



Foraminifera

Plate 9

Quinqueloculina cf. seminula (Linnaeus, 1758)

1. BEE004-169

Late Rupelian, Delémont-Beuchille Est
mould, L 1145 × W 722 μm

a) lateral view (image *Quinqueloculina cf seminula A.psd*)

b) lateral view 2 (image *Quinqueloculina cf seminula B.psd*)

Cycloforina cf. ludwigi (Reuss, 1866)

2. BEE004-169

Late Rupelian, Delémont-Beuchille Est
mould, L 1031 × W 562 μm

lateral view (*Cycloforina cf ludwigi.psd*)

Cycloforina cf. hauerina (d'Orbigny, 1846)

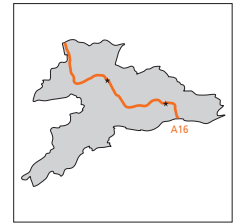
3. BEE004-169

Late Rupelian, Delémont-Beuchille Est
mould, L 715 × W 324 μm

a) lateral view (image *Cycloforina cf hauerina B.psd*)

b) lateral view 2 (image *Cycloforina cf hauerina A.psd*)

LAGENIDA

Nodosaria soluta (Reuss, 1851)**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Lagenida	Nodosariidae	<i>Nodosaria</i>	<i>soluta</i>

Determination (name/date): Martina Pippèrr/27.10.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713 / 250 616
Delémont - Beuchille (DEL-BEU)	593 610 / 244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	1	-33.2 m	49	RNA987-22, 91-92

Material

10 specimens

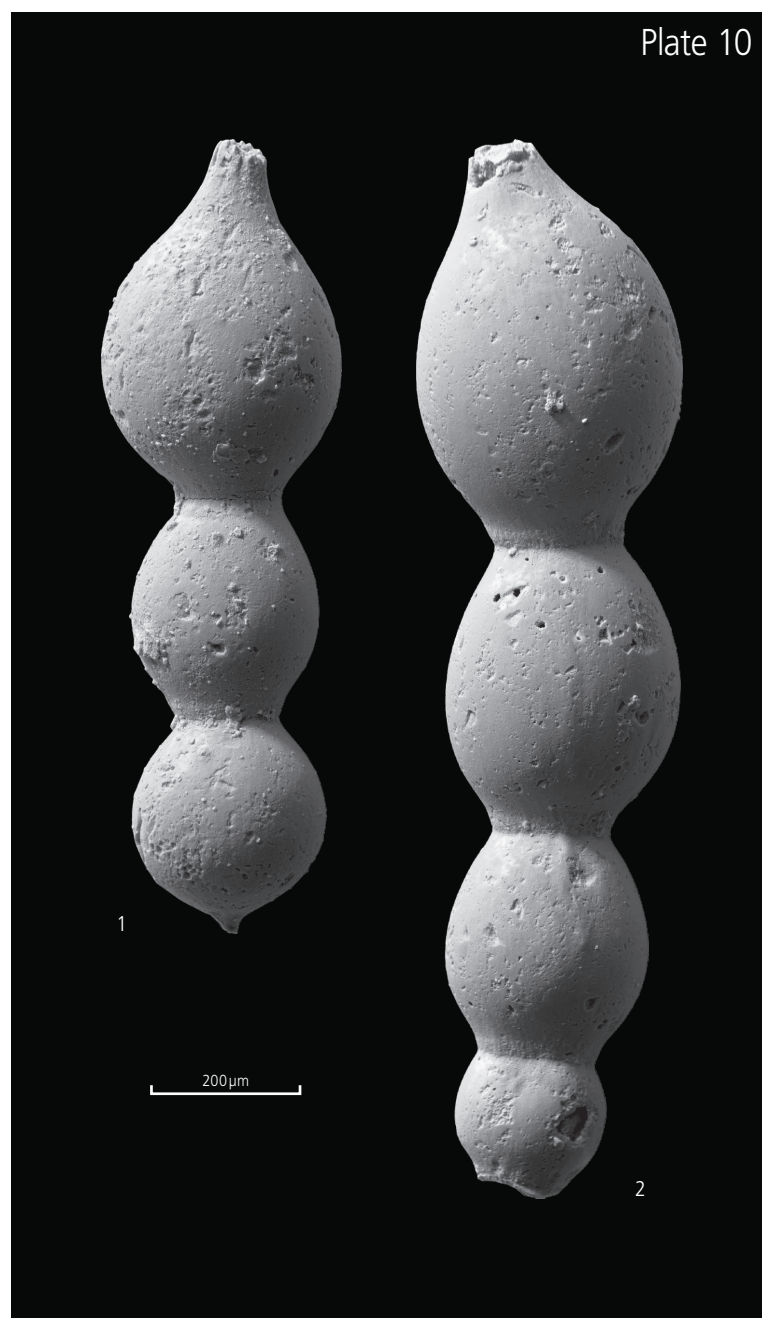
Synonymy

Genus *Nodosaria* Lamarck, 1812

Type species: *Nautilus radicola* Linnaeus, 1758

Nodosaria soluta (Reuss, 1851)

- * 1851 *Dentalina soluta* m. – Reuss, p. 60, pl. 3, fig. 4
- 1855 *Nodosaria soluta* n.sp. – Bornemann, p. 322, pl. 12, fig. 12
- 1884 *Nodosaria soluta* var. *recta* – Andreae, p. 201, pl. 10, fig. 6-7
- 1958 *Nodosaria soluta* – Batjes, p. 114, pl. 3, fig. 17-18
- 1970 *Dentalina soluta* – Kiesel, p. 226, pl. 8, fig. 4
- 2010 *Nodosaria soluta* – Pirkenseer et al., pl. 5, fig. 7-8



Foraminifera

Plate 10

Nodosaria soluta (Reuss, 1851)

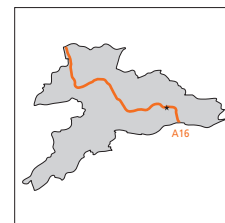
1. RNA987-91

Late Rupelian, Cornol-Route Nationale
max. D 1051 × H 318 μm
lateral view (image Nodosaria 68_32SID.psd)

2. RNA987-92

Late Rupelian, Cornol-Route Nationale
max. D 1403 × H 352 μm
lateral view (image Nodosaria 68_33SID.psd)

LAGENIDA

Lenticulina cf. *insignis* (Reuss, 1865)**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Lagenida	Vaginulinidae	<i>Lenticulina</i>	cf. <i>insignis</i>

Determination (name/date): Claudius Pirkenseer/06.12.2017.

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

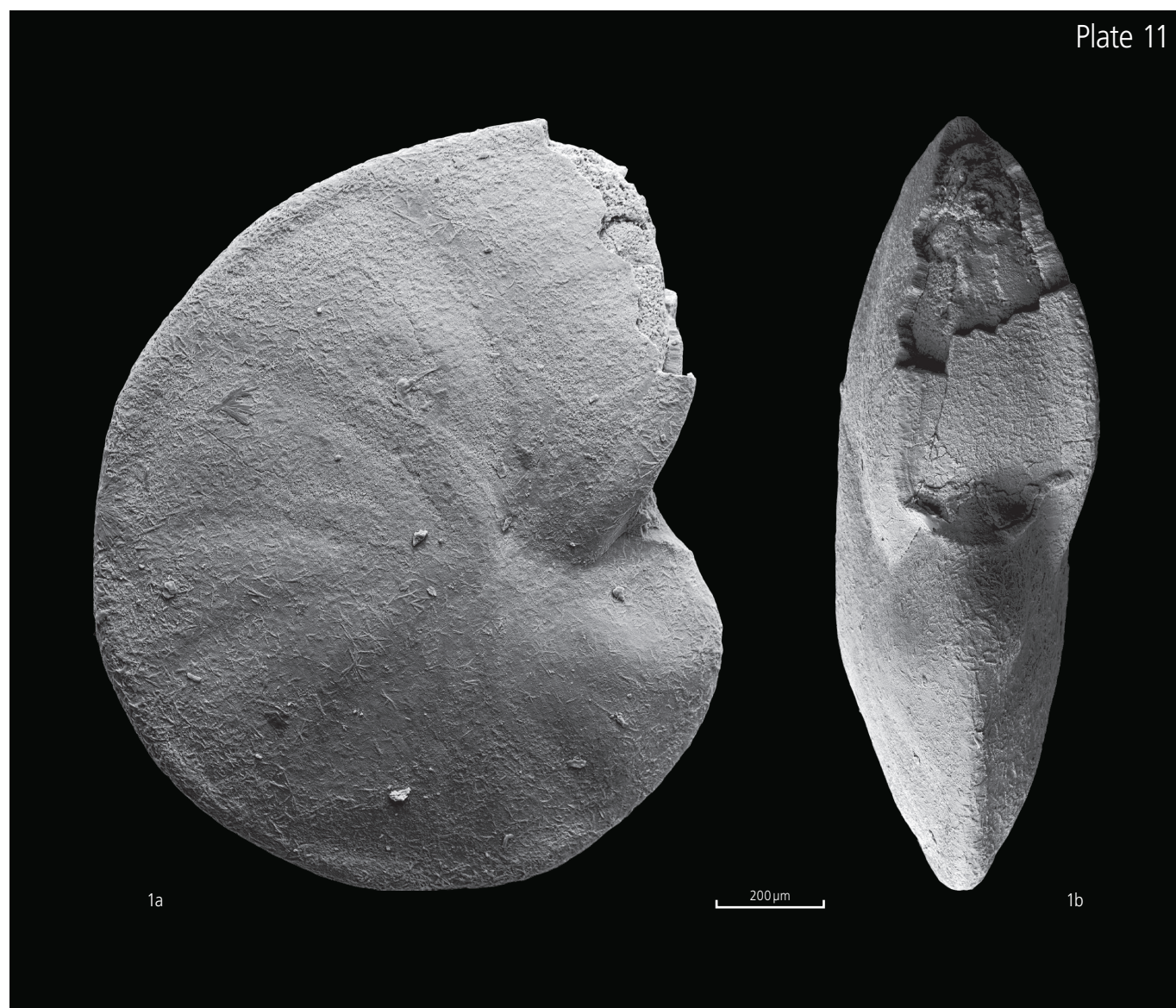
Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
DEL-BEE	9	102	962	BEE003-240, 948

Material

1 specimen

SynonymyGenus *Lenticulina* Lamarck, 1804Type species: *Lenticulites rotulata* Lamarck, 1804*Lenticulina* cf. *insignis* (Reuss, 1865)

- * 1865 *Robulina insignis* n. sp. – Reuss, p. 466, pl. 5, fig. 4
- 1884 *Cristellaria (Robulina)* cf. *insignis* – Andreae, p. 208



Foraminifera

Plate 11

Lenticulina cf. insignis (Reuss, 1865)

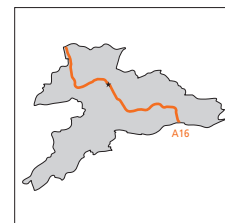
1. BEE003-948

Late Rupelian, Delémont - Beuchille Est

max D 1409 × T 454 μm

a) spiral view (image Lenticulina cf insignis A.psd)

b) peripheral view (image Lenticulina cf insignis B.psd)

LAGENIDA
Guttulina spp.**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Lagenida	Polymorphinidae	<i>Guttulina</i>	–

Determination (name/date): Martina Pippèr 27.10.2015/Claudius Pirkenseer 28.11.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol-Route Nationale (COR-RNA)	577 713/250 616

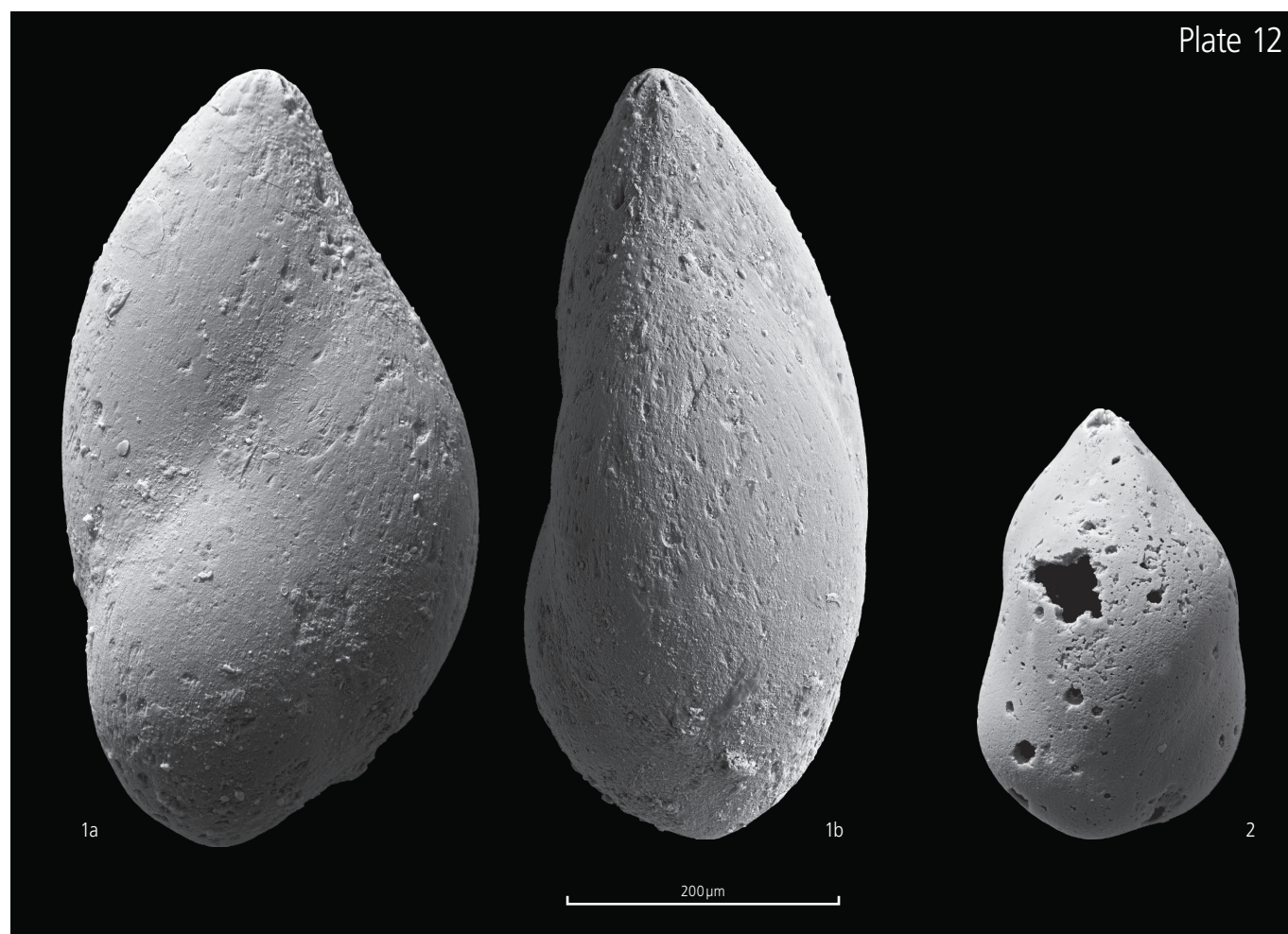
Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	1	-33.2 m	49	RNA987-13, 72
COR-RNA	1	-35.8 m	47	RNA987-17, 26, 95
COR-RNA	1	-37.7 m	53	RNA987-29

Material

at least 15 specimens

Remarks

When reviewing the literature and the available material the presence of a wide variety of morphologically similar species is evident. Our scarce material is insufficient for a positive specific determination.



Foraminifera

Plate 12

Guttulina spp.

1. RNA987-95

Late Rupelian, Cornol-Route Nationale

L 567 × W 303 μm

a) lateral view (image Guttulina 68_30SID.psd)

b) lateral view 2 (image Guttulina 68_30SI2.psd)

2. RNA987-72

Late Rupelian, Cornol-Route Nationale

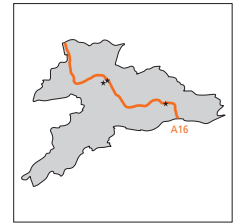
L 314 × W 196 μm

lateral view (image Guttulina 68_31SID.psd)

LAGENIDA

Glandulina aequalis Reuss, 1863 - *ovula* d'Orbigny, 1846

morphogroup

**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Lagenida	Glandulinidae	<i>Glandulina</i>	<i>aequalis-ovula</i> gr.

Determination (name/date): Martina Pippèr/27.10.2015; Claudius Pirkenseer/28.11.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CGN-CLJ	1	-4.0 m	2	CLJ007-41
CGN-CLJ	1	-6.0 m	3	CLJ007-42
CGN-CLJ	1	-8.0 m	4	CLJ007-43
CGN-CLJ	1	-10.0 m	5	CLJ007-44
CGN-CLJ	1	-12.0 m	6	CLJ007-45
CGN-CLJ	1	-14.0 m	7	CLJ007-46
? CGN-CLJ	1	-16.0 m	8	CLJ007-47
? CGN-CLJ	1	-20.0 m	10	CLJ007-49
COR-RNA	1	-33.2 m	49	RNA987-13
COR-RNA	1	-35.8 m	47	RNA987-17, 21, 81-83
COR-RNA	1	-37.7 m	53	RNA987-29
COR-RNA	2	-9.2 m	57	RNA987-39-41
COR-RNA	2	-16.4 m	55	RNA987-35
? DEL-BEE	9	102	962	BEE003-240
? DEL-BEE	19	1800	260	EE004-171

Material

at least 57 specimens, 19 specimens uncertain

Synonymy

Genus *Glandulina* d'Orbigny, 1839

Type species: *Nodosaria (Glandulina) laevigata* d'Orbigny, 1826

Glandulina ovula d'Orbigny, 1846

- * 1846 *Glandulina ovula* – d'Orbigny, p. 29, pl. 1, fig. 6-7
- 1857 *Glandulina candula* nov. spec. – Egger, p. 304, pl. 15, fig. 28-29
- 1863 *Glandulina elliptica* – Reuss, p. 47, pl. 3, fig. 29-31
- 1974 *Glandulina ? laevigata inflata* – Doehl & Sonne, p. 25, pl. 6, fig. 40
- 1985 *Glandulina ovula* – Papp & Schmid, p. 21, pl. 2, fig. 1-9
- 1987 *Glandulina ovula* – Wenger, p. 266, pl. 6, fig. 15-16
- 1998 *Glandulina ovula* – Cicha et al., p. 98, pl. 29, fig. 6
- 2007 *Glandulina ovula* – Schudack & Nuglisch, p. 20, pl. 3, fig. 57-58

Glandulina aequalis Reuss, 1863

- * 1863 *Glandulina aequalis* – Reuss, p. 48, pl. 3, fig. 28
- 1958 *Glandulina aequalis* – Batjes, p. 123, pl. 4, fig. 5-6
- 1970 *Glandulina aequalis* – Le Calvez, p. 99, fig. 35
- 1974 *Pseudonodosaria ? aequalis* – Doehl & Sonne, p. 19, pl. 2, fig. 11
- ? 1974 *Glandulina ex gr. reussi* – Doehl & Sonne, p. 26, pl. 6, fig. 42
- 1987 *Glandulina aequalis* – Reiser, p. 76, pl. 6, fig. 9

Remarks

When reviewing the literature (e.g. Papp & Schmid 1985) and the available material the presence of a wide variety of intermediate forms between both species (and the recent *Glandulina laevigata* (d'Orbigny 1826) becomes apparent. Our material only contains macrospheric specimens with well-rounded basal end.

Foraminifera

Plate 13

Glandulina aequalis Reuss, 1863 morphotype

1. RNA987-81

Late Rupelian, Cornol-Route Nationale

L 498 × W 150 μm

lateral view (image Glandulina 68_27SID.psd)

2. RNA987-82

Late Rupelian, Cornol-Route Nationale

L 473 × W 178 μm

lateral view (image Glandulina 68_28SID.psd)

Glandulina ovula d'Orbigny, 1846 morphotype

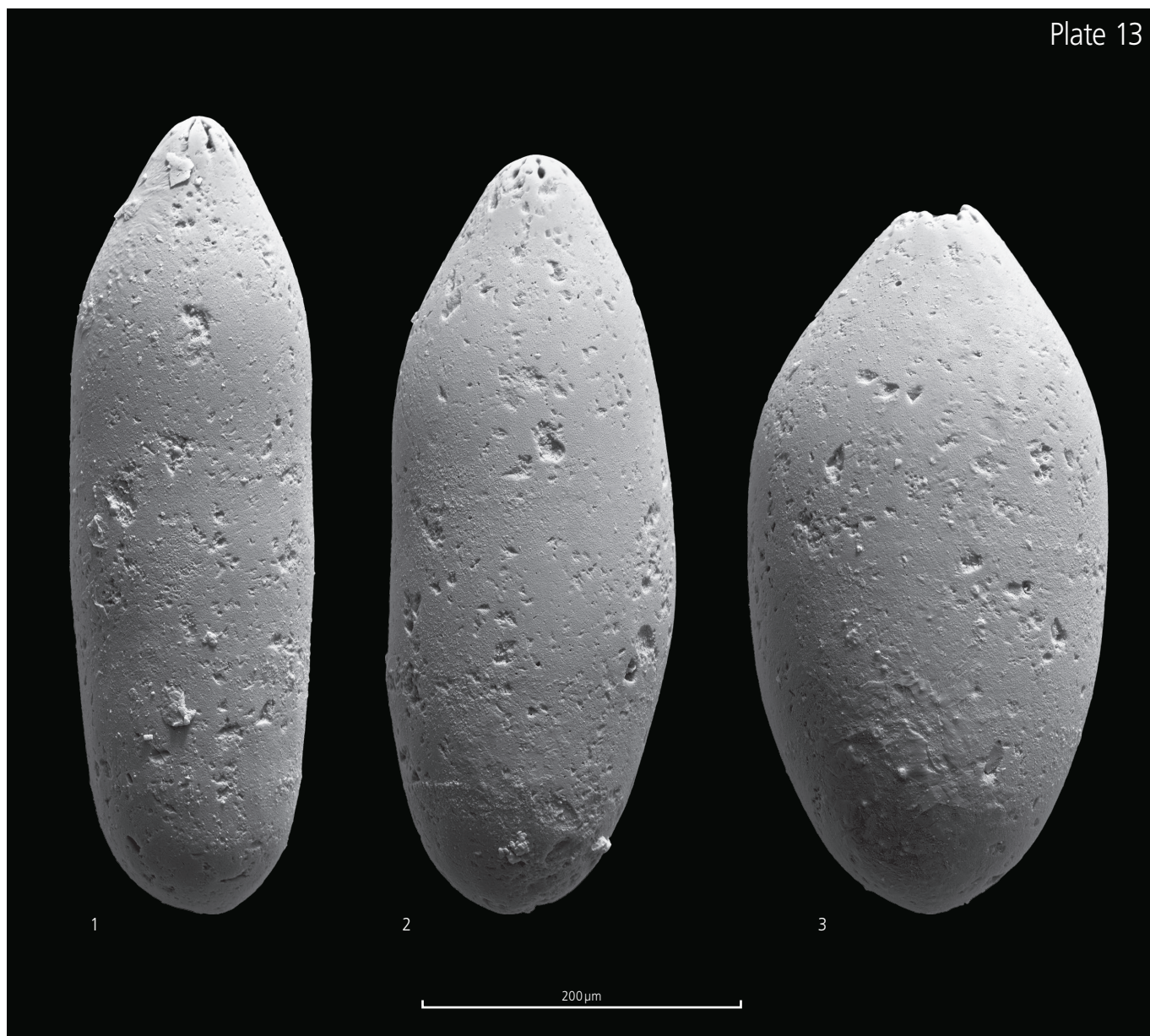
3. RNA987-83

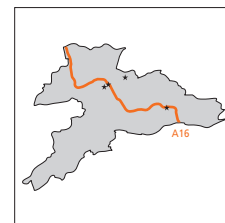
Late Rupelian, Cornol-Route Nationale

L 442 × W 224 μm

lateral view (image Glandulina 68_29SID.psd)

Plate 13



LAGENIDA
Pyrulina spp.**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Lagenida	Polymorphinidae	<i>Pyrulina</i>	–

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/05.12.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Charmoille - Village (CHA-CHM)	582 650/ 252 375
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

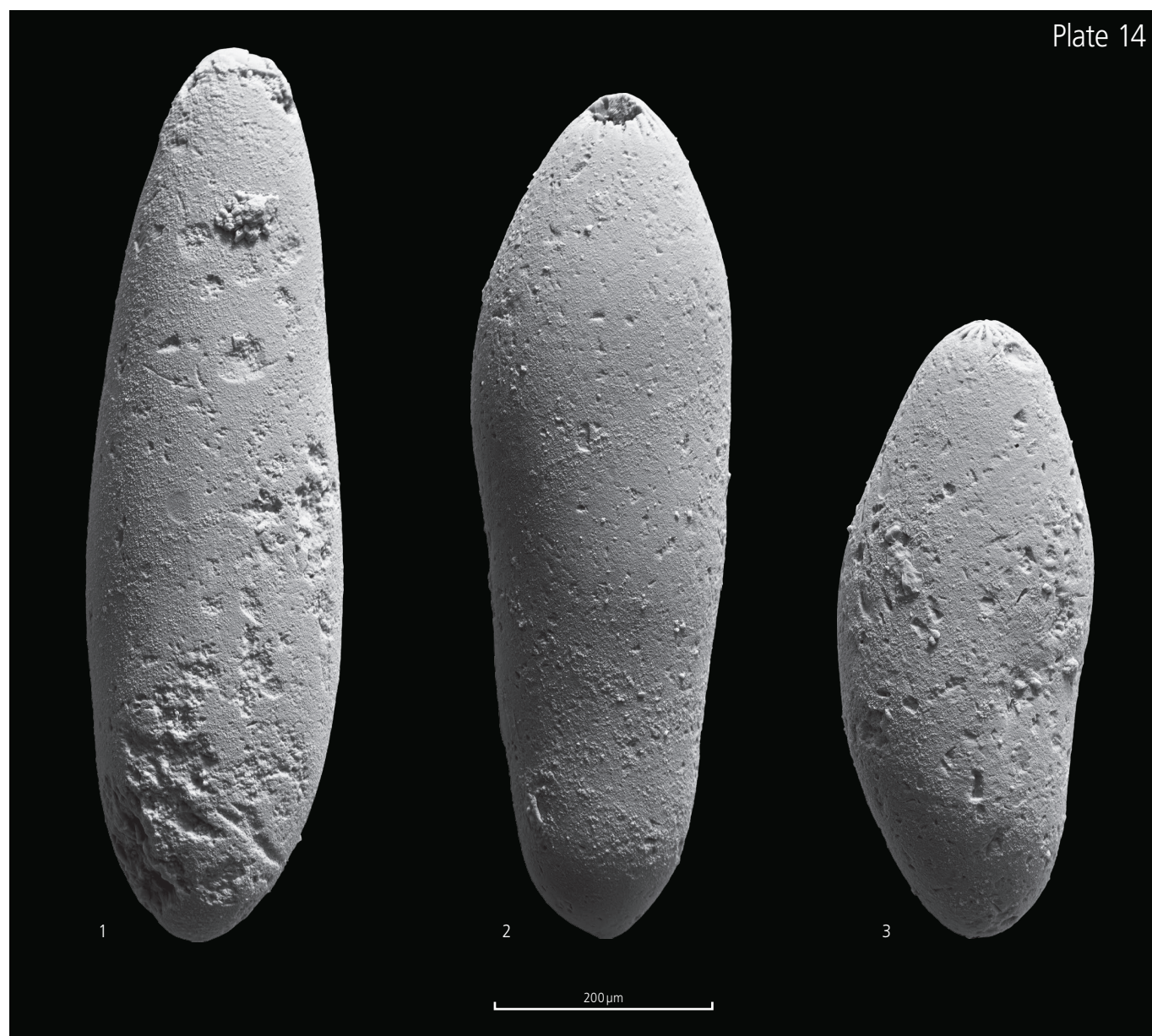
Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CGN-CLJ	1	-4.0 m	2	CLJ007-41
CGN-CLJ	1	-8.0 m	4	CLJ007-43
CGN-CLJ	1	-10.0 m	5	CLJ007-44
CGN-CLJ	1	-14.0 m	7	CLJ007-46
CGN-CLJ	1	-16.0 m	8	CLJ007-47
CHA-CHM	4	-46.0 m	23	CHM003-56
CHA-CHM	4	-48.0 m	24	CHM003-59
COR-RNA	2	-9.2 m	57	RNA987-41
COR-RNA	2	-16.4 m	55	RNA987-35
DEL-BEE	19	1800	260	BEE004-171
DEL-BEE	19	1900	261/2	BEE004-215, BEE006-144
POR-ETA	2	-11.0 m	11	ETA004-114

Material

at least 259 specimens, 4 specimens uncertain

Remarks

The opacity of many specimens obscuring the internal chamber arrangement renders a specific assignment difficult. *Pyrulina fusiformis* Roemer, 1838, *P. cylindroides* Roemer, 1838 and *Pyrulina* aff. *vicksburgensis* sensu Doehl & Sonne (1974) represent taxa with similar external morphology.



Foraminifera

Plate 14

Pyrulina spp.

1. CLJ007-

Late Rupelian, Courgenay-Clos Jeannerat

L 814 × W 234 μm

apical view (image Pyrulina 68_24API.psd)

2. RNA987-

Late Rupelian, Cornol-Route Nationale

L 768 × W 240 μm

apical view (image Pyrulina 68_25API.psd)

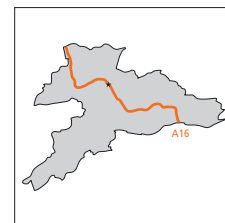
3. RNA987-

Late Rupelian, Cornol-Route Nationale

L 565 × W 234 μm

apical view (image Pyrulina 68_26API.psd)

ROTAIIDA

Bulimina coprolithoides Andreae, 1884**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Buliminidae	<i>Bulimina</i>	<i>coprolithoides</i>

Determination (name/date): Martina Pippèr/27.10.2015; Claudius Pirkenseer/17.03.2016

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	1	-33.2 m	49	RNA987-13, 73-74

Material

3 specimens

Synonymy

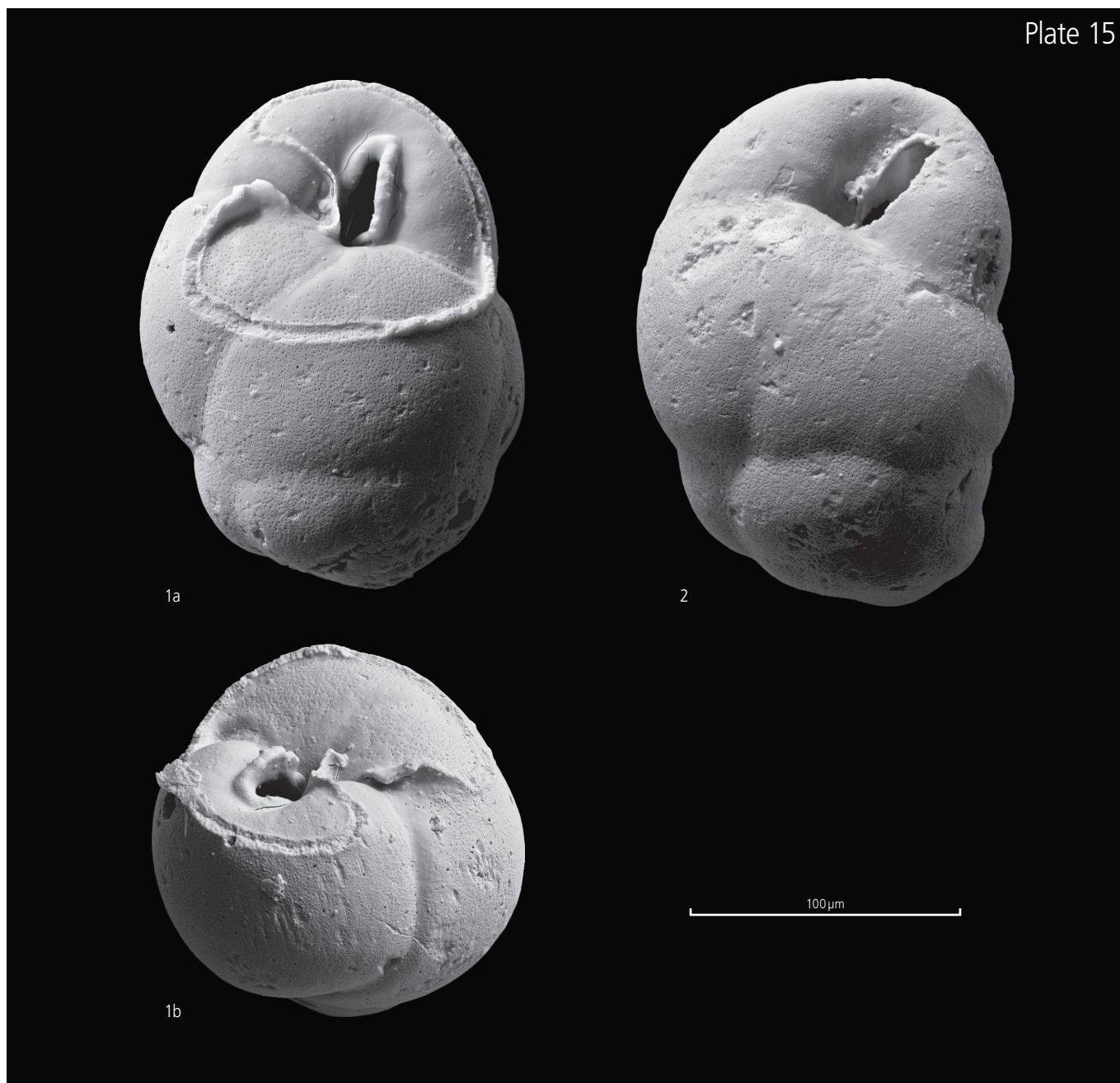
Genus *Bulimina* d'Orbigny, 1826

Type species: *Bulimina marginata* d'Orbigny, 1826

Bulimina coprolithoides Andreae, 1884

- * 1884 *Bulimina coprolithoides* n.sp. – Andreae, p. 305, pl. 6, fig. 4
- 1962 *Eponides kiliani* – Doebli, p. 390, pl. 57, fig. 7
- 1987 *Caucasina coprolithoides* – Reiser, p. 79, pl. 7, fig. 1, 6
- 1998 *Bulimina coprolithoides* – Cicha et al., p. 86, pl. 47, fig. 1
- 2004 *Caucasina coprolithoides* – Gebhardt, fig. 15/16
- 2005 *Caucasina coprolithoides* – Schudack & Nuglisch, p. 61, pl. 3, fig. 40
- 2010 *Praeglobobulimina coprolithoides* – Pirkenseer et al., pl. 7, fig. 13

Plate 15



Foraminifera

Plate 15

Bulimina coprolithoides Andreae, 1884

1. RNA987-73

Late Rupelian, Cornol-Route Nationale

max. D 142 × L 187 μm

a) lateral view (image Bulimina 68_61SID.psd)

b) umbilical view (image Bulimina 68_61TOP.psd)

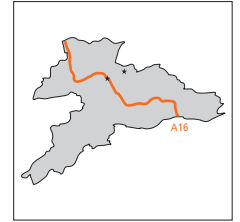
2. RNA987-74

Late Rupelian, Cornol-Route Nationale

max. D 139 × L 194 μm

lateral view (image Bulimina 68_62SID.psd)

ROTAIIDA

Bolivina beyrichi Reuss, 1851**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Bolivinitidae	<i>Bolivina</i>	<i>beyrichi</i>

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/17.03.2016

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Charmoille - Village (CHA-CHM)	582 650/ 252 375
Cornol - Route Nationale (COR-RNA)	577 713/250 616

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CHA-CHM	4	-48.0 m	24	CHM003-59, 80
COR-RNA	1	-35.8 m	47	RNA987-17, 27

Material

approximately 18 specimens

Synonymy

Genus *Bolivina* d'Orbigny, 1839

Type species: *Bolivina plicata* d'Orbigny, 1839

Bolivina beyrichi Reuss, 1851

- * 1851 *Bolivina Beyrichi* – Reuss, p. 83, pl. 6, fig. 51
- 1875 *Bolivina beyrichi* var. *carinata* – Hantken, pl. 7, fig. 12
- 1884 *Bolivina Beyrichi* – Andreae, pl. 8, fig. 4-8
- 1958 *Bolivina beyrichi* – Batjes, p. 131, pl. 5, fig. 11
- 1962 *Bolivina melettica* – Doebl, p. 390, pl. 7, fig. 9
- 1967 *Bolivina beyrichi beyrichi* – Hofmann, p. 137, pl. 3, fig. 1-4
- 1967 *Bolivina beyrichi carinata* – Hofmann, p. 142, pl. 3, fig. 5-6
- 1987 *Bolivina beyrichi beyrichi* – Reiser, p. 85, pl. 8, fig. 6, 11
- 1987 *Bolivina beyrichi carinata* – Reiser, p. 85, pl. 8, fig. 8, 13
- 1994 *Bolivina beyrichi* – Grimm, p. 78, pl. 1, fig. 6
- 1987 *Brizalina beyrichi* – Huber, p. 74, pl. 5, fig. 6-9
- 1998 *Bolivina beyrichi beyrichi* – Cicha et al., p. 83, pl. 44, fig. 3
- 2000 *Bolivina beyrichi* – Mehrnusch, p. 223, pl. 1, fig. 1-8, pl. 2, fig. 1-8
- 2010 *Bolivina beyrichi* – Pirkenseer et al., p. 14, pl. 7, fig. 3-4

Remarks

On average larger than *Bolivina versatilis* and *B. melettica* (identical scale applied to all species of *Bolivina*). The former shows straighter sutures and a more contorted test, the latter features regularly arched sutures, more inflated chambers and no lateral carinae. Poorly preserved specimens are difficult to separate from *Bolivina melettica*.

Plate 16



Foraminifera

Plate 16

Bolivina beyrichi Reuss, 1851

1. CHM003-80

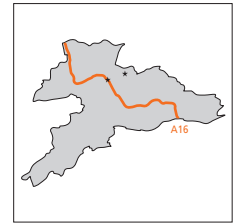
Late Rupelian, Charmoille-Village

L 665 × W 234 × H 136 μm

a) lateral view (image Bolivina 68_22SID.psd)

b) peripheral view (image Bolivina 68_22SI2.psd)

ROTAIIDA

Bolivina melettica Andreae, 1884**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Bolivinitidae	<i>Bolivina</i>	<i>melettica</i>

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/17.03.2016

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Charmoille - Village (CHA-CHM)	582 650/ 252 375
Cornol - Route Nationale (COR-RNA)	577 713/250 616

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CHA-CHM	4	-48.0 m	24	CHM003-59, 79
COR-RNA	1	-35.8 m	47	RNA987-27

Material

approximately 15 specimens

Synonymy

- Genus *Bolivina* d'Orbigny, 1839
 Type species: *Bolivina plicata* d'Orbigny, 1839
Bolivina melettica Andreae, 1884
- * 1884 *Bolivina melettica* n.sp. – Andreae, p. 165, pl. 11, fig. 5
 1958 *Bolivina beyrichi* var. *melettica* – Batjes, p. 131, pl. 5, fig. 10
 1967 *Bolivina melettica* – Hofmann, p. 177, pl. 1, fig. 3
 1994 *Bolivina melettica* – Huber, p. 73, pl. 5, fig. 1-4
 2010 *Bolivina melettica* – Pirkenseer et al., p. 15, pl. 7, fig. 9

Remarks

Intermediate in size between *Bolivina versatilis* and *B. beyrichi* (identical scale applied to all species of *Bolivina*). The former shows straighter sutures and a more contorted test, the latter features a distinct mid-suture kink and a tendency to form lateral carinae. Poorly preserved specimens are difficult to separate from *Bolivina beyrichi*.



Foraminifera

Plate 17

Bolivina melettica Andreae, 1884

1. CHM003-79

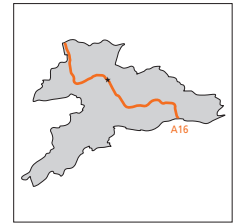
Late Rupelian, Charmoille-Village

L 531 × W 192 × H 125 µm

a) lateral view (image Bolivina 68_21SID.psd)

b) peripheral view (image Bolivina 68_21SI2.psd)

ROTAIIDA

Bolivina cf. *versatilis* Hofmann, 1967**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Bolivinitidae	<i>Bolivina</i>	cf. <i>versatilis</i>

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/17.03.2016

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	1	-33.2 m	49	RNA987-13, 71, 75

Material

approximately 5 specimens

Synonymy

Genus *Bolivina* d'Orbigny, 1839

Type species: *Bolivina plicata* d'Orbigny, 1839

Bolivina cf. *versatilis* Hofmann, 1967

- * 1967 *Bolivina versatilis versatilis* – Hofmann, p. 149, pl. 2, fig. 12, pl. 4, fig. 1
- 1987 *Bolivina versatilis* – Reiser, p. 86, pl. 8, fig. 10, 15
- 1998 *Bolivina versatilis* – Cicha et al., pl. 43, fig. 17

Remarks

The nominate species *Bolivina versatilis* shows shallow sutures with crenulations. In our material the chambers are only weakly inflated, thus the crenulations are indistinct. Juvenile test portion bears indistinct striations.



Foraminifera

Plate 18

Bolivina cf. versatilis versatilis Hofmann, 1967

1. RNA987-71

Late Rupelian, Cornol-Route Nationale

L 412 \times W 158 \times H 100 μ m

a) lateral view (image Bolivina 68_20SID.psd)

b) peripheral view (image Bolivina 68_20SI2.psd)

2. RNA987-75

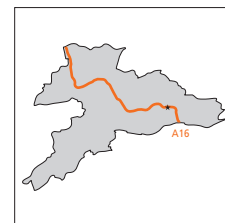
Late Rupelian, Cornol-Route Nationale

L 456 \times W 136 \times H \approx 80 μ m

a) lateral view (image Bolivina 68_63SID.psd)

b) peripheral view (image Bolivina 68_63SI2.psd)

ROTAIIDA

Fursenkoina mustoni (Andreae, 1884)**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Bolivinitidae	<i>Fursenkoina</i>	<i>mustoni</i>

Determination (name/date): Martina Pippèr/27.10.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
DEL-BEE	19	1800	260	BEE004-171, 294

Material

3 specimens

SynonymyGenus *Fursenkoina* Loeblich & Tappan, 1961Type species: *Virgulina squamosa* d'Orbigny in Deshayes, 1832*Fursenkoina mustoni* (Andreae, 1884)

- * 1884 *Virgulina mustoni* – Andreae, p. 254, pl. 11, fig. 4
- 1892 *Virgulina mustoni* – Förster, pl. 10, fig. 18
- 1987 *Fursenkoina mustoni* – Reiser, p. 80, pl. 7, fig. 4, 9
- 1998 *Fursenkoina mustoni* – Cicha et al., p. 97, pl. 55, fig. 2-3
- 2008 *Fursenkoina mustoni* – Picot et al., p. 492
- 2011 *Fursenkoina mustoni* – Pippèr, fig. 4/4-5



Foraminifera

Plate 19

Fursenkoina mustoni (Andreae, 1884)

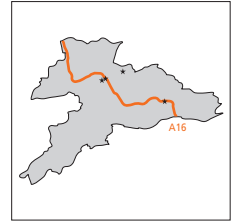
1. BEE004-294

Late Rupelian, Delémont - Beuchille Est

L 444 × W 196 μm

lateral view (image Fursenkoina 68_23SID.psd)

ROTAIIDA

Cancris subconicus (Terquem, 1882)**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Haynesinidae	<i>Cancris</i>	<i>subconicus</i>

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/17.03.2016

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Charmoille - Village (CHA-CHM)	582 650/252 375
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CGN-CLJ	1	-4.0 m	2	CLJ007-41
CGN-CLJ	1	-10.0 m	5	CLJ007-44
CGN-CLJ	1	-14.0 m	7	CLJ007-46
CGN-CLJ	1	-16.0 m	8	CLJ007-47
CGN-CLJ	1	-20.0 m	10	CLJ007-49
CHA-CHM	4	-48.0 m	24	CHM003-59
COR-RNA	1	-33.2 m	49	RNA987-13
COR-RNA	1	-35.8 m	47	RNA987-17, 18, 26, 32, 84-85
COR-RNA	1	-37.7 m	53	RNA987-28-29
COR-RNA	2	-9.2 m	57	RNA987-40
COR-RNA	2	-16.4 m	55	RNA987-35
? DEL-BEE	19	1800	260	BEE004-170
DEL-BEE	19	1900	261	BEE004-213-214, 216, 217

Material

at least 209 specimens, 15 specimens uncertain

Synonymy

Genus *Cancris* Montfort, 1808

Type species: *Nautilus auricula* Fichtel & Moll, 1798

Cancris subconicus (Terquem, 1882)

- * 1882 *Rotalina subconica* Terq. – Terquem, p. 61, pl. 4, fig. 5
- 1942 *Cancris turgidus* – Cushman & Todd, p. 92, pl. 24, fig. 3-4
- 1958 *Cancris turgidus* – Batjes, p. 149, pl. 10, fig. 5
- 1961 *Cancris subconicus* – Kaasschieter, p. 213, pl. 12, fig. 6-8
- 1974 *Cancris ? turgidus* – Doebel & Sonne, p. 32, pl. 8, fig. 68
- 1983 *Cancris subconicus* – Setiawan, p. 117, pl. 8, fig. 6
- 1987 *Cancris subconicus* – Reiser, p. 99, pl. 11, fig. 10-12
- 1994 *Cancris ? turgidus* – Huber, p. 77, pl. 7, fig. 5-7
- 2005 *Baggina subconica* – Schudack & Nuglisch., p. 61, pl. 3, fig. 42-43
- 2010 *Cancris turgidus* – Pirkenseer et al., pl. 9, fig. 4

Foraminifera

Plate 20

Cancris subconicus (Terquem, 1882)

1. RNA987-84

Late Rupelian, Cornol-Route Nationale

max. D 440 × H 283 μm

a) apical view (image Cancris 68_10API.psd)

b) umbilical view (image Cancris 68_10UMB.psd)

c) lateral view (image ACancris 68_10SID.psd)

2. RNA987-85

Late Rupelian, Cornol-Route Nationale

max. D 396 × H 233 μm

a) apical view (image Cancris 68_11API.psd)

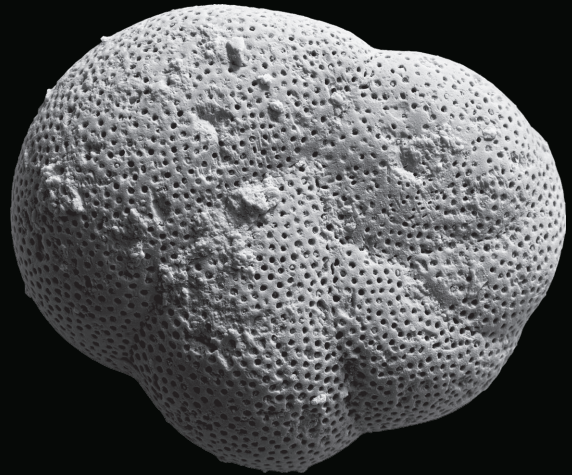
b) umbilical view (image Cancris 68_11UMB.psd)

c) lateral view (image Cancris 68_11SID.psd)

Plate 20



1a



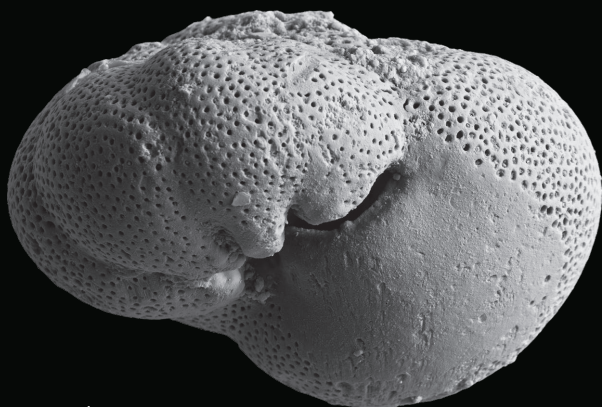
2a



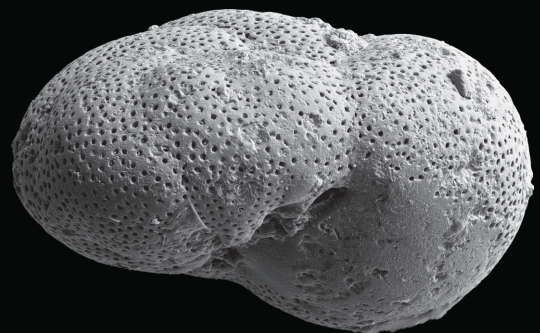
1b



2b



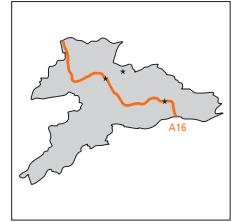
1c



2c

200 μm

ROTAIIDA

Rosalina globularis d'Orbigny, 1826**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Roslinidae	<i>Rosalina</i>	<i>globularis</i>

Determination (name/date): Martina Pippèr/27.10.2015; Claudius Pirkenseer/05.12.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Charmoille - Village (CHA-CHM)	582 650/252 375
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
? CHA-CHM	4	-44.0 m	22	CHM003-54
COR-RNA	1	-33.2 m	49	RNA987-13
COR-RNA	1	-35.8 m	47	RNA987-17, 25, 93-94
COR-RNA	1	-37.7 m	53	RNA987-29-30
DEL-BEE	19	1900	261	BEE004-216

Material

at least 36 specimens, 3 specimens uncertain

Synonymy

		Genus <i>Rosalina</i> d'Orbigny, 1826
		Type species: <i>Rosalina globularis</i> d'Orbigny, 1826
		<i>Rosalina globularis</i> d'Orbigny, 1826
*	1826	<i>Rosalina globularis</i> – d'Orbigny, p. 271, pl. 13, fig. 1-4
	1958	<i>Discorbis globularis</i> – Batjes, p. 145, pl. 12, fig. 8
?partim	1974	<i>Rosalina globularis</i> – Doehl & Sonne, p. 31, pl. 8, fig. 65-66
?	1987	<i>Rosalina globularis semiporata</i> – Wenger, p. 305, pl. 15, fig. 10-12
	1994	<i>Rosalina</i> sp. – Huber, p. 77, pl. 7, fig. 8-10
?	2004	<i>Rosalina</i> cf. <i>bradyi</i> – Gebhardt, p. 261, fig. 16/22-23
	2005	<i>Rosalina globularis</i> – Grimm & Grimm, pl. 1, fig. 8

Remarks

Smaller specimens seem to be more trochospiral than larger individuals that tend to appear much flatter in lateral view.

Foraminifera

Plate 21

Rosalina globularis d'Orbigny, 1826

1. RNA987-93

Late Rupelian, Cornol-Route Nationale

max. D 301 × H 191 μm

a) apical view (image Rosalina 68_12API.psd)

b) umbilical view (image Rosalina 68_12UMB.psd)

c) lateral view (image Rosalina 68_12SID.psd)

2. RNA987-94

Late Rupelian, Cornol-Route Nationale

max. D 345 × H 222 μm

a) apical view (image Rosalina 68_13API.psd)

b) umbilical view (image Rosalina 68_13UMB.psd)

c) lateral view (image Rosalina 68_13SID.psd)

Plate 21



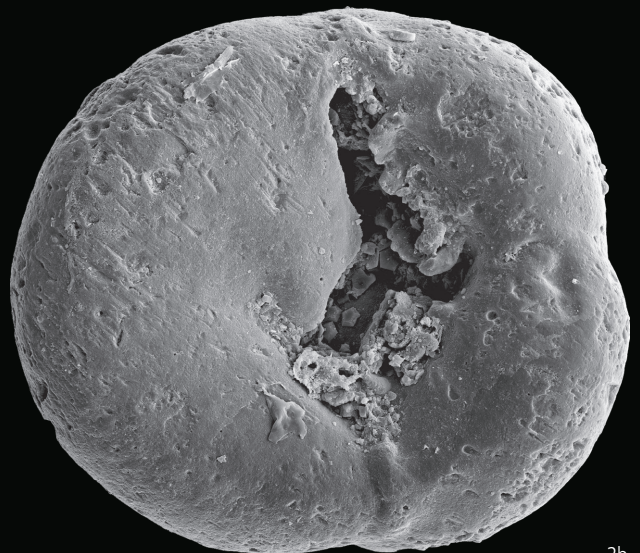
1a



2a



1b



2b



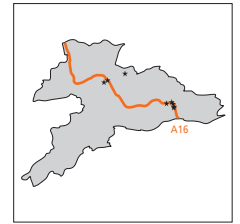
1c



2c

200µm

ROTALIIDA
Cibicoides spp.



Taxonomy

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Cibicididae	<i>Cibicoides</i>	–

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/22.11.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Charmoille - Village (CHA-CHM)	582 650/252 375
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035
Courrendlin - Pécas (CRD-PCA)	595 690/243 390
Courrendlin - Poillat (CRD-POI)	594 795/244 510
Courrendlin - Solé (CRD-SOL)	595 700/243 560
Courrendlin - Vieille Église (CRD-VEG)	595 395/244 270
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CGN-CLJ	1	-8.0 m	4	CLJ007-43
CGN-CLJ	1	-10.0 m	5	CLJ007-44
CGN-CLJ	1	-16.0 m	8	CLJ007-47
CGN-CLJ	1	-20.0 m	10	CLJ007-49
CHA-CHM	4	-44.0 m	22	CHM003-54
CHA-CHM	4	-46.0 m	23	CHM003-56
CHA-CHM	4	-48.0 m	24	CHM003-59
COR-RNA	1	-33.2 m	49	RNA987-13, 66, 70, 78-80
COR-RNA	1	-35.8 m	47	RNA987-11, 17, 21, 31-32, 62-63
COR-RNA	1	-37.7 m	53	RNA987-28-30, 96-97, 100-103
COR-RNA	2	-9.2 m	57	RNA987-40, 41, 116
COR-RNA	2	-16.4 m	55	RNA987-35, 37
CRD-PCA	119	500	109	PCA008-423
CRD-PCA	127	500	121	PCA008-448
CRD-PCA	138	500	127	PCA008-484
CRD-POI	7	200	7	POI005-54
? CRD-POI	47	–	112/152/286/385	POI007-3063/2537/1834/997
? CRD-POI	69	–	361	POI007-1888
? CRD-POI	142	16	75/83/86	POI010-348/326/297
? CRD-POI	145	–	1	POI010-163
? CRD-POI	260	–	88	POI010-455
? CRD-SOL	2	-9.9 m	19	SOL004-71
? CRD-VEG	18	16		VEG006-637
DEL-BEE	9	103	961	BEE003-219
DEL-BEE	19	1800	260	BEE004-170
DEL-BEE	19	1900	261	BEE004-216

Material

at least 470 specimens, 32 specimens uncertain

Remarks

Fossil and extant species of *Cibicides* and *Cibicoides* are in need of a thorough revision. As has been discussed in Schweizer et al. (2009) a morphological attribution to each genus or species is rendered difficult or arbitrary in light of results from molecular phylogeny, due to the existence of a high morphological variability in single genetic species and the presence of cryptic taxa. Since external morphology in cibicidids is driven by their mode of life (attached to substrate and/or free-living) the validity of their former generic (e.g. sensu Loeblich & Tappan 1988) and specific subdivision needs to be re-evaluated for fossil morphospecies.

Our material adheres to three morphogroups:

- *Cibicoides* sp. 1 represents small-sized (200-300 μm max. D) planoconvex keeled specimens featuring about 8-10 chambers in the outer whorl, subdivided by strongly curved sutures, an imperforate umbilical and lateral side as well as a closed umbilicus (leading to a subconical lateral view).
- The *Cibicoides lobatulus* (Walter & Jacob 1798 [recent]) - *communis* (Roemer 1838 [fossil]) morphogroup includes specimens of highly variable sizes ranging between 250 to 700 μm (or larger, see Pirkenseer et al. 2010, "*Cibicoides roemeri*") maximal diameter. Small individuals are generally planoconvex to concavoconvex, while larger specimens are generally slightly biconvex. Final chambers are generally strongly inflated in all sizes, with only the youngest chambers featuring a sharp keel, whereas in older chambers the keel is indistinct. Individuals bear perforations on the entire test except for the area around the aperture and on the keel. Sutures on the umbilical side are straight.
- *Cibicoides* sp. 2 comprises distinctly biconvex keeled medium-sized specimens with an occluded apical side.

To illustrate the morphological and size variation all specimens are figured to the same scale on plate 1 and 2. Small-sized individuals are figured additionally at a larger scale for more details on plate 3 and 4. Most specimens are derived from closely spaced samples of drillcore RNA-F1 (except for RNA987-116). Specimens from the localities PCA, POI, SOL and VEG are presumed to be reworked from older strata and thus generally uncertain of even generic affiliation.

Foraminifera

Plate 22

Cibicidoides sp. 1

1. RNA987-66

Late Rupelian, Cornol - Route Nationale
max. D 220 × H 113 μm

- a) apical view (image Cibicidoides 68_01API.psd)
- b) umbilical view (image Cibicidoides 68_01UMB.psd)
- c) lateral view (image Cibicidoides 68_01SID.psd)

2. RNA987-70

Late Rupelian, Cornol - Route Nationale
max. D 203 × H 92 μm

- a) apical view (image Cibicidoides 68_02API.psd)
- b) umbilical view (image Cibicidoides 68_02UMB.psd)
- c) lateral view (image Cibicidoides 68_02SID.psd)

3. RNA987-63

Late Rupelian, Cornol - Route Nationale
max. D 303 × H 143 μm

- a) apical view (image Cibicidoides 68_65API.psd)
- b) umbilical view (image Cibicidoides 68_65UMB.psd)
- c) lateral view (image Cibicidoides 68_65SID.psd)

Cibicidoides lobatulus (Walter & Jacob, 1798) - *communis* (Roemer 1838) morphogroup

4. RNA987-80

Late Rupelian, Cornol - Route Nationale
max. D 247 × H 130 μm

- a) apical view (image Cibicidoides 68_73API.psd)
- b) umbilical view (image Cibicidoides 68_73UMB.psd)
- c) lateral view (image Cibicidoides 68_73SID.psd)

5. RNA987-79

Late Rupelian, Cornol - Route Nationale
max. D 282 × H 165 μm

- a) apical view (image Cibicidoides 68_72API.psd)
- b) umbilical view (image Cibicidoides 68_72UMB.psd)
- c) lateral view (image Cibicidoides 68_72SID.psd)

6. RNA987-62

Late Rupelian, Cornol - Route Nationale
max. D 304 × H 146 μm

- a) apical view (image Cibicidoides 68_64API.psd)
- b) umbilical view (image Cibicidoides 68_64UMB.psd)
- c) lateral view (image Cibicidoides 68_64SID.psd)

7. RNA987-78

Late Rupelian, Cornol - Route Nationale
max. D 391 × H 168 μm

- a) apical view (image Cibicidoides 68_71API.psd)
- b) umbilical view (image Cibicidoides 68_71UMB.psd)
- c) lateral view (image Cibicidoides 68_71SID.psd)

8. RNA987-116

Late Rupelian, Cornol - Route Nationale
max. D 454 × H 150 μm

- a) apical view (image Cibicidoides 68_09API.psd)
- b) umbilical view (image Cibicidoides 68_09UMB.psd)
- c) lateral view (image Cibicidoides 68_09SID.psd)

9. RNA987-103

Late Rupelian, Cornol - Route Nationale
max. D 501 × H 229 μm

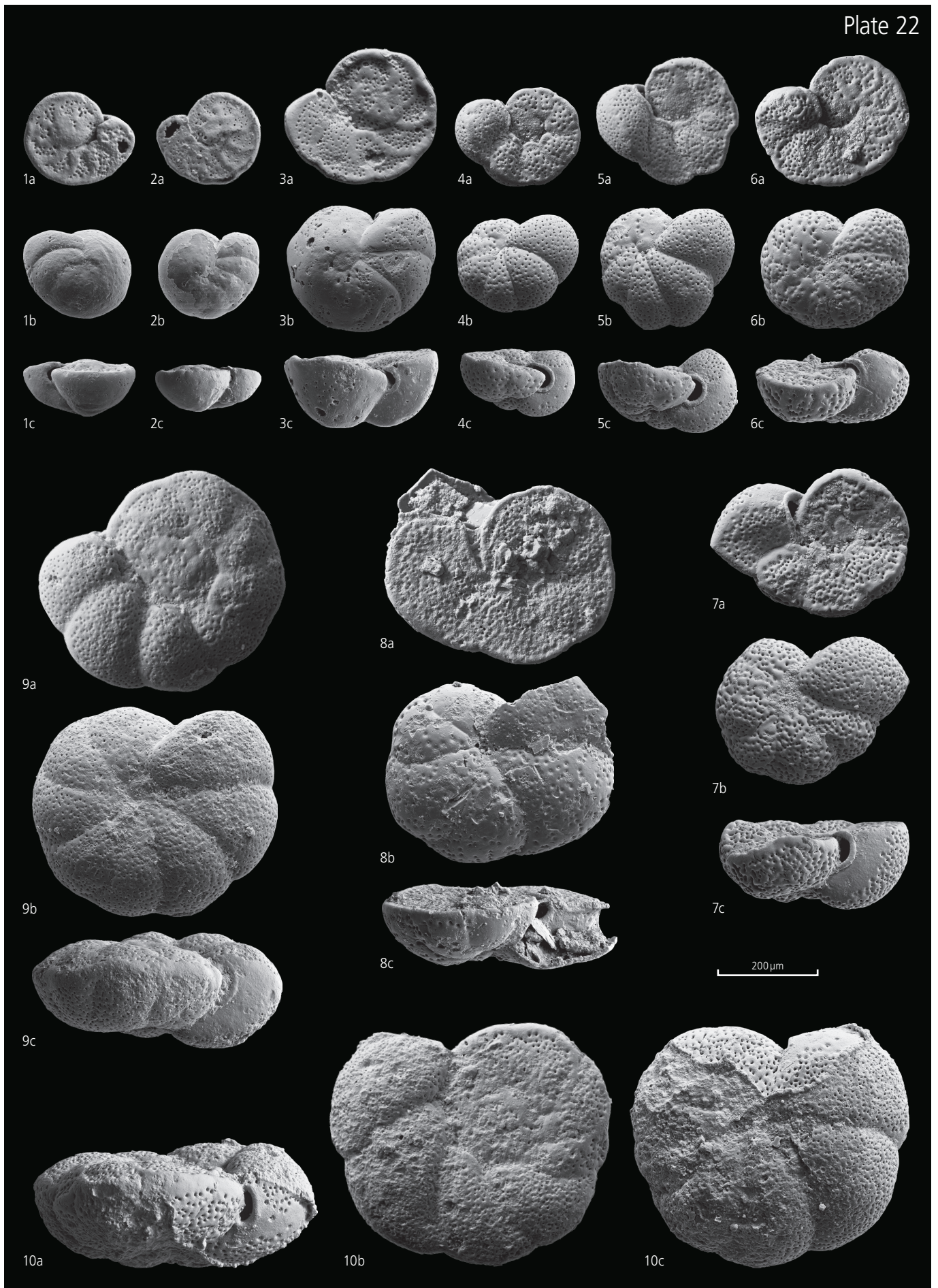
- a) apical view (image Cibicidoides 68_08API.psd)
- b) umbilical view (image Cibicidoides 68_08UMB.psd)
- c) lateral view (image Cibicidoides 68_08SID.psd)

10. RNA987-102

Late Rupelian, Cornol - Route Nationale
max. D 561 × H 244 μm

- a) lateral view (image Cibicidoides 68_07SID.psd)
- b) apical view (image Cibicidoides 68_07API.psd)
- c) umbilical view (image Cibicidoides 68_07UMB.psd)

Plate 22



Foraminifera

Plate 23

Cibicoides lobatulus (Walter & Jacob, 1798) -
communis (Roemer 1838) morphogroup

1. RNA987-100

Late Rupelian, Cornol-Route Nationale

max. D 684 × H 257 μm

- a) apical view (image Cibicoides 68_05API.psd)
- b) umbilical view (image Cibicoides 68_05UMB.psd)
- c) lateral view (image Cibicoides 68_05SID.psd)

2. RNA987-101

Late Rupelian, Cornol-Route Nationale

max. D 702 × H 268 μm

- a) apical view (image Cibicoides 68_06API.psd)
- b) umbilical view (image Cibicoides 68_06UMB.psd)
- c) lateral view (image Cibicoides 68_06SID.psd)

Cibicoides sp. 2

3. RNA987-97

Late Rupelian, Cornol-Route Nationale

max. D 416 × H 219 μm

- a) apical view (image Cibicoides 68_04API.psd)
- b) umbilical view (image Cibicoides 68_04UMB.psd)
- c) lateral view (image Cibicoides 68_04SID.psd)

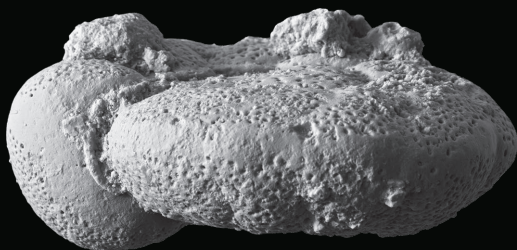
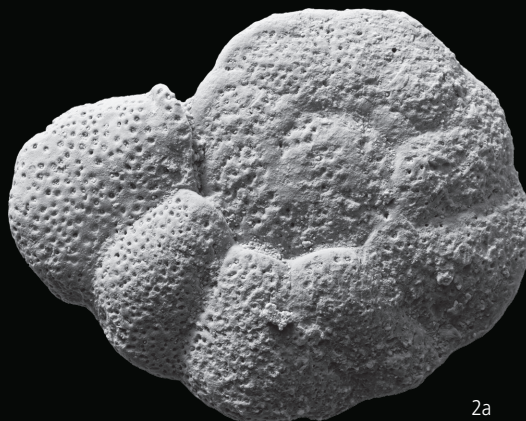
4. RNA987-96

Late Rupelian, Cornol-Route Nationale

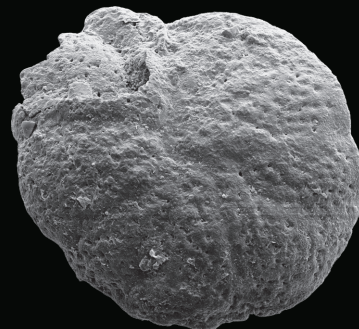
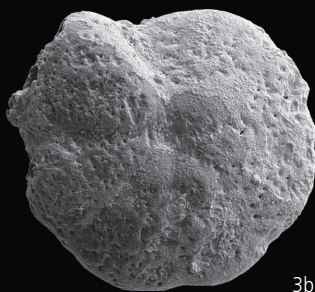
max. D 492 μm

- a) apical view (image Cibicoides 68_03API.psd)
- b) umbilical view (image Cibicoides 68_03UMB.psd)

Plate 23



200 μm



Foraminifera

Plate 24

Cibicoides sp. 1

1. RNA987-66

Late Rupelian, Cornol-Route Nationale

max. D 220 × H 113 μm

- a) apical view (image Cibicoides 68_01API.psd)
- b) umbilical view (image Cibicoides 68_01UMB.psd)
- c) lateral view (image Cibicoides 68_01SID.psd)

2. RNA987-70

Late Rupelian, Cornol-Route Nationale

max. D 203 × H 92 μm

- a) apical view (image Cibicoides 68_02API.psd)
- b) umbilical view (image Cibicoides 68_02UMB.psd)
- c) lateral view (image Cibicoides 68_02SID.psd)

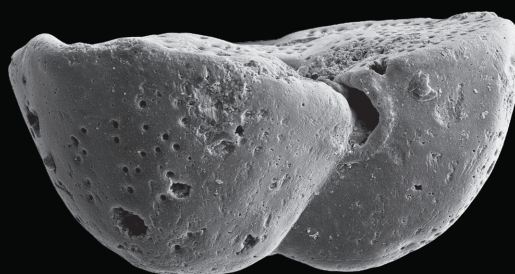
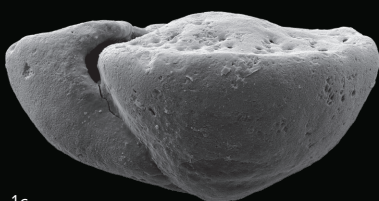
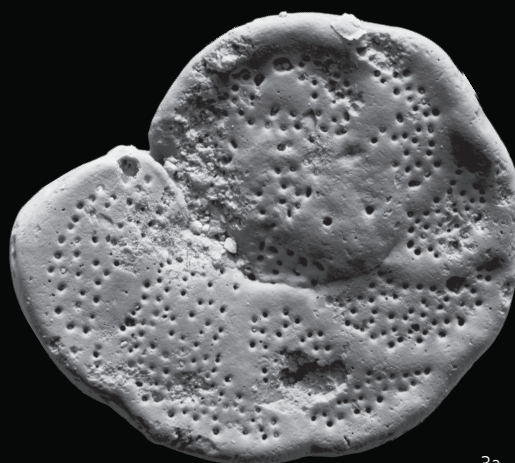
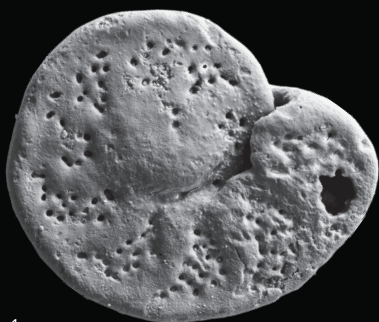
3. RNA987-63

Late Rupelian, Cornol-Route Nationale

max. D 303 × H 143 μm

- a) apical view (image Cibicoides 68_65API.psd)
- b) umbilical view (image Cibicoides 68_65UMB.psd)
- c) lateral view (image Cibicoides 68_65SID.psd)

Plate 24



200 μm

Foraminifera

Plate 25

Cibicoides lobatulus (Walter & Jacob, 1798) - *communis*
(Roemer 1838) morphogroup

1. RNA987-80

Late Rupelian, Cornol-Route Nationale

max. D 247 × H 130 μm

- a) apical view (image Cibicoides 68_73API.psd)
- b) umbilical view (image Cibicoides 68_73UMB.psd)
- c) lateral view (image Cibicoides 68_73SID.psd)

2. RNA987-79

Late Rupelian, Cornol-Route Nationale

max. D 282 × H 165 μm

- a) apical view (image Cibicoides 68_72API.psd)
- b) umbilical view (image Cibicoides 68_72UMB.psd)
- c) lateral view (image Cibicoides 68_72SID.psd)

3. RNA987-62

Late Rupelian, Cornol-Route Nationale

max. D 304 × H 146 μm

- a) apical view (image Cibicoides 68_64API.psd)
- b) umbilical view (image Cibicoides 68_64UMB.psd)
- c) lateral view (image Cibicoides 68_64SID.psd)

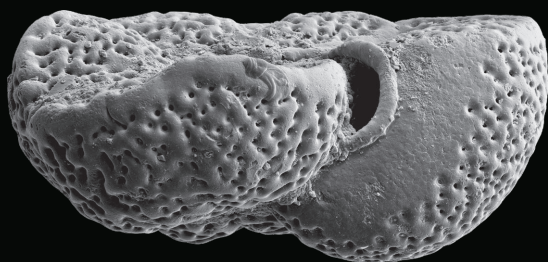
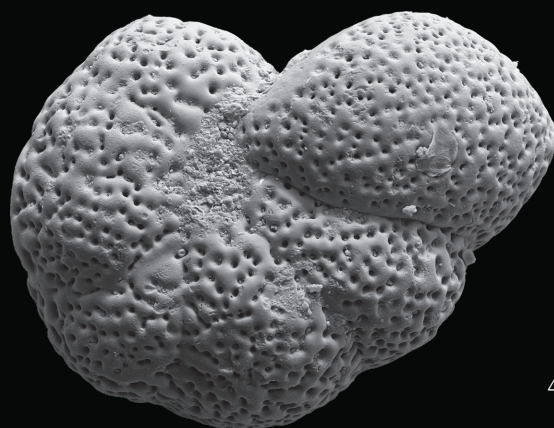
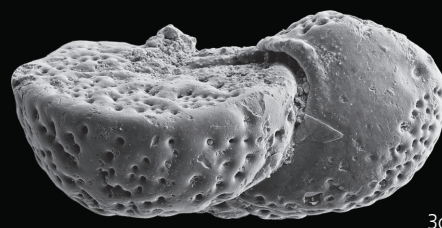
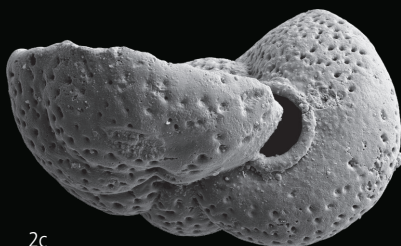
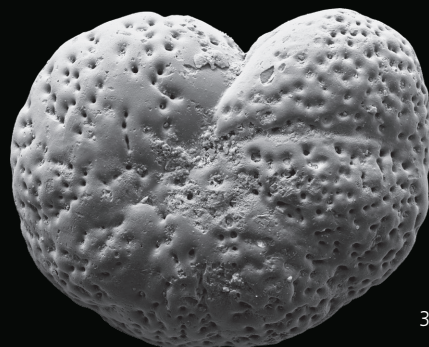
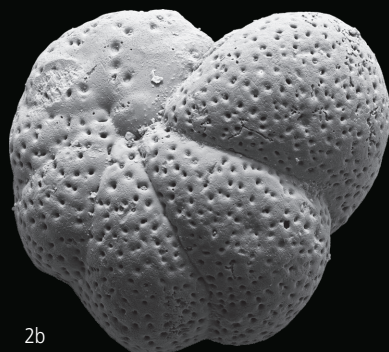
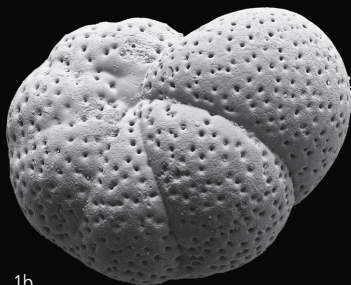
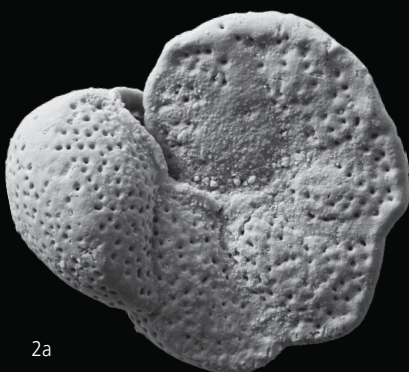
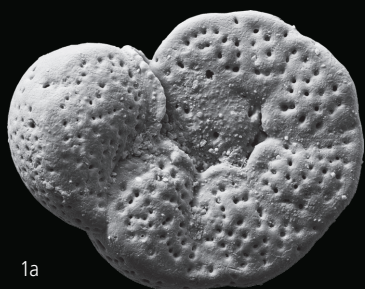
4. RNA987-78

Late Rupelian, Cornol-Route Nationale

max. D 391 × H 168 μm

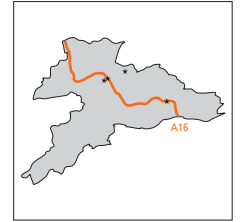
- a) apical view (image Cibicoides 68_71API.psd)
- b) umbilical view (image Cibicoides 68_71UMB.psd)
- c) lateral view (image Cibicoides 68_71SID.psd)

Plate 25



200 μm

ROTAIIDA

Protelphidium nonioninoides (Andreae, 1884)**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Nonionidae	<i>Protelphidium</i>	<i>nonioninoides</i>

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/17.03.2016

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Charmoille - Village (CHA-CHM)	582 650/252 375
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CGN-CLJ	1	-4.0 m	2	CLJ007-41
CGN-CLJ	1	-8.0 m	4	CLJ007-43
CGN-CLJ	1	-12.0 m	6	CLJ007-45
? CGN-CLJ	1	-16.0 m	8	CLJ007-47
CHA-CHM	4	-44.0 m	22	CHM003-54
CHA-CHM	4	-46.0 m	23	CHM003-56
COR-RNA	1	-33.2 m	49	RNA987-13
COR-RNA	1	-37.7 m	53	RNA987-30
COR-RNA	2	-9.2 m	57	RNA987-41
COR-RNA	2	-16.4 m	55	RNA987-35
DEL-BEE	9	102	962	BEE003-240
DEL-BEE	9	103	961	BEE003-219
DEL-BEE	19	1800	260	BEE004-170
DEL-BEE	19	1900	261	BEE004-213-214, 216-217

Material

122 specimens, 2 specimens uncertain

Remarks

We follow the discussion in Wenger (1987) concerning the retention of the genus *Protelphidium* (based on the presence of "open intercameral sutures"), but agree that the generic definitions of *Nonion* and *Protelphidium* remain uncertain. In *Nonion* the chambers generally increase size at a higher rate, are more inflated and ovoid/elongated in apertural view, with the umbilical granulation reaching into the less depressed umbilical part of the sutures.

The similar *Protelphidium roemeri* (Cushman 1936) potentially represents a junior synonym of *P. nonioninoides*.

SynonymyGenus *Protelphidium* Haynes, 1956Type species: *Protelphidium hofkeri* Haynes, 1956*Protelphidium nonioninoides* (Andreae, 1884)

- | | |
|--------------|---|
| * 1884 | <i>Pulvinulina nonioninoides</i> – Andreae, p. 256, pl. 11, fig. 2 |
| ?partim 1958 | <i>Nonion roemeri</i> – Batjes, p. 142, pl. 7, fig. 5 |
| 1958 | <i>Nonion roemeri</i> – Batjes, p. 142, pl. 7, fig. 5 |
| 1962 | <i>Elphidium?</i> <i>nonioninoides</i> – Doebli, p. 389, pl. 57, fig. 6 |
| 1966 | <i>Nonion graniferum</i> – Le Calvez, p. 412, pl. 3, fig. 3-4 |
| 1987 | <i>Protelphidium</i> sp. – Reiser, p. 96, pl. 10, fig. 10-11 |
| 1994 | <i>Porosonion roemeri</i> – Huber, p. 88, pl. 14, fig. 5-7 |
| 2004 | <i>Protelphidium nonioninoides</i> – Gebhardt, fig. 16/14 |
| 2005 | <i>Protelphidium nonioninoides</i> – Grimm et al., pl. 1, fig. 7 |
-

Foraminifera

Plate 26

Protelphidium nonioninoides (Andreae, 1884)

1. RNA987-

Late Rupelian, Cornol-Route Nationale

max. D 226 × H 102 μm

a) umbilical view (image Protelphidium 68_16API.psd)

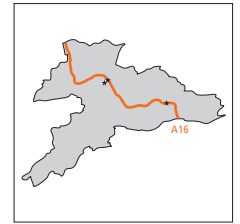
b) lateral view (image Protelphidium 68_16SID.psd)

Plate 26



200 μm

ROTAIIDA

Melonis affinis (Reuss, 1851)**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Melonidae	<i>Melonis</i>	<i>affinis</i>

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/17.03.2016

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CGN-CLJ	1	-4.0 m	2	CLJ007-41
CGN-CLJ	1	-6.0 m	3	CLJ007-42
CGN-CLJ	1	-8.0 m	4	CLJ007-43
CGN-CLJ	1	-10.0 m	5	CLJ007-44
CGN-CLJ	1	-12.0 m	6	CLJ007-45
CGN-CLJ	1	-14.0 m	7	CLJ007-46
CGN-CLJ	1	-16.0 m	8	CLJ007-47
CGN-CLJ	1	-20.0 m	10	CLJ007-49
COR-RNA	1	-33.2 m	49	RNA987-13
COR-RNA	1	-35.8 m	47	RNA987-17, 21, 26, 31-32, 104-105
COR-RNA	1	-37.7 m	53	RNA987-28-30
COR-RNA	2	-9.2 m	57	RNA987-40-41
COR-RNA	2	-16.4 m	55	RNA987-35
DEL-BEE	2	7	30	BEE002-62
DEL-BEE	9	103	961	BEE003-219
DEL-BEE	16	1	112	BEE003-840
DEL-BEE	19	1800	260/767	EE004-170, 173/858
DEL-BEE	19	1900	261	BEE004-214

Material

at least 1050 specimens, uncertain (but low) number of *Melonis* cf. *pompilioides*

Remarks

Some thicker specimens are tentatively attributed to *Melonis pompilioides* (Fichtel & Moll 1798)

SynonymyGenus *Melonis* de Montfort, 1808Type species: *Nautilus pompilioides* Fichtel & Moll, 1798*Melonis affinis* (Reuss, 1851)

- * 1851 *Nonionina affinis* m. – Reuss, p. 72, pl. 5, fig. 32
 - 1958 *Nonion affine* – Batjes, p. 140, pl. 6, fig. 12
 - 1970 *Melonis affine* – Kiesel, p. 281, pl. 15, fig. 7
 - 1974 *Nonion affine* – Doehl & Sonne, p. 36, pl. 10, fig. 79
 - 1987 *Melonis affinis* – Reiser, p. 95, pl. 10, fig. 6-7
 - 1994 *Melonis affinis* – Grimm, p. 83, pl. 4, fig. 3
 - 1994 *Melonis affinis* – Huber, p. 81, pl. 10, fig. 1-6
 - 2005 *Melonis affine* – Schudack & Nuglisch, p. 73, pl. 8, fig. 148
 - 2006 *Melonis affinis* – de Man, p. 306, pl. 17, fig. 3
 - 2008 *Melonis affinis* – Picot et al., p. 492, pl. 1, fig. 1-2
 - 2010 *Melonis affinis* – Pirkenseer et al., pl. 10, fig. 5
-

Foraminifera

Plate 27

Melonis affinis (Reuss, 1851)

1. RNA987-104

Late Rupelian, Cornol-Route Nationale

max. D 392 × H 208 μm

a) umbilical view (image Melonis 68_14API.psd)

b) lateral view (image Melonis 68_14SID.psd)

2. RNA987-105

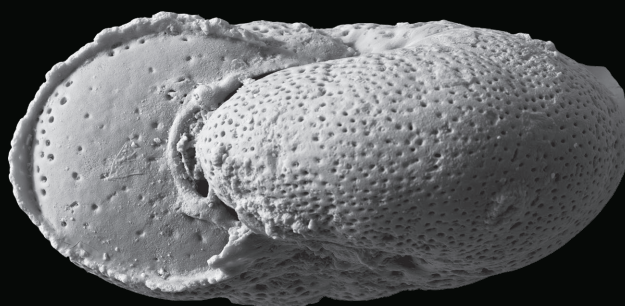
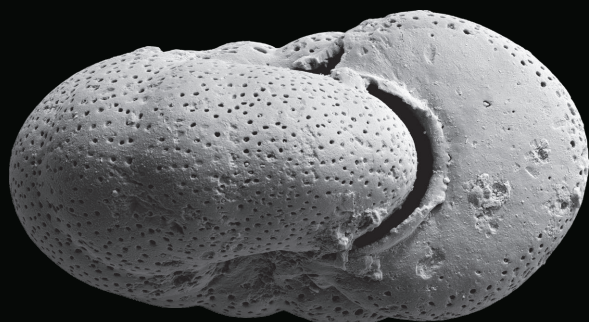
Late Rupelian, Cornol-Route Nationale

max. D 404 × H 197 μm

a) umbilical view (image Melonis 68_15API.psd)

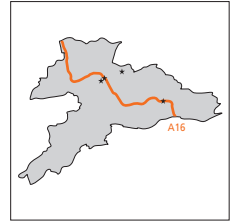
b) lateral view (image Melonis 68_15SID.psd)

Plate 27



200 μ m

ROTAIIDA

Hansenisca soldanii (d'Orbigny, 1826)**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Gavelinellidae	<i>Hansenisca</i>	<i>soldanii</i>

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/28.11.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Charmoille - Village (CHA-CHM)	582 650/252 375
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CGN-CLJ	1	-6.0 m	3	CLJ007-42
CGN-CLJ	1	-10.0 m	5	CLJ007-44
CGN-CLJ	1	-12.0 m	6	CLJ007-45
CHA-CHM	4	-44.0 m	22	CHM003-54
CHA-CHM	4	-46.0 m	23	CHM003-56
CHA-CHM	4	-48.0 m	24	CHM003-59, 81-82
COR-RNA	2	-16.4 m	55	RNA987-35, 37
DEL-BEE	19	1800	260	BEE004-170

Material

at least 72 specimens, 4 specimens uncertain; at least 131 specimens as *Gyroidinoides/Hansenisca* indet.

Synonymy

Genus *Hansenisca* Loeblich & Tappan, 1988
 Type species: *Gyroidina soldanii* d'Orbigny, 1826
Hansenisca soldanii (d'Orbigny, 1826)

- * 1826 *Gyroidina soldanii* – d'Orbigny, p. 278
- 1846 *Rotalina soldanii* – d'Orbigny, p. 155, pl. 8, fig. 10-12
- 1958 *Gyroidina soldanii* – Batjes, p. 147, pl. 7, fig. 12-15
- 1987 *Gyroidina soldanii* – Reiser, p. 101, pl. 12, fig. 7, 10-11
- 1994 *Hansenisca soldanii* – Grimm, p. 86, pl. 2, fig. 9
- 1998 *Hansenisca soldanii* – Cicha et al., p. 105, pl. 72, fig. 6-8
- 1998 *Hansenisca soldanii* – Rögl, p. 146, pl. 6, fig. 4-5
- 2005 *Gyroidina soldanii* – Rasmussen, p. 106, pl. 17, fig. 12-14
- 2005 *Hansenisca soldanii* – Schudack & Nuglisch, p. 79, pl. 10, fig. 196-197
- 2006 *Hansenisca soldanii* – de Man, p. 300, pl. 15, fig. 7
- non2010 *Gyroidina soldanii* – Margreth, p. 125, pl. 40, fig. 1
- 2010 *Gyroidina neosoldanii* – Margreth, p. 125, pl. 40, fig. 2
- 2010 *Hansenisca soldanii* – Pirkenseer et al., pl. 11, fig. 4

Remarks

Poorly preserved specimens are difficult to attribute either to *Hansenisca* or *Gyroidinoides*., since both feature open umbilici and potentially apertural flaps. *Gyroidina* sensu Loeblich & Tappan (1988) features a closed umbilicus. Variations in spiral height, grade and kind of spiral curvature as well as peripheral angularity complicate specific assignment.

Foraminifera

Plate 28

Hansenisca soldanii (d'Orbigny, 1826)

1. CHM003-81

Late Rupelian, Charmoille-Village

max. D 337 × H 214 μm

a) apical view (image Hansenisca 68_53API.psd)

b) umbilical view (image Hansenisca 68_53UMB.psd)

c) lateral view (image Hansenisca 68_53SID.psd)

2. CHM003-82

Late Rupelian, Charmoille-Village

max. D 369 × H 204 μm

a) apical view (image Hansenisca 68_54API.psd)

b) umbilical view (image Hansenisca 68_54UMB.psd)

c) lateral view (image Hansenisca 68_54SID.psd)

Plate 28



1a



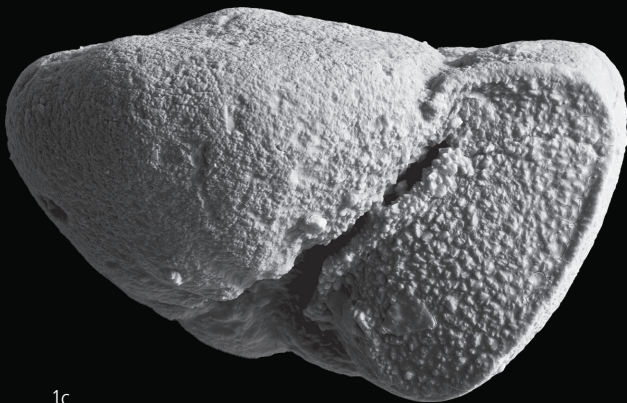
2a



1b



2b



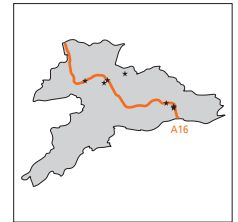
1c



2c

200 μm

ROTAIIIDA

Aubignyna kiliani (Andreae, 1884)**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Haynesinidae	<i>Aubignyna</i>	<i>kiliani</i>

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/17.03.2016

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Charmoille - Village (CHA-CHM)	582 650/252 375
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035
Courrendlin - Hauts Rochets (CRD-HRT)	595 640/243 145
Courrendlin - Pécas (CRD-PCA)	595 690/243 390
Courrendlin - Solé (CRD-SOL)	595 700/243 560
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Porrentruy - Étang (POR-ETA)	571 474/251 036

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CGN-CLJ	1	-4.0 m	2	CLJ007-41
CGN-CLJ	1	-8.0 m	4	CLJ007-43
CGN-CLJ	1	-10.0 m	5	CLJ007-44
CGN-CLJ	1	-12.0 m	6	CLJ007-45
CGN-CLJ	1	-14.0 m	7	CLJ007-46
CGN-CLJ	1	-16.0 m	8	CLJ007-47
CGN-CLJ	1	-20.0 m	10	CLJ007-49
CHA-CHM	4	-46.0 m	23	CHM003-56
CHA-CHM	4	-48.0 m	24	CHM003-59, 83-84
COR-RNA	1	-33.2 m	49	RNA987-13
COR-RNA	1	-35.8 m	47	RNA987-21
COR-RNA	2	-9.2 m	57	RNA987-41
COR-RNA	2	-16.4 m	55	RNA987-35
CRD-PCA	81	500	87	PCA008-351
CRD-PCA	98	600	90	PCA008-465
CRD-PCA	127	500	121	PCA008-448
CRD-PCA	138	500	127	PCA008-484
CRD-PCA	147	600	133	PCA008-628
CRD-SOL	2	-9.9 m	19	SOL004-71
CRD-SOL	22	400	54	SOL006-203
DEL-BEE	9	100	110	BEE003-473
DEL-BEE	9	102	962	BEE003-240
DEL-BEE	9	103	961	BEE003-219
DEL-BEE	9	201	213	BEE003-273
DEL-BEE	19	300	124	BEE003-312
DEL-BEE	19	1800	260	BEE004-170, 172
DEL-BEE	19	1900	261	BEE004-213-214, 216
POR-ETA	2	-11.0 m	11	ETA004-114

Material

at least 305 specimens

Synonymy

Genus *Aubignyna* Margerel, 1970

Type species: *Rotalia perlucida* Heron-Allen & Earland, 1913

Aubignyna kiliani (Andreae, 1884)

- * 1884 *Pulvinulina Kiliani* – Andreae, p. 255, pl. 11, fig. 1
- 1958 *Rotalia kiliani* – Batjes, p. 166, pl. 12, fig. 8
- 1962 *Eponides kiliani* – Doehl, p. 390, pl. 57, fig. 7
- 1987 *Ammonia kiliani* – Reiser, p. 105, pl. 13, fig. 13-15
- 1994 *Aubignyna kiliani* – Huber, p. 86, pl. 13, fig. 1-6
- 1998 *Aubignyna kiliani* – Cicha et al., p. 81, pl. 73, fig. 1-3
- 2010 *Aubignyna kiliani* – Pirkenseer et al., pl. 11, fig. 5

Remarks

Poorly preserved specimens can not be distinguished from *Ammonia*.

Foraminifera

Plate 29

Aubignyna kiliani (Andreae, 1884)

1. CHM003-83

Late Rupelian, Charmoille-Village

max. D 323 × H 150 μm

a) apical view (image Aubignyna 68_55API.psd)

b) umbilical view (image Aubignyna 68_55UMB.psd)

c) lateral view (image Aubignyna 68_55SID.psd)

2. CHM003-84

Late Rupelian, Charmoille-Village

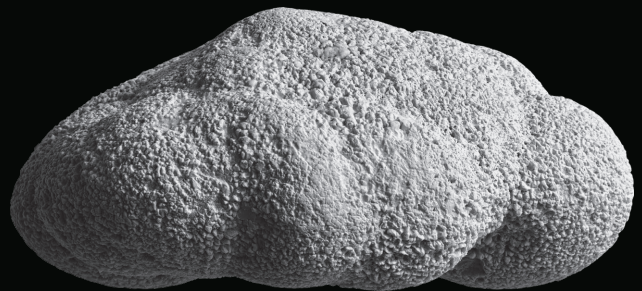
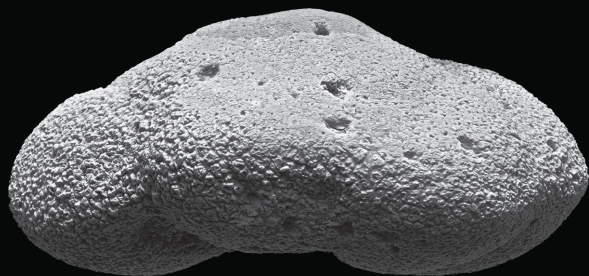
max. D 353 × H 161 μm

a) apical view (image Aubignyna 68_56API.psd)

b) umbilical view (image Aubignyna 68_56UMB.psd)

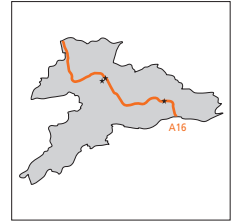
c) lateral view (image Aubignyna 68_56SID.psd)

Plate 29



200 µm

ROTAIIDA
Buccella sp. 1



Taxonomy

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Trichohyalidae	<i>Buccella</i>	–

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/22.11.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CGN-CLJ	1	-6.0 m	3	CLJ007-42
CGN-CLJ	1	-14.0 m	7	CLJ007-46
CGN-CLJ	1	-16.0 m	8	CLJ007-47
CGN-CLJ	1	-20.0 m	10	CLJ007-49
COR-RNA	1	-33.2 m	49	RNA987-13
COR-RNA	1	-35.8 m	47	RNA987-21
COR-RNA	1	-37.7 m	53	RNA987-28-30
DEL-BEE	19	1900	261	BEE004-213, 295-296

Material

at least 106 specimens, 21 specimens uncertain

Synonymy

- Genus *Buccella* Anderson, 1952
Type species: *Eponides hannai* Phleger & Parker, 1951
Buccella sp. 1
- 2008 *Buccella* [sic] sp. – Picot et al., pl. 1, fig. 11-12
2010 *Buccella granulata* – Pirkenseer et al., pl. 11, fig. 6

Remarks

A species of *Buccella* with a flat umbilical side and a moderately to strongly convex apical side. The peripheral margin is well-rounded.

Foraminifera

Plate 30

Buccella sp. 1

1. BEE004-295

Late Rupelian, Delémont - Beuchille Est

max. D 282 × H 161 μm

a) apical view (image Buccella 68_55API.psd)

b) umbilical view (image Buccella 68_57UMB.psd)

c) lateral view (image Buccella 68_57SID.psd)

2. BEE004-296

Late Rupelian, Delémont - Beuchille Est

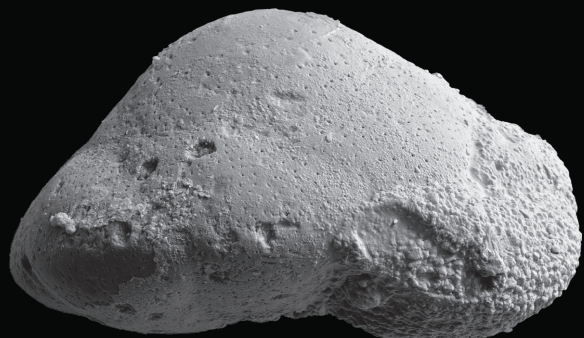
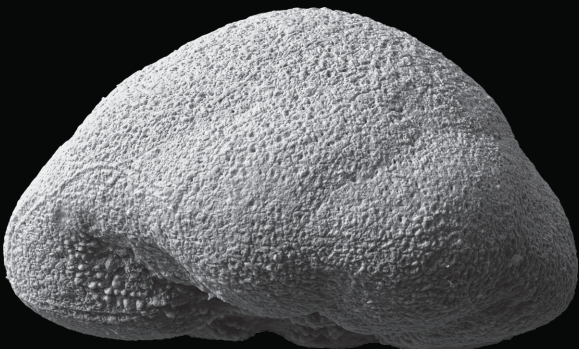
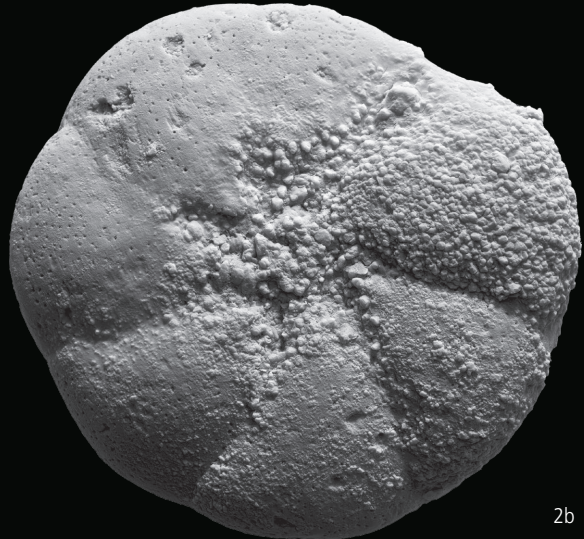
max. D 275 × H 162 μm

a) apical view (image Buccella 68_58API.psd)

b) umbilical view (image Buccella 68_58UMB.psd)

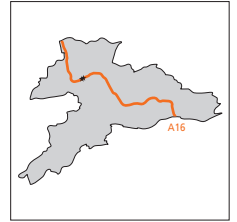
c) lateral view (image Buccella 68_58SID.psd)

Plate 30



200 μm

ROTAIIDA
Buccella sp. 2



Taxonomy

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Trichohyalidae	<i>Buccella</i>	–

Determination (name/date): Martina Pippèrr / 27.10.2015; Claudius Pirkenseer / 22.11.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Porrentruy-Étang (POR-ETA)	571 474/251 036
Porrentruy-Oiselier (POR-OIS)	571 750/250 500

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
POR-ETA	3	-7.0 m	27	ETA004-161, 247-248
POR-ETA	3	-8.0 m	28	ETA004-162
POR-OIS	2	–	6	OIS000-9, 39-40

Material

34 specimens, 1 specimen uncertain

Synonymy

- Genus *Buccella* Anderson, 1952
Type species: *Eponides hannai* Phleger & Parker, 1951
Buccella sp. 2
- ? 1994 *Buccella* sp. 2 – Huber, pl. 14, fig. 8-9

Remarks

A biconvex species of *Buccella* with a low to moderately convex apical side and a subacute peripheral margin.

Foraminifera

Plate 31

Buccella sp. 2

1. ETA004-274

Late Rupelian, Porrentruy-Étang

max. D 306 × H 162 μm

a) apical view (image Buccella 68_59API.psd)

b) umbilical view (image Buccella 68_59UMB.psd)

c) lateral view (image Buccella 68_59SID.psd)

2. ETA004-275

Late Rupelian, Porrentruy-Étang

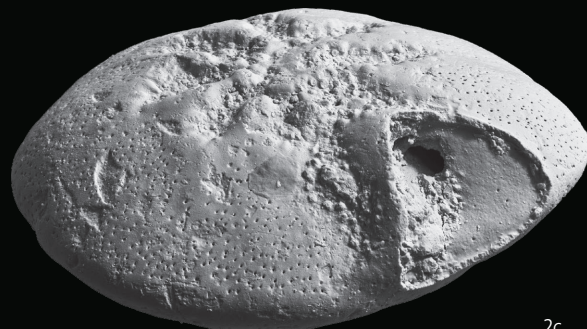
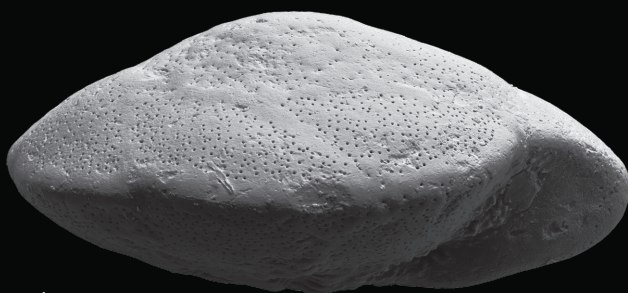
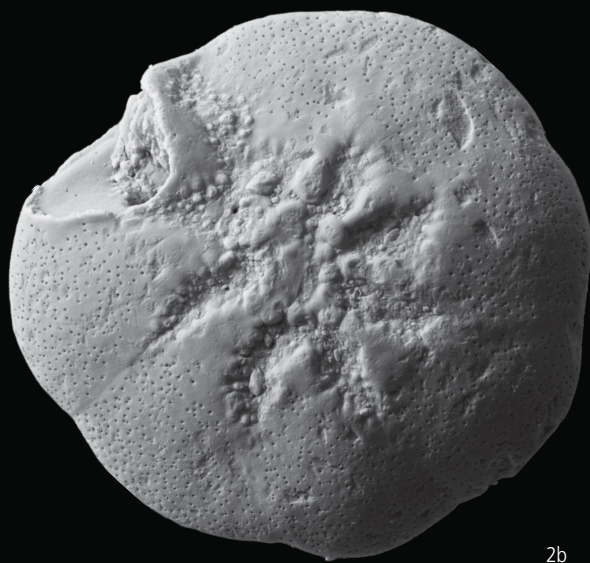
max. D 286 × H 135 μm

a) apical view (image Buccella 68_60API.psd)

b) umbilical view (image Buccella 68_60UMB.psd)

c) lateral view (image Buccella 68_60SID.psd)

Plate 31



200 µm

Foraminifera

Plate 32

Buccella sp. 2

1. OIS000-39

Late Rupelian, Porrentruy - Oiselier

max. D 266 × H 127 μm

a) apical view (image Buccella 69_27API.psd)

b) umbilical view (image Buccella 69_27UMB.psd)

c) lateral view (image Buccella 69_27SID.psd)

2. OIS000-40

Late Rupelian, Porrentruy - Oiselier

max. D 280 × H 141 μm

a) apical view (image Buccella 69_28API.psd)

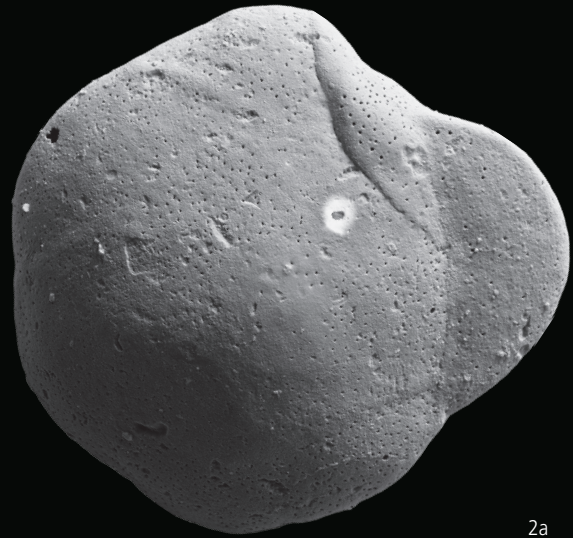
b) umbilical view (image Buccella 69_28UMB.psd)

c) lateral view (image Buccella 69_28SID.psd)

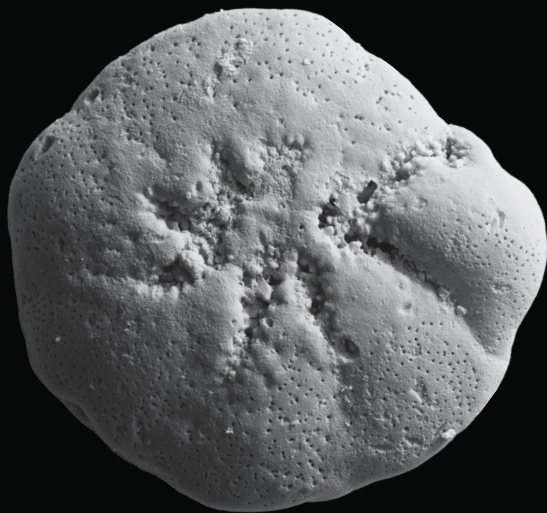
Plate 32



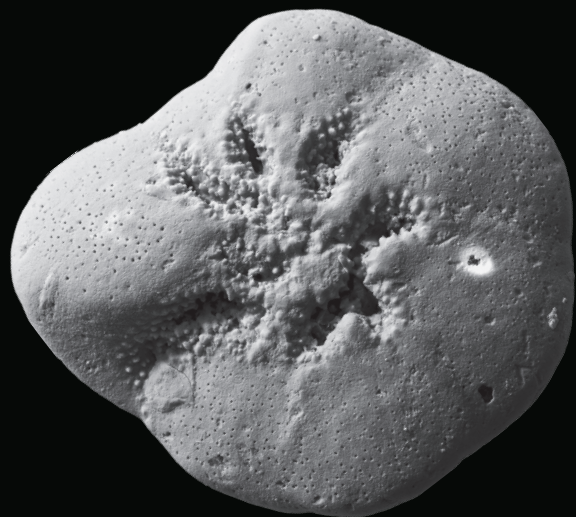
1a



2a



1b



2b



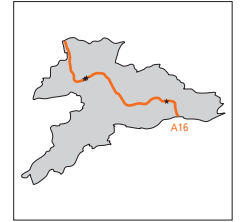
1c



2c

200 μm

ROTAIIIDA

Pararotalia canui (Cushman, 1928)**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Calcarinidae	<i>Pararotalia</i>	<i>canui</i>

Determination (name/date): Martina Pippèrr/27.10.2015; Claudius Pirkenseer/05.12.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Porrentruy - Étang (POR-ETA)	571 474/251 036
Porrentruy - Oiselier (POR-OIS)	571 900/250 500

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
DEL-BEE	9	102	962	BEE003-240
DEL-BEE	9	103	961	BEE003-219, 220
DEL-BEE	9	201	213	BEE003-273
DEL-BEE	19	300	124	BEE003-312
DEL-BEE	19	1800	260	BEE004-170, 172-173
DEL-BEE	19	1900	261	BEE004-214-216
POR-ETA	2	-11.0 m	11	ETA004-114
POR-OIS	2	–	6	OIS000-9, 33-38

Material

28 specimens (OIS000-9); at least 437 specimens as *Pararotalia*? *Praepararotalia* spp. (other samples)

Synonymy

		Genus <i>Pararotalia</i> Le Calvez, 1949
		Type species: <i>Rotalina inermis</i> Terquem, 1882
		<i>Pararotalia canui</i> (Cushman, 1928)
?	1855	<i>Rotalia stellata</i> – Reuss, p. 242, pl. 5, fig. 54
*	1928	<i>Rotalia canui</i> nom. nov. – Cushman, p. 55, pl. 3, fig. 2
	1957	<i>Pararotalia curryi</i> – Loeblich & Tappan, p. 13, pl. 3, fig. 5-7
?partim	1958	<i>Pararotalia canui</i> – Batjes, p. 168, pl. 12, fig. 5-6, [?]
	1960	<i>Pararotalia canui</i> subsp. <i>rhenana</i> – Ellermann, p. 688, pl. 54, fig. 7
	1987	<i>Pararotalia canui</i> – Reiser, p. 105, pl. 14, fig. 1-3
	1998	<i>Pararotalia canui</i> – Cicha et al., p. 116, pl. 73, fig. 11-13
	2005	<i>Pararotalia curryi</i> – Schudack & Nuglisch, p. 79, pl. 11, fig. 209
	2010	<i>Pararotalia canui</i> – Pirkenseer et al., p. 17, pl. 11, fig. 9

Remarks

We follow the discussion in Reiser (1987) concerning the specific assignment of *Pararotalia canui*, since Cushman (1928) attributed unrelated new material from the Rupelian of the Paris Basin to *Rotalia stellata* Reuss from the Chattian of northern Germany, 1855 while providing a new name (under assumption of precedence of *Rotalia stellata* Ehrenberg, 1840). Accordingly *Pararotalia curryi* Loeblich & Tappan, 1957 is put into synonymy, and Cushman's specimens becoming the holotypes for *P. canui*. We however agree with Loeblich & Tappan (1957) with the uncertain status of *Rotalia stellata* sensu Reuss (1855), which probably represents a different larger species lacking spines and featuring an acute periphery.

Our material shows a wide variety of morphologies (all figured specimens are derived from the same sample), ranging from lobate forms with inflated chambers to stellate specimens with angular periphery. An umbilical plug is not always preserved.

Foraminifera

Plate 33

Pararotalia canui (Cushman, 1928)

1. OIS000-37

Late Rupelian, Porrentruy-Oiselier

max. D 340 × H 146 µm (without spines)

specimen with inflated chambers, lobate periphery and angular pseudospine base

a) apical view (image Pararotalia 69_25API.psd)

b) umbilical view (image Pararotalia 69_25UMB.psd)

c) lateral view (image Pararotalia 69_25SID.psd)

2. OIS000-36

Late Rupelian, Porrentruy-Oiselier

max. D 343 × H 125 µm (without spines)

specimen with inflated chambers, lobate periphery and angular pseudospine base

a) apical view (image Pararotalia 69_24API.psd)

b) umbilical view (image Pararotalia 69_24UMB.psd)

c) lateral view (image Pararotalia 69_24SID.psd)

3. OIS000-34

Late Rupelian, Porrentruy-Oiselier

max. D 233 × H 93 µm (without spines)

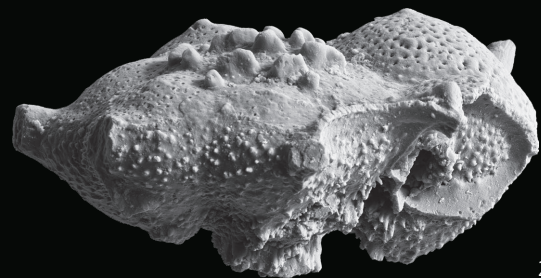
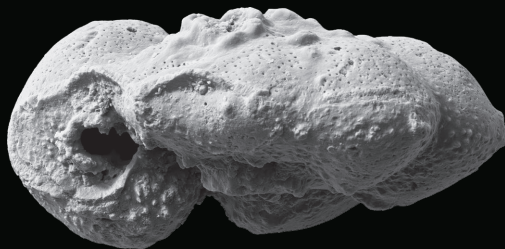
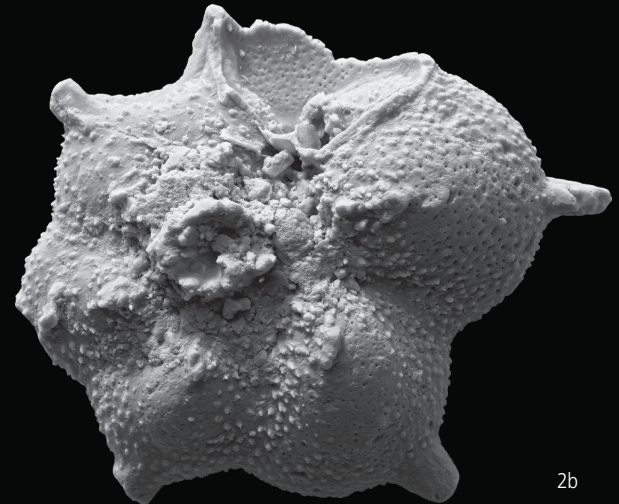
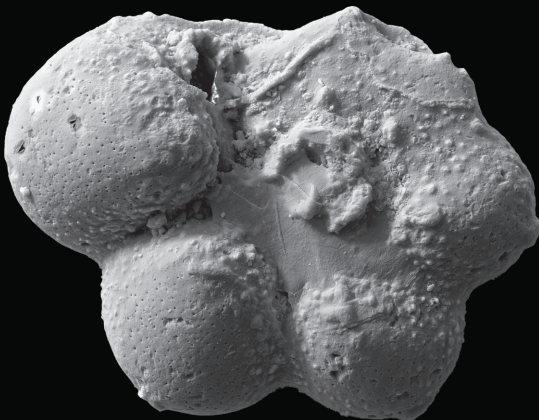
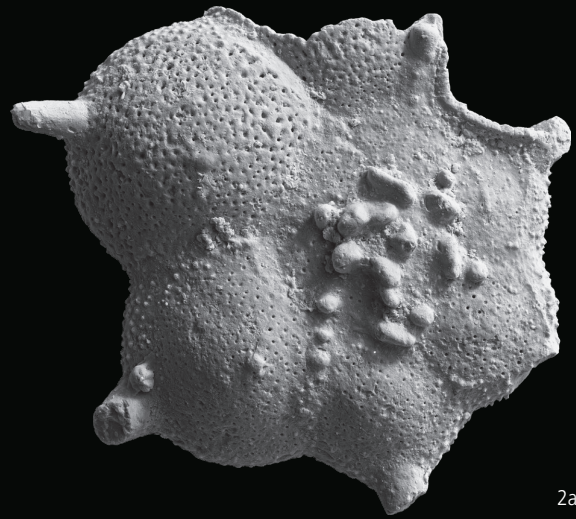
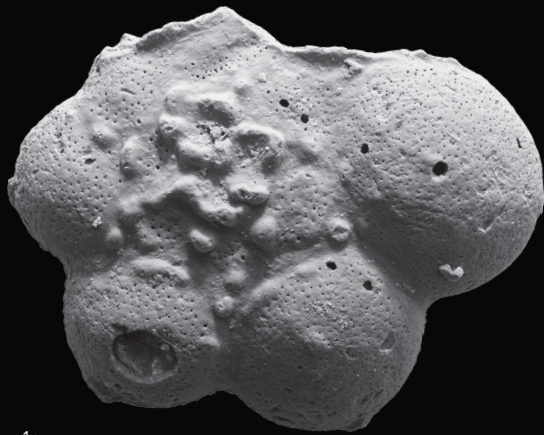
small intermediate specimen with semi-inflated chambers, tendency to stellar/angular periphery and angular pseudospine base

a) apical view (image Pararotalia 69_22API.psd)

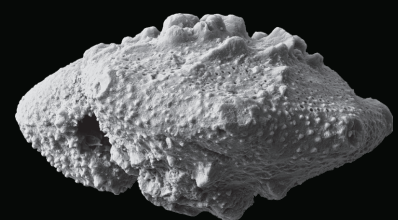
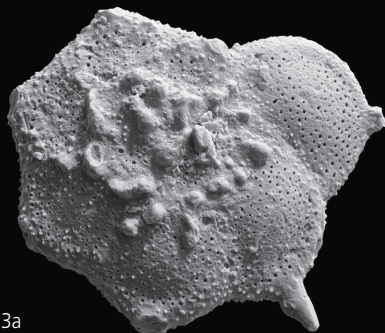
b) umbilical view (image Pararotalia 69_22UMB.psd)

c) lateral view (image Pararotalia 69_22SID.psd)

Plate 33



200µm



Foraminifera

Plate 34

Pararotalia canui (Cushman, 1928)

1. OIS000-33

Late Rupelian, Porrentruy-Oiselier

max. D 326 × H 134 μm (without spines)

intermediate specimen with semi-inflated chambers, tendency to stellar/angular periphery and rounded pseudospine base

a) apical view (image Pararotalia 69_21API.psd)

b) umbilical view (image Pararotalia 69_21UMB.psd)

c) lateral view (image Pararotalia 69_21SID.psd)

2. OIS000-38

Late Rupelian, Porrentruy-Oiselier (without spines)

max. D 313 × H 146 μm

specimen with weakly inflated chambers, stellar/angular periphery and rounded pseudospine base

a) apical view (image Pararotalia 69_26API.psd)

b) umbilical view (image Pararotalia 69_26UMB.psd)

c) lateral view (image Pararotalia 69_26SID.psd)

3. OIS000-35

Late Rupelian, Porrentruy-Oiselier

max. D 227 × H 102 μm (without spines)

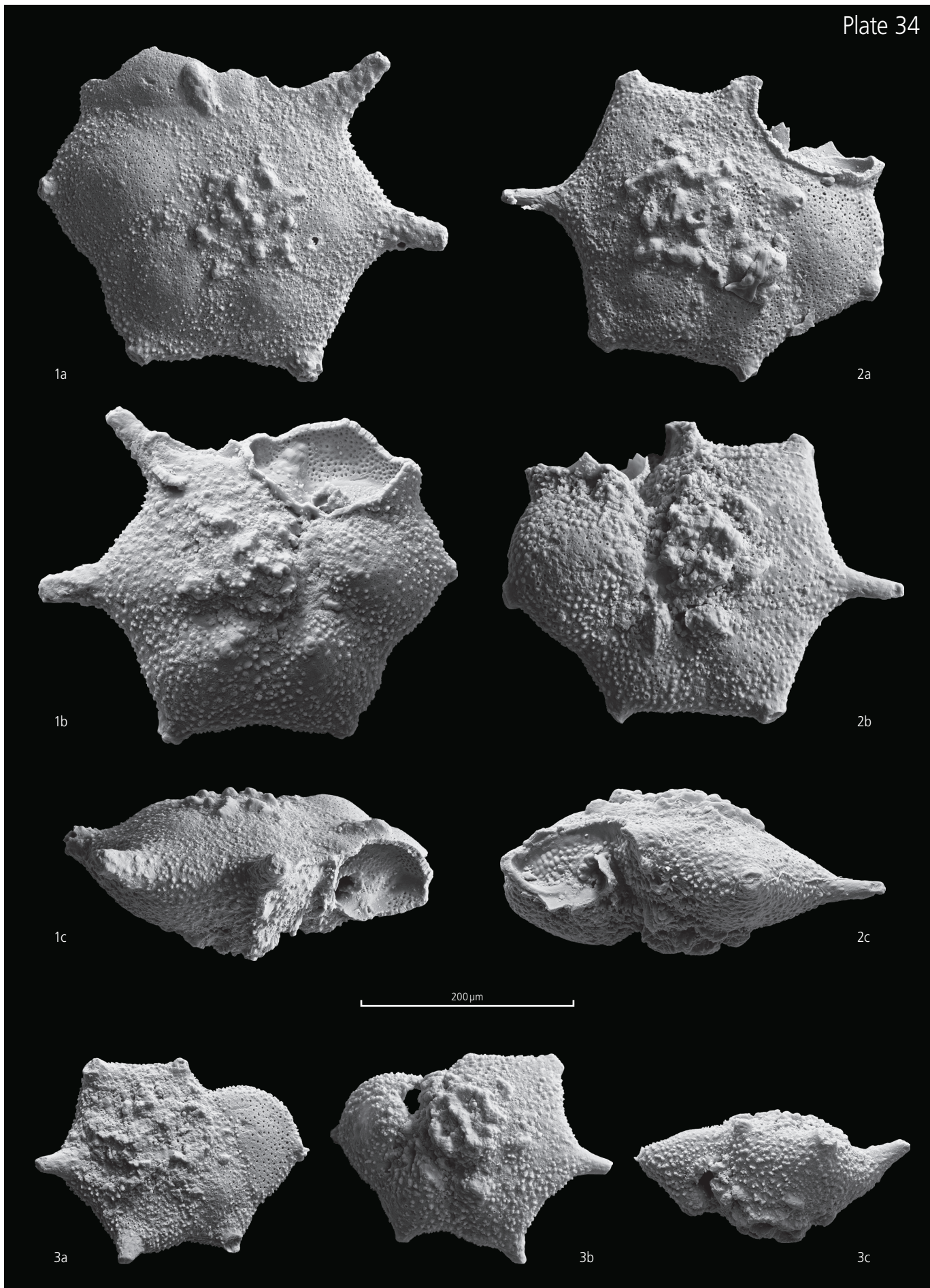
small stellate specimen with angular chambers and rounded pseudospine base

a) apical view (image Pararotalia 69_23API.psd)

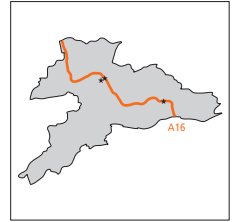
b) umbilical view (image Pararotalia 69_23UMB.psd)

c) lateral view (image Pararotalia 69_23SID.psd)

Plate 34



ROTAIIDA

Biapertorbis alteconicus Pokorný, 1956**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Discorbinellidae	<i>Biapertorbis</i>	<i>alteconicus</i>

Determination (name/date): Martina Pippèr/27.10.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713 / 250 616
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740 / 250 035
Delémont - Beuchille Est (DEL-BEE)	593 610 / 244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
? CGN-CLJ	1	-20.0 m	10	CLJ007-49
COR-RNA	1	-33.2 m	49	RNA987-12-13, 64-65
COR-RNA	1	-35.8 m	47	RNA987-21
? DEL-BEE	19	1800	260	BEE004-170

Material

7 specimens, 3 specimens uncertain

Synonymy

Genus *Biapertorbis* Pokorný, 1956

Type species: *Biapertorbis biaperturata* Pokorný, 1956

Biapertorbis alteconicus Pokorný, 1956

- * 1956 *Biapertorbis alteconica* – Pokorný, p. 266, fig. 7-8
- 1974 *Discorbis ? orbicularis* – Doehl & Sonne, p. 31, pl. 7, fig. 62
- 1987 *Discorbis alteconicus* – Reiser, p. 98, pl. 11, fig. 7-9
- 1998 *Biapertorbis alteconicus* – Cicha et al., p. 82, pl. 63, fig. 9-10
- 2005 *Biapertorbis alteconicus* – Schudack & Nuglisch, p. 64, pl. 4, fig. 64-65

Foraminifera

Plate 35

Biapertorbis alteconicus Pokorný, 1956

1. RNA987-64

Late Rupelian, Cornol-Route Nationale

max. D 241 × H ≈122 μm

- a) apical view (image Biapertorbis alteconicus 68_74API.psd)
- b) umbilical view (image Biapertorbis alteconicus 68_74UMB.psd)
- c) lateral view (image Biapertorbis alteconicus 68_74SID.psd)

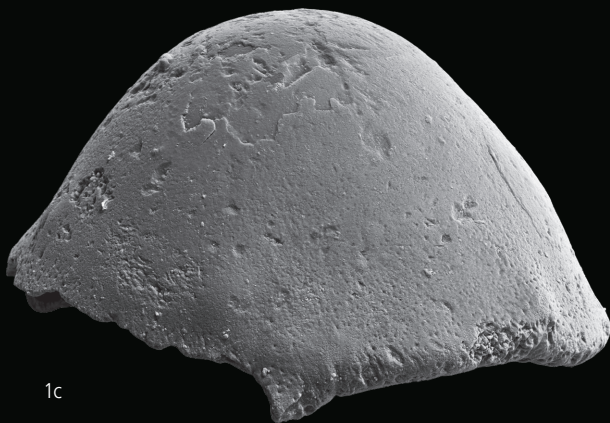
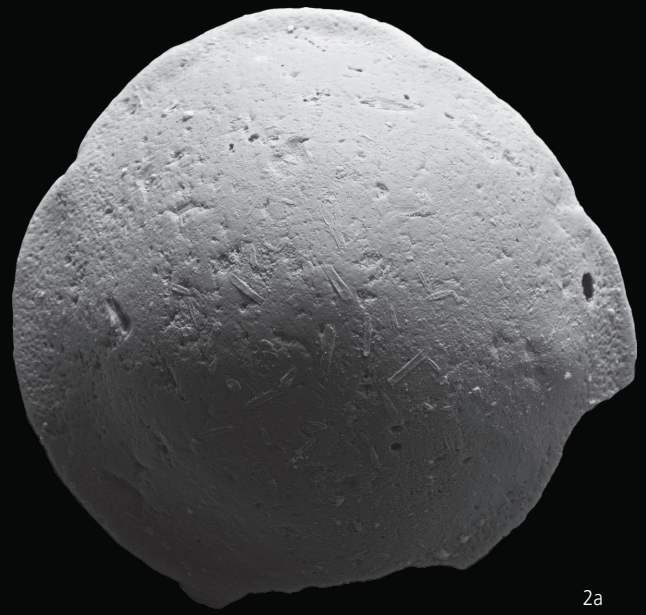
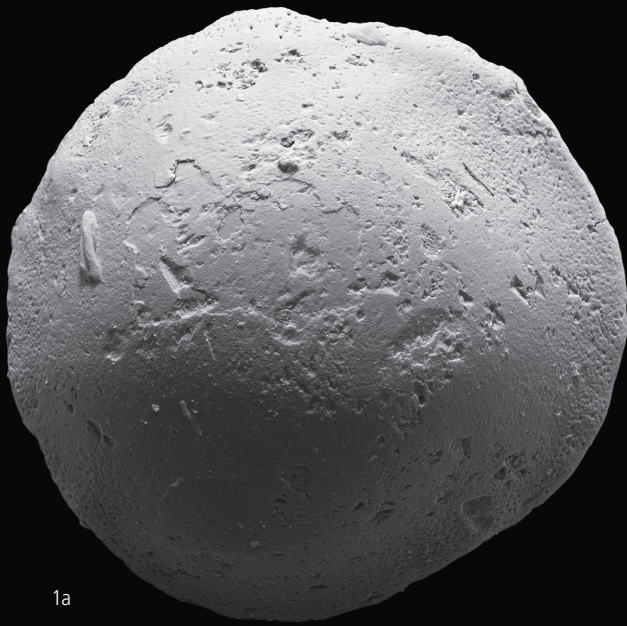
2. RNA987-65

Late Rupelian, Cornol-Route Nationale

max. D 240 × H 118 μm

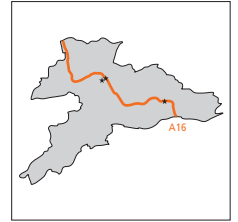
- a) apical view (image Biapertorbis alteconicus 68_75API.psd)
- b) umbilical view (image Biapertorbis alteconicus 68_75UMB.psd)
- c) lateral view (image Biapertorbis alteconicus 68_75SID.psd)

Plate 35



200 μm

ROTAIIDA

Elphidiella cryptostoma (Egger, 1857)**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Elphidiellidae	<i>Elphidiella</i>	<i>cryptostoma</i>

Determination (name/date): Martina Pippèr/27.10.2015; Claudius Pirkenseer/29.11.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
? CGN-CLJ	1	-20.0 m	10	CLJ007-49
COR-RNA	1	-33.2 m	49	RNA987-13, 68-69
COR-RNA	1	-35.8 m	47	RNA987-17, 32
? DEL-BEE	19	1800	260	BEE004-170

Material

39 specimens, 3 specimens uncertain

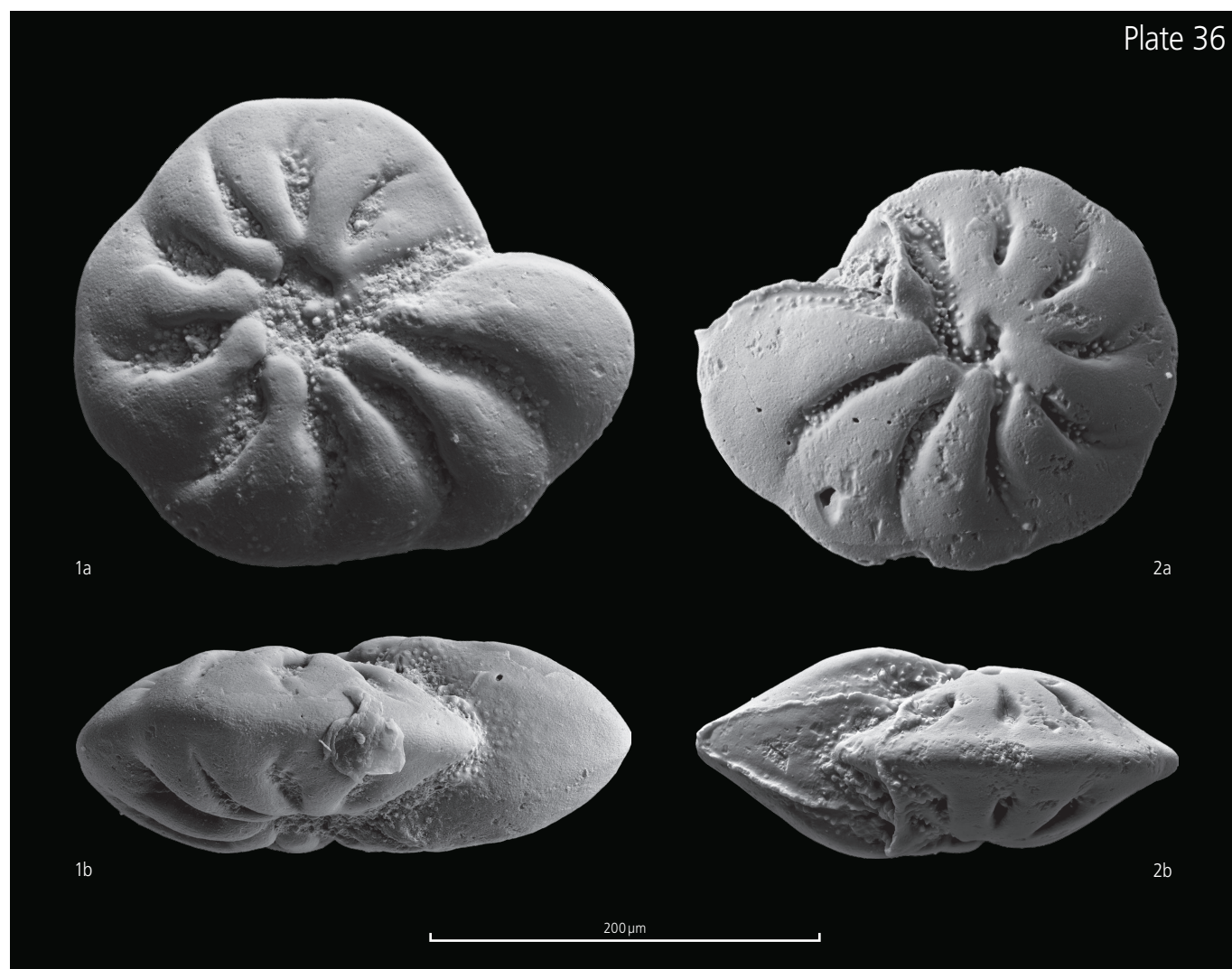
Synonymy

Genus *Elphidiella* Cushman, 1936

Type species: *Polystomella arctica* Parker & Jones, 1864

Elphidiella cryptostoma (Egger, 1857)

- * 1857 *Polystomella cryptostoma* – Egger, p. 301, pl. 9, fig. 19-20
- 1884 *Nonionina buxovillana* – Andreae, pl. 11, fig. 3
- 1974 *Elphidium ? buxovillanum* – Doebel & Sonne., p. 32, pl. 9, fig. 69
- 1987 *Elphidiella cryptostoma* – Wenger, p. 296, pl. 13, fig. 2-3
- 2004 *Protelphidium decoratum* – Gebhardt, p. 261, fig. 16/6, 11
- 2009 *Elphidiella cryptostoma* – Pippèr & Reichenbacher, fig. 4/10-11



Foraminifera

Plate 36

Elphidiella cryptostoma (Egger, 1857)

1. RNA987-68

Late Rupelian, Cornol-Route Nationale
max. D 288 × H 112 μm

a) apical view (image Elphidiella 68_17API.psd)

b) lateral view (image Elphidiella 68_17SID.psd)

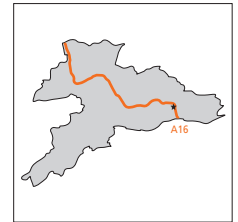
2. RNA987-69

Late Rupelian, Cornol-Route Nationale
max. D 248 × H 109 μm

a) apical view (image Elphidiella 68_18API.psd)

b) lateral view (image Elphidiella 68_18SID.psd)

ROTAIIDA

Elphidium crispum (Linnaeus, 1758)**Taxonomy**

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	Elphidiellidae	<i>Elphidium</i>	<i>crispum</i>

Determination (name/date): Martina Pippèrr/27.10.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Montchaibeux Member	MN4	Miocene/Burdigalian

Occurrences (localities)

Name	Coordinates CH
Courrendlin-Solé (CRD-SOL)	595 700/243 560
Courrendlin - Pécas (CRD-PCA)	595 690/243 390

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CRD-PCA	120	500	111	PCA008-615
CRD-PCA	147	600	133	PCA008-628
CRD-SOL	17	–	5	SOL006-141
CRD-SOL	27	750	3/4	SOL008-39/18, 167

Material

5 specimens, 3 specimens uncertain

Synonymy

Genus *Elphidium* Montfort, 1808

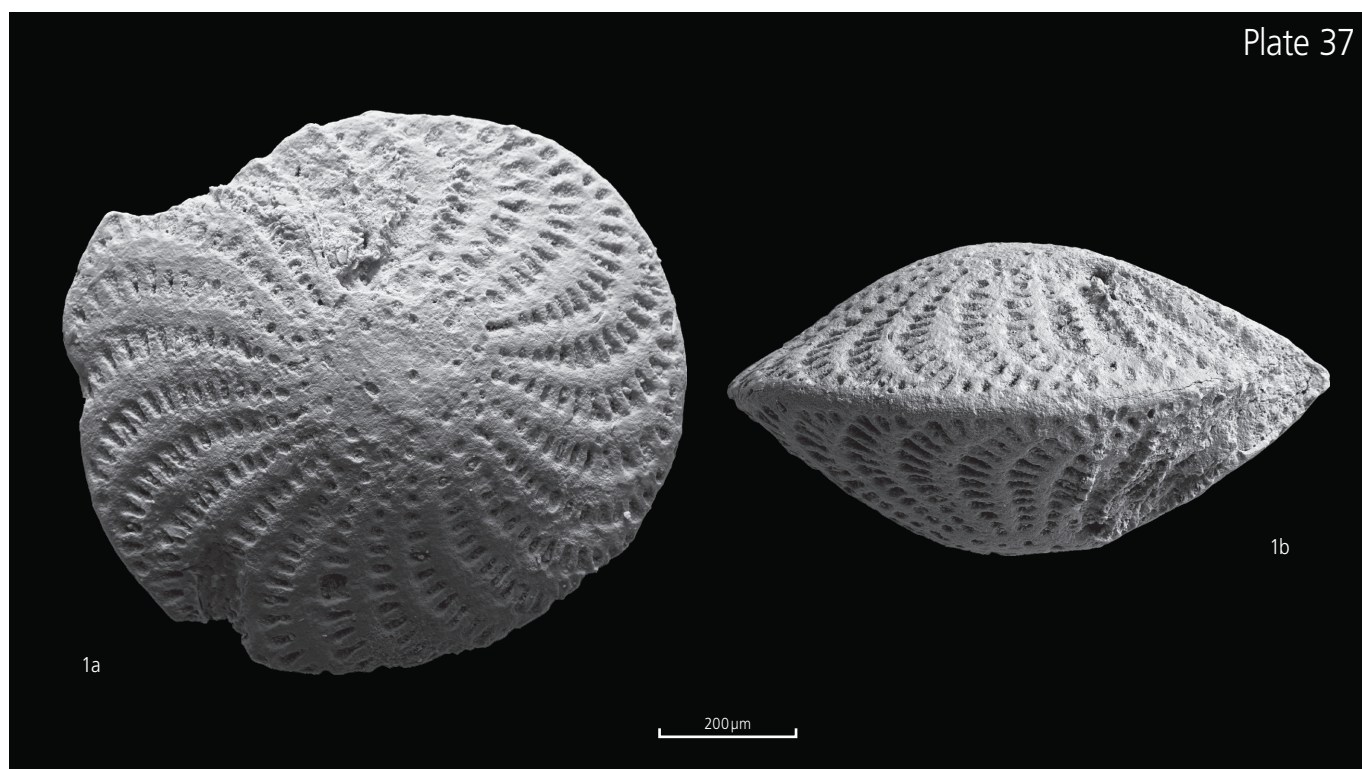
Type species: *Nautilus macellum* Fichtel & Moll, 1798

Elphidium crispum (Linnaeus, 1758)

- * 1758 *Nautilus crispus* – Linnaeus, p. 709
- 1846 *Polystomella crista* – d'Orbigny, p. 125, pl. 6, fig. 9-14
- 1857 *Polystomella crista* – Egger, p. 303, pl. 15, fig. 1-2
- 1987 *Elphidium crispum* – Wenger, p. 289, pl. 11, fig. 14, 18
- 1998 *Elphidium crispum* – Cicha et al., p. 95, pl. 75, fig. 16-17
- 2003 *Elphidium crispum* – Becker, pl. 8, fig. a
- 2005 *Elphidium crispum* – Rasmussen, p. 109, pl. 19, fig. 4
- 2011 *Elphidium [crispum]* – Havran, pl. 7, fig. 1 [species name not indicated on plate, but core log]

Remarks

All specimens are recorded from non-marine strata of the Montchaibeux Member (Bois de Raube Formation) overlying the partially eroded sediments of the OMM (Upper Marine Molasse, for stratigraphy see e.g. Prieto et al. 2018) and are thus reworked.



Foraminifera

Plate 37

Elphidium crispum (Linnaeus, 1758)

1. SOL008-167

Burdigalian, Courrendlin-Solé

max. D 895 × H 452 μm

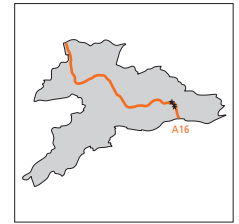
a) apical view (image Elphidium 68_19API.psd)

b) lateral view (image Elphidium 68_19SID.psd)

FORAMINIFERA

allochthonous benthic Foraminifera

(mainly redeposited in the basal Molasse alsacienne s.l.)



Taxonomy

Phylum	Order	Family	Genus	Species
Foraminifera	various	various	various	various

Determination (name/date): Martina Pippèr/27.10.2015; Claudius Pirkenseer/12.12.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Molasse alsacienne s.l.	MP 24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Courrendlin - Pécas (CRD-PCA)	595 690/243 390
Courrendlin - Poillat (CRD-POI)	594 650/244 600
Courrendlin - Pré Chevalier (CRD-PRC)	594 700/243 560
Courrendlin - Vieille Église (CRD-VEG)	595 395/244 270

Material

CRD-PCA: at least 330 specimens/CRD-POI: at least 1244 specimens/CRD-PRC: at least 22 specimens/CRD-VEG: at least 51 specimens

Remarks

Most calcareous specimens are very poorly preserved and bear quartz grain imprints (see plates). Material is mainly reworked from underlying "Meeressand" deposits (faunal overlap, see autochthonous assemblages in e.g. Huber 1994, Pirkenseer et al. 2010) and redeposited in the basal "Molasse alsacienne s.l." (late Rupelian) localities CRD-POI/PRC/VEG. Few taxa (e.g. *Elphidium crispum* from locality CRD-PCA) are possibly derived from completely eroded local OMM sediments and mixed with older material and redeposited in the Montchaibeux Member (Miocene).

Samples L = Locality Y = sampling year N = cell number U = Unit La = Layer S = number of specimens/aggl. = agglutinated indet.

L	Y	N	U	La	S	Taxa (number)
PCA	2008	280	58	500	1	? <i>Reticulophragmium</i>
PCA	2008	351	81	600	3	<i>Aubignyna kiliani</i> (1), ?aggl. (2)
PCA	2008	305	81	600	2	? <i>Reticulophragmium</i>
PCA	2008	333	97	500	53	cf. <i>Reticulophragmium acutidorsatum</i> (15), ?aggl. (38)
PCA	2008	465	98	500	7	<i>Aubignyna kiliani</i> (4), ? <i>Elphidiella</i> (1), indet. (2)
PCA	2008	580	98	600	1	Foraminifera indet.
PCA	2008	323	99	600	40	<i>Reticulophragmium acutidorsatum</i> (9, partly cf.), ?aggl. (33)
PCA	2008	356	99	0-500	3	<i>Ammonia beccarii</i> group (1), indet. (2)
PCA	2008	478	100	500	1	<i>Ammonia beccarii</i> group
PCA	2008	400	100	500	21	<i>Reticulophragmium acutidorsatum</i> (3, partly cf.), ?aggl. (18)
PCA	2003	8	101		4	Foraminifera indet.
PCA	2008	575	105	600	5	? <i>Reticulophragmium</i> (1), indet. 4
PCA	2008	423	119	500	1	<i>Cibicidoides tenellus</i>
PCA	2008	601	119	500	35	<i>Reticulophragmium acutidorsatum</i> (5, partly cf.), ?aggl.
PCA	2008	615	120	1100	50	<i>Reticuloph. acutidorsatum</i> (3, partly cf.), <i>Elphidium crispum</i> (1), ? <i>Marginulina</i> (1)
PCA	2008	286	123	500	60	? partly <i>Reticulophragmium</i>
PCA	2008	550	123	0-500	1	<i>Lenticulina</i> sp.
PCA	2008	445	126	600	1	Foraminifera indet.
PCA	2008	448	127		13	<i>Reticuloph. acutid.</i> (3), <i>Aubignyna kiliani</i> (2+2cf.), <i>Cibicidoides</i> (1), <i>Hanzawaia</i> (1), indet. (4)
PCA	2008	420	131	1000	5	?aggl. (4), <i>Hanzawaia</i> (1)
PCA	2008	654	133	1000	1	? <i>Lenticulina</i>
PCA	2008	484	138	1300	8	<i>Elphidium</i> (1), <i>Aubignyna kiliani</i> (1+2cf.), <i>Ammonia beccarii</i> group (2), <i>Cibicidoides</i> (1)
PCA	2008	502	140	1000	1	? <i>Vaginulinopsis</i> or similar taxa

Samples L = Locality Y = sampling year N = cell number U = Unit La = Layer S = number of specimens/aggl. = agglutinated indet.						
L	Y	N	U	La	S	Taxa (number)
PCA	2008	628	147	600	10	<i>Elphidium crispum</i> (1), <i>A. kiliani</i> (3), <i>A. beccarii</i> group (2), ? <i>Vaginulinopsis</i> , ? <i>Asterigerinata</i> (1)
PCA	2008	638	147	1000	1	cf. <i>Ammonia beccarii</i> group
PCA	2008	561	173	1000	1	?aggl.
PRC	2002	23	1	2	9	indet.
PRC	2004	254	2	300	1	<i>Heterolepa dutemplei</i>
PRC	2004	253	7		1	indet.
PRC	2004	257	8		1	indet.
PRC	2004	282	13	700	3	cf. <i>Heterolepa</i> , ? <i>Lenticulina</i> , indet.
PRC	2004	286	13	700	2	<i>Vaginulinopsis</i> , cf. <i>Lenticulina</i>
PRC	2004	248	14	600	2	<i>Hanzawaia boueana</i> , fragments indet. (2)
PRC	2004	247	14	600	3	? <i>Vulvulina</i> , cf. <i>Heterolepa dutemplei</i> , indet.
VEG	2006	147	12		1	indet.
VEG	2006	204	15		3	indet.
VEG	2006	637	18		1	? <i>Cibicoides</i>
VEG	2006	653	18		1	? <i>Marginulinopsis</i>
VEG	2006	441	19		4	? <i>Dentalina</i>
VEG	2006	800	20		1	uniserial indet.
VEG	2006	559	20		1	indet.
VEG	2006	617	28		1	indet. (? <i>Fronicularia</i> or similar taxa)
VEG	2006	619	28		1	uniserial indet.
VEG	2006	687	29		1	indet.
VEG	2006	372	30		1	? <i>Heterolepa</i>
VEG	2006	315	33		2	indet.
VEG	2006	569	34		1	indet.
VEG	2006	754	35		1	uniserial indet.
VEG	2006	414	36		1	indet.
VEG	2006	416	36		1	<i>Vulvulina spinosa</i>
VEG	2006	578	39		1	indet.
VEG	2006	459	41		1	? <i>Vaginulinopsis</i>
VEG	2006	701	42		2	indet.
VEG	2006	703	42		4	indet.
VEG	2006	508	47		1	cf. <i>Vulvulina</i>
VEG	2006	512	47		2	indet.
VEG	2006	518	47		9	cf. <i>Heterolepa</i> (1), indet.
VEG	2006	809	49		1	indet.
VEG	2006	795	50	200	4	? Foraminifera
VEG	2006	779	50	500	1	<i>Lenticulina</i>
VEG	2006	787	50	500	3	indet.
POI	2005	54	7	200	5	<i>Cibicoides ungerianus</i> (1+1?), <i>Cibicoides</i> sp. indet. (1), Foram. indet.
POI	2005	146	13	220	18	indet.
POI	2005	158	13	220	1	indet.
POI	2007	2092	21		3	<i>Heterolepa</i> cf. <i>dutemplei</i> (1), uniserial indet. (2)
POI	2007	2697	21		2	? <i>Heterolepa/Cibicoides</i> , uniserial indet.
POI	2007	2068	25		1	indet.
POI	2007	1410	32		1	<i>Hanzawaia</i> (? <i>H. boueana</i>)
POI	2007	3223	32		4	? <i>Nodosaria</i> (1), indet.
POI	2007	2669	45		5	<i>Heterolepa</i> cf. <i>dutemplei</i> (2), indet.
POI	2007	2108	45		1	<i>Heterolepa</i> cf. <i>dutemplei</i>
POI	2007	1827	46		6	cf. <i>Vaginulinopsis</i> (1), ? <i>Heterolepa/Cibicoides</i> (1), fragments uniserial indet. (4)
POI	2007	1768	46		3	<i>Lenticulina</i> cf. <i>inornata</i> (1), indet. (2)
POI	2007	2099	47		1	? <i>Dentalina</i>
POI	2007	3063	47		1	? <i>Cibicoides</i>
POI	2007	3015	47		3	<i>Heterolepa</i> cf. <i>dutemplei</i> (2), indet. (1)
POI	2007	2314	47		2	<i>Heterolepa</i> cf. <i>dutemplei</i> , uniserial indet.
POI	2007	1834	47		3	<i>Cibicoides</i> (1), uniserial indet. (1)
POI	2007	3075	47		2	<i>Bulimina</i> (<i>B. arndti</i> Hagn or similar species), ? <i>Heterolepa</i>
POI	2007	1280	47		1	uniserial indet.
POI	2007	988	47		6	<i>Heterolepa</i> cf. <i>dutemplei</i> (1+1?), cf. <i>Hanzawaia</i> (1), fragments indet.
POI	2007	997	47		1	? <i>Cibicoides</i>
POI	2007	1054	47		10	<i>Lenticulina</i> (1), cf. <i>Vaginulinopsis</i> (2), ? <i>Heterolepa</i> (1), indet.

Samples L = Locality Y = sampling year N = cell number U = Unit La = Layer S = number of specimens/aggl. = agglutinated indet.						
L	Y	N	U	La	S	Taxa (number)
POI	2007	2342	47		5	<i>Heterolepa</i> cf. <i>dutemplei</i> (2), uniserial indet. (1), indet. (2)
POI	2007	3229	47		4	indet.
POI	2007	3127	47		1	<i>Heterolepa</i> cf. <i>dutemplei</i>
POI	2007	1750	47		1	? <i>Dentalina</i>
POI	2007	2781	47		4	? <i>Heterolepa</i> (1), indet.
POI	2007	3021	47		7	? <i>Heterolepa</i> (3), fragments indet. (4)
POI	2007	2537	47		13	? <i>Lenticulina</i> (3), ? <i>Neoflabellina</i> (1 frag.), <i>Heterolepa</i> (1), ? <i>Cibicidoides</i> (1), indet.
POI	2007	1663	47		1	Foraminifera indet.
POI	2007	3238	47		3	? <i>Lenticulina</i> (1), ? <i>Hanzawaia</i> (1), indet. (1)
POI	2007	2019	47		3	<i>Dentalina</i> (similar <i>Laevidentalina elegans</i>), fragments uniserial indet. (2)
POI	2007	1722	47		1	indet.
POI	2007	3072	47		4	<i>Lenticulina</i> (2), ? <i>Heterolepa/Cibicidoides</i> (2)
POI	2007	1715	47		6	<i>Lenticulina</i> spp. (4), ? <i>Vaginulinopsis</i> (1), indet. (1)
POI	2007	1698	47		3	<i>Dentalina</i> (similar <i>Laevidentalina elegans</i>), indet. (2)
POI	2007	3082	47		4	? <i>Lenticulina</i> (1), <i>Heterolepa</i> cf. <i>dutemplei</i> (1), indet. (2)
POI	2007	2180	47		5	indet.
POI	2007	2413	47		7	cf. <i>Vaginulinopsis</i> (1), <i>Lenticulina</i> (1, similar <i>L. inornata</i>), ? <i>Heterolepa</i> (1), indet. (2)
POI	2007	2726	47		7	? <i>Dentalina</i> (1), ? <i>Lenticulina</i> (1), <i>Heterolepa</i> cf. <i>dutemplei</i> (1), indet.
POI	2007	2547	47		3	cf. <i>Nodosaria bactridium</i> (1), indet. (2)
POI	2007	2752	47		2	indet.
POI	2007	2772	47		4	cf. <i>Lenticulina</i> (1), fragments indet.
POI	2007	2836	47		1	<i>Vaginulinopsis</i>
POI	2007	2582	47		10	cf. <i>Vaginulinopsis</i> (1), ? <i>Nodosaria</i> spp. (2 fragments), <i>Heterolepa</i> cf. <i>dutemplei</i> (3), fragments indet.
POI	2007	2708	47		6	? <i>Lenticulina</i> (1), <i>Heterolepa</i> cf. <i>dutemplei</i> (2), fragments indet.
POI	2007	2042	55		2	indet.
POI	2007	1996	56		9	indet.
POI	2007	1385	57		7	indet.
POI	2007	2429	57		7	<i>Vulvulina</i> (1), ? <i>Vaginulinopsis gladius</i> (1), ? <i>Nodosaria bactridium</i> (1)
POI	2007	2504	57		27	? <i>Lenticulina</i> , cf. <i>Nodosaria</i> (2 frag.), cf. <i>Vaginulinopsis</i> (5), ? <i>Heterolepa</i> (2), indet.
POI	2007	2188	57		3	uniserial indet.
POI	2007	3086	57		1	indet.
POI	2007	1346	57		2	<i>Heterolepa</i> cf. <i>dutemplei</i> , indet.
POI	2007	1913	57		4	<i>Vulvulina</i> (? <i>V. spinosa</i>), ? <i>Lenticulina</i> , <i>Heterolepa</i> , indet.
POI	2007	2441	57		7	? <i>Dentalina/Nodosaria</i> (5 fragments)
POI	2007	2521	57		22	<i>Nodosariids</i> (4 frag.), <i>Gyroidinoides/Hansensca</i> (3), ? <i>Heterolepa</i> (2), <i>Planulina costata</i> (1 m), indet.
POI	2007	948	57		70	? <i>Vaginulinopsis</i> , ? <i>Marginulinopsis</i> , <i>Dentalina/Nodosaria</i> , cf. <i>Hanzawaia</i> , <i>Heterolepa</i> , rest largely indet.
POI	2007	950	57		2	? <i>Dentalina</i> , indet.
POI	2007	968	57		1	indet.
POI	2007	3108	57		2	cf. <i>Vaginulinopsis</i> , <i>Hanzawaia</i> (? <i>H. boueana</i>)
POI	2007	772	58		2	cf. <i>Nodosaria</i> , indet.
POI	2007	784	58		6	cf. <i>Dentalina</i> (similar <i>Laevidentalina elegans</i>), cf. <i>Nodosaria</i> , uniserial indet. (4)
POI	2007	789	58		2	? <i>Vaginulinopsis</i> , cf. <i>Marginulinopsis</i>
POI	2007	1677	58		100	<i>Vulvulina</i> , ? <i>Lenticulina</i> , <i>Planularia</i> , cf. <i>Vaginulinopsis</i> , <i>Hanzawaia</i> (? <i>H. boueana</i>), ? <i>Heterolepa</i> ,
POI	2007	2496	58		44	<i>Vulvulina</i> (1), cf. <i>Planularia</i> (1 frag.), cf. <i>Vaginulinopsis</i> , <i>Dentalina</i> , <i>Nodosaria</i> , <i>Heterolepa</i> , indet.
POI	2007	2744	58		40	? <i>Vulvulina</i> (1), <i>Karriella</i> (1), <i>Lenticulina</i> , cf. <i>Vaginulinopsis</i> , <i>Saracenaria</i> (1 frag.), <i>Nodosaria/Dentalina</i> spp.,
POI	2007	2165	59		6	? <i>Nodosaria</i> , <i>Hanzawaia</i> (? <i>H. boueana</i>) ? <i>Heterolepa</i> , uniserial indet.
POI	2007	2168	59		2	indet.
POI	2007	2798	59		13	? <i>Lenticulina</i> (1 frag.), cf. <i>Vaginulinopsis</i> (3), ? <i>Heterolepa/Cibicidoides</i> (2), fragments indet.
POI	2007	1867	59		1	indet.
POI	2007	1878	59		2	indet.
POI	2007	2618	59		1	indet.
POI	2007	1339	59		1	indet.
POI	2007	2475	65		10	? <i>Nodosaria/Dentalina</i> , ? <i>Heterolepa</i> , largely indet.
POI	2007	2711	65		11	indet.
POI	2007	2722	65		19	cf. <i>Vaginulinopsis</i> (2), ? <i>Dentalina/Nodosaria</i> (4 frag.), ? <i>N. intermittens</i> (1),
POI	2007	2155	65		6	cf. <i>Vaginulinopsis</i> (2), ? <i>Nodosaria</i> , ? <i>Heterolepa</i>
POI	2007	2013	67	0-50	10	? <i>Vulvulina</i> (1 frag.), ? <i>Vaginulinopsis</i> (1), cf. <i>Nodosaria</i> , cf. <i>Dentalina</i> , ? <i>Heterolepa</i> (1), indet.
POI	2007	740	68		1	indet.
POI	2007	1902	68		11	? <i>Vaginulinopsis</i> , ? <i>Nodosaria</i> , ? <i>Heterolepa</i> , indet.
POI	2007	1927	68		2	cf. <i>Vulvulina</i> , cf. <i>Nodosaria</i>
POI	2007	1846	69		3	cf. <i>Heterolepa</i> (1), indet.
POI	2007	1888	69		1	? <i>Cibicidoides</i>
POI	2007	1893	69		3	indet.
POI	2007	539	69		1	indet.

Samples L = Locality Y = sampling year N = cell number U = Unit La = Layer S = number of specimens/aggl. = agglutinated indet.						
L	Y	N	U	La	S	Taxa (number)
POI	2007	2625	69		8	?Lenticulina (1), ?Dentalina (1), Nodosaria (1), cf. Heterolepa, indet.
POI	2007	2049	87		2	indet.
POI	2007	1467	89		1	indet.
POI	2007	1951	97		4	?Nodosariids (3 fragments), ?Heterolepa (1)
POI	2007	2802	97		12	cf. Vulvulina (2), ?Nodosariids (6 fragments), ?Heterolepa (1), Gyroidinoides/Hansenisca (1)
POI	2007	1077	98		5	indet., Vaginulinopsis (1)
POI	2007	1079	98		15	Nodosariids + indet.
POI	2007	1080	98		2	Heterolepa
POI	2007	1097	98		2	indet.
POI	2007	1331	98		12	cf. Lenticulina (2), Heterolepa (2), Nodosariids indet.
POI	2007	695	98		5	Hanzawaia (1), indet.
POI	2007	718	98		4	cf. Vaginulinopsis (1), indet.
POI	2007	719	98		8	likely Dentalina + Nodosaria
POI	2007	1323	98		1	?Fronicularia or Neoflabellina
POI	2007	1363	98		9	cf. Vaginulinopsis (2), Hanzawaia (1), ?Heterolepa (2), cf. Nodosaria (2), indet.
POI	2007	1368	98		5	indet.
POI	2007	1374	98		100	?Vulvulina, Lenticulina, Vaginulinopsis, cf. Nodosaria, Gyroidinoides/Hansenisca, Heterolepa, cf. Hanzawaia, largely indet.
POI	2007	2685	99		2	?Dentalina/Nodosaria, fragment indet.
POI	2007	1138	101		1	indet.
POI	2007	1306	101		2	indet.
POI	2007	819	117		3	indet.
POI	2007	2850	117		8	cf. Lenticulina, Fronicularia or similar taxa (1), Nodosariids, ?Heterolepa
POI	2007	1044	118		2	indet.
POI	2007	2356	118		24	?Vaginulinopsis (2 frag.), Nodosariids (8?), Hanzawaia (?H. boueana) (1), cf. Heterolepa (2),
POI	2007	1979	118		23	?Vulvulina (2 frag.), Lenticulina, ?Vaginulinopsis, cf. Dentalina, cf. Nodosaria, Uvigerina hantkeni (1),
POI	2007	1990	120		7	indet.
POI	2010	356	142	4	3	indet.
POI	2010	373	142	15	1	indet.
POI	2010	348	142	16	3	cf. Cibicidoides
POI	2010	312	142		18	indet.
POI	2010	320	142		20	indet.
POI	2010	326	142		15	?Vulvulina (1 frag.), Planularia (1), ?Cibicidoides, indet.
POI	2010	366	142		27	Vulvulina spinosa (3+1?), Lenticulina, ?Dentalina, Heterolepa, Hanzawaia, (?H. boueana), Planulina costata
POI	2010	297	142		23	Vulvulina spinosa (3), ?Nodosaria spp. (2 frag.), Cibicidoides ungerianus (1), indet.
POI	2010	163	145		2	?Cibicidoides
POI	2010	407	173		1	cf. Lenticulina
POI	2010	459	189		4	indet.
POI	2010	217	191		30	Vulvulina (?V. spinosa), cf. Lenticulina, Vaginulinopsis, Nodosariids (11?), Heterolepa, indet.
POI	2010	205	191		6	?Nodosariids, Gyroidinoides/Hansenisca, indet. (4)
POI	2010	422	192		8	Nodosaria bactridium (1), cf. Dentalina, Heterolepa, ?Hanzawaia, indet.
POI	2010	171	192		11	Vulvulina spinosa (1 m), Lenticulina (1), Nodosariids (6), indet.
POI	2010	252	200		8	Vulvulina (1), fragments indet.
POI	2010	468	201		16	nodosariids
POI	2010	397	239		3	indet.
POI	2010	382	242		17	?Lenticulina (2), ?Vaginulinopsis (2), Dentalina (1), Nodosariids (5), Gyroidinoides/Hansenisca (1), indet.
POI	2010	417	242		16	Vulvulina (2 frag.), Vaginulinopsis (? V. gladius), Dentalina/Nodosaria spp. (4),
POI	2010	484	242		19	Vulvulina (1), ?Lenticulina (2), Nodosariids (2), Heterolepa (1), Gyroidinoides/Hansenisca (1), indet.
POI	2010	307	259		15	Nodosariids + indet.
POI	2010	336	260		11	Vulvulina spinosa (1+1?), Lenticulina (2), Vaginulinopsis gladius (1), Heterolepa (?H. cf. dutemplei), indet.
POI	2010	442	260		5	?Vaginulinopsis (1), ?Nodosaria (frag.), Gyroidinoides/Hansenisca (?H. soldanii), indet.
POI	2010	455	260		8	cf. Nodosaria, Gyroidinoides/Hansenisca, ?Cibicidoides ungerianus, indet. (5)
POI	2010	282	261		20	Nodosariids + indet.
POI	2010	265	261		18	Vulvulina, Dentalina/Nodosaria spp., Heterolepa, indet.

Foraminifera

Plate 38

Reticulophragmium acutidorsatum (Hantken, 1868)

1. PCA008-681
Late Rupelian, Courrendlin - Pécas
max. D 1205 × H 352 µm
a) lateral view (image Reticulophragmium 68_49SID.psd)
b) peripheral view (image Reticulophragmium 68_49SI2.psd)

Karrieriella siphonella exilis Hagn, 1952

2. POI010-651
Late Rupelian, Courrendlin - Poillat
L 1457 × W 513 µm
lateral view (image benthic Foraminifera 69_12SID.psd)

3. POI010-652
Late Rupelian, Courrendlin - Poillat
L 1980 × W 754 µm
lateral view (image benthic Foraminifera 69_13SID.psd)

Vulvulina spinosa Cushman, 1927

4. POI010-652
Late Rupelian, Courrendlin - Poillat
L 1394 × W 902 µm
a) lateral view (image Vulvulina 68_45SID.psd)
b) peripheral view (image Vulvulina 68_45SI2.psd)

5. POI010-637
Late Rupelian, Courrendlin - Poillat
L 1496 × W 771 µm
a) lateral view (image Vulvulina 68_46SID.psd)
b) apertural view (image Vulvulina 68_46TOP.psd)

Nodosaria cf. elegantissima (d'Orbigny, 1846)

6. POI010-647
Late Rupelian, Courrendlin - Poillat
L 1527 × W 351 µm
lateral view (image benthic Foraminifera 69_17SID.psd)

Nodosaria soluta (Reuss, 1851)

7. POI007-3357
Late Rupelian, Courrendlin - Poillat
L 1943 × W 443 µm
lateral view (image benthic Foraminifera 69_08SID.psd)

cf. *Pyramidulina bactridium* (Reuss, 1866)

8. POI010-644
Late Rupelian, Courrendlin - Poillat
L 2176 × W 365 µm
lateral view (image Nodosaria 68_35SID.psd)

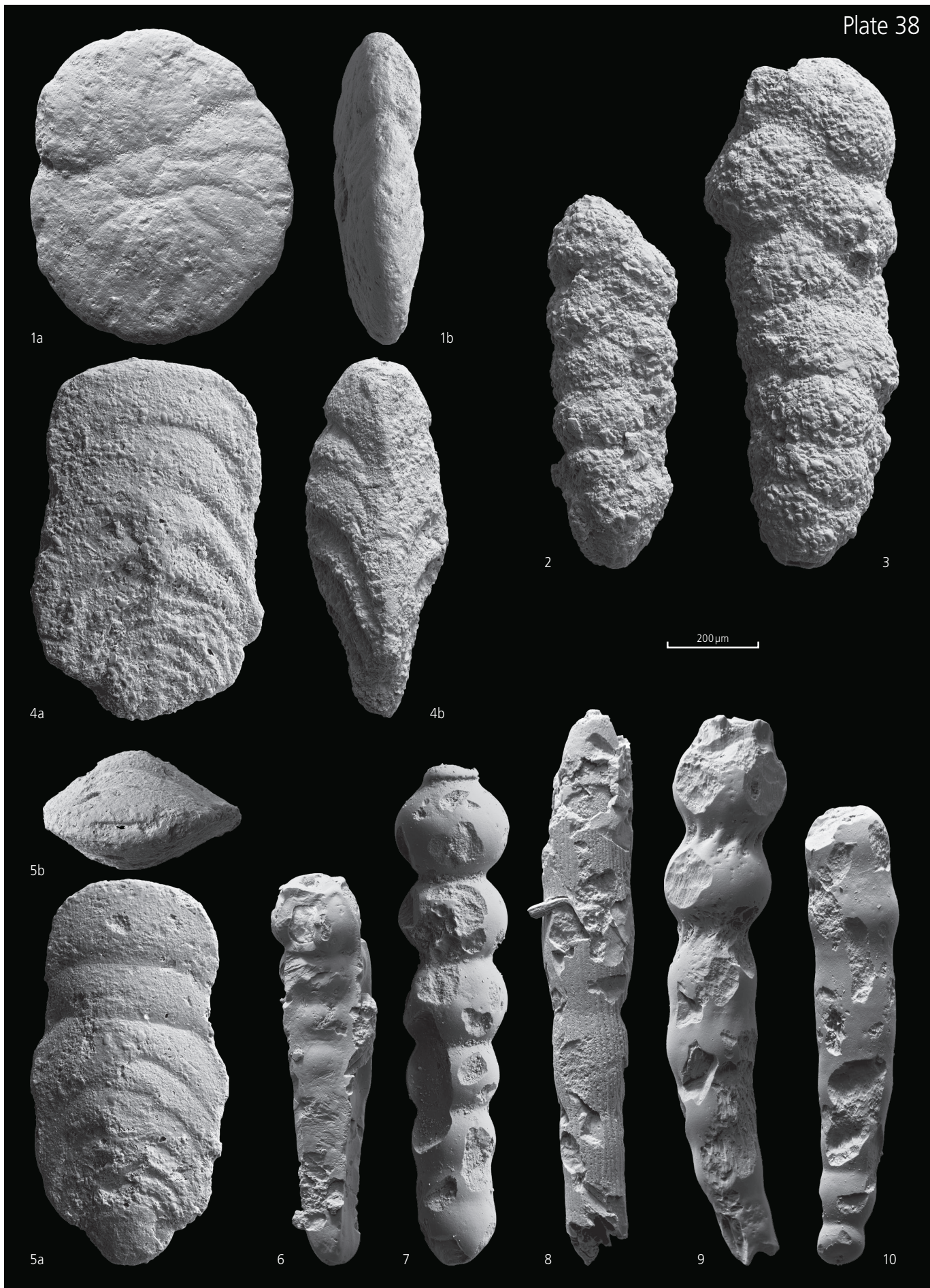
cf. *Nodosaria intermittens* (Roemer, 1838)

9. POI007-3349
Late Rupelian, Courrendlin - Poillat
L 2126 × W 440 µm
lateral view (image Nodosaria 68_34SID.psd)

cf. *Laevidentalina elegans* (d'Orbigny, 1846)

10. POI007-3339
Late Rupelian, Courrendlin - Poillat
L 1776 × W 352 µm
lateral view (image Dentalina 68_36SID.psd)

Plate 38



Foraminifera

Plate 39

Vaginulinopsis gladius (Philippi, 1843)

1. POI010-640
Late Rupelian, Courrendlin - Poillat
L 1632 × W 461 μm
lateral view (image Vaginulina 68_39SID.psd)

Vaginulinopsis sp.

2. POI007-3342
Late Rupelian, Courrendlin - Poillat
L 1405 × W 605 μm
lateral view (image Vaginulina 68_38SID.psd)

Vaginulinidae indet.

3. POI007-3359
Late Rupelian, Courrendlin - Poillat
L 1459 × W 912 μm
a) lateral view (image benthic Foraminifera 69_10SID.psd)
b) peripheral view (image benthic Foraminifera 69_10SI2.psd)

?*Planularia* spp.

4. POI007-3356
Late Rupelian, Courrendlin - Poillat
L 1239 × W 955 μm
lateral view (image benthic Foraminifera 69_07SID.psd)

5. POI010-639
Late Rupelian, Courrendlin - Poillat
L 1472 × W 849 μm
lateral view (image Planulina 68_37SID.psd)

Bulimina sp.

6. POI010-639
Late Rupelian, Courrendlin - Poillat
L 1040 × W 627 μm
lateral view (image benthic Foraminifera 69_15SID.psd)

7. POI007-3358
Late Rupelian, Courrendlin - Poillat
L 1033 × W 535 μm
a) lateral view (image benthic Foraminifera 69_09SID.psd)
b) apertural view (image benthic Foraminifera 69_09TOP.psd)

Heterolepa dutemplei (d'Orbigny, 1846)

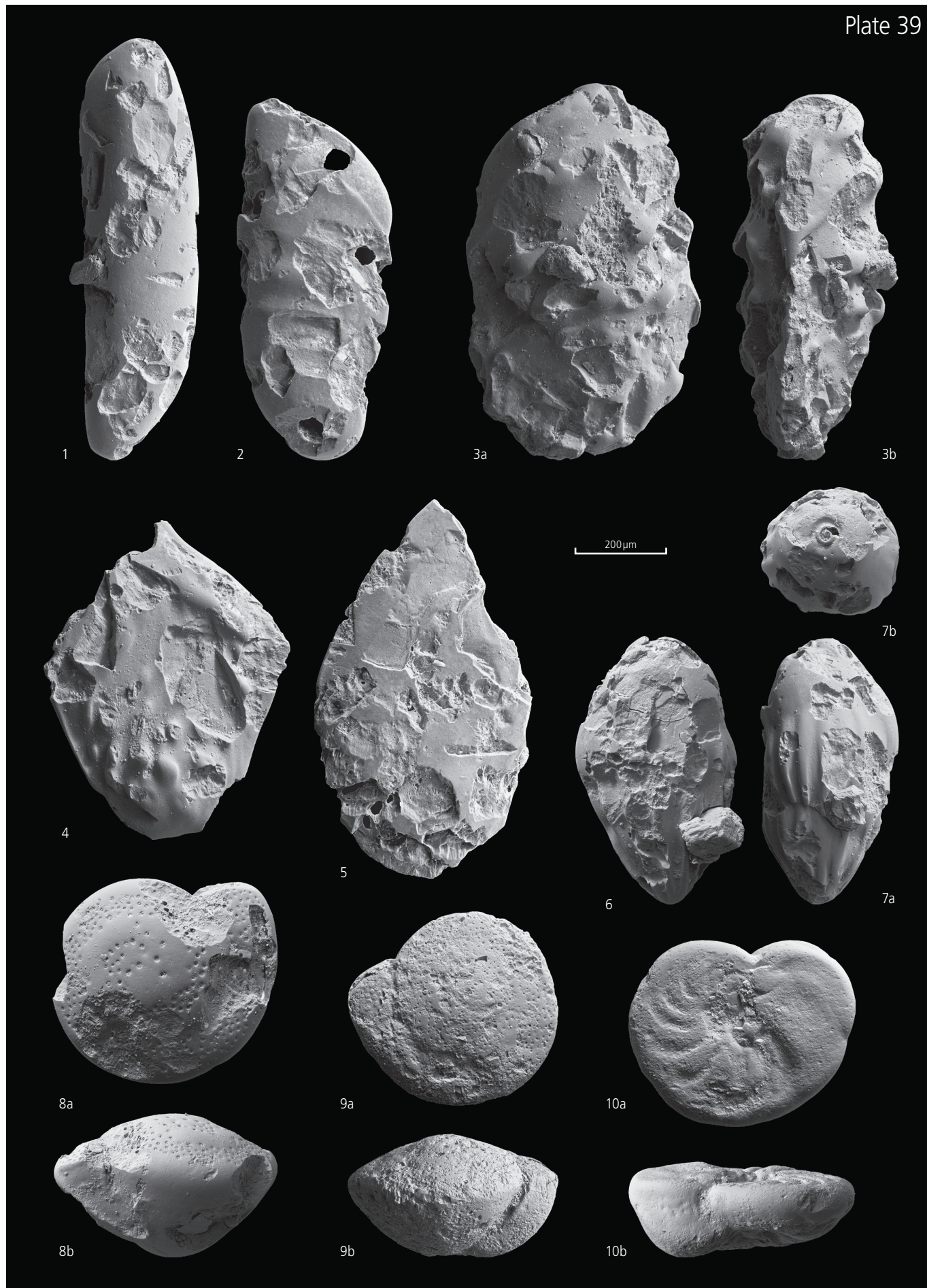
8. POI007-3360
Late Rupelian, Courrendlin - Poillat
max. D 929 × H 594 μm
a) apical view (image Foraminifera 69_11API.psd)
b) lateral view (image Foraminifera 69_11SID.psd)

9. PRC004-334
Late Rupelian, Courrendlin - Pré Chevalier
max. D 818 × H 485 μm
a) apical view (image Heterolepa 68_51API.psd)
b) lateral view (image Heterolepa 68_51SID.psd)

Hanzawaia bouenana (d'Orbigny, 1846)

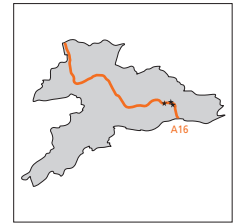
10. PRC004-333
Late Rupelian, Courrendlin - Pré Chevalier
max. D 867 × H 328 μm
a) apical view (image Hanzawaia 68_52API.psd)
b) lateral view (image Hanzawaia 68_52SID.psd)

Plate 39



FORAMINIFERA

allochthonous Larger Benthic Foraminifera (“nummulites”)
(redeposited in the basal “Molasse alsacienne s.l.”)



Taxonomy

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	various	various	various

Determination (name/date): Claudius Pirkenseer 12.12.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Molasse alsacienne s.l.	MP 24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Courrendlin - Poillat (CRD-POI)	594 650/244 600
Courrendlin - Vieille Église (CRD-VEG)	595 395/244 270
Delémont - Beuchille (DEL-BEU)	593 125/244 580

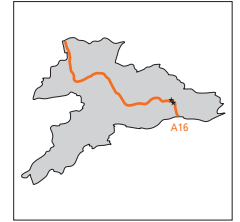
Remarks

In contrast to reworked Late Cretaceous and Eocene planktic Foraminifera allochthonous Larger Benthic Foraminifera are not known from the late Rupelian and early Chattian of the Upper Rhine Graben. The larger size and weight might explain their shorter transport distance (just reaching the southernmost Upper Rhine Graben). A provenance from the Helveticum is most likely, since in some samples reworked alpine planktic Foraminifera co-occur. A detailed study based on thin sections is required in order to pinpoint the taxonomy of the strongly abraded specimens. The material has been preliminarily attributed to a “amphisteginid”, “asterocyclinid” and “nummulitic” habitus.

Samples					L = Locality Y = sampling year N = cell number U = Unit La = Layer				
L	Y	N	U	La	L	Y	N	U	La
POI	2007	640	37		POI	2007	2185	57	
POI	2007	924	47		POI	2007	2213	57	
POI	2007	953	57		POI	2007	2283	57	
POI	2007	981	47		POI	2007	2480	65	
POI	2007	999	47		POI	2007	2487	58	
POI	2007	1062	47		POI	2007	2520	57	
POI	2007	1099	98		POI	2007	2535	47	
POI	2007	1315	101		POI	2007	2713	65	
POI	2007	1371	98		POI	2007	2795	59	
POI	2007	1382	57		POI	2007	3005	47	
POI	2007	1413	47		POI	2007	3027	47	
POI	2007	1651	47		VEG	2006	481	33	
POI	2007	1675	58		VEG	2006	511	47	
POI	2007	1700	47		VEG	2006	516	47	
POI	2007	1754	47		VEG	2006	660	18	
POI	2007	1771	46		VEG	2006	752	35	
POI	2007	1787	47		VEG	2006	760	35	
POI	2007	1801	47		VEG	2006	763	35	
POI	2007	1802	47		VEG	2006	824	35	
POI	2007	1868	59		BEU	2001	1048	20	200
POI	2007	2047	87		BEU	2001	1067	20	
POI	2007	2090	55		POI	2010	273	192	

FORAMINIFERA

allochthonous Cretaceous and Eocene planktic Foraminifera (redeposited in the basal “Molasse alsacienne s.l.”)



Taxonomy

Phylum	Order	Family	Genus	Species
Foraminifera	Rotaliida	various	various	various

Determination (name/date): Claudius Pirkenseer 12.12.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Molasse alsacienne s.l.	MP 24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Courrendlin - Poillat (CRD-POI)	594 650 / 244 600
Courrendlin - Pré Chevalier (CRD-PRC)	594 700 / 243 560

Material

CRD-POI: approx. 177 planktic specimens (may also include poorly preserved Oligocene planktic Foraminifera)/CRD-PRC : at least 3 specimens

Remarks

Reworked Late Cretaceous and Eocene planktic Foraminifera are known from the late Rupelian and early Chattian of the entire Upper Rhine Graben (Fischer 1965; Schäfer 2000; Schäfer & Kuhn 2004; Grimm et al. 2005). Pirkenseer et al. (2010, 2011) record a total of 18 Eocene and 8 Late Cretaceous species implying Ypresian to Priabonian as well as Cenomanian, Turonian to Santonian and Campanian to Maastrichtian alpine source rocks. While the material from the underlying marine “Couches à Mélettes” and “Marnes à Cyrènes” is generally well-preserved, our material from the quartz-rich sands of the basal “Molasse alsacienne s.l.” is poorly preserved and hinders a specific determination.

Samples L = Locality Y = sampling year N = cell number U = Unit La = Layer S = number of specimens C = Cretaceous/E = Eocene							
L	Y	N	U	La	S	C/P	Taxa (number)
POI	2005	54	7	200	15	?C-E	incl. ? <i>Pseudohastigerina</i>
POI	2007	2537	47		2	?C	
POI	2007	2547	47		4	C	
POI	2007	2708	47		1	C-?	
POI	2007	2798	59		1	C	
POI	2007	2802	97		4	C	
POI	2007	1097	98		1	C	
POI	2007	2685	99		1	?E	? <i>Subbotina</i>
POI	2010	356	142	4	11	P	incl. <i>Acarinina</i>
POI	2010	348	142	16	13	P	mainly Eocene
POI	2010	312	142		11	C	2 Cretaceous specimens
POI	2010	320	142		4	C	1 Cretaceous specimen
POI	2010	366	142		18	C-?E	
POI	2010	297	142		9	C-?E	2 Cretaceous specimens, ?Eocene
POI	2010	163	145		17	E	Eocene
POI	2010	459	189		16	C-E	6 Cretaceous specimens, <i>Globigerinatheka</i> , <i>Acarinina</i>
POI	2010	397	239		4	?E	
POI	2010	484	242		1	C	
POI	2010	307	259		13	C	6 Cretaceous specimens
POI	2010	455	260		8	E	incl. <i>Acarinina</i>
POI	2010	282	261		13	C-E	3 Cretaceous specimens, <i>Globigerinatheka</i>
POI	2010	265	261		10	?E	
PRC	2004	257	8		3	C-E	2 Cretaceous specimens, <i>Acarinina</i>

Foraminifera

Plate 40

Acarinina wilcoxensis (Cushman & Ponton, 1932) -
bullbrooki (Bolli, 1957) lineage

1. RNA987-61

Late Rupelian, Cornol-Route Nationale

max. D 294 × H 182 μm

a) apical view (image Acarinina 69_03API.psd)

b) umbilical view (image Acarinina 69_03UMB.psd)

c) lateral view (image Acarinina 69_03SID.psd)

Globigerinatheka sp.

2. POI010-650

Late Rupelian, Courrendlin-Poillat

D 410 μm

a) view 1 (image planktic Foraminifera 69_20SID.psd)

b) view 2 (image planktic Foraminifera 69_20SI.psd)

3. POI010-648

Late Rupelian, Courrendlin-Poillat

D 581 μm

a) view 1 (image planktic Foraminifera 69_18SID.psd)

b) view 2 (image planktic Foraminifera 69_18SI2.psd)

4. POI010-649

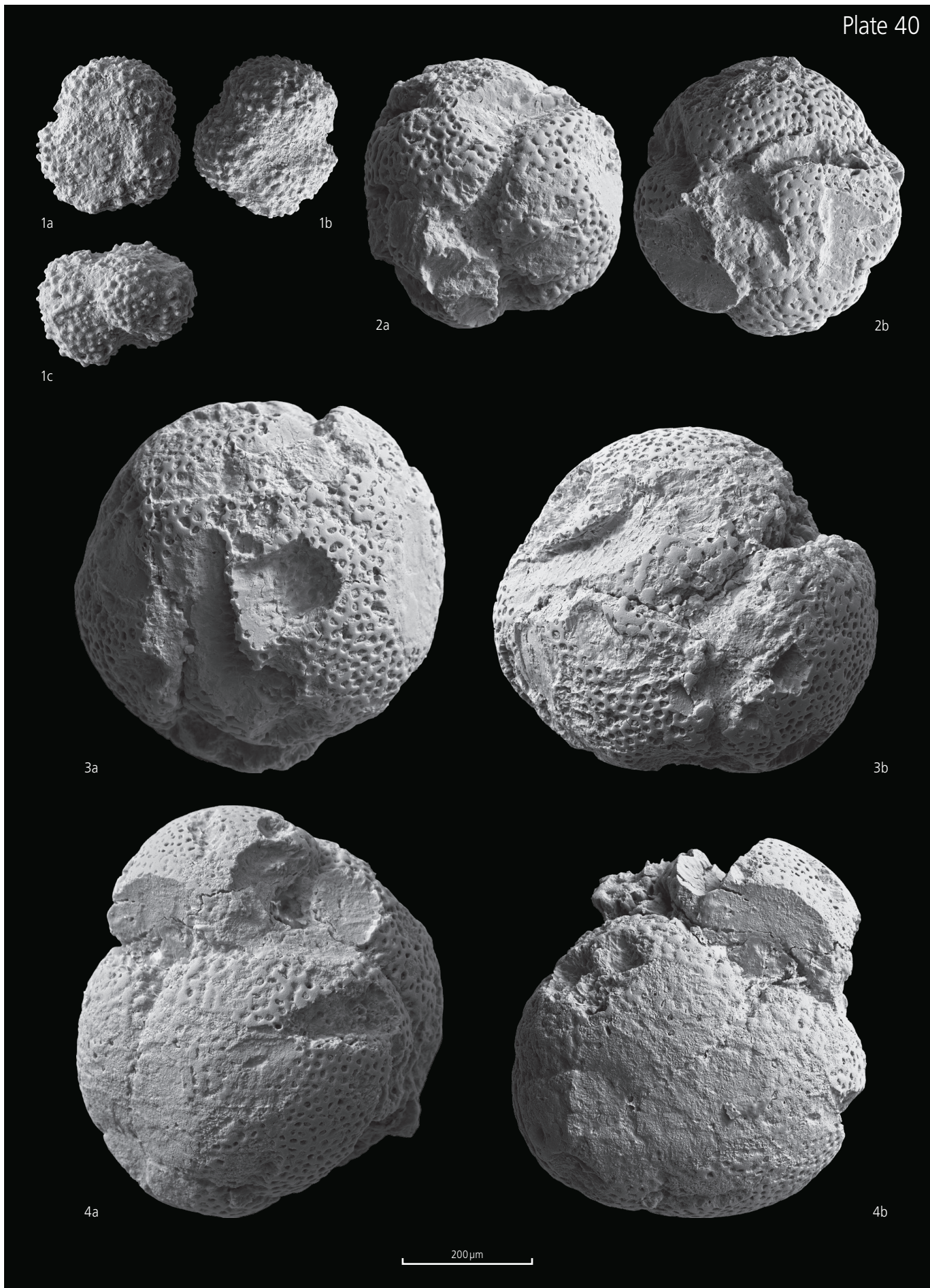
Late Rupelian, Courrendlin-Poillat

D 1394 μm

a) view 1 (image planktic Foraminifera 69_19SID.psd)

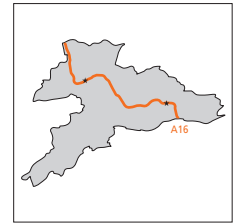
b) view 2 (image planktic Foraminifera 69_19SI2.psd)

Plate 40



Ostracoda

PLATYCOPIDA

Cytherella gracilis (Lienenklaus, 1894)**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Platycopida	Cytherellidae	<i>Cytherella</i>	<i>gracilis</i>

Determination (name/date): Laurent Picot/14.12.2005 ; Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Porrentruy-Étang (POR-ETA)	571 474/251 036
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
POR-ETA	3	-14.0 m	34	ETA004-187, 249
DEL-BEE	19	1800	260/767	BEE004-165, 274/BEE003-557

Material

adult: 16 carapaces, 1 right valve

Measurements (µm)

See plate. The preservation of the remaining material is insufficient for reliable measures.

Taxonomic remarks

Oertli (1956) discusses the similarity of the taxa *Cytherella gracilis* and *C. angusta* (both erected in Lienenklaus 1894) and merges both to the former species. Uffenorde (1981) elaborates on the considerable size and shape variation of *Cytherella gracilis*. Considering the wide geographical and temporal distribution (see below) of this species a revision of small, elongated rectangular, sparsely ornamented or smooth *Cytherella* species should be envisaged. This is illustrated by the attribution of early Eocene material from northern Spain to *Cytherella gracilis* (Ducasse 1972), which may rather conform to the regionally occurring similar *C. gamardensis* Deltel, 1964 (sensu Ducasse 1981) or Palaeocene *C. lagenalis* Marliere, 1958. This especially applies to slightly abraded material, where fine surface ornamentation may be obscured.

Type locality and horizon

Doberg near Bünde (Nordrhein-Westfalen, northwestern Germany), "Ober-Oligocän" (sensu Lienenklaus 1894), "Chattien" (sensu Oertli 1956).

Lectotype

Right valve (collection Lienenklaus), Institute of Geology, University of Göttingen (Germany).

Synonymy

Genus *Cytherella* Jones, 1849

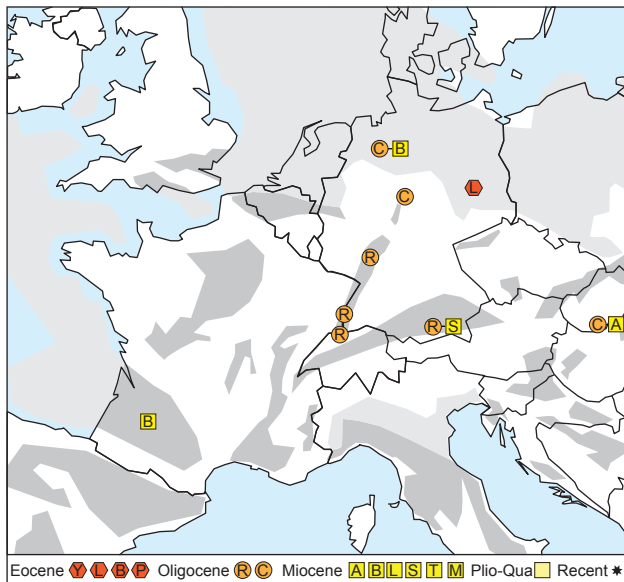
Type species: *Cytherina ovata* Roemer, 1840

Cytherella gracilis Lienenklaus, 1894

- * 1894 *Cytherella gracilis* – Lienenklaus, p. 267-268, pl. 18, fig. 11
- 1894 *Cytherella angusta* – Lienenklaus, p. 267, pl. 18, fig. 10. [see discussion in Oertli 1956]
- 1896 *Cytherella parallela* – Lienenklaus in Kissling, p. 32-33, pl. 2, fig. 15
- 1956 *Cytherella gracilis* – Oertli, p. 27-29, pl. 1, fig. 1-6
- 1962 *Cytherella gracilis* – Bassiouni, p. 13, pl. 1, fig. 1
- 1963 *Cytherella gracilis* – Stchepinsky, p. 153
- 1965 *Cytherella gracilis* – Moyes, p. 9, pl. 1, fig. 9
- 1969 *Cytherella gracilis* – Pietrzeniuk, p. 12, pl. 2, fig. 3, pl. 15, fig. 3
- 1969 *Cytherella gracilis* – Scheremeta, p.42, pl. 1, fig. 1
- non1972 *Cytherella gracilis* – Ducasse, pl. 3, fig. 5, pl. 4, fig. 3
- 1975 *Cytherella gracilis* – Brestenská, p. 380, pl. 3, fig. 11
- 1975 *Cytherella gracilis* – Faupel, p. 62-63, pl. 10, fig. 1
- 1981 *Cytherella (Cytherella) gracilis* – Uffenorde, p. 131, pl. 10, fig. 1
- 1993 *Cytherella gracilis* – Kammerer, p. 49-50, pl. 1, fig. 3-6
- 2002 *Cytherella gracilis* – Picot, p. 131, pl. 1, fig. 1-2
- 2005 *Cytherella gracilis* – Grimm et al., p. 236, pl. 1, fig. 12
- 2008 *Cytherella gracilis* – Picot et al., pl. 2, fig. 1

Geographic and stratigraphic distribution

The first record dates to the middle Eocene of eastern Germany (Pietrzeniuk 1969). Rupelian occurrences have been reported for northwestern Switzerland, eastern France and southwestern Germany (Lienenklaus in Kissling 1896; Oertli 1956; Picot 2002; Picot et al. 2008), the Alsace (Stchepinsky 1963) and the Mainz Basin (Kammerer 1993; Grimm et al. 2005). The species has also been reported from the Chattian to Aquitanian of southern Slovakia (Brestenská 1975), the Chattian of the type locality (Lienenklaus 1894) and northern Hessen (central Germany; Faupel 1975) and the Burdigalian of the Aquitaine Basin (Moyes 1965) as well as northern Germany (Bassiouni 1962). Not illustrated reports include a continuous Chattian to Burdigalian occurrence in northern Niedersachsen (northern Germany; Uffenorde 1980, 1986), a Rupelian to Serravallian occurrence in southern Bavaria (Witt 1967), the Chattian of the northwestern Caucasus (Schweyer 1938) and ?Chattian to lower Miocene of the southern Ukraine (Scheremeta 1969).



Temporal and spatial distribution of *Cytherella gracilis* in the Cenozoic of Europe.

Ostracoda

Plate 41

Cytherella gracilis Lienenklaus, 1894

1. ETA004-249

Late Rupelian, Porrentruy-Étang

Right valve, L 630 × H 316 μm

a) lateral view (image Cytherella 66_23OUT.psd)

b) internal view (image Cytherella 66_23IN.psd)

2. BEE004-274

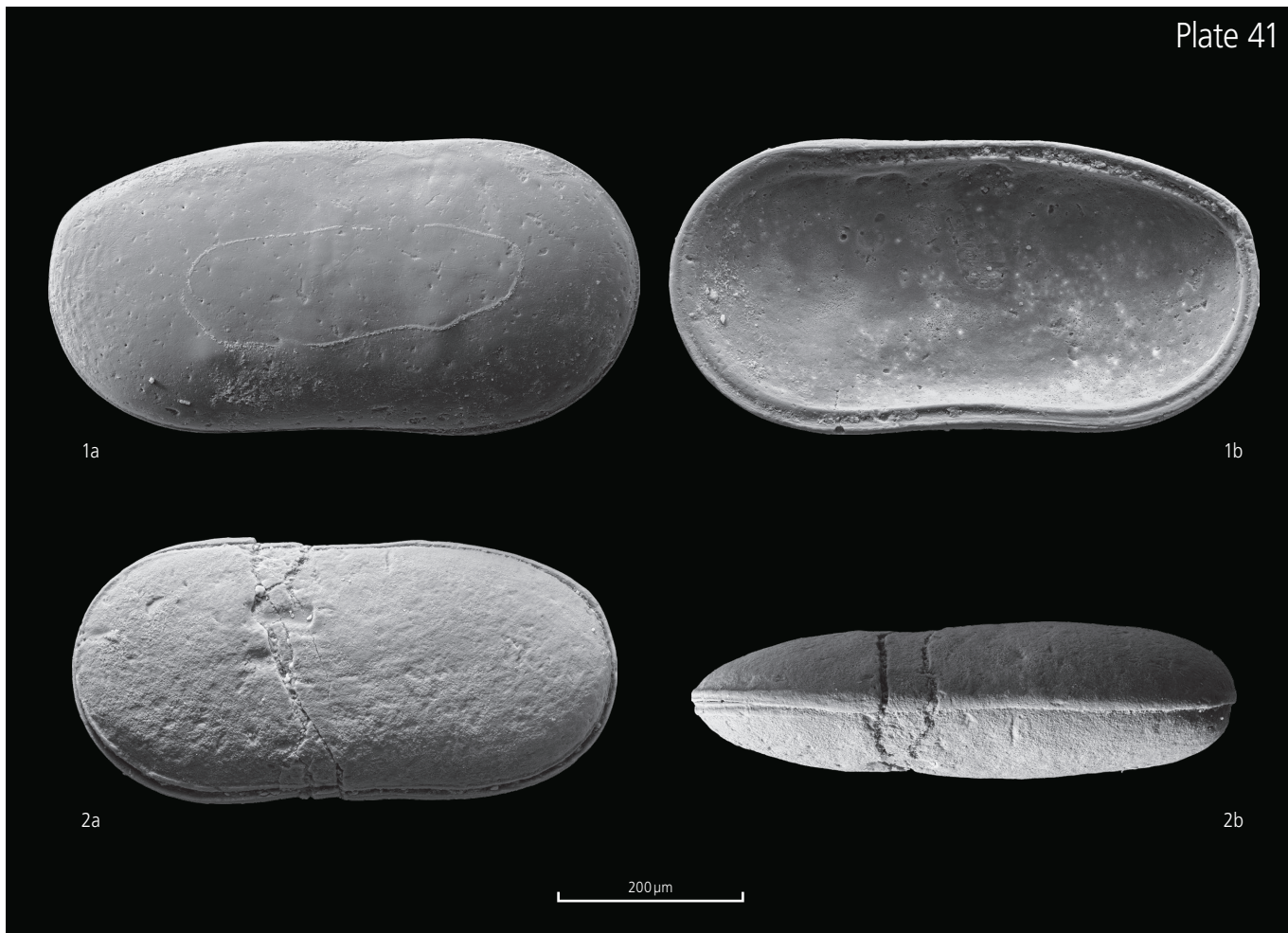
Late Rupelian, Delémont-Beuchille Est

Carapace, L 583/571 × H 280/263 × W 167 μm

a) left lateral view (image Cytherella 66_65OUT.psd)

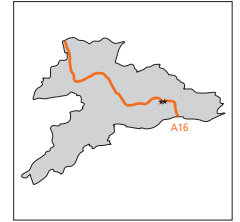
b) dorsal view (image Cytherelloidea 66_65DOR.psd)

Plate 41



PLATYCOPIDA

Cytherelloidea jonesiana (Bosquet, 1852)



Taxonomy

Class	Order	Family	Genus	Species
Ostracoda	Platycopida	Cytherellidae	<i>Cytherelloidea</i>	<i>jonesiana</i>

Determination (name/date): Laurent Picot/14.12.2005; Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Communance (DEL-COM)	592 128/244453
Delémont - Beuchille Est (DEL-BEE)	593 610/244595

Locality	Unit	Layer	Initial sample number	Cell or specimen number
DEL-BEE	17	5	965	BEE003-810
DEL-BEE	19	1800	260/767	BEE004-165, 276-277/BEE003-667, 860, 1004
DEL-BEE	19	1900	261	BEE004-218
DEL-COM	5	-64.0 m	29	COM990-11

Material

adult: 28 carapaces, 1 right valve

Measurements (µm)

diverse samples	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	R	1	690	–	357	–	1.93	
	C	14	657-753	697	365-420	384	1.71-1.90	1.82

Taxonomic remarks

Cytherelloidea jonesiana is very similar to *Cytherelloidea praesulcata* Lienenklaus, 1894 from the Oligocene of northwestern Germany. It differs by the presence of an anterior admarginal groove, and a liplike swelling of the anterior margin in dorsal view. These characteristics have also been described for material from the Chattian of the Mainz Basin (Kammerer 1993), but has not been detected further to the south in the Upper Rhine Graben. Keen (1972b) erects the subspecies *C. j. crassata* based on a freak development of the marginal ridge and attributes this either to stratigraphical reasons (in younger specimens less developed), or changing palaeoecological attributes influencing shell calcification ratios. Since we observe a range of developments of the marginal ridges in our material we rather concur with the ecological interpretation.

Synonymy

Genus *Cytherelloidea* Alexander, 1929

Type species: *Cythere (Cytherella) williamsoniana* Jones, 1849

Cytherelloidea jonesiana (Bosquet, 1852)

- * 1852 *Cytherella jonesiana* – Bosquet, p. 16-17, pl. 1, fig. 4a-d
- 1896 *Cytherella jonesiana* – Lienenklaus in Kissling, p. 32, pl. 2, fig. 14
- 1956 *Cytherelloidea jonesiana* – Oertli, p. 29-31, pl. 1, fig. 13-17
- 1957 *Cytherella jonesiana* – Keij, p. 45-46, pl. 1, fig. 11
- 1963 *Cytherelloidea jonesiana* – Stchepinsky, p. 154
- 1972b *Cytherelloidea jonesiana jonesiana* – Keen, p. 273, pl. 45, fig. 1, 3, 5, 7-8
- 1972b *Cytherelloidea jonesiana crassata* subsp. nov. – Keen, p. 273-274, pl. 45, fig. 2, 4, 6, 9-10
- 1975 *Cytherelloidea jonesiana* – Doebl & Sonne, p. 147, pl. 3, fig. 27
- ? 1975 *Cytherelloidea jonesiana* – Faupel, p. 64-65, pl. 10, fig. 3
- 1985 *Cytherella jonesiana* – Ducasse et al., p. 268, pl. 71, fig. 11
- 1989 *Cytherelloidea jonesiana jonesiana* – Keen, p. 261, pl. 1, fig. 12
- ? 1993 *Cytherella jonesiana* – Nazik, p. 21, pl. 1, fig. 2-3
- non1999 *Cytherella jonesiana* – Şafak, p. 7, pl. 2, fig. 13
- ? 2007 *Cytherella jonesiana* – Zhu et al., p. 718, fig. 3-15
- 2008 *Cytherelloidea jonesiana* – Picot et al., pl. 2, fig. 2
- non2009 *Cytherella jonesiana* – Kapucuoğlu, p. 49, pl. 4, fig. 1

Type locality and horizon

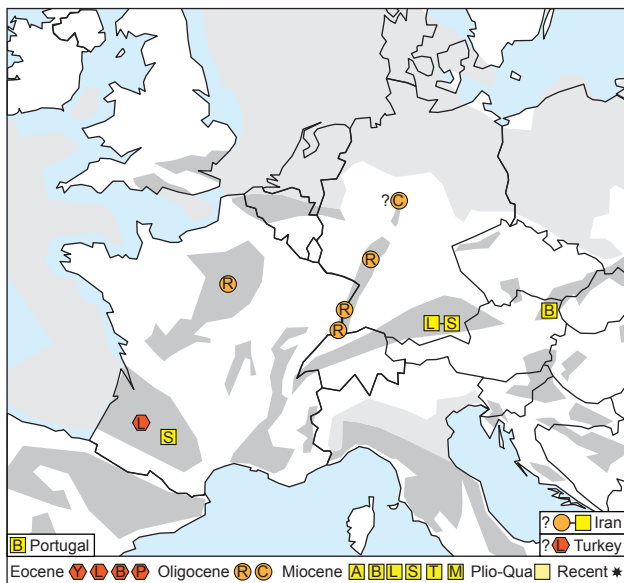
Not given, region of Jeurre or Etréchy (near Étampes, Paris Basin, northern France), “éocène supérieur”, “sables de Fontainebleau” (sensu Bosquet 1852), “Stampien” (sensu Keij 1957).

Lectotype

Right valve (collection Bosquet No. 4, Keij 1957), Institut Royal des Sciences naturelles de Belgique, Bruxelles (Belgium)

Geographic and stratigraphic distribution

Lutetian of the Aquitanian Basin (SW France: Ducasse et al. 1985) and probably Turkey (Nazik 1993). Rupelian occurrences include the Basel area and the Swiss Jura (Switzerland: Oertli 1956; Keen 1972b; Picot et al. 2008), the Alsace (eastern France: Stchepinsky 1963), the Mainz Basin (Doebl & Sonne 1975), the Paris Basin (France: Bosquet 1852; Keij 1957; Keen 1972b; Ducasse et al. 1985). Material from the Chattian of northern Hessen (central Germany; Faupel 1975) may possibly be attributed to the species. Younger, not illustrated reports date to the Burdigalian of Portugal (Pais et al. 2012) and Austria (Rögl et al. 1997), the Serravallian of the Aquitanian Basin (Ducasse & Cahuzac 1997) and the middle Miocene of southern Bavaria (Witt 1967).



Temporal and spatial distribution of *Cytherelloidea jonesiana* in the Cenozoic of Europe.

geometric forms=epochs letters=stages
without letters=epoch (nonspecific)
gray areas=main sedimentary basins

Measurements (μm) of *Cytherelloidea jonesiana*

Female carapaces and right valve				Male carapaces				
Table 1a	Length	Height	L/H	Table 1b	Length	Height	L/H	
	657	365	1.80		724	396	1.83	
	661	367	1.80		733	405	1.81	
	662	376	1.76		743	391	1.90	
	676	376	1.79		753	420	1.79	
	685	386	1.78		753	415	1.81	
	685	367	1.87		753	405	1.86	
	690	357	1.93		Average	743	405	1.83
	690	381	1.81	A-1 carapace				
	691	404	1.71	Table 1c	Length	Height	L/H	
	695	367	1.89		632	357	1.77	
	695	376	1.85					
	695	376	1.85					
	704	376	1.87					
704	376	1.87						
Average	685	375	1.83					

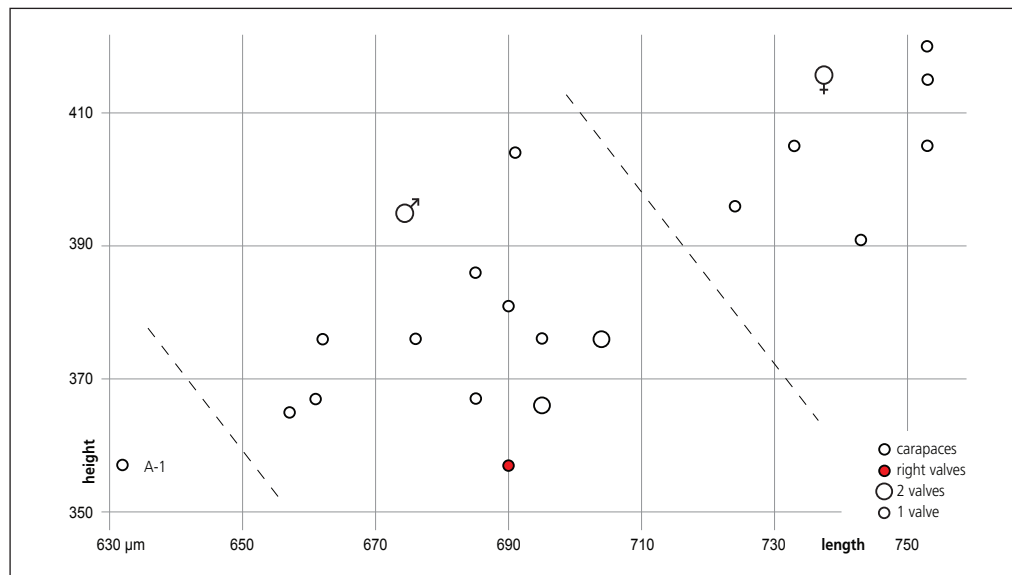


Fig. 1. Length/height plot of *Cytherelloidea jonesiana* carapaces and right valves.

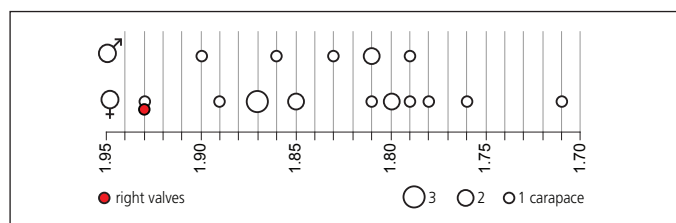


Fig. 2. Distribution of length/height ratios of *Cytherelloidea jonesiana* carapaces and right valves.

Ostracoda

Plate 42

Cytherelloidea jonesiana (Bosquet, 1852)

1. BEE004-276

Late Rupelian, Delémont - Beuchille Est

Female carapace, L 691/671 × H 404 × W 264 μm

a) right lateral view (image Cytherelloidea 66_67OUT.psd)

b) dorsal view (image Cytherelloidea 66_67DOR.psd)

2. BEE004-277

Late Rupelian, Delémont - Beuchille Est

Male carapace, L 662/652 × H 376 × W 257 μm

a) left lateral view (image Cytherelloidea 66_68OUT.psd)

b) ventral view (image Cytherelloidea 66_68VEN.psd)

3. BEE003-1004

Late Rupelian, Delémont - Beuchille Est

Male carapace, L 657 × H 365 × W 201 μm

a) lateral view (image Cytherelloidea 67_24OUT.psd)

b) dorsal view (image Cytherelloidea 67_24DOR.psd)

4. BEE003-557

Late Rupelian, Delémont - Beuchille Est

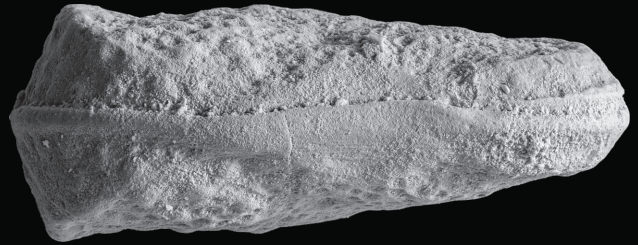
Male carapace, L 657 × H 384 μm

right lateral view (image Cytherelloidea BEE_plot1_3.psd)

Plate 42



1a



1b



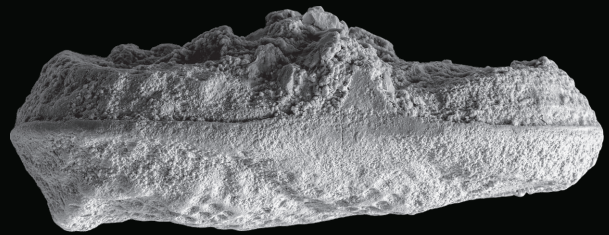
2a



2b



3a



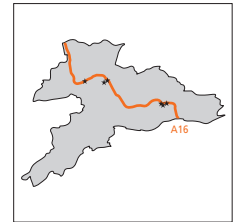
3b



4



PODOCOPIDA

Cytheridea sandbergeri Kammerer, 1989**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cytherideidae	<i>Cytheridea</i>	<i>sandbergeri</i>

Determination (name/date): Laurent Picot/14.12.2005; Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 24/NP24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035
Rossemaison - Clos Leuchu (ROS-CLU)	592 630/243 770
Delémont - Communance (DEL-COM)	592 128/244 453
Porrentruy - Étang (POR-ETA)	571 474/251 036
Cornol - Route Nationale (COR-RNA)	577 713/250 616

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CGN-CLJ	1	-6.0 m	3	CLJ007-42
CGN-CLJ	1	-12.0 m	6	CLJ007-45
CGN-CLJ	1	-14.0 m	7	CLJ007-46
CGN-CLJ	1	-16.0 m	8	CLJ007-47
CGN-CLJ	1	-34.0 m	17	CLJ007-51
COR-RNA	1	-35.8 m	47	RNA987-20
COR-RNA	1	-37.7 m	53	RNA987-34
COR-RNA	2	-9.2 m	55	RNA987-36
COR-RNA	2	-16.4 m	57	RNA987-38, 111
DEL-BEE	2	7	30	BEE002-64
DEL-BEE	9	100	110	BEE003-479
DEL-BEE	9	101	963	BEE003-252
DEL-BEE	9	102	962	BEE003-241, 973
DEL-BEE	9	103	961	BEE003-218
DEL-BEE	9	201	213	BEE003-272
DEL-BEE	14	1	679	BEE003-834
DEL-BEE	16	1	112	BEE004-839
DEL-BEE	17	5	965	BEE003-810
DEL-BEE	19	1800	1/260/767	BEE006-34/BEE004-165-167/BEE003-557, 860-861, 970
DEL-BEE	19	1900	2/261/769	BEE006-93/BEE004-218/BEE003-461, 867, 995-997
DEL-COM	5	-62.0 m	25	COM990-9, 43-44
DEL-COM	5	-64.0 m	29	COM990-11
POR-ETA	2	-6.0 m	4	ETA004-122, 238
POR-ETA	2	-7.0 m	5	ETA004-123
POR-ETA	2	-6.0 m	6	ETA004-100
POR-ETA	2	-7.0 m	7	ETA004-103, 225
POR-ETA	2	-8.0 m	8	ETA004-109
POR-ETA	2	-9.0 m	9	ETA004-110
POR-ETA	2	-10.0 m	10	ETA004-112, 235
POR-ETA	2	-11.0 m	11	ETA004-115
POR-ETA	2	-13.0 m	13	ETA004-118
POR-ETA	2	-14.0 m	14	ETA004-221
POR-ETA	3	-7.0 m	27	ETA004-127

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
POR-ETA	3	-10.0 m	30	ETA004-130, 243-244
POR-ETA	3	-13.0 m	33	ETA004-133
POR-ETA	3	-14.0 m	34	ETA004-187
POR-ETA	3	-15.0 m	35	ETA004-191
POR-ETA	3	-16.0 m	36	ETA004-195
POR-ETA	3	-17.0 m	37	ETA004-200
POR-ETA	3	-18.0 m	38	ETA004-205
POR-ETA	3	-19.0 m	39	ETA004-209
POR-ETA	3	-20.0 m	40	ETA004-214
ROS-CLU	1	-10.6 m	54	CLU007-197
ROS-CLU	1	-10.8 m	55	CLU007-198

Material

adult: 1025 carapaces, 29 carapace fragments, 59 left valves, 79 right valves, 27 valve fragments

juvenile: 6 carapaces, 4 left valves, 4 right valves

Measurements (μm)

BEE003-461	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	female L	25	825-931	880	451-514	487	1.75-1.87	1.81
	female R	27	800-912	853	417-485	458	1.79-1.93	1.86
	male L	22	834-955	911	437-485	464	1.91-2.03	1.96
	male R	21	841-926	890	422-466	443	1.97-2.08	2.01
	uncertain L	1	917	–	485	–	1.89	–
	uncertain R	1	897	–	461	–	1.95	–
	A-1 stage L	1	635	–	344	–	1.85	–
COM990-9	female L	15	791-849	817	434-463	444	1.80-1.88	1.84
	female R	15	772-830	792	410-444	421	1.84-1.93	1.88
	male L	6	849-907	872	427-463	437	1.96-2.05	1.99
	male R	6	825-873	847	400-434	415	2.00-2.08	2.04

Taxonomic remarks

Note the difference in the size ranges between varying samples (see measures of SEM images and text-fig. 26 in Pirkenseer & Berger 2011). Large variations in outline shape hampers an entirely unambiguous separation of female and male specimens. The measuring of carapaces revealed the variability between left and right valves in individual specimens and between specimens.

The probably endemic late Rupelian *Cytheridea sandbergeri* is closely related to the coeval *Cytheridea pernota* from northwestern Europe. Formerly the latter species has been described from sediments of the Upper Rhine Graben and the northern Jura (Oertli & Key 1955; Picot et al. 2008).

The presence of *Cytheridea sandbergeri* in early Rupelian sediments of the Upper Rhine Graben sensu Griebemer et al. (2007) has been emended (Pirkenseer & Berger 2011). The occurrence of *Cytheridea sandbergeri* as far east as the Tarim Basin and as early as the late Eocene (Bosboom et al. 2014) seems doubtful.

Synonymy

Genus *Cytheridea* Bosquet, 1852

Type species: *Cythere mülleri* Münster, 1830 (designated by Brady & Norman 1889)

Cytheridea sandbergeri Kammerer, 1989

- 1896 *Cytheridea Muelleri* sp. – Lienenklaus in Kissling, p. 25-26, pl. 2, fig. 5
- 1955 *Cytheridea pernota* n.sp. – Oertli & Key, p. 19-25, pl. 1, fig. 8-13 [non pl. 1, fig. 1-7, 25]
- 1955 *Cytheridea pernota* – Oertli, p. 36, pl. 2, fig. 33-38
- 1963 *Cytheridea pernota* – Stchepinsky, p. 158
- * 1989 *Cytheridea sandbergeri* sp. nov. – Kammerer, p. 120-127, p. 121/123/125/127 fig. 1-3
- 1993 *Cytheridea sandbergeri* – Kammerer, p. 55-56, pl. 3, fig. 1-5, 8, 10
- 2002 *Cytheridea pernota* – Picot, p. 138, pl. 4, fig. 3-7
- 2004 *Cytheridea sandbergeri* – Schindler & Nungesser, p. 17, 18, 19, fig. 3/6
- 2005 *Cytheridea sandbergeri* – Grimm et al., p. 249, pl. 1, fig. 13
- 2008 *Cytheridea pernota* – Picot et al., pl. 2, fig. 12-13
- 2011 *Cytheridea sandbergeri* – Pirkenseer & Berger, 36-39, pl. 4, fig. 4-8

Type locality and horizon

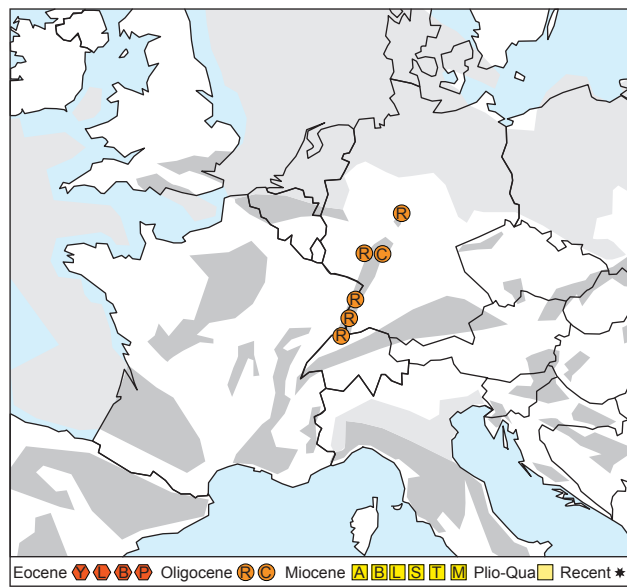
Drilling No. 27 (KB 2), sample 6015/5922, 83.5 m to 83.75 m, Bodenheim, Mainz Basin (Germany), "Schleichsand", Rupelian (sensu Kammerer 1989).

Holotype

Female left valve, No. SMF Xc 14751, Forschungsinstitut Senckenberg (Frankfurt a. M., Germany).

Geographic and stratigraphic distribution

Cytheridea sandbergeri occurs in the late Rupelian of the Upper Rhine Graben and Hessian Depression (for references see synonymy list).



Temporal and spatial distribution of Cytheridea sandbergeri in the Cenozoic of Europe.

geometric forms=epochs letters=stages
 without letters=epoch (nonspecific)
 gray areas=main sedimentary basins

Measurements (μm) of *Cytheridea sandbergeri* in sample BEE003-461

Female right valves				Female left valves				Male right valves				Male left valves			
Table 1a	Length	Height	L/H	Table 1b	Length	Height	L/H	Table 1c	Length	Height	L/H	Table 1d	Length	Height	L/H
	849	475	1.79		883	504	1.75		858	437	1.97		926	485	1.91
	873	485	1.80		902	514	1.75		888	451	1.97		834	437	1.91
	849	466	1.82		878	500	1.76		883	446	1.98		873	456	1.91
	849	466	1.82		888	504	1.76		902	456	1.98		912	475	1.92
	849	466	1.82		883	500	1.77		926	466	1.99		931	485	1.92
	878	480	1.83		858	485	1.77		841	422	1.99		936	485	1.93
	854	466	1.83		902	509	1.77		844	422	2.00		912	470	1.94
	854	466	1.83		897	504	1.78		912	456	2.00		922	475	1.94
	863	470	1.84		863	485	1.78		912	456	2.00		907	461	1.97
	892	485	1.84		888	495	1.79		926	461	2.01		955	485	1.97
	839	456	1.84		873	485	1.80		907	451	2.01		863	437	1.98
	858	466	1.84		917	509	1.80		897	446	2.01		902	456	1.98
	844	456	1.85		858	475	1.81		912	451	2.02		922	466	1.98
	849	456	1.86		863	475	1.82		892	441	2.02		922	466	1.98
	844	451	1.87		873	480	1.82		883	437	2.02		941	475	1.98
	800	427	1.88		825	451	1.83		883	437	2.02		941	475	1.98
	883	470	1.88		834	456	1.83		873	432	2.02		868	437	1.99
	810	432	1.88		888	485	1.83		907	446	2.03		907	456	1.99
	868	461	1.88		902	493	1.83		902	441	2.04		955	480	1.99
	815	432	1.89		844	461	1.83		863	422	2.05		931	466	2.00
	825	437	1.89		878	475	1.85		878	422	2.08		883	437	2.02
	863	456	1.89		902	485	1.86	Average	890	443	2.01		897	441	2.03
	878	461	1.91		922	495	1.86					Average	911	464	1.96
	912	475	1.92		931	500	1.86								
	839	437	1.92		844	451	1.87								
	897	466	1.93	Average	880	487	1.81								
	805	417	1.93												
Average	853	458	1.86												

Measurements (μm) of *Cytheridea sandbergeri* in sample BEE003-461

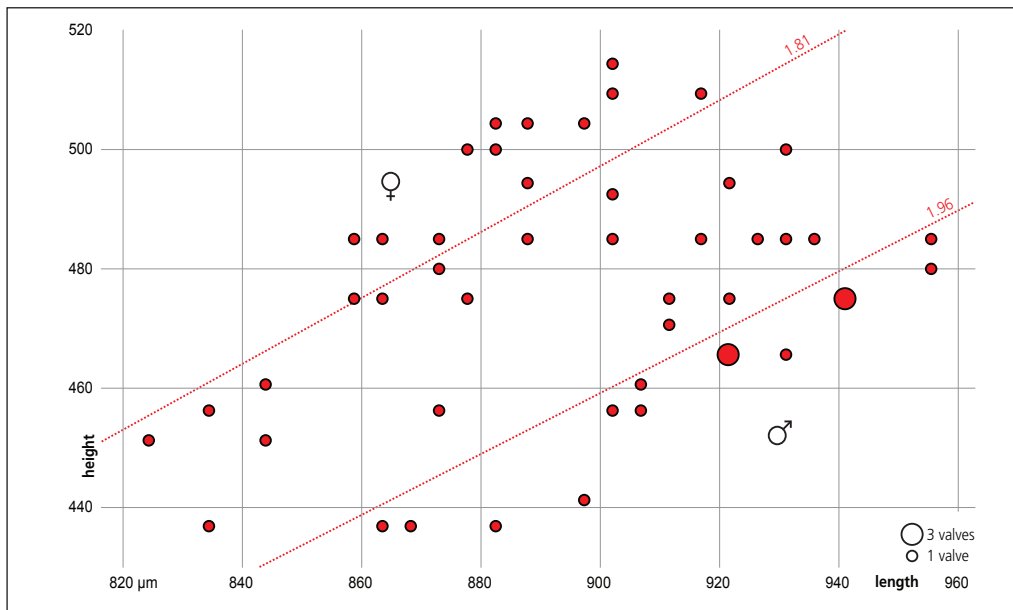


Fig. 3. Length/height plot of *Cytheridea sandbergeri* left valves of measures on carapaces (sample BEE003-461).

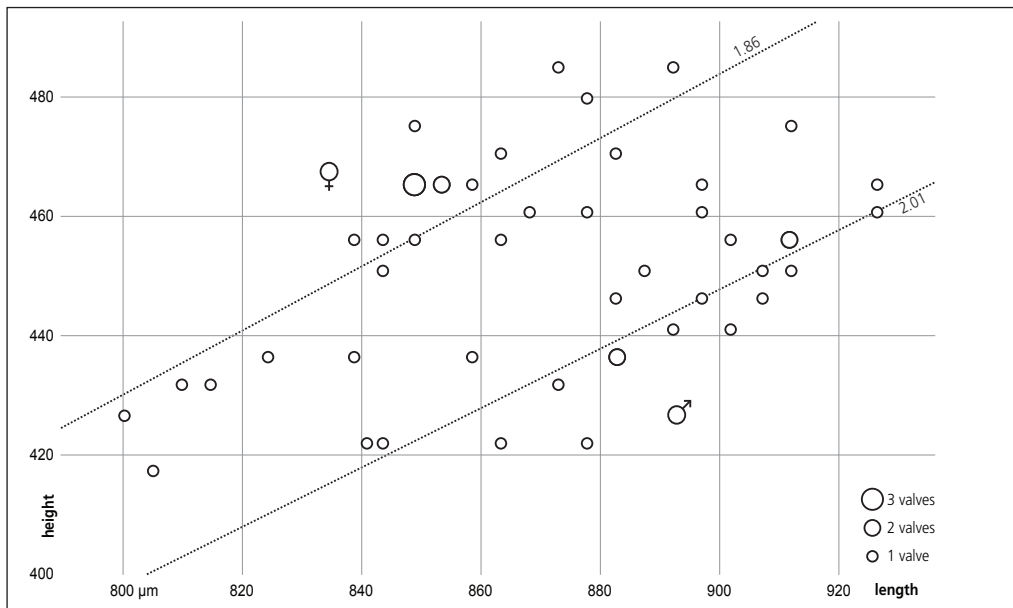


Fig. 4. Length/height plot of *Cytheridea sandbergeri* right valves of measures on carapaces (sample BEE003-461).

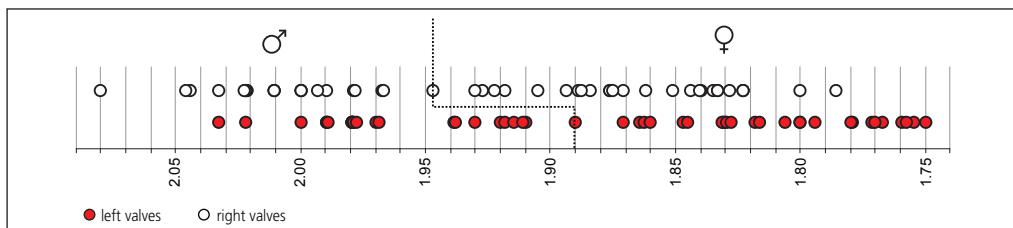


Fig. 5. Distribution of length/height ratios of *Cytheridea sandbergeri* left and right valves in sample BEE003-461.

Measurements (μm) of *Cytheridea sandbergeri* in sample COM990-9

Female right valves				Female left valves				Male right valves			
Table 2a	Length	Height	L/H	Table 2b	Length	Height	L/H	Table 2c	Length	Height	L/H
	772	420	1.84		791	439	1.80		830	415	2.00
	782	425	1.84		811	449	1.81		873	434	2.01
	782	425	1.84		825	454	1.82		859	420	2.05
	772	415	1.86		811	444	1.83		849	415	2.05
	791	425	1.86		820	449	1.83		825	400	2.06
	830	444	1.87		796	434	1.83		844	405	2.08
	796	425	1.88		849	463	1.83	Average	847	415	2.04
	791	420	1.89		811	441	1.84				
	791	420	1.89		801	434	1.84				
	777	410	1.89		820	444	1.85				
	777	410	1.89		820	444	1.85				
	791	415	1.91		849	458	1.85				
	791	415	1.91		825	444	1.86				
	830	434	1.91		811	434	1.87				
	811	420	1.93		815	434	1.88				
Average	792	421	1.88	Average	817	444	1.84				

Male left valves			
Table 2d	Length	Height	L/H
	849	434	1.96
	907	463	1.96
	859	434	1.98
	859	429	2.00
	878	434	2.02
	878	427	2.05
Average	872	437	1.99

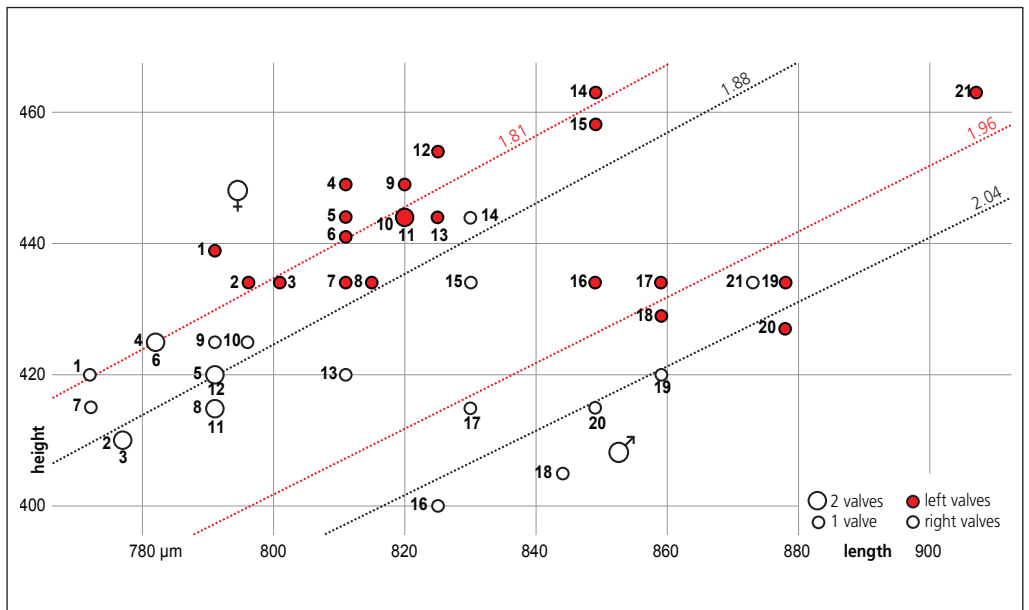


Fig. 6. Length/height plot of *Cytheridea sandbergeri* left and right valves of measures on carapaces (sample COM990-9). Small numbers in bold denote equivalent left and right valves of individual carapaces.

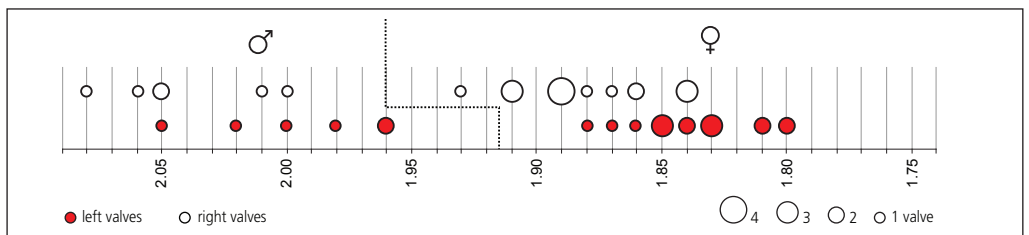


Fig. 7. Distribution of length/height ratios of *Cytheridea sandbergeri* left and right valves in sample COM990-9.

Ostracoda

Plate 43

Cytheridea sandbergeri Kammerer, 1989

1. RNA987-111

Late Rupelian, Cornol-Route Nationale

A-1 instar right valve, L 603 × H 343 × W 168 μm

a) lateral view (image Cytheridea 66_32OUT.psd)

b) dorsal view (image Cytheridea 66_32DOR.psd)

2. ETA004-238

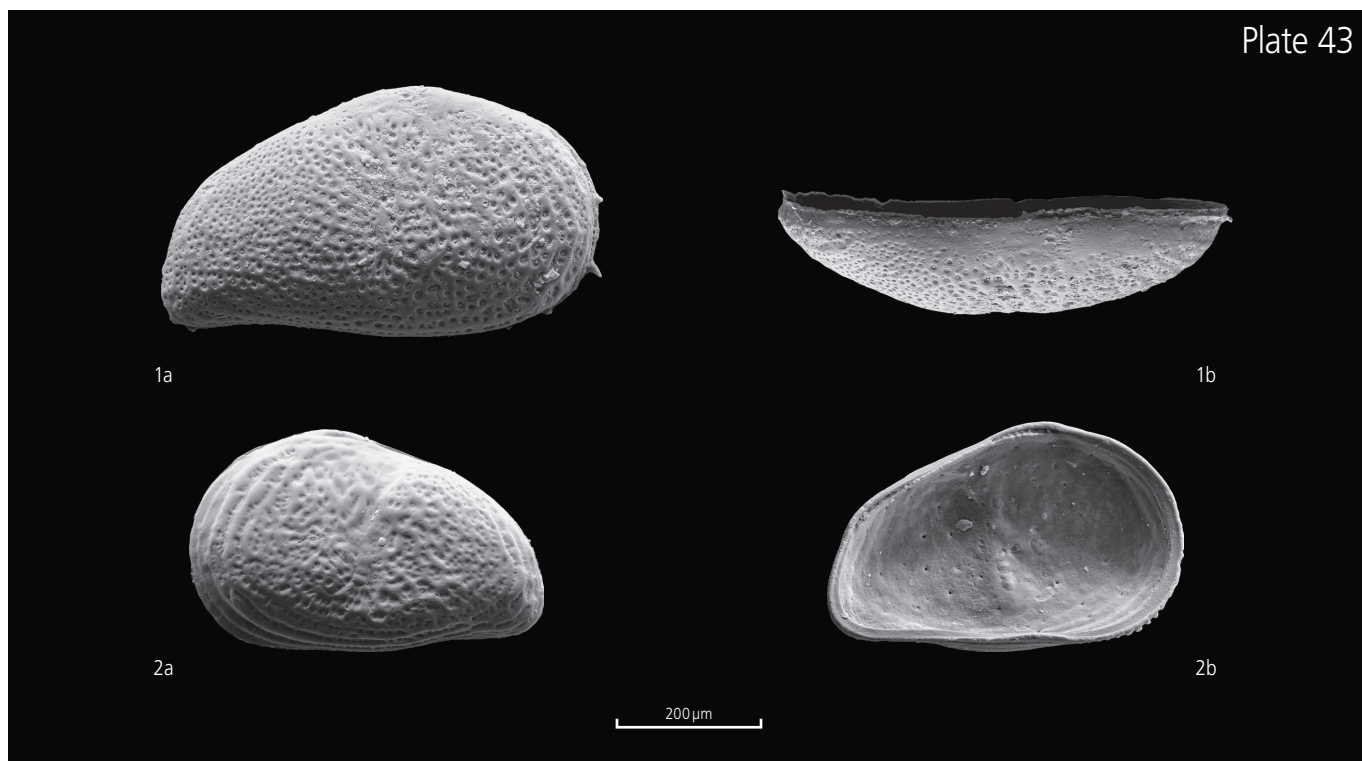
Late Rupelian, Porrentruy-Étang

A-2 instar left valve, L 484 × H 304 μm

a) lateral view (image Cytheridea 66_18OUT.psd)

b) internal view (image Cytheridea 66_18IN.psd)

Plate 43



Ostracoda

Plate 44

Cytheridea sandbergeri Kammerer, 1989

1. COM990-43

Late Rupelian, Delémont - Communance

Male carapace, small specimen, shell drilled dorsally by predatory gastropod, L 833 × H 419 × W 336 µm

a) left lateral view (image Cytheridea drilled 66_47OUT.psd)

b) dorsal view (image Cytheridea drilled 66_47DOR.psd)

2. COM990-44

Late Rupelian, Delémont - Communance

Female carapace, moderately high specimen, shell drilled laterally by predatory gastropod, L 807 × H 434 × W 346 µm

a) left lateral view (image Cytheridea drilled 66_48OUT.psd)

b) dorsal view (image Cytheridea drilled 66_48DOR.psd)

3. BEE003-997

Late Rupelian, Delémont - Beuchille Est

Female carapace, high specimen, L 834 × H 478 × W 360 µm

a) right lateral view (image Cytheridea 67_21OUT.psd)

b) ventral view (image Cytheridea 67_21VEN.psd)

4. BEE003-557

Late Rupelian, Delémont - Beuchille Est

Female carapace, very high specimen, L 810 × H 496 µm

right lateral view (image Cytheridea BEE_plot1_6.tif)

5. BEE003-557

Late Rupelian, Delémont - Beuchille Est

Female carapace, very small specimen, but adult habitus,

L 692 × H 408 µm

right lateral view (image Cytheridea BEE_plot1_7.tif)

6. BEE003-995

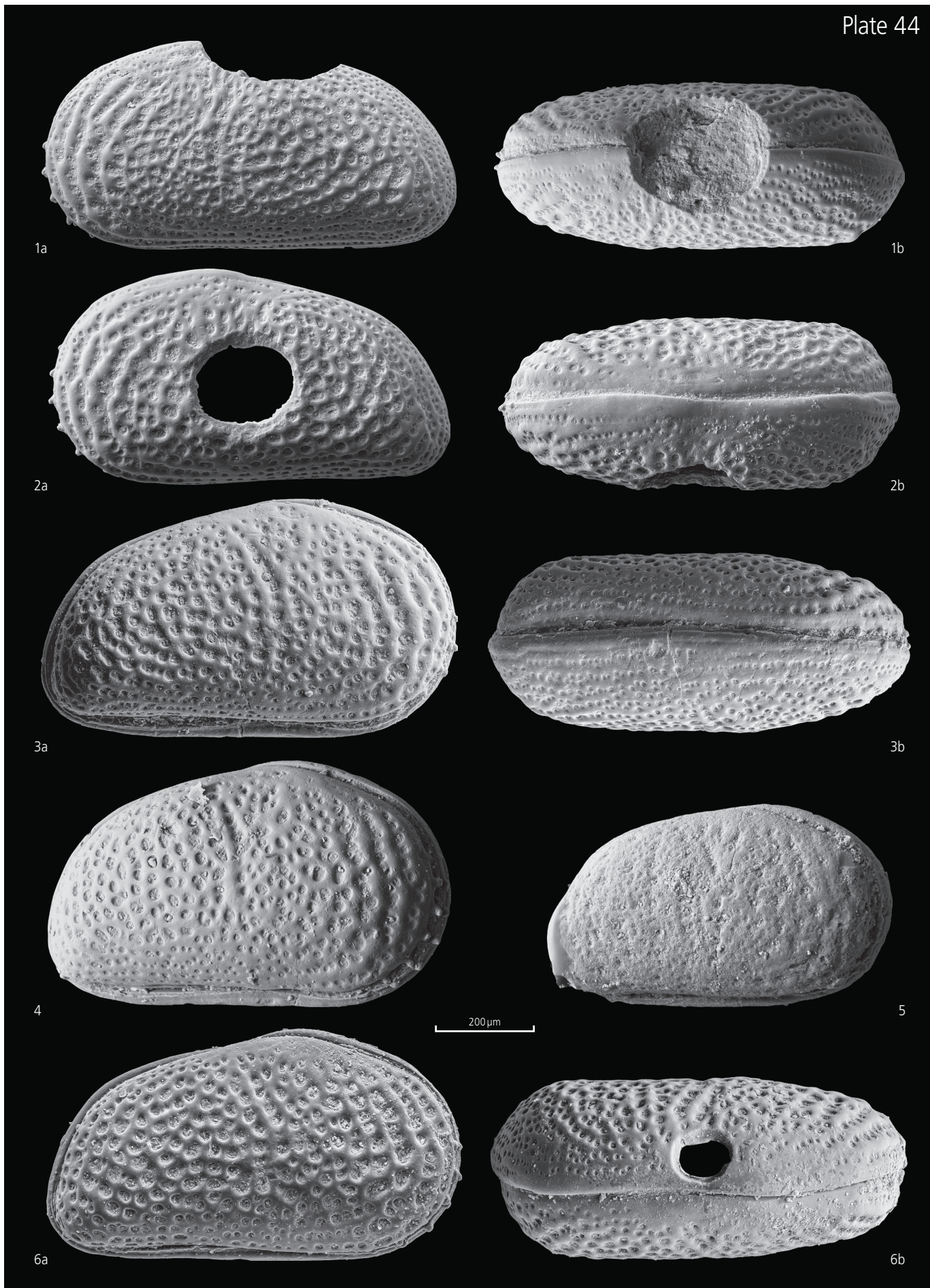
Late Rupelian, Delémont - Beuchille Est

Female carapace, moderately high specimen, shell drilled dorsally by predatory gastropod, L 831 × H 464 × W 367 µm

a) right lateral view (image Cytheridea 67_19OUT.psd)

b) dorsal view (image Cytheridea 67_19DOR.psd)

Plate 44



Ostracoda

Plate 45

Cytheridea sandbergeri Kammerer, 1989

1. BEE003-996

Late Rupelian, Delémont-Beuchille Est

Female carapace, small but relatively high specimen, more strongly inclined posterodorsal margin, L 779 × H 448 × W 347 μm

a) right lateral view (image Cytheridea 67_20OUT.psd)

b) ventral view (image Cytheridea 67_20VEN.psd)

2. ETA004-235

Late Rupelian, Porrentruy-Étang

Female left valve, small but relatively high specimen, more strongly inclined posterodorsal margin, L 776 × H 449 μm

a) lateral view (image Cytheridea 66_40OUT.psd)

b) internal view (image Cytheridea 66_41IN.psd)

3. ETA004-225

Late Rupelian, Porrentruy-Étang

Female right valve, small and low specimen, L 791 × H 410 μm

a) lateral view (image Cytheridea 66_15OUT.psd)

b) internal view (image Cytheridea 66_15IN.psd)

4. ETA004-243

Late Rupelian, Porrentruy-Étang

Female right valve, small and low specimen, L 790 × H 410 μm

a) lateral view (image Cytheridea 66_19OUT.psd)

b) internal view (image Cytheridea 66_19IN.psd)

5. ETA004-244

Late Rupelian, Porrentruy-Étang

Female left valve, very small but high specimen, juvenile habitus, L 715 × H 413 μm

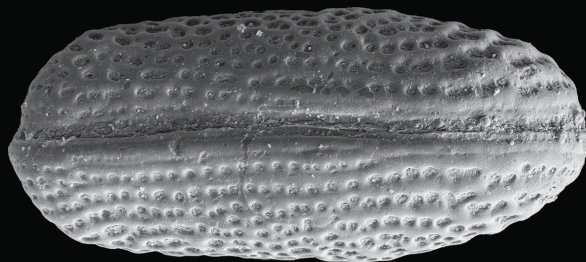
a) lateral view (image Hemicyprideis Cytheridea 66_20OUT.psd)

b) internal view (image Cytheridea 66_20IN.psd)

Plate 45



1a



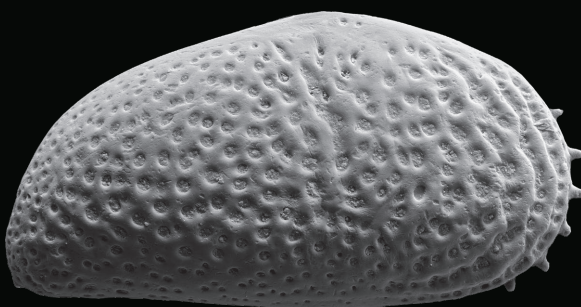
1b



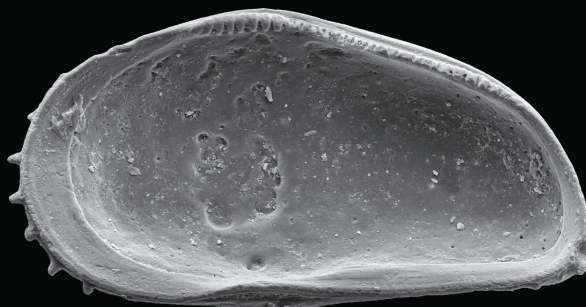
2a



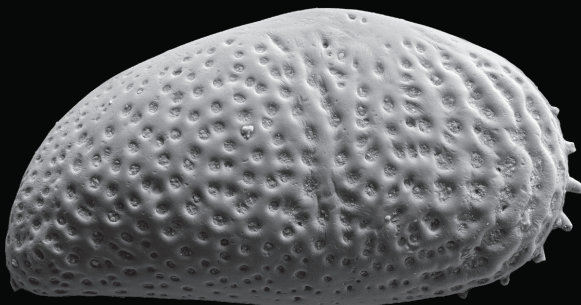
2b



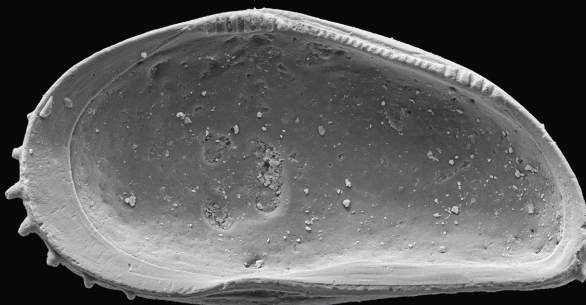
3a



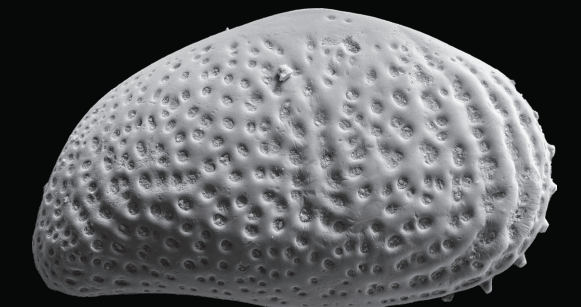
3b



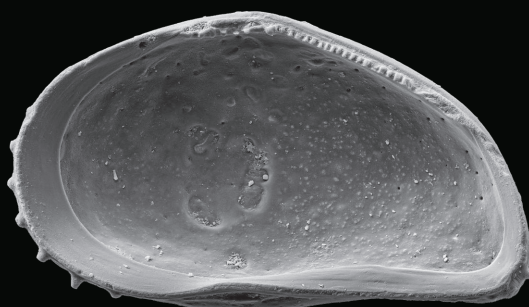
4a



4b



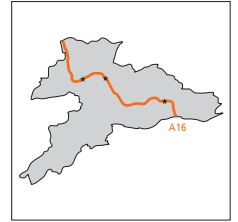
5a



5b

200 μm

PODOCOPIDA

Cyamocytheridea punctatella (Bosquet, 1852)**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cytheridaeidae	<i>Cyamocytheridea</i>	<i>punctatella</i>

Determination (name/date): Laurent Picot/14.12.2005; Claudius Pirkenseer/17.10.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Porrentruy - Étang (POR-ETA)	571 474/251 036

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	1	-37.7 m	53	RNA987-34
COR-RNA	2	-9.2 m	57	RNA987-38
DEL-BEE	9	100	110	BEE003-479
DEL-BEE	9	201	213	BEE003-272
DEL-BEE	17	5	965	BEE003-810
DEL-BEE	19	1800	260	BEE004-165-166, 285-288
POR-ETA	2	-5.0 m	5	ETA004-103

Material

adult: 92 carapaces, 9 left valves, 7 right valves; juvenile: 4 left valves, 1 right valve

Measurements (µm)

BEE004-165	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	adult C	37	555-685	612	290-357	320	1.77-2.03	1.91
	A-1 stage C	2	536-545	541	290	290	1.85-1.88	1.87

Taxonomic remarks

Cyamocytheridea punctatella sensu Oertli (1956) is a morphologically variable species. Less well rounded, more semicircular specimens are interpreted to represent males, whereas the more ovoid individuals are attributed to females. Accordingly different morphs have been either reassigned to a new species (*Cyamocytheridea* sp. A in Kammerer 1993, *C. cf. devexa* and *C. cf. hebertiana* in Pirkenseer & Berger 2011) or subspecies (*C. p. producta* in Margerie 1961; Keen 1972b, 1978). The development of tubercles is restricted to juveniles by Oertli (1956). In part of our material and Pirkenseer & Berger (2011) also adult-sized specimens carry vesicles.

Both *Cyamocytheridea hebertiana* (Bosquet 1852) from the Eocene of the Paris Basin and *C. devexa* (Lienenklaus 1905) from the Rupelian of the Mainz Basin are larger and feature lower and narrower posterior and anterior valve margins.

Type locality and horizon

Jeurre and Étréchy near Paris (France), Bergh near Kleine-Spouwen (Belgium), "argile sableuse à *Nucules*", exact locality and horizon not given.

Holotype

Not given, material lost according to Kammerer (1993).

Synonymy

Genus *Cyamocytheridea* Oertli, 1956

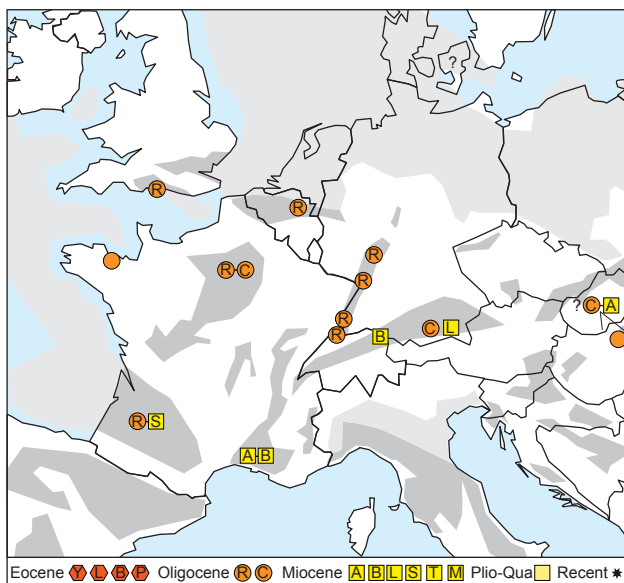
Type species: *Bairdia punctatella* Bosquet, 1852

Cyamocytheridea punctatella (Bosquet, 1852)

- * 1852 *Bairdia punctatella* nova species – Bosquet, p. 26, pl. 1, fig. 10
- 1896 *Cytheridea cuneata* nov. sp. – Lienenklaus in Kissling, p. 27-28, pl. 2, fig. 7
- 1905 *Cytheridea cuneata* – Lienenklaus, p. 44. [sensu Oertli 1956]
- 1956 *Cyamocytheridea punctatella* – Oertli, p. 50-53, pl. 5, fig. 128-143
- 1957 *Haplocytheridea punctatella* – Keij, p. 63, pl. 2, fig. 11-12, pl. 3, fig. 13-15 [?male sensu Oertli 1956]
- 1962 *Cyamocytheridea* sp. Cy 21 [aff. reversa]. – Malz, p. 395, pl. 58, fig. 14
- 1963 *Cyamocytheridea punctatella* – Apostolescu et al., p. 4691
- 1963 *Cyamocytheridea punctatella* – Stchepinsky, p. 159-160
- 1965 *Cyamocytheridea punctatella* – Moyes, p. 33, pl. 4, fig. 1
- 1967 *Cyamocytheridea punctatella* – Witt, p. 95, 96
- 1969 *Cyamocytheridea punctatella* – Carbonnel, p. 74, pl. 4, fig. 21-22
- 1972b *Cyamocytheridea punctatella punctatella* – Keen, p. 290, pl. 56, fig. 16
- 1972b *Cyamocytheridea punctatella producta* – Keen, p. 290-291, pl. 52, fig. 10
- 1975 *Cyamocytheridea punctatella* – Brestenská, p. 397, pl. 2, fig. 12-15
- non 1975 *Cyamocytheridea punctatella* – Doebi & Sonne, p. 142, pl. 2, fig. 9. [*C. devexa*, see also Kammerer 1993]
- 1978 *Cyamocytheridea punctatella punctatella* – Keen, pl. 4, fig. 10
- 1978 *Cyamocytheridea punctatella producta* – Keen, p. 442, pl. 4, fig. 12
- 1982 *Cyamocytheridea punctatella* – Carbonnel, tab. 1
- 1985 *Cyamocytheridea punctatella* – Ducasse et al., p. 281, pl. 76, fig. 9-10
- 1985 *Cyamocytheridea punctatella* – Müller, p. 18-19, pl. 1, fig. 17-19
- 1989 *Cyamocytheridea punctatella punctatella* – Keen, p. 261, pl. 1, fig. 12
- 1993 *Cyamocytheridea* sp. A – Kammerer, p. 608, pl. 5, fig. 5-6. [?male sensu Oertli 1956]
- 1993 *Cyamocytheridea punctatella* – Kammerer, p. 59-60, pl. 5, fig. 1-4. [?female sensu Oertli 1956]
- 1996 *Cyamocytheridea punctatella* – Ducasse & Bekaert, p. 321, pl. 41, fig. 1
- 2002 *Cyamocytheridea punctatella* – Picot, p. 138-139, pl. 5, fig. 1-3
- 2004 *Cyamocytheridea punctatella* – Monostori, p. 41-42, pl. 7, fig. 2-3
- 2008 *Cyamocytheridea punctatella* – Picot et al., p. 492, tab. 2, fig. 4-5, pl. 2, fig. 11, 14
- 2011 *Cyamocytheridea punctatella* – Pirkenseer & Berger, p. 40-43, pl. 5, fig. 3-4
- 2011 *Cyamocytheridea* cf. *devexa* – Pirkenseer & Berger, p. 39, pl. 4, fig. 9 [?male sensu Oertli 1956]
- 2011 *Cyamocytheridea* cf. *hebertiana* – Pirkenseer & Berger, p. 39-40, pl. 5, fig. 1-2 [?female sensu Oertli 1956]

Geographic and stratigraphic distribution

Cyamocytheridea punctatella occurs in the southern part of the northwest European Cenozoic Basin (northern France, southern England and Belgium) in the Rupelian (Keen 1972b, 1978, 1989) and also the Chattian of the Paris Basin (Ducasse et al. 1985a). The species is recorded from the early Oligocene to the Serravallian in the Aquitaine Basin (southern France: Moyes 1965; Ducasse et al. 1985; Ducasse & Bekaert 1996) and the early Miocene of the Montpellier Basin (southern France: Carbonnel 1970). The species is present in the Rupelian of the entire Upper Rhine Graben (Oertli 1956; Malz 1962; Stchepinsky 1963; Picot 2002; Picot et al. 2008). The species occurs in the early Miocene (Carbonnel 1982) of the western Molasse Basin, in the Chattian and Langhian of southern Bavaria (Witt 1967; Müller 1985) as well as the Chattian to Aquitanian of the southern Slovakia and northern Hungary (Brestenská 1975), and possibly the entire Oligocene of northern Hungary (Monostori 2004).



Temporal and spatial distribution of *Cyamocytheridea punctatella* in the Cenozoic of Europe.

geometric forms=epochs letters=stages
without letters=epoch (nonspecific)
gray areas=main sedimentary basins

Measurements (μm) of *Cyamocytheridea punctatella*

Adult carapaces				Adult carapaces				A-1 stage carapaces			
Table 1	Length	Height	L/H	Table 1	Length	Height	L/H	Table 2	Length	Height	L/H
	555	314	1.77		608	312	1.95		536	290	1.85
	565	309	1.83		618	318	1.94		545	290	1.88
	569	309	1.84		618	318	1.94	Average	541	290	1.87
	584	309	1.89		618	309	2.00				
	584	304	1.92		618	304	2.03				
	589	328	1.79		625	336	1.86				
	589	314	1.88		627	347	1.81				
	589	290	2.03		627	318	1.97				
	591	317	1.86		627	318	1.97				
	593	314	1.89		627	309	2.03				
	593	309	1.92		633	350	1.81				
	593	307	1.93		637	338	1.89				
	598	304	1.97		637	314	2.03				
	603	323	1.87		647	318	2.03				
	607	327	1.86		647	318	2.03				
	608	338	1.80		656	347	1.89				
	608	328	1.85		666	328	2.03				
	608	328	1.85		685	357	1.92				
	608	318	1.91	Average	612	320	1.91				

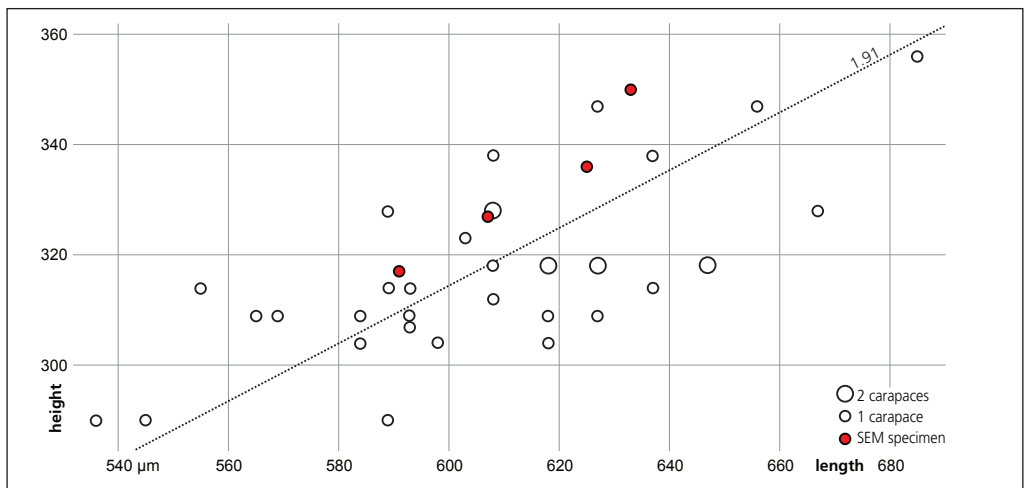


Fig. 8. Length/height plot of *Cyamocytheridea punctatella* carapaces (sample BEE004-306). The wide diffuse scatter compares to the scatter illustrated in Pirkenseer & Berger (2011), but in our case may be partly due to the rather poor preservation.

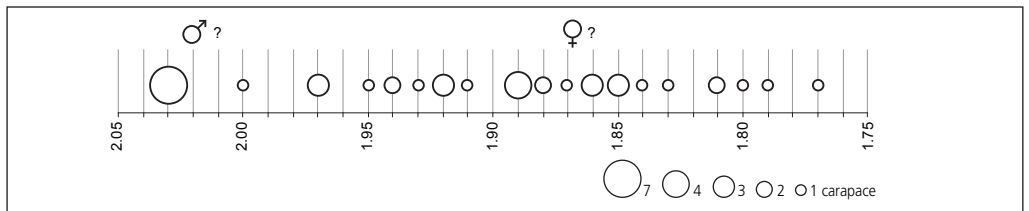


Fig. 9. Distribution of length/height ratios of *Cyamocytheridea punctatella* carapaces (sample BEE004-306). No distinctive clustering is evident.

Ostracoda

Plate 46

Cyamocytheridea punctatella (Bosquet, 1852)

1. BEE004-285

Late Rupelian, Delémont - Beuchille Est

Carapace, L 625 × H 336 × W 320 μm

a) left lateral view (image Cyamocytheridea 66_76OUT.psd)

b) dorsal view (image Cyamocytheridea 66_76DOR.psd)

2. BEE004-286

Late Rupelian, Delémont - Beuchille Est

Carapace, L 633 × H 350 × W 319 μm

a) left lateral view (image indet Cyamocytheridea 66_77OUT.psd)

b) dorsal view (image Cyamocytheridea 66_77DOR.psd)

3. BEE004-287

Late Rupelian, Delémont - Beuchille Est

Carapace, L 607 × H 327 × W 268 μm

a) right lateral view (image Cyamocytheridea 66_78OUT.psd)

b) dorsal view (image Cyamocytheridea 66_78DOR.psd)

4. BEE004-288

Late Rupelian, Delémont - Beuchille Est

Carapace, L 591 × H 317 × W 275 μm

a) left lateral view (image Cyamocytheridea 66_79OUT.psd)

b) dorsal view (image Cyamocytheridea 66_79DOR.psd)

Plate 46



1a



1b



2a



2b



3a



3b



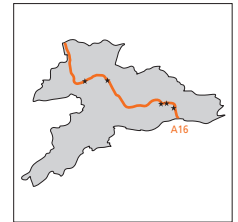
4a



4b

200 μ m

PODOCOPIDA

Hemicyprideis helvetica (Lienenklaus, 1895)

Taxonomy

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cytherideidae	<i>Hemicyprideis</i>	<i>helvetica</i>

Determination (name/date): Laurent Picot/14.12.2005; Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 24/NP24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL- BEE)	593 610/244 595
Delémont - Communance (DEL- COM)	592 128/244 453
Porrentruy - Étang (POR-ETA)	571 474/251 036
Courrendlin - Hauts Rochets (CRD-HRT)	595 640/243 145
Cornol - Route Nationale (COR-RNA)	577 713/250 616

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	2	-9.2 m	55	RNA987-36
COR-RNA	2	-16.4 m	57	RNA987-38, 113
CRD-HRT	15	-14.9 m	59	HRT988-28
CRD-HRT	15	-53.0 m	45	HRT988-25
CRD-HRT	15	-69.0 m	53	HRT988-24
DEL-BEE	17	5	965	BEE003-810
DEL-BEE	19	1800	260/767	BEE004-165-168, 307/BEE003-557, 860-861
DEL-BEE	19	1900	261/769	BEE004-218/BEE003-867
DEL-COM	5	-55.0 m	1	COM990-3
DEL-COM	5	-62.0 m	25	COM990-9
DEL-COM	5	-64.0 m	29	COM990-11
POR-ETA	2	-4.0 m	24	ETA004-150
POR-ETA	2	-6.0 m	4	ETA004-122
POR-ETA	2	-7.0 m	5	ETA004-123
POR-ETA	2	-6.0 m	6	ETA004-100
POR-ETA	2	-7.0 m	7	ETA004-103, 223-224, 226-227
POR-ETA	2	-8.0 m	8	ETA004-109, 228, 230-231
POR-ETA	2	-9.0 m	9	ETA004-110, 233
POR-ETA	2	-10.0 m	10	ETA004-112, 236-237
POR-ETA	3	-1.0 m	21	ETA004-124
POR-ETA	3	-5.0 m	25	ETA004-125
POR-ETA	3	-6.0 m	26	ETA004-126
POR-ETA	3	-7.0 m	27	ETA004-127, 241
POR-ETA	3	-8.0 m	28	ETA004-128
POR-ETA	3	-9.0 m	29	ETA004-129
POR-ETA	3	-10.0 m	30	ETA004-130
POR-ETA	3	-11.0 m	31	ETA004-131
POR-ETA	3	-12.0 m	32	ETA004-132
POR-ETA	3	-13.0 m	33	ETA004-133
POR-ETA	3	-14.0 m	34	ETA004-187
POR-ETA	3	-15.0 m	35	ETA004-191
POR-ETA	3	-16.0 m	36	ETA004-195
POR-ETA	3	-17.0 m	37	ETA004-200
POR-ETA	3	-18.0 m	38	ETA004-205
POR-ETA	3	-20.0 m	40	ETA004-214

Material

adult: 280 carapaces, 277 left valves, 207 right valves, 34 valve fragments

juvenile: 9 carapaces, 23 left valves, 9 right valves

Measurements (µm)

HRT998-28e	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	female L	21	663-723	694	405-450	413	1.62-1.72	1.68
	female R	36	616-698	662	359-398	378	1.69-1.81	1.75
	male L	8	689-771	736	370-420	393	1.84-1.92	1.87
	male R	7	689-737	712	349-369	359	1.93-2.07	1.99
	uncertain L	1	717	–	403	–	1.78	–
ETA004-129	female L	18	631-708	665	383-432	398	1.63-1.74	1.67
	female R	9	601-640	620	340-374	359	1.68-1.79	1.73
	male L	11	665-718	691	354-388	374	1.81-1.89	1.85
	male R	4	665-728	684	344-354	349	1.92-2.06	1.96

Taxonomic remarks

Note the difference in the size ranges between varying samples (table 1 & 2, fig. 10-13), with the specimens from the Delémont Basin (HRT988-28) being larger on average than those from the Ajoie (ETA004-129). Similar size differences between two localities (smaller in drilling DP-202 to the north, larger in drilling Allschwil-2 to the east) have been recorded from the southern Upper Rhine Graben (Pirkenseer & Berger 2011).

Noding or absence thereof is recorded in all intermediate and terminal stages. Noding starts with slight disturbance of the valve surface and irregularity in the distribution of the ornamental pits. First to appear are the two large vertically arranged nodes just behind valve-mid-length and a thickened anterior ridge. A small posteroventral node represents the third appearing element, and the final noding stage includes two small additional anteroventral and one posterodorsal nodes. In their final stage nodes themselves are accentuated by small swellings of the node surface. The merging of the species *Hemicyprideis basiliensis* (Oertli & Key 1956) and *H. helvetica* as (noded, smooth or intermediate) ecomorphotypes of *H. helvetica* has been outlined in Pirkenseer & Berger (2010).

Synonymy

Genus *Hemicyprideis* Malz & Triebel, 1970

Type species: *Hemicyprideis aucta* Malz & Triebel, 1970

Hemicyprideis helvetica (Lienenklaus, 1895)

- * 1896 *Cytheridea muelleri* sp., var. *helvetica* – Lienenklaus in Kissling, 26-27, pl. 2, fig. 6
- 1955 *Haplocytheridea basiliensis* – Oertli & Key, p. 26-27, pl. 1, fig. 25-33
- 1956 *Haplocytheridea basiliensis* – Oertli 1956, p. 45, pl. 3, fig. 73-79
- 1956 *Haplocytheridea helvetica* – Oertli, p. 43-45, pl. 4, fig. 80-93
- non 1957 *Hemicyprideis helvetica* – Keij, p. 62, pl. 3, fig. 27-30
- 1962 *Haplocytheridea basiliensis* – Malz, p. 394, pl. 58, fig. 3-4
- 1963 *Haplocytheridea helvetica* – Stchepinsky, p. 159
- 1965 *Haplocytheridea helvetica* – Moyes, p. 34-35, pl. 4, fig. 11, [non fig. 14]
- 1970 *Hemicyprideis helvetica* – Malz & Triebel, p. 47, pl. 13, fig. 102-105
- 1972b *Hemicyprideis helvetica* – Keen, pl. 52, fig. 11-12
- 1975 *Hemicyprideis helvetica* – Brestenská, p. 398, pl. 6, fig. 1-6
- 1978 *Hemicyprideis helvetica* – Malz, pl. 1, fig. 1-2
- 1985a *Hemicyprideis helvetica* – Ducasse et al., p. 291, pl. 76, fig. 15
- 1985 *Hemicyprideis helvetica* – Müller, p. 24-25, pl. 4, fig. 5-8
- 1993 *Hemicyprideis helvetica* – Kammerer, p. 61-63, pl. 4, fig. 4-9
- 1996 *Hemicyprideis helvetica* – Ducasse & Bekaert, p. 321, pl. 41, fig. 3
- 2002 *Hemicyprideis basiliensis* – Picot, p. 140, pl. 5, fig. 4
- 2002 *Hemicyprideis helvetica* – Picot, p. 139-140, pl. 5, fig. 5-8
- 2004 *Hemicyprideis helvetica* – Gebhardt, p. 263, pl. 20, fig. 5-6
- 2004 *Hemicyprideis helvetica* – Monostori, p. 43, pl. 7, fig. 8, pl. 8, fig. 1-4
- 2004 *Hemicyprideis helvetica* – Schindler & Nungesser, p. 17, 18, 19, fig. 3/1
- 2008 *Hemicyprideis helvetica* – Picot et al., p. 192, fig. 4-6, tab. 2, pl. 2, fig. 9-10
- 2010 *Hemicyprideis helvetica* – Pirkenseer & Berger, p. 43-46, fig. 33-34, pl. 5, fig. 5-6, pl. 6, fig. 1-5

Type locality and horizon

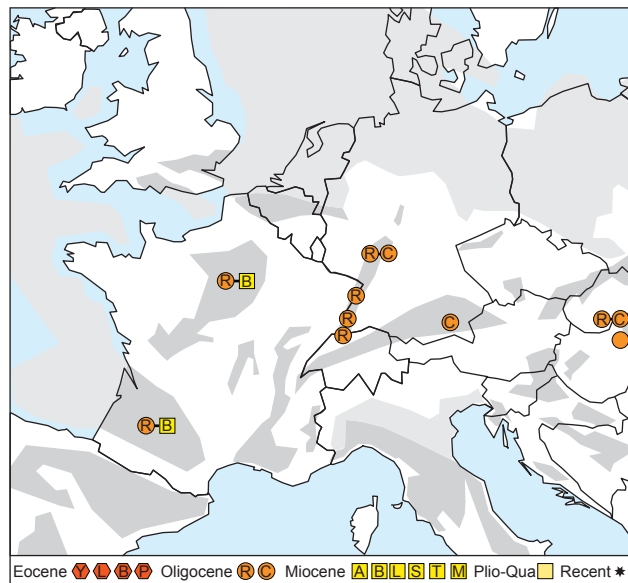
Mine shaft Lachat, La Communance, southwest of Delémont (sample 161) (NW Switzerland), "Blaue Tone", Rupelian (sensu Oertli 1956)

Lectotype

Female right valve (chosen by Oertli 1956), collection Lienenklaus, Geological Institute University of Göttingen (Germany)

Geographic and stratigraphic distribution

Hemicyprideis helvetica occurs in the Rupelian to Burdigalian in the Aquitaine and Paris Basin (Ducasse et al. 1985; Ducasse & Bekaert 1996), the Rupelian of the Upper Rhine Graben (Lienenklaus 1895; Oertli 1956; Stchepinsky 1963; Malz & Triebel 1970; Kammerer 1993; Picot 2002; Picot 2008; Pirkenseer & Berger 2011), early Chattian in the Bavarian Molasse Basin (Müller 1985) and the Oligocene of Hungary and Slovakia (Brestenská 1975; Monostori 2004). The Miocene records are probably due to incorrectly identified material.



Temporal and spatial distribution of Hemicyprideis helvetica in the Cenozoic of Europe.

geometric forms=epochs letters=stages
 without letters=epoch (nonspecific)
 gray areas=main sedimentary basins

Measurements (μm) of *Hemicyprideis helvetica* in sample ETA004-129

Female right valves				Female left valves				Male right valves				Male left valves			
Table 2a	Length	Height	L/H	Table 2b	Length	Height	L/H	Table 2c	Length	Height	L/H	Table 2d	Length	Height	L/H
	601	359	1.68		631	388	1.63		674	354	1.90		694	383	1.81
	611	364	1.68		640	393	1.63		664	344	1.93		698	383	1.82
	640	373	1.71		660	403	1.64		669	344	1.94		708	388	1.83
	640	373	1.71		684	417	1.64	Average	669	348	1.93		703	383	1.84
	626	364	1.72		708	432	1.64	aberrant	684	349	2.06		689	373	1.84
	621	359	1.73		631	383	1.65						718	388	1.85
	606	344	1.76		650	393	1.65						664	359	1.85
	626	354	1.77		650	393	1.65						669	359	1.86
	606	340	1.79		645	388	1.66						698	373	1.87
Average	620	359	1.73		669	403	1.66						694	369	1.88
					689	412	1.67						669	354	1.89
					684	407	1.68					Average	691	374	1.85
					669	398	1.68								
					655	388	1.69								
					650	383	1.70								
					664	388	1.71								
					698	403	1.73								
					694	398	1.74								
					Average	665	398	1.67							

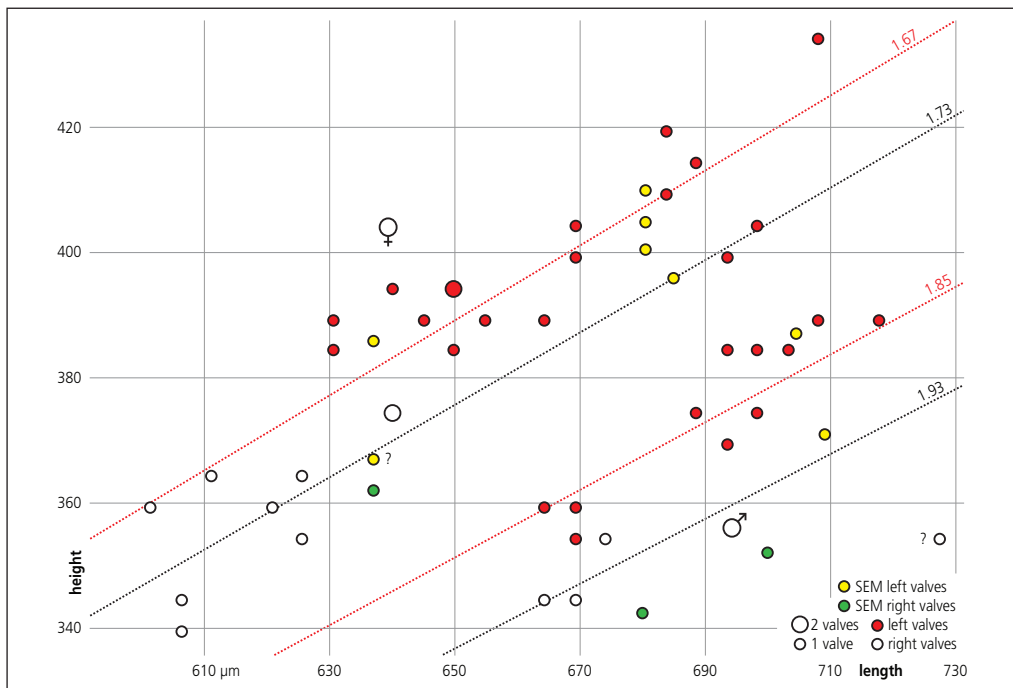


Fig. 12. Length/height plot of *Hemicyprideis helvetica* left and right valves in sample ETA004-129. Values of SEM-illustrated specimens from the locality ETA004 indicated with yellow and green dots stippled lines = lines of best fit (with gradient indicated)

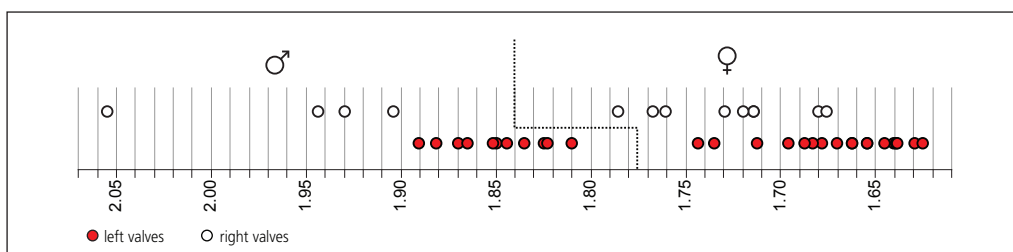


Fig. 13. Distribution of length/height ratios of *Hemicyprideis helvetica* left and right valves in sample ETA004-129.

Ostracoda

Plate 47

Hemicyprideis helvetica (Lienenklaus, 1895)

1. ETA004-230

Late Rupelian, Porrentruy-Étang

Female left valve, regular ornamentation and smooth valve surface,
L 643 × H 396 μm

a) lateral view (image Hemicyprideis 66_12OUT.psd)

b) internal view (image Hemicyprideis 66_12IN.psd)

2. ETA004-236

Late Rupelian, Porrentruy-Étang

Female left valve, slightly disturbed ornamentation and valve surface,
L 656 × H 393 μm

a) lateral view (image Hemicyprideis 66_5OUT.psd)

b) internal view (image Hemicyprideis 66_5IN.psd)

3. ETA004-226

Late Rupelian, Porrentruy-Étang

Female left valve, slightly noded specimen, shell drilled by predatory
gastropod, L 650 × H 399 μm

a) lateral view (image Hemicyprideis 66_16OUT.psd)

b) internal view (image Hemicyprideis 66_16IN.psd)

4. ETA004-231

Late Rupelian, Porrentruy-Étang

Female left valve, more strongly noded specimen, L 651 × H 389 μm

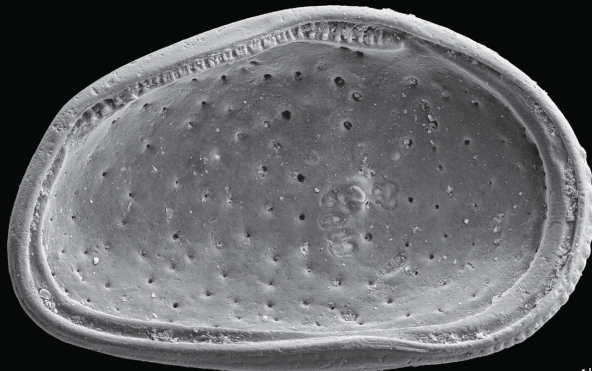
a) lateral view (image Hemicyprideis 66_8OUT.psd)

b) internal view (image Hemicyprideis 66_8IN.psd)

Plate 47



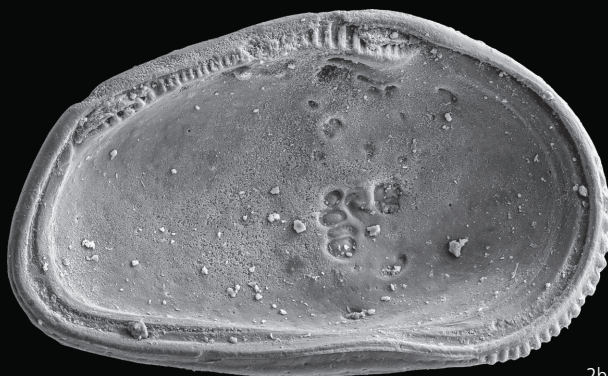
1a



1b



2a



2b



3a



3b



4a



4b

200 μ m

Ostracoda

Plate 48

Hemicyprideis helvetica (Lienenklaus, 1895)

1. ETA004-223

Late Rupelian, Porrentruy-Étang

Female left valve, more strongly noded specimen, L 618 × H 382 μm

a) lateral view (image Hemicyprideis 66_13OUT.psd)

b) internal view (image Hemicyprideis 66_13IN.psd)

2. ETA004-237

Late Rupelian, Porrentruy-Étang

Female left valve, more strongly noded specimen, L 595 × H 361 μm

a) lateral view (image Hemicyprideis 66_6OUT.psd)

b) internal view (image Hemicyprideis 66_6IN.psd)

3. ETA004-241

Late Rupelian, Porrentruy-Étang

Female right valve, heavily noded specimen, L 615 × H 363 μm

a) lateral view (image Hemicyprideis 66_22OUT.psd)

b) internal view (image Hemicyprideis 66_22IN.psd)

4. BEE004-165

Late Rupelian, Delémont-Beuchille Est

Female carapace, slightly disturbed ornamentation and valve surface,

L 664 × 398 H μm

right lateral view (image BEE_plot1_20.tif)

5. BEE003-557

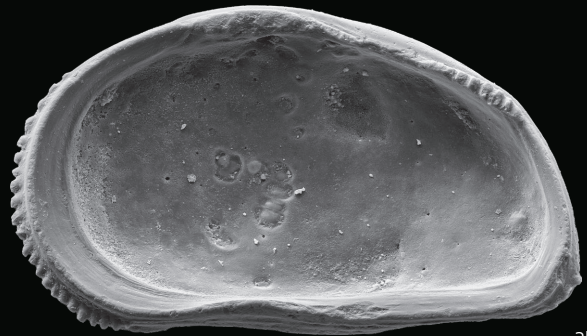
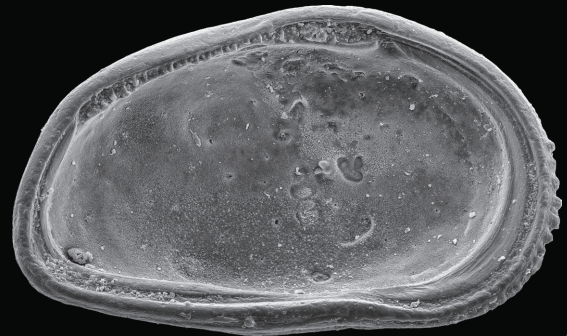
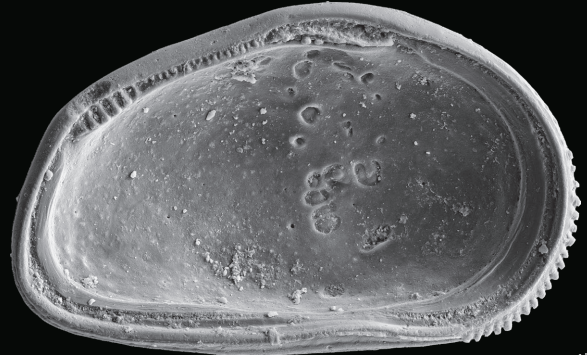
Late Rupelian, Delémont-Beuchille Est

Very high female left valve, moderately noded specimen,

L 620 × H 407 μm

lateral view (image BEE_plot1_5.tif)

Plate 48



200 μ m

Ostracoda

Plate 49

Hemicyprideis helvetica (Lienenklaus, 1895)

1. ETA004-233

Late Rupelian, Porrentruy-Étang

Male left valve, slightly disturbed ornamentation and valve surface,
L 656 × H 361 μm

a) lateral view (image Hemicyprideis 66_7OUT.psd)

b) internal view (image Hemicyprideis 66_7IN.psd)

2. ETA004-228

Late Rupelian, Porrentruy-Étang

Male right valve, slightly noded specimen, L 658 × H 343 μm

a) lateral view (image Hemicyprideis 66_10OUT.psd)

b) internal view (image Hemicyprideis 66_10IN.psd)

3. ETA004-224

Late Rupelian, Porrentruy-Étang

Male left valve, slightly disturbed ornamentation and valve surface,
L 674 × H 384 μm

a) lateral view (image Hemicyprideis 66_14OUT.psd)

b) internal view (image Hemicyprideis 66_14IN.psd)

4. ETA004-227

Late Rupelian, Porrentruy-Étang

Male right valve, slightly disturbed ornamentation and valve surface,
L 656 × H 347 μm

a) lateral view (image Hemicyprideis 66_17OUT.psd)

b) internal view (image Hemicyprideis 66_17IN.psd)

5. RNA987-113

Late Rupelian, Cornol-Route Nationale

A-1 instar right valve, noded specimen, L 500 × H 303 μm

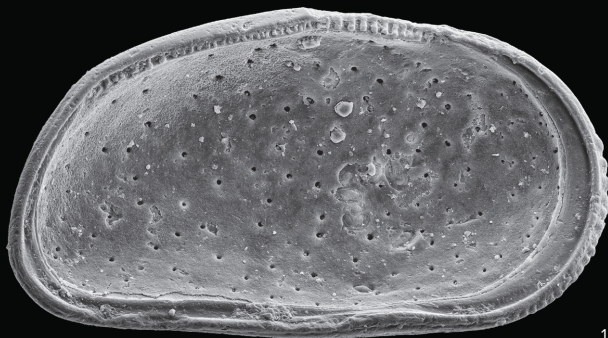
a) lateral view (image Hemicyprideis juv 66_34OUT.psd)

b) internal view (image Hemicyprideis 66_34DOR.psd)

Plate 49



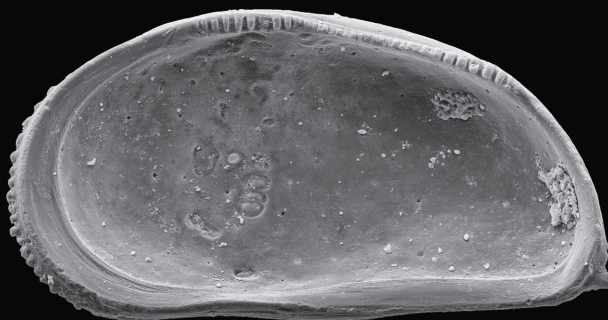
1a



1b



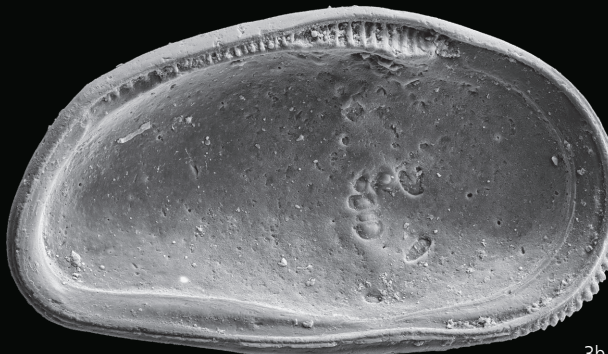
2a



2b



3a



3b



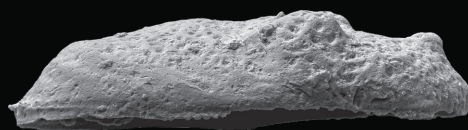
4a



4b



5a

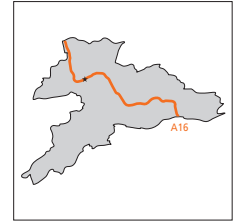


5b

200 μ m

PODOCOPIDA

Neocyprideis parallela (Lienenklaus, 1905)



Taxonomy

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cytherideidae	<i>Neocyprideis</i>	<i>parallela</i>

Determination (name/date): Claudius Pirkenseer/28.09.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Porrentruy-Étang (POR-ETA)	571 474/251 036

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
POR-ETA	2	-5.0 m	5	ETA004-123, 239
POR-ETA	3	-12.0 m	32	ETA004-132, 246

Material

juvenile: 1 left valve, 1 right valve

Measurements (µm)

diverse samples	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	A-1 stage L	1	582	–	374	–	1.55	–
	A-1 stage R	1	579	–	349	–	1.66	–

Taxonomic remarks

A detailed overview of the species is given in Malz (1973). The coeval *Neocyprideis williamsoniana* (Bosquet 1852) differs in its larger size, the more densely pitted valve surface, a more inflated posterior end, a lower L/H-ratio and a more concave ventral margin. The very similar *Neocyprideis enkheimensis* Malz, 1973 from the early Miocene of the northern Upper Rhine Graben differs only in its steeper posterodorsal part of the posterior margin and the somewhat greater width. *Neocyprideis aquitanica* Kollmann & Moyes, 1963 from the early Miocene of the Aquitaine Basin differs in a lower L/H-ratio and a non-vertical posterior margin (e.g. Bassiouni 1979).

Synonymy

- Genus *Neocyprideis* Apostolescu, 1956
- Type species: *Cyprideis (Neocyprideis) durocortoriensis* Apostolescu, 1956
- Neocyprideis parallela* (Lienenklaus, 1905)
- * 1905 *Cytheridea parallela* n.sp. – Lienenklaus, p. 45, pl. 4, fig. 21
- 1905 *Neocyprideis williamsoniana* – Lienenklaus, p. 44-45. [sensu Malz 1973]
- 1963 *Cyprideis (Neocyprideis)* sp. – Stchepinsky, p. 157-158, pl. h.t., fig. 14-16
- 1973 *Neocyprideis parallela* – Malz, p. 190-192, pl. 19, fig. 1-10, pl. 20, fig. 17-19
- 1993 *Neocyprideis parallela* – Kammerer, p. 63-64, pl. 6, fig. 1-4

Type locality and horizon

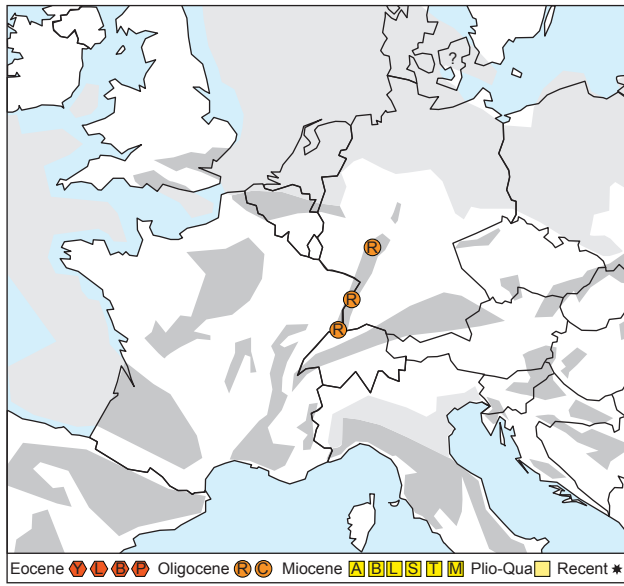
Alzey or Hochstadt near Frankfurt a.M. (Germany), exact locality and horizon not given, "Cyrenenmergel", "Upper Oligocene" sensu Lienenklaus (1905)

Holotype

Not given, left valve figured, type material IMGPGö 366-46, collection Lienenklaus, Geological Institute Göttingen.

Geographic and stratigraphic distribution

Neocyprideis parallela exclusively occurs in the the Rupelian of the Upper Rhine Graben (Lienenklaus 1905; Stchepinsky 1963; Malz 1973; Kammerer 1993).



Temporal and spatial distribution of Neocyprideis parallela in the Cenozoic of Europe.

geometric forms=epochs letters=stages
 without letters=epoch (nonspecific)
 gray areas=main sedimentary basins

Ostracoda

Plate 50

Neocyprideis parallela (Lienenklaus, 1905)

1. ETA004-246

Late Rupelian, Porrentruy-Étang

A-1 instar, left valve, L 582 × H 374 μm

a) lateral view (image Neocyprideis 66_24OUT.psd)

b) internal view (image Neocyprideis 66_24IN.psd)

2. ETA004-239

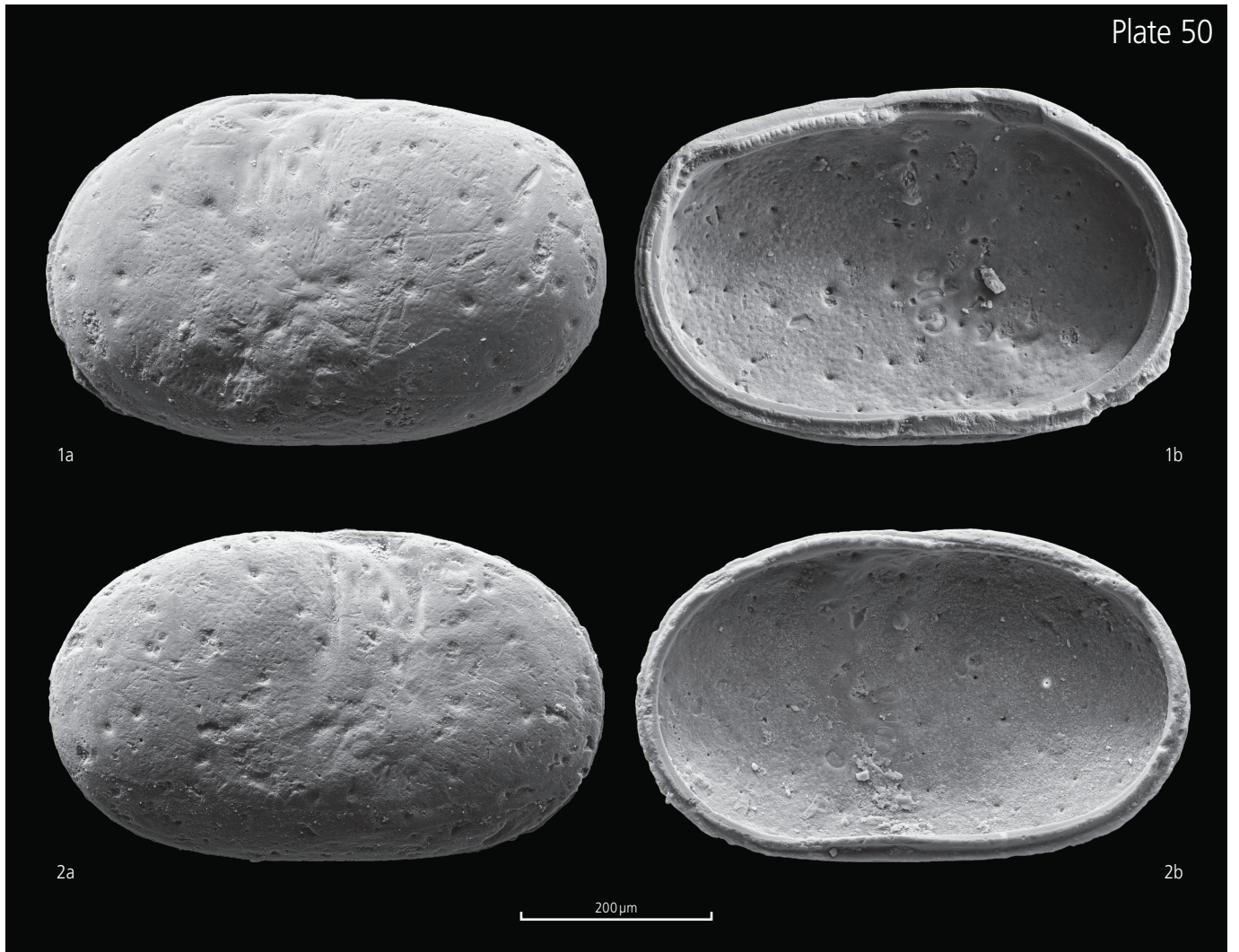
Late Rupelian, Porrentruy-Étang

A-1 instar, right valve, L 579 × H 349 μm

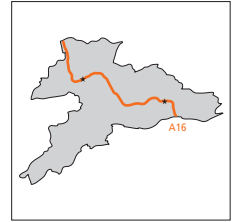
a) lateral view (image Neocyprideis 66_25OUT.psd)

b) internal view (image Neocyprideis 66_25IN.psd)

Plate 50



PODOCOPIDA

Schuleridea rauracica Oertli, 1956

Taxonomy

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cytheridae	<i>Schuleridea</i>	<i>rauracica</i>

Determination (name/date): Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Porrentruy - Étang (POR-ETA)	571 474/251 036

Locality	Unit	Layer	Initial sample number	Cell or specimen number
DEL-BEE	17	5	965	BEE003-810
DEL-BEE	19	1800	1	BEE006-34
DEL-BEE	19	1800	260	BEE004-165, 167, 265, 266, 289, 290
DEL-BEE	19	1800	767	BEE003-557, 860, 1003
POR-ETA	2	-7 m	7	ETA004-103
POR-ETA	3	-15 m	35	ETA004-191

Measurements (µm)

diverse samples	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	female C/L	22	644-758	678	396-483	421	1.52-1.66	1.61
	female R	2	625-639	632	368-377	373	1.66-1.74	1.70
	male C/L	18	653-786	710	386-449	410	1.69-1.80	1.73
	male R	2	648-675	662	358-370	364	1.81-1.82	1.82

Taxonomic remarks

Schuleridea rauracica differs from *S. perforata* in a less pointed dorsal and caudal angle and hence a more rounded, less triangular lateral shape (Oertli 1956). The three size outliers correspond to the size differences between the localities Sorne and Birse River Bed mentioned in Oertli (1956). Historically much material from the Eocene to the Miocene was attributed to the *Schuleridea perforata* group (including specimens adhering to *S. rauracica*), the unlikelihood of which has been commented on by e.g. Oertli (1956), Kollmann (1958) and Moos (1970).

Synonymy

Genus *Schuleridea* Swartz & Swain, 1946Type species: *Schuleridea acuminata* Swartz & Swain, 1946*Schuleridea rauracica* Oertli, 1956

- * 1956 *Schuleridea rauracica* n.sp. – Oertli, p. 47-50, pl. 5, fig. 110-123
- 1958 *Schuleridea (Aequicytheridea) rauracica* - Kollmann, pl. 4, fig. 4, pl. 21, fig. 6-7
- 1963 *Aequicytheridea rauracica* - Apostolescu, p. 4690
- 1963 *Schuleridea (Aequicytheridea) rauracica* - Stchepinsky, p. 160
- 1975 *Schuleridea (Aequicytheridea) rauracica* - Doehl & Sonne, p. 143, pl. 2, fig. 10
- 1985 *Schuleridea rauracica* - Ducasse et al., p. 282, pl. 77, fig. 4-6
- 2002 *Schuleridea* sp. - Picot, p. 142, pl. 6, fig. 4-5
- 2004 *Schuleridea rauracica* - Monostori, p. 44-45, pl. 9, fig. 1-2
- 2008 *Schuleridea* sp. - Picot et al., pl. 2, fig. 5

Type locality and horizon

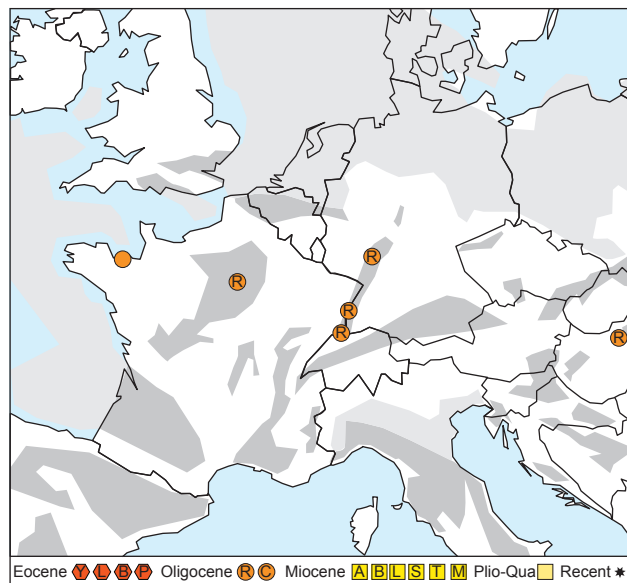
locality 167, River Sorne bed southwest of Delémont (NW Switzerland), “Blaue Tone”, “Rupelian” (sensu Oertli 1956).

Holotype

Male right valve, MOOE330/1, Naturhistorisches Museum Bern (Switzerland).

Geographic and stratigraphic distribution

Schuleridea rauracica occurs in the late Rupelian of the Delémont Basin (Oertli 1956; Picot et al. 2008), the Alsace (Stchepinsky 1963), the Mainz Basin (Doebel & Sonne 1975) and potentially the Ajoie subbasin (Picot 2002), the Rupelian of Hungary (Monostori 2004) and the Paris Basin (Kollmann 1958; Ducasse et al. 1985) as well as the Oligocene of the Bretagne (Apostolescu 1963).



Temporal and spatial distribution of Schuleridea rauracica in the Cenozoic of Europe.

geometric forms=epochs letters=stages
without letters=epoch (nonspecific)
gray areas=main sedimentary basins

Measurements (μm) of *Schuleridea rauracica* in diverse samples

Female left valves and carapaces				Male left valves and carapaces				Female right valves			
Table 1a	Length	Height	L/H	Table 1c	Length	Height	L/H	Table 1b	Length	Height	L/H
	644	425	1.52		685	405	1.69		625	377	1.66
	753	483	1.56		653	386	1.69		639	368	1.74
	658	418	1.57		695	410	1.69	Average	632	373	1.70
	700	444	1.58		701	413	1.70				
	669	420	1.59		704	415	1.70				
	666	418	1.59		743	434	1.71				
	680	425	1.60		728	425	1.71				
	680	425	1.60		690	400	1.72				
	661	410	1.61		700	405	1.73				
	685	425	1.61		676	391	1.73				
	685	425	1.61		719	415	1.73				
	758	468	1.62		700	400	1.75				
	656	405	1.62		786	449	1.75				
	666	410	1.62		724	408	1.77				
	676	415	1.63		748	422	1.77				
	709	434	1.63		685	386	1.78				
	647	396	1.63		733	410	1.79				
	647	396	1.63		714	396	1.80				
	680	415	1.64		Average	710	410	1.73			
661	400	1.65									
668	402	1.66									
666	400	1.66									
Average	678	421	1.61								

Male right valves			
Table 1d	Length	Height	L/H
	648	358	1.81
	675	370	1.82
Average	662	364	1.82

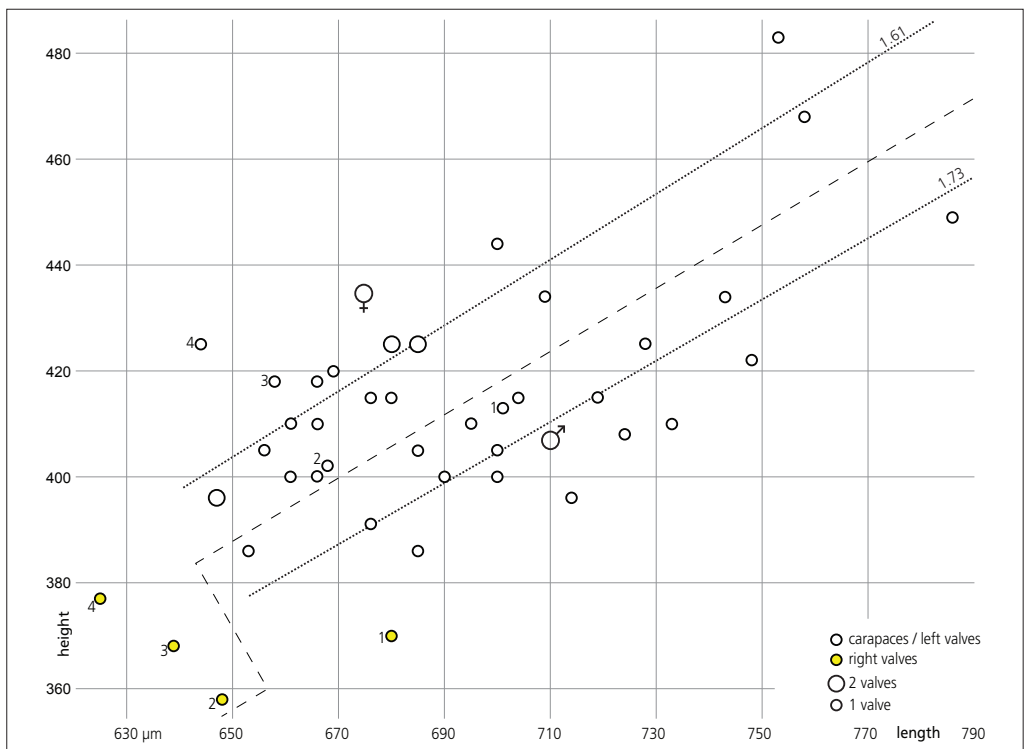


Fig. 14. Length/height plot of *Schuleridea rauracica* left and right valves (various samples). Small numbers in bold denote equivalent left and right valves of individual carapaces. Note the three size outliers in the top right corner.

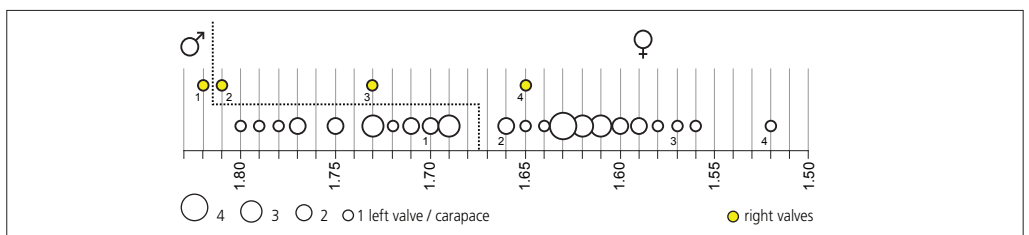


Fig. 15. Distribution of length/height ratios of *Schuleridea rauracica* left and right valves in various samples.

Ostracoda

Plate 51

Schuleridea rauracica Oertli, 1956

1. BEE004-265

Late Rupelian, Delémont-Beuchille Est

female carapace, very high specimen drilled by predatory gastropod,

left valve L 644 × H 425 µm, right valve L 625 × H 377 µm, W 322 µm

a) right lateral view (image Schuleridea drilled 66_56OUT.psd)

b) ventral view (image Schuleridea 66_56VEN.psd)

2. BEE004-165

Late Rupelian, Delémont-Beuchille Est

Female carapace, very high specimen, L 636 × H 423 µm

left lateral view (image Schuleridea BEE_plot1_17.psd)

3. BEE004-266

Late Rupelian, Delémont-Beuchille Est

Female carapace, high specimen, left valve L 658 × H 418 µm, right

valve L 639 × H 368 µm, W 307 µm

a) right lateral view (image Schuleridea 66_57OUT.psd)

b) dorsal view (image Schuleridea 66_57DOR.psd)

4. BEE003-1003

Late Rupelian, Delémont-Beuchille Est

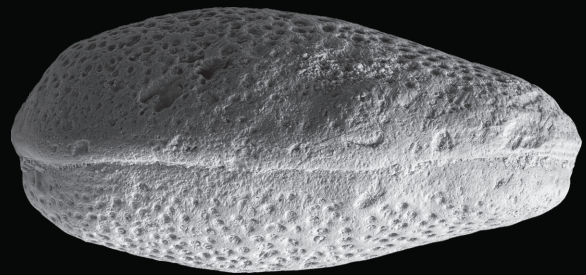
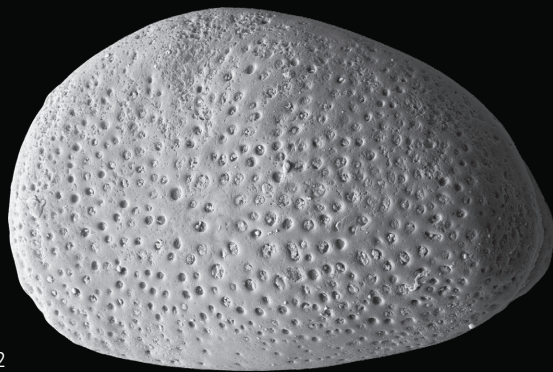
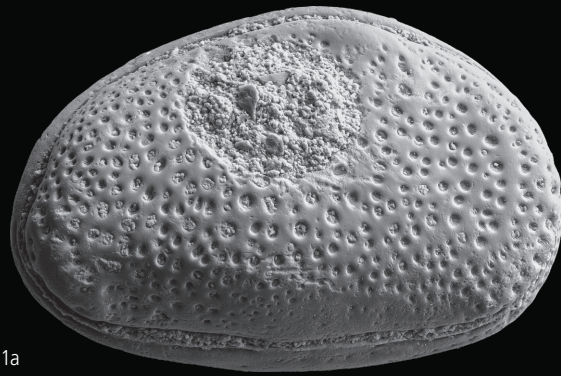
Female carapace, low intermediate specimen, right valve very low, left

valve L 668 × H 402 µm, right valve L 648 × H 358 µm, W 289 µm

a) right lateral view (image Schuleridea 67_23OUT.psd)

b) dorsal view (image Schuleridea 67_23DOR.psd)

Plate 51



200 μ m

Ostracoda

Plate 52

Schuleridea rauracica Oertli, 1956

1. BEE004-290

Late Rupelian, Delémont-Beuchille Est

Male carapace, high intermediate specimen,

left valve L 701 × H 413 μm, right valve L 675 × H 370 μm, W 304 μm

a) right lateral view (image Schuleridea 66_81OUT.psd)

b) ventral view (image Schuleridea 66_81VEN.psd)

2. BEE004-289

Late Rupelian, Delémont-Beuchille Est

Male carapace, L 728 × H 425 × W 305 μm

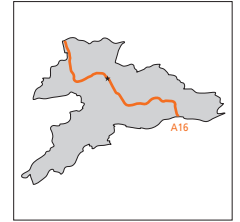
a) left lateral view (image Schuleridea 66_80OUT.psd)

b) dorsal view (image Schuleridea 66_80DOR.psd)

Plate 52



PODOCOPIDA

Pontocythere therwilensis Oertli, 1956**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cushmanideidae	<i>Pontocythere</i>	<i>therwilensis</i>

Anatomy: carapace and isolated valve

Détermination (name/date): Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol-Route Nationale (COR-RNA)	577 713/250 616

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	2	-9.2 m	57	RNA987-38, 108

Material

adult: 1 carapace

juvenile: 1 right valve

Measurements (µm)

RNA987-108e	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	adult C	1	875	–	343	–	2.55	–

Taxonomic remarks

The resembling Priabonian *Pontocythere haskinsi* (Keen 1977) from the Hampshire Basin is distinctly smaller than *P. therwilensis*, with the highest point in lateral view lying much closer to the posterior end of the valve of the latter species. *Pontocythere lithodomoides* (Bosquet 1852) from the Rupelian of the Paris Basin and Belgium is of a comparable size to *P. therwilensis*, but differs in extending the lateral concentric ridges to the ventral part of the valve and a more arched dorsal margin (following the emendation in Keij 1957).

SynonymyGenus *Pontocythere* Dubowsky, 1939Type species: *Pontocythere tchernjawschii* Dubowsky, 1939*Pontocythere therwilensis* Oertli, 1956

- * 1956 *Pontocythere therwilensis* – Oertli, p. 57-58, pl. 6, fig. 152-155
- 1963 *Pontocythere therwilensis* – Stchepinsky, p. 160
- 1975 *Pontocythere therwilensis* – Brestenská, p. 399, pl. 5, fig. 15
- ? 1985 *Pontocythere lithodomoides* – Carbonel, 327, pl. 93, fig. 13-14

Type locality and horizon

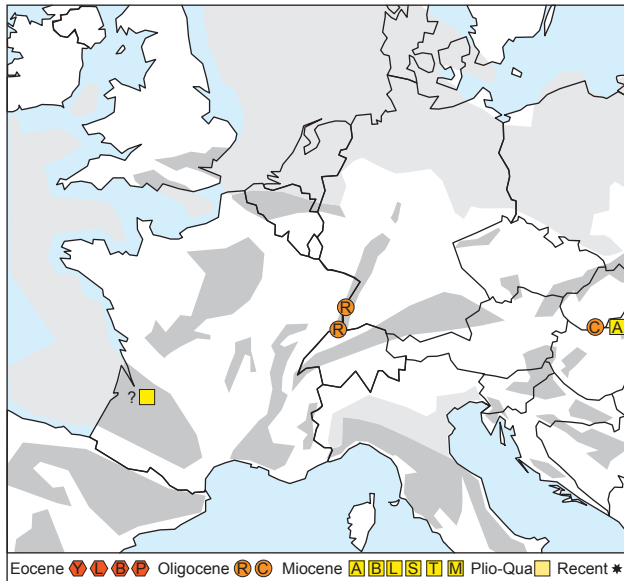
locality 1005, Therwil south of Basel (NW Switzerland), "Cyrenensande", "lower Chattian" (sensu Oertli 1956).

Holotype

Male right valve, MOOE1100/3, Naturhistorisches Museum Bern (Switzerland).

Geographic and stratigraphic distribution

Pontocythere therwilensis occurs in the late Rupelian of the southern Upper Rhine Graben (Oertli 1956; Pirkenseer & Berger 2011) and the Alsace (Stchepinsky 1963). Chattian to Aquitanian ("Egerian") of southern Slovakia (Brestenská 1975). A potential occurrence relates to the Miocene of the Aquitaine Basin (Carbonel 1985).



Temporal and spatial distribution of Pontocythere therwilensis in the Cenozoic of Europe.

geometric forms=epochs letters=stages
without letters=epoch (nonspecific)
gray areas=main sedimentary basins

Ostracoda

Plate 53

Pontocythere therwilensis Oertli, 1956

1. RNA987-108

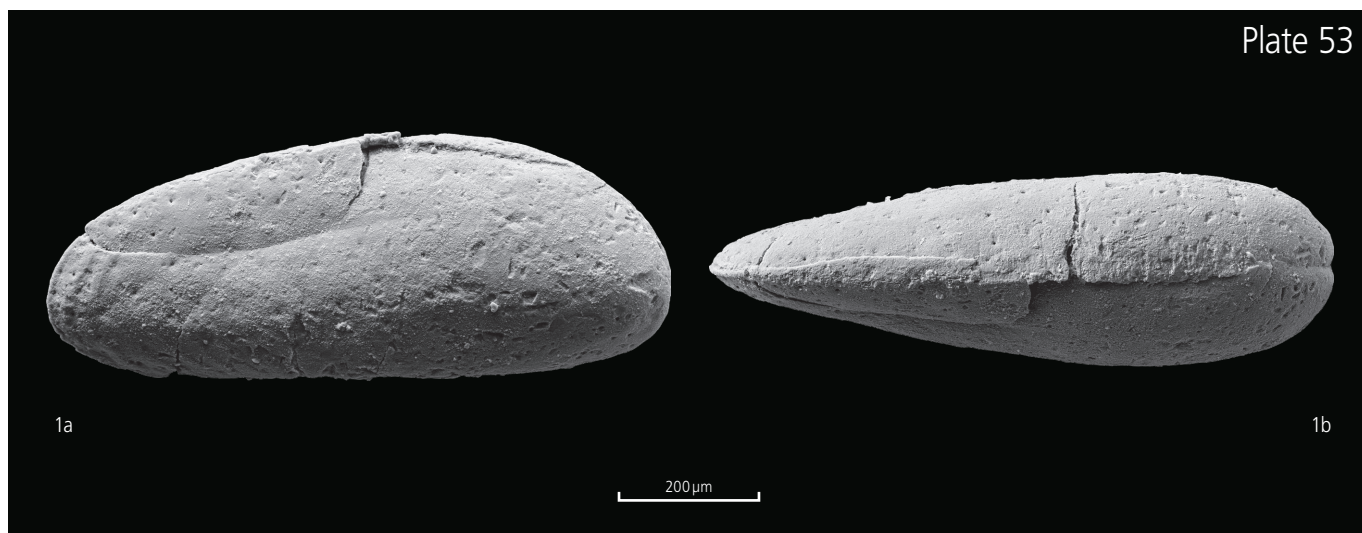
Late Rupelian, Cornol-Route Nationale

Carapace, L 875 × H 343 × W 272 μm

a) left lateral view (image Pontocythere 66_29OUT.psd)

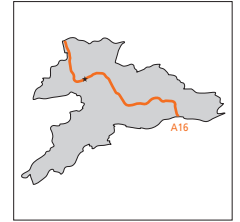
b) dorsal view (image Pontocythere 66_29DOR.psd)

Plate 53



PODOCOPIDA

Hammatocythere hebertiana (Bosquet, 1852) *trituberculata* (Reuss, 1869)
(trituberculate type, sensu Ducasse & Rouselle 1979)



Taxonomy

Class	Order	Family	Genus	Species	Subspecies
Ostracoda	Podocopida	Hemicytheridae	<i>Hammatocythere</i>	<i>hebertiana</i>	<i>trituberculata</i>

Determination (name/date): Laurent Picot/14.12.2005; Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Serie grise undifferentiated	MP 24/NP24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Porrentruy-Étang (POR- ETA)	571 474/251 036

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
POR-ETA	2	-7.0 m	5	ETA004-123, 240
POR-ETA	2	-6.0 m	6	ETA004-100
POR-ETA	2	-7.0 m	7	ETA004-103
POR-ETA	2	-8.0 m	8	ETA004-109, 232
POR-ETA	2	-9.0 m	9	ETA004-110
POR-ETA	2	-10.0 m	10	ETA004-112, 234
POR-ETA	3	-9.0 m	29	ETA004-129, 242
POR-ETA	3	-10.0 m	30	ETA004-130
POR-ETA	3	-11.0 m	31	ETA004-131
POR-ETA	3	-15.0 m	35	ETA004-191
POR-ETA	3	-16.0 m	36	ETA004-195
POR-ETA	3	-18.0 m	38	ETA004-205
POR-ETA	3	-20.0 m	40	ETA004-214, 252-253

Material

adult: 8 left valves, 1 left valve fragment, 9 right valves, 2 right valve fragments

Measurements (µm)

Stade	Quantity	Length	mean	Height	mean	le/he	mean
female L	1	777	–	463	–	1.68	–
female R	5	733-791	787	425-458	437	1.71-1.80	1.75
male L	7	796-844	819	473-497	481	1.67-1.72	1.70
male R	4	820-840	829	454-473	461	1.78-1.81	1.80

Taxonomic remarks

Both subspecies of *Hammatocythere hebertiana* may in fact represent a single pool of morphotypes, since published images and our material show transitional ornamentation (e.g. specimen figured in Lord et al. 2009). Polymorphism within the subspecies *trituberculata* has already been highlighted in Ducasse & Rouselle (1979). This concerns the number (2-4) and degree of formation (continuous, intermittent, traces) of the ridges anterior to the subcentral tubercle, the strength of the reticulation and position of individual reinforced ridges as well as the prominence of the clear area behind the anterior marginal rim (e.g. Keen 1972b). Extensive polymorphism has also been discussed for the sister taxon *Hammatocythere oertlii* (Ducasse & Rouselle 1978).

Despite the generally weak development of the reticulation most sola can be assigned to the main lateral fossal patterns sensu Liebau (1969) and Benson (1972) (fig. 3). Identification of pore cones is much more difficult due to the low stature or absence of cones as well as their integration as a part of the thickened lateral ridges. The position of the latter may not be consistent. The position of the postero-median ridge of specimen pl. 55.1, 3 lies between fossae rows M and N, whereas in specimen pl. 55.2 it lies one row further ventral (N and O).

Synonymy

Genus *Hammatocythere* Keen, 1972

Type species: *Cythere hebertiana* Bosquet, 1852

Hammatocythere hebertiana (Bosquet 1852) *trituberculata* (Reuss, 1869)

- * 1869 *Cythere trituberculata* – Reuss, p. 485-486, pl. 6, fig. 6
- 1965 *Quadracocythere hebertiana* – Moyes, p. 89, pl. 10, fig. 11
- 1972b *Hammatocythere trituberculata* – Keen, p. 303-304, pl. 53, fig. 7-8
- 1976 *Hammatocythere hebertiana trituberculata* – Keen, p. 321-322, fig. 2
- 1979 *Hammatocythere hebertiana trituberculata* – Ducasse & Rousselle, p. 226-235, pl. 1, fig. 1-15, pl. 2, fig. 13-15
- 2002 *Hammatocythere* cf. *trituberculata* – Picot, p. 144, pl. 8, fig. 6-8
- 2002 *Hammatocythere* cf. *trituberculata* – Picot et al., pl. 3, fig. 11, 14

Type locality and horizon

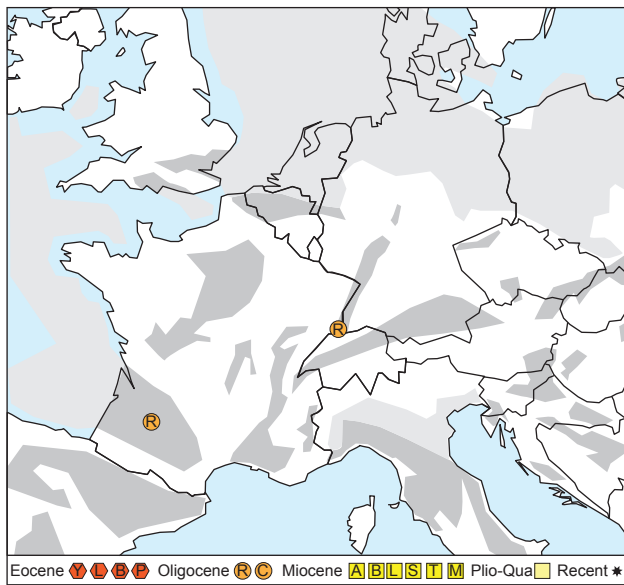
Gaas (Dax), Aquitaine Basin (southern France), "Oligocene" (sensu Reuss 1869).

Holotype

Carapace figured, specimen not specified, depository not given.

Geographic and stratigraphic distribution

Hammatocythere hebertiana trituberculata occurs in the Rupelian of the Aquitaine Basin (Keen 1972b; Ducasse & Rousselle 1979) and the late Rupelian of the Ajoie Subbasin (Picot 2002; Picot et al. 2008).



Temporal and spatial distribution of *Hammatocythere hebertiana trituberculata* in the Cenozoic of Europe.

geometric forms=epochs letters=stages
without letters=epoch (nonspecific)
gray areas=main sedimentary basins

Measurements (μm) of *Hammatocythere hebertiana trituberculata* in all samples

Female right valves			
Table 1a	Length	Height	L/H
	733	425	1.73
	762	425	1.80
	777	439	1.77
	782	458	1.71
791	444	1.78	
Average	769	438	1.76

Male right valves			
Table 1c	Length	Height	L/H
	820	454	1.81
	820	454	1.81
	835	463	1.80
	840	473	1.78
Average	829	461	1.80

Male left valves			
Table 1d	Length	Height	L/H
	796	478	1.67
	811	473	1.71
	811	473	1.71
	820	487	1.68
	820	478	1.72
	844	497	1.70
	830	483	1.72
Average	819	481	1.70

Female left valves			
Table 1b	Length	Height	L/H
	777	463	1.68

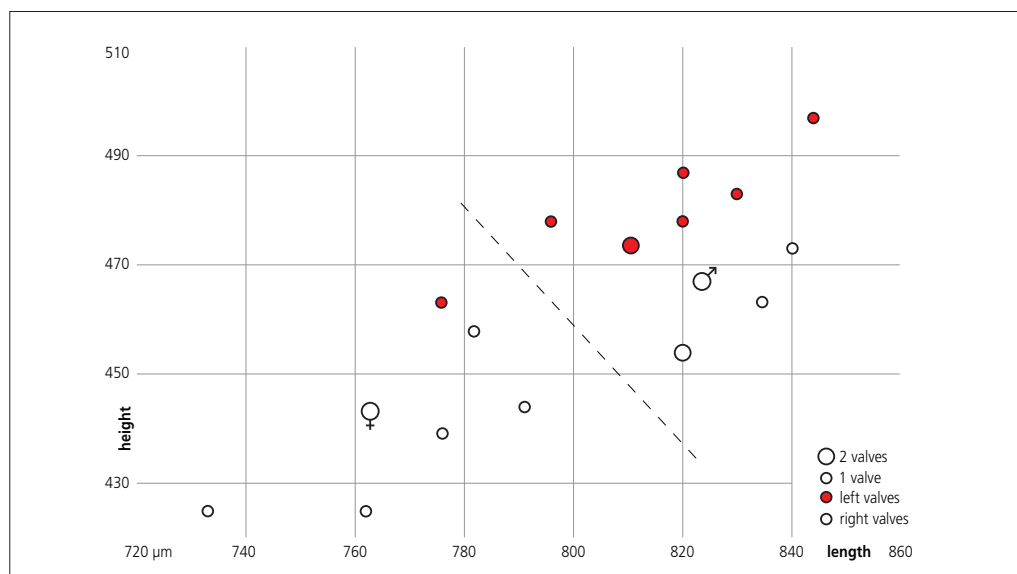


Fig. 16. Length/height plot of *Hammatocythere hebertiana trituberculata* left and right valves (all samples).

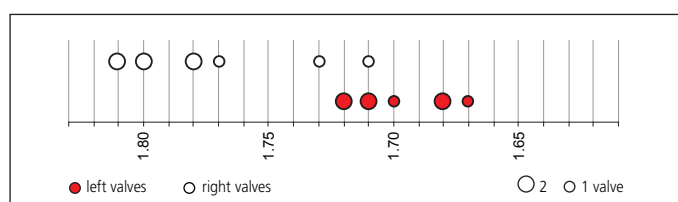


Fig. 17. Distribution of length/height ratios of *Hammatocythere hebertiana trituberculata* left and right valves in all samples.

Ostracoda

Plate 54

Hammatocythere hebertiana (Bosquet, 1852)

trituberculata (Reuss, 1869)

(trituberculate type, sensu Ducasse & Rousselle 1979)

1. ETA004-253

Late Rupelian, Porrentruy-Étang

Male right valve, L 820 × H 454 × W 219 μm

a) lateral view (image Hammatocythere 69_32OUT.psd)

b) internal view (image Hammatocythere 69_32IN.psd)

c) dorsal view (image Hammatocythere 69_32DOR.psd)

2. ETA004-252

Late Rupelian, Porrentruy-Étang

Male right valve, L 840 × H 473 × W 229 μm

a) lateral view (image Hammatocythere 69_31OUT.psd)

b) internal view (image Hammatocythere 69_31IN.psd)

c) dorsal view (image Hammatocythere 69_31DOR.psd)

3. ETA004-232

Late Rupelian, Porrentruy-Étang

Male right valve, L 820 × H 454 μm

a) lateral view (image Hammatocythere 66_9OUT.psd)

b) internal view (image Hammatocythere 66_9IN.psd)

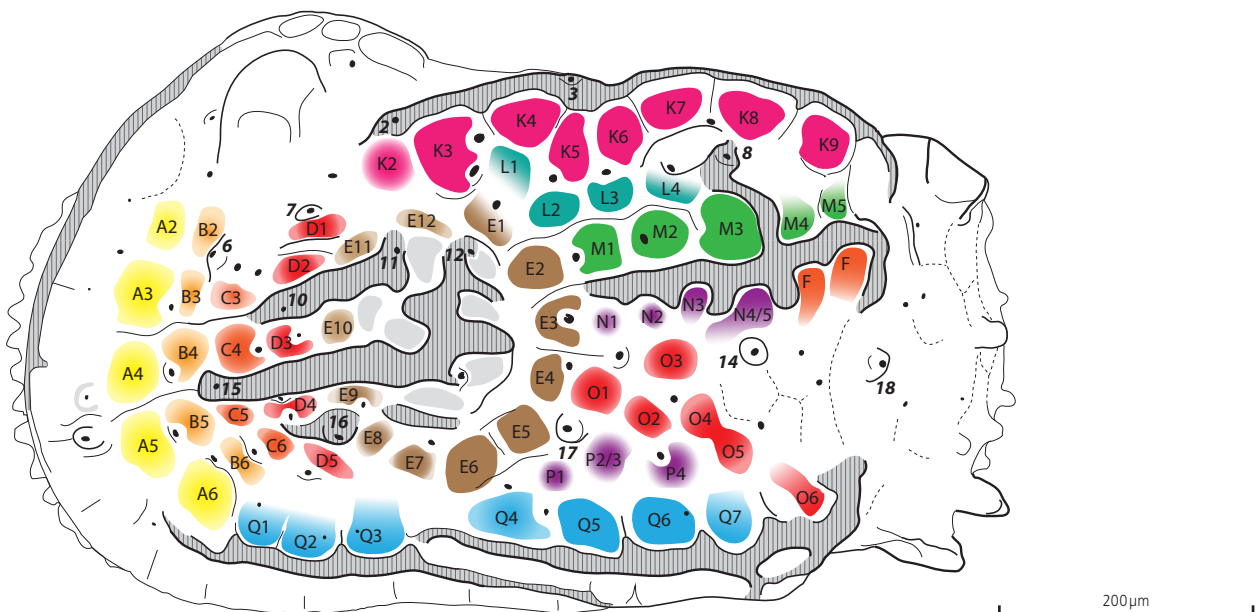
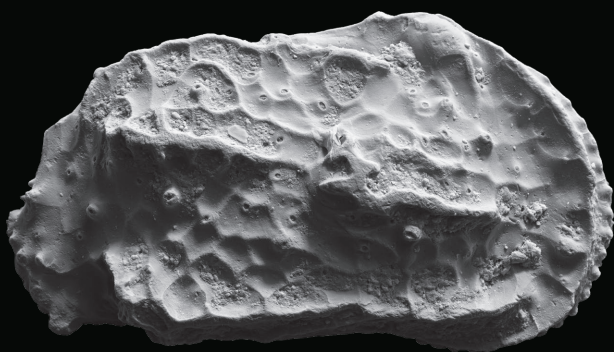
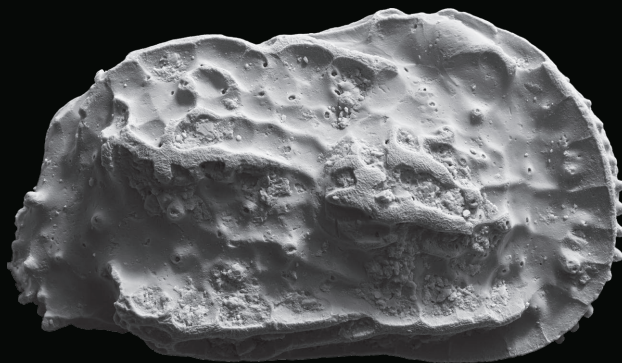


Fig. 18. Homologous ornamentation patterns of a *Hammatocythere hebertiana trituberculata* left valve (HRT004-234). Sola color coded, pore cones in bold italics. Numbering follows Liebau 1969 and Benson 1972.

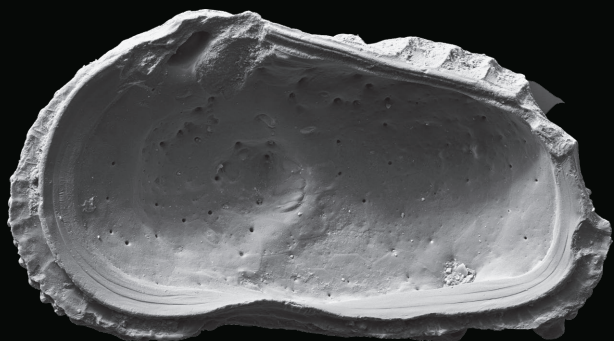
Plate 54



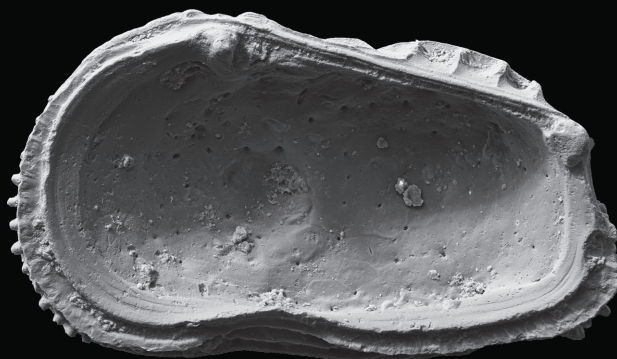
1a



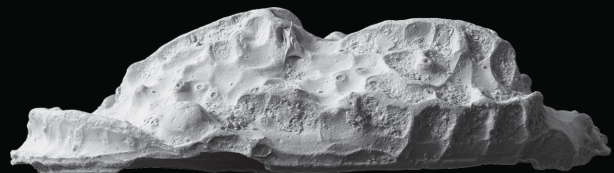
2a



1b



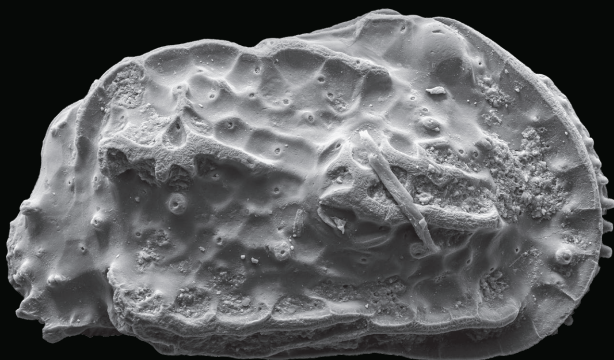
2b



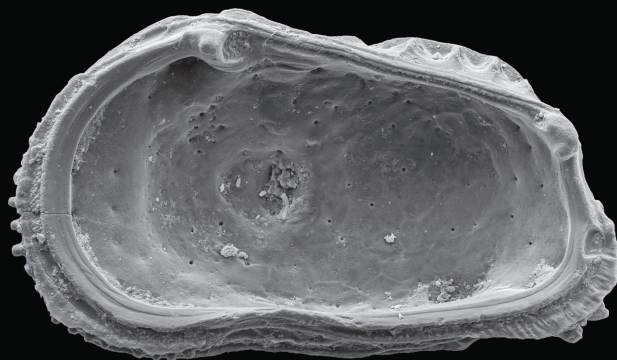
1c



2c



3a



3b

200 μ m

Ostracoda

Plate 55

Hammatocythere hebertiana (Bosquet, 1852)

trituberculata (Reuss, 1869)

(trituberculate type, sensu Ducasse & Rousselle 1979)

1. ETA004-242

Late Rupelian, Porrentruy-Étang

Male left valve, L 820 × H 478 × W 229 μm

a) lateral view (image Hammatocythere 69_29OUT.psd)

b) internal view (image Hammatocythere 69_29IN.psd)

c) dorsal view (image Hammatocythere 69_29DOR.psd)

2. ETA004-240

Late Rupelian, Porrentruy-Étang

Male left valve, L 820 × H 487 × W 242 μm

a) lateral view (image Hammatocythere 69_30OUT.psd)

b) internal view (image Hammatocythere 69_30IN.psd)

c) dorsal view (image Hammatocythere 69_30DOR.psd)

3. ETA004-234

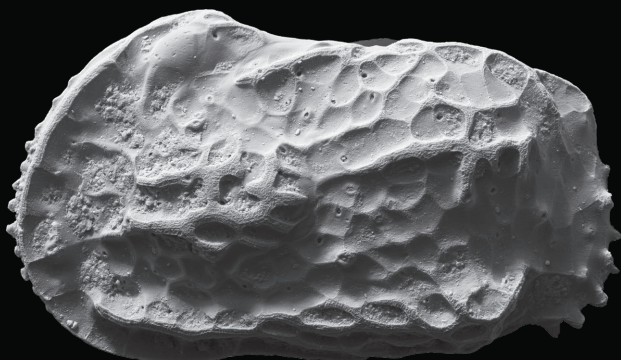
Late Rupelian, Porrentruy-Étang

Male left valve, L 811 × H 473 μm

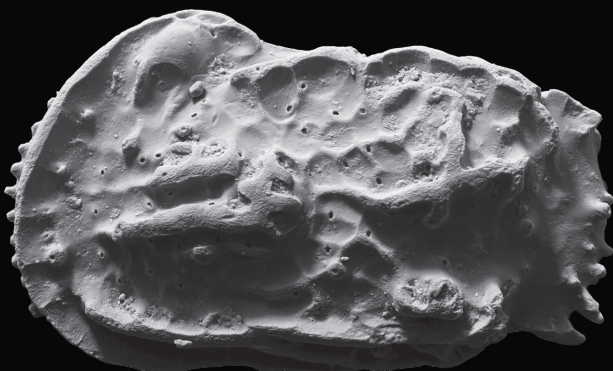
a) lateral view (image Hammatocythere 66_30OUT.psd)

b) internal view (image Hammatocythere 66_31IN.psd)

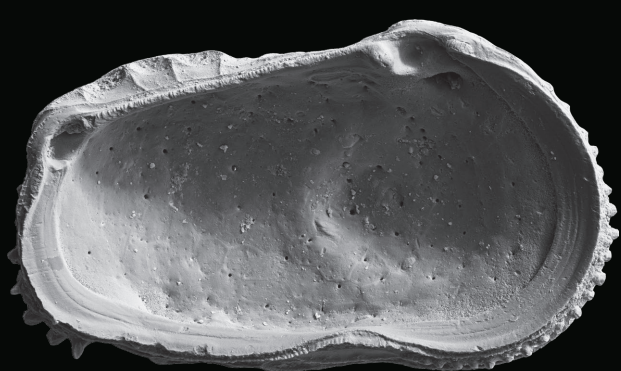
Plate 55



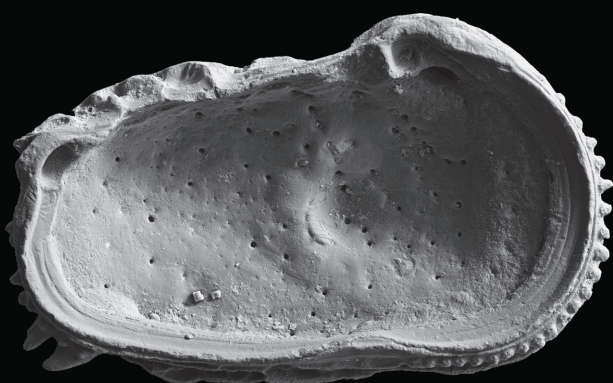
1a



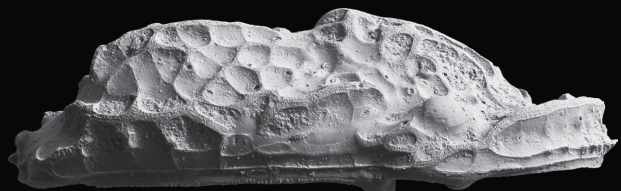
2a



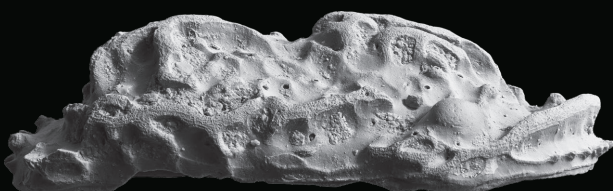
1b



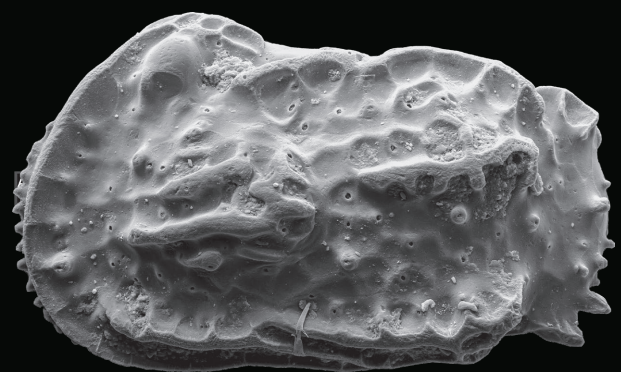
2b



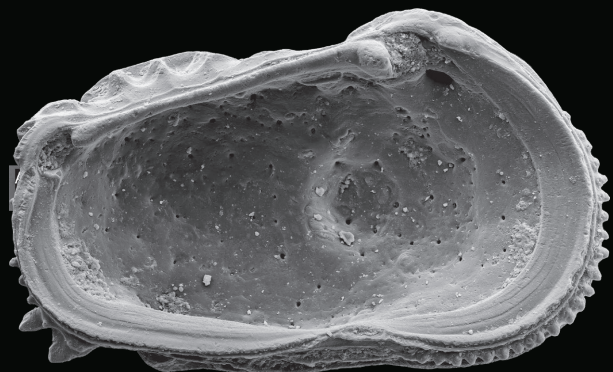
1c



2c



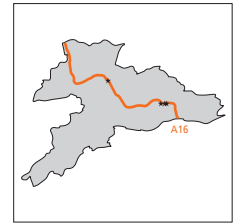
3a



3b

200 μm

PODOCOPIDA

"Leguminocythereis" sorneana Oertli, 1956

Taxonomy

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Trachyleberididae	<i>"Leguminocythereis"</i>	<i>sorneana</i>

Determination (name/date): Laurent Picot/14.12.2005; Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 24/NP24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL- BEE)	593 610/244 595
Delémont - Beuchille (DEL- BEU)	593 125/244 580
Delémont - Communance (DEL- COM)	592 128/244 453
Cornol - Route Nationale (COR-RNA)	577 713/250 616

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	1	-35.8 m	47	RNA987-20
COR-RNA	2	-16.4 m	57	RNA987-38, 112
DEL-BEE	9	101	963	BEE003-252
DEL-BEE	9	102	962	BEE003-241
DEL-BEE	14	1	679	BEE003-834
DEL-BEE	16	1	112	BEE004-839
DEL-BEE	19	1800	260/767	BEE004-165/BEE003-557
DEL-BEE	19	1900	261/769	BEE004-218/BEE003-461, 867, 985-987
DEL-BEU	20	510	574	BEU001-587
DEL-COM	5	-60.0 m	27	COM990-10
DEL-COM	5	-62.0 m	25	COM990-9, 35-38, 40-41, 45

Material

adult: 1012 carapaces, 44 carapace fragments, 7 left valves, 7 right valves, 4 valve fragments
juvenile: 15 carapaces, 11 left valves, 4 right valves

Measurements (µm)

BEE003-972	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	female C	14	1065-1173	1110	547-592	570	1.90-2.02	1.95
	male C	22	1153-1271	1213	557-606	581	2.03-2.13	2.09
	A-1 instar	2	869-936	903	463	463	1.88-2.02	1.95
	A-2 instar	6	618-695	672	357-389	377	1.73-1.84	1.78
	A-3 instar	1	511	–	304	–	1.68	–
BEE003-834	female C	41	1065-1153	1116	538-595	568	1.90-2.07	1.96
	male C	33	1144-1251	1215	528-587	574	2.05-2.19	2.12

Taxonomic remarks

The genus *Leguminocythereis* Howe, 1936 is based on Oligocene North American material. Liebau (1975) argues that resembling European material represents an analogous development within the Hammatocytherini, as opposed to true *Leguminocythereis* being part of the Buntoniinae. *"Leguminocythereis" lienenklausi* represents a contemporaneous species in the southern Upper Rhine Graben, but is easily distinguished by a linear arrangement of lateral ornamentation and the lack of the pronounced anterior ridge and adjacent groove parallel to the second lateral mesh row. A slight overlap of female and male morphotypes exist, hindering a clear distinction of sexes in intermediate specimens (see measures and plates).

Synonymy

Genus **not established** (sensu Liebau 1975)

Type species: **not assignable**

"Leguminocythereis" sorneana Oertli, 1956

- 1896 *Cythere scrobiculata* sp. – Lienenklaus in Kissling, p. 22, pl. 2, fig. 2
- * 1956 *Leguminocythereis sorneana* n.sp. – Oertli, p. 91-93, pl. 12, fig. 320-337
- 1975 *Leguminocythereis sorneana* – Doehl & Sonne, p. 144-145, pl. 3, fig. 18
- 2002 *Leguminocythereis sorneata* [sic] - Picot, p. 143-144, pl. 9, fig. 3
- non2008 *Leguminocythereis sorneana*– Monostori, 56-57, pl. 16, fig. 6
- 2008 *Leguminocythereis sorneana* – Picot et al., pl. 2, fig. 7-83
- 2011 *"Leguminocythereis" sorneana* – Pirkenseer & Berger, 62-64, fig. 49, pl. 9, fig. 1-4
- non2014 *"Leguminocythereis" sorneana* – Bosboom et al., 109, fig. 5a/9-10

Type locality and horizon

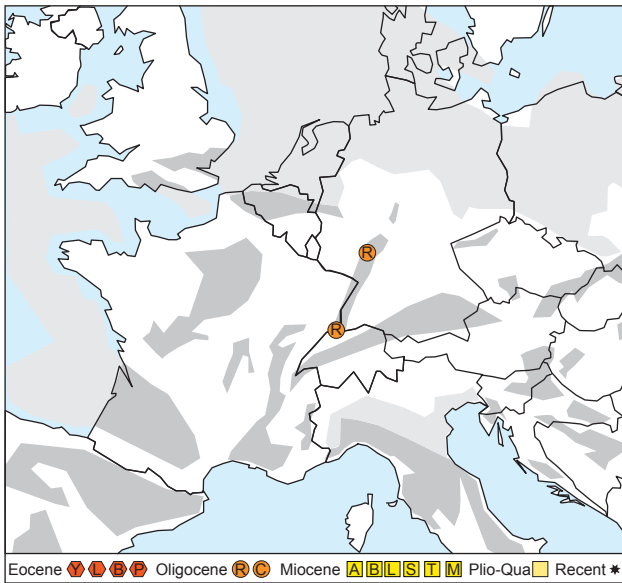
Sorne River bed, Delémont Basin near Delémont (NW Switzerland), "Blaue Tone", "Oberes Rupel" (sensu Oertli 1956).

Holotype

Male right valve, MOOE1180/1, Naturhistorisches Museum Bern (Switzerland).

Geographic and stratigraphic distribution

"Leguminocythereis" sorneana occurs in the late Rupelian of the Ajoie (Picot 2002) and Delémont Basin (Lienenklaus in Kissling 1896; Oertli 1956; Picot et al. 2008), the southern Upper Rhine Graben (Pirkenseer & Berger 2011) and the Mainz Basin (Doehl & Sonne 1975).



Temporal and spatial distribution of "Leguminocythereis" sorneana in the Cenozoic of Europe.

geometric forms=epochs letters=stages
 without letters=epoch (nonspecific)
 gray areas=main sedimentary basins

Measurements (µm) of “*Leguminocythereis*” *sorneana* in sample BEE003-972

Female carapaces				Male carapaces				Male carapaces				A-1 carapaces				
Table 1a	Length	Height	L/H	Table 1b	Length	Height	L/H	Table 1b	Length	Height	L/H	Table 1c	Length	Height	L/H	
	1075	567	1.90		1153	567	2.03		1271	606	2.10		869	463	1.88	
	1075	567	1.90		1212	592	2.05		1202	573	2.10		936	463	2.02	
	1095	567	1.93		1202	587	2.05		1232	587	2.10	Average	904	463	1.95	
	1095	567	1.93		1179	573	2.06		1232	587	2.10	A-2				
	1095	567	1.93		1198	577	2.08		1232	587	2.10	Table 1d	Length	Height	L/H	
	1134	587	1.93		1193	573	2.08		1212	577	2.10		618	357	1.73	
	1085	561	1.93		1222	587	2.08		1212	577	2.10		685	386	1.78	
	1065	547	1.95		1222	587	2.08		1226	581	2.11		685	386	1.78	
	1153	592	1.95		1202	577	2.08		1222	577	2.12		695	389	1.79	
	1124	577	1.95		1163	557	2.09		1222	573	2.13		676	376	1.79	
	1105	561	1.97		1226	587	2.09		Average	1213	581		2.09	676	367	1.84
	1134	567	2.00		1241	592	2.10		Average	1213	581		2.09	Average	672	377
	1134	567	2.00						A-3 carapaces							
	1173	581	2.02						Table 1e				Length	Height	L/H	
Average	1110	570	1.95									511	304	1.68		

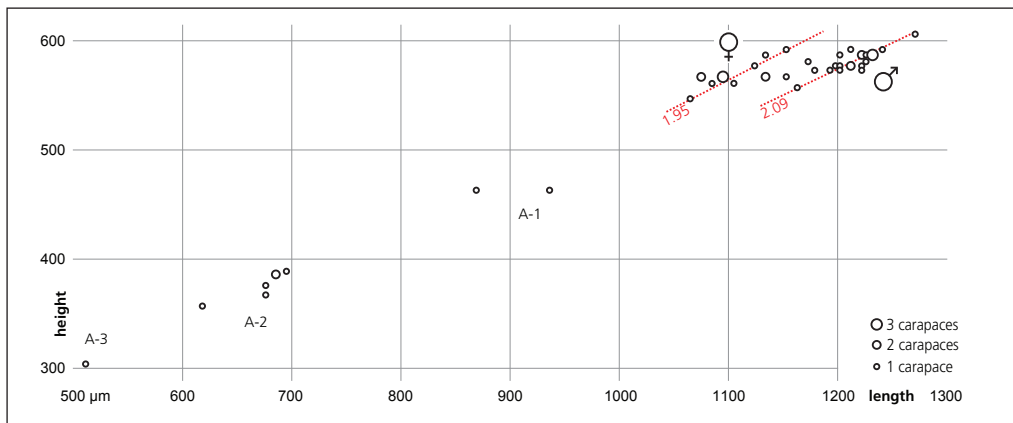


Fig. 19. Length/height plot of adult and juvenile “*Leguminocythereis*” *sorneana* carapaces in sample BEE003-972.

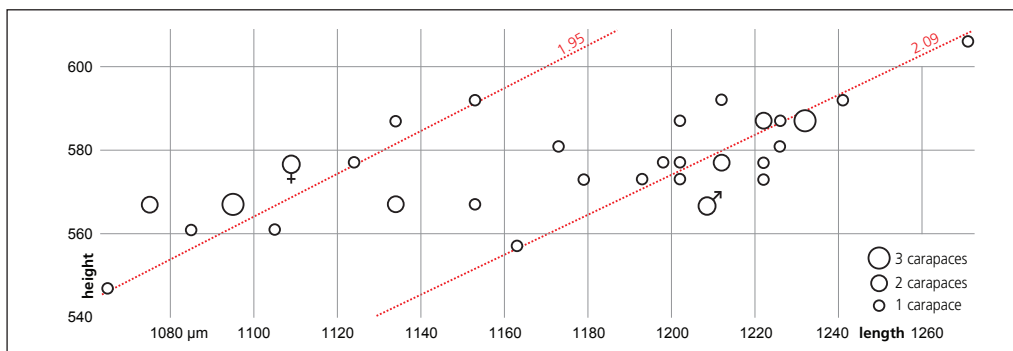


Fig. 20. Length/height plot of adult “*Leguminocythereis*” *sorneana* carapaces in sample BEE003-972.

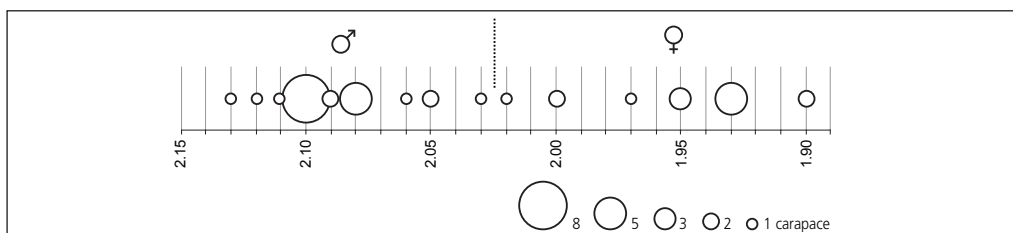


Fig. 21. Distribution of length/height ratios of “*Leguminocythereis*” *sorneana* carapaces in sample BEE003-972.

Measurements (μm) of “*Leguminocythereis*” *sorneana* in sample BEE003-834

Female carapaces				Female carapaces				Male carapaces				Male carapaces			
Table 2a	Length	Height	L/H	Table 2a	Length	Height	L/H	Table 2b	Length	Height	L/H	Table 2b	Length	Height	L/H
	1065	561	1.90		1095	557	1.96		1193	581	2.05		1173	557	2.11
	1114	587	1.90		1095	557	1.96		1193	581	2.05		1238	587	2.11
	1101	577	1.91		1114	567	1.97		1212	587	2.07		1241	587	2.12
	1114	581	1.92		1114	567	1.97		1193	577	2.07		1222	577	2.12
	1105	573	1.93		1114	567	1.97		1218	587	2.08		1193	561	2.13
	1114	577	1.93		1105	561	1.97		1222	587	2.08		1251	587	2.13
	1114	577	1.93		1108	561	1.98		1232	587	2.10		1251	587	2.13
	1114	577	1.93		1085	547	1.98		1232	587	2.10		1241	581	2.14
	1134	587	1.93		1105	557	1.98		1232	587	2.10		1173	547	2.14
	1134	587	1.93		1105	557	1.98		1232	587	2.10		1222	567	2.16
	1153	596	1.93		1124	567	1.98		1232	587	2.10		1144	528	2.17
	1114	573	1.95		1075	538	2.00		1232	587	2.10		1251	577	2.17
	1114	573	1.95		1114	557	2.00		1212	577	2.10		1232	567	2.17
	1105	567	1.95		1134	567	2.00		1212	577	2.10		1212	557	2.18
	1105	567	1.95		1134	567	2.00		1193	567	2.10		1212	557	2.18
	1105	567	1.95		1114	553	2.01		1193	567	2.10		1222	557	2.19
	1124	577	1.95		1153	567	2.03		1173	557	2.11	Average	1215	574	2.12
	1124	577	1.95		1153	567	2.03								
	1144	587	1.95		1120	547	2.05								
	1144	587	1.95	Average	1134	547	2.07								
					1116	568	1.96								

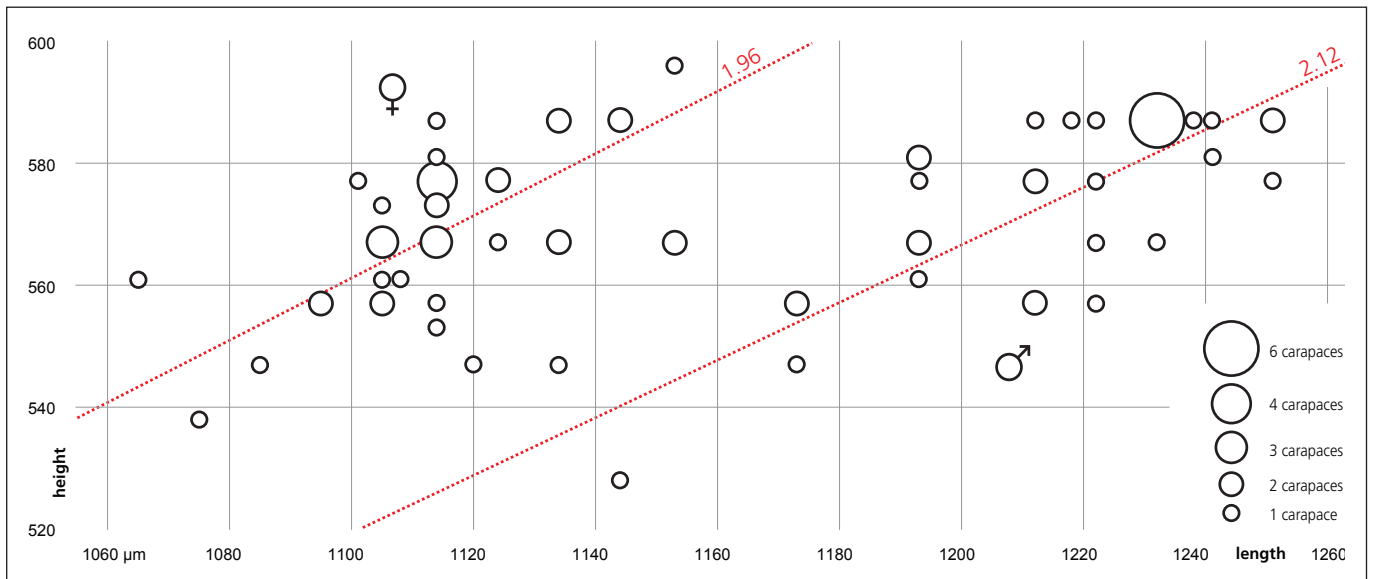


Fig. 22. Distribution of length/height ratios of “*Leguminocythereis*” *sorneana* carapaces in sample BEE003-834.

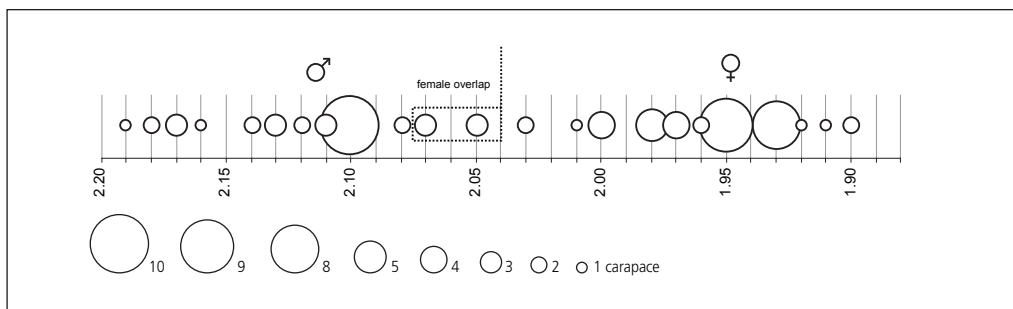


Fig. 23. Length/height plot of “*Leguminocythereis*” *sorneana* carapaces in sample BEE003-834.

Ostracoda

Plate 56

"Leguminocythereis" sorneana Oertli, 1956

1. COM990-45

Late Rupelian, Delémont - Communance

Male left valve, normal specimen, L 1178 × H 572 μm

a) external view (image Leguminocythereis 66_49OUT.psd)

b) internal view (image Leguminocythereis 66_49IN.psd)

2. COM990-35

Late Rupelian, Delémont - Communance

Male carapace, short and high specimen, L 1180 × H 571 × W 564 μm

a) left lateral view (image Leguminocythereis 66_39OUT.psd)

b) dorsal view (image Leguminocythereis 66_39DOR.psd)

3. COM990-41

Late Rupelian, Delémont - Communance

Male carapace, very short and moderately high specimen, shell drilled laterally by predatory gastropod, L 1142 × H 552 × W 542 μm

a) left lateral view (image Leguminocythereis 66_45OUT.psd)

b) dorsal view (image Leguminocythereis 66_45DOR.psd)

4. COM990-36

Late Rupelian, Delémont - Communance

Female carapace, long and low specimen, L 1174 × H 584 × W 585 μm

a) left lateral view (image Leguminocythereis 66_40OUT.psd)

b) dorsal view (image Leguminocythereis 66_40DOR.psd)

5. BEE003-986

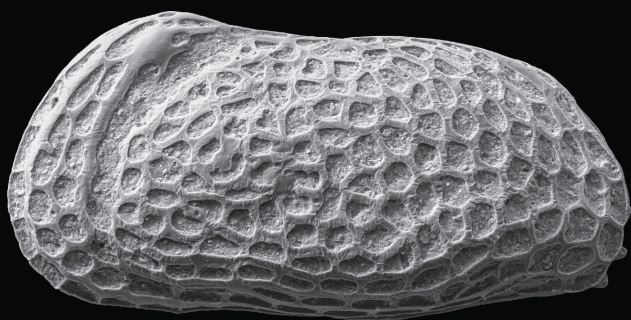
Late Rupelian, Delémont - Beuchille Est

Female carapace, long and low specimen, shell drilled laterally by predatory gastropod, L 1154 × H 583/555 × W 606 μm

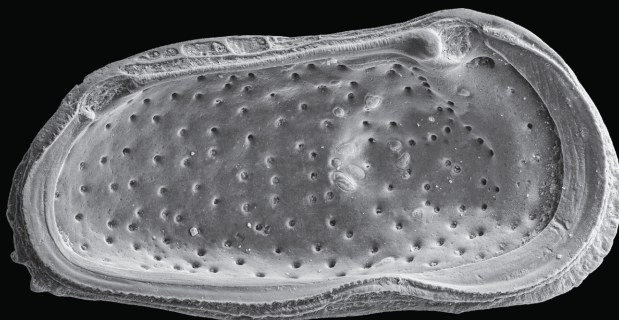
a) right lateral view (image Leguminocythereis 67_10OUT.psd)

b) ventral view (image Leguminocythereis 67_10VEN.psd)

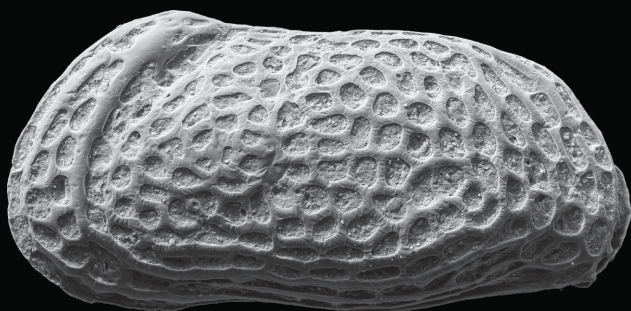
Plate 56



1a



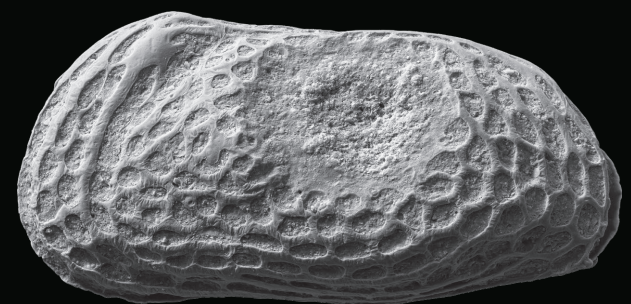
1b



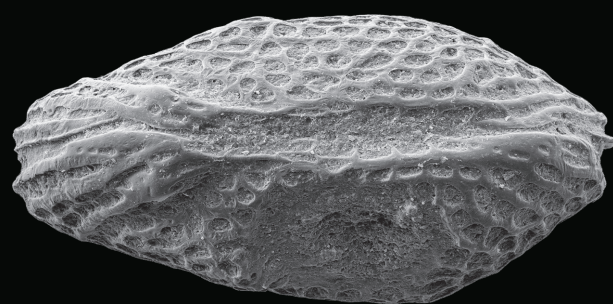
2a



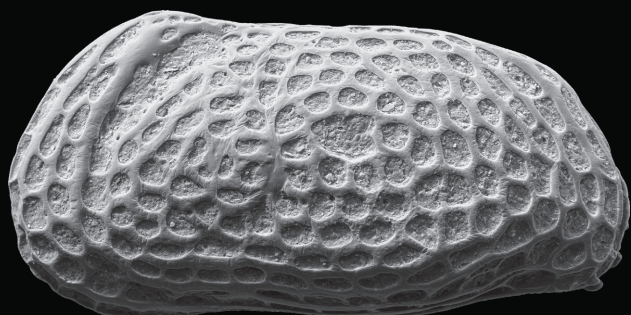
2b



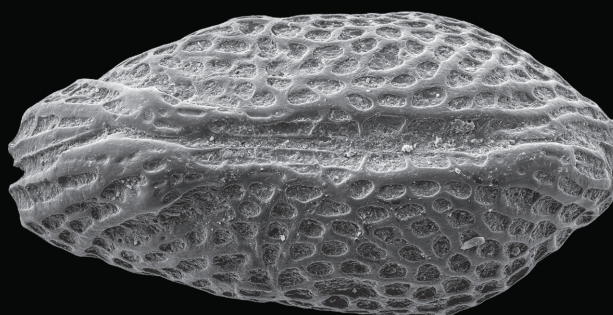
3a



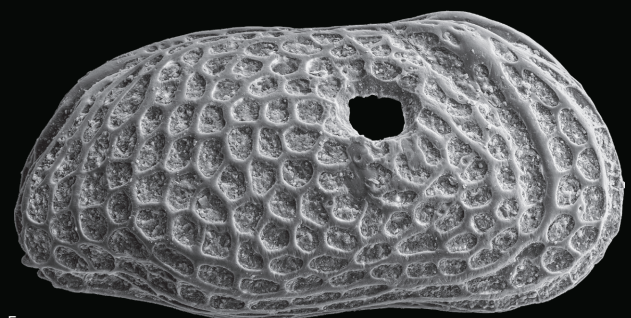
3b



4a



4b



5a



5b

200 μm

Ostracoda

Plate 57

"Leguminocythereis" sorneana Oertli, 1956

1. COM990-37

Late Rupelian, Delémont - Communance

Female carapace, long and low specimen, L 1145 × H 559 × W 561 μm

a) right lateral view (image Leguminocythereis 66_41OUT.psd)

b) dorsal view (image Leguminocythereis 66_41DOR.psd)

2. COM990-38

Late Rupelian, Delémont - Communance

Female carapace, short and high specimen,

L 1064 × H 564 × W 543 μm

a) right lateral view (image Leguminocythereis 66_42OUT.psd)

b) dorsal view (image Leguminocythereis 66_42DOR.psd)

3. BEE003-985

Late Rupelian, Delémont - Beuchille Est

Female carapace, very short and high specimen,

L 1048 × H 586 × W 539 μm

a) right lateral view (image Leguminocythereis 67_9OUT.psd)

b) ventral view (image Leguminocythereis 67_9VEN.psd)

4. COM990-40

Late Rupelian, Delémont - Communance

A-1 instar carapace, L 877 × H 474 × W 457 μm

a) right lateral view (image Leguminocythereis 66_44OUT.psd)

b) dorsal view (image Leguminocythereis 66_44DOR.psd)

5. BEE003-987

Late Rupelian, Delémont - Beuchille Est

A-2 instar carapace, L 648 × H 371 × W 357 μm

a) right lateral view (image Leguminocythereis 66_41OUT.psd)

b) dorsal view (image Leguminocythereis 67_11DOR.psd)

"Leguminocythereis" sp.

6. RNA987-112

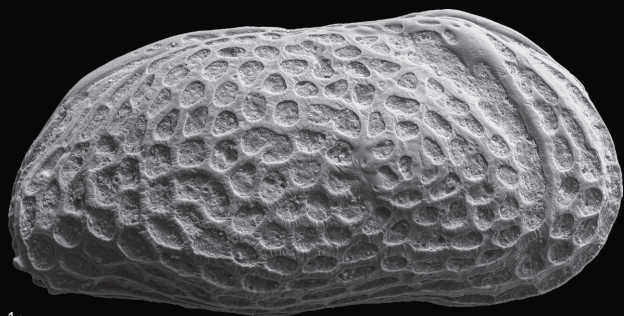
Late Rupelian, Cornol - Route Nationale

juvenile left valve, probably A-2 instar, L 578 × H 282 × W 160 μm,
too elongated to be attributed to *"Leguminocythereis" sorneana*

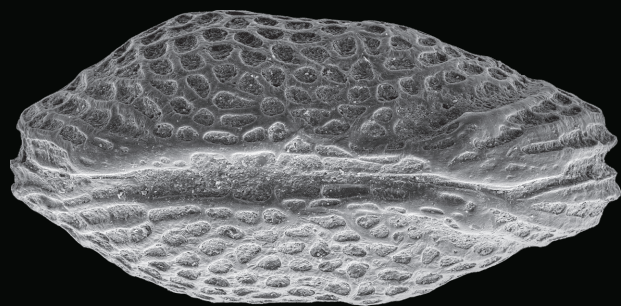
a) external view (image Leguminocythereis 66_33OUT.psd)

b) dorsal view (image Leguminocythereis 66_33DOR.psd)

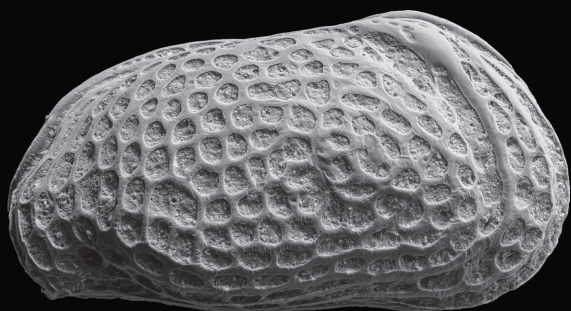
Plate 57



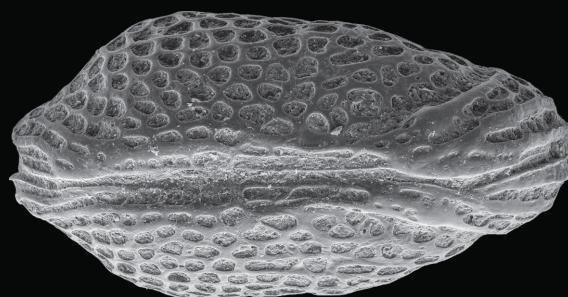
1a



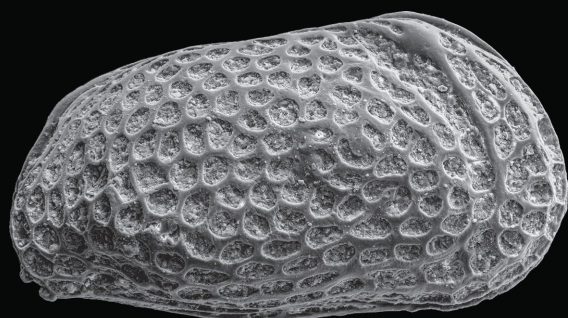
1b



2a



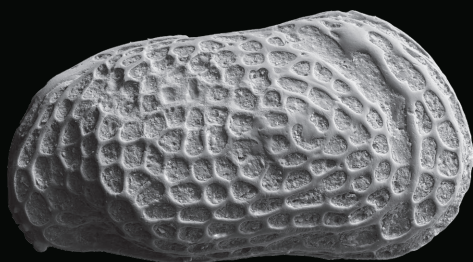
2b



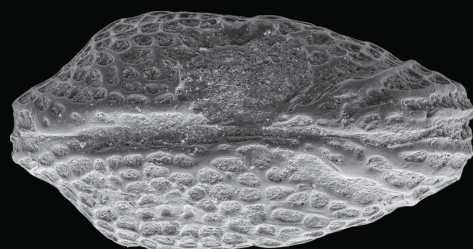
3a



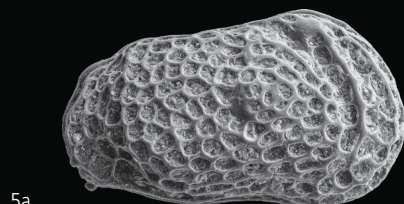
3b



4a



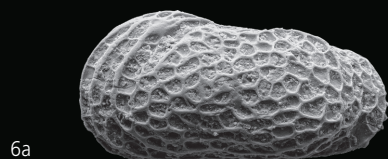
4b



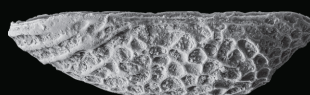
5a



5b



6a

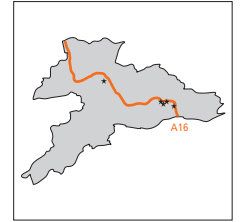


6b

200 μ m

PODOCOPIDA

Pterygocythereis ceratoptera (Bosquet, 1852)



Taxonomy

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Trachyleberididae	<i>Pterygocythereis</i>	<i>ceratoptera</i>

Determination (name/date): Laurent Picot/14.12.2005 ; Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Pterygocythereis ceratoptera

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Delémont - Communance (DEL-COM)	592 128/244 453
Rossemaison - Clos Leuchu (ROS-CLU)	592 630/243 770

Pterygocythereis indet.

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035
Courrendlin - Hauts Rochets (CRD-HRT)	595 640/243 145

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
<i>Pterygocythereis ceratoptera</i>				
DEL-BEE	19	1800	1	BEE006-35
DEL-BEE	19	1900	260	BEE004-168, 292
DEL-COM	5	-62.0 m	25	COM990-9, 42
DEL-COM	5	-64.0 m	29	COM990-11
ROS-CLU	1	-10.6 m	54	CLU007-197
<i>Pterygocythereis</i> indet.				
CGN-CLJ	1	-8.0 m	4	CLJ007-43
CGN-CLJ	1	-14.0 m	7	CLJ007-46
CRD-HRT	15	-53.0 m	45	HRT988-25
DEL-BEE	9	102	962	BEE003-241, 975
DEL-BEE	9	201	213	BEE003-272
DEL-BEE	19	1800	1, 260	BEE006-33, 92/BEE004-165, 168, 292, 304

Material

adult: 6 carapaces (31 carapaces, 6 fragments, poor preservation = *Pterygocythereis* sp.)
 juvenile: (2 carapaces, 1 fragmentary right valve, poor preservation)

Measurements (µm)

diverse samples	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	female C	1	835	–	449	–	1.86	–
	female C or A-1	1	785	–	412	–	1.91	–

Taxonomic remarks

Bosquet (1852) mentions three type localities distributed over northern France and Belgium. Keij (1857) merges Bosquet's material with *Pterygocythereis fimbriata* (v. Münster 1830), however figures one specimen (he considers to represent a juvenile) likely belonging to *P. ceratoptera*. Since Bosquet's illustrated specimen appears rather schematic (though bearing characteristics later attributed to *P. ceratoptera*), and not linked to any of the proposed localities it remains impossible to deduce a definite type locality. This may also have influenced the decision of Ducasse et al. (1985) to treat the French material as *P. fimbriata* (though the figured specimen clearly represents *P. ceratoptera*).

Pterygocythereis fimbriata (v. Münster 1830) represents a resembling but distinct coeval European species (Guernet 1990; Pirkenseer & Berger 2011), whereas *P. coronata* (Römer 1838) (and the synonymous *P. siveteri* Athersuch 1978) may be considered as younger successor taxon. Recent material of *P. jonesii* (Baird 1850) has often been dubbed *P. ceratoptera* (e.g. Bonaduce et al. 1975). Since all of these taxa look superficially similar, the reader is advised to consult the overview of the genus *Pterygocythereis* summarised in Guernet (1990). An exhaustive list of synonymy is provided below. Care should also be taken in case ecomorphotypes may be present, as is the case with "*P. helvetica*" and "*P. retinodosa*" (sensu Oertli 1956), which adhere however to *P. ceratoptera* (Pirkenseer & Berger 2011).

Synonymy

Genus *Pterygocythereis* Blake, 1933

Type species: *Cythereis jonesii* Baird, 1850

Pterygocythereis ceratoptera (Bosquet, 1852)

- * 1852 *Cythere ceratoptera* nov.spec. - Bosquet, p. 114-116, pl. 6, fig. 2
- non 1869 *Cythere Jonesii* var. *ceratoptera* - Brady, p. 45, 46
- non 1878 *Cythere ceratoptera* - Terquem, pl. 14, fig. 13
- partim 1889 *Cythere jonesii* var. *ceratoptera* - Brady & Norman, p. 170
- ? 1896 *Cythere fimbriata* - Lienenklaus in Kissling, p. 24-25, pl. 2, fig. 4 (abraded specimens or *P. "retinodosa"* morph)
- non 1900 *Cythere Jonesi* [sic] var. *ceratoptera* - Namias, p. 99-100, pl. 14, fig. 29-30
- non 1901 *Cythere ceratoptera* - Egger, p. 446, pl. 5, fig. 11-12
- non 1949 *Pterygocythereis jonesii ceratoptera* - Ruggieri, 26-27, pl. 1, fig. 10
- 1956 *Pterygocythereis ceratoptera* - Oertli, p. 86-87, pl. 11, fig. 299-301, pl. 16, fig. 402-403
- 1956 *Pterygocythereis helvetica* - Oertli, p. 87-88, pl. 11, fig. 310, pl. 16, fig. 404-406
- 1956 *Pterygocythereis retinodosa* n. sp. - Oertli, p. 83-85, pl. 11, fig. 291-298, pl. 15, fig. 397-398, pl. 16, fig. 410
- partim 1957 *Pterygocythereis fimbriata fimbriata* - Keij, p. 94, pl. 14, fig. 3
- 1963 *Pterygocythereis helvetica* - Stchepinsky, p. 166
- 1963 *Pterygocythereis retinodosa* - Stchepinsky, p. 166
- non 1964 *Pterygocythereis jonesii ceratoptera* - Ascoli, tab. 2, pl. 2, fig. 11
- non 1964 *Pterygocytheris* [sic] *jonesi* [sic] subsp. *ceratoptera* - Puri et al., 55
- ? 1965 *Pterigocythereis* [sic] *ceratoptera* - Moyes, p. 87-88, pl. 10, fig. 4
- 1967 *Pterygocythereis ceratoptera* - Witt, p. 34, pl. 2, fig. 5
- ? 1969 *Pterygocythereis ceratoptera* - Carbonnel, 123
- non 1969 *Pterygocythereis jonesii* subsp. *ceratoptera* - Puri et al., 377
- ? 1971 *Pterigocythereis* [sic] *jonesii ceratoptera* - Aruta & Buccheri, p. 190
- non 1972 *Pterygocythereis (Pterygocythereis) ceratoptera* - Sissingh, p. 111, pl. 8, fig. 1
- 1973 *Pterygocythereis ceratoptera* - Ducasse, p. 93
- non 1975 *Pterygocythereis ceratoptera* - Bonaduce et al., p. 143, pl. 2, fig. 10
- non 1975 *Pterygocythereis (Pterygocythereis) ceratoptera* - Breman, p. 59, pl. 8, fig. 108
- non 1975 *Pterygocythereis ceratoptera* - Brestenská, p. 393-394, pl. 7, fig. 12-14
- 1975 *Pterygocythereis ceratoptera* - Doebel & Sonne, p. 141-142, tab. 1, pl. 1, fig. 5
- 1975 *Pterygocythereis (Pterygocythereis) glimmerodensis* n.sp. - Faupel, p. 15-16, pl. 5, fig. 2-3
- non 1975 *Pterygocythereis ceratoptera* - Ruggieri & Sprovieri, p. 1620
- 1980 *Pterygocythereis ceratoptera* s.l. - Uffenorde, tab. 1, fig. 4
- 1980 *Pterygocythereis ceratoptera* s.l. - Uffenorde, p. 120, tab. 1, fig. 3
- 1981 *Pterygocythereis ceratoptera* - Antunes et al., p. 164
- 1981 *Pterygocythereis (Pterygocythereis) ceratoptera* - Uffenorde, p. 176-177, pl. 2, fig. 8
- ? 1982 *Pterygocythereis ceratoptera* - Carbonnel & Ballesio, tab. 1, 4
- 1985 *Pterygocythereis fimbriata* - Ducasse et al., pl. 79, fig. 14-15.
- non 1988 *Pterygocythereis ceratoptera* - Lachenal & Bodergat, 78
- ? 1990 *Pterygocytheis* [sic] *ceratoptera* s.l. - von Daniels et al., tab. 2
- 1990 *Pterygocythereis ceratoptera* - Guernet, p. 285-286, pl. 3, fig. 8-10
- non 1996 *Pterigocythereis* [sic] *ceratoptera* - Tunoğlu, p. 111, pl. 1, fig. 6-11
- 1996 *Pterygocythereis ceratoptera* s.l. - Ziegler, p. 25-26, fig. 2/1, 5
- partim 1998 *Pterygocythereis ceratoptera* - Carbonnel, p. 25, tab. 1-3, pl. 1, fig. 4-7
- non 1999 *Pterygocythereis ceratoptera* - Şafak, p. 166, tab. 1, pl. 3, fig. 3
- ? 2001 *Pterygocythereis ceratoptera* - Bossio et al., p. 121
- non 2001 *Pterygocythereis ceratoptera* - Nazik, p. 118, tab. 1, 3-4, fig. 2G
- 2002 *Pterygocythereis ceratoptera* - Picot, p. 141-142, pl. 7, fig. 7-8, pl. 8, fig. 1-3

Synonymy

- 2004 *Pterigocythereis* [sic] *ceratoptera* - Gebhardt, p. 264, fig. 17/14 (heavily abraded specimen)
- 2004 *Pterigocythereis* [sic] *glimmerodensis* - Gebhardt, p. 264, fig. 17/9
- ? 2004 *Pterigocythereis* cf. *ceratoptera* - Monostori, p. 53, pl. 14, fig. 5-7
- ? 2005 *Pterigocythereis* *ceratoptera* - Janz & Vennemann, app. A.
- non2006 *Pterigocythereis* *ceratoptera* - Zavodnik et al., p. 93
- 2007 *Pterigocythereis* *ceratoptera* - Griebemer et al., p. 53-54, pl. 30, fig. 1-9
- non2008 *Pterigocythereis* *ceratoptera* - Pascual et al., p. 47, 59, fig. 5
- 2008 *Pterigocythereis* *ceratoptera* - Picot et al., p. 492, tab. 2, pl. 3, fig. 1-2
- ? 2008 *Pterigocythereis* *ceratoptera* - Rupp et al., p. 19
- ? 2009 *Pterigocythereis* *ceratoptera* - Witt, p. 58-59, pl. 1, fig. 16
- non2013 *Pterigocythereis* *ceratoptera* - Cabral & Loureiro, p. 149, pl. 8, fig. 18
- ? 2014 *Pterigocythereis* [sic] *ceratoptera* - Bosboom et al., p. 107, fig. 5a/9-10
- non2015 *Pterigocythereis* *ceratoptera* - Perçin-Paçal et al., tab. 1

Type locality and horizon

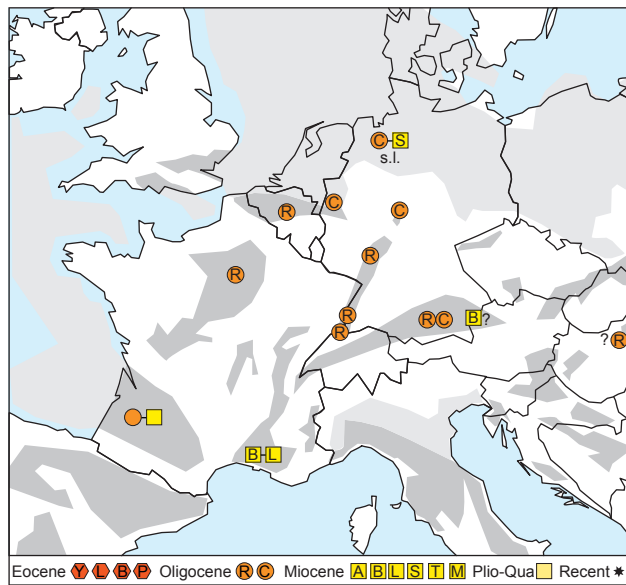
not designated, Rupelian (sensu Bosquet 1852):
 Rupelmonde (Belgium), "argile de Basele"
 Bergh/Kleine-Spouwen (Belgium), "couche argilo-sableuse à Nucules"
 Étampes (France), "Sables de Jeurre et d'Étrechy"

Holotype

Not designated, left valve and carapace figured; "collection Bosquet", depository not given.

Geographic and stratigraphic distribution

Pterigocythereis ceratoptera is widely distributed in the Oligocene of western Europe (Aquitaine, Paris, Belgium, North-Germany and the Molasse Basin as well as the Upper Rhine Gaben). Miocene occurrences are less common and remain (partly) doubtful due to lack of taxonomic information.



Temporal and spatial distribution of *Pterigocythereis ceratoptera* in the Cenozoic of Europe.

geometric forms=epochs letters=stages
 without letters=epoch (nonspecific)
 gray areas=main sedimentary basins

Ostracoda

Plate 58

Pterygocythereis ceratoptera (Bosquet, 1852)

1. COM990-42

Late Rupelian, Delémont - Communance

female carapace, L 835 × H 449 × W 583 μm

a) right lateral view (image Pterygocythereis 66_46OUT.psd)

b) dorsal view (image Pterygocythereis 66_46DOR.psd)

2. BEE004-292

Late Rupelian, Delémont - Beuchille Est

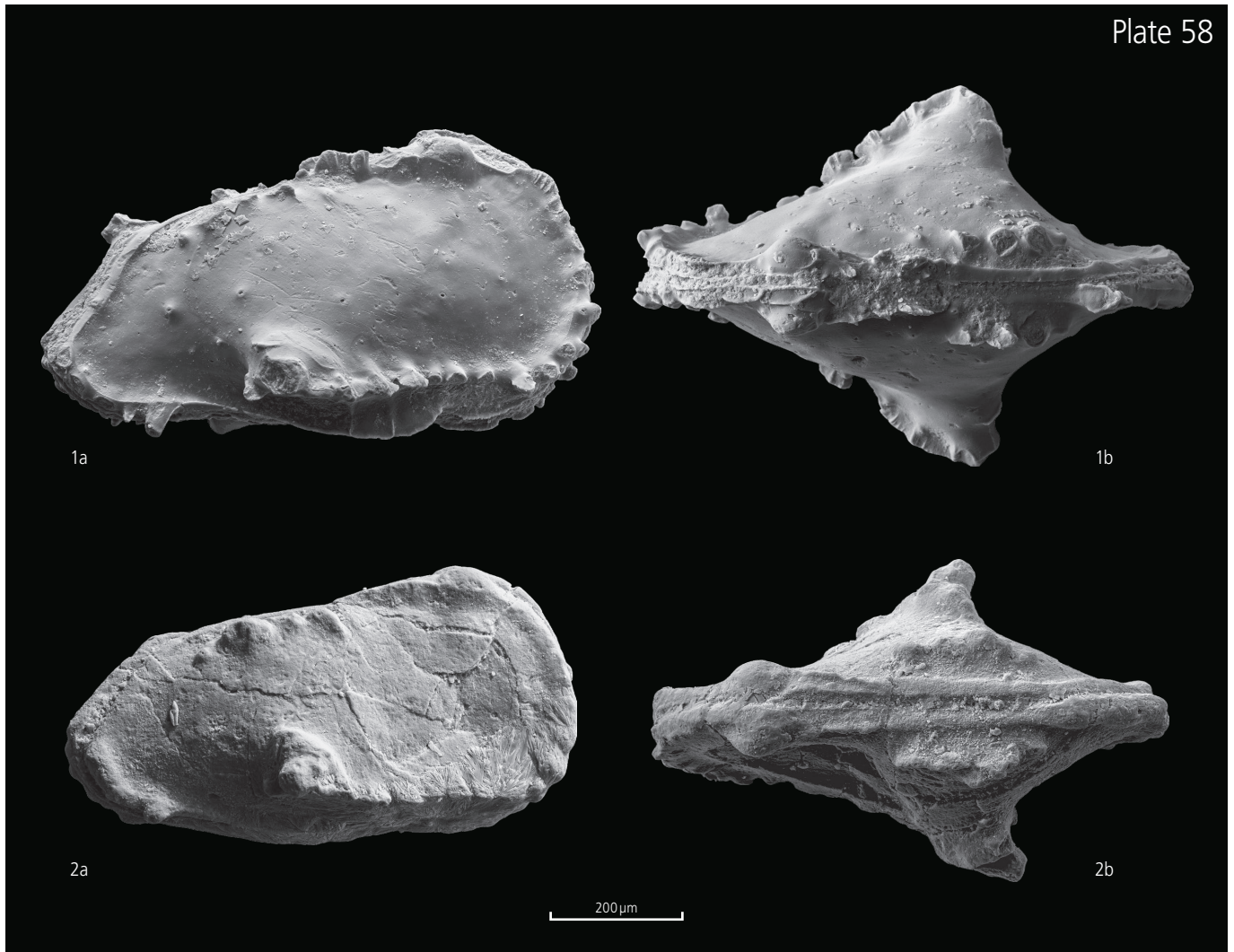
Female or A-1 stage carapace, heavily abraded,

L 785 × H 412 × W 492 μm

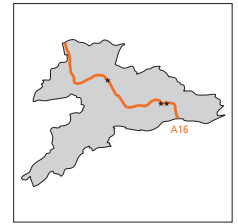
a) right lateral view (image Pterygocythereis 66_83OUT.psd)

b) dorsal view (image Pterygocythereis 66_83DOR.psd)

Plate 58



PODOCOPIDA

Pterygocythereis volans Oertli, 1956**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Trachyleberididae	<i>Pterygocythereis</i>	<i>volans</i>

Determination (name/date): Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Delémont - Communance (DEL-COM)	592 128/244 453

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	2	-9.2 m	57	RNA987-38, 106-107
DEL-BEE	19	1900	2	BEE006-92
DEL-COM	5	-64.0 m	29	COM990-11

Material

adult: 2 carapaces, 1 left valve, 1 right valve, (31 carapaces, 6 fragments, poor preservation = *Pterygocythereis* sp.)
juvenile: (2 carapaces, 1 fragmentary right valve, poor preservation)

Measurements (µm)

RNA987-38	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	adult L	1	944	–	522	–	1.81	–
	adult R	1	977	–	493	–	1.98	–

Taxonomic remarks

The similar-sized, potentially ancestral species *Pterygocythereis aquitanica* Ducasse, 1964 from the middle-late Eocene of the Aquitaine Basin (France) differs in a more rectangular lateral outline (less sloping dorsal margin) and in bearing a continuous dorsal ridge.

Synonymy

Genus *Pterygocythereis* Blake, 1933

Type species: *Cythereis jonesii* Baird, 1850

Pterygocythereis volans Oertli, 1956

- * 1956 *Pterygocythereis volans* n. sp. – Oertli, p. 85-86, pl. 11, fig. 306, 308, pl. 15, fig. 399-401
- ? 1961 *Pterygocythereis volans* – Ruggieri, p. 7
- ? 1985 *Pterygocythereis* aff. *volans* – Müller, p. 16, pl. 1, fig. 15-16
- ? 1988 *Pterygocythereis volans* – Vinken (ed.), p. 243
- 1994 *Pterygocythereis volans* – Ziegler, p. 188, fig. 9/6-7
- 1996 *Pterygocythereis volans* – Ziegler, p. 26
- 2002 *Pterygocythereis volans* – Picot, p. 142, pl. 7, fig. 3-6
- 2008 *Pterygocythereis volans* – Picot et al., p. 492, tab. 2
- 2011 *Pterygocythereis volans* – Pirkenseer & Berger, p. 70-71, pl. 10, fig. 6-7

Type locality and horizon

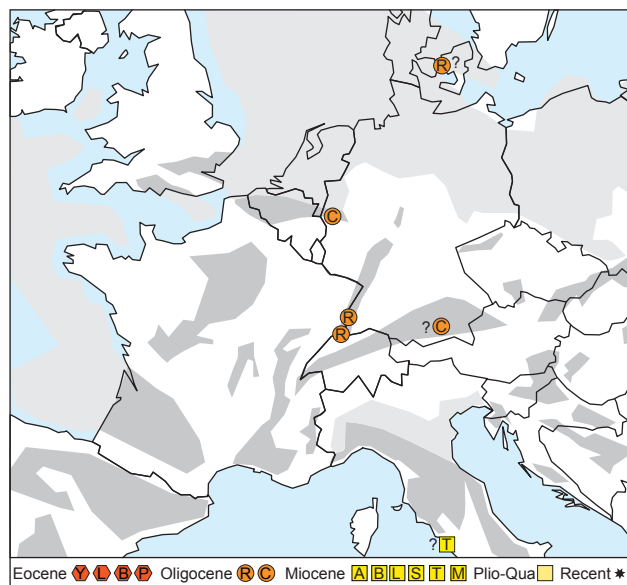
Sample 158, River Sorne bed near Delémont (Switzerland), "Blaue Tone" (Rupelian sensu Oertli 1956).

Holotype

Right valve, MOOE 460/1, Museum of Natural History, Bern (Switzerland).

Geographic and stratigraphic distribution

Occurrences are limited to the Rupelian of the southern Upper Rhine Raben and the northern Jura (Oertli 1956; Picot 2002, Pirkenseer & Berger 2011) and the Chattian of western Germany (Ziegler 1994). Uncertain occurrences include the Rupelian of Denmark (Vinken [ed.] 1988), the Chattian of Bavaria (Müller 1985) and a doubtful report from the Tortonian of Sicily (Ruggieri 1961).



Temporal and spatial distribution of Pterygocythereis volans in the Cenozoic of Europe.

geometric forms=epochs letters=stages
 without letters=epoch (nonspecific)
 gray areas=main sedimentary basins

Ostracoda

Plate 59

Pterygocythereis volans Oertli, 1956

1. RNA987-106

Late Rupelian, Cornol-Route Nationale

Right valve, L 977 × H 493 × W 344 μm

a) lateral view (image Pterygocythereis 66_27OUT.psd)

b) dorsal view (image Pterygocythereis 66_27DOR.psd)

2. RNA987-107

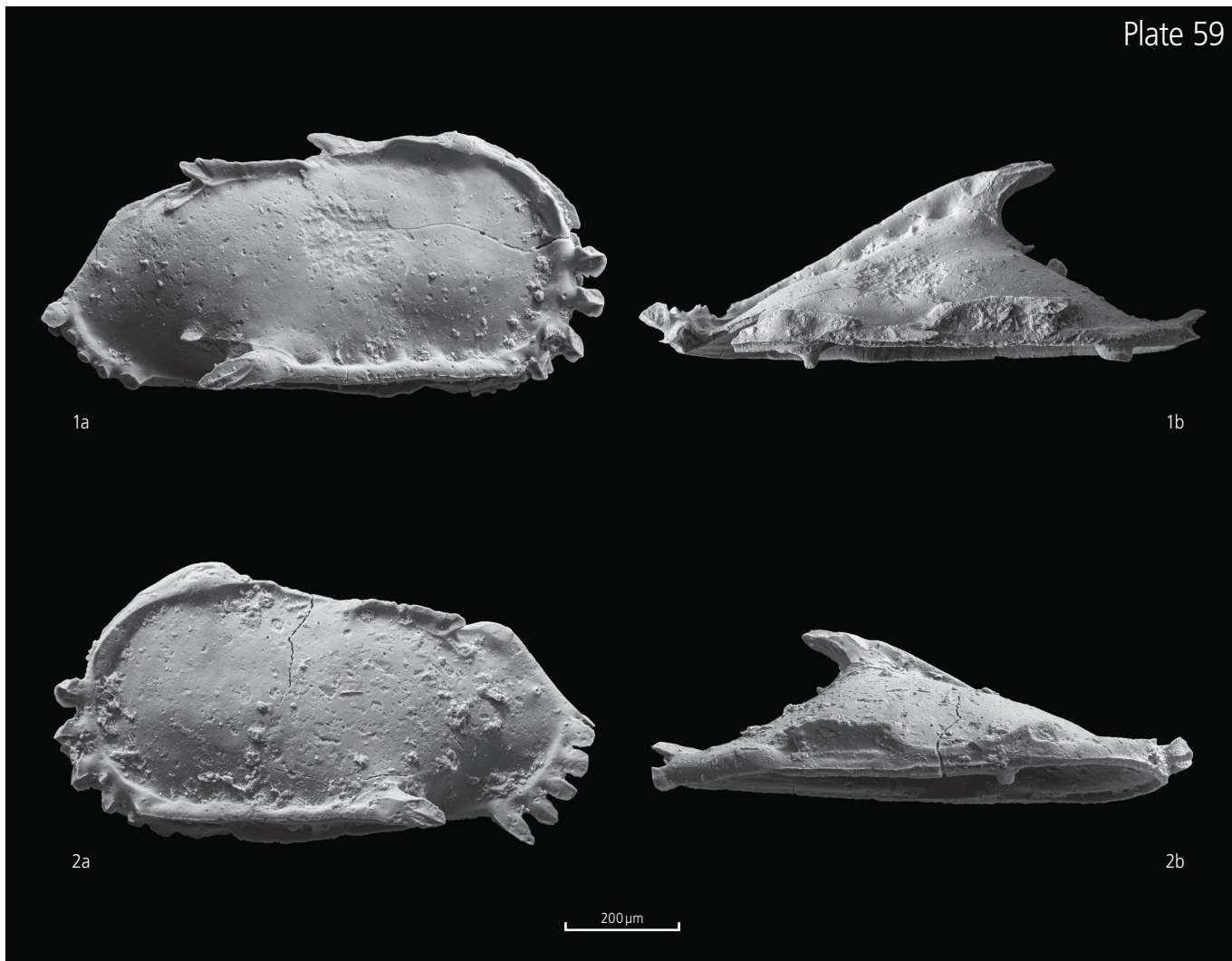
Late Rupelian, Cornol-Route Nationale

Left valve, L 944 × H 522 × W 285 μm

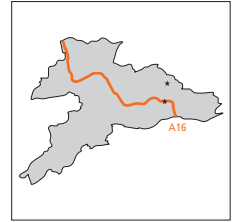
a) lateral view (image Pterygocythereis 66_28OUT.psd)

b) dorsal view (image Pterygocythereis 66_28DOR.psd)

Plate 59



PODOCOPIDA

? *Echinocythereis ligula* (Lienenklaus, 1895)

Taxonomy

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Hemicytheridae	<i>Echinocythereis</i> (?)	<i>ligula</i>

Determination (name/date): Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Soyhières - Route de France (SOY-RFR)	594 275/249 225

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
DEL-BEE	16	1	112	BEE003-839
DEL-BEE	17	5	965	BEE003-810
DEL-BEE	19	1800	1/260/767	BEE006-1, 38, 179/BEE004-165, 168, 271, 293/BEE003-557
SOY-RFR	2	–	3	RFR008-15

Material

adult: 13 carapaces

Measurements (µm)

RNA987-57	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	adult L	1	1014	–	358	–	2.83	–
	adult R	1	1034	–	347	–	2.97	–

Taxonomic remarks

The internal morphological characteristics of this rare species can not be observed in our material and are neither sufficiently described in the literature. Oertli (1956) gives a good overview, however remains doubtful about a definite generic classification. Hence this species can still not be unambiguously attributed to the genus *Echinocythereis* (summed up generic classification in Morkhoven 1963). The distinctive feature of posteroventral and postero-medial swellings (in varying degrees) can be observed in all of our specimens. Oertli (1956) hints at the variability of the ornamentation of this species possibly being linked to palaeoenvironmental stress. Oertli (1956) considers *Echinocythereis ligula* as descendent from *E. scabra*.

Due to the dualism of tubercles (sensu classical *Echinocythereis*) and a partial development of a reticulation most sola or intratubercular spaces can be assigned to the main lateral fossal patterns sensu Liebau (1969) and Benson (1972) (fig. 3). Identification of pore cones is not possible due to the abraded nature of the material and the ubiquitous presence of ornamental tubercles.

Synonymy

Genus *Echinocythereis* Puri, 1953Type species: *Cythereis garretti* Howe & McGuirt, 1935? *Echinocythereis ligula* Oertli, 1956

- * 1896 *Cythere ligula* nov. spec. – Lienenklaus in Kissling, p. 24, pl. 2, fig. 3
- 1956 *Echinocythereis? ligula* – Oertli, p. 81-82, pl. 10, fig. 281-284, p. 11, fig. 285-290
- 1963 *Echinocythereis? ligula* – Stchepinsky, p. 164
- 1969 *Echinocythereis ligula* – Scheremeta, 47
- non2004 *Echinocythereis ligula* – Monostori, 54, pl. 15, fig. 3
- 2008 ?*Muellerina* sp. – Picot et al., pl. 3, fig. 3

Type locality and horizon

La Communance (Jura), Delémont Basin (NW Switzerland), "Mittel-Oligocän" [late Rupelian] (sensu Kissling 1896)

Holotype

Adult carapace, left and right valves as well as juvenile left valve figured, depository not given.

Geographic and stratigraphic distribution

Late Rupelian of the Delémont Basin (Lienenklaus in Kissling 1896; Oertli 1956; Picot et al. 2008), possibly the Paleogene of the Ukraine (Scheremeta 1969). The specimen figured in Monostori (2004) does not represent this species. Accordingly it potentially represents a species endemic to the Upper Rhine Graben.

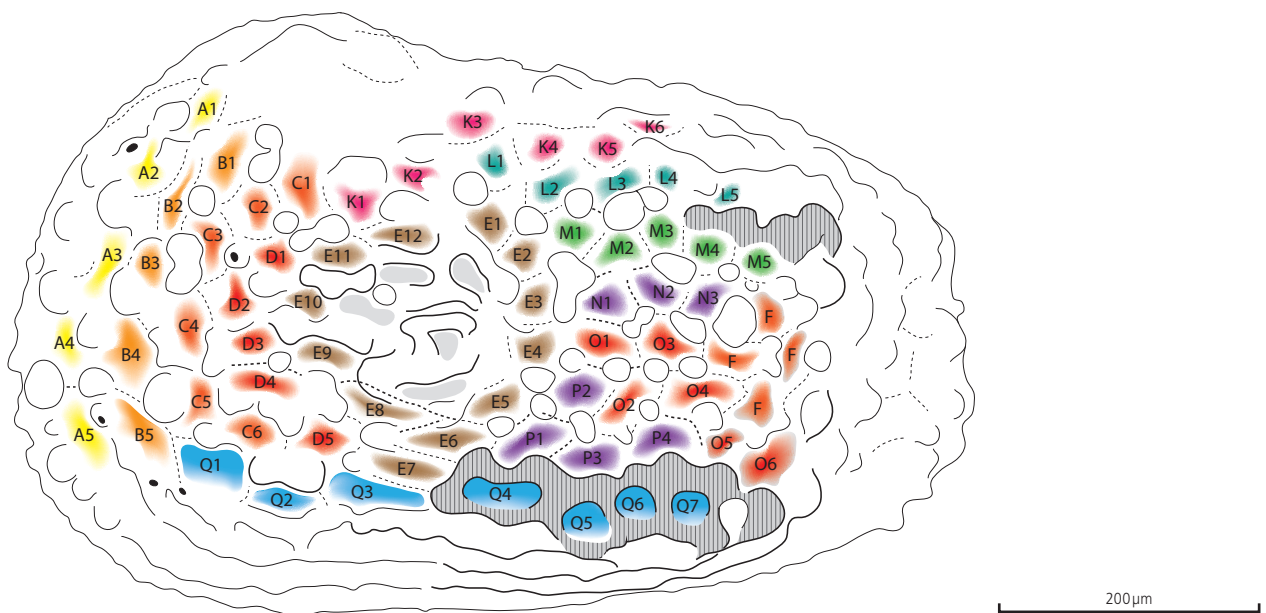
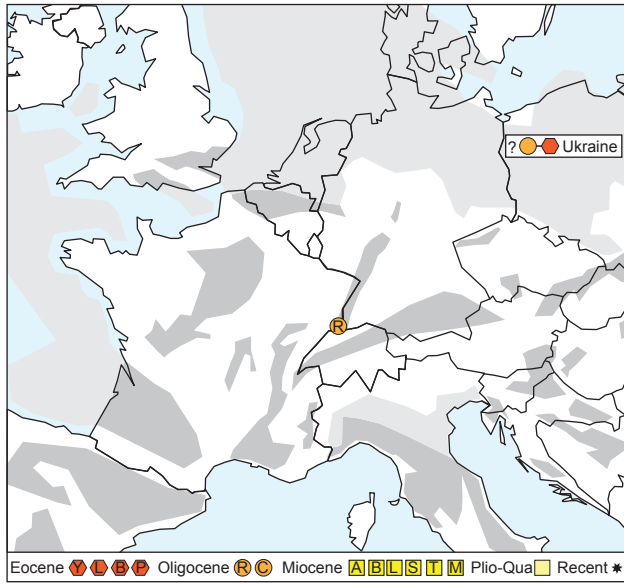


Fig. 24. Homologous ornamentation patterns of a ?Echinocythereis ligula carapace (BEE006-38). Sola color coded, pore cones in bold italics. Numbering follows Liebau 1969 and Benson 1972.

Measurements (μm) of *?Echinocythereis ligula*

Female carapaces			
Table 1a	Length	Height	L/H
	717	441	1.63
	801	492	1.63
	736	452	1.63
Average	747	457	1.63

Male carapaces			
Table 1b	Length	Height	L/H
	801	458	1.75
	782	444	1.76
	678	380	1.78
	811	454	1.79
	760	419	1.81
	772	420	1.84
	782	425	1.84
	708	385	1.84
	Average	784	437

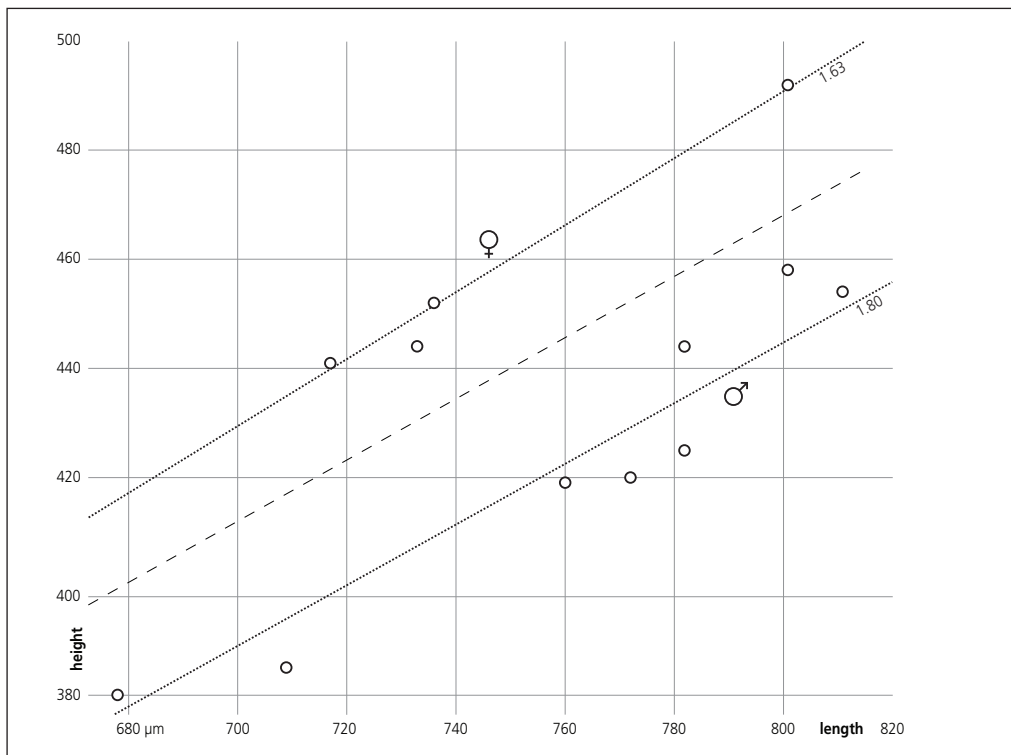


Fig. 25. Length/height plot of *?Echinocythereis ligula* carapaces (all samples).

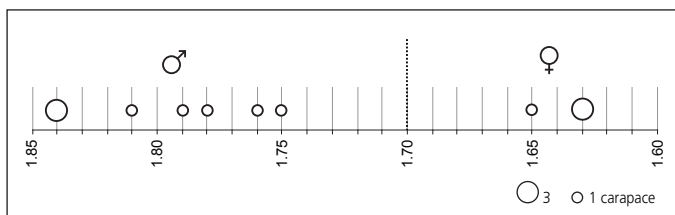


Fig. 26. Distribution of length/height ratios of *?Echinocythereis ligula* carapaces.

Ostracoda

Plate 60

?*Echinocythereis ligula* (Lienenklaus, 1896)

1. BEE006-179

Late Rupelian, Delémont - Beuchille Est

Female carapace, L 736 × H 452 × W 403 μm

a) left lateral view (image Echinocythereis 66_10OUT.psd)

b) dorsal view (image Echinocythereis 66_1DOR.psd)

2. BEE004-271

Late Rupelian, Delémont - Beuchille Est

Female carapace, L 717 × H 441 × W 400 μm

dorsal view (image Echinocythereis 66_62DOR.psd)

3. BEE003-860

Late Rupelian, Delémont - Beuchille Est

Male carapace, small specimen, L 678 × H 380 μm

left lateral view (image Echinocythereis BEE_plot1_15.psd)

4. BEE004-165

Late Rupelian, Delémont - Beuchille Est

Male carapace, small specimen, L 709 × H 385 μm

right lateral view (image Echinocythereis BEE_plot1_19.psd)

5. BEE004-293

Late Rupelian, Delémont - Beuchille Est

Male carapace, L 760 × H 419 × W 364 μm (width without tubercle)

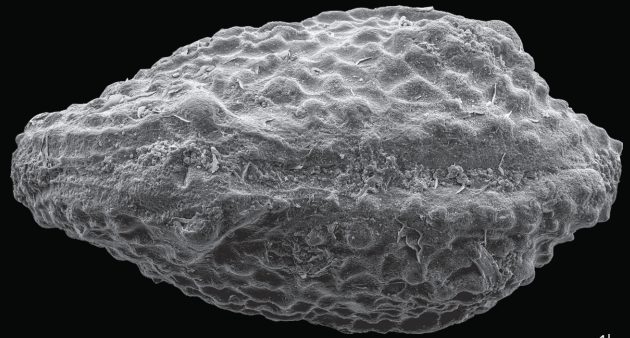
a) left lateral view (image Echinocythereis 66_84OUT.psd)

b) dorsal view (image Echinocythereis 66_84DOR.psd)

Plate 60



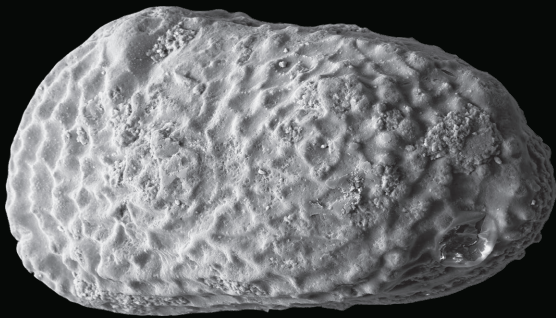
1a



1b



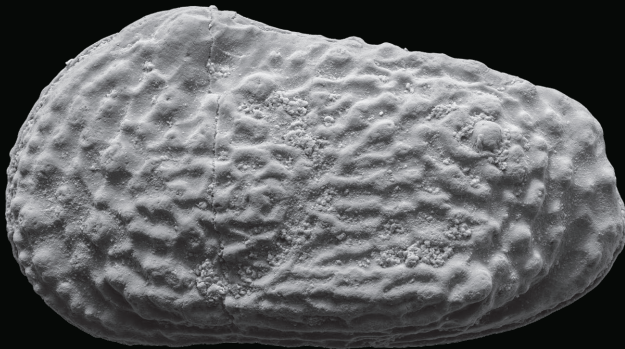
2



3



4



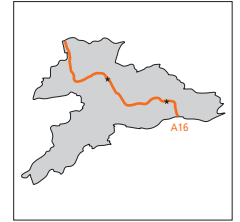
5a



5b

200 μ m

PODOCOPIDA

Pokornyella limbata (Bosquet, 1852)*Pokornyella* sp.

Taxonomy

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Hemicytheridae	<i>Pokornyella</i>	<i>limbata</i>

Determination (name/date): Laurent Picot/14.12.2005; Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Cornol - Route Nationale (COR-RNA)	577 713/250 616

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
DEL-BEE	19	1800	767/260	BEE003-557/BEE004-165
COR-RNA	2	-9.2 m	57	RNA987-38, 109

Material

adult: 5 carapaces (3 carapaces = *Pokornyella* sp.)

Measurements (µm)

diverse samples	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	<i>P. limbata</i> C	1	607	–	358	–	1.70	–
	<i>P. sp.</i> C	1	579	–	380	–	1.52	–

Taxonomic remarks

The similarity of several Oligocene species of *Pokornyella* and the variation of the *P. limbata* species concept sensu different authors leads to an uncertainty regarding precise specific attribution, especially when poor preservation is taken into account. Oertli (1956) gives a concise account on material he considers to represent valid *P. limbata* specimens. His figured material shows distinctly triangular specimens (females) and comparatively lower males, with a slender outline in dorsal view. This deviates from the specimen figured in Keij (1956), which while laterally looks quite similar sports a wide outline in dorsal view (more akin to *Pokornyella calix* Oertli, 1956).

Pokornyella calix according to Oertli's (1956) figures and description features a more rectangular lateral view, reduced dorsal ridges (compared to *P. limbata*) and less distinct large anterior fossae. This characterisation is more or less born out by the detailed description of *Pokornyella limbata* and *calix* morphotypes in Ducasse & Coustillas (1981), with some possible overlap (also with some *P. aff. galeata* morphs).

Problems separating these morphotypes arise with poorly preserved material, where "low" females of one species may potentially be confused with comparatively "high" males of another species. The dorsally slender *Pokornyella limbata* sensu Sönmez-Gökçen (1964) from the Rupelian of northwestern Turkey looks similar in left valves, but the highest point of the right valve lies at 2/3 length and not at the anterior cardinal angle.

Further resembling species include the middle Eocene *Pokornyella limbata anteglabra* Monostori, 1998, *P. osnabrugensis* (Lienenklaus 1894) (lacks dorsal ridge; Moos 1965; Oertli 1956) and the more rectangular *P. lattorfiana* (Lienenklaus 1900) (Moos 1968; both from the early Oligocene of northwestern Germany). Some differences are based on (comparatively small) variations of the lateral ornamentation, which suggests the necessity of a revision of morphologically overlapping taxa.

The scarce material from the research area can not entirely be attributed to *Pokornyella limbata*. The in dorsal view very slender specimen on pl. 61.2 may represent an abraded female featuring a much finer lateral punctation (ecomorphotype?).

Synonymy

Genus *Pokornyella* Oertli, 1956

Type species: *Cythere limbata* Bosquet, 1852

Pokornyella gr. *limbata* (Bosquet, 1852)

- * 1852 *Cythere limbata* nov.spec. – Bosquet, p. 78-79, pl. 4, fig. 1
- non 1946 *Hemicythere limbata* ? – van den Bold, p. 102, pl. 6, fig. 15, pl. 9, fig. 11
- non 1955 *Hemicythere limbata* – Apostolescu, p. 266-267, pl. 2, fig. 29-30
- 1956 *Pokornyella limbata* - Oertli, p. 98-100, pl. 14, fig. 366-377
- 1957 *Pokornyella limbata* - Keij, p. 116-117, pl. 13, fig. 6, pl. 18, fig. 12-14
- ? 1964 *Pokornyella limbata* – Sönmez-Gökçen, p. 57-58, pl. 28, fig. 9
- 1965 *Pokornyella limbata* - Moyes, p. 108-109, pl. 13, fig. 5
- ? 1973 *Pokornyella limbata* – Sönmez-Gökçen, p. 67, pl. 8, fig. 25-30
- 1975 *Pokornyella limbata* – Doebl & Sonne, p. 144, pl. 2, fig. 17
- 1977 *Pokornyella* ex gr. *limbata* - Ruggieri et al., fig. 1/2, 3/3, pl. 1, fig. 1
- 1981 *Pokornyella limbata* – Ducasse & Coustillas, p. 15-16, pl. 3, fig. 4-9
- 1985 *Pokornyella limbata* – Ducasse et al., pl. 82, fig. 16
- non 1988 *Pokornyella* sp. gr. *limbata* – Barbin & Guernet, p. 221, pl. 2, fig. 9, 12
- 1993 *Pokornyella limbata* – Kammerer, p. 73-74
- ? 1998 *Pokornyella limbata anteglabra* n. ssp. – Monostori, p. 54-55, pl. 8, fig. 7-10
- 2002 *Pokornyella limbata* - Picot, p. 148
- v 2008 *Pokornyella limbata* - Picot et al., p. 492, pl. 2, fig. 6

Type locality and horizon

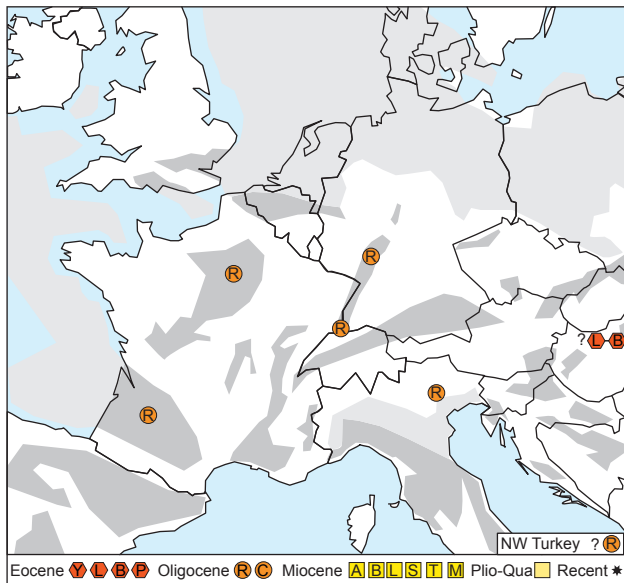
not designated, (sensu Bosquet 1852):
 Étrechy and Jeurre (France), "sable tertiaire éocène"
 Acy and Guépesle (France), "sables moyens"

Lectotype

Left valve (chosen by Keij 1957), "collection Bosquet" (No. 42), Royal Institute for Natural Sciences of Belgium (Brussels).

Geographic and stratigraphic distribution

Pokornyella limbata is distributed in the Rupelian of the Aquitaine (Moyes 1965, Ducasse & Coustillas 1981), the Paris (Bosquet 1852; Keij 1957; Ducasse et al. 1985), the Po (Ruggieri et al. 1977) and the Mainz Basin (Doebl & Sonne 1975; Kammerer 1993) as well as the southernmost Upper Rhine Gaben (Oertli 1956; Picot 2002; Picot et al. 2008). A subspecies probably representing a precursor taxon has been reported from Hungary (Monostori 1998).



Temporal and spatial distribution of *Pokornyella limbata* in the Cenozoic of Europe.

geometric forms=epochs letters=stages
 without letters=epoch (nonspecific)
 gray areas=main sedimentary basins

Ostracoda

Plate 61

Pokornyella limbata (Bosquet, 1852)

1. BEE003-557

Late Rupelian, Delémont - Beuchille Est

Carapace, L 607 × H 358 μm

right lateral view (image Pokornyella_limbata_lat.psd)

Pokornyella sp.

2. RNA987-109

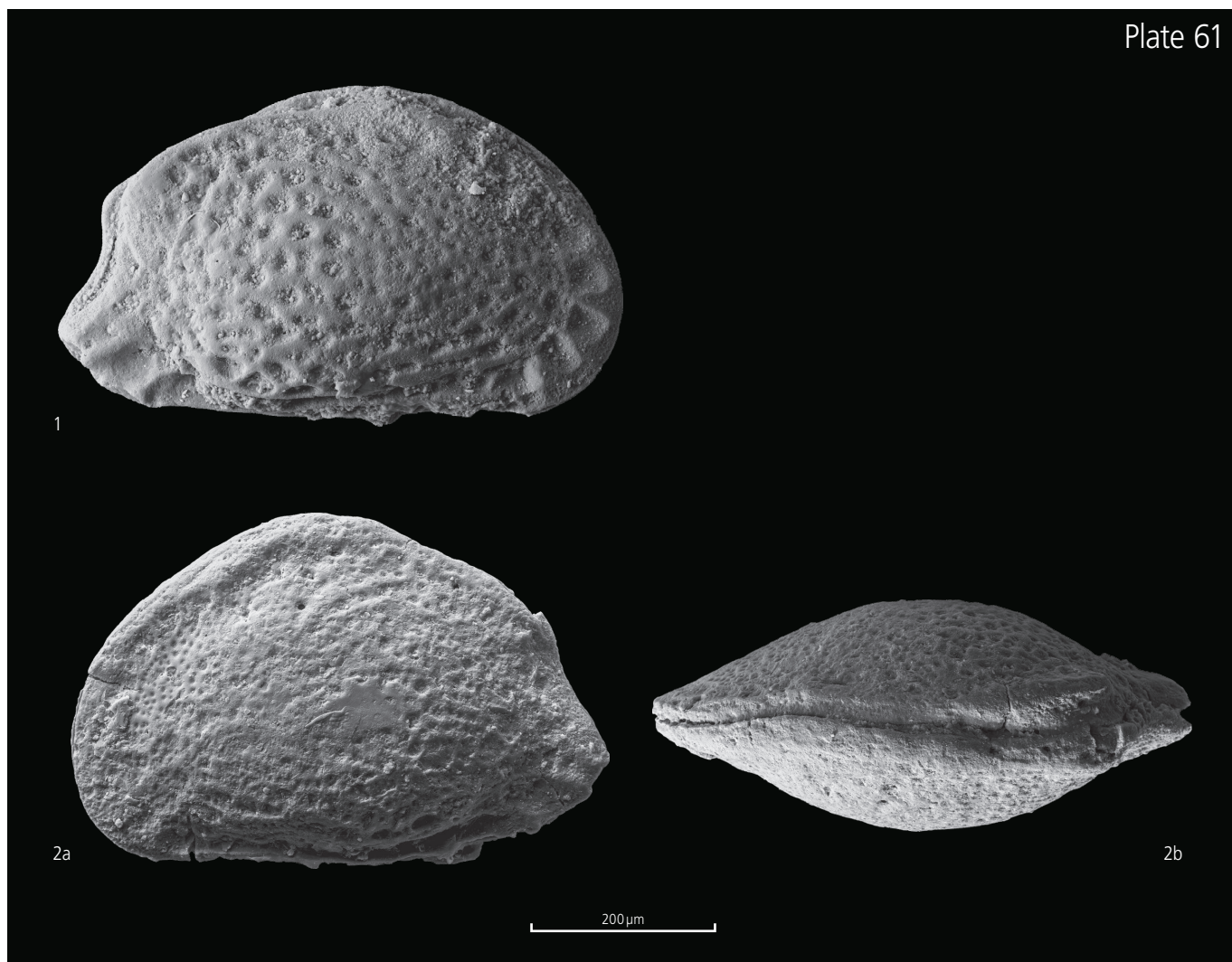
Late Rupelian, Cornol - Route Nationale

Carapace, L 579 × H 380 × W 248 μm

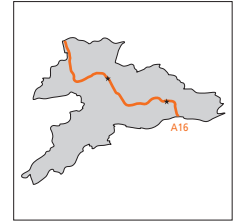
a) left lateral view (image Pokornyella 66_30OUT.psd)

b) dorsal view (image Pokornyella 66_30DOR.psd)

Plate 61



PODOCOPIDA

Cytheretta bernensis Oertli, 1956**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cytherettidae	<i>Cytheretta</i>	<i>bernensis</i>

Determination (name/date): Claudius Pirkenseer/28.09.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Delémont - Communance (DEL-COM)	592 128/244 453

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
DEL-BEE	19	1800	1/260/767	BEE006-33/BEE004-165, 168/BEE003-557, 860
DEL-BEE	19	1900	261	BEE004-218
DEL-COM	5	-64.0 m	29	COM990-11, 46-47

Material

adult: 21 carapaces, 1 left valve (fragmentary specimens not counted; specimen count may be lower due to generally poor preservation and morphological and size overlap with *Cytheretta tenuistriata*).

Measurements (µm)

diverse samples	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	female C							
	female C	1	879	–	473	–	1.86	–
	male C	1	950	–	489	–	1.94	–

Taxonomic remarks

Cytheretta bernensis is characterised by its medium size, fine punctation distributed over the entire valve surface, delicate anastomosing ridges and a - partly strongly pronounced (in females) - posteroventral valve bulge, leading to a cuneiform outline in dorsal view (see *Cytheretta tenuistriata*, fig. 29) with rather blunt posterior and anterior ends.

Cytheretta tenuipunctata (sensu Keen 1972a) is very similar in size and morphology except for a more lenticular outline in dorsal view and the lack of posteroventral bulges. Keen (1972a) attached *Cytheretta bernensis* to the *C. tenuipunctata* superspecies and maintains the distinction from the larger *C. tenuipunctata* (as opposed to Keij 1957; see discussion for *Cytheretta tenuistriata*).

Synonymy

Genus *Cytheretta* Müller, 1894

Type species: *Ilyobates (?) judaea* Brady, 1868 [sensu Athersuch 1977]

Superspecies: *Cytheretta tenuipunctata* (Bosquet, 1852) [sensu Keen 1972]

Morphogroup: *Cytheretta tenuipunctata* (Bosquet, 1852) - *bernensis* Oertli, 1956

Cytheretta bernensis Oertli, 1956

- * 1956 *Cytheretta bernensis* – Oertli, p. 62-63, pl. 7., fig. 172, 18
- 2008 *Cytheretta bernensis* – Picot et al., p. 492, fig. 5

Type locality and horizon

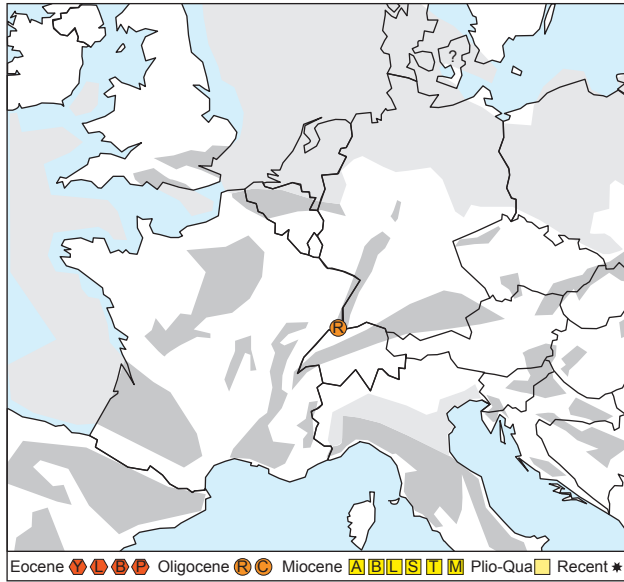
River Sorne bed southwest of Delémont (Switzerland), sample locality 475, "Blaue Tone" (Rupelian) sensu Oertli (1956).

Holotype

Male right valve, MOOE 1640/1, Natural History Museum of Bern.

Geographic and stratigraphic distribution

Cytheretta bernensis occurs exclusively in the Rupelian of the southernmost Upper Rhine Graben (Oertli 1956; Picot et al. 2008).



Temporal and spatial distribution of Cytheretta bernensis in the Cenozoic of Europe.

geometric forms=epochs letters=stages
without letters=epoch (nonspecific)
gray areas=main sedimentary basins

Ostracoda

Plate 62

Cytheretta bernensis Oertli, 1956

1. COM990-46

Late Rupelian, Delémont - Communance

Male carapace, note the fine punctation and anastomosing ridges on the entire valve surface, L 950 × H 489 × W 453 μm

a) left lateral view (image Cytheretta 66_50OUT.psd)

b) ventral view (image Cytheretta 66_50VEN.psd)

2. COM990-47

Late Rupelian, Delémont - Communance

Female carapace, slightly abraded specimen,

L 879 × H 473 × W 440 μm

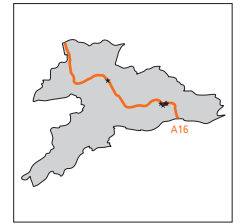
a) left lateral view (image Cytheretta 66_51OUT.psd)

b) dorsal view (image Cytheretta 66_51DOR.psd)

Plate 62



PODOCOPIDA

Cytheretta tenuistriata (Reuss, 1853)**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cytherettidae	<i>Cytheretta</i>	<i>tenuistriata</i>

Determination (name/date): Claudius Pirkenseer/28.09.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Delémont - Beuchille (DEL-BEU)	593 125/244 580
Delémont - Communance (DEL-COM)	592 128/244 453
Rossemaison - Clos Leuchu (ROS-CLU)	592 630/243 770

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	1	-35.8 m	47	RNA987-20
COR-RNA	1	-37.7 m	53	RNA987-34
COR-RNA	2	-9.2 m	57	RNA987-38
DEL-BEE	2	7	30	BEE002-63
DEL-BEE	9	101	963	BEE003-252
DEL-BEE	9	102	962	BEE003-241
DEL-BEE	9	103	961	BEE003-218
DEL-BEE	9	201	213	BEE003-272
DEL-BEE	14	1	679	BEE003-835, 998-1002
DEL-BEE	17	5	965	BEE003-810
DEL-BEE	19	1800	1/260/285/767	BEE006-33/BEE004-165, 257, 304-305/ BEE003-301, 979, 557, BEE003-861
DEL-BEE	19	1900	2/261/769	BEE006-89/BEE004-218-219, 299-301/ BEE003-461, 988-994
DEL-BEE	21	1	294	BEE003-570
DEL-BEU	20	510	574	BEU001-587
DEL-COM	5	-62.0 m	25	COM990-9, 39
DEL-COM	5	-64.0 m	29	COM990-11
ROS-CLU	1	-16.0 m	–	CLU007-197
ROS-CLU	1	-18.0 m	–	CLU007-198

Material

adult: 297 carapaces, 3 left valves, 5 right valves (fragmentary specimens not counted; specimen count may be lower due to generally poor preservation and morphological and size overlap with *Cytheretta bernensis*)

juvenile: 9 carapaces, 3 left valves, 1 right valve

Measurements (µm)

Despite abundant material no additional measurements were carried out due to the poor preservation of the specimens (including deformed carapaces)

diverse samples	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	female C	8	923-1045	967	506-579	537	1.72-1.86	–
	male C	10	1028-1155	1102	533-602	573	1.85-2.02	–
	?A-1 stage C	1	901	–	530	–	1.70	–

Taxonomic remarks

In 1852 Bosquet described and figured *Cythere jurinei* v. *B tenuipunctata* from the Oligocene of Belgium featuring small indistinct punctae on the entire valve surface arranged in longitudinal rows in weakly developed grooves. He indicates a length of 950 µm for the figured specimen. Reuss' (1853) species definition of *Cytherella tenuistriata* from the Oligocene of the Mainz Basin reads similar, however mentions the arrangement of the punctae in single or double rows and the position of the greatest width in the posterior third of the valve, but does not indicate the size. His type figure suggests the presence of a partly diagonal arrangement of punctae.

A first thorough overview of the species *Cytheretta tenuistriata* was elaborated in Triebel (1952) based on new material from the type locality (see there for more details). This large-sized taxon (1080-1130 µm in females, 1220-1280 µm in males) features 6 to 8 indistinct longitudinal ridges of which the median ones merge to an elliptical spot over the adductor muscle scars and surround a double row of punctae. Ornamentation is absent in the posterior and anterior part of the valve. Triebel (1952) also erects the species *Cytheretta posticalis*, which is identical in shape but of somewhat smaller size, with the only distinguishing feature being the strongly reduced ornamentation. The latter consists of a remnant of a rhombical mesh of delicate ridges restricted to the area above the posteroventrolateral valve bulge. This mesh surrounds fields of fine punctae, with the ornamentation being more pronounced on the right valve.

Keij (1957) synonymises *Cytheretta tenuistriata* with *C. tenuipunctata*, without taking into account the size differences (his lectotype chosen from Bosquet's material measures only 960 µm) and the different provenance of both species. His description is nearly identical to Triebel's (1952), adding the potential for some anastomosing of ridges and a lack of ornamentation also on the dorsal side. Oertli (1956) puts three new species of *Cytheretta* (*bernensis*, *variabilis*, *triebeli*) from the Oligocene of northwestern Switzerland in context to *C. tenuistriata* and *C. posticalis*, however does not reference *C. tenuipunctata*.

Due to the pronounced size difference of co-occurring specimens despite the similarity in ornamentation and shape Keen (1972a) maintains both species, but attributes both taxa (including others) to the superspecies *Cytheretta tenuipunctata*. Interestingly he does not include *Cytheretta posticalis* in the superspecies, despite the similarities mentioned by Triebel (1952). *Cytheretta klähni* Stchepinsky, 1963 from the Rupelian of the Alsace is included in the synonymy since it was separated based only on an intermediate ornamentation and shape in dorsal view.

Our material includes abundant transitional specimens (shape, size and ornamentation) intermediate to *Cytheretta tenuistriata* and *C. posticalis* sensu Triebel (1952). Since both taxa originate from the same type region (Mainz Basin), which is part of the larger Upper Rhine Graben sedimentary basin, we accordingly synonymise them. Though a single small female specimen approaches a *tenuipunctata* habitus (see pl. 66.3), it is still too large to be attributed to the latter species. Accordingly we adhere to the (super)species concept sensu Keen (1972a).

Note that females and right valves of both sexes always show a higher degree of ornamentation than males and left valves. The posterior end of females in dorsal view features on average a steeper angle than males and accordingly a more cuneiform/less lenticular outline (fig. 29c). The more ornamented right valve shows a tendency to bulge out more at the posteroventrolateral part than the left valve. For otherwise similar specimens (ridge pattern, size and shape), but featuring a striking difference in punctae size compare e.g. pl. 66.1-2.

Synonymy

Genus *Cytheretta* Müller, 1894

Type species: *Ilyobates (?) judaea* Brady, 1868 [sensu Athersuch 1977]

Superspecies: *Cytheretta tenuipunctata* (Bosquet, 1852) [sensu Keen 1972]

Morphogroup: *Cytheretta tenuistriata* (Reuss, 1853) - *posticalis* (Triebel, 1952)

Cytheretta tenuistriata (Reuss, 1853)

- | | | |
|--------|-------|--|
| * | 1853 | <i>Cytherella tenuistriata</i> n. sp. – Reuss, p. 676-677, p. 9, fig. 10 |
| partim | 1905 | <i>Cythereis jurinei</i> – Lienenklaus, p. 31-32. [sensu Triebel 1952] |
| | 1952 | <i>Cytheretta posticalis</i> n.sp. – Triebel, p. 23-24, pl. 3., fig. 18-21 |
| | 1952 | <i>Cytheretta tenuistriata</i> – Triebel, p. 22-23, pl. 3., fig. 12-15 |
| | 1956 | <i>Cytheretta posticalis</i> – Oertli, p. 59-60, pl. 6., fig. 160-162 |
| | 1956 | <i>Cytheretta tenuistriata</i> – Oertli, p. 61, pl. 6., fig. 163-165 |
| | 1963 | <i>Cytheretta klähni</i> – Stchepinsky, p. 161-162, pl. h.t., fig. 4-7 |
| non | 1964 | <i>Cytheretta tenuistriata</i> – Sönmez-Gökçen, p. 53-54, pl. 1., fig. 4 |
| | 1972a | <i>Cytheretta posticalis parisiensis</i> subsp. nov. – Keen, p. 320-321, pl. 18., fig. 1-4, 6 |
| | 1972a | <i>Cytheretta tenuistriata tenuistriata</i> – Keen, p. 312-313, pl. 13., fig. 1-12 |
| | 1972a | <i>Cytheretta tenuistriata ornata</i> – Keen, p. 313-314, pl. 16., fig. 5, 7 |
| | 1973 | <i>Cytheretta tenuistriata</i> – Sönmez-Gökçen, p. 45, pl. 5., fig. 25-27 |
| ? | 1975 | <i>Cytheretta posticalis</i> – Brestenská, p. 394 |
| ? | 1975 | <i>Cytheretta tenuistriata</i> – Brestenská, p. 395 |
| | 1975 | <i>Cytheretta tenuistriata</i> – Doehl & Sonne, p. 142, pl. 1, fig. 8 |
| | 1975 | <i>Cytheretta posticalis</i> – Faupel, p. 19-20, pl. 2, fig. 4 |
| | 1975 | <i>Cytheretta tenuistriata</i> – Faupel, p. 20-21, pl. 2, fig. 5 |
| | 1978 | <i>Cytheretta posticalis parisiensis</i> – Keen, tab. 3, pl. 8., fig. 13 |
| | 1993 | <i>Cytheretta posticalis</i> – Kammerer, p. 75-76, pl. 10., fig. 1-6 |
| non | 1993 | <i>Cytheretta tenuistriata</i> or cf. <i>tenuistriata</i> [lapsus] - Nazik, p. 24, pl. 1, fig. 10-12 |
| ? | 1999 | <i>Cytheretta tenuistriata</i> – Şafak et al., p. 29, pl. 2, fig. 14 |
| | 2002 | <i>Cytheretta posticalis</i> – Picot, p. 144-145, pl. 6., fig. 6-8, pl. 7, fig. 1-2 |
| ? | 2004 | <i>Cytheretta posticalis</i> – Monostori, p. 64, pl. 19., fig. 6 |
| ? | 2005 | <i>Cytheretta tenuistriata</i> – Janz & Vennemann, App. A |
| | 2008 | <i>Cytheretta posticalis</i> – Picot et al., p. 59-60, pl. 3., fig. 4 |
| | 2008 | <i>Cytheretta posticalis</i> – Picot et al., p. 59-60, pl. 3., fig. 4 |
| | 2009 | <i>Cytheretta posticalis parisiensis</i> – Lord et al., pl. 2., fig. 7 |
| | 2011 | <i>Cytheretta posticalis</i> – Pirkenseer & Berger, p. 77-79, pl. 11., fig. 6-7, pl. 12, fig. 1-2 |
| ? | 2012 | <i>Cytheretta tenuistriata</i> – Carbonel et al., fig. 17-18 |

Type locality and horizon

Weinheim bei Alzey (Germany), “unterer Meeressand” sensu Reuss (1853), Rupelian sensu Triebel (1952).

Holotype

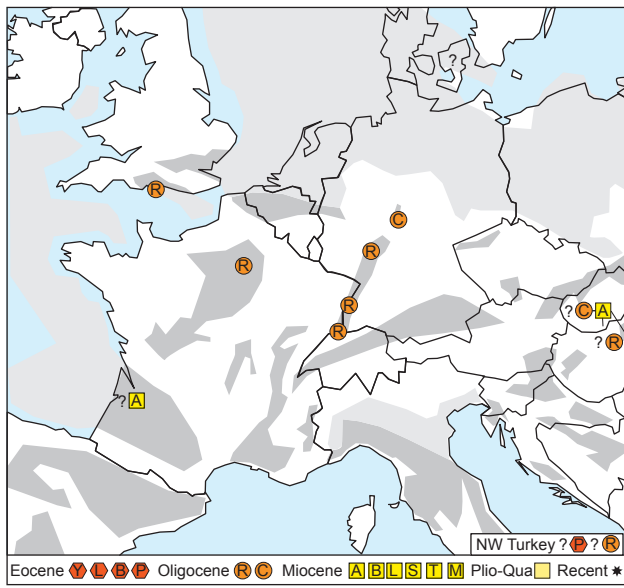
Not designated, material lost (see Triebel 1952).

Neotype

Male carapace chosen from new material from the type locality (Triebel 1952), X/e 1635, Senckenberg Museum, Frankfurt a.M. (Germany).

Geographic and stratigraphic distribution

Cytheretta tenuistriata occurs mainly in the Rupelian of the Upper Rhine Graben (Oertli 1956; Stchepinsky 1963; Kammerer 1993; Picot et al. 2008; Pirkenseer & Berger 2011), the Hampshire Basin (Keen 1978; Lord et al. 2009), the Paris Basin (Keen 1982) as well as in the Chattian of central Germany (Faupel 1975). Potential records include the Priabonian and Rupelian of northwestern Turkey (Sönmez-Gökçen 1973, Şafak et al. 1999), the Rupelian of Hungary and southern Slovakia (Brestenská 1975; Monostori 2004) and the Aquitanian of southwestern France (Carbonel et al. 2012). The species may have occurred in a wider area, depending on a future taxonomic reevaluation of related taxa.



Temporal and spatial distribution of *Cytheretta tenuistriata* in the Cenozoic of Europe.

geometric forms=epochs letters=stages without letters=epoch (nonspecific) gray areas=main sedimentary basins

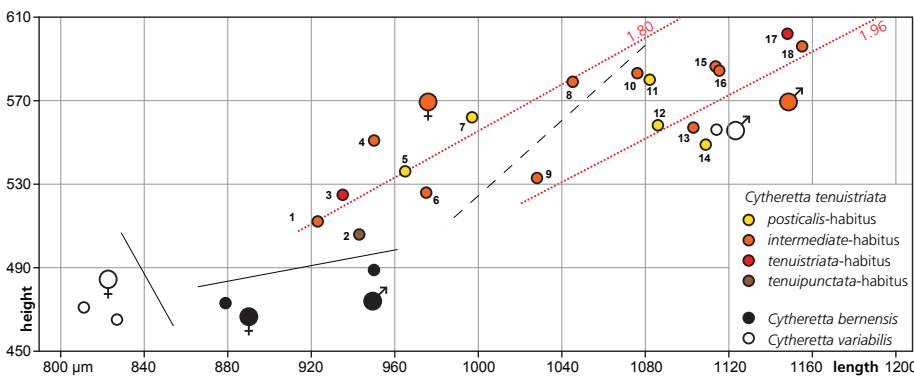


Fig. 27. Length/height plot of colour-coded *Cytheretta* spp. carapaces. Small numbers in bold denote equivalent carapaces in fig. 27 and 28. Close position of large females (8) and small high males (10, 11) may lead to misinterpretation in isolated specimens. Note the much larger *Cytheretta variabilis* male.

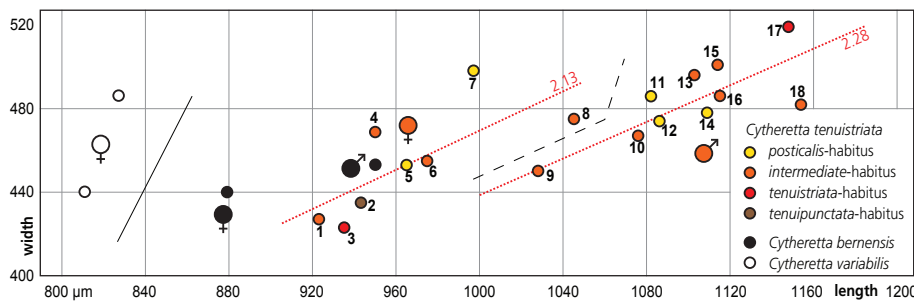


Fig. 28. Length/width plot of colour-coded *Cytheretta* spp. carapaces. Note the more consistent clustering of intermediate males (10, 11) from fig. 27. Female 8 shows conform L/H-ratio in fig. 28, but “male” L/W-ratio in fig. 28.

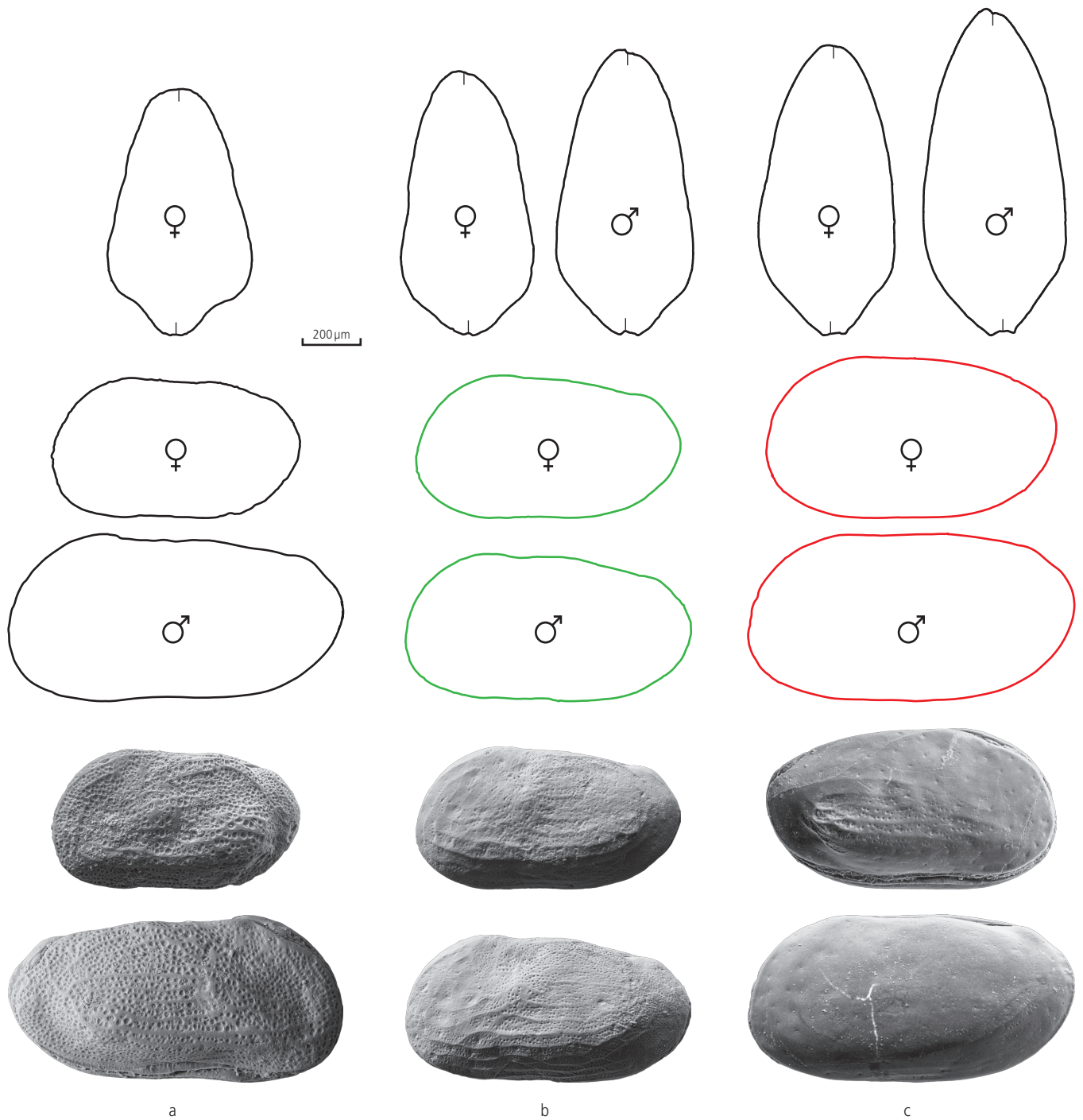


Fig. 29. Ornamentation and dorsal view vs. lateral view outline comparison of *Cytheretta* carapaces from the research area.

- a) *Cytheretta variabilis*: note the pronounced lateral bulge near the posterior end, the coarse punctation, the widely rounded anterior end, the slightly concave ventral margin and the slightly "humpbacked" dorsal margin. Note the exceptionally large male specimen.
- b) *Cytheretta bernensis*: intermediate features including less pronounced posterior lateral bulges leading to a more cuneiform dorsal view. Ornamentation consists of fine punctation on the entire valve surface and fine anastomosing ridges.
- c) *Cytheretta tenuistriata* standard specimens (no 5 & 12 from fig. 27 & 28): reduced ornamentation, ovoid lateral outline and more lenticular outline in dorsal view.

Ostracoda

Plate 63

Cytheretta tenuistriata (Reuss, 1853) - *posticalis*
(Triebel, 1952) morphogroup

1. BEE003-979

Late Rupelian, Delémont-Beuchille Est

Male carapace, slightly abraded normal specimen, *posticalis*-habitus with strongly reduced ornamentation, and few coarse punctae distributed over the entire valve surface, L 1109 × H 549 × W 478 μm

a) left lateral view (image Cytheretta 67_22OUT.psd)

b) ventral view (image Cytheretta 67_22VEN.psd)

2. BEE003-1002

Late Rupelian, Delémont-Beuchille Est

Male carapace, well preserved comparatively high specimen, *posticalis*-habitus with strongly reduced ornamentation, and few coarse punctae distributed over the entire valve surface, L 1086 × H 558 × W 474 μm

a) left lateral view (image Cytheretta 67_30OUT.psd)

b) dorsal view (image Cytheretta 67_30DOR.psd)

3. BEE003-988

Late Rupelian, Delémont-Beuchille Est

Male carapace, well preserved high specimen approaching female lateral proportions, *posticalis*-habitus with strongly reduced ornamentation, and few coarse punctae distributed over the entire valve surface, L 1082 × H 580 × W 486 μm

a) right lateral view (image Cytheretta 67_12OUT.psd)

b) ventral view (image Cytheretta 67_12VEN.psd.psd)

4. BEE003-1000

Late Rupelian, Delémont-Beuchille Est

Male carapace, well preserved normal specimen, *posticalis*-habitus with reduced ornamentation, but slight tendency to *tenuistriata*-habitus with hints of lateral reticulation and more numerous fine punctae, L 1103 × H 557 × W 496 μm

a) left lateral view (image Cytheretta 67_28OUT.psd)

b) dorsal view (image Cytheretta 67_28DOR.psd)

5. BEE003-998

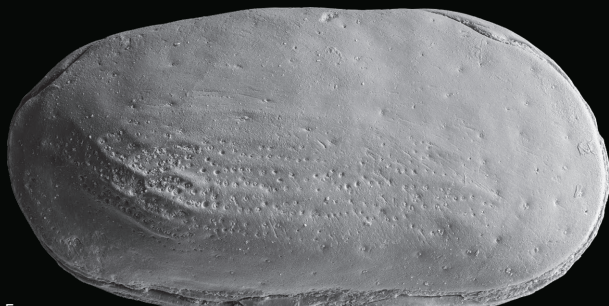
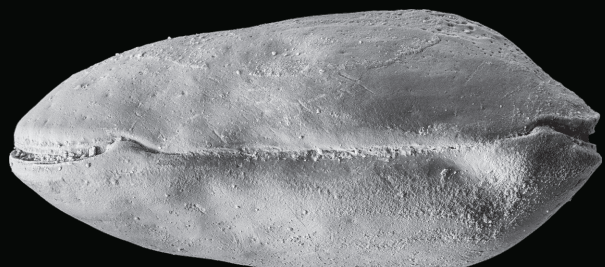
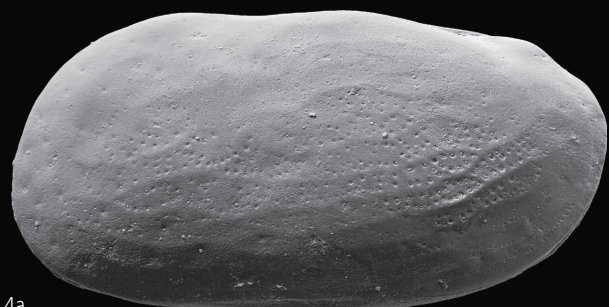
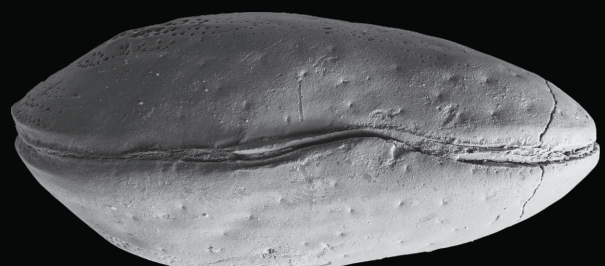
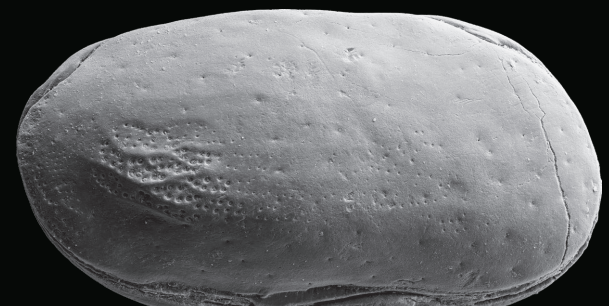
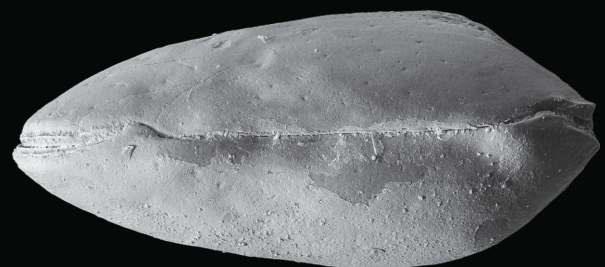
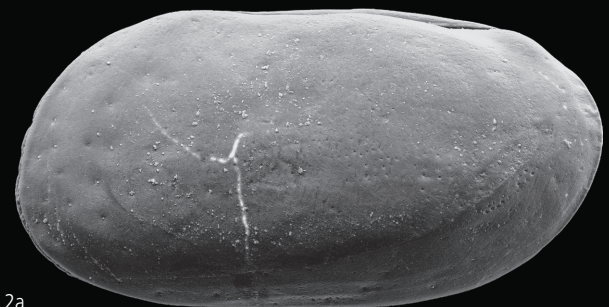
Late Rupelian, Delémont-Beuchille Est

Male carapace, well preserved comparatively high specimen, *posticalis*-habitus with reduced ornamentation, but tendency to *tenuistriata*-habitus with hints of lateral reticulation and more numerous fine punctae, L 1114 × H 586 × W 501 μm

a) right lateral view (image Cytheretta 67_26OUT.psd)

b) ventral view (image Cytheretta 67_26VEN.psd)

Plate 63



200 μm

Ostracoda

Plate 64

Cytheretta tenuistriata (Reuss, 1853) - *posticalis*
(Triebel, 1952) morphogroup

1. BEE004-299

Late Rupelian, Delémont-Beuchille Est

Male carapace, well preserved comparatively high specimen, *posticalis*-*habitus*, but approaching *tenuistriata*-*habitus*,

L 1115 × H 585 × W 486 μm

a) right lateral view (image *Cytheretta* 67_1OUT.psd)

b) ventral view (image *Cytheretta* 67_1VEN.psd)

2. BEE004-300

Late Rupelian, Delémont-Beuchille Est

Male carapace, slightly abraded large normal specimen, approaching *tenuistriata*-*habitus* with lateral reticulation and numerous fine punctae that are restricted to lateral valve centre,

L 1155 × H 596 × W 482 μm

a) right lateral view (image *Cytheretta* 67_2OUT.psd)

b) dorsal view (image *Cytheretta* 67_2DOR.psd)

3. BEE003-989

Late Rupelian, Delémont-Beuchille Est

Male carapace, slightly abraded small normal specimen, approaching *tenuistriata*-*habitus* with lateral reticulation and numerous fine punctae that are restricted to lateral valve centre,

L 1028 × H 533 × W 450 μm

a) right lateral view (image *Cytheretta* 67_13OUT.psd)

b) ventral view (image *Cytheretta* 67_13VEN.psd)

4. BEE004-301

Late Rupelian, Delémont-Beuchille Est

Male carapace, well preserved large comparatively high specimen, *tenuistriata*-*habitus* with lateral reticulation and numerous fine punctae, L 1148 × H 602 × W 519 μm

a) right lateral view (image *Cytheretta* 67_3OUT.psd)

b) ventral view (image *Cytheretta* 67_3VEN.psd)

5. BEE003-991

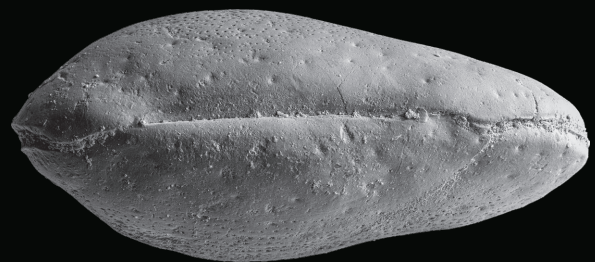
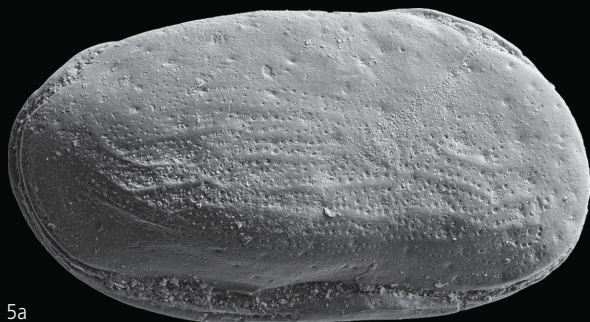
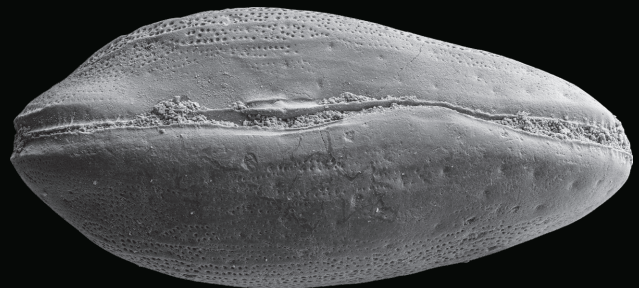
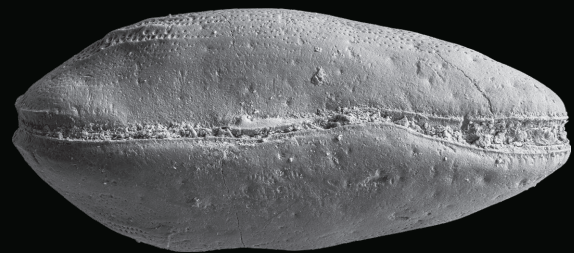
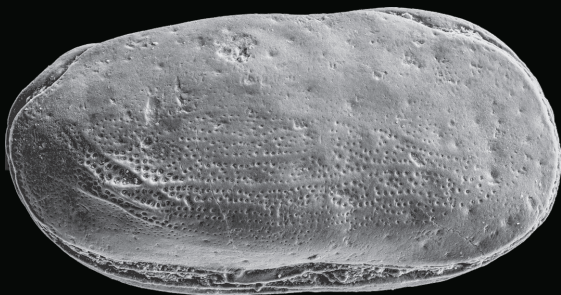
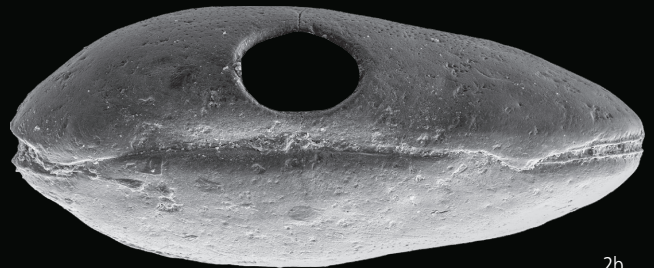
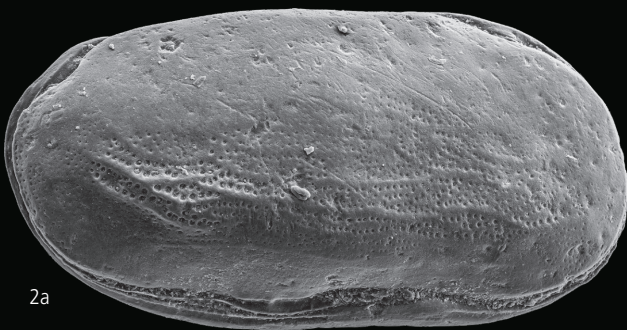
Late Rupelian, Delémont-Beuchille Est

Male carapace, slightly abraded high specimen approaching female lateral proportions, approaching *tenuistriata*-*habitus* with lateral reticulation and numerous fine punctae, but restricted to lateral valve centre, L 1076 × H 583 × W 467 μm

a) right lateral view (image *Cytheretta* 67_15OUT.psd)

b) dorsal view (image *Cytheretta* 67_15DOR.psd)

Plate 64



200 μ m

Ostracoda

Plate 65

Cytheretta tenuistriata (Reuss, 1853) - *posticalis*
(Triebel, 1952) morphogroup

1. BEE003-1001

Late Rupelian, Delémont-Beuchille Est

Female carapace, well preserved normal specimen, *posticalis*-habitus,
L 965 × H 536 × W 452 μm

a) right lateral view (image Cytheretta 67_29OUT.psd)

b) ventral view (image Cytheretta 67_29VEN.psd)

2. BEE003-994

Late Rupelian, Delémont-Beuchille Est

Female carapace, well preserved high specimen, *posticalis*-habitus,
L 997 × H 562 × W 498 μm

a) left lateral view (image Cytheretta 67_18OUT.psd)

b) dorsal view (image Cytheretta 67_18DOR.psd)

3. COM990-39

Late Rupelian, Delémont-Communance

Female carapace, slightly abraded large normal specimen, *posticalis*-
habitus, but slight tendency to *tenuistriata*-habitus with single and
double rows of punctae between reticulation,
L 1045 × H 579 × W 475 μm

a) right lateral view (image Cytheretta 66_43OUT.psd)

b) dorsal view (image Cytheretta 66_43DOR.psd)

4. BEE003-993

Late Rupelian, Delémont-Beuchille Est

Female carapace, well preserved low specimen, *posticalis*-habitus,
but approaching *tenuistriata*-habitus with double rows of punctae
between reticulation, L 975 × H 526 × W 454 μm

a) left lateral view (image Cytheretta 67_17OUT.psd)

b) dorsal view (image Cytheretta 67_17.psd)

5. BEE003-992

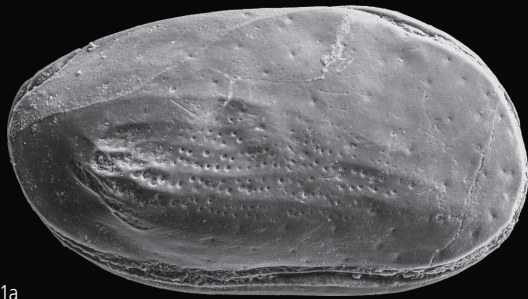
Late Rupelian, Delémont-Beuchille Est

Female carapace, well preserved normal small specimen, *posticalis*-
habitus, but approaching *tenuistriata*-habitus with double rows of
punctae between reticulation, L 923 × H 512 × W 427 μm

a) left lateral view (image Cytheretta 67_16OUT.psd)

b) ventral view (image Cytheretta 67_16VEN.psd)

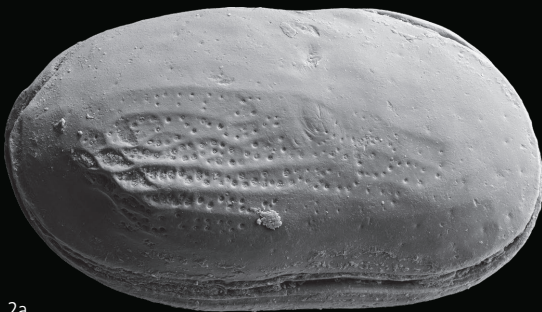
Plate 65



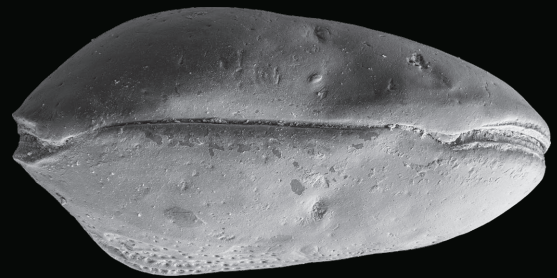
1a



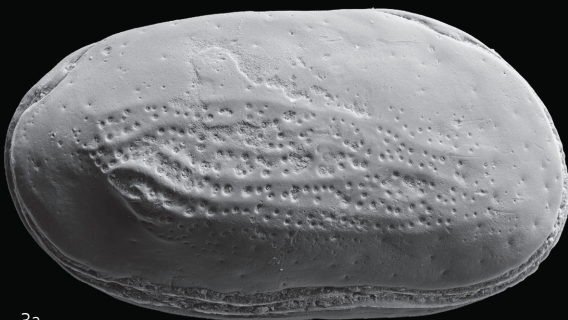
1b



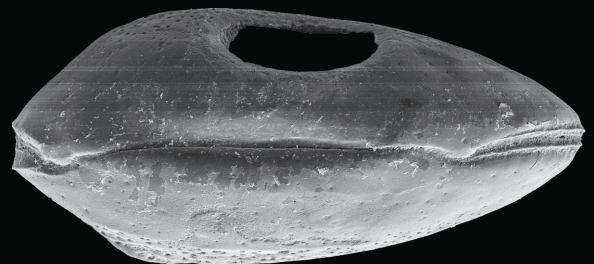
2a



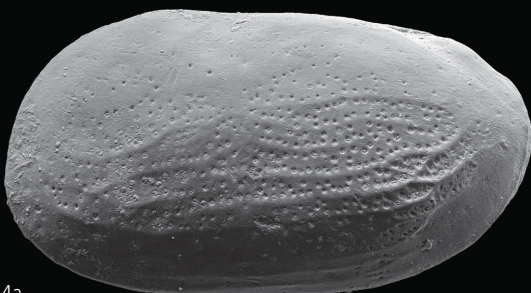
2b



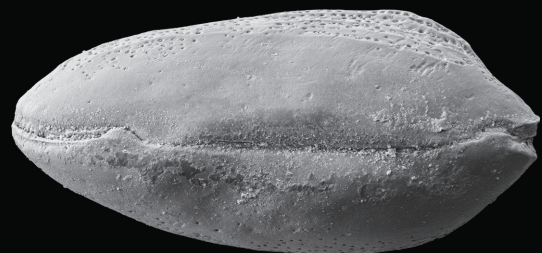
3a



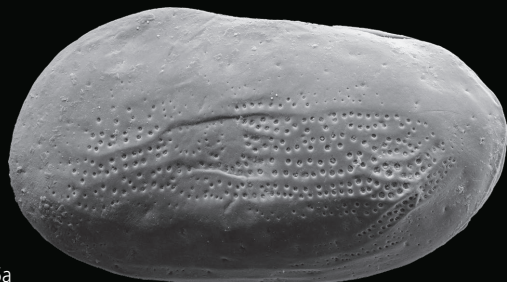
3b



4a



4b



5a



5b

200 μm

Ostracoda

Plate 66

Cytheretta tenuistriata (Reuss, 1853) - *posticalis*
(Triebel, 1952) morphogroup

1. BEE003-999

Late Rupelian, Delémont-Beuchille Est

Female carapace, well preserved very high specimen, approaching *tenuistriata*-habitus with single and double rows of large punctae between reticulation, L 950 × H 551 × W 469 μm

a) right lateral view (image Cytheretta 67_27OUT.psd)

b) slightly tilted dorsal view (image Cytheretta 67_27DOR.psd)

2. BEE003-990

Late Rupelian, Delémont-Beuchille Est

Female carapace, well preserved high and small specimen, *tenuistriata*-habitus with double and triple rows of small punctae between reticulation, L 935 × H 525 × W 423 μm

a) left lateral view (image Cytheretta 67_14OUT.psd)

b) ventral view (image Cytheretta 67_14VEN.psd)

3. BEE004-267

Late Rupelian, Delémont-Beuchille Est

Female carapace, slightly abraded low specimen, *tenuistriata*-habitus with irregular arrangement of very small punctae between partly anastomosing reticulation, approaching *tenuipunctata*-habitus, but not size, L 943 × H 506 × W 435 μm

a) left lateral view (image Cytheretta 66_58OUT.psd)

b) ventral view (image Cytheretta 66_58DOR.psd)

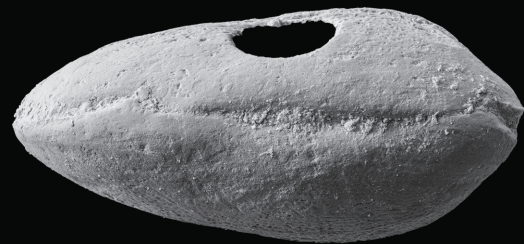
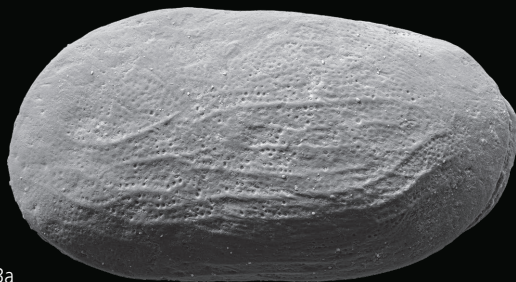
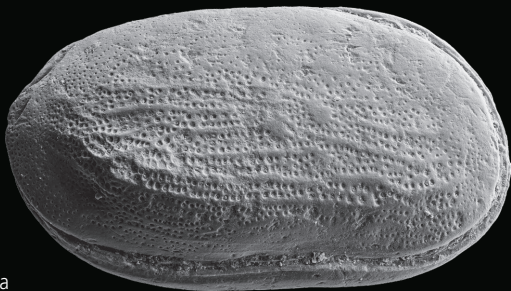
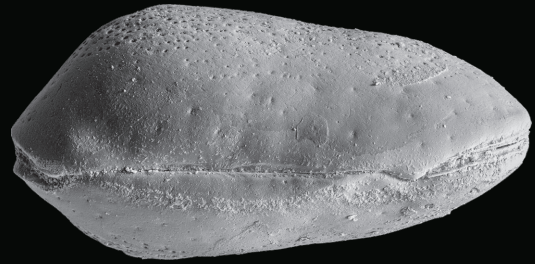
4. BEE004-165

Late Rupelian, Delémont-Beuchille Est

Potential A-1 stage carapace, squeezed and cracked specimen, L 901 × H 530 μm

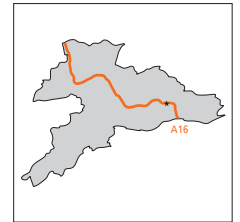
left lateral view (image Cytheretta BEE_plot1_18.psd)

Plate 66



200 μ m

PODOCOPIDA

Cytheretta variabilis Oertli, 1956**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cytherettidae	<i>Cytheretta</i>	<i>variabilis</i>

Determination (name/date): Claudius Pirkenseer/28.09.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
DEL-BEE	17	5	965	BEE003-810
DEL-BEE	19	1800	1/260/767	BEE003-557, 860, 957, 1005/BEE004-165, 269/BEE006-33

Material

adult: 9 carapaces

Measurements (µm)

diverse samples	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	female C	3	787-827	808	465-471	468	1.69-1.78	1.73
	male C	1	1114	–	556	–	2.00	–

Taxonomic remarks

Cytheretta variabilis is characterised by its medium size, a coarse punctation distributed over the entire valve surface, very broadly rounded anterior margin in lateral view and a pronounced posteroventral valve bulge, leading to a distinct outline in dorsal view (see *Cytheretta tenuistriata*, fig. 29) with blunt anterior margin and strongly concave outline between the posterior end and the greatest width. Keen (1972a) tentatively attached *Cytheretta variabilis* to the *C. tenuipunctata* superspecies, which appears to be justified when comparing the ridge patterns in both taxa.

Poorly preserved material from the Rupelian of Hungary has been attributed to *Cytheretta variabilis*, which otherwise seems to represent a species endemic to the southern Upper Rhine Graben. Note that the figured specimens correspond to the extremes in size variations given in Oertli (1956).

SynonymyGenus *Cytheretta* Müller, 1894Type species: *Ilyobates* (?) *judaea* Brady, 1868 [sensu Athersuch 1977]? Superspecies: *Cytheretta tenuipunctata* (Bosquet, 1852) [sensu Keen 1972]*Cytheretta variabilis* Oertli, 1956

- * 1956 *Cytheretta variabilis* – Oertli, p. 62-63, pl. 7., fig. 172, 180-188
- ? 2004 *Cytheretta variabilis* – Monostori, p. 65, pl. 19, fig. 7-8
- 2008 *Cytheretta variabilis* – Picot et al., fig. 5, pl. 3, fig. 7 [non 8, lapsus]

Type locality and horizon

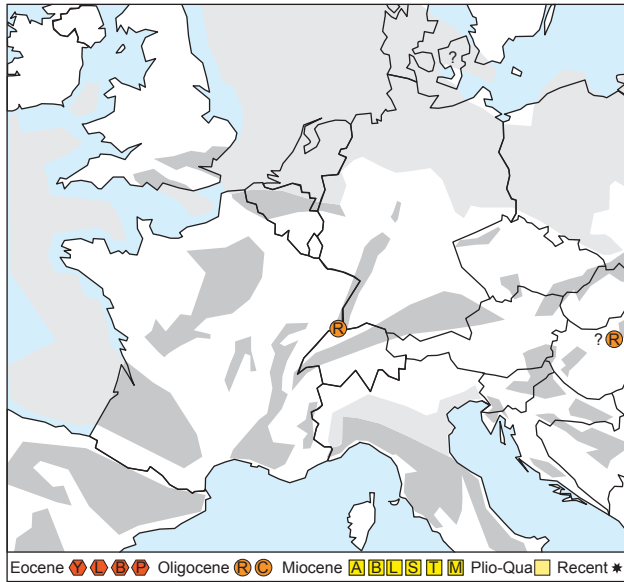
River Sorne bed southwest of Delémont (Switzerland), sample locality 167, "Blaue Tone" (Rupelian) sensu Oertli (1956).

Holotype

Female left valve, MOOE 1650/1, Natural History Museum of Bern.

Geographic and stratigraphic distribution

Cytheretta variabilis occurs in the Rupelian of the southernmost Upper Rhine Graben (Oertli 1956; Picot et al. 2008). A potential record includes the Rupelian of Hungary (Monostori 2004).



Temporal and spatial distribution of Cytheretta variabilis in the Cenozoic of Europe.

geometric forms=epochs letters=stages
 without letters=epoch (nonspecific)
 gray areas=main sedimentary basins

Ostracoda

Plate 67

Cytheretta variabilis Oertli, 1956

1. BEE003-957

Late Rupelian, Delémont-Beuchille Est

Male carapace, very large specimen, lateral ridges delicate, but recognisable, L 1114 × H 556 μm

right lateral view (image Cytheretta BEE_plot1_2.psd)

2. BEE003-1005

Late Rupelian, Delémont-Beuchille Est

Female carapace, very small specimen, normal punctae, lateral ridges indistinct, L 827 × H 465 × W 486 μm

a) left lateral view (image Cytheretta 67_25OUT.psd)

b) ventral view (image Cytheretta 67_25VEN.psd)

3. BEE004-269

Late Rupelian, Delémont-Beuchille Est

Female carapace, large punctae, lateral ridges nearly absent, L 811 × H 471 × W 440 μm

a) right lateral view (image Cytheretta 66_60OUT.psd)

b) dorsal view (image Cytheretta 66_60DOR.psd)

4. BEE003-810

Late Rupelian, Delémont-Beuchille Est

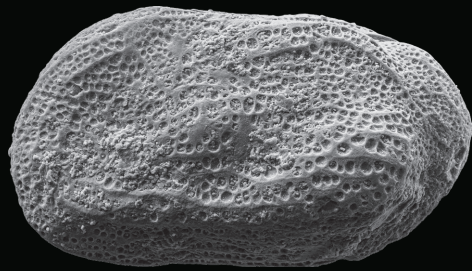
Female carapace, extremely small specimen, ?possibly large A-1 instar, very large punctae, lateral ridges not developed, L 787 × H 467 μm

right lateral view (image Cytheretta BEE_plot1_14.psd)

Plate 67



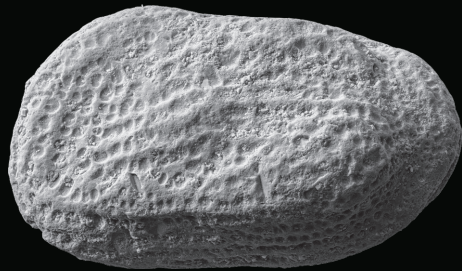
1a



2a



2b



3a



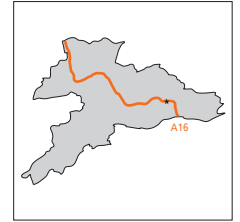
3b



4

200 μm

PODOCOPIDA

Flexus concinnus (Triebel, 1952)**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cytherettidae	<i>Flexus</i>	<i>concinnus</i>

Determination (name/date): Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Related cell or specimen number
DEL-BEE	17	5	965	BEE003-810
DEL-BEE	19	1800	260/767	BEE004-165, 168, 268, 270, 291/BEE003-557
DEL-BEE	19	1900	261	BEE004-218

Material

adult: 9 carapaces

Measurements (µm)

diverse samples	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	female C/L	3	709-735	725	400-407	403	1.74-1.84	1.80
	female R	1	698	–	349	–	2.00	–

Taxonomic remarks

Oertli (1956) erected the separate species *Cytheretta gutzwilleri* for material from the southernmost Upper Rhine Graben, based on a much finer reticulation and less well-developed longitudinal lateral ridges than was described for *Flexus concinnus* sensu Triebel (1952). Kammerer (1993) and Pirkenseer & Berger (2011) however merged both species due to the occurrence of intermediately ornamented specimens (showing a similar second order reticulation) interpreted to represent ecomorphotypes.

Interestingly the material in Oertli (1956) and from DEL-BEE is smaller or at the lowest end of the size spectrum cited in Kammerer (1993), Triebel (1952) and Pirkenseer & Berger (2011). Length/height-ratios in the DEL-BEE material are also considerably lower (mean female L/H 1.80 vs. 1.96) than those from the southern Upper Rhine Graben (Pirkenseer & Berger 2011).

Synonymy

Genus *Flexus* Neviani, 1928

Type species: *Cythere plicata* von Münster, 1830

Flexus concinnus (Triebel, 1952)

- 1852 *Cythere plicata* – Bosquet, p. 60, pl. 2, fig. 30 [sensu Keen 1972a]
- 1863 *Cythere plicata* - von Speyer, p. 29, pl. 4, fig. 2 [sensu Faupel 1975]
- 1905 *Cythereis plicata* – Lienenklaus, p. 37 [sensu Triebel 1952]
- * 1952 *Cytheretta concinna* n.sp. – Triebel, p. 27-29, pl. 5, fig. 31-33
- non 1955 *Cytheretta concinna* - Apostolescu, 261, pl. 4, fig. 72-74 [*Cytheretta decipiens*, see Keen 1972a]
- 1956 *Cytheretta gutzwilleri* n. sp. - Oertli, p. 64-65, pl. 8, fig. 189-192
- 1957 *Cytheretta concinna* - Keij, p. 132-133, pl. 10, fig. 6
- ? 1967 *Cytheretta (Protocytheretta) concinna* – Kheil, p. 223-224, pl. 1C, fig. 7 [possibly reworked sensu author]
- 1967 *Flexus gutzwilleri* - Witt, p. 78
- ? 1971 *Cytheretta (Protocytheretta) concinna* - Kollmann, p. 679, tab. 5/2
- ? 1971 *Cytheretta concinna* - Scheremeta, p. 147-148, 157, tab. 1
- 1972a *Flexus concinnus* - Keen, p. 339, pl. 22, fig. 2, 3, 5
- ? 1972a *Flexus gutzwilleri* - Keen, p. 340, pl. 22, fig. 4
- ? 1973 *Cytheretta concinna* - Sönmez-Gökçen, p. 44, pl. 5, fig. 18-19
- 1975 *Cytheretta concinna* - Faupel, p. 142, pl. 1, fig. 7
- 1975 *Cytheretta (Flexus) aff. concinna* - Faupel, p. 22, pl. 2, fig. 6
- 1993 *Flexus concinnus* - Kammerer, p. 77-78, pl. 10, fig. 9-10
- non 1999 *Cytheretta concinna* - Şafak et al., pl. 3, fig. 15
- 2008 *Cytheretta gutzwilleri* - Picot et al., pl. 3, fig. 8 [non pl. 3, fig. 7 = *Cytheretta variabilis*]
- 2011 *Flexus concinnus* - Pirkenseer & Berger, p. 81-83, pl. 12, fig. 7, pl. 13, fig. 1-2

Type locality and horizon

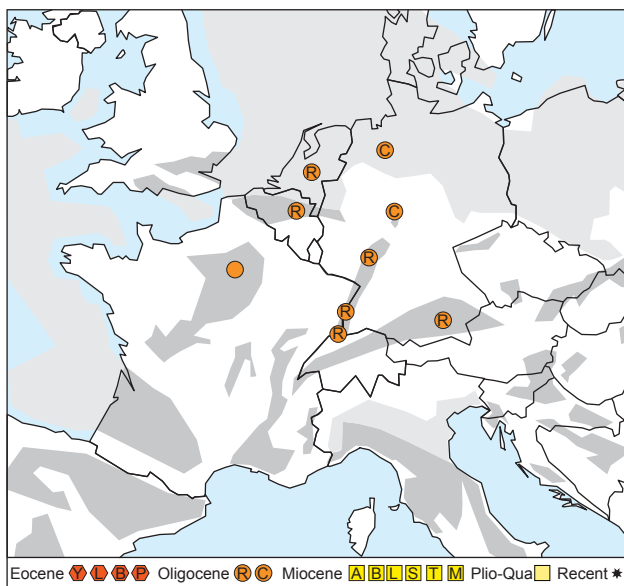
Locality Welschberg near Waldböckelheim (W Germany), “Meeressand”, “Rupelian” (sensu Triebel 1952).

Holotype

Female carapace, SMF X/e 1676, Senckenberg Museum, Frankfurt a.M. (Germany).

Geographic and stratigraphic distribution (sensu authors)

Flexus concinnus is a species occurring in the Oligocene (especially the Rupelian) of central and northwestern Europe (Triebel 1952; Oertli 1956; Keij 1957; Witt 1967; Keen 1972a; Faupel 1975; Kammerer 1993; Picot et al. 2008; Pirkenseer & Berger 2011). Older (Bartonian-Priabonian; e.g. Keij 1957; Scheremeta 1971; Sönmez-Gökçen 1973) and younger (Eggenburgian; Kollmann 1971) records should be treated cautiously, since sufficient information or good illustrations are lacking.



Temporal and spatial distribution of *Flexus concinnus* in the Cenozoic of Europe.

geometric forms=epochs letters=stages
without letters=epoch (nonspecific)
gray areas=main sedimentary basins

Ostracoda

Plate 68

Flexus concinnus (Triebel, 1952)

1. BEE004-268

Late Rupelian, Delémont - Beuchille Est

Female carapace, L 730 × H 403 × W 267 μm

a) left lateral view (image Flexus 66_59OUT.psd)

b) dorsal view (image Flexus 66_59DOR.psd)

2. BEE004-270

Late Rupelian, Delémont - Beuchille Est

Female carapace, L 735 × H 400 μm

left lateral view (image Flexus 66_61OUT.psd)

3. BEE003-557

Late Rupelian, Delémont - Beuchille Est

Female carapace, small specimen,

left valve L 645 × H 370 μm, right valve L 630 × H 319 μm

left lateral view (image Flexus BEE_plot1_4.psd)

4. BEE004-291

Late Rupelian, Delémont - Beuchille Est

Female carapace,

left valve L 709 × H 407 μm, right valve L 698 × H 349 μm, W 372 μm

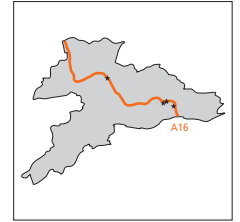
a) right lateral view (image Flexus 66_82OUT.psd)

b) dorsal view (image Flexus 66_82DOR.psd)

Plate 68



PODOCOPIDA

Loxoconcha cf. *marionae* Kammerer, 1993**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Loxoconchidae	<i>Loxoconcha</i>	cf. <i>marionae</i>

Determination (name/date): Claudius Pirkenseer/29.08.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Courrendlin - Hauts Rochets (CRD-HRT)	595 640/243 145
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Rossemaison - Clos Leuchu (ROS-CLU)	592 630/243 770

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	2	-9.2 m	57	RNA987-38, 110
COR-RNA	2	-16.4 m	55	RNA987-36
CRD-HRT	15	-53.0 m	?	HRT988-25
DEL-BEE	9	100	110	BEE003-479
DEL-BEE	9	101	963	BEE003-252
DEL-BEE	9	102	962	BEE003-241
DEL-BEE	9	103	961	BEE003-218
DEL-BEE	9	201	213	BEE003-272
DEL-BEE	19	1800	767	BEE003-557
DEL-BEE	19	1900	2/769	BEE006-91/BEE003-461, 867, 980-981
ROS-CLU	1	-106.0 m	54	CLU007-197

Material

adult: 156 carapaces, 3 left valves, 2 right valves (fragmentary specimens not counted)

juvenile: 3 carapaces, 1 left valve, 2 right valves

Measurements (µm)

Despite abundant material no additional measurements were carried out due to the poor preservation of the specimens (abraded caudal processes, deformed carapaces)

diverse samples	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	female C	1	647	–	358	–	1.81	–
	male C	1	651	–	309	–	2.11	–
	A-1 stage C	1	544	–	292	–	1.86	–

Taxonomic remarksFor the discussion see *Loxoconcha nystiana*.

Synonymy

Genus *Loxoconcha* Sars, 1866

Type species: *Cythere rhomboidea* Fischer, 1855

Loxoconcha cf. *marionae* Kammerer, 1993

- partim 1918 *Loxoconcha favata* n. sp. – Kuiper, p. 25-26, pl. 1, fig. 7
- ? 1963 *Loxoconcha alsatica* n. sp. – Stchepinsky, p. 162-164, pl. h.t., fig. 17-24
- ? 1969 *Loxoconcha favata* – Scheremeta, p. 157, pl. 15, fig. 11
- [* 1993 *Loxoconcha (Kuiperiana) marionae* n. sp. – Kammerer, p. 80-81, pl. 11, fig. 8-12.]
- ?partim 1956 *Loxoconcha favata* – Oertli, p. 67-68, pl. 8, fig. 198-206 [non 207]
- 2002 *Loxoconcha nystiana* – Picot, 145, pl. 9, fig. 4-6.

Type locality and horizon

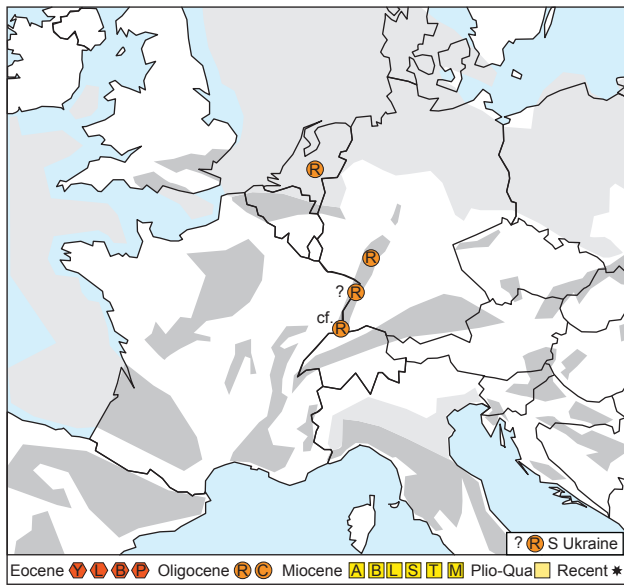
Drilling 27 (KB2), sample 6015/5921, depth 83.25-83.50 m, Bodenheim near Mainz (Germany), "mittlere Zwischenschichten, Schleichsand", Rupelian (?) (sensu Kammerer 1993).

Holotype

Female left valve, SMF Xe 15282, Senckenberg Research Institute, Frankfurt a.M. (Germany).

Geographic and stratigraphic distribution

Loxoconcha marionae occurs in the Rupelian of the Mainz Basin (Kammerer 1993) and possibly the late Rupelian of the middle and southern Upper Rhine Graben (partim? Oertli 1956; Stchepinsky 1963; Picot 2002). Other European material may also be attributed to this species, but this is hampered by a generally poor documentation (e.g. Scheremeta 1969).



Temporal and spatial distribution of *Loxoconcha marionae* in the Cenozoic of Europe.

geometric forms=epochs letters=stages
without letters=epoch (nonspecific)
gray areas=main sedimentary basins

Ostracoda

Plate 69

Loxoconcha cf. *marionae* Kammerer, 1993

1. BEE003-980

Late Rupelian, Delémont-Beuchille Est

Male carapace, L 651 × H 309 × W 273 μm

a) left lateral view (image Loxoconcha 67_4OUT.psd)

b) ventral view (image Loxoconcha 67_4DOR.psd)

2. BEE003-981

Late Rupelian, Delémont-Beuchille Est

Female carapace, L 647 × H 358 × W 287 μm

a) left lateral view (image Loxoconcha 67_5OUT.psd)

b) ventral view (image Loxoconcha 67_5DOR.psd)

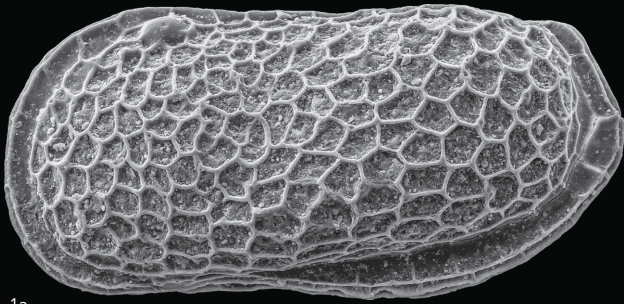
3. RNA987-110

Late Rupelian, Cornol-Route Nationale

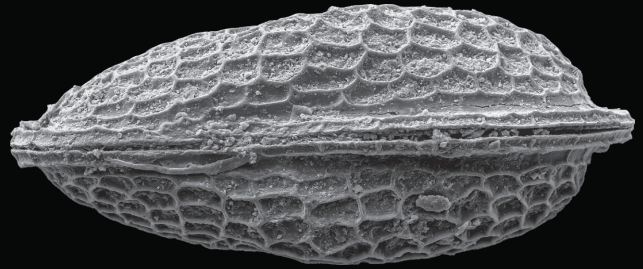
?A-1 instar left valve, L 544 × H 292 μm

lateral view (image Loxoconcha 66_31OUT.psd)

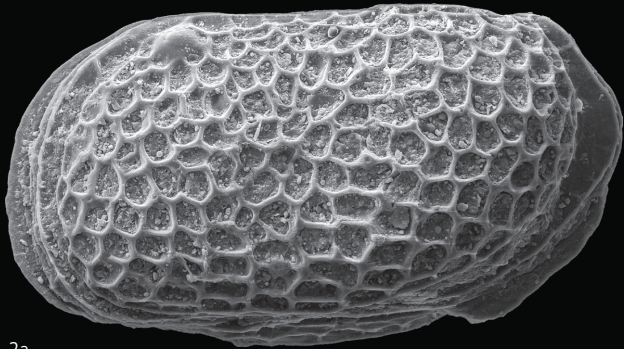
Plate 69



1a



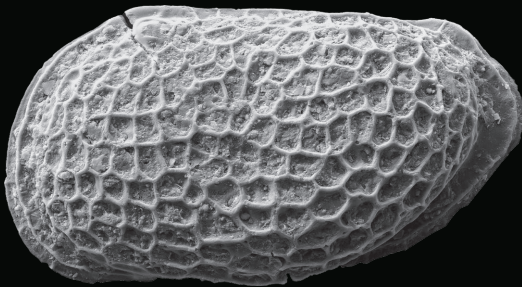
1b



2a



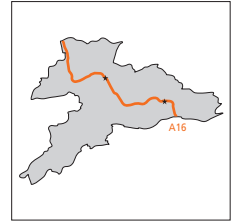
2b



3

200 μ m

PODOCOPIDA

Loxoconcha nystiana (Bosquet, 1852)**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Loxoconchidae	<i>Loxoconcha</i>	<i>nystiana</i>

Determination (name/date): Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	1	-35.8 m	47	RNA987-20
COR-RNA	1	-37.7 m	53	RNA987-34
DEL-BEE	2	7	30	BEE002-64
DEL-BEE	19	1800	1/260/767	BEE006-37/BEE004-165-166, 275, 281-282/BEE003-557
DEL-BEE	19	1900	2/261/769	BEE006-94/BEE004-218, 297-298/BEE003-461, 867, 982-984

Material

adult: 173 carapaces, 1 left valve, 2 right valves (fragmentary specimens not counted)

juvenile: 14 carapaces

Measurements (μm)

Despite abundant material no additional measurements were carried out due to the poor preservation of the specimens (abraded caudal processes, deformed carapaces)

diverse samples	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	female C	8	652-723	698	361-376	369	1.78-1.96	1.89
	male C	2	713-751	732	347-358	353	2.05-2.10	2.08
	A-1 stage C	1	513	–	302	–	1.70	–
	A-3 stage C	2	332-341	337	182-200	191	1.71-1.82	1.77

Taxonomic remarks

Similar sized Oligocene *Loxoconcha* are difficult to separate due to the presence of ecomorphotypes with varying sizes and ornamentation (Keen 1982; Kammerer 1993; Pirkenseer & Berger 2011), particularly when preservation is poor. In the past this led to the description of the similar species *Loxoconcha nystiana* (Bosquet 1852), *L. tenuimargo* (Reuss 1856), *L. intorta* (Lienenklaus 1905), *L. favata* (Kuiper 1918), *L. kuiperi* (Keij 1957), *L. alsatica* (Stchepinsky 1963) and *L. marionae* (Kammerer 1993). While some species retain their status, *Loxoconcha favata*, *L. kuiperi* and *L. alsatica* must be discussed in relation to *L. nystiana* and *L. marionae*.

Already the type description and figure of *Cythere nystiana* in Bosquet (1852) presents issues, since they rather seem to allude to a species of the Trachyleberididae than the Loxoconchidae. Keij (1957) in his revision of Bosquet's material mentions a mixup of "*Echinocythereis hispida*" (original specimens from France, probably the one figured as type) with several species of *Loxoconcha*. Keij (1957) chose a right female valve from Belgium as lectotype for *Loxoconcha nystiana*, ignoring the fact that the description of Bosquet's *Cythere nystiana* rather fits a Trachyleberididae, which would have had precedence over *Cythere hispida* Speyer, 1863 (see *ibid.* p. 23-24, pl. 2, fig. 9).

Kuiper (1918) mentions *Cythere nystiana* in the introduction, but does not discuss this species in context with his new taxon *Loxoconcha favata*, which conforms to Keij's (1957) description. Keij's (1957) emended description, figures and measurement define a distinct species concept for *Loxoconcha nystiana*, with one feature being the marginal concentric rows of fossae. He does however not mention *Loxoconcha favata*, which possibly has precedence over *L. nystiana* if *C. nystiana* is applied to Bosquet's rather trachyleberidid type description and figure. Since the type information on *Loxoconcha favata* is also ambiguous, we adhere for the time being to the *L. nystiana* concept *sensu* Keij (1957).

We conclude that the species features of *Loxoconcha nystiana* include a concentric pattern of fossae arrangement near the anterior, ventral and posterior valve margins. Fossae are of small to medium size and moderate depression taking on a more rounded aspect where they are more weakly developed. Fossae may be very weakly developed or absent in certain specimens / "populations", which has been referred to palaeoenvironmentally stressful habitats (Keen 1982, Kammerer 1993, Pirkenseer & Berger 2011). The posterior part of the dorsal margin is either visible or only slightly obscured in lateral view.

Part of the material from the research area is markedly different and has accordingly been related to *Loxoconcha marionae* Kammerer, 1993. Though of similar size, the fossae are more pronounced (greater height of the muri) and not arranged concentrically but partly longitudinally. The caudal process is broader both at its posterior end and posteroventral part. Together with a stronger inflation of the posterodorsal valve surface that always hides this part of the valve margin this leads to an "upturned" posterior valve portion (especially in males). Since our material does not entirely conform to these features (probably due to the inferior quality of the material), it is referred to as *Loxoconcha cf. marionae* (see *ibid.*). Several specimens illustrated in the literature showing a pronounced reticulation lacking a concentric arrangement may possibly belong to this species, notably in Kuiper (1918), Oertli (1956), Stchepinsky (1963) and Picot (2002).

In relation to the uncertainty regarding these species a reevaluation of the similar more or less contemporaneous Rupelian to early Miocene species of *Loxoconcha* should be considered.

Synonymy

Genus *Loxoconcha* Sars, 1866

Type species: *Cythere rhomboidea* Fischer, 1855

Loxoconcha nystiana (Bosquet, 1852 ?) emend. Keij, 1957

partim	1852	<i>Cythere nystiana</i> nov. spec. – Bosquet, p. 65-66, [material, not figures and description; see Keij 1957]
	1896	<i>Loxoconcha tenuimargo</i> – Lienenklaus in Kissling, p. 28, pl. 2, fig. 8
	1905	<i>Loxoconcha tenuimargo</i> – Lienenklaus, p. 51 [see Kammerer 1993]
partim	1918	<i>Loxoconcha favata</i> n. sp. – Kuiper, p. 25-26, [non pl. 1, fig. 7]
?	1918	<i>Loxoconcha wanneri</i> – Kuiper, p. 26-27, pl. 1, fig. 8
partim	1956	<i>Loxoconcha favata</i> – Oertli, p. 67-68, pl. 8, fig. 198-206 [non 207]
emend.	1957	<i>Loxoconcha nystiana</i> – Keij, p. 142-143, pl. 21, fig. 12, pl. 22, fig. 17-19
	1958	<i>Loxoconcha nystiana</i> – Goerlich, tab. 1
?	1963	<i>Loxoconcha alsatica</i> n. sp. – Stchepinsky, p. 162-164, pl. h.t., fig. 17-24
?	1967	<i>Loxoconcha favata</i> – Witt, p. 90, 91, 92
?	1969	<i>Loxoconcha nystiana</i> – Scheremeta, p. 158-159, pl. 15, fig. 7-8
?	1971	<i>Loxoconcha nystiana</i> – Scheremeta, p. 159, tab. 2
	1972b	<i>Loxoconcha nystiana</i> – Keen, p. 310, pl. 55, fig. 11, 14
?	1975	<i>Loxoconcha favata</i> – Brestenská, p. 405, pl. 10, fig. 1-6
	1978	<i>Loxoconcha nystiana</i> – Keen, tab. 5, pl. 12, fig. 14
	1982	<i>Loxoconcha nystiana</i> – Keen, p. 397, pl. 2, fig. 1, 4
	1989	<i>Loxoconcha nystiana</i> – Keen, pl. 1, fig. 7
	1993	<i>Loxoconcha (Kuiperiana) nystiana</i> – Kammerer, p. 82-84, pl. 12, fig. 7-9
?	2004	<i>Loxoconcha favata</i> – Monostori, p. 67, pl. 21, fig. 6-7, pl. 22, fig. 1
	2004	<i>Loxoconcha nystiana</i> – Schindler & Nungesser, p. 17, 18, 19
	2008	<i>Loxoconcha delemontensis</i> – Picot et al., p. 492, 496, fig. 5, pl. 3, fig. 12-13
	2008	<i>Loxoconcha favata</i> – Picot et al., fig. 4-5, tab. 2, pl. 3, fig. 9-10
	2009	<i>Loxoconcha nystiana</i> – Lord et al., fig. 7, pl. 7, fig. 11
?	2014	<i>Loxoconcha ex gr. nystiana</i> – Bosboom et al., p. 107, fig. 5a/11-12

Type locality and horizon

not designated, Rupelian (sensu Bosquet 1852): Bergh/Kleine-Spouwen (Belgium), "couche argilo-sableuse à Nucules" sensu Bosquet (1852), "Nucula compta-clay" selected as type locality by Keij (1957).
 [Jeurre and Étrechy (France), "Couche à Ostrea cyathula", representing "Echinocythereis hispida" according to Keij (1957).]

Holotype

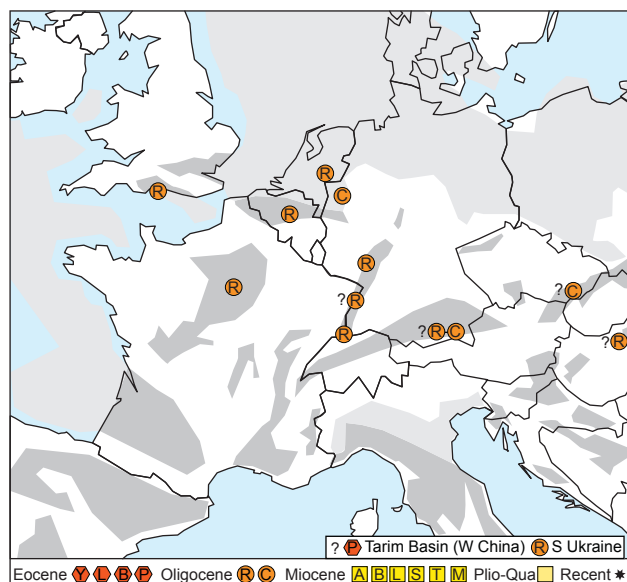
Not designated, left valve and carapace figured; "collection Bosquet", depository not given.

Lectotype

Female right valve chosen by Keij (1957), collection Bosquet No. 31, Institut Royal des Sciences Naturelles de Belgique, Brussels.

Geographic and stratigraphic distribution

Loxoconcha nystiana occurs mainly in the Rupelian of the Upper Rhine Graben (Oertli 1956; Kammerer 1993; Picot et al. 2008; Pirkenseer & Berger 2011), the Hampshire Basin (Lord et al. 2009), the Paris Basin (Keen 1982) Holland (Kuiper 1918) and Belgium (Keij 1957) as well as in the Chattian of northwestern Germany (Goerlich 1958). Potential records include the Priabonian of the Tarim Basin (Bosboom et al. 2013), the Rupelian Bavaria (Witt 1967), Hungary (Monostori 2004) and the Ukraine (Scheremeta 1969) as well as the Chattian of eastern Molasse Basin (Witt 1967) and southern Slovakia (Brestenská 1975). The species may have occurred in a wider area, depending on a future taxonomic reevaluation of related taxa.



Temporal and spatial distribution of *Loxoconcha nystiana* in the Cenozoic of Europe.

geometric forms=epochs letters=stages
 without letters=epoch (nonspecific)
 gray areas=main sedimentary basins

Ostracoda

Plate 70

Loxoconcha nystiana (Bosquet, 1852)

1. BEE004-165

Late Rupelian, Delémont-Beuchille Est

Female carapace, small and high specimen, L 652 × H 361 μm

left lateral view (image Loxoconcha BEE_plot1_21.psd)

2. BEE004-165

Late Rupelian, Delémont-Beuchille Est

Female carapace, high specimen, L 668 × H 376 μm

left lateral view (image Loxoconcha BEE_plot1_22.psd)

3. BEE004-275

Late Rupelian, Delémont-Beuchille Est

Female carapace, large elongated specimen,

L 721 × H 371 × W 266 μm

a) left lateral view (image Loxoconcha 66_66OUT.psd)

b) dorsal view (image Loxoconcha 66_66DOR.psd), slender shape with distinct posterior carapace swelling

4. BEE004-298

Late Rupelian, Delémont-Beuchille Est

Female carapace, normal specimen, L 706 × H 374 × W 288 μm

a) left lateral view (image Loxoconcha 66_86OUT.psd)

b) dorsal view (image Loxoconcha 66_86DOR.psd), moderately slender shape with moderate posterior carapace swelling

5. BEE004-297

Late Rupelian, Delémont-Beuchille Est

Female carapace, normal specimen, L 689 × H 370 × W 306 μm

a) right lateral view (image Loxoconcha 66_85OUT.psd)

b) dorsal view (image Loxoconcha 66_85DOR.psd), moderately wide shape with distinct posterior carapace swelling

6. BEE004-282

Late Rupelian, Delémont-Beuchille Est

Female carapace, large elongated specimen,

L 716 × H 369 × W 320 μm

a) right lateral view (image Loxoconcha 66_73OUT.psd)

b) dorsal view (image Loxoconcha 66_73DOR.psd), wide shape with moderate posterior carapace swelling

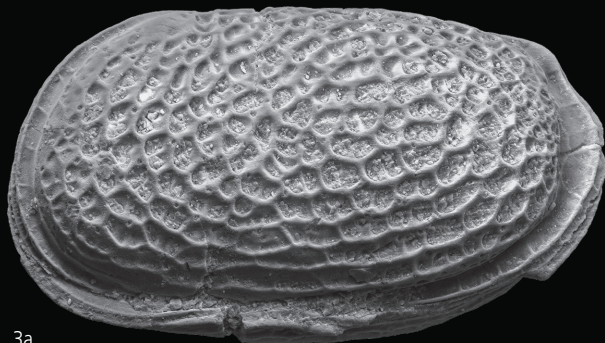
Plate 70



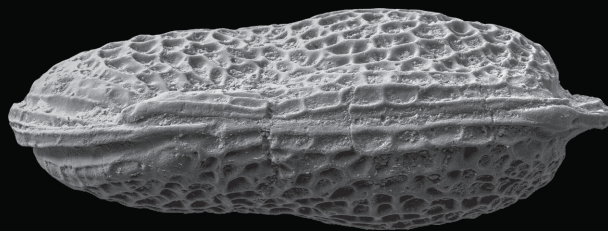
1



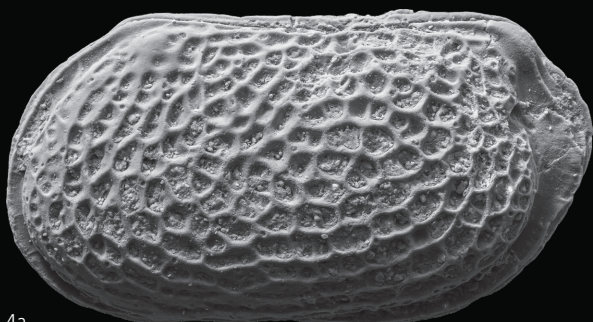
2



3a



3b



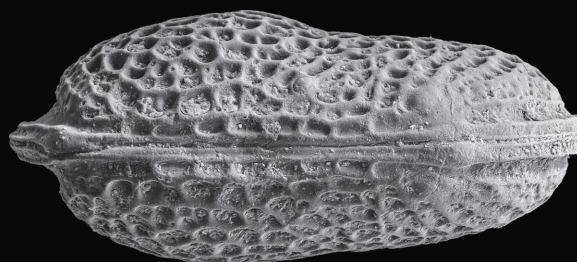
4a



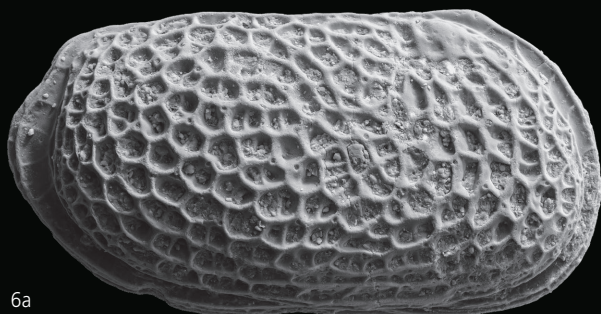
4b



5a



5b



6a



6b

200 μ m

Ostracoda

Plate 71

Loxoconcha nystiana (Bosquet, 1852)

1. BEE003-984

Late Rupelian, Delémont-Beuchille Est

Female carapace, large elongated specimen,

L 723 × H 369 × W 303 μm

a) left lateral view (image Loxoconcha 67_8OUT.psd)

b) dorsal view (image Loxoconcha 67_8DOR.psd), wide shape with indistinct posterior carapace swelling

2. BEE003-983

Late Rupelian, Delémont-Beuchille Est

Female carapace, elongated specimen L 711 × H 362 × W 320 μm

a) left lateral view (image Loxoconcha 67_7OUT.psd)

b) ventral view (image Loxoconcha 67_7VEN.psd), wide rotund shape

3. BEE003-982

Late Rupelian, Delémont-Beuchille Est

Male carapace, standard specimen, L 751 × H 358 × W 287 μm

a) left lateral view (image Loxoconcha 67_6OUT.psd)

b) dorsal view (image Loxoconcha 67_6DOR.psd)

4. BEE004-165

Late Rupelian, Delémont-Beuchille Est

Male carapace, small specimen L 713 × H 347 μm

left lateral view (image Loxoconcha BEE_plot1_23.psd)

5. BEE004-165

Late Rupelian, Delémont-Beuchille Est

A-1 instar carapace, L 513 × H 302 μm

right lateral view (image Loxoconcha BEE_plot1_12.psd)

6. BEE004-165

Late Rupelian, Delémont-Beuchille Est

A-3 instar carapace, L 341 × H 200 μm

right lateral view (image Loxoconcha BEE_plot1_13.psd)

7. BEE004-281

Late Rupelian, Delémont-Beuchille Est

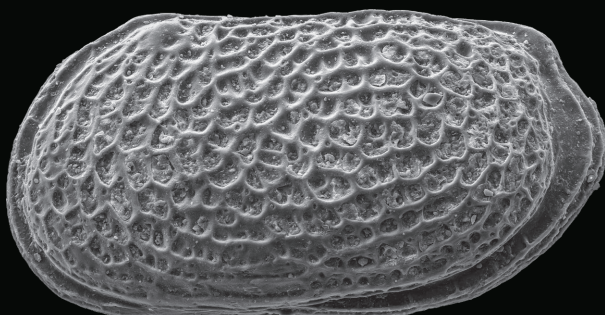
?A-3 instar carapace, aberrantly low specimen or different species,

L 332 × H 182 × W 160 μm

a) lateral view (image Loxoconcha 66_72OUT.psd)

b) dorsal view (image Loxoconcha 66_72DOR.psd)

Plate 71



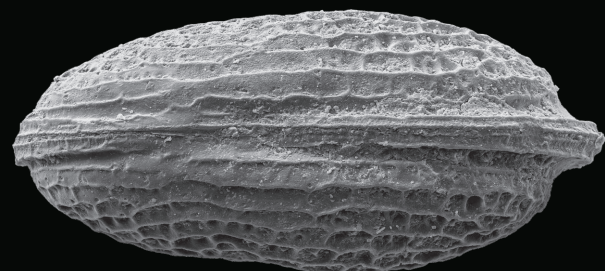
1a



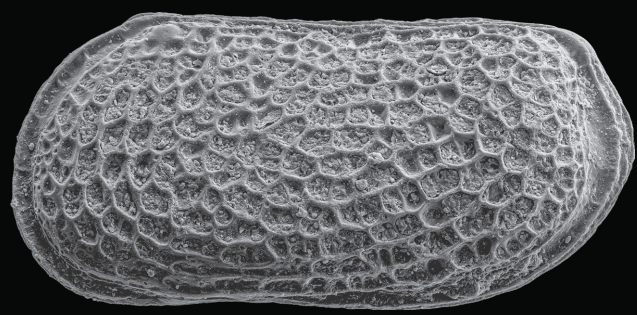
1b



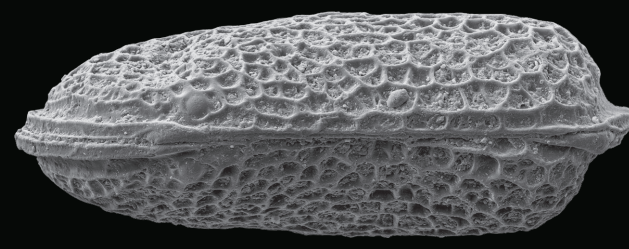
2a



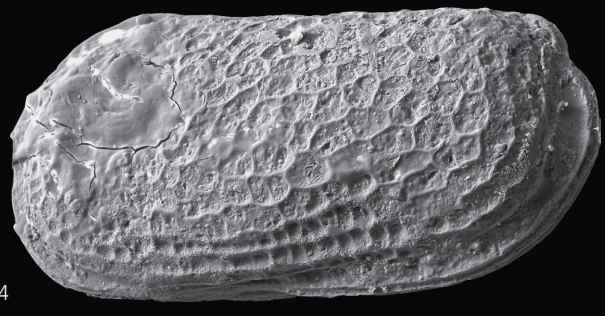
2b



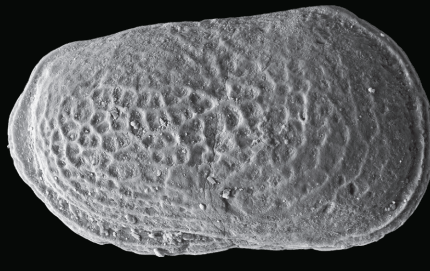
3a



3b



4



5



7a



7b

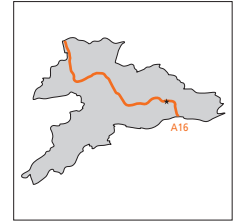


6

200 μm

PODOCOPIDA

Loxoconcha gr. *subovata* (von Muenster, 1830)



Taxonomy

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Loxoconchidae	<i>Loxoconcha</i>	<i>subovata</i>

Determination (name/date): Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
DEL-BEE	19	1800	260	BEE004-165, 278, 284

Material

adult: ≈ 10 carapaces (morphological overlap of poorly preserved specimens with juvenile *Loxoconcha nystiana* possible)

Measurements (µm)

BEE003-165	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	adult C	8	374-406	390	216-217	217	1.72-1.88	1.80

Taxonomic remarks

For a more extensive outline of this species taxonomic relationships see Pirkenseer & Berger (2011). According to a variety of authors this species shows a wide range of shapes and ornamentation (e.g. Keij 1957; Scherer 1964; Uffenorde 1981). This prompted Kammerer (1993) to a unification of *Loxoconcha delemontensis* with *L. subovata*, with many intermediate forms between a "subrectangular" and "ovoid" morphotype. Together with a varying grade of reticulation this is considered to represent fluctuating palaeoenvironmental proxies. Scherer (1964) and Pirkenseer & Berger (2011) consider a ventrolateral swelling of the carapce bearing low ridges that hide the median part of the ventral valve margin in lateral view as characteristic for this species. This circumstance has been figured as early as in Kissling (1896), but not commented on in most other publications. This feature is however not present in otherwise similar, strongly reticulated juvenile specimens (A-3 instars) of *Loxoconcha nystiana*. Our material is rather rectangular in lateral outline with comparatively weakly developed ventrolateral ridges. In the past many small-sized "ovoid" and "subrectangular" Loxoconchidae have been labelled as *Loxoconcha subovata* (see synonymy list). Due to the ostensibly widespread temporal (early Eocene to late Miocene) and geographical (entire Europe, probably to Middle East) distribution and the taxonomic uncertainty we attribute a group status to this species. A thorough restudy of (Palaeogene) small-sized Loxoconchidae is advised. *Loxoconcha linearis linearis* Carbonnel, 1969 from the Miocene of the Rhone Basin represents a very similar, though larger descendant species. For an overview of similar small-sized early Eocene *Loxoconcha* see Haskins (1970).

Synonymy

Genus *Loxoconcha* Sars, 1866Type species: *Cythere rhomboidea* Fischer, 1855*Loxoconcha* gr. *subovata* (von Muenster, 1830)

- * 1830 *Cythere subovata* – von Muenster, p. 63, pl. 1, fig. 24-26, 28-30
 ? 1838 *Cytherina subovata* – Roemer, p. 515, pl. 6, fig. 4
 1894 *Loxoconcha subovata* – Lienenklaus, p. 234-235, pl. 16, fig. 4
 ? 1895 *Loxoconcha subovata* – Lienenklaus, p. 146
 1896 *Loxoconcha subovata* – Lienenklaus in Kissling, p. 28-29, pl. 2, fig. 9
 non 1900 *Loxoconcha subovata* – Egger, p. 183-184, pl. 27, fig. 7-9
 non 1901 *Loxoconcha subovata* – Egger, p. 454, pl. 3, fig. 18-19
 1905 *Loxoconcha subovata* – Lienenklaus, p. 51
 v 1956 *Loxoconcha delemontensis* – Oertli, p. 68-69, pl. 8, fig. 220-230
 1956 *Loxoconcha subovata* – Oertli, p. 69, pl. 8, fig. 211-219
 1957 *Loxoconcha subovata* – Keij, p. 144, pl. 22, fig. 15-16
 1958 *Loxoconcha subovata* – Goerlich, tab. 1
 ? 1962 *Loxoconcha subovata* – Curry, tab. 7
 1964 *Loxoconcha delemontensis* – Scherer, p.19-20, tab. 1, pl. 3, fig. 20-27
 1965 *Loxoconcha subovata* – Eagar, p. 23, tab. 1-2
 non 1965 *Loxoconcha subovata* – Moyes, p. 73-74, pl. 7, fig. 12 [see Uffendorde 1981]
 ? 1967 *Loxoconcha* cf. *delemontensis* – Witt, p. 85, 86, 88
 1969 *Loxoconcha delemontensis* – Ascoli, p. 54, 63, range chart 1
 1969 *Loxoconcha subovata* – Carbonnel, p. 180, pl. 9, fig. 16
 ? 1969 *Loxoconcha subovata* – Scheremeta, p. 160-161, pl. 15, fig. 12
 ? 1969 *Loxoconcha subovata* – Pietrzeniuk, p. 94, pl. 9, fig. 1-2
 1970 *Loxoconcha subovata* – Haskins, p. 209-210, pl. 9, fig. 1-2
 1970 *Loxoconcha subovata* – Hiltermann, p. 81, 82
 ? 1971 *Loxoconcha subovata* – Chabanovskaya, p. 200, range chart
 ? 1971 *Loxoconcha subovata* – Scheremeta, p. 156
 non 1971 *Loxoconcha subovata* – Kollmann, p. 654-655, pl. 19, fig. 8-9 [material similar to Moyes 1965 sensu author]
 1972b *Loxoconcha delemontensis* – Keen, p. 309-310, pl. 55, fig. 15
 ? 1973 *Loxoconcha delemontensis* – Sönmez-Gökçen, p. 73, pl. 9, fig. 15-16
 1975 *Loxoconcha delemontensis* – Brestenská, p. 404, pl. 11, fig. 9-14
 non 1975 *Loxoconcha subovata* – Brestenská, p. 405, pl. 12, fig. 11-12
 1975 *Loxoconcha delemontensis* [sic] – Doebl & Sonne, p. 145, tab. 1, pl. 3, fig. 21
 1975 *Loxoconcha subovata* – Faupel, p. 49, pl. 13, fig. 1, 3
 ?partim 1976 *Loxoconcha delemontensis* – Carbonnel, p. 260, 261, tab. 1, pl. 1, fig. 1-4
 ? 1980 *Loxoconcha subovata* – Charrier & Carbonnel, tab. 1
 1981 *Loxoconcha (Loxoconcha) subovata* – Uffendorde, p. 178, tab. 1, pl. 3, fig. 15, 19
 1982 *Loxoconcha delemontensis* – Carbonnel, tab. 2-3, pl. 2, fig. 9, [non 10]
 1985 *Loxoconcha subovata* – v. Daniels et al., tab. 2
 1985 *Loxoconcha delemontensis* – Ducasse et al., pl. 87, fig. 5
 non 1986 *Loxoconcha subovata* – Ciampo, tab. 1, 3, 6, pl. 4, fig. 4
 ? 1986 *Loxoconcha* cf. *subovata* – Gramann, p. 419
 1986 *Loxoconcha subovata* – Uffendorde, fig. 2, 4, 6
 1987 *Loxoconcha (Loxoconcha) subovata* – Malz, p. 174-175
 1990 *Lonoconcha* [sic] *subovata* – Tanar & Gökçen, p. 177
 ? 1991 *Loxoconcha clinata* (morph "inerme") – Ducasse et al., p. 438, pl. 1, fig. 6-8
 1991 *Loxoconcha delemontensis* – Ducasse et al., p. 439-440, pl. 1, fig. 11-12
 1991 *Loxoconcha delemontensis* – Ducasse et al., p. 448, 450, pl. 2, fig. 9-10
 1991 *Loxoconcha subovata* – King, p. 210, pl. 22, fig. 10-13
 1993 *Loxoconcha (Kuiperiana) subovata* – Kammerer, p. 84-86, pl. 12, fig. 1-6
 1994 *Loxoconcha delemontensis* – Ziegler, p. 185, 188, fig. 9/2, 9/5
 1994 *Loxoconcha delemontensis* – Ziegler, p. 188, fig. 9/1, 9/3-4
 1996 *Loxoconcha delemontensis* – Ducasse & Bekaert, p. 322, pl. 41, fig. 8
 1996 *Loxoconcha subovata* – Ducasse & Bekaert, p. 326, pl. 43, fig. 8
 ? 1997 *Loxoconcha subovata* – Ducasse & Cahuzac, fig. 4, pl. 3, fig. 3
 ? 1997 *Loxoconcha delemontensis* – Tunoğlu & Gökçen, fig. 3
 1997 *Loxoconcha delemontensis* – Ziegler, p. 366, pl. 2, fig. 3, pl. 3, fig. 4-5, pl. 5, fig. 4
 1997 *Loxoconcha subovata* – Ziegler, p. 366, pl. 1, fig. 1-5
 1999 *Loxoconcha subovata* – Mostafawi, p. 8, pl. 11, fig. 8
 ? 1999 *Loxoconcha subovata* – Öğrünç & Nazik, p. 56, pl. 3, fig. 8
 2001 *Loxoconcha subovata* – Uffendorde, p. 244, tab. 2
 2004 *Loxoconcha delemontensis hungarica* – Monostori, p. 66-67, pl. 20, fig. 7, pl. 21, fig. 1-5
 non 2004 *Loxoconcha subovata* sensu Brestenská – Monostori, p. 67-68, pl. 22, fig. 2
 ? 2005 *Loxoconcha subovata* – Janz & Vennemann, app. A
 non 2008 *Loxoconcha delemontensis* – Picot et al., p. 492, 498, pl. 3, fig. 12-13
 ? 2011 *Loxoconcha* cf. *subovata* – Havran, fig. 39, pl. 2, fig. 13-15
 2011 *Loxoconcha subovata* – Pirkenseer & Berger, p. 87-89, fig. 5, pl. 13, fig. 9
 2013 *Loxoconcha* cf. *subovata* – Lavoyer, p. 25, annex p. 185-193, pl. 8, fig. 1
 2013 *Loxoconcha* ex gr./cf. *subovata* [lapsus] – Pirkenseer et al., p. 349, fig. 7/36.

Type locality and horizon

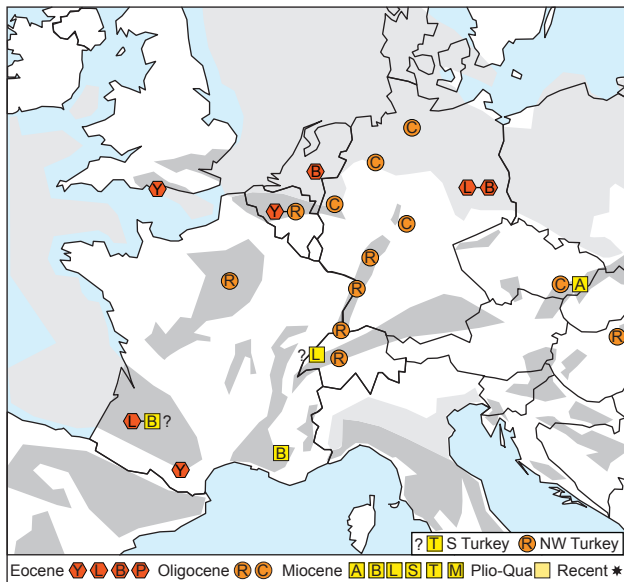
Astrup near Osnabrück (Germany), "Chattian" (sensu Kammerer 1993)

Syntypes

Left valve and a carapace, collection "v. Münster (1830)", Roemer-Pelizaeus Museum of Hildesheim (Germany) (see Malz 1987)

Geographic and stratigraphic distribution

Loxoconcha gr. *subovata* records are distributed over Europe. Since the type material was derived from Chattian sediments in northwestern Germany, Miocene and Eocene occurrences should be treated cautiously. Only well-documented references are figured below. Eocene records include the Aquitaine Basin (Ducasse et al. 1985, Pirkenseer et al. 2013), the Hampshire Basin (Haskins 1970; King 1991), Belgium and Holland (Keij 1957) and eastern Germany (Pietrzniuk 1969). The Upper Rhine Graben and Mainz Basin (Oertli 1956; Doehl & Sonne 1975; Kammerer 1993; Pirkenseer & Berger 2011, Lavoyer 2013), the Paris Basin (Keen 1972b), the Swiss Molasse Basin (Scherer 1964), the Aquitaine Basin (Ducasse et al. 1985, 1991, Ducasse & Bekaert 1996), Belgium (Keij 1957), Hungary (Monostori 2004) and northwestern Turkey (Sönmez-Gökçen 1973) feature Rupelian records. Chattian occurrences are limited to middle, northern and northwestern Germany (von Muenster 1830, Lienenklaus 1894, Faupel 1975, Uffenorde 1981, Ziegler 1997) as well as southern Slovakia (Brestenská 1975). *Loxoconcha* gr. *subovata* has been determined in Miocene sediments of the Aquitaine Basin (Ducasse et al. 1991, Ducasse & Bekaert (1996), the southern Rhone Basin (Carbonnel 1969), the Cenozoic of the Swiss Jura (Havran 2011) and southern Turkey (Öğrünç & Nazik 1999), though most of the records remain uncertain.



Temporal and spatial distribution of *Loxoconcha* gr. *subovata* in the Cenozoic of Europe.

geometric forms=epochs letters=stages
 without letters=epoch (nonspecific)
 gray areas=main sedimentary basins

Ostracoda

Plate 72

Loxoconcha gr. *subovata* (von Muenster, 1830)

1. BEE004-284

Late Rupelian, Delémont-Beuchille Est

Carapace, slightly tilted specimen with abraded ventrolateral ridges,

L 374 × H 217 × W 206 μm

a) left lateral view (image Loxoconcha 66_75OUT.psd)

b) dorsal view (image Loxoconcha 66_75DOR.psd)

2. BEE004-278

Late Rupelian, Delémont-Beuchille Est

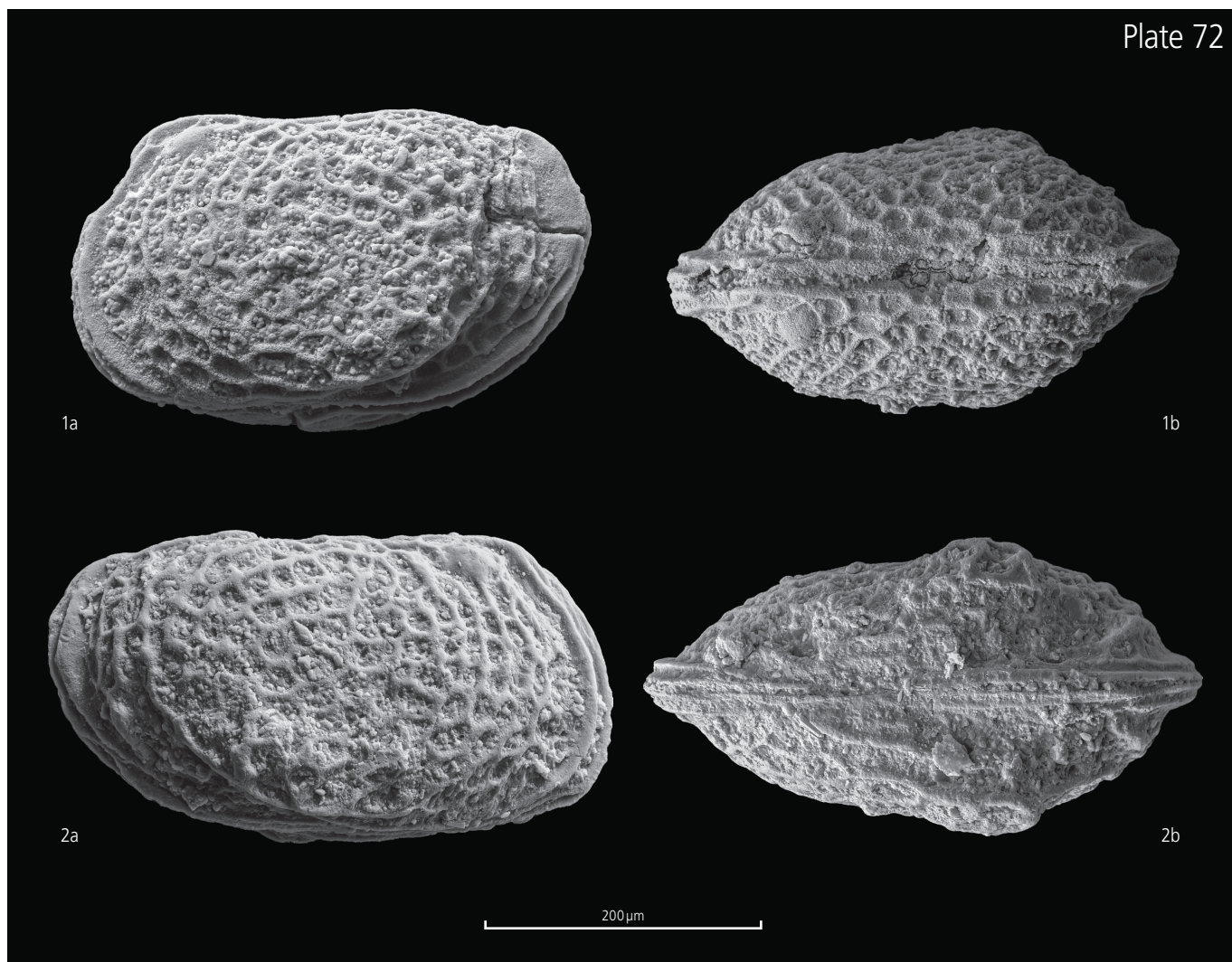
Carapace, specimen with abraded ventrolateral ridges,

L 406 × H 216 × W 215 μm

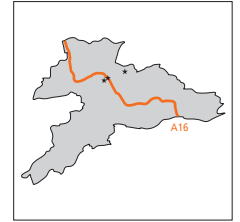
a) right lateral view (image Loxoconcha 66_69OUT.psd)

b) ventral view (image Loxoconcha 66_69VEN.psd)

Plate 72



PODOCOPIDA

Eucytherura macropora (Lienenklaus, 1894)**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cytheruridae	<i>Eucytherura</i>	<i>macropora</i>

Determination (name/date): Claudius Pirkenseer/28.09.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Charmoille - Village (CHA-CHM)	582 650/252 375
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Courgenay - Clos Jeannerat (CGN-CLJ)	576 740/250 035

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CHA-CHM	4	-46.0 m	23	CHM003-57, 78
COR-RNA	1	-35.8 m	47	RNA987-20, 89, 90
CGN-CLJ	1	-12.0 m	6	CLJ007-45

Material

adult: 1 carapace, 1 left valve, 4 right valves

Measurements (µm)

diverse samples	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	female L	1	361	–	207	–	1.74	–
	female R	2	392-403	398	214-222	218	1.82-1.83	1.83

Taxonomic remarks

In relation to nomenclature the type species *Cytheropteron macroporum* Lienenklaus, 1894 should not be confused with *Cytherura macropora* from the same reference, which has been reassigned to *Microcytherura (Tetracytherura) macropora* in Moos (1971).

Eucytherura macropora seems to represent a species of relatively high morphological variability (e.g. Pietrzeniuk 1969; Moos 1973), probably related to its long temporal range (late Eocene to middle Miocene). Accordingly the very similar *Eucytherura keiji* Pietrzeniuk, 1969 from the late Eocene of eastern Germany may represent a morphotype of *E. macropora*, which is born out by the occasional attribution of *macropora*-like material to *E. keiji* (e.g. Faupel 1975; Barbin & Guernet 1988).

The very small (270-290 µm) and morphologically different subspecies *Eucytherura macropora pygmaea* Ohmert, 2017 should be assigned to a new species. A naming conflict arises however from the precedence of *Cypridina pygmaea* Reuss, 1850, which has been assigned to the genus *Eucytherura* in Sissingh (1972) and Oteanu (2006). To complicate matters the type length given in Reuss (1850) is very short (300 µm), whereas *Eucytherura pygmaea* sensu Sissingh (1972) from the Miocene of Greece is much larger (420 µm) and looks similar to *E. macropora* and hence underlines the necessity of a rediscussion of the taxon *pygmaea*.

Synonymy

Genus *Eucytherura* Mueller, 1894

Type species: *Cythere complexa* Brady, 1867 [sensu Alexander 1937]

Morphogroup: *Eucytherura macropora* (Lienenklaus, 1894) - *keiji* Pietrzeniuk, 1969

Eucytherura macropora (Lienenklaus, 1894)

- * 1894 *Cytheropteron macroporum* – Lienenklaus, p. 246, pl. 17, fig. 4
- 1896 *Cytheropteron macroporum* – Lienenklaus in Kissling, p. 29-30, pl. 2, fig. 11
- ?partim 1957 *Eucytherura dentata* – Keij, p. 151, pl. 23, fig. 4-8 [fig. 4-7 ?overlap with *E. keiji*]
- 1958 *Eucytherura macropora* – Goerlich, tab. 1
- ? 1967 *Eucytherura macropora* – Kheil, p. 225, pl. 3C, fig. 3
- ? 1969 *Eucytherura dentata* – Ascoli, p. 61-62, range chart 1-2. [sensu Barbin & Guernet 1988]
- 1969 *Eucytherura macropora* – Pietrzeniuk, p. 100, pl. 12, fig. 15, pl. 21, fig. 9
- 1969 *Eucytherura dentata* – Scheremeta, p. 129-130, pl. 11, fig. 12-13
- 1973 *Eucytherura macropora* – Moos, p. 84-85, pl. 1, fig. 1-5
- 1975 *Eucytherura dentata* – Doehl & Sonne, p. 143-144, pl. 2, fig. 14
- 1975 *Eucytherura dentata* – Brestenská, p. 400, pl. 9, fig. 10-14
- 1975 *Eucytherura* cf. *keiji* – Faupel, p. 36-37, pl. 6, fig. 4 [males]
- 1975 *Eucytherura macropora* – Faupel, p. 35-36, pl. 6, fig. 3 [females]
- 1981 *Eucytherura macropora* – Uffenorde, p. 180, pl. 3, fig. 21
- 1985 *Eucytherura macropora* – von Daniels et al., tab. 2
- 1986 *Eucytherura macropora* – Uffenorde, fig. 2, 4
- ? 1988 *Eucytherura* cf. *keiji* – Barbin & Guernet, p. 222, pl. 4, fig. 7
- 1993 *Eucytherura macropora* – Kammerer, p. 91-93, pl. 14, fig. 1-6, 8
- 1999 *Eucytherura macropora* – Mostafawi, p. 9, pl. 11, fig. 13
- 2004 *Eucytherura dentata* – Monostori, p. 69, pl. 22, fig. 4 [lapsus].
- non2017 *Eucytherura macropora pygmaea* n.ssp. – Ohmert, p. 93, pl. 11, fig. 19-20

Type locality and horizon

Doberg near Bünde (Germany), exact locality and horizon not given, "Upper Oligocene" sensu Lienenklaus (1894).

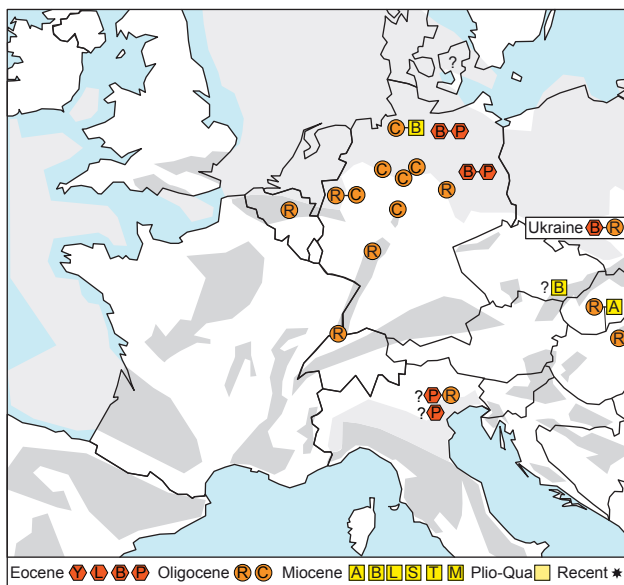
Lectotype

Left valve, chosen from type material by Kammerer (1993), IMGPGö 361-70-1, collection Lienenklaus, Geological Institute Göttingen.

Geographic and stratigraphic distribution

Eucytherura macropora occurs in the late Eocene of eastern Germany (Pietrzeniuk 1969), the late Eocene to Rupelian of Ukraine (Scheremeta 1969), the Rupelian of the Upper Rhine Graben (Lienenklaus in Kissling 1896; Doehl & Sonne 1975; Kammerer 1993), Belgium (Keij 1957), Hungary (Monostori 2004) and northeastern Germany (Moos 1973), the Rupelian to Aquitanian of southern Slovakia (Brestenská 1975), the Rupelian to Chattian of western Germany (Goerlich 1958), the Chattian of central and northwestern Germany (Lienenklaus 1894; Moos 1973; Faupel 1975; Uffenorde 1981, 1986; Mostafawi 1988) as well as the Miocene of northern Germany (Uffenorde 1981, 1986).

Potential records hail from the Priabonian to Rupelian of northeastern Italy (Ascoli 1969; Barbin & Guernet 1988) as well as the Burdigalian of the southern Czech Republic (Kheil 1967).



Temporal and spatial distribution of *Eucytherura macropora* in the Cenozoic of Europe.

geometric forms=epochs letters=stages
without letters=epoch (nonspecific)
gray areas=main sedimentary basins

Ostracoda

Plate 73

Eucytherura macropora (Lienenklaus, 1900)

1. CHM003-78

Late Rupelian, Charmoille-Village

Female left valve, abraded specimen, note the shorter caudal process and the blunter alae,

L 361 × H 207 μm

a) lateral view (image Eucytherura 66_2OUT.psd)

b) internal view (image Eucytherura 66_2IN.psd)

2. RNA987-89

Late Rupelian, Cornol-Route Nationale

Female right valve, less distinct lateral ridges compared to specimen below, celation developed on muri, L 403 × H 222 μm

a) lateral view (image Eucytherura 66_37OUT.psd)

b) internal view (image Eucytherura 66_37IN.psd)

3. RNA987-90

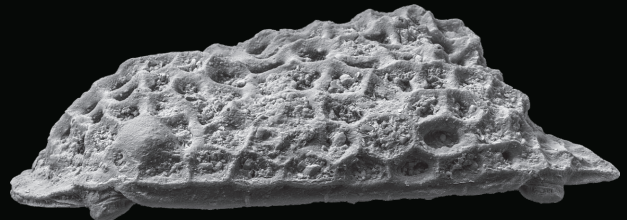
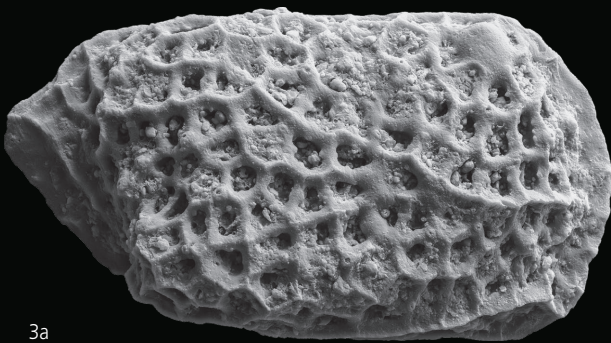
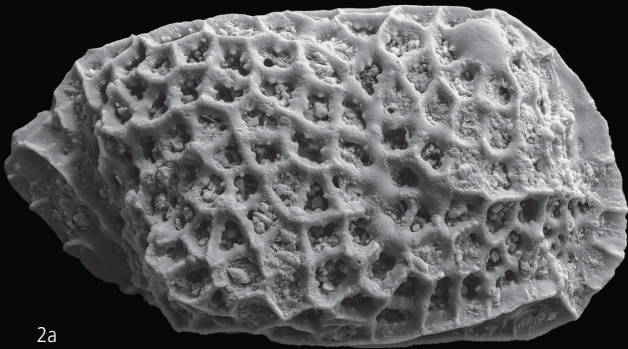
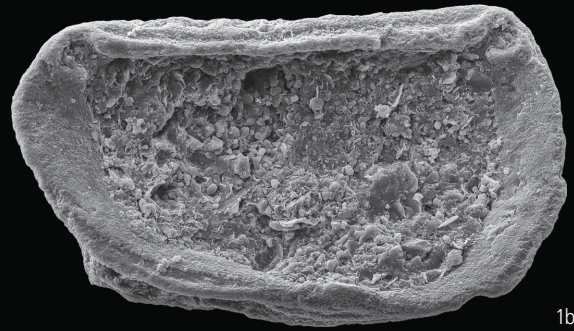
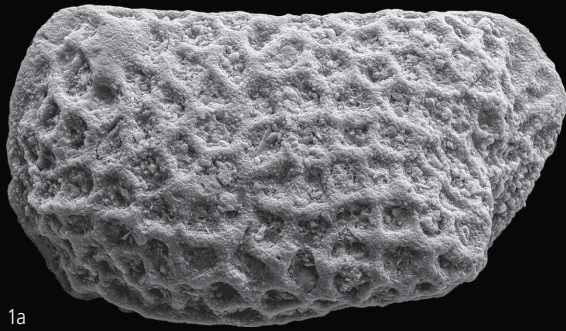
Late Rupelian, Cornol-Route Nationale

Female right valve, L 392 × H 214 × W 126 μm

a) lateral view (image Eucytherura 66_38OUT.psd)

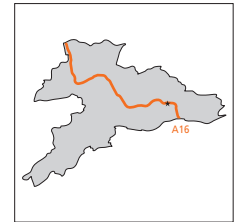
b) dorsal view (image Eucytherura 66_38DOR.psd)

Plate 73



200 μ m

PODOCOPIDA

Semicytherura alata Lienenklaus, 1894**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cytheruridae	<i>Semicytherura</i>	<i>alata</i>

Determination (name/date): Claudius Pirkenseer/28.09.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
DEL-BEE	19	1800	260	BEE004-165, 279, 283

Material

adult: 2 carapaces

Measurements (μm)

Stade	Quantity	Length	mean	Height	mean	le/he	mean
adult C	1	436	–	209	–	2.09	–
adult C frag	1	[398]	–	202	–	–	–

Taxonomic remarks

The small and schematic type figure of *Semicytherura alata* seems to overemphasise the carapace width compared to the type description, leading to a very inflated, nearly circular outline in dorsal view. The morphological variability of this species has been stressed by Moos (1971) and illustrated by Doehl & Sonne (1975) and Kammerer (1993), amongst others. The alae in our material appear blunted due to poor preservation.

Semicytherura reticulata (Lienenklaus 1894) from the same type area is very similar and may well fall within the morphological variation of *S. alata*. Due to its larger size and the accounts of Oertli (1956) and Moos (1971) the species status is kept valid. *Semicytherura hoplites* (Egger 1858) from the early Burdigalian of Ortenburg (Bavaria) looks similar (though type figure and description are very schematic), but is larger according to the author. The strongly inflated (in dorsal view) similar-sized *Semicytherura rothauseni* Schäfer, 1993 from the Chattian-Aquitaina of the Mainz Basin and smaller *S. dunkeri* Moos, 1971 from the Rupelian of central Germany lack distinct alae and feature a shorter, rounded caudal process.

The material recorded by Sönmez-Gökçen (1973) from the Rupelian of northwestern Turkey bears strong resemblance to *Semicytherura alata* in size (the given height measure seems to be exaggerated compared to the figured specimen) and shape.

Synonymy

Genus *Semicytherura* Wagner, 1957

Type species: *Cythere nigrescens* Baird, 1838

Semicytherura alata (Lienenklaus, 1894)

- * 1894 *Cytherura alata* – Lienenklaus, p. 241-242, pl. 16, fig. 10
- non1894 *Cytherura alata* – Müller, p. 188, pl. 18, fig. 1, 7-8 [homonym, see van den Bold 1957]
- 1896 *Cytherura alata* – Lienenklaus in Kissling, p. 29, pl. 2, fig. 10
- 1956 *Cytherura alata* – Oertli, p. 76-78, pl. 10, fig. 264-267
- 1971 *Semicytherura alata* – Moos, p. 62-63, pl. 7, fig. 3-4
- ? 1972 *Cytherura alata* – Ducasse, p. 282, pl. 4, fig. 4
- ? 1973 *Cytherura* sp. – Sönmez-Gökçen, p. 58, pl. 7, fig. 31-32
- 1975 *Semicytherura alata* – Brestenská, p. 400, pl. 10, fig. 8-9
- 1975 *Semicytherura* cf. *alata* – Doehl & Sonne, p. 144, pl. 2, fig. 16
- ?partim1975 *Semicytherura alata* – Faupel, p. 44-45, pl. 2, fig. 7, ?non8
- 1980 *Semicytherura alata* – Uffenorde, tab. 1
- ? 1981 *Cytherura alata* – Nascimento, p. 194, tab. 1
- 1985 *Semicytherura alata* – von Daniels et al., p. 162, tab. 2
- 1986 *Semicytherura alata* – Uffenorde, fig. 2, 4, 6
- 1993 *Semicytherura alata* – Kammerer, p. 93, pl. 15, fig. 1-4
- non2002 *Semicytherura* cf. *alata* – Gross, p. 126-127, pl. 45, fig. 1-4, pl. 46, fig. 2-3, 8-9
- non2011 *Semicytherura alata* – Hajek-Tadesse & Prtoljan, p. 450, fig. 3/18

Type locality and horizon

Doberg near Bünde (Germany), exact locality and horizon not given, "Upper Oligocene" sensu Lienenklaus (1894).

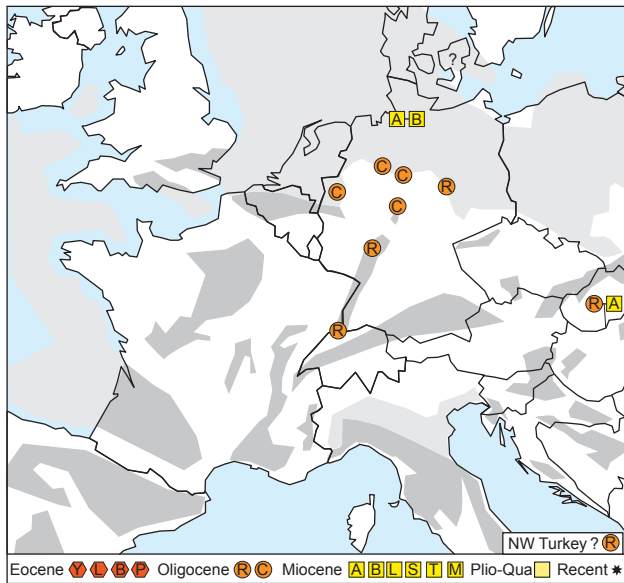
Lectotype

Female left valve, chosen from type material by Oertli (1956), collection Lienenklaus, Geological Institute Göttingen.

Geographic and stratigraphic distribution

Semicytherura alata occurs in the Rupelian of the Upper Rhine Graben (Lienenklaus in Kissling 1896; Oertli 1956; Doehl & Sonne 1975; Kammerer 1993) and northeastern Germany (Moos 1971), the Rupelian to Aquitanian of southern Slovakia (Brestenská 1975), the Chattian of central and north-western Germany (Lienenklaus 1894; Moos 1971; Faupel 1975; Uffenorde 1986) as well as the Miocene of northern Germany (Uffenorde 1980, 1986). A potential record stems from the Rupelian of northwestern Turkey (Sönmez-Gökçen 1973).

The occurrence of the species in the Aquitanian of the Lisbon area (Nascimento 1981) and the Ypresian of northern Spain (Ducasse 1972) can not be verified due to insufficient documentation.



Temporal and spatial distribution of *Semicytherura alata* in the Cenozoic of Europe.

geometric forms=epochs letters=stages
without letters=epoch (nonspecific)
gray areas=main sedimentary basins

Ostracoda

Plate 74

Semicytherura alata (Lienenklaus, 1894)

1. BEE004-279

Late Rupelian, Delémont-Beuchille Est

Carapace, specimen with broken caudal process,

L [398] × H 202 × W 198 μm

a) left lateral view (image Semicytherura 66_70OUT.psd)

b) dorsal view (image Semicytherura 66_70DOR.psd)

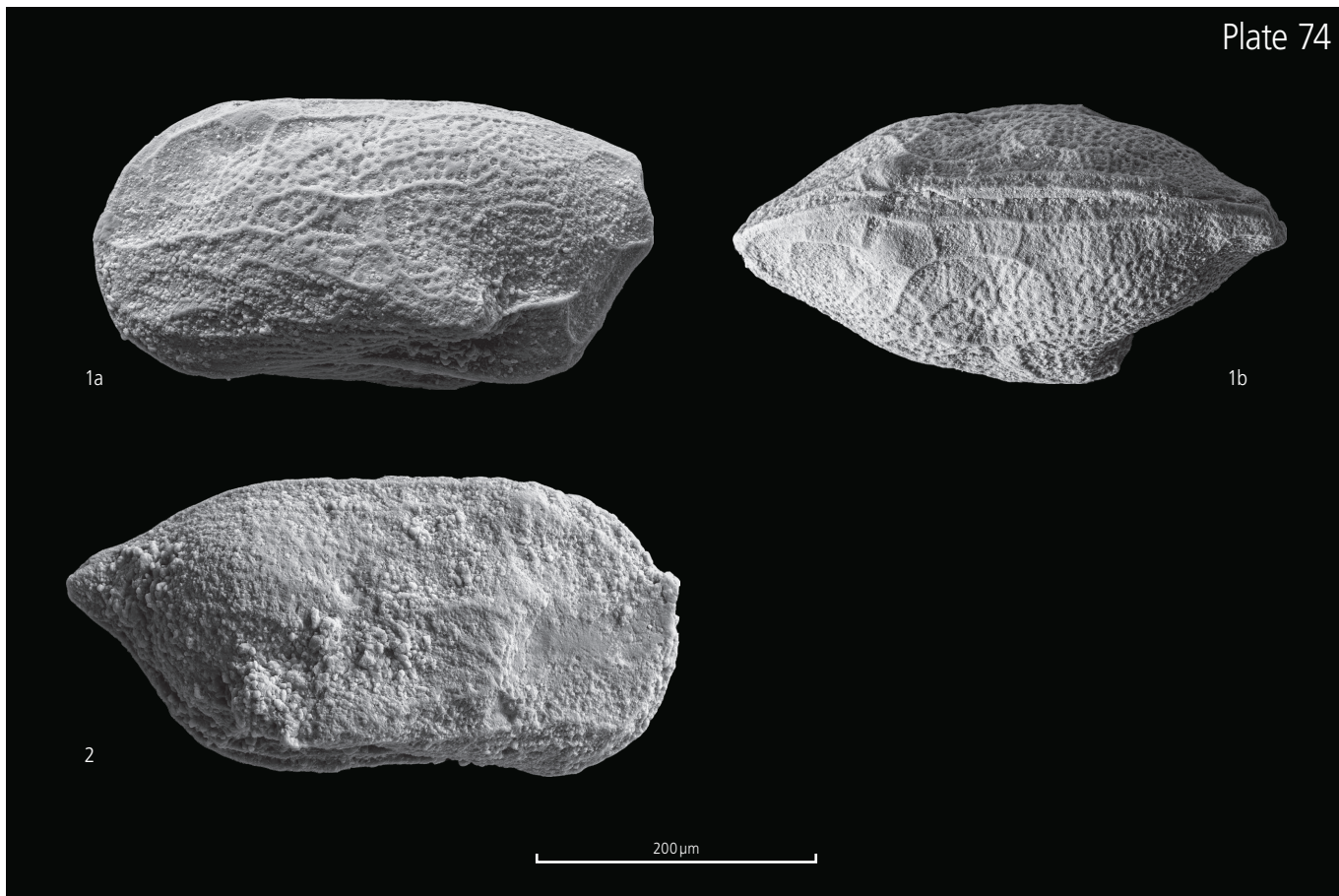
2. BEE004-283

Late Rupelian, abraded specimen, Delémont-Beuchille Est

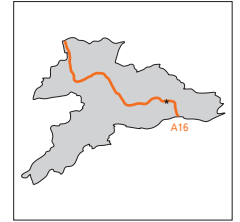
Carapace, L 436 × H 209 μm

right lateral view (image Semicytherura 66_74OUT.psd)

Plate 74



PODOCOPIDA

Semicytherura gracilis (Lienenklaus, 1895)**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cytheruridae	<i>Semicytherura</i>	<i>gracilis</i>

Determination (name/date): Claudius Pirkenseer/28.09.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
DEL-BEE	19	1800	260	BEE004-165, 280

Material

adult: 1 carapace

Measurements (µm)

Stade	Quantity	Length	mean	Height	mean	le/he	mean
adult C	1	406	–	184	–	2.21	–

Taxonomic remarks

Recent *Semicytherura sella* and *S. striata* (Sars 1866) and *S. rara* (Mueller 1894) are somewhat similar in dorsal view, ornamentation and outline, but not identical. The type description in Lienenklaus (1895) conforms well to our specimen, except for the ornamentation ("large shallow fossae between longitudinal ridges"), which is also mirrored by the illustration in Keij (1957). Kammerer (1993) describes and figures new material from the Mainz Basin and elaborates on the high variability of the ornamentation. Accordingly he places the delicately ornamented *Semicytherura porcina* (Keen 1972b) in tentative synonymy. Kammerer (1993) raises the subspecies *Semicytherura gracilis foliacea* Moos, 1971 to species status. Eocene records (Scheremeta 1969; Haskins 1979) are poorly documented and thus unreliable.

SynonymyGenus *Semicytherura* Wagner, 1957Type species: *Cythere nigrescens* Baird, 1838*Semicytherura gracilis* (Lienenklaus, 1895)

- * 1895 *Cytherura gracilis* – Lienenklaus, p. 149-150, pl. 3, fig. 3
- non 1901 *Cytherura gracilis* – Egger, p. 459, pl. 8, fig. 26-27
- ? 1957 *Cytherura gracilis* – Keij, p. 146, pl. 23, fig. 16
- non 1969 *Cytherura gracilis* – Scheremeta, p. 125, pl. 11, fig. 7
- ? 1970 *Cytherura gracilis* – Haskins, p. 17, pl. 1, fig. 28-29
- non 1971 *Semicytherura gracilis foliacea* n.ssp. – Moos, p. 63-65, pl. 7, fig. 5-6. [sensu Kammerer 1993]
- 1972b *Cytherura porcina* – Keen, p. 307, pl. 55, fig. 9, 12, pl. 56, fig. 8-11
- non 1975 *Semicytherura gracilis foliacea* – Faupel, p. 45, pl. 1, fig. 2. [sensu Kammerer 1993]
- 1993 *Semicytherura gracilis* – Kammerer, p. 94-95, pl. 15, fig. 5-10, pl. 16, fig. 10

Type locality and horizon

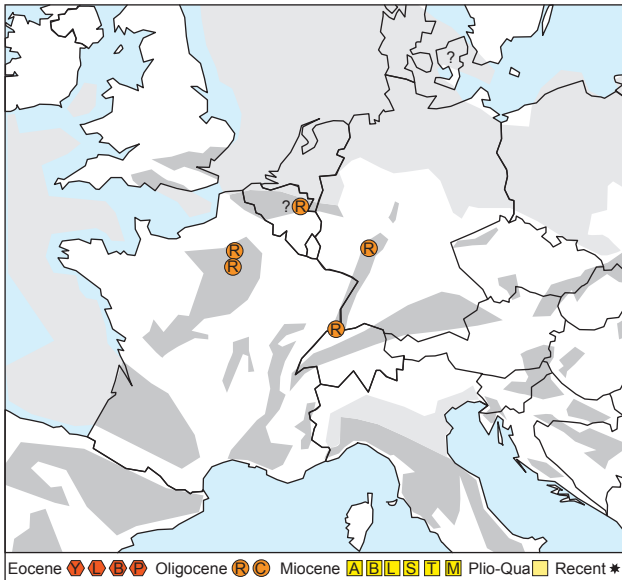
Jeurre near Étampes (France), exact locality and horizon not given.

Holotype

Not given.

Geographic and stratigraphic distribution

Semicytherura gracilis occurs in the Rupelian of the Upper Rhine Graben (this work, Kammerer 1993), the Paris Basin (Lienenklaus 1895; Keen 1972b) and probably Belgium (Keij 1957).



Temporal and spatial distribution of Semicytherura gracilis in the Cenozoic of Europe.

geometric forms=epochs letters=stages
 without letters=epoch (nonspecific)
 gray areas=main sedimentary basins

Ostracoda

Plate 75

Semicytherura gracilis (Lienenklaus, 1895)

1. BEE004-280

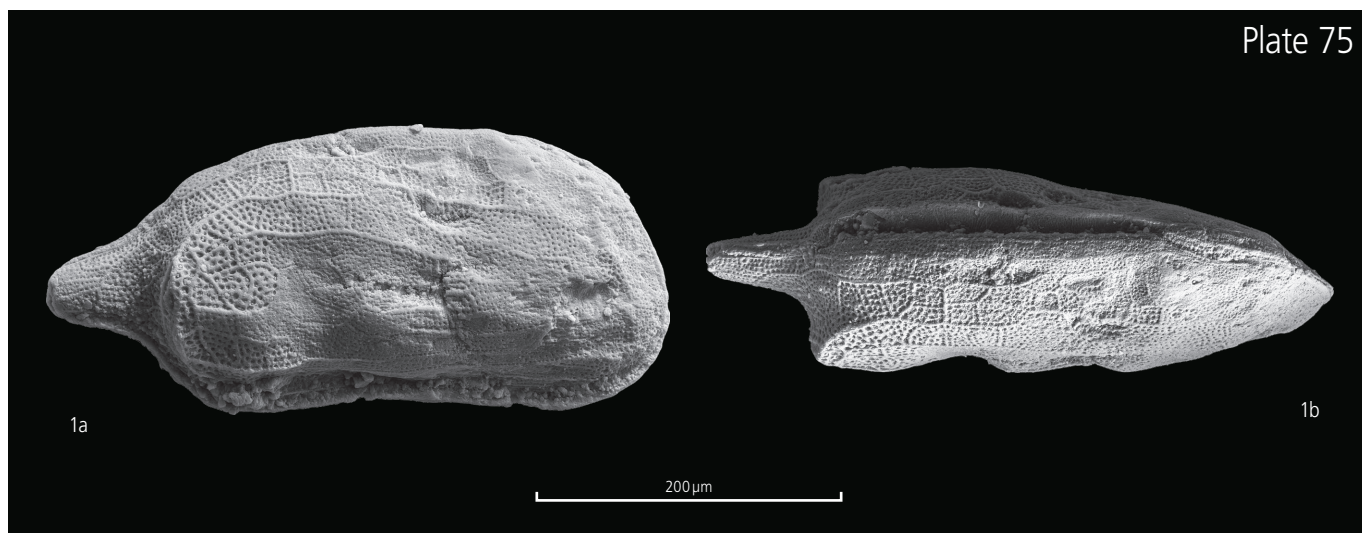
Late Rupelian, Delémont-Beuchille Est

Carapace, L 406 × H 184 × W 134 μm

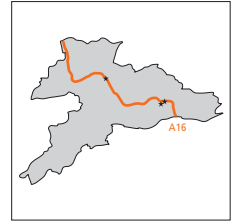
a) right lateral view (image Semicytherura 66_71OUT.psd)

b) dorsal view (image Semicytherura 66_71DOR.psd)

Plate 75



PODOCOPIDA

Paracypris aerodynamica Oertli, 1956**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Candonidae	<i>Paracypris</i>	<i>aerodynamica</i>

Determination (name/date): Laurent Picot/14.12.2005 ; Claudius Pirkenseer/20.08.2015

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Cornol - Route Nationale (COR-RNA)	577 713/250 616
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Rossemaison - Clos Leuchu (ROS-CLU)	592 630/243 770

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
COR-RNA	2	-9.2 m	57	RNA987-38, 114, 115
COR-RNA	2	-16.4 m	55	RNA987-36
DEL-BEE	9	101	963	BEE003-252
DEL-BEE	9	201	213	BEE003-272, 974
DEL-BEE	14	1	679	BEE003-835
DEL-BEE	19	1800	767	BEE003-861
ROS-CLU	1	-106.0 m	54	CLU007-197

Material

adult: 17 carapaces, 4 left valves, 3 right valves, 1 fragmentary carapace, 2 fragmentary left valves, 2 fragments

Measurements (µm)

RNA987-57	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	adult L	1	1014	–	358	–	2.83	–
	adult R	1	1034	–	347	–	2.97	–

Taxonomic remarks

The very elongated *Paracypris aerodynamica* resembles the widely distributed Recent *P. polita* Sars, 1866 and the early Rupelian *P. propinqua* Triebel, 1963 from the Mainz Basin (Germany). The latter species is relatively higher, features distinct cardinal angles and a more dorsally positioned posterior end, while the former appears more stocky and arcuate in lateral view (Oertli 1956).

Synonymy

Genus *Paracypris* Sars, 1866

Type species: *Paracypris polita* Sars, 1866

Paracypris aerodynamica Oertli, 1956

- * 1956 *Paracypris aerodynamica* n. sp. – Oertli, p. 32-33, pl. 1, fig. 24-26, 28-30
- ? 1958 *Paracypris* cf. *aerodynamica* – Goerlich, p. 218, tab. 1
- 1963 *Paracypris aerodynamica* – Stchepinsky, p. 155, tab. 1
- non 1969 *Paracypris aerodynamica* – Ascoli, p. 55, range chart 2 [see Barbin & Guernet 1988, p. 223]
- ? 1971 *Paracypris aerodynamica* – Scheremeta, p. 159, tab. 2
- ? 1975 *Paracypris aerodynamica* – Brestenská, p. 386, tab. 6
- 1994 *Paracypris aerodynamica* – Ziegler, p. 185, fig. 8
- 2002 *Paracypris aerodynamica* – Picot, p. 132-133, pl. 3, fig. 2-4
- 2008 *Paracypris aerodynamica* – Picot et al., p. 492, tab. 2, pl. 2, fig. 3

Type locality and horizon

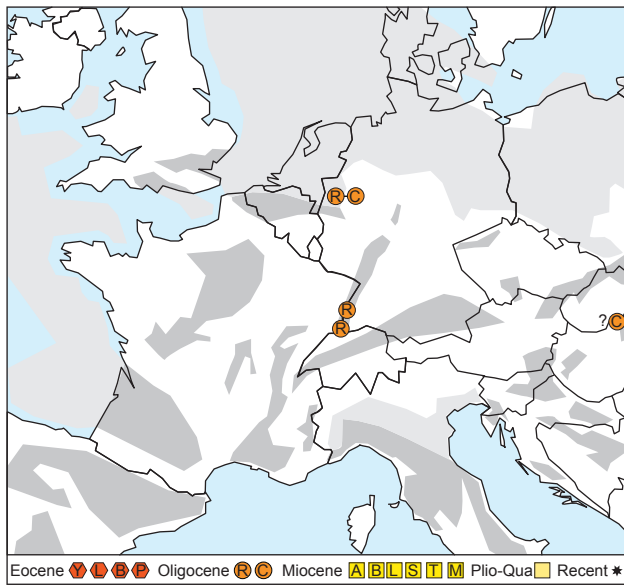
“Tongrube Laufen”, clay pit near Laufen (Switzerland), “Blaue Tone”, Rupelian (sensu Oertli 1956).

Holotype

Carapace, MOOE 1110/1, Natural History Museum of Bern (Switzerland).

Geographic and stratigraphic distribution

Paracypris aerodynamica shows a rather restricted occurrence in the late Rupelian of the southern Upper Rhine Graben (Oertli 1956; Stchepinsky 1963; Picot 2002) and the middle Oligocene of northwestern Germany (Goerlich 1958; Ziegler 1994). Records further to the east cannot be verified due to a lack of information (Scheremeta 1971; Brestenská 1975).



Temporal and spatial distribution of Paracypris aerodynamica in the Cenozoic of Europe.

geometric forms=epochs letters=stages
 without letters=epoch (nonspecific)
 gray areas=main sedimentary basins

Ostracoda

Plate 76

Paracypris aerodynamica Oertli, 1956

1. RNA987-114

Late Rupelian, Cornol-Route Nationale

Left valve, L 1014 × H 358 × W 159 μm

a) lateral view (image Paracypris 66_35OUT.psd)

b) dorsal view (image Paracypris 66_35DOR.psd)

2. RNA987-115

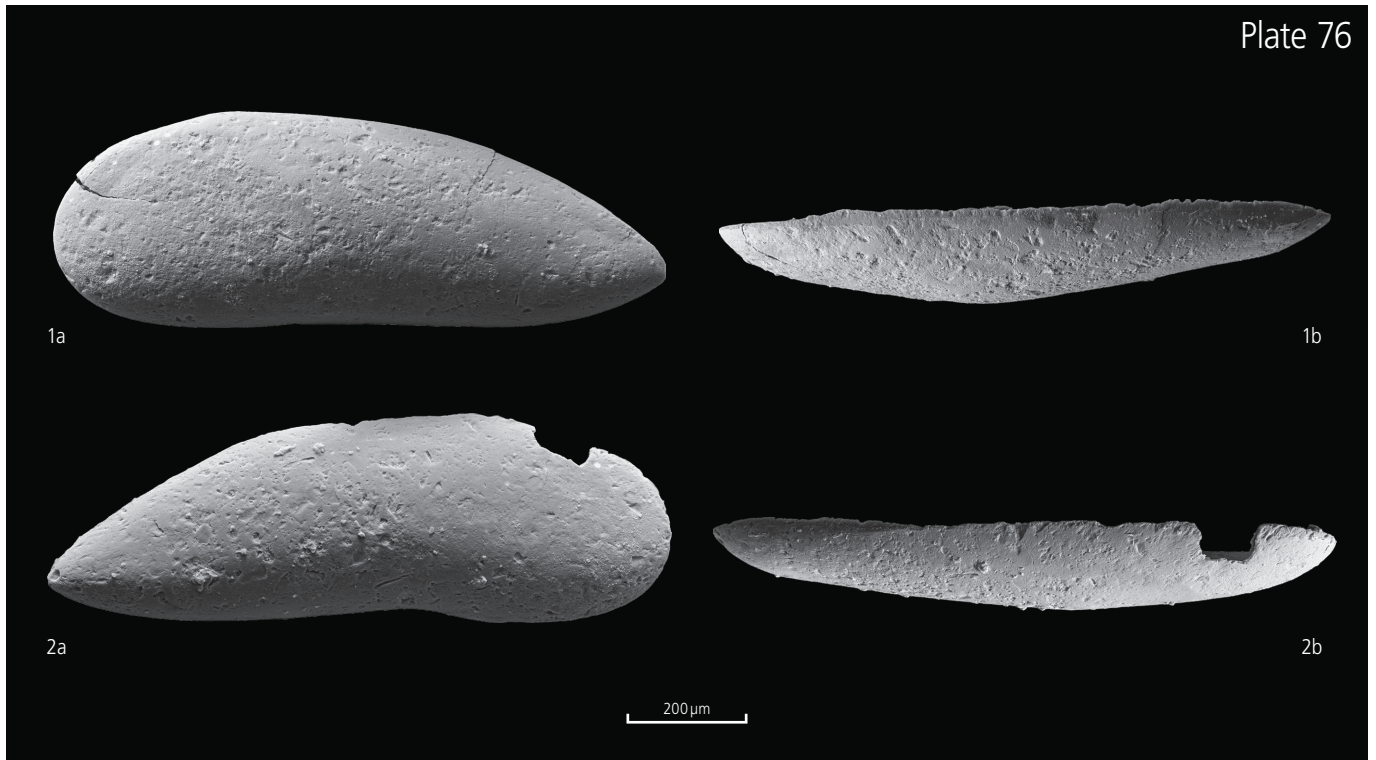
Late Rupelian, Cornol-Route Nationale

Right valve, L 1034 × H 347 × W 146 μm

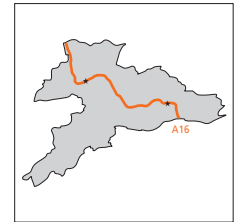
a) lateral view (image Paracypris 66_36OUT.psd)

b) dorsal view (image Paracypris 66_36DOR.psd)

Plate 76



PODOCOPIDA

Phlyctenophora grosdidieri Stchepinsky, 1963**Taxonomy**

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Candonidae	<i>Phlyctenophora</i>	<i>grosdidieri</i>

Determination (name/date): Claudius Pirkenseer/16.10.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Delémont - Beuchille Est (DEL-BEE)	593 610/244 595
Porrentruy - Étang (POR-ETA)	571 474/251 036

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
DEL-BEE	19	1800	260/767	BEE004-165, 272-273/BEE003-557, 860
DEL-BEE	19	1900	769	BEE003-867
POR-ETA	2	-7.0 m	7	ETA004-103
POR-ETA	2	-8.0 m	8	ETA004-109, 229
POR-ETA	3	-7.0 m	27	ETA004-127
POR-ETA	3	-9.0 m	29	ETA004-129
POR-ETA	3	-10.0 m	30	ETA004-130, 245
POR-ETA	3	-15.0 m	35	ETA004-191

Material

adult: 24 carapaces, 5 left valves, 5 right valves (partly pyritised, partly ? moulds)

Measurements (µm)

diverse samples	Stade	Quantity	Length	mean	Height	mean	le/he	mean
	adult L	1	779	–	385	–	2.02	–
	adult R	1	741	–	366	–	2.03	–
	adult C, ?	2	705-742	723	340-354	347	2.07-2.10	
	mould						2.09	

Taxonomic remarks

The genera *Phlyctenophora* Brady, 1880 and *Ghardaglaia* Hartmann, 1964a of the subfamily Paracypridinae (e.g. Hartmann & Puri 1974) were mainly separated by means of their soft part anatomy. Both feature branching anterior marginal pore channels (e.g. Hartmann 1974; Puri & Hulings 1976) and somewhat similar arrangement of muscle scars. The latter have not been illustrated for the type of *Phlyctenophora* in Brady (1880), and the type figure of *P. zealandica* remains vague even in the lectotype designation in Puri & Hulings (1976). Hartmann (1964b) even considers *Phlyctenophora* to represent a junior synonym of *Paracypris*, however with partial validity restored in Hartmann & Puri (1974). Based on shell morphology alone, *Phlyctenophora* was chosen due to its precedence over *Ghardaglaia*.

Phlyctenophora grosdidieri Stchepinsky, 1963 was initially described from the central Upper Rhine Graben, and subsequently from the eastern Molasse Basin (e.g. Reichenbacher et al. 2004). Stchepinsky (1963) does not give an indication about the morphology of the marginal pore channels nor the muscle scar pattern, but the rest of the valve morphology applies to our material (with no other similar species described for the basin). Müller (1985) and Reichenbacher et al. (2004) describe the presence of three morphotypes ("broad", "intermediate" and "slender").

The morphologically very similar *Pontocypris oligocaenica* Zálányi, 1929 has been tentatively been assigned to *Phlyctenophora* in Brestenská (1975). The only difference of the specimens figured in Brestenská (1975) relative to *Phlyctenophora grosdidieri* result in a slightly blunter and somewhat higher positioned posterior end and a more well rounded, somewhat larger anterior end of the left valve. The figured specimens in Reichenbacher et al. (2004) seem to represent intermediate forms with a posterior end similar to *oligocaenica*, but an anterior end as in *grosdidieri*. The validity of the precedence of *Phlyctenophora oligocaenica* thus remains to be verified.

Synonymy

Genus *Phlyctenophora* Brady, 1880

Type species: *Phlyctenophora zealandica* Brady, 1880

Phlyctenophora grosdidieri Stchepinsky, 1963

- 1956 *Candona candidula* – Oertli, p. 33-34, pl. 1, fig. 21-23p.
- * 1963 *Phlyctenophora grosdidieri* n. sp. – Stchepinsky, p. 155-156, pl. h.t., fig. 8-13
- 1967 *Phlyctenophora grosdidieri* – Witt, p. 95
- ? 1969 *Pontocypris oligocaenica* – Scheremeta, p. 66, pl. 4, fig. 1-2. [sensu Brestenská 1975]
- ? 1971 *Phlyctenophora grosdidieri* – Kollmann, tab. 5/6
- ? 1975 ? *Phlyctenophora oligocaenica* – Brestenská, p. 386-397, pl. 4, fig. 1-6
- 1980 *Phlyctenophora grosdidieri* – Hagn & Moussavian, p. 142, 143
- 1985 *Phlyctenophora grosdidieri* – Müller, p. 12, pl. 1, fig. 1-3
- 2002 *Ghardaglaia cf. pectinata* – Picot, p. 133, pl. 1, fig. 6-8. [SEM images likely distorted]
- ?partim 2004 *Phlyctenophora grosdidieri* – Reichenbacher et al., p. 654-655, pl. 2, fig. 1-9 [slender to broad morphotypes]

Type locality and horizon

Drilling DP-30 near Entzheim (France), sample horizon 176 m, "Stampien supérieur", "Marnes à Cyrènes" sensu Stchepinsky (1963).

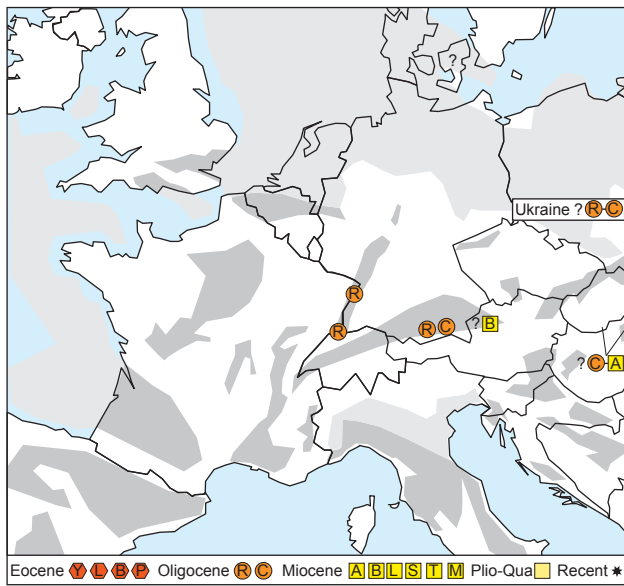
Holotype

A.S. 15, depository not given.

Geographic and stratigraphic distribution

Phlyctenophora grosdidieri occurs in the Rupelian of the Upper Rhine Graben (Oertli 1956; Stchepinsky 1963; Picot 2002), the Rupelian to Chattian of Bavaria (Witt 1967; Hagn & Moussavian 1980; Müller 1985; Reichenbacher et al. 2004).

Potential records hail from the Rupelian to Chattian of the Ukraine (Scheremeta 1969), the Chattian to Aquitanian of northehrn Hungary and southern Slovakia (Brestenská 1975) as well as the Burdigalian of northern Austria (Kollmann 1971), depending on the future taxonomic status of *Pontocypris oligocaenica* Zálányi, 1929.



Temporal and spatial distribution of *Phlyctenophora grosdidieri* in the Cenozoic of Europe.

geometric forms=epochs letters=stages
without letters=epoch (nonspecific)
gray areas=main sedimentary basins

Ostracoda

Plate 77

Phlyctenophora grosdidieri Stchepinsky, 1963

1. ETA004-229

Late Rupelian, Porrentruy-Étang

Left valve, note the structure of the anteroventral free inner lamella,

L 779 × H 385 μm

a) lateral view (image indet 66_11OUT.psd)

b) internal view (image indet 66_11IN.psd)

2. ETA004-245

Late Rupelian, Porrentruy-Étang

Right valve, note the structure of the anteroventral free inner lamella,

L 741 × H 366 μm

a) lateral view (image indet 66_21OUT.psd)

b) internal view (image indet 66_21OUT.psd)

3. BEE004-272

Late Rupelian, Delémont-Beuchille Est

Carapace, pyritised specimen, possibly mould,

L 742 × H 354 × W 274 μm

a) left lateral view (image indet 66_63OUT.psd)

b) dorsal view (image indet 66_63DOR.psd)

4. BEE004-273

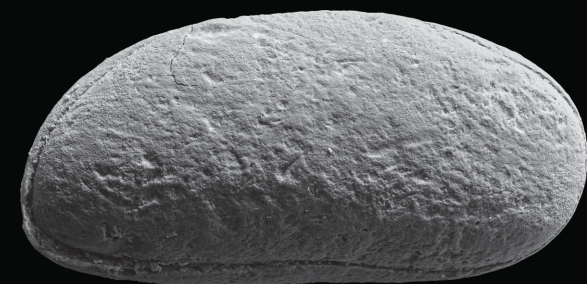
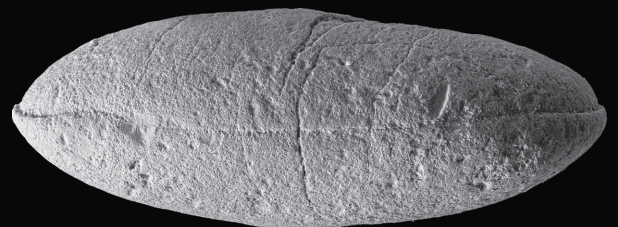
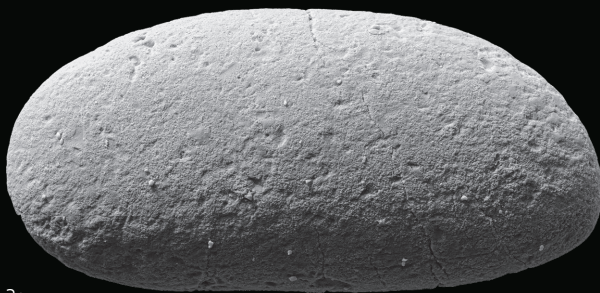
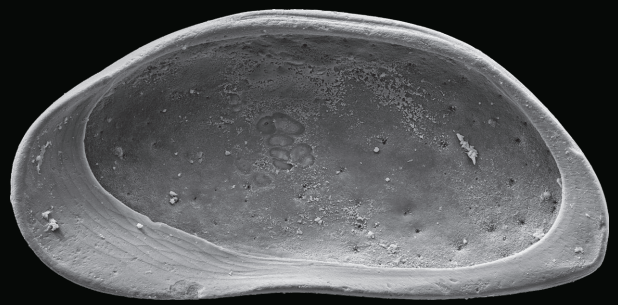
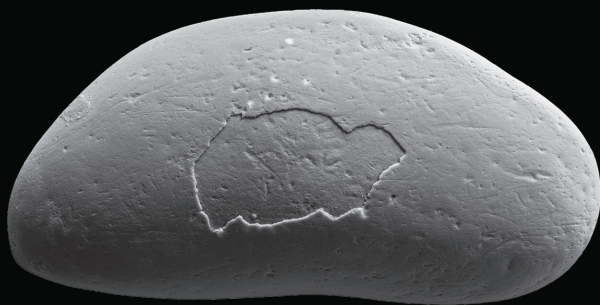
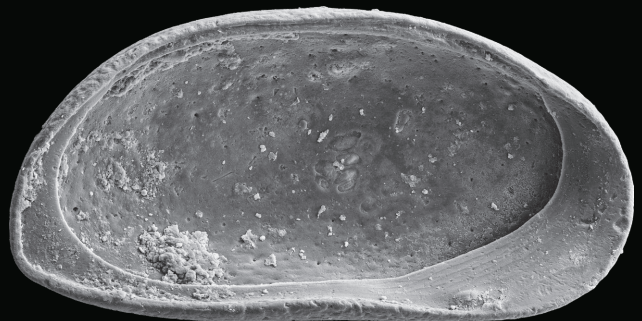
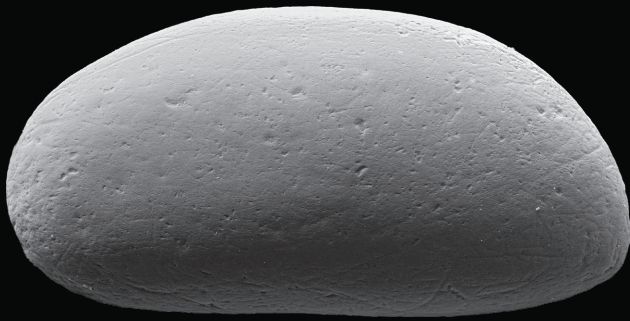
Late Rupelian, Delémont-Beuchille Est

Carapace, pyritised specimen, possibly mould,

L 705 × H 340 μm

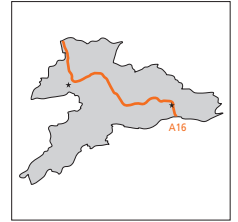
Right lateral view (image indet 66_64OUT.psd)

Plate 77



200 μm

PODOCOPIDA
Reworked Jurassic ostracods



Taxonomy

Class	Order	Family	Genus	Species
Ostracoda	Podocopida	Cytheridaeidae	<i>Schuleridea</i>	–
		Progonocytheridae	<i>Amphicythere</i>	<i>confudens</i>
		Progonocytheridae	? <i>Macrodentina</i>	–
		–	indet.	indet.

Determination (name/date): Claudius Pirkenseer/18.10.2017

Stratigraphy

Lithostratigraphy	Biostratigraphy	Chronostratigraphy
Série grise undifferentiated	MP 23-24/NP23-24	Oligocene/Late Rupelian

Occurrences (localities)

Name	Coordinates CH
Chevenez - La Combe (CHE-LCO)	595 690/243 390
Courrendlin - Pécas (CRD-PCA)	567 750/248 870

Locality	Unit	Layer	Initial sample number	Associated cell or specimen number
CHE-LCO	1	–	1	LCO009-6, 46
CRD-PCA	131	1000	123	PCA008-417, 678-680

Material

adult: 4 carapaces

Measurements (µm)

see plate captions

Taxonomic remarks

Amphicythere confudens Oertli, 1957 is the only confidently identified reworked Jurassic species. *Schuleridea* n. sp. sensu Oertli (1959) from the Porrentruy area was apparently never definitely described as type. The remaining two specimens cannot be assigned taxonomically with certainty due to very poor preservation.

Ostracoda

Plate 78

Reworked Jurassic ostracods

1. *Amphicythere confudens* Oertli, 1957

PCA008-680

Late Rupelian, Courrendlin-Pécas

Female carapace, L 556 × H 388 × W 314 μm

a) right lateral view (image Amphicythere reworked 66_55OUT.psd)

b) dorsal view (image Amphicythere reworked 66_55DOR.psd)

2. gen. et sp. indet.

PCA008-678

Late Rupelian, Courrendlin-Pécas

Carapace, L 615 × H 316 × W 319 μm

Right lateral view (image indet reworked 66_53OUT.psd)

3. *Schuleridea* n. sp. Oertli, 1959

PCA008-679

Late Rupelian, Courrendlin-Pécas

Carapace, L 514 × H 407 μm

Left lateral view (image Schuleridea reworked 66_54OUT.psd)

4. ? *Macrodentina* sp.

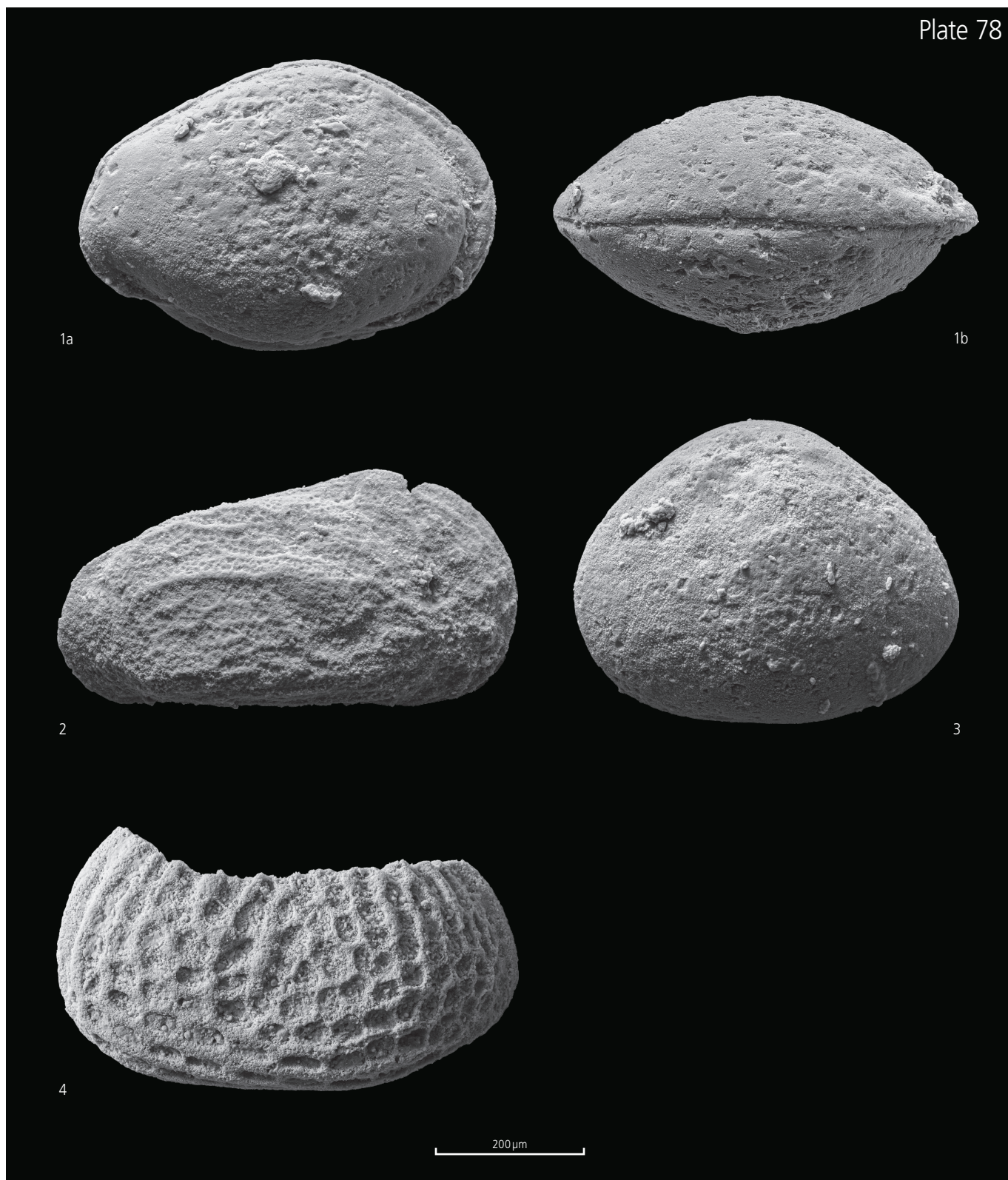
LCO009-46

? Rupelian-Chattian, Chevenez-La Combe

Carapace, L 616 × H - μm

Left lateral view (image reworked Macrodentina indet 66_52OUT.psd)

Plate 78



3 Bibliographie

References

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