



Hans Egger (Ed.)

SELECTED TYPE SPECIMENS IN THE
COLLECTIONS OF THE GEOLOGICAL SURVEY OF AUSTRIA

JAHRBUCH

2010

BAND 150/1+2

Geologische Bundesanstalt

www.geologie.ac.at

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Medieninhaber, Herausgeber und Verleger: Geologische Bundesanstalt, Neulinggasse 38, A 1030 Wien.
Editor: Hans Egger
Redaktion: Hans Egger und Thomas Hofmann
Lektorat: Dido Massimo
Verlagsort: Wien.
Herstellungsort: Horn.
Ziel des „Jahrbuches der Geologischen Bundesanstalt“
ist die Dokumentation und Verbreitung erdwissenschaftlicher Forschungsergebnisse.
Satz, Gestaltung und Druckvorbereitung: Peter Ableidinger im Auftrag der Geologischen Bundesanstalt.
Druck: Ferdinand Berger & Söhne Ges.m.b.H., A 3580 Horn.

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Dedication to Herbert Stradner

Between 1950 and 1960, before he joined the staff of the Geological Survey of Austria, Herbert Stradner worked as a teacher at a secondary school in Vienna. During this time, he finished his thesis on Neogene silicoflagellates and, in 1956, graduated in palaeobotany at the University of Vienna. His thesis was examined and approved by the eminent palaeontologist Georges Deflandre, in Paris. Two years later, Herbert Stradner published his first paper on calcareous nannoplankton. Soon after this, he became a pioneer in the research of this group and, up to now, has published over one hundred descriptions of new species (archaeomonads, diatoms, calcareous nannofossils and

silicoflagellates), many of them important stratigraphical markers. In this volume, a revision of his taxonomic work on nannofossils is presented together with papers by other authors on holotypes stored in the extensive collections of the Geological Survey of Austria. In view of his outstanding contributions to calcareous nannoplankton stratigraphy and taxonomy over a period of more than 50 years, it is with great pleasure that the Department of Paleontology and the authors of this volume dedicate their contributions to Herbert Stradner, who celebrates his 85th birthday on May 23rd, 2010.

Hans Egger

PREFACE

In May 2008, the Department of Paleontology began to prepare a series of papers on the holotypes stored in the extensive collection of the Geological Survey of Austria. The principal objective of these papers was to document the scientifically more important parts of the collection – essentially, the holotypes, isotypes, lectotypes, syntypes and paratypes. Originally, it was planned to publish individual papers immediately after their completion in the yearbook of the Geological Survey. However, in the end, the manuscripts have been combined into a special volume, dedicated to Herbert STRADNER, the former Head of the Department.

Due to the lack of paleontologists and stratigraphers with the required expertise at the Geological Survey, the publication of a distinctive and representative volume need the collaboration of additional scientists from other institutions. Thus we are grateful to our colleagues Marie-Pierre AUBRY and Monique BONNEMAISON (Rutgers University, USA), Barbara MELLER (University of Vienna) and Milos SIBLIK (Czech Academy of Science, Prague) who agreed to help with the project by contributing important manuscripts.

The volume comprises eight papers, each dealing with a different fossil group. In the first paper, Herbert STRADNER, Marie-Pierre AUBRY and Monique BONNEMAISON present a taxonomic and stratigraphic revision of the 103 species and 13 genera of calcareous nannoplankton taxa described by Herbert STRADNER since 1959. As a by-product, these type specimens are now inventoried and have become a proper part of the collection.

Ilse DRAXLER, in the second paper, documents 33 spore holotypes from the pioneering work undertaken by Wilhelm KLAUS in Upper Permian and lowermost Triassic strata in Italy. These important specimens are also now properly inventoried within the Geological Survey collection, after being re-discovered during the preparation of this volume at the Department of Palaeontology, University of Vienna.

Both papers written by Barbara MELLER deal with leaf assemblages originally described by Constantin von ETTINGSHAUSEN. Altogether, 127 species from the lower Oligocene of Bad Häring and the Miocene of the Vienna Basin, represented by their holotypes, isotypes and syntypes, are documented in these excellent publications, which for the first time combine new photographs of the type specimens with the original drawings.

Helga PRIEWALDER, in the fifth paper, presents 21 chitinozoan holotypes from the CRAMER collection, an important collection acquired by the Geological Survey in 1990. Identification of the holotypes was difficult since information concerning the sample numbers was frequently incorrect or missing and the figures are often of poor quality in CRAMER's original publications. The new photographic documentation of the retrievable holotypes will contribute to a better understanding of the original definition of the species.

The paper by Holger GEBHARDT lists and illustrates 193 holotypes, 108 lectotypes, and 8 syntypes (total 309) of foraminiferal type specimens previously described in several historical and more recent publications by various authors. The material of D'ORBIGNY (1846), with its 108 lectotypes and 7 holotypes, is certainly the most important portion of the foraminiferal type collection stored in the Geological Survey.

Irene ZORN, in the seventh paper, reports on the 44 ostracod type specimens in the collection, ranging in age from the Carboniferous to the Miocene. Details of the type specimens, their current classification, as well as original pictures, are presented. As in the paper of GEBHARDT, the original figures have been scanned and, where possible, digitally improved, to save the specimens from further handling.

For the last paper, Milos SIBLIK presents an inventory of the 44 Triassic and Lower Jurassic brachiopod holotypes established by Alexander BITTNER in a number of publications. This contribution is the first part of a planned catalogue of all Mesozoic brachiopod holotypes deposited in the collections of the Geological Survey. The second part is in preparation and will be published in autumn in the next issue of the yearbook.

Thanks are due to all the authors of this volume for their excellent contributions and to Hugh RICE who improved the English of several manuscripts. I am grateful to the entire staff of the Department of Paleontology for their technical assistance during the preparation of the volume, in particular, to Ilka WÜNSCHE who did a large part of the photography. I am indebted to Markus KOGLER and Stephan PRIBITZER for their patience and diligence in preparing scans and figures and to Monika BRÜGGEMANN-LEDOLTER for her help in preparing part of the plates.

Hans Egger
Head of Department of Paleontology

**Calcareous Nannofossil Type Specimens
 in the Collection of the Geological Survey of Austria:
 A Taxonomic and Stratigraphic Update**

HERBERT STRADNER*), MARIE-PIERRE AUBRY**) & MONIQUE BONNEMAISON***)

211 Text-Figures

*Nannoplankton
 Taxonomy
 Cenozoic
 Mesozoic
 Type Specimens
 Palaeontological collection*

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**Kalkige Nannofossilien (Typenmaterial) in der Sammlung der Geologischen Bundesanstalt:
 Eine taxonomische und stratigraphische Neubearbeitung**

Zusammenfassung

Eine taxonomische und stratigraphische Revision aller von Herbert STRADNER – allein oder mit Kollegen – beschriebenen Arten und Gattungen von kalkigem Nannoplankton (haptophyte Algen) wurde durchgeführt. Die Originalbeschreibungen und -illustrationen aus diversen Publikationen werden wiedergegeben. Da die Beschreibungen oft nur in deutscher Sprache vorlagen und viele Arten ursprünglich nur mit Zeichnungen dokumentiert waren, wurden diese jetzt mit Übersetzungen in die englische Sprache und neuen Mikrophotographien ergänzt. Vierundsiebzig känozoische (9 Gattungen und 65 Arten) und 43 mesozoische (5 Gattungen und 38 Arten) Taxa wurden bearbeitet und im aktuellen taxonomischen System positioniert. Das Typenmaterial wird in den Sammlungen der Geologischen Bundesanstalt (Wien) aufbewahrt.

Abstract

This document constitutes a taxonomic reference for the collection of calcareous nannoplankton (Haptophytes) type specimens designated by one of us (HS), alone or with colleagues, and deposited at the Geological Survey of Austria. The original descriptions and illustrations of the 117 described taxa are reproduced, accompanied when necessary of a literal English translation, and often complemented by the first photographic illustrations of their holotypes and paratypes. Thus 74 Cenozoic (9 genera and 65 species) and 43 Mesozoic (5 genera and 38 species) taxa are considered. The taxonomy is updated and replaced by a current and comprehensive high rank taxonomy. A new family and several new combinations are introduced.

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Introduction

A sound taxonomic framework is at the core of geological studies that rely upon the paleontological record, whether biostratigraphic, evolutionary or paleoenvironmental. In the early days of discovery of the living and extinct coccolithophorids it was acceptable to accompany the formal descriptions of new taxa solely with interpretative hand-drawn illustrations of holotypes and paratypes. Subsequent publications of photographs in the optical and/or electron microscope have usually helped clarify the concept of such species, but rarely have photographs of hand-drawn holotypes been published.

As part of an initiative of the Geological Survey of Austria, this paper compiles all taxa (103 species and 14 genera) described by one of us (HS) over the years, placing them in a current and comprehensive taxonomic framework. As part of our work, all slides containing holotypes described by STRADNER were incorporated now into the collections of the Geological Survey of Austria. To make the material retrievable, the new collection numbers replace the old designations mentioned in the original papers of STRADNER. As conceived, this document constitutes a taxonomic reference for the collection of holotypes designated by STRADNER and deposited at the Geological Survey. The description of all taxa and their original illustrations (for species) are republished herein, and photographs of many holotypes (and paratypes) are published for the first time.

The new photographs were taken with a Zeiss Axioplan light microscope at a magnification of 1000x. They support the original documentation of the type specimens, which were figured by hand-drawings in the early papers of HS. Some of these drawings show idealized figures of the type specimens, which have been made using the features of a number of syntypes or by reconstruction of incomplete specimens. Thus, for taking the photographs of this type material, it was necessary to select a lectotype out of a number of syntypes. In the more recent papers of HS, the holotypes are defined by photographs or electron micrographs. In the latter case, the collection number of the micrograph is given with the description of the holotype.

The generic names under which several species were first described have changed, a logical consequence of improved bases for generic taxonomy. Thus we have selected the most sound, generally accepted recombinations. We have indicated synonymies and we discuss the taxonomic status of several taxa. A number of taxa have been described based on overgrown specimens. This is especially true of those described from the lower Eocene of Cuba. Overcalcification of nannofossils in the Cuba samples makes it difficult to discern between specific features and secondary alteration due to overgrowth. Accordingly we suggest suppression of some names (e.g., *Discoaster trinus*; *Heliorthus fallax*), either because they designate clear artifacts of recrystallization (e.g., dicoasters with arms associated in two triplets), or because original ambiguity has prevented their use, and other valid names are available (albeit without historical priority) for the same taxa. In contrast, we maintain the usefulness of the lower Eocene marker *Tribrachiatulus bramlettei*, a species that has been docu-

mented worldwide and by many authors since its description in 1960. Other species were described from specimens reworked in much younger rocks. For these taxa the correct stratigraphic distribution is given. The biostratigraphic frameworks referred to are those of AUBRY (1996), MARTINI (1971) and OKADA & BUKRY (1980) for the Cenozoic taxa; SISSINGH (1977), PERCH-NIELSEN (1985), BOWN et al. (1998), BURNETT (1998) for the Mesozoic taxa. Some of the taxa discussed herein have been poorly cited. This is largely because they were described from shallow water deposits, resulting in their biostratigraphic range being poorly established. A broad zonal distribution is given for these taxa.

The original German or English descriptions of species are given *verbatim*. If only German descriptions existed they were translated into English. We have not attempted to redescribe the taxa using the current terminology. On occasions, the same type levels and type localities were referred to differently in different publications.

Finally, we have included all taxa in a high rank taxonomy, involving families and orders. However the coccoliths referred to as *holococcoliths* (composed of tightly packed tiny rhombs, not of the cycles of modified rhombs that characterize *heterococcoliths*) are excluded because in the living coccolithophores hetero- and holococcoliths are secreted sequentially, representing, respectively, the diploid and haploid phases of the life cycle. Consequently, the taxonomic names that have been given to holococcoliths are taxonomically irrelevant and synonymous with the names given to heterococcoliths associated in the same cycle. Although it is reasonable to assume that holococcoliths represent the haploid stage in extinct species, it is not possible to determine which heterococcolith and holococcolith are parts of the same cycle. It cannot be excluded either that some species are represented only by the calcified haploid stage (a valid concern for living species as well, although no such case has been reported). Although it is important to retain the holococcolith name for extinct taxa, inclusion in a separate order or family would be meaningless, whereas inclusion in existing such taxa is an impossible task. Holococcolith taxa described by STRADNER (and co-authors) are thus treated separately from the current classification.

The high rank taxonomy of the Mesozoic coccolithophores has been in a continuous state of flux, with substantial disagreements among authors as to the generic content of families (see AUBRY, 1998). We provisionally use here the classification established by BOWN (1998). Mesozoic taxa (*Braarudosphaera africana*, *Micrantholithus obtusus*, *Scampanella cornuta*), which may be classified in Cenozoic taxonomy are treated in these families.

An e-book of this publication with complementary data is prepared to be published at the end of 2010. It will contain to more taxa (e.g. *Trochastrites* nov. gen., STRADNER 1961, p. 114 and *Tetralithus gothicus* DEFLANDRE *trifidus* n. ssp. STRADNER 1961, 124 and 126), which will be also documented in an extra publication.

Taxonomy CENOZOIC

Order: Biscutales AUBRY (in press)
Family: Prinsiaceae HAY & MOHLER 1967

Genus: *Prinsius* HAY & MOHLER, 1967

Type species: *Coccolithus bisulcus* STRADNER, 1963 (in GOHRBRANDT et al.), p. 72, Text-Fig. 1a, b, Pl. 8, Figs. 3–6.

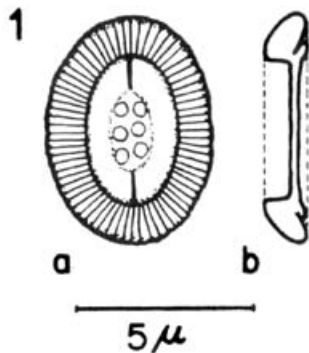
Original description of *Coccolithus bisulcus* STRADNER, 1963

Holotypus: GBA 2009/058/0062.

Derivatio nominis: *bisulcus* (Lat.) = zweigefurcht.

Locus typicus: Nußdorf am Haunsberg, Salzburg (Station 63/2/263/1 bei GOHRBANDT, 1963).

Stratum typicum: Paleozän, tiefere Zone E bei GOHRBANDT (1963).



Text-Fig. 1a.
Original drawing of *Coccolithus bisulcus*.

Beschreibung: Ovale Gehäuseelemente mit doppelter Randscheibe; Binnenraum längsoval bis zweispitzig, in Richtung der Längsachse durch zwei schmale Furchen unterteilt. Zwischen den Furchen sind bei Phasenkontrastbeleuchtung Poren in unregelmäßiger Anordnung zu erkennen. Letztere können besonders bei größeren Exemplaren fehlen oder infolge der Fossilisation nicht mehr erkennbar sein. Die sehr fein gerieften Randscheiben bestehen aus radiär angeordneten Kalklamellen.

Dimensionen: Längsachse 4–6,5 µm, Querachse 3–5 µm, Höhe 1–1,5 µm.

Beziehungen: *Coccolithus bisulcus* n. sp. ist nahe mit *Coccolithus pelagicus* (WALLICH) SCHILLER verwandt, von welchem er sich durch die andersartige Gestaltung des Binnenraumes unterscheidet. *Coccolithus pelagicus* hat zwei nahe dem Zentrum befindliche Poren, *Coccolithus bisulcus* jedoch zwei bis an die Randscheiben sich erstreckende Schlitze mit einem im Zentrum dazwischenliegenden Porenfeld.

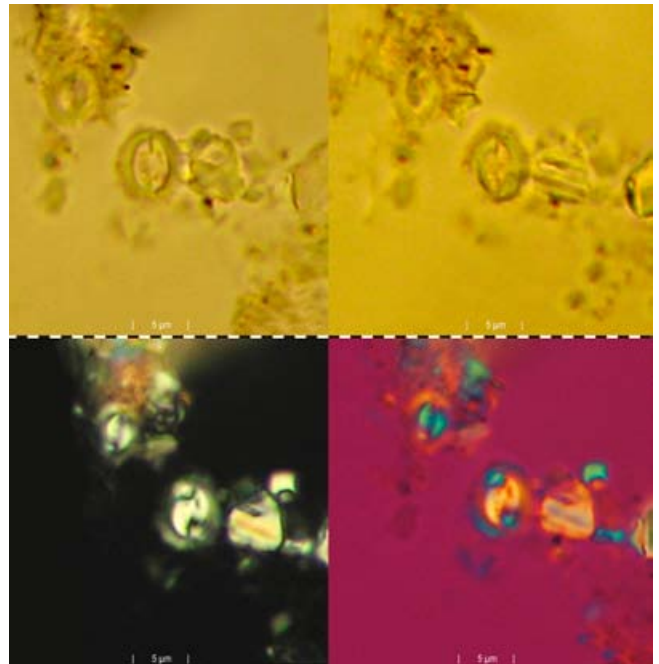
Bemerkungen: Diese Art konnte in den meisten Proben der paleozänen Schichten vereinzelt angetroffen werden; am Locus typicus ist sie sogar sehr häufig.

English translation:

Holotype: GBA 2009/058/0062.

Derivation of name: *bisulcus* (Lat.) = with two slits.

Type locality: Nußdorf at Haunsberg, Salzburg (Station 63/2/263/1 in GOHRBANDT et al., 1963).



Text-Fig. 1b.
Placoliths in normal light and in polarized light.

Level: Paleocene, Zone E of GOHRBANDT (1963).

Diagnosis: Oval coccoliths with double peripheral shield, central area oval or slightly pointed in the longer axis. Two grooves in main direction enclose the centre of the coccolith, which is perforated by a small number of irregularly orientated holes. These also can be missing (or not be observable). The peripheral plates show a delicate striation of calcite lamellae.

Size: Length 4–6.5 µm, width 3–5 µm, height 1–1.5 µm.

Relations: *Coccolithus bisulcus* is closely related to *C. pelagicus*, from which it differs by the different design of the central area. The two grooves enclosing several pores between them makes it easy to differentiate from *C. pelagicus* with only two pores.

Occurrence: In Paleocene samples rare to common, at the type locality even frequent.

Comments:

Biostratigraphic distribution: Upper Paleocene – lowermost Eocene. Zone NP3 through Zone NP10.

Genus: *Toweius* HAY & MOHLER, 1967

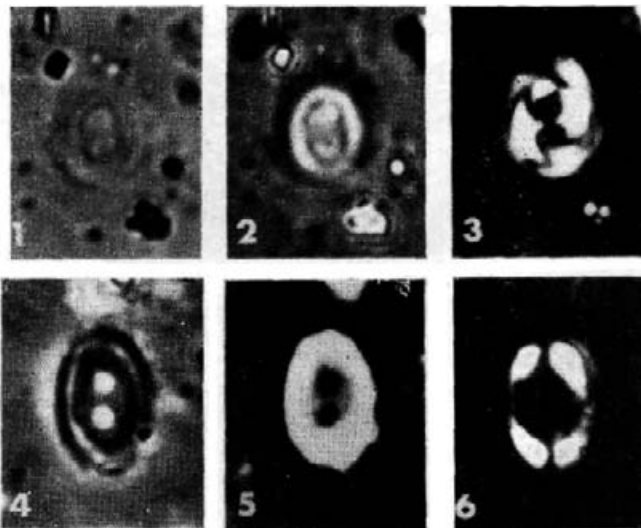
Comments:

Taxonomic status: *Coccolithus petrinus* STRADNER, 1969, p. 413, Pl. 84, Figs. 1–6, is most likely a junior synonym of *Toweius occultatus* (LOCKER) PERCH-NIELSEN, 1971 (= *Coccolithus occultatus* LOCKER, 1967, p. 764, 765, Pl. 1, Fig. 5, Pl. 2, Figs. 9, 10).

Original description of *Coccolithus petrinus* STRADNER, 1969

Holotype: GBA 2009/058/0064.

Derivation of name: *petrinus* (Lat.) = from the rocks.



Text-Fig. 2.
Original photographs of the holotype of *Coccolithus petrinus*.

Type locality: Hagenbach Valley, Lower Austria, Stat. 4.
Level: Lower Eocene.

Synonym: *Coccolithus* cf. *pelagicus* (WALLICH); BOUCHÉ, 1962, p. 83, Pl. 1, Fig. 24.

Diagnosis: Elliptical placoliths with proximal and distal plate, the central area perforated by two circular pores. Transversal bridge not as pronounced as in the larger *Coccolithus crassipons* BOUCHÉ. Rare.

Order: Chiastozygales AUBRY (in press)
Family: Neococcolithaceae AUBRY (in press)

Genus: Chiphragmalithus BRAMLETTE & SULLIVAN, 1961

Type species: *Chiphragmalithus calathus* BRAMLETTE & SULLIVAN 1961, p. 156, Pl. 10, Figs. 7a, b, 8–10.

Synonym: *Heliorthus* BRONNIMANN & STRADNER 1960, p. 368.

Type species: *Heliorthus fallax* BRONNIMANN & STRADNER 1960, p. 368, Figs. 8–10.

Comments:

Taxonomic status: *Chiphragmalithus calathus* BRAMLETTE & SULLIVAN 1961 being a junior synonym of *Heliorthus fallax* (type of the genus *Heliorthus* BRONNIMANN & STRADNER 1960) the name *Heliorthus* should have priority over the name *Chiphragmalithus* BRAMLETTE & SULLIVAN 1961 (see AUBRY, in press). However, the taxon *fallax* (and the corresponding genus *Heliorthus*) is based on an overgrown specimen, which would justify rejection of the name *fallax* and conservation of the name *calathus*.

Stratigraphic distribution: Zone NP12.

Original description of
***Heliorthus* BRONNIMANN & STRADNER, 1960**

Derivatio nominis: Kombiniert aus Heliolithae und Ortholithae.

Locus typicus: Universidad-Formation, Stat. 489, Kuba.

Diagnose: Ein Coccolith, dessen Binnenraum von einem dicken, nach Art der Gattung *Tetralithus* gebauten Kreuz er-

füllt ist. Im polarisierten Lichte verhält sich dieses Kreuz ortholithisch, die schmale Randscheibe hingegen heliolithisch. Es scheint also die Textur der Randscheibe radialstrahlig, die des Kreuzes parallelstrahlig zu sein.

Größe: 8–13 µm.

Beziehungen: *Heliorthus* ist nahe verwandt mit *Tetralithus copulatus* DEFLANDRE, von dem er sich aber durch die kleineren Dimensionen des „Tetralithus“-Kreuzes unterscheidet.

English translation:

Derivation of name: word combination of parts of: Heliolithae and Ortholithae.

Diagnosis: Coccoliths, the central area of which is filled by a central cross behaving under crossed nicols like a *Tetralithus*, that is ortholithical. The marginal plate however behaves heliolithical. The microcrystal texture of the marginal plate is radially orientated, while the central cross seems to be parallelly orientated.

Size: 8–13 µm.

Remarks: *Heliorthus* is closely related to *Tetralithus copulatus* DEFLANDRE, from which it can be distinguished by the smaller size of the central cross.

Original description of the
type species *Heliorthus fallax* STRADNER, 1960
(in BRONNIMANN & STRADNER)

Lectotypus: GBA 2009/058/0017/1.

Derivatio nominis: *fallax* (Lat.) = trügerisch.

Locus typicus: Universidad-Formation, Stat. 489, Kuba.

Diagnose: Die Beschreibung dieser einstweilen einzigen Art der neuen Gattung *Heliorthus* fällt mit der des Genotypus zusammen. Die Ansichten der beiden Flachseiten zeigen ein etwas unterschiedliches Bild. Fig. 3a/9 scheint der distalen Fläche zu entsprechen.

Größe des Holotypus: 10–13 µm.

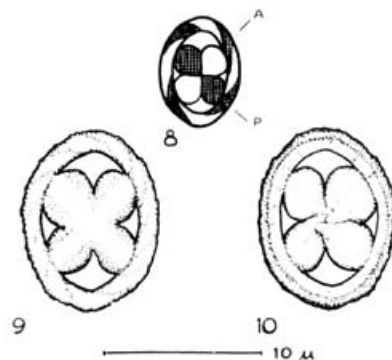
English translation:

Lectotype: GBA 2009/058/0017/1.

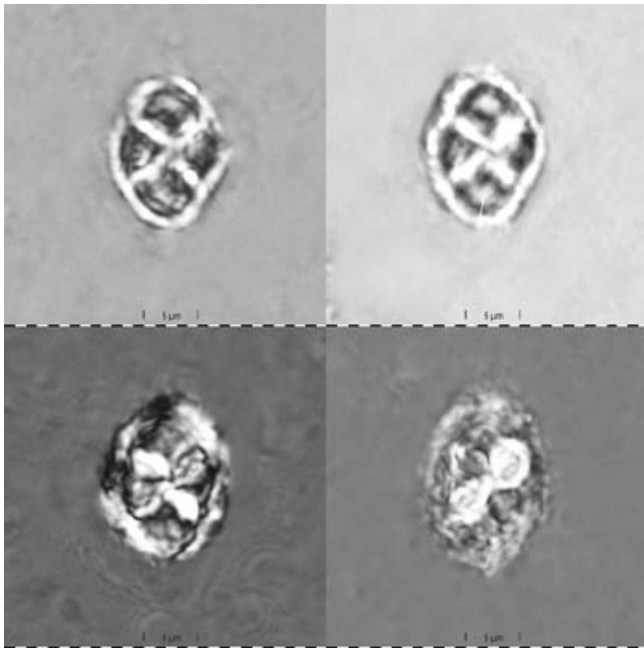
Derivation of name: *fallax* (Lat.) = deceitful.

Type locality: The description of this species corresponds to that of the genus; the two flat sides differ; Fig. 3a/9 shows the distal side.

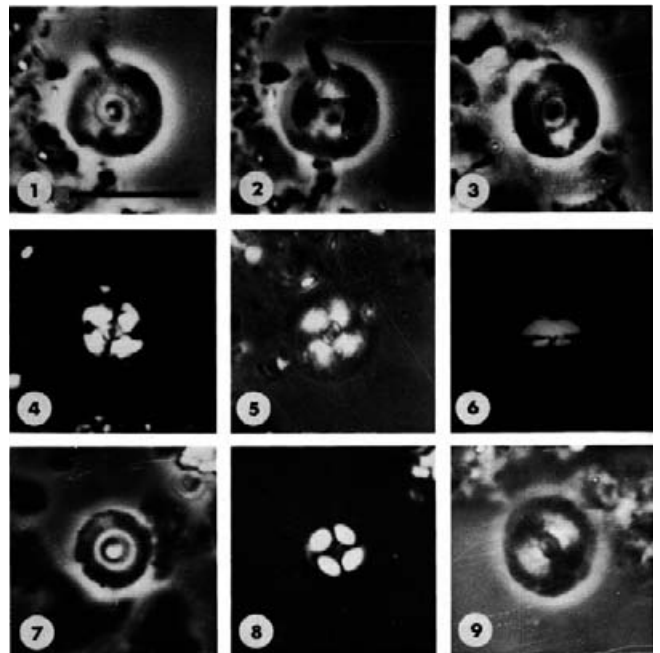
Size: 10–13 µm.



Text-Fig. 3a.
Original drawing of *Heliorthus fallax*.



Text-Fig. 3b.
Lectotype of *Heliorthus fallax* in normal light at different focus levels and in polarized light.



Text-Fig. 4b.
Original photographs of *Cyclococcolithus leptoporus* ssp. *centrovalis*.
Scale = 5 µm.

**Order: Cocosphaerales HAECKEL, 1894 emend.
YOUNG & BOWN, 1997**

Family: Calcidiscaceae YOUNG & BOWN, 1997

Genus: Calcidiscus KAMPTNER, 1950

Type species: *Calcidiscus leptoporus* (MURRAY & BLACKMAN) KAMPTNER *centrovalis* (STRADNER & FUCHS) PERCH-NIELSEN 1984 (= *Cyclococcolithus leptoporus* (MURRAY & BLACKMAN) KAMPTNER *centrovalis* STRADNER & FUCHS, 1980, p. 255, 256, Pl. 5, Figs. 1–9, Pl. 6, Figs. 2–6, Pl. 7, Figs. 1–6, Text-Figs. 2 A, B

**Original description of
Cyclococcolithus leptoporus (MURRAY & BLACKMAN)
KAMPTNER centrovalis STRADNER & FUCHS, 1980**

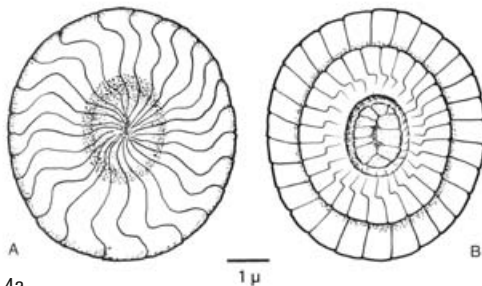
Holotypus: TEM-Platte Nr. 13581, Taf. 6, Fig. 4 und 5. Distalansicht.

Paratypus: TEM-Platte Nr. 13568, Taf. 7, Fig. 1. Proximalansicht.

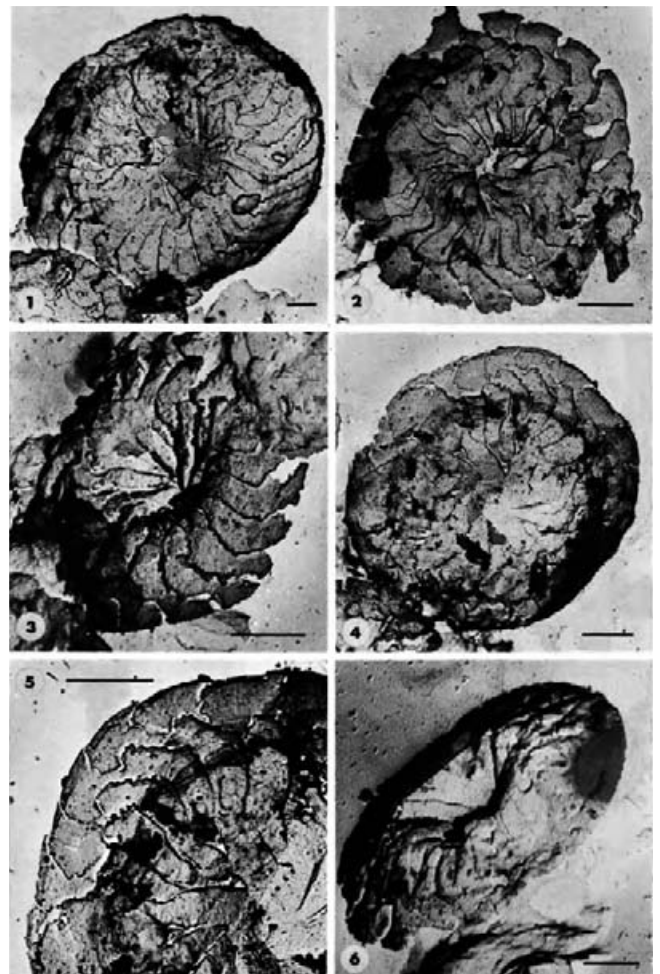
Derivatio nominis: *centrum* (Lat.) = Mitte; *ovalis* (Lat.) = eiförmig; Wortkombination: in der Mitte länglich rund.

Locus typicus: Tiefbohrung Laxenburg 1 der ÖMV-AG, Kern 350–355 m, Kiste 3 oben.

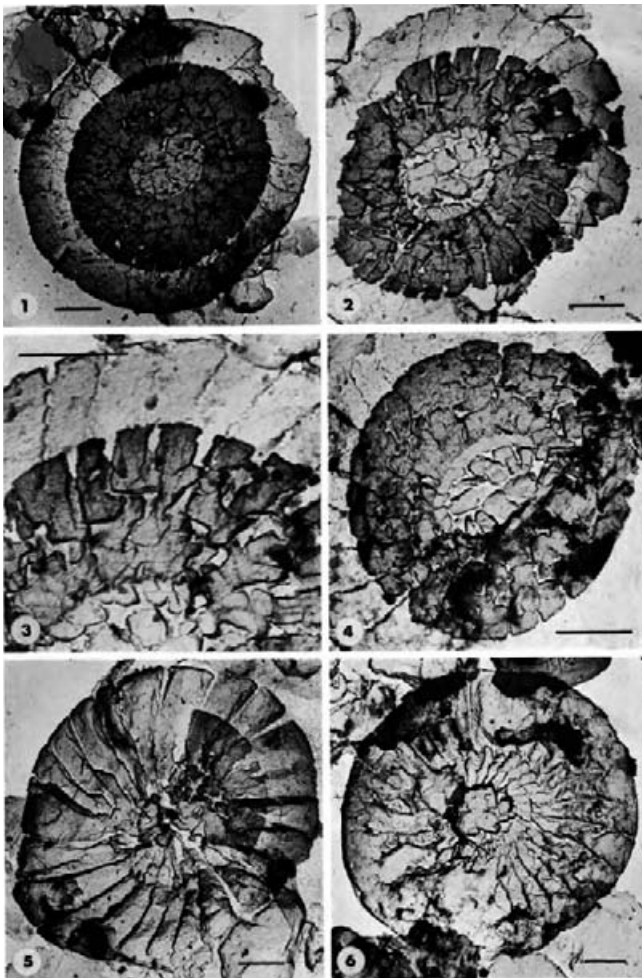
Stratum typicum: Höheres Untersarmatium (Ober-Miozän).



Text-Fig. 4a.
Original drawing of the distal (A) and proximal (B) side.



Text-Fig. 4c.
Distal view of etched specimens (2, 3); distal view of the holotype TEM Micrograph 13581 (4); detail of the holotype specimen (5); oblique view of the distal side (6).
Scale = 1 µm.



Text-Fig. 4d.
View of the proximal side: a well preserved specimen (1), a slightly etched specimen (2), detail of the elements (3). Distal side with elliptical central area (4), proximal view of a distal plate, proximal plate largely destroyed (5), proximal view of the distal plate without proximal plate (6).
Scale = 1 µm.

Beschreibung: Placolithen, die aufgrund ihrer allgemeinen Form und Konstruktion der Art *Cyclococcolithus leptoporus* zugeordnet werden, von der sie sich aber durch folgende Merkmale unterscheiden: Die Mittelfläche (central area) ist breitelliptisch oder breitoval, die Anzahl der Elemente liegt zwischen derjenigen von *Cyclococcolithus leptoporus* var. B (31 ± 2) und var. C (19 ± 2) nach MCINTYRE et al. (1967). Die Einzelelemente sind auf der Distalseite durch S-förmig gekrümmte Suturen getrennt. Bei gekreuzten Nikols erscheint die Distalscheibe dunkel, nur die Proximalscheibe zeigt ein deutliches Löschkreuz.

Dimensionen: Holotypus: Länge 6 µm, Breite 5,5 µm, Höhe ca. 3 µm.

Paratypus: Länge 6 µm, Breite 5 µm, Höhe ca. 3 µm.

Größenvariation: 3–7 µm.

English translation:

Holotype: TEM plate no.13581. Paratype: TEM plate no. 13568.

Derivation of name: *centrum* (Lat.) = centre, *ovalis* (Lat.) = oval.

Type locality: OMV deepwell Laxenburg 1, core 350–355 m.
Level: Upper part of Lower Sarmatian (Upper Miocene).

Diagnosis: Broad elliptical placoliths, which according to their general features have to be assigned to *Cyclococcolithus leptoporus leptoporus*, from which they differ by their overall geometry: The central area is broad elliptical, the same as the outer circumference. The suture lines of the distal and also of the proximal side are curved. In polarized light the proximal shield appears dark, while the distal shield shows a distinct extinction cross.

Size: Length 6 µm, width 5.5 µm, height approximately 3 µm.

Amplitude of size variations: 3–7 µm.

Comments:

Biostratigraphic distribution: Upper Miocene (Tortonian); Zone NN11.

Family: Coccolithaceae POCHE, 1913 emend. YOUNG & BOWN, 1997

Genus: *Cruciplacolithus* HAY & MOHLER in HAY, MOHLER, ROTH, SCHMIDT & BOUDREAUX, 1967

Type species: *Cruciplacolithus tenuis* (STRADNER) HAY & MOHLER in HAY et al. 1967 (= *Heliorthus tenuis* STRADNER, 1961, p. 84, Text-Figs. 64–65; = *Coccolithus helis* STRADNER, 1963 (nom. substit. pro *Coccolithus (Heliorthus) tenuis* STRADNER, non *Coccolithus tenuis* KAMPTNER, 1937) in GOHRBANDT, 1963, p. 74, Pl. 8, Fig. 16, Pl. 9, Figs. 1–2]).

Original description of *Heliorthus tenuis* STRADNER, 1961

Lectotypus: GBA 2009/058/0003/1.

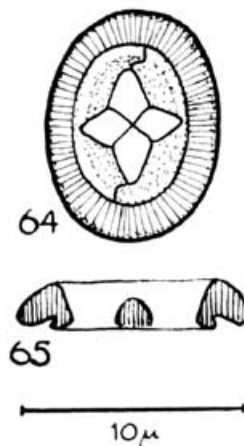
Derivatio nominis: *tenuis* (Lat.) = zart.

Locus typicus: Haidhof bei Ernstbrunn, Niederösterreich. Häufig.

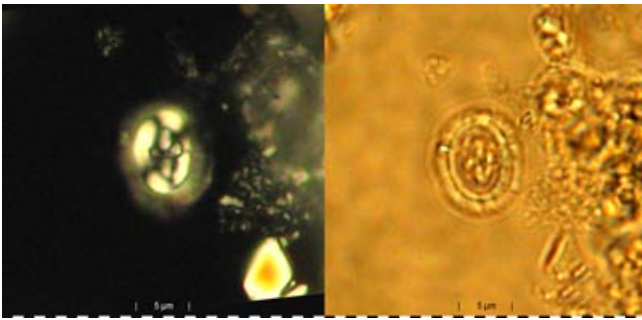
Stratum typicum: Oberste Kreide (Danien).

Diagnose: Elliptischer Coccolith, dessen Randscheibe sehr schmal ist und einen großen mit einem entlang der Hauptachsen orientierten flachen Tetralithuskreuz geschmückten Binnenraum umschließt. Die periphere Randscheibe ist zart gerieft und verhält sich bei gekreuzten Nikols heliolithisch, das Kreuz des Binnenraumes hingegen ortholithisch.

Größe: 8–12 µm.



Text-Fig. 5a.
Original drawing of *Heliorthus tenuis*.



Text-Fig. 5b.
Lectotype of *Heliorthus tenuis* in normal light and in polarized light.

English translation:

Lectotype: GBA 2009/058/003/1.

Derivation of name: *tenuis* (Lat.) = delicate

Type locality: Haidhof near Ernstbrunn, Lower Austria.
Common.

Level: Danian.

Description: Elliptical coccoliths with narrow marginal plate and a large central cross oriented in the directions of the main axes of the wide central area. The peripheral plate shows a heliolithical structure, the cross of the central area however an ortholithical one.

Size: 8–12 μm .

Comments:

Stratigraphic distribution: Paleocene (Danian–Thanetian). The lowest occurrence of *C. tenuis* defines the NP2/NP3 zonal boundary (MARTINI, 1971) and the CP1/CP2 (Okada & Bukry, 1980). Highest occurrence in Subzone NP9a.

Family: Markaliaceae AUBRY (in press)

Genus: *Markalius* BRAMLETTE & MARTINI, 1964

Type species: *Markalius inversus* (DEFLANDRE) BRAMLETTE & MARTINI, 1964 (= *Cyclococcolithus leptoporus* (MURRAY & BLACKMANN, 1898) KAMPTNER 1941 var. *inversus* DEFLANDRE, in DEFLANDRE & FERT, 1954, p. 150, Pl. 9, Figs. 4–7).

**Original description of
Cyclococcolithus astroporus STRADNER, 1963
(in GOHRBRANDT et al.)**

Holotypus: GBA 2009/058/0063.

Derivatio nominis: *aster* (Gr.) = Stern; *poros* (Gr.) = Pore.

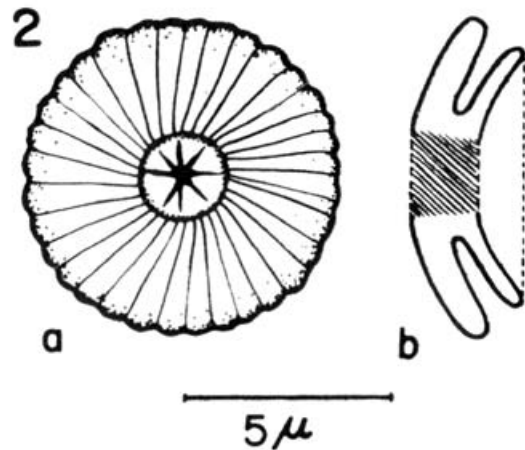
Locus typicus: Nußdorf am Haunsberg (Station 63/2/30/4 in GOHRBANDT, 1963).

Stratum typicum: Paleozän, Zone A.

Beschreibung: Im Umriss kreisrunde Gehäuseelemente mit doppelter Randscheibe, welche aus stark gekurvten Lamellen zusammengesetzt ist. Der runde Binnenraum ist von einer zarten, aus radiären Elementen zusammengesetzten Membran erfüllt, welche von sternförmig angeordneten Schlitzen durchbrochen wird.

Dimensionen: Durchmesser 5–7 μm ; Binnenraum 1–1,5 μm ; Höhe 2,5 μm .

Beziehungen: *Cyclococcolithus astroporus* ist eng mit *Cyclococcolithus leptoporus* (MURRAY & BLACKMAN) KAMPTNER verwandt.



Text-Fig. 6a.
Original drawing of *Cyclococcolithus astroporus*.

Zur Unterscheidung beider Arten dient die Struktur der Binnenraum-Membran, welche bei letzterer Art von Poren durchbrochen ist.

Erstauftreten: Zone A of GOHRBANDT et al. (1963); Station 63/2/165–166/6).

English translation:

Holotype: GBA 2009/058/0063.

Derivaton of name: *aster* (Gr.) = star, *poros* (Gr.) = pore.

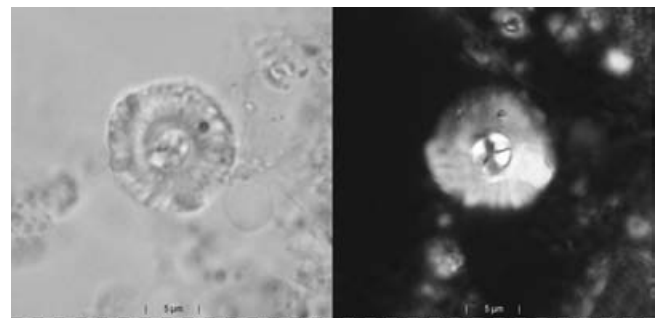
Type locality: Nußdorf at Haunsberg, Salzburg (Station 63/2/30/4 in GOHRBANDT, 1963).

Level: Lower Paleocene.

Diagnosis and description: Circular coccoliths with double rim plates, which are composed of curved lamellae. The circular central area is filled with a membrane composed of radial elements. Narrow slits between them form a slender dark star.

Relations: *Cyclococcolithus astroporus* is closely related to *Cyclococcolithus leptoporus* (MURRAY & BLACKMAN) KAMPTNER, from which it differs by the lack of an open central pore and by its central “star”.

Size: 7–9 μm in diameter.



Text-Fig. 6b.
Original photographs of the holotype in normal light and polarized light.

Comments:

Taxonomic status: *Markalius astroporus* (STRADNER) HAY & MOHLER in HAY et al., 1967, p. 434 (= *Cyclococcolithus astroporus* STRADNER 1963 (in Gohrbrandt et al.), p. 75, Text-Figs. 3, 2a, b, Pl. 9, Figs. 5–7) is a junior synonym of *Markalius inversus* (DEFLANDRE).

Order: Discoasterales HAY, 1977
Family: Biantholithaceae AUBRY (in press)

Genus: *Biantholithus* BRAMLETTE & MARTINI, 1964

Biantholithus astralis STEINMETZ & STRADNER, 1984, p. 676, Pl. 52, Figs. 1, 4, Pl. 53, Figs. 1, 2.

**Original description of
Biantholithus astralis STEINMETZ & STRADNER, 1984**

Holotype: Plate 53, Figure 1. Negative 2/92/007.

Derivation of name: *astra* (Lat.) = stars.

Type locality: Southeast Atlantic Ocean, Angola Basin, DSDP 530A-50-1, 6–7 cm.

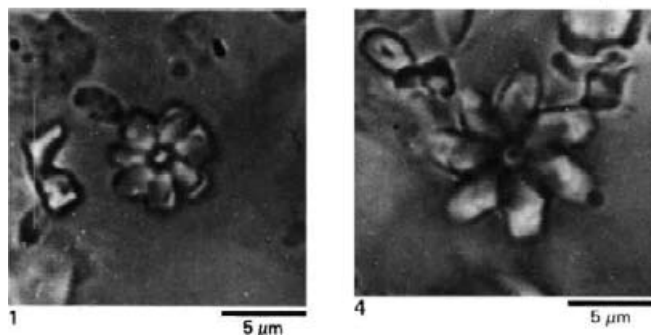
Level: Danian (*Cruciplacolithus tenuis* Zone (MARTINI, 1971), *Cruciplacolithus tenuis* Subzone (BUKRY, 1973a, 1975).

Description: This new species consists of seven to eight segments radiating from a common center. The segments are slightly imbricate and slightly tilted, as are the blades of a windmill. Each segment is in contact with adjacent segments for a little more than half its length. Beyond the point of contact, the segments taper slightly and end with rounded tips. A small hole is present in the center where the segments meet.

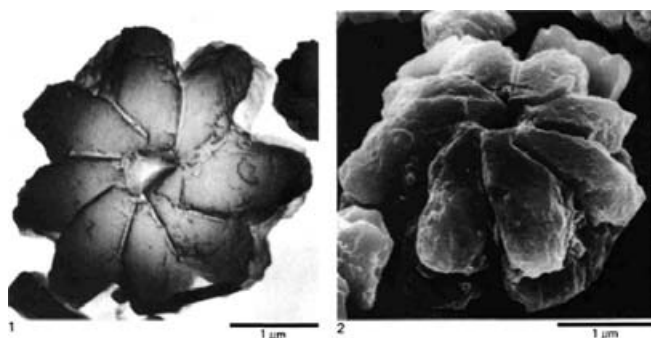
Remarks: *Biantholithus sparsus* BRAMLETTE & MARTINI differs from *Biantholithus astralis* nov. spec., in that it has eight to twelve segments which are in contact for almost their entire length.

Comments:

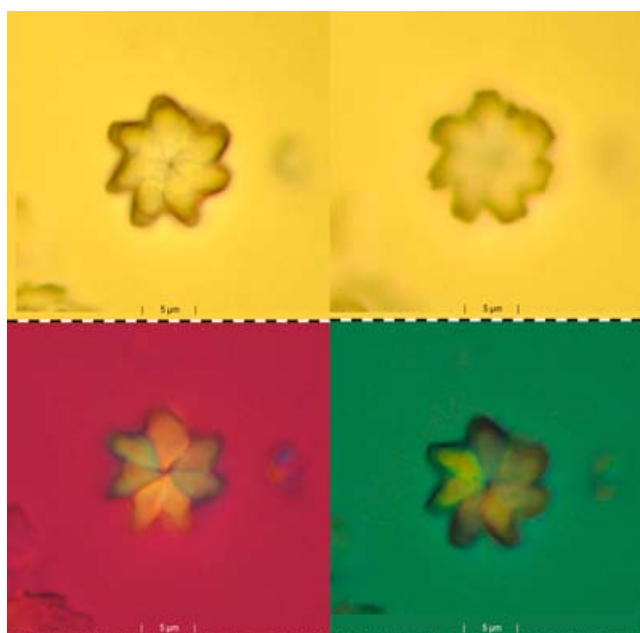
Stratigraphic distribution: Lower Paleocene (Danian); Zone NP1–NP3.



Text-Fig. 7a.
Original photographs of syntypes of *Biantholithus astralis*.



Text-Fig. 7b.
Original photograph of the holotype.



Text-Fig. 7c.
Photographs of a syntype in normal and polarized light at different focus levels.

Family: Discoasteraceae TAN SIN HOK, 1927
orth. mut. VEKSHINA, 1959

Comments:

STRADNER & PAPP's study (1961) of the shape of the sutures on either sides of discoasters is at the basis of THEODORIDIS's reintroduction with emendation (1983, 1984) of the genera *Eudiscoaster* TAN SIN HOK 1927 and *Heliodiscoaster* TAN SIN HOK 1927. This taxonomic revision is rarely followed, the all encompassing genus name *Discoaster* being preferred for pragmatic reasons. We provisionally follow AUBRY (in press) in accepting the scientific validity of these two genera.

Genus: *Eu-discoaster* TAN SIN HOK, 1927 emended
THEODORIDIS, 1984

Comments:

Four species described by STRADNER have been/are reassigned to *Eudiscoaster*:

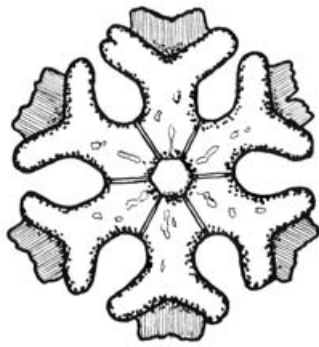
- *Eu-discoaster icarus* (STRADNER) FLORES VILLAJERO 1986 (= *Discoaster icarus* STRADNER, 1973, p. 1138, Pl. 41, Figs. 10, 11).
- *Eu-discoaster musicus* (STRADNER) THEODORIDIS 1983 (= *Discoaster musicus* STRADNER, 1959, p. 1088, Text-Fig. 28).
- *Eu-discoaster perforatus* (STRADNER) AUBRY & STRADNER n. c. (= *Discoaster perforatus* STRADNER 1959a, p. 1087, Text-Fig. 27).

Original description of *Discoaster icarus*
STRADNER, 1973

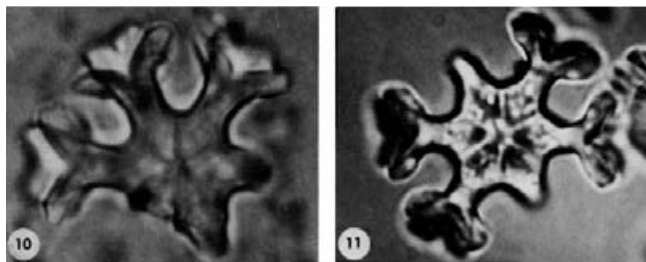
Holotype: Plate 41, Figure 10 in STRADNER, 1973 (slide: GBA 2009/058/0068).

Paratypes: Plate 41, Figure 11.

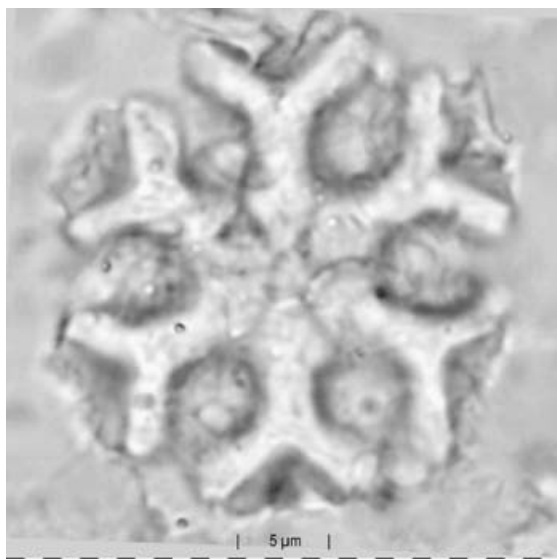
Derivation of name: *Ikaros* (Gr.) = son of Daedalus; in Latin *Icarus*.



Text-Fig. 8a.
Original drawing of *Discoaster icarus*.



Text-Fig. 8b.
Original photographs of the holotype of *Discoaster icarus*.



Text-Fig. 8c.
Photograph of a syntype.

Type locality: DSDP 13-134-7, CC, Balearic Abyssal Plain/Sardinian Margin, lat. 30° 11.70'N, long. 7° 18.25'E.

Level: Upper Miocene, Messinian.

Diagnosis: A discoaster of the *D. variabilis* group with rays terminating in a wide-angle of bifurcating branches with "flaps" between the branches. Larger asterolites with a diameter to about 30 µm, as well as small specimens, show these flap-like extensions. The center of the convex or distal side of *Discoaster icarus* n. sp. is decorated with a hexagonal prismatic knob and the rays are separated by straight suture lines. The concave or proximal side also shows straight suture lines but lacks a central knob. The

membranes of the "flaps" are bent toward the concave side and are best seen in oblique side view. In some asterolites they are bent so sharply that they can hardly be seen in plain view.

Comments:

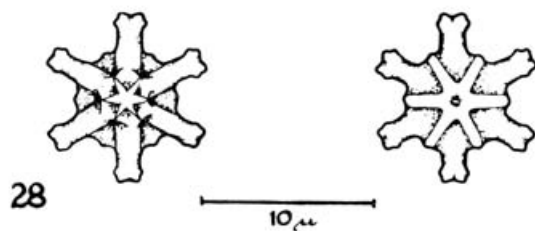
Stratigraphic distribution: Upper Miocene (Tortonian); Upper Zone NN11.

**Original description of *Discoaster musicus*
STRADNER, 1959a**

Lectotype: GBA 2009/058/0004/1.

Derivation of name: *musicus* (Lat.) = musical. Dedicated to my dear music-loving parents.

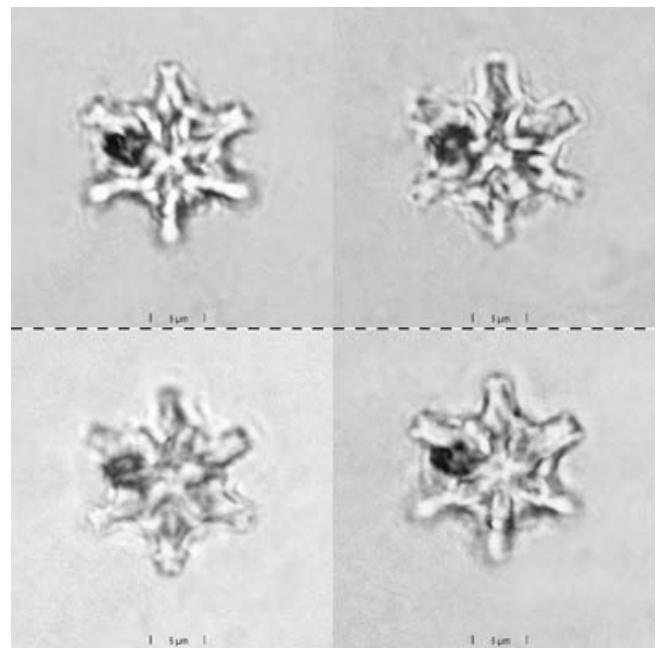
Type locality: Frättingsdorf.



Text-Fig. 9a.
Original drawing of *Discoaster musicus*.

Level: Miocene, Lower Tortonium (Lower Lagenid Zone).

Description: Asterolites with six short rays and a richly decorated central area. The rays have slightly enlarged ends with a shallow terminal notch and two lateral knots resembling those of slender asterolites of *Discoaster distinctus*. The tips of the large central star of the convex face can be seen as extra interstitial corners of the central disc. On the concave face the rays reach as broad ridges to the centre. The central area of this face can be decorated by an additional star.



Text-Fig. 9b.
Holotype in normal light at different focus levels.

Comments:

Taxonomic status: *Discoaster sanmiguelensis* BUKRY 1981, p. 462, Pl. 2, Figs. 7–10, Pl. 3, Figs. 1–14, is a junior synonym of *E. musicus*.

Stratigraphic distribution: Upper lower to upper middle Miocene (Upper Burdigalian to Lower Tortonian); Zone NN4 to lower NN8 (rare).

Original description of *Discoaster perforatus* STRADNER, 1959a

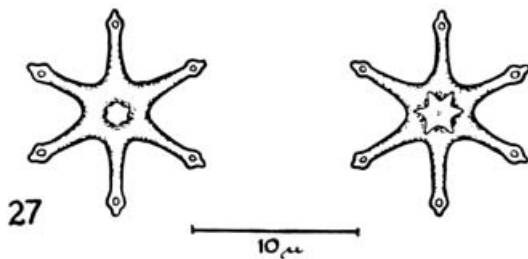
Lectotype: GBA 2009/058/0006.

Derivation of name: *perforatus* (Lat.) = perforated.

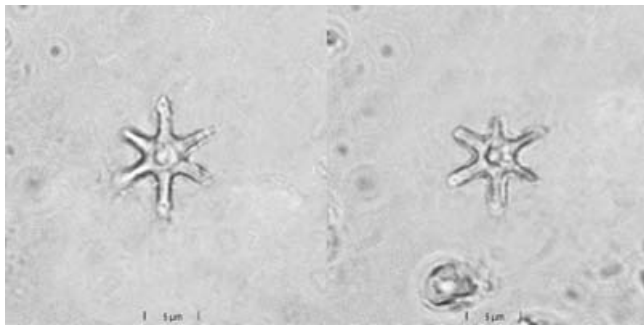
Type locality: Frättingsdorf.

Level: Miocene, Tortonian (Lower Lagenid Zone).

Description: Asterolith six-rayed with slender asteroradii, which shortly before their pointed endings are enlarged to give space to a round perforation. The central disc is resembling that of *Discoaster challengerii* with which it is found co-occurring.



Text-Fig. 10a.
Original drawing of *Discoaster perforatus*.



Text-Fig. 10b.
Holotype in normal light at different focus levels.

Comments:

Stratigraphic distribution: Middle Miocene (Upper Langhian to Lower Serravallian); Zone NN5–NN6.

Genus: *Heliodiscoaster* TAN SIN HOK, 1927 emended THEODORIDIS, 1984

Comments:

Ten species of discoasters have been recombined to *Heliodiscoaster*:

- *Heliodiscoaster aecus* (BRONNIMANN & STRADNER) AUBRY & STRADNER n. c. (= *Discoaster aecus* BRONNIMANN & STRADNER, 1960, p. 366, Pl. 1, Figs. 1–3).

- *Heliodiscoaster bronnimanni* (STRADNER) AUBRY & STRADNER n. c. (= *Discoaster bronnimanni* STRADNER 1961, p. 85, Text-Fig. 82).
- *Heliodiscoaster currens* (STRADNER) AUBRY & STRADNER n. c. (= *Discoaster currens* STRADNER, 1959a, p. 3, Fig. 6).
- *Heliodiscoaster gemmeus* (STRADNER & PAPP) THEODORIDIS 1983 (= *Discoaster gemmeus* STRADNER 1959a, p. 6, Fig. 21).
- *Heliodiscoaster gemmifer* (STRADNER) AUBRY & STRADNER n. c. (= *Discoaster gemmifer* STRADNER, 1961, p. 86, Text-Fig. 83).
- *Heliodiscoaster kuepperi* (STRADNER) THEODORIDIS 1983 (= *Discoaster kuepperi* STRADNER 1959b, p. 478, Figs. 17, 21).
- *Heliodiscoaster martinii* (STRADNER) AUBRY & STRADNER n. c. (= *Discoaster martinii* STRADNER 1959b, p. 479, Figs. 45, 47).
- *Heliodiscoaster munitus* (STRADNER) AUBRY & STRADNER n. c. (= *Discoaster munitus* STRADNER 1961, p. 85, Text-Fig. 81).
- *Heliodiscoaster ornatus* (STRADNER) THEODORIDIS 1983 (= *Discoaster ornatus* STRADNER, 1959a, p. 8, Fig. 30, not *Discoaster tani* BRAMLETTE & RIEDEL subsp. *ornatus* BRAMLETTE & WILCOXON 1967, p. 112, Pl. 7, Figs. 7–8).
- *Heliodiscoaster salisburgensis* (STRADNER) AUBRY & STRADNER n. c. (= *Discoaster salisburgensis* STRADNER 1961, p. 8, Text-Figs. 77, 78).
- *Heliodiscoaster strictus* (STRADNER) AUBRY & STRADNER n. c. (= *Discoaster strictus* STRADNER 1961, p. 85, Text-Fig. 80).
- *Heliodiscoaster wemmelenensis* (ACHUTHAN & STRADNER) THEODORIDIS 1983 (= *Discoaster wemmelenensis* ACHUTHAN & STRADNER, 1967, p. 5, Pl. 4, Figs. 3, 4).

Three other taxa based on poorly preserved material are regarded as superfluous, and are therefore not recombined to *Heliodiscoaster* herein:

- *Discoaster geometricus* BRONNIMANN & STRADNER 1960, p. 366, Pl. 1, Figs. 4, 5.
- *Discoaster trinus* STRADNER 1961, p. 9, Text-Fig. 79.
- *Discoaster uncinatus* BRONNIMANN & STRADNER 1960, p. 366, Pl. 1, Figs. 6, 7.

We recommend suppression of these names.

Original description of *Discoaster aecus* BRONNIMANN & STRADNER, 1960

Lectotypus: GBA 2009/058/0015.

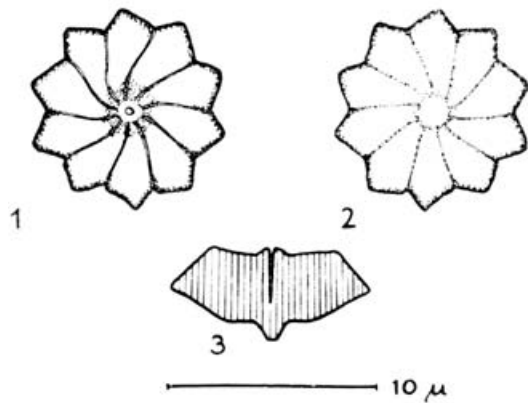
Derivatio nominis: *aecus* (Lat.) = flach, eben.

Locus typicus: Universidad-Formation, BR-Stat. 858, Kuba.

Beschreibung: Ein rosettenförmiger Discoaster, dessen Flachseiten weitgehend an *Discoaster barbadiensis* erinnern, von welchem er sich aber durch einen völlig andersartigen Querschnitt unterscheidet. Der Asterolith hat auf der Facies superior zentral einen dünnen Kanal, der weit ins Innere des verhältnismäßig sehr dicken Kalkkörperchens hineinreicht. Der Stiel ist im Gegensatz zu *Discoaster barbadiensis* kurz.

Größe: 10–15 µm.

Beziehungen: *Discoaster aecus* steht zwischen den beiden Arten *Discoaster salisburgensis* STRADNER (1961, Fig. 27) aus dem Paläozän und *Discoaster barbadiensis* TAN SIN HOK aus dem mittleren und oberen Eozän.



Text-Fig. 11.
Original drawing of *Discoaster aecus*.

English translation:

Lectotype: GBA 2009/058/0015.

Derivation of name: *aecus* (Lat.) = flat, even.

Description: Rosette-shaped discoasters, which in plan view resemble *Discoaster barbadiensis* Tan Sin Hok by the similar number of rays or sectors. One side, which is corresponding to the convex side of *D. barbadiensis* is flat or slightly concave and has a tiny central canal. The other side has a short knob or stem. *Discoaster aecus* is considered an intermediary taxon between *Discoaster salisburgensis* and *Discoaster barbadiensis*.

Size: 10–15 μm.

Comments:

Stratigraphic distribution: Middle Eocene (Lutetian); Subzone NP14b to Zone NP15

**Original description of *Discoaster bronnimanni*
STRADNER, 1961**

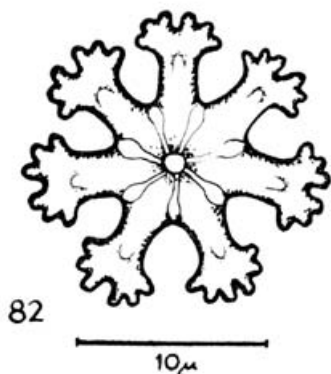
Derivatio nominis: Herrn Dr. Paul BRÖNNIMANN, Tripolis, Libya, zugeeignet.

Locus typicus: Aragon, Mexiko. Selten.

Stratum typicum: Mitteleozän.

Ein Discoaster, dessen Strahlen distal in sechs kurze, zu je dreien gebündelte Ästchen aufgespalten sind. Die Unterteilungslinien der Facies superior sind linkswendig geknickt, die der Facies inferior sind gerade.

Größe: 12–16 μm.



Text-Fig. 12.
Original drawing of *Discoaster bronnimanni*.

English translation:

Derivatio nominis: dedicated to Dr. Paul BRÖNNIMANN, Tripolis, Libya.

Type locality: Aragon, Mexico. Selten.

Type level: Middle Eocene.

Description: Discoasters with bifurcated arms ending with trilobate knobs. Sutures are straight on the proximal side and curved on the distal side.

Size: 12–16 μm.

Comments:

Syntypes lost due to corrosion of the embalming medium in slide GBA 2009/058/0025.

Stratigraphic distribution: Middle Eocene (Lutetian); Zone NP15.

**Original description of *Discoaster currens*
STRADNER, 1959a**

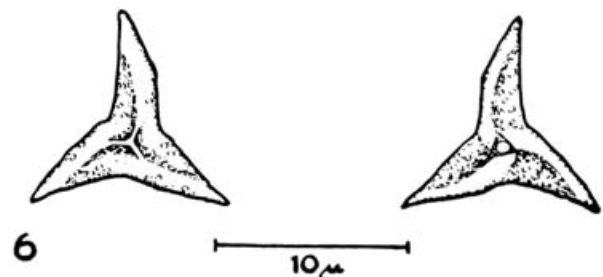
Lectotype: GBA 2009/058/0001.

Derivatio nominis: *currens* (Lat.) = running.

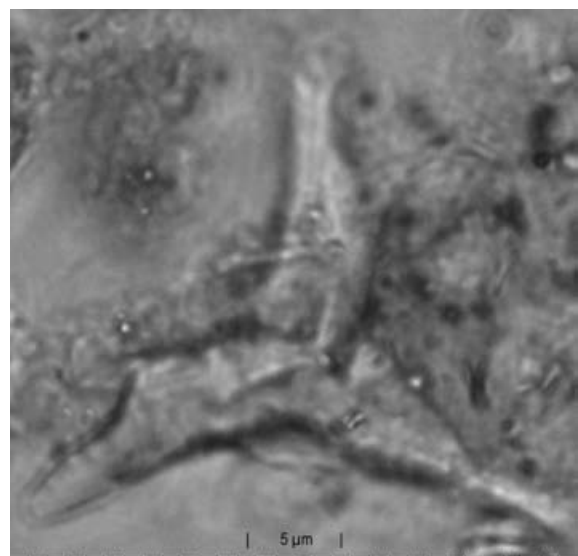
Type locality: Mattsee, Station 133.

Level: Paleocene (Thanetian).

Description: Asteroliths of triradiate shape, the rays resembling those of *Discoaster lodoensis*. On one face of the



Text-Fig. 13a.
Original drawing of *Discoaster currens*.



Text-Fig. 13b.
Lectotype of *Discoaster currens* in normal light.

asterolith the ridges of the curved rays run together to a little triradiate star; on the other face there is a tiny knob. This new form-species seems to be closely related to *Discoaster lodoensis*, from which it was separated because there are no regular four-radiate links between the two form-species in the Austrian material. For the type series and its variability see STRADNER (1959).

Comments:

Taxonomic status: this morphotype may represent a 3-rayed variety of *E. lodoensis*.

Stratigraphic distribution: The original stratigraphic assignment does not represent the actual stratigraphic level, which is Lower Eocene (NP12).

**Original description of *Discoaster gemmeus*
STRADNER, 1959a**

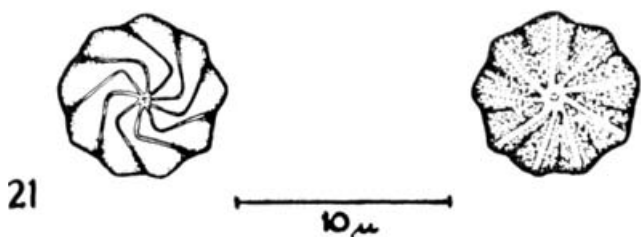
Lectotype: GBA 2009/058/0003.

Derivatio nominis: *gemmeus* (Lat.) = gleaming.

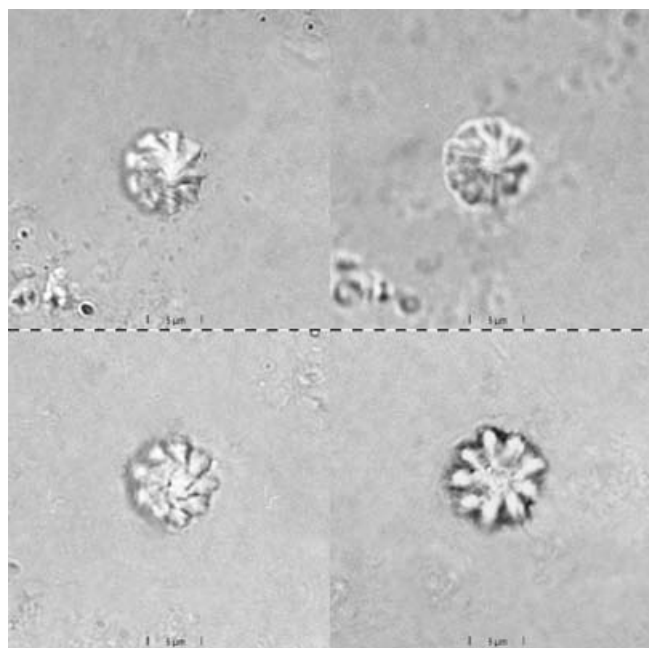
Type locality: Mattsee, station 133.

Level: Middle Paleocene (Thanetian).

Description: Asteroliths with eight or nine rounded rays that are united most of their length. The superior face has crooked suture-lines as in *Discoaster mirus*, the inferior face has high ridges which unite in the centre to a cone-shaped structure. Between these ridges suture lines only can be



Text-Fig. 14a.
Original drawing of *Discoaster gemmeus*.



Text-Fig. 14b.
Syntypes in normal light at different focus levels.

seen near the periphery. Sometimes a central pore is visible. This new form-species is easily found because of its strong light-fraction in low magnification. The asteroliths appear to have a gleaming emerald colour because of their considerable thickness.

Comments:

Taxonomic status: Because of the broad definition, the concept of *gemmeus* is applicable to Paleocene and Eocene morphotypes. The name *mohleri* was introduced by BUKRY & PERCIVAL (1971, p. 128) for the Paleocene morphotypes. It is possible that the early Eocene concept of *gemmeus* overlaps with the concept of *H. robustus* (HAQ) AUBRY & STRADNER n. c. (= *Discoaster robustus* HAQ, 1970, p. 12, Pl. 15, Fig. 7). Possibly a morphotype of *D. mirus* DEFLANDRE 1954.

Stratigraphic distribution: Lower Eocene (the original stratigraphic assignment does not represent the actual stratigraphic level).

**Original description of *Discoaster gemmifer*
STRADNER & PAPP, 1961**

Lectotypus: GBA 2009/058/0037.

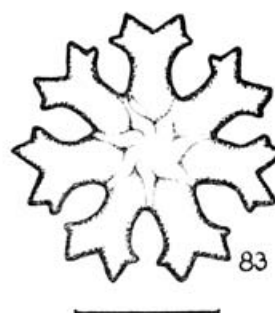
Derivatio nominis: *gemmifer* (Lat.) = Perlen tragend.

Locus typicus: Mattsee, Salzburg. Häufig.

Stratum typicum: Mitteleozän.

Weiteres Vorkommen: Aragon, Mexiko.

Größe: 8–20 μm.



Text-Fig. 15a.
Original drawing of *Discoaster gemmifer*.

Etiam: Die vom Verfasser 1959a als *Discoaster distinctus* MARTINI beschriebenen Discoasteriden. Asterolithen, deren Arme distal einen annähernd 90°igen Öffnungswinkel haben und an deren aufgespaltenen Strahlenenden laterale Knötchen („Perlen“) zu erkennen sind. Diese Art ist eng mit *Discoaster distinctus* MARTINI und *Discoaster nivalis* MANIVIT verwandt, von welchen sie sich aber durch die Art ihrer Strahlenendigungen unterscheidet.

English translation:

Lectotype: GBA 2009/058/0037.

Derivation of name: *gemmifer* (Lat.) = wearing pearls.

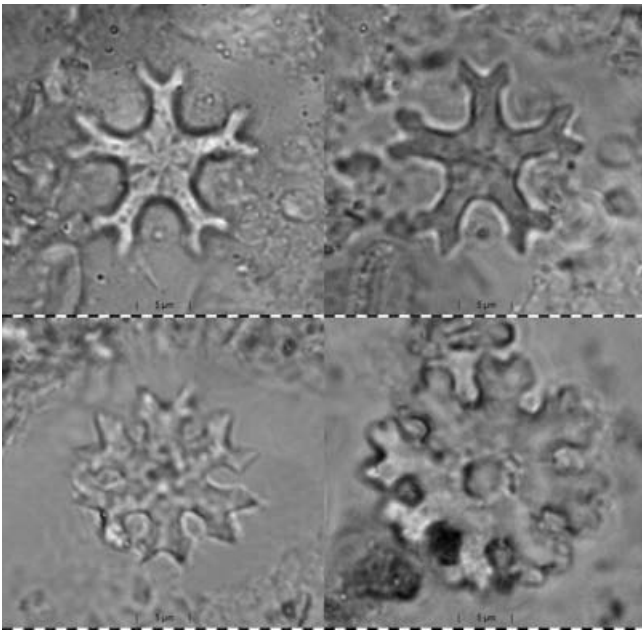
Type locality: Mattsee, Salzburg, Sta. 130, common.

Level: NP12, Lower Eocene.

Size: 8–20 μm.

Other occurrence: Aragon Formation, Mexico. There are also those Discoasters, which in 1959 were assigned to *Discoaster distinctus* MARTINI by the author.

Discoasters with five to nine free rays that at their distal ends have a widely opened bifurcation, 90 degrees or more, and at both lateral sides of their broadened ends



Text-Fig. 15b.
Syntypes of *Discoaster gemmifer* in normal light at different focus levels.

possess small knobs. Closely related to *Discoaster deflandrei*, *D. distinctus* and *D. nivalis* MANIVIT, from which they differ by their characteristic distal ends of the rays.

Comments:

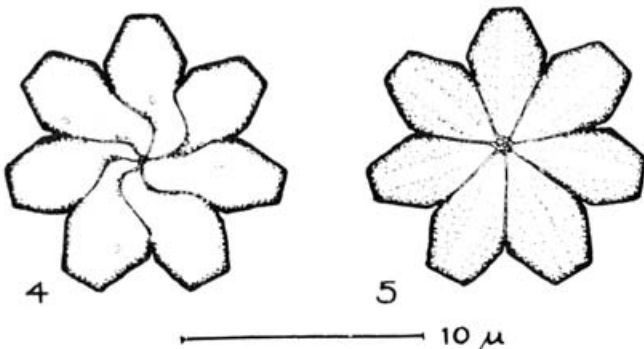
Taxonomic status: STRADNER & PAPP (1961, p. 69, Pl. 8, Figs. 1–10, Pl. 11, Figs. 4, 5) broadened considerably STRADNER'S concept (1961) of the taxon, by accepting a considerable morphologic variability, which led to taxonomic overlaps with other taxa, most notably with *D. cruciformis* MARTINI, 1958, p. 357, Pl. 2, Figs. 9a, b. We restrict here the concept of this taxon to the holotype that exhibits the characteristic angular and uneven terminations of the rays. Stratigraphic distribution: Lower and Middle Eocene (Ypresian–Lutetian); Zone NP12–NP16.

**Original description of *Discoaster geometricus*
BRÖNNIMANN & STRADNER, 1960**

Lectotypus: GBA 2009/058/0016/1.

Derivatio nominis: *geometricus* (Lat.) = geometrisch.

Locus typicus: Universidad-Formation, BR-Stat. 489, Kuba.



Text-Fig. 16.
Original drawing of *Discoaster geometricus*.

Diagnose und Beschreibung: Ein Discoaster, dessen gekürzte Strahlen von annähernd geradlinigem Umriss sind. Die Unterteilungslinien der Facies superior sind nur leicht geschwungen, die Unterteilungslinien der Facies inferior sind besonders bei den sechsstrahligen Asterolithen zu je zweien bogenförmig verbunden, so dass die sogenannte „Hemidiscoaster“-Struktur entsteht. Asterolithen 4- bis 8-strahlig.

Größe: 7–12 μm.

Beziehungen: Dieser *Discoaster* ist in die Verwandtschaft von *Discoaster deflandrei* BRAMLETTE & RIEDEL einerseits und *Discoaster molengraaffi* TAN SIN HOK andererseits zu stellen. Möglicherweise stellt *Discoaster geometricus* eine Übergangsform zwischen den beiden genannten Arten dar.

English translation:

Lectotype: GBA 2009/058/0016/1.

Derivatio nominis: *geometricus* (Lat.) = geometrical.

Locus typicus: Universidad Formation, BR-Stat. 489, Kuba.

Diagnose and description: Asteroliths with 4–8 straight rays. On one of the flat sides the suture lines are curved, on the other side two of these can be united in such a way as to show the so called “hemidiscoaster” appearance.

Size: 7–12 μm.

Relations to *Discoaster deflandrei* BRAMLETTE & RIEDEL and *Discoaster molengraaffi* TAN SIN HOK are indicated.

Comments:

Taxonomic status: probably a superfluous taxon based on an overgrown discoaster.

**Original description of *Discoaster kuepperi*
STRADNER, 1959b**

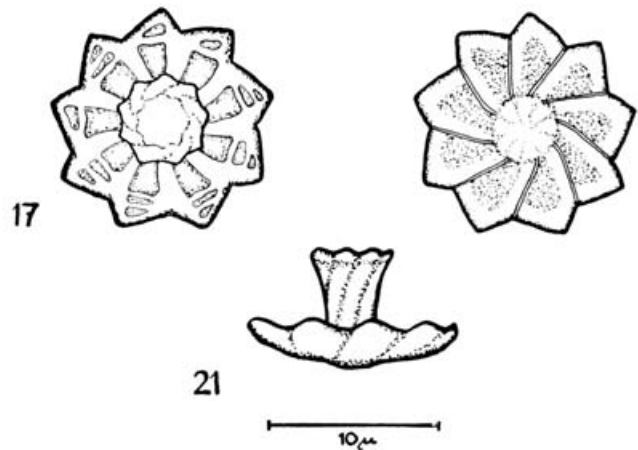
Lectotype: GBA 2009/058/0009.

Derivatio nominis: Herrn Dir. Prof. Dr. H. KÜPPER, Wien, in Dankbarkeit gewidmet.

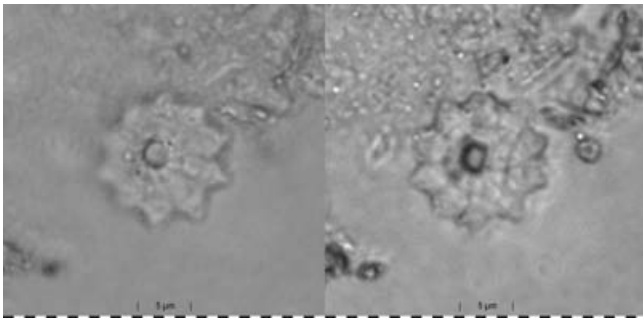
Stratum typicum: Mittleres Paläozän (Thanetium).

Locus typicus: Mattsee, Salzburg, Stat. 130; selten.

Asterolithen mit meist neun keilförmigen, in distaler Richtung stumpfwinkelig zugespitzten Asteroradien. Diese sind nach der Art von *Discoaster lodoensis* BRAMLETTE & RIEDEL geschwungen und mit Verstärkungsrippen versehen. Die



Text-Fig. 17a.
Original drawing of *Discoaster kuepperi*.



Text-Fig. 17b.
Lectotype of *Discoaster kuepperi* in normal light.
View of the concave side at different focus.

Strahlen dieser Formart sind meist mehr als drei Viertel ihrer Länge miteinander verwachsen. Auf der Facies superior sind sie mit je ein oder zwei Querrippen verziert, welche langgestreckte Grübchen umschließen, ein Merkmal, das sonst bei keiner anderen Art vorkommt. Ein weiteres sehr charakteristisches Merkmal ist die zu einer gedrehten und kannelierten Säule ausgebildete Bulla centralis, die an ihrem oberen Ende trichterförmig erweitert ist. Der Öffnungswinkel dieses Trichters beträgt etwas weniger als 90°.

Größe: 9–12 µm.

English translation:

Lectotype: GBA 2009/058/0009.

Derivation of name: Thankfully dedicated to Dr. Prof. Dr. H. KÜPPER, Vienna.

Type level: NP12, lower Eocene.

Type locality: Mattsee, Salzburg, Stat. 130, rare.

Asteroliths with 9 wedge-shaped, bluntly pointed rays. These are curved the same way as in *Discoaster lodoensis* BRAMLETTE & RIEDEL and also with reinforcing ribs joined together to about three fourth of their length. The concave face shows a striation cross to the sutures with elongate dips in between. A remarkable feature of this species is the funnel-shaped proximal bulla centralis, in other species only a knob, here however a flaring column with an opening angle less than 90 degrees.

Size: 9–12 µm.

Comments:

Stratigraphic range: Lower Eocene (Ypresian; Zone NP11 – Subzone NP14a).

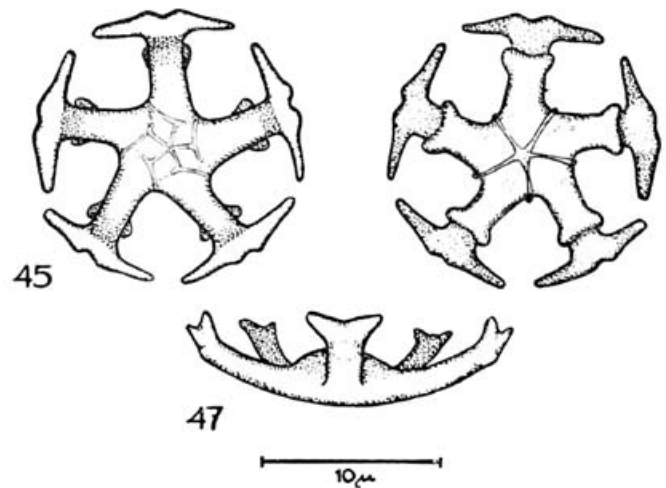
The stratigraphic age of the type level from which *H. kuepperi* was described was thought to be middle Paleocene (Thanetian) at the time of publication. Subsequent studies (see references) have indicated a lower Eocene (Ypresian) age, which is in agreement with the known stratigraphic range of *H. kuepperi* outside of Austria.

**Original description of *Discoaster martinii*
STRADNER, 1959b**

Synonym *Discoaster pentaradiatus* TAN SIN HOK not MARTINI, 1958, S. 359, Pl. 3, Figs. 12 a, b. Not *Discoaster pentaradiatus* TAN SIN HOK of BRAMLETTE & RIEDEL, 1954, p. 401, Text-Fig. 2 b, Pl. 39, Fig. 11.

Lectotypus: GBA 2009/058/0010/1.

Derivatio nominis: Herrn Dr. E. MARTINI, Frankfurt, der diese Formart als erster beschrieb, gewidmet.

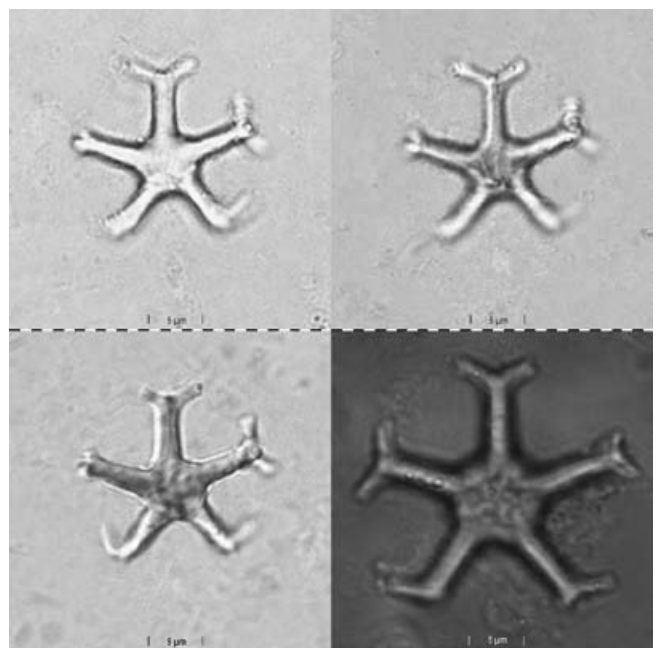


Text-Fig. 18a.
Original drawing of *Discoaster martinii*.

Locus typicus: Aragon, Mexiko.

Stratum typicum: Unteres Eozän.

Fünfstrahlige Asterolithen, deren Strahlen ähnlich wie die von *Discoaster tani* BRAMLETTE & RIEDEL stark gewölbt sind und in zwei lange abstehende Enden gespalten sind. Die Achsen der Strahlen treffen nicht im Mittelpunkt zusammen, sondern gehen an diesem nahe vorbei. Nahe der Stelle, an der sich die Strahlen mit einem sehr stumpfen Winkel gabeln, sind große breite Höcker ausgebildet. Diese überragen auf der konvex gewölbten Facies inferior die Breite der Strahlen, so dass sie auch von der Facies superior, der konkaven Flachseite, her sichtbar sind. Dies trifft aber nur auf ausgesprochen robuste Exemplare zu, wie ein solches in Abb. 45 dargestellt wurde. Die Mehrzahl der gefundenen Asterolithen entspricht MARTINI'S Mikrofoto 12 b. Unterteilungslinien wie bei *Discoaster tani* BRAMLETTE & RIEDEL.



Text-Fig. 18b.
Two syntypes in normal light at different focus levels.

English translation:

Lectotype: GBA 2009/058/0010/1.

Derivation of name: Dedicated to Dr. Erlend MARTINI, Frankfurt/Main, who first has described this form-species.

Type Locality: Aragon, Mexico.

Level: Lower Eocene.

Diagnosis: Four or five-rayed asteroliths, the rays of which are similar to those of *Discoaster tani* BRAMLETTE & RIEDEL; all curved in one direction and with split endings. The axes of the rays do not meet in the centre of the asterolith, they pass by it.

The bifurcations of the rays are spreading widely, up to 180 degrees, and are distinctly thinner than the rays themselves. In some specimens there are also small knobs proximal of the bifurcations as shown in the drawing (Fig. 45).

The majority of the asteroliths correspond to the microphoto 12 b in MARTINI'S paper.

Comments:

Stratigraphic distribution: Middle Eocene (Lutetian); Zone NP15.

**Original description of *Discoaster munitus*
STRADNER, 1961**

Lectotypus: GBA 2009/058/0026.

Derivatio nominis: *munitus* (Lat.) = befestigt.

Locus typicus: Aragon, Mexiko. Selten.

Stratum typicum: Mitteleozän.

Asterolithen mit sehr großer Zentralscheibe und sehr gedrungenen, kurzen Strahlen, die lateral verbreitert und distal dachartig abgeflacht sind.

Größe: 12–15 µm.

English translation:

Lectotype: GBA 2009/058/0026.

Derivation of name: *munitus* (Lat.) = fortified.

Type locality: Aragon, Mexico.

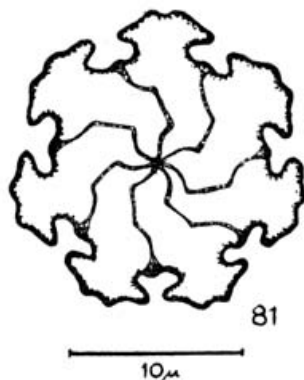
Level: Middle Eocene. Rare.

Size: 12–15 µm.

Diagnosis: Asteroliths with large central area and short sturdy rays, which are laterally broadened and flattened in the shape of a roof.

Comments:

Stratigraphic distribution: Middle Eocene (Lutetian); Zone NP13. Closely related to *Discoaster mirus* DEFLANDRE 1954.



Text-Fig. 19.
Original drawing of *Discoaster munitus*.

**Original description of *Discoaster ornatus*
STRADNER, 1959a**

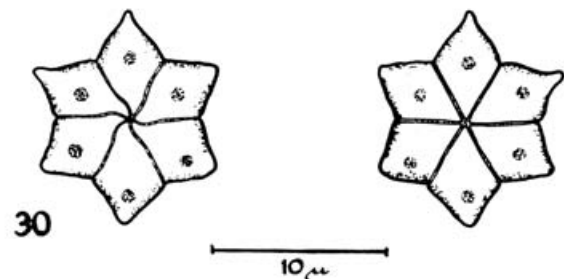
Lectotype: GBA 2009/058/0005/1.

Derivation of name: *punctis "ornatus"* (Lat.) = "decorated" with dots.

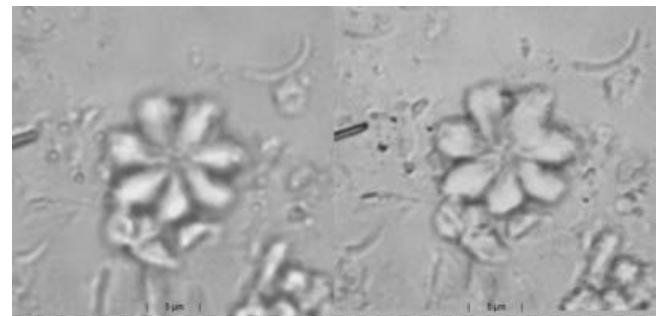
Type locality: Matzen oilfield.

Level: Miocene, Tortonian.

Diagnosis: Asteroliths 6 to 9-rayed with pointed ends and a pore at the distal half of the ray. The rays are rather broad; the incisions between them are acute. The smaller the asterolith the bigger the pore. The pores are similar to those of *Pemma rotundum* Klumpp (Braarudosphaeridae DEFLANDRE), but they are not so near the centre as with *Pemma*. The superior face has curved or crooked suture-lines, the inferior face straight ones.



Text-Fig. 20a.
Original drawing of *Discoaster ornatus*.



Text-Fig. 20b.
Syntype in normal light at different focus levels.

Comments:

Taxonomic status: The irregular outline of this discoaster implies strong overgrowth. This taxon is likely based on an artifact of preservation and is superfluous. However, the shapes of the sutures between rays imply that it belongs to *Helio-discoaster*.

Stratigraphic range: Lower Oligocene (Rupelian); Zone NP21–NP23.

**Original description of *Discoaster salisburgensis*
STRADNER, 1961**

Lectotypus: GBA 2009/058/0027.

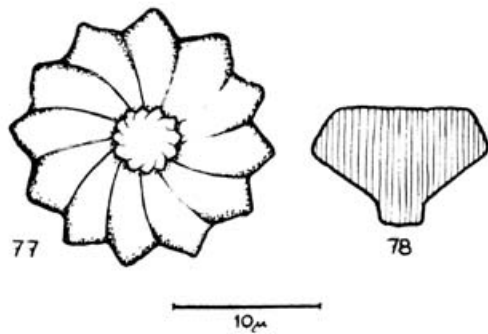
Derivatio nominis: *salisburgensis* (Lat.) = aus Salzburg.

Locus typicus: Kühlgraben, Untersberg bei Salzburg. Häufig.

Stratum typicum: Paläozän.

Ein vielstrahliger Discoaster von laibchenförmiger Gestalt, dessen eine Flachseite etwas konisch erhöht ist und einen

kurzen, aber kräftigen Stiel trägt. Zur Unterscheidung dieser Art von dem in der Flachansicht sehr ähnlichen *Discoaster barbadiensis* TAN SIN HOK emend. BRAMLETTE & RIEDEL ist unbedingt die Seitenansicht des Asterolithen erforderlich. Größe: 8–15 µm.



Text-Fig. 21a.
Original drawing of *Discoaster salisburgensis*.

English translation:

Lectotype: GBA 2009/058/0027.

Derivation of name: *salisburgensis* = from Salzburg, Austria.

Type locality: Kühlgraben, Untersberg, south of Salzburg.

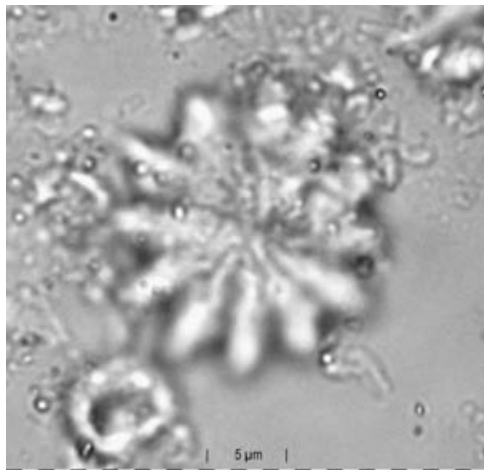
Level: Paleocene.

Description: A many-rayed discoaster of bulky shape, with one of the flat sides conical and mounted by a short stub. To distinguish this species from the similar but more slender *Discoaster barbadiensis* TAN SIN HOK emend. BRAMLETTE & RIEDEL the asteroliths have to be observed in side view.

Size: 8–15 µm.

Comments:

Stratigraphic distribution: Upper Paleocene to Lower Eocene (Thanetian–Ypresian); Zone NP9 to Zone NP12.



Text-Fig. 21b.
Lectotype in normal light.

Original description of *Discoaster strictus* STRADNER, 1961

Lectotypus: GBA 2009/058/0028.

Derivatio nominis: *strictus* (Lat.) = straff.

Locus typicus: Aragon, Mexiko. Mäßig häufig.

Stratum typicum: Mitteleozän.

Asterolithen meist sechsstrahlig mit geraden, gegen die Spitze sich verjüngenden Strahlen. Die Unterteilungslinien der Facies superior sind zweimal geknickt und stellen ein wichtiges Unterscheidungsmerkmal gegenüber *Discoaster tani* BRAMLETTE & RIEDEL dar.

Größe: 12–20 µm.

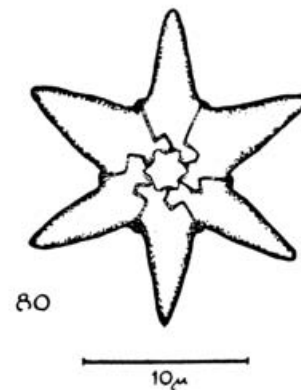
English translation:

Lectotype: GBA 2009/058/0028.

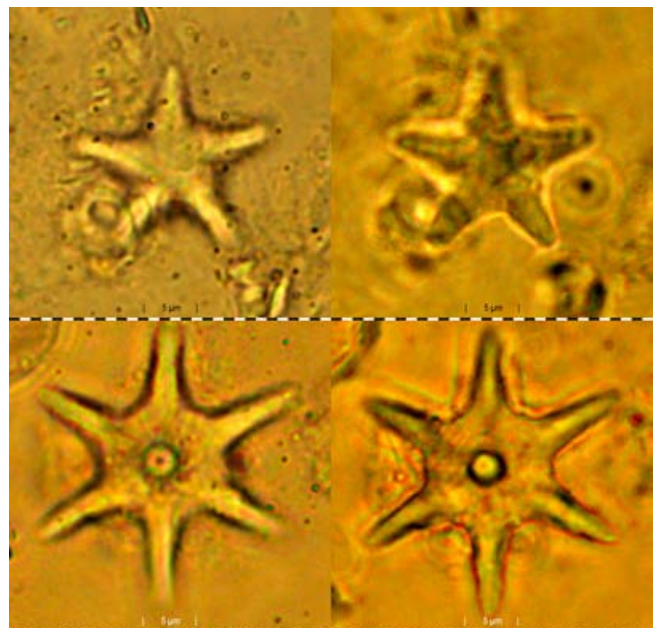
Derivation of name: *strictus* (Lat.) = tight.

Type locality: Aragon, Mexico, moderately common.

Level: Middle Eocene.



Text-Fig. 22a.
Original drawing of *Discoaster strictus*.



Text-Fig. 22b.
Lectotype in normal light.

Diagnosis: Asteroliths with usually six tapering straight rays. The sutures between the rays are bent twice. They differ from *Discoaster tani* BRAMLETTE & RIEDEL by their larger size and their sutures.

Size: 12–20 µm.

Comments:

Taxonomic status: regarded by some as a synonym of *H. subbloedensis* BRAMLETTE & SULLIVAN, 1961, (e.g. Theodoridis, 1984), this is a rare but distinct taxon.

Stratigraphic distribution: Middle Eocene (Lutetian); Zone NP14b to lower Zone NP16.

**Original description of *Discoaster trinus*
STRADNER, 1961**

Lectotypus: GBA 2009/058/0029.

Derivatio nominis: *trinus* (Lat.) = je drei.

Locus typicus: Holzmannberg, Oberösterreich. Häufig.

Stratum typicum: Mitteleozän.

Ein Discoaster, dessen sechs Strahlen auf beiden Flachseiten zu je dreien verwachsen sind, und zwar so, dass die Winkel zwischen den verwachsenen Strahlen 120 Grad betragen und je ein Strahl, der auf der gegenüberliegenden Flachseite verwachsen ist, ausgelassen wird. Die Enden der Strahlen sind gekerbt. Diese Art ist eng mit *Discoaster molengraaffi* Tan Sin Hok aus dem Jungtertiär der Insel Rotti verwandt.

Größe: 10–16 µm.

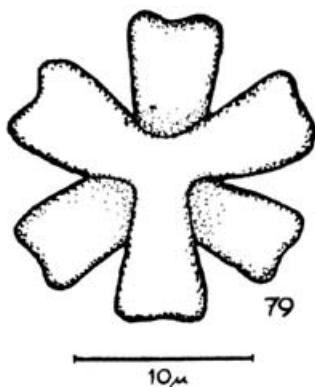
English translation:

Lectotype: GBA 2009/058/0029.

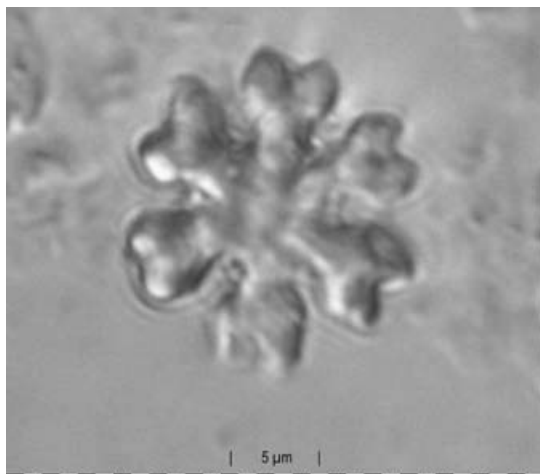
Derivation of name: *trinus* (Lat.) = three each.

Type locality: Holzmannberg, Upper Austria.

Level: Middle Eocene.



Text-Fig. 23a.
Original drawing of *Discoaster trinus*.



Text-Fig. 23b.
Discoaster trinus in normal light.

Six-rayed discoasters in which three rays are united to form angles of 120 degrees. The tips of the broad rays are slightly notched.

Size: 10–16 µm.

Comments:

Taxonomic status: superficial taxon based on a strongly overgrown discoaster.

**Original description of *Discoaster uncinatus*
STRADNER, 1960**

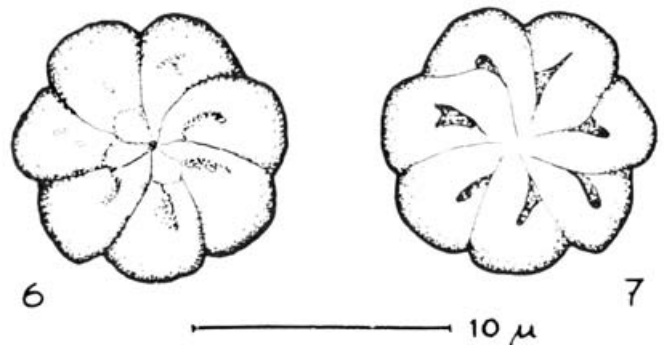
Lectotypus: GBA 2009/058/0016/2.

Derivatio nominis: *uncinatus* (Lat.) = hakig.

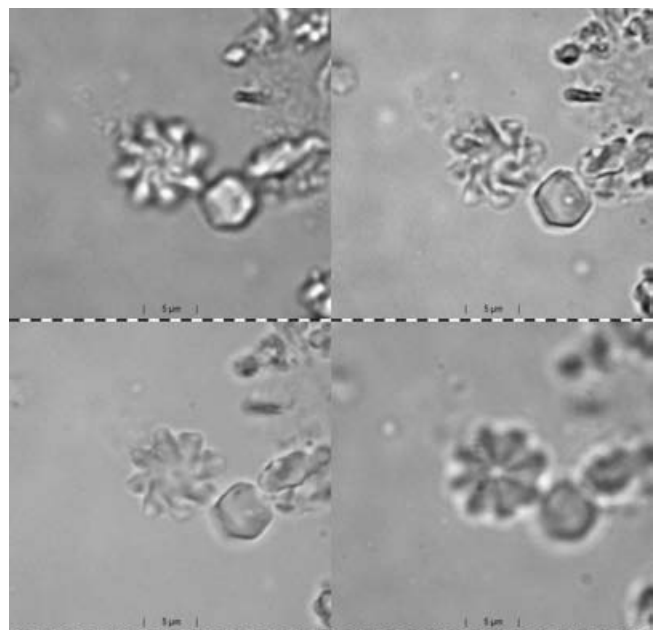
Locus typicus: Universidad-Formation, BR-Stat. 489, Kuba.

Diagnose und Beschreibung: Ein Discoaster, dessen Strahlen auf der Facies inferior eine hakenförmige Struktur zeigen. Die Strahlen haben keine freien Enden, sondern beteiligen sich nur mit ihrer runden Biegungskante an der Bildung der Umrisslinie.

Größe: 10–14 µm.



Text-Fig. 24a.
Original drawing of *Discoaster uncinatus*.



Text-Fig. 24b.
Lectotype in normal light at different focus levels.

Beziehungen: *Discoaster uncinatus* n. sp. gehört wegen seiner stark gebogenen Strahlen in die engere Verwandtschaft von *Discoaster lodoensis* BRAMLETTE & RIEDEL.

English translation:

Lectotype: GBA 2009/058/0016/2.

Derivation of name: *uncinatus* (Lat.) = hook-shaped.

Type locality: BR-Stat. 489, Cuba.

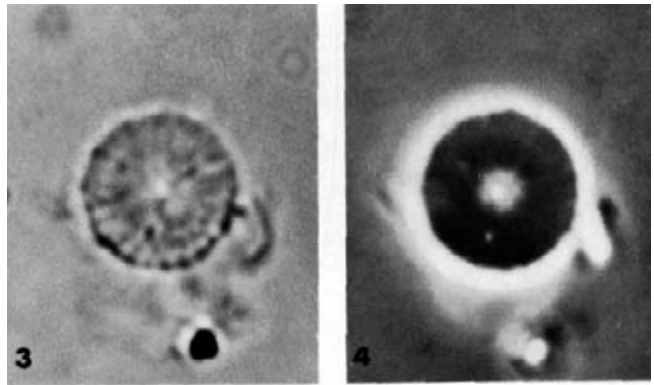
Diagnosis: Discoasters with rays bent like hooks on one of their flat side. These have no free ends, but with their curved parts form the outline of the discoaster.

Size: 10–14 µm.

Relations: *Discoaster uncinatus* is possibly related to *Discoaster lodoensis* BRAMLETTE & RIEDEL.

Comments:

Taxonomic status: A superfluous taxon based on a corroded discoaster.



3. *Discoaster wemmelenis* nov. spcc.
4. Same specimen

Text-Fig. 25b.
Original photographs in phase contrast.

**Original description of *Discoaster wemmelenis*
ACHUTHAN & STRADNER, 1969**

Holotype: GBA 2009/058/0066.

Derivation of name: from “Wemmel”, Belgium.

Type locality: Wemmel, Belgium; Sands of Wemmel.

Level: “Wemmelian”.

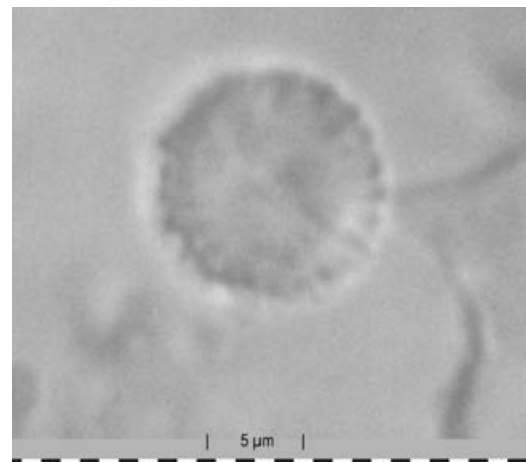
Diagnosis: Heliodiscoasters consisting of 20 to 30 wedge-shaped rays, which are packed in a radial arrangement. Outline in plane view slightly serrate. The side view shows that both faces are centrally depressed, one of the faces being more convex than the other. The sloping margin of the former (distal) face is more pronounced than that of the latter (proximal). No central knob.

Size: Diameter: 5 µm or less, height: half the diameter.

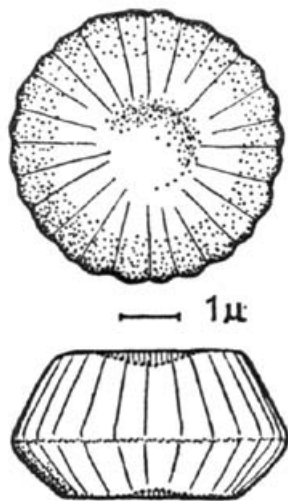
Discussion: *Discoaster wemmelenis* differs from *Discoaster lenticularis* by its smaller diameter and greater thickness as well as by the lacking of any central boss or knob.

Comments:

Stratigraphic distribution: Middle Eocene (Lutetian; Subzone NP14b – Zone NP16).



Text-Fig. 25c.
Lectotype in normal light at different focus levels.



Text-Fig. 25a.
Original drawing of *Discoaster wemmelenis*.

**Family: Sphenolithaceae DEFLANDRE, 1952 orth.
mut. VEKSHINA, 1959**

Genus: *Iselithina* STRADNER, 1966

Type species: *Iselithina iris* STRADNER, 1966, p. 339, Text-Figs. 12–15.

Comments:

Coccoliths assigned to *Iselithina* are strongly modified from an original type. They may be derived from sphenoliths (thus placement of the genus in the Family Sphenolithaceae) or from placoliths (in which case they should be placed in the Family Calcidiscaceae) (see AUBRY, in press).

Original description of *Iselithina* STRADNER, 1966

Derivation nominis: Ilse = Name einer weiblichen Wasser-gottheit (altgerm. Mythologie), lithos (Gr.) = Stein.

Diagnose: Coccolithen, welche aus einem zentralen, aus schraubig angeordneten Kristallplatten aufgebauten Kernstück und zwei verschiedenartig ausgebildeten, im Umriss kreisrunden, durch charakteristische Poren gekennzeichneten Randscheiben bestehen. Die flach kegelförmige proximale Randscheibe hat zwischen den peripher schwach

gerundeten, in der Mitte leicht gekerbten Kristallplatten schlitzförmige Poren, welche vom Kernstück aus in fast radialer Richtung verlaufen und nur eine sehr geringe Inklination der Kristallplatten erkennen lassen. Das Kernstück kann zentral vollkommen verschlossen sein oder ringförmig ausgebildet. Die zu seinem Aufbau verwendeten Platten laufen in Richtung zur distalen Randscheibe hin zu speichenförmigen Gebilden aus. Die distale Randscheibe besteht in der Regel aus weniger Einzelementen als die proximale Randscheibe. Ihre abgerundet-trapezförmigen, gewölbten Kristallplatten sitzen pilzhutartig auf den vom Kernstück ausgehenden Speichen. Das Niveau der distalen Randscheibe liegt über und somit außerhalb dem des Kernstückes. Die äußere und innere Mantelfläche der distalen Randscheibe sind kegelmantelförmig geneigt.

English translation:

Derivation of name: Ilse = name of a water goddess (German mythology); an allusion to the first name of Ilse STRADNER (1927–2003); *lithos* (Gr.) = stone.

Diagnosis and description: Circular coccoliths consisting of a proximal ring composed of mushroom-shaped elements, which are supported by thin stems emanating from a twisted and perforated central core. The proximal circular shield consists of straight wedge-shaped elements with rounded tips. These elements are touching each other near the periphery leaving open elongate slots between them. The proximal shield consists of about twice as many elements as compared to the distal ring. The orientation of the distal crystal plates, which are lifted by tiny spokes in distal direction, corresponds to the mantle of a flat cone. They are held above the central core.

Comments:

Taxonomic status: The genus *Hayella* ROTH, 1969, p. 464 is a junior synonym of *Ilselithina* STRADNER, 1966.

Original description of *Ilselithina iris* STRADNER, 1966 (in STRADNER & ADAMIKER)

Holotypus: Stereo-Platten Nr. 2 595/2 596/65, 4.800 fach.

Paratypus: Stereo-Platten Nr. 2 533/2 534/65, 9.800 fach.

Derivatio nominis: Iris = Augensterne; Göttin des Regenbogens (griech. Mythologie).

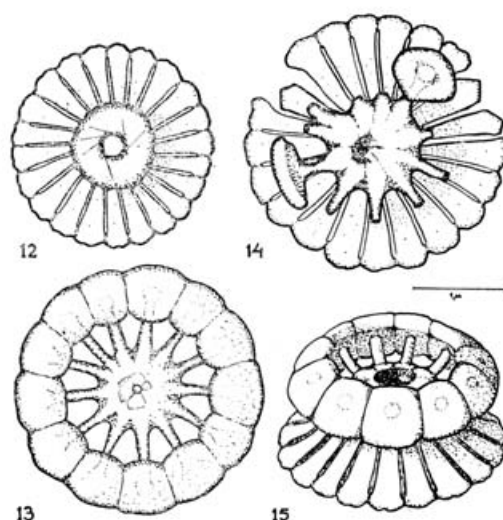
Locus typicus: Oamaru, Neuseeland; Diatomit von Williams Bluff.

Stratum typicum: Obereozän.

Diagnose: Die Artdiagnose dieser bis jetzt einzigen Art der neuen Gattung deckt sich mit der Gattungsbeschreibung. So weit bis jetzt beobachtet wurde, schwankt die Zahl der Kristallplatten der proximalen Randscheibe von 18 bis 28, der distalen Randscheibe von 11 bis 13.

Größe des Holotypus: Durchmesser der vollständig erhaltenen distalen Randscheibe 3,1 µm.

Anmerkung: Der Erstnachweis dieser Art gelang an Hand einer Bohrprobe der Österreichischen Mineralölverwaltung AG, und zwar in obereozänem Bohrklein aus der Schussbohrung L 107/75 bei Klein Schweinbarth, Niederösterreich (Taf. 3, Fig. 5, Platte Nr. 1 521/65, 9.800 fach). Da es sich bei einer Bohrung nur um einen vorübergehenden Aufschluss handelt und die gleiche Art im neuseeländischen Obereozän von Oamaru jederzeit in zugänglichen „outcrops“ gefunden werden kann, wur-



Text-Fig. 26a.

Original drawing of *Ilselithina iris*.

Distal view of the proximal plate with fragments of the core (12), distal view of the distal plate (13, holotype), distal view of the inner plate (14), reconstruction of a complete specimen (15).

All specimens from Oamaru, New Zealand.

de Oamaru als Typuslokalität gewählt (vgl. STRADNER & EDWARDS, 1967, Pl. 21).

English translation:

Holotype: TEM stereo-plates 2 595+2 596/65; paratype; 2 533+2 534/65.

Derivation of name: Iris = goddess of the rainbow (Greek mythology)

Type locality: Diatomite of Oamaru, New Zealand (STRADNER & EDWARDS, 1968).

Level: Upper Eocene.

Diagnosis and description: The features of this as yet only species of the new genus *Ilselithina* are described in the generic definition.

Remarks: *Ilselithina iris* was originally discovered in cuttings of a seismic drilling by OMV AG in Austria (L 107/75 near Klein Schweinbarth, Lower Austria). For type locality, however, the New Zealand Oamaru site was preferred, since it is always accessible.



Text-Fig. 26b.

Electron micrograph of a fragmentary specimen corresponding to Text-Fig. 26a/12.

Comments:

Taxonomic status: *Hayella elegans* ROTH, 1969, p. 464, Pl. 1, Figs. 1, 2 is a junior synonym of *Iselithina iris* STRADNER, 1966.

Stratigraphic distribution: Upper Eocene – Lower Oligocene (Priabonian–Rupelian); Zone NP19–20–NP22.

Genus: *Sphenolithus* DEFLANDRE 1952

Type species *Sphenolithus radians* DEFLANDRE in GRASSÉ 1952, p. 466, Text-Figs. 343J–K, 363A–G.

Synonym: *Nannoturbella* BRÖNNIMANN & STRADNER, 1960, p. 368.

Type species: *Nannoturbella moriformis* BRÖNNIMANN & STRADNER 1960, p. 368, Text-Figs. 11–16.

Comments:

Taxonomic status: *Nannoturbella moriformis* BRÖNNIMANN & STRADNER 1960 exhibits the morphological, optical and structural characteristics of sphenoliths for which the genus *Sphenolithus* was erected. Based on ICBN rules, the name *Sphenolithus* has priority over *Nannoturbella*.

**Original description of *Nannoturbella*
BRÖNNIMANN & STRADNER, 1960**

Derivatio nominis: *nannos* (gr.) = Zwerg, *turbo* (Lat.) = Kreisel.

Locus typicus: Alkazar-Formation, BR-Stat. 538, Kuba.

Stratum typicum: Unter-Eozän.

Diagnose: Ein aus zahlreichen keil- bis kegelförmigen Elementen zusammengesetztes, meist halbkugelförmiges Kalkkörperchen. Die Einzelemente sind nach außen hin konvex, wodurch das äußere Erscheinungsbild einer zusammengesetzten Beere entstehen kann. Wegen der radiären Anordnung der Einzelemente zeigt das Kalkkörperchen im polarisierten Lichte bei gekreuzten Nikols in jeder beliebigen Lage ein charakteristisches Lösungskreuz.

Größe: ca. 5 µm.

Beziehungen: *Nannoturbella* schließt sich morphologisch eng an *Nannoconus* an, von welcher Gattung sie aber durch ihre geringen Dimensionen und durch den Mangel eines offenen Lumens (Hohlraumes) abweicht. Auch das Verhalten im polarisierten Lichte kann gut zur Unterscheidung beider Gattungen herangezogen werden.

English translation:

Derivation of name: *nannos* (gr.) = dwarf, *turbo* (Lat.) = top.

Type location: Alkazar Formation, BR-St. 538, Cuba.

Level: Lower Eocene.

Diagnosis and description: Hemispherical or elongated hemispherical calcareous bodies, composed of numerous cone or wedge-shaped separate elements. Due to their radial arrangement and the elongated form of these crystal elements *Nannoturbella* shows a distinct extinction cross in polarized light.

Size: 5 µm.

Relation: The genus *Nannoturbella* seems closely related to the genus *Nannoconus*, from which it differs by the lack of a central canal or cavity.

**Original description of *Nannoturbella moriformis*
BRÖNNIMANN & STRADNER, 1960**

Lectotypus: GBA 2009/058/0018/3.

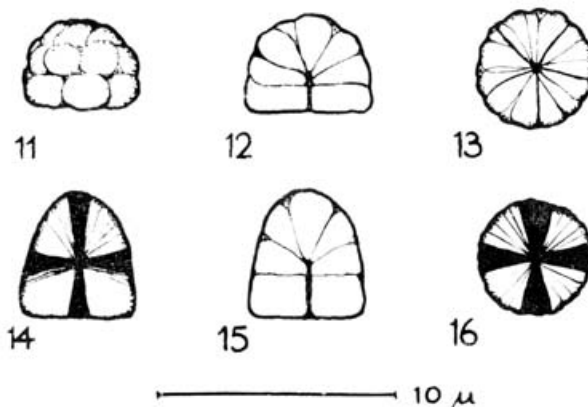
Derivatio nominis: *morum* (Lat.) = die Maulbeere.

Locus typicus: Alkazar-Formation, BR-Stat. 538, Kuba.

Stratum typicum: Unter-Eozän.

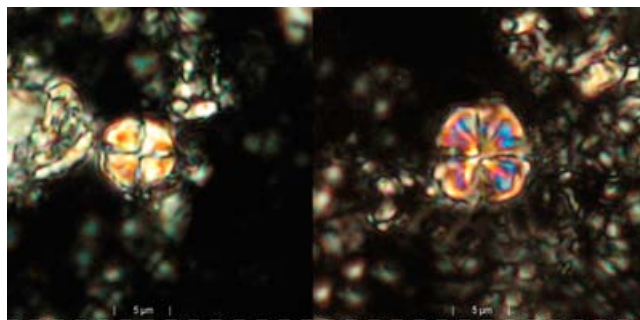
Diagnose: Bis jetzt die einzige Art der neuen Gattung. Ihre Diagnose stimmt mit der des Genotypus überein.

Größe: Durchmesser des Holotypus: 5 µm.



Text-Fig. 27a.

Original drawings of *Nannoturbella moriformis*: side views and axial views.



Text-Fig. 27b.

Lectotype in normal light and polarized light.

English translation:

Lectotype: GBA 2009/058/0018/3 (BR/538/1T).

Derivaton of name: *morum* (Lat.) = mulberry.

Type locality: Alkazar Formation, BR-St. 538, Cuba.

Type level: Lower Eocene.

Diagnose: See the generic description. The rounded ends of the wedge-like elements result in an appearance reminding of a mulberry.

Order: Pontosphaerales AUBRY (in press)

Family: Pontosphaeraceae LEMMERMANN, 1908

Genus: *Scyphosphaera* LOHMANN, 1902

Type species: *Scyphosphaera apsteinii* LOHMANN 1902, p. 132, Pl. 4, Figs. 26–30.

Comments:

Taxonomic status: The name *Argyrosphaera* AUBRY, LIU, DE VARGAS & PROBERTS in AUBRY & BORD (2009) [NOT 2008]

may have been introduced prematurely for Eocene lopadoliths with a flat basal plate and a thick margin. The recombinations *Argyrosphaera columella* (STRADNER) AUBRY, LIU, DE VARGAS & PROBERTS in AUBRY & BORD 2009 (= *Scyphosphaera columella* STRADNER, 1968, p. 416, Pl. 88, Figs. 1–4, Text-Fig. 2[7–9]) and *Argyrosphaera tubicena* (STRADNER) AUBRY, LIU, DE VARGAS & PROBERTS in AUBRY & BORD 2009 (= *Scyphosphaera tubicena* STRADNER, 1968, p. 416, Pl. 88, Figs. 9–12, Text-Fig. 2) are not followed here.

**Original description of *Scyphosphaera columella*
STRADNER, 1969**

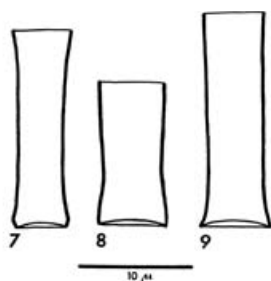
Synonym: 1961 “Lopadolith from Dodo 39”, BRAMLETTE & SULLIVAN, Pl. 5, Fig. 19.

Holotype: GBA 2009/058/0065/2.

Derivation of name: *columella* (Lat.) = small pillar.

Type locality: Hagenbach Valley, Northern Vienna Woods, Lower Austria, Stat. 400.

Level: Lower Eocene.



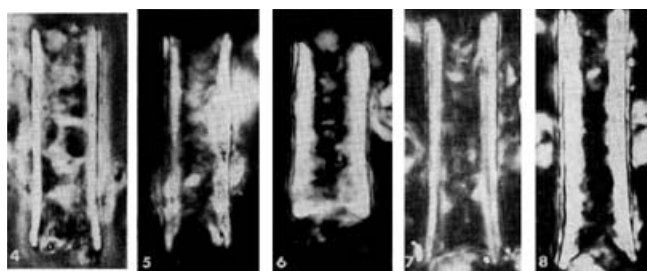
Text-Fig. 28a.
Original drawings of *Scyphosphaera columella*.

Diagnosis and description: Tube-shaped lopadoliths with almost parallel side lines, only slightly constricted above the somewhat widening bottom-end, which is closed by an inward vaulted plate. No striation of tube or perforation of bottom plate discernible.

Size: 12 µm.

Comments:

Stratigraphic distribution: Lower and Middle Eocene (Ypresian–Lutetian); Zone NP12–NP16.



Text-Fig. 28b.
Original photographs of syntypes.



Text-Fig. 28c.
Syntype in normal light and polarized light at different focus levels.

**Original description of *Scyphosphaera tubicena*
STRADNER, 1969**

Synonym: Lopadolith from Dodo 52, BRAMLETTE & SULLIVAN, 1961, Pl. 5, Fig. 20.

Holotype: GBA 2009/058/0065/3.

Derivation of name: *tubicen* (Lat.) = “trumpet-blower”.

Type locality: Hagenbach Valley, Northern Vienna Woods, Lower Austria, Stat. 2060.

Level: Lower Eocene.

Diagnosis and description: Trumpet-shaped lopadoliths. In side view shaft with parallel contour, flaring towards the bottom, which is closed by a plane or only slightly vaulted bottom plate. No striation of shaft or perforation of bottom plate recognizable. Proximal end in many specimens damaged and bottom plate missing. Inside often filled with substance showing optical refraction similar to calcite.

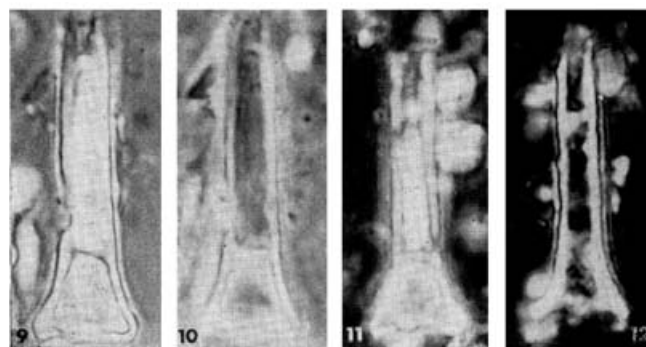
Size: 20 µm.

Comments:

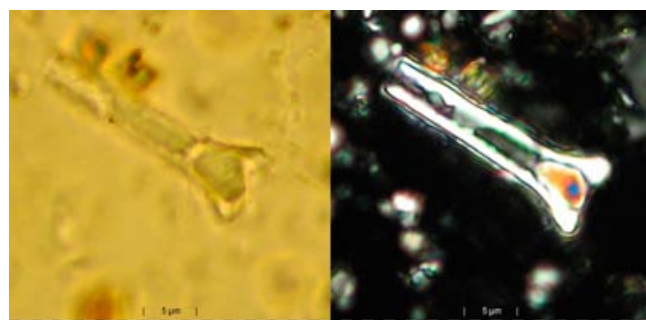
Stratigraphic distribution: Lower and Middle Eocene (Ypresian–Lutetian); Zone NP12–NP15.



Text-Fig. 29a.
Original drawings of *Scyphosphaera tubicena*.



Text-Fig. 29b.
Original photographs of the holotype.



Text-Fig. 29c.
Lectotype in normal light and polarized light.

**Order: Syracosphaerales HAY, 1977 emended
YOUNG et al., 2003**

Family: Blackitaceae AUBRY (in press)

**Genus: *Blackites* HAY & TOWE, 1962, emended
STRADNER & EDWARDS, 1968**

Blackites hayi STRADNER & EDWARDS, 1968, p., Pl. 31, Figs. 6, 7, Text-Figs. 5a, b

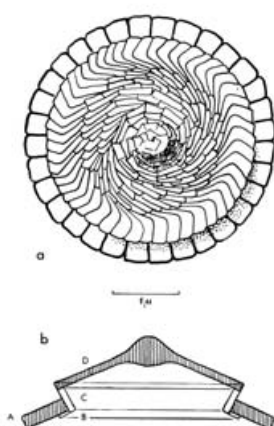
**Original description of *Blackites hayi* STRADNER &
EDWARDS, 1968**

Holotype: TEM Micrographs 3376+3377/65.

Derivation of name: Named in honour of Prof. William W. HAY, Univ. of Illinois.

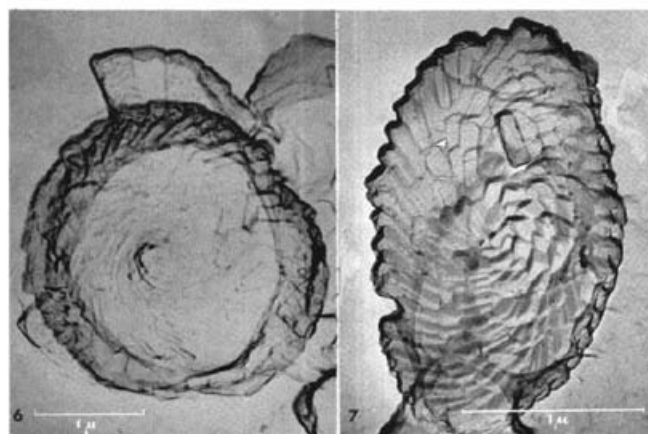
Type locality: Diatomite at William's Bluff, Oamaru, N. Z.

Level: Upper Eocene.



Text-Fig. 30a.
Original drawings of *Blackites hayi*.

Description: Rhabdoliths with a circular, cupula-shaped basalplate without central tube. The outer ring (A) of trapezoid-shaped crystal plates is similar to that of *Blackites rectus* (DEFLANDRE), as far as can be judged from the fragmentary specimen of Pl. 31, Fig. 6. The inner cupula-shaped structure (D) of spirally arranged crystal units is overlapping two cycles which can be correlated with the cycles (B) and (G) of *Blackites rectus* (DEFLANDRE). There is a narrow



Text-Fig. 30b.
Electron micrographs of holotype (6) and paratype (7).

cycle of radial crystals supporting the cycle (A) at its proximal side and another reversed-conical cycle (G) of crystal laths, which are thought to be analogous to cycle (G) in *Blackites rectus*. The cupula (D) is composed of a whirl of numerous elongated crystals adjoining and partly penetrating each other. At the centre they are turned upright so that the cupula is thicker there and appears tipped like the cupula of a mosque.

Size: Diameter 3–7 µm in holotype (TEM Micrographs 3376+3377/65), diameter of the cupula 2–9 µm in holotype, 2–2 µm in paratype (TEM Micrographs 1899+1900/65).

Discussion: *Blackites hayi* nov. spec., is an atypical representative of the genus because it lacks the characteristic tube or shaft. However, the ultrastructure of the basal plate leaves no doubt as to its generic position, since it shows all typical features of *Blackites* described first by Hay & Towe.

Blackites herculeus (STRADNER) AUBRY 1999 (= *Rhabdosphaera herculea* STRADNER 1969, p. 415, Pl. 89, Figs. 9–12

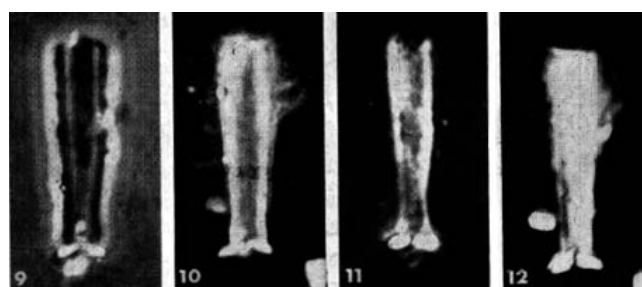
**Original description of *Rhabdosphaera herculea*
STRADNER, 1969**

Holotype: GBA 2009/058/0065/1.

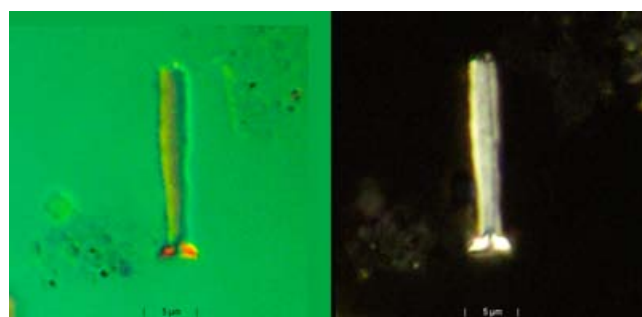
Derivation of name: Hercules = name of hero (Greek Mythology)

Type locality: Hagenbach Valley, Northern Vienna Woods, Lower Austria Stat. 4 and 14.

Level: Lower Eocene, "*Marthasterites tribrachiatus* Zone".



Text-Fig. 31a.
Original photographs of the holotype (10, 12) and paratype (9, 11) of *Rhabdosphaera herculea*.



Text-Fig. 31b.
Syntype in normal light and polarized light.

Diagnosis and description: Rhabdoliths with shaft in form of a large hollow tube, which is slightly constricted in its proximal quarter and slowly flaring towards its widely opened distal end. Striation of shaft enclosing an angle of

about 70° with the direction of the main axis. Some specimens with shaft slightly tapering in its distal half. Greatest diameter of shaft equal or greater than that of basal plate. Usually only the “club-shaped” shafts without basal plate are encountered. Therefore a zone of minor resistance can be expected within the collar-zone or between the collar and the basal plate.

Size: 18 µm.

Comments:

Taxonomic status: *Rhabdolithus solus* PERCH-NIELSEN, 1971, p. 52, Pl. 45, Figs. 10-13 and Pl. 61, Figs. 36-38, is a junior synonym of *B. herculeus* (STRADNER).

Stratigraphic range: Lower Eocene (Ypresian); Zone NP10–NP12.

Cretarhabdus lentus STRADNER in STRADNER & EDWARDS, 1968, p. 33, 34, Pl. 44, Fig. 7, Text-Fig. 6

Original description of *Cretarhabdus lentus* STRADNER in STRADNER & EDWARDS, 1968

Holotype: TEM Micrographs 3325+3326/65.

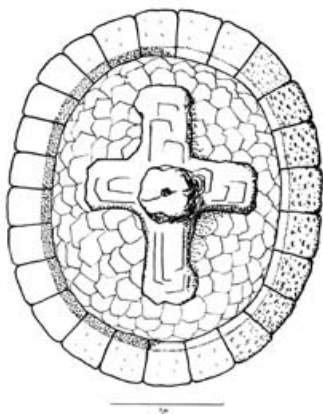
Derivation of name: *lentus* (Lat.) = late.

Type locality: Williams Bluff diatomite, Oamaru, New Zealand.

Level: Upper Eocene.

Diagnosis and description: Coccoliths consisting of a broadelliptical basal plate with a narrow outer ring of about 32 relatively large, rectangular to trapezoidal plates and a wide central area completely filled in with a mesh structure of tightly packed irregular crystal units, which partly overlap each other like tiles. A robust axial cross is spanning the central area and pointing with its central knob in distal direction.

Size: Length 3–8 µm, width 2–9 µm (holotype).



Text-Fig. 32a.
Original drawings of *Cretarhabdus lentus*.

Discussion: The stereoscopic couple of the only specimen encountered yet does not show a second proximal basal plate. Up to now the genus *Cretarhabdus* has only been reported from Cretaceous sediments. Reworking has not been observed in any of the Oamaru samples. It therefore seems likely that this specimen is either of upper Eocene age or has been introduced during the laboratory preparation of this sample.



Text-Fig. 32b.
Electron micrograph of the holotype.

Comments:

Taxonomic status: *Cretarhabdus lentus* is a junior synonym of *Blackites vitreus* (DEFLANDRE) SHAFIK 1981 (= *Rhabdolithus vitreus* DEFLANDRE in DEFLANDRE & FERT, 1954, 157, Pl. 12, Figs. 28, 29, Text-Figs. 83, 84). Recombination to *Blackites* should be provisional (AUBRY, 1999).

Genus: *Rhabdosphaera* HAECKEL 1894, p. 111 emend. NORRIS 1984

Type species: *Rhabdosphaera clavigera* MURRAY & BLACKMANN, 1898, p. 438, 439, Text-Figs. (designated by HAY & TOWE, 1962, p. 504).

Rhabdosphaera sicca (STRADNER) STRADNER & FUCHS 1977 (= *Rhabdolithus siccus* STRADNER in BACHMANN, PAPP & STRADNER, 1963, p. 158, Pl. 24, Fig. 8, Text-Figs. 3, 3a).

Original description of *Rhabdolithus siccus* STRADNER, 1963 in BACHMANN, PAPP & STRADNER, 1963

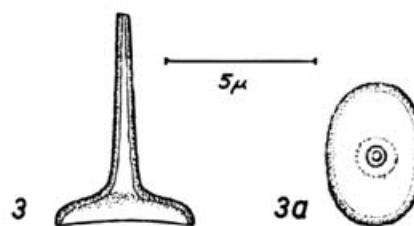
Holotypus: GBA 2009/058/0061.

Derivatio nominis: *siccus* (Lat.) = schlicht, einfach.

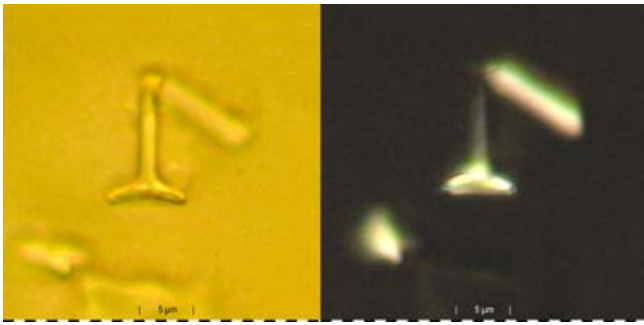
Locus typicus: Ziegelei Frättingsdorf, Niederösterreich.

Stratum typicum: Torton, untere Lagenidenzone.

Diagnose und Beschreibung: Im Umriss breitelliptische, distal leicht aufgewölbte und mit einem langen zentralen konischen Verlängerungsrohr versehene Coccolithen (Gehäuseelemente von Kalkflagellaten). Weder der Rand der Basalscheibe noch deren Fläche oder der für die Gattung *Rhabdolithus* (*Rhabdosphaera*) kennzeichnende röhrenförmige



Text-Fig. 33a.
Original drawings of *Rhabdolithus siccus*.



Text-Fig. 33b.
Holotype of *Rhabdolithus siccus* in normal light and polarized light.

Aufsatz zeigen irgendeine Ornamentation. Von dem im ungarischen Torton massenhaft vorkommenden *Rhabdolithus pannonicus* BALDI-BEKE unterscheidet sich *Rhabdolithus siccus* durch den elliptischen Umriss der Basalplatte und durch das Vorhandensein eines Zentralkanals.

Vorkommen: In fast allen nannofossilführenden Tortonmergeln Österreichs selten; leicht auffindbar im Torton des Lavantales, wo kieselige Bruchstücke fehlen.

Dimensionen: Basalplatte: 3 x 5 µm, Höhe 14 µm.

English translation:

Holotype: GBA 2009/058/0061.

Derivation of name: *siccus* (Lat.) = simple.

Type locality: Brickyard Frättingsdorf, Lower Austria.

Type level: Badenian, Lower Miocene, lower Lagenid zone.

Diagnosis and description: Rhabdoliths with slightly vaulted elliptical basalplate and a long central tapering tube extending in distal direction. No ornamentation recognizable on basal plate or tube by light microscopical means.

Related to *Rhabdolithus pannonicus* BALDI-BEKE, from which it differs by its oval plate and its hollow tube.

Size: Basal plate: 3 x 5 µm, height 14 µm.

Comments:

Stratigraphic distribution: Upper Miocene (Tortonian); Zone NN9–NN11.

Family: Syracosphaeraceae LEMMERMANN, 1903 emended AUBRY, 2009

Genus: Syracosphaera LOHMANN, 1902

Type species: *Syracosphaera pulchra* LOHMANN, 1902, p. 133, 134, Pl. 4, Figs. 34, 36, 36a, b, 37 (designation by LOEBLICH & TAPPAN, 1963).

?*Syracosphaera lunularia* STRADNER & FUCHS, 1978, p. 496, 497, Pl. 12, Figs. 15, 6, Pl. 13, Figs. 13–16.

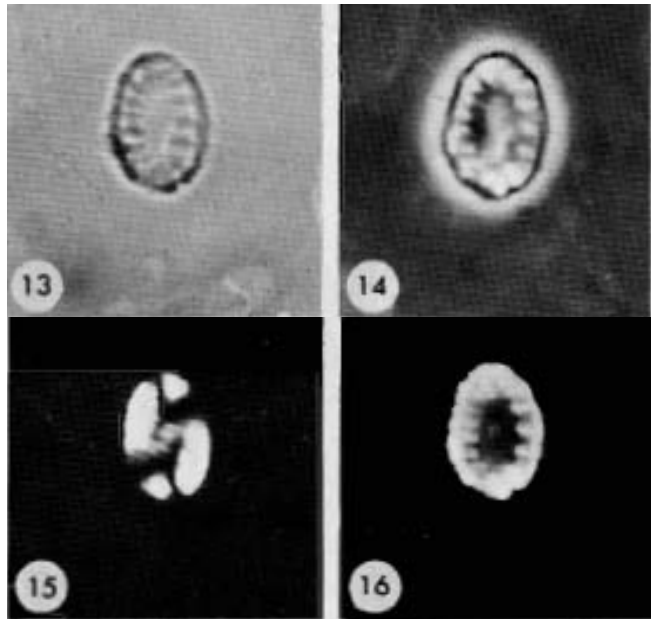
Original description of *Syracosphaera lunaria* STRADNER & FUCHS, 1978

Holotypus: GBA 2009/058/0069.

Derivatio nominis: Entfernte Ähnlichkeit mit den Schotenwänden der Mondviole (*Lunaria rediviva*).

Locus typicus: Stützenhofen, NÖ.

Stratum typicum: Untere Lagenidenzone des Badenien. Mittelmiozän.



Text-Fig. 34.
Original photographs of the holotype of *Syracosphaera lunaria* in normal light (13), polarized light (15), positive (14) and negative (16) phase contrast.

Beschreibung: Elliptische Kalkplättchen, deren Randzone durch ca. 7–16 zentripetale oder schräg liegende Einschnitte gekennzeichnet ist. Zuordnung zu *Syracosphaera fraglich*, eventuell *Pontosphaera*?

Größe: 7–10 µm.

English translation:

Holotype: GBA 2009/058/0069.

Derivation of name: In plan view resembling the fruit membranes of *Lunaria rediviva*, in shape but not in size.

Type locality: Stützenhofen, Lower Austria.

Level: Badenian, Middle Miocene, lower Lagenid zone.

Diagnosis and description: Elliptical calcareous plates with a distinct rim, inside of which a row of elongated pores is running parallel to the rim. Number of pores 7–16.

Size: Length 10 µm, width 7 µm.

Relations: Assignment to the genus *Syracosphaera* is hypothetical.

Comments:

Taxonomical status: The coccolith clearly exhibits the characteristics of the Family Syracosphaeraceae. However assignment to the genus *Syracosphaera* s. st. is provisional because the coccosphere is unknown. Coccospheres of *Syracosphaera* are typically dimorphic.

Stratigraphic distribution: Middle Miocene (Badenian); Zone NN5.

Order: Zygodiscales YOUNG & BOWN, 1997 emended AUBRY in press

Family: Zygodiscaceae HAY & MOHLER, 1967

Genus: Nothodiscus AUBRY & STRADNER nov. nom.

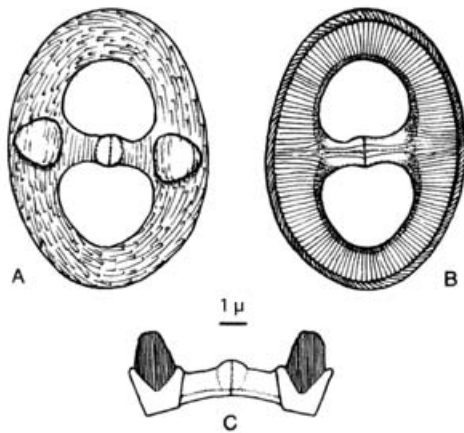
Type species: *Nothodiscus pax* AUBRY & STRADNER nov.com. (*Transversopontis pax* STRADNER & SEIFERT, 1980, p.281, Pl.1, Figs. 1–9).

Description: Coccoliths consisting of the four structural units characteristic of the family. The tranverse bar is mar-

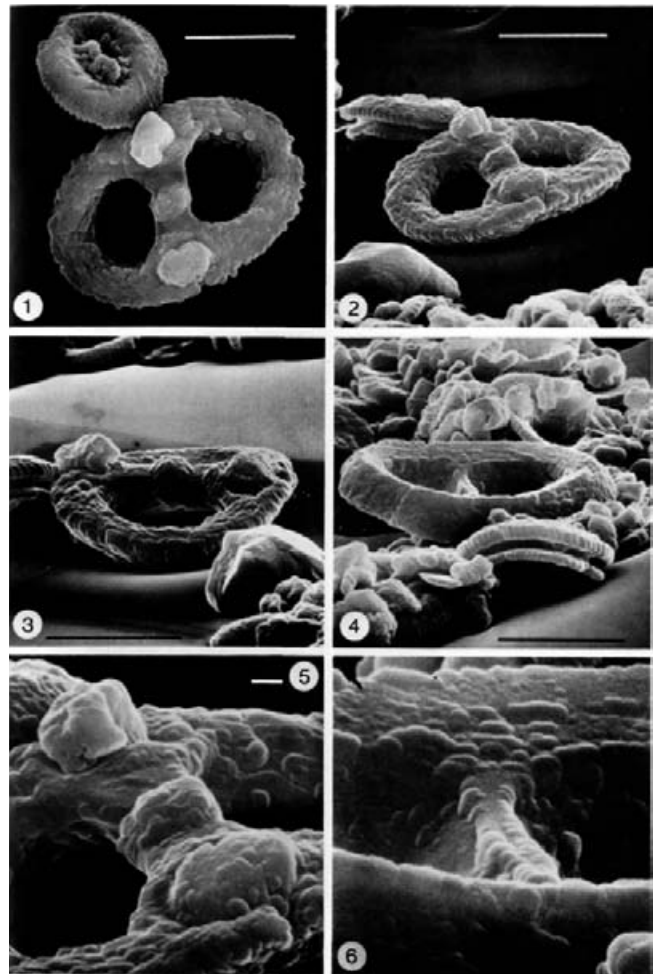
edly beveled in the basal plate, with corresponding prominent and irregular outgrowths on the distal side. Thickenings may also occur on the distal side of the bar.

Remarks: The relation of *N. pax* to *N. fibula* (GHETA, 1976, p. 144, Pl. 2, Figs. 1, 4–9) AUBRY and STRADNER n. c. requires clarification. *N. pax* may be a junior synonym of *N. fibula*, which would broaden the range of the taxon.

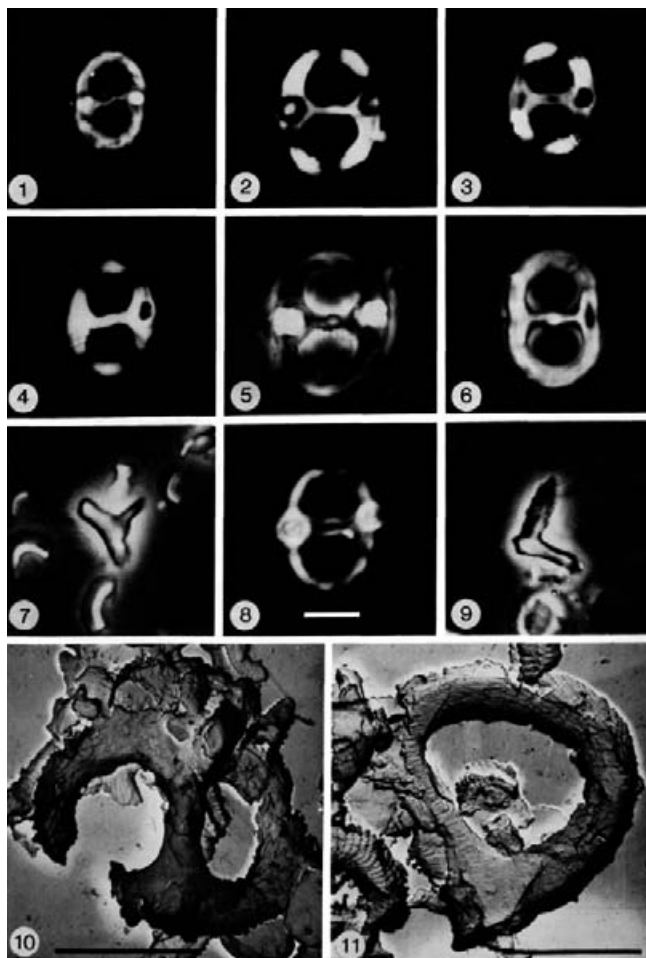
**Original description of *Transversopontis pax*
STRADNER & SEIFERT, 1980**



Text-Fig. 35a.
Original drawings of *Transversopontis pax*.
A: distal view, B: proximal view, C: lateral view.
Scale = 1 µm.



Text-Fig. 35c.
Stereoscan images of the holotype.
Distal view (1), oblique distal view (2), lateral view (3), close up of the transversal bridge showing two distal horns, strongly corroded and a medial hump.
Oblique proximal view of the paratype (4), close up of transversal bridge showing two parallel pads; oblique proximal view (6).
Scale in Text-Figs. 1–4: 5 µm.
Scale in Text-Figs. 5 and 6: 1 µm.



Holotypus: Pl. 2, Figs. 1–3 in STRADNER & SEIFERT, 1980 (GBA 2009/058/0070).

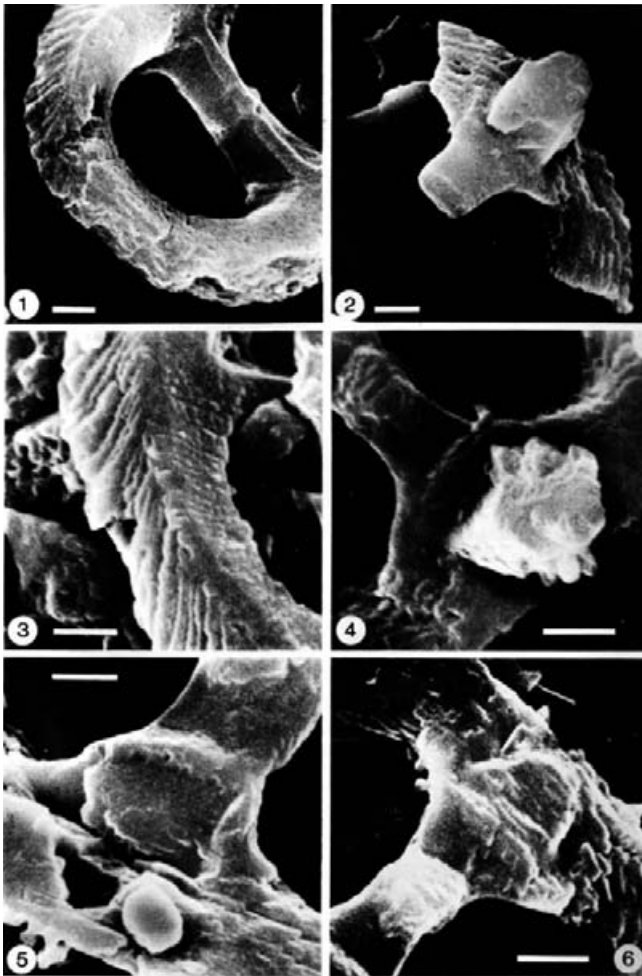
Derivatio nominis: *pax* (Lat.) = Frieden.

Locus typicus: Niederhollabrunn, Niederösterreich.

Stratum typicum: Diatomeenschichten des basalen Oligozän (NP21).

Diagnose und Beschreibung: Discolithen der Heterococcolithen-Phase mit elliptischem Basalring und einer annähernd in Richtung der Querachse liegenden oder etwas schräg gestellten, mit zwei lateralen Distalhörnern und einer mit einem nur wenig aufragenden Mittelhöcker versehenen Querbrücke. Die Ultrastruktur der Distal- und der Proximalseite entspricht denjenigen bei anderen Arten von *Transversopontis*, *Discolithina* (vgl. STRADNER & EDWARDS, 1968: 36)

Text-Fig. 35b.
Photographs of the plane view.
Polarized light (2, 3, 4) and phase contrast (1, 5, 6, 8); basal ring and distal horn in phase contrast (7, 9). Electron micrograph of a damaged specimen (10, 11) – distal views showing two distal horns (10). Proximal view (11) of a corroded specimen without preserved ultrastructure of the proximal side.
Scale = 5 µm.



Text-Fig. 35d.

Stereoscan images of syntypes.

Oblique proximal view showing a distinct suture in the transversal bridge (1), oblique distal view of a fragment with single distal horn (2), proximal view of the ultrastructure of the proximal side and the basal ring (3), distal view of a large distal horn and of the medial hump (4), distal view of the basal ring and the transversal bridge after loss of a distal horn (5), oblique distal view of the transversal bridge and of a distal horn (6).
Scale = 1 µm.

und auch *Helicosphaera*: auf der Distalseite sind die Suturen flach spiralig bis randparallel, auf der Proximalseite hingegen radiär angeordnet. Die Schrägseite des Basalringes zeigt proximal betrachtet gegen den Uhrzeigersinn geneigte Riefen. Die Querbrücke lässt eine Quernaht und proximal zwei parallele Wülste erkennen. Die Distalhörner und der Mittelhöcker entsprechen in ihrer Ultrastruktur der Distalseite. Die Basalringe sind leicht in proximaler Richtung konkav gewölbt, entsprechend der mehr oder weniger sphärischen Gestalt der lebenden Kalkflagellatenzelle, der sie aufsäßen.

Dimensionen: Längsachse von 9–13 µm, Länge der Distalhörner von 1 bis über 5 µm schwankend.

Holotypus: Länge 12 µm, Breite 8 µm, Höhe 4 µm.

English translation:

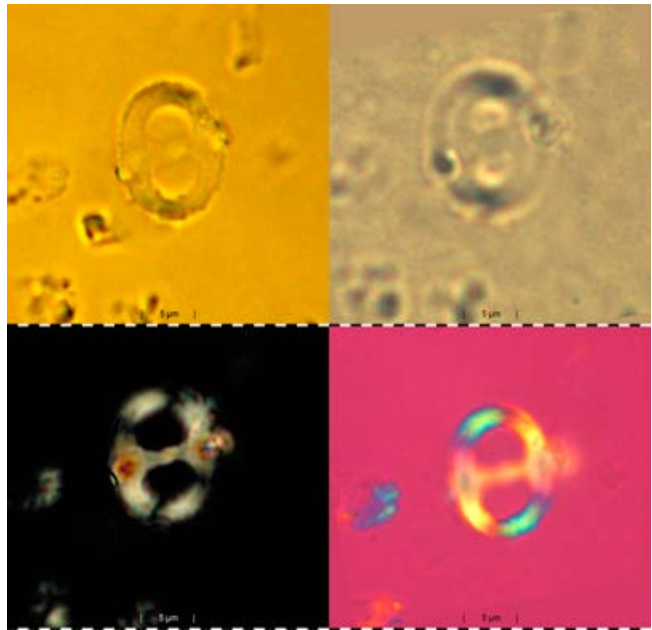
Holotype: Pl. 2, Fig. 1–3, paratype: Pl. 2, Figs. 4–6.

Derivation of name: *pax* (Lat.) = peace.

Type locality: Niederhollabrunn, Lower Austria.

Type level: Diatomaceous marl of basal Oligocene (NP21).

Discoliths built during the Heterococcolith phase of life cycle. The basal ring is elliptical with a transversal bridge,



Text-Fig. 35e.

Syntype in normal light and polarized light at different focus levels.

which is divided by a suture line. Two clumsy horns situated on the distal side of either side of the transversal bridge are the characteristic feature of this species. The ultrastructure of the distal as well as of the proximal side is similar to that of other species in the genera *Transversopontis*, *Helicosphaera* and *Discolithina* (compare STRADNER & EDWARDS, 1968); The central bridge, which can be slightly tilted against the transversal axis, shows thickenings on the distal as well as on the proximal side. The basal ring is concavely vaulted and thus fitting the spherical volume of the living cell.

Size: Length 12 µm, width 8 µm, height 3 µm.

Comments:

Stratigraphic distribution: Uppermost Eocene to Lowermost Oligocene; Zone NP21.

Incertae sedis

Family: Braarudosphaeraceae DEFLANDRE, 1947

Genus: Braarudosphaera DEFLANDRE, 1947

Braarudosphaera africana STRADNER, 1961, Text-Fig. 44

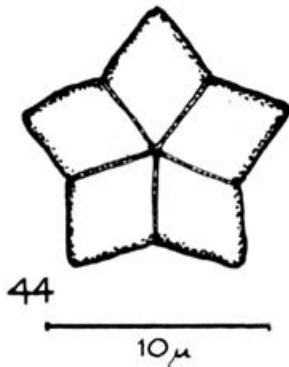
= NOËL 1958, Étude de Coccolithes, S. 189, T. IX, Fig. 4 [informally described as “Braarudosphaera à pentalithes très affilés (Albien des Ravix)”].

Original description of *Braarudosphaera africana* STRADNER, 1961

Paratypus: GBA 2009/058/0008/1.

Von NOËL wurde diese Art in Phosphaten des Albium von Ravix, Nordafrika, gefunden, aber nicht beschrieben. Pentolithen, deren Einzelteile mit ihren distalen Kanten spitze Winkel einschließen. Zwischen den Spitzen der Einzelteile liegen Einschnitte, in welche die Unterteilungslinien münden.

Größe: 10–15 µm.



Text-Fig. 36.
Original drawing of *Braarudosphaera africana* (hypotype).

Weiteres Vorkommen: Aragon, Mexiko (Mittelleozän), selten.

English translation:

This species was described by Noël from the Albian phosphates of Ravix, North Africa, but not named. Pentaliths, consisting of five rhombical parts of identical shape, with the distal tips of these enclosing acute angles. The suture lines between the parts meet the outline of the pentalith halfway between the tips.

Size: 10–15 μm.

Another occurrence: Aragon Formation, Mexico, rare.

Comments:

STRADNER thought, wrongly, that taxa signalled by Noël came from North Africa, but Ravix is in France.

Stratigraphic range: Upper Aptian to Lower Cenomanian. This taxa was probably reworked in Aragon Formation.

Braarudosphaera bigelowi subsp. *parvula* STRADNER, 1960, p. 3, Text-Fig. 2

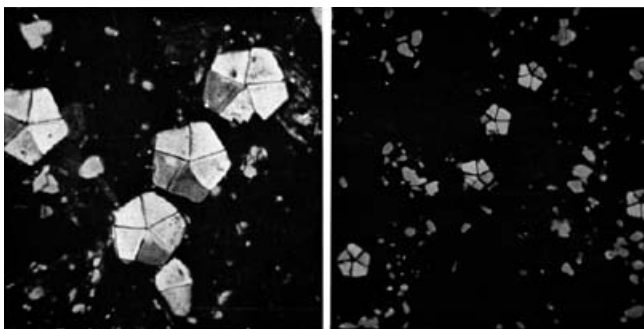
Original description of *Braarudosphaera bigelowi* subsp. *parvula* STRADNER, 1960

Syntypes: GBA 2009/058/0014.

Derivation of name: *parvula* (Lat.) = die kleine

Type level: OMV deepwell Himberg 1, 1189.5–1380 m. OMV deepwell Laxenburg 1.305 m, Upper Sarmatian of the Vienna Basin.

Die durch ihre geringen Dimensionen auffallende Kleinform von *Braarudosphaera bigelowi* (GRAN & BRAARUD) DEFLANDRE. Die Pentalithen dieser neuen Unterart entsprechen in ihrem Aufbau denen der typischen Art, sie sind aber an-



Text-Fig. 37a.
Original images of syntypes of *Braarudosphaera bigelowi* ssp. *parvula* (right), *Braarudosphaera bigelowi* (left).

nähernd um die Hälfte kleiner und wesentlich dünner. Im polarisierten Lichte erscheinen sie wegen ihrer geringen Dicke nur wenig leuchtend; ihr Durchmesser ist meist kleiner als 10 μm, ihre durchschnittliche Dicke beträgt 2 μm. Da diese neue Unterart auch selbständig ohne Beigesellung der typ. *Braarudosphaera bigelowi* vorkommt, erscheint eine Abtrennung der neuen Unterart *Braarudosphaera bigelowi parvula* gerechtfertigt und angezeigt. Man beachte, dass das Mikrofoto 2, welches die neue Unterart im polarisierten Lichte zeigt, mit der gleichen Vergrößerung (Objektiv 100x mit Ölimmersion, Planokular 10 X) wie das Mikrofoto 1 der typischen Art hergestellt wurde. Hauptvorkommen im Sarmat des südlichen Wiener Beckens: Tiefbohrung Himberg 1: 950 bis 1030 m, Tiefbohrung Laxenburg 1: 300 bis 305 m, Tiefbohrung Laxenburg 2: Spülprobe bei 205 m. Da die Hauptvorkommen der Kleinform, so weit bis jetzt beobachtet, im Hangenden des Vorkommens der typischen Form liegen, also in geologisch jüngeren Schichten des Sarmats, kann die Größenverminderung als eine Folge der zunehmenden Verbrackung des Sarmatmeeres angesehen werden. Hauptvorkommen im Sarmat des südlichen Wiener Beckens: Tiefbohrung Himberg 1: 1189,5 bis 1380 m; Tiefbohrung Laxenburg 1: 350 bis 355 m, Tiefbohrung Laxenburg 2: Spülprobe bei 210 m.

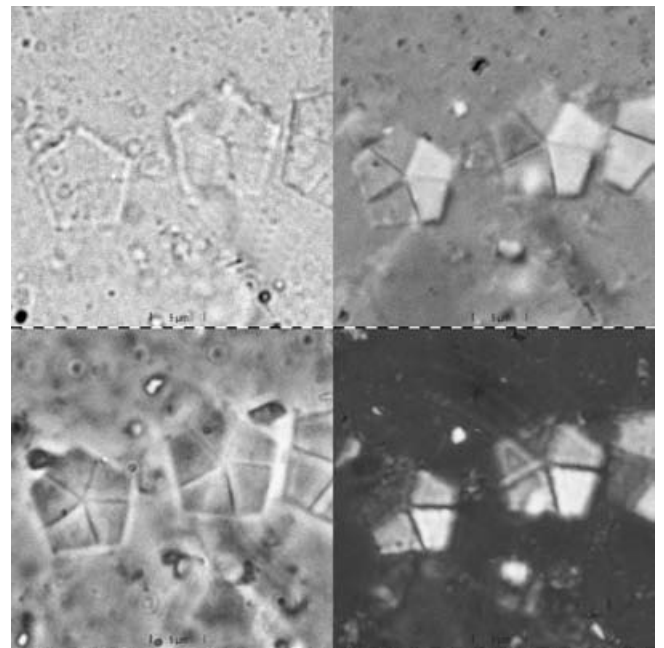
English translation:

Syntypes: GBA 2009/058/0014.

Derivation of name: *parvula* (Lat.) = the small one.

Type level: OMV deepwell Himberg 1, 1189.5 m – 1380 m. OMV deepwell Laxenburg 1.305 m, Upper Sarmatian of the Vienna Basin.

Pentaliths of *Braarudosphaera bigelowi* (GRAN & BRAARUD) DEFLANDRE that are only half the size of the common species. They measure less than 10 μm. Since they are thinner than the common species, they appear darker under crossed nicols. The blooms of this subspecies occurred in the younger Sarmatian, at a time when the water of the Paratethys was turning brackish, that is in core distance about 50 m above the occurrence of the normal-sized pentaliths.



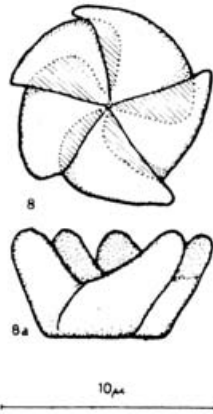
Text-Fig. 37b.
Syntypes in normal and polarized light and phase contrast.

Comments:

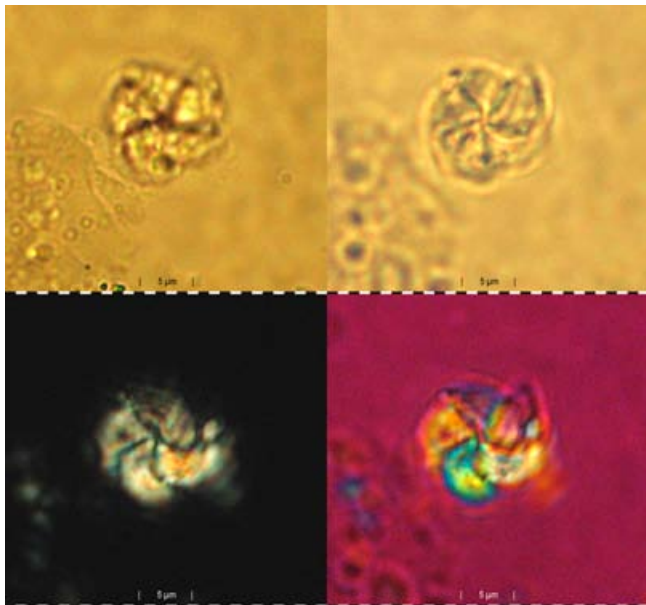
Stratigraphic distribution: Upper Miocene (Sarmatian); Zone NN11.

Braarudosphaera turbinea STRADNER, 1963, p. 10, Pl. 6, Figs. 8, 8a

Original description of *Braarudosphaera turbinea* STRADNER, 1963



Text-Fig. 38a. Original drawings of *Braarudosphaera turbinea*.



Text-Fig. 38b. Lectotype in normal and polarized light at different focus levels.

Holotype: GBA 2009/058/0049.

Derivation of name: *turbineus* (Lat.) = whirling.

Type locality: Haidhof W Ernstbrunn, Lower Austria.

Level: Danian.

Description: Pentaliths consisting of 5 roughly triangular sectors overlapping each other counterclockwise, the tips of which are tilted up to the distal side.

Comments:

Stratigraphic distribution: Upper Cretaceous to lower Paleocene (Maastrichtian–Danian); HO in Zone NP3.

Braarudosphaera undata STRADNER, 1959b, p. 487, Text-Fig. 65

Original description of *Braarudosphaera undata* STRADNER, 1959b

Lectotypus: GBA 2009/058/0008/2.

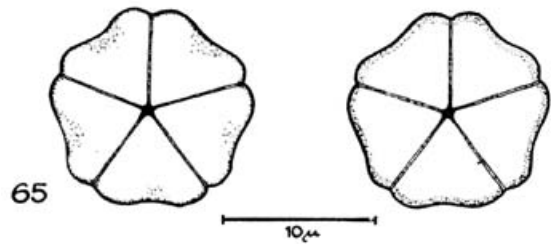
Derivatio nominis: *unda* (Lat.) = Welle.

Locus typicus: Aragon-Formation, Mexico.

Stratum typicum: Unter-Eozän.

Diagnose: Pentalithen mit gewelltem Umriss. Jeder Einzelteil hat zwischen zwei runden Höckern eine sanfte Einbuchtung. Paläozän (Thanetium) von Mattsee, Stat. 130, Salzburg; Unteres Eozän von Aragon, Mexiko.

Größe: 12–14 µm.



Text-Fig. 39a. Original drawings of *Braarudosphaera undata*.

English translation:

Lectotype: GBA 2009/058/0008/2.

Derivation of name: *unda* (Lat.) = wave.

Type locality: Aragon Formation, Mexico.

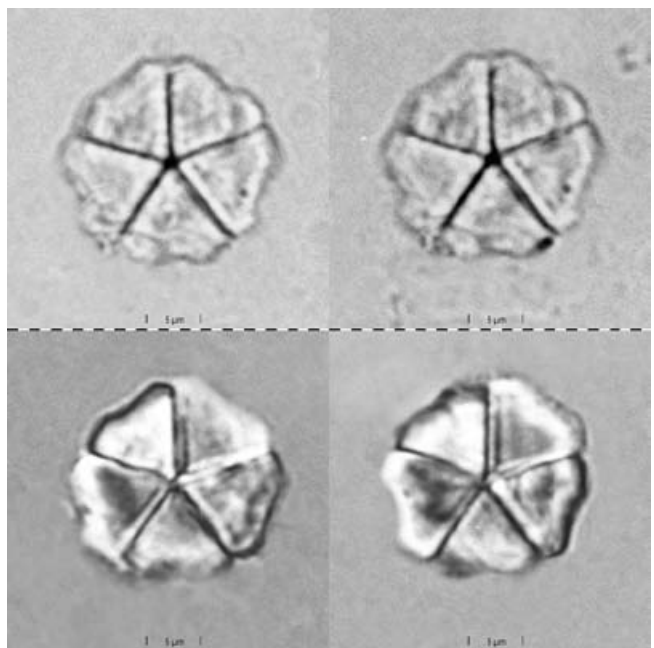
Level: Lower Eocene.

Pentaliths with wavy outline. Each of the five symmetrical segments is slightly indented on its peripheral side.

Size: 12–14 µm

Comments:

Stratigraphic distribution: Middle Eocene (Lutetian); Zone NP14b–NP15b.



Text-Fig. 39b. Lectotype in normal and polarized light.

Genus: *Micrantholithus* DEFLANDRE in DEFLANDRE & FERT, 1954

Micrantholithus angulosus STRADNER in STRADNER & PAPP, 1961, p. 482 (= *Micrantholithus flos* subcent. *angulosus* STRADNER 1959b, p. 482, Text-Figs. 61, 62).

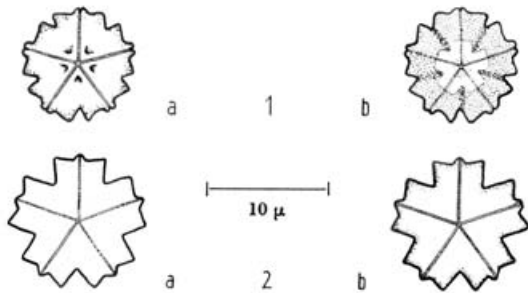
Original description of *Micrantholithus flos* subcent *angulosus* STRADNER, 1959b

Lectotypus: GBA 2009/058/0038.

Derivatio nominis: *angulosus* (Lat.) = winkelig.

Locus typicus: Gujabal, Mexiko.

Level: Mittel-Eozän.

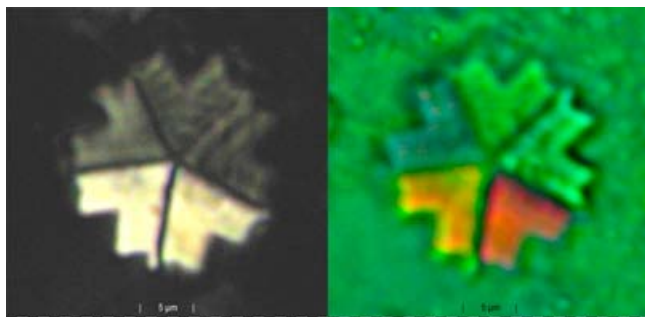


Text-Fig. 40a.
Original drawings of *Micrantholithus angulosus*.

Diagnose und Beschreibung: Pentalithen bestehend aus 5 Einzelteilen, deren Umrisslinien kantig sind und am Außenrand des Einzelsteines 3 Buchten bilden, eine tiefere in der Mitte und je eine seichtere nahe der rechten und linken Unterteilungslinie. Die zwischen den seichten Lateralbuchten liegenden Anteile von je 2 benachbarten Einzelsteinen ragen ein wenig in distaler Richtung vor. Verstärkungsleisten fehlen oder sind nur sehr dünn ausgebildet. Die Pentalithen sind flach, gelegentlich aber sehr dick.

Durchmesser: 9–13 µm.

Beziehungen: *Micrantholithus angulosus* hat die beiden Lateralbuchten mit *Micrantholithus bramlettei* DEFLANDRE gemeinsam, welcher allerdings an Stelle eines Mitteleinschnittes eine distale Erweiterung der Einzelsteine besitzt. Ansonsten steht *Micrantholithus angulosus* vermittelnd zwischen *Micrantholithus flos* DEFLANDRE und *Micrantholithus vesper* DEFLANDRE.



Text-Fig. 40b.
Holotype in polarized and normal light.

English translation:

Lectotype: GBA 2009/058/0038.

Derivation of name: *angulosus* (Lat.) = angular.

Type locality: Gujabal, Mexico.

Type level: Middle Eocene.

Diagnosis and description: Pentaliths consisting of five radially arranged triangular symmetrical parts with rough-edged distal rim. This rim shows a deeper notch in the middle and two smaller lateral notches. The straight suture lines are extended in distal direction. The pentaliths vary in thickness, some are flat, others sturdy.

Size: 9–13 µm.

Remarks: *Micrantholithus angulosus* can be considered a transitional form between *Micrantholithus flos* DEFLANDRE and *Micrantholithus vesper* DEFLANDRE.

Comments:

Stratigraphic distribution: Middle Eocene (Bartonian); Zone NP16–NP17.

Micrantholithus obtusus STRADNER, 1963, p. 11, Pl. 6, Figs. 11 and 11a

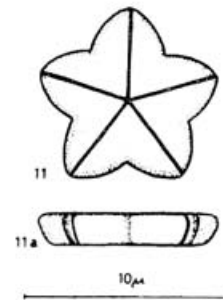
Original description of *Micrantholithus obtusus* STRADNER, 1963

Holotype: GBA 2009/058/0056.

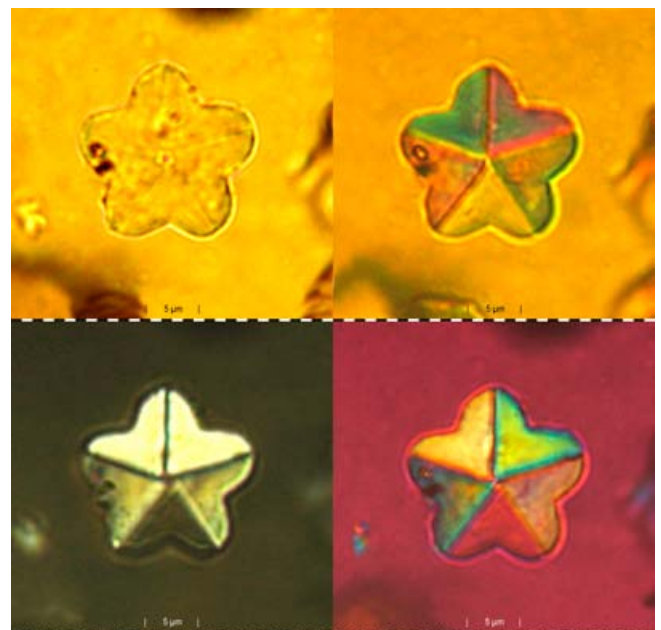
Derivation of name: *obtusus* (Lat.) = blunt.

Type locality: Nordhorn Nord 11, Germany.

Level: Upper Hauterivian.



Text-Fig. 41a.
Original drawings of *Micrantholithus obtusus*.

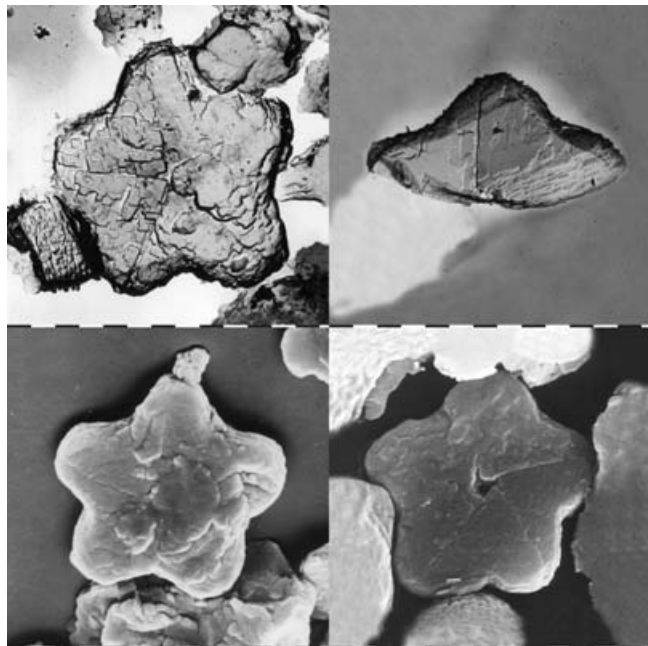


Text-Fig. 41b.
Lectotype in polarized and normal light at different focus levels.

Diagnosis and description: Star-like pentoliths consisting of 5 flat sectors with notched margins and blunt tips.

Comments:

Stratigraphic distribution: Berriasian to Aptian.



Text-Fig. 41c.
TEM and SEM micrographs of *Micrantholithus obtusus*.

Family: Lithostromationaceae DEFLANDRE, 1959

Genus: Trochoaster KLUMPP, 1953

Type species: *Trochoaster simplex* KLUMPP 1953, p. 385.

Synonym: *Polycladolithus* DEFLANDRE in DEFLANDRE & FERT, 1954, p. 170.

Type species: *Polycladolithus operosus* DEFLANDRE in DEFLANDRE & FERT, 1954, p. 170, Pl. 12, Figs. 3–6, Text-Fig. 125.

Comments:

Taxonomic status: MARTINI & STRADNER (1960) established synonymy of *Polycladolithus* and *Trochoaster*.

Trochoaster conglobatus STRADNER, 1962, p. 374, Pl. 2, Figs. 16, 18.

Original description of *Trochoaster conglobatus* STRADNER, 1962

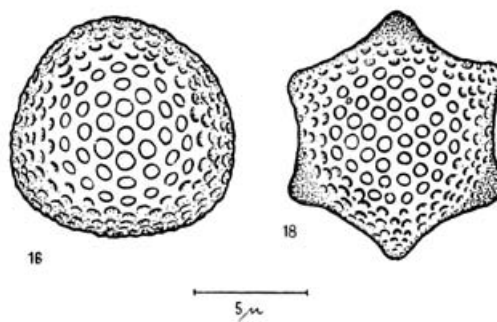
Holotypus: GBA 2009/058/0039/3.

Derivatio nominis: *conglobatus* (Lat.) = gerundet.

Locus typicus: Basale Glaukonitsande des Steinbruches Reingruberhöhe bei Bruderndorf, Niederösterreich.

Stratum typicum: Obereozän (jüngeres Led; GOHRBANDT, 1962).

Diagnose und Beschreibung: Durch unzählige runde Poren durchbrochene, stark aufgetriebene, im Umriss annähernd runde bis abgerundete-sechseckige hohle Kalkkörperchen. Ähnlich wie bei *Trochoaster deflandrei* (STRADNER) MARTINI & STRADNER sind je drei durch Winkel von 120° voneinander getrennte Sternspitzen einer Seite zugekehrt, während die zu diesen alternierend angeordneten anderen Spitzen der

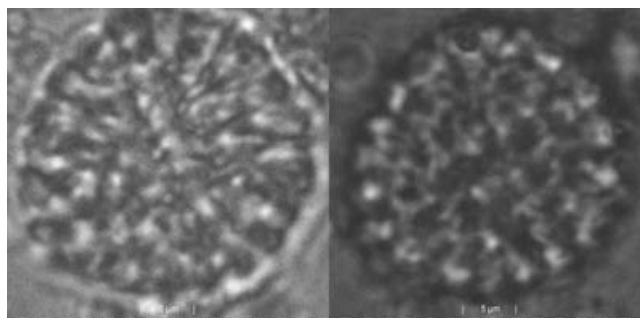


Text-Fig. 42a.
Original drawing of *Trochoaster conglobatus*.

gegenüberliegenden Seite zugekehrt sind. Die Lage der Poren ist keinem starren Muster unterworfen, gelegentlich liegen jedoch Poren im Quincunx-Muster. Selten.

Dimensionen: Durchmesser 8–10 µm, Höhe 7–9 µm.

Beziehungen: *Trochoaster* ist nahe mit *Trochoaster deflandrei* (STRADNER) MARTINI & STRADNER verwandt, von welchem er sich durch den plumpen Bau und die weitaus größere Anzahl von Poren unterscheidet. Der gleichzeitig im Typusmaterial vorkommende *Trochoaster simplex* KLUMPP (vgl. Taf. II, Fig. 17) hat wesentlich größere Poren bzw. Fenster, welche nach einem sehr regelmäßigen System angeordnet sind (vgl. STRADNER & PAPP, 1961, S. 130–134).



Text-Fig. 42b.
Holotype in normal light at different focus levels.

English translation:

Holotype: GBA 2009/058/0039/3.

Derivation of name: *conglobatus* (Lat.) = rounded.

Type locality: Basal glauconitic sands of the Reingruberhöhe quarry, Bruderndorf, Lower Austria.

Level: Upper Eocene (Led; GOHRBANDT, 1962). Stratotype of the NP19 Nannoplankton Zone of MARTINI.

Diagnosis and description: Rounded or broadly hexagonal inflated nannofossils showing innumerable pores on their surface. Similar to *Trochoaster deflandrei* (STRADNER) MARTINI & STRADNER in the hexagonal forms the blunt tips are alternatively pointing to either this or that side of the nannofossil, with angles of 120 degrees between them. The small round pores show a more or less random distribution, sometimes they lie in quincunx pattern.

Relations: *Trochoaster conglobatus* is closely related to *Trochoaster deflandrei*, from which it differs by its massive volume and the greater number of pores. The co-occurring *Trochoaster simplex* KLUMPP has larger pores or windows respectively, which are aligned in a very regular system (compare STRADNER & PAPP, 1961, p. 130–134).

Size: 10–12 µm.

Comments:

Stratigraphic distribution: Upper Eocene (Priabonian); Zone NP19–20.

Trochoaster deflandrei (STRADNER) MARTINI & STRADNER, 1960 (= *Polycladolithus deflandrei* STRADNER, 1959b, p. 487, Text-Fig. 76, 77i–l).

Original description of *Polycladolithus deflandrei* STRADNER, 1959b

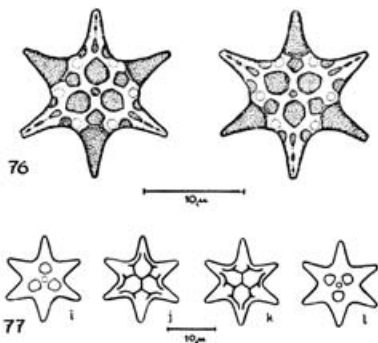
Lectotypus: GBA 2009/058/0011.

Derivatio nominis: Herrn Dir. Prof. Dr. G. DEFLANDRE, Paris, in Dankbarkeit gewidmet.

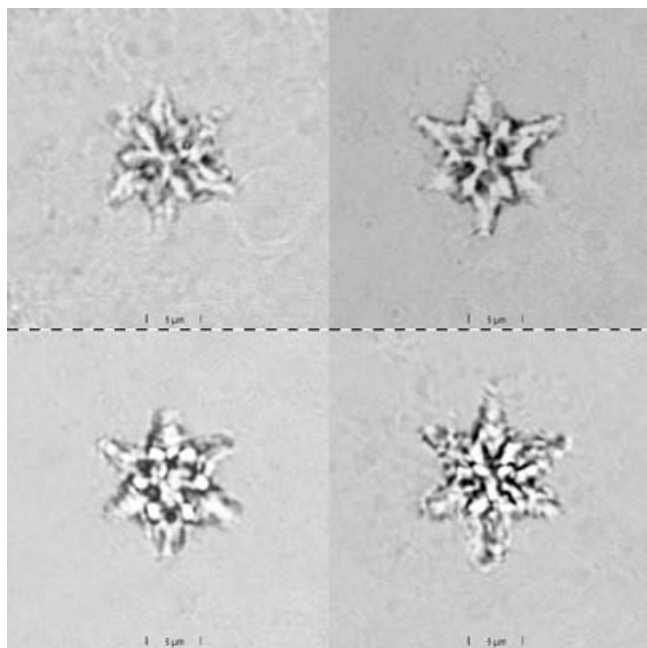
Locus typicus: Aragon, Mexiko.

Stratum typicum: Unter-Eozän.

Diagnose und Beschreibung: Sechssarmige Kalkkörperchen mit reichen Oberflächenverzierungen. Die Primärfenster sind im Gegensatz zu *Polycladolithus stellaris* groß ausgebildet, wodurch sich die gesamten Symmetrieverhältnisse des Kalkkörperchens von denen der vorigen Formart unterscheiden. Je drei zu einer Seite gehörenden Arme stehen räumlich ab. Die schematische Darstellung der Strukturen



Text-Fig. 43a. Original drawings of *Polycladolithus deflandrei*.



Text-Fig. 43b. Holotype in normal light at different focus levels.

zeigt deutlich den eigenartigen Bau dieses wundersamen Nannofossiles.

Größe: 15–17 µm.

English translation:

Lectotype: GBA 2009/058/0011.

Derivation of name: Thankfully dedicated to Prof. Dr. Georges DEFLANDRE, Paris.

Type locality: Aragon, Mexico.

Level: Lower Eocene.

Description and diagnosis: Star shaped calcareous nannofossils with six pointed rays and rich surface ornamentation. Contrary to *Polycladolithus stellaris* nov. spec., the primary windows surrounding the central hole are larger than there. Three alternating rays with angles of 120 degrees between them are pointing either towards the observer or away from it. The schematic drawings show the complicated inner structure of this astounding nannofossil at different optical levels.

Size: 15–17 µm.

Comments:

Stratigraphic distribution: Lower Eocene to Upper Pliocene (Ypresian–Gelasian).

Polycladolithus stellaris STRADNER, 1959b, p. 487, Text-Figs. 74, 75, 77e–h

Original description of *Polycladolithus stellaris*, STRADNER, 1959b

Lectotypus: GBA 2009/058/0012.

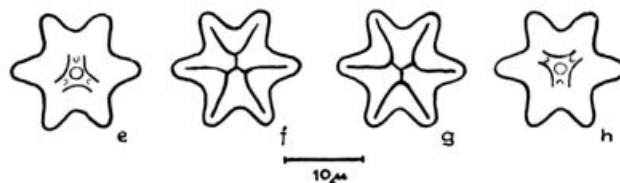
Derivatio nominis: *stellaris* (Lat.) = sternförmig.

Locus typicus: Tiefbohrung Puchkirchen 1, Oberösterreich.

Stratum typicum: Unteroligozän.

Beschreibung: Kalkkörperchen mit sternförmigem Umriss, meist sechsstrahlig. Ein zentrales Fenster und die kräftigen Sternarme unterscheiden diese Formart von der vorhergehenden. Der Aufbau der Hauptachsen ähnelt dem von Lithostromation. Die dem Zentralfenster nahen Primärfenster sind in ihrer Ausbildung unterdrückt.

Größe: 12–15 µm.



Text-Fig. 44a. Original drawings of *Polycladolithus stellaris*.

English translation:

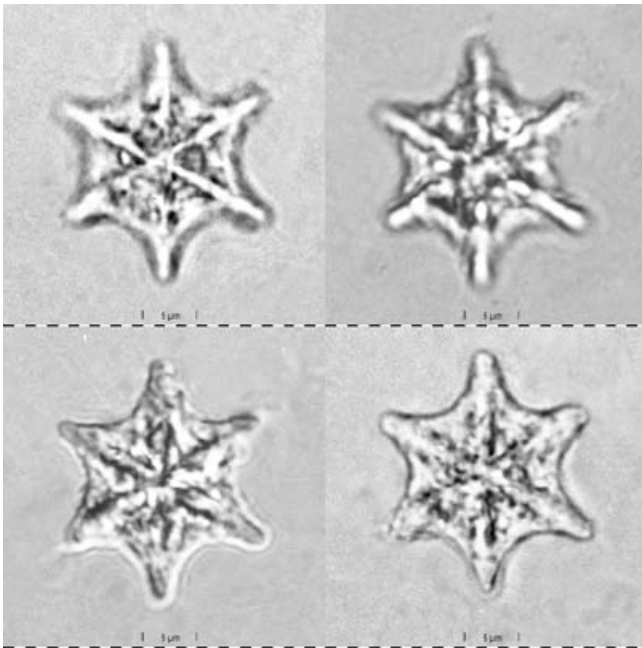
Lectotype: GBA 2009/058/0012.

Derivation of name: *stellaris* (Lat.) = star-shaped.

Type locality: RAG deepwell Puchkirchen 1, Upper Austria.

Level: Lower Oligocene.

Diagnosis and description: Calcareous bodies of star-shaped outline, in most cases hexangular. The reticulate surface pattern is identical on both sides, however shifted by 120 degrees, as can be recognized by the position of the Y-shaped part surrounding the central hole.



Text-Fig. 44b.
Holotype of *Polycladolithus stellaris* in normal light at different focus levels.

The primary windows surrounding it are reduced in size. By studying different optical levels of this delicate nanno-fossil, one can understand its complicated structure.

Size: 12–15 µm.

Comments:

Taxonomic status: *P. stellaris* is a junior synonym of *Trochoaster simplex* (see MARTINI & STRADNER, 1960, p. 266).

Family: Nannotetrinaceae AUBRY & STRADNER nov. fam.

Type genus: Nannotetrina ACHUTHAN & STRADNER, 1969, p. 7.

Diagnosis: Nannoliths in the form of a pyramid with a roughly quadrangular or hexagonal base. The sides are formed by four lateral plate-like elements that may be thickened outwardly along their main axis. The inside of the pyramid is divided into four alveolar cavities by four central elements forming an orthogonal cross. The central elements meet with the lateral elements along their main axis, and thus the four central plates alternate with sutures between the lateral elements.

Genus: Nannotetrina nom. nov. subst. pro Nannotetraster sensu restr. ACHUTHAN & STRADNER, 1969, p. 7

Type species: *Nannotetraster fulgens* (STRADNER) ACHUTAN & STRADNER, 1969 (= *Nannotetraster fulgens* STRADNER in MARTINI & STRADNER 1960, p. 268, Text-Figs. 10, 16a, b).

Original description of Nannotetraster fulgens STRADNER in MARTINI & STRADNER, 1960

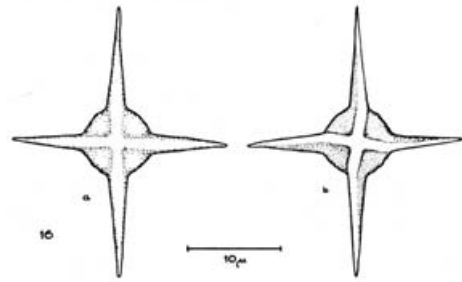
Lectotypus: GBA 2009/058/0020.

Derivatio nominis: *fulgere* (Lat.) = strahlen.

Locus typicus: Aragon, Mexiko.

Stratum typicum: Unter-Eozän.

Diagnose: Ein *Nannotetraster* mit vier langen dünnen spitzen Strahlen, die aufeinander senkrecht stehen.

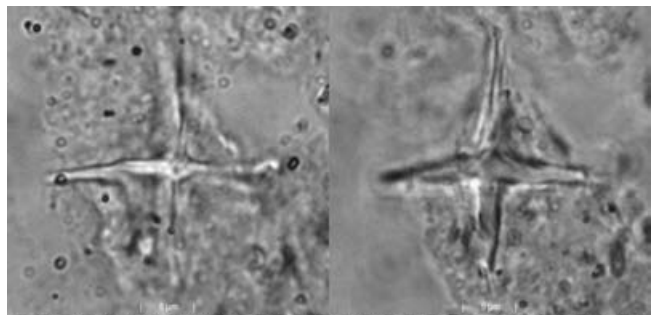


Text-Fig. 45a.
Original drawings of *Nannotetraster fulgens*.

Beschreibung: Das Relief der beiden Flachseiten ist verschieden. Auf der Facies superior, als welche nicht wie bisher die das stärker erhabene Kreuz tragende Seite angesehen werden kann, sondern die bei vielen Nannotetrasterarten mit Unterteilungslinien versehene Flachseite betrachtet werden muss, sind die Strahlen durchlaufend geradkantig. Auf der Facies inferior hingegen sind die erhabenen Kanten der Strahlen in distaler Richtung leicht nach links geknickt.

Größe: 20–30 µm.

Beziehungen: *Nannotetraster fulgens* gehört wegen seiner geknickten Strahlenkanten in die Verwandtschaft von *Nannotetraster swasticoides* (MARTINI) MARTINI & STRADNER, *N. coronatus* MARTINI, *N. insignatus* MARTINI und *N. alatus* MARTINI.



Text-Fig. 45b.
Holotype in normal light at different focus levels.

English translation:

Lectotype: GBA 2009/058/0020.

Derivation of name: *fulgens* (Lat.) = beaming, radiating.

Type locality: Aragon Formation, Mexico.

Level: Lower Eocene.

Diagnosis and description: Asteroliths with four pointed spines exceeding in their length the diameter of the central disc. The reliefs of their flat sides are different: One side is decorated with a straight cross extending out into the spines, while the stronger cross-shaped structure of the other side is twisted in clockwise direction. No suture lines are visible.

Relations: Due to its twisted cross *Nannotetraster fulgens* appears closely related to *N. swasticoides* (MARTINI) STRADNER & MARTINI, to *N. insignatus* MARTINI and *N. alatus* MARTINI.

Size: 20–30 µm.

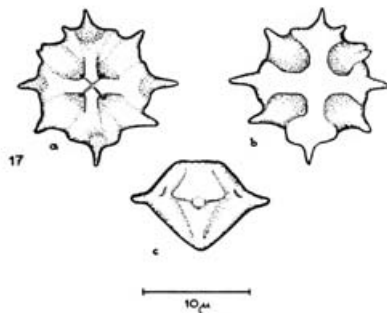
Comments:

Stratigraphic distribution: Middle Eocene (Lutetian). The lowest occurrence of *N. fulgens* defines the base of Zone NP15. Highest occurrence in lower Zone NP16.

Nannotetrina spinosa (STRADNER) BUKRY 1973 (= *Nannotetraster spinosus* STRADNER, 1960 in MARTINI & STRADNER, 1960, p. 269, Text-Figs. 11, 17a–c

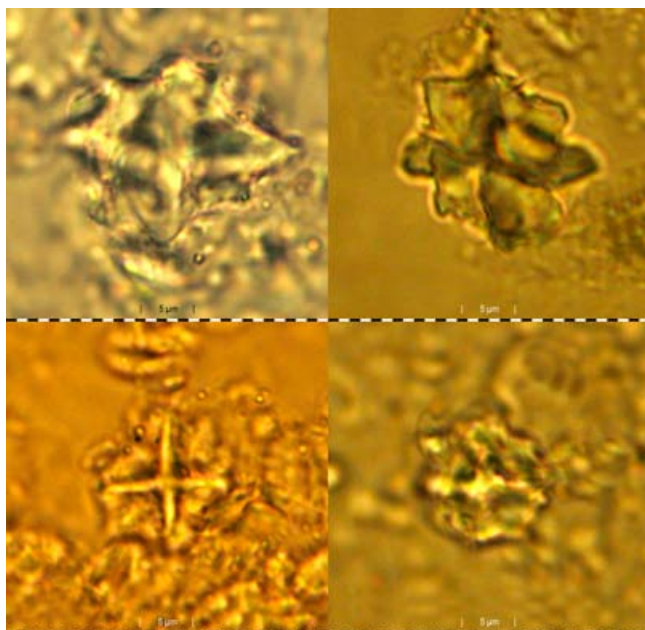
Original description of *Nannotetraster spinosus* STRADNER, 1960 in MARTINI & STRADNER, 1960

Lectotypus: GBA 2009/058/0021.
 Derivation nominis: *spinosus* (Lat.) = dornig.
 Locus typicus: Mattsee Station 37, Salzburg, Österreich.
 Stratum typicum: Mittleres Eozän (Lutetium).
 Weiteres Vorkommen: Kühlgraben, Salzburg (Ypres).
 Diagnose: Ein *Nannotetraster*, dessen vier Strahlen distal stark verbreitert sind und von einem kurzen Dorn überragt werden.



Text-Fig. 46a.
 Original drawings of *Nannotetraster spinosus*.

Beschreibung: Die Facies superior zeigt im Zentrum Unterteilungslinien. Die vier Strahlen sind auf beiden Seiten reliefartig erhoben, auf der Facies superior weniger als auf der Facies inferior. Die Reliefkanten der Facies superior sind nahe der Peripherie gegabelt, doch tragen auch die neben diesen Gabelungen gelegenen Anteile der Sektoren Dornfortsätze.
 Größe: 13–15 µm.



Text-Fig. 46b.
 Syntypes in normal light.

Beziehungen: *Nannotetraster spinosus* scheint mit *Nannotetraster cristatus* (MARTINI) MARTINI & STRADNER nahe verwandt zu sein, da letztere Art auf der Facies superior ebenso symmetrische Gabelungen aufweist.

English translation:

Lectotype: GBA 2009/058/0021.
 Derivation of name: *spinosus* (Lat.) = with spines.
 Type locality: Mattsee Station 37 (ABERER & BRAUMÜLLER, 1958), Salzburg, Austria.
 Level: Middle Eocene (Lutetian).
 Diagnosis and description: Asterolithus consisting of four sectors which on their outline are surmounted by two or more short spines. One side is decorated with a cross-shaped structure distally broadened near the rim. The other side also shows a cross-shaped central structure, which is bifurcated near the rim thus embracing one of the thorns, the main spine of each sector.

Remarks: Closely related to *Nannotetraster cristatus* (MARTINI) MARTINI & STRADNER, which also shows bifurcations.

Size: 13–15 µm.

Comments:

Stratigraphic distribution: Middle Eocene (Lutetian). Subzone NP14b–NP15.

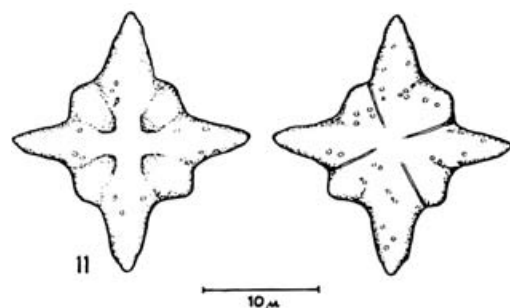
Nannotetrina austriaca (STRADNER) AUBRY, 1988 (= *Trochoaster austriacus* STRADNER, 1959a, p. 8, Text-Fig. 11).

Original description of *Trochoaster austriacus* STRADNER, 1959a

Lectotype: GBA 2009/058/0007.
 Derivatio nominis: *austriacus* (Lat.) = Austrian.
 Type locality: Nußdorf at Haunsberg (Holzmannberg).
 Level: Middle Eocene (Lutetian).

Diagnosis and description: Asteroliths consisting of 4 rays which are almost twice as long as the radius of the basal plate. In this new formspecies the basal plate seems to be derived from parts of the rays, as can be concluded from the course of the suture-lines. On one face the rays are united in the center to a slender, low relief cross, on the other side the suture-lines can be seen dividing the asterolith into four similar rays of irregular symmetry.

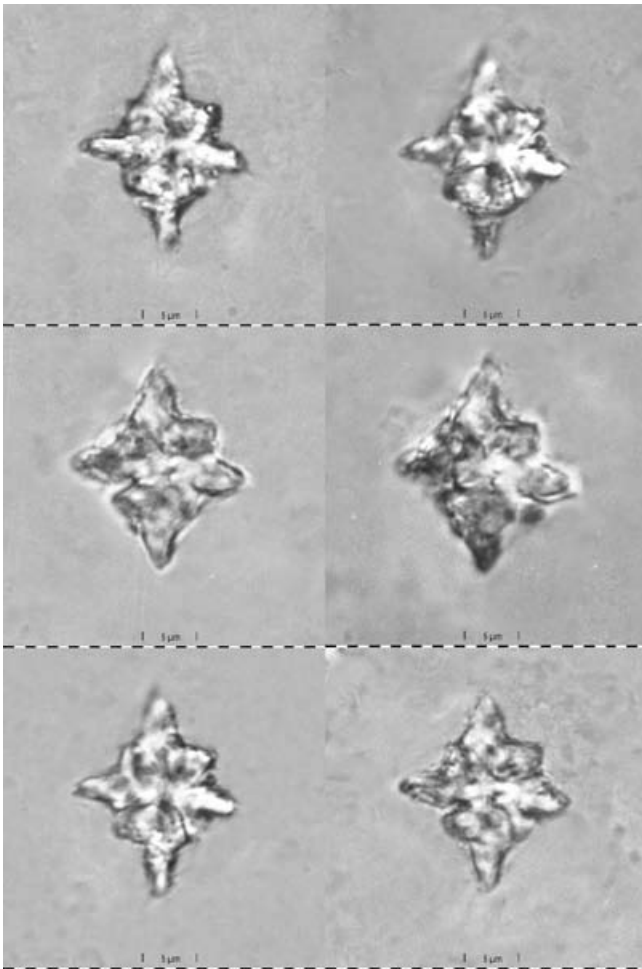
Size: 15–20 µm.



Text-Fig. 47a.
 Original drawings of *Trochoaster austriacus*.

Comments:

Stratigraphic distribution: Middle Eocene (Lutetian); Zone NP15a to lower NP16.



Text-Fig. 47b.
Lectotype of *Trochoaster austriacus* in normal light at different focus levels.

Nannotetrina mexicana (STRADNER) BUKRY, 1973b (= *Trochoaster mexicanus* STRADNER, 1959b, p. 480, Text-Fig. 55)

**Original description of *Trochoaster mexicanus*
STRADNER, 1959b**

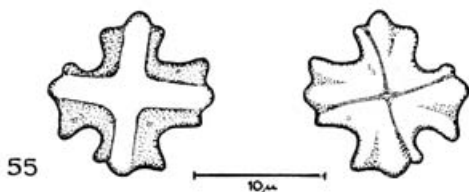
Lectotypus: GBA 2009/058/0013.

Derivatio nominis: *Mexicanus* = aus Mexiko stammend.

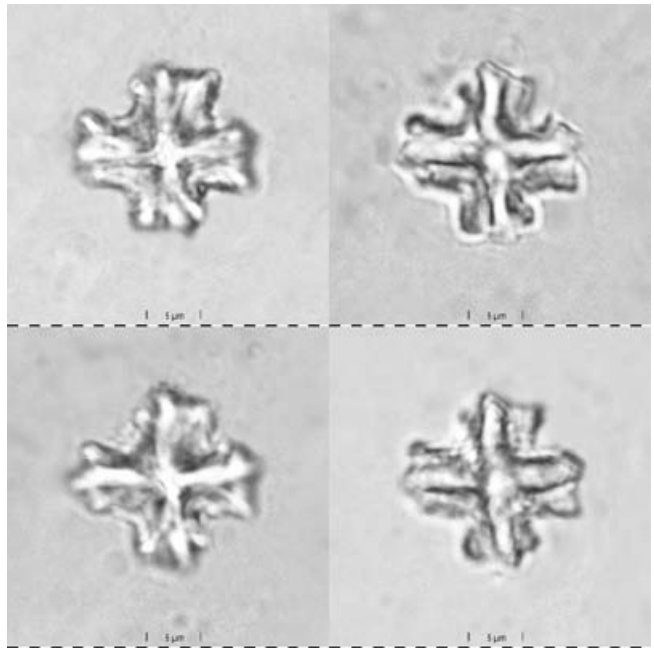
Locus typicus: Aragon, Mexiko; selten.

Stratum typicum: Unteres Eozän.

Beschreibung: Asterolithen bestehend aus vier Asteroradien, von denen jeder in drei verschieden große Höcker ausläuft. Wie von der Facies inferior her betrachtet zu erkennen ist, sind die beiden vom Mittelpunkt am weitesten entfernten Strahlenenden eng miteinander verwachsen und nur durch eine schwache Furche getrennt. Der drit-



Text-Fig. 48a.
Original drawings of *Trochoaster mexicanus*.



Text-Fig. 48b.
Holotype in normal light at different focus levels.

te und kleinste Strahlenanteil ist von den beiden größeren durch eine weite Bucht getrennt und als kleiner Höcker dem ihm anliegenden nächsten Asteroradius angeschlossen. Die Facies superior trägt ein reliefartig erhöhtes Balkenkreuz, die Facies inferior hat deutliche Unterteilungslinien.

Größe: 10–12 µm.

English translation:

Derivation of name: occurring in Mexico.

Lectotype: GBA 2009/058/0013.

Type locality: Aragon Formation.

Level: Lower Eocene. Rare.

Diagnosis and description: Asteroliths of four-rotate symmetry, consisting of four asymmetrical parts separated by slightly curved suture lines. These are visible only on one side, while the other side is decorated by a heavy cross-shaped structure. The four sectors show a wavy outline with three bigger knobs on the left separated by a bay from a small knob on the right (viewed from the side with the sutures).

Size: 10–12 µm.

Comments:

Stratigraphic distribution: Middle Eocene (Lutetian); Zone NP15a to lower NP16.

Nannotetrina pappi (STRADNER) PERCH-NIELSEN, 1971 (= *Trochoaster pappi* STRADNER, 1959b, p. 480, Text-Fig. 54)

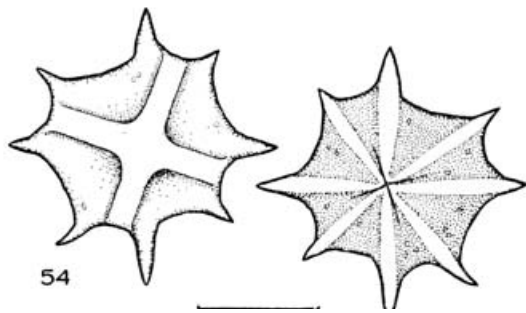
**Original description of *Trochoaster pappi*
STRADNER, 1959b**

Lectotypus: GBA 2009/058/0010/2.

Derivatio nominis: Herrn Univ. Prof. Dr. A. PAPP in Dankbarkeit gewidmet.

Locus typicus: Aragon, Mexiko.

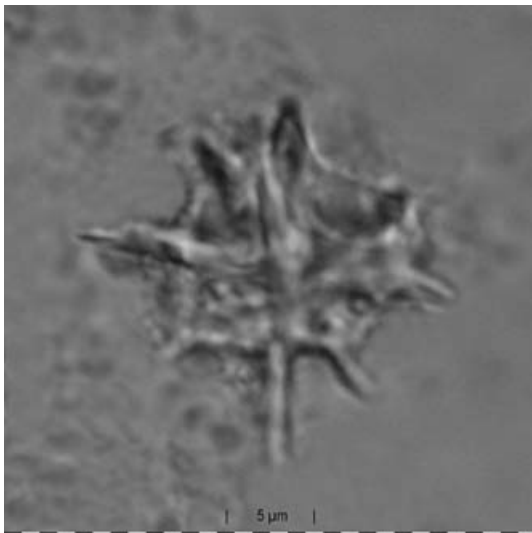
Stratum typicum: Unter-Eozän.



Text-Fig. 49a.
Original drawings of *Trochoaster pappii*.

Beschreibung: Asterolithen mit gebuchtetem Unterbau, der von acht spitzen Strahlenfortsätzen überragt wird. Die Balken des Reliefkreuzes der Facies superior enden in den Buchten des Unterbaues. Die Facies inferior ist durch acht strahlenförmig angeordnete Rippen verziert. Die Unterteilungslinien lassen erkennen, dass zu jedem Asteroradius ein kräftiger langer und ein etwas kürzerer Dornfortsatz gehören, die mit den entsprechenden Fortsätzen des anliegenden Asteroradius Winkel von 90° einschließen.

Größe: 20–22 μm .



Text-Fig. 49b.
Holotype in normal light.

English translation:

Lectotype: GBA 2009/058/0010/2.

Derivation of name: Thankfully dedicated to Univ. Prof. Dr. A. PAPP, Vienna.

Type locality: Aragon Formation, Mexico.

Level: Lower Eocene.

Diagnosis and description: Asteroliths of four-rayed symmetry, each of the four sectors being extended into two pointed spines that unite at the centre. One side is decorated by a broad cross-shaped structure, while on the other side short suture lines are visible near the centre.

Size: 20–22 μm .

Comments:

Stratigraphic distribution: Middle Eocene (Lutetian); Zone NP15.

Family: Rhomboasteraceae AUBRY (in press)

Genus: *Imperiaster* MARTINI, 1970

Type species: *Imperiaster obscurus* (MARTINI) MARTINI, 1970 (= *Discoaster obscurus* MARTINI, 1958, p. 358, Pl. 1, Figs. 4a-c).

Syn: *Marthasterites reginus* STRADNER, 1962, p. 372, Pl. 3, Figs. 8–10.

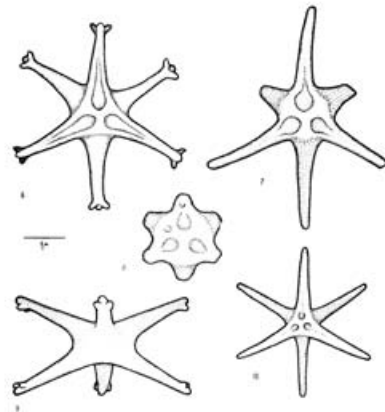
Original description of *Marthasterites reginus* STRADNER, 1962

Holotypus: GBA 2009/058/0044.

Derivatio nominis: *reginus* (Lat.) = königlich.

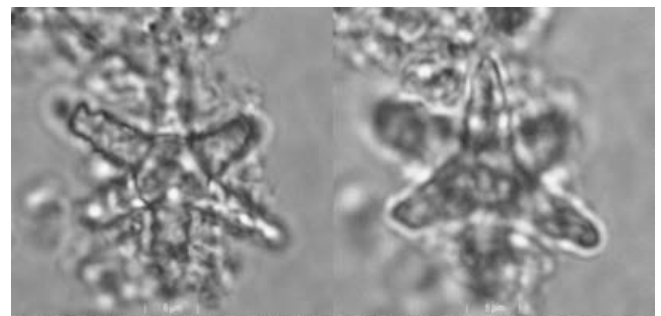
Locus typicus: Argiles d'Ypres, Steinbruch der Gebr. De Simpele in Kortemark, Belgien.

Stratum typicum: Unteres Ypresian.



Text-Fig. 50a.
Original drawings of *Marthasterites reginus*.

Diagnose und Beschreibung: Kalkkörperchen aus einem ortholithisch aufgebauten Stück bestehend aus sechs sich verjüngenden, distal mit je zwei lateral abstehenden Fortsätzen versehenen, leicht gekrümmten Armen, ohne Nahtlinien. Je drei Arme schließen bei Flachansicht Winkel von 120° ein und sind zu den alternierend angeordneten Armen, welche in einer anderen Ebene liegen, um 60° verschoben. Durch Heben und Senken des Objektivs ist an flachliegenden Exemplaren zu erkennen, dass je drei Arme zum bzw. vom Beschauer weggerichtet sind und dass die Mitte des Kalkkörperchens beiderseits konkav ist. Das Mittelfeld ist durch drei in der Mitte vereinte Rippen und dazwischenliegende Furchen, welche in Richtung der Arme liegen, verziert. Die von den Enden der Arme schräg lateral abstehenden Fortsätze sind gegen die alternierend



Text-Fig. 50b.
Holotype in normal light at different focus levels.

angeordneten Arme gerichtet. Die nicht an allen Exemplaren erkennbare sehr schwache Krümmung der Arme lässt die Zusammengehörigkeit von je zwei Armen, ähnlich wie bei *Marthasterites contortus* (STRADNER) DEFLANDRE, erkennen. Nicht selten.

Größe: Durchmesser 18–28 µm, Höhe 8–13 µm.

English translation:

Holotype: GBA 2009/058/0044.

Derivation of name: *reginus* (Lat.) = royal.

Type locality: Argiles d'Ypres, quarry of Gebr. De Simpele, Kortemark, Belgium.

Level: Lower Ypresian.

Diagnosis and description: Ortholithical calcareous bodies in their overall design resembling *Marthasterites bramlettei*, however showing long tapering and slightly curved rays, which in well preserved specimens show small bifurcations near the ends of the rays. The triangular flat sides are concave with three ribs uniting in the centre. The dimples between these ribs are elongated into grooves in distal direction. Related to *M. bramlettei* and *M. contortus* as well. Not rare.

Size: Diameter 18–28 µm, height 8–13 µm.

Comments:

Stratigraphic distribution: Lower Eocene (Ypresian). Short stratigraphic range in Zone NP11.

Genus: *Rhombaster* BRAMLETTE & SULLIVAN, 1961

Rhombaster spineus (SHAFIK & STRADNER) PERCH-NIELSEN, 1984 (= *Marthasterites spineus* SHAFIK & STRADNER, 1971, p. 93, Text-Figs. 6, 7a–d)

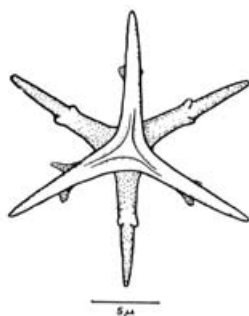
Original description of *Marthasterites spineus* SHAFIK & STRADNER, 1971

Holotype: GBA 2009/058/0067.

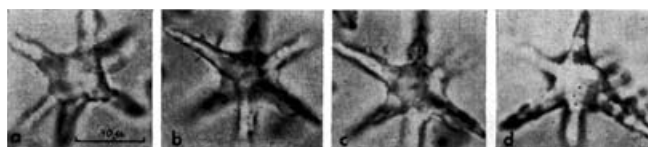
Derivatio nominis: *spineus* (Lat.) = with spines.

Type locality: Ash El-Mellaha range, Western Red Sea Coast, Egypt (Esna shale).

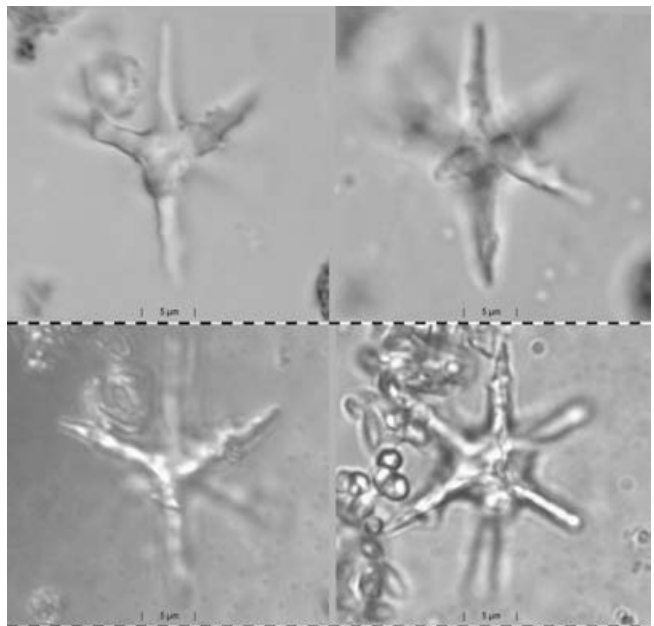
Level: Paleocene.



Text-Fig. 51a.
Original drawings of *Marthasterites spineus*.



Text-Fig. 51b.
Original photographs of the holotype.



Text-Fig. 51c.
Holotype in normal light at different focus levels.

Diagnosis: An ortholithical nannofossil consisting of a pair of triradiate stars, which are united at their centre and shifted by 60° to give the appearance of a regular sixradiate star with arms alternating at different focus. The arms wear spines directed towards each other at about the middle of their free length.

Comments: A species of *Marthasterites*, which in its general appearance is similar to *M. reginus*, from which it differs however by the following features:

- a) The spine-like bifurcation of the six free arms is not at their ends, but at about half of their free length and not very regular. There is mostly only one spine, sometimes there are two.
- b) the curving of the arms is very slight, the coiling is reversed as compared to *M. reginus*.
- c) the ornamentation of the central field consists of three ridges, which are uniting at the centre enclosing angles of 120°. These ridges are in the same direction as the arms and not shifted 60° as in *M. reginus*.

Size: 30–40 µm.

Comments:

Stratigraphic distribution: Upper Paleocene (Thanetian); Zone NP9b.

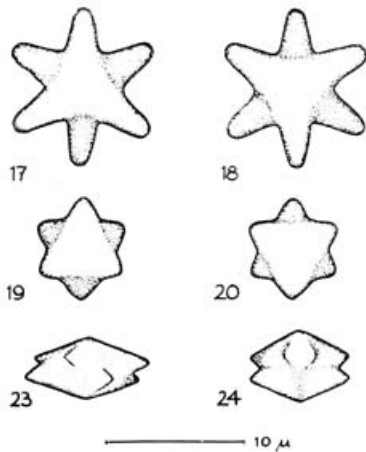
Genus: *Tibrachiatus* SHAMRAI, 1963

Tibrachiatus bramlettei (BRÖNNIMANN & STRADNER) PROTO DECIMA, ROTH & TODESCO, 1975 (= *Marthasterites bramlettei* BRÖNNIMANN & STRADNER, 1960, p. 366, Text-Figs. 17–20, 23, 24; = *Marthasterites riedeli* BRÖNNIMANN & STRADNER, 1960, p. 366, Pl. 1, Figs. 21, 22)

Original description of *Marthasterites bramlettei* BRÖNNIMANN & STRADNER, 1960

Lectotypus: GBA 2009/058/0018/1.

Derivatio nominis: Zu Ehren von Herrn Prof. M.N. BRAMLETTE, La Jolla, Kalifornien, der diese Art als erster fand (Briefliche Mitteilung vom 12. November 1958).



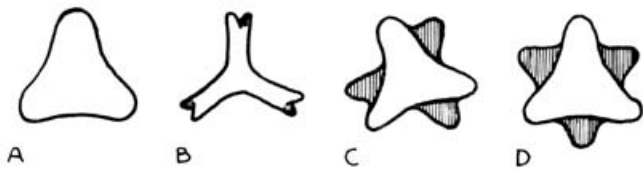
Text-Fig. 52a.
Original drawings of *Marthasterites bramlettei*.

Locus typicus: Alkazar-Formation, BR-Stat. 538, Kuba.

Stratum typicum: Unter-Eozän (*Tr. velascoensis*-Zone).

Diagnose und Beschreibung: Ein Kalkkörperchen von regelmäßigem sechsstrahligem Umriss ohne Unterteilungslinien, von dem je drei Armenden wie die Zacken eines Zionsternes miteinander verbunden sind. Von einer Flachseite her betrachtet erscheinen die drei dem Beschauer näher liegenden verbundenen Strahlen als gleichseitiges Dreieck, unter welchem beim Senken des Objektivs die anderen drei Strahlen als ein um 60° gedrehtes ebenso großes Dreieck erscheinen.

Größe: 8–13 µm.

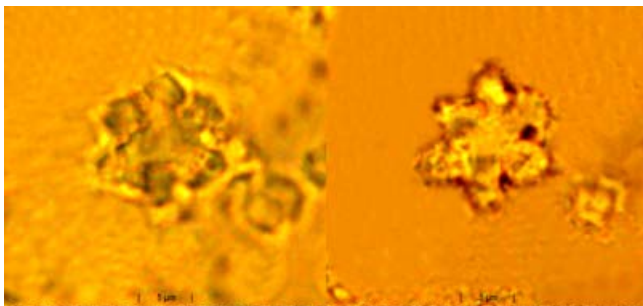


Text-Fig. 52b.
Schematic drawings showing the different orientation of the rays of *Marthasterites tribrachiatus robustus* (A), *Marthasterites tribrachitus tribrachiatus* (B), *Marthasterites contortus* (C) and *Marthasterites bramlettei* (D).

Beziehungen: *Marthasterites bramlettei* stellt offenbar das Endglied in den Phasen der Aufspaltung der Arme innerhalb der Gattung *Marthasterites* dar. *Marthasterites contortus* STRADNER ist als die unmittelbar davorstehende Phase anzusehen.

English translation:

Lectotype: GBA 2009/058/0018/1.



Text-Fig. 52c.
Syntypes in normal light at different focus levels.

Derivation of name: In honour of Prof. M.N. BRAMLETTE, La Jolla, California, who has seen this species for the first time (his letter of Nov. 12th, 1958).

Type locality: Alkazar Fm, BR-Stat. 538, Cuba.

Level: Lower Eocene (*Tr. velascoensis* Zone).

Diagnosis and description: Calcareous body with star-shaped six-rayed outline, partition lines missing. In plan view this fossil appears composed of two equilateral triangular parts that are offset from each other in an angle of 60 degrees, thus resembling a Zionistic star emblem. By shifting the focus of the microscope objective the different levels of both triangles can be understood best.

Size: 8–13 µm.

Relations: Whether the different degrees of splitting represent an evolutionary line from *Marthasterites tribrachiatus robustus* via *M. tribrachiatus tribrachiatus* to *M. contortus* and finally to *M. bramlettei* or vice versa has to be clarified.

Comments:

Taxonomic status: The concept of *Tribrachiatus bramlettei* is based on overgrown material. This has led to widespread confusion with the closely related species of *Rhombaster*. We agree with Romein's interpretation (1979) of the morphological and structural differences between the nannoliths in the two genera.

Stratigraphic distribution: The lowest occurrence of *T. bramlettei* defines the base of Zone NP10. Highest occurrence in lowermost Subzone NP10d (Aubry, 1996).

Synonym: *Marthasterites riedelii* BRÖNNIMANN & STRADNER, 1960, p. 366, Pl. 1, Figs. 21, 22, is most likely a synonym of *T. bramlettei*.

Original description of *Marthasterites riedelii* BRÖNNIMANN & STRADNER, 1960

Lectotypus: GBA 2009/058/0018/2.

Derivatio nominis: Zu Ehren von Herrn Geologen W.R. RIEDEL, La Jolla, Kalifornien.

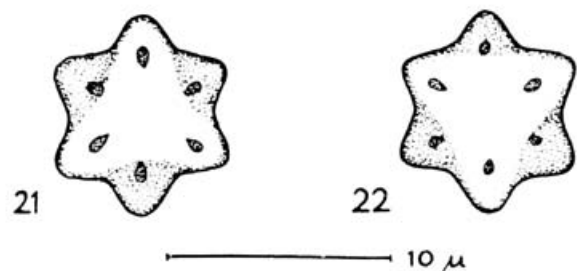
Locus typicus: Alkazar-Formation, BR-Stat. 538. Kuba.

Stratum typicum: Unter-Eozän (*Tr. velascoensis* Zone).

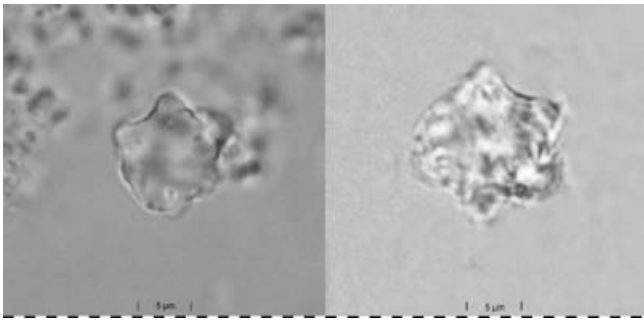
Diagnose und Beschreibung: Ein Kalkkörperchen mit demselben räumlichen Aufbau wie die vorhergegangene Art *Marthasterites bramlettei*, von der es sich durch den Besitz von je sechs länglichen Poren unterscheidet.

Größe: 10 µm.

Beziehungen: Eine zunächst mit *Marthasterites bramlettei* und im weiteren Sinne mit *Marthasterites contortus* (STRADNER) DEFLANDRE und *Marthasterites tribrachiatus* (BRAMLETTE & RIEDEL) DEFLANDRE verwandte Art.



Text-Fig. 53a.
Original drawings of *Marthasterites riedelii*.



Text-Fig. 53b.
Holotype in normal light at different focus levels.

English Translation:

Lectotype: GBA 2009/058/0018/2 (BR/535/1J).

Derivation of name: In honour of W.R. RIEDEL, geologist, La Jolla, California.

Type locality: Alkazar Formation, BR-Sta. 538, Cuba.

Level: Lower Eocene (*Tr. velascoensis* Zone).

Diagnosis and description: Calcareous bodies of identical geometrical structure as *Marthasterites bramlettei* n. sp., from which it differs by the presence of 6 elongate pores on each of its flat sides. Related to *M. bramlettei*, *M. contortus* and *M. tribrachiatus*.

Comments:

Taxonomic status: *M. riedelii* is likely based on a strongly overgrown specimen of *T. bramlettei*.

Tribrachiatus contortus (STRADNER) BUKRY, 1972 (= *Discoaster contortus* STRADNER 1959a, p. 187, Text-Figs. 35, 36)

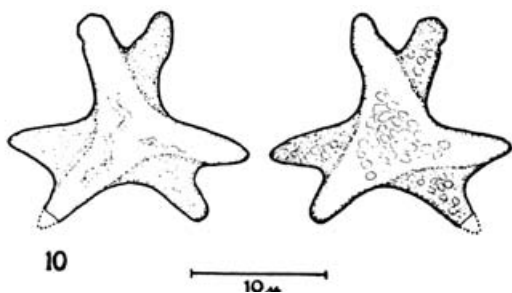
Original description of *Discoaster contortus* STRADNER, 1959a

Lectotype: GBA 2009/058/0002.

Derivation of name: *contortus* (Lat.) = twisted.

Type locality: Göllersdorf.

Level: Miocene.



Text-Fig. 54a.
Original drawings of *Discoaster contortus*.

Description: Asteroliths consisting of six arms of which three on each side are connected in a similar way as those of *Discoaster tribrachiatus*. The angle of contortion between the pair of ray-groups is about 40°, so that the rays are on either face of the asterolith alternatively high and low, the angles between them alternatively 40° and 80°. No sutures, generally no central knob (Helvetium). Possibly reworked from the Cretaceous where similar forms were found.



Text-Fig. 54b.
Holotype in normal light.

Comments:

Taxonomic status: the lectotype of *T. contortus* was first illustrated by AUBRY (1996, Pl. 2, Figs. 1–6) to emphasize the differences between this taxon and *Tribrachiatus digitalis* AUBRY 1996, p. 245, 246, 249, Pl. 1, Figs. 1–12, Pl. 2, Figs. 11, 12.

Biostratigraphic range: Lowest occurrence defines the base of Subzone NP10d (Aubry, 1996). Highest occurrence defines the top of Zone NP10 (MARTINI, 1971).

Tribrachiatus robustus (STRADNER) AUBRY & STRADNER n. c. (= *Discoaster tribrachiatus* subcent. *robustus* STRADNER, 1959, p. 477, Text-Figs. 4, 9; = *Marthasterites robustus* STRADNER in STRADNER & PAPP, 1961, p. 109, Pl. 34, Figs. 7a, b, 8; Text-Figs. 11[4], 20[1]).

Original description of *Discoaster tribrachiatus* subcent. *robustus* STRADNER, 1959b

Holotypus: nicht festgelegt.

Locus typicus: Kühlgraben am Untersberg (Salzburg, Österreich).

Stratum typicum: Paläozän.

Beschreibung: Die dreiarmigen schlanken Asterolithen dieser Formart sind in Bezug zur Hauptebene gewölbt. Die Enden der Arme können einfach oder gegabelt sein. Bei den stark gegabelten Formen ist die zu *Discoaster contortus* analoge Orientierung der Enden auffallend. *Discoaster lodonensis* MARTINI und *Discoaster bramlettei* MARTINI, welche *Discoaster tribrachiatus* recht ähnlich sind, konnten bis jetzt in Österreich noch nicht nachgewiesen werden. Die ältesten Formen aus dem Dan II sind sehr robust und haben im Gegensatz zu den später vorkommenden Asterolithen im Querschnitt ovale Arme. Man könnte diese Formen auch *Discoaster tribrachiatus robustus* nov. subcent. bezeichnen.

English translation:

Holotype: not designated.

Type locality: Kühlgraben am Untersberg (Salzburg, Österreich).

Level: Paläozän.

Description: This is the oldest form of *Discoaster tribrachiatus*, which is very robust and has arms that are ovoid in cross section.

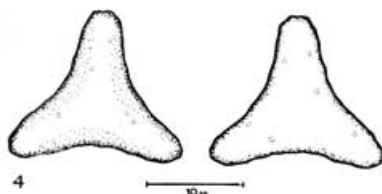
Original description of *Marthasterites robustus* (STRADNER) STRADNER in STRADNER & PAPP, 1961

Lectotype: GBA 2009/058/0005/2.

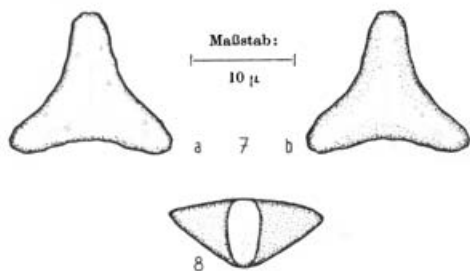
Derivatio nominis: *robustus* (Lat.) = robust.

Locus typicus: Kühlgraben am Untersberg (Salzburg, Österreich).

Stratum typicum: Paläozän.



Text-Fig. 55a.
Original drawings of *Marthasterites robustus*.



Text-Fig. 55b.
Original drawings of *Marthasterites robustus*.

Diagnose und Beschreibung: Dreieckige oder Y-förmige Kalkkörperchen, deren Arme im Querschnitt sehr hoch und elliptisch sind und Winkel von je 120° einschließen. Die Enden der Arme sind entweder abgerundet oder leicht gekerbt. In der Seitenansicht erscheint das Kalkkörperchen im Gegensatz zu *Marthasterites tribrachiatus* (BRAMLETTE & RIEDEL) DEFLANDRE immer dreieckig und nie konkav-konvex gewölbt.

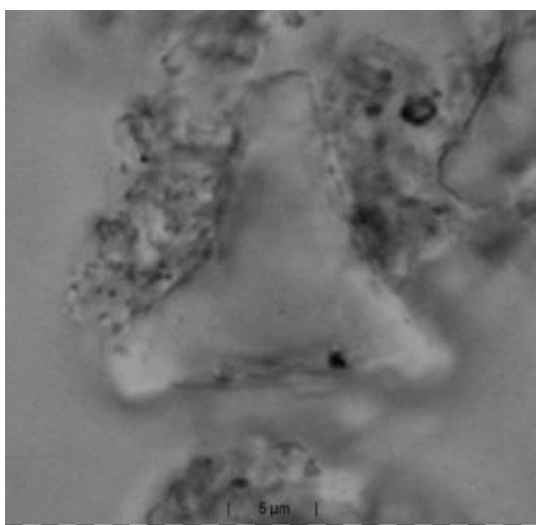
Durchmesser: 6–16 µm.

Beziehungen: *Marthasterites robustus* scheint der direkte Vorläufer des nach HAY & SCHAUB erst im oberen Ilerdien einsetzenden *Marthasterites tribrachiatus* zu sein.

English translation:

Lectotype: GBA 2009/058/0005/2.

Derivation of name: *robustus* (Lat.) = robust.



Text-Fig. 55c.
Lectotype in normal light.

Type locality: Kühlgraben, Untersberg, Salzburg.

Level: Paleocene.

Calcareous bodies of triangular or Y-shaped outline, without suture lines. In side view the arms appear elliptical in cross section. Contrary to *Marthasterites tribrachiatus* (BRAMLETTE & RIEDEL) DEFLANDRE the arms are neither curved nor split.

Size: 6–16 µm.

Comments:

Taxonomic status: the taxon *robustus* is recombined to *Tribrachiatus* to correct unsatisfactory generic assignments to *Discoaster* and *Marthasterites*. It is not clear however whether *T. robustus* is a discrete species or part of the morphologic variability of *T. orthostylus*.

Stratigraphic range: Originally reported as a Paleocene taxon.

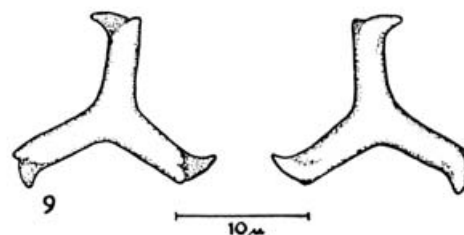
Tribrachiatus rotans (STRADNER) AUBRY & STRADNER n. c. (= *Discoaster rotans* STRADNER, 1959a, p. 4, Text-Fig. 9)

Original description of *Discoaster rotans* STRADNER, 1959a

Lectotype: GBA 2009/058/0004/2.

Derivation of name: *rotans* (Lat.) = turning.

Type locality: Mattsee Station 133.



Text-Fig. 56a.
Original drawings of *Discoaster rotans*.

Level: Middle Paleocene (Thanetian).

Description: Asteroliths of similar shape as those of *Discoaster tribrachiatus* from which they differ in the bifurcation of their arms. One of the two endings of an arm is a short stub, whereas the other is a sturdy curved spine, the terminal notch being shallow and oblique. Seen from the convex side of the asterolith all three spines point counter-clockwise, thus giving the asterolith somewhat a resemblance to a germanic sun-rune.

Comments:

Taxonomic status: the taxon *rotans* is recombined to *Tribrachiatus* to correct unsatisfactory generic assignments to



Text-Fig. 56b and c.
Holotype in normal light at different focus levels..

Discoaster and to *Marthasterites* (by DEFLANDRE, 1959, p. 139). It is not clear however whether *T. rotans* is a discrete species or part of the morphologic variability of *T. orthostylus*.
Stratigraphic range: Originally reported as a Paleocene taxon.

Family: Triquetrorhabdulaceae LIPPS, 1969

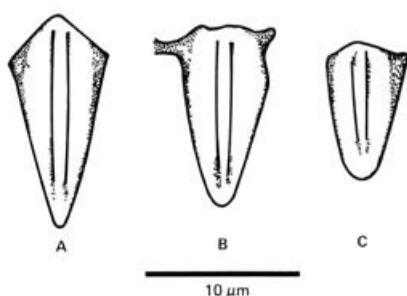
Genus: *Triquetrorhabdulus* LIPPS, 1969

Triquetrorhabdulus auritus STRADNER & ALLRAM, 1981, p. 595, Pl. 7, Figs. 1–8

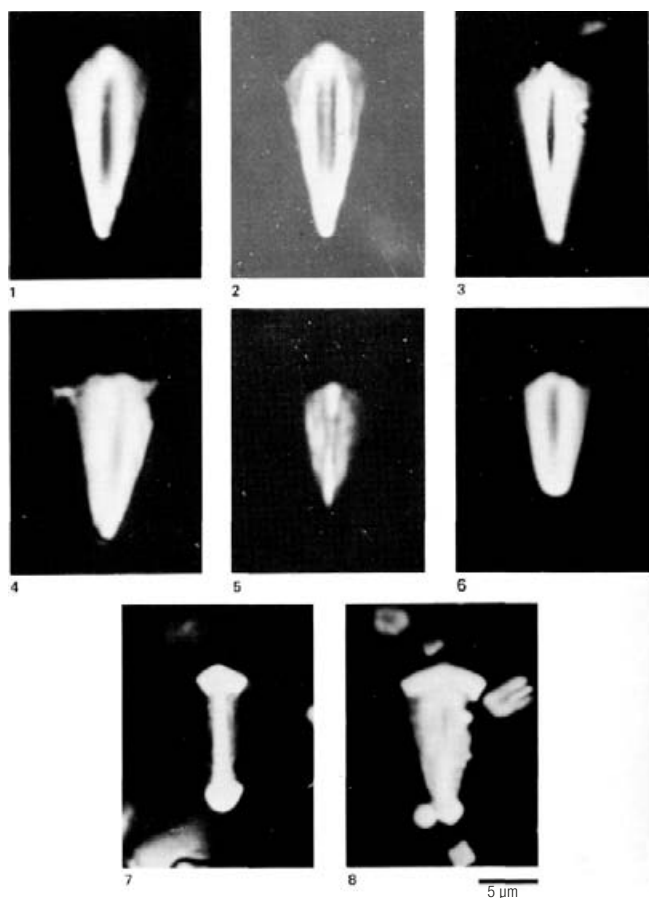
Original description of *Triquetrorhabdulus auritus* STRADNER & ALLRAM, 1981

Holotype: GBA 2009/058/0071.

Derivation of name: *auritus* (Lat.) = with ears.



Text-Fig. 57a.
Original drawings of *Triquetrorhabdulus auritus*.



Text-Fig. 57b.
Original photographs of syntypes.

Type locality: DSDP Sample 489A-12.CC, Middle America Trench off Southern Mexico.

Level: Lower Miocene, *Discoaster druggii* nannoplankton Zone NN2.

Diagnosis: Calcareous bodies consisting of three elongate triangular flat blades that are united with their hypotenuse at angles of 120°, thus forming wedge-shaped bodies of deltoid outline in side view. At their greatest width these bodies are extended, in some specimens, into “ears”.

Remarks: *Triquetrorhabdulus auritus* is distinguished from *T. carinatus* by its shorter, more deltoid outline; from *T. milowii* by its projecting ridges or spineous extensions at the wide area of the blades. For *T. milowii* no such angular ridges or extensions have been described. While the lateral view of *T. milowii* shows a more or less rounded outline, *T. auritus* has a more wedge-shaped outline with straight edges.

Size (Holotype): Length 14 µm, width 6 µm.

Comments:

Stratigraphic distribution: Lower Miocene (Aquitanian–Burdigalian); Zone NN1–NN2.

Family: Lapideacassaceae BOWN & YOUNG, 1997

Genus: *Scampanella* FORCHHEIMER & STRADNER, 1973, p. 286 emended PERCH-NIELSEN & FRANZ, 1977, p. 852

Type species: *Scampanella cornuta* FORCHHEIMER & STRADNER, 1973, p. 285, Pl.1, Figs.1-5, 7 and 8

Original description of *Scampanella* FORCHHEIMER & STRADNER, 1973

Derivatio nominis: *S* = Abkürzung für Schweden, *campanella* (Lat.) = Glöckchen.

Diagnose: Zylindrische, hohe Coccolithen, die aus zirka acht länglichen, parallelen Platten aufgebaut sind, von denen zwei gegenüberliegende Platten distal in zwei divergierende Stacheln verlängert erscheinen. Nahe dem distalen Ende dieser Platten befindet sich ein Kranz von Poren oder Kerben, je eine pro Platte.

Anmerkung: Diese neue Gattung kann als ein Vorläufer des obereozänen Coccolithen *Naninfula deflandrei* PERCH-NIELSEN, welcher ein Holococcolith ist, angesehen werden. Die Ultrastruktur von *Scampanella cornuta* gibt Hinweise darauf, dass es sich auch hier eher um Holococcolithen als um Heterococcolithen handeln dürfte.

English translation:

Derivation of name: *S* = abbr. for Sweden, *campanella* (Lat.) = bell.

Diagnosis: Cylindrical hollow coccoliths, consisting of about eight elongate parallel plates, two of which extending into diverging spines. Near the extensions of the rounded distal end there is a cycle of pores or notches, one to each plate.

Remarks: This new genus might be considered a forerunner of the Upper Eocene nanofossil *Naninfula deflandrei* Perch-Nielsen, which is a holococcolith. The ultrastructure of *Scampanella cornuta* indicates that it could be a holococcolith rather than a heterococcolith.

**Original description of *Scampanella cornuta*
FORCHHEIMER & STRADNER, 1973**

Derivatio nominis: *cornu* (Lat.) = Horn.

Holotypus: Das in den Figuren 1 bis 5, 7 und 8 dargestellte Exemplar (Katalognummer S Kp 359/59 a).

Locus typicus: Tiefbohrung Köpingsberg 1, bei 986,35 m, Schweden.

Stratum typicum: Hauterive (nach Pollenanalysen eingestuft).

Paratypus: Das in den Figuren 6 und 9 dargestellte Exemplar (Katalognummer GBA Elmilab 2968).

Fundort des Paratypus: Klafferbrunn, Niederösterreich

Alter: Coniacium.

Diagnose: Siehe Gattungsdiagnose.

Beschreibung: Das proximale, offene Ende zeigt kreisförmige Rillen, welche möglicherweise andeuten, dass der zylindrische Körper in eine Basalplatte eingesetzt gewesen ist. Die distale Seite mit den zwei Hörnern ist gerundet, die beiden Hörner scheinen Verlängerungen von je einem oder mehreren separaten Apikalelementen zu sein. Aus der Lage der Suturen ist ersichtlich, dass es sich nicht um direkte Verlängerungen der Längsplatten handelt. Die Hörner sind in distaler Richtung von einer Längsfurche

durchzogen. Im Elektronenmikrogramm (Fig. 9) sind zwei bevorzugte Richtungen in der Orientierung der Mikrokristalle zu erkennen, ähnlich wie bei Holococcolithen z. B. *Zygrhablithus bijugatus* DEFLANDRE (siehe STRADNER & EDWARDS, 1968, Pl. 42).

Größe:

	Holotypus	Paratypus
Gesamthöhe	10,0 µm	9,0 µm
Höhe ohne Hörner	7,6 µm	7,3 µm
Durchmesser	4,5 µm	5,0 µm
Länge der Hörner	3,0 µm	2,7 µm

English translation:

Holotype: The specimen shown in the Figs. 1–5, 7 and 8 (catalogue no. GBA Elmilab S Kp 359/59 a).

Paratype: The specimen shown in the Figs. 6 and 9 (catalogue no. GBA Elmilab 2968).

Derivation of name: *cornu* (Lat.) = horn.

Type locality: Köpingsberg Borehole No. 1, at 986.35 m, Sweden.

Level: Hauterivian (according to pollen analyses).

Paratype locality: Klafferbrunn, Lower Austria, station 947 of R. GRILL.

Level: Coniacian (according to foraminifera determined by W. FUCHS).

Diagnosis: The same as the generic diagnosis.

Description: The proximal open end shows circular grooves, which might indicate that the cylindrical body was inserted in a basal plate. The distal side with the two horns is rounded, the horns appear to be extensions of one or more separate apical elements each. As shown by the position of the sutures they are not extensions of the longitudinal plates. Each horn has a longitudinal groove, which is open in distal direction. In the transmission electronmicrograph two preferred directions are evident in the orientation of the microcrystals, similar to holococcoliths such as *Zygrhablithus bijugatus* DEFLANDRE (see STRADNER & EDWARDS, 1968, Pl. 42).

Size:

	Holotype	Paratype
Total height	10,0 µm	9,0 µm
Height without horns	7,6 µm	7,3 µm
Diameter	4,5 µm	5,0 µm
Length of horns	3,0 µm	2,7 µm

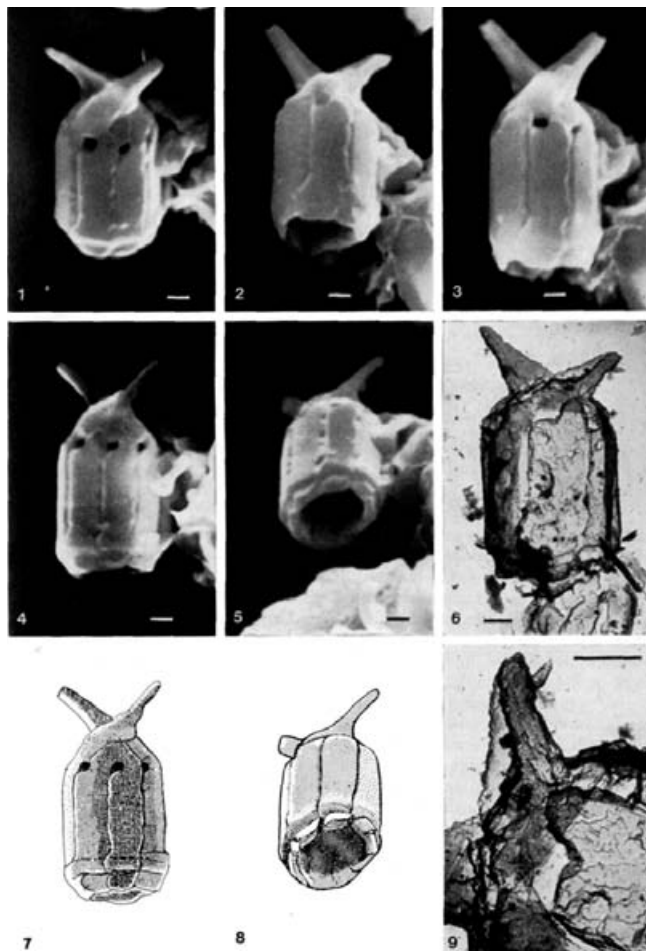
Genus: *Favolithora* STRADNER, 1961

Type species: *Favolithora cyclopa* STRADNER, 1961, p. 87, Text-Figs. 72, 73.

Original description of *Favolithora* STRADNER, 1961

Derivatio nominis: *favus* (Lat.) = Honigwabe, *lithos* (gr.) = Stein, *thora* = die ersten beiden Silben des Gattungsnamen *Thoracosphaera*.

Hohle Kalkgehäuse, deren Wände aus prismatischen Bausteinen aufgebaut sind. Die Größe der in Reihen angeordneten, im Umriss meist sechseckigen Einzelsteine beträgt



Text-Fig. 58. Original photographs of the holotype and paratype of *Scampanella cornuta*. Holotype, oblique distal view (1), oblique proximal view (2), lateral view (3), lateral view after slight axial rotation (4), oblique view of proximal opening (5), schematic drawings of 4 and 5 (7, 8). Paratype, lateral view (6), close up of the distal part of the paratype showing ultrastructure of the horn (9). Scale bars: 1µm.

4–6 µm. Im polarisierten Lichte verhalten sie sich ähnlich wie die Porolithen von *Thoracosphaera heimi* Kamptner.

English translation:

Derivation of name: combination of *favus* (Lat.) = honeycomb, *lithos* (Gr.) = stone.

Calcareous shells the walls of which are composed of prismatic blocks. The size of these usually hexagonal blocks is 4–6 µm. Under crossed nicols they show similarity to the poroliths of *Thoracosphaera heimi*.

Comments:

Favolithora is an isolated fragmentary calcareous fossil of indeterminate origin, possibly a fragment of a dinocyst.

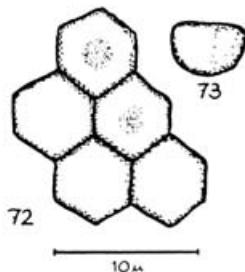
Original description of *Favolithora cyclopia* STRADNER, 1961

Holotypus: GBA 2009/058/0031.

Derivatio nominis: *cyclopius* (Lat.) = zyklisch.

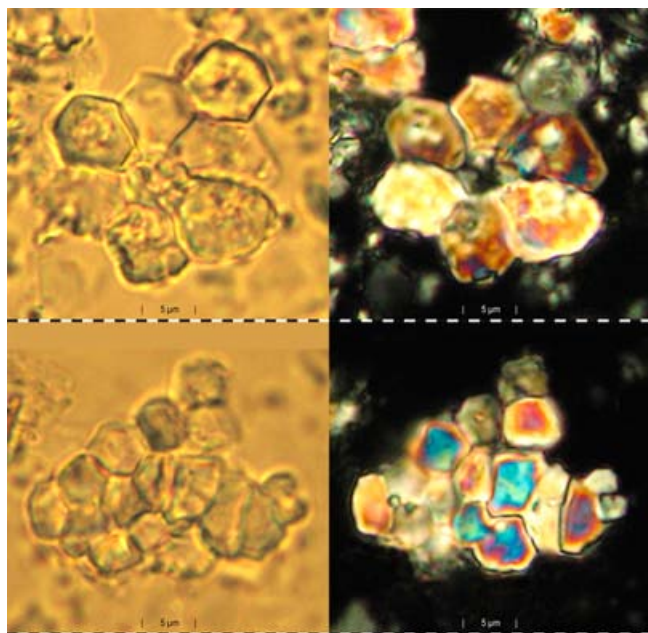
Locus typicus: Eitelgraben S Salzburg. Nicht selten.

Stratum typicum: Paläozän.



Text-Fig. 59a.
Original drawings of *Favolithora cyclopia*.

Die Beschreibung dieser Art ist durch die des Genotypus gegeben. In den verschiedenen aufgesammelten Wandbruchstücken überwiegen die sechseckigen Bausteine gegenüber den fünfeckigen. Sie erinnern in der Art, wie sie aneinandergefügt sind, an die sogenannten Zyklopenmauern des prähistorischen Griechenland (Mykene).



Text-Fig. 59b.
Syntypes in polarized and normal light.

Größe der Einzelteile: Durchmesser meist 5 µm, Höhe 3–5 µm.

English translation:

The description of this species corresponds to that of the genus. Some fragments show blocks with pentagonal outline also. In cross-polarized light the blocks show different orientations.

Size: Diameter of the blocks about 5 µm, height 3–5 µm.

Holococcolith genera

Genus: *Corannulus* STRADNER, 1962, P. 365

Type species: *Corannulus germanicus* STRADNER, 1962, p. 366, Pl. 1, Figs. 21–30.

Synonyms: *Guttolithion* STRADNER, 1962, p. 374.

Type species: *Guttolithion cassum* STRADNER, 1962, p. 375, Pl. 3, Figs. 1–5.

Comments:

Two species were originally included in the genus *Corannulus*: *Corannulus arenarius* STRADNER, 1962, p. 368, Pl. 1, Figs. 14–20.

Corannulus germanicus STRADNER, 1962, p. 366, Pl. 1, Figs. 21–30.

Original description of *Corannulus* STRADNER, 1962

Derivatio nominis: Wortzusammensetzung aus den lateinischen Hauptwörtern *corona* = Krone und *annulus* = Ring.

Von fossilen Kalkflagellaten herrührende großporige Gehäuseelemente von unregelmäßig ovalem oder zahnkranzartigem Umriss. Von einem schwach ovalen bis annähernd kreisrunden zentralen, erhöhten Ring nehmen 7–12 in zentrifugaler Richtung steil abfallende radiale Stege ihren Ausgang. Ihre Ansatzstellen sind als erhöhte Rippen auch bei stark reduzierten Arten erhalten. Die peripheren Enden der Stege können frei sein (*Corannulus germanicus* n. sp.) oder durch Bögen miteinander verbunden sein (*Corannulus arenarius* n. sp.). Die große zentrale Öffnung, welche an den Ansatzstellen der Stege leicht ausgebuchtet ist, ist in letzterem Falle von einem Kranz von abgerundet dreieckigen oder trapezförmigen Fenstern umgeben. Diese Gattung von Coccolithen scheint durch starke Reduktion großporiger Vorläuferformen ex gr. *Discolithus macroporus* DEFLANDRE entstanden zu sein. Da die beiden neuen Arten *Corannulus arenarius* und *Corannulus germanicus* schwer in der Gattungsdiagnose von *Discolithus* KAMPTNER 1955 unterzubringen waren, wurde für sie der neue Gattungsname *Corannulus* gewählt.

English translation:

Derivation of name: combined from two latin nouns: *corona* = crown; *annulus* = ring.

Holococcolithic elements with widely open pores and irregular oval outline, in *Corannulus germanicus* resembling a cogwheel. The oval ring surrounding a large central pore shows 7–12 centrifugal extensions that in *Corannulus germanicus* are free, in *Corannulus arenarius* however are joined by arcs thus forming a bumpy outline that is embracing a ring of trapezoid or triangular windows. In side view it can be seen, that these frail looking structures are composed of relatively high ledges or strips of calcite. No extinction un-

der crossed nicols. This genus seems to be related to *Discolithus macroporus* DEFLANDRE.

Comments:

Taxonomic status: *Diademopetra* HAY, MOHLER & WADE, 1966, p. 397 is also a junior synonym of *Corannulus* STRADNER 1962.

Original description of *Corannulus arenarius* STRADNER, 1962

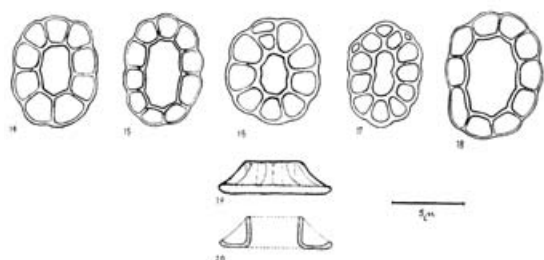
Holotypus: GBA 2009/058/0039/1.

Derivatio nominis: *arena* (Lat.) = Sand.

Locus typicus: Basale Glaukonitsande des Steinbruches Reingruberhöhe bei Bruderndorf, Niederösterreich.

Stratum typicum: Obereozän (jüngeres Led; Gohrbandt, 1962).

Diagnose und Beschreibung: Gehäuseelemente im Umriss unregelmäßig oval, sehr großporig, mit stark erhöhter zentraler Porenumrandung. Um einen großen, durch die Verschmelzung von zwei Poren entstandenen freien Raum (Zentralpore oder „Arena“) schart sich ein Kranz von sehr weiten peripheren Poren, deren Durchmesser jedoch stets kleiner ist als der der länglichen Zentralpore. Mitunter können auch noch zusätzliche Poren (vgl. Taf. I, Fig. 17) ein-

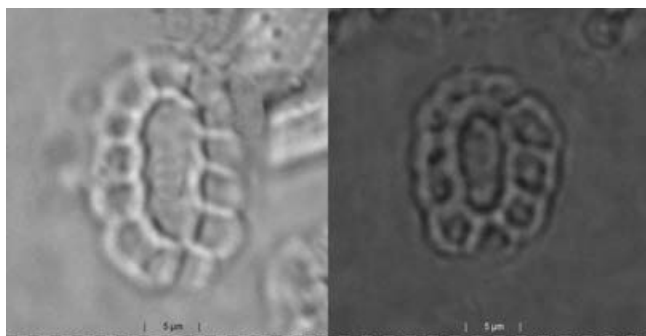


Text-Fig. 60a.
Original drawings of *Corannulus arenarius*.

geschoben sein. Der Rand ist außen, den Konturen der peripheren Poren entsprechend, leicht gebuchtet. Die Seitenansicht zeigt, dass die Stege zwischen den Poren am Rande niedrig sind, gegen die Zentralpore steil (ca. 45°) ansteigen und als Umrandung der Zentralpore stark erhöht sind. Der Außenrand des Coccolithen erscheint leicht aufgebördelt.

Dimensionen: Längsachse 7–9 µm, Querachse 5–7 µm, Höhe 2,5 µm.

Beziehungen: Diese neue Nannofossilart scheint ein Vorläufer von *Corannulus germanicus* n. sp. zu sein. Differential-



Text-Fig. 60b.
Syntypes in normal light.

diagnostisch sind die unterschiedlichen Porendurchmesser gegenüber anderen ähnlichen Arten, wie z. B. *Discolithus macroporus* DEFLANDRE, von Wichtigkeit.

English translation:

Holotype: GBA 2009/058/0039/1.

Derivation of name: *arena* (Lat.) = sand.

Type locality: Basal glauconitic sands of the Reingruberhöhe quarry at Bruderndorf, Lower Austria, which is the stratotype locality of nannoplankton Zone NP19.

Diagnosis and description: Calcareous shell elements of irregular oval outline, with large pores, and elevated ring. The central pore seems to be equivalent to two combined pores without septum between them. The central ring is surrounded by 9 to 13 trapezoid or triangular pores; their outer limitations being wavy. The side view shows that the central ring is higher than the ledges surrounding it (see Fig. 19 and 20).

Size: Length 4–7 µm, width 3.5–6 µm, height 2 µm.

Occurrence: As yet only known from the Reingruberhöhe, Bruderndorf in Lower Austria, stratotype locality of nannoplankton Zone NP19.

Relations: This new species is closely related to *Discolithus macroporus*, from which it differs by its double size, and with *Corannulus germanicus*, which has no outer rim however.

Comments:

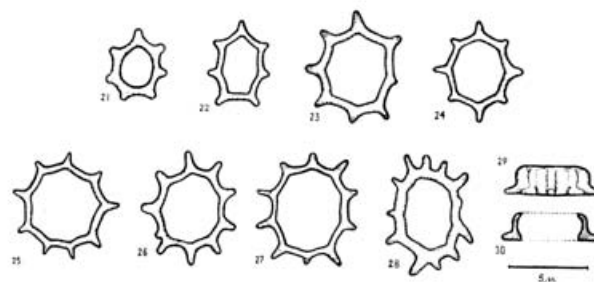
Stratigraphic distribution: Middle to Upper Eocene (Bartonian to Priabonian); Zone NP16–NP19.

Original description of *Corannulus germanicus* STRADNER, 1962

Holotypus: GBA 2009/058/0039/2.

Derivatio nominis: *germanicus* (Lat.) = aus Deutschland.

Die erste Mitteilung über diese Art von Nannofossilien stammt „aus Deutschland“, und zwar von Dr. Erlend MARTINI, welcher 1958 ein Mikrophoto (Taf. 6, Fig. 31) beschriftet als „unbestimmtes Skelettelement SM. B 7996 (A 31.1/101.3). – Hohne 1001: 155,7–121,7 m K. 2; oberes Obereozän“ wiedergab.

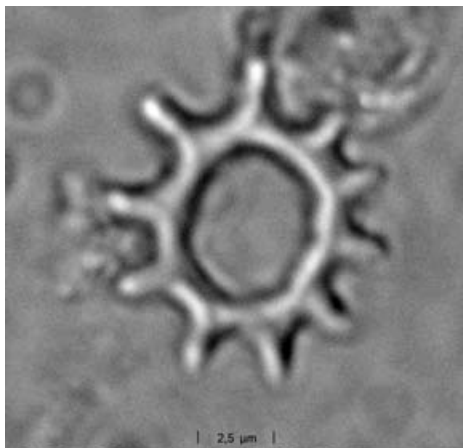


Text-Fig. 61a.
Original drawings of *Corannulus germanicus*.

Locus typicus: Basale Glaukonitsande des Steinbruches Reingruberhöhe bei Bruderndorf, Niederösterreich.

Stratum typicum: Obereozän (jüngeres Led; K. GOHRBANDT, 1962).

Diagnose und Beschreibung: Gehäuseelemente von zahnkranzartiger Gestalt, jedoch nur selten annähernd kreisrund, sondern meist etwas längsoval. Die Zahl der mehr oder weniger spitzen Stege („Zähne“) variiert von 7–12.



Text-Fig. 62b.
Holotype in normal light.

Das eine große zentrale Fenster ist an den Ansatzstellen der Stege leicht peripher ausgebuchtet. Die Seitenansicht zeigt, dass die Umrandung des Zentralfensters stark erhöht ist und durch die rippenartig hinauslaufenden Stege verstärkt wird. Die Abstände zwischen den Stegen, welche als stark reduzierte Umrandungsteile von nicht ausgebildeten peripheren Fenstern anzusehen sind (vgl. *Corannulus arenarius* n. sp.), sind meist untereinander gleich, doch können auch sehr unregelmäßige Formen, wie z. B. Taf. I, Fig. 28, gefunden werden.

Dimensionen: Längsachse 4–7 µm, Querachse 3,5–6 µm, Höhe 2 µm.

Vorkommen und Fundorte: In Österreich bis jetzt nur aus dem Obereozän der Reingrubberhöhe (loc. typ.) bekannt, dort mäßig häufig; in Deutschland aus dem oberen Obereozän der Tiefbohrung Hohne 1001, 115,7–121,7 m K. 2.

Beziehungen: *Corannulus germanicus* n. sp. lässt sich von *Corannulus arenarius* n. sp., welcher vermittelnd zwischen dieser Art und großporigen Vorläuferformen ex gr. *Discolithus macroporus* steht, ableiten. Bemerkungen: Dieses Nannofossil erscheint bei Betrachtung in negativem Phasenkontrast wegen seiner starken Lichtbrechung sehr hell, in normalem Durchlicht jedoch sehr dunkel, was auch aus dem Mikrophoto in MARTINI (1958, Taf. 6, Fig. 31) deutlich hervorgeht.

English translation:

Holotype: GBA 2009/058/0039/2.

Derivation of name: *germanicus* (Lat.) = from Germany.

The first hint at this new species was given by MARTINI (1958 on plate no. 6, Fig. 31), described as “undetermined skeletal element” from the upper Eocene of deepwell Hohne 1001 (115.7–121.7 m, K. 2) in Germany.

Type locality: Basal glauconitic sands of the Reingrubberhöhe quarry at Bruderndorf, Lower Austria, which is the stratotype locality of nannoplankton Zone NP19.

Diagnosis and description: calcareous shell elements of a hitherto unknown coccolithophorid in his motile phase. These elements in their outline resemble little cogwheels, however most of the time they are oval and rarely circular. The number of their more or less pointed “teeth” varies from 7 to 12. The large circular aperture is slightly sinuated at the points where the “teeth” are situated on the outside. In side view one can see that these are not round,

but rather strips or ledges on the outside of the more or less cylindrical central annulus. Irregular forms are not uncommon.

Size: Length 4–7 µm, width 3.5–6 µm, height 2 µm.

Comments:

Taxonomic status: *Diademopetra luma* HAY, MOHLER & WADE 1966, p. 397, Pl. 13, Figs. 4, 5 and *Guttolithion cassum* STRADNER 1962 are junior synonyms of *Corannulus germanicus* STRADNER 1962.

Biostratigraphic range: Ranges from upper middle Eocene through Upper Eocene (Bartonian–Priabonian; NP17–NP19).

Original description *Guttolithion* STRADNER, 1962

Derivatio nominis: *gutta* (Lat.) = Tropfen, *lithos* (Gr.) = Stein.

Flache, plankonvexe Kalkplättchen von unregelmäßig ovalem, gebuchtetem Umriss, mit einer konischen zentralen Durchbohrung, welche auf der konvexen Flachseite von einem unregelmäßig gelappten Wall umgeben ist. Der Umriss wird durch 10–16 nicht immer gleich weit voneinander entfernten, mehr oder weniger spitzen Zacken und dazwischenliegenden runden Buchten bestimmt. Die Oberfläche des Kalkkörperchens ist etwas gerauht und lässt keine Unterteilungslinien erkennen. Herrn Doz. Dr. E.J. Zirkl, welcher das Genero-Typus-Exemplar polarisationsoptisch untersuchte, ist der Verfasser für die folgende Diagnose zu Dank verpflichtet:

„Das Nannofossil *Guttolithion cassum* erscheint bei gekreuzten Polarisatoren vollständig isotrop. Da die Lichtbrechung größer ist als 1,5 (Lichtbrechung des Einbettungsmittels), scheiden Opal, Chalzedon und andere SiO₂-Modifikationen aus. Im konoskopischen Licht erhält man ein deutliches negatives Interferenzbild. Damit muss das Nannofossil aus einem Kalziteinzelkristall bestehen.“

English translation:

Derivation of name: *gutta* (Latin) = drop, *lithos* (Gr.) = stone.

Type locality: Basal glauconitic sands of the Reingrubberhöhe quarry at Bruderndorf, Lower Austria.

Level: stratotype locality of nannoplankton Zone NP19 (Upper Eocene).

Flat, broad, elliptical platelet with irregular dented outline, flat on the proximal side, slightly conical on the distal side, and with a central oval conical perforation. The characteristic outline shows 10–16 tips with bays between them. No sutures or separation lines. A holococcolith, which in polarized light is completely isotropic, in conoscopic light showing a negative interference picture like a single calcite crystal (diagnose by J. ZIRKL).

Comments:

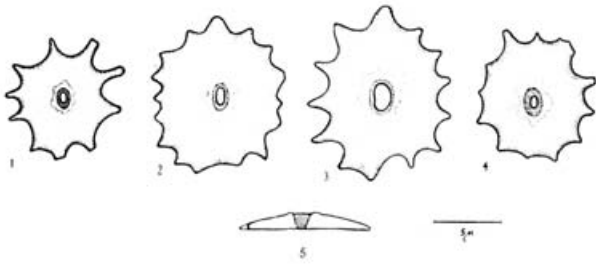
Taxonomic status: Junior synonym of *Corannulus* STRADNER 1962 (see AUBRY, 1988).

Original description *Guttolithion cassum* STRADNER, 1962

Holotypus: GBA 2009/058/0040.

Derivatio nominis: *cassus* (Lat.) = leer.

Locus typicus: Basale Glaukonitsande des Steinbruches Reingrubberhöhe bei Bruderndorf, Niederösterreich.



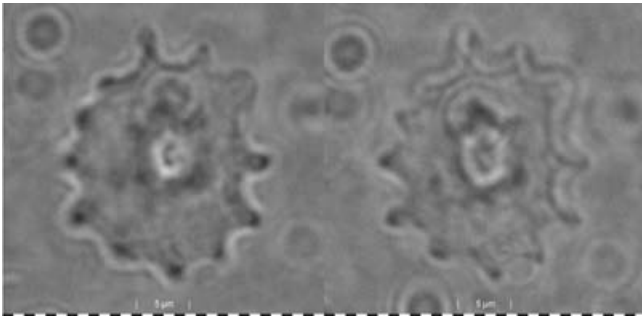
Text-Fig. 62a.
Original drawings of *Guttolithion cassum*.

Stratum typicum: Obereozän (jüngeres Led; K. GOHRBANDT, 1962).

Diagnose und Beschreibung: Die Beschreibung dieser bis jetzt einzigen Art der Gattung *Guttolithion* deckt sich mit der des Genero-Typus (s.o.). Selten.

Dimensionen: Längsachse 9–13 µm, Querachse 8–12 µm, Höhe 1 µm.

Beziehungen: *Guttolithion cassum* kann wegen seiner polarisationsoptischen Eigenschaften unter die Ortholithae DEFLANDRE s. l. eingereiht werden, doch fehlen zur Zeit noch Hinweise, in welche engere systematische Gruppe dieses außergewöhnlich einfach geformte Nannofossil einzureihen ist.



Text-Fig. 62b.
Holotype in normal light at different focus levels.

English translation:

Holotype: GBA 2009/058/0040.

Derivation of name: *cassus* (Lat.) = empty.

Type locality: Basal glauconitic sands of the Reingruberhöhe quarry at Bruderndorf, Lower Austria.

Level: stratotype locality of nannoplankton Zone NP19 (Upper Eocene).

Diagnosis and description: Identical with the description of the as yet monospecific genus.

Size: Length 9–13 µm, width 8–12 µm, height 1 µm.

Comments:

Taxonomic status: Regarded as a junior synonym of *Corannulus germanicus* STRADNER 1962 by AUBRY (1988, p. 81). However, a quantitative study ought to clarify this relationship.

Genus: *Lanternithus* STRADNER, 1962, p. 375

Type species: *Lanternithus minutus* STRADNER, 1962, p. 375, Pl. 2, Figs. 12–15.

Original description of *Lanternithus* STRADNER, 1962

Derivatio nominis: *lanterna* (Lat.) = Laterne; *lithos* (Gr.) = Stein. Aus mehreren Platten zusammengesetzte, in der Draufsicht länglich-sechseckige, in den Seitenansichten trapezförmige Umrisslinien zeigende Kalkkörperchen mit zentralem Hohlraum. Je dicker die polarisationsoptisch als Einzelkristalle sich verhaltenden Platten sind, umso kleiner ist der zentrale Hohlraum. Die einzelnen Platten sind durch schräge, die Winkel halbierende Verbindungsflächen miteinander vereinigt.

English translation:

Derivation of name: *lanterna* (Lat.) = lantern; *lithos* (Gr.) = stone.

Calcareous composite shell of a holococcolith, in top view elongate hexangular, in side view trapezoidal, with a central cavity. The plates composing the shell are joining in acute angles as can be seen under crossed nicols.

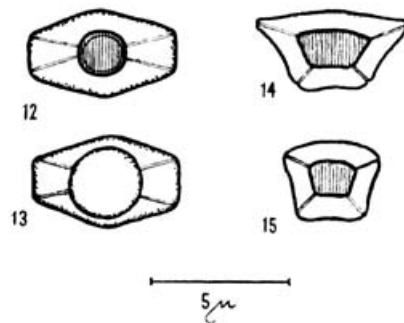
Original description of *Lanternithus minutus* STRADNER, 1962

Holotypus: GBA 2009/058/0041.

Derivatio nominis: *minutus* (Lat.) = winzig.

Locus typicus: Basale Glaukonitsande des Steinbruches Reingruberhöhe bei Bruderndorf, Niederösterreich. Stellenweise sehr häufig.

Stratum typicum: Obereozän (jüngeres Led; K. GOHRBANDT, 1962).



Text-Fig. 63a.
Original drawings of *Lanternithus minutus*.

Diagnose und Beschreibung: Die Beschreibung dieser bis jetzt einzigen Art der Gattung *Lanternithus* ist durch die des Genero-Typus gegeben.

Dimensionen: Längsachse 3,5–5,5 µm, Querachse 2–3 µm, Höhe 2–3 µm.

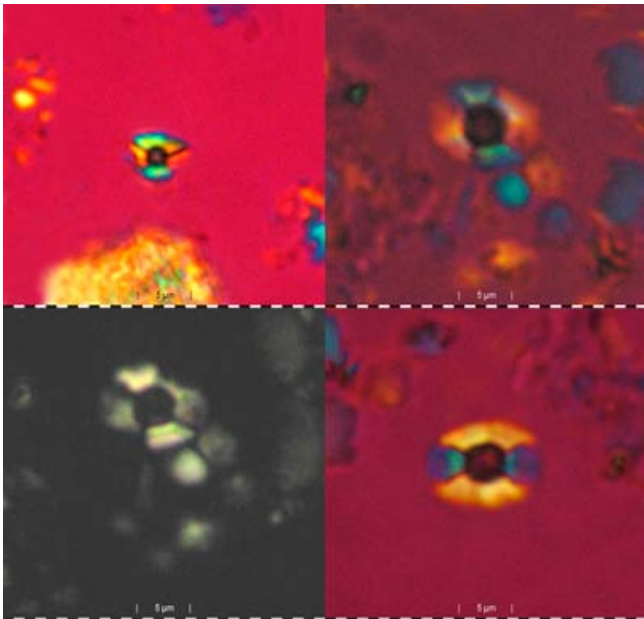
Beziehungen: *Lanternithus minutus* kann mit keinem bis jetzt beschriebenen Nannofossil des Alttertiärs oder des Mesozoikums in Verbindung gebracht werden. *Pyxilithus problematicus* DEFLANDRE hat einen relativ größeren Hohlraum und anders gestaltete Umrisslinien.

Bemerkungen: Der Hohlraum von *Lanternithus minutus* ist häufig durch einen Pyritkristall oder infolge schlechten Eindringens des Einschlussmediums von einer winzigen Luftblase erfüllt.

English translation:

Holotype: GBA 2009/058/0041.

Derivation of name: *minutus* (Lat.) = tiny.



Text-Fig. 63b.
Syntypes of *Lanternithus minutus* in polarized light.

Type locality: Basal glauconitic sands of the Reingrubberhöhe quarry at Bruderndorf, Lower Austria.

Level: stratotype locality of nannoplankton Zone NP19.

Diagnosis and description: Identical with the description of the as yet monospecific genus.

Relations: It differs from *Pyxillithus problematicus* DEFLANDRE, which has a larger central cavity and different outlines.

Remarks: Often we can find the central cavity of *Lanternithus minutus* filled with pyrite crystals or with a tiny air bubble.

Comments:

Stratigraphic range: middle Eocene through lower Oligocene (Lutetian–Rupelian; Zone NP15–NP23).

Genus: *Orthozygus* BRAMLETTE & WILCOXON, 1967, p. 116

Type species: *Zygodolithus aureus* STRADNER, 1962, p. 368, Pl. 1, Figs. 31–36.

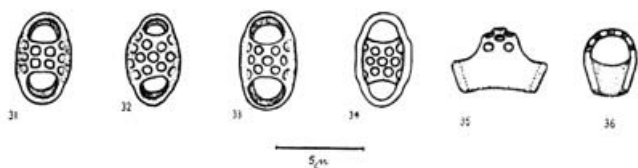
Original description of *Zygodolithus aureus* STRADNER, 1962

Holotypus: GBA 2009/058/0045.

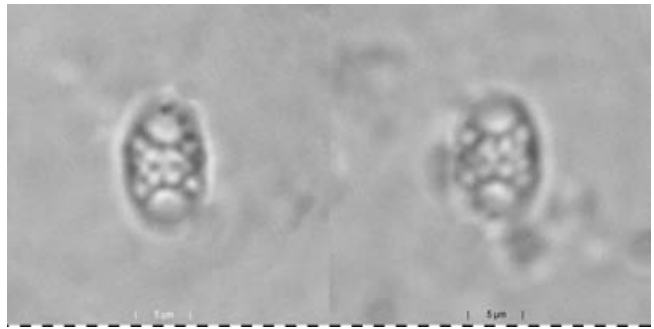
Derivatio nominis: *aureus* (Lat.) = golden.

Locus typicus: Basale Glaukonitsande des Steinbruches Reingrubberhöhe bei Bruderndorf, Niederösterreich.

Stratum typicum: Obereozän (jüngeres Led; K. GOHR-BANDT, 1962).



Text-Fig. 64a.
Original drawings of *Zygodolithus aureus*.



Text-Fig. 64b.
Holotype in normal light at different focus levels.

Diagnose und Beschreibung: Gehäuseelemente bestehend aus einem in Draufsicht ovalen, sich proximal konisch verjüngenden hohen Ring, welcher distal in Richtung der Querachsen von einem durch zahlreiche Poren durchbrochenen, stark gewölbten Joch überspannt wird. Die Anordnung der Poren entspricht im Mittelteil des Joches meist dem Quincunx (eine zentrale Pore, welche von sechs gleichgroßen Poren umgeben ist), doch können auch Exemplare mit nur vier oder fünf Poren auf dem Apex des Joches gefunden werden. Die mehr lateral schauenden Poren sind wegen der starken Wölbung des Joches nur als Querschnitte zu erkennen.

Dimensionen: Längsachse 5–6 µm, Querachse 3–5 µm, Höhe 3–4 µm.

English translation:

Holotype: GBA 2009/058/0045.

Derivation of name: *aureus* (Lat.) = golden.

Type locality: Basal glauconitic sands of the Reingrubberhöhe quarry in Bruderndorf, Lower Austria. Stratotype locality of nannoplankton Zone NP19.

Calcareous shell elements of a holococcolith, with an oval outline, and a central transversal bridge perforated by several pores. Side view conical towards the proximal side, the bridge vaulting the larger distal opening of the basal ring. The pores of the bridge can be arranged either in the corners of a square, or in the so called “quincunx pattern” with one pore in the centre and 6 of equal size surrounding it.

Size: Length 5–6 µm, width 3–5 µm, height 3–4 µm.

Occurrences: In all Upper Eocene outcrops reported by the author (STRADNER, Verh. Geol. B.-A., 1962, III, p. 107) in the Waschbergzone, Lower Austria. At some places rather rare.

Relations: *Zygodolithus aureus* nov. spec. shows similarities to some recent Coccolith species (compare KAMPTNER, 1941, Pls. X–XII, e.g. *Corisphaera arethusae* KAMPTNER and *Corisphaera ponticulifera* KAMPTNER).

Comments:

Stratigraphic range: Upper Eocene to lower Oligocene (Priabonian–Rupelian; Zone NP19–NP23).

Genus: *Zygrhablithus* DEFLANDRE 1959

Type species: *Zygodolithus bijugatus* DEFLANDRE in DEFLANDRE & FERT, 1954, p. 148, Pl. 11, Figs. 20, 21, Text-Fig. 59

Comments:

Taxonomic status: Several species names have been erected to designate various views of the holococcolith

Zygrhablithus bijugatus (DEFLANDRE). *Isthmolithus claviformis* BRÖNNIMANN & STRADNER 1960, p. 368, Pl. 1, Figs. 25–43 and *Lucianorhabdus dispar* STRADNER 1961, p. 87, Text-Figs. 49, 51, 52) are such superfluous names.

**Original description of *Isthmolithus claviformis*
BRÖNNIMANN & STRADNER, 1960**

Lectotypus: GBA 2009/058/0017/2.

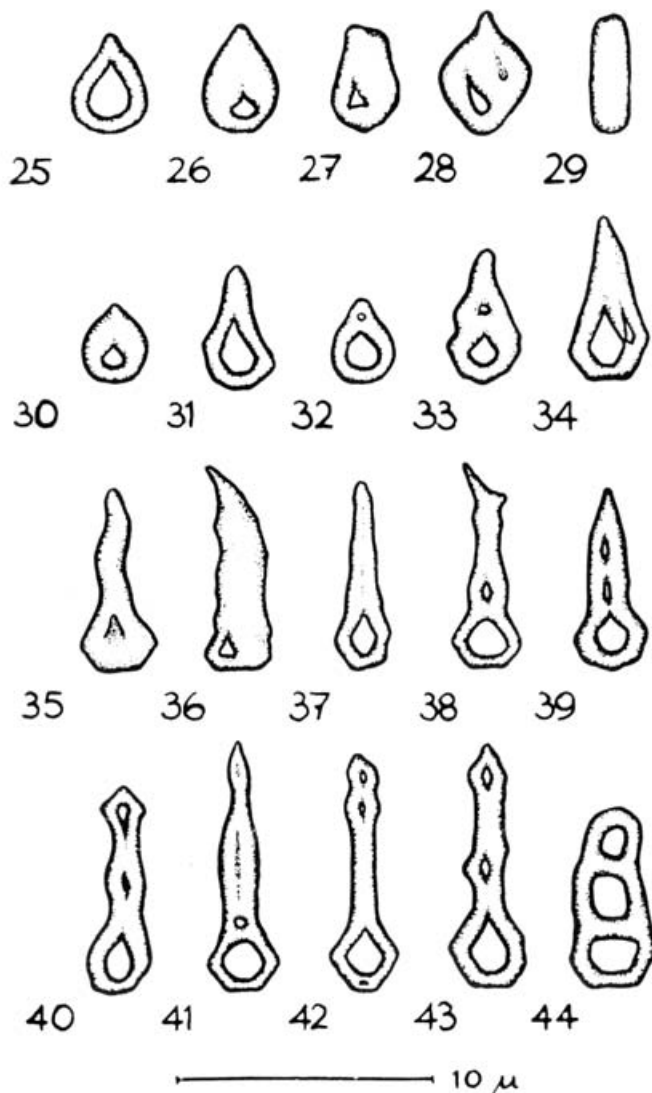
Derivatio nominis: *clavis* (Lat.) = Schlüssel.

Locus typicus: Universidad-Formation, BR-Stat. 489, Kuba.

Diagnose und Beschreibung: Flache, längliche Kalkplättchen, deren eines Ende verbreitert und von einem Fenster mit tropfenförmigem Umriss durchbrochen ist. Diese neue Art, welche meist nur durch ihre einfachsten Formen (1. Reihe) vertreten ist, bildet auch die verschiedensten Übergangsformen zu *Isthmolithus recurvus* DEFLANDRE.

Größe: 4–11 µm.

Beziehungen: *Isthmolithus claviformis* ist eng mit *Isthmolithus recurvus* DEFLANDRE verwandt, doch kann zur Zeit schwer



Text-Fig. 65.
Original drawings of *Isthmolithus claviformis*.

festgestellt werden, welche Art sich aus welcher entwickelt hat. *Isthmolithus claviformis* liegt in seinem Vorkommen vor *Isthmolithus recurvus* DEFLANDRE, welcher von MARTINI als typisch für das Ober-Eozän angesehen wird. Nur allzu leicht wäre man nämlich geneigt, *Isthmolithus claviformis* als degenerierte Form von *Isthmolithus recurvus* DEFLANDRE anzusehen, wogegen aber das zeitlich verschiedene Vorkommen spricht.

English translation:

Lectotype: GBA 2009/058/000.

Derivation of name: *clavis* = (Lat.) key; in the shape of a key. Diagnosis and description: Flat longitudinal calcareous plates, which on their wider end leave a tear-shaped window open. The other end is pointed. In overall view these very small specimens resemble small keys.

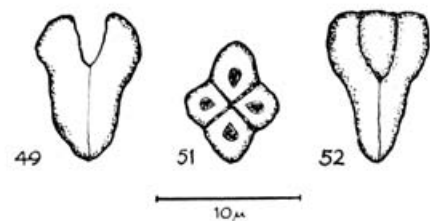
Comments:

Taxonomic status: *Isthmolithus claviformis* represents fragments of poorly preserved holococcoliths of *Z. bijugatus*.

**Original description of *Lucianorhabdus dispar*
STRADNER, 1961**

Holotypus: GBA 2009/058/0033.

Derivatio nominis: *dispar* (Lat.) = ungleich.



Text-Fig. 66.
Original drawings of *Lucianorhabdus dispar*.

Locus typicus: Mattsee, Salzburg. Häufig.

Stratum typicum: Mitteleozän.

Kalkkörperchen, deren vier längliche Einzelteile verschieden lang sind und auf der distalen Fläche vier grubige Vertiefungen besitzen. Je zwei gegenüberliegende Einzelteile sind gleichlang. Das in der Richtung der Querachse der Facies distalis liegende Paar von Einzelteilen kann leicht aus der Klammer der sie haltenden längeren Einzelteile herausfallen. Beim Drehen im linear polarisierten Lichte erscheinen je zwei gegenüberliegende Einzelteile abwechselnd hell und dunkel analog zu *Tetralithus pyramidus* GARDET.

Größe: 5–11 µm.

English translation:

Holotypus: GBA 2009/058/0033.

Derivatio nominis: *dispar* (Lat.) = different in size.

Wedgeshaped calcareous bodies consisting of four longitudinal elements of different length, two long ones and two short ones arranged alternating round the main axis. Viewed from the axial side these four elements appear under crossed nicols like a small *Tetralithus*. The broader flat basal end shows four tear-shaped dimples.

Size: 5–11 µm.

Comments:

Taxonomic status: *Lucianorhabdus dispar* designates poorly preserved holococcoliths of *Z. bijugatus*.

MESOZOIC

HETEROCOCCOLITHS

Order: Arkhangelskiales BOWN & HAMPTON in BOWN & YOUNG, 1997

Family: Kamptneriaceae BOWN & HAMPTON in BOWN & YOUNG, 1997

Genus: *Gartnerago* BUKRY, 1969

Gartnerago obliquum (STRADNER) REINHARDT 1970 (= *Arkhangelskiella obliqua* STRADNER, 1963, p. 176, Pl. 1, Figs. 2, 2a)

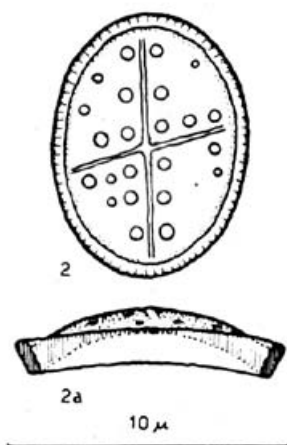
Original description of *Arkhangelskiella obliqua* STRADNER, 1963

Holotype: GBA 2009/058/0047.

Derivation of name: *obliquus* (Lat.) = oblique.

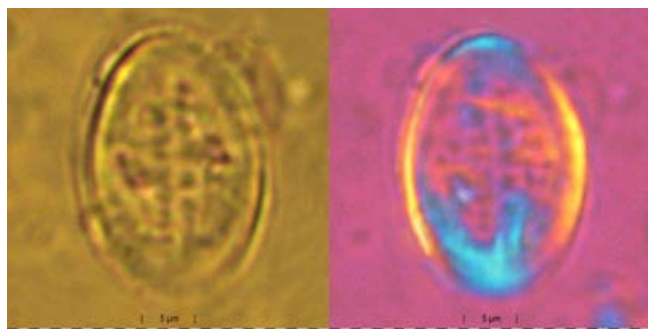
Type locality: Ameis 1 (ÖMV) Lower Austria.

Level: Upper Turonian.



Text-Fig. 67a.
Original drawing of *Arkhangelskiella obliqua*.

Description: Elliptical coccoliths with simple margin and wide central area, which is decorated with an oblique cross; the longer crossbars lie in direction of the main axis. A varying number of pores perforate the sectors of the central area.



Text-Fig. 67b.
Holotype in normal light at different focus levels.

Comments:

Stratigraphic distribution: Cenomanian to Campanian.

Genus: *Kamptnerius* DEFLANDRE, 1959

Kamptnerius punctatus STRADNER, 1963, p. 177, Pl. 2, Figs. 3-3a

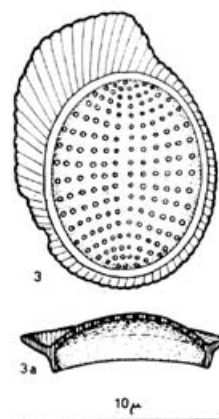
Original description of *Kamptnerius punctatus* STRADNER, 1963

Holotype: GBA 2009/058/0043/2.

Derivation of name: *punctatus* (Lat.) = dotted.

Type locality: Klafferbrunn, Lower Austria (GRILL 4557/3/947).

Level: Upper Turonian – Emscherian.



Text-Fig. 68a.
Original drawing of *Kamptnerius punctatus*.

Description: Coccoliths with large vaulted elliptical central area, which is perforated by numerous pores arranged to a symmetrical pattern of lines. The peripheral fringe is radially striated and in most cases of irregular outline.



Text-Fig. 68b.
Holotype in normal light and partly polarized light.

Comments:

Stratigraphic distribution: Turonian to Maastrichtian.

Family: Arkhangelskiellaceae BUKRY, 1969 emend. BOWN & HAMPTON in BOWN & YOUNG, 1997

Genus: *Aspidolithus* NOEL, 1969

Aspidolithus parvus parvus (STRADNER) NOEL 1969 (= *Arkhangelskiella parca* STRADNER, 1963, p. 176, Pl. 1, Figs. 3, 3a)

**Original description of *Arkhangelskiella parca*
STRADNER, 1963**

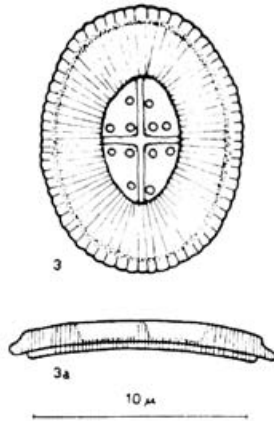
Holotype: GBA 2009/058/0048.

Derivation of name: *parcus* (Lat.) = modest.

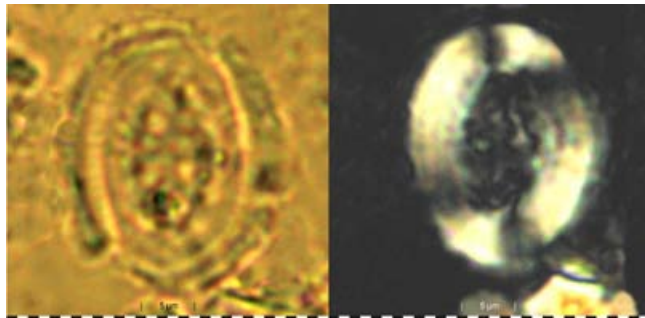
Type locality: Perwang 1 (RAG).

Level: Upper Campanian.

Description: Elliptical coccoliths with narrow central area and wide double marginal plates. A straight central cross divides the central area into sectors, which are perforated each by a few pores.



Text-Fig. 69a.
Original drawing of *Arkhangelskiella parca*.



Text-Fig. 69b.
Holotype in normal light and polarized light.

Comments:

Taxonomic status: *Aspidolithus* NOËL, 1969 is considered as a junior synonym of *Broinsonia* BUKRY, 1969 by some authors. *Broinsonia* is often used for taxa with a distinct central cross and *Aspidolithus* for taxa with perforated segments separated by axial sutures.

The evolution of the *Aspidolithus parcus* group has been discussed by many authors (see PERCH-NIELSEN, 1984). The subspecies *A. parcus parcus* (STRADNER) NOËL, 1969 most closely resembles STRADNER's holotype.

Stratigraphic distribution: Campanian.

**Order: Podorhabdales ROOD, HAY & BARNARD,
1971 emend. BOWN, 1987**

Family: Cretarhabdaceae THIERSTEIN, 1973

Genus: *Cretarhabdus* BRAMLETTE & MARTINI, 1964

Cretarhabdus striatus (STRADNER) BLACK 1973 (= *Arkhangelskiella striata* STRADNER, 1963, p. 176, Pl. 1, Figs. 1, 1a)

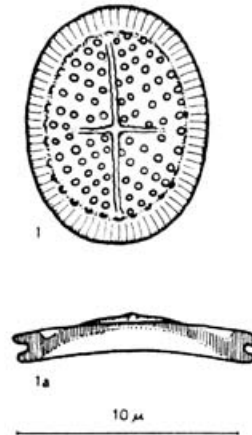
**Original description of *Arkhangelskiella striata*
STRADNER, 1963**

Holotype: GBA 2009/058/0046.

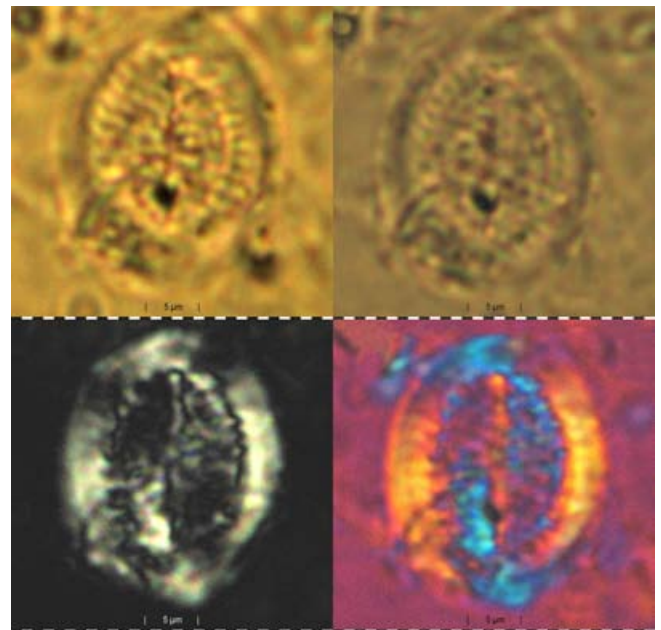
Derivation of name: *striatus* (Lat.) = striped.

Type locality: Leidschendam 1 (NV. Ned. Aardolie Maatsch.), Netherlands.

Level: Lower Albian.



Text-Fig. 70a.
Original drawing of *Arkhangelskiella striata*.



Text-Fig. 70b.
Holotype in normal light and polarized light at different focus levels.

Description: Elliptical coccoliths with wide central area and double marginal plates. Numerous pores are arranged in lines which meet at oblique angles at the straight central cross.

Comments:

Stratigraphic distribution: Aptian to Cenomanian.

Genus: *Polypodorhabdus* NOËL, 1965

Polypodorhabdus pienaari SHAFIK & STRADNER, 1971, p. 86, Pl. 14, Figs. 1–4, Text-Fig. 4

Synonyms: 1969 PIENAAR, p. 92, Pl. 8, Fig. 8. *Cretarhabdus decorus*.

non 1954 DEFLANDRE, in DEFLANDRE & FERT, p. 45, Pl. 13, Figs. 4–6, Text-Fig. 87; non 1964 BRAMLETTE & MARTINI, p. 300, Pl. 3, Figs. 9–12.

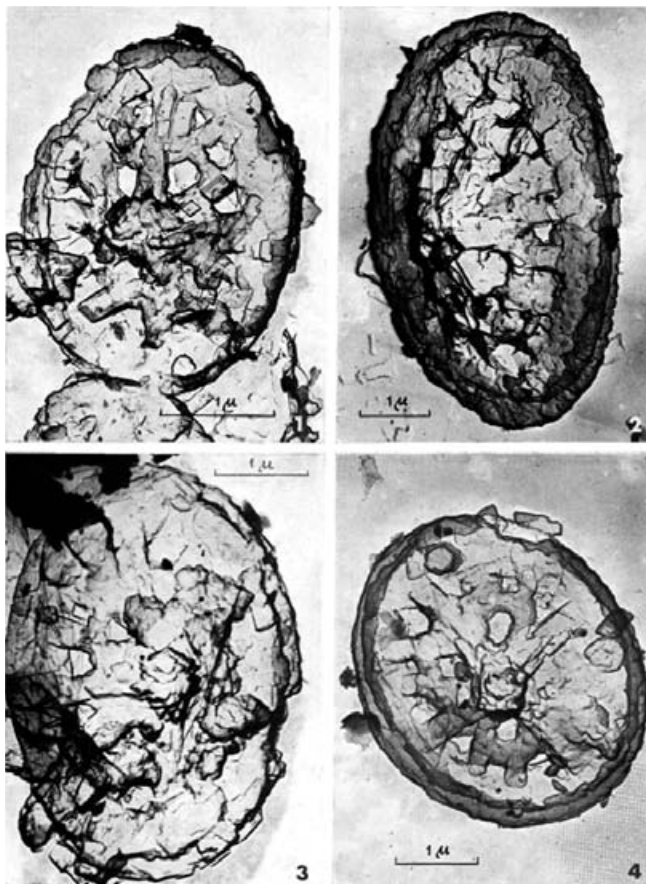
**Original description of *Polypodorhabdus pienaari*
SHAFIK & STRADNER, 1971**

Holotype: Electron micrograph 1395, Pl. 14, Fig. 4.

Paratypes: Electron micrograph 1119 u. 1467, Pl. 14, Figs. 1 & 3.



Text-Fig. 71a.
Original drawing of *Polypodorhabdus pienaari*.



Text-Fig. 71b.
TEM micrographs of syntypes (1–3) and distal view of the holotype (4).

Derivation of name: This new species is dedicated to Richard N. PIENAAR, University of Natal, Durban, S. A., who published the first picture of this species in 1968.

Type locality: Gebel Tarbouli, Egypt, Stat. Nr. 6.

Level: Upper Maastrichtian.

Description: Elliptical coccoliths with bilamellar rim and a wide central area spanned by a complicated symmetric structure, which according to PIENAAR, is described as follows: “Two parallel bars originate halfway down the longitudinal and transverse arms of the cross and are attached to the distal shield. From each of these bars two further bars develop opposite each other. These small bars fuse resulting in 4 pores in each quadrant.” The central stalk was not found to be hollow, but compact and quadrangular in cross-section.

Differential diagnosis: *Polypodorhabdus pienaari* does not have a hollow stem as indicated by microphotographs showing *C. decorus* in side view (see DEFLANDRE & FERT (1954), BRAMLETTE & MARTINI (1964), and PIENAAR (1969), Pl. 11, Fig. 8). All available electron micrographs give evidence of a compact stalk. Therefore a distinction from *Cretarhabdus decorus* seems justified.

Comments:

Stratigraphic distribution: Maastrichtian.

**Family: Axopodorhabdaceae BOWN & YOUNG,
1997**

Genus: *Cribracorona* PERCH-NIELSEN, 1973

Cribracorona gallica (STRADNER) PERCH-NIELSEN, 1973 (= *Coccolithus gallicus* STRADNER, 1963, p. 176, Pl. 1, Text-Figs. 8–8a)

**Original description of *Coccolithus gallicus*
STRADNER, 1963**

Holotype: GBA 2009/058/0051.

Derivation of name: *gallicus* (Lat.) = from France.

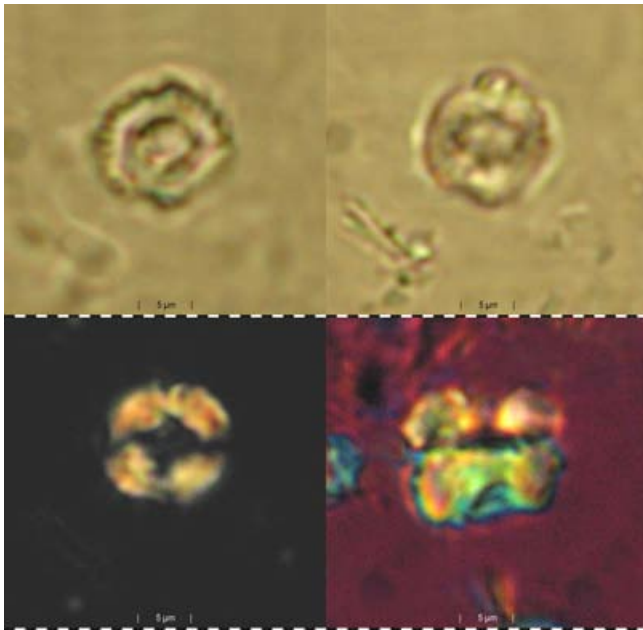
Type locality: Atlantic coast between Biarritz and Bidart, SW France.

Level: Maastrichtian.

Description: Coccoliths consisting of two subcircular or circular plates; the distal one consists of slightly counter-clockwise radiating petaloid plates, the proximal one is of more cylindrical form with a smaller diameter.



Text-Fig. 72a.
Original drawing of *Coccolithus gallicus*.



Text-Fig. 72b.
Axial view of holotype at different focus levels (1, 2), in polarized light (3), side view (4).

Comments:

Stratigraphic distribution: Upper Campanian to Maastrichtian.

Family: Biscutaceae BLACK, 1971

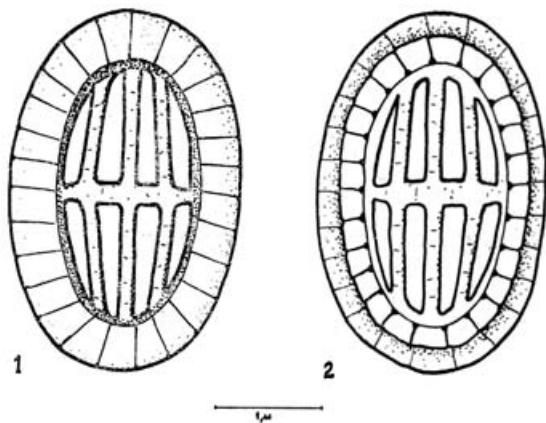
Genus: *Sollasites* BLACK, 1967

Sollasites horticus (STRADNER, ADAMIKER & MARESCH) CEPEK & HAY, 1969 (= *Coccolithus horticus* STRADNER, ADAMIKER & MARESCH in STRADNER & ADAMIKER 1966, p. 337, Text-Figs. 1, 2, Pl. 2, Fig. 4)

Original description of *Coccolithus horticus* STRADNER, ADAMIKER & MARESCH, 1966

Holotypus: Platte Nr. 17 769, 20.000 fach, Facies proximalis.

- 1. Paratypus: Platte Nr. 18 150, 8.000 fach, Facies distalis.
- 2. Paratypus: Stereo-Platten Nr. 821/822/65, 4.800 fach.



Text-Fig. 73a.
Original drawing of *Coccolithus horticus*.



Text-Fig. 73b.
TEM micrograph of the holotype and syntype in phase contrast.

Derivatio nominis: *horticus* = (Lat.) Gärtner.

Typuslokalität: Tiefbohrung Delft 2 (NAM), Niederlande.

Stratum typicum: Albium.

Coccolithen mit elliptischem Umriss, einer größeren distalen und einer etwas kleineren proximalen Randscheibe; der relativ große Binnenraum ist von acht Längsfenstern durchbrochen, welche je vier von einem Quersteg getrennt werden. Von den Längsstegen liegt der mittlere in der Hauptachse. Die rechts und links davon liegenden Seitenstege verlaufen nicht genau parallel dazu, so dass die Fenster des Binnenraumes nicht parallelrandig, sondern unregelmäßig trapezförmig sind, wobei die breitere Basis der Trapeze auf dem Quersteg zu liegen kommt. Die Randscheiben sind aus Kristallplatten zusammengesetzt, welche sich nur wenig überlappen und nur schwach geneigt sind. Die Coccusphaere der unbegeißelten Phase, von der die hier beschriebenen Coccolithen stammen, scheint derjenigen von *Coccolithus pelagicus* oder *Coccolithus helis* ähnlich gewesen zu sein, also von kugelförmiger Gestalt.

Größe des Holotypus: 3,3 µm lang, 2 µm breit.

Anmerkungen: Eine nahe verwandte Art scheint *Coccolithus helis* STRADNER nach den von BRAMLETTE & MARTINI 1964, Taf. 7, Fig. 5 und 6 gezeigten Elektronenmikrogrammen zu sein. Bei dieser Art sind die seitlichen Längsstege noch mehr geneigt, so dass es zur Ausbildung von dreieckigen Fenstern kommt. *Coccolithus helis* tritt im Danium – Paleozän auf.

English translation:

Holotype: TEM 17769.

Paratypes: TEM 18150 and TEM 621/622/65.

Derivation of name: *horticus* (Lat.) = gardener.

Type locality: NAM deep well Delft 2, Netherlands.

Level: Albian.

Size: Length 3.3 µm, width 2 µm.

Elliptical coccoliths with narrow marginal plates, a larger distal plate and a smaller proximal plate, surrounding a wide central opening, which is decorated with a grid of one transversal bar and six longitudinal bars. The broader transversal bar and the somewhat narrower longitudinal bars are the framework which embraces four central trapezoidal and four lateral triangular windows. The sutures between the plates of the marginal rim are straight and are orientated in centrifugal direction. These coccoliths are hetero-coccoliths, that means products of the non-motile phase of a living organism.

Comments:

Stratigraphic distribution: Upper Jurassic to Upper Cretaceous.

Order: Watznaueriales BOWN, 1987

Family: Watznaueriaceae ROOD, HAY & BARNARD, 1971

Genus: *Watznaueria* REINHARDT, 1964

Watznaueria britannica (STRADNER) REINHARDT, 1964 (= *Coccolithus britannicus* STRADNER, 1963, p. 176, Pl. 1, Figs. 7–7a)

Original description of *Coccolithus britannicus* STRADNER, 1963

Holotype: GBA 2009/058/0050.

Derivation of name: *britannicus* (Lat.) = from England.

Type locality: Redcliff Point between Weymouth and White Nothe, Dorset (BARNARD 1952).

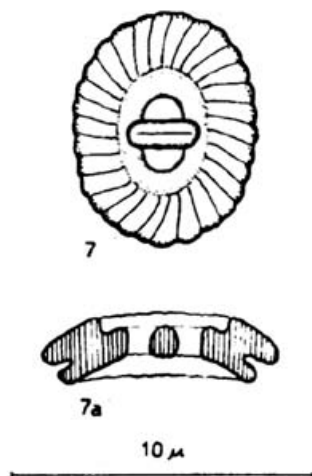
Level: Lower Oxfordian.

Description: Elliptical coccoliths consisting of two closely appressed plates; the oval central opening is transversely spanned by a short sturdy bridge.

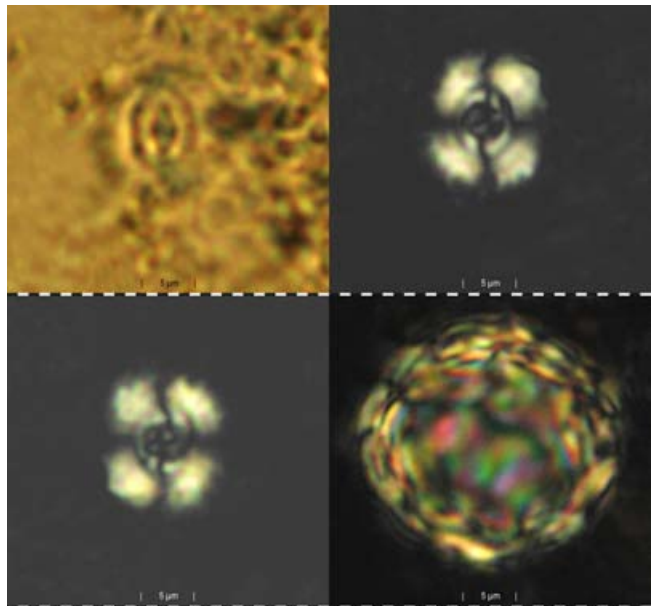
Comments:

Taxonomic status: Assignment to the genus *Watznaueria* should be regarded as provisional.

Stratigraphic distribution: Toarcian to Campanian.



Text-Fig. 74a.
Original drawing of *Coccolithus britannicus*.



Text-Fig. 74b.
Syntypes of *Coccolithus britannicus* in normal light and polarized light (1, 2, 3) and coccosphaere (4).

Watznaueria opaca (STRADNER) REINHARDT, 1966 (= *Coccolithus opacus* STRADNER, 1961, p. 79, Text-Fig. 11–13)

Original description of *Coccolithus opacus* STRADNER, 1961

Holotypus: GBA 2009/058/0022.

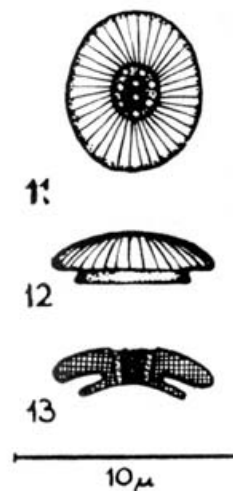
Derivatio nominis: *opacus* (Lat.) = dunkel.

Locus typicus: Schleifenbächle hinter Achdorf, Wutachgebiet, Württemberg. Häufig.

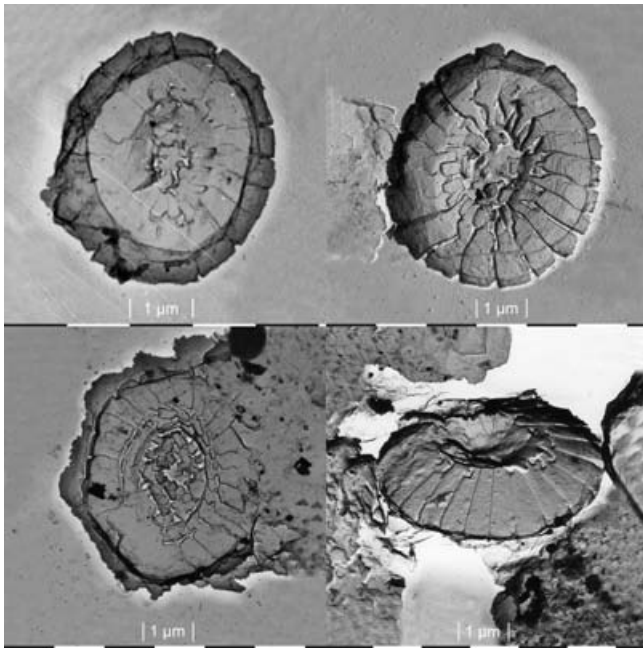
Stratum typicum: *Variabilis*-Zone (Unterer Lias Zeta).

Ein breitelliptischer Placolith, der aus einer gewölbten distalen Randscheibe, einer etwas kleineren proximalen Randscheibe und einem durch mehrere Poren durchbrochenen Mittelstück besteht. Die Randscheiben sind leicht gerieft. Der Coccolith zeigt im polarisierten Lichte ein typisches Löschungskreuz, er erscheint aber im Vergleich zu *Coccolithus pelagicus* (WALLICH) SCHILLER wesentlich dunkler.

Größe: 5–8 µm.



Text-Fig. 75a.
Original drawing of *Coccolithus opacus*.



Text-Fig. 75b.
TEM micrographs of *Coccolithus opacus* syntypes of (distal views [1–2], proximal view [3], oblique side view [4]).

English translation:

Holotype: GBA 2009/058/0022.

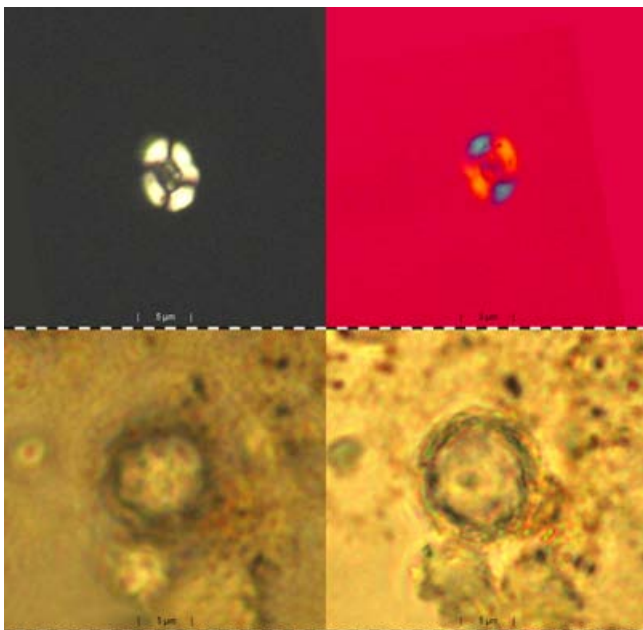
Derivation of name: *opacus* (Lat.) = dark.

Type locality: Schleifenbächle at Achdorf, Wutach district, Württemberg, Germany.

Level: *Variabilis* Zone, lower Jurassic (“Lias – Zeta”).

Size: 5–8 µm.

Description: Broad-elliptical placoliths with a vaulted, radially striated distal plate and a somewhat smaller proximal plate. The central area is perforated by several small pores. In cross-polarized light the coccoliths show the typical extinction cross as in *Watznaueria barnesae*, they are however smaller and darker.



Text-Fig. 75c
Syntypes in polarized light (1–2), coccosphaere at different focus levels (3–4).

Comments:

Taxonomic status: Assignment to the genus *Watznaueria* should be regarded as provisional.

Stratigraphic distribution: Liassic.

Genus: Lotharingius NOËL, 1973

Lotharingius sigillatus (STRADNER) PRINS in GRÜN, PRINS & ZWEILI, 1974 (= *Discolithus sigillatus* STRADNER, 1961, p. 79, Text-Figs. 14, 15)

Original description of *Discolithus sigillatus* STRADNER, 1961

Holotypus: GBA 2009/058/0030.

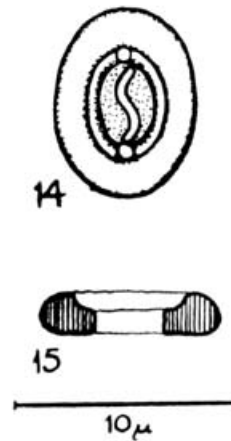
Derivatio nominis: *sigillatus* (Lat.) = mit kleinen Figuren verziert.

Locus typicus: Schleifenbächle hinter Achdorf, Wutachgebiet, Württemberg. Mäßig häufig.

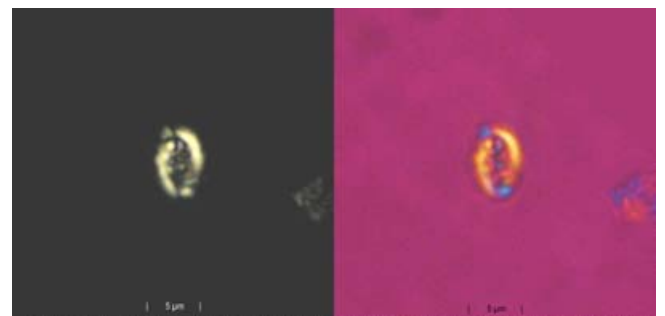
Stratum typicum: *Variabilis*-Zone (Unterer Lias Zeta).

Ein elliptischer Discolith, dessen Binnenraum durch eine sigma-förmige Figur verziert ist und dessen innerer vertiefter Rand durch zwei in der Längsachse der Ellipse liegende Punkte verziert ist.

Größe: 6–8 µm.



Text-Fig. 76a.
Original drawing of *Discolithus sigillatus*.



Text-Fig. 76b.
Syntype in polarized light.

English translation:

Holotype: GBA 2009/058/0030.

Derivation of name: *sigillatus* (Lat.) = decorated with small figures.

Type locality: Schleifenbächle at Achdorf, Wutach district, Württemberg, Germany.

Level: *Variabilis* Zone, lower Liassic.

Diagnosis and description: Elliptical discolith, the central area of which is decorated with a sigma-shaped design, with two dots on each side along the longer axis of the ellipse.

Size: 6–8 µm.

Comments:

Stratigraphic distribution: Upper Pliensbachian to Oxfordian.

Order: Eiffelithales ROOD, HAY & BARNARD, 1971

Family: Chiastozygaceae ROOD, HAY & BARNARD, 1973, emend. VAROL & GIRGIS, 1994

Genus: *Loxolithus* NOËL, 1965

Type species: *Loxolithus armilla* (BLACK & BARNES) NOËL, 1965 (= *Cyclolithus armilla* BLACK & BARNES, 1959, p. 327, Pl. 12, Fig. 2).

Original description of *Discolithus lucidus* STRADNER, 1963

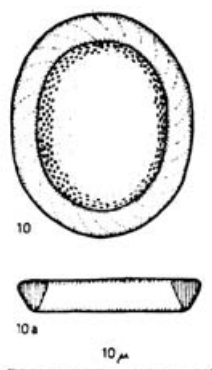
Holotype: GBA 2009/058/0054.

Derivation of name: *lucidus* (Lat.) = bright.

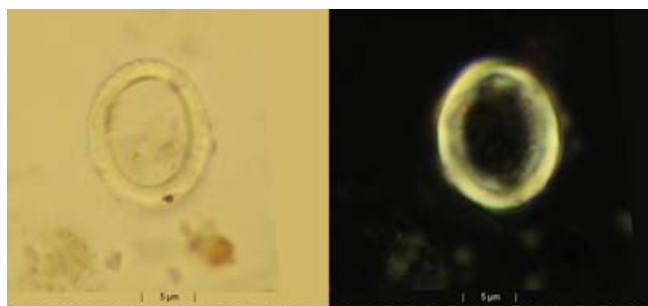
Type locality: Waidach, Salzburg, Field sample 28/14 (ABERER & BRAUMÜLLER, RAG).

Level: Upper Maastrichtian.

Description: Elliptical coccoliths with simple marginal ring of triangular cross section; the large central opening is spanned by a very delicate membrane.



Text-Fig. 77a.
Original drawing of *Discolithus lucidus*.



Text-Fig. 77b.
Holotype in normal and polarized light.

Comments:

Taxonomic status: *Discolithus lucidus* STRADNER, 1963, p. 11, Pl. 4, Text-Figs. 10-10a, is regarded here as a junior synonym of *Loxolithus armilla* (BLACK & BARNES, 1959) NOËL, 1965, p. 67, Fig. 3.

Stratigraphic distribution: Oxfordian to Maastrichtian.

Genus: *Barringtonella* BLACK, 1973

Barringtonella flabellosa (STRADNER, ADAMIKER & MARESCH) BLACK, 1973 (= *Zycolithus flabellus* STRADNER in STRADNER, ADAMIKER & MARESCH, 1968, p. 36, Pl. 31)

Original description of *Zycolithus flabellus* STRADNER in STRADNER, ADAMIKER & MARESCH, 1968

Holotype: TEM Plate 17589.

Paratype: TEM Plate 888/65.

Derivation of name: *flabellum* (Lat.) = fan.

Type locality: NAM deep well Delft 2, Netherlands.

Level: Albian.



Text-Fig. 78.
TEM micrographs of holotype (1) and paratype (2).

Diagnosis and description: *Zycoliths* with elliptical rim composed of imbricated crystal plates and a transversal or a cross-shaped central structure subdividing the central area into two halves or into four quadrants. A fan-shaped curtain of crystals, which are converging towards the focuses of the ellipse, fills the openings. It connects the rim with the middle part of the transversal bar, in specimens with also longitudinal bars it also inserts in these. On the distal side a central knob or tube can be observed, on the proximal side the double row of crystal plates and sutures in the medial line of the cross bars are the same as with *Zycolithus crux*.

Size: Holotype: length 5.7 µm, width 4 µm; paratype: length 3 µm, width 2.4 µm.

Discussion: In optical microscopes this species is not with certainty discernable from *Zygodiscus erectus* or from *Zygodiscus crux* depending on whether longitudinal bars are developed or not. As also intermediate forms between those shown in Pl. 31, Fig. 1 and Fig. 2 could be found, both the forms with single bridge and with central cross were included in this species, if the fan-like crystal-lace typical for *Zygodiscus flabellus* was present. *Discolithus surirella* DEFLANDRE & FERT 1954, p. 144, Text-Figs. 30 and 31 differs from *Zygodiscus flabellus* in not having a central structure. The system of lamellae, however, is rather similar.

Comments:

Stratigraphic distribution: Albian to Cenomanian.

Genus: *Tranolithus* STOVER, 1966

Tranolithus tarboulensis (SHAFIK & STRADNER) BONNEMAISON & STRADNER (n. c.) (= *Zygodiscus tarboulensis* SHAFIK & STRADNER, 1971, p. 91, Pl. 37, Figs. 1–4, Text-Fig. 5)

Original description of *Zygodiscus tarboulensis* SHAFIK & STRADNER, 1971

Holotype: EM no. 1135 (Fig. 2).

Paratypes: EM no. 443, EM no. 1147 (Figs. 1, 3).

Derivation of name: Discovered in a sample from the Gebel Tarbouli, Egypt Type locality: Gebel Tarbouli, Egypt, Stat. no. 7–1.

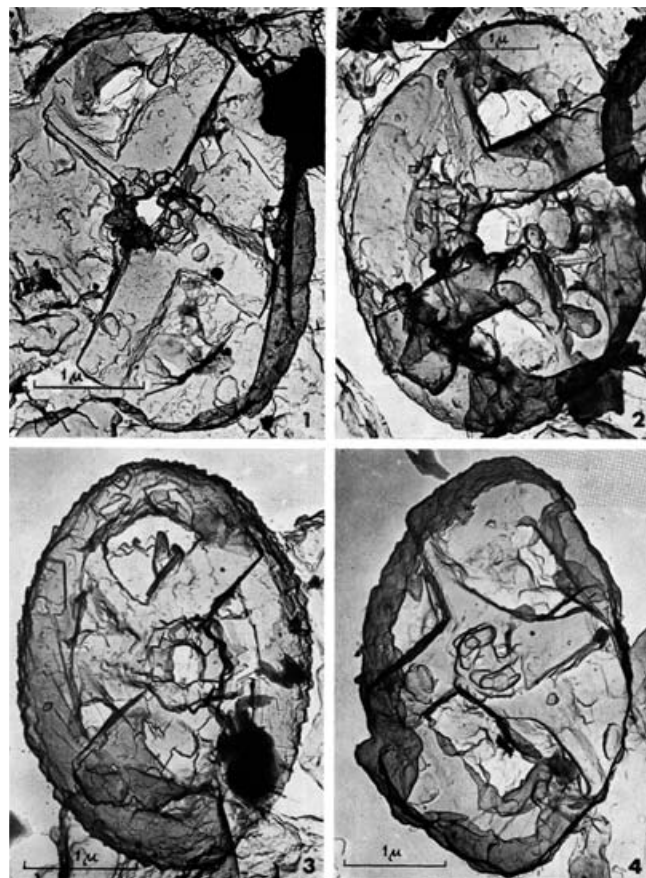
Level: Upper Maastrichtian.



Text-Fig. 79a.
Original drawing of *Zygodiscus tarboulensis*.

Diagnosis and description: Elliptical “zygodisc” with smooth or slightly serrate rim consisting of 30–50 dextrally imbricated elements. The central area is bridged by three elements: one transversal low bridge, from which rises a hollow stem, and two angular structures with arms of different width. These angles support the central stem with their corners and embrace less than 90 degrees. They are not symmetrical, but identical after rotation of 180°. Lines bisecting the angles bypass the central stem and run about parallel to the main axis of the elliptical rim. There are six windows with notches towards the centre, two large ones and four small ones.

Remarks: *Zygodiscus tarboulensis* is closely related to *Zygodiscus macleodae* BUKRY, from which it differs by the asymmetrical arrangement of the central structure and by the sharp notches of the framed perforations.



Text-Fig. 79b.
TEM micrographs of holotype (2) and syntypes (1, 3, 4).

Comments:

Taxonomic status: *T. tarboulensis* is closely related to *Z. biclavatus* BUKRY, 1969. The short arms of the two “L”-shaped elements bordering the central stem, are approximately parallel to the coccolith short axis in the holotype of *Z. biclavatus* and form an angle with it in *T. tarboulensis*.

Stratigraphic distribution: Upper Maastrichtian.

Family: Rhagodiscaceae HAY, 1977

Genus: *Rhagodiscus* REINHARDT, 1967

Rhagodiscus angustus (STRADNER) REINHARDT, 1971 (= *Rhabdolithus angustus* STRADNER, 1963, p. 178, Pl. 5, Text-Figs. 6–6a)

Original description of *Rhabdolithus angustus* STRADNER, 1963

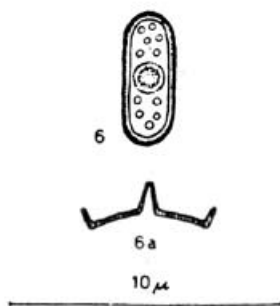
Holotype: GBA 2009/058/0059/2.

Derivation of name: *angustus* (Lat.) = narrow.

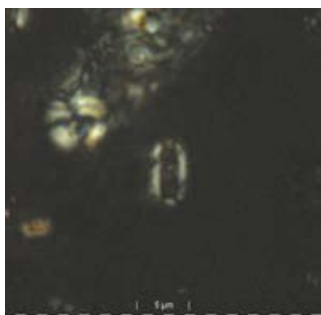
Type locality: Wanneperveen 1 (N. V. Ned. Aardolie Maatsch.), Netherlands.

Level: Upper Albian.

Diagnosis and description: Slightly vaulted coccoliths with parallel longitudinal flanks, rounded at the ends and margin tilted up to the distal side. The central stem is conical and comparatively short.



Text-Fig. 80a.
Original drawing of *Rhabdolithus angustus*.



Text-Fig. 80b.
Syntype in polarized light.

Comments:

Stratigraphic distribution: Aptian to Maastrichtian.

Rhagodiscus asper (STRADNER) REINHARDT, 1967 (= *Discolithus asper* STRADNER, 1963, p. 177, Pl. 2, Text-Figs. 4, 4a, 5, 5a)

Original description of *Discolithus asper* STRADNER, 1963

Holotype: GBA 2009/058/0053.

Derivation of name: *asper* (Lat.) = rough.

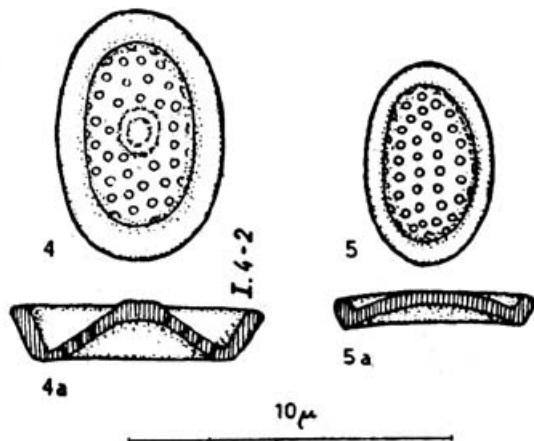
Type locality: Nordhorn Nord 11, Germany.

Level: Upper Hauterivian.

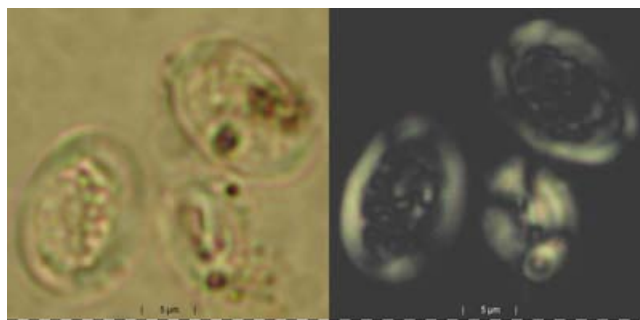
Description: Elliptical coccoliths with vaulted central area perforated by many pores; simple margin tilted up in distal direction.

Comments:

Stratigraphic distribution: Tithonian to Cenomanian.



Text-Fig. 81a.
Original drawing of *Rhabdolithus asper*.



Text-Fig. 81b.
Two syntypes in normal and polarized light.

Order: Stephanolithiales BOWN & YOUNG, 1997

Family: Stephanolithiaceae BLACK, 1968

Genus: *Corollithion* STRADNER, 1961, p. 83

Type species: *Corollithion exiguum* STRADNER, 1961, p. 83, Text-Figs. 58–61.

Original description of *Corollithion* STRADNER, 1961

Derivatio nominis: *corolla* (Lat.) = kleine Krone, *lithos* (Gr.) = Stein.

Flache, radiäre Kalkkörperchen von sechseckigem Umriss mit sechs in Richtung der Diagonalen gelegenen Durchbrechungen. Der nabenartige Mittelteil, von dem die Speichen ausgehen, trägt einen in Richtung der Hauptachse distal abstehenden kurzen Stiel. Der Rand des Kalkkörperchens ist geneigt, so dass der proximale Durchmesser kleiner ist als der distale. Die Gattung *Corollithion* gehört wahrscheinlich in die engere Verwandtschaft von *Stephanolithion* DEFLANDRE und *Zygoolithus* KAMPTNER.

English translation:

Derivation of name: *corolla* (Lat.) = little crown, *lithos* (Gr.) = stone.

Flat calcareous bodies with hexagonal circumference and six triangular windows arranged along the diagonals of the hexagon. The centre, which is elongated into a knob showing in distal direction is connected with the rim by six spikes. In side view one can see the rim converging in proximal direction.

Relation: Closely related to the genera *Stephanolithion* DEFLANDRE and *Zygoolithus* KAMPTNER.

Original description of *Corollithion exiguum* STRADNER, 1961

Holotypus: GBA 2009/058/0024.

Derivatio nominis: *exiguus* (Lat.) = winzig.

Locus typicus: Waidach, Nußdorf (Haunsberg), Salzburg. Mäßig häufig.

Stratum typicum: Obere Kreide (Senon).

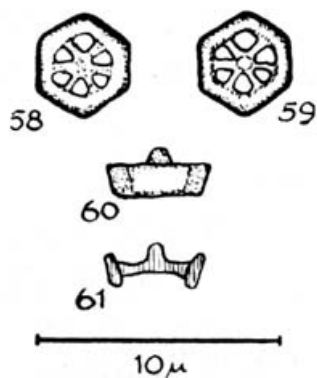
Die Beschreibung der bis jetzt einzigen Art der Gattung *Corollithion* fällt mit der des Genotypus zusammen. Größe: 4–7 µm.

English translation:

Holotype: GBA 2009/058/0024.

Derivation of name: *exiguus* (Lat.) = tiny.

Type locality: Waidach, Nußdorf (Haunsberg), Salzburg, Stat. 28 GOHRBANDT.

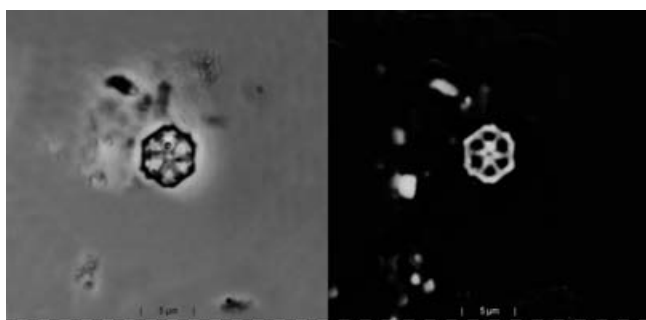


Text-Fig. 82a.
Original drawing of *Corollithion exiguum*.

Level: Upper Maastrichtian, *Micula prinsii* Zone.

Diagnosis: See the generic diagnosis.

Size: 4–7 µm.



Text-Fig. 82b.
Holotype in positive and negative phase contrast.

Comments:

Stratigraphic distribution: Upper Cenomanian to Maastrichtian.

Corollithion signum STRADNER, 1963, p. 177, Pl. 1, Text-Figs. 13–13a.

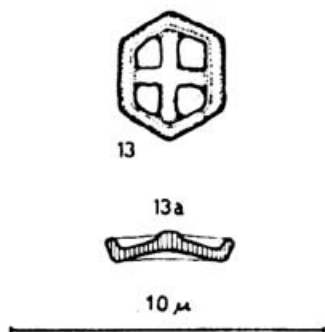
**Original description of *Corollithion signum*
STRADNER, 1963**

Holotype: GBA 2009/058/0052.

Derivation of name: *signum* (Lat.) = sign.

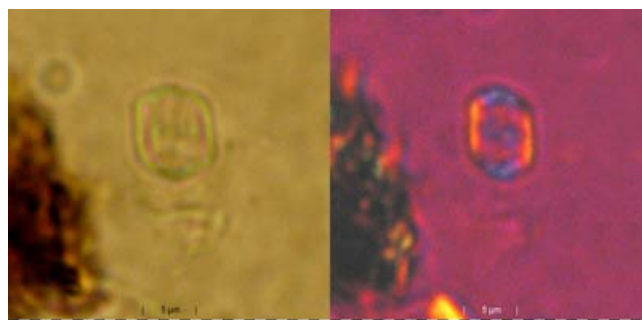
Type locality: Klafferbrunn, Lower Austria (GRILL 4557/3/947).

Level: Upper Turonian – Emscherian.



Text-Fig. 83a.
Original drawing of *Corollithion signum*.

Description: Coccoliths with hexagonal outline; the large central opening is filled out with a straight cross (Lat.: cum signo crucis).



Text-Fig. 83b.
Lectotype in normal and polarized light.

Comments:

Stratigraphic distribution: Albian to Maastrichtian.

Genus: *Stoverius* PERCH-NIELSEN, 1986

Stoverius baldiae (STRADNER) PERCH-NIELSEN, 1986 (= *Zygoolithus baldiae* STRADNER & ADAMIKER, 1966, p. 338, Pl. 2, Fig. 2, Text-Figs. 3, 4)

**Original description of *Zygoolithus baldiae*
STRADNER & ADAMIKER, 1966**

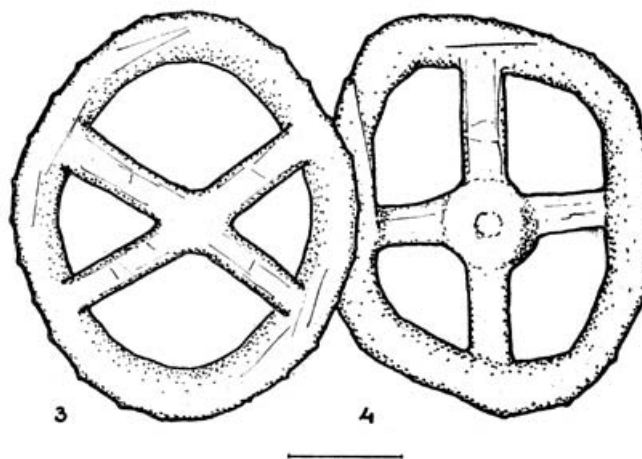
Holotypus: Platte Nr. 17 707, 8.000 fach.

Paratypus: Stereo-Platten Nr. 519/520/65, 4.000 fach.

Derivatio nominis: Frau Dr. Maria BALDI, Budapest, zugeeignet, die diese Art erstmalig aus ungarischem Barrémium dokumentiert hat. Literatur: BALDI-BEKE, M., 1964, Taf. 1, Fig. 7; MANIVIT, H., 1965, Taf. 1, Fig. 6 a, b, S. 194.

Locus typicus: Tiefbohrung Delft 2 (NAM), Niederlande.

Stratum typicum: Albium.



Text-Fig. 84a.
Original drawing of *Zygoolithus baldiae*.

Diagnose: Zygoolithen mit breitelliptischem bis annähernd kreisförmigem Umriss und diagonal liegendem schlankem Zentralkreuz, dessen Balken sich meist nicht rechtwinkelig schneiden. Der Rand des Zygoolithen ist schmal, aus sich weit überdeckenden, annähernd in peripherer Richtung

angeordneten Kristallplatten zusammengesetzt. Seine Form ist oft von der Idealellipse abweichend, und zwar, wenn sogenannte „Quetschformen“ vorliegen. Bei solchen können die Ränder an ein oder mehreren Stellen begründet sein, so dass rhombische, trapezförmige und sogar sechseckige, abgerundete Umrisse entstehen. Quetschformen scheinen auf eine sehr dichte Lagerung der Entstehungszentren der Zygoolithen innerhalb des Plasmakörpers des Flagellaten zurückzuführen sein. Auch *Zygoolithus delftensis* und die Kalkkörperchen der Gattungen *Scapholithus*, *Corolithion* und *Calciosolenia* scheinen auf diese Weise ihre geradkantigen Umrisse erhalten zu haben.

Größe: 3,5 µm lang, 3 µm breit.



Text-Fig. 84b.
TEM micrograph of holotype and syntype in polarized light.

English translation:

Derivation of name: Dedicated to Dr. Maria BALDI, who for the first time showed a picture of this species.

Holotype: TEM no. 17707; paratype: 519/520/65.

Diagnosis and description: Zygooliths with broad-oval or circular outline. The narrow basal ring is spanned by four bars which are united in the centre. These bars forming the letter X enclose angles more or less than 90 degrees. Squeezed forms like in Fig. 4 and some with a central knob can also be found. The marginal rim is composed of overlapping crystal plates.

Remark: The cause for square-cut edges in Zygooliths can be understood as lack of space on the surface of the coccosphere during its construction. Straight outlines can be seen also in *Zygoolithus delftensis* and *Corolithion exiguum*.

Size: Length 3.5 µm, width 3 µm.

Comments:

Stratigraphic distribution: Albanian.

Genus: *Truncatoscaphus* ROOD, HAY & BARNARD, 1971

Truncatoscaphus delftensis (STRADNER & ADAMIKER) ROOD, et al., 1971 (= *Zygoolithus delftensis* STRADNER & ADAMIKER, 1966, p. 338, Pl. 2, Fig. 3, Text-Figs. 8–11)

Original description of *Zygoolithus delftensis* STRADNER & ADAMIKER, 1966

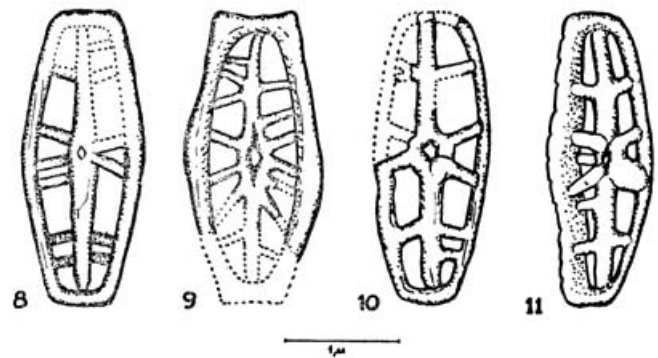
Derivatio nominis: aus Delft, Niederlande.

Holotypus: Platte Nr. 348/65, 20.000 fach und Stereoplatte 346/347/65, 9.800 fach.

Paratypus: Platte Nr. 17 479, 20.000 fach.

Locus typicus: Tiefbohrung Delft 2 (NAM), Niederlande.

Stratum typicum: Albium.



Text-Fig. 85a.
Original drawing of *Zygoolithus delftensis*.

Diagnose: Zygoolithen mit durchlaufendem Längssteg, von welchem zu beiden Seiten eine variable Anzahl von Seitenstegen fiederförmig abzweigt. Umriss des Außenringes länglich sechseckig; Die beiden sich gegenüber liegenden Endkanten sind verkürzt, der Längssteg steht rechtwinkelig zur kurzen Querdiagonale des Sechseckes. Die Seitenstege sind, wie Stereogramme zeigen, nicht alle in einer Ebene angeordnet, sondern treffen den äußeren Ring,



Text-Fig. 85b.
TEM micrograph of holotype and syntype in polarized light.

welcher aus flachliegenden Kristallplatten aufgebaut ist, in verschiedener Höhe. Längliche Zentralpore meistens vorhanden.

Anmerkung: Diese neue Art scheint mit *Zygoolithus rhombicus* verwandt zu sein, von der sie sich durch den hier sechseckigen, dort rautenförmigen Umriss und durch den durchlaufenden Längssteg unterscheidet. Auch *Zygoolithus geometricus* GORKA gehört in die nähere Verwandtschaft dieser Arten. Man kann annehmen, dass an der lebenden Zelle die einzelnen Zygoolithen von *Zygoolithus delftensis* nach einem Quincunx-Muster, welches in Richtung des Längssteges gestreckt war, angeordnet waren. Die komplette Zelle hatte vermutlich spindelförmige Gestalt.

Größe des Holotypus: 2,4 µm lang, 1,2 µm breit.

English translation:

Holotype: TEM Plate 348/65 and stereo plates 346+347/65.

Derivation of name: *delftensis* = originating from Delft.

Type locality: NAM deep well Delft 2, Netherlands.

Level: Albian.

Diagnosis and description: Elongate hexagonal zygooliths with a central bar in den direction of the main axis, from which several oblique lateral bars are extending to the rim. The elongate bar is perforated in its centre. The short lateral bars are lying in different levels as can be seen in stereo micrographs.

Remarks: Related to *Zygoolithus rhombicus* and to *Zygoolithus geometricus* GORKA. It can be assumed that the complete coccosphere was spindle-shaped and that the zygooliths on it were arranged in an elongate quincunx pattern.

Size of holotype: Length 2.4 µm, width 1.2 µm.

Comments:

Stratigraphic distribution: Tithonian? to Albian.

Genus: *Rhombolithion* BLACK, 1973

Rhombolithion rhombicum (STRADNER) BLACK, 1973 (= *Zygoolithus rhombicus* STRADNER & ADAMIKER, 1966, p. 339, Pl. 2, Fig. 1, Text-Figs. 5–7)

**Original description of *Zygoolithus rhombicus*
STRADNER & ADAMIKER, 1966**

Holotypus: Stereo-Platten Nr. 895/896/65, 9.800 fach.

Paratypus: Stereo-Platten Nr. 823/824/65, 9.300 fach.

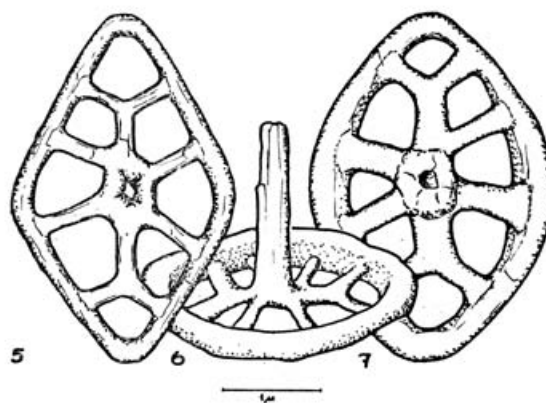
Derivatio nominis: *rhombos* (griech.) = Raute.

Locus typicus: Tiefbohrung Delft 2 (NAM), Niederlande.

Stratum typicum: Albium.

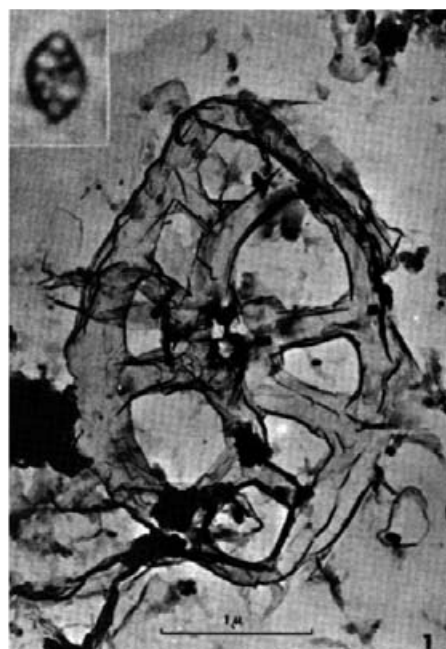
Diagnose: Zygoolithen mit rautenförmigem Umriss und einem den Binnenraum unterteilenden Stegsystem, welches acht annähernd gleichgroße Fenster freilässt. Der in der Längsachse liegende Steg ist an seinen Enden gegabelt. Von ihm zweigen zu beiden Seiten je vier Seitenstege ab. Der Rand besteht aus flach übereinanderliegenden länglichen Kristallplatten. Von der Mitte des Zygoolithen kann, ähnlich wie bei *Zygoolithus erectus* DEFLANDRE & FERT, ein in distaler Richtung sich etwas verjüngendes, röhrenförmiges Gebilde absteigen. Falls dieses nicht ausgebildet oder zerstört ist, kann eine zentrale Pore erkennbar sein.

Größe des Holotypus: 3,2 µm lang, 2,2 µm breit.



Text-Fig. 86a.
Original drawing of *Zygoolithus rhombicus*.

Anmerkung: Die Stege können wie bei vielen anderen Zygoolithen-Arten als Verschmelzungsprodukte von Bogenelementen angesehen werden. Diese Art unterscheidet sich von der Gattung *Dictyolithus* GORKA durch ihren streng zygomorphen Bau und eine geringere Porezahl.



Text-Fig. 86b.
TEM micrograph of holotype and syntype in phase contrast.

English translation:

Holotyp: TEM Plate no. 895/896/65.

Paratype: TEM Plate no.823/824/65.

Derivation of name: *rhombus* (Gr.) = rhombus.

Type locality: NAM deep well Delft 2, Netherlands.

Level: Albian.

Diagnosis and description: Zygooliths with rhombical or rounded rhombical outline and a central knob or rod pointing in distal direction, similar to *Zygoolithus erectus* DEFLANDRE & FERT. This central structure is connected with the delicate rim by a system of bars, which radiate from the centre. Two stronger bars or ribs are aligned along the main axis and bifurcated, four other non-bifurcated shorter bars are spreading laterally towards the rim, two on each side. They are bypassing the shorter axis of the zygoolith.

A central pore can be seen in some specimens. The rim is composed of calcite laminae.

Remark: This zygolith differs from those of the Genus *Dic-tyolithus* GORKA by its strictly zymorphic outline and its lesser number of windows.

Comments:

Stratigraphic distribution: Oxfordian to Tithonian, and from Albian to Campanian.

Incertae sedis

Genus: *Liliasterites* STRADNER & STEINMETZ, 1984, P. 594

Type species: *Liliasterites angularis* SVABENICKA & STRADNER in STRADNER & STEINMETZ p. 594, Pl. 24, Figs. 1–4, Text-Fig. 6A

Original description of *Liliasterites*

Derivation of name: The six rays of this nannofossil alternate in two levels, reminiscent of the three petals and three sepals in the flower of a lily (latin *Lilium*).

Remarks: This Genus comprises six-rayed, star-shaped, flat, calcareous nannofossils, composed of angular elements. In better-preserved specimens, sutures can be observed. Two levels of rays – that is rays 1, 3, and 5 in the upper level and rays 2, 4, and 6 in the lower level, with the intervals between the rays alternately wide and narrow – give these forms a close similarity to *Marthasterites contortus*. They differ from *Marthasterites* by the presence of sutures. Also, disintegrated angular elements throw light on the composition of *Liliasterites*, which possibly is an ancestor of the Genus *Marthasterites*.

Original description of *Liliasterites angularis* SVABENICKA & STRADNER, 1984

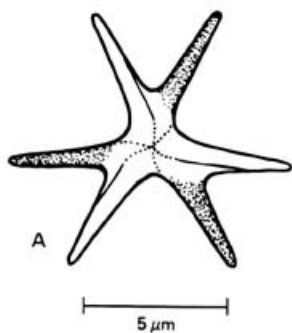
Holotype: Plate 24 in STRADNER & STEINMETZ, 1984, Fig. 1; Paratypes: Plate 24, Figs. 2–4

Derivation of name: *angularis* (Lat.) = angular.

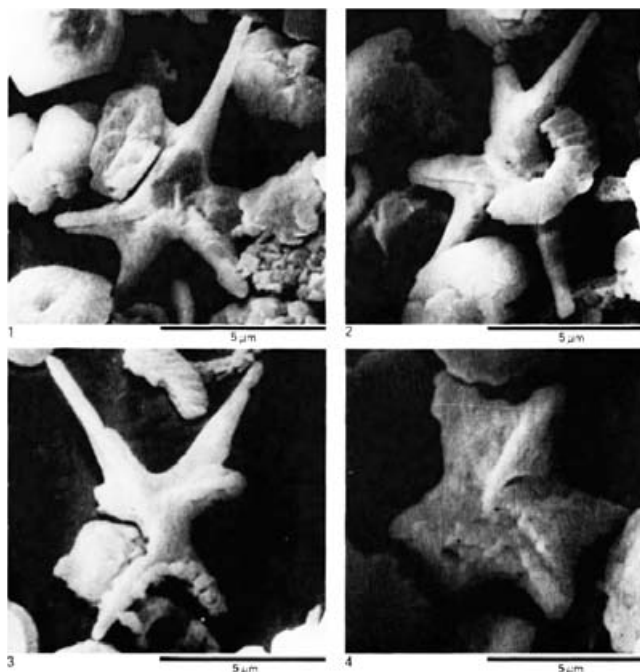
Type locality: Right bank of the Ohre river, S. of Kystra vilage, CSSR.

Level: Upper Turonian

Remarks: A species of *Liliasterites* with six tapering, pointed rays. In the central area three-rayed symmetry dominates. Two neighboring rays, each in a different level, are separated by a suture line, which indicates that the nannofossil is composed of angular elements (hence the species epithet “angularis”).



Text-Fig. 87a.
Original drawing of *Liliasterites angularis*.



Text-Fig. 87b.
SEM images of holotype (1) and syntypes (2–4).

Size: Diameter of holotype 12 µm, length of free ray 4 µm.

Another occurrence in the Angola Basin, South Atlantic: DSDP Sample 530A-95-1, 107–108 cm. Late Turonian.

Discussion: *Liliasterites angularis* together with *L. atlanticus* are considered evolutionary steps in a line which leads to the Genus *Marthasterites*. *L. angularis* marks with its first occurrence the lower boundary of the new late Turonian nan-noplankton zone bearing its name. In Bohemia, *L. angularis* is a rare species in a late Turonian nannoflora without *Marthasterites furcatus* and without *Micula staurophora*. The layer in which it is found is between 3 and 4 m below the so-called coprolite horizon, which marks the upper boundary of the Jizera Formation to the overlying Teplice Formation. A detailed description of these two formations is to be found in CECH et al. (1980, pp. 286–291). A diagrammatic section of the lower Teplice Formation and the upper Jizera Formation at Kystra is shown in Fig. 9 of that paper. The Kystra samples with *L. angularis* are a deep-grey, calcareous clay stone with silty admixture and biodeutral streaks. The vilage of Kystra lies near Louny in the western part of the Bohemian Cretaceous Basin. The exposure is 150 m long and 20 m high, on the right bank of the Ohre river south of Kystra. In KRHOVSKY (1981, p. 2.1) SVABENICKA has reported on the occurrence of *Marthasterites furcatus* in the coprolite layer of Kystra (lowest occurrence) and at 0.55 and 2.5 m above the coprolite layer. This indicates that the coprolite layer at Kystra corresponds to the base of the *M. furcatus* nanoplankton zone, which is considered the base of the Coniacian (sensu CEPEK & HAY, 1969, emend. PERCH-NIELSEN, 1977). In Bohemia, the correlation between *Inocerami* and *M. furcatus* at the Turonian/Coniacian boundary by KRHOVSKY (1981) has shown the importance of more detailed biostratigraphic work being done at the new standard Turonian and Coniacian stratotypes. KRHOVSKY concludes that in the Cretaceous of Bohemia the Turonian/Coniacian boundary is to run along the IX–X Formations contact in the upper Jizera Formation, provided that *M. furcatus* is proven at the Coniacian stratotype. The *Inoceramus*

schloenbachi – *L. inconstans* group would thus be of Coniacian age. Possibly the distinction between the genera *Liliasterites* and *Marthasterites* in the critical boundary layers will provide means for a more detailed zonation.

Comments:

Stratigraphic distribution: Middle to Upper Turonian.

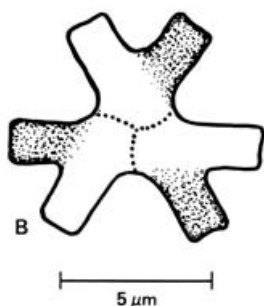
**Original description of *Liliasterites atlanticus*
STRADNER & STEINMETZ, 1984**

Holotypes: Plate 23, Fig. 5 (holotype); Plate 22, Fig. 7, Plate 23, Figs. 2 and 4 (paratypes).

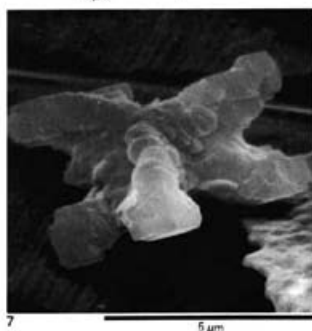
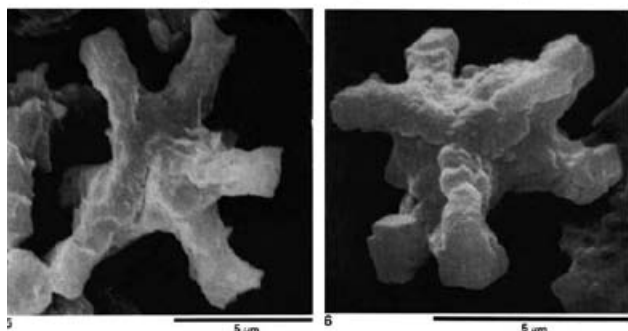
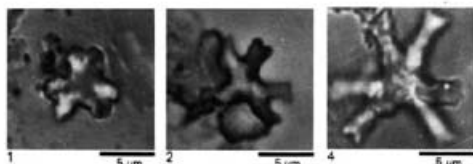
Derivation of name: *atlanticus* = from the Atlantic Ocean.

Type locality: South Atlantic (Angola Basin), DSDP Sample 530A-95-1, 107–108 cm.

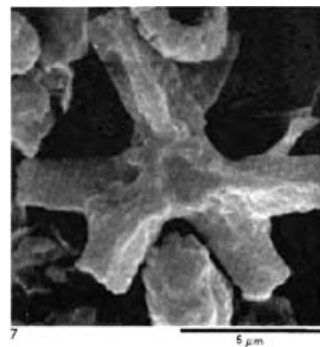
Level: Upper Turonian.



Text-Fig. 88a.
Original drawing of *Liliasterites atlanticus*.



Text-Fig. 88b.
Syntypes in normal light (1, 2, 4). SEM images of holotype (5) and syntypes (6, 7).



Text-Fig. 88c.
SEM image of paratype.

Description: A species of *Liliasterites* with broad, truncated rays, the ends of which are either notched or block-shaped. Three alternating rays with angles of 120 degrees between them in one level are offset against the other three rays by about 60 degrees, so that three bundles of two alternating arms result.

Comments:

Stratigraphic distribution: Upper Turonian.

Genus: *Ceratolithoides* BRAMLETTE & MARTINI, 1964

Ceratolithoides aculeus (STRADNER) PRINS & SISSINGH in SISSINGH, 1977 (= *Zygrhablithus aculeus* STRADNER, 1961, p. 82, Text-Figs. 53–57)

**Original description of *Zygrhablithus aculeus*
STRADNER, 1961**

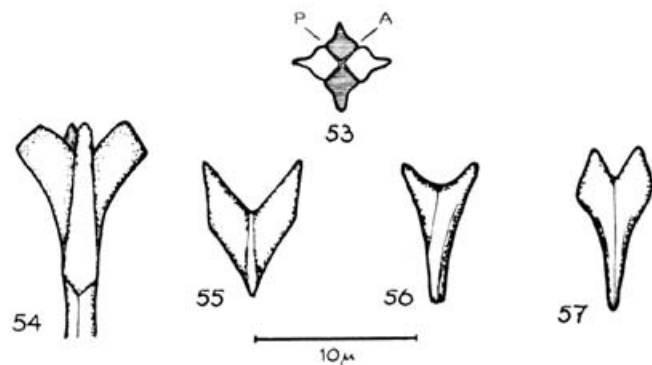
Holotypus: GBA 2009/058/0036.

Derivatio nominis: *aculeus* (Lat.) = Spitze.

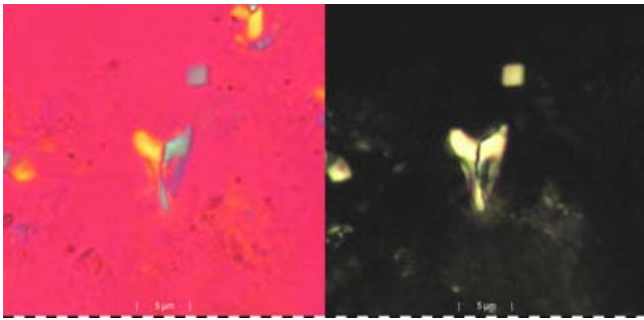
Locus typicus: Steinbruch östlich der Straße NW Hochbruckenberg, Wienerwaldflysch, Niederösterreich. Mäßig häufig.

Stratum typicum: Senon im weiteren Sinne.

Beschreibung: Ein *Zygrhablithus*, dessen distaler, tetralithischer Fortsatz spitzig ist und flügelartige Enden hat. Letztere schließen im Gegensatz zu *Zygrhablithus intercicus* DEFLENDRE einen spitzen Winkel ein. Die Facies distalis des Fortsatzes entspricht in ihrem polarisationsoptischen Verhalten weitgehend der von *Tetralithus pyramidus* GARDET. Vollständige Exemplare (Placolithischer + tetralithischer Teil) konnten noch nicht gefunden werden.



Text-Fig. 89a.
Original drawings of *Zygrhablithus aculeus*.



Text-Fig. 89b.
Lectotype in polarized light.

Größe: 8–10 µm.

English translation:

Holotype: GBA 2009/058/0036.

Derivation of name: *aculeus* (Lat.) = tip.

Type locality: Vienna Woods, BRIX Stat. 86, quarry NW Hochbruckenbergr.

Level: Upper Cretaceous.

Description: Presumably distal tips of zygrabliths occurring separately and behaving in polarized light like tiny tetraliths of *Tetralithus pyramidus* GARDET, in lateral view they resemble arrow tips. No complete specimens (Placolith + tetralithic tip) could be found yet.

Size: Length 8–10 µm.

Comments:

Stratigraphic distribution: Campanian to Maastrichtian.

Family: Polycyclolithaceae FORCHHEIMER, 1972 emend. VAROL, 1992

Genus: *Lithastrinus* STRADNER, 1962, p. 369

Type species: *Lithastrinus grillii* STRADNER 1962, p. 369, Pl. 2, Figs. 1–5.

Original description of *Lithastrinus* Stradner 1962

Derivatio nominis: Wortzusammensetzung aus den griechischen Hauptwörtern *lithos* = Stein und *astron* = Stern.

Von fossilen Kalkflagellaten herrührende Gehäuseelemente von 6- bis 9-strahligem radiärem Aufbau, in der Hauptebene stark eingeschnürt. Die 6–9 Sektoren, welche sich polarisationsoptisch ähnlich wie die Einzelteile der Pentolithen von Braarudosphaeriden verhalten, sind durch links-gängig-schraubige Verbindungsflächen miteinander vereinigt, wodurch sie in Bezug zur Richtung der Hauptachse schräg zu liegen kommen. Die sternförmig zusammenlaufenden Verbindungsflächen (Unterteilungslinien) weichen auf halbem Wege zwischen Außenbegrenzung des Kalkkörperchens und Hauptachse (Mittellinie) etwas auseinander (Aussparungen). Die peripher abstehenden Enden der Sektoren können spitz und gebogen (*Lithastrinus grillii*) oder gerundet (*Lithastrinus floralis*) sein und liegen in zwei zur Hauptebene parallelen Ebenen (Flachseiten). Durch die starke Verwindung der Einzelsektoren kommen die beiden in verschiedenen Ebenen liegenden abstehenden Enden eines Sektors jeweils über oder unter das Ende eines Nachbarsektors zu liegen. Dies bewirkt beim Heben und

Senken des Immersionsobjektives ein Rotieren des Zentrums und ein Umspringen des Bildes der Randpartien des Nannofossils, da ja die in verschiedenen Schärfeebenen liegenden Flachseiten aus den peripher abstehenden Enden schraubig gedrehter Sektoren gebildet werden.

English translation:

Derivation of name: word combination of *lithos* (Gr.) = stone and *astron* (Gr.) = star.

Star-shaped bodies derived from cretaceous calcareous flagellates. Number of sectors 6–9, which behave similar to the sectors of the Braarudosphaerids on behalf of their optical orientation. The sectors are united by oblique planes in a left-coiling way, thus giving the fossil a twisting appearance when the optical focus is changed. The two tips of each sector point in centrifugal direction and cause the two levels of the star-shaped fossil. In the generotype *Lithastrinus grillii* the sectors of the star are slightly curved and pointed, in *Lithastrinus floralis* they are short and rounded. In *Lithastrinus grillii* the upper rays of the star overlap the rays underneath, which are shifted 60 degrees. Near the centre the sutures widen to little pores.

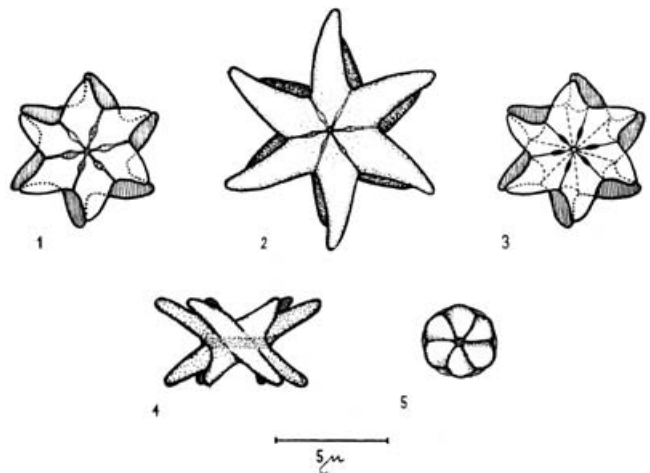
Original description of *Lithastrinus grillii* STRADNER, 1962

Holotypus: GBA 2009/058/0043/1.

Derivatio nominis: Herrn Chefgeologen Dr. Rudolf GRILL, Geologische Bundesanstalt Wien, Erdölabteilung, in Dankbarkeit zugeeignet.

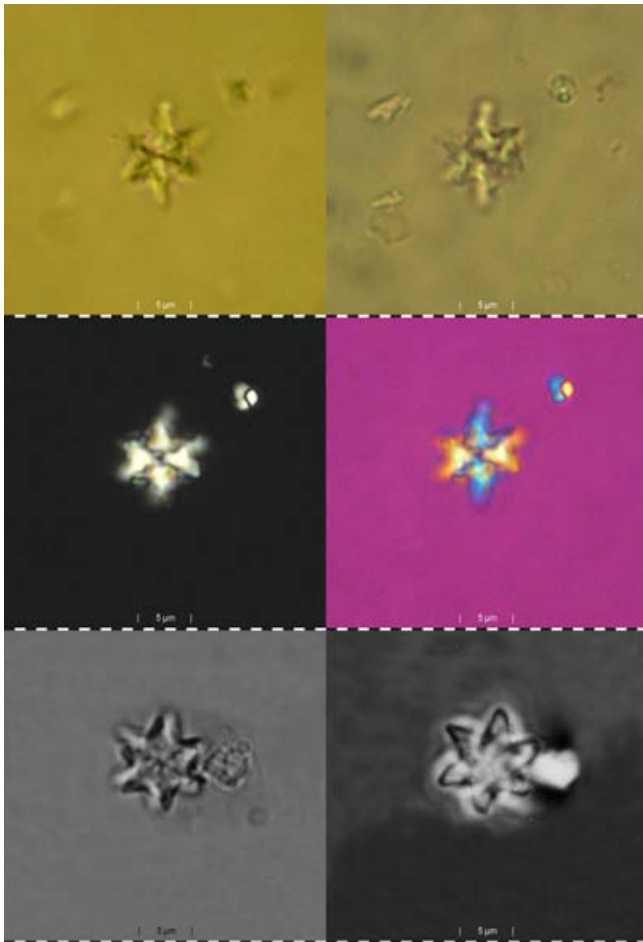
Locus typicus: Graben nordwestlich Klafterbrunn, 1 km westlich Bildstock 407, Niederösterreich (GRILL, 1953, S. 77).

Stratum typicum: Klementer Schichten (Höheres Turon – Emscher).



Text-Fig. 90a.
Original drawings of *Lithastrinus grillii*.

Diagnose und Beschreibung: Sternförmige Kalkkörperchen aus 6 stark gedrehten, gegabelten, sich überdachenden Sektoren bestehend. Bei Änderung der Schärfeebene können zwei verschieden orientierte sternförmige Umrissbilder eingestellt werden, von denen das jeweils höher liegende in zentrifugaler Richtung nach rechts gebogene Spitzen zeigt. In der Seitenansicht (Taf. II, Fig. 4) ist die starke Einschnürung des Kalkkörperchens in der Hauptebene zu sehen. Die Durchmesser der beiden sternförmigen



Text-Fig. 90b.
Syntypes in normal light, polarized light and phase contrast at different focus levels of *Lithastrinus grillii*.

migen Flachseiten sind besonders bei großen Exemplaren verschieden. Es ist anzunehmen, dass die größere Flachseite in Bezug zur Lage des Zellkernes des Kalkflagellaten in distaler Richtung orientiert war. Die Sektoren lassen an den Unterteilungsflächen auf halber Strecke zwischen dem sehr feinen Zentralkanal und dem Außenrand schwache Aussparungen erkennen, welche wegen der starken Schräglage der Sektoren jedoch nicht als Fenster erscheinen. Selten.

Dimensionen: Durchmesser 7–11 µm, Höhe 3–5 µm.

Beziehungen: *Lithastrinus grillii* ist wegen der polarisationsoptischen Eigenschaften seiner Sektoren, die sich wie Einzelkristalle verhalten, in die engere Verwandtschaft der Familie der Braarudosphaeriden zu stellen. Ob auch Beziehungen zu den aus dem Paleozän beschriebenen Gattungen *Heliolithus* BRAMLETTE und *Fasciculithus* BRAMLETTE und SULLIVAN bestehen, ist noch ungeklärt.

Bemerkungen: Für die Untersuchung dieses Nannofossiles eignet sich positive und negative Phasenkontrastbeleuchtung (Anoptral-Kontrast) in besonderem Maße.

English translation:

Holotype: GBA 2009/058/0043/1

Derivation of name: Thankfully dedicated to Dr. Rudolf GRILL, chief geologist at the Geological Survey of Austria

Type locality: NW Klafferbrunn, Lower Austria.

Level: Klement Beds, Upper Turonian – Emscherian.

Diagnosis and description: Star-shaped calcareous bodies consisting of six curved overlapping sectors, which are joined in such a way that their rays are offset by 60 degrees. In plan view they seem to consist of two different stars, the upper one twisted counterclockwise, the one below it twisted clockwise, depending on the focus level of the microscope. In side view the waist of the calcareous body looks laced. In larger specimens one of the stars, the distal one (?) can be wider than the other one. The suture lines embrace a tiny central pore and also between themselves oval pores at a certain distance from the centre.

Relations: Closely related to *Lithastrinus floralis*, but evidently not to the tertiary Genus *Discoaster*. Relation to the genera *Braarudosphaera* and *Hexalithus* are uncertain.

Size: 7–11 µm in diameter, 3–5 µm in height.

Comments:

Taxonomic status: Corrected name: *L. grillii*.

Stratigraphic distribution: Coniacian to Campanian.

Genus: *Eprolithus* STOVER, 1966

Eprolithus floralis (STRADNER) STOVER, 1966 (= *Lithastrinus floralis* STRADNER, 1962, p. 370, Pl. 2, Figs. 6–11)

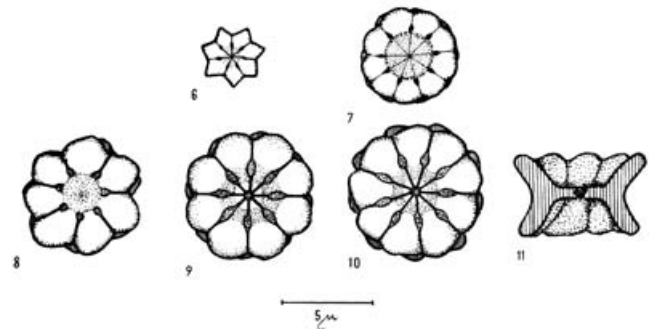
Original description of *Lithastrinus floralis* STRADNER, 1962

Holotypus: GBA 2009/058/0042.

Derivatio nominis: *flos* (Lat.) = Blüte, Blume.

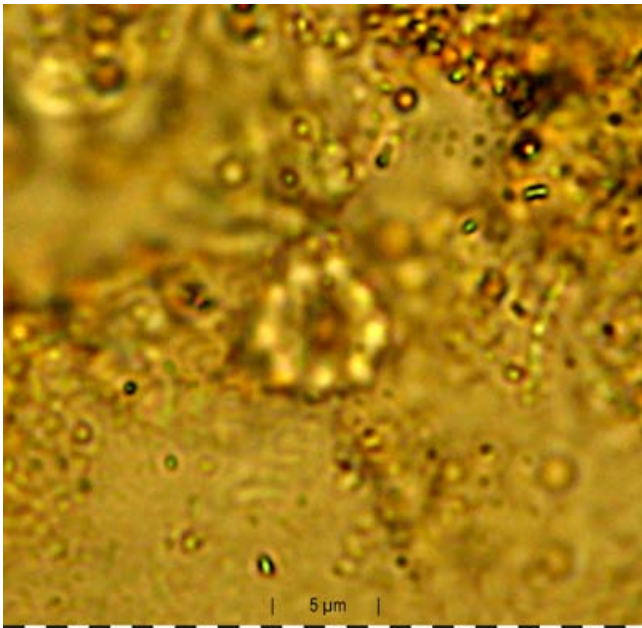
Locus typicus: Haidberg, Hohlweg von P. 387 NE gegen Falkenstein, großer Hangrutsch knapp NE des angeführten Punktes (R. Grill 4557/1/510), Niederösterreich.

Stratum typicum: Höheres Senon.



Text-Fig. 91a.
Original drawings of *Lithastrinus floralis*.

Diagnose und Beschreibung: Kalkkörperchen bestehend aus 7–9 gegabelten Sektoren, welche so zusammengesetzt sind, dass sie in der Flachansicht zwei sich überdeckende und zueinander linksgängig-schraubig verstellte rosettenförmige „Blütenbilder“ ergeben. Die Flachansichten (Taf. II, Fig. 7–10) zeigen, dass die Sektoren etwa auf der halben Strecke zwischen der Zentralachse und der Peripherie des Kalkkörperchens beiderseits Aussparungen haben, wodurch eine den Sektoren entsprechende Anzahl von Fenstern freibleibt. Die meist gerundeten oder stumpfen distalen Enden eines Sektors stehen, wie dem Schnittbild Taf. II, Fig. 11 zu entnehmen ist, weit voneinander ab



Text-Fig. 91b.
Holotype in normal light.

und geben so zur Bildung von zwei konkaven Flachseiten Anlass. Ein kurzer Zentralkanal durchdringt die Mittelwand des Kalkkörperchens und verbindet so die beiden hohlen Flachseiten.

Dimensionen: Durchmesser 3,5–8 µm, Höhe 2,5–5 µm.

Weitere Vorkommen: Im Gegensatz zum seltenen *Lithastrinus grilli* konnte *Lithastrinus floralis* auch in zahlreichen Turonium-Vorkommen anderer Länder (Böhmen, Deutschland, Holland, Polen) nachgewiesen werden. Stellenweise häufig.

Beziehungen: Für *Lithastrinus floralis* als nächsten Verwandten von *Lithastrinus grilli* sind die gleichen systematischen Beziehungen, wie dort besprochen, anzunehmen.

English translation:

Holotype: GBA 2009/058/0042.

Derivation of name: *flos* (Lat.) = flower.

Type locality: Haidberg S Falkenstein, Lower Austria.

Level: Upper Senonian.

Diagnosis and description: Calcareous bodies composed of 7 to 9 forked and twisted elements in such a way that they form a flower-shaped face on the basal as well as on the upper side. The twist of the sectorial elements is sinistrotrogyr. The sutures between the sectors leave a tiny central pore open. At a certain distance towards the periphery of the "flower" a circle of oval pores is imitating a ring of stamina. Upper and lower face are concave and connected by the central pore.

Relations: *Lithastrinus floralis* n. sp. is closely related to *Lithastrinus grillii* and possibly also to other genera mentioned there.

Size: 10–15 µm.

Comments:

Stratigraphic distribution: Aptian to Santonian.

Genus: *Tegulalithus* CRUX, 1986

Tegulalithus septentrionalis (STRADNER) CRUX, 1986 (= *Lithastrinus septentrionalis* STRADNER, 1963, p. 11, Pl. 2, Text-Figs. 7-7a)

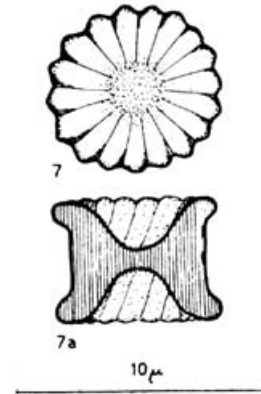
Original description of *Lithastrinus septentrionalis* STRADNER, 1963

Holotype: GBA 2009/058/0055.

Derivation of name: *septentrionalis* (Lat.) = northerly.

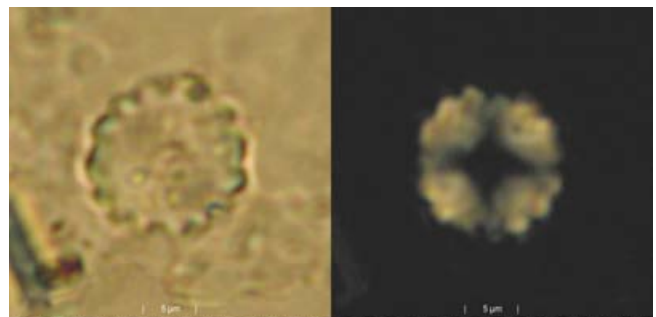
Type locality: Nordhorn Nord 11, Germany.

Level: Upper Hauterivian.



Text-Fig. 92a.
Original drawing of *Lithastrinus septentrionalis*.

Coccoliths in plan-view rosette-shaped, circular, in side-view (cross-section) resembling a time-glass. Number of the twisted sectors 15–20 as compared to *Lithastrinus floralis* STRADNER with usually 9 sectors.



Text-Fig. 92b.
Holotype in normal and polarized light.

Comments:

Stratigraphic distribution: Hauterivian.

Tegulalithus tessellatus (STRADNER, ADAMIKER & MARESCH) CRUX, 1986 (= *Lithastrinus tessellatus* STRADNER in STRADNER et al., 1968, p. 43, Pls. 43, 44, Text-Figs. 7/1, 7/2)

Original description of *Lithastrinus tessellatus* STRADNER in STRADNER et al., 1968

Holotype: Electron micrograph 17 223.

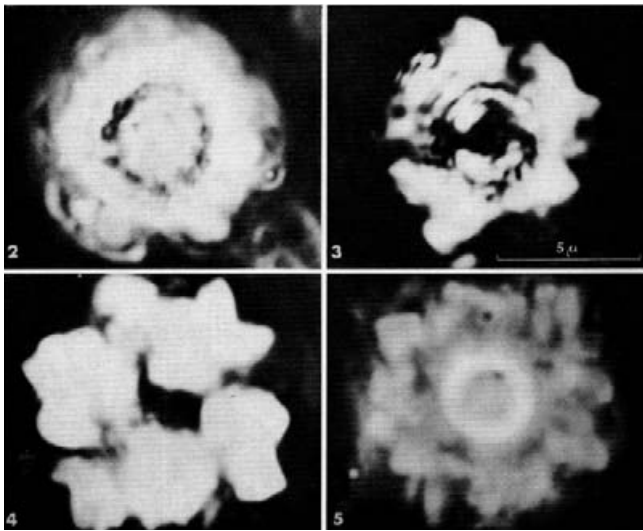
Paratype: Electron micrograph 17 376.

Derivation of name: *tessellatus* (Lat.) = tessellated.

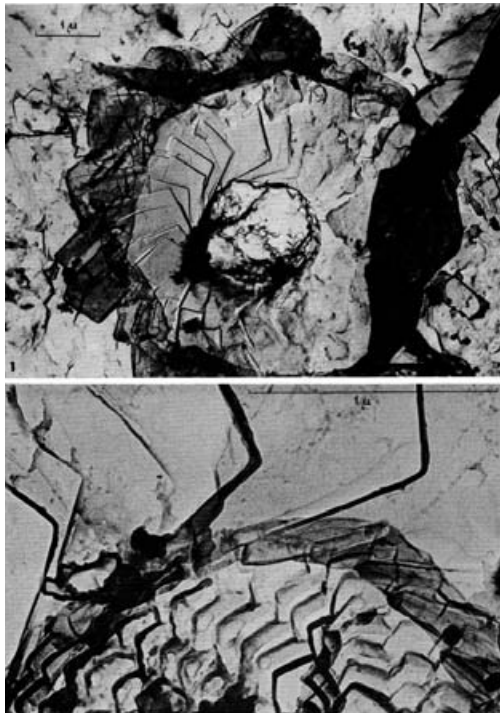
Type locality: Netherlands, deep well Delft 2.

Level: Albian.

Diagnosis and description: Circular coccoliths in shape of a flat spool, composed of very numerous superimposed crystal slabs of rhombohedral design. The crystal plates



Text-Fig. 93a.
Syntypes of *Lithastrinus tessellatus* in phase contrast and polarized light.



Text-Fig. 93b.
TEM micrographs of holotype and paratype.

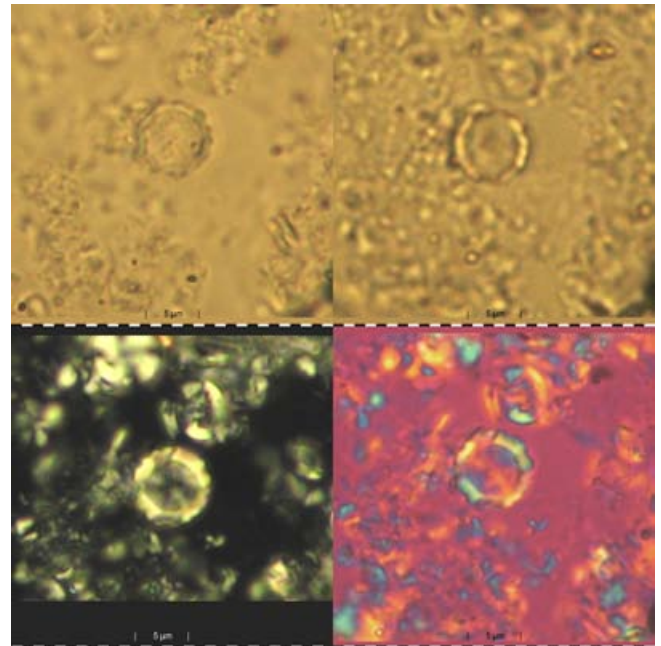
which form the upper and lower rim of the spool are larger than those of the constricted middle part of it. A regular tessellated or mosaic-like pattern is formed inside the concave cavities on either side of the coccolith. The inner parts of crystal slabs are arranged there in slanting rows and after shadowing with heavy metal they show serrate margin lines.

Size: Diameter of holotype 8 μm, of paratype 7 μm.

Dicussion: *Lithastrinus tessellatus* seems closely related to *Lithastrinus septentrionalis* STRADNER, as far as can be judged from comparisons with the optical microscope. The latter species however has a more regular outline and the crystal elements of the rims can be more clearly recognized there.

Comments:

Stratigraphic distribution: Albian.



Text-Fig. 93c.
Syntypes in normal and polarized light.

Genus: *Micula* VEKSHINA, 1959

Micula swastica (sensu PRINS, 1977) STRADNER & STEINMETZ, 1984, p. 595, Pl. 31, Figs. 3, 5, 6

**Original description of *Micula swastica*
STRADNER & STEINMETZ, 1984**

Holotype: Plate 31, Fig. 6.

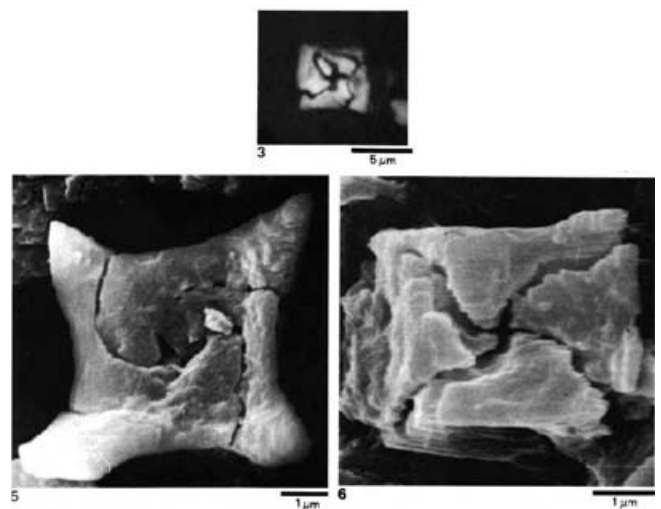
Paratype: Plate 31, Fig. 3 in STRADNER & STEINMETZ, 1984.

Derivation of name: In ancient India a “swastica” was a kind of cross emblematic for the sun.

Type location: DSDP Sample 530A-50-2, 13–14 cm (South Atlantic, Angola Basin).

Level: Upper Maastrichtian, at the Cretaceous/Tertiary boundary.

Diagnosis and Description: Cube-shaped calcareous bodies composed of two layers, each consisting of four hook-



Text-Fig. 94.
SEM images of holotype (6) and syntype (5) of *Micula swastica*; paratype in polarized light(3).

shaped elements combined in such a way that the suture lines on two opposing faces of the cube form a “swastica”.
 Remarks: In November 1977, B. PRINS demonstrated the evolutionary trends from *Eprolithus* STOVER to *Micula* VEKSHINA at a meeting on mid-Cretaceous nannofossils in The Hague, Netherlands. In his lectures he applied the new name “*Micula swastica*” to those types of *Micula* which show crooked suture lines and which finally evolved into *M. murus* and *M. prinsii*. As far as we know, this new name has not yet appeared in print. At Hole 530A such types, which fit into the pictorial definitions of *M. swastica* and *M. cf. swastica* sensu PRINS (1977) are described as follows:

Reference: PRINS (1977): Meeting on mid-Cretaceous Nannofossil. Working papers, chapter on *Micula*, Pl. 9, Figs. 4, 6; Pl. 10, figs, laic. CRUX 1982, p. 99.

Comments:

Stratigraphic distribution: ?Coniacian to Maastrichtian.

Micula concava (STRADNER) VERBEEK, 1976 (= *Nannotetraster concavus* STRADNER in MARTINI & STRADNER, 1960, p. 269, Figs. 18a-d

Original description of *Nannotetraster concavus* STRADNER, 1960

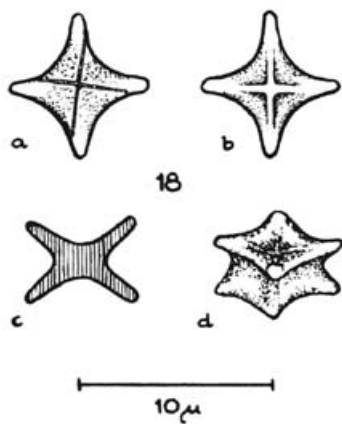
Holotypus: GBA 2009/058/0019.

Paratypus: WA 01/F.

Derivation of name: *concavus* (Lat.) = ausgehöhlt.

Locus typicus: Waidach, Haunsberg, Salzburg, Österreich.

Stratum typicum: Obere Kreide (Senon).



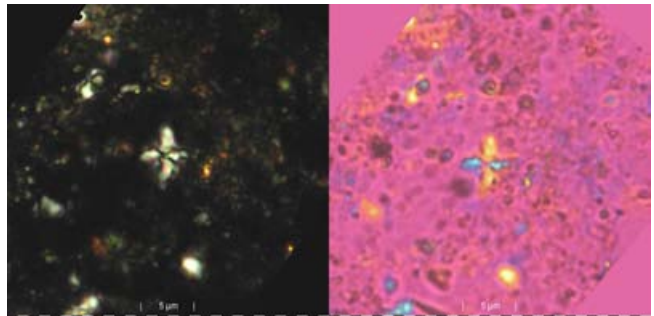
Text-Fig. 95a.
 Original drawings of *Nannotetraster concavus*.

Diagnose: Ein kleinwüchsiger Nannotetraster mit konkav gewölbten Reliefseiten und kurzen Strahlen, die nicht in der Hauptebene, sondern in der Richtung der Sagittalachsen gegabelt sind.

Beschreibung: Dieser kleine Nannotetraster, der in Bezug auf seine geringen Dimensionen nur von *Nannotetraster staurophorus* (GARDET) MARTINI & STRADNER unterboten wird, ändert beim Wenden in flüssigem Einschlußmedium scheinbar nie seine Umrissform. Dies kommt davon, dass alle sechs Seiten dieses winzigen Kalkkörperchens eingedellt sind. Das Reliefkreuz der Facies inferior liegt also im Gegensatz zu allen bisher gefundenen Nannotetrastern in einer Mulde ebenso wie die Unterteilungslinien der Facies superior.

Größe: 5–7 µm.

Beziehungen: *Nannotetraster concavus* hat mit *Nannotetraster staurophorus* (GARDET) MARTINI & STRADNER nicht nur das oberkretazische Alter gemeinsam, sondern ist auch mit letzterer Art größenordnungsmäßig vergleichbar.



Text-Fig. 95b.
 Syntype in polarized and normal light.

English translation:

Nannotetraster concavus STRADNER 1960 in MARTINI & STRADNER, 1960

Holotype: GBA 2009/058/0019.

Derivation of name: *concavus* (Lat.) = concave.

Type locality: Waidach, Haunsberg, Salzburg, Austria.

Level: Upper Cretaceous.

Description: Minute calcareous nannofossils showing a slender rhombical outline, which is repeatedly showing up when the object is revolving in liquid embalming medium. This phenomenon results from the fact, that *Nannotetraster concavus* resembles a dice with all six sides pressed in towards the centre. The four sectors are forked in the direction of the main axis thus producing two spines each.

Size: 5–7 µm.

Relations: Closely related to *Nannotetraster staurophorus* (GARDET) STRADNER & MARTINI.

Comments:

Stratigraphic distribution: Santonian to Maastrichtian.

Micula quadrata (STRADNER, 1961) PERCH-NIELSEN, 1984 (= *Tetralithus quadratus* Stradner, 1961, p. 86, Fig. 92)

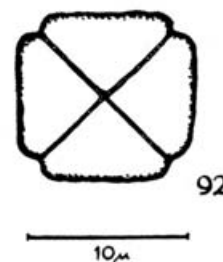
Original description of *Tetralithus quadratus* STRADNER, 1961

Holotypus: GBA 2009/058/0035.

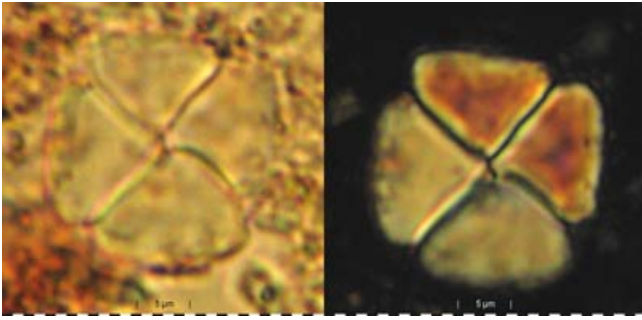
Derivatio nominis: *quadratus* (Lat.) = viereckig, quadratisch.

Locus typicus: Eitelgraben, Salzburg. Selten.

Stratum typicum: Paläozän.



Text-Fig. 96a.
 Original drawing of *Tetralithus quadratus*.



Text-Fig. 96b.
Holotype of *Tetralithus quadratus* in normal and polarized light.

Ein Tetralith, dessen Umfang annähernd quadratisch ist und dessen Unterteilungslinien in der Richtung der Diagonalen des Quadrates liegen. Die Ecken des Quadrates sind ausgespart. Polarisationsoptisches Verhalten so wie von *Tetralithus pyramidus* GARDET.

Größe: 8–12 µm.

English translation:

Holotype: GBA 2009/058/0035.

Derivation of name: *quadratus* (Lat.) = square; quadratic.

Type locality: Eitelgraben, Untersberg, Salzburg.

Level: Paleocene.

Tetraliths with roughly quadratic circumference, with the corners of the square left out, with sutures in the direction of the diagonals pointing to the missing corners. In other words: Tetraliths consisting of four triangular prismatic parts, which are joined together with their right-angled sides, the hypotenuses forming the circumference. Related to *Tetralithus pyramidus* GARDET.

Size: 8–12µm.

Comments:

Stratigraphic distribution: Santonian to Maastrichtian, probably reworked in Paleocene.

Family: Microrhabdulaceae DEFLANDRE, 1963

Genus: Microrhabdulus DEFLANDRE, 1959

Microrhabdulus constrictus STRADNER, 1963, p. 11, Pl. 4, Fig. 16

Original description of *Microrhabdulus constrictus* STRADNER, 1963

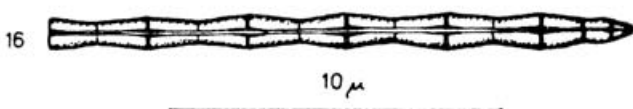
Holotype: GBA 2009/058/0057.

Derivation of name: *constrictus* (Lat.) = tied.

Type locality: Hallembaye, (S. A. Les Ciments Liégeois), Smectique (gray marl), Netherlands.

Level: Campanian.

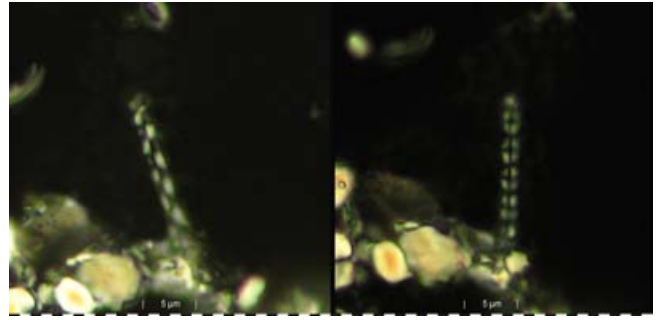
Diagnosis and description: Rod-shaped nannofossils with slight constrictions at intervals about twice their diameters. Central canal very narrow.



Text-Fig. 97a.
Original drawing of *Microrhabdulus constrictus*.

Comments:

Taxonomic status: The irregular outline of this *Microrhabdulus* species may be the result from diagenesis. Probably a superfluous taxon.



Text-Fig. 97b.
Syntypes in polarized light at different orientation.

Microrhabdulus nodosus STRADNER, 1963, p. 11, Pl. 4, Fig. 13

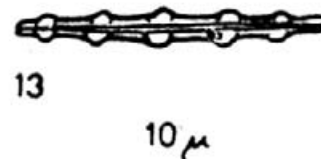
Original description of *Microrhabdulus nodosus* STRADNER, 1963

Holotype: GBA 2009/058/0058.

Derivation of name: *nodosus* (Lat.) = knotty.

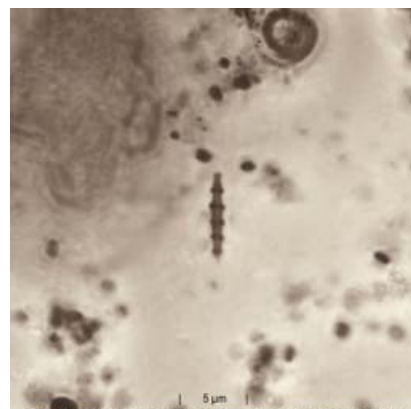
Type location: Deep well Ameis 1 (ÖMV) Lower Austria.

Level: Turonian.



Text-Fig. 98a.
Original drawing of *Microrhabdulus nodosus*.

Diagnosis and description: Rod-shaped nannofossils with knotty thickenings at certain intervals of their lengths. Central canal very narrow.



Text-Fig. 98b.
Holotype in phase contrast.

Comments:

Taxonomic status: *Microrhabdulus nodosus* STRADNER is a junior synonym of *Microrhabdulus belgicus* HAY & TOWE, 1963.

Stratigraphic distribution: Cenomanian to Maastrichtian.

Family: *Nannoconaceae* DEFLANDRE, 1959

Genus: *Nannoconus* KAMPTNER 1931, p. 289

**Original description of *Nannoconus abundans*
STRADNER & GRÜN, 1973**

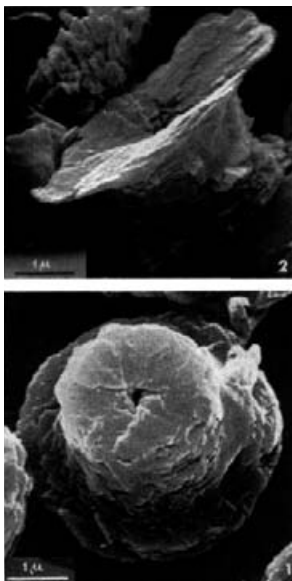
Holotype: Electron micrograph 71.234/9 – Pl. 3, Fig. 2.
Paratypes: Electron micrograph Nr. 71.95/2 – Pl. 1, Fig. 1 (paratype A). Nr. 71.95/3 – Pl. 1, Fig. 2 (paratype A). Pl. 6, Figs. 1–3 (paratype B).

Derivation of name: *abundans* (Lat.) = abundant (number of laminae).

Type locality: Schacht Konrad I, near Salzgitter, Germany, at 673 m.

Level: Lower Cretaceous, Lower Barremian.

Diagnosis: A unicellular flagellate forming a sphere con-

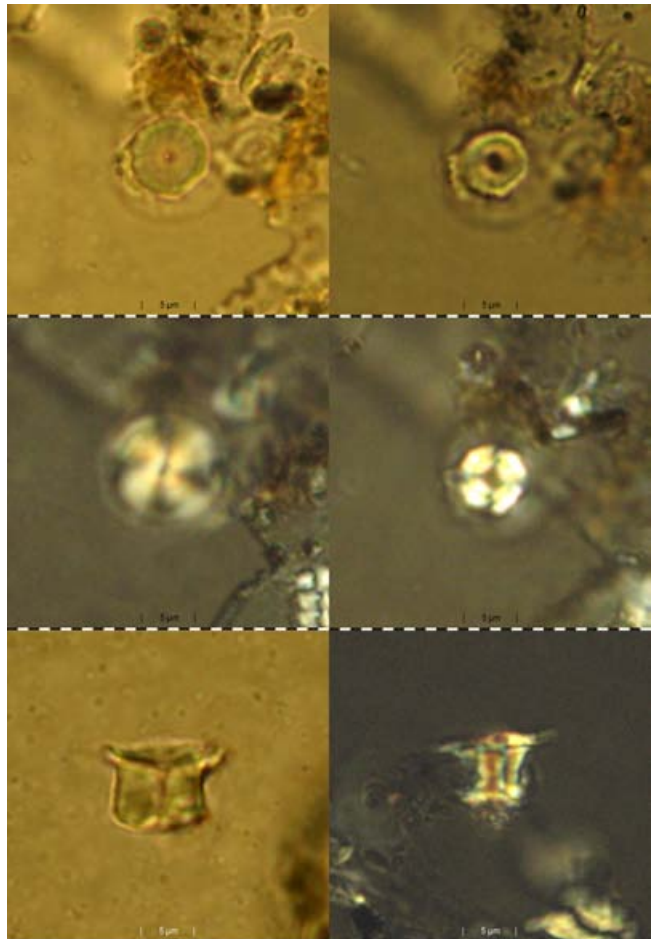


Text-Fig. 99a.
SEM image of holotype (2) and paratype (1) of *Nannoconus abundans*.

sisting of calcareous, cylindrical to hyperboloidal bodies (= nannoconus) built up by flat, wedge-shaped calcite plates of various length arranged around a straight axial canal forming a pillar of about the same height as its diameter, with a flaring flange presumably at the distal end and a small flange at the proximal end. The distal flange may have twice the diameter of the pillar, the proximal flange is inconspicuous and not always present. The central pillar, which is slightly constricted in its middle part, shows obliquely situated grooves arranged clockwise. The distal flange is composed of only a few layers of calcite plates and is flat-concave on its distal side. The central canal is usually narrow with a serrate inner contour.

Size: Maximum diameter 12 μm , maximum height 8 μm .

Discussion: The newly described *Nannoconus abundans* is related to those *Nannoconus* species, which show a constriction in their outline, e. g. *Nannoconus boletus* DEFLANDRE (1962, p. 2639, Fig. 6 and 1967, p. 776) and *Nannoconus dauvillieri* DEFLANDRE (1959, p. 2374, Figs. 1, 2). It differs from these two species by having a thin flaring distal end composed of only few crystal layers. The axial view of *Nannoconus abundans* can be similar to *Coccolithites circumradius*



Text-Fig. 99b.
Syntypes in normal light (1, 2), polarized light (3, 4) and side view (5, 6).

STOVER (1966, p. 138, pi. 5, Figs. 2–4) especially under the light microscope. However, the SEM and TEM pictures reveal a completely different shape.

Distribution: To the authors *Nannoconus abundans* is known only from the Barremian of Schacht Konrad I, near Salzgitter. Considering the worldwide distribution of calcareous nannoplankton one would assume a wider occurrence. However only few Barremian nannofloras have been described (BALDI-BEKE, 1965; BOUCHE, 1963; NOEL, 1959; BRÖNNIMANN, 1955; THIERSTEIN, 1971).

This fact, a possibly limited stratigraphic range as well as ecological factors might be the reason for *Nannoconus abundans* not having become known before.

Comments:

Stratigraphic distribution: Barremian to Aptian.

**Original description of *Nannoconus planus*
STRADNER, 1963, p. 177, Pl. 3, Figs. 7, 7a, 7b**

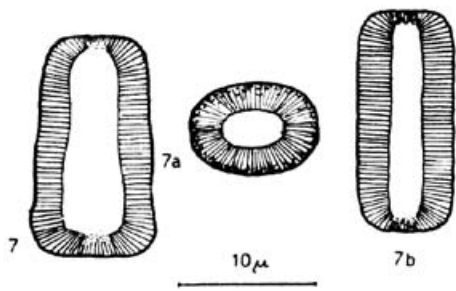
Holotype: GBA 2009/058/0059/1.

Derivation of name: *planus* (Lat.) = flat.

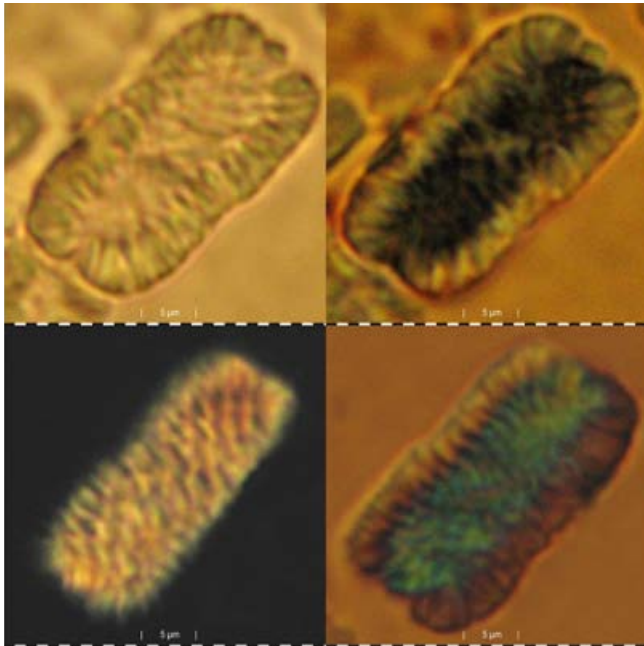
Type locality: Leidschendam 1 (N. V. Ned. Aardolie Maatsch.) Netherlands.

Level: Lower Albian.

Diagnosis and description: Tests in cross section elliptical, in axial section either cylindrical or rather inflated depend-



Text-Fig. 100a.
Original drawing of *Nannoconus planus*.



Text-Fig. 100b.
Syntypes in normal and polarized light at different focus levels.

ing whether viewed from the smaller side or from the flat-tened side.

Comments:

Stratigraphic distribution: Albian.

Family: Schizosphaerellaceae DEFLANDRE 1959

Genus: Schizosphaerella DEFLANDRE 1938, p. 1116

Type species: *Schizosphaerella punctulata* DEFLANDRE & DANGE-ARD 1938, p. 1116, Figs. 1–6

Synonym: *Nannopatina* STRADNER 1961, p. 78.

Type species: *Nannopatina grandaeva* STRADNER 1961, p. 78, Text-Figs. 1–10.

Original description of Nannopatina STRADNER, 1961

Derivatio nominis: *nannos* (Gr.) = Zwerg, *patina* (Lat.) = Schüssel.

Diagnose: Aus zwei dünnwandigen, halbkugeligen oder tonnenförmigen Schalen zusammengesetzte Kalkgehäuse von einzelligen Meeresorganismen. Die Primärschale umfasst mit ihrem Äquatorialrand den etwas nach außen gebogenen Rand der Sekundärschale. Die Außenfläche ist von Poren und Höckern, die im Quincunx angeordnet sind,

übersät. Der submikroskopische Aufbau der Wand zeigt Ähnlichkeit mit dem von *Thoracosphaera*.

English translation:

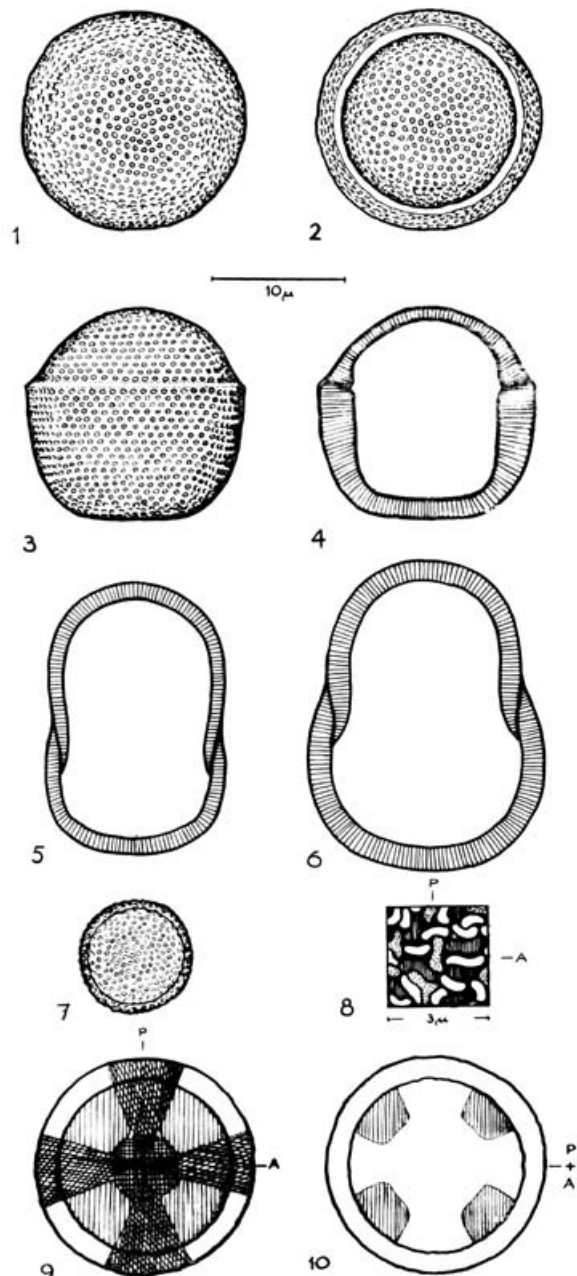
Derivation of name: *nannos* = dwarf; *patina* = bowl.

Diagnosis: Calcareous shells composed of two semi-globular or barrel-shaped halves, originating from unicellular marine organisms. The primarily constructed of these half-shells is overlapping with its equatorial rim the somewhat smaller other half. The surface shows numerous small perforations and humps. The submicroscopical structure of the wall is similar to that of *Thoracosphaera*.

Original description of Nannopatina grandaeva STRADNER, 1961

Holotypus: GBA 2009/058/0034

Derivatio nominis: *grandaevus* (Lat.) = sehr alt.



Text-Fig. 101.
Original drawings of *Nannopatina grandaeva*.

Locus typicus: Schleifenbächle hinter Achdorf, Wutachgebiet, Württemberg, sehr häufig.

Stratum typicum: Lias Zeta, Jurensis-Mergel. Weitere Vorkommen: *Variabilis*-Zone desselben Fundortes; Steilwand des Aubächle oberhalb Aselfingen, Wutachgebiet, Württemberg; *Numismalis*-Mergel (Unterer Lias Gamma); Schleifenbächle hinter Achdorf, Wutachgebiet, Württemberg; *Opalinus*-Ton (Oberer Dogger Alpha). England: Wear Cliff or Green Belemnite Marls (Lower Lias) near Seatown, Dorset, England.

Diagnose: Die Beschreibung dieser einstweilen einzigen Art der neuen Gattung fällt mit der des Genotypus zusammen. Die im englischen Lias gefundenen Schalen und Gehäuse sind vereinzelt äquatorial etwas eingeschnürt und zeigen die feinen Poren nicht so deutlich und auch nicht so regelmäßig angeordnet wie diejenigen aus dem deutschen Lias.

Größe: 8–20 µm.

English translation:

Holotypus: GBA 2009/058/0034

Type locality: Schleifenbächle near Achdorf, Wutach area, Württemberg, abundant.

Level: Lower Jurassic, *Jurensis* Marlstone.

Other occurrences: *Variabilis* Zone of the same locality; Württemberg; *Opalinus* Clay (Middle Jurassic).

England: Wear Cliff or Green Belemnite Marls (Lower Lias) near Seatown, Dorset, England.

Description: The species definition coincides with the generic description. The calcareous shells of this species found in England have a slightly reduced diameter at the equatorial level.

Size: 8–20 µm.

Comments:

Taxonomic status: *Stomiosphaera minutissima* is also a synonym of *Schizosphaerella punctulata* (AUBRY, DÉPÊCHE & DUFOUR, 1988, p. 715).

HOLOCOCOLITHS

Family: Calyptosphaeraceae BOUDREAUX & HAY, 1969

Genus: *Calculites* PRINS & SISSINGH IN SISSINGH, 1977

Calculites ovalis (STRADNER) PRINS & SISSINGH in SISSINGH, 1977 (= *Tetralithus ovalis* STRADNER, 1963, p. 178, Pl. 6, Text-Figs. 7, 7a)

**Original description of *Tetralithus ovalis*
STRADNER, 1963**

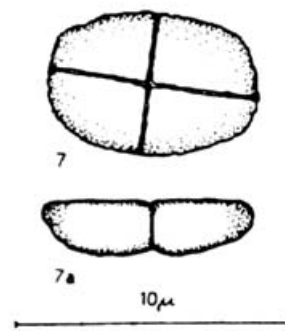
Holotype: GBA 2009/058/0060.

Derivation of name: *ovalis* (Lat.) = oval.

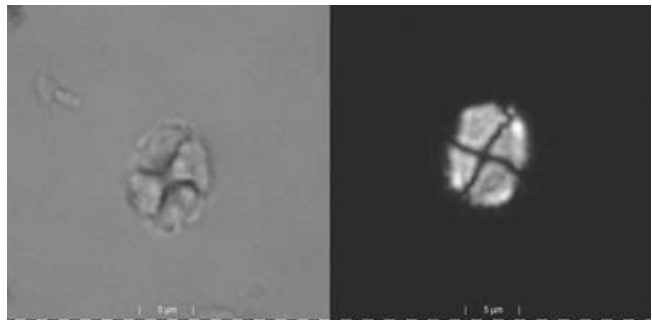
Type locality: Klafferbrunn, Lower Austria.

Level: Upper Turonian – Emscherian.

Diagnosis and description: Flat tetraliths consisting of four sectors fitting closely together to form a plate with oval circumference. The suture lines may lie in the main axes or diagonally or in between.



Text-Fig. 102a.
Original drawing of *Tetralithus ovalis*.



Text-Fig. 102b.
Holotype in normal and polarized light.

Comments:

Stratigraphic distribution: Upper Coniacian to Campanian.

Calcareous dinoflagellate

Class: Dinophyceae FRITSCH, 1929

Order: Peridinales HAECKEL, 1894

**Suborder: Peridiniineae FOTT, 1959
emend. BUJAK & DAVIES, 1983**

Family: Peridiniaceae EHRENBERG, 1831

**Subfamily: Calciodinelloideae FENSOME
et al., 1993**

Genus: *Cervisiella* HILDEBRAND-HABEL, WILLEMS & VERSTEEGH, 1999

Type species: *Cervisiella saxea* (STRADNER) HILDEBRAND-HABEL, WILLEMS & VERSTEEGH, 1999 (= *Thoracosphaera saxea* STRADNER, 1961, p. 84, fig. 71)

**Original description of *Thoracosphaera saxea*
STRADNER, 1961**

Holotypus: GBA 2009/058/0032/2.

Derivatio nominis: *saxeus* (Lat.) = steinern.

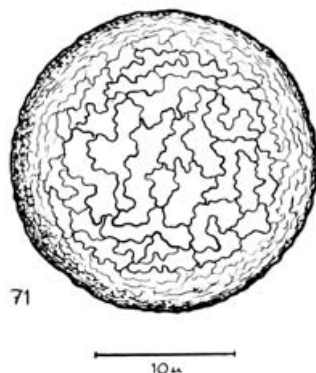
Locus typicus: Haidhof bei Ernstbrunn, Niederösterreich.

Stratum typicum: Danien. Mäßig häufig.

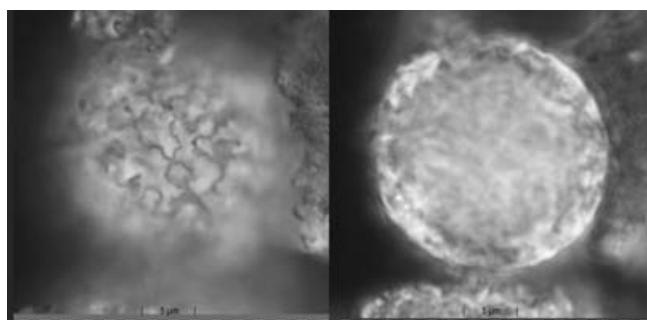
Ein aus zahlreichen, sehr unregelmäßig geformten Einzelsteinen zusammengesetztes, hohlkugeliges Gehäuse mit geschlängelten Nahtlinien. Die bei gekreuzten Nikols verschiedenartig löschenden Einzelsteine stellen nicht einzelne Porolithen wie bei *Thoracosphaera heimi* KAMPTNER dar,

sondern können nur als Verschmelzungseinheiten aus einer größeren Anzahl von außergewöhnlich kleinen ortholithischen Bausteinen von gleicher polarisationsoptischer Orientierung aufgefasst werden.

Größe: Gehäusedurchmesser 30 µm, Länge der Einzelsteine 4–6 µm.



Text-Fig. 103a.
Original drawing of *Thoracosphaera saxea*.



Text-Fig. 103b.
Syntype in polarized light at different focus levels.

English translation:

Holotype: GBA 2009/058/0032/2.

Derivation of name: *saxeus* (Lat.) = stony.

Type locality: Haidhof near Ernstbrunn, Lower Austria.

Type level: Danian (Zone NP 2).

Diagnosis and description: Spherical calcareous hollow shells with erratic suture lines, like those of a skull. In polarized light separate groups of small poroliths seem to be molten together showing identical crystal orientation, contrary to *Thoracosphaera heimi* KAMPTNER, in which the separate poroliths show different orientations each.

Size: 30 µm. Size of the stone elements 4–6 µm.

Comments:

Stratigraphic distribution: Abundant in the Danian.

UNCLASSIFIED TAXON

Original description of *Coccolithus nuntius*
STRADNER, 1968 IN STRADNER, ADAMIKER &
MARESCH, 1968, p. 26, Pl. 5, Figs. 2, 3, Text-Fig. 9

Holotype: TEM plate 17355.

Paratype: TEM plate 18072.

Derivation of name: *nuntius* (Lat.) = messenger.

Type locality: NAM deep well Delft 2.

Level: Albian.

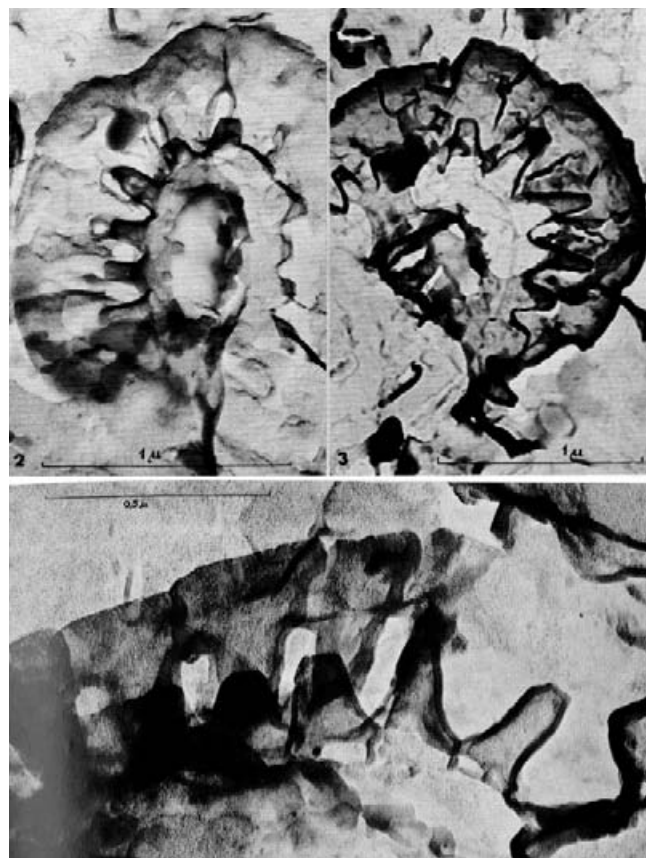
Diagnosis and description: Elliptical coccoliths with one shield formed in a similar way as in *Coccolithus* HUXLEY, with crystal plates sparing out slot-shaped windows orientated in radial direction. Number of segments ranging from 14 to 20. The other shield, which is only fragmentarily known, consists of an equal number of spine-shaped rays. These are protruding from an elliptical ring surrounding the central area and are in most places damaged, with broken-off ends. No outer rim of that other shield was encountered in any of the specimens found.

Size: Holotype: length 1.7 µm, width 1.4 µm; paratype: length 2.8 µm, width 1.7 µm.

Discussion: This new species agrees in many respects with *Coccolithus* HUXLEY shown by BRAARUD, GAARDER, MARKALI & NORDLI 1952 and COHEN 1965, from which it differs by the smaller number of segments. Whether there is a central structure in this new Albian species is not certain, but can be assumed.

Comments:

Taxonomic status: With only pictures of fragmentary specimens, we are not able to assign this taxon to a genus.



Text-Fig. 104a.
TEM micrographs of holotype (2) and syntypes of *Coccolithus nuntius*.

Acknowledgements

We are most grateful to Hans EGGER for his tireless assistance during the completion of this project; we take pleasure in acknowledging the invaluable evaluations of the formal status of species of coccolithophores in taxonomic compilations by A. LOEBLICH and H. TAPPAN (1966 to 1973), S.E. VAN HECK (1979 to 1982), J. STEINMETZ (1983 to 1989) and W. SIESSER (1990–2003). These have consid-

erably facilitated our taxonomic work over the years. For their assistance in preparing the figures we are indebted to Markus KOGLER and Stephan PRIBITZER.

Copyrights for the material republished here were obtained from the Geological Survey of Austria, the Deep Sea Drilling Project, and the Erdöl-Zeitschrift. We are grateful to these agencies for their comprehension.

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Upper Permian Spore Holotypes of W. KLAUS from the Southern Alps (Dolomites, Italy) in the Collections of the Geological Survey of Austria

ILSE DRAXLER*)

4 Plates

*Palynology
Type Specimens
Permian
Southern Alps
Paleontological collection*

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Oberpermische Sporen-Holotypen von W. KLAUS aus den Südalpen (Dolomiten, Italien) in den Sammlungen der Geologischen Bundesanstalt

Zusammenfassung

Von den von Wilhelm KLAUS (1921–1927) angefertigten und erstbeschriebenen Dauerpräparaten mit Sporen-Holotypen aus dem Oberperm der Dolomiten (Italien) sind noch 33 erhalten. Diese werden an der Geologischen Bundesanstalt aufbewahrt und werden hier neu dokumentiert. Drei Präparate konnten nicht mehr aufgefunden werden. Das Material stammt aus schwarzen Tonsteinlagen der Gröden-Formation („Grödner Sandstein“, Arenaria di Val Gardena). Es wurden im Durchlichtmikroskop Farbfotos angefertigt, die zusammen mit den Daten der Originalabbildungen, den Angaben über Typus-Schichten und -Lokalitäten, den Präparate-Nummern und den Engländer-Angaben zu den einzelnen Objekten präsentiert werden. Probenmaterial oder Aufbereitungsrückstände der Proben, aus denen die Sporen-Holotypen gewonnen wurden, sind nicht mehr an der Geologischen Bundesanstalt vorhanden.

Abstract

Thirty-three permanent slides with spore holotypes from black shale horizons in the Upper Permian Gröden Formation (Arenaria di Val Gardena) of the Southern Alps (Dolomites, Italy), that were prepared and described for the first time by Wilhelm KLAUS (1921–1927), are stored at the Geological Survey of Austria. Three slides with holotypes have been lost. Colour photographs were taken of the holotypes in a transmitting light microscope and are presented here in four plates together with the more important published publication data on the type figures, the type strata and localities, the collection numbers of the slides and the Engländer data of the types. Rock material or organic residues of the samples are not available at the Geological Survey.

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Introduction

With the exception of the excellently preserved spores, discovered by KLAUS (1953a) in the evaporitic succession of the Haselgebirge, the Upper Permian to Lower Triassic evaporites of the Eastern Alps are devoid of fossils. Thus to establish the age of the evaporites, it was necessary, to calibrate their palynological record with biostratigraphically well constrained deposits. For this reason, in the early 1960s KLAUS (1921–1987), the pioneer of Permian–Triassic palynology, started investigating black claystones from the siliciclastic succession of the Gröden Formation in the Arenaria di Val Gardena (northern Italy). Although KLAUS started and carried out these internationally important studies whilst at the Geological Survey, he continued with them subsequently including sulphur-isotope investigations at the University of Vienna until his early death in 1987 (KLAUS, 1972, 1974, 1977, 1987).

The Upper Permian age of the spore-bearing material from the Gröden Formation was well known from mega- and microfauna. KLAUS found many similarities between the microflora of the Gröden Formation and that of the main part from the alpine salt deposits. This led to a biostratigraphical correlation between these deposits and proved the Upper Permian age of the alpine evaporites.

Fifty-five formspecies of spores were treated and described on the basis of single grains (KLAUS, 1953b) and photomicrographs, thirty-six of which were considered to be new species (KLAUS, 1963). Of this collection 33 permanent slides with spore holotypes are stored at the collection of the Geological Survey. The three other holotypes are missing: *Illinites bentzi*, *Taeniaesporites alatus*, *Jugasporites schaubergeroides*.

In general, the preservation of these holotypes, which are mounted in glycerine jelly between two coverglasses, is good. However, air bubbles occur in most slides endangering the holotypes by oxidation. This makes it necessary, to re-embed the specimens in the near future.

For this paper, the holotypes have been re-photographed in colour although the black and white photos of KLAUS are of excellent quality. All the light microscope photographs were taken with a digital camera (Canon Power Shot S80) on a Leitz Diaplan transmitting light microscope. The slides of most specimens have numbers given by KLAUS but as the slides have now been integrated into the Geological Survey collections, new collection numbers have been given.

Description of the Spore Types

Preliminary Notes

This paper is not a systematic revision of the Upper Permian spore holotypes described by KLAUS 1963. Instead, the types are presented together with the relevant data given in the original description and with light microscope colour photographs.

The holotypes described here are cited under their original names given by KLAUS (1963) and in the order of the publication KLAUS (1963). The slide number was given by KLAUS (1963) and is in the original description of the holotype.

Description

Converrucosisporites dejerseyi KLAUS 1963

(Pl. 1, Fig. 1)

Coll. no.: GBA 2010/013/0001.

Holotype: Single grain preparation slide Nr. 431, Englandfinder F37/4.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Seceda West, Cuecenes near St. Ulrich, fine-sandy to clayish layer with plant debris in Gröden Formation.

Type figure: KLAUS 1963, p. 249, Pl. 1, Fig. 1.

Converrucosisporites eggeri KLAUS 1963

(Pl. 1, Fig. 2)

Coll. no.: GBA 2010/013/0002.

Holotype: Single grain preparation slide Nr. 425, Englandfinder H40/2.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Runggaditsch, on the way to Panider Pass (Passo Piné) next the farm building of Sepp Oberrauch, Lower clayband in Gröden Formation.

Type figure: KLAUS 1963, p. 254, Pl. 1, Fig. 2.

Endosporites hexareticulatus KLAUS 1963

(Pl. 1, Fig. 3)

Coll. no.: GBA 2010/013/0007.

Holotype: Single grain preparation slide Nr. 480, Englandfinder A45/2.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge, near Fontana Fredda (Kaltenbrunn), Gröden Formation, lower dark clayish layer.

Type figure: KLAUS 1963, p. 266, Pl. 4, Fig. 9.

***Perisaccus granulatus* KLAUS 1963**

(Pl. 1, Fig. 4)

Coll. no.: GBA 2010/013/0010.

Holotype: Single grain preparation slide Nr. 461, Englandfinder N39.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge, near Fontana Fredde (Kaltenbrunn), lower layer with plant fossils, clay layer with plant debris.

Type figure: KLAUS 1963, p. 269, Pl. 4, Fig. 12.

***Illinites parvus* KLAUS 1963**

(Pl. 1, Fig. 5)

Coll. no.: GBA 2010/013/0014.

Holotype: Single grain preparation slide Nr. 414, Englandfinder S40/4.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Runggaditsch, narrow pass near the farm-building of Sepp Oberrauch, coaly clay-layer in Gröden Formation, Upper belt.

Type figure: KLAUS 1963, p. 271, Pl. 5, Fig. 18.

***Illinites gamsi* KLAUS 1963**

(Pl. 1, Fig. 6)

Coll. no.: GBA 2010/013/0015.

Holotype: Single grain preparation slide Nr. 415, Englandfinder P38/4.

Type level: Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge near Kaltenbrunn (Fontana Fredde), Upper clay layer.

Type figure: KLAUS 1963, p. 273, Pl. 5, Fig. 16.

Remarks: No type level is in the description of the holotype but it corresponds with *Taeniaesporites* and, therefore, it should be Lower Upper-Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

***Illinites pemphicus* KLAUS 1963**

(Pl. 1, Fig. 7)

Coll. no.: GBA 2010/013/0016.

Holotype: Single grain preparation slide Nr. 401, Englandfinder M34/2.

Type level: Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Cuecenes in Val Gardena near St. Ulrich (Ortisei).

Type figure: KLAUS 1963, p. 273, Pl. 5, Fig. 17.

Illinites bentzi

The slide with the holotype is lost. First description in KLAUS 1955.

***Jugasporites paradelasaucei* KLAUS 1963**

(Pl. 1, Fig. 9)

Coll. no.: GBA 2010/013/0019.

Holotype: Single grain preparation slide Nr. 410, Englandfinder O40/2.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge near Kaltenbrunn (Fontana Fredde), lowermost layer with plant fossils, clay layer in sandstone with plant debris.

Type figure: KLAUS 1963, p. 279, Pl. 6, Fig. 23.

***Jugasporites schaubergoides* KLAUS 1963**

The slide with the holotype is lost.

***Jugasporites lueckoides* KLAUS 1963**

(Pl. 1, Fig. 10)

Coll. no.: GBA 2010/013/0021.

Holotype: Single grain preparation slide Nr. 400, Englandfinder Q41.

Type level: Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Runggaditsch, narrow pass near the farm-building of Sepp Oberrauch, dark coaly claylayer in Gröden Formation.

Type figure: KLAUS 1963, p. 280, Pl. 6, Fig. 21.

***Limitisporites parvus* KLAUS 1963**

(Pl. 1, Fig. 8)

Coll. no.: GBA 2010/013/0020.

Holotype: Single grain preparation slide Nr. 346, Englandfinder M36/2.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge near Kaltenbrunn (Fontana Fredde), lowermost layer with plant fossils.

Type figure: KLAUS 1963, p. 286, Pl. 6, Fig. 25.

Remarks: This holotype is on the slide nr. 346 with the label "*Jugasporites schaubergoides*".

***Limitisporites leschiki* KLAUS 1963**

(Pl. 1, Fig. 11)

Coll. no.: GBA 2010/013/0023.

Holotype: Single grain preparation slide Nr. 405, Englandfinder N40.

Type level: Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge near Kaltenbrunn (Fontana Fredde), black clay layer with plant fragments.

Type figure: KLAUS 1963: p. 285, Pl. 6, Fig. 26.

***Scutasporites unicus* KLAUS 1963**

(Pl. 1, Fig. 12)

Coll. no.: GBA 2010/013/0027.

Holotype: Single grain preparation slide Nr. 404, Englandfinder K34r.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Runggaditsch, road to Panider Pass (Passo Piné), near the farmbuilding of Sepp Oberrauch, Lower clay band in Gröden Formation.

Type figure: KLAUS 1963, p. 290, Pl. 7, Figs. 30, 31.

***Gigantosporites hallstattensis* KLAUS 1963**

(Pl. 2, Fig. 1)

Coll. no.: GBA 2010/013/0029.

Holotype: Single grain preparation slide Nr. 477, Englandfinder O39r.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Runggaditsch, lower claybed in Gröden Formation, outcrop on the way from Runggaditsch to Panider Pass (Passo Piné) near the farmbuilding of Sepp Oberrauch.

Type figure: KLAUS 1963, p. 293, Pl. 8, Figs. 34–35.

***Gigantosporites aletoides* KLAUS 1963**

(Pl. 2, Fig. 2)

Coll. no.: GBA 2010/013/0035.

Holotype: Single grain preparation slide Nr. 478, Englandfinder.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Runggaditsch, lower clay bed in Gröden Formation, outcrop on the way from Runggaditsch to Panider Pass (Passo Piné) near the farmbuilding of Sepp Oberrauch.

Type figure: KLAUS 1963, p. 293, Pl. 9, Fig. 40.

***Gigantosporites illinoides* KLAUS 1963**

(Pl. 2, Fig. 3)

Coll. no.: GBA 2010/013/0037.

Holotype: Single grain preparation slide Nr. 479, Englandfinder R22/2.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Runggaditsch, lower clay bed in Gröden Formation, outcrop on the way from Runggaditsch to Panider Pass (Passo Piné) near the farm building of Sepp Oberrauch.

Type figure: KLAUS 1963, p. 294, Pl. 9, Fig. 39.

***Gardenasporites heisseli* KLAUS 1963**

(Pl. 2, Fig. 5)

Coll. no.: GBA 2010/013/0038.

Holotype: Single grain preparation slide Nr. 455, Englandfinder N41.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge near Kaltenbrunn (Fontana Fredde), lowermost layer with plant fossils, clay layer in sandstone with plant debris.

Type figure: KLAUS 1963, p. 296, Pl. 10, Figs. 42–43.

***Gardenasporites moroderi* KLAUS 1963**

(Pl. 2, Fig. 6)

Coll. no.: GBA 2010/013/0040.

Holotype: Single grain preparation slide Nr. 456, Englandfinder P38.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Cuedenes near St. Ulrich. Fine sandy to clayey layer with plant fragments in Gröden Formation.

Type figure: KLAUS 1963, p. 297, Pl. 10, Figs. 44–45.

***Gardenasporites leonardii* KLAUS 1963**

(Pl. 2, Fig. 4)

Coll. no.: GBA 2010/013/0041.

Holotype: Single grain preparation slide Nr. 439, Englandfinder O32/2.

Type level: Lower Upper Permian, Gröden Formation (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge, near Fontana Fredde (Kaltenbrunn), Upper black clay layer with plant debris.

Type figure: KLAUS 1963, p. 297, Pl. 11, Figs. 46–47.

Remarks: Originally the specimen was located on single grain preparation slide Nr. 457 which now is free of any spore. The specimen is located now on a slide with the label "*Striatites marginalis*".

***Gardenasporites oberrauchi* KLAUS 1963**

(Pl. 2, Fig. 7)

Coll. no.: GBA 2010/013/0042.

Holotype: Single grain preparation slide Nr. 458, Englandfinder O36/3.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Cuedenes near St. Ulrich (Ortisei). Finesandy to clayey layer with plantfragments in Gröden Formation (Arenaria di Val gardena).

Type figure: KLAUS 1963, p. 298, Pl. 11, Figs. 48–49.

***Lueckisporites microgranulatus* KLAUS 1963.**

(Pl. 3, Fig. 1)

Coll. no.: GBA 2010/013/0044.

Holotype: Single grain preparation slide Nr. 458, Englandfinder M38/2.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge near Kaltenbrunn (Fontana Fredde), lowermost layer with plant fossils, clay layer in sandstone with plant debris.

Type figure: KLAUS 1963, p. 303, Pl. 12; Fig. 57.

Remarks: The slide Nr. 458 also was given to *Gardenasporites oberrauchi*.

***Lueckisporites globosus* KLAUS 1963**

(Pl. 3, Fig. 2)

Coll. no.: GBA 2010/013/0047.

Holotype: Single grain preparation slide Nr. 459, Englandfinder P39.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge, not far from Kaltenbrunn (Fontana Fredde), lower clayey layer with plant debris.

Type figure: KLAUS 1963, p. 304, Pl. 13, Fig. 60.

***Lueckisporites parvus* KLAUS 1963**

(Pl. 3, Fig. 3)

Coll. no.: GBA 2010/013/0048.

Holotype: Single grain preparation slide Nr. 460, Englandfinder P30.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge, not far from Kaltenbrunn (Fontana Fredde), lower clayey layer in Grödner sandstone.

Type figure: KLAUS 1963, p. 304, Pl. 12, Fig. 58.

***Taeniaesporites ortisei* KLAUS 1963**

(Pl. 3, Fig. 4)

Coll. no.: GBA 2010/013/0051.

Holotype: Single grain preparation slide Nr. 446, Englandfinder N36.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge near Fontana Fredde (Kaltenbrunn), Upper black clayey layer with plant debris.

Type figure: KLAUS 1963, p. 310, Pl. 14, Figs. 67–68.

***Taeniaesporites labdacus* KLAUS 1963**

(Pl. 3, Fig. 5)

Coll. no.: GBA 2010/013/0054.

Holotype: Single grain preparation slide Nr. 447, Englandfinder O40/4.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge near Fontana Fredde (Kaltenbrunn), Upper black clayey layer with plant debris.

Type figure: KLAUS 1963, p. 311, Pl. 13, Figs. 65–66.

***Taeniaesporites alatus* KLAUS 1963**

Coll. no.: GBA 2010/013/0055.

Remarks: The holotype is lost but a paratype is available (Coll. no.: GBA 2010/013/0056).

***Strotersporites jansonii* KLAUS 1963**

(Pl. 3, Fig. 6)

Coll. no.: GBA 2010/013/0058.

Holotype: Single grain preparation slide Nr. 475, Englandfinder M37/1.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge near Kaltenbrunn (Fontana Fredde), lowermost layer with plant fossils, clayey layer in sandstone with plant debris.

Type figure: KLAUS 1963, p. 317, Pl. 15, Figs. 74–75.

***Strotersporites wilsoni* KLAUS 1963**

(Pl. 3, Fig. 7)

Coll. no.: GBA 2010/013/0061.

Holotype: Single grain preparation slide Nr. 474, Englandfinder N45/3.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Runggaditsch.

Type figure: KLAUS 1963, p. 318, Pl. 16, Fig. 77.

***Striatites marginalis* KLAUS 1963**

(Pl. 4, Fig. 1)

Coll. no.: GBA 2010/013/0063.

Holotype: Englandfinder P28/1.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Runggaditsch, lower clay bed in Gröden Formation (Arenaria di Val Gardena) outcrop on the way from Runggaditsch to Panider Pass (Passo Piné) near the farm-building of Sepp Oberrauch.

Type figure: KLAUS 1963, p. 323, Pl. 17, Figs. 80–81.

Remarks: The holotype is no more on slide Nr. 439, it is on another slide without number. On the slide with Nr. 439 and the label *Striatites marginalis* is the holotype of *Gardenasporites leonardi*.

***Striatites minor* KLAUS 1963**

(Pl. 4, Fig. 2)

Coll. no.: GBA 2010/013/0064.

Holotype: Single grain preparation slide Nr. 440, Englandfinder S46/4.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge near Kaltenbrunn (Fontana Fredde), lowermost layer with plant fossils, clayey layer in sandstone with plant debris.

Type figure: KLAUS 1963, p. 324, Pl. 17, Fig. 82.

***Striatites angulistriatus* KLAUS 1963**

(Pl. 4, Fig. 3)

Coll. no.: GBA 2010/013/0065.

Holotype: Single grain preparation slide Nr. 441, Englandfinder L32.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Cuecenes near St. Ulrich. Finesandy to clayey layer with plantfragments in Gröden Formation.

Type figure: KLAUS 1963, p. 324, Pl. 17, Fig. 83.

***Vesicaspora schemeli* KLAUS 1963**

(Pl. 4, Fig. 4)

Coll. no.: GBA 2010/013/0072.

Holotype: Single grain preparation slide Nr. 443, Englandfinder L46/3.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Runggaditsch, lower claybed in Gröden Formation, outcrop on the way from Runggaditsch to Panider Pass (Passo Piné) near the farmbuilding of Sepp Oberrauch.

Type figure: KLAUS 1963, p. 336, Pl. 18, Fig. 84.

***Vittatina ovalis* KLAUS 1963**

(Pl. 4, Fig. 5)

Coll. no.: GBA 2010/013/0077.

Holotype: Single grain preparation slide Nr. 502, Englandfinder Q37.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge near Kaltenbrunn (Fontana Fredde), lowermost layer with plant fossils, clayey layer in Gröden Formation.

Type figure: KLAUS 1963, p. 341, Pl. 20, Fig. 97.

***Vittatina angulistriata* KLAUS 1963**

(Pl. 4, Fig. 7)

Coll. no.: GBA 2010/013/0078.

Holotype: Single grain preparation slide Nr. 503, Englandfinder N38/1.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge near Kaltenbrunn (Fontana Fredde), lowermost layer with plant fossils, clayey layer in Gröden Formation.

Type figure: KLAUS 1963, p. 342, Pl. 20, Figs. 98–99.

***Ephedripites primus* KLAUS 1963**

(Pl. 4, Fig. 6)

Coll. no.: GBA 2010/013/0079.

Holotype: Single grain preparation slide Nr. 504, Englandfinder N38.

Type level: Lower Upper Permian, Gröden Formation = Grödner Sandstein (Arenaria di Val Gardena).

Type locality: Butterloch, Bletterbach Gorge near Fontana Fredde (Kaltenbrunn), lower clayish layer in Gröden Formation.

Type figure: KLAUS 1963, p. 343, Pl. 20, Fig. 100.

Alphabetic List of Spore Types

<i>alatus Taeniaesporites</i>	p. 89	<i>marginalis Striatites</i>	p. 89
<i>aletoides Gigantosporites</i>	p. 88	<i>microgranulatus Lueckisporites</i>	p. 88
<i>angulistriata Vittatina</i>	p. 90	<i>minor Striatites</i>	p. 89
<i>angulistriatus Striatites</i>	p. 90	<i>moroderi Gardenasporites</i>	p. 88
<i>dejerseyi Converrucosisporites</i>	p. 86	<i>oberrauchi Gardenasporites</i>	p. 88
<i>eggeri Converrucosisporites</i>	p. 86	<i>ortisei Taeniaesporites</i>	p. 89
<i>gamsi Illinites</i>	p. 87	<i>ovalis Vittatina</i>	p. 90
<i>globosus Lueckisporites</i>	p. 89	<i>paradelasaucei Jugasporites</i>	p. 87
<i>granulatus Perisaccus</i>	p. 87	<i>parvus Illinites</i>	p. 87
<i>hexareticulatus Endosporites</i>	p. 86	<i>parvus Limitisporites</i>	p. 87
<i>heisseli Gardenasporites</i>	p. 88	<i>parvus Lueckisporites</i>	p. 89
<i>illinoides Gigantosporites</i>	p. 88	<i>pemphicus Illinites</i>	p. 87
<i>jansonii Strotersporites</i>	p. 89	<i>primus Ephedripites</i>	p. 90
<i>labdacus Taeniaesporites</i>	p. 89	<i>schemeli Vesicaspora</i>	p. 90
<i>leonardii Gardenasporites</i>	p. 88	<i>unicus Scutasporites</i>	p. 88
<i>leschiki Limitisporites</i>	p. 87	<i>wilsoni Strotersporites</i>	p. 89
<i>lueckoides Jugasporites</i>	p. 87		

Type-Localities with List of Holotypes

Runggaditsch Val di Gardena

Illinites parvus
Jugasporites lueckoides
Scutasporites unicus
Gigantosporites hallstattensis
Gigantosporites aletoides
Gigantosporites illinoides
Striatites marginalis
Converrucosisporites eggeri
Vesicaspora schemeli
Strotersporites wilsoni
Taeniaesporites alatus

Cuecenes near St. Ulrich (Ortisei), Val di Gardena

Converrucosisporites dejerseyi
Illinites pemphicus
Gardenasporites moroderi
Gardenasporites oberrauchi
Striatites angulistriatus

Butterloch, Bletterbach Gorge

Endosporites hexareticulatus
Perisaccus granulatus
Illinites gamsi
Limitisporites leschiki
Limitisporites parvus
Gardenasporites heisseli
Jugasporites paradelasaucei
Gardenasporites leonardii
Strotersporites jansonii
Lueckisporites microgranulatus
Lueckisporites globosus
Lueckisporites parvus
Taeniaesporites labdacus
Striatites minor
Vittatina angulistriata
Vittatina ovalis
Ephedripites primus

Acknowledgements

I am grateful to Helga PRIEWALDER for her help in taking digital pictures of some holotypes, to Markus KOGLER for image processing, and to Irene ZORN for putting the collection numbers on the slides and in the manuscript and for a critical review of the text. Thanks are due to Hans EGGER

for reviewing the manuscript, to Alfred GRUBER for useful remarks on the lithostratigraphy of the sample locations, and to Hugh RICE for linguistic corrections of the manuscript.

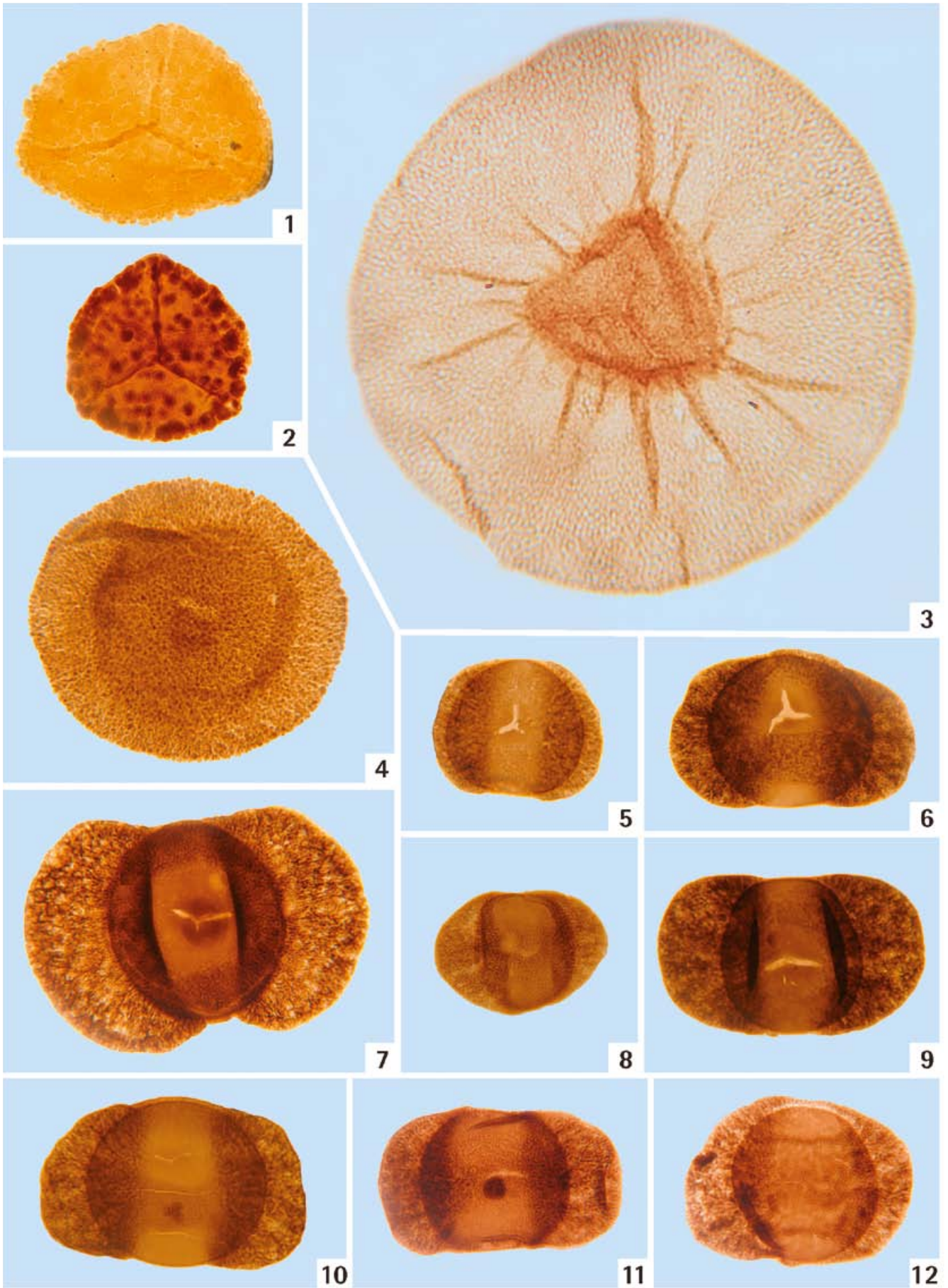
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Plate 1

- Fig. 1: *Converrucosporites dejerseyi*.
Fig. 2: *Converrucosporites eggeri*.
Fig. 3: *Endosporites hexareticulatus*.
Fig. 4: *Perisaccus granulatus*.
Fig. 5: *Illinites parvus*.
Fig. 6: *Illinites gamsi*.
Fig. 7: *Illinites pemphicus*.
Fig. 8: *Limitisporites parvus*.
Fig. 9: *Jugasporites paradelasaucei*.
Fig. 10: *Jugasporites lueckoides*.
Fig. 11: *Limitisporites leschiki*.
Fig. 12: *Scutasporites unicus*.

Magnification of all Figures = x 750



50µm

Plate 2

Fig. 1: *Gigantosporites hallstattensis*.

Fig. 2: *Gigantosporites aletoides*.

Fig. 3: *Gigantosporites illinoides*.

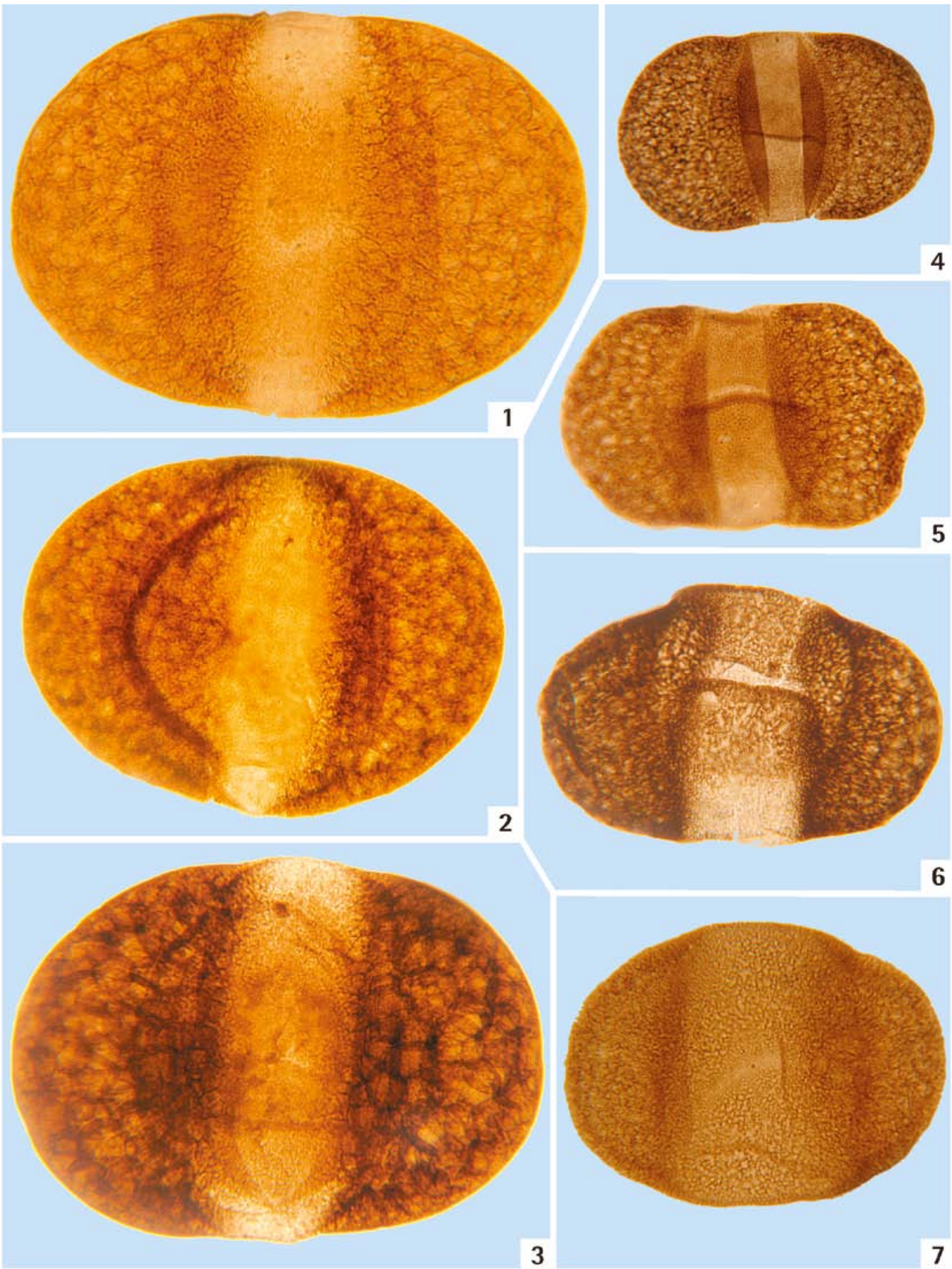
Fig. 4: *Gardenasporites leonardii*.

Fig. 5: *Gardenasporites heisseli*.

Fig. 6: *Gardenasporites moroderi*.

Fig. 7: *Gardenasporites oberrauchi*.

Magnification of all Figures = x 750



50µm

Plate 3

Fig. 1: *Lueckisporites microgranulatus*.

Fig. 2: *Lueckisporites globosus*.

Fig. 3: *Lueckisporites parvus*.

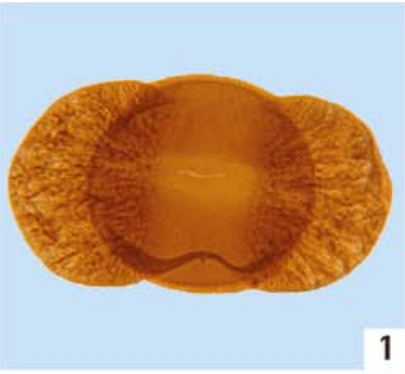
Fig. 4: *Taeniaesporites ortisei*.

Fig. 5: *Taeniaesporites labdacus*.

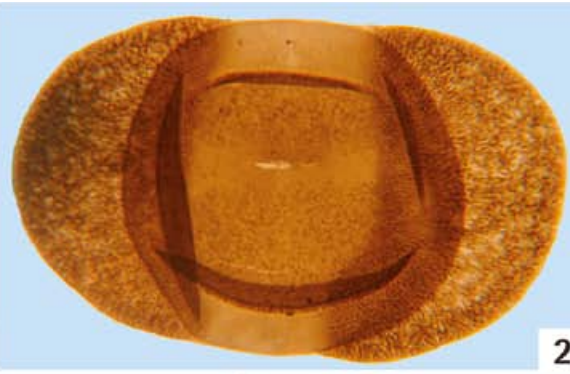
Fig. 6: *Strotersporites jansonii*.

Fig. 7: *Strotersporites wilsoni*.

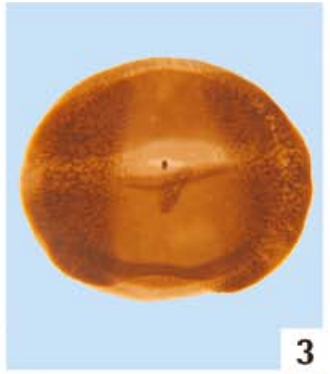
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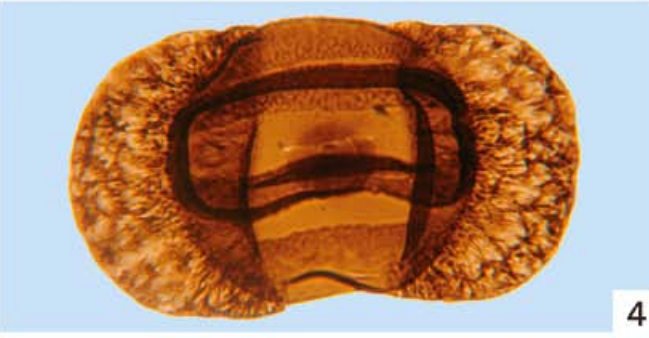
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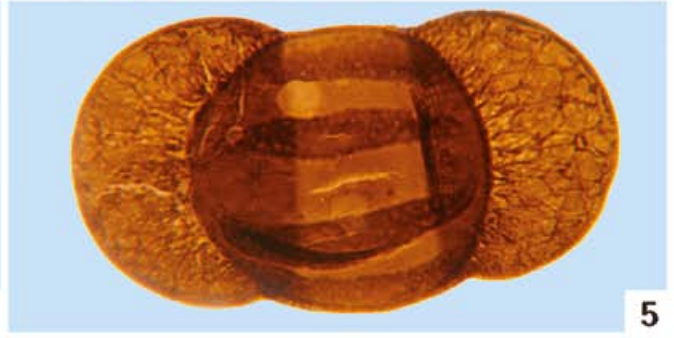
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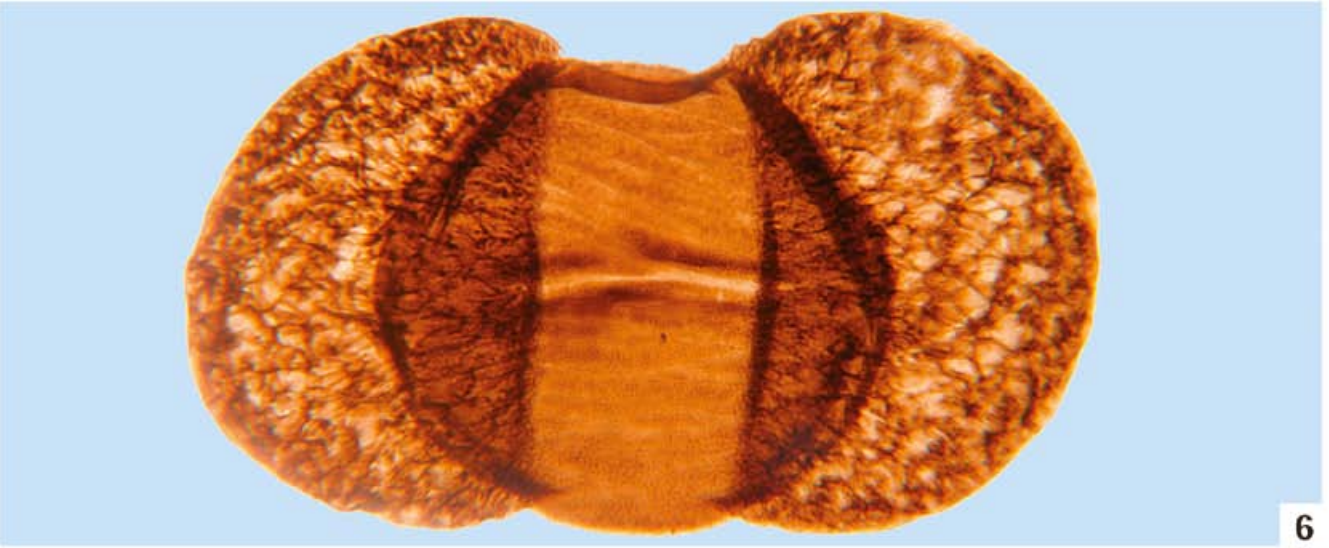
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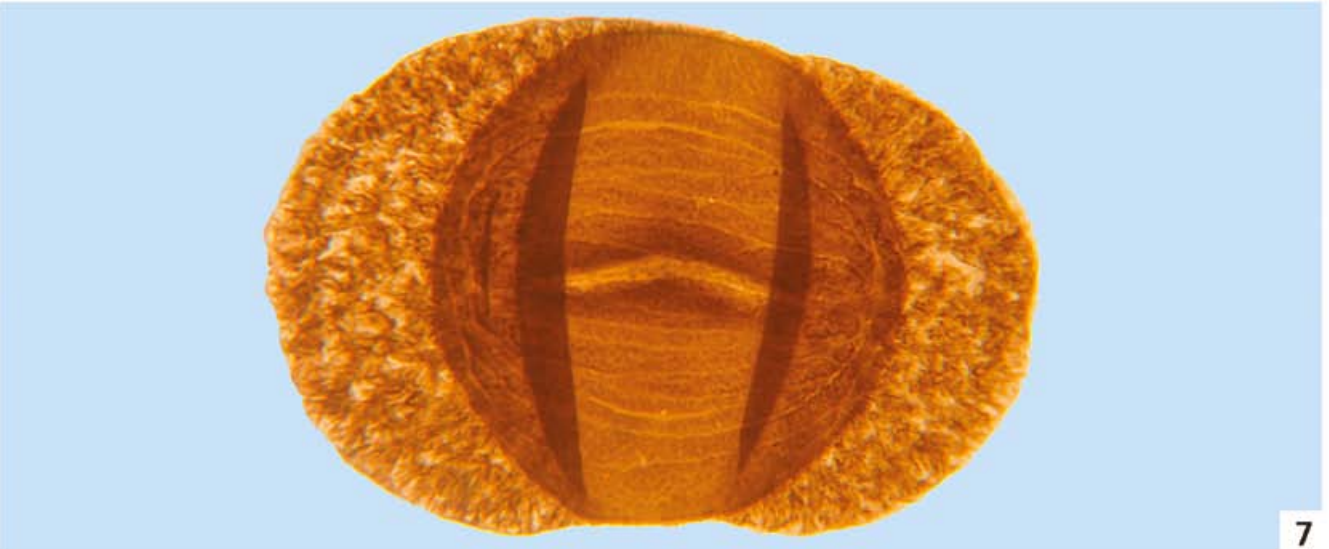
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5



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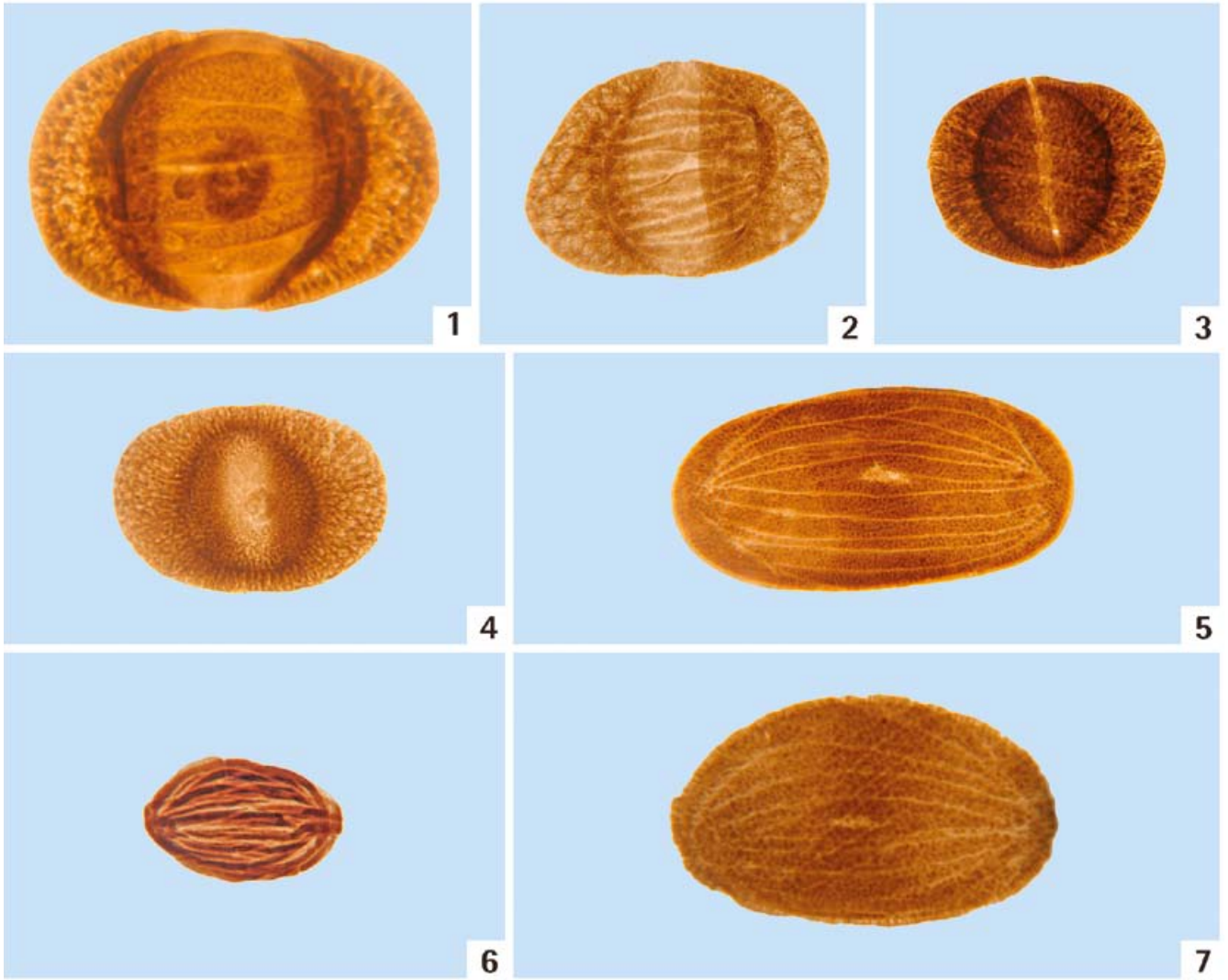
7

50µm

Plate 4

- Fig. 1: *Striatites marginalis*.
Fig. 2: *Striatites minor*.
Fig. 3: *Striatites angulistriatus*.
Fig. 4: *Vesicaspora schemeli*.
Fig. 5: *Vittatina ovalis*.
Fig. 6: *Ephedripites primus*.
Fig. 7: *Vittatina angulistriatus*.

Magnification of all Figures = x 750



50µm

Type Specimens of ETTINGSHAUSEN's Tertiary Flora in the Surroundings of Vienna (1851) in the Collections of the Geological Survey of Austria

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2 Tables, 7 Plates

*Paleobotany
Type Specimens
Vienna Basin
Miocene
Paleontological collection*

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Typusexemplare von ETTINGSHAUSEN'S „Tertiärer Flora der Umgebungen von Wien“ (1851) in den Sammlungen der Geologischen Bundesanstalt

Zusammenfassung

Die Geologische Bundesanstalt in Wien verwahrt in ihren Sammlungen viele der Typus-Exemplare fossiler Pflanzenarten, die von Constantin Freiherr von ETTINGSHAUSEN (1826–1897) in seiner „Tertiären Flora der Umgebungen von Wien“ (1851) beschrieben worden waren. Die 14 Holotypen und mehrere Syntypen von vier weiteren Taxa werden in der vorliegenden Arbeit ausführlich dokumentiert, und morphologische Details sowie systematisch-taxonomische Revisionen soweit wie möglich erwähnt.

Abstract

The collection of the Geological Survey of Austria in Vienna hosts most of the type-specimens of fossil plant taxa described by Constantin von ETTINGSHAUSEN (1826–1897) in his “Tertiary Flora in the Surroundings of Vienna” (1851). The 14 holotypes and several syntypes of four other new taxa are newly documented here in detail. Morphological details and systematic-taxonomic revisions have also been mentioned when possible.

Introduction

The “Tertiary Flora in the Surroundings of Vienna” represents the first publication of a series called “The Tertiary Floras from the Austrian Monarchy”, started by Constantin von ETTINGSHAUSEN (1826–1897) in 1851. In the preamble, W. HAIDINGER, the director of the k.k. Geologische Reichsanstalt (= Geological Survey), highlighted the geological conclusions based on the fossil floras and added that the Geological Survey would continue intensively with such studies. He also mentioned that the plant re-

mains from Vienna had been preferred to other Austrian fossil floras, because at that time data on the fossil flora of the Vienna Basin were limited in comparison to its fauna. The flora comprises about 150 plant remains, mainly leaf impressions, from Middle and Late Miocene sandstone concretions and marls from Vienna, together with a few specimens from other areas. The majority of samples were collected during the construction of the new imperial “Arsenal” in Vienna (3rd district); the others derive from a brickyard in Hernals (17th district). Although it was then thought that these localities were of the same

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age, they were recognized to be separate units, of different ages, shortly afterwards (e.g. STUR, 1867; SCHAFFER, 1904–1906). The plant-bearing sediments in Hernals belong to the Sarmatian (Late Middle Miocene) and those from the Arsenal to the Pannonian (Early Late Miocene). Co-occurring molluscs and vertebrates are of biostratigraphic significance. Additionally, some leaf remains from other districts in Vienna (Simmering, Laaerberg, Inzersdorf; all of Pannonian age), from Parschlug (Styria; Miocene) and from Zagorje (Sagor, Slovenia; Oligocene) and Bilina (North Bohemia, Czech Republic; Miocene) were also included by ETTINGSHAUSEN (1851). Currently, most of the specimens are stored in the Geological Survey; others are stored in the “Hof-Mineralien-Cabinet” (now the Natural History Museum, Vienna) according to the plate explanations in ETTINGSHAUSEN (1851).

ETTINGSHAUSEN (1851) described 36 taxa (Tab.1), 28 as new species. 21 types of these are stored at the Geological Survey but four types are still missing. One type, that should be stored at the Natural History Museum, Vienna, according to the plate explanations, is deposited at the survey. Some types were re-found in the course of this work. In the past, many of the type specimens were coated with a layer of lacquer: this hides some structures so that not all the correct morphology can be seen, especially at the leaf margin. No attempt has been made as yet to remove the lacquer. Other type specimens, on the same

sediment sample, are not lacquered, suggesting they were not recognized or studied at the time of lacquering. A few samples, which have been marked as typespecimens, do not represent the figured type-specimens unambiguously.

During much of the last century the material was not available and comparative studies were based only on the drawings and descriptions of ETTINGSHAUSEN (1851) (e.g. BERGER, 1955). In the 1970s, work on a new inventory of the Geological Survey collection was started; in 1991, HUMMEL published the first paper documenting the results of her re-investigation of the Betulaceae of the Viennese Tertiary flora.

The holotypes, isotypes and syntypes of 18 taxa have been fully documented in this paper, with some remarks about their morphological features and their taxonomic position, when possible. Five holotypes are represented with their counterparts, which here have been classified as isotypes, because the International Code of Botanical Nomenclature (MCNEILL et al., 2006) defines an isotype as a duplicate of the holotype, covering any additional herbarium specimen(s) collected from the same plant. Although fossil leaves and their counterparts could be regarded as one broken specimen, this would result in a holotype consisting of at least two specimens: this is contrary to the rules of the Code, which state that the holotype must be only one specimen.

List of taxa	Type	Type storage according to the plate explanations	Type storage x=present ?= no information
<i>Culmites arundinaceus</i> UNGER	F	GBA	x
<i>Culmites ambiguus</i> n.sp.	S	NHM	?
<i>Cyperites tertiaris</i> UNGER	F	GBA	x
<i>Potamogeton ungeri</i> n.sp.	H	GBA	x
Cupressineae	F	GBA	?
<i>Pinites partschii</i> n.sp.	S	NHM	?
	S	GBA	?
<i>Betula prisca</i> n.sp.	S	GBA	x
<i>Betula brongniartii</i> n.sp.	H	GBA	x
<i>Alnus kefersteinii</i> UNGER	F	GBA	x
<i>Fagus castaneaefolia</i> UNGER	F	GBA	x
<i>Quercus haidingeri</i> n.sp.	S	NHM	?
	S	GBA	?
<i>Planera ungeri</i> n.sp.	S	GBA	x, ?
	S	NHM	?
<i>Artocarpidium cecropiaefolium</i> n.sp.	H	GBA	x
<i>Liquidambar europaeum</i> A.BRAUN	F	GBA	x
<i>Daphnogene polymorpha</i> n.sp.	F	GBA	x
<i>Laurus swosowicziana</i> UNGER	F	GBA	x
<i>Laurus ocoteaefolia</i> n.sp.	H,IT	GBA	x
<i>Laurus phoeboides</i> n.sp.	H	GBA	?
<i>Hakea pseudonitida</i> n.sp.	H,IT	GBA	x
<i>Dryandra vindobonensis</i> n.sp.	H	NHM	?
<i>Bumelia ambigua</i> n.sp.	H	NHM	?
<i>Diospyros pannonica</i> n.sp.	H,IT	GBA	x
<i>Styrax pristinum</i> n.sp.	H	GBA	?

List of taxa	Type	Type storage according to the plate explanations	Type storage x=present ?= no information
<i>Andromedites paradoxus</i> n.sp.	H,IT	GBA	x
<i>Cissus platanifolia</i> n.sp.	H	NHM	?
<i>Sterculia vindobonensis</i> n.sp.	H	GBA	x
<i>Bombax sagorianus</i> n.sp.	H ?	GBA	x
<i>Pterospermum ferox</i> n.sp.	S	GBA	?
<i>Pterospermum dubium</i> n.sp.	H	NHM	x GBA
<i>Acer pseudocreticum</i> n.sp.	H	GBA	?
<i>Cupanoides miocenicus</i> n.sp.	H	NHM	?
<i>Rhamnus augustinii</i> n.sp.	H	GBA	x
<i>Pterocarya haidingeri</i> n.sp.	H,IT	GBA	x
<i>Myrtus austriaca</i> n.sp.	S	GBA	x, ?
<i>Leguminosites machaeriodes</i> n.sp.	H	GBA	x
<i>Leguminosites ingaefolius</i> n.sp.	H	GBA	x
<i>Cassia ambigua</i> UNGER	F	GBA	x, ?

Table 1.

List of taxa described by ETTINGSHAUSEN 1851.

F = figured specimens, HT = Holotype, IT = Isotype, ST = Syntype, GBA = Geological Survey of Austria, NHM = Natural History Museum, Vienna.

List of Type Specimens

The specimens are listed according to their inventory numbers.

Potamogeton ungeri ETTINGSHAUSEN, 1851

(Pl. 7, Fig. 2a–d)

Coll. no.: GBA 1851/002/0002b.

Type: Holotype.

Type level: Miocene, Pannonian.

Type locality: Arsenal, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 10, Pl. 1, Fig. 3.

Revised: *Panicum ungeri* (ETTINGSHAUSEN, 1851) STUR, 1867.

Remarks: The leaf impression is about 2.6 cm long and 0.5 mm wide, the base is acute, the apex might be recurved, which differs from the original figure (Pl. 7, Fig. 2c). Traces of preparation tools indicate that the apical part was exposed later (see the white scratches in Fig. 2b on Plate 7). One distinct primary vein is accompanied by three parallel running secondaries on each side; between these secondaries are 4–5 very thin parallel veins (Pl. 7, Fig. 2d). All veins derive from the base. STUR (1867) revised it as a *Panicum* species because of the lack of veins perpendicular to the parallel secondary veins.

Remarks: ETTINGSHAUSEN described one cone, cone impressions and twigs without needles with the same species name. A comparison of the cone compression in the collection (Pl. 4, Fig. 1b–c), which is labelled as a syntype, differs from the figured specimen in some features. The cone is smaller (9 cm long in contrast to the figured specimen, which is 10 cm) and recurved. The specimen (Pl. 4, Fig. 1a) differs also by the slightly oblique shape and the exposed base. There are old labels in the box, that mention “Gumpendorf Quergasse No. 361” as the locality, not Laaerberg, as in the plate explanation of ETTINGSHAUSEN. According to the plate explanation, the figured specimen should be stored in the Natural History Museum Vienna. Figs. 11–12 on Plate 1 in ETTINGSHAUSEN’s paper show fragmentary cone impressions from Laaerberg; these are missing in the Geological Survey collection. There are some small yellow woody fragments in a separate box, which are too fragmentary for any reconstruction. The twigs without needles (ETTINGSHAUSEN, 1851, Pl. 1, Figs. 13–14) from the Arsenal are also missing. STUR (1867: 148), however, mentioned a cone from Gumpendorf, and the cone in the collection is therefore reference material to that work.

Pinites partschii ETTINGSHAUSEN, 1851

(Pl. 4, Fig. 1a–c)

Coll. no.: GBA 1851/002/0004.

Type: Syntype ?

Type level: Miocene, Pannonian.

Type locality: Gumpendorf, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 11, Pl. 1, Fig. 10

Betula prisca ETTINGSHAUSEN, 1851

(Pl. 6, Figs. 1–3)

Coll. no.: GBA 1851/002/0005/1.

Type: Syntype.

Type level: Miocene, Pannonian.

Type locality: Arsenal, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 11, Pl. 1, Fig. 15.

Revised: *Betula* aff. *subpubescens* GÖPPERT 1855.

Remarks: Despite some morphological differences between the specimen and the type figure (Pl. 6, Fig. 1a–b), the general shape and the old label stuck on the specimen prove the identity of the specimen as the figured specimen. It is a fragment of a leaf with neither base nor apex. The margin is only indistinctly preserved, showing a double serrate margin type.

Coll. no.: GBA 1851/002/0005/2.

Type: Syntype.

Type level: Miocene, Pannonian.

Type locality: Arsenal, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 11, Pl. 1, Fig. 16.

Revised: *Betula* aff. *subpubescens* GÖPPERT 1855.

Remarks: The specimen shows some differences to the figure (Pl. 6, Fig. 2a–b). The lamina is slightly narrower and longer and the number of secondary veins on the right side is 8, not 7, as in the figure. It is possible that this vein was regarded as the margin of the lamina. The lacquer might have caused the wrong view of the margin. The counterpart of this syntype (coll. no.: GBA 1851/002/0005/3 = Pl. 6, Fig. 3a–b) also has a well preserved petiole.

This species and the type material have been discussed in detail by HUMMEL (1991), who suggested that the type material is too fragmentary (Arsenal) and partly missing (Bilina) and, in any event, belongs to two species. The specimens from the Arsenal are very similar – so far it is possible to determine from the poor preservation – to *B. subpubescens* GÖPPERT 1855 (see HUMMEL, 1991: 66) and the leaves from Bilina are different from the leaves from the Arsenal site and might belong to *Alnus*. BUDANTSEV (1982) chose the figured specimen from Bilina as Lectotype, but this specimen has not been found as yet. The conclusions of HUMMEL (1991) concerning *B. prisca* are that these are mainly remains of *Carpinus* because of the cordate base, and that all the material that has been described as *B. prisca*, should be re-investigated.

More specimens from the Arsenal locality are stored in the collection with the same collection number, but they were not mentioned by ETTINGSHAUSEN. Table 2 gives an overview of the specimens and numbers.

Betula brongniartii ETTINGSHAUSEN, 1851

(Pl. 1, Fig. 1a–d)

Coll. no.: GBA 1851/002/0006.

Type: Holotype.

Type level: Miocene, Pannonian.

Type locality: Arsenal, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 12, Pl. 1, Fig. 18.

Remarks: The leaf impression is about 37 mm long and the width, measured and calculated from the half part is about 40 mm. The apex is not preserved, the base rounded. Since the lacquer does not cover all parts of the impression and covers part of the matrix, this might have led to false ideas about the specimen. The venation is pinnate and craspedodromous; distances between the secondary veins are uniform to smoothly decreasing to the base, their course is slightly sinusoidal-like. The margin is double serrate. Veins of the 3rd category are distinct and very dense (Pl. 1, Fig. 1d). Near the margin, veins (at least once) derive from the lower side of the secondaries and terminate in the smaller teeth between the main teeth.

A second specimen of this species, from the same locality, was mentioned but not figured by STUR (1867: 151), who concluded that the cordate (“herzförmig bis ausgerandet”) base of this species will often complicate distinction from *Carpinus grandis* UNGER, 1850.

Rhamnus augustinii ETTINGSHAUSEN, 1851

(Pl. 7, Fig. 1a–d)

Coll. no.: GBA 1851/002/0007Ac.

Type: Holotype.

Type level: Miocene, Pannonian.

Type locality: Arsenal, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 23, Pl. 5, Fig. 3d,

Remarks: The type specimen is 4.5 cm long, but the apical part is missing; the width is about 2.1 cm, the venation is craspedodromous. The primary vein is straight and the angle of the secondary veins acute. Six pairs of secondary veins are preserved, the lower ones are nearly opposite, the upper ones are different. The margin is preserved in one area, with weak serrate or crenate teeth.

ETTINGSHAUSEN 1851	GBA Inventory Number	HUMMEL 1991	Remarks
Pl. 1, Fig. 15	1851/002/0005/1	Pl. 1, Fig. 1	Syntype
Pl. 1, Fig. 16	1851/002/0005/2	Pl. 1, Fig. 2	Syntype
-	1851/002/0005/3	Pl. 1, Fig. 3	Counterpart of 5/2
Pl. 1, Fig. 17	Not found	-	Lectotype in: TAKHTAJAN, A. & ZHILIN, S. 1982 (Eds.), refigured on Pl. 82, Fig.3
-	1851/002/0005/4	Pl. 1, Fig. 4	
-	1851/002/0005/5	-	
-	1851/002/0005/6	-	Counterpart of 5/5

Table 2.
Overview of the specimens of *Betula prisca* ETTINGSHAUSEN in the collection.

The specimen is associated with leaves that were initially identified as *Alnus kefersteinii* UNGER. Later they were identified as a different species, *Alnus hörnesii* STUR, 1867, which has been recognized as a synonym of *Alnus ducalis* GAUDIN in GAUDIN & STROZZI, 1858 emend. KNOBLOCH, 1968.

***Planera ungeri* ETTINGSHAUSEN, 1851**

(Pl. 5, Fig. 2a–c)

Coll. no.: GBA 1851/002/0010A.

Type: Syntype.

Type level: Miocene, Sarmatian.

Type locality: Hernals, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 14, Pl. 2, Fig. 9.

Coll. no.: GBA 1851/002/0010B.

Type: Counterpart of this syntype.

Remarks: This species is a synonym of *Zelkova zelkovifolia* (UNGER, 1841) BUZEK & KOTLABA in KOTLABA, 1963. The other specimens (syntypes), figured by ETTINGSHAUSEN, derive from Inzersdorf, Bilina and Parschlug and have not been found in the collection of the Geological Survey up to now.

***Artocarpidium cecropiaefolium* ETTINGSHAUSEN, 1851**

(Pl. 5, Fig. 3a–b)

Coll. no.: GBA 1851/002/0011.

Type: Syntype.

Type level: Miocene, Pannonian.

Type locality: Simmering, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 15, Pl. 2, Fig. 4.

Remarks: STUR (1867: 157) identified the specimen as *Carpinus grandis* UNGER and included ETTINGSHAUSEN's two specimens in the synonym list (but listed Figs. 2–3, instead of 3–4). The second syntype (Pl. 2, Fig. 3) is stored in the collection of the Natural History Museum Vienna according to ETTINGSHAUSEN's plate explanation.

***Leguminosites ingaeifolius* ETTINGSHAUSEN, 1851**

(Pl. 7, Fig. 3a–c)

Coll. no.: GBA 1851/002/0012/1b.

Type: Holotype ?

Type level: Miocene, Pannonian.

Type locality: Arsenal, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 26, Pl. 5, Fig. 8 (not 24, as mentioned in the text).

Remarks: The specimen is 5.6 cm long and 2.3 cm wide (Pl. 7, Fig. 3a–b). There are not many other features to observe, making comparison with the drawing more difficult. The oldest label mentions *Leguminosites ingaeifolius* and also that it is identical with *Juglans vetusta* HEER, 1859 (mentioned also in STUR, 1867: 181 with a question mark). It is associated with *Liquidambar europaeum* A. BRAUN, 1836 (ETTINGSHAUSEN, 1851: Pl. 2, Fig. 21) on the same sediment sample.

***Laurus ocoteaefolia* ETTINGSHAUSEN, 1851**

(Pl. 1, Fig. 2a–d)

Coll. no.: GBA 1851/002/0015A.

Type: Holotype.

Type level: Miocene, Pannonian.

Type locality: Arsenal, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 17, Pl. 3, Fig. 4.

Coll. no.: GBA 1851/002/0015B.

Type: Isotype.

Revised: *Salix ocoteaefolia* (ETTINGSHAUSEN, 1851) STUR, 1867.

Remarks: The leaf impression shows an elongate, narrow ovate to lanceolate shape, with neither base nor apex. The fragment is 9 cm long and 1.7 cm wide. The measurements, mentioned in ETTINGSHAUSEN (1851: 17: 12–14 cm long and 2 cm wide) are different and probably represent the sizes of the specimens from other localities, which he had already started to investigate (e.g. Zagorje, see below). The 6–11 secondary veins described by ETTINGSHAUSEN are probably also related to that material, because the holotype and isotype show about 10 on each side. The venation seems to be brochidodromous. The margin type is not mentioned by ETTINGSHAUSEN and is mainly not preserved. The isotype seems to be entire-margined near the base and shows at least two small teeth at one side in the middle part of the leaf. STUR (1867: 92) recombined the specimens to *Salix ocoteaefolia* (ETTINGSHAUSEN, 1851) STUR, 1867, which is also noted on the old label. However, STUR regarded the species as entire-margined and mentioned this feature as one of the differences to *Salix varians* GOEPFERT, 1855. He also mentioned the larger distances between the secondary veins as another distinguishing feature. *Salix lavateri* A. BRAUN, 1851 emend. HANTKE, 1954 from Miocene sediments in Switzerland is also very similar. HANTKE (1954) has distinguished *S. varians* and *S. lavateri* by their different width.

Other records have been described, such as those from the Early Oligocene (e.g. Häring, Austria; Sagor [= Zagorje], Slovenia) (ETTINGSHAUSEN, 1853, 1872, 1877) and Early/Middle Miocene (Styria; e.g. ETTINGSHAUSEN, 1888). ENGELHARDT (1922) described this species from Messel (Germany, Eocene) and only recently JUNGWIRTH (2004) listed it from the Paleogene of Slovenia, where he cited the species as a synonym of leaves that he identified as *Laurophyllum* cf. *acutumontanum* MAI 1963. This species was at first described from the Oligocene of Seifhennersdorf in Germany (MAI, 1963: 72), but *Laurus ocoteaefolia* has not been listed as a synonym.

***Hakea pseudonitida* ETTINGSHAUSEN, 1851**

(Pl. 2, Fig. 1a–c)

Coll. no.: GBA 1851/002/0017A.

Type: Holotype.

Type level: Miocene, Sarmatian.

Type locality: Hernals, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 17, Pl. 3, Fig. 5.

Coll. no.: GBA 1851/002/0017B.

Type: Isotype.

Remarks: The 2.3 cm long and 0.3 cm wide leaf impression and the counterpart have an acute to attenuate base and apex, the margin is roughly serrate, with 3–4 teeth on each side. The veins of 2nd and 3rd order have not been preserved.

There is no other entry of this species in the Oetyp-database (Catalogue of Palaeontological Types in Austrian Collections) at present. It might be a small leaf of *Myrica*.

***Diospyros pannonica* ETTINGSHAUSEN, 1851**

(Pl. 2, Fig. 2a–c)

Coll. no.: GBA 1851/002/0018A.

Type: Holotype.

Type level: Miocene, Pannonian.

Type locality: Arsenal, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 19, Pl. 3, Fig. 8.

Coll. no.: GBA 1851/002/0018B.

Type: Isotype.

Remarks: The holotype is a very faint leaf impression of 6.4 cm length and 3.5 cm width. The apical part is lacking, the base acute and probably slightly asymmetric. The course of the thin secondaries (angle 10–15° first, then about 70°) (Pl. 2, Fig. 2c) is different from the original drawing (Pl. 2, Fig. 2a). The isotype is very fragmentary and the impression much fainter.

***Andromedites paradoxus* ETTINGSHAUSEN, 1851**

(Pl. 3, Fig. 1a–d)

Coll. no.: GBA 1851/002/0020A.

Type: Holotype.

Type level: Miocene, Pannonian.

Type locality: Arsenal, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 19, Pl. 3, Fig. 10.

Coll. no.: GBA 1851/002/0020B.

Type: Isotype.

Remarks: ETTINGSHAUSEN figured the holotype well; due to the unusual leaf shape, he regarded it as an Ericaceae.

***Sterculia vindobonensis* ETTINGSHAUSEN, 1851**

(Pl. 2, Fig. 3a–b)

Coll. no.: GBA 1851/002/0021.

Type: Holotype.

Type level: Miocene, Pannonian.

Type locality: Arsenal, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 20, Pl. 4, Fig. 2.

Revised: *Acer vindobonensis* (ETTINGSHAUSEN, 1851) BERGER, 1955 emend. STRÖBITZER-HERRMAN, 2002.

Remarks: The holotype is a fragmentary impression with 3 lobes; at least two left lobes are lacking. The lacquer on the impression does not fit perfectly with the specimen and the leaf margin. The margin has been described as entire, which has been confirmed by STRÖBITZER-HERRMAN (2002), who has also noticed that the margin is imperfectly preserved. She emended the diagnosis of the

species based on specimens from the Laaerberg locality (2002: 65). According to these descriptions, the species has mainly 7 lobes, only occasionally do the smaller leaves have just 5 lobes. The margins are entire at the base, but slightly serrate near the apex of the lobes.

***Bombax sagorianus* ETTINGSHAUSEN, 1851**

(Pl. 3, Fig. 2a–c)

Coll. no.: GBA 1851/002/0022.

Type: Holotype ?

Type level: Oligocene.

Type locality: Savine (Sagor = Zagorje), Slovenia.

Type figure: ETTINGSHAUSEN, C. v. 1851: 21, Pl. 4 Fig. 3.

Remarks: This specimen is very similar to the figured specimen, but not identical. Holotype with a question mark has been written on the label. The leaf size, 7.1 cm length and 3.1 cm width, is the same, as is the symmetrical ovate shape with the acuminate apex, and the undulate margin. A major difference is the complete left basal part of the specimen in comparison to the incomplete one in the drawing.

The collection of the Geological Survey in Vienna hosts numerous specimens from the area of Zagorje in Slovenia, which were partly published by ETTINGSHAUSEN in e.g. 1872, 1877.

***Pterospermum dubium* ETTINGSHAUSEN, 1851**

(Pl. 4, Fig. 3a–c)

Coll. no.: GBA 1851/002/0023.

Type: Holotype.

Type level: Miocene, Pannonian.

Type locality: Simmering, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 21, Pl. 4, Fig. 6.

Remarks: The fragmentary specimen is 6 cm long and 7.5 cm wide. The base is asymmetrical, the apical part is missing. The secondary veins derive from the primary vein at irregular distances between 4 to 21 mm, the angle is about 80°. The margin is indistinct, but appears to be serrate near the base.

This holotype should be stored in the Natural History Museum, Vienna, according the original plate explanations, but the similarity of the drawing and the specimen in the collection of the survey is unambiguous. In contrast, the specimens of *Pterospermum ferox* ETTINGSHAUSEN, 1851, from Parschlug and Bilin, which should be in the collection of the Geological Survey, are still missing.

***Pterocarya haidingeri* ETTINGSHAUSEN, 1851**

(Pl. 4, Fig. 2a–d)

Coll. no.: GBA 1851/002/0026A

Type: Holotype.

Type level: Miocene, Pannonian.

Type locality: Arsenal, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 24, Pl. 5, Fig. 4.

Coll. no.: GBA 1851/002/0026B.

Type: Isotype.

Remarks: Holotype and isotype are both incomplete. They are at least 8 cm long without the apical part. The primary vein is distinct, the venation probably semicraspedodromous. The old label mentions it as a synonym of *Carya ungeri* ETTINGSHAUSEN and *Juglans bilinica* UNGER, 1850. KNOBLOCH (1969) included this specimen with a question mark in his list of synonyms of *Pterocarya paradisiaca* (UNGER, 1850) ILJINSKAYA, 1962 as well as *Juglans bilinica* UNGER, 1850.

***Myrtus austriaca* ETTINGSHAUSEN, 1851**

(Pl. 3, Fig. 3a–c)

Coll. no.: GBA 1851/002/0027.

Type: Syntype.

Type level: Miocene, Pannonian.

Type locality: Arsenal, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 25, Pl. 5, Fig. 5d. (not Fig. 10 as mentioned there).

Remarks: The small leaf impression is 2.5 cm long and 8 mm wide; apex and base are not totally complete, the

leaf margin is entire and distinct. Apart from the distinct primary vein, other venation is slightly indicated in the upper part (Pl. 5, Fig. 3c). The second syntype (ETTINGSHAUSEN, 1851: Pl. 5, Fig. 6), also from the Arsenal, is still missing. The specimen shows similarities to *Buxus* and *Leguminosae*, which should be compared in detail.

***Leguminosites machaeroides* ETTINGSHAUSEN, 1851**

(Pl. 5, Fig. 1a–c)

Coll. no.: GBA 1851/002/0028.

Type: Holotype.

Type level: Miocene, Pannonian.

Type locality: Arsenal, in Vienna, Austria.

Type figure: ETTINGSHAUSEN, C. v. 1851: 26, Pl. 5, Fig. 7.

Remarks: The weak leaf impression shows no more details than figured by ETTINGSHAUSEN.

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Plate 1

Fig. 1a–d: *Betula brongniartii* ETTINGSHAUSEN, 1851.

Fig. 1a: Sediment block with the holotype and other leaf fragments.
GBA 1851/002/0006.

Fig. 1b: Type figure of ETTINGSHAUSEN, 1851, Pl. 1, Fig. 18.

Fig. 1c: Holotype, the rectangle marks the area shown in Fig. 1d.

Fig. 1d: Detail of the tertiary venation, picture is turned around about 100° to the left in comparison to Fig. 1c; at the left margin, the thick lacquer hides the venation.
Scale 0.1 cm.

Fig. 2a–d: *Laurus ocoteaefolia* ETTINGSHAUSEN, 1851.

Fig. 2a: Overview of the sediment block with the holotype at the right margin; the rectangle marks the area shown in Fig. 2d.
GBA 1851/002/0015 A.

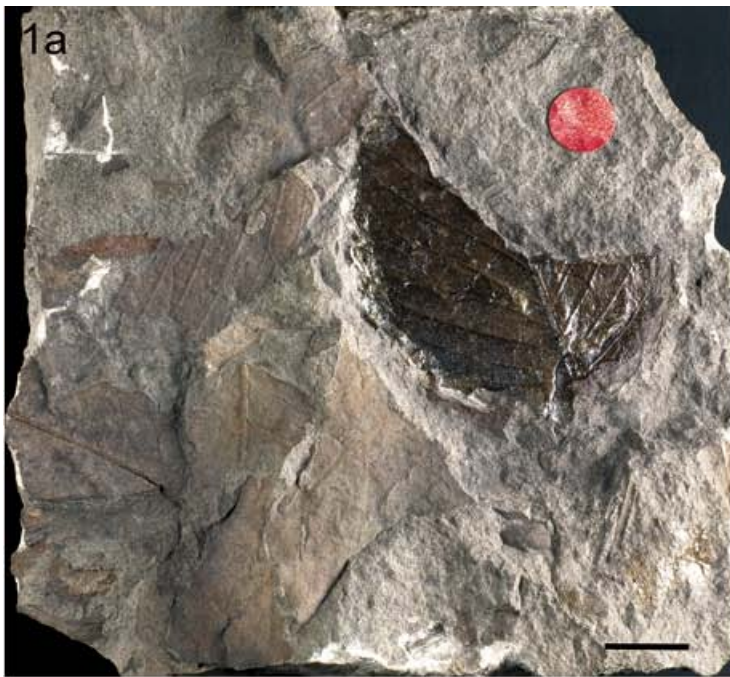
Fig. 2b: Type figure of ETTINGSHAUSEN, 1851, Pl. 3, Fig. 4.

Fig. 2c: Isotype of the species.
GBA 1851/002/0015 B.

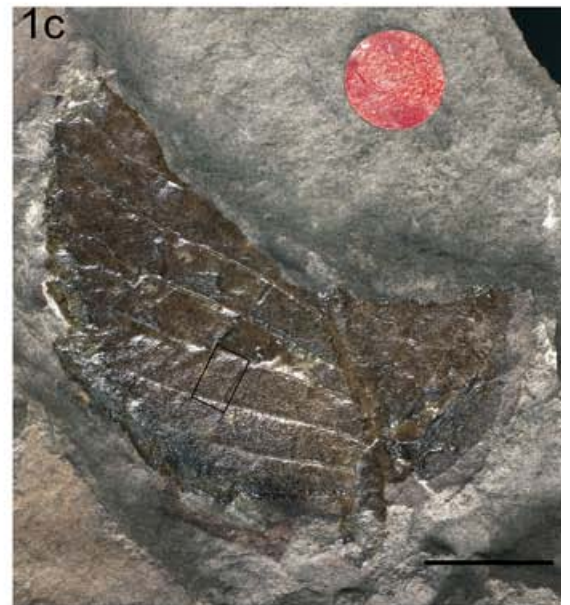
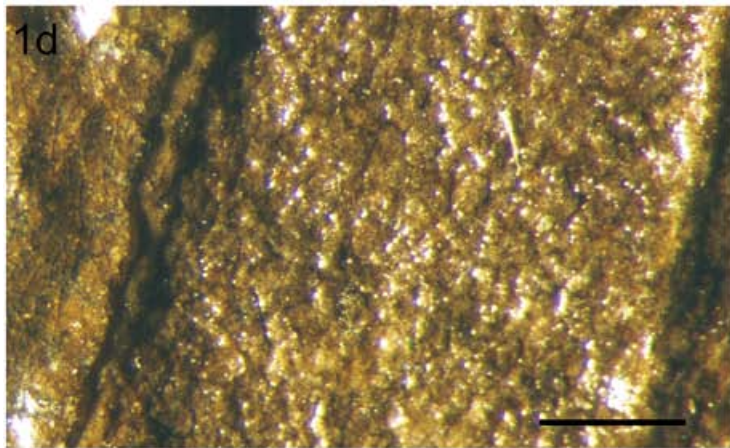
Fig. 2d: Detail of the venation of the holotype (Fig. 2a).
Scale 0.5 cm.

Scale 1 cm, if not mentioned otherwise.

Type figures from ETTINGSHAUSEN, 1851 are shown in their original size.



1b



2b



Plate 2

Fig. 1a–c: *Hakea pseudonitida* ETTINGSHAUSEN, 1851.

Fig. 1a: Type figure of ETTINGSHAUSEN, 1851, Pl. 3, Fig. 5.

Fig. 1b: Holotype associated with the cast of a bivalve.
GBA 1851/002/0017A.

Fig. 1c: Isotype, GBA 1851/002/0017B.

Fig. 2a–c: *Diospyros pannonica* ETTINGSHAUSEN, 1851.

Fig. 2a: Type figure of ETTINGSHAUSEN, 1851, Pl. 3, Fig. 8.

Fig. 2b: Holotype, a red dot has been glued directly on the leaf impression.
GBA 1851/002/0018A.

Fig. 2c: Detail of the middle part of the holotype (Fig. 1b), the arrows point to the base of the secondary veins.
Scale 0.5 cm.

Fig. 3a–b: *Sterculia vindobonensis* ETTINGSHAUSEN, 1851.

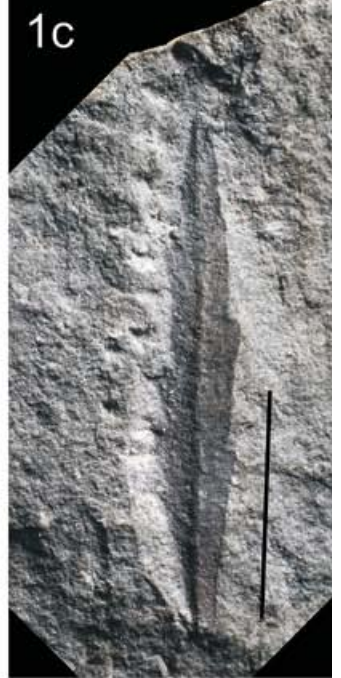
Fig. 3a: Type figure of ETTINGSHAUSEN, 1851, Pl. 4, Fig. 2.

Fig. 3b: Holotype.
GBA 1851/002/0021.

Scale 1 cm, if not mentioned otherwise.

Type figures from ETTINGSHAUSEN, 1851 are shown in their original size.

1a



2a



3a



Plate 3

Fig. 1a–d: *Andromedites paradoxus* ETTINGSHAUSEN, 1851.

Fig. 1a: Type figure of ETTINGSHAUSEN, 1851, Pl. 3, Fig. 10.

Fig. 1b: Holotype.
GBA 1851/002/0020A.

Fig. 1c: Holotype apex in detail.

Fig. 1d: Holotype base in detail.

Fig. 2a–c: *Bombax sagorianus* ETTINGSHAUSEN, 1851.

Fig. 2a: Type figure of ETTINGSHAUSEN, 1851, Pl. 4, Fig. 3.

Fig. 2b: Probable holotype.
GBA 1851/002/0022.

Fig. 2c: Left part of the basal leaf area of the probable holotype (Fig. 2b) in detail, the picture has been turned around to the right.
Scale 0.5 cm.

Fig. 3a–c: *Myrtus austriaca* ETTINGSHAUSEN, 1851.

Fig. 3a: Type figure of ETTINGSHAUSEN, 1851, Pl. 5, Fig. 5. ♂.

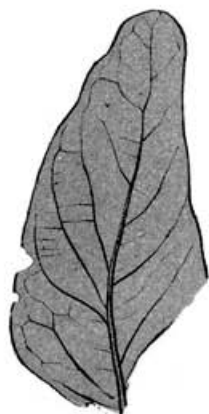
Fig. 3b: Syntype.
GBA 1851/002/0027.

Fig. 3c: Detail of the apical part of the holotype (Fig. 3b) with weak impression of the venation.
Scale 0.5 cm.

Scale 1 cm, if not mentioned otherwise.

Type figures from ETTINGSHAUSEN, 1851 are shown in their original size.

1a



1b



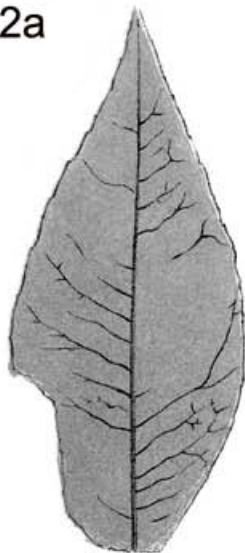
1c



1d



2a



2b



2c



3a



3b



3c



Plate 4

- Fig. 1a–c: *Pinites partschii* ETTINGSHAUSEN, 1851.
Fig. 1a: Type figure of ETTINGSHAUSEN, 1851, Pl. 1, Fig. 10.
Fig. 1b–c: Probable syntype, the cone is shown in different views.
GBA 1851/002/0004.

- Fig. 2a–d: *Pterocarya haidingeri* ETTINGSHAUSEN, 1851.
Fig. 2a: Type figure of ETTINGSHAUSEN, 1851, Pl. 5, Fig. 4.
Fig. 2b: Holotype.
GBA 1851/002/0026A.
Fig. 2c: Isotype.
GBA 1851/002/0026B.
Fig. 2d: Detail of the isotype (Fig. 2c) from the left margin.

- Fig. 3a–b: *Pterospermum dubium* ETTINGSHAUSEN, 1851.
Fig. 3a: Type figure of ETTINGSHAUSEN, 1851, Pl. 4, Fig. 6.
Fig. 3b: Holotype.
GBA 1851/002/0023.
Fig. 3c: Basal part of the holotype (Fig. 3b) in detail.
Scale 0.5 cm.

Scale 1 cm, if not mentioned otherwise.

Type figures from ETTINGSHAUSEN, 1851 are shown in their original size.

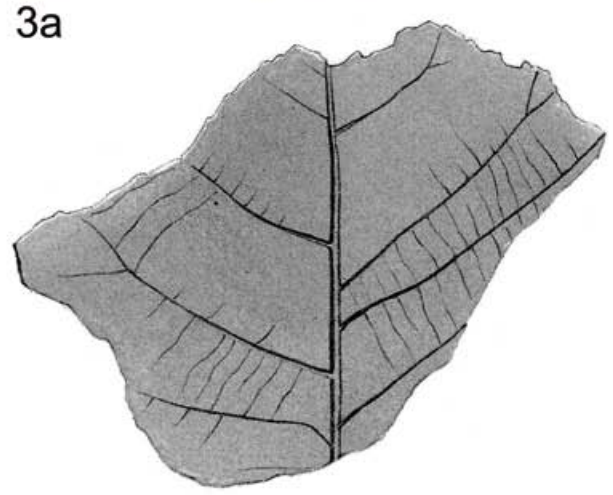
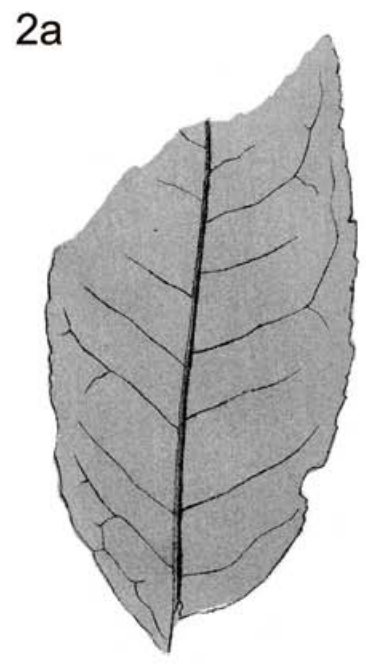


Plate 5

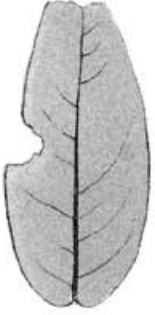
Fig. 1a–c: *Leguminosites machaerioides* ETTINGSHAUSEN, 1851.
Fig. 1a: Type figure of ETTINGSHAUSEN, 1851, Pl. 5, Fig. 7.
Figs. 1b–c: Holotype, in different magnifications.
GBA 1851/002/0028.

Fig. 2a–c: *Planera ungeri* ETTINGSHAUSEN, 1851.
Fig. 2a: Type figure of ETTINGSHAUSEN, 1851, Pl. 2, Fig. 9.
Fig. 2b: Syntype.
GBA 1851/002/0010A.
Fig. 2c: Counterpart of the syntype.
GBA 1851/002/0010B.

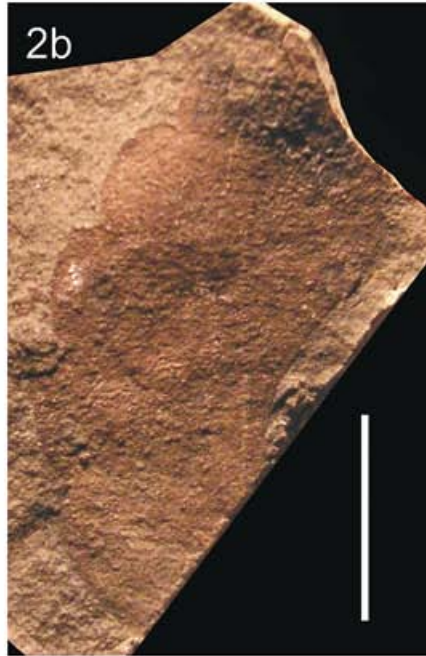
Fig. 3a–b: *Artocarpidium cecropiaefolium* ETTINGSHAUSEN, 1851.
Fig. 3a: Type figure of ETTINGSHAUSEN, 1851, Pl. 2, Fig. 46.
Fig. 3b: Syntype.
GBA 1851/002/0011.

Scale 1 cm, if not mentioned otherwise.
Type figures from ETTINGSHAUSEN, 1851 are shown in their original size.

1a



2a



3a

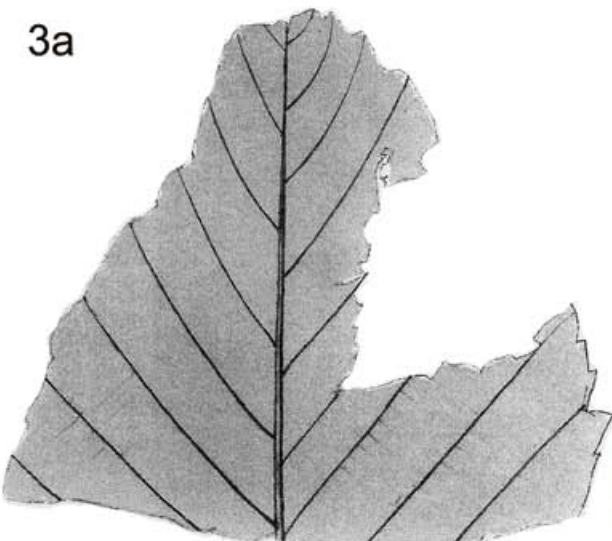


Plate 6

- Figs. 1–3: *Betula prisca* ETTINGSHAUSEN, 1851.
- Fig. 1a: Type figure of ETTINGSHAUSEN, 1851, Pl. 1, Fig. 15.
- Fig. 1b: Syntype.
GBA 1851/002/0005/1.
- Fig. 1c: Detail of the venation of Fig. 1b.
Scale 0.5 cm.
- Fig. 2a: Type figure of ETTINGSHAUSEN, 1851, Pl. 1, Fig. 16.
- Fig. 2b: Syntype.
GBA 1851/002/0005/2.
- Fig. 3a: Counterpart of the syntype (Fig. 2b).
GBA 1851/002/0005/3.
- Fig. 3b: Detail of the counterpart syntype (Fig. 3a) base with the petiole.
Scale 0.5 cm.

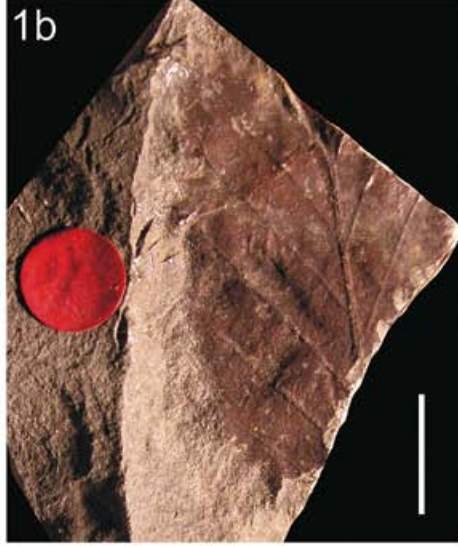
Scale 1 cm, if not mentioned otherwise.

Type figures from ETTINGSHAUSEN, 1851 are shown in their original size.

1a



1b



2a



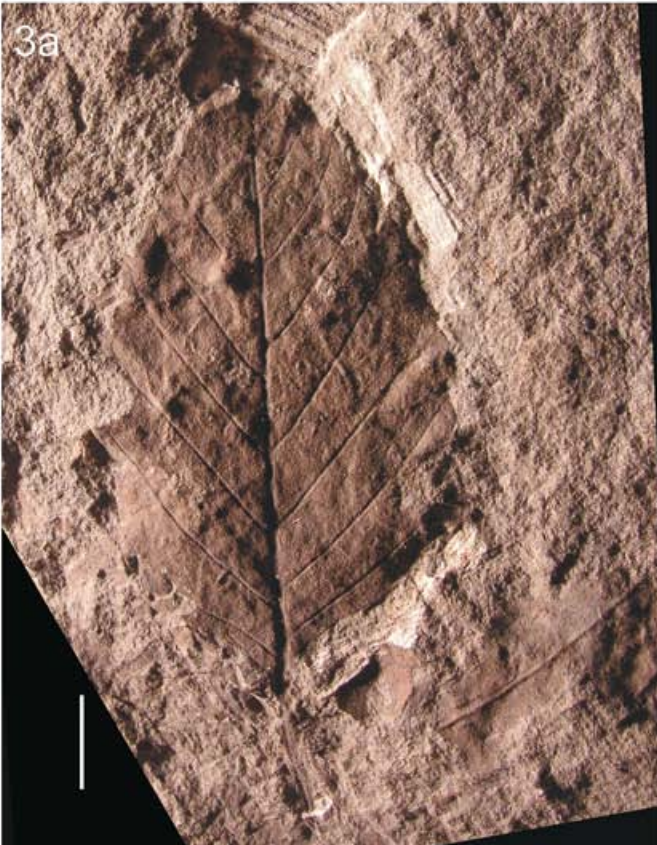
1c



2b



3a



3b

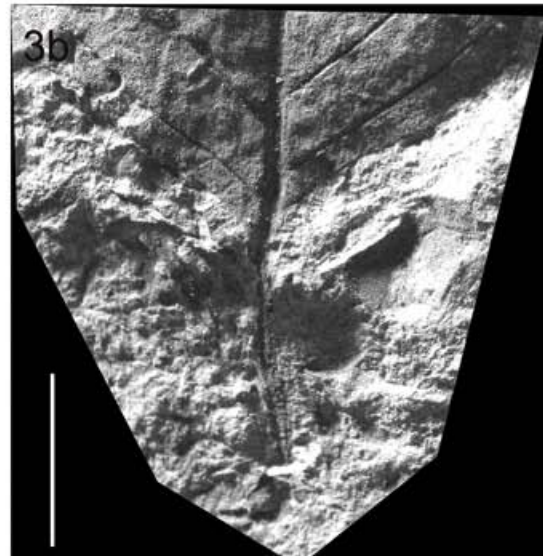


Plate 7

Fig. 1a–d: *Rhamnus augustinii* ETTINGSHAUSEN, 1851.

Fig. 1a: Sediment block with the holotype at the left lower margin (arrow), associated with leaves of *Alnus ducalis* (GAUDIN in GAUDIN & STROZZI, 1858) KNOBLOCH 1968 (GBA 1851/002/0007A).
Scale 3 cm.

Fig. 1b: Holotype.
GBA 1851/002/0007Ac.

Fig. 1c: Type figure of ETTINGSHAUSEN, 1851, Pl. 5, Fig. 3.

Fig. 1d: Detail of the type figure of ETTINGSHAUSEN, 1851, Pl. 5, Fig. d.

Fig. 2a–d: *Potamogeton ungeri* ETTINGSHAUSEN, 1851.

Fig. 2a: Sediment block with the holotype at the left margin (arrow) (GBA 1851/002/0002b), associated with *Cyperites tertiaris* UNGER (GBA 1851/002/0002a), left of the red dot and other plant fragments.

Fig. 2b: Holotype.
GBA 1851/002/0002b.

Fig. 2c: Type figure of ETTINGSHAUSEN, 1851, Pl. 1, Fig. 3.

Fig. 2d: Detail of the holotype (Fig. 2b) venation.
Scale 0.1 cm.

Fig. 3a–c: *Leguminosites ingaefolius* ETTINGSHAUSEN, 1851.

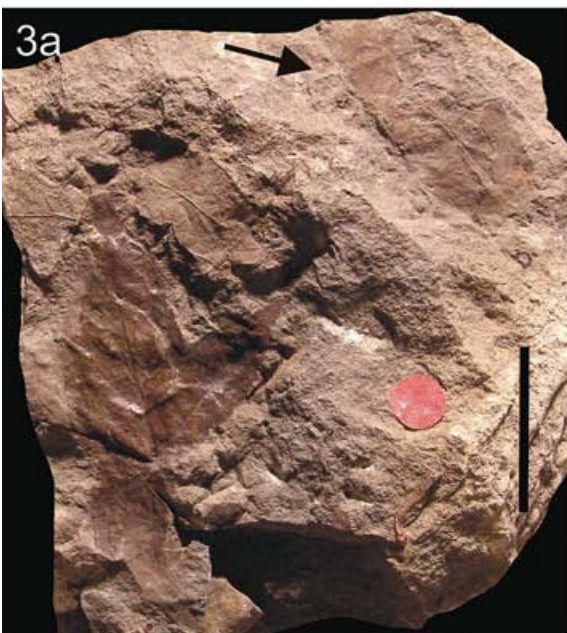
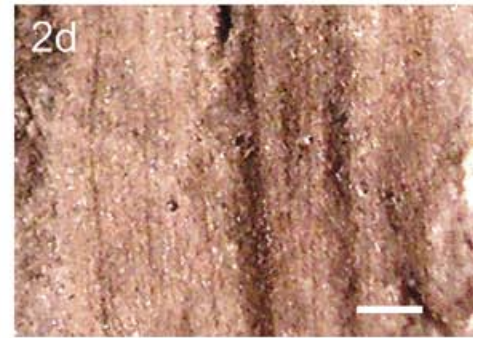
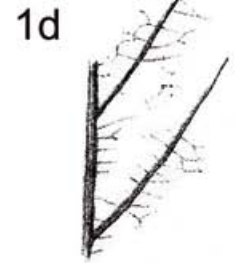
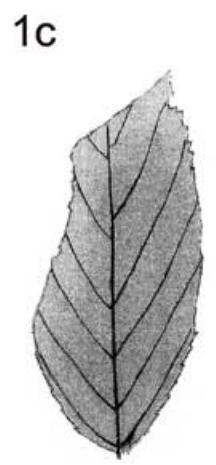
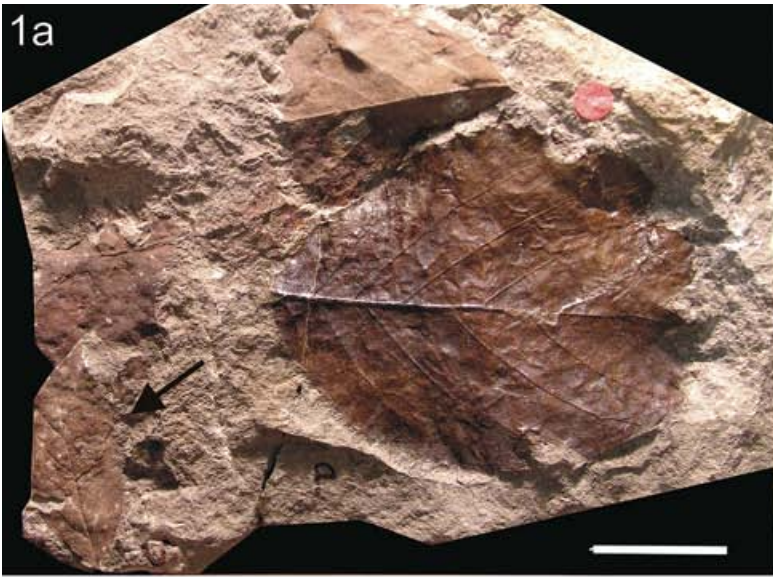
Fig. 3a: Sediment block with probable the holotype (GBA 1851/002/00012b) at the right upper margin (arrow), associated with *Liquidambar europaeum* A. BRAUN, 1836 (GBA 1851/002/0012/1a).

Fig. 3b: Type figure of ETTINGSHAUSEN, 1851, Pl. 5, Fig. 8.

Fig. 3c: Holotype?
GBA 1851/002/00012/1b.

Scale 1 cm, if not mentioned otherwise.

Type figures from ETTINGSHAUSEN, 1851 are shown in their original size.



**Type Specimens in ETTINGSHAUSEN'S Tertiary Flora from Häring in Tyrol (1853)
 in the Collections of the Geological Survey of Austria**

BARBARA MELLER^{*)}

1 Table, 43 Plates

*Paleobotany
 Type Specimens
 Inn Valley
 Oligocene
 Paleontological collection*

Contents

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**Typusexemplare von ETTINGSHAUSENS Tertiär Flora von Häring in Tirol (1853)
 in den Sammlungen der Geologischen Bundesanstalt**

Zusammenfassung

Constantin Freiherr von ETTINGSHAUSEN (1826–1897) beschrieb 1853 eine umfangreiche, 181 Arten umfassende fossile Flora aus der unteroligozänen Häring-Formation (Bergpeterl Member). Die Mehrzahl aller Holotypen, Isotypen und Syntypen der 122 neu beschriebenen Arten befindet sich in der paläobotanischen Typensammlung der Geologischen Bundesanstalt in Wien und ist hier aufgelistet und abgebildet.

Abstract

In 1853, Constantin von ETTINGSHAUSEN (1826–1897) described 181 species from the Lower Oligocene Bergpeterl Member of the Häring Formation. Most of the holotypes, isotypes and syntypes of the new species are stored in the paleobotanical type collection of the Geological Survey of Austria. They are all listed and figured here.

Introduction

Nearly 4,000 plant fossils form the basis of the voluminous publication of ETTINGSHAUSEN (1853) about the flora of Häring, now called Bad Häring, in Tyrol. This volume was the second part of the series called “The Tertiary Floras from the Austrian Monarchy”. The plant fossils, mainly leaves, were collected by ETTINGSHAUSEN, together with some miners, during 4 weeks in the summer of 1850, because he had been ordered to investigate the locality by the Geological Survey. The plant fossils were mainly found

at the top of the 1–10 m thick coal-bearing layer, with only a few found at the base (ETTINGSHAUSEN, 1853: 2). ETTINGSHAUSEN (1853) described 181 species, 59 of which had been previously described either by other paleobotanists or by himself (e.g. UNGER, 1850; ETTINGSHAUSEN, 1851) (Tab. 1). The other species were all new. The whereabouts of the type specimens of nine of the 122 new taxa is currently unknown but the remaining 113 new species are documented here by their holotypes, isotypes and syntypes, although for 37 species not all the syntypes are present (Tab. 1).

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Plant fossils from Bad Häring are also stored in the general part of the paleobotanical collection of the Geological Survey, in the paleobotanical collection of the Natural History Museum in Vienna, in the collection of the Botanical Institute of the Karl-Franzens University, Graz, and in the collection of the University of Innsbruck. The major part of the Graz collection is based on the work of ETTINGSHAUSEN, who was Professor of Botany and Phytopaleontology at Graz (KOVAR-EDER, 1997a, b).

The Bad Häring locality lies in the Lower Inn Valley, which has been geologically described in detail by, for example, ORTNER & STINGL (2001). The valley, which is an early inner-Alpine basin within the developing Alpine orogen, has been interpreted as a piggy-back basin. The plant fossils were derived from the Bergpeterl Member, which is the upper part of the Häring Formation, and includes both the coal layer and the "Bitumenmergel". ORTNER & STINGL (2001: 164) interpreted the Bergpeterl Member as a shallow marine deposit that developed from a fan delta, represented by the basal Lengerergraben Member. They also proposed that a fluvial system, flowing from the south, brought much of the plant debris that had previously been deposited in nearshore areas into the delta area of the river. The Bergpeterl Member was deposited in the Lower Rupelian of Lower Oligocene age (ORTNER & STINGL, 2001). The floristic composition (BUTZMANN & GREGOR, 2002) proves this age also.

The fossil plant assemblages of the Häring Formation in the Lower Inn Valley are the only known leaf assemblages of Lower Oligocene age in Austria. They have never been studied in detail since the time of ETTINGSHAUSEN. Investigations of other Lower Oligocene floras (e.g. from Bechlejovice, Czech Republic; KVACEK & WALTHER, 2004: 32) rarely include comparisons with the Bad Häring flora. Reasons for this might be both the often poor preservation of the leaf venation and that it has proved impossible to make cuticle preparations. However, in recent years, plant fossils from the Häring and overlying Paisslberg Formation in other collections have been morphologically investigated by BUTZMANN & GREGOR (2002), HEYUNG et al. (2003) and BUTZMANN et al. (2009). They first reviewed the collection of plant fossils from the Häring Formation in Bad Häring stored at the Geological-Paleontological Institute of the University in Innsbruck. They included a list of ETTINGSHAUSEN'S taxa with some remarks about their systematic position. The second publication deals with a new element from the overlying "Zementmergel" at Bad Häring, now included in the Paisslberg Formation. The third publication represents a systematic-taxonomic investigation of a fossil leaf flora from the Häring Formation at the Duxer Köpfl, near Kufstein, collected in 1969 and stored in the collection of the Bavarian State Collection of Palaeontology and Geology in Munich.

List of Type Specimens

The specimens are arranged according to their inventory numbers.
All material derives from the same locality and level.

Type level: Oligocene.

Type locality: Bad Häring, Tyrol, Austria.

Confervites capilliformis ETTINGSHAUSEN, 1853

(Pl. 1, Fig. 1)

Coll. no.: GBA 1853/001/0001.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 25, Pl. 4, Fig. 1.

Sphaerococcites alcornis ETTINGSHAUSEN, 1853

(Pl. 1, Fig. 2)

Coll. no.: GBA 1853/001/0002B.

Type: Counterpart of the syntype (ETTINGSHAUSEN, C. v. 1853: 25, Pl. 4, Fig. 2).

Remark: One syntype is missing.

Puccinites lanceolatus ETTINGSHAUSEN, 1853

(Pl. 1, Fig. 3)

Coll. no.: GBA 1853/001/0003.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 26, Pl. 4, Fig. 11.

Xylomites zizyphi ETTINGSHAUSEN, 1853

(Pl. 1, Fig. 4)

Coll. no.: GBA 1853/001/0005.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 26, Pl. 4, Fig. 6.

Sphaerites milliarius ETTINGSHAUSEN, 1853

(Pl. 1, Figs. 5–6)

Coll. no.: GBA 1853/001/0006/1.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 26, Pl. 4, Fig. 8.

Coll. no.: GBA 1853/001/0006/2A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 26, Pl. 4, Fig. 9.

Coll. no.: GBA 1853/001/0006/2B.

Type: Counterpart of the syntype.

Goniopteris braunii ETTINGSHAUSEN, 1853

(Pl. 2, Fig. 1)

Coll. no.: GBA 1853/001/0009.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 28, Pl. 31, Fig. 1.

***Caulinites articulatus* ETTINGSHAUSEN, 1853**

(Pl. 2, Figs. 2–4)

Coll. no.: GBA 1853/001/0010/1.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 28, Pl. 4, Fig. 13.

Coll. no.: GBA 1853/001/0010/2A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 28, Pl. 4, Fig. 14.

Coll. no.: GBA 1853/001/0010/2B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0010/3.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 28, Pl. 4, Fig. 15.

***Zosterites tenuifolius* ETTINGSHAUSEN, 1853**

(Pl. 2, Fig. 5)

Coll. no.: GBA 1853/001/0011A.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 28, Pl. 4, Fig. 16.

Coll. no.: GBA 1853/001/0011B.

Type: Isotype.

***Potamogeton acuminatus* ETTINGSHAUSEN, 1853**

(Pl. 2, Fig. 6)

Coll. no.: GBA 1853/001/0013.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 29, Pl. 4, Fig. 17.

***Potamogeton ovalifolius* ETTINGSHAUSEN, 1853**

(Pl. 2, Fig. 7)

Coll. no.: GBA 1853/001/0014.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 29, Pl. 4, Fig. 18.

***Potamogeton speciosus* ETTINGSHAUSEN, 1853**

(Pl. 3, Fig. 1)

Coll. no.: GBA 1853/001/0015.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 30, Pl. 4, Fig. 19.

***Juniperites eocenica* ETTINGSHAUSEN, 1853**

(Pl. 3, Fig. 2)

Coll. no.: GBA 1853/001/0021A.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 33, Pl. 5, Fig. 6.

Coll. no.: GBA 1853/001/0021B.

Type: Isotype.

***Cupressites freneloides* ETTINGSHAUSEN, 1853**

(Pl. 3, Figs. 3–6)

Coll. no.: GBA 1853/001/0022/1.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 34, Pl. 5, Fig. 1.

Coll. no.: GBA 1853/001/0022/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 34, Pl. 5, Fig. 2.

Coll. no.: GBA 1853/001/0022/3A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 34, Pl. 5, Fig. 3.

Coll. no.: GBA 1853/001/0022/3B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0022/4A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 34, Pl. 5, Fig. 5.

Coll. no.: GBA 1853/001/0022/4B.

Type: Counterpart of the syntype.

***Cupressites goepperti* ETTINGSHAUSEN, 1853**

(Pl. 3, Fig. 7)

Coll. no.: GBA 1853/001/0023.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 34, Pl. 5, Fig. 4.

***Pinites palaeostrobis* ETTINGSHAUSEN, 1853**

(Pl. 3, Fig. 8; Pl. 4, Figs. 1–7)

Coll. no.: GBA 1853/001/0026/1A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 35, Pl. 6, Fig. 23.

Coll. no.: GBA 1853/001/0026/1B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0026/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 35, Pl. 6, Fig. 24.

Coll. no.: GBA 1853/001/0026/3.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 35, Pl. 6, Fig. 26.

Coll. no.: GBA 1853/001/0026/4.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 35, Pl. 6, Fig. 27.

Coll. no.: GBA 1853/001/0026/5.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 35, Pl. 6, Fig. 28.

Coll. no.: GBA 1853/001/0026/6A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 35, Pl. 6, Fig. 29.

Coll. no.: GBA 1853/001/0026/6B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0026/7.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 35, Pl. 6, Fig. 30.

Coll. no.: GBA 1853/001/0026/8.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 35, Pl. 6, Fig. 33.

Coll. no.: GBA 1853/001/0026/9.
Type: Syntype.
Type figure: Ettingshausen, C.v. 1853: 35, Pl. 6, Fig. 25.

Remark: Three other specimens are not figured and might have been added later. The other figured syntypes have not been discovered yet in the collection.

***Podocarpus haeringiana* ETTINGSHAUSEN, 1853**
(Pl. 5, Fig. 1)

Coll. no.: GBA 1853/001/0028.
Type: Holotype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 36, Pl. 9, Fig. 1.

***Podocarpus mucronulata* ETTINGSHAUSEN, 1853**
(Pl. 5, Fig. 2)

Coll. no.: GBA 1853/001/0030.
Type: Holotype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 37, Pl. 9, Fig. 3

***Casuarina haidingeri* ETTINGSHAUSEN, 1853**
(Pl. 5, Figs. 3–8; Pl. 6, Fig. 1)

Coll. no.: GBA 1853/001/0033/1.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 38, Pl. 9, Fig. 17.

Coll. no.: GBA 1853/001/0033/2.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 38, Pl. 9, Fig. 18.

Coll. no.: GBA 1853/001/0033/3.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 38, Pl. 9, Fig. 19.

Coll. no.: GBA 1853/001/0033/4A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 38, Pl. 9, Fig. 20.

Coll. no.: GBA 1853/001/0033/4B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0033/5A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 38, Pl. 9, Fig. 21.

Coll. no.: GBA 1853/001/0033/5B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0033/6.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 38, Pl. 9, Fig. 22.

Coll. no.: GBA 1853/001/0033/7.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 38, Pl. 9, Fig. 23.

***Myrica antiqua* ETTINGSHAUSEN, 1853**
(Pl. 6, Figs. 2–3)

Coll. no.: GBA 1853/001/0034/1.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 39, Pl. 10, Fig. 1.

Coll. no.: GBA 1853/001/0034/2.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 39, Pl. 10, Fig. 2.

***Alnites reussii* ETTINGSHAUSEN, 1853**
(Pl. 6, Figs. 4–5; Pl. 7, Figs. 1–2)

Coll. no.: GBA 1853/001/0035/1A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 39, Pl. 31, Fig. 13.

Coll. no.: GBA 1853/001/0035/1B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0035/2.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 39, Pl. 31, Fig. 14.

Coll. no.: GBA 1853/001/0035/3A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 39, Pl. 31, Fig. 15.

Coll. no.: GBA 1853/001/0035/3B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0035/4.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 39, Pl. 31, Fig. 16.

Remark: One syntype is missing.

***Quercus deformis* ETTINGSHAUSEN, 1853**

(Pl. 7, Fig. 3)

Coll. no.: GBA 1853/001/0037A.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 40, Pl. 10, Fig. 3.

Coll. no.: GBA 1853/001/0037B.

Type: Isotype.

***Ficus insignis* ETTINGSHAUSEN, 1853**

(Pl. 7, Fig. 4)

Coll. no.: GBA 1853/001/0040B.

Type: Isotype.

Remark: The holotype (ETTINGSHAUSEN, C. v. 1853: 42, Pl. 10, Fig. 7) has not been discovered yet. The specimen in the collection seems to be the counterpart of the figured specimen.

***Salicites stenophyllos* ETTINGSHAUSEN, 1853**

(Pl. 6, Fig. 6)

Coll. no.: GBA 1853/001/0042.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 10, Fig. 10.

***Pisonia eocenica* ETTINGSHAUSEN, 1853**

(Pl. 8, Figs. 1–5; Pl. 9, Figs. 1–5; Pl. 10, Figs. 1–5)

Coll. no.: GBA 1853/001/0043/1.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 1.

Coll. no.: GBA 1853/001/0043/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 6.

Coll. no.: GBA 1853/001/0043/3.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 7.

Coll. no.: GBA 1853/001/0043/4.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 9.

Coll. no.: GBA 1853/001/0043/5.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 10.

Coll. no.: GBA 1853/001/0043/6.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 11.

Coll. no.: GBA 1853/001/0043/7.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 12.

Coll. no.: GBA 1853/001/0043/8.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 13.

Coll. no.: GBA 1853/001/0043/9A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 14.

Coll. no.: GBA 1853/001/0043/9B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0043/10.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 15.

Coll. no.: GBA 1853/001/0043/11B.

Type: Counterpart of the syntype (ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 18).

Remark: The syntype is still missing.

Coll. no.: GBA 1853/001/0043/12.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 19.

Coll. no.: GBA 1853/001/0043/13.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 20.

Coll. no.: GBA 1853/001/0043/14.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 21.

Coll. no.: GBA 1853/001/0043/15A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 43, Pl. 11, Fig. 22.

Coll. no.: GBA 1853/001/0043/15B.

Type: Counterpart of the syntype.

***Monimia haeringiana* ETTINGSHAUSEN, 1853**

(Pl. 10, Figs. 6–7)

Coll. no.: GBA 1853/001/0044/1.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 44, Pl. 10, Fig. 12.

Coll. no.: GBA 1853/001/0044/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 44, Pl. 10, Fig. 13.

***Monimia anceps* ETTINGSHAUSEN, 1853**

(Pl. 10, Fig. 8)

Coll. no.: GBA 1853/001/0045.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 45, Pl. 10, Fig. 11.

***Daphnogene grandifolia* ETTINGSHAUSEN, 1853**

(Pl. 11, Fig. 1)

Coll. no.: GBA 1853/001/0047A.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 45, Pl. 31, Fig. 10.

Coll. no.: GBA 1853/001/0047B.

Type: Isotype.

***Daphnogene haeringiana* ETTINGSHAUSEN, 1853**

(Pl. 11, Fig. 2)

Coll. no.: GBA 1853/001/0050.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 46, Pl. 11, Fig. 27.

***Laurus tetrantheroides* ETTINGSHAUSEN, 1853**

(Pl. 11, Fig. 3)

Coll. no.: GBA 1853/001/0052.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 47, Pl. 12, Fig. 2.

***Leptomeria gracilis* ETTINGSHAUSEN, 1853**

(Pl. 11, Figs. 4–6; Pl. 12, Figs. 1–2)

Coll. no.: GBA 1853/001/0054/1.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 48, Pl. 12, Fig. 20.

Coll. no.: GBA 1853/001/0054/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 48, Pl. 12, Fig. 21.

Coll. no.: GBA 1853/001/0054/3.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 48, Pl. 13, Fig. 3.

Coll. no.: GBA 1853/001/0054/4.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 48, Pl. 13, Fig. 4.

Coll. no.: GBA 1853/001/0054/5A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 48, Pl. 13, Fig. 6.

Coll. no.: GBA 1853/001/0054/5B.

Type: Counterpart of the syntype.

Remark: One syntype is still missing.

***Leptomeria flexuosa* ETTINGSHAUSEN, 1853**

(Pl. 12, Fig. 4; Pl. 13, Fig. 1)

Coll. no.: GBA 1853/001/0055/1A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 48, Pl. 13, Fig. 1.

Coll. no.: GBA 1853/001/0055/1B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0055/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 48, Pl. 13, Fig. 2.

***Leptomeria distans* ETTINGSHAUSEN, 1853**

(Pl. 12, Fig. 3)

Coll. no.: GBA 1853/001/0056.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 48, Pl. 12, Fig. 19.

***Santalum salicinum* ETTINGSHAUSEN, 1853**

(Pl. 12, Fig. 5; Pl. 13, Figs. 2–3)

Coll. no.: GBA 1853/001/0057/1B.

Type: Counterpart of the syntype (ETTINGSHAUSEN, C. v. 1853: 49, Pl. 12, Fig. 3).

Remark: This syntype is still missing.

Coll. no.: GBA 1853/001/0057/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 49, Pl. 12, Fig. 4.

Coll. no.: GBA 1853/001/0057/3.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 49, Pl. 12, Fig. 5.

***Santalum acheronticum* ETTINGSHAUSEN, 1853**

(Pl. 14, Figs. 1–3)

Coll. no.: GBA 1853/001/0058/1.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 49, Pl. 12, Fig. 7.

Coll. no.: GBA 1853/001/0058/2A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 49, Pl. 12, Fig. 8.

Coll. no.: GBA 1853/001/0058/2B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0058/3A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 49, Pl. 12, Fig. 10.

Coll. no.: GBA 1853/001/0058/3B.

Type: Counterpart of the syntype.

Remark: Two syntypes are still missing.

***Santalum osyrinum* ETTINGSHAUSEN, 1853**

(Pl. 14, Figs. 4–6)

Coll. no.: GBA 1853/001/0059/1A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 49, Pl. 12, Fig. 16.

Coll. no.: GBA 1853/001/0059/1B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0059/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 49, Pl. 12, Fig. 17.

Coll. no.: GBA 1853/001/0059/3B.

Type: Counterpart of the syntype (ETTINGSHAUSEN, C. v. 1853: 49, Pl. 12, Fig. 18).

Remark: This syntype has not been discovered yet.

***Santalum microphyllum* ETTINGSHAUSEN, 1853**

(Pl. 14, Figs. 7–9)

Coll. no.: GBA 1853/001/0060/1.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 50, Pl. 12, Fig. 11.

Coll. no.: GBA 1853/001/0060/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 50, Pl. 12, Fig. 12.

Coll. no.: GBA 1853/001/0060/3.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 50, Pl. 12, Fig. 13.

***Apocynophyllum haeringianum* ETTINGSHAUSEN, 1853**

(Pl. 15, Figs. 1–2)

Coll. no.: GBA 1853/001/0076/1A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 58, Pl. 20, Fig. 8.

Coll. no.: GBA 1853/001/0076/1B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0076/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 58, Pl. 20, Fig. 9.

***Apocynophyllum parvifolium* ETTINGSHAUSEN, 1853**

(Pl. 15, Fig. 3)

Coll. no.: GBA 1853/001/0077.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 58, Pl. 20, Fig. 10.

***Apocynophyllum alyxiaefolium* ETTINGSHAUSEN, 1853**

(Pl. 15, Fig. 4)

Coll. no.: GBA 1853/001/0078.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 58, Pl. 20, Fig. 11.

***Myoporum ambiguum* ETTINGSHAUSEN, 1853**

(Pl. 15, Fig. 5)

Coll. no.: GBA 1853/001/0079A.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 59, Pl. 20, Fig. 21.

Coll. no.: GBA 1853/001/0079B.

Type: Isotype.

***Myrsine europaea* ETTINGSHAUSEN, 1853**

(Pl. 15, Fig. 6; Pl. 16, Fig. 1)

Coll. no.: GBA 1853/001/0081A.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 60, Pl. 21, Fig. 2.

Coll. no.: GBA 1853/001/0081B.

Type: Isotype.

***Myrsine celastroides* ETTINGSHAUSEN, 1853**

(Pl. 16, Fig. 2)

Coll. no.: GBA 1853/001/0082.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 60, Pl. 21, Fig. 3.

***Ardisia oceanica* ETTINGSHAUSEN, 1853**

(Pl. 16, Figs. 3–4)

Coll. no.: GBA 1853/001/0083/1A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 60, Pl. 21, Fig. 4.

Coll. no.: GBA 1853/001/0083/1B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0083/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 60, Pl. 21, Fig. 5.

***Maesa protogaea* ETTINGSHAUSEN, 1853**

(Pl. 16, Fig. 5)

Coll. no.: GBA 1853/001/0084.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 60, Pl. 21, Fig. 1.

***Diospyros haeringiana* ETTINGSHAUSEN, 1853**
(Pl. 17, Figs. 1–2)

Coll. no.: GBA 1853/001/0085/1A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 61, Pl. 21, Fig. 26.
Coll. no.: GBA 1853/001/0085/1B.
Type: Counterpart of the syntype.
Coll. no.: GBA 1853/001/0085/2.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 61, Pl. 22, Fig. 11.

***Sapotacites mimusops* ETTINGSHAUSEN, 1853**
(Pl. 17, Fig. 3)

Coll. no.: GBA 1853/001/0087B.
Type: Isotype.
Remark: The holotype (ETTINGSHAUSEN, C. v. 1853: 62, Pl. 21, Fig. 22) is still missing.

***Sapotacites lanceolatus* ETTINGSHAUSEN, 1853**
(Pl. 17, Fig. 4)

Coll. no.: GBA 1853/001/0088A.
Type: Holotype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 62, Pl. 21, Fig. 24.
Coll. no.: GBA 1853/001/0088B.
Type: Isotype.

***Sapotacites minor* ETTINGSHAUSEN, 1853**
(Pl. 18, Figs. 1–2)

Coll. no.: GBA 1853/001/0089/1.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 62, Pl. 21, Fig. 7.
Coll. no.: GBA 1853/001/0089/2.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 62, Pl. 21, Fig. 8.

Remark: A third syntype has been figured by ETTINGSHAUSEN (1853: Pl. 21, Fig. 6) but has not been discovered yet.

***Sapotacites truncatus* ETTINGSHAUSEN, 1853**
(Pl. 18, Fig. 3)

Coll. no.: GBA 1853/001/0090.
Type: Holotype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 62, Pl. 21, Fig. 9.

***Sapotacites vaccinioides* ETTINGSHAUSEN, 1853**
(Pl. 18, Figs. 4–7)

Coll. no.: GBA 1853/001/0091/1.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 63, Pl. 21, Fig. 12.

Coll. no.: GBA 1853/001/0091/2.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 63, Pl. 21, Fig. 13.

Coll. no.: GBA 1853/001/0091/3.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 63, Pl. 21, Fig. 14.

Coll. no.: GBA 1853/001/0091/4.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 63, Pl. 21, Fig. 16.

Remark: Three syntypes are still missing.

***Sapotacites parvifolius* ETTINGSHAUSEN, 1853**
(Pl. 18, Fig. 8)

Coll. no.: GBA 1853/001/0092.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 63, Pl. 21 Fig. 18.
Remark: The second syntype is still missing

***Sapotacites ambiguus* ETTINGSHAUSEN, 1853**
(Pl. 18, Fig. 9)

Coll. no.: GBA 1853/001/0093.
Type: Holotype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 63, Pl. 21 Fig. 25.

***Arbutus eocenica* ETTINGSHAUSEN, 1853**
(Pl. 19, Fig. 1)

Coll. no.: GBA 1853/001/0095.
Type: Holotype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 64, Pl. 21, Fig. 23.

***Andromeda reticulata* ETTINGSHAUSEN, 1853**
(Pl. 19, Figs. 2–3)

Coll. no.: GBA 1853 1853/001/0097/1.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 65, Pl. 22, Fig. 9.

Coll. no.: GBA 1853/001/0097/2.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 65, Pl. 22, Fig. 10.

***Ceratopetalum haeringianum* ETTINGSHAUSEN, 1853**
(Pl. 19, Figs. 4–10; Pl. 20, Figs. 1–4)

Coll. no.: GBA 1853/001/0099/1.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 65, Pl. 22, Fig. 13.

Coll. no.: GBA 1853/001/0099/2.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 65, Pl. 22, Fig. 15.

Coll. no.: GBA 1853/001/0099/3.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 65, Pl. 22, Fig. 18.

Coll. no.: GBA 1853/001/0099/4.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 65, Pl. 22, Fig. 19.

Coll. no.: GBA 1853/001/0099/5.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 65, Pl. 22, Fig. 20.

Coll. no.: GBA 1853/001/0099/6.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 65, Pl. 22, Fig. 21.

Coll. no.: GBA 1853/001/0099/7.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 65, Pl. 22, Fig. 23.

Coll. no.: GBA 1853/001/0099/8A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 65, Pl. 22, Fig. 26.

Coll. no.: GBA 1853/001/0099/8B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0099/9A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 65, Pl. 22, Fig. 22.

Coll. no.: GBA 1853/001/0099/9B.
Type: Counterpart of the syntype

Coll. no.: GBA 1853/001/0099/10.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 65, Pl. 22, Fig. 25.

Coll. no.: GBA 1853/001/0099/11.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 65, Pl. 22, Fig. 24.

Remark: Three syntypes are still missing.

***Weinmannia paradisica* ETTINGSHAUSEN, 1853**
(Pl. 20, Figs. 5–10)

Coll. no.: GBA 1853/001/0100/1.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 1.

Coll. no.: GBA 1853/001/0100/2.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 2.

Coll. no.: GBA 1853/001/0100/3.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 3.

Coll. no.: GBA 1853/001/0100/4.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 4.

Coll. no.: GBA 1853/001/0100/5.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 6.

Coll. no.: GBA 1853/001/0100/6.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 7.

Remark: One syntype is missing.

***Weinmannia microphylla* ETTINGSHAUSEN, 1853**
(Pl. 21, Figs. 1–10; Pl. 22, Figs. 1–8)

Coll. no.: GBA 1853/001/0101/1A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 8.

Coll. no.: GBA 1853/001/0101/1B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0101/2.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 9.

Coll. no.: GBA 1853/001/0101/3.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 10.

Coll. no.: GBA 1853/001/0101/4.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 11.

Coll. no.: GBA 1853/001/0101/5.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 12.

Coll. no.: GBA 1853/001/0101/6A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 13.

Coll. no.: GBA 1853/001/0101/6B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0101/7.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 14.

Coll. no.: GBA 1853/001/0101/8.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 15.

Coll. no.: GBA 1853/001/0101/9.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 16.

Coll. no.: GBA 1853/001/0101/10A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 17.

Coll. no.: GBA 1853/001/0101/10B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0101/11.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 18.

Coll. no.: GBA 1853/001/0101/12.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 19.

Coll. no.: GBA 1853/001/0101/13.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 20.

Coll. no.: GBA 1853/001/0101/14.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 22.

Coll. no.: GBA 1853/001/0101/15.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 23.

Coll. no.: GBA 1853/001/0101/16.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 25.

Coll. no.: GBA 1853/001/0101/17.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 26.

Coll. no.: GBA 1853/001/0101/18.
Type: Syntype ?
Type figure: ETTINGSHAUSEN, C. v. 1853: 66, Pl. 23, Fig. 29.

Remark: A few of the syntypes are missing.

***Dombeyopsis dentata* ETTINGSHAUSEN, 1853**
(Pl. 22, Fig. 9)

Coll. no.: GBA 1853/001/0102.
Type: Holotype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 67, Pl. 31, Fig. 21.

***Hiraea borealis* ETTINGSHAUSEN, 1853**
(Pl. 23, Figs. 1–2)

Coll. no.: GBA 1853/001/0103/1.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 67, Pl. 23, Fig. 31.

Coll. no.: GBA 1853/001/0103/2A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 67, Pl. 23, Fig. 32.

Coll. no.: GBA 1853/001/0103/2B.
Type: Counterpart of the syntype.

Remark: One syntype is missing.

***Banisteria haeringiana* ETTINGSHAUSEN, 1853**
(Pl. 23, Figs. 3–4)

Coll. no.: GBA 1853/001/0104/1.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 68, Pl. 23, Fig. 34.

Coll. no.: GBA 1853/001/0104/2.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 68, Pl. 23, Fig. 35.

Remark: One syntype is missing.

***Dodonaea salicites* ETTINGSHAUSEN, 1853**
(Pl. 23, Figs. 5–6)

Coll. no.: GBA 1853/001/0105/1B.
Type: Counterpart of the syntype (ETTINGSHAUSEN, C. v. 1853: 68, Pl. 23, Fig. 36).
Remark: The syntype is missing.

Coll. no.: GBA 1853/001/0105/2A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 68, Pl. 23, Fig. 38.

Coll. no.: GBA 1853/001/0105/2B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0105/3.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 68, Pl. 23, Fig. 43.

Remark: Several syntypes are missing.

***Pittosporum fenzlii* ETTINGSHAUSEN, 1853**
(Pl. 23, Figs. 7–8; Pl. 24, Figs. 1–2)

Coll. no.: GBA 1853/001/0107/1A.
Type: Syntype.
Type figure: ETTINGSHAUSEN, C. v. 1853: 69, Pl. 24, Fig. 3.

Coll. no.: GBA 1853/001/0107/1B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0107/2.

Type: Syntype ?

Type figure: ETTINGSHAUSEN, C. v. 1853: 69, Pl. 24, Fig. 6.

Coll. no.: GBA 1853/001/0107/3.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 69, Pl. 24, Fig. 7.

Coll. no.: GBA 1853/001/0107/4.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 69, Pl. 24, Fig. 8.

Remark: Three syntypes are missing.

***Celastrus protogaesus* ETTINGSHAUSEN, 1853**

(Pl. 24, Figs. 3–11)

Coll. no.: GBA 1853/001/0108/1.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 22.

Coll. no.: GBA 1853/001/0108/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 17 upper left.

Remark: Such a sediment block as shown in Fig. 17 has not been found and has probably been created by the drawer.

Coll. no.: GBA 1853/001/0108/3.

Type: Labelled as syntype, but not comparable to one of the figured specimens on Pl. 24, Fig. 17.

Coll. no.: GBA 1853/001/0108/4.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 17 upper right.

Coll. no.: GBA 1853/001/0108/5.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 17.

Coll. no.: GBA 1853/001/0108/6.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 19.

Coll. no.: GBA 1853/001/0108/7A.

Type: Syntype ?

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 20 probably.

Coll. no.: GBA 1853/001/0108/7B.

Type: Counterpart of the probable syntype.

Coll. no.: GBA 1853/001/0108/8.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 25.

Coll. no.: GBA 1853/001/0108/9A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 24.

Coll. no.: GBA 1853/001/0108/9B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0108/10.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 26.

Coll. no.: GBA 1853/001/0108/11.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 28.

Coll. no.: GBA 1853/001/0108/12.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 29.

***Celastrus pseudoilex* ETTINGSHAUSEN, 1853**

(Pl. 25, Figs. 7–10)

Coll. no.: GBA 1853/001/0109/1A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 31.

Coll. no.: GBA 1853/001/0109/1B.

Type: Counterpart of the syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 32.

Coll. no.: GBA 1853/001/0109/2A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 34.

Coll. no.: GBA 1853/001/0109/2B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0109/3.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 35.

Coll. no.: GBA 1853/001/0109/4.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 70, Pl. 24, Fig. 36.

Remark: Two syntypes are missing.

***Celastrus acuminatus* ETTINGSHAUSEN, 1853**

(Pl. 25, Fig. 1)

Coll. no.: GBA 1853/001/0110.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 71, Pl. 24, Fig. 16.

***Celastrus deperditus* ETTINGSHAUSEN, 1853**

(Pl. 25, Fig. 2)

Coll. no.: GBA 1853/001/0111.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 71, Pl. 24, Fig. 15.

***Celastrus acherontis* ETTINGSHAUSEN, 1853**

(Pl. 25, Fig. 3)

Coll. no.: GBA 1853/001/0112.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 71, Pl. 24, Fig. 14.

***Celastrus pachyphyllus* ETTINGSHAUSEN, 1853**

(Pl. 25, Figs. 4–5)

Coll. no.: GBA 1853/001/0114/1.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 72, Pl. 24, Fig. 12.

Coll. no.: GBA 1853/001/0114/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 72, Pl. 24, Fig. 13.

***Celastrus aeoli* ETTINGSHAUSEN, 1853**

(Pl. 25, Fig. 6; Pl. 26, Fig. 1)

Coll. no.: GBA 1853/001/0115/1.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 72, Pl. 24, Fig. 9.

Coll. no.: GBA 1853/001/0115/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 72, Pl. 24, Fig. 10.

Remark: One syntype is missing.

***Evonymus aegipanos* ETTINGSHAUSEN, 1853**

(Pl. 26, Fig. 2)

Coll. no.: GBA 1853/001/0117.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 73, Pl. 24, Fig. 41.

***Elaeodendron haeringianum* ETTINGSHAUSEN, 1853**

(Pl. 26, Figs. 3–4)

Coll. no.: GBA 1853/001/0118/1A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 73, Pl. 24, Fig. 37.

Coll. no.: GBA 1853/001/0118/1B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0118/2A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 73, Pl. 24, Fig. 38.

Coll. no.: GBA 1853/001/0118/2B.

Type: Counterpart of the syntype.

***Elaeodendron dubium* ETTINGSHAUSEN, 1853**

(Pl. 27, Figs. 1–2)

Coll. no.: GBA 1853/001/0119/1A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 74, Pl. 24, Fig. 39.

Coll. no.: GBA 1853/001/0119/1B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0119/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 74, Pl. 24, Fig. 40.

***Ilex oreadam* ETTINGSHAUSEN, 1853**

(Pl. 27, Fig. 3)

Coll. no.: GBA 1853/001/0120.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 74, Pl. 25, Fig. 7.

***Ilex aizoon* ETTINGSHAUSEN, 1853**

(Pl. 27, Fig. 4)

Coll. no.: GBA 1853/001/0121.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 74, Pl. 25, Fig. 8.

***Rhamnus pomaderroides* ETTINGSHAUSEN, 1853**

(Pl. 27, Fig. 7)

Coll. no.: GBA 1853/001/0123.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 75, Pl. 25, Fig. 2.

***Rhamnus colubrinoides* ETTINGSHAUSEN, 1853**

(Pl. 27, Figs. 5–6)

Coll. no.: GBA 1853/001/0124/1.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 75, Pl. 25, Fig. 4.

Coll. no.: GBA 1853/001/0124/2A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 75, Pl. 25, Fig. 3.

Coll. no.: GBA 1853/001/0124/2B.

Type: Counterpart of the syntype.

Remark: One syntype is missing.

***Colliguaja protogaea* ETTINGSHAUSEN, 1853**

(Pl. 28, Fig. 1)

Coll. no.: GBA 1853/001/0126A.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 76, Pl. 26, Fig. 11.

Coll. no.: GBA 1853/001/0126B.

Type: Isotype.

***Euphorbiophyllum stillingioides* ETTINGSHAUSEN, 1853**

(Pl. 28, Figs. 2–3)

Coll. no.: GBA 1853/001/0127/1A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 77, Pl. 26, Fig. 1.

Coll. no.: GBA 1853/001/0127/1B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0127/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 77, Pl. 26, Fig. 2.

***Euphorbiophyllum subrotundum* ETTINGSHAUSEN, 1853**

(Pl. 28, Fig. 4)

Coll. no.: GBA 1853/001/0128.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 77, Pl. 26, Fig. 5.

Remark: The second specimen has not been found in the collection.

***Euphorbiophyllum omalanthoides* ETTINGSHAUSEN, 1853**

(Pl. 28, Fig. 5)

Coll. no.: GBA 1853/001/0129.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 77, Pl. 26, Fig. 3.

Remark: A second specimen with this identification was stored together with the holotype. But ETTINGSHAUSEN has mentioned only 1 specimen, therefore, that specimen probably does not belong to the type material.

***Euphorbiophyllum lanceolatum* ETTINGSHAUSEN, 1853**

(Pl. 29, Fig. 1)

Coll. no.: GBA 1853/001/0130.

Type: Holotype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 78, Pl. 26, Fig. 4.

***Phyllanthus haeringiana* ETTINGSHAUSEN, 1853**

(Pl. 29, Figs. 2–4)

Coll. no.: GBA 1853/001/0131/1A.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 78, Pl. 26, Fig. 7.

Coll. no.: GBA 1853/001/0131/1B.

Type: Probably the counterpart of the syntype.

Coll. no.: GBA 1853/001/0131/2.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 78, Pl. 26, Fig. 9.

Coll. no.: GBA 1853/001/0131/3.

Type: Syntype.

Type figure: ETTINGSHAUSEN, C. v. 1853: 78, Pl. 26, Fig. 8.

Remark: One syntype is missing.

***Rhus prisca* ETTINGSHAUSEN, 1853**

(Pl. 29, Figs. 5–9; Pl. 30, Figs. 1–4)

Coll. no.: GBA 1853/001/0133/1.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 79, Pl. 26, Fig. 14.

Coll. no.: GBA 1853/001/0133/2.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 79, Pl. 26, Fig. 17.

Coll. no.: GBA 1853/001/0133/3.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 79, Pl. 26, Fig. 18.

Coll. no.: GBA 1853/001/0133/4.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 79, Pl. 26, Fig. 19.

Coll. no.: GBA 1853/001/0133/5.

Type: Syntype ?

Type Figure: ETTINGSHAUSEN, C. v. 1853: 79, Pl. 26, Fig. 23.

Coll. no.: GBA 1853/001/0133/6A.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 79, Pl. 26, Fig. 15.

Coll. no.: GBA 1853/001/0133/6B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0133/7.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 79, Pl. 26, Fig. 16.

Coll. no.: GBA 1853/001/0133/8.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 79, Pl. 26, Fig. 21.

Coll. no.: GBA 1853/001/0133/9.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 79, Pl. 26, Fig. 22.

Remark: Two syntypes are missing.

***Rhus juglandogena* ETTINGSHAUSEN, 1853**
(Pl. 30, Figs. 5–7; Pl. 31, Figs. 1–3)

Coll. no.: GBA 1853/001/0135/1.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 80, Pl. 26, Fig. 24.

Coll. no.: GBA 1853/001/0135/2.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 80, Pl. 26, Fig. 25.

Coll. no.: GBA 1853/001/0135/3.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 80, Pl. 26, Fig. 26.

Coll. no.: GBA 1853/001/0135/4.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 80, Pl. 26, Fig. 28.

Coll. no.: GBA 1853/001/0135/5.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 80, Pl. 26, Fig. 29.

Coll. no.: GBA 1853/001/0135/6A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 80, Pl. 26, Fig. 27.

Coll. no.: 1853/001/0135/6B.
Type: Counterpart of the syntype.

***Rhus fraxinoides* ETTINGSHAUSEN, 1853**
(Pl. 31, Fig. 4)

Coll. no.: GBA 1853/001/0136A.
Type: Holotype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 80, Pl. 26, Fig. 43.

Coll. no.: GBA 1853/001/0136B.
Type: Isotype.

***Rhus cassiaeformis* ETTINGSHAUSEN, 1853**
(Pl. 31, Figs. 5–7; Pl. 32, Figs. 1–4)

Coll. no.: GBA 1853/001/0138/1.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 26, Fig. 30.

Coll. no.: GBA 1853/001/0138/2A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 26, Fig. 33.

Coll. no.: GBA 1853/001/0138/2B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0138/3.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 26, Fig. 35.

Coll. no.: GBA 1853/001/0138/4A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 26, Fig. 36.

Coll. no.: GBA 1853/001/0138/4B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0138/5.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 26, Fig. 34.

Coll. no.: GBA 1853/001/0138/6.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 26, Fig. 37.

Coll. no.: GBA 1853/001/0138/7.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 26, Fig. 38.

Remark: Two syntypes are missing.

***Zanthoxylon haeringianum* ETTINGSHAUSEN, 1853**
(Pl. 32, Fig. 7)

Coll. no.: GBA 1853/001/0139.
Type: Holotype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 81, Pl. 27, Fig. 1.

***Terminalia ungeri* ETTINGSHAUSEN, 1853**
(Pl. 32, Figs. 5–6)

Coll. no.: GBA 1853/001/0141/1A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 82, Pl. 27, Fig. 4.

Coll. no.: GBA 1853/001/0141/1B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0141/2.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 82, Pl. 27, Fig. 5.

***Rhizophora thinophila* ETTINGSHAUSEN, 1853**

(Pl. 33, Fig. 1)

Coll. no.: GBA 1853/001/0142.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 82, Pl. 27, Fig. 28.

Remark: The second syntype is still missing.

***Callistemophyllum diosmoides* ETTINGSHAUSEN, 1853**

(Pl. 33, Figs. 2–5)

Coll. no.: GBA 1853/001/0143/1A.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 83, Pl. 27, Fig. 6.

Coll. no.: GBA 1853/001/0143/1B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0143/2.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 83, Pl. 27, Fig. 7.

Coll. no.: GBA 1853/001/0143/3.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 83, Pl. 27, Fig. 8.

Coll. no.: GBA 1853/001/0143/4.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 83, Pl. 27, Fig. 9.

***Callistemophyllum verum* ETTINGSHAUSEN, 1853**

(Pl. 33, Figs. 6–7)

Coll. no.: GBA 1853/001/0144/1.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 83, Pl. 27, Fig. 11.

Coll. no.: GBA 1853/001/0144/2.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 83, Pl. 27, Fig. 12.

***Callistemophyllum speciosum* ETTINGSHAUSEN, 1853**

(Pl. 33, Figs. 8–9)

Coll. no.: GBA 1853/001/0145/1.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 83, Pl. 27, Fig. 10.

Coll. no.: GBA 1853/001/0145/2.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 83, Pl. 27, Fig. 15.

Remark: A third syntype is missing.

Callistemophyllum melaleucaeforme

ETTINGSHAUSEN, 1853

(Pl. 34, Figs. 1–2)

Coll. no.: GBA 1853/001/0146/1.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 27, Fig. 13.

Coll. no.: GBA 1853/001/0146/2A.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 27, Fig. 14.

Coll. no.: GBA 1853/001/0146/2B.

Type: Counterpart of the syntype.

***Eucalyptus haeringiana* ETTINGSHAUSEN, 1853**

(Pl. 34, Figs. 3–6; Pl. 35, Figs. 1–8; Pl. 36, Figs. 1–6)

Coll. no.: GBA 1853/001/0147/1.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 2.

Coll. no.: GBA 1853/001/0147/2.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 4.

Coll. no.: GBA 1853/001/0147/3.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 6.

Coll. no.: GBA 1853/001/0147/4.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 8.

Coll. no.: GBA 1853/001/0147/5.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 5.

Coll. no.: GBA 1853/001/0147/6.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 9.

Coll. no.: GBA 1853/001/0147/7A.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 11.

Coll. no.: GBA 1853/001/0147/7B.

Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0147/8.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 13.

Coll. no.: GBA 1853/001/0147/9.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 14

Coll. no.: GBA 1853/001/0147/10.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 15.

Coll. no.: GBA 1853/001/0147/11.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 16.

Coll. no.: GBA 1853/001/0147/12A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 18.

Coll. no.: GBA 1853/001/0147/12B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0147/13.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 20.

Coll. no.: GBA 1853/001/0147/14.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 23.

Coll. no.: GBA 1853/001/0147/15A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 17.

Coll. no.: GBA 1853/001/0147/15B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0147/16A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 19.

Coll. no.: GBA 1853/001/0147/16B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0147/17.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 21.

Coll. no.: GBA 1853/001/0147/18.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 84, Pl. 28, Fig. 22.

Remark: Some syntypes are missing.

***Metrosideros calophyllum* ETTINGSHAUSEN, 1853**
(Pl. 36, Fig. 7)

Coll. no.: GBA 1853/001/0149.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 85, Pl. 27, Fig. 18.
Remark: The second syntype is missing.

***Metrosideros extincta* ETTINGSHAUSEN, 1853**
(Pl. 36, Fig. 8)

Coll. no.: GBA 1853/001/0150A.
Type: Holotype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 85, Pl. 27, Fig. 19.

Coll. no.: GBA 1853/001/0150B.
Type: Isotype.

***Myrtus atlantica* ETTINGSHAUSEN, 1853**
(Pl. 36, Fig. 9)

Coll. no.: GBA 1853/001/0153A.
Type: Probably the holotype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 86, Pl. 27, Fig. 23.

Coll. no.: GBA 1853/001/0153B.
Type: Probably the isotype.

***Myrtus oceanica* ETTINGSHAUSEN, 1853**
(Pl. 37, Figs. 1–4)

Coll. no.: GBA 1853/001/0154/1.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 86, Pl. 27, Fig. 24.

Coll. no.: GBA 1853/001/0154/2.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 86, Pl. 27, Fig. 25.

Coll. no.: GBA 1853/001/0154/3A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 86, Pl. 27, Fig. 26.

Coll. no.: GBA 1853/001/0154/3B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0154/4.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 86, Pl. 27, Fig. 27.

***Phaseolites kennedyoides* ETTINGSHAUSEN, 1853**
(Pl. 37, Fig. 5)

Coll. no.: GBA 1853/001/0156.
Type: Holotype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 87, Pl. 29, Fig. 2.

***Phaseolites microphyllus* ETTINGSHAUSEN, 1853**
(Pl. 37, Figs. 6–8)

Coll. no.: GBA 1853/001/0157/1.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 87, Pl. 29, Fig. 3.

Coll. no.: GBA 1853/001/0157/2A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 87, Pl. 29, Fig. 5.

Coll. no.: GBA 1853/001/0157/2B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0157/3.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 87, Pl. 29, Fig. 6.

Remark: One syntype is missing.

***Dalbergia haeringiana* ETTINGSHAUSEN, 1853**
(Pl. 38, Figs. 1–2)

Coll. no.: GBA 1853/001/0158/1.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 87, Pl. 29, Fig. 8.

Coll. no.: GBA 1853/001/0158/2A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 87, Pl. 29, Fig. 9.

Coll. no.: GBA 1853/001/0158/2B.
Type: Counterpart of the syntype.

Remark: One syntype is missing.

***Caesalpinia haidingeri* ETTINGSHAUSEN, 1853**
(Pl. 38, Figs. 3–10; Pl. 39, Figs. 1–5)

Coll. no.: GBA 1853/001/0163/1A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 21.

Coll. no.: GBA 1853/001/0163/1B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0163/2A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 22.

Coll. no.: GBA 1853/001/0163/2B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0163/3A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 24.

Coll. no.: GBA 1853/001/0163/3B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0163/4.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 25.

Coll. no.: GBA 1853/001/0163/5.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 27.

Coll. no.: GBA 1853/001/0163/6.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 28.

Coll. no.: GBA 1853/001/0163/7.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 29.

Coll. no.: GBA 1853/001/0163/8.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 32.

Coll. no.: GBA 1853/001/0163/9.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 33.

Coll. no.: GBA 1853/001/0163/10A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 34.

Coll. no.: GBA 1853/001/0163/10B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0163/11.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 37.

Coll. no.: GBA 1853/001/0163/12.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 38.

Coll. no.: GBA 1853/001/0163/13.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 39.

Remark: Several syntypes are missing.

***Cassia pseudoglandulosa* ETTINGSHAUSEN, 1853**
(Pl. 39, Figs. 6–10; Pl. 40, Figs. 1–2)

Coll. no.: GBA 1853/001/0164/1.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 48.

Coll. no.: GBA 1853/001/0164/2.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 49.

Coll. no.: GBA 1853/001/0164/3.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 50.

Coll. no.: GBA 1853/001/0164/4A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 51.

Coll. no.: GBA 1853/001/0164/4B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0164/5.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 52.

Coll. no.: GBA 1853/001/0164/6.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 54.

Coll. no.: GBA 1853/001/0164/7.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 89, Pl. 29, Fig. 55.
Remark: One syntype is missing.

***Cassia zephyri* ETTINGSHAUSEN, 1853**
(Pl. 40, Figs. 3–10)

Coll. no.: GBA 1853/001/0167/1B.
Type: Labelled as counterpart of the syntype (ETTINGSHAUSEN, C. v. 1853: 90, Pl. 30, Fig. 1), but differs slightly.
Remark: The syntype is missing.

Coll. no.: GBA 1853/001/0167/2.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 90, Pl. 30, Fig. 2.

Coll. no.: GBA 1853/001/0167/3.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 90, Pl. 30, Fig. 3.

Coll. no.: GBA 1853/001/0167/4.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 90, Pl. 30, Fig. 4.

Coll. no.: GBA 1853/001/0167/5.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 90, Pl. 30, Fig. 5.

Coll. no.: GBA 1853/001/0167/6.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 90, Pl. 30, Fig. 6.

Coll. no.: GBA 1853/001/0167/7.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 90, Pl. 30, Fig. 7.

Coll. no.: GBA 1853/001/0167/8.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 90, Pl. 30, Fig. 8.

***Cassia feroniae* ETTINGSHAUSEN, 1853**
(Pl. 41, Figs. 1–3)

Coll. no.: GBA 1853/001/0168/1.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 91, Pl. 30, Fig. 9.

Coll. no.: GBA 1853/001/0168/2.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 91, Pl. 30, Fig. 10.

Coll. no.: GBA 1853/001/0168/3.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 91, Pl. 30, Fig. 11.

***Leguminosites dalbergioides* ETTINGSHAUSEN, 1853**
(Pl. 41, Figs. 4–6)

Coll. no.: GBA 1853/001/0171/1A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 91, Pl. 30, Fig. 18.

Coll. no.: GBA 1853/001/0171/1B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0171/2.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 91, Pl. 30, Fig. 19.

Coll. no.: GBA 1853/001/0171/3.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 91, Pl. 30, Fig. 20.

***Mimosites haeringiana* ETTINGSHAUSEN, 1853**
(Pl. 41, Figs. 7–8; Pl. 42, Figs. 1–9)

Coll. no.: GBA 1853/001/0173/1A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 24.

Coll. no.: GBA 1853/001/0173/1B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0173/2.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 25.

Coll. no.: GBA 1853/001/0173/3.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 26.

Coll. no.: GBA 1853/001/0173/4.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 27.

Coll. no.: GBA 1853/001/0173/5.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 28.

Coll. no.: GBA 1853/001/0173/6A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 29.

Coll. no.: GBA 1853/001/0173/6B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0173/7B.
Type: Counterpart of the syntype (ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 30).
Remark: This syntype is still missing.

Coll. no.: GBA 1853/001/0173/8.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 31.

Coll. no.: GBA 1853/001/0173/9.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 32.

Coll. no.: GBA 1853/001/0173/10.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 34.

Coll. no.: GBA 1853/001/0173/11.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 37.
Remark: Several syntypes are missing.

***Mimosites cassiaeformis* ETTINGSHAUSEN, 1853**
(Pl. 42, Figs. 10–17; Pl. 43, Fig. 1)

Coll. no.: GBA 1853/001/0174/1.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 38.

Coll. no.: GBA 1853/001/0174/2.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 39.

Coll. no.: GBA 1853/001/0174/3.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 40.

Coll. no.: GBA 1853/001/0174/4.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 42.

Coll. no.: GBA 1853/001/0174/5.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 43.

Coll. no.: GBA 1853/001/0174/6A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 45.

Coll. no.: GBA 1853/001/0174/6B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0174/7.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 47.

Coll. no.: GBA 1853/001/0174/8A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 48.

Coll. no.: GBA 1853/001/0174/8B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0174/9.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 92, Pl. 30, Fig. 49.
Remark: Some syntypes are missing.

***Acacia coriacea* ETTINGSHAUSEN, 1853**
(Pl. 43, Figs. 2–3)

Coll. no.: GBA 1853/001/0177/1.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 93, Pl. 30, Fig. 51.

Coll. no.: GBA 1853/001/0177/2.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 93, Pl. 30, Fig. 52.
Remark: One syntype is missing.

***Acacia mimosoides* ETTINGSHAUSEN, 1853**
(Pl. 43, Figs. 4–5)

Coll. no.: GBA 1853/001/0178/1A.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 93, Pl. 30, Fig. 60.

Coll. no.: GBA 1853/001/0178/1B.
Type: Counterpart of the syntype.

Coll. no.: GBA 1853/001/0178/2.
Type: Syntype.
Type Figure: ETTINGSHAUSEN, C. v. 1853: 93, Pl. 30, Fig. 61.

***Acacia proserpinae* ETTINGSHAUSEN, 1853**
(Pl. 43, Figs. 6–7)

Coll. no.: GBA 1853/001/0179/1.
Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 94, Pl. 30, Fig. 53.

Coll. no.: GBA 1853/001/0179/2.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 94, Pl. 30, Fig. 54.

***Acacia diana* ETTINGSHAUSEN, 1853**

(Pl. 43, Figs. 8–9)

Coll. no.: GBA 1853/001/0180/1.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 94, Pl. 30, Fig. 58.

Coll. no.: GBA 1853/001/0180/2.

Type: Syntype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 94, Pl. 30, Fig. 59.

***Inga europaea* ETTINGSHAUSEN, 1853**

(Pl. 43, Fig. 10)

Coll. no.: GBA 1853/001/0181A.

Type: Holotype.

Type Figure: ETTINGSHAUSEN, C. v. 1853: 94, Pl. 30, Fig. 62.

Coll. no.: GBA 1853/001/0181B.

Type: Isotype.

**Overview of the missing Type Specimens and those taxa from Häring,
which had been described earlier**

	Types missing	All specimens of a taxon missing	Described earlier
1	<i>Sphaerococcites alcicornis</i> ETTINGSHAUSEN 1853, Pl. 4, Figs. 2–3.	<i>Hypnites haeringianus</i> ETTINGSHAUSEN, 1853	<i>Xylomites umbilicatus</i> UNGER, 1847
2	<i>Xylomites zizyphi</i> ETTINGSHAUSEN 1853, Pl. 4, Figs. 4, 5, 7.	<i>Zosterites affinis</i> ETTINGSHAUSEN, 1853	<i>Equisetites braunii</i> UNGER, 1850
3	<i>Pinites palaeostrobis</i> ETTINGSHAUSEN 1853, Pl. 6, Figs. 22, 31, 32	<i>Typhaeloipum haeringianum</i> ETTINGSHAUSEN, 1853	<i>Typhaeloipum maritimum</i> UNGER, 1850
4	<i>Alnites reussii</i> ETTINGSHAUSEN 1853, Pl. 31, Fig. 17	<i>Podocarpus appollinis</i> ETTINGSHAUSEN, 1853	<i>Flabellaria raphifolia</i> STERNBERG, 1821
5	<i>Ficus insignis</i> ETTINGSHAUSEN, 1853, Pl. 10, Fig. 7	<i>Jacaranda borealis</i> ETTINGSHAUSEN, 1853	<i>Flabellaria verrucosa</i> UNGER
6	<i>Pisonia eocenica</i> ETTINGSHAUSEN 1853, Pl. 11, Figs. 2–5, 8, 16–18	<i>Sapotacites sideroxyloides</i> ETTINGSHAUSEN, 1853	<i>Flabellaria major</i> UNGER, 1847
7	<i>Leptomeria gracilis</i> ETTINGSHAUSEN 1853, Pl. 13, Fig. 5	<i>Pittosporum tenerimum</i> ETTINGSHAUSEN, 1853	<i>Callitrites brongniartii</i> ENDLICHER, 1847
8	<i>Santalum salicinum</i> ETTINGSHAUSEN 1853, Pl. 12, Fig. 3	<i>Rhus degener</i> ETTINGSHAUSEN, 1853	<i>Chamaecyparites hardtii</i> ENDLICHER, 1847
9	<i>Santalum acheronticum</i> ETTINGSHAUSEN 1853, Pl. 12, Figs. 6, 9		<i>Araucarites sternbergii</i> GÖPPERT in BRONN
10	<i>Santalum osyrinum</i> ETTINGSHAUSEN 1853, Pl. 12, Figs. 14, 15, 18		<i>Podocarpus taxites</i> UNGER, 1850
11	<i>Sapotacites mimusops</i> ETTINGSHAUSEN 1853, Pl. 21, Fig. 22		<i>Podocarpus eocenica</i> UNGER, 1850
12	<i>Sapotacites minor</i> ETTINGSHAUSEN 1853, Pl. 21, Fig. 6		<i>Quercus goepperti</i> WEBER, 1852
13	<i>Sapotacites vaccinioides</i> ETTINGSHAUSEN 1853, Pl. 21, Figs. 10–11, 15		<i>Planera ungeri</i> ETTINGSHAUSEN, 1851
14	<i>Sapotacites parvifolius</i> ETTINGSHAUSEN 1853, Pl. 21, Fig. 17.		<i>Ficus jynx</i> UNGER, 1850
15	<i>Ceratopetalum haeringianum</i> ETTINGSHAUSEN 1853, Pl. 22, Figs. 14, 16, 17,		<i>Artocarpidium integrifolium</i> UNGER, 1850
16	<i>Weinmannia microphylla</i> ETTINGSHAUSEN, 1853, Pl. 23, Figs. 24, 27, 28		<i>Daphnogene polymorpha</i> ETTINGSHAUSEN, 1851
17	<i>Weinmannia paradisiaca</i> ETTINGSHAUSEN, 1853, Pl. 23, Fig. 5		<i>Daphnogene cinnamomifolia</i> UNGER, 1850
18	<i>Hiraea borealis</i> ETTINGSHAUSEN, 1853, Pl. 23, Fig. 30		<i>Daphnogene lanceolata</i> UNGER, 1850
19	<i>Banisteria haeringiana</i> ETTINGSHAUSEN, 1853, Pl. 23, Fig. 33		<i>Laurus lalages</i> UNGER, 1850
20	<i>Dodonaea salicites</i> ETTINGSHAUSEN, 1853, Pl. 23, Figs. 37, 39–42		<i>Laurus phoeboides</i> ETTINGSHAUSEN, 1851
21	<i>Pittosporum fenzii</i> ETTINGSHAUSEN, 1853, Pl. 24, Figs. 2, 4, 5		<i>Persoonia daphnes</i> ETTINGSHAUSEN, 1851
22	<i>Celastrus protogaeus</i> ETTINGSHAUSEN, 1853, Pl. 24, Figs. 18, 21, 23, 27		<i>Persoonia myrtilus</i> ETTINGSHAUSEN, 1851
23	<i>Celastrus pseudoilix</i> ETTINGSHAUSEN 1853, Pl. 24, Figs. 30, 33		<i>Grevillea haeringiana</i> ETTINGSHAUSEN, 1851
24	<i>Celastrus aeoli</i> ETTINGSHAUSEN 1853, Pl. 24, Fig. 11		<i>Embothrites leptospermos</i> ETTINGSHAUSEN, 1851

	Types missing	All specimens of a taxon missing	Described earlier
25	<i>Rhamnus colubrinoides</i> ETTINGSHAUSEN, 1853, Pl. 25, Fig. 5		<i>Hakea plurinervia</i> ETTINGSHAUSEN, 1851
26	<i>Euphorbiophyllum subrotundum</i> ETTINGSHAUSEN, 1853, Pl. 26, Fig. 6		<i>Hakea myrsinites</i> ETTINGSHAUSEN, 1851
27	<i>Phyllanthus haeringiana</i> ETTINGSHAUSEN, 1853, Pl. 26, Fig. 10		<i>Lomatia reticulata</i> ETTINGSHAUSEN, 1851
28	<i>Rhus prisca</i> ETTINGSHAUSEN, 1853, Pl. 26, Figs. 13, 20		<i>Banksia longifolia</i> ETTINGSHAUSEN, 1851
29	<i>Rhus cassiaeformis</i> ETTINGSHAUSEN, 1853, Pl. 26, Figs. 31, 32		<i>Banksia haeringiana</i> ETTINGSHAUSEN, 1851
30	<i>Rhizophora thinophila</i> ETTINGSHAUSEN, 1853, Pl. 27, Fig. 29		<i>Banksia ungeri</i> ETTINGSHAUSEN, 1851
31	<i>Callistemphyllum speciosum</i> ETTINGSHAUSEN, 1853, Pl. 27, Fig. 16		<i>Banksia dillenoides</i> ETTINGSHAUSEN, 1851
32	<i>Eucalyptus haeringiana</i> ETTINGSHAUSEN, 1853, Pl. 28, Figs. 3, 7, 10, 12		<i>Dryandra brongniartii</i> ETTINGSHAUSEN, 1851
33	<i>Metrosideros calophyllum</i> ETTINGSHAUSEN, 1853, Pl. 27, Fig. 17		<i>Dryandroides hakeaeifolius</i> ETTINGSHAUSEN, 1850
34	<i>Phaseolites microphyllus</i> ETTINGSHAUSEN, 1853, Pl. 29, Fig. 4		<i>Dryandroides lignitum</i> ETTINGSHAUSEN, 1851
35	<i>Dalbergia haeringiana</i> ETTINGSHAUSEN, 1853, Pl. 29, Fig. 7		<i>Dryandroides brevifolius</i> ETTINGSHAUSEN, 1851
36	<i>Caesalpinia haidingeri</i> ETTINGSHAUSEN, 1853, Pl. 29, Figs. 23, 26, 30, 31, 35, 36		<i>Bumelia oreadum</i> UNGER, 1850
37	<i>Cassia pseudoglandulosa</i> ETTINGSHAUSEN, 1853, Pl. 29, Fig. 53		<i>Andromeda protogaea</i> UNGER, 1850
38	<i>Cassia zephyri</i> ETTINGSHAUSEN, 1853, Pl. 30, Fig. 1		<i>Panax longissimum</i> UNGER, 1850
39	<i>Mimosites haeringiana</i> ETTINGSHAUSEN, 1853, Pl. 30, Figs. 23, 30, 33, 35, 36		<i>Celastrus oreophilus</i> UNGER, 1850
40	<i>Mimosites cassiaeformis</i> ETTINGSHAUSEN 1853, Pl. 30, Figs. 41, 44, 46, 50		<i>Celastrus persei</i> UNGER, 1850
41	<i>Acacia coriacea</i> ETTINGSHAUSEN, 1853, Pl. 29, Fig. 17		<i>Ilex parschlugiana</i> UNGER, 1847
42			<i>Ceanothus zizyphoides</i> UNGER, 1847
43			<i>Juglans hydrophila</i> UNGER, 1850
44			<i>Rhus stygia</i> UNGER, 1847
45			<i>Getonia antholithus</i> UNGER, 1847
46			<i>Eucalyptus oceanica</i> UNGER, 1850
47			<i>Eugenia appollinis</i> UNGER, 1850
48			<i>Eugenia haeringiana</i> UNGER, 1850
49			<i>Phaesolites orbicularis</i> UNGER, 1850
50			<i>Palaeobium heterophyllum</i> , UNGER, 1850
51			<i>Palaeobium haeringiana</i> UNGER, 1850
52			<i>Palaeobium radobojense</i> UNGER, 1850
53			<i>Sophora europaea</i> UNGER, 1850
54			<i>Cassia lignitum</i> UNGER, 1850
55			<i>Cassia ambigua</i> UNGER, 1850
56			<i>Cassia hyperborea</i> UNGER, 1850
57			<i>Cassia phaseolites</i> UNGER, 1851
58			<i>Mimosites palaeogaea</i> UNGER, 1850
59			<i>Acacia sotzkiana</i> UNGER, 1850
60			<i>Acacia parschlugiana</i> UNGER, 1850

Table 1. Overview about those taxa, which ETTINGSHAUSEN has described in 1853, but which are missing, and those taxa, which had been described earlier by ETTINGSHAUSEN and other palaeobotanists.

Plates

The type figures of ETTINGSHAUSEN 1853 are always shown in their size in the original publication.

The scale bars of the types are always 2 cm, if not mentioned otherwise.

Plate 1

- Fig. 1: *Confervites capilliformis* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 4, Fig. 1.
Fig. 1b: Sediment block with the holotype and other plant fragments; the rectangle marks the part, which is shown in Fig. 1c.
Fig. 1c: Detail of the holotype.
Scale bar 5 mm.
Fig. 1b–c: GBA 1853/001/0001.
- Fig. 2: *Sphaerococcites alcicornis* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 4, Fig. 2.
Fig. 2b: Sediment block with numerous plant fragments and the probable counterpart of the type figure.
Fig. 2c: Detail of Fig. 2b.
Scale bar 5 mm.
Fig. 2b–c: GBA 1853/001/0002B.
- Fig. 3: *Puccinites lanceolatus* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 4, Fig. 11.
Fig. 3b: Holotype.
Fig. 3c: Detail of the middle part of the holotype.
Scale bar 5 mm.
Fig. 3b–c: GBA 1853/001/0003.
- Fig. 4: *Xylomites zizyphi* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 4, Fig. 6.
Fig. 4b: Syntype on a leaf of *Ceanothus zizyphoides* UNGER.
Fig. 4c: Detail of the lower part of the leaf.
Scale bar 5 mm.
Fig. 4b–c: GBA 1853/001/0005.
- Fig. 5: *Sphaerites milliarius* ETTINGSHAUSEN, 1853.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 4, Fig. 8.
Fig. 5b: Leaf fragment with the leaf fungi.
Scale bar 5 mm.
GBA 1853/001/0006/1.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 4, Fig. 9.
Fig. 6b: Leaf fragment with the leaf fungi.
Scale bar 5 mm.
GBA 1853/001/0006/2A.
- Fig. 6c: Counterpart.
Scale bar 5 mm.
GBA 1853/001/0006/2B.
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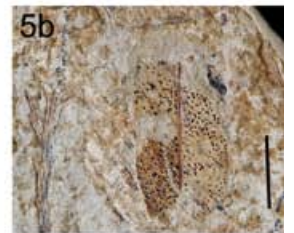
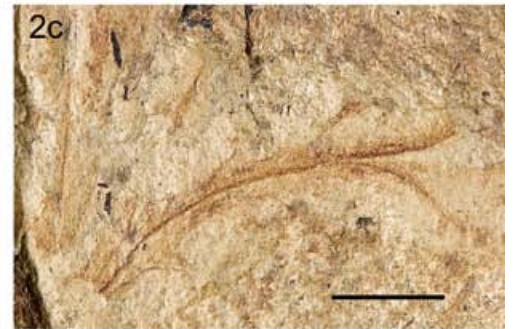


Plate 2

- Fig. 1: *Goniopteris braunii* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 31, Fig. 1.
Fig. 1b: Holotype.
Fig. 1c: Detail of the middle part of the holotype.
Scale bar 5 mm.
Fig. 1b–c: GBA 1853/001/0009.
- Figs. 2–4: *Caulinites articulatus* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 4, Fig. 13.
Fig. 2b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0010/1.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 4, Fig. 14.
Fig. 3b: Syntype.
GBA 1853/001/0010/2A.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 4, Fig. 15.
Fig. 4b: Syntype.
GBA 1853/001/0010/3.
- Fig. 5: *Zosterites tenuifolius* ETTINGSHAUSEN, 1853.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 4, Fig. 16.
Fig. 5b: Holotype.
GBA 1853/001/0011A.
- Fig. 6: *Potamogeton acuminatus* ETTINGSHAUSEN, 1853.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 4, Fig. 17.
Fig. 6b: Holotype.
Fig. 6c: Detail of the holotype.
Scale bar 5 mm.
Fig. 6b–c: GBA 1853/001/0013.
- Fig. 7: *Potamogeton ovalifolius* ETTINGSHAUSEN, 1853.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 4, Fig. 18.
Fig. 7b: Holotype.
GBA 1853/001/0014.
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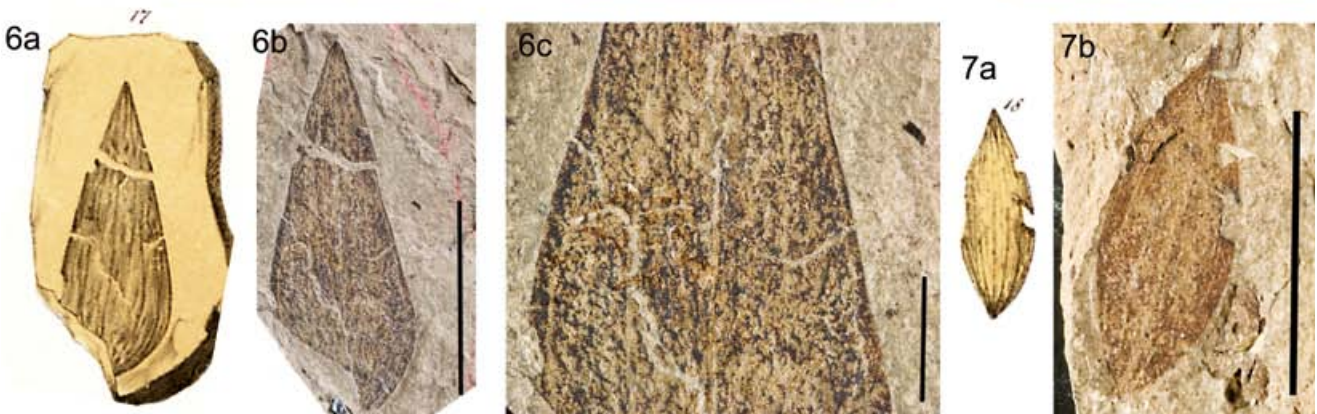
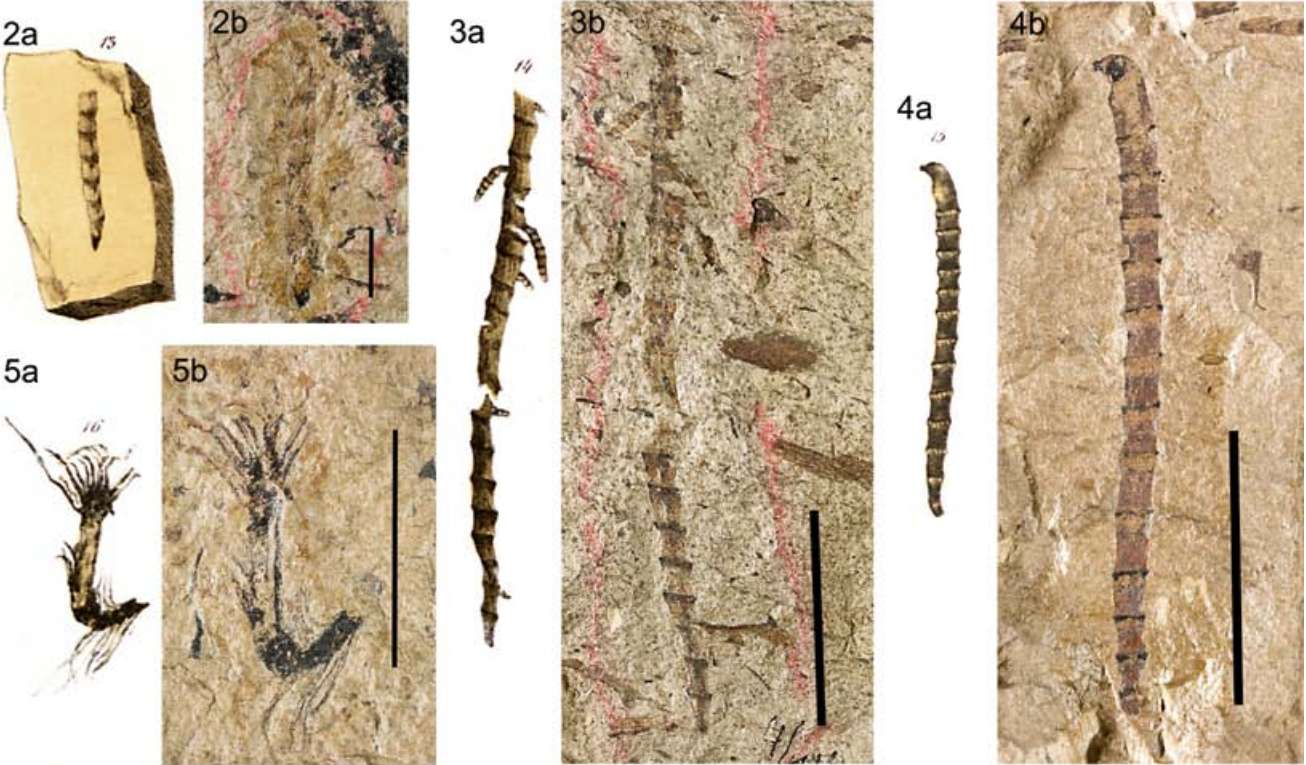
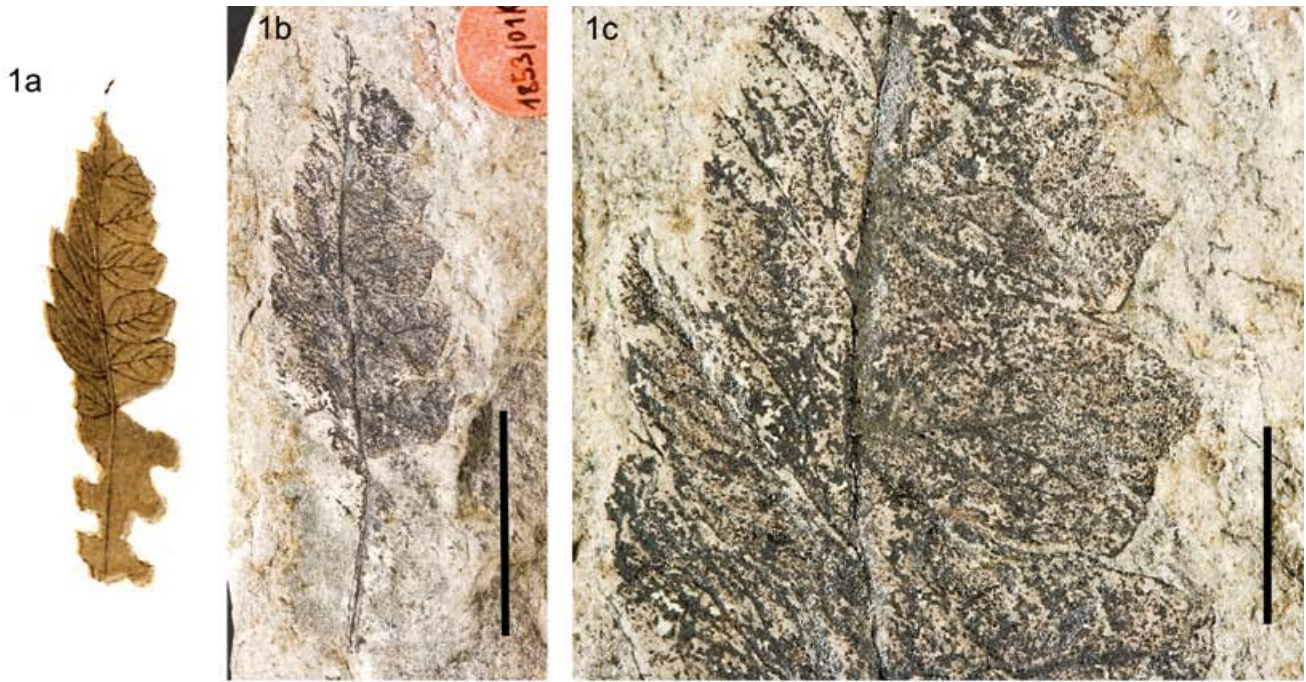


Plate 3

- Fig. 1: *Potamogeton speciosus* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 4, Fig. 19.
Fig. 1b: Holotype.
Fig. 1c: Detail of the middle part of the holotype.
Scale bar 5 mm.
Fig. 1b–c: GBA 1853/001/0015.
- Fig. 2: *Juniperites eocenica* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 5, Fig. 6.
Fig. 2b: Holotype.
Scale bar 5 mm.
GBA 1853/001/0021A.
- Figs. 3–6: *Cupressites freneloides* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 5, Fig. 1.
Fig. 3b: Syntype.
GBA 1853/001/0022/1.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 5, Fig. 2.
Fig. 4b: Syntype.
GBA 1853/001/0022/2.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 5, Fig. 3.
Fig. 5b: Syntype.
GBA 1853/001/0022/3A.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 5, Fig. 5.
Fig. 6b: Syntype.
GBA 1853/001/0022/4A.
- Fig. 7: *Cupressites goepperti* ETTINGSHAUSEN, 1853.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 5, Fig. 7.
Fig. 7b: Holotype.
GBA 1853/001/0023.
- Fig. 8: *Pinites palaeostrobus* ETTINGSHAUSEN, 1853.
Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 6, Fig. 23.
Fig. 8b: Syntype.
GBA 1853/001/0026/1A.
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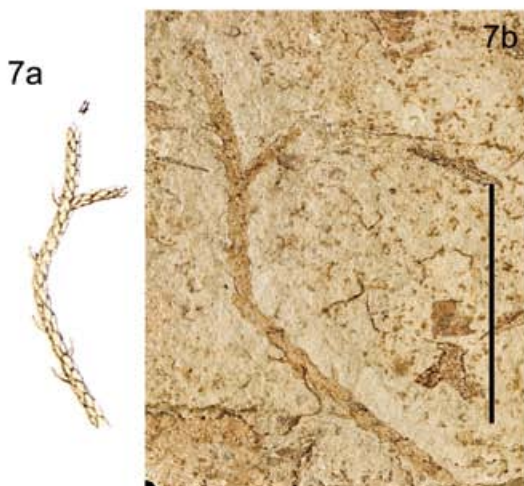
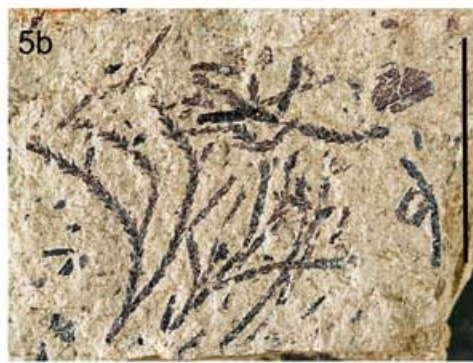
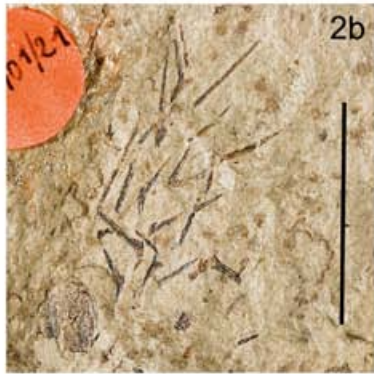
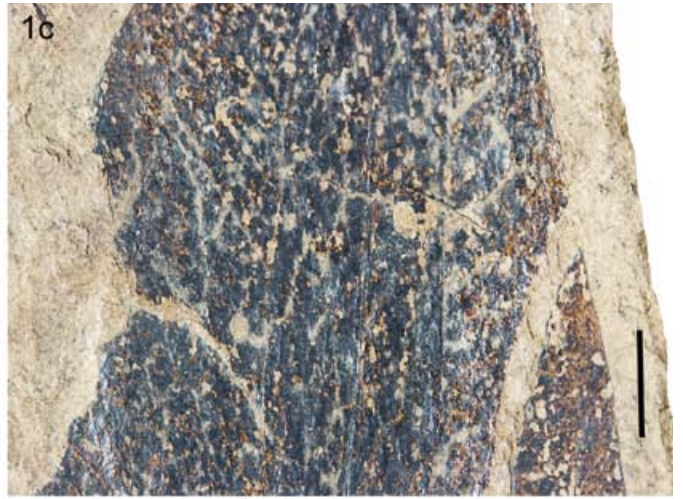


Plate 4

- Figs. 1–7: *Pinites palaeostrobis* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 6, Fig. 24.
Fig. 1b: Syntype.
GBA 1853/001/0026/2.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 6, Fig. 26.
Fig. 2b: Syntype.
GBA 1853/001/0026/3.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 6, Fig. 27.
Fig. 3b: Syntype.
GBA 1853/001/0026/4.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 6, Fig. 28.
Fig. 4b: Syntype.
GBA 1853/001/0026/5.
- Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 6, Fig. 29.
Fig. 5b: Syntype.
GBA 1853/001/0026/6A.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 6, Fig. 30.
Fig. 6b: Syntype.
GBA 1853/001/0026/7.
- Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 6, Fig. 33.
Fig. 7b: Syntype.
GBA 1853/001/0026/8.
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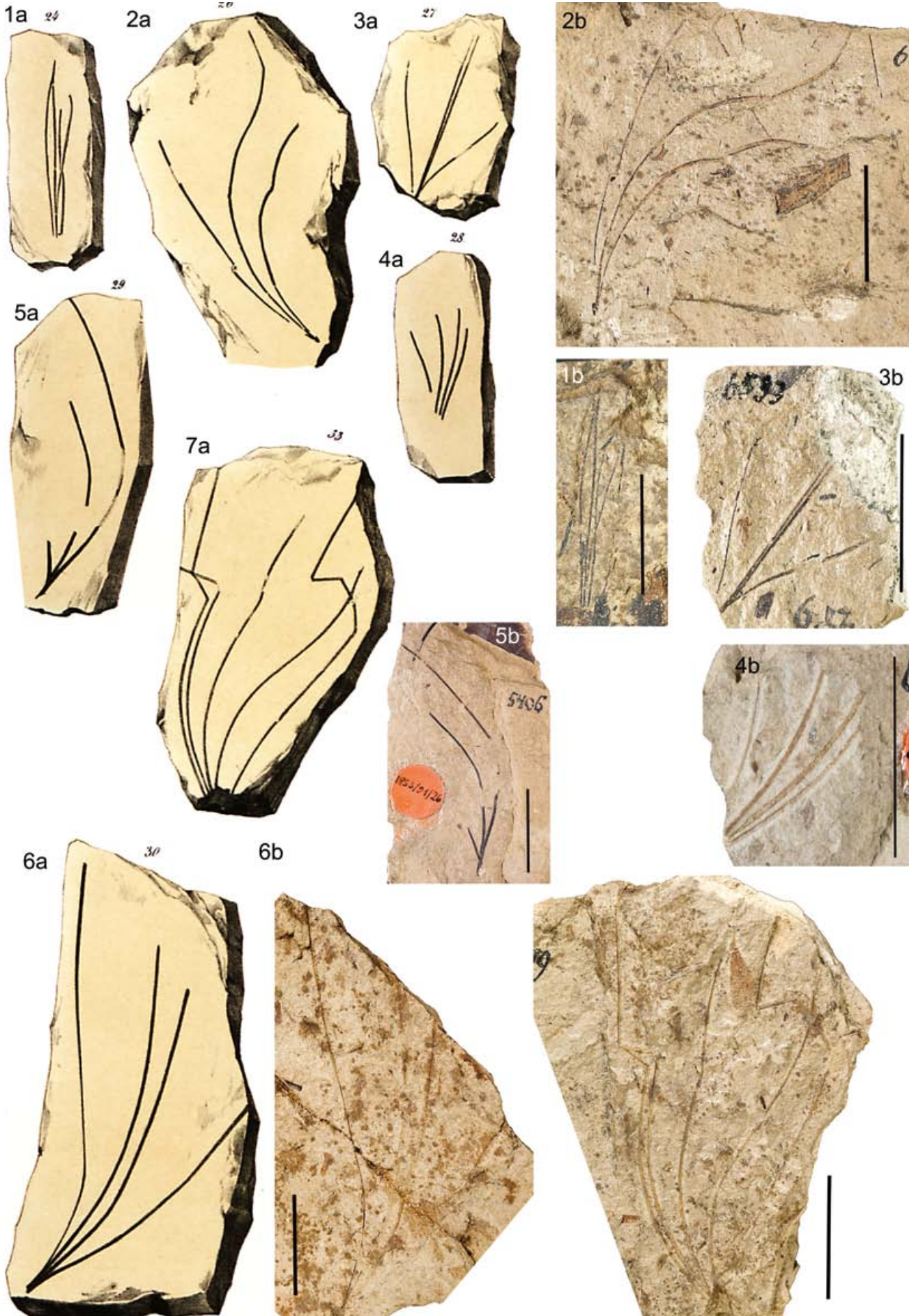


Plate 5

- Fig. 1: *Podocarpus haeringiana* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 9, Fig. 1.
Fig. 1b: Holotype.
GBA 1853/001/0028.
- Fig. 2: *Podocarpus mucronulata* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 9, Fig. 3.
Fig. 2b: Holotype.
GBA 1853/001/0030.
- Figs. 3–8: *Casuarina haidingeri* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 9, Fig. 17.
Fig. 3b: Syntype.
GBA 1853/001/0033/1.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 9, Fig. 18.
Fig. 4b: Syntype.
GBA 1853/001/0033/2.
- Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 9, Fig. 19.
Fig. 5b: Syntype.
GBA 1853/001/0033/3.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 9, Fig. 20.
Fig. 6b: Syntype.
GBA 1853/001/0033/4A.
- Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 9, Fig. 21.
Fig. 7b: Syntype.
GBA 1853/001/0033/5A.
- Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 9, Fig. 22.
Fig. 8b: Syntype.
GBA 1853/001/0033/6.
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Plate 6

- Fig. 1: *Casuarina haidingeri* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 9, Fig. 23.
Fig. 1b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0033/7.
- Figs. 2–3: *Myrica antiqua* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 10, Fig. 1.
Fig. 2b: Syntype.
GBA 1853/001/0034/1.
Fig. 2c: Detail of the middle part of the syntype.
Scale 5 mm.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 10, Fig. 2.
Fig. 3b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0034/2.
- Figs. 4–5: *Alnites reussii* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 31, Fig. 13.
Fig. 4b: Syntype.
Fig. 4c: Detail of the lower part of the syntype.
Scale 5 mm.
Fig. 4b–c: GBA 1853/001/0035/1A.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 31, Fig. 14.
Fig. 5b: Syntype.
GBA 1853/001/0035/2.
- Fig. 6: *Salicites stenophyllos* ETTINGSHAUSEN, 1853.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 10, Fig. 10.
Fig. 6b: Holotype.
Fig. 6c: Detail of the middle part of the holotype.
Scale 5 mm.
Fig. 6b–c: GBA 1853/001/0042.
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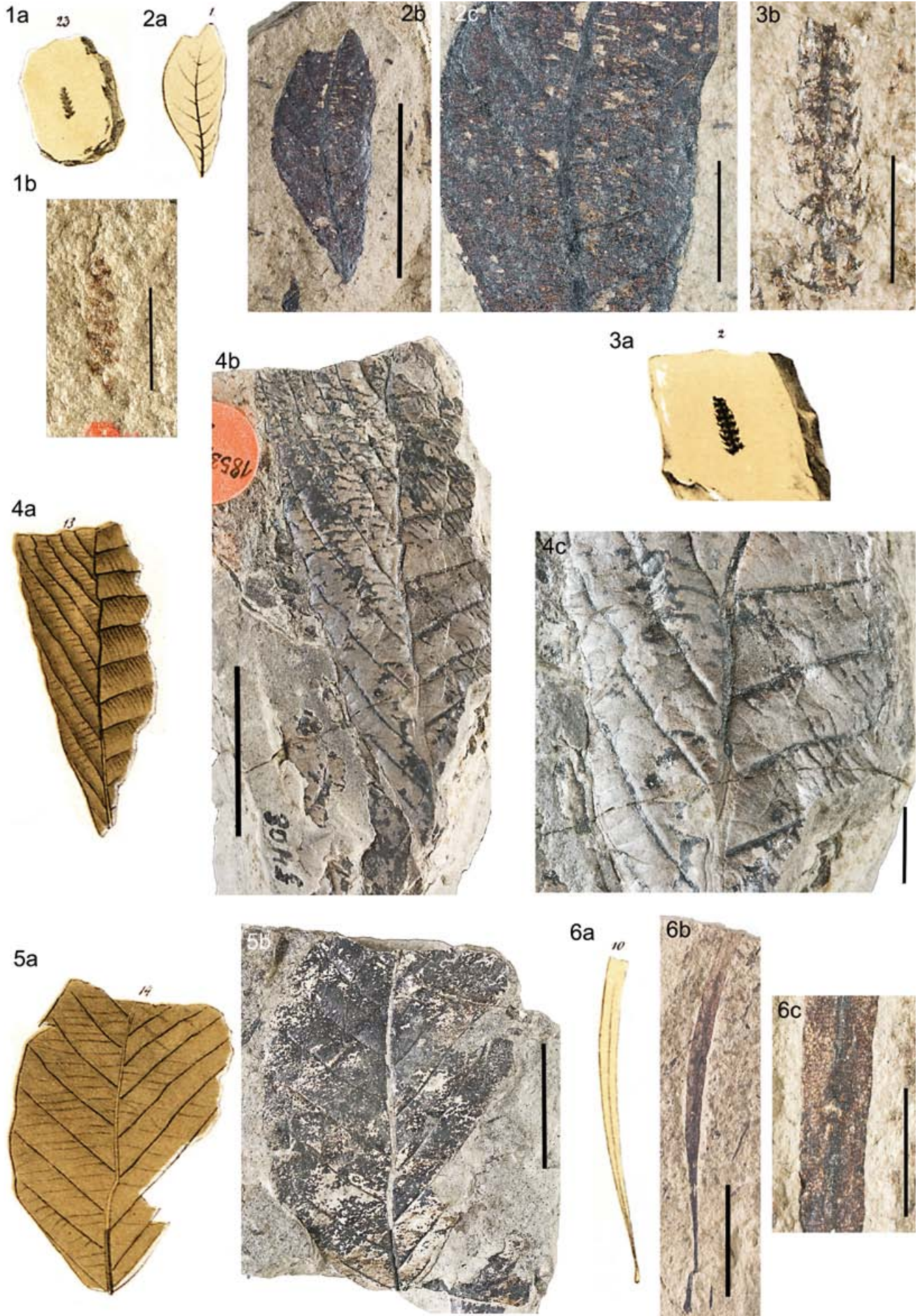


Plate 7

- Figs. 1–2: *Alnites reussii* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 31, Fig. 15.
Fig. 1b: Syntype.
GBA 1853/001/0035/3A.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 31, Fig. 16.
Fig. 2b: Syntype.
GBA 1853/001/0035/4.
- Fig. 3: *Quercus deformis* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 10, Fig. 3.
Fig. 3b: Holotype.
Fig. 3c: Detail of the basal part of the holotype.
Scale bar 5 mm.
Fig. 3b–c: GBA 1853/001/0037A.
- Fig. 4: *Ficus insignis* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 10, Fig. 7.
Fig. 4b: Isotype.
Fig. 4c: Detail of the basal part of the isotype.
Scale bar 5 mm.
Fig. 4b–c: GBA 1853/001/0040A.
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Plate 8

- Figs. 1–5: *Pisonia eocenica* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 1.
Fig. 1b: Syntype.
GBA 1853/001/0043/1.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 6.
Fig. 2b: Syntype.
Fig. 2c: Detail of the middle part of the syntype.
Scale bar 5 mm.
Fig. 2b–c: GBA 1853/001/0043/2.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 7.
Fig. 3b: Syntype.
GBA 1853/001/0043/3.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 9.
Fig. 4b: Syntype.
Fig. 4c: Detail of the middle part of the syntype.
Scale bar 5 mm.
Fig. 4b–c: GBA 1853/001/0043/4.
- Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 10.
Fig. 5b: Syntype.
Fig. 5c: Detail of the lower part of the probable syntype.
Scale bar 5 mm.
Fig. 5b–c: GBA 1853/001/0043/5.
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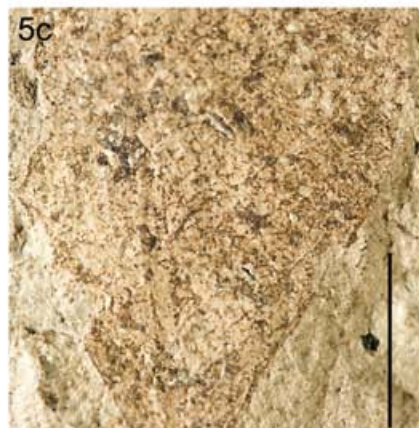


Plate 9

- Figs. 1–5: *Pisonia eocenica* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 11.
Fig. 1b: Syntype.
GBA 1853/001/0043/6.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 12.
Fig. 2b: Syntype.
Fig. 2c: Detail of the middle part of the syntype.
Scale bar 5 mm.
Fig. 2b–c: GBA 1853/001/0043/7.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 13.
Fig. 3b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0043/8.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 14.
Fig. 4b: Syntype.
Fig. 4c: Detail of the middle part of the syntype.
Scale bar 5 mm.
Fig. 4b–c: GBA 1853/001/0043/9A
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 15.
Fig. 5b: Syntype.
GBA 1853/001/0043/10.

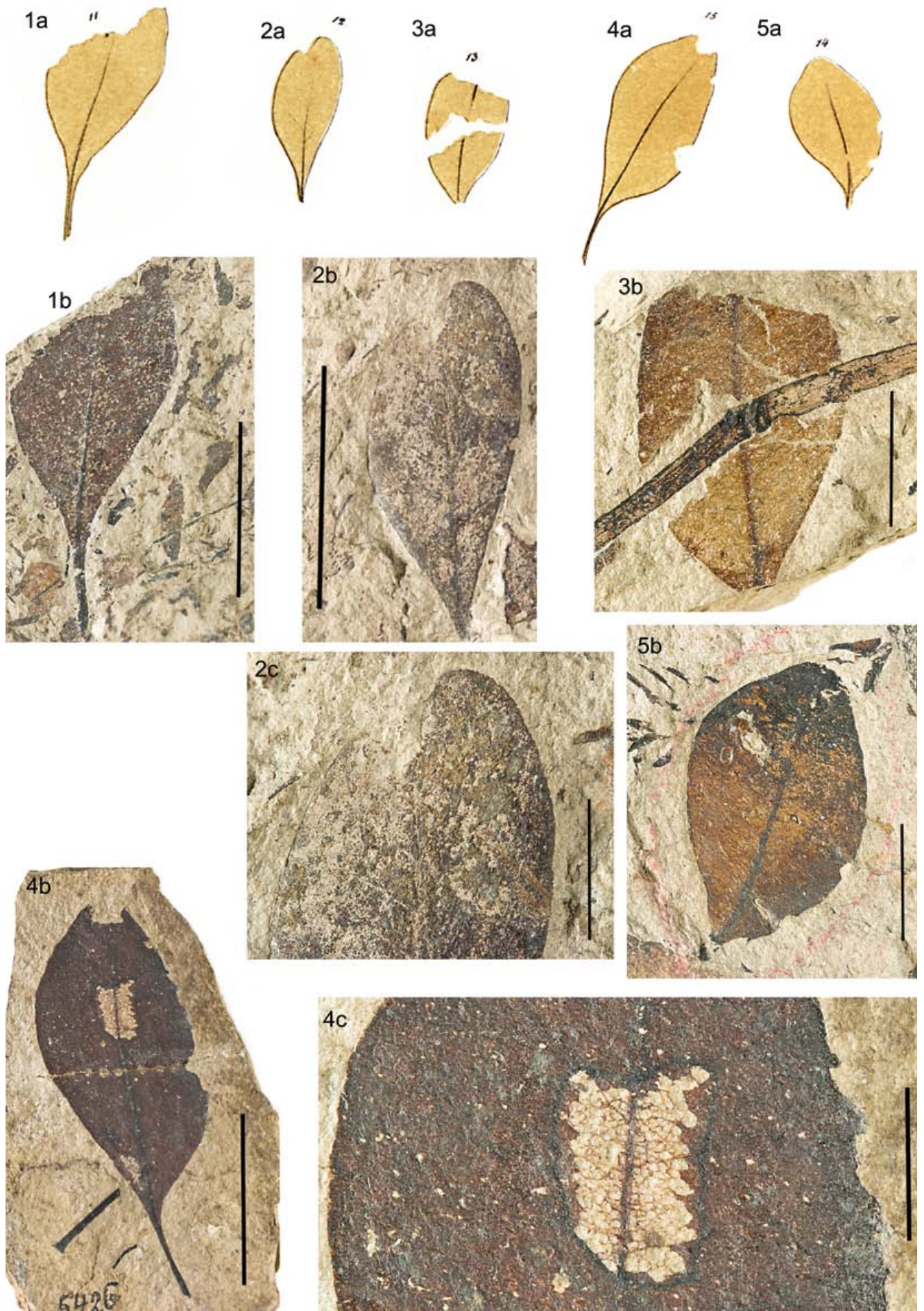


Plate 10

- Figs. 1–5: *Pisonia eocenica* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 18.
Fig. 1b: Counterpart of the figured syntype.
GBA 1853/001/0043/11B.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 19.
Fig. 2b: Syntype.
GBA 1853/001/0043/12.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 20.
Fig. 3b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0043/13.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 21.
Fig. 4b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0043/14.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 22.
Fig. 5b: Syntype.
GBA 1853/001/0043/15A.
Fig. 5c: Counterpart of the syntype.
GBA 1853/001/0043/15B.
Fig. 5d: Details of the counterpart.
Scale bar 5 mm.
- Figs. 6–7: *Monimia haeringiana* ETTINGSHAUSEN, 1853.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 12.
Fig. 6b: Syntype.
GBA 1853/001/0044/1.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 13.
Fig. 7b: Syntype.
GBA 1853/001/0044/2.
- Fig. 8: *Monimia anceps* ETTINGSHAUSEN, 1853.
Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 11.
Fig. 8b: Holotype.
GBA 1853/001/0045.

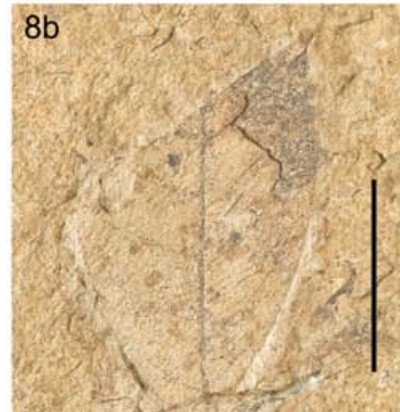
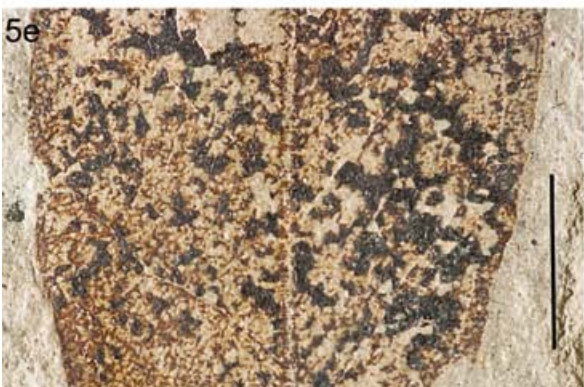
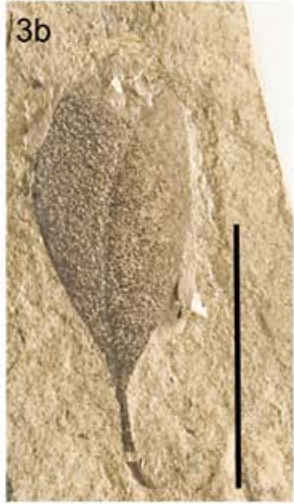


Plate 11

- Fig. 1: *Daphnogene grandifolia* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 31, Fig. 10.
Fig. 1b: Holotype.
GBA 1853/001/0047A.
- Fig. 2: *Daphnogene haeringiana* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 11, Fig. 27.
Fig. 2b: Holotype.
Fig. 2c: Detail of the upper part of the leaf fragment.
Scale bar 5 mm.
Fig. 2b–c: GBA 1853/001/0050.
- Fig. 3: *Laurus tetrantheroides* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 12, Fig. 2.
Fig. 3b: Holotype.
Fig. 3c: Detail of the upper part of the leaf fragment.
Scale bar 5 mm.
Fig. 3b–c: GBA 1853/001/0052
- Figs. 4–6: *Leptomeria gracilis* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 12, Fig. 20.
Fig. 4b: Syntype.
GBA 1853/001/0054/1.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 13, Fig. 3.
Fig. 5b: Syntype.
GBA 1853/001/0054/3.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 13, Fig. 6.
Fig. 6b: Syntype.
GBA 1853/001/0054/5A.
-

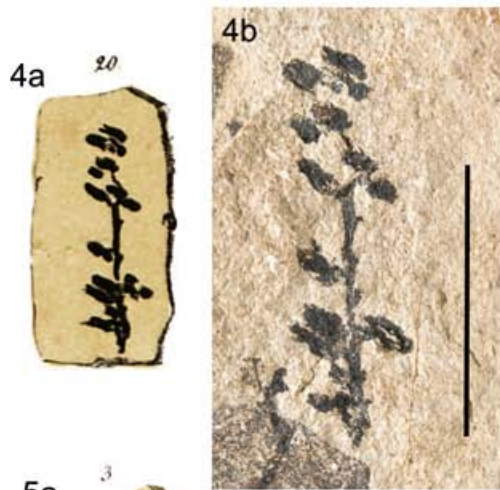
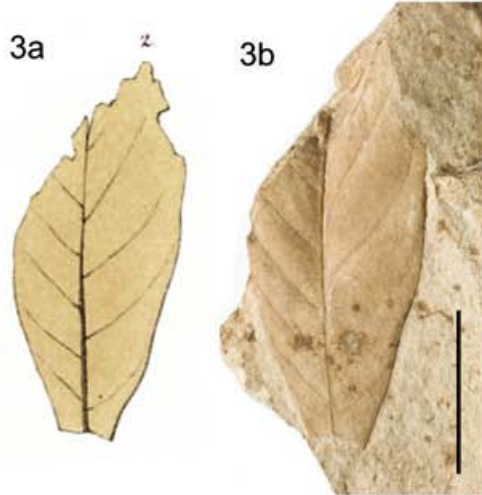
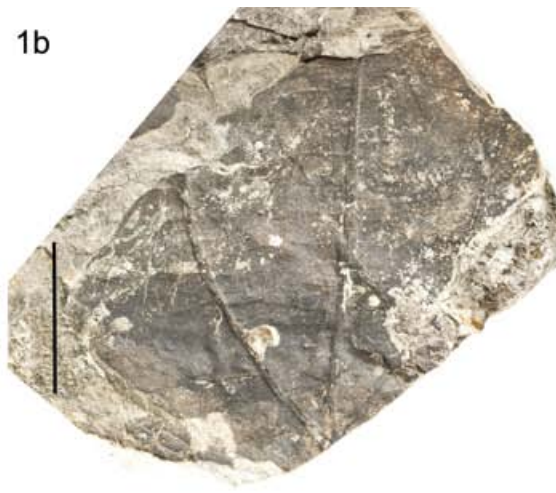


Plate 12

- Figs. 1–2: *Leptomeria gracilis* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 12, Fig. 21.
Fig. 1b: Syntype.
GBA 1853/001/0054/2.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 13, Fig. 4.
Fig. 2b: Syntype.
GBA 1853/001/0054/4.
- Fig. 3: *Leptomeria distans* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 12, Fig. 19.
Fig. 3b: Holotype.
GBA 1853/001/0056.
- Fig. 4: *Leptomeria flexuosa* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 13, Fig. 2.
Fig. 4b: Syntype.
GBA 1853/001/0055/2.
- Fig. 5: *Santalum salicinum* ETTINGSHAUSEN, 1853.
Fig. 5a: Counterpart of the type figure of ETTINGSHAUSEN, Pl. 12, Fig. 3.
Fig. 5b: Syntype.
GBA 1853/001/0057/1B.

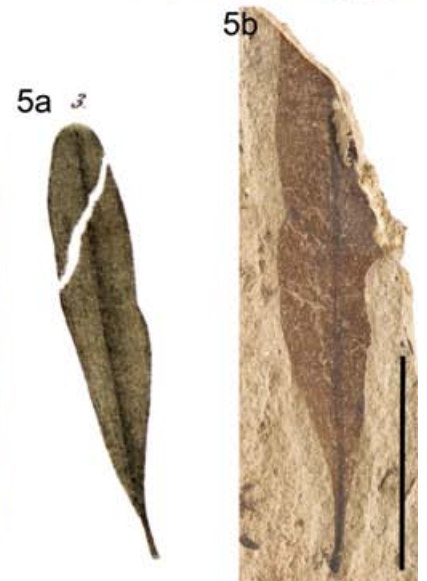
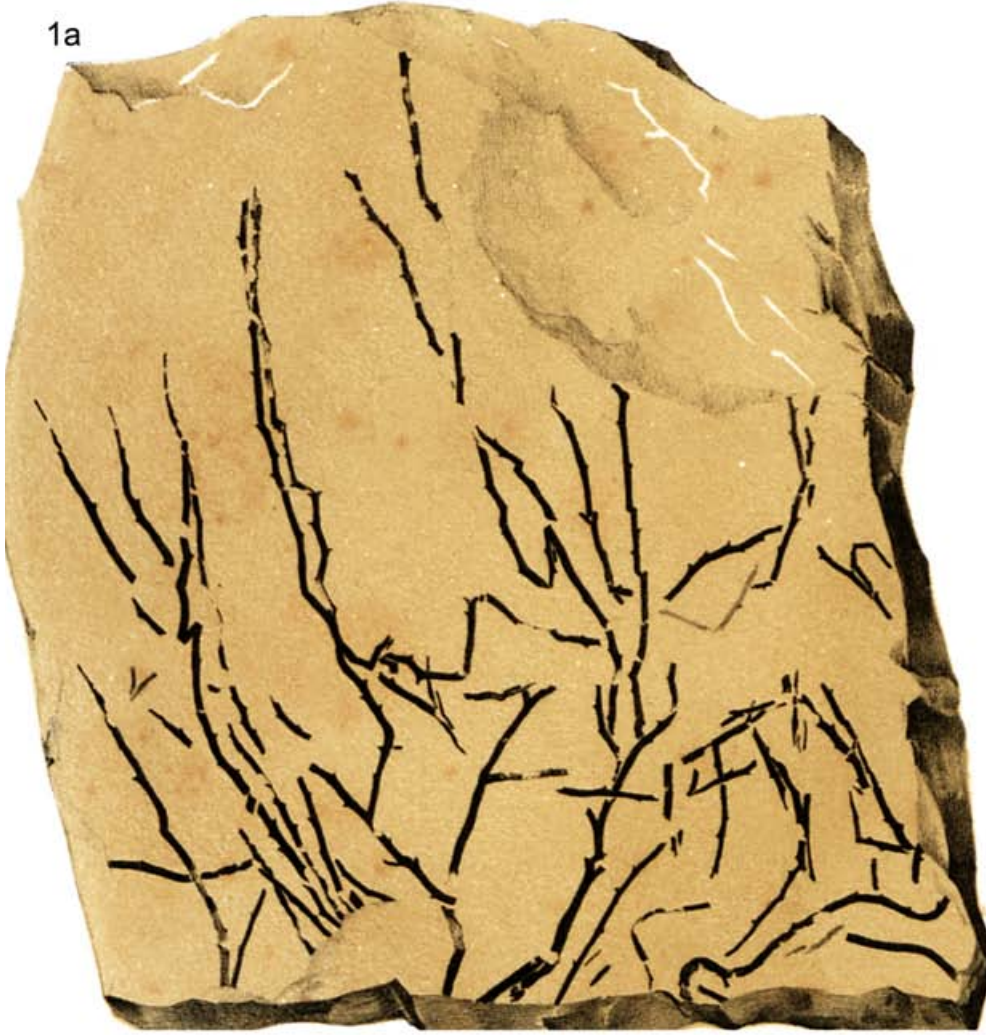


Plate 13

- Fig. 1: *Leptomeria flexuosa* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 13, Fig. 1.
Fig. 1b: Syntype.
GBA 1853/001/0055/1A.
- Figs. 2–3: *Santalum salicinum* ETTINGSHAUSEN, 1853.
Fig. 2a: Counterpart of the type figure of ETTINGSHAUSEN, Pl. 12, Fig. 4.
Fig. 2b: Syntype.
GBA 1853/001/0057/2.
Fig. 3a: Counterpart of the type figure of ETTINGSHAUSEN, Pl. 12, Fig. 5.
Fig. 3b: Syntype.
GBA 1853/001/0057/3.

1a



2a



2b



3a



3b



1b

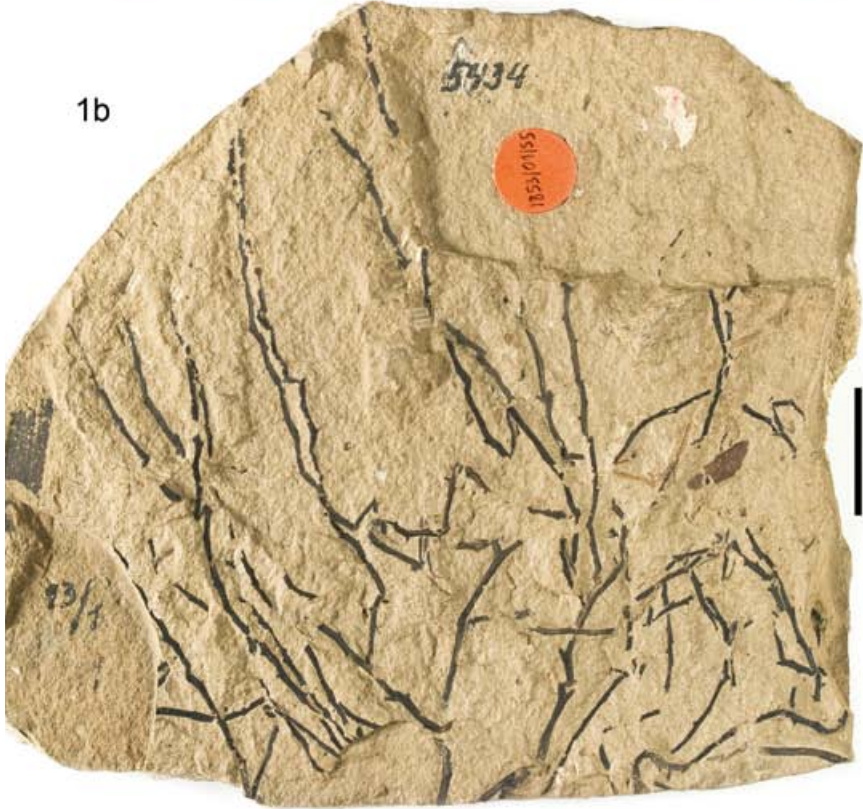


Plate 14

- Figs. 1–3: *Santalum acheronticum* ETTINGSHAUSEN, 1853.
Fig. 1a: Counterpart of the type figure of ETTINGSHAUSEN, Pl. 12, Fig. 7.
Fig. 1b: Syntype.
GBA 1853/001/0058/1.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 12, Fig. 8.
Fig. 2b: Syntype.
Fig. 2c: Detail of the lower part of the syntype.
Scale bar 5 mm.
- Fig. 2b–c: GBA 1853/001/0058/2A.
Fig. 2d–e: GBA 1853/001/0058/2BB.
Fig. 2d: Counterpart of the syntype.
Fig. 2e: Detail of the apical part of the counterpart.
Scale bar 5 mm.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 12, Fig. 10.
Fig. 3b: Syntype.
GBA 1853/001/0058/3A.
- Fig. 3c: Counterpart of the syntype.
GBA 1853/001/0058/3B.
- Figs. 4–6: *Santalum osyrinum* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 12, Fig. 16.
Fig. 4b: Syntype.
GBA 1853/001/0059/1A.
- Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 12, Fig. 17.
Fig. 5b: Syntype.
GBA 1853/001/0059/2.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 12, Fig. 18.
Fig. 6b: Counterpart of the specimen.
GBA 1853/001/0059/3B.
- Fig. 6c: Detail of the upper middle part of the counterpart.
Scale bar 5 mm.
- Figs. 7–9: *Santalum microphyllum* ETTINGSHAUSEN, 1853.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 12, Fig. 11.
Fig. 7b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0060/1.
- Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 12, Fig. 12.
Fig. 8b: Syntype.
Scale bar 1 cm.
- Fig. 8c: Detail of the middle part of the leaf.
Scale bar 5 mm.
- Fig. 8b–c: GBA 1853/001/0060/2.
Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 12, Fig. 13.
Fig. 9b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0060/3.
-

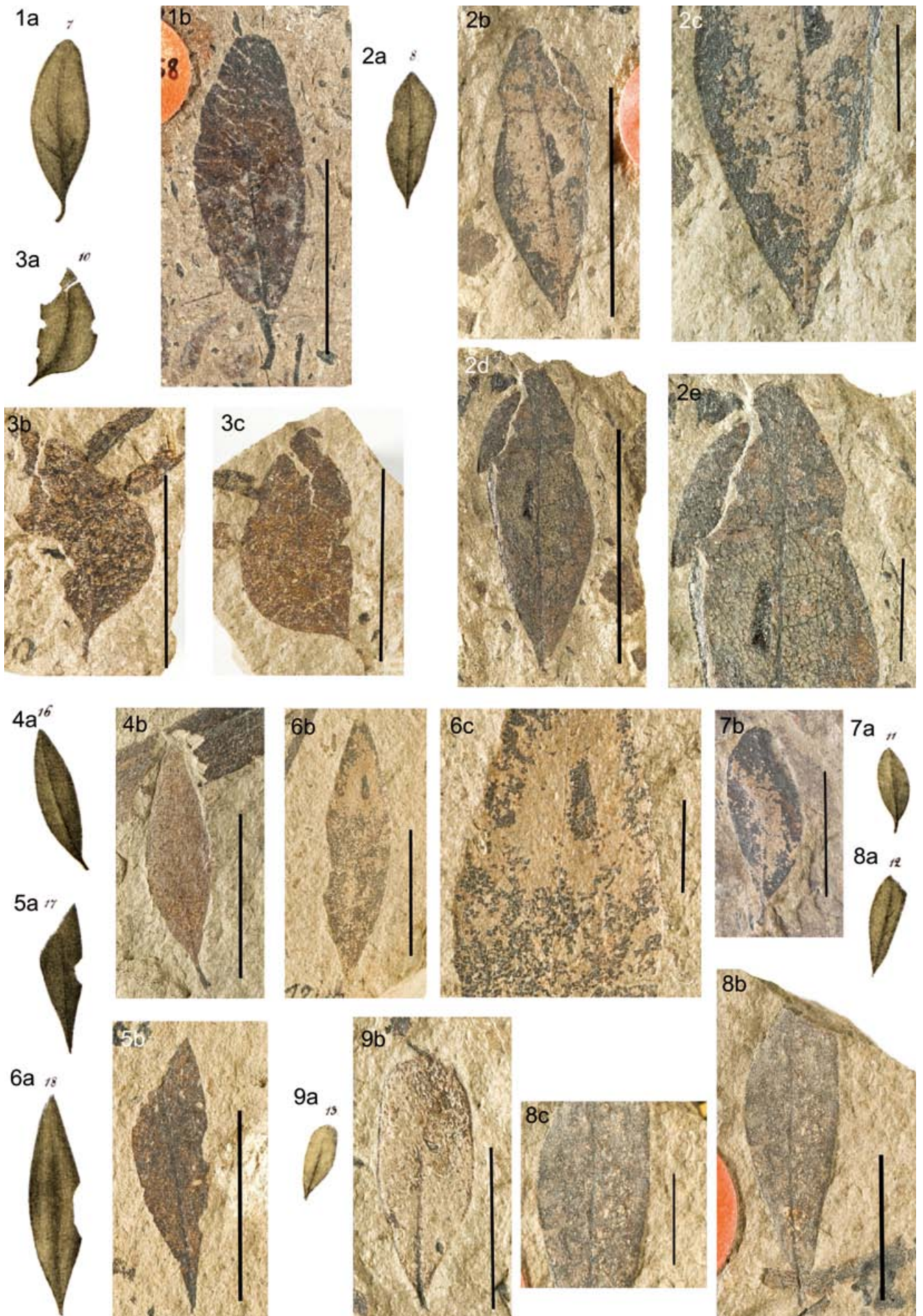


Plate 15

- Figs. 1–2: *Apocynophyllum haeringianum* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 20, Fig. 8.
Fig. 1b: Syntype.
GBA 1853/001/0076/1A.
Fig. 1c: Counterpart of the syntype.
Fig. 1d: Detail of the upper part of the counterpart.
Scale bar 5 mm.
Fig. 1e: Detail of the lower part of the counterpart.
Scale bar 5 mm.
- Fig. 1c–e: GBA 1853/001/0076/1B.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 20, Fig. 9.
Fig. 2b: Syntype.
Fig. 2c: Detail of the upper part of the syntype.
Scale bar 5 mm.
Fig. 2d: Detail of the lower part of the syntype.
Scale bar 5 mm.
- Fig. 2b–d: GBA 1853/001/0076/2.
- Fig. 3: *Apocynophyllum parvifolium* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 20, Fig. 10.
Fig. 3b: Holotype.
Fig. 3c: Detail of the lower part of the leaf.
Scale bar 5 mm.
- Fig. 3b–c: GBA 1853/001/0077.
- Fig. 4: *Apocynophyllum alyxiaefolium* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 20, Fig. 11.
Fig. 4b: Holotype.
GBA 1853/001/0078.
- Fig. 5: *Myoporum ambiguum* ETTINGSHAUSEN, 1853.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 20, Fig. 21.
Fig. 5b: Holotype.
GBA 1853/001/0079A.
Fig. 5c: Isotype.
Fig. 5d: Detail of the middle part of the isotype.
Scale bar 5 mm.
- Fig. 5c–d: GBA 1853/001/0079B.
- Fig. 6: *Myrsine europaea* ETTINGSHAUSEN, 1853.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 2.
Fig. 6b: Holotype.
Scale bar 1 cm.
GBA 1853/001/0081A.
-

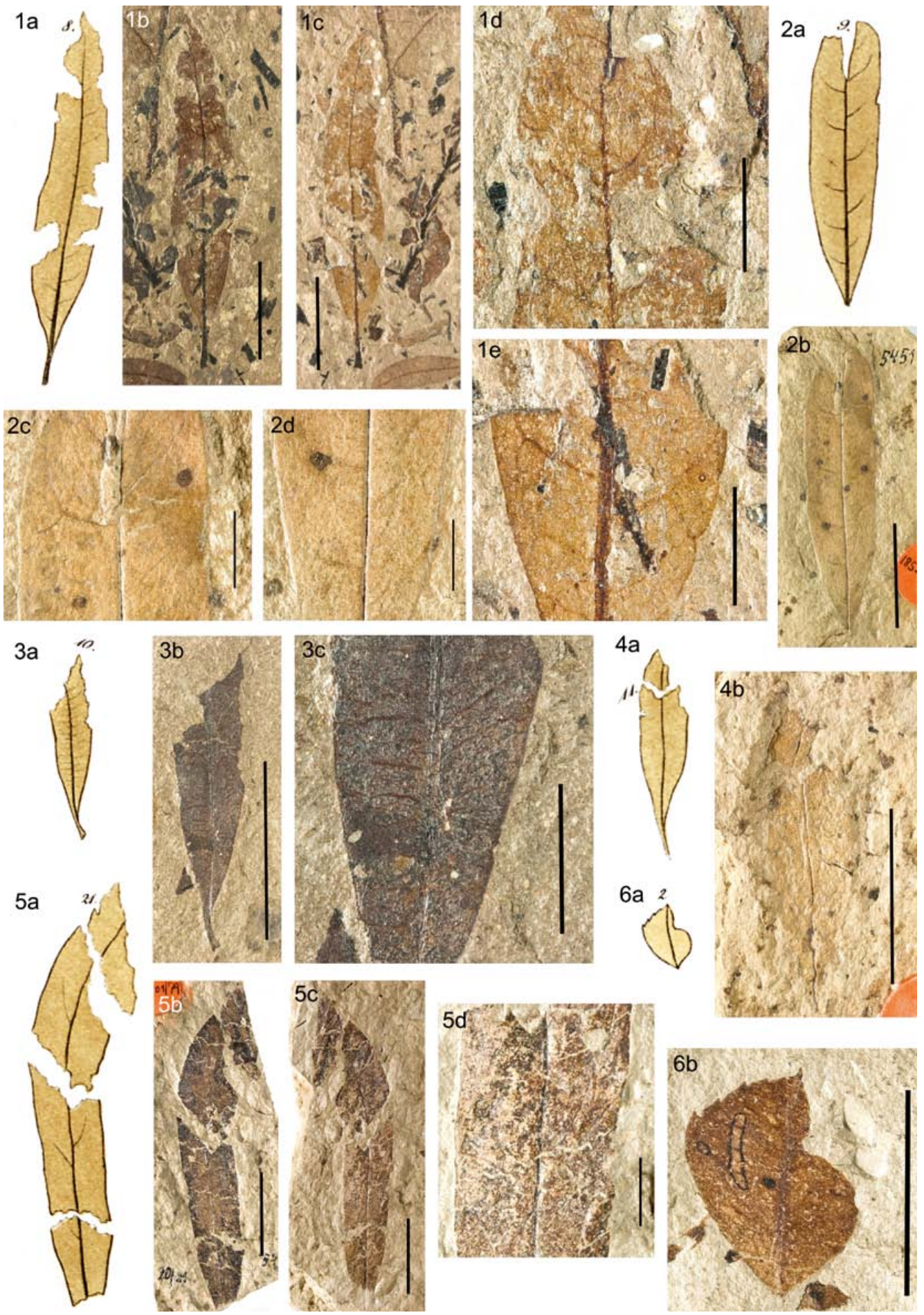


Plate 16

- Fig. 1: *Myrsine europaea* ETTINGSHAUSEN, 1853, Isotype.
Scale bar 1 cm.
GBA 1853/001/0081B.
- Fig. 2: *Myrsine celastroides* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 3.
Fig. 2b: Holotype.
Scale bar 1 cm.
GBA 1853/001/0082.
- Figs. 3–4: *Ardisia oceanica* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 4.
Fig. 3b: Syntype.
GBA 1853/001/0083/1A.
Fig. 3c: Counterpart of the syntype.
Fig. 3d: Detail of the middle part of the leaf.
Scale bar 5 mm.
Fig. 3c–d: GBA 1853/001/0083/1B.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 5.
Fig. 4b: Syntype.
Fig. 4c: Detail of the lower right part of the leaf.
Scale bar 5 mm.
Fig. 4b–c: 1853/001/0083/2.
- Fig. 5: *Maesa protogaea* ETTINGSHAUSEN, 1853.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 1.
Fig. 5b: Holotype.
GBA 1853/001/0084.



3a



3b



4a



4b



5a



5b



4c



Plate 17

- Figs. 1–2: *Diospyros haeringiana* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 26.
Fig. 1b: Syntype.
GBA 1853/001/0085/1A.
Fig. 1c: Counterpart of the syntype.
Fig. 1d: Detail of the middle part of the counterpart.
Scale bar 5 mm.
- Fig. 1c–d: GBA 1853/001/0085/1B
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 11.
Fig. 2b: Syntype.
GBA 1853/001/0085/2.
- Fig. 3: *Sapotacites mimosops* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 22.
Fig. 3b: Isotype.
GBA 1853/001/0087B.
- Fig. 4: *Sapotacites lanceolatus* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 24.
Fig. 4b: Holotype.
GBA 1853/001/0088A.
Fig. 4c: Isotype.
Fig. 4d: Detail of the apical part.
Scale bar 5 mm.
Fig. 4e: Detail of the right middle part.
Scale bar 5 mm.
- Fig. 4c–e: GBA 1853/001/0088B.

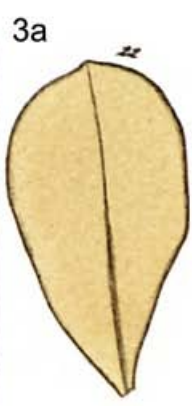


Plate 18

- Figs. 1–2: *Sapotacites minor* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 7.
Fig. 1b: Syntype.
GBA 1853/001/0089/1.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 8.
Fig. 2b: Syntype.
GBA 1853/001/0089/2.
- Fig. 3: *Sapotacites truncatus* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 9.
Fig. 3b: Holotype.
GBA 1853/001/0090.
- Figs. 4–7: *Sapotacites vaccinioides* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 12.
Fig. 4b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0091/1.
- Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 13.
Fig. 5b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0091/2.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 14.
Fig. 6b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0091/3.
- Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 16.
Fig. 7b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0091/4.
- Fig. 8: *Sapotacites parvifolius* ETTINGSHAUSEN, 1853.
Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 18.
Fig. 8b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0092.
- Fig. 9: *Sapotacites ambiguus* ETTINGSHAUSEN, 1853.
Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 25.
Fig. 9b: Holotype.
GBA 1853/001/0093.
-

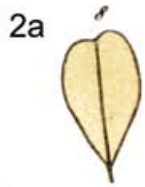


Plate 19

- Fig. 1: *Arbutus eocenica* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 21, Fig. 23.
Fig. 1b: Holotype.
Scale bar 1 cm.
GBA 1853/001/0095.
- Figs. 2–3: *Andromeda reticulata* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 9.
Fig. 2b: Syntype.
GBA 1853/001/0097/1.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 10.
Fig. 3b: Syntype.
GBA 1853/001/0097/2.
- Figs. 4–10: *Ceratopetalum haeringianum* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 13.
Fig. 4b: Syntype.
GBA 1853/001/0099/1.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 15.
Fig. 5b: Syntype.
GBA 1853/001/0099/2.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 18.
Fig. 6b: Syntype.
GBA 1853/001/0099/3.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 19.
Fig. 7b: Syntype.
GBA 1853/001/0099/4.
Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 20.
Fig. 8b: Syntype.
GBA 1853/001/0099/5.
Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 21.
Fig. 9b: Syntype.
GBA 1853/001/0099/6.
Fig. 10a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 23.
Fig. 10b: Syntype.
GBA 1853/001/0099/7.
-

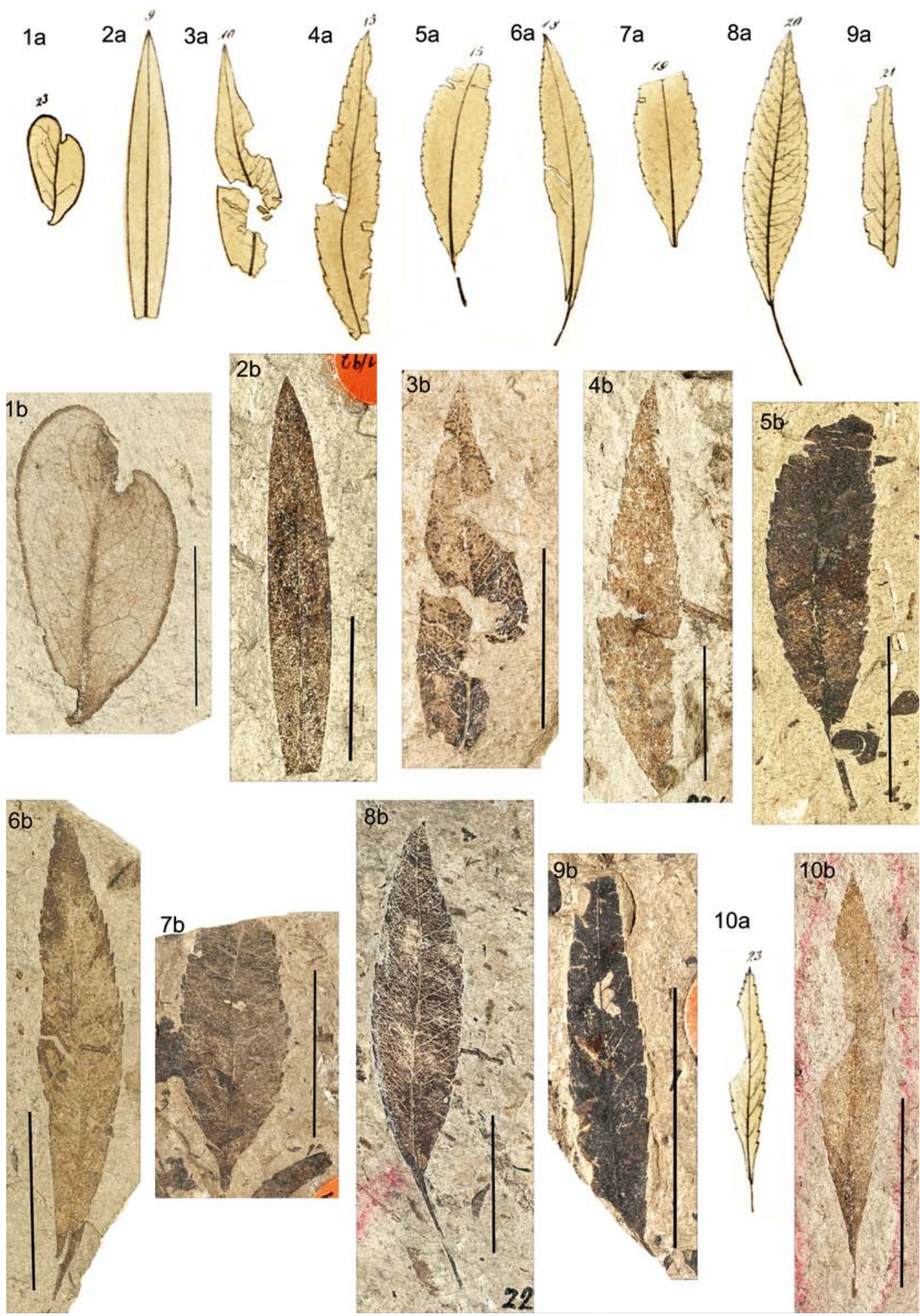


Plate 20

- Figs. 1–4: *Ceratopetalum haeringianum* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 26.
Fig. 1b: Syntype.
GBA 1853/001/0099/8A.
Fig. 1c: Counterpart of the syntype.
GBA 1853/001/0099/8B.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 22.
Fig. 2b: Syntype.
GBA 1853/001/0099/9A.
Fig. 2c: Counterpart of the syntype.
GBA 1853/001/0099/9B.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 25.
Fig. 3b: Syntype.
GBA 1853/001/0099/10.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 22, Fig. 24.
Fig. 4b: Syntype.
GBA 1853/001/0099/11.
- Figs. 5–10: *Weinmannia paradisica* ETTINGSHAUSEN, 1853.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 1.
Fig. 5b: Syntype.
GBA 1853/001/0100/1.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 2.
Fig. 6b: Syntype.
GBA 1853/001/0100/2.
- Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 3.
Fig. 7b: Syntype.
GBA 1853/001/0100/3.
- Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 4.
Fig. 8b: Syntype.
GBA 1853/001/0100/4.
- Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 6.
Fig. 9b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0100/5.
- Fig. 10a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 7.
Fig. 10b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0100/6.
-

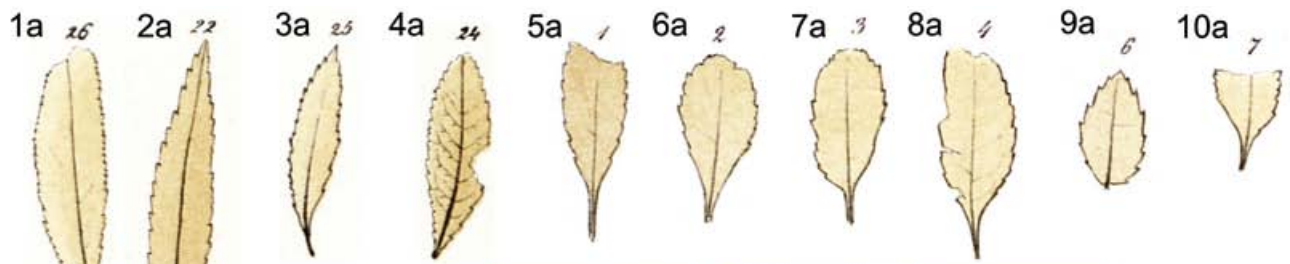


Plate 21

- Figs. 1–10: *Weinmannia microphylla* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 8.
Fig. 1b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0101/1A.
Fig. 1c: Counterpart of the syntype.
Scale bar 1 cm.
GBA 1853/001/0101/1B.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 9.
Fig. 2b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0101/2.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 10.
Fig. 3b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0101/3.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 11.
Fig. 4b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0101/4.
- Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 12.
Fig. 5b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0101/5.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 13.
Fig. 6b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0101/6A.
Fig. 6c: Counterpart of the syntype.
Scale bar 1 cm.
GBA 1853/001/0101/6B.
- Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 14.
Fig. 7b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0101/7.
- Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 15.
Fig. 8b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0101/8.
- Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 16.
Fig. 9b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0101/9.
- Fig. 10a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 17.
Fig. 10b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0101/10A.
Fig. 10c: Counterpart of the syntype.
Scale bar 5 mm.
GBA 1853/001/0101/10B.
-

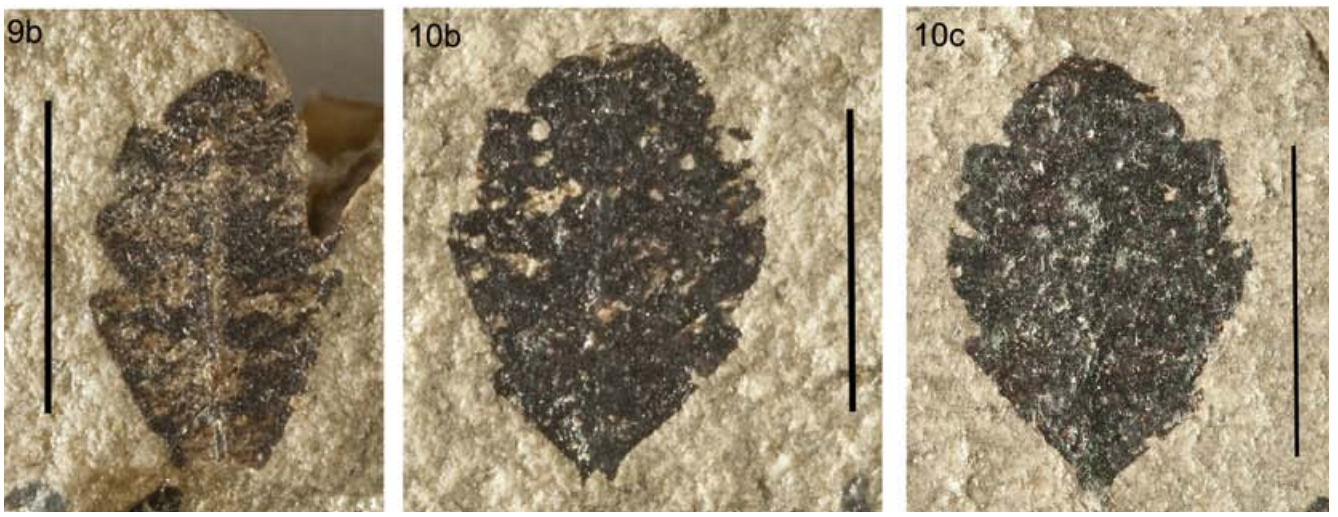
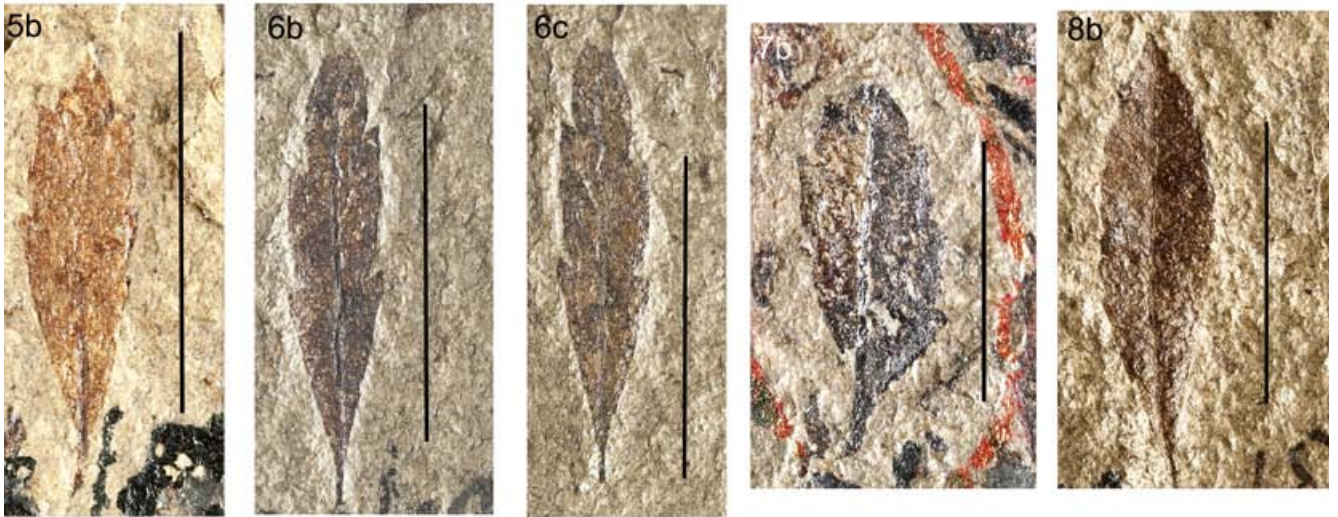
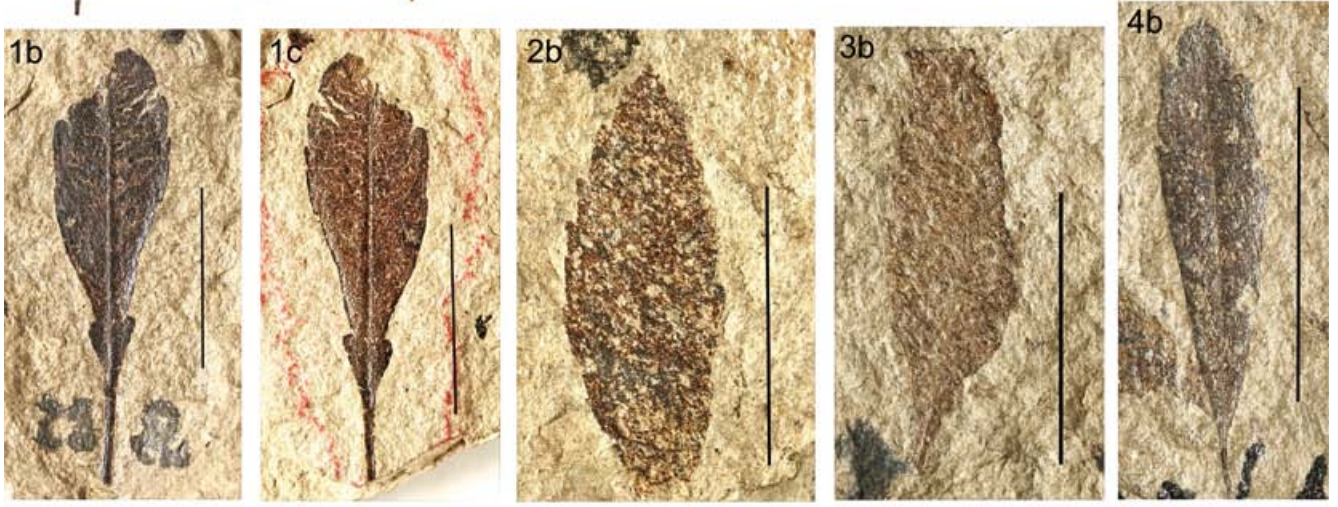
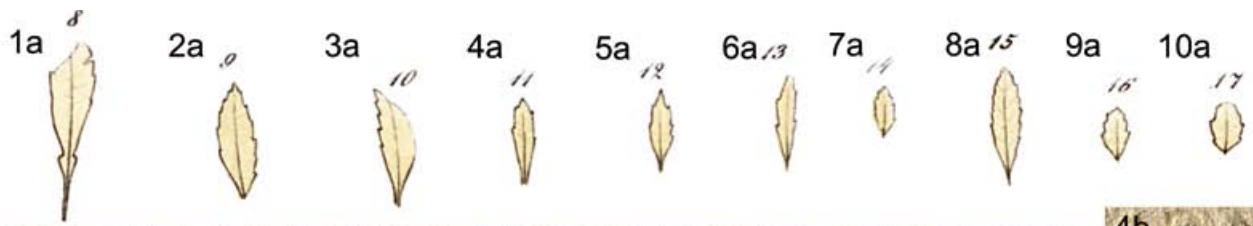


Plate 22

- Figs. 1–8: *Weinmannia microphylla* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 18.
Fig. 1b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0101/11.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 19.
Fig. 2b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0101/12.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 20.
Fig. 3b: Probably the syntype.
Scale bar 5 mm.
GBA 1853/001/0101/13.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 22.
Fig. 4b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0101/14.
- Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 23.
Fig. 5b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0101/15.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 25.
Fig. 6b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0101/16.
- Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 26.
Fig. 7b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0101/17.
- Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 29.
Fig. 8b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0101/18.
- Fig. 9: *Dombeyopsis dentata* ETTINGSHAUSEN, 1853.
Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 31, Fig. 21.
Fig. 9b: Holotype.
Fig. 9c: Detail of the right upper part of the leaf fragment.
Scale bar 5 mm.
Fig. 9b–c: GBA 1853/001/0102
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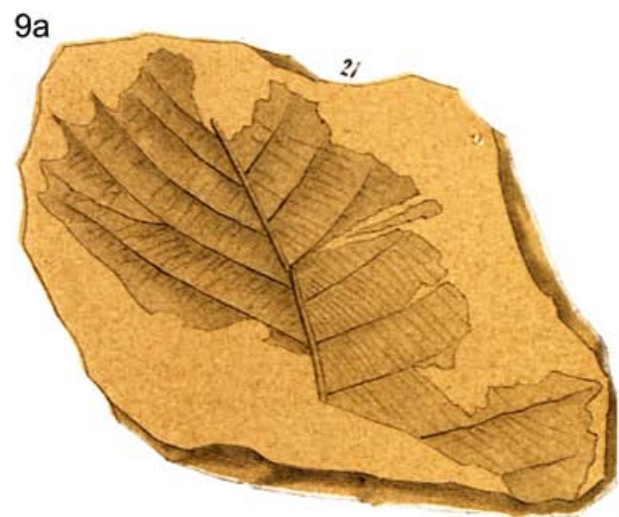
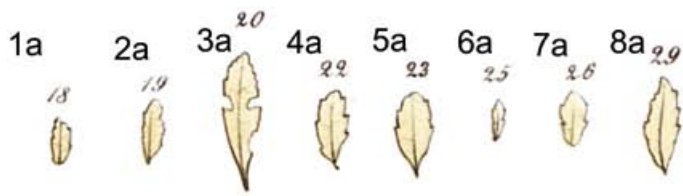


Plate 23

- Figs. 1–2: *Hiraea borealis* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 31.
Fig. 1b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0103/1.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 32.
Fig. 2b: Syntype.
GBA 1853/001/0103/2A.
Fig. 2c: Counterpart of the syntype.
GBA 1853/001/0103/2B.
- Figs. 3–4: *Banisteria haeringiana* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 34.
Fig. 3b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0104/1.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 35.
Fig. 4b: Syntype.
Fig. 4c: Detail of the middle part of the leaf.
Scale bar 5 mm.
Fig. 4b–c: GBA 1853/001/0104/2.
- Figs. 5–6: *Dodonaea salicites* ETTINGSHAUSEN, 1853.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 36.
Fig. 5b: Counterpart of the syntype.
Scale bar 1 cm.
GBA 1853/001/0105/1B.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 38.
Fig. 6b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0105/2A.
Fig. 6c: Counterpart of the syntype.
Scale bar 5 mm.
GBA 1853/001/0105/2B.
- Figs. 7–8: *Pittosporum fenzlii* ETTINGSHAUSEN, 1853.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 3.
Fig. 7b: Syntype.
GBA 1853/001/0107/1A.
Fig. 7c: Counterpart of the syntype.
GBA 1853/001/0107/1B.
- Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 7.
Fig. 8b: Syntype.
GBA 1853/001/0107/3.
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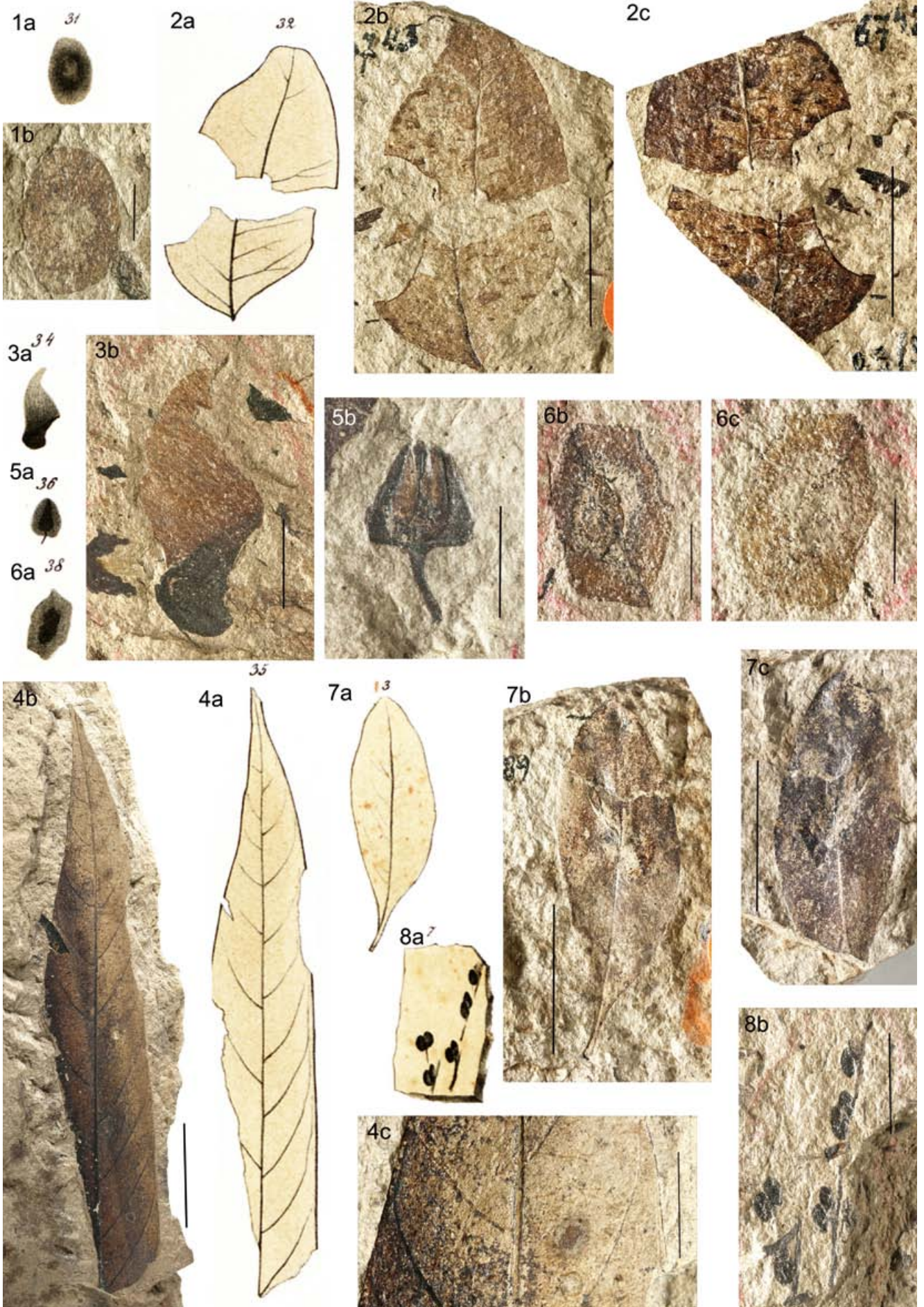


Plate 24

- Figs. 1–2: *Pittosporum fenzlii* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 6.
Fig. 1b: Syntype.
Fig. 1c: Detail of the upper part of the leaf fragment.
Fig. 1b–c: GBA 1853/001/0107/2.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 8.
Fig. 2b: Syntype.
GBA 1853/001/0107/4.
- Figs. 3–11: *Celastrus protogaeus* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 17.
Fig. 3b: Probable syntype.
Scale bar 5 mm.
GBA 1853/001/0108/2.
Fig. 3c: Specimen not comparable to one figured by
ETTINGSHAUSEN, Pl. 24, Fig. 17.
Fig. 3d: Syntype, comparable to ETTINGSHAUSEN, Pl. 24, Fig. 17
upper right.
GBA 1853/001/0105/3.
Fig. 3e: Syntype, comparable to ETTINGSHAUSEN, Pl. 24, Fig. 17.
GBA 1853/001/0105/4.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 22.
Fig. 4b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0108/1.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 19.
Fig. 5b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0108/6.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 23, Fig. 20.
Fig. 6b: Probable syntype.
Scale bar 5 mm.
GBA 1853/001/0108/7A.
Fig. 6c: Counterpart of the probable syntype.
GBA 1853/001/0108/7B.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 25.
Fig. 7b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0108/8.
Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 24.
Fig. 8b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0108/9A.
Fig. 8c: Counterpart of the syntype.
GBA 1853/001/0108/9B.
Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 26.
Fig. 9b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0108/10.
Fig. 10a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 28.
Fig. 10b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0108/11.
Fig. 11a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 29.
Fig. 11b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0108/12.

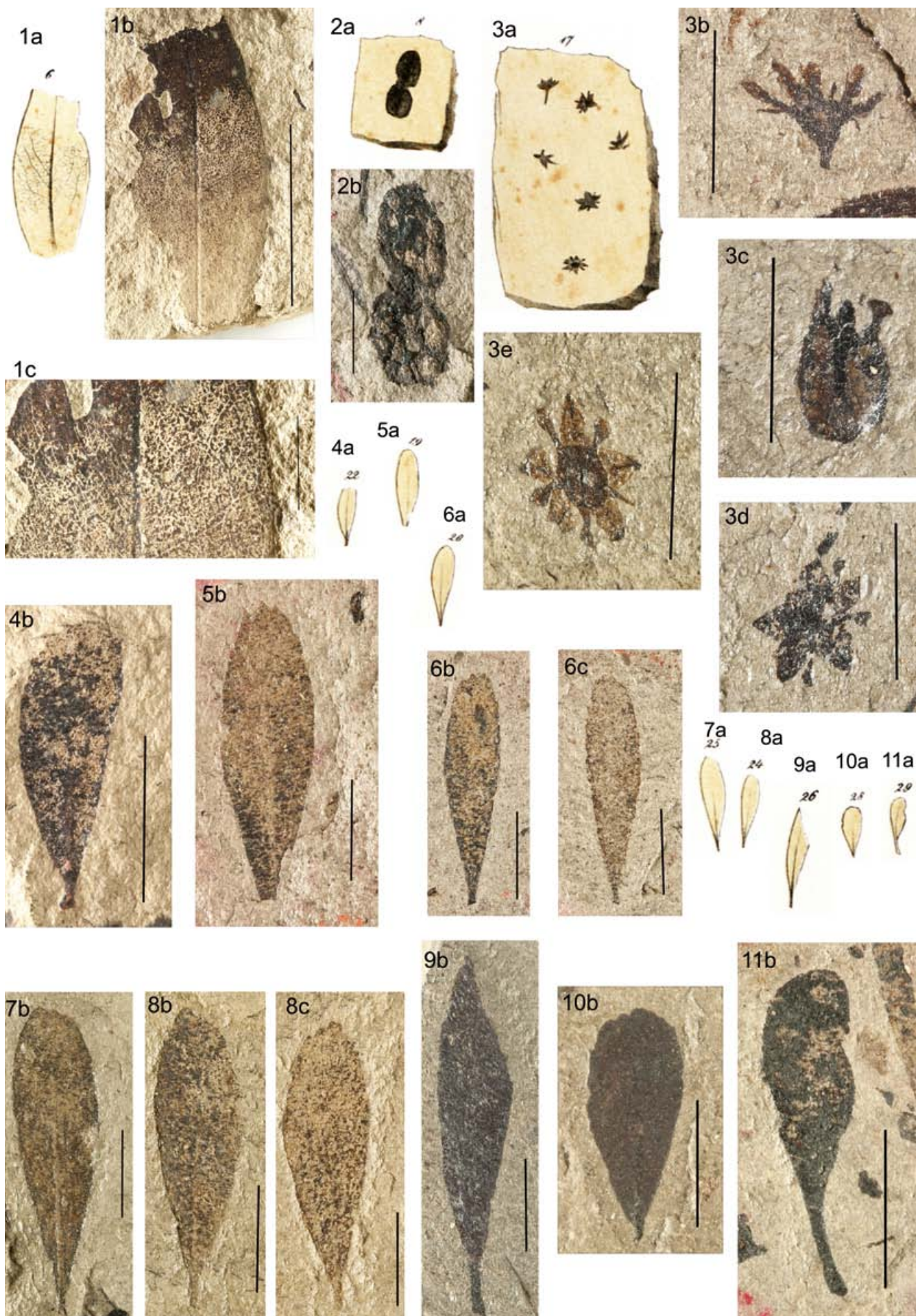


Plate 25

- Fig. 1: *Celastrus acuminatus* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 16.
Fig. 1b: Holotype.
Fig. 1c: Detail of the middle part of the leaf.
Scale bar 5 mm.
Fig. 1b–c: GBA 1853/001/0110.
- Fig. 2: *Celastrus deperditus* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 15.
Fig. 2b: Holotype.
Scale bar 1 cm.
Fig. 2c: Detail of the middle part of the leaf.
Scale bar 5 mm.
Fig. 2b–c: 1853/001/0111A.
- Fig. 3: *Celastrus acherontis* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 14.
Fig. 3b: Holotype.
Scale bar 5 mm.
GBA 1853/001/0112.
- Figs. 4–5: *Celastrus pachyphyllus* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 12.
Fig. 4b: Syntype.
Fig. 4c: Detail of the lower part of the leaf.
Scale bar 5 mm.
Fig. 4b–c: GBA 1853/001/0114/1.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 13.
Fig. 5b: Syntype.
GBA 1853/001/0114/2.
- Fig. 6: *Celastrus aeoli* ETTINGSHAUSEN, 1853.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 10.
Fig. 6b: Syntype.
GBA 1853/001/0115/2.
- Figs. 7–10: *Celastrus pseudoilex* ETTINGSHAUSEN, 1853.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 31.
Fig. 7b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0109/1A.
Fig. 7c: Counterpart of the syntype.
Scale bar 5 mm.
GBA 1853/001/0109/1B.
Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 34.
Fig. 8b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0109/2A.
Fig. 8c: Counterpart of the syntype.
Scale bar 5 mm.
GBA 1853/001/0109/2B.
Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 35.
Fig. 9b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0109/3.
Fig. 10a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 36.
Fig. 10b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0109/4.
-

Plate 26

- Fig. 1: *Celastrus aeoli* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 9.
Fig. 1b: Syntype.
GBA 1853/001/0115/1.
- Fig. 2: *Evonymus aegipanos* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 41.
Fig. 2b: Holotype.
Fig. 2c: Detail of the upper part of the leaf.
Scale bar 5 mm.
Fig. 2b–c: GBA 1853/001/0117.
- Figs. 3–4: *Elaeodendron haeringianum* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 37.
Fig. 3b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0118/1A.
Fig. 3c: Counterpart of the syntype.
GBA 1853/001/0118/1B.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 38.
Fig. 4b: Syntype.
GBA 1853/001/0118/1A.
Fig. 4c: Counterpart of the syntype.
GBA 1853/001/0118/2B.

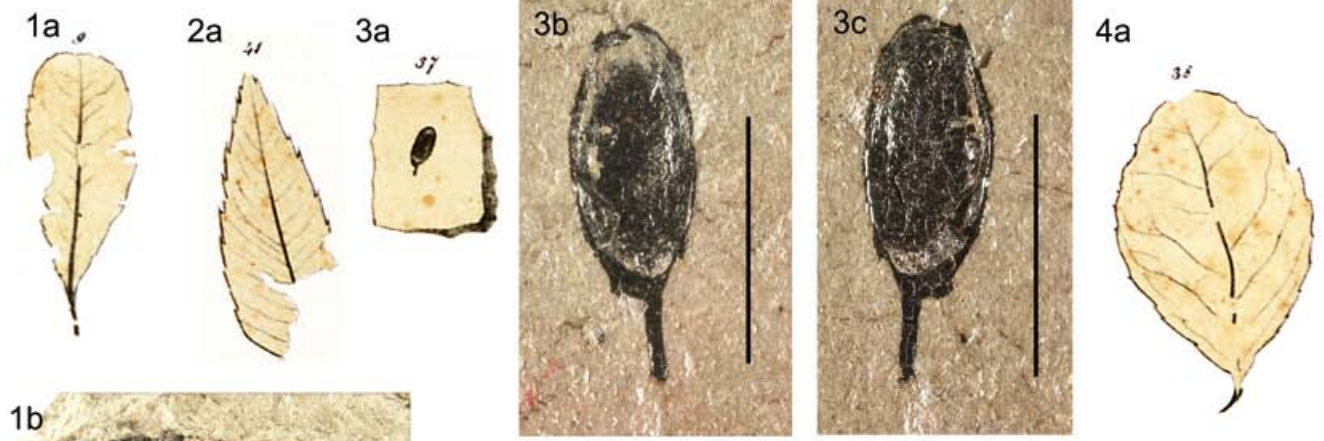


Plate 27

- Figs. 1–2: *Elaeodendron dubium* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 39.
Fig. 1b: Syntype.
GBA 1853/001/0119/1A.
Fig. 1c: Counterpart of the syntype.
GBA 1853/001/0119/1B.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 24, Fig. 40.
Fig. 2b: Syntype.
GBA 1853/001/0119/2.
- Fig. 3: *Ilex oreadum* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 25, Fig. 7.
Fig. 3b: Holotype.
Scale bar 1 cm.
GBA 1853/001/0120.
- Fig. 4: *Ilex aizoon* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 25, Fig. 8.
Fig. 4b: Holotype.
Scale bar 1 cm.
GBA 1853/001/0121.
- Figs. 5–6: *Rhamnus colubrinoidea* ETTINGSHAUSEN, 1853.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 25, Fig. 3.
Fig. 5b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0124/2A.
Fig. 5c: Counterpart of the syntype.
GBA 1853/001/0124/2B.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 25, Fig. 4.
Fig. 6b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0124/1.
- Fig. 7: *Rhamnus pomaderroides* ETTINGSHAUSEN, 1853.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 25, Fig. 2.
Fig. 7b: Holotype.
Fig. 7c: Detail of the upper right part of the leaf.
Scale bar 5 mm.
Fig. 7b–c: GBA 1853/001/0123.
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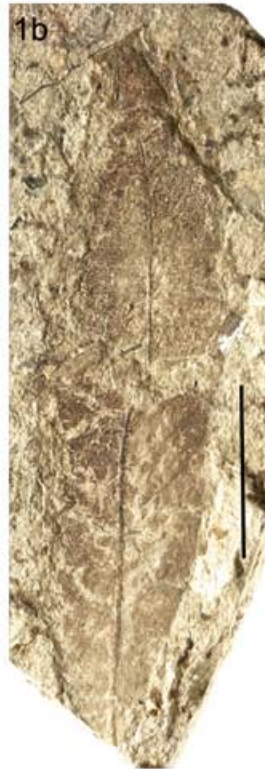
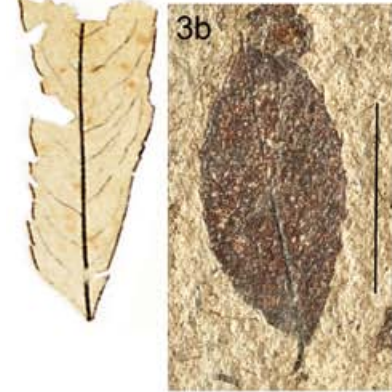
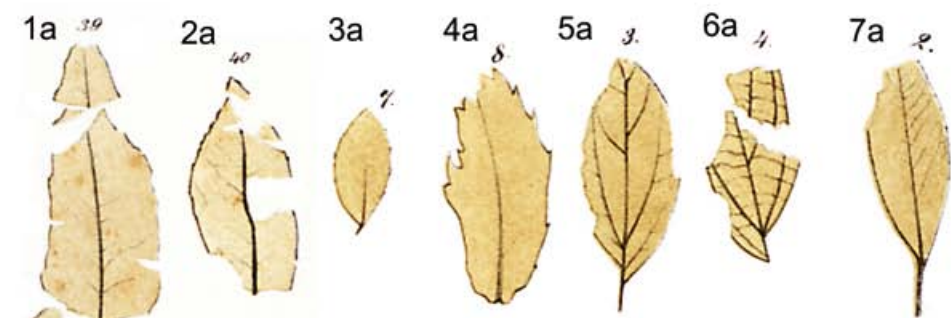


Plate 28

- Fig. 1: *Colliguaja protogaea* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 11.
Fig. 1b: Holotype.
Fig. 1c: Isotype.
GBA 1853/001/0126B.
Fig. 1d: Detail of the apical part of the holotype.
Scale bar 5 mm.
Fig. 1b, d: GBA 1853/001/0126A.
- Figs. 2–3: *Euphorbiophyllum stillingioides* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 1.
Fig. 2b: Syntype.
GBA 1853/001/0127/1A.
Fig. 2c: Counterpart of the syntype.
GBA 1853/001/0127/1B.
Fig. 2d: Detail of the right upper part of the syntype.
Scale bar 5 mm.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 2.
Fig. 3b: Syntype.
GBA 1853/001/0127/2.
- Fig. 4: *Euphorbiophyllum subrotundum* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 5.
Fig. 4b: Syntype.
GBA 1853/001/0128.
- Fig. 5: *Euphorbiophyllum omalanthoides* ETTINGSHAUSEN, 1853.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 3.
Fig. 5b: Holotype.
Fig. 5c: Detail of the upper part of the leaf.
Scale bar 5 mm.
Fig. 5b–c: GBA 1853/001/0129.
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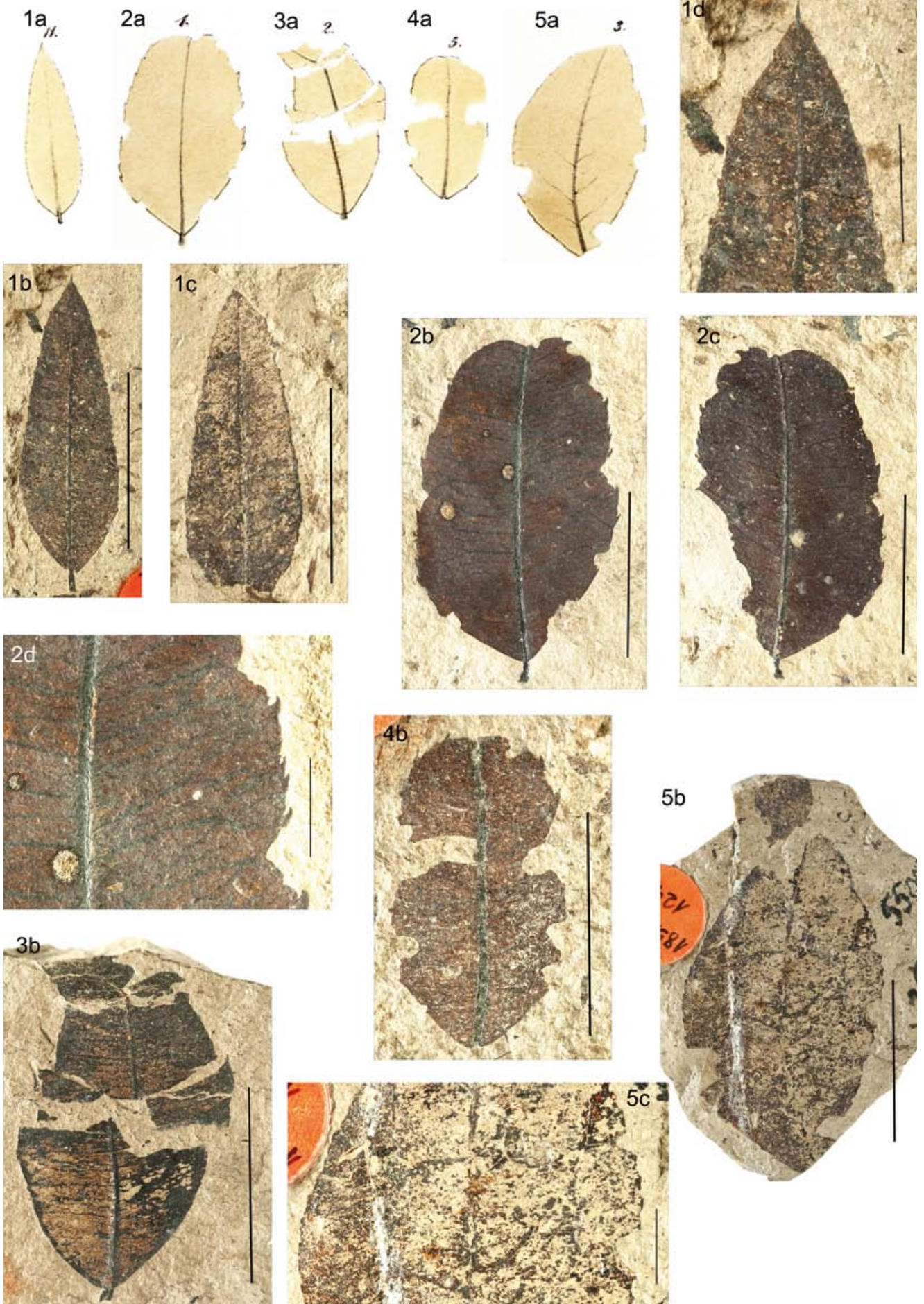


Plate 29

- Fig. 1: *Euphorbiophyllum lanceolatum* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 4.
Fig. 1b: Holotype.
Fig. 1c: Detail of the upper part of the leaf.
Scale bar 5 mm.
Fig. 1b–c: GBA 1853/001/0130.
- Figs. 2–4: *Phyllanthus haeringiana* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 7.
Fig. 2b: Syntype.
GBA 1853/001/0131/1A.
Fig. 2c: Counterpart of the syntype.
GBA 1853/001/0131/1B.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 9.
Fig. 3b: Syntype.
GBA 1853/001/0131/2.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 8.
Fig. 4b: Syntype.
GBA 1853/001/0131/3.
- Figs. 5–9: *Rhus prisca* ETTINGSHAUSEN, 1853.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 14.
Fig. 5b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0133/1.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 17.
Fig. 6b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0133/2.
- Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 18.
Fig. 7b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0133/3.
- Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 19.
Fig. 8b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0133/4.
- Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 23.
Fig. 9b: Syntype.
Scale bar 1 cm.
Fig. 9c: Detail of the upper part of the leaf.
Scale bar 5 mm.
Fig. 9d: Detail of the lower part of the leaf.
Scale bar 5 mm.
Fig. 9b–d: GBA 1853/001/0133/5.
-

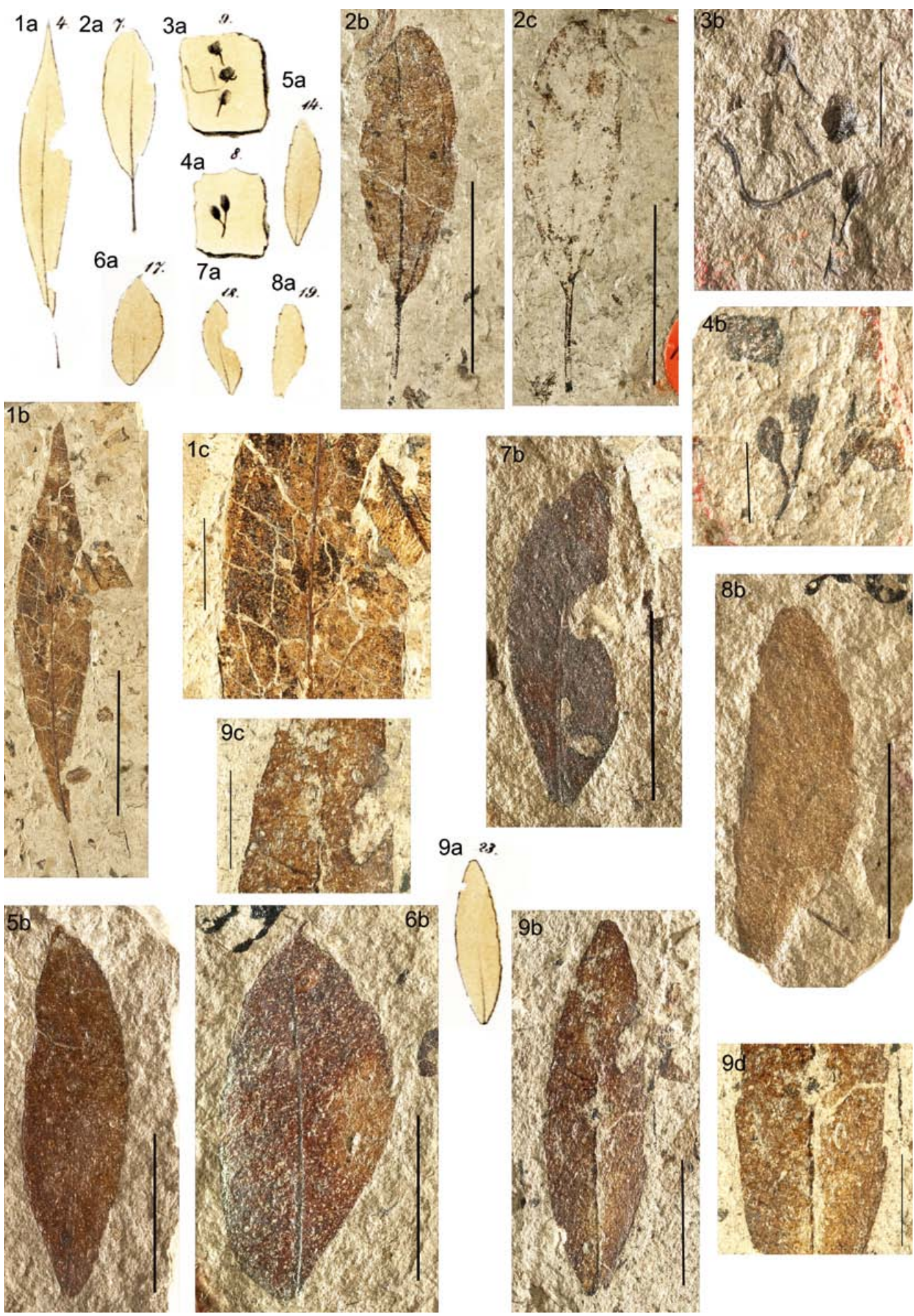


Plate 30

- Figs. 1–4: *Rhus prisca* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 15.
Fig. 1b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0133/6A.
Fig. 1c: Counterpart of the syntype.
Scale bar 5 mm.
GBA 1853/001/0133/6B.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 16.
Fig. 2b: Syntype.
Scale bar 1 cm.
Fig. 2c: Detail of the middle part of the leaf.
Scale bar 5 mm.
- Fig. 2b–c: GBA 1853/001/0133/7.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 21.
Fig. 3b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0133/8.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 22.
Fig. 4b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0133/9.
- Figs. 5–7: *Rhus juglandogene* ETTINGSHAUSEN, 1853.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 24.
Fig. 5b: Syntype.
Fig. 5c: Detail of the middle left part of the leaf.
Scale bar 5 mm.
- Fig. 5b–c: GBA 1853/001/0135/1.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 25.
Fig. 6b: Syntype.
Fig. 6c: Detail of the middle part of the leaf.
Scale bar 5 mm.
- Fig. 6b–c: GBA 1853/001/0135/2.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 26.
Fig. 7b: Syntype.
GBA 1853/001/0135/3.

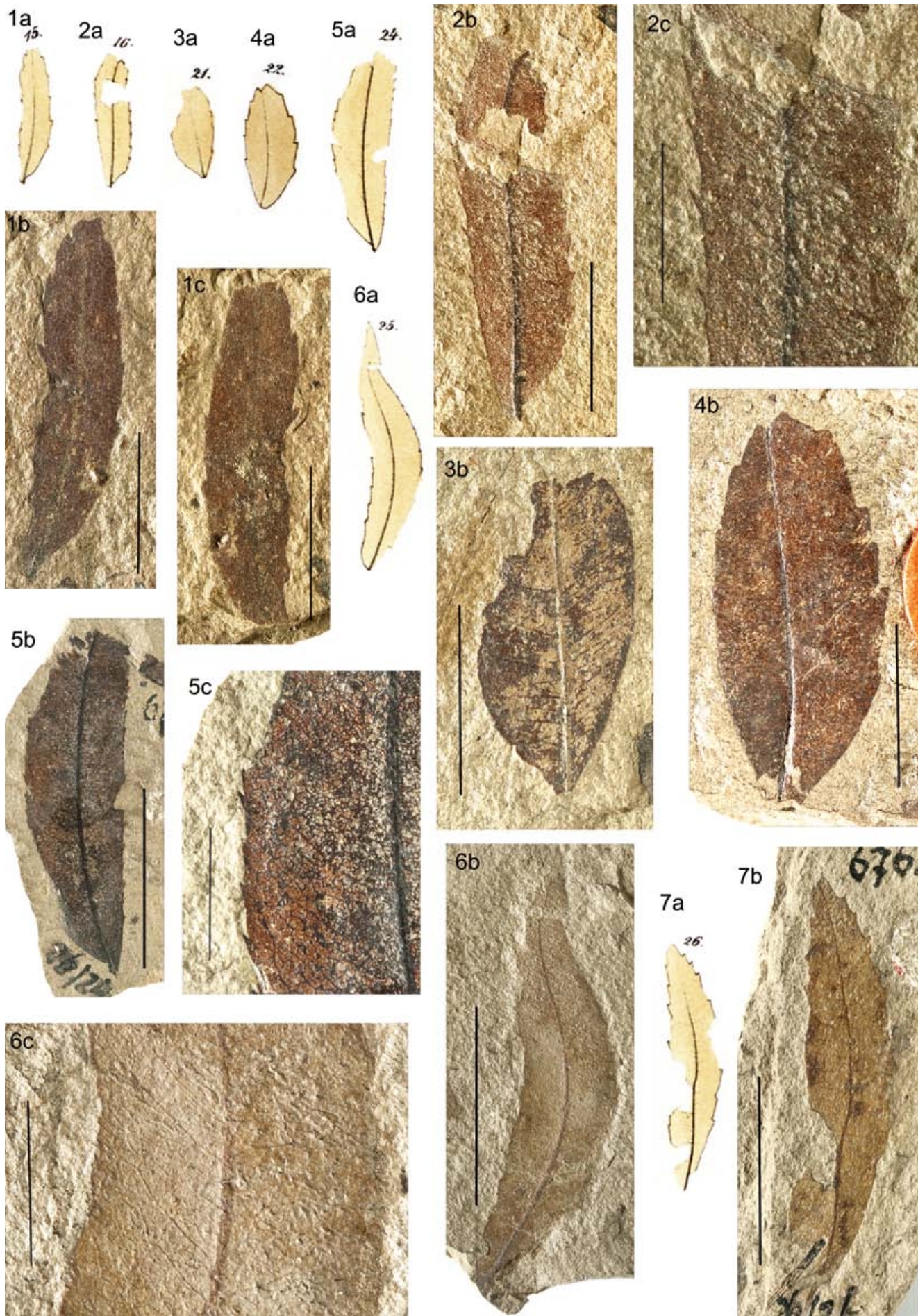


Plate 31

- Figs. 1–3: *Rhus juglandogena* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 28.
Fig. 1b: Syntype.
Fig. 1c: Detail of the middle part of the leaf.
Scale bar 5 mm.
- Fig. 1b–c: GBA 1853/001/0135/4.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 29.
Fig. 2b: Syntype.
Fig. 2c: Detail of the middle part of the leaf.
Scale bar 5 mm.
- Fig. 2b–c: GBA 1853/001/0135/5.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 27.
Fig. 3b: Syntype.
GBA 1853/001/0135/6A.
Fig. 3c: Counterpart of the syntype.
GBA 1853/001/0135/6B.
- Fig. 4: *Rhus fraxinoides* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 43.
Fig. 4b: Holotype.
GBA 1853/001/0136A.
Fig. 4c: Isotype.
GBA 1853/001/0136B.
- Figs. 5–7: *Rhus cassiaeformis* ETTINGSHAUSEN, 1853.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 30.
Fig. 5b: Syntype.
GBA 1853/001/0138/1.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 33.
Fig. 6b: Syntype.
Fig. 6c: Counterpart of the syntype.
GBA 1853/001/0138/2B.
Fig. 6d: Detail of the middle part of the syntype.
Scale bar 5 mm.
- Fig. 6b, d: GBA 1853/001/0138/2A.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 35.
Fig. 7b: Syntype.
GBA 1853/001/0138/3.
-



Plate 32

- Figs. 1–4: *Rhus cassiaeformis* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 36.
Fig. 1b: Syntype.
GBA 1853/001/0138/4A.
Fig. 1c: Counterpart of the syntype.
GBA 1853/001/0138/4B
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 34.
Fig. 2b: Syntype.
GBA 1853/001/0138/5.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 37.
Fig. 3b: Syntype.
GBA 1853/001/0138/6.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 26, Fig. 38.
Fig. 4b: Syntype.
GBA 1853/001/0138/7.
- Figs. 5–6: *Terminalia ungeri* ETTINGSHAUSEN, 1853.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 4.
Fig. 5b: Syntype.
Fig. 5c: Counterpart of the syntype.
GBA 1853/001/0141/1B.
Fig. 5d: Detail of the middle part of the syntype.
Scale bar 5 mm.
Fig. 5b, d: GBA 1853/001/0141/1A.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 5.
Fig. 6b: Syntype.
GBA 1853/001/0141/2.
- Fig. 7: *Zanthoxylon haeringianum* ETTINGSHAUSEN, 1853.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 1.
Fig. 7b: Holotype.
GBA 1853/001/0139.

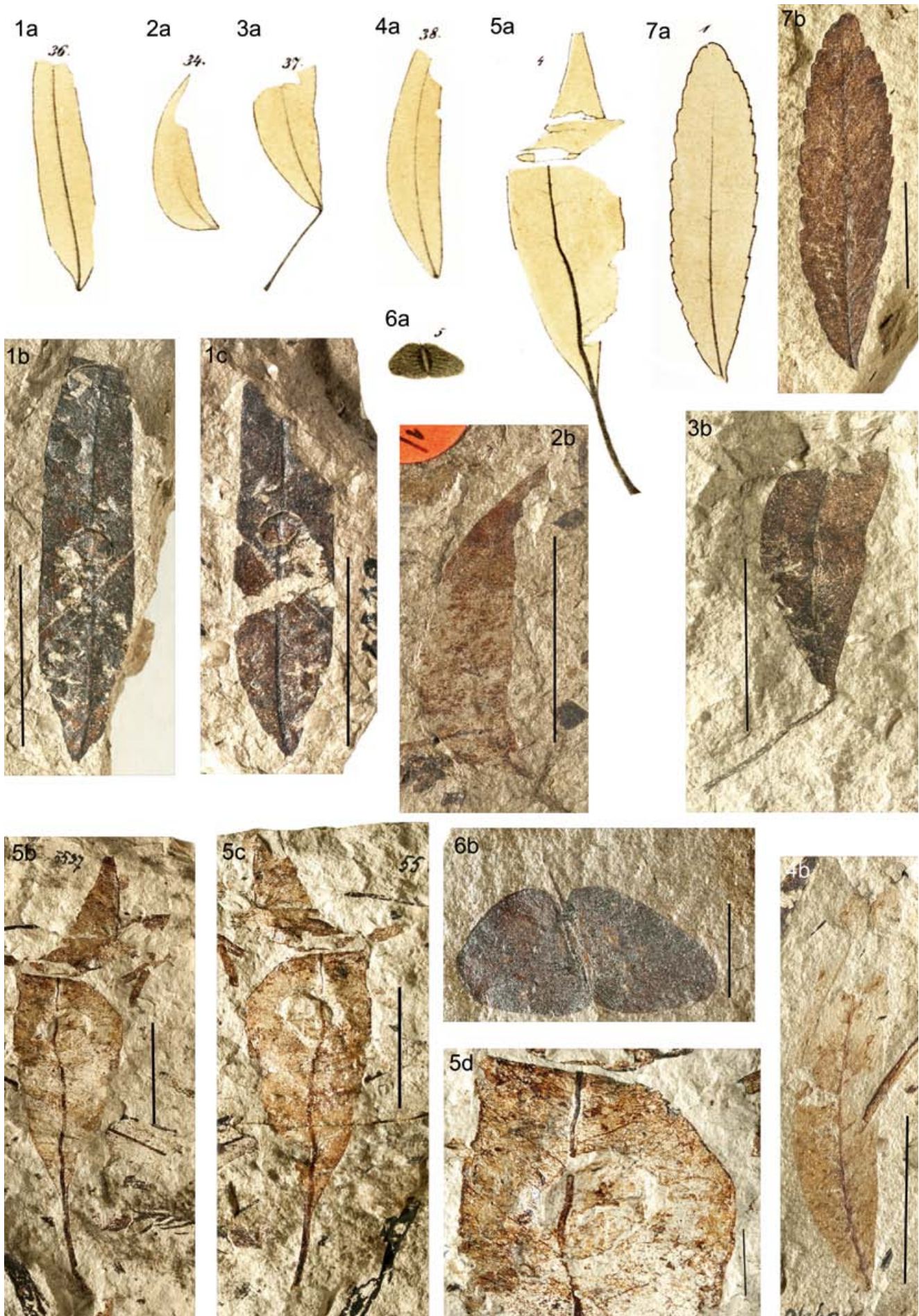


Plate 33

- Fig. 1: *Rhizophora thinophila* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 28.
Fig. 1b: Syntype.
Fig. 1a–b: GBA 1853/001/0142.
- Figs. 2–5: *Callistemophyllum diosmoides* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 6.
Fig. 2b: Syntype.
GBA 1853/001/0143/1A.
Fig. 2c: Counterpart of the syntype.
GBA 1853/001/0143/1B.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 7.
Fig. 3b: Syntype.
GBA 1853/001/0143/2.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 8.
Fig. 4b: Syntype.
Fig. 4c: Detail of the middle part of the leaf.
Scale bar 5 mm.
Fig. 4b–c: GBA 1853/001/0143/3
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 9.
Fig. 5b: Syntype.
GBA 1853/001/0143/4.
- Figs. 6–7: *Callistemophyllum verum* ETTINGSHAUSEN, 1853.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 11.
Fig. 6b: Syntype.
GBA 1853/001/0144/1.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 12.
Fig. 7b: Syntype.
Fig. 7c: Detail of the middle part of the syntype.
Scale bar 5 mm.
Fig. 7b–c: GBA 1853/001/0144/2.
- Figs. 8–9: *Callistemophyllum speciosum* ETTINGSHAUSEN, 1853.
Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 10.
Fig. 8b: Syntype.
GBA 1853/001/0145/1.
Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 15.
Fig. 9b: Syntype.
Fig. 9c: Detail of the middle part of the syntype.
Scale bar 5 mm.
Fig. 9b–c: GBA 1853/001/0145/2.
-



Plate 34

- Figs. 1–2: *Callistemophyllum melaleucaeforme* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 13.
Fig. 1b: Syntype.
GBA 1853/001/0146/1.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 14.
Fig. 2b: Syntype.
GBA 1853/001/0146/2A.
Fig. 2c: Counterpart of the syntype.
GBA 1853/001/0146/2B.
- Figs. 3–6: *Eucalyptus haeringiana* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 2.
Fig. 3b: Syntype.
Fig. 3c: Detail of the lower part of the leaf.
Scale bar 5 mm.
- Fig. 3b–c: GBA 1853/001/0147/1.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 4.
Fig. 4b: Syntype.
Fig. 4c: Detail of the lower part of the leaf.
Scale bar 5 mm.
- Fig. 4b–c: GBA 1853/001/0147/2.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 6.
Fig. 5b: Syntype.
Fig. 5c: Detail of the middle part of the leaf.
Scale bar 5 mm.
- Fig. 5b–c: GBA 1853/001/0147/3.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 8.
Fig. 6b: Syntype.
Fig. 6c: Detail of the middle part of the leaf.
Scale bar 5 mm.
- Fig. 6b–c: GBA 1853/001/0147/4.
-

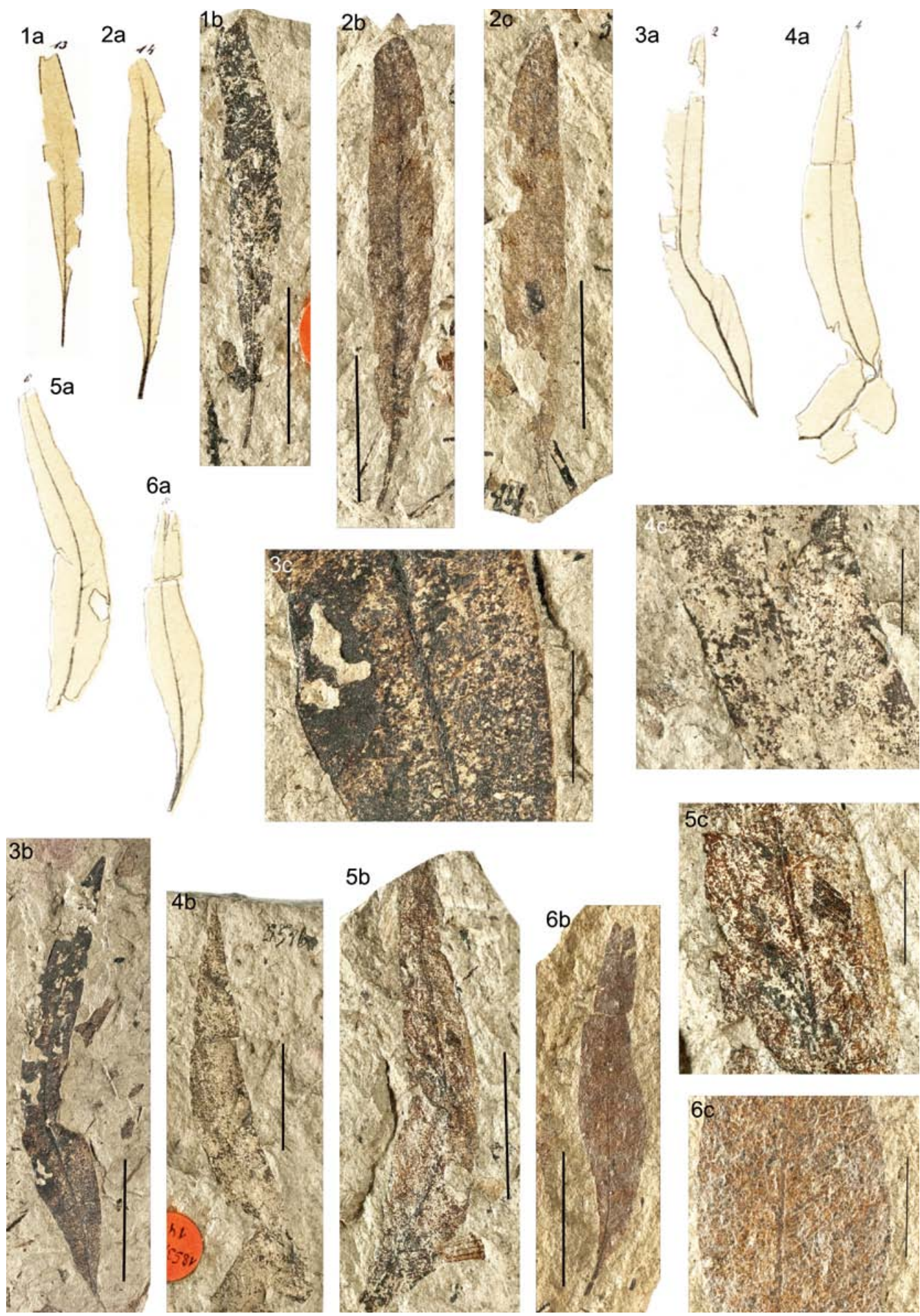


Plate 35

- Figs. 1–8: *Eucalyptus haeringiana* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 5.
Fig. 1b: Syntype.
GBA 1853/001/0147/5.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 9.
Fig. 2b: Syntype.
GBA 1853/001/0147/6.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 11.
Fig. 3b: Syntype.
GBA 1853/001/0147/7A.
Fig. 3c: Counterpart of the syntype.
GBA 1853/001/0147/7B.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 13.
Fig. 4b: Syntype.
GBA 1853/001/0147/8.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 14.
Fig. 5b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0147/9.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 15.
Fig. 6b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0147/10.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 16.
Fig. 7b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0147/11.
Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 18.
Fig. 8b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0147/12A.
Fig. 8c: Counterpart of the syntype.
Scale bar 5 mm.
GBA 1853/001/0147/12B.

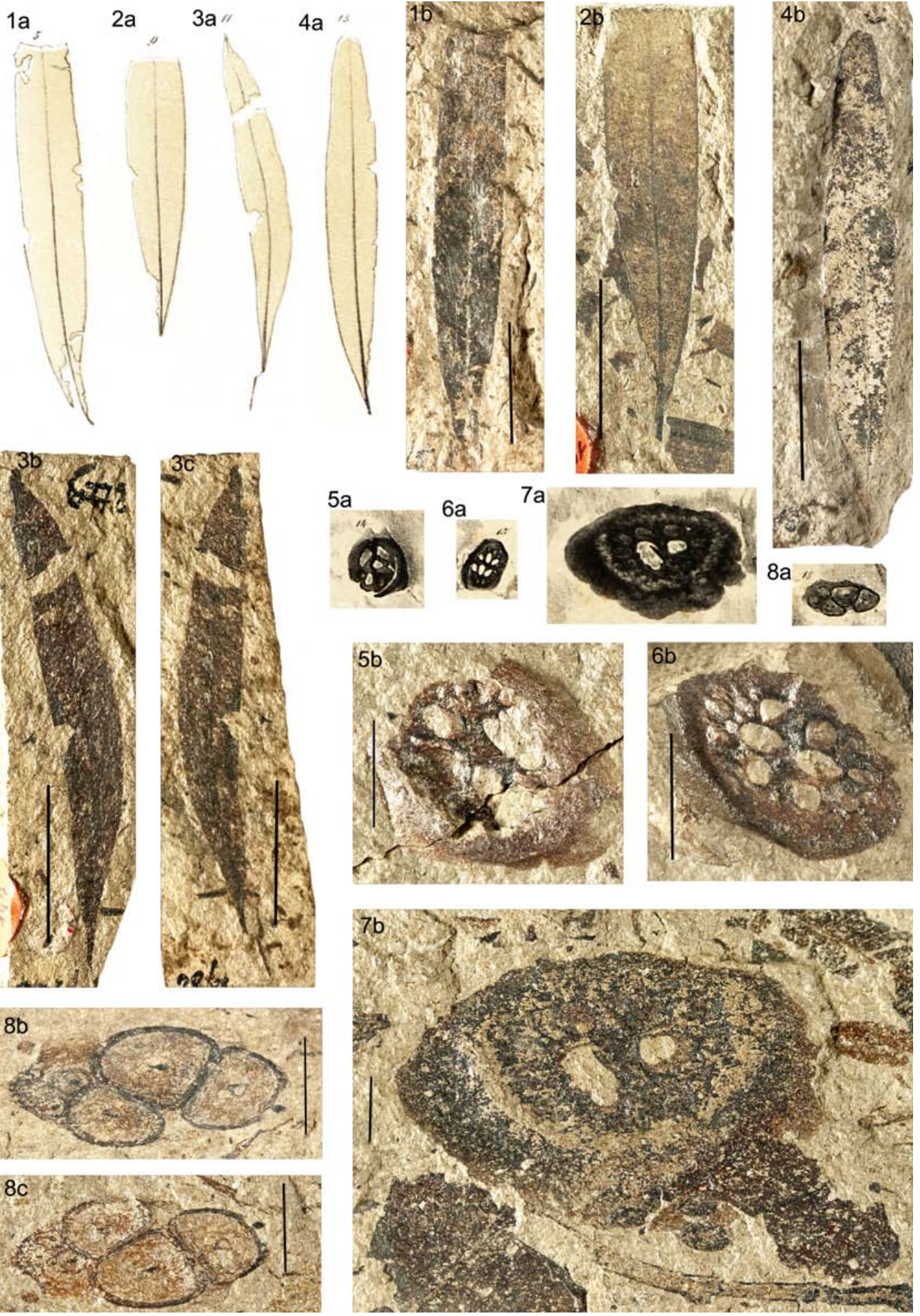


Plate 36

- Figs. 1–6: *Eucalyptus haeringiana* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 20.
Fig. 1b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0147/13.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 23.
Fig. 2b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0147/14.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 17.
Fig. 3b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0147/15A.
- Fig. 3c: Counterpart of the syntype.
GBA 1853/001/0147/15B.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 19.
Fig. 4b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0147/16A.
- Fig. 4c: Counterpart of the syntype.
GBA 1853/001/0147/16B.
- Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 21.
Fig. 5b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0147/17.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 28, Fig. 22.
Fig. 6b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0147/718.
- Fig. 7: *Metrosideros calophyllum* ETTINGSHAUSEN, 1853.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 18.
Fig. 7b: Syntype.
GBA 1853/001/0149.
- Fig. 8: *Metrosideros extincta* ETTINGSHAUSEN, 1853.
Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 19.
Fig. 8b: Holotype.
Scale bar 5 mm.
GBA 1853/001/0150A.
- Fig. 8c: Isotype.
Scale bar 5 mm.
GBA 1853/001/0150B.
- Fig. 9: *Myrtus atlantica* ETTINGSHAUSEN, 1853.
Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 23.
Fig. 9b: Holotype ?
Fig. 9c: Isotype ?
GBA 1853/001/0153B.
- Fig. 9d: Detail of the upper part of the leaf fragment.
Scale bar 5 mm.
Fig. 9a–b, d: GBA 1853/001/0153A.

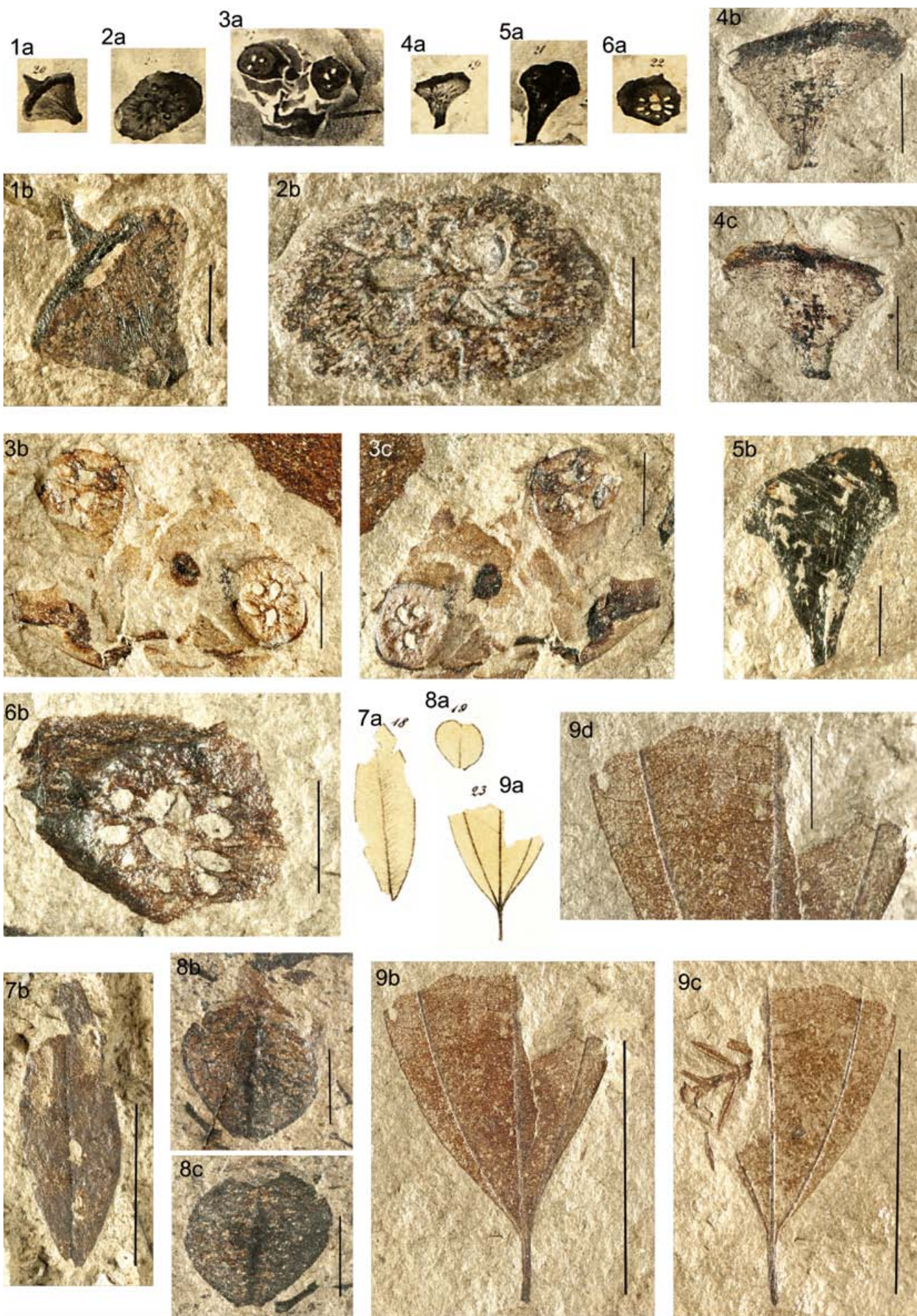


Plate 37

- Figs. 1–4: *Myrtus oceanica* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 24.
Fig. 1b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0154/1.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 25.
Fig. 2b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0154/2.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 26.
Fig. 3b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0154/3A.
- Fig. 3c: Counterpart of the syntype.
GBA 1853/001/0154/3B.
- Fig. 3d: Detail of the middle part of the leaf.
Scale bar 5 mm.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 27, Fig. 27.
Fig. 4b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0154/4.
- Fig. 5: *Phaseolites kennedyoides* ETTINGSHAUSEN, 1853.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 2.
Fig. 5b: Holotype.
Scale bar 1 cm.
- Fig. 5c: Detail of the apical part of the leaf.
Scale bar 5 mm.
- Fig. 5b–c: GBA 1853/001/0156.
- Figs. 6–8: *Phaseolites microphyllus* ETTINGSHAUSEN, 1853.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 3.
Fig. 6b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0157/1.
- Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 5.
Fig. 7b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0157/2A.
- Fig. 7c: Counterpart of the syntype.
GBA 1853/001/0157/2B.
- Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 6.
Fig. 8b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0157/3.
-

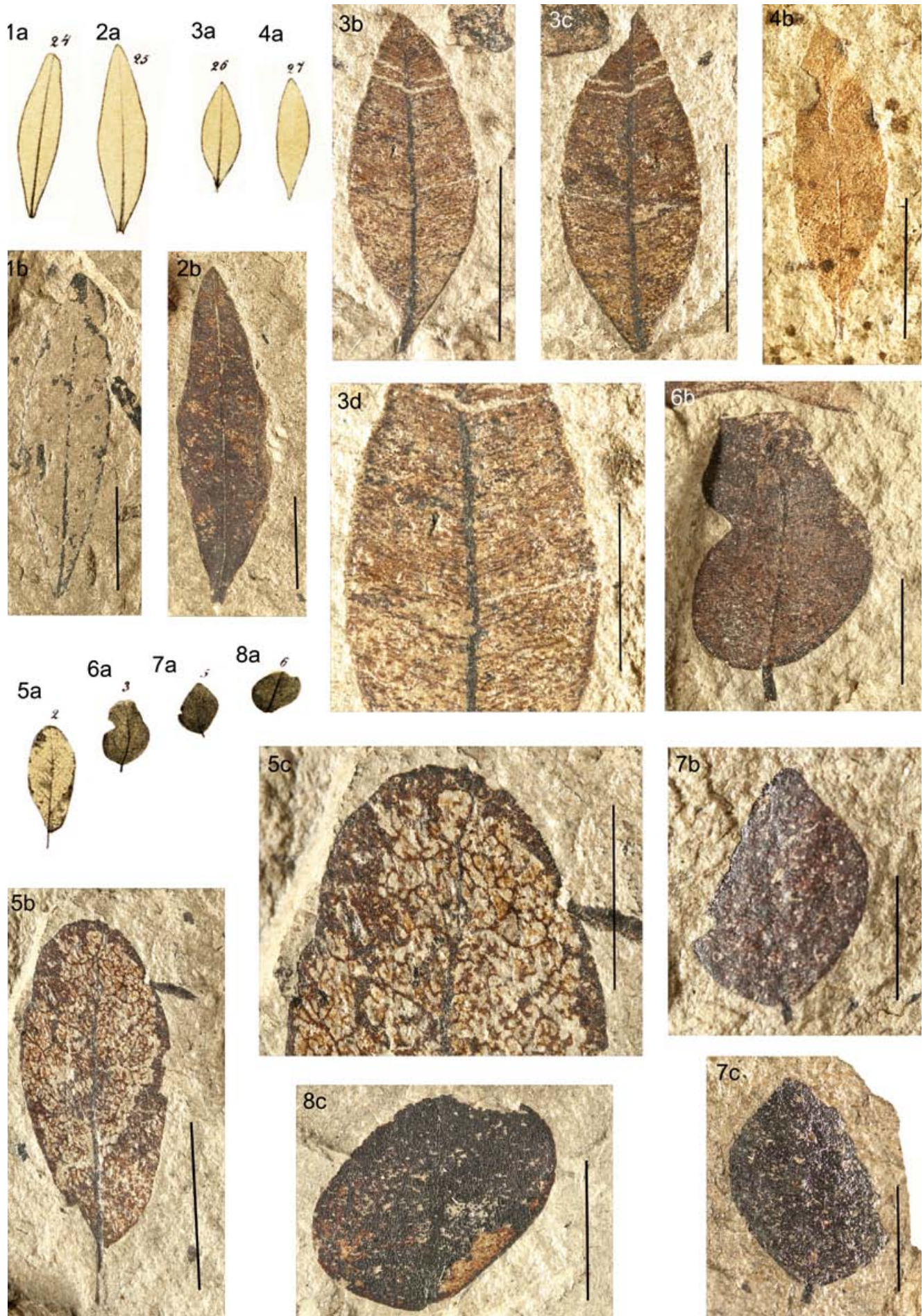


Plate 38

- Figs. 1–2: *Dalbergia haeringiana* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 8.
Fig. 1b: Syntype.
GBA 1853/001/0158/1.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 9.
Fig. 2b: Syntype.
GBA 1853/001/0158/2A.
- Fig. 2c: Counterpart of the syntype.
GBA 1853/001/0158/2B.
- Figs. 3–10: *Caesalpinia haidingeri* ETTINGSHAUSEN, 1853.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 21.
Fig. 3b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0163/1A.
- Fig. 3c: Counterpart of the syntype.
Scale bar 5 mm.
GBA 1853/001/0163/1B.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 22.
Fig. 4b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0163/2A.
- Fig. 4c: Counterpart of the syntype.
Scale bar 5 mm.
GBA 1853/001/0163/2B.
- Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 24.
Fig. 5b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0163/3A.
- Fig. 5c: Counterpart of the syntype.
Scale bar 5 mm.
GBA 1853/001/0163/3B.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 25.
Fig. 6b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0163/4.
- Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 27.
Fig. 7b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0163/5.
- Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 28.
Fig. 8b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0163/6.
- Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 29.
Fig. 9b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0163/7.
- Fig. 10a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 32.
Fig. 10b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0163/8.
-

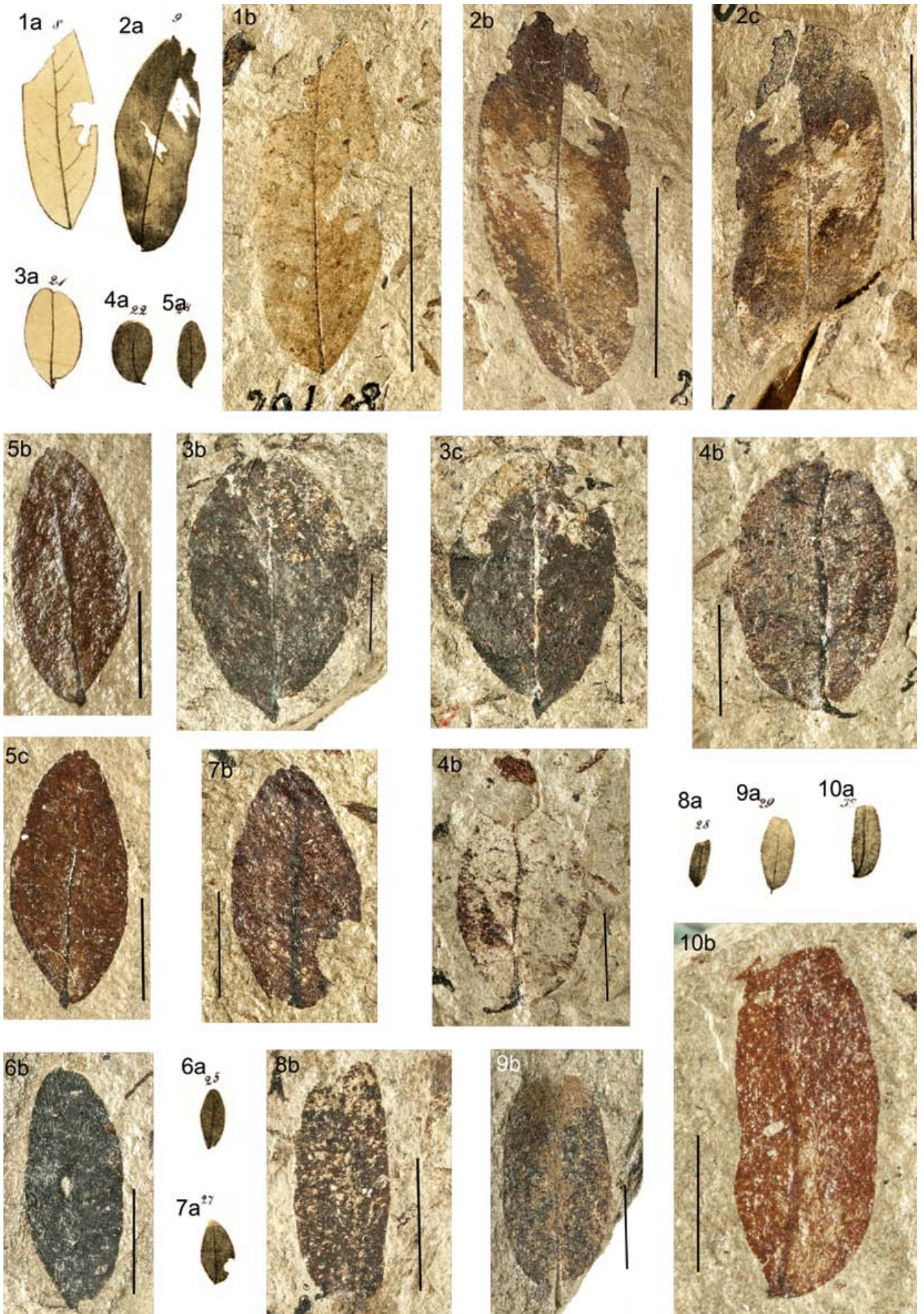


Plate 39

- Figs. 1–5: *Caesalpinia haidingeri* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 33.
Fig. 1b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0163/9.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 34.
Fig. 2b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0163/10A.
- Fig. 2c: Counterpart of the syntype.
Scale bar 5 mm.
GBA 1853/001/0163/10B.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 37.
Fig. 3b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0163/11.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 38.
Fig. 4b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0163/12.
- Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 39.
Fig. 5b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0163/13.
- Figs. 6–10: *Cassia pseudoglandulosa* ETTINGSHAUSEN, 1853.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 48.
Fig. 6b: Syntype.
GBA 1853/001/0164/1.
- Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 49.
Fig. 7b: Syntype.
GBA 1853/001/0164/2.
- Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 50.
Fig. 8b: Syntype.
GBA 1853/001/0164/3.
- Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 51.
Fig. 9b: Syntype.
GBA 1853/001/0164/4A.
- Fig. 9c: Counterpart of the syntype.
GBA 1853/001/0164/4B.
- Fig. 10a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 52.
Fig. 10b: Syntype.
GBA 1853/001/0164/5.
-

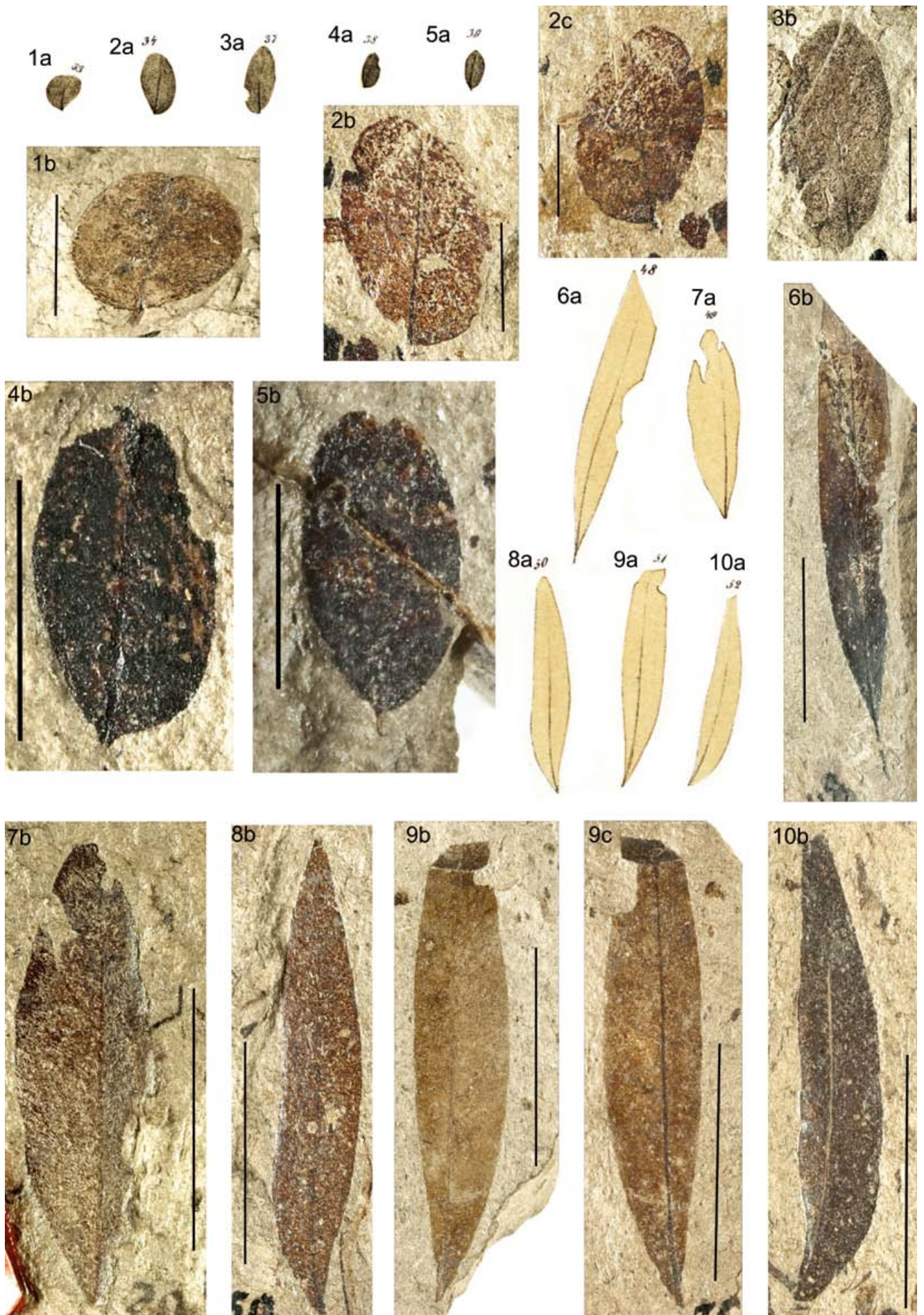


Plate 40

- Figs. 1–2: *Cassia pseudoglandulosa* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 54.
Fig. 1b: Syntype.
GBA 1853/001/0164/6.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 29, Fig. 35.
Fig. 2b: Syntype.
GBA 1853/001/0164/7.
- Figs. 3–10: *Cassia zephyri* ETTINGSHAUSEN, 1853.
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 1.
Fig. 3b: Probably the counterpart of the figured syntype.
GBA 1853/001/0167/1B.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 2.
Fig. 4b: Syntype.
GBA 1853/001/0167/2.
- Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 3.
Fig. 5b: Syntype.
GBA 1853/001/0167/3.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 4.
Fig. 6b: Syntype.
GBA 1853/001/0167/4.
- Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 5.
Fig. 7b: Syntype.
GBA 1853/001/0167/5.
- Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 6.
Fig. 8b: Syntype.
GBA 1853/001/0167/6.
- Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 7.
Fig. 9b: Syntype.
GBA 1853/001/0167/7.
- Fig. 10a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 8.
Fig. 10b: Syntype.
GBA 1853/001/0167/8.
-

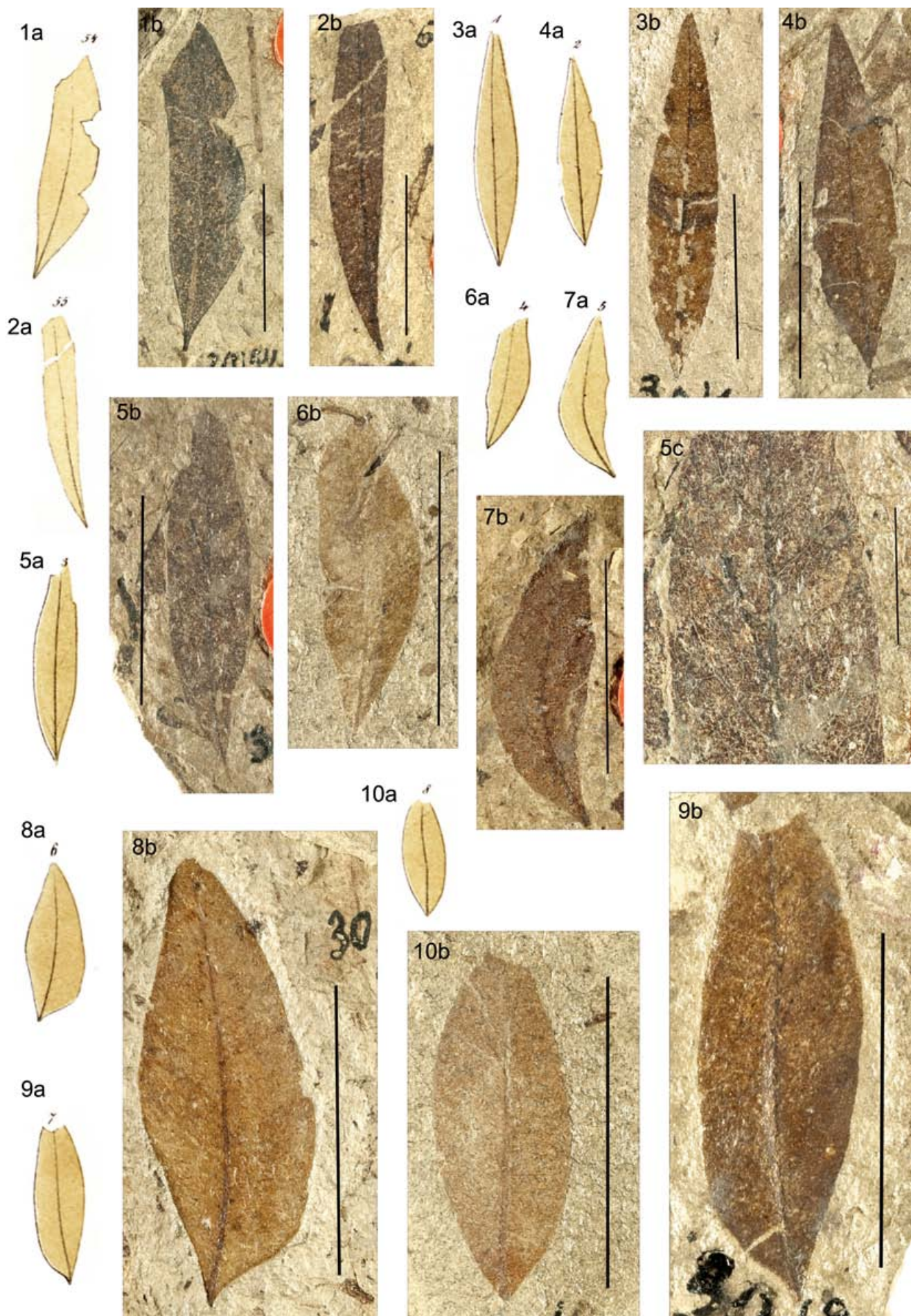


Plate 41

- Figs. 1–3: *Cassia feroniae* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 9.
Fig. 1b: Syntype.
GBA 1853/001/0168/1.
- Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 10.
Fig. 2b: Syntype.
GBA 1853/001/0168/2.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 11.
Fig. 3b: Syntype.
GBA 1853/001/0168/3.
- Figs. 4–6: *Leguminosites dalbergioides* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 18.
Fig. 4b: Syntype.
Fig. 4c, e: Counterpart of the syntype.
GBA 1853/001/0171/1B.
- Fig. 4d: Detail of the upper part of the leaf.
Scale bar 5 mm.
- Fig. 4b, d: GBA 1853/001/0171/1A
Fig. 4e: Detail of the middle part of the leaf.
Scale bar 5 mm.
- Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 19.
Fig. 5b: Syntype.
GBA 1853/001/0171/2.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 20.
Fig. 6b: Syntype.
GBA 1853/001/0171/3.
- Figs. 7–8: *Mimosites haeringiana* ETTINGSHAUSEN, 1853.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 24.
Fig. 7b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0173/1A.
- Fig. 7c: Counterpart of the syntype.
GBA 1853/001/0173/1B.
- Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 25.
Fig. 8b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0173/2.
-

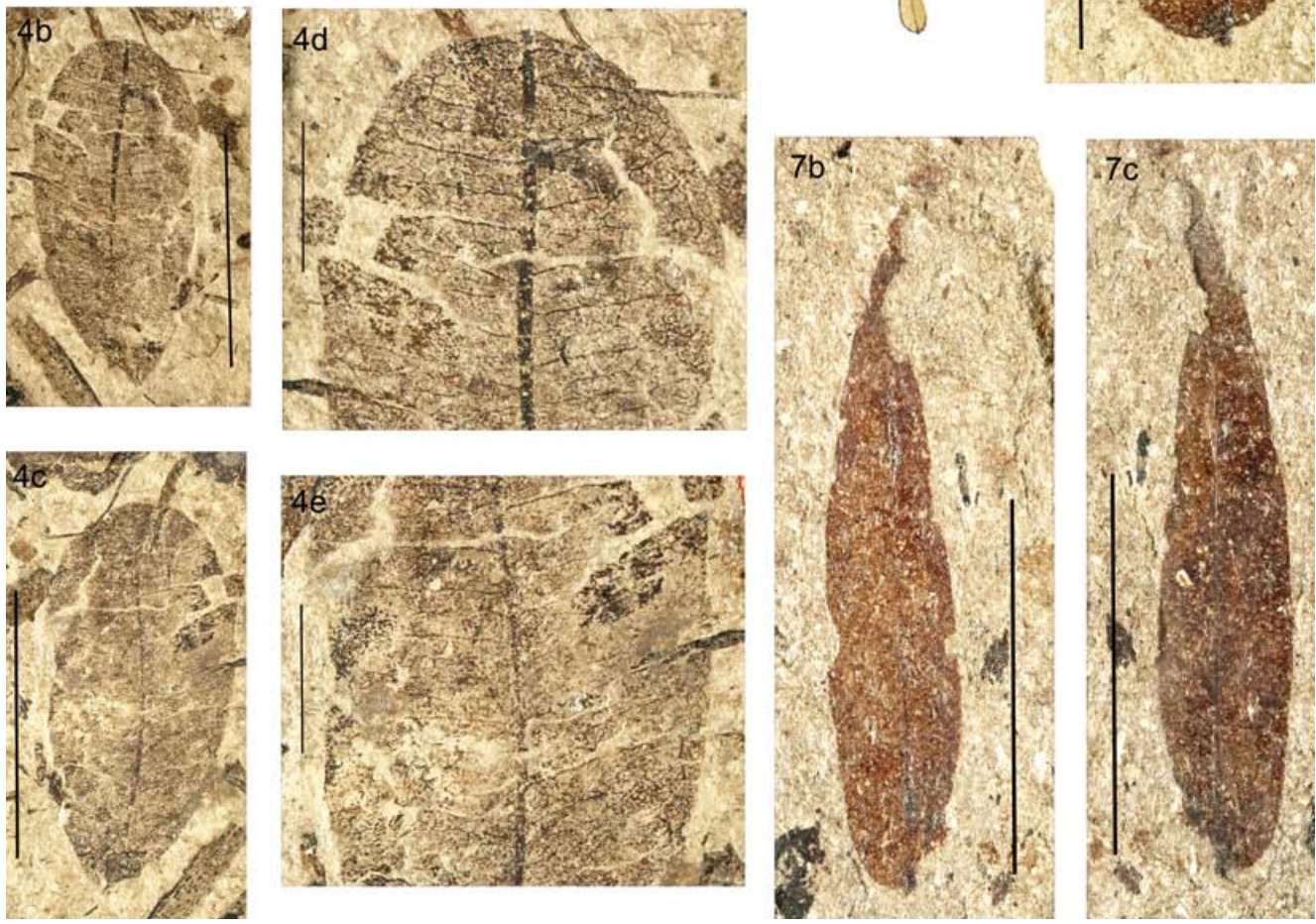
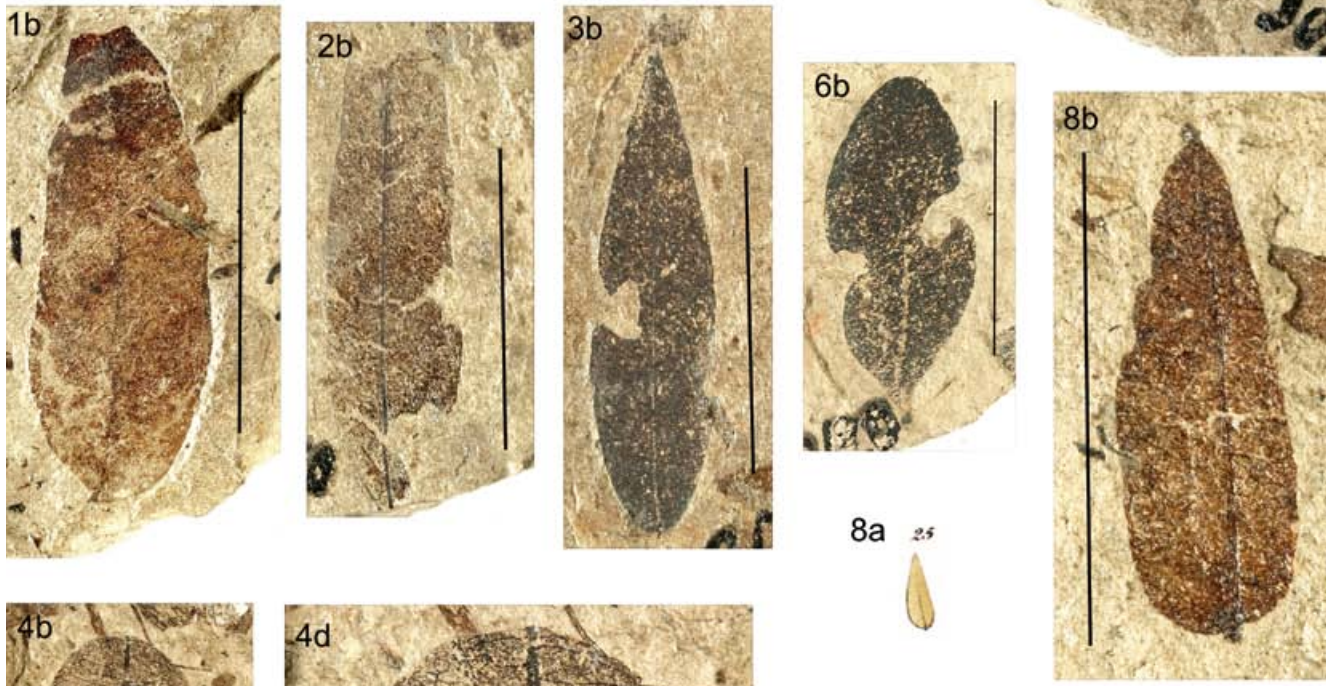
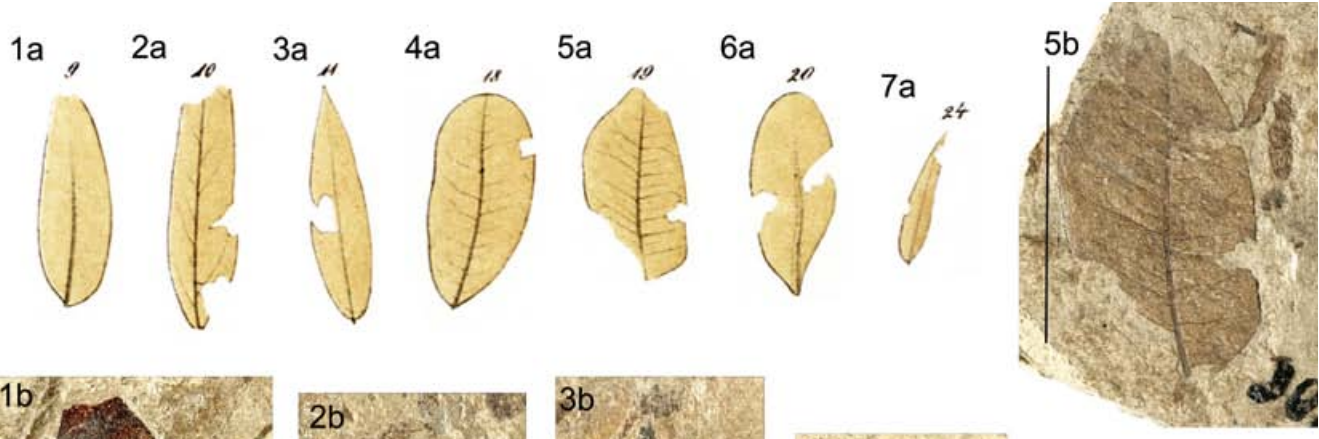


Plate 42

- Figs. 1–9: *Mimosites haeringiana* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 26.
Fig. 1b: Syntype.
Scale bar 1 cm.
Fig. 1c: Detail of the middle part of the leaf.
Scale bar 5 mm.
- Fig. 1b–c: GBA 1853/001/0173/3.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 27.
Fig. 2b: Syntype.
Scale bar 5 mm.
GBA 1853/001/0173/4.
- Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 28.
Fig. 3b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0173/5.
- Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 29.
Fig. 4b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0173/6A.
- Fig. 4c: Counterpart of the syntype.
Scale bar 1 cm.
GBA 1853/001/0173/6B.
- Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 30.
Fig. 5b: Counterpart of the syntype.
Scale bar 1 cm.
GBA 1853/001/0173/7B.
- Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 31.
Fig. 6b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0173/8.
- Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 32.
Fig. 7b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0173/9.
- Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 34.
Fig. 8b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0173/10.
- Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 37.
Fig. 9b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0173/11.
- Figs. 10–17: *Mimosites cassiaeformis* ETTINGSHAUSEN, 1853.
Fig. 10a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 38.
Fig. 10b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0174/1.
- Fig. 11a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 39.
Fig. 11b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0174/2.
- Fig. 12a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 40.
Fig. 12b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0174/3.
- Fig. 13a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 42.
Fig. 13b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0174/4.
- Fig. 14a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 43.
Fig. 14b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0174/5.
- Fig. 15a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 45.
Fig. 15b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0174/6A.
- Fig. 15c: Counterpart of the syntype.
Scale bar 1 cm.
GBA 1853/001/0174/6B.
- Fig. 16a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 47.
Fig. 16b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0174/7.
- Fig. 17a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 49.
Fig. 17b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0174/9.
-

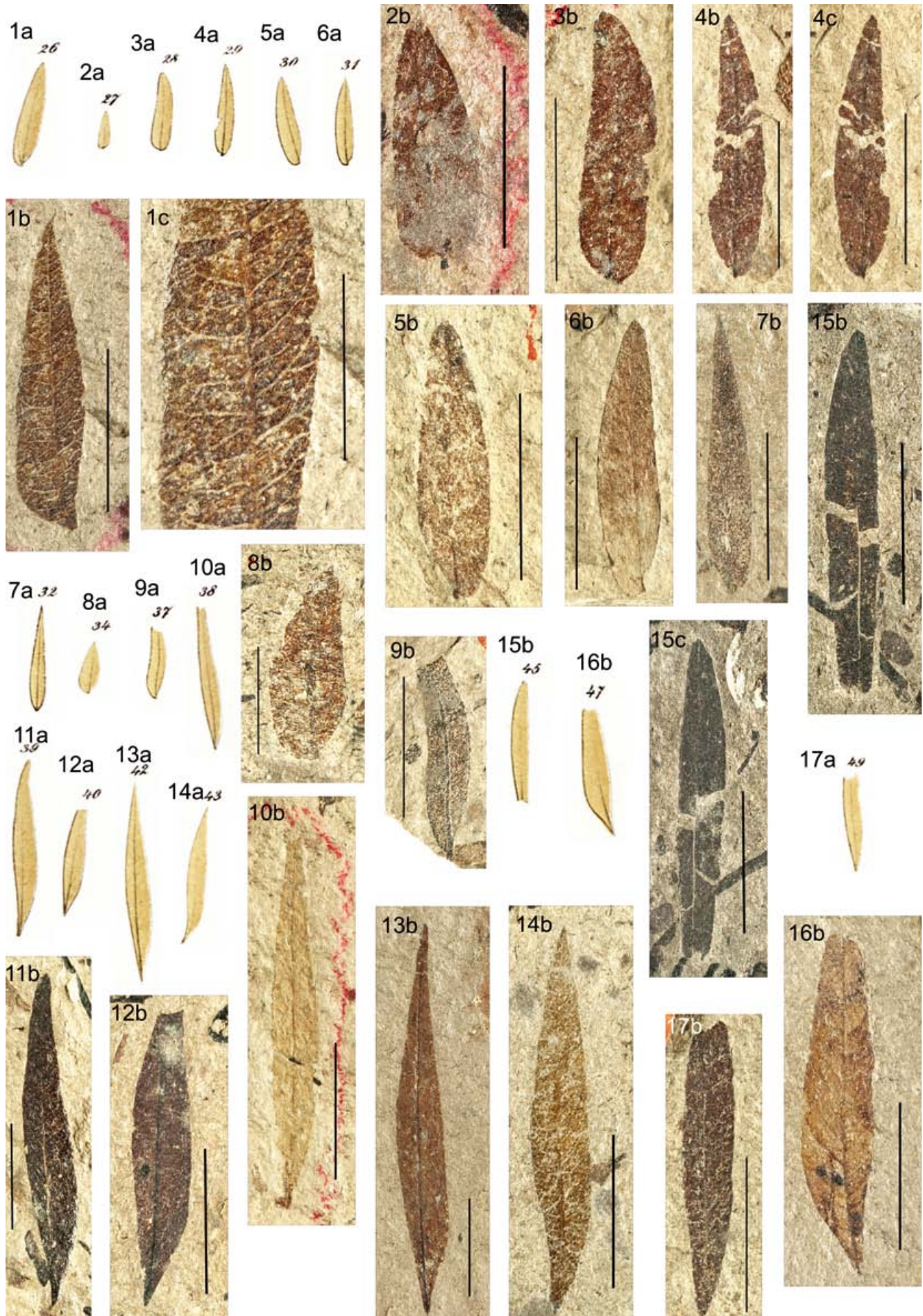
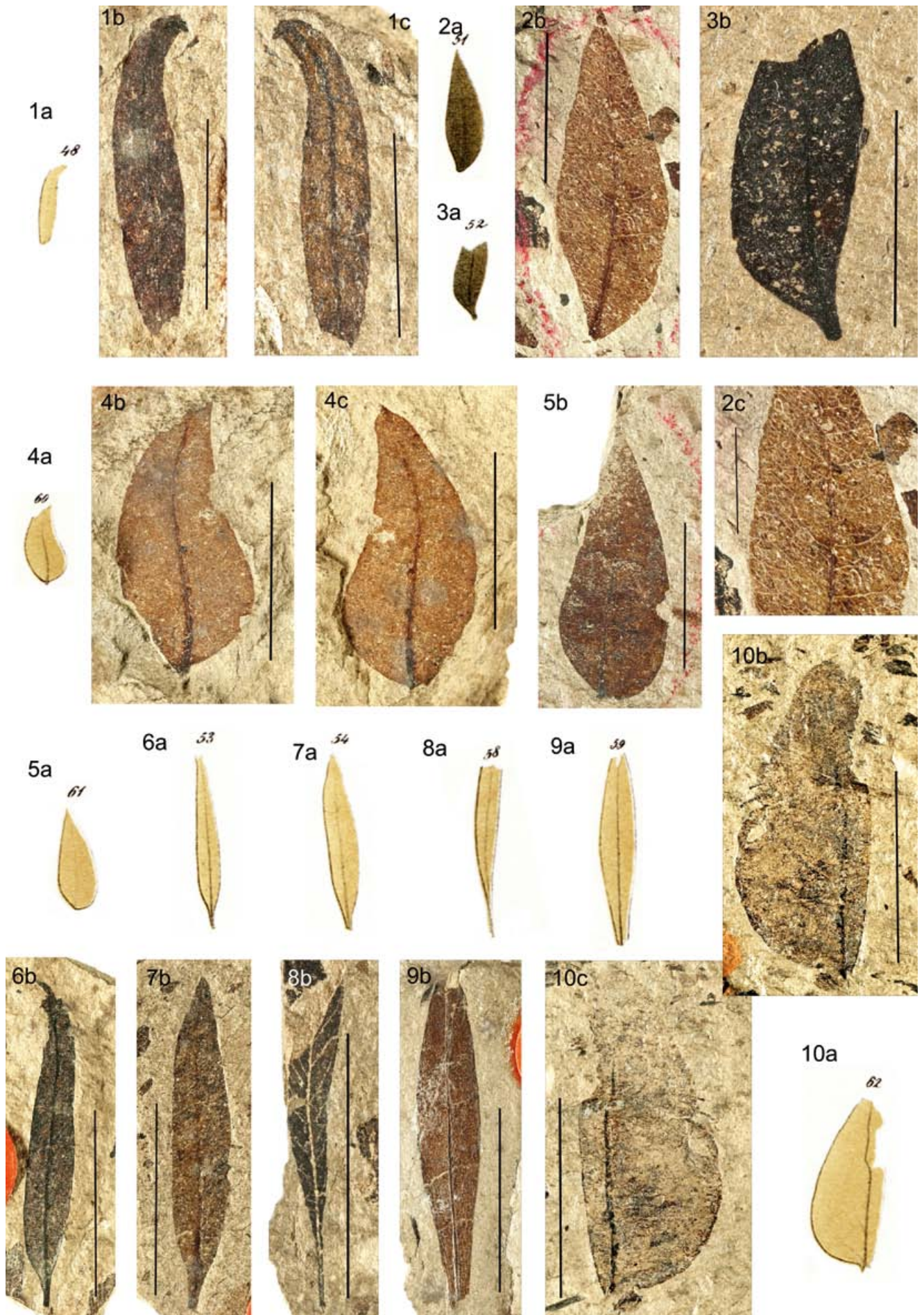


Plate 43

- Fig. 1: *Mimosites cassiaeformis* ETTINGSHAUSEN, 1853.
Fig. 1a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 48.
Fig. 1b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0174/8A.
Fig. 1c: Counterpart of the syntype.
GBA 1853/001/0174/8B.
- Figs. 2–3: *Acacia coriacea* ETTINGSHAUSEN, 1853.
Fig. 2a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 51.
Fig. 2b: Syntype.
Scale bar 1 cm.
Fig. 2c: Detail of the middle part of the syntype.
Scale bar 5 mm.
Fig. 2b–c: GBA 1853/001/0177/1
Fig. 3a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 52.
Fig. 3b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0177/2.
- Figs. 4–5: *Acacia mimosoides* ETTINGSHAUSEN, 1853.
Fig. 4a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 60.
Fig. 4b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0178/1A.
Fig. 4c: Counterpart of the syntype.
GBA 1853/001/0178/1B.
Fig. 5a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 61.
Fig. 5b: Syntype.
Scale bar 1 cm.
GBA 1853/001/0178/2.
- Figs. 6–7: *Acacia proserpinae* ETTINGSHAUSEN, 1853.
Fig. 6a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 53.
Fig. 6b: Syntype.
GBA 1853/001/0179/1.
Fig. 7a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 54.
Fig. 7b: Syntype.
GBA 1853/001/0179/2.
- Figs. 8–9: *Acacia diana* ETTINGSHAUSEN, 1853.
Fig. 8a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 58.
Fig. 8b: Syntype.
GBA 1853/001/0180/1.
Fig. 9a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 59.
Fig. 9b: Syntype.
GBA 1853/001/0180/2.
- Fig. 10: *Inga europaea* ETTINGSHAUSEN, 1853.
Fig. 10a: Type figure of ETTINGSHAUSEN, Pl. 30, Fig. 62.
Fig. 10b: Holotype.
GBA 1853/001/0181A.
Fig. 10c: Isotype.
GBA 1853/001/0181B.
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Acknowledgements

All the excellent photographs were made by Ilka WÜNSCHE from the department of palaeontology and collections of the Geological Survey in Austria. I am also grateful to Jo-

hann EGGER, from the same institute, who made it possible to make this catalogue. Many thanks to Rainer BUTZMANN (München) for providing geological data.

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Manuskript bei der Schriftleitung eingelangt am 2. März 2010

**Chitinozoan Type Specimens in the F.H. CRAMER Collection
 at the Geological Survey of Austria**

HELGA PRIEWALDER*)

3 Text-Figures, 3 Plates

*Palynomorphs
 Type Specimens
 Pennsylvania
 China
 Spain
 Lower Palaeozoic
 Paleontological collection*

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Chitinozoen Typusexemplare in der F. H. CRAMER-Sammlung an der Geologischen Bundesanstalt

Zusammenfassung

Die Sammlung von FRITZ H. CRAMER, die sich seit 1990 an der Geologischen Bundesanstalt in Wien (GBA) befindet, umfasst tausende Dauerpräparate mit Acritarchen, Chitinozoen und Sporen aus dem Altpaläozoikum verschiedener Kontinente, weiters zahlreiche Aufbereitungsrückstände und Gesteinsproben. Bei der genauen Durchmusterung aller in Frage kommenden Präparate konnten 21 der 46 von CRAMER und seinen Co-Autoren beschriebenen Chitinozoen-Holotypen wiedergefunden werden (von 2 Arten konnten nur die Paratypen lokalisiert werden). Von diesen wurden im Durchlichtmikroskop Farbfotos angefertigt. Sie werden hier zusammen mit den Daten der Originalabbildungen, den Angaben über Typus-Schichten und -Lokalitäten, den Nummern der Präparate-Boxen, den Präparate-Nummern und den Englandfinder-Angaben zu den einzelnen Objekten präsentiert. Weiters wird angeführt, ob noch Probenmaterial und/oder Aufbereitungsrückstände der Proben, aus denen die Chitinozoen-Holotypen gewonnen wurden, vorhanden sind.

Abstract

The collection of FRITZ H. CRAMER, with thousands of permanent slides (containing Lower Paleozoic acritarchs, chitinozoans and spores from several continents) and with numerous organic residues and rock samples, has been housed at the Geological Survey of Austria (GBA) since 1990. The slides were examined for CRAMER'S 46 chitinozoan holotypes, of which 21 were recovered (of two species only paratypes were found). Of these, colour photographs were made using a transmitting light microscope. They are presented here in combination with the published data of the type figures, the indications of the type strata and type localities, the collection numbers of the cases in which the slides are stored, the slide numbers and the Englandfinder data of the types. Furthermore, information is provided about whether rock material and/or organic residues of the type samples are available.

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Introduction

From the early sixties to the late seventies of the 20th century, Fritz H. CRAMER, frequently in co-authorship with his wife Maria del Carmen R. DIEZ, published numerous articles on Lower Paleozoic palynomorphs (acritarchs, chitinozoans and spores), including hundreds of new species.

In 1990, after CRAMER's retirement from scientific work, the Geological Survey of Austria (GBA) acquired his complete collection. This comprised thousands of permanent slides, organic residues in small tubes and rock samples. The whole collection has been carefully examined and re-arranged by the present author and its contents documented.

One aim of the reorganisation was to identify the slides with the chitinozoan holotypes in the collection. This turned out to be difficult, as in CRAMER's publications up to 1967, information concerning the sample numbers of the holotypes was frequently incorrect or missing.

Moreover, it has been discovered that many holotypes are missing. All but one of the slides with the 18 chitinozoan holotypes of CRAMER (1964) are missing and are now regarded as lost (see PRIEWALDER, 1997: General Remarks, p. 75); only the slide with *Sphaerochitina llorona* has been found.

From the eight holotypes in CRAMER (1967), only 1 holotype and 2 paratypes have been found again (*Conochitina lageniforma*, *C. parvidecipiens* [paratype], *Plectochitina ? taugourdeauii* [paratype]). In contrast, the slides with the holotypes in CRAMER (1969) and (1970) (*Conochitina ? monterrosae* and *Angochitina sinica*, respectively) have been identified without difficulty. One of the 8 holotypes in CRAMER & DIEZ (1978) has not been found (*Sphaerochitina gerardis*) and finally all ten holotypes in DIEZ & CRAMER (1978) have been identified.

The decision to publish a special volume dealing exclusively with fossil holotypes in the GBA collections has been used to re-photograph the chitinozoan holotypes of CRAMER and his co-workers with a modern equipment, since the original figures frequently are of poor quality. In several cases, the colour photographs presented here might con-

tribute to a better understanding of the original definition of the species.

PRIEWALDER (1997) carried out SEM-studies on the chitinozoans from sample 813 of CRAMER (1964), which came from the uppermost San Pedro Formation of the La Vid de Gordón section in the Cantabrian Mountains in Spain. PRIEWALDER (1997) identified neotypes for 3 species for which the holotypes had been lost: *Plectochitina carminae* CRAMER, 1964, *P. rosendae* CRAMER, 1964 and *Pseudoclathrochitina carmenchui* (CRAMER, 1964). These species are also included in this work.

If rock material and/or organic residues of the samples from which the holotypes were derived are present in the collection, this has been mentioned in the remarks. However, note that the residues might be spoiled, since SEM-examination of the chitinozoans of sample 813 (PRIEWALDER, 1997) revealed that the fossils from this residue were covered by a film of unknown composition and were thus not suitable for morphological studies. Note also that in most cases only small pieces of the rock samples are available.

The slides of the CRAMER collection have been deposited in 152 boxes and stored together with the organic residues, as a separate constituent of the micropaleontological collection of the GBA, with the sample numbers and slide numbers given by CRAMER. However, for the sake of efficient recovery, the slides with the chitinozoan holotypes have in addition been given slide numbers of the GBA collections (GBA 2009/031/1–25).

The slides with the neotypes (PRIEWALDER, 1997), however, are part of the GBA collection and have been kept under the slide numbers GBA 1997/1/1–3. The rock samples have been packed in eight wooden cases and deposited in the case storage of the GBA, under the key word "CRAMER".

All the light microscope photographs were taken with a digital camera (Canon PowerShot S80) on a transmitting light microscope (Leitz Ortholux II). For the SEM-pictures the JEOL JSM 200 Scanning Electron Microscope at the Institute of Geosciences, University of Rennes, was used.

Description of the Chitinozoan Types

Preliminary Notes

Note that this paper is not a systematic revision of the chitinozoan holotypes in the CRAMER collection. Instead, its aim is to combine in one article all the available types with the relevant data given in the original descriptions and to present better quality light microscope photographs of the fossils.

The holotypes, neotypes and paratypes described here are cited under their original generic names (except for *Pseudoclathrochitina carmenchui*) and are arranged in alphabetic order of the names of the genera. This chapter is followed by an alphabetic list of the species names.

Description

Ancyrochitina ancyrea var. *mileches* CRAMER & DIEZ, 1978

(Pl. 1, Fig. 2a, b)

Coll. no. of the slide: GBA 2009/031/24.

CRAMER collection at GBA: Box 113 – Slide 760370-C1 – Engländer L.43.

Type level: Furada Formation (middle shale portion, sample 760370), early Ludlow.

Type locality: Outcrop about 1 km west of Soto de los Infantes, Province of Oviedo, Spain.

Type figure: CRAMER & DIEZ, 1978, p. 163, Pl. 2, Fig. 11.

Remarks:

It is not clear whether the outcrop from which sample 760370 comes is situated east or west of the village Soto de los Infantes, because in the description of *Plectochitina filligrana* (CRAMER & DIEZ, 1978, p. 174), from the same sample, the locality is given as “outcrop about 1 km east of Soto de los Infantes”.

The slide number for the holotype given in CRAMER & DIEZ, 1978 (slide 760370-C5) is incorrect.

Vesicle length of the holotype (this paper): 157 µm (in CRAMER & DIEZ, 1978: Not stated).

***Ancyrochitina cantabrica* CRAMER & DIEZ, 1978**

(Pl. 2, Fig. 3a–c)

Coll. no. of the slide: GBA 2009/031/11.

CRAMER collection at GBA: Box 77 – Slide 6542-C1 – Eng-landfinder N.48.

Type level: San Pedro Formation (sample 6542), middle Gedinnian.

Type locality: Outcrop west of the village Torrestío, Province of León, Spain.

Type figure: CRAMER & DIEZ, 1978, p. 163, Pl. 7, Fig. 12.

Remarks:

Vesicle length of the holotype (this paper): 243 µm (CRAMER & DIEZ, 1978: Not stated).

Rock sample and residue available.

***Ancyrochitina dunensis* CRAMER & DIEZ, 1978**

(Pl. 1, Fig. 7a–c)

Coll. no. of the slide: GBA 2009/031/19.

CRAMER collection at GBA: Box 107 – Slide 760163-C1 – Eng-landfinder V.27.

Type level: San Pedro Formation (sample 760163), Silurian Devonian boundary.

Type locality: Outcrop west of Geras de Gordón, on the path along the River Casares, Province of León, Spain.

Type figure: CRAMER & DIEZ, 1978, p. 164, Pl. 4, Fig. 10, 13.

Remarks:

Vesicle length of the holotype (this paper): 115 µm (CRAMER & DIEZ, 1978: Not stated).

***Ancyrochitina gonzali* DIEZ & CRAMER, 1978**

(Pl. 1, Fig. 6a–b)

Coll. no. of the slide: GBA 2009/031/13.

CRAMER collection at GBA: Box 94 – Slide 71035-C1 – Eng-landfinder F.37.2.

Type level: La Vid Shales (Sample 71035).

Type locality: Argovejo (locality 71022: 42°54'07" N / 05°06'55" W), Province of León, NW Spain.

Type figure: DIEZ & CRAMER, 1978, p. 206, Pl. 1, Fig. 5.

Remarks:

Vesicle length of the holotype (this paper): 120 µm (DIEZ & CRAMER, 1978: 94 µm).

Rock sample available.

***Angochitina laevigata* DIEZ & CRAMER, 1978**

(Pl. 3, Fig. 7a–b)

Coll. no. of the slide: GBA 2009/031/4.

CRAMER collection at GBA: Box 50 – Slide 71027-C1 – Eng-landfinder E.32.

Type level: La Vid Shales (sample 71027).

Type locality: Argovejo (locality 71022: 42°54'07" N / 05°06'55" W), Province of León, NW Spain.

Type figure: DIEZ & CRAMER, 1978, p. 208, Pl. 1, Fig. 28.

Remarks:

Vesicle length of the holotype (this paper): 112 µm (DIEZ & CRAMER, 1978: 88 µm).

Rock sample available.

***Angochitina sinica* CRAMER, 1970**

(Pl. 3, Fig. 2a–c)

Coll. no. of the slide: GBA 2009/031/6.

CRAMER collection at GBA: Box 56 – Slide 6295-A1 – Eng-landfinder G.31.4.

Type level: Probably Devonian (sample 6295).

Type locality: Latitude 25° North, longitude 103°48' East; south of Luliang, 57 km east of Kunming; Yunnan Province, China.

Type figure: CRAMER, 1970, p. 1123, Pl. 151, Fig. 5.

Remarks:

Vesicle length of the holotype (this paper): 143 µm (CRAMER, 1970: Not stated).

Rock sample and residue available.

***Angochitina tridigitifera* DIEZ & CRAMER, 1978**

(Pl. 1, Fig. 4a–c)

Coll. no. of the slide: GBA 2009/031/14.

CRAMER collection at GBA: Box 94 – Slide 71037-C1 – Eng-landfinder R.49.2.

Type level: La Vid Shales (sample 71037).

Type locality: Argovejo (locality 71022: 42°54'07" N / 05°06'55" W), Province of León, NW Spain.

Type figure: DIEZ & CRAMER, 1978, p. 209, Pl. 1, Fig. 31.

Remarks:

Vesicle length of the holotype (this paper): 129 µm (DIEZ & CRAMER, 1978: 108 µm).

Rock sample available.

***Angochitina turdela* DIEZ & CRAMER, 1978**

(Pl. 3, Fig. 6)

Coll. no. of the slide: GBA 2009/031/15.

CRAMER collection at GBA: Box 94 – Slide 71035-C1 – Eng-landfinder G.28.

Type level: La Vid Shales (sample 71035).

Type locality: Argovejo (locality 71022: 42°54'07" N / 05°06'55" W), Province of León, NW Spain.

Type figure: DIEZ & CRAMER, 1978, p. 209, Pl. 1, Fig. 33.

Remarks:

The slide number for the holotype given in DIEZ & CRAMER, 1978 (slide 71037-C1) is incorrect.

Vesicle length of the holotype (this paper): 98 μm (DIEZ & CRAMER, 1978: 90 μm).

Rock sample available.

***Conochitina lageniforma* CRAMER, 1967**

(Pl. 2, Fig. 5a–b)

Coll. no. of the slide: GBA 2009/031/10.

CRAMER collection at GBA: Box 76 – Slide 861-A6 – Englandfinder P.34.1.

Type level: Formigoso Formation (sample 861).

Type locality: Aralla de Luna section; second outcrop of the San Pedro Formation on the left side of the dirt road (from Villamanín by Cubillas [de Arbas] and Aralla [de Luna] to road C-623) after the topographically lowermost hairpin curve, running from Aralla (de Luna) to Cubillas (de Arbas); Cantabrian Mountains, Province of León, Spain.

Type figure: CRAMER, 1967, p. 90, Pl. 2, Fig. 35.

Remarks:

Vesicle length of the holotype (this paper): 129 μm (CRAMER, 1967: Not stated).

***Conochitina ? monterrosae* CRAMER, 1969**

(Pl. 2, Fig. 7a–c)

Coll. no. of the slide: GBA 2009/031/3.

CRAMER collection at GBA: Box 24 – Slide 6012-P7 – Englandfinder G.26.4.

Type level: Rose Hill Formation (120 feet below the top, sample 6012), upper lower Silurian.

Type locality: Outcrop near Millerstown (road excavation project for Route 22 north of Millerstown), Pennsylvania, USA.

Type figure: CRAMER, 1969, p. 490, Pl. 70, Fig. 16.

Remarks:

Vesicle length of the holotype (this paper): 77 μm (CRAMER, 1969: Not stated).

Residue available.

***Conochitina parvidecipiens* CRAMER, 1967**

(Pl. 2, Fig. 2)

Coll. no. of the slide: GBA 2009/031/1.

CRAMER collection at GBA: Box 4 – Slide 916-A5 – Englandfinder K.25.

Level of the paratype: Formigoso Formation (sample 916).

Type locality: El Tueiro section in the southernmost outcrop of the Formigoso Formation at the east side of road C-630, north of the village Villasimpliz (de Gordón); Cantabrian Mountains, Province of León, Spain.

Holotype figure (Holotype not found): CRAMER, 1967, p. 91, Pl. 2, Fig. 26.

Paratype figure: CRAMER, 1967, Pl. 2, Fig. 27.

Remarks:

The holotype is not in slide 0917–A5, as mentioned by CRAMER, 1967 (p. 91).

Vesicle length of the paratype (this paper): 203 μm (vesicle lengths for the species in CRAMER 1967: 220–280 μm).

***Gotlandochitina labdata* DIEZ & CRAMER, 1978**

(Pl. 3, Fig. 5a–b)

Coll. no. of the slide: GBA 2009/031/20.

CRAMER collection at GBA: Box 110 – Slide 760332-C2 – Englandfinder U.38.4.

Type level: La Vid Shales (sample 760332).

Type locality: 1.5 km N of Barrios de Luna, on the road C-623 (locality 760328: 42°51'16" N / 05°52'00" W), Province of León, NW Spain.

Type figure: DIEZ & CRAMER, 1978, p. 210, Pl. 1, Fig. 39.

Remarks:

Vesicle length of the holotype (this paper): 154 μm (DIEZ & CRAMER, 1978: 144 μm).

Residue available.

***Linochitina chalata* DIEZ & CRAMER, 1978**

(Pl. 1, Fig. 5a–b)

Coll. no. of the slide: GBA 2009/031/21.

CRAMER collection at GBA: Box 110 – Slide 760333-C2 – Englandfinder U.29.1.

Type level: La Vid Shales (sample 760333).

Type locality: 1.5 km N of Barrios de Luna, on the road C-623 (locality 760328: 42°51'16" N / 05°52'00" W), Province of León, NW Spain.

Type figure: DIEZ & CRAMER, 1978, p. 210, Pl. 2, Fig. 58.

Remarks:

Total length of the holotype, including carina (this paper): 109 μm (DIEZ & CRAMER, 1978: 90 μm).

Residue available.

***Linochitina diegui* DIEZ & CRAMER, 1978**

(Pl. 2, Fig. 8a–c)

Coll. no. of the slide: GBA 2009/031/16.

CRAMER collection at GBA: Box 94 – Slide 71032-C1 – Englandfinder E.21.3.

Type level: La Vid Shales (sample 71032).

Type locality: Argovejo (locality 71022: 42°54'07" N / 05°06'55" W), Province of León, NW Spain.

Type figure: DIEZ & CRAMER, 1978, p. 211, Pl. 2, Fig. 55.

Remarks:

Total length of the holotype, including carina (this paper): 117 μm (DIEZ & CRAMER, 1978: 99 μm).

***Plectochitina carminae* CRAMER, 1964**

(Text-Fig. 1)

Coll. no. of the slide: GBA 1997/1/1 – Englandfinder M.35.3.

Type level: San Pedro Formation (uppermost shale intercalation, sample 813), *Margachitina elegans* biozone, Pridoli.

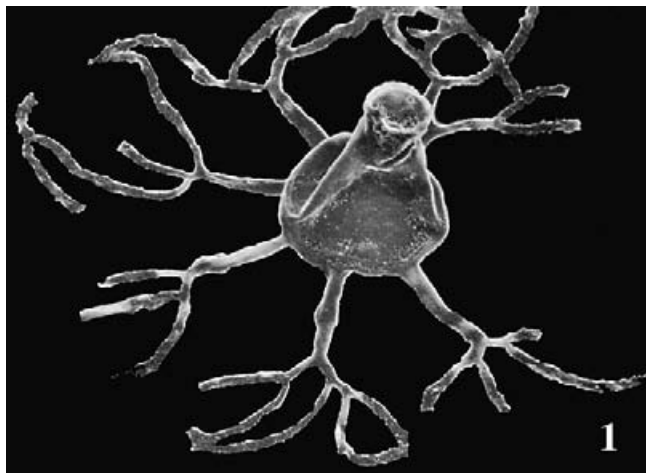
Type locality: La Vid de Gordón section, Cantabrian Mountains, Province of León, Spain.

Holotype figure (Holotype lost): CRAMER, 1964, p. 346, Pl. 20, Fig. 21.

Neotype figure: PRIEWALDER, 1997, p. 77, Pl. 2, Fig. 1; Pl. 4, Fig. 1, 7, 8.

Remarks:

Vesicle length of the neotype: No data, as measurement is not possible because of the specimen's compression in the direction of the symmetry axis.



Text-Fig. 1.
Plectochitina carminae CRAMER, 1964. SEM-photo; x 235 (from PRIEWALDER, 1997).

***Plectochitina filigrana* CRAMER & DIEZ, 1978**

(Pl. 1, Fig. 8a–b)

Coll. no. of the slide: GBA 2009/031/25.

CRAMER collection at GBA: Box 113 – Slide 760370-C5 – Englandfinder X.12.1.

Type level: Furada Formation (middle shale portion, sample 760370), early Ludlow.

Type locality: Outcrop about 1 km east of Soto de los Infantes, Province of Oviedo, Spain.

Type figure: CRAMER & DIEZ, 1978, p. 174, Pl. 2, Fig. 1.

Remarks:

It is not clear whether the outcrop from which sample 760370 comes is situated east or west of the village Soto de los Infantes, because in the description of *Ancyrochitina ancyrea* var. *mileches* (CRAMER & DIEZ, 1978, p. 163), from the same sample, the locality is given as “outcrop about 1 km west of Soto de los Infantes”.

Vesicle length of the holotype (this paper): 109 µm (CRAMER & DIEZ, 1978: Not stated).

***Plectochitina irregularis* CRAMER & DIEZ, 1978**

(Pl. 3, Fig. 4a–c)

Coll. no. of the slide: GBA 2009/031/12.

CRAMER collection at GBA: Box 77 – Slide 6538-C2 – Englandfinder R.39.3.

Type level: San Pedro Formation (uppermost shale intercalation, sample 6538), late Gedinian.

Type locality: Outcrop west of Torrestío, Province of León, Spain.

Type figure: CRAMER & DIEZ, 1978, p. 173, Pl. 1, Fig. 1, 2.

Remarks:

Vesicle length of the holotype (this paper): 151 µm (CRAMER & DIEZ, 1978: Not stated).

Rock sample and residue available.

***Plectochitina rosendae* CRAMER, 1964**

(Pl. 2, Fig. 9a–c)

Coll. no. of the slide: GBA 1997/1/3 – Englandfinder N.37.4.

Type level: San Pedro Formation (uppermost shale intercalation, sample 813), *Margachitina elegans* biozone, Pridoli.

Type locality: La Vid de Gordón section, Cantabrian Mountains, Province of León, Spain.

Holotype figure (Holotype lost): CRAMER, 1964, p. 347, Pl. 20, Fig. 7.

Neotype figure: PRIEWALDER, 1997, p. 77, Pl. 4, Fig. 3.

Remarks:

Vesicle length of the neotype: 142 µm.

***Plectochitina* (?) *taugourdeauii* CRAMER, 1967**

(Pl. 3, Fig. 3a–b)

Coll. no. of the slide: GBA 2009/031/2.

CRAMER collection at GBA: Box 4 – Slide 909-A2 – Englandfinder N.27.

Level of the paratype: Formigoso Formation (sample 909).

Type locality: El Tueiro section in the southernmost outcrop of the Formigoso Formation at the east side of road C-630 north of the village Villasimpliz (de Gordón); Cantabrian Mountains, Province of León, Spain.

Holotype figure (Holotype not found): CRAMER 1967, p. 127, Pl. 4, Fig. 96.

Paratype figure: CRAMER 1967, p. 127, Pl. 4, Fig. 92.

Remarks:

The holotype is not in slide 909–A2, as stated by CRAMER, 1967 (p. 127).

Most probably the paratype on Pl. 4, Fig. 92 is the real holotype, not only because of its correct slide number, but also because the vesicle length given for the holotype (270 µm) applies to this object, whilst the other one (Pl. 4, Fig. 96, designated as holotype) is much smaller.

Vesicle length of the paratype (this paper): 270 µm (of the holotype in CRAMER, 1967: 270 µm).

Residue available.

***Plectochitina variabilis* CRAMER & DIEZ, 1978**

(Pl. 3, Fig. 1a–c)

Coll. no. of the slide: GBA 2009/031/17.

CRAMER collection at GBA: Box 94 – Slide 71046-C1 – Englandfinder V.43.4.

Type level: San Pedro Formation (middle shale part of exposure, sample 71046), latest Ludlow or earliest Gedinian.

Type locality: Argovejo, Province of León, Spain.

Type figure: CRAMER & DIEZ, 1978, p. 175, Pl. 7, Fig. 4.

Remarks:

Vesicle length of the holotype (this paper): 148 µm (CRAMER & DIEZ, 1978: Not stated).

Rock sample and residue available.

Pseudoclarochitina carmenchui (CRAMER, 1964)
(Text-Figs. 2, 3)



Text-Fig. 2.
Pseudoclarochitina carmenchui (CRAMER, 1964). SEM-photo; x 560 (from PRIEWALDER, 1997).



Text-Fig. 3.
Detail of Text-Fig. 2; bottom of the vesicle. x 610 (from PRIEWALDER, 1997).

Coll. no. of the slide: GBA 1997/1/2 – Englandfinder L.39.3.
Type level: San Pedro Formation (uppermost shale intercalation, sample 813), *Margachitina elegans* biozone, Pridoli.
Type locality: La Vid de Gordón section, Cantabrian Mountains, Province of León, Spain.

Holotype figure (Holotype lost): CRAMER, 1964, p. 346, Pl. 24, Fig. 18.

Neotype figure: PRIEWALDER, 1997, p. 78, Pl. 1, Figs. 2, 6; Pl. 5, Figs. 8, 9.

Remarks:

Vesicle length of the neotype: 99 μm .

Sphaerochitina llorona CRAMER, 1964
(Pl. 2, Fig. 1)

Coll. no. of the slide: GBA 2009/031/9.

CRAMER collection at GBA: Box 68 – Slide 1170-11 – Englandfinder A.39.

Type level: San Pedro Formation (sample 1170), Ludlow.

Type locality: Oblanca de Luna, Province of León, NW Spain.

Type figure: CRAMER, 1964, p. 352, Pl. 23, Fig. 3.

Remarks:

Vesicle length of the holotype (this paper): 179 μm (CRAMER, 1964: Not stated).

Sphaerochitina minima DIEZ & CRAMER, 1978
(Pl. 1, Fig. 1a–c)

Coll. no. of the slide: GBA 2009/031/22.

CRAMER collection at GBA: Box 112 – Slide 760383-C1 – Englandfinder L.23.4.

Type level: Nieva Formation (sample 760383).

Type locality: 3km west on local road C-633, from Belmonte to Las Estacas (locality 760383: 43°17'35" N / 06°14'25" W), Province of Oviedo, Spain.

Type figure: DIEZ & CRAMER, 1978, p. 212, Pl. 2, Fig. 70.

Remarks:

Vesicle length of the holotype (this paper): 252 μm (DIEZ & CRAMER, 1978: 224 μm).

Residue available.

Sphaerochitina ricardi DIEZ & CRAMER, 1978
(Pl. 1, Fig. 3a–c)

Coll. no. of the slide: GBA 2009/031/5.

CRAMER collection at GBA: Box 50 – Slide 71028-C1 – Englandfinder P.44.4.

Type level: La Vid Shales (sample 71028).

Type locality: Argovejo (locality 71022: 42°54'07" N / 05°06'55" W), Province of León, NW Spain.

Type figure: DIEZ & CRAMER, 1978, p. 212, Pl. 2, Fig. 79.

Remarks:

Vesicle length of the holotype (this paper): 171 μm (DIEZ & CRAMER, 1978: 134 μm).

Rock sample available.

Urochitina abelgensis DIEZ & CRAMER, 1978
(Pl. 2, Fig. 6a–b)

Coll. no. of the slide: GBA 2009/031/18.

CRAMER collection at GBA: Box 94 – Slide 71032-C1 – Englandfinder O.43.

Type level: La Vid Shales (sample 71032).

Type locality: Argovejo (locality 71022: 42°54'07" N / 05°06'55" W), Province of León, NW Spain.

Type figure: DIEZ & CRAMER, 1978, p. 213, Pl. 2, Fig. 81.

Remarks:

Total vesicle length of the holotype, including peduncle (this paper): 130 μm (DIEZ & CRAMER, 1978: 99 μm).

Rock sample available.

Urochitina santullanensis CRAMER & DIEZ, 1978

(Pl. 2, Fig. 4a–b)

Coll. no. of the slide: GBA 2009/031/23.

CRAMER collection at GBA: Box 112 – Slide 760118-C1 – Englandfinder Q.38.

Type level: Black shales outcropping topographically below slightly ferruginous quartzitic sandstone (sample 760118), early Givetian.

Type locality: Path west of the village of Valle de Santullán, Province of Palencia, Spain (coordinates: 42°55'49" N / 4°20'20" W).

Type figure: CRAMER & DIEZ, 1978, p. 177, Text-Fig. 8 (specimen on the left).

Remarks:

The slide number for the holotype given in CRAMER & DIEZ, 1978 (slide 760118-B2) is incorrect.

Vesicle length of the holotype (this paper): 146 µm (CRAMER & DIEZ, 1978: Not stated).

Alphabetic List of Species

<i>abelgensis</i> , <i>Urochitina</i> , DIEZ & CRAMER, 1978	p. 236	<i>llorona</i> , <i>Sphaerochitina</i> , CRAMER, 1964	p. 236
<i>ancyrea</i> var. <i>mileches</i> , <i>Ancyrochitina</i> , CRAMER & DIEZ, 1978	p. 232	<i>minima</i> , <i>Sphaerochitina</i> , DIEZ & CRAMER, 1978	p. 236
<i>cantabrica</i> , <i>Ancyrochitina</i> , CRAMER & DIEZ, 1978	p. 233	<i>monterrosae</i> , <i>Conochitina</i> ?, CRAMER, 1969	p. 234
<i>carmenchui</i> , <i>Pseudoclastrochitina</i> , (CRAMER, 1964)	p. 236	<i>parvidecipiens</i> , <i>Conochitina</i> , CRAMER, 1967	p. 234
<i>carminae</i> , <i>Plectochitina</i> , CRAMER, 1964	p. 234	<i>ricardi</i> , <i>Sphaerochitina</i> , DIEZ & CRAMER, 1978	p. 236
<i>chalata</i> , <i>Linochitina</i> , DIEZ & CRAMER, 1978	p. 234	<i>rosendae</i> , <i>Plectochitina</i> , CRAMER, 1964	p. 235
<i>diegui</i> , <i>Linochitina</i> , DIEZ & CRAMER, 1978	p. 234	<i>santullanensis</i> , <i>Urochitina</i> , CRAMER & DIEZ, 1978	p. 237
<i>dunensis</i> , <i>Ancyrochitina</i> , CRAMER & DIEZ, 1978	p. 233	<i>sinica</i> , <i>Angochitina</i> , CRAMER, 1970	p. 233
<i>filigrana</i> , <i>Plectochitina</i> , CRAMER & DIEZ, 1978	p. 235	<i>staplinis</i> , <i>Hoegisphaera</i> , CRAMER, 1966	p. 242
<i>gonzali</i> , <i>Ancyrochitina</i> , DIEZ & CRAMER, 1978	p. 233	<i>taugourdeauii</i> , <i>Plectochitina</i> (?), CRAMER, 1967	p. 235
<i>irregularis</i> , <i>Plectochitina</i> , CRAMER & DIEZ, 1978	p. 235	<i>tortugoides</i> , <i>Hoegisphaera</i> , CRAMER, 1966	p. 242
<i>labdata</i> , <i>Gotlandochitina</i> , DIEZ & CRAMER, 1978	p. 234	<i>tridigitifera</i> , <i>Angochitina</i> , DIEZ & CRAMER, 1978	p. 233
<i>laevigata</i> , <i>Angochitina</i> , DIEZ & CRAMER, 1978	p. 233	<i>turdela</i> , <i>Angochitina</i> , DIEZ & CRAMER, 1978	p. 233
<i>lagenoforma</i> , <i>Conochitina</i> , CRAMER, 1967	p. 234	<i>variabilis</i> , <i>Plectochitina</i> , CRAMER & DIEZ, 1978	p. 235

Acknowledgements

Hugh RICE is thanked for correcting the English manuscript and Martina MARINELLI and Stephan PRIBITZER for their help with the preparation of the plates.

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Plate 1

- Fig. 1: *Sphaerochitina minima* DIEZ & CRAMER, 1978.
a) Lateral view. x 255.
b) Detail of Fig. 1a: Spiny ornamentation of the chamber wall. x 1100.
c) Detail of Fig. 1a: Spiny ornamentation of the wall close to the aperture. x 1320.
- Fig. 2: *Ancyrochitina* var. *ancyrea mileches* CRAMER & DIEZ, 1978.
a) Lateral view. x 340.
b) Detail of Fig. 2a: Processes around the aperture. x 570.
- Fig. 3: *Sphaerochitina ricardi* DIEZ & CRAMER, 1978.
a) Lateral view. x 315.
b) Detail of Fig. 3a: Spiny ornamentation of the wall close to the aperture. x 450.
c) As Fig. 3b, but different focus level: bifurcated spines. x 560.
- Fig. 4: *Angochitina tridigitifera* DIEZ & CRAMER, 1978.
a) Lateral view. x 345.
b) Detail of Fig. 4a: Ornamentation of the chamber wall. x 730.
c) Detail of Fig. 4a: Spiny ornamentation of the wall close to the aperture. x 600.
- Fig. 5: *Linochitina chalata* DIEZ & CRAMER, 1978.
a) Lateral view. x 360.
b) Detail of Fig. 5a: Membranous carina. x 740.
- Fig. 6: *Ancyrochitina gonzali* DIEZ & CRAMER, 1978.
a) Lateral view. x 370.
b) Detail of Fig. 6a: Bifurcated process on the left chamber margin with tiny bifurcations at the tips. x 860.
- Fig. 7: *Ancyrochitina dunensis* CRAMER & DIEZ, 1978.
a) Lateral view. x 390.
b) Detail of Fig. 7a: Process on the right chamber margin. x 770.
c) Detail of Fig. 7a: Distal part of the neck. x 630.
- Fig. 8: *Plectochitina filigrana* CRAMER & DIEZ, 1978.
a) Lateral view. x 345.
b) Detail of Fig. 8a: Detail of the spongy carina. x 800.
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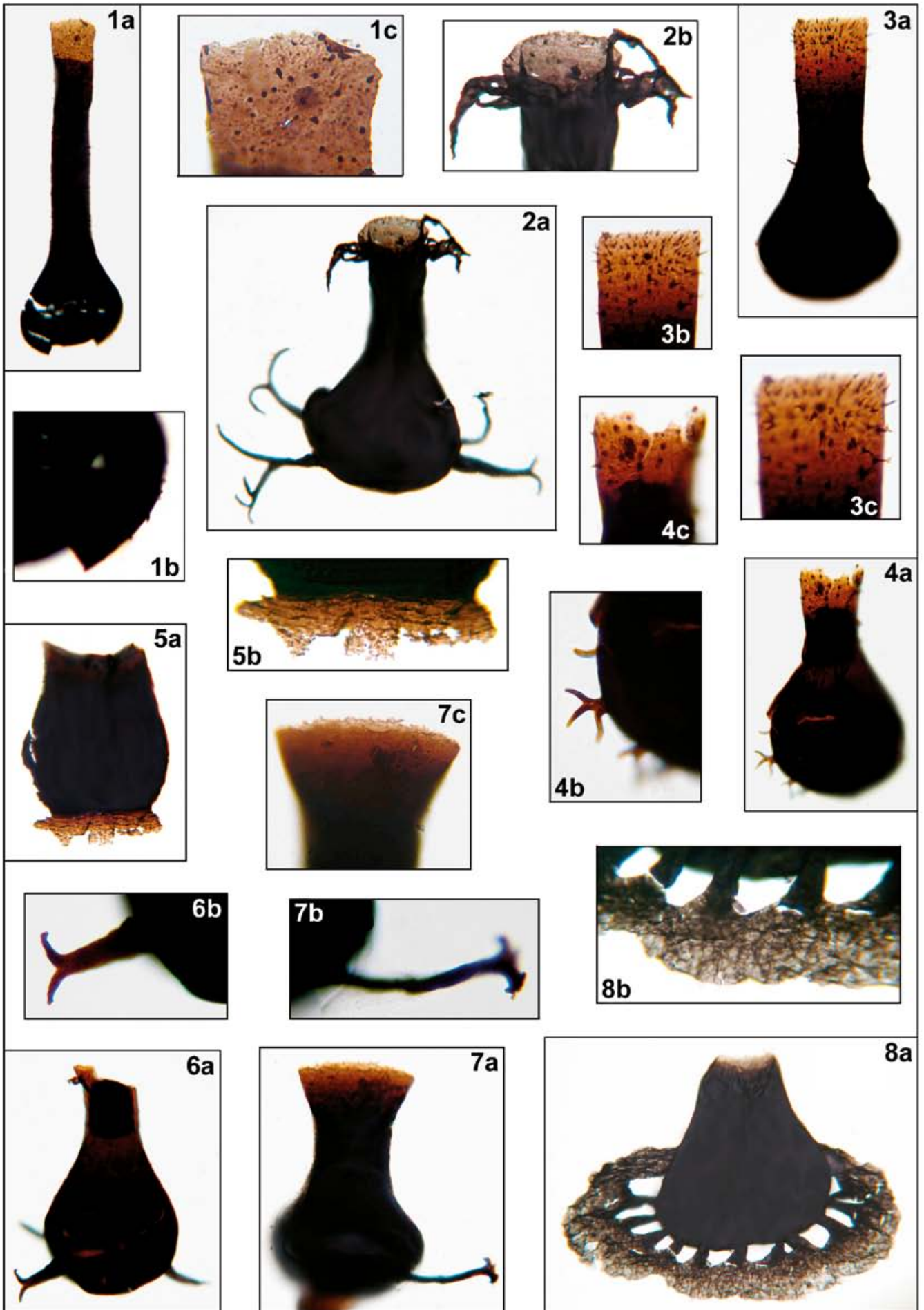


Plate 2

- Fig. 1: *Sphaerochitina llorona* CRAMER, 1964.
Lateral view. x 275.
- Fig. 2: *Conochitina parvidecipiens* CRAMER, 1967.
Lateral view. x 295.
- Fig. 3: *Ancyrochitina cantabrica* CRAMER & DIEZ, 1978.
a) Lateral view. x 260.
b) Detail of Fig. 3a: Cell-like processes on the left chamber margin. x 820.
c) Detail of Fig. 3a: Distal part of the neck. x 650.
- Fig. 4: *Urochitina santullanensis* CRAMER & DIEZ, 1978.
a) Lateral view. x 340.
b) Detail of Fig. 4a: Thin-walled copula. x 960.
- Fig. 5: *Conochitina lageniforma* CRAMER, 1967.
a) Lateral view. x 345.
b) Detail of Fig. 5a: Verrucate ornamentation on the basal margin. x 720.
- Fig. 6: *Urochitina abelgensis* DIEZ & CRAMER, 1978.
a) Lateral view. x 360.
b) Detail of Fig. 6a: Broken peduncle. x 630.
- Fig. 7: *Conochitina ? monterrosae* CRAMER, 1969.
a) Lateral view. x 320.
b) Detail of Fig. 7a: Processes on the chamber margin. x 390.
c) Detail of Fig. 7a: Collarette with crenulate rim. x 580.
- Fig. 8: *Linochitina diegui* DIEZ & CRAMER, 1978.
a) Lateral view. x 385.
b) Detail of Fig. 8a: Basal part of the chamber with short carina. x 490.
c) Detail of Fig. 8a: Aperture with tiny perforations along the rim. x 560.
- Fig. 9: *Plectochitina rosendae* CRAMER, 1964.
a) Lateral view. x 340.
b) Detail of Fig. 9a: Cell-like processes on the right chamber margin. x 570.
c) Detail of Fig. 9a: Aperture with crenulate rim. x 600.
-

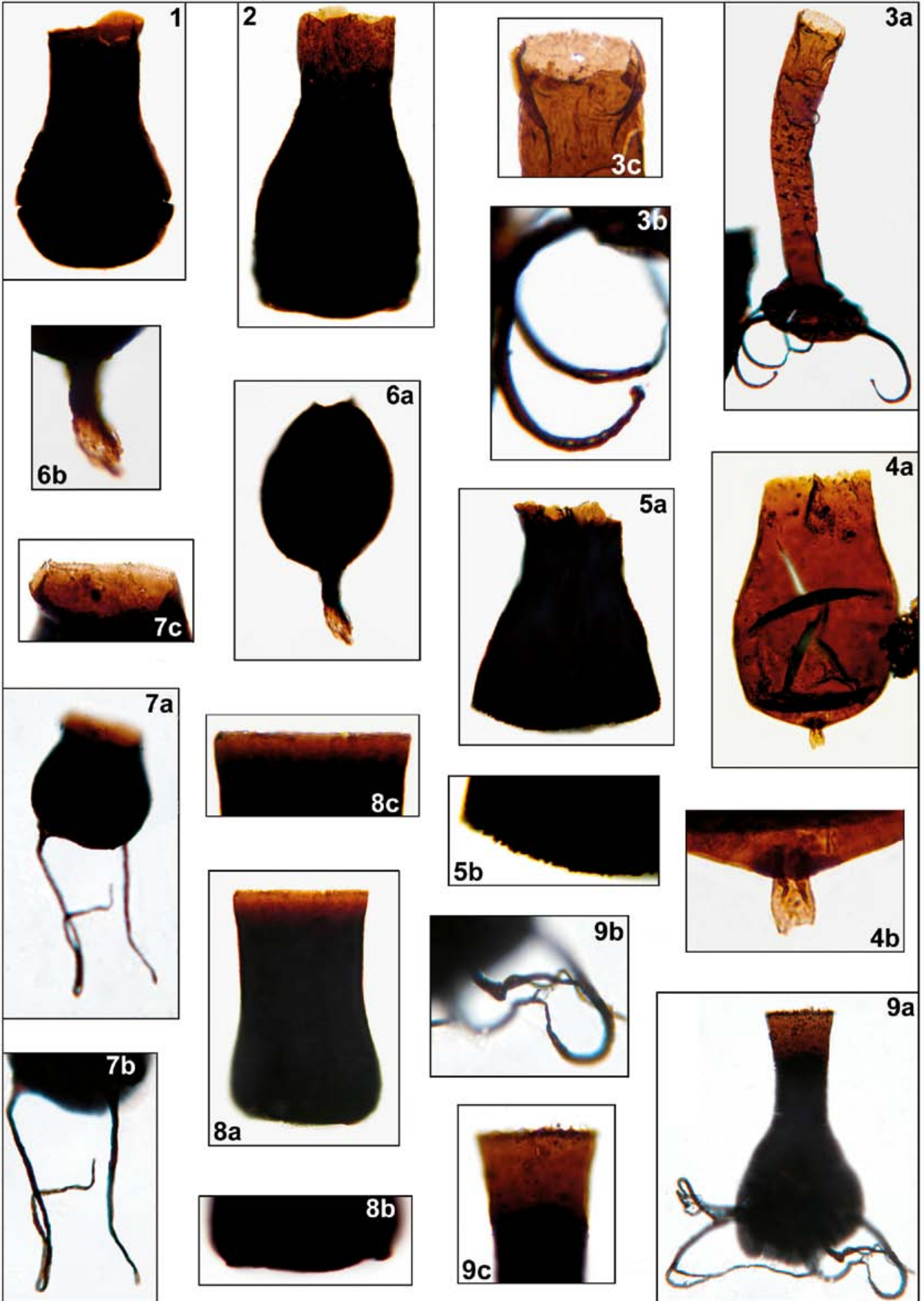


Plate 3

Fig. 1: *Plectochitina variabilis* CRAMER & DIEZ, 1978.

- a) Lateral view. x 325.
- b) Detail of Fig. 1a: Process at the right chamber margin. x 700.
- c) Detail of Fig. 1a: Processes at the left chamber margin. x 690.

Fig. 2: *Angochitina sinica* CRAMER, 1970.

- a) Lateral view. x 345.
- b) Detail of Fig. 2a: Neck with prosom. x 590.
- c) Detail of Fig. 2a: Chamber with dense spiny ornamentation. x 450.

Fig. 3: *Plectochitina* (?) *taugourdeauii* CRAMER, 1967.

- a) Lateral view. x 240.
- b) Detail of Fig. 3a: Broken process at the right chamber margin. x 840.

Fig. 4: *Plectochitina irregularis* CRAMER & DIEZ, 1978.

- a) Lateral view. x 320.
- b) Detail of Fig. 4a: Detail of the process at the right chamber margin (in the background). x 970.
- c) Detail of Fig. 4a: Processes at the right chamber margin (in the front). x 620.

Fig. 5: *Gotlandochitina labdata* DIEZ & CRAMER, 1978.

- a) Lateral view. x 320.
- b) Detail of Fig. 5a: Multirooted spines on the neck. x 700.

Fig. 6: *Angochitina turdela* DIEZ & CRAMER, 1978.

- Lateral view. x 335.

Fig. 7: *Angochitina laevigata* DIEZ & CRAMER, 1978.

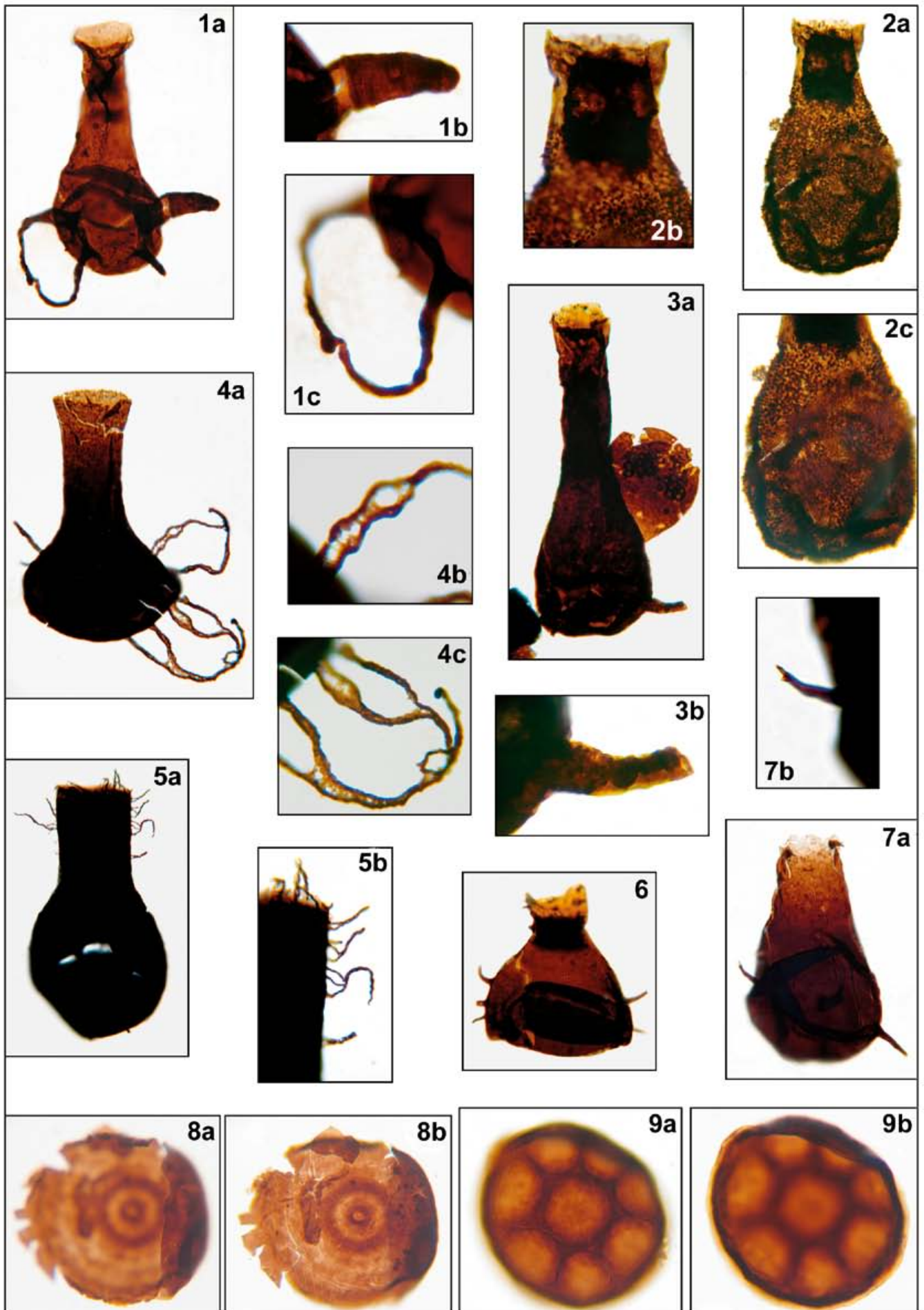
- a) Lateral view. x 395.
- b) Detail of Fig. 7a: Spine with bifurcated tip on the left flank. x 980.

Fig. 8: *Hoegisphaera staplinis* CRAMER, 1966.

- a) Normal view. x 710.
Coll. no. of the slide: GBA 2009/031/7. CRAMER collection at GBA: Box 62 – Slide 22354-5-1 – Englandfinder O.41.1.
Type level: San Pedro Formation (sample 22354), middle shale, Ludlow to Lower Gedinnian (?).
Type locality: Near Valporquero de Torio (first, and topographically lowermost, exposure of the San Pedro Formation at the right hand of the country road from La Venta to Valporquero), Cantabrian Mountains, Spain.
Type figure: CRAMER, 1966, p. 78, Pl. 1, Fig. 3.
Diameter = 52 µm.
- b) As Fig. 8a, but different focus level. x 725.

Fig. 9: *Hoegisphaera tortugoides* CRAMER, 1966.

- a) Normal view. x 785
Coll. no. of the slide: GBA 2009/031/8. CRAMER collection at GBA: Box 62 – Slide 22354-5-7 – Englandfinder O.20.
Type level: San Pedro Formation (sample 22354), middle shale, Ludlow to Lower Gedinnian (?).
Type locality: Near Valporquero de Torio (first, and topographically lowermost, exposure of the San Pedro Formation at the right hand of the country road from La Venta to Valporquero), Cantabrian Mountains, Spain.
Type figure: CRAMER, 1966, p. 80, Pl. 1, Fig. 2.
Diameter = 50 µm.
- b) As Fig. 9a, but different focus level. x 820.



Foraminiferal Holotypes, Lectotypes, and Syntypes Stored in the Paleontological Collection of the Geological Survey of Austria

HOLGER GEBHARDT*)

7 Plates

*Micropaleontology
 Foraminifera
 Type Specimens
 Triassic
 Miocene
 Paleontological collection*

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Foraminiferenholo-, Foraminiferenlecto-, und Foraminiferensyntypen in der paläontologischen Sammlung der Geologischen Bundesanstalt

Zusammenfassung

Die an der Geologischen Bundesanstalt in Wien aufbewahrten Foraminiferenholo-, -lecto- und -syntypen werden aufgelistet und abgebildet. Die dazugehörigen Veröffentlichungen werden kurz beschrieben. Der historische Zuwachs der Holo-, Lecto- und Syntypen in dieser Sammlung wird diskutiert. Im Zusammenhang mit dem Vorschlag eines GSSP für die Basis des Jura (Kuhjoch, Tirol) und einer Neuinterpretation der frühen Evolution planktischer Foraminiferen hat das Interesse an Stücken aus dieser Sammlung in letzter Zeit deutlich zugenommen.

Abstract

Foraminiferal holotypes, lectotypes, and syntypes stored in the paleontological collection of the Geological Survey of Austria have been listed and figured and the corresponding publications briefly described. The historical growth of holotypes, lectotypes, and syntypes in the collection has been discussed. Due to both the proposal that the GSSP marking the base of the Jurassic System be sited in the Kuhjoch section in Tyrol and a revision of the early evolution of planktic foraminifera, interest in the collection has increased markedly in recent years.

Introduction

The paleontological collection of the Geological Survey of Austria hosts a number of foraminiferal type specimens described in several important historical and more recent publications. In this contribution, 193 holotypes, 108 lectotypes, and 8 syntypes (in total 309) have been listed and figured. Some general information on the corresponding publications in which they were first described has also been provided.

Only the material originally described by D'ORBIGNY (1846) has been completely revised (PAPP & SCHMID, 1985). Phylogenetic revisions are in progress for some of the genera and species first described by FUCHS (1968, 1973) and

OBERHAUSER (1960) and proposed to be potential ancestors of planktic foraminifera. In order to avoid confusion, revised names have only been used for the D'ORBIGNY (1846) material.

Due to the large number of type specimens, detailed information on specific type levels, type localities and type figures has not been presented here, as it has been in the other contributions to this volume. For most of the species listed, such additional information has already been published in the Catalogue of Foraminifera (ELLIS & MESSINA, 1940 et seq.) and can be obtained from there or from the associated website (www.micropress.org). All species descriptions or further modern revisions were published in readily accessible journals.

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For this publication, the order of type specimens has been based first on the order of the publication dates and secondly on their alphabetical order (Plates 1–7). Only one view per species is figured in this contribution. Type localities, type levels and collection numbers have been given beneath the species names in the plate explanations.

Publications from 1846 to 1998

D'ORBIGNY 1846 (Plates 1–3)

After the rediscovery of the material collected by HAUER and initially described in the well known monograph of D'ORBIGNY (1846), PAPP & SCHMID (1985) revised this very important collection. HAUER collected foraminifera from Middle Miocene (Badenian) rocks, mainly in the vicinity of Vienna (Baden, Nußdorf, Kahlenberg) and a few other places in the former Austrian Empire. From these samples, D'ORBIGNY described 228 species. However, for a long time, the collection was ascribed to REUSS, until PAPP et al. (1977) recognised it as being the type material described in D'ORBIGNY's (1846) monograph and discussed the evidence for the allocation of the material to HAUER and D'ORBIGNY.

Apart from the large number of lectotypes (107) and a few holotypes (7) selected by PAPP & SCHMID (1985), some specimens in the collection have been used to define new species and subspecies by other authors. A new genus (*Hauerina*) was erected by PAPP & SCHMID (1985). In 1954, PAPP & KÜPPER used specimens from Vöslau to define the subspecies *Heterostegina costata levitesta*, but later PAPP & SCHMID (1985) denied the rank of subspecies for specimens with a smooth surface and consequently also for *H. costata levitesta*. PAPP & SCHMID (1978) chose a specimen from D'ORBIGNY's material for the genotype of the new genus *Stellarticulina*. However, the lectotype of *S. mutabilis* was figured only as a crude line drawing. The revised names of PAPP & SCHMID (1985) for the figured type specimens have been used here since these names are well established in modern foraminiferal literature.

SCHUBERT 1904 (Plate 3)

SCHUBERT (1904) described foraminiferal assemblages from a drill-core from Wels in Upper Austria. He erected one new species (*Bulimina rotula*) and four other new subspecies from the same site. The age assignment of the strata is not clear but is most likely late Oligocene ("Meletta-Schuppe") to early Miocene ("Schlier").

SCHUBERT 1914 (Plate 3)

Only one new genus and species (*Pavonitina styriaca*) from Middle Miocene rocks in Styria was described in the short paper by SCHUBERT (1914). The author discusses phylogenetic relationships to related genera.

NOTH 1951 (Plate 3)

NOTH (1951) described eight new species of various genera (6 holotypes, 2 syntypes) from Cretaceous rocks of various tectonic units. Sample locations for the holo-

and Korneuburg (Lower Austria).

NOTH 1952 (Plate 3)

This very short paper described only one holotype of a new genus (*Plectorecurvoides alternans*) from the (possibly Cretaceous) flysch rocks of Rinerbach in Upper Austria (NOTH, 1952).

OBERHAUSER 1957 (Plate 3)

OBERHAUSER (1957) described foraminifera from Carnian rocks (Upper Triassic) of the Eastern Alps west of Wiener Neustadt (Lower Austria). Six new species and subspecies of the genera *Trocholina* and *Paratrocholina* were described (4 holotypes, 2 lectotypes).

WEINHANDL 1958 (Plate 3)

The short paper of WEINHANDL (1958) described one new genus and species (*Schackoinella sarmatica*) from a Sarmatian (Middle Miocene) locality in Vienna.

OBERHAUSER 1960 (Plates 3, 4)

In this paper, OBERHAUSER (1960) dealt with foraminifera and other microfossils of Ladinian and Carnian (Triassic) age from the Eastern Alps and Iran. The Austrian material came from Hohe Wand, Alt-Aussee, and Helenental. Further samples were taken in Süd-Tirol (Dolomites, Italy) and Aghdarband (Chorassan, Iran). In total, 1 new genus (*Austrocolomia*) and 26 new foraminifera species and subspecies were described, including two species allocated to the planktic genus *Globigerina*. The early planktic foraminifera are currently being reviewed by a working group led by Prof. M. HART (Plymouth University). Preliminary results, based on wall structure and chamber arrangement, however, show that these species were benthic foraminifera. One species considered to be new by HUDSON et al. (2009) was not named by OBERHAUSER (1960) and thus has not been listed here.

OBERHAUSER 1963 (Plate 4)

In this short paper, OBERHAUSER (1964) described a new genus with one species (*Pragoconulus robustus*) from the Seelandalpe in northern Italy (Ladinian, Triassic).

OBERHAUSER 1964 (Plate 4)

OBERHAUSER (1964) discussed the systematic position of the genera *Permodiscus*, *Trocholina* and *Triasina*. Five new species of the genera *Permodiscus* and *Trocholina* were described in Triassic rocks from northern Italy and Austria.

SCHMID 1967 (Plate 4)

This paper dealt with two planktic foraminifera (*Globigerinoides grilli*, *Globigerinoides kuehni*; SCHMID, 1967), of which one (*G. kuehni*) was subsequently considered to be a synonym of the other (*G. grilli*, RÖGL, 1985). The specimens were found in Badenian (Middle Miocene) marls from the type locality of the Badenian stage, the former brickyard at Sooss near Baden (Lower Austria).

FUCHS 1967 (Plates 4, 5)

FUCHS (1967) described 30 new species and one new subspecies amongst many already known mid-Albian species from a deep well near Delft, Netherlands. FUCHS (1967) also erected six new genera (*Clarella*, *Discospirella*, *Edithaella*, *Echinoporina*, *Grillita*, and *Oberhauserina*) and one new subfamily (Edithaellinae). The fossiliferous assemblage particularly rich in species (154 species and subspecies in total) of one core sample has been investigated to better constrain the stratigraphic age of the strata.

FUCHS 1968 (Plate 5)

FUCHS (1968) introduced 21 new species (from five new genera: *Kollmanita*, *Oberhauserella*, *Praegubkinella*, *Schlagerina*, *Schmidita*) of so-called "Triassic Globigerinas". For some of them, FUCHS (1968) suggested a planktic habitat. As with the material collected by OBERHAUSER (1960), these potential ancestors of modern planktic foraminifera are currently being reviewed (see above). Evolutionary lineages have already been discussed in FUCHS (1967). The Ladinian to Rhaetic (Triassic) material came from northern Italy (Prager Dolomiten, St. Cassian) and Austria (Upper and Lower Austria, Carinthia, Salzburg).

OBERHAUSER 1968 (Plate 5)

OBERHAUSER (1968) described two new species of the genus *Austrocolomia* from Triassic rocks of the Eastern Alps. The stratigraphic distribution of the entire genus was also documented.

FUCHS 1970 (Plates 5, 6)

The rich and well-preserved lower Liassic (Lower Jurassic) foraminiferal assemblages of three samples collected at a temporary outcrop near Hernstein in Lower Austria were described by FUCHS (1970). The total number of species described was 106 of which 23 were new. A new genus, *Sieberina*, was also erected by FUCHS (1970). The assemblages showed a distinct similarity with boreal regions and gave valuable information for the refinement of alpine stratigraphy.

SCHMID 1971 (Plate 6)

The short paper of SCHMID (1971) defined the new species *Uvigerina grilli*, which is an important index species in Neogene Paratethys biostratigraphy.

FUCHS 1971 (Plates 6, 7)

In this monograph, FUCHS (1971) described 193 species, including 42 new species and a new genus, *Luliusina*. The material was from an especially rich and well-preserved sample from a mid-Barrémian outcrop in Vorarlberg (Austria). FUCHS (1971) not only described the diverse benthic assemblage, but also emphasized the phylogenetic relationships and evolution of early planktic foraminifera.

FUCHS 1973 (Plate 7)

FUCHS (1973) discussed the phylogenetic relationships of Middle to Late Jurassic Globigerina-like foraminifera from southern Poland. The new genera (*Eoheterohelix*, *Eoceratobulimina*, *Jurassorotalia*, *Mariannenina*, *Polskanella*, *Tectoglobigerina*, *Wo-*

letzina) were considered to be ancestors of Early Cretaceous planktic foraminifera. In total, 18 new "planktic" and benthic species were described.

GEBHARDT 1998 (Plate 7)

GEBHARDT (1998) described three new arenaceous species from the Maastrichtian Mamu Formation of the Anambra Basin in Nigeria. The holo- and paratypes were originally stored at the collection of the Technische Universität Berlin (TUB) but were relocated to the Geological Survey of Austria because proper storage for the type specimens could no longer be guaranteed in Berlin (GEBHARDT, 2008).

Discussion

An early phase of type description and deposition began with D'ORBIGNY (1846) and lasted until the early 20th century (SCHUBERT, 1904, 1914). In these, only line drawings were published and the holotype concept was not yet established. Consequently, figured types are either syntypes, or lectotypes if the material was revised later (e.g., PAPP & SCHMID, 1985). The material of D'ORBIGNY (1846) with its 108 lectotypes and 7 holotypes is certainly the most important portion of the foraminiferal type specimens stored in this collection.

In the 1950s to 1970s abundant new species and genera were described and added to the collection with both OBERHAUSER (1957, 1960, 1963, 1964, 1968) and FUCHS (1967, 1968, 1970, 1971, 1973) as the main contributors. Since the material of FUCHS (1973) was deposited, no new holotypes have been added to the collection of the Geological Survey. The material of GEBHARDT (1998) was transferred to the collection because proper storage could no longer be guaranteed in its old repository.

The material of OBERHAUSER and FUCHS in particular has attracted more attention in the past few years. The Triassic/Jurassic boundary has become a topic of special interest with the proposal that the Global Stratigraphic Section and Point, GSSP, marking the base of the Hettangian stage, and the Jurassic System should be placed in the Kuhjoch Section in Tyrol. The foraminiferal content is one of the most important constraints for this boundary (HILLEBRANDT et al., 2007, HILLEBRANDT, 2008, HILLEBRANDT & URLICHS, 2008).

Rising interest in the early evolution of planktic foraminifera in recent times has initiated the revision and phylogenetic re-interpretation of the so-called "Triassic Globigerinas" by a British working group led by Prof. M. HART (Plymouth-University). The revisions may lead to changes at generic and species levels for the species described by OBERHAUSER and FUCHS. The first results have shown that many of the potential ancestors of planktic forms were actually benthic (HUDSON et al., 2009).

Acknowledgements

Thanks to Hugh RICE for improving the English and to Irene ZORN (both Vienna) for assistance with the database at the Geological Survey of Austria.

Plate 1

- Fig. 1: *Adelosina longirostra* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0501.
- Fig. 2: *Adelosina schreibersi* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0519.
- Fig. 3: *Ammobaculites agglutinans* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0196.
- Fig. 4: *Amphistegina hauerina* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0340.
- Fig. 5: *Anomalina badensis* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0280.
- Fig. 6: *Articulina gibbosula* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0464.
- Fig. 7: *Asterigerinata planorbis* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0336.
- Fig. 8: *Bigenerina agglutinans* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0392.
- Fig. 9: *Bolivina antiqua* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0395.
- Fig. 10: *Bolivina compressa* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0380.
- Fig. 11: *Bolivina digitalis* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0389.
- Fig. 12: *Bulimina elongata* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0319.
- Fig. 13: *Bulimina pyrula* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0314.
- Fig. 14: *Ceratocancris haueri* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0211.
- Fig. 15: *Cibicides boueanus* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0275.
- Fig. 16: *Cibicides ungerianus* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0236.
- Fig. 17: *Cycloforina badensis* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0535.
- Fig. 18: *Cycloforina contorta* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0531.
- Fig. 19: *Cycloforina hauerina* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0472.
- Fig. 20: *Cycloforina nussdorfensis* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0511.
- Fig. 21: *Dentalina acuta* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0069.
- Fig. 22: *Dentalina antennula* D'ORBIGNY 1846.
Holotype, Badenian, Baden. Coll. no.: GBA 1981/003/0061.
- Fig. 23: *Dentalina badensis* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0033.
- Fig. 24: *Dentalina boueana* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0043.
- Fig. 25: *Dentalina brevis* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0049.
- Fig. 26: *Dentalina elegans* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0038.
- Fig. 27: *Dentalina inornata* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0034.
- Fig. 28: *Dentalina scripta* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0060.
- Fig. 29: *Dendritina haueri* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0189.
- Fig. 30: *Elphidium aculeatum* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0187.
- Fig. 31: *Elphidium fichtelianum* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0164.
- Fig. 32: *Elphidium flexuosum* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0169.
- Fig. 33: *Elphidium hauerinum* (D'ORBIGNY 1846).
Lectotype, Badenian, Vienna. Coll. no.: GBA 1981/003/0155.
- Fig. 34: *Elphidium obtusum* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0162.
- Fig. 35: *Elphidium reginum* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0182.
- Fig. 36: *Elphidium rugosum* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0161.
- Fig. 37: *Eponides boueanus* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0215.
- Fig. 38: *Fursenkoina acuta* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0385.
- Fig. 39: *Gaudryina mayeriana* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0406.
- Fig. 40: *Globigerina regularis* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0254.
- Fig. 41: *Globigerinoides quadrilobatus* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0263.
- Fig. 42: *Glandulina ovula* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0008.
- Fig. 43: *Globulina punctata* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0373.
- Fig. 44: *Globulina spinosa* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0378.
- Fig. 45: *Guttulina austriaca* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0356.
- Fig. 46: *Guttulina ovata* (D'ORBIGNY 1846).
Holotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0381.
- Fig. 47: *Hanzawaia boueana* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0138.
- Fig. 48: *Hauerina compressa* D'ORBIGNY 1846.
Lectotype, Badenian, Vienna. Coll. no.: GBA 1981/003/0153.

D'ORBIGNY 1846, all Figs. from PAPP & SCHMID (1985).
Scale bars 0.1 mm.

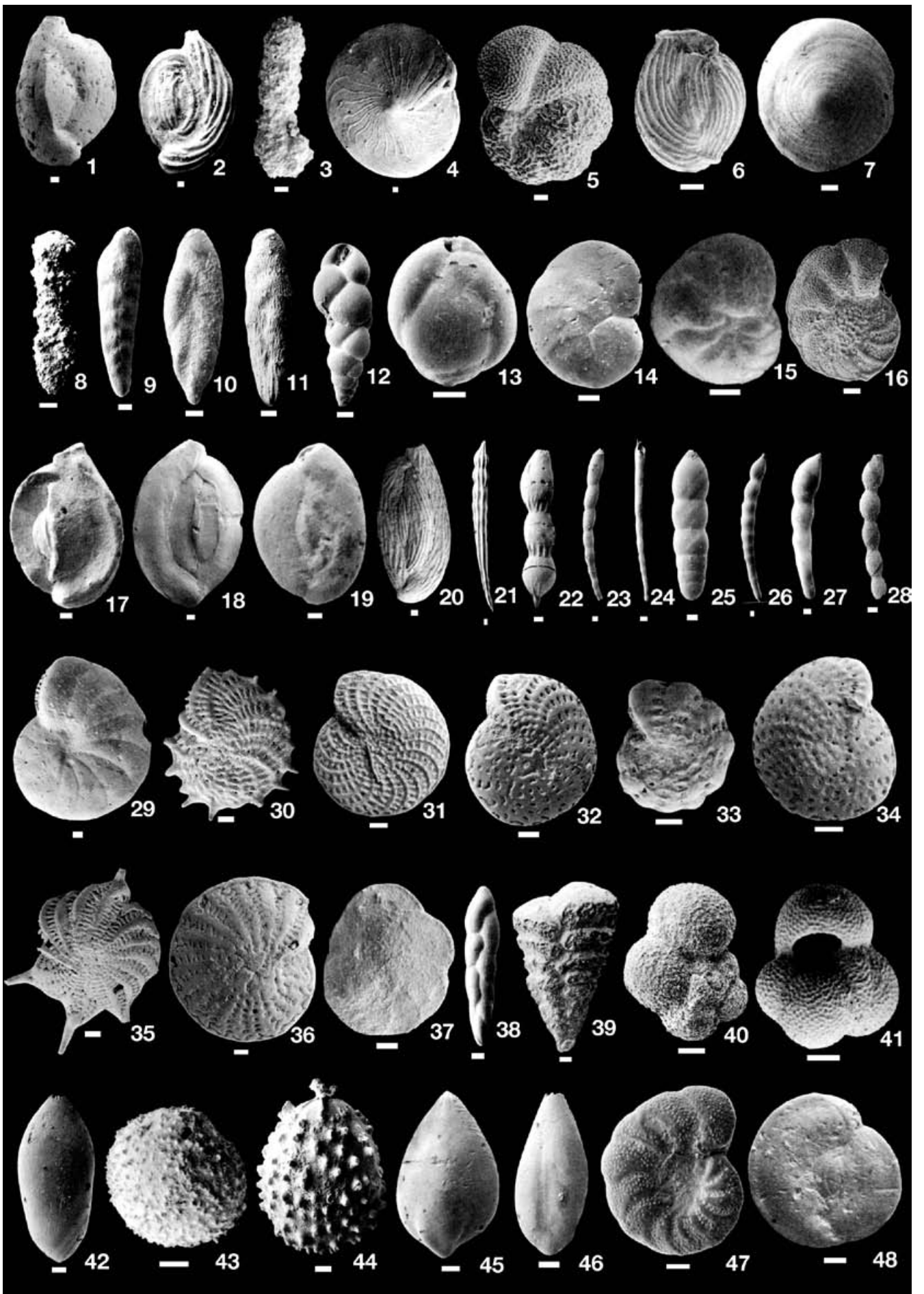


Plate 2

- Fig. 1: *Heterolepa dutemplei* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0240.
- Fig. 2: *Heterostegina costata* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0346.
- Fig. 3: *Heterostegina costata levitesta* PAPP & KÜPPER 1954.
Holotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0348.
- Fig. 4: *Lagena clavata* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0005.
- Fig. 5: *Lenticulina arcuata* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0093.
- Fig. 6: *Lenticulina ariminensis* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0106.
- Fig. 7: *Lenticulina clypeiformis* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0118.
- Fig. 8: *Lenticulina cymboides* (D'ORBIGNY 1846).
Holotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0091.
- Fig. 9: *Lenticulata inornata* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0120.
- Fig. 10: *Lenticulina ornata* (D'ORBIGNY 1846).
Holotype, Badenian, Baden. Coll. no.: GBA 1981/003/0112.
- Fig. 11: *Lingulina costata* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0074.
- Fig. 12: *Marginulina nodosaria* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0352.
- Fig. 13: *Marginulina obliqua* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0351.
- Fig. 14: *Marginulina similis* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0081.
- Fig. 15: *Neoeponides schreibersi* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0226.
- Fig. 16: *Nodosaria badensis* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0027.
- Fig. 17: *Nodosaria elegantissima* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0064.
- Fig. 18: *Nodosaria guttifera* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0050.
- Fig. 19: *Nodosaria irregularis* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0013.
- Fig. 20: *Nodosaria longiscata* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0010.
- Fig. 21: *Nodosaria rudis* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/00017.
- Fig. 22: *Nodosaria urnula* (D'ORBIGNY 1846).
Holotype, Badenian, Baden. Coll. no.: GBA 1981/003/0062.
- Fig. 23: *Nummuloculina contraria* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0431.
- Fig. 24: "*Orbiculina*" *rotella* D'ORBIGNY 1846.
Lectotype, Miocene, Buitur. Coll. no.: GBA 1981/003/0198.
- Fig. 25: *Orbulina bilobata* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0268.
- Fig. 26: *Planularia lanceolata* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0100.
- Fig. 27: *Planulina austriaca* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0283.
- Fig. 28: *Polymorphina complanata* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0387.
- Fig. 29: *Pyrgo clypeata* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0423.
- Fig. 30: *Pyrgo inornata* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0433.
- Fig. 31: *Pyrgo lunula* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0425.
- Fig. 32: *Pyrgo simplex* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0427.
- Fig. 33: *Quinqueloculina akneriana* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0496.
- Fig. 34: *Quinqueloculina boueana* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0508.
- Fig. 35: *Quinqueloculina buchiana* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0486.
- Fig. 36: *Quinqueloculina haidingeri* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0492.
- Fig. 37: *Quinqueloculina peregrina* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0503.
- Fig. 38: *Quinqueloculina triangularis* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0481.
- Fig. 39: *Quinqueloculina ungeriana* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0498.
- Fig. 40: *Rosalina obtusa* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0309.
- Fig. 41: *Rotalia aculeata* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0250.
- Fig. 42: *Schackoinella imperatoria* (D'ORBIGNY 1846).
Lectotype, Badenian, Tarnopol. Coll. no.: GBA 1981/003/0299.
- Fig. 43: *Sigmoilopsis bronniana* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0479.
- Fig. 44: *Sinuloculina consobrina* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0460.
- Fig. 45: *Sinuloculina mayeriana* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0476.
- Fig. 46: *Siphonodosaria verneuili* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0046.
- Fig. 47: *Spirolina austriaca* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0194.
- Fig. 48: *Spiroloculina badensis* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0437.

D'ORBIGNY 1846, all Figs. from PAPP & SCHMID (1985).
Scale bars 0.1 mm.

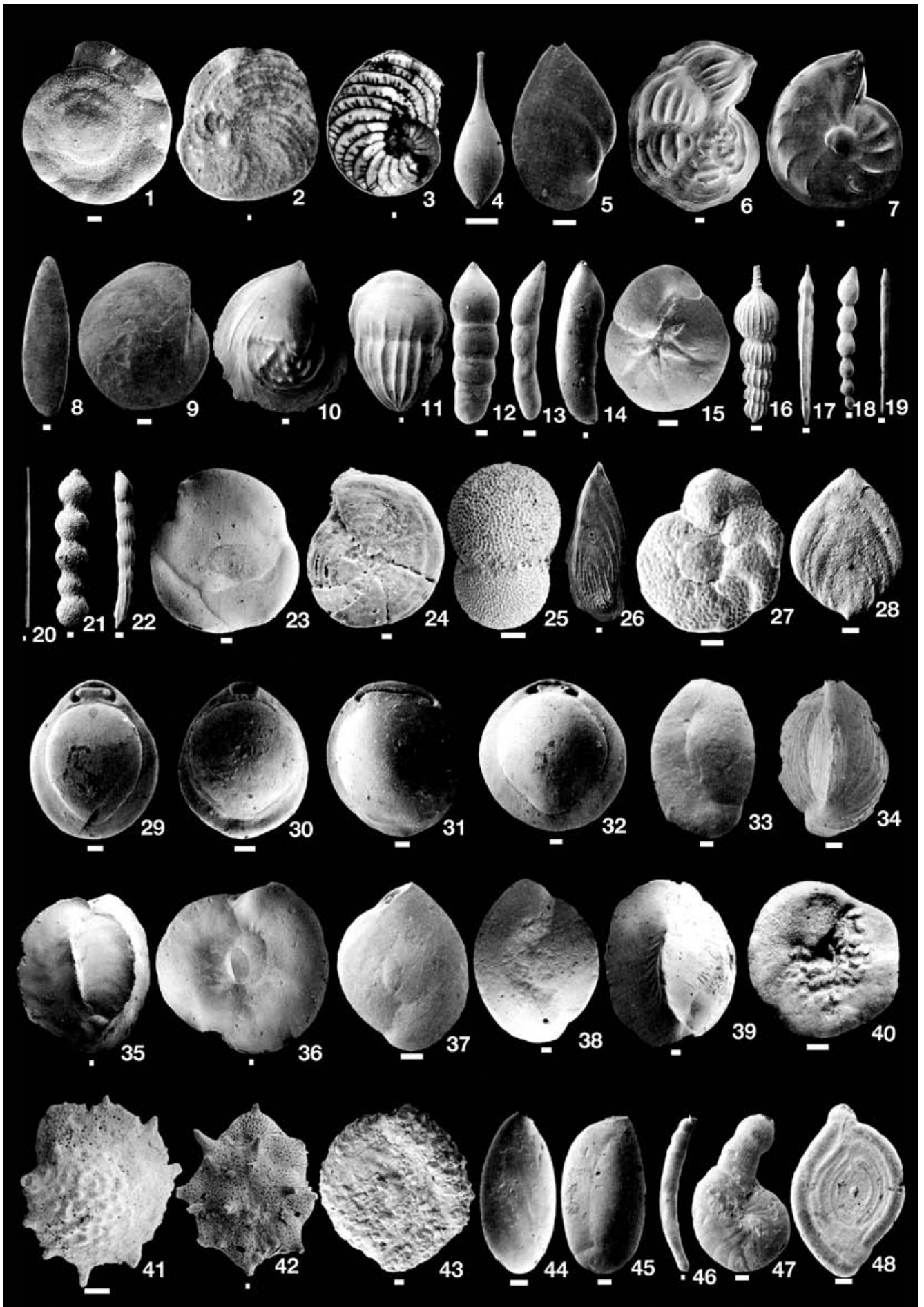


Plate 3

- Fig. 1: *Spiroloculina canaliculata* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0435.
- Fig. 2: *Spiroloculina excavata* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0441.
- Fig. 3: *Spiroplectinella carinata* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0413.
- Fig. 4: *Stellarticulina mutabilis* (D'ORBIGNY 1846).
Lectotype, Badenian, Bad Vöslau.
Coll. no.: 1 GBA 978/004/0001.
(Fig. from PAPP & SCHMID 1978).
- Fig. 5: *Stilostomella adolphina* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0058.
- Fig. 6: *Stilostomella consobrina* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0042.
- Fig. 7: *Textularia deperdita* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0405.
- Fig. 8: *Textularia gramen* D'ORBIGNY 1846.
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0417.
- Fig. 9: *Textularia mariae* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0409.
- Fig. 10: *Textularia nussdorfensis* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0400.
- Fig. 11: *Triloculina inflata* D'ORBIGNY 1846.
Holotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0461.
- Fig. 12: *Triloculina scapha* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0451.
- Fig. 13: *Uvigerina semiornata* D'ORBIGNY 1846.
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0324.
- Fig. 14: *Vaginulinopsis hauerina* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0085.
- Fig. 15: *Vaginulinopsis pedum* (D'ORBIGNY 1846).
Lectotype, Badenian, Baden. Coll. no.: GBA 1981/003/0079.
- Fig. 16: ?*Valvulineria akneriana* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0233.
- Fig. 17: *Valvulineria complanata* (D'ORBIGNY 1846).
Lectotype, Badenian, Nußdorf. Coll. no.: GBA 1981/003/0294.
- Fig. 18: *Bulimina rotula* SCHUBERT 1904.
Syntype, Miocene, Wels. Coll. no.: GBA 1904/002/0005.
- Fig. 19: *Bulimina affinis* var. *tenuissimestriata* SCHUBERT 1904.
Syntype, Miocene, Wels. Coll. no.: GBA 1904/002/0003.
- Fig. 20: *Bulimina elegans* var. *gibba* SCHUBERT 1904.
Syntype, Miocene, Wels. Coll. no.: GBA 1904/002/0004.
- Fig. 21: *Cristellaria josephina* var. *umbonata* SCHUBERT 1904.
Syntype, Miocene, Wels. Coll. no.: GBA 1904/002/0002.
- Fig. 22: *Sagrina dimorpha* var. *ornata* SCHUBERT 1904.
Syntype, Miocene, Wels. Coll. no.: GBA 1904/002/0006.
- Fig. 23: *Pavonitina styriaca* SCHUBERT 1914.
Syntype, Miocene, Laubegg. Coll. no.: GBA 1914/001/0001.
- Fig. 24: *Cyclammmina polygonata* NOTH 1951.
Syntype, Senonian, Nußbach. Coll. no.: GBA 1951/001/0175.
- Fig. 25: *Lenticulina (Margulinopsis) hemicylindrica* NOTH 1951.
Holotype, Senonian, Nußbach. Coll. no.: GBA 1951/001/0243.
- Fig. 26: *Lenticulina (Saraceneria) praemudonensis* NOTH 1951.
Holotype, Hauterivian, Korneuburg.
Coll. no.: GBA 1951/001/0026.
- Fig. 27: *Lenticulina (Vagulinopsis) angulata* NOTH 1951.
Holotype, Albian, Leonstein. Coll. no.: GBA 1951/001/0149.
- Fig. 28: *Lenticulina (Vagulinopsis) korneuburgensis* NOTH 1951.
Holotype, Hauterivian, Korneuburg.
Coll. no.: GBA 1951/001/0022.
- Fig. 29: *Lituotuba nußbachensis* NOTH 1951.
Holotype, Senonian, Nußbach. Coll. no.: GBA 1951/001/0195.
- Fig. 30: *Rhizammina grilli* NOTH 1951.
Syntype, Senonian, Nußbach. Coll. no.: GBA 1951/001/0165.
- Fig. 31: *Trocholina infragranulata* NOTH 1951.
Holotype, Hauterivian, Korneuburg.
Coll. no.: GBA 1951/001/0029.
- Fig. 32: *Plectrorecurvoides alternans* NOTH 1952.
Holotype, Albian–Cenomanian, Rinerbach.
Coll. no.: GBA 1952/001/0001.
- Fig. 33: *Trocholina (Paratrocholina) eomesozoica* OBERHAUSER 1957.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1957/002/0019.
- Fig. 34: *Trocholina (Trocholina) biconvexa biconvexa* OBERHAUSER 1957.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1957/002/0011.
- Fig. 35: *Trocholina (Trocholina) biconvexa major* OBERHAUSER 1957.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1957/002/0017.
- Fig. 36: *Trocholina (Trocholina) biconvexa minor* OBERHAUSER 1957.
Lectotype, Carnian, Hohe Wand. Coll. no.: GBA 1957/002/0013.
- Fig. 37: *Trocholina (Trocholina) multispira* OBERHAUSER 1957.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1957/002/0001.
- Fig. 38: *Trocholina (Trocholina) ventroplana* OBERHAUSER 1957.
Lectotype, Carnian, Hohe Wand. Coll. no.: GBA 1957/002/0007.
- Fig. 39: *Schackoinella sarmatica* WEINHANDL 1958.
Holotype, Sarmatian, Kaasgraben.
Coll. no.: GBA 1958/001/0001.
- Fig. 40: *Ammovertella persica* OBERHAUSER 1960.
Holotype, Ladinian, Aghdarband.
Coll. no.: GBA 1960/004/0002.
- Fig. 41: *Austrocolomia marschalli* OBERHAUSER 1960.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1960/004/0096.
- Fig. 42: *Darbyella kollmanni* OBERHAUSER 1960.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1960/004/0028.
- Fig. 43: *Darbyella nothi* OBERHAUSER 1960.
Holotype, Carnian, Helenental. Coll. no.: GBA 1960/004/0029.
- Fig. 44: *Dentalina vadaszi* OBERHAUSER 1960.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1960/004/0031.
- Fig. 45: *Endothyra austrotriadica* OBERHAUSER 1960.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1960/004/0005.
- Fig. 46: *Endothyra grünbachensis* OBERHAUSER 1960.
Holotype, Carnian, Grünbach. Coll. no.: GBA 1960/004/0008.
- Fig. 47: *Endothyra kupperi* OBERHAUSER 1960.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1960/004/0009.
- Fig. 48: *Eponides helenentalensis* OBERHAUSER 1960.
Holotype, Triassic, Helenental. Coll. no.: GBA 1960/004/0101.
- Figs. 1–17: D'ORBIGNY 1846, all Figs. from PAPP & SCHMID (1985) except Fig. 4.
Figs. 18–22: SCHUBERT (1904), no scale given.
Fig. 23: SCHUBERT (1914).
Figs. 24–31: NOTH 1951, Fig. 30, no scale given.
Fig. 32: NOTH (1952).
Figs. 33–38: OBERHAUSER (1957).
Fig. 39: WEINHANDL (1958).
Figs. 40–48: OBERHAUSER (1960).
- Scale bars 0.1 mm.

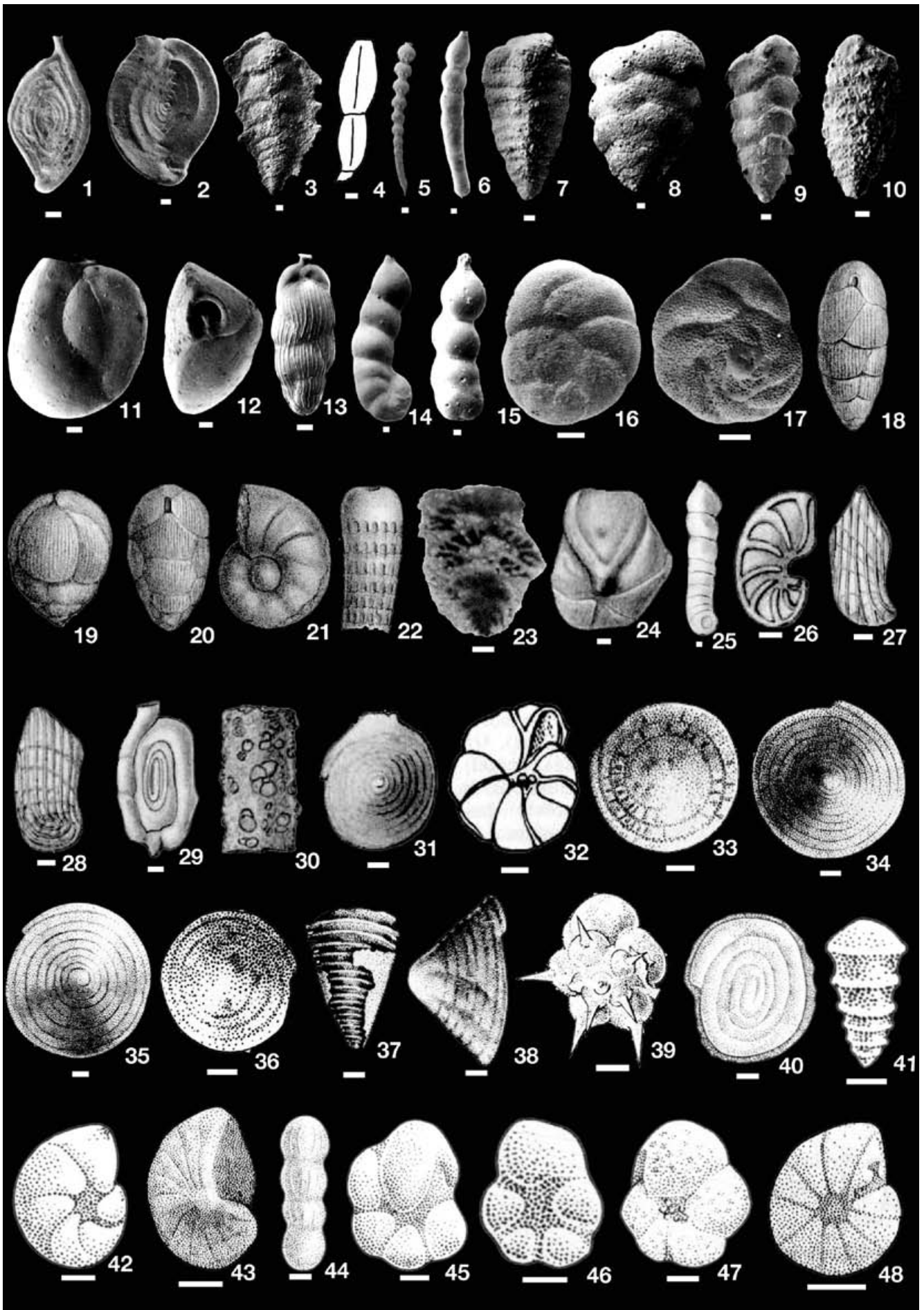


Plate 4

- Fig. 1: *Falsopalmula dolomitica* OBERHAUSER 1960.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1960/004/0054.
- Fig. 2: *Frondicularia ruttneri* OBERHAUSER 1960.
Holotype, Ladinian–Carnian, Aghdarband.
Coll. no.: GBA 1960/004/0090.
- Fig. 3: *Globigerina ladinica* OBERHAUSER 1960.
Holotype, Ladinian, Settsass-Scharte.
Coll. no.: GBA 1960/004/0108.
- Fig. 4: *Globigerina mesotriassica* OBERHAUSER 1960.
Holotype, Ladinian, Settsass-Scharte.
Coll. no.: GBA 1960/004/0106.
- Fig. 5: *Lingulina aghdarbandi* OBERHAUSER 1960.
Holotype, Ladinian–Carnian, Aghdarband.
Coll. no.: GBA 1960/004/0060.
- Fig. 6: *Lingulina dracosimilis* OBERHAUSER 1960.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1960/004/0064.
- Fig. 7: *Lingulina infirmis* OBERHAUSER 1960.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1960/004/0066.
- Fig. 8: *Lingulina iranica* OBERHAUSER 1960.
Holotype, Ladinian–Carnian, Aghdarband.
Coll. no.: GBA 1960/004/0067.
- Fig. 9: *Lingulina iranica sieberi* OBERHAUSER 1960.
Holotype, Ladinian–Carnian, Aghdarband.
Coll. no.: GBA 1960/004/0070.
- Fig. 10: *Lingulina klebelsbergi* OBERHAUSER 1960.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1960/004/0072.
- Fig. 11: *Marginulina karnica* OBERHAUSER 1960.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1960/004/0030.
- Fig. 12: *Polytaxis seelandensis* OBERHAUSER 1960.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1960/004/0027.
- Fig. 13: *Pseudoglandulina plöchingeri* OBERHAUSER 1960.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1960/004/0050.
- Fig. 14: *Pseudoglandulina rosenbergi* OBERHAUSER 1960.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1960/004/0052.
- Fig. 15: *Quadratina irregularis* OBERHAUSER 1960.
Holotype, Carnian, Hohe Wand. Coll. no.: GBA 1960/004/0042.
- Fig. 16: *Spiroloculina praecursor* OBERHAUSER 1960.
Holotype, Ladinian, Settsass-Scharte.
Coll. no.: GBA 1960/004/0024.
- Fig. 17: *Pragsoconulus robustus* OBERHAUSER 1963.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1963/003/0001.
- Fig. 18: *Permodiscus planidiscoides* OBERHAUSER 1964.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1964/002/0011.
- Fig. 19: *Permodiscus pragsooides* OBERHAUSER 1964.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1964/002/0010.
- Fig. 20: *Trocholina acuta* OBERHAUSER 1964.
Holotype, Rhaetian, Hohe Wand. Coll. no.: GBA 1964/002/0009.
- Fig. 21: *Trocholina cordevolica* OBERHAUSER 1964.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1964/002/0008.
- Fig. 22: *Trocholina permodiscoides* OBERHAUSER 1964.
Holotype, Norian, Panüler Schrofen.
Type material not available.
- Fig. 23: *Globigerinoides grilli* SCHMID 1967.
Holotype, Badenian, Sooss. Coll. no.: GBA 1967/001/0002.
- Fig. 24: *Globigerinoides kuehni* SCHMID 1967.
Holotype, Badenian, Sooss. Coll. no.: GBA 1967/001/0001.
- Fig. 25: *Ammobaculites amabilis* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0014.
- Fig. 26: *Ammobaculites germanicus* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0015.
- Fig. 27: *Cornusphaera grandis* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0143.
- Fig. 28: *Discospirella obscura* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0006.
- Fig. 29: *Dentalina hollandica* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0064.
- Fig. 30: *Echinoporita erinaceus* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0149.
- Fig. 31: *Edithaella sessilis* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0141.
- Fig. 32: *Ellipsoidella cuneiformis* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0172.
- Fig. 33: *Eoguttulina fusus* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0134.
- Fig. 34: *Gavelinella umbilicitecta* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0177.
- Fig. 35: *Globotextularia parva* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0028.
- Fig. 36: *Grillita planispira* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0145.
- Fig. 37: *Hemisphaerammina obstinata* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0003.
- Fig. 38: *Lenticulina (Margulinopsis) sequana* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0098.
- Fig. 39: *Lenticulina (Saracenaria) bononiensis forticarinata* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0103.
- Fig. 40: *Lenticulina (Vaginulinopsis) carinata* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0109.
- Fig. 41: *Miliammina procera* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0011.
- Fig. 42: *Nouria tenera* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0010.
- Fig. 43: *Nubecularia concava* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0033.
- Fig. 44: *Oberhauserina morator* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0159.
- Fig. 45: *Orthomorphina cretacea* FUCHS 1967.
Holotype, middle Albian, Delft. Coll. no.: GBA 1967/006/0115.
- Figs. 1–16: OBERHAUSER (1960).
Fig. 17: OBERHAUSER (1963).
Figs. 18–22: OBERHAUSER (1964).
Figs. 23, 24: SCHMID (1967).
Figs. 25–45: FUCHS (1967).

Scale bars 0.1 mm.

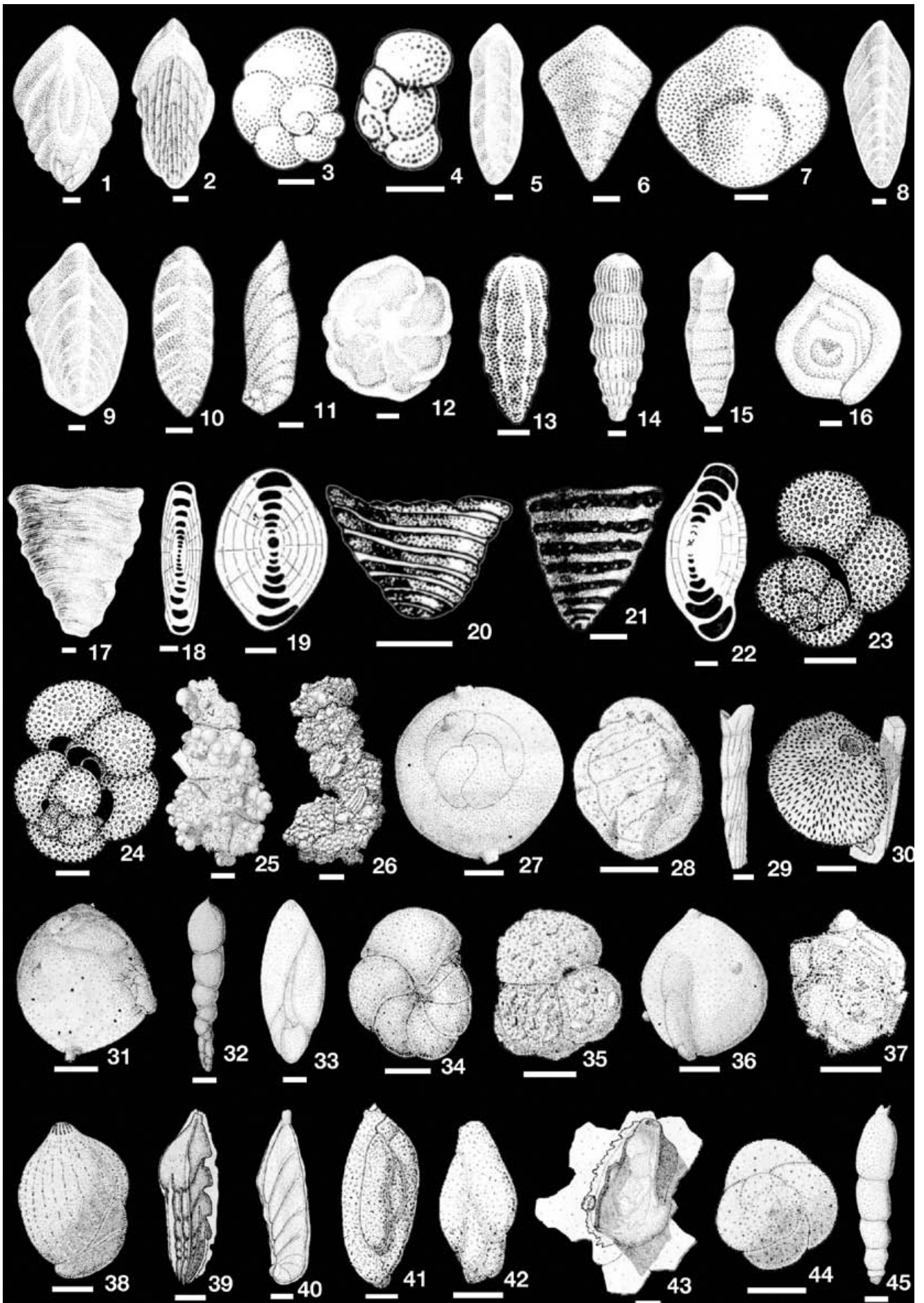


Plate 5

- Fig. 1: *Pseudopolymorphina subtilis* FUCHS 1967.
Holotype, middle Albian, Delft.
Coll. no.: GBA 1967/006/0137.
- Fig. 2: *Pseudopyrulinoides magnus* FUCHS 1967.
Holotype, middle Albian, Delft.
Coll. no.: GBA 1967/006/0138.
- Fig. 3: *Pseudopyrulinoides solidus* FUCHS 1967.
Holotype, middle Albian, Delft.
Coll. no.: GBA 1967/006/0139.
- Fig. 4: *Pyrulinoides hollandica* FUCHS 1967.
Holotype, middle Albian, Delft.
Coll. no.: GBA 1967/006/0140.
- Fig. 5: *Spiroloculina exigua* FUCHS 1967.
Holotype, middle Albian, Delft.
Coll. no.: GBA 1967/006/0037.
- Fig. 6: *Uvigerinammina triangula* FUCHS 1967.
Holotype, middle Albian, Delft.
Coll. no.: GBA 1967/006/0026.
- Fig. 7: *Vaginulina albiensis* FUCHS 1967.
Holotype, middle Albian, Delft.
Coll. no.: GBA 1967/006/0120.
- Fig. 8: *Vaginulina borealis* FUCHS 1967.
Holotype, middle Albian, Delft.
Coll. no.: GBA 1967/006/0122.
- Fig. 9: *Vaginulina delftensis* FUCHS 1967.
Holotype, middle Albian, Delft.
Coll. no.: GBA 1967/006/0125.
- Fig. 10: *Vaginulina pseudodebilis* FUCHS 1967.
Holotype, middle Albian, Delft.
Coll. no.: GBA 1967/006/0126.
- Fig. 11: *Diplostromina multifimbriata* FUCHS 1968.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1967/005/0001.
- Fig. 12: *Kollmannita cordevolica* FUCHS 1968.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1967/005/0012.
- Fig. 13: *Kollmannita diplostrominaeformis* FUCHS 1968.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1967/005/0002.
- Fig. 14: *Kollmannita gemmaeformis* FUCHS 1968.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1967/005/0010.
- Fig. 15: *Kollmannita multiloculata* FUCHS 1968.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1967/005/0003.
- Fig. 16: *Kollmannita praeladinica* FUCHS 1968.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1967/005/0005.
- Fig. 17: *Oberhauserella alta* FUCHS 1968.
Holotype, Rhaetian, Hinterer Gosausee.
Coll. no.: GBA 1967/005/0023.
- Fig. 18: *Oberhauserella karinthiaca* FUCHS 1968.
Holotype, Carnian, Eisenkappel.
Coll. no.: GBA 1967/005/0017.
- Fig. 19: *Oberhauserella norica* FUCHS 1968.
Holotype, Norian, Roßmoos.
Coll. no.: GBA 1967/005/0027.
- Fig. 20: *Oberhauserella ovata* FUCHS 1968.
Holotype, Rhaetian, Hohe Wand.
Coll. no.: GBA 1967/005/0035.
- Fig. 21: *Oberhauserella parviforamen* FUCHS 1968.
Holotype, Rhaetian, Hohe Wand.
Coll. no.: GBA 1967/005/0034.
- Fig. 22: *Oberhauserella praerhaetica* FUCHS 1968.
Holotype, Rhaetian, Hinterer Gosausee.
Coll. no.: GBA 1967/005/0030.
- Fig. 23: *Oberhauserella quadrilobata* FUCHS 1968.
Holotype, Rhaetian, Hohe Wand.
Coll. no.: GBA 1967/005/0018.
- Fig. 24: *Praegubkinella kryptumbilicata* FUCHS 1968.
Holotype, Rhaetian, Xanten.
Coll. no.: GBA 1967/005/0048.
- Fig. 25: *Praegubkinella turgescens* FUCHS 1968.
Holotype, Rhaetian, Xanten.
Coll. no.: GBA 1967/005/0043.
- Fig. 26: *Schlagerina altispira* FUCHS 1968.
Holotype, Rhaetian, Hohe Wand.
Coll. no.: GBA 1967/005/0039.
- Fig. 27: *Schlagerina angustumbilicata* FUCHS 1968.
Holotype, Rhaetian, Hohe Wand.
Coll. no.: GBA 1967/005/0036.
- Fig. 28: *Schlagerina scissumbilicata* FUCHS 1968.
Holotype, Rhaetian, Hohe Wand.
Coll. no.: GBA 1967/005/0042.
- Fig. 29: *Schlagerina subcircularis* FUCHS 1968.
Holotype, Rhaetian, Hohe Wand.
Coll. no.: GBA 1967/005/0040.
- Fig. 30: *Schmidita hebergelloides* FUCHS 1968.
Holotype, Rhaetian, Hohe Wand.
Coll. no.: GBA 1967/005/0014.
- Fig. 31: *Schmidita inflata* FUCHS 1968.
Holotype, Carnian, Eisenkappel.
Coll. no.: GBA 1967/005/0013.
- Fig. 32: *Austrocolomia cordevolica* OBERHAUSER 1968.
Holotype, Ladinian, Seelandalpe.
Coll. no.: GBA 1967/007/0004.
- Fig. 33: *Austrocolomia rhaetica* OBERHAUSER 1968.
Holotype, Rhaetian, Hohe Wand.
Coll. no.: GBA 1967/007/0002.
- Fig. 34: *Conicospirillina planispiralis* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0134.
- Fig. 35: *Dentalina liassica* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0039.
- Fig. 36: *Hippocrepina rudis* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0003.
- Fig. 37: *Lenticulina (Astaculus) austroalpina* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0078.
- Fig. 38: *Lenticulina (Astaculus) securis* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0085.
- Fig. 39: *Lenticulina (Lenticulina) cicatricosus* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0086.
- Fig. 40: *Lenticulina (Lenticulina) semireticulata* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0087.
- Fig. 41: *Lenticulina (Marginulopsis) noervangi* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0089.

Figs. 1–10: FUCHS (1967).
Figs. 11–31: FUCHS (1968).
Figs. 32, 33: OBERHAUSER (1968).
Figs. 34–41: FUCHS (1970).

Scale bars 0.1 mm.

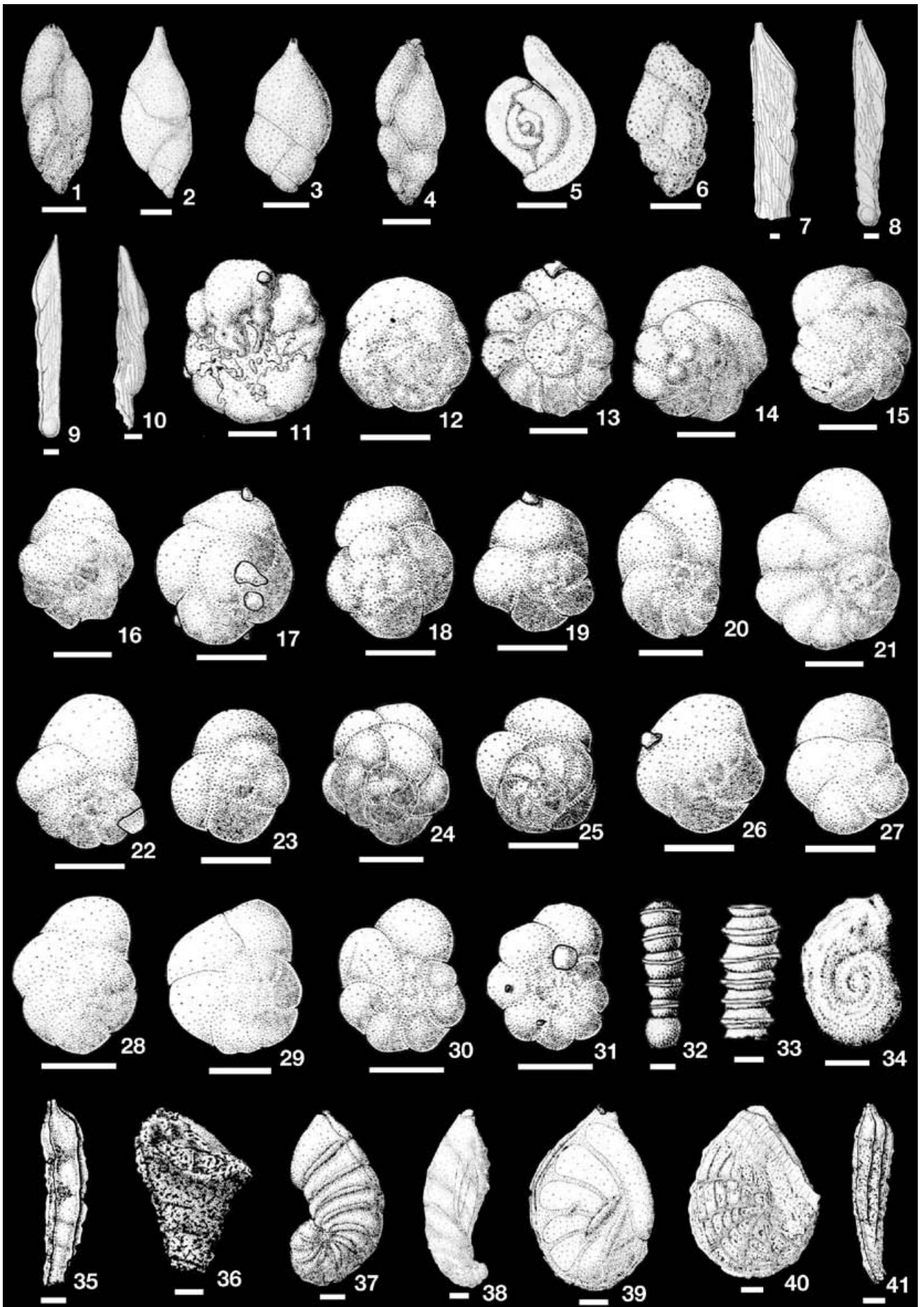


Plate 6

- Fig. 1: *Lenticulina (Planularia) hernsteinensis* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0094.
- Fig. 2: *Lenticulina (Vaginulinopsis) barnardi* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0099.
- Fig. 3: *Marginulina pseudolamellosa* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0104.
- Fig. 4: *Oberhauserella crassa* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0130.
- Fig. 5: *Oberhauserella planiconvexa* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0131.
- Fig. 6: *Ophthalmidium minutum* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0013.
- Fig. 7: *Orthovertella semiinvoluta* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0011.
- Fig. 8: *Palmula demissa* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0106.
- Fig. 9: *Planiinvoluta rotunda* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0012.
- Fig. 10: *Pseudonodosaria pumila* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0010.
- Fig. 11: *Schlagerina orbis* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0132.
- Fig. 12: *Sieberina sagitta* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0116.
- Fig. 13: *Sieberina virgata* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0117.
- Fig. 14: *Sigmomorphina guttula* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0128.
- Fig. 15: *Uzbekistania globosa* FUCHS 1970.
Holotype, lower Liassic, Hernstein.
Coll. no.: GBA 1970/003/0006.
- Fig. 16: *Uvigerina grilli* SCHMID 1971.
Holotype, Badenian, Sooss.
Coll. no.: GBA 1971/001/0001.
- Fig. 17: *Adercotryma fossilis* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0017.
- Fig. 18: *Amphicoryna infracretacea* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0059.
- Fig. 19: *Arenobulimina lepida* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0038.
- Fig. 20: *Buccicrenata tuberosa* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0022.
- Fig. 21: *Cassidella alpina* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0210.
- Fig. 22: *Ceratolamarckina austroalpina* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0225.
- Fig. 23: *Ceratolamarckina obesa* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0226.
- Fig. 24: *Conorboides conula* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0227.
- Fig. 25: *Conorboides glabra* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0229.
- Fig. 26: *Conorboides ornata* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0232.
- Fig. 27: *Dentalina fibula* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0071.
- Fig. 28: *Eoguttulina levis* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0154.
- Fig. 29: *Eoguttulina pusilla* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0155.
- Fig. 30: *Eouvigerina austriaca* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0175.
- Fig. 31: *Gaudryina intercedens* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0030.
- Fig. 32: *Glandulopleurostomella imperfecta* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0156.
- Fig. 33: *Globigerinelloides primitivus* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0200.
- Fig. 34: *Goesella procera* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0042.
- Fig. 35: *Guembelitra coniungens* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0182.
- Fig. 36: *Hedbergella pseudoplanispiralis* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0191.
- Fig. 37: *Hedbergella ranzenbergensis* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0192.
- Fig. 38: *Hedbergella velata* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0193.
- Fig. 39: *Hedbergella ventricosa* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0194.
- Fig. 40: *Heterohelix hohenemsensis* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0204.
- Fig. 41: *Heterohelix trochospiralis* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0206.
- Fig. 42: *Iuliusina grata* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0186.

Figs. 1–15: FUCHS (1970).

Fig. 16: SCHMID (1971).

Figs. 17–42: FUCHS (1971).

Scale bars 0.1 mm.

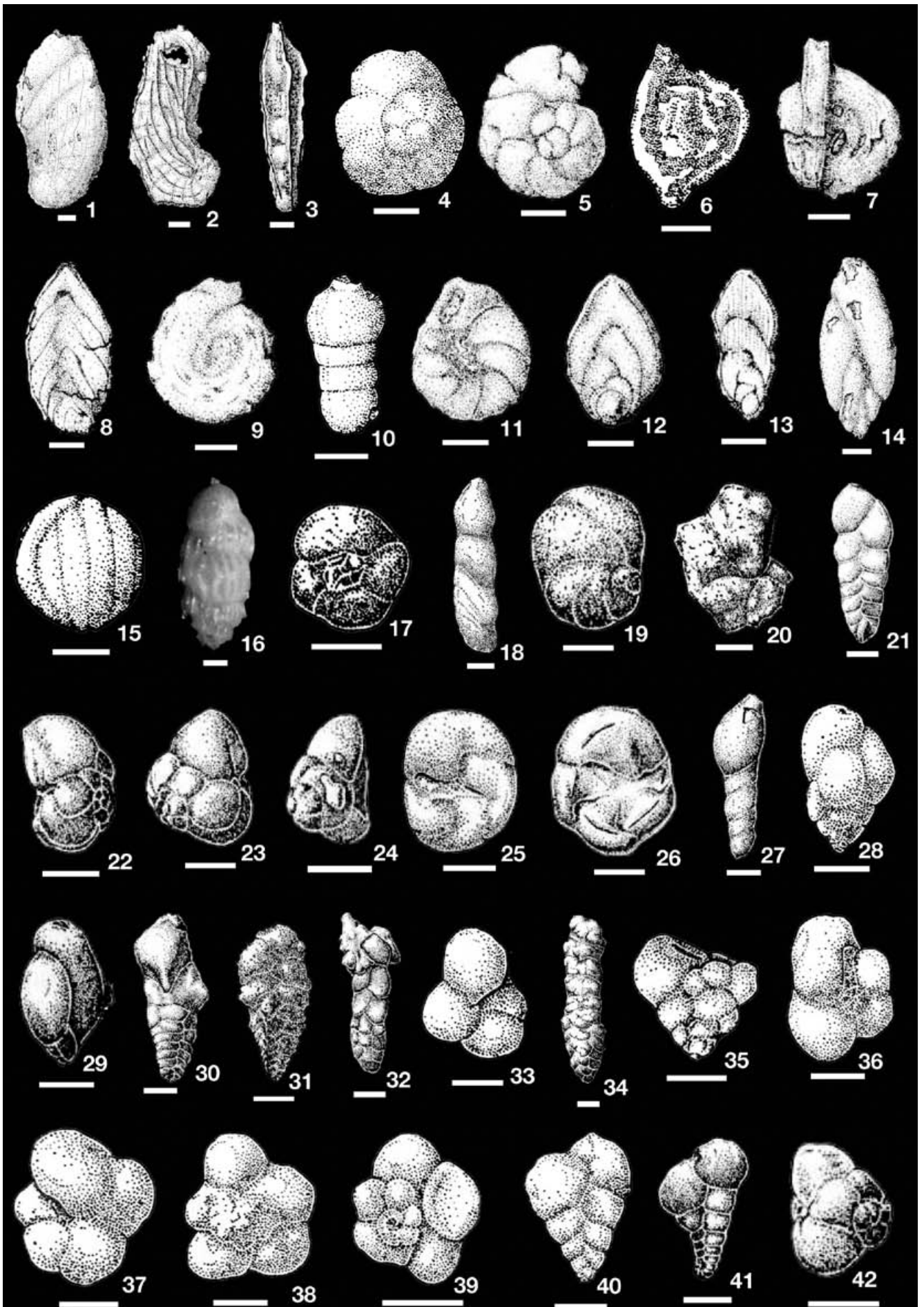
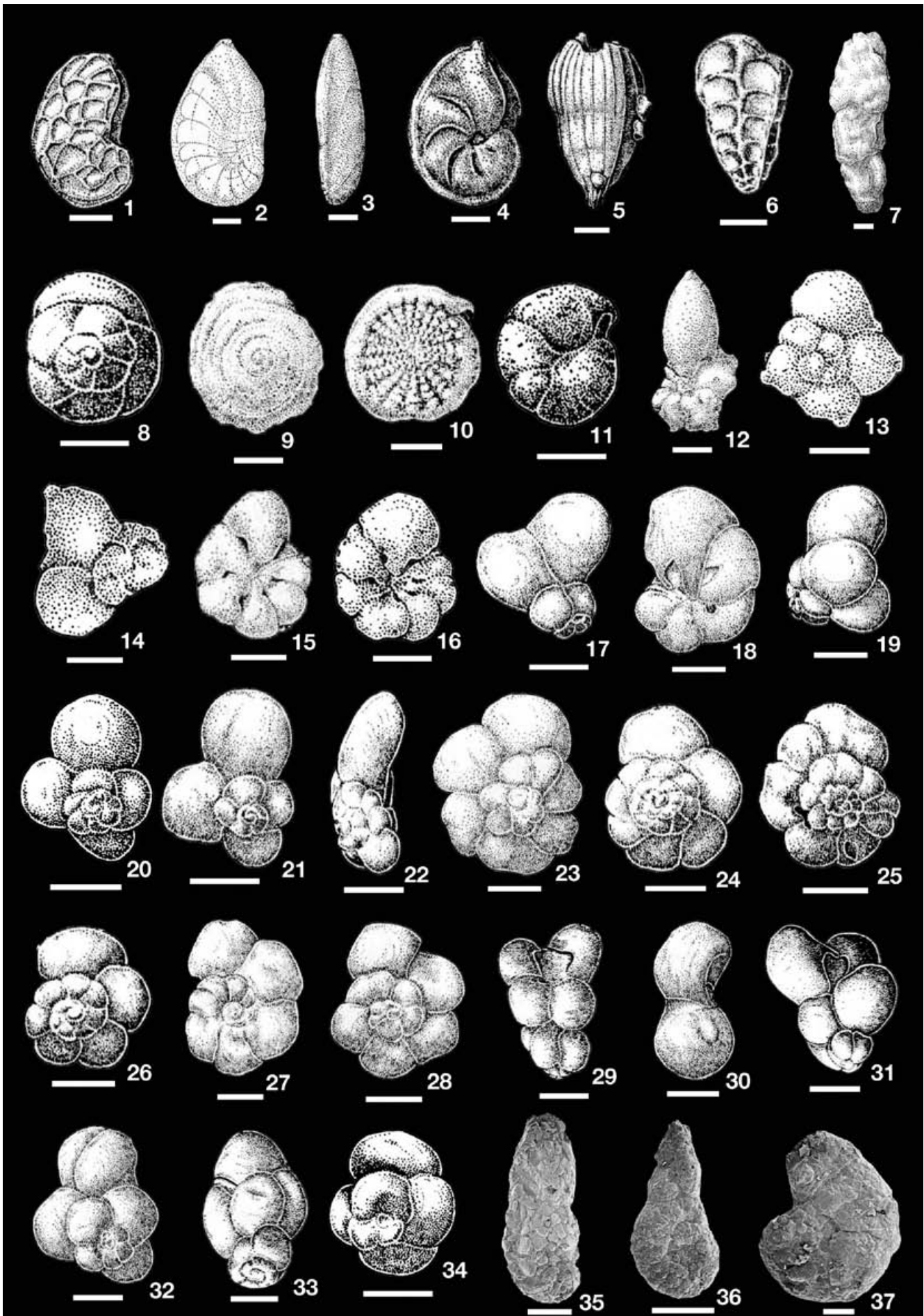


Plate 7

- Fig. 1: *Lenticulina (Astaculus) alemannia* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0087.
- Fig. 2: *Lenticulina (Astaculus) soluta* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0096.
- Fig. 3: *Lenticulina (Astaculus) telum* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0097.
- Fig. 4: *Lenticulina (Lenticulina) pseudoatheria* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0101.
- Fig. 5: *Lingulina aculeata* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0142.
- Fig. 6: *Loxostomum incredibile* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0212.
- Fig. 7: *Nodophthalmidium vastum* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0048.
- Fig. 8: *Oberhauserina barremiana* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0233.
- Fig. 9: *Paalzowella infracretacea* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0213.
- Fig. 10: *Planispirillina ranzenbergensis* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0178.
- Fig. 11: *Recurvoides exiguus* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0018.
- Fig. 12: *Schackoina armata* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0201.
- Fig. 13: *Schackoina francogallicorum* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0202.
- Fig. 14: *Schackoina trifolia* FUCHS 1971.
Holotype, middle Barremian, Ranzenberg.
Coll. no.: GBA 1971/003/0203.
- Fig. 15: *Ticinella austriaca* FUCHS 1971.
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Coll. no.: GBA 1973/003/0004.
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Holotype, Oxfordian, Wiek.
Coll. no.: GBA 1973/003/0005.
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Holotype, lower Maastrichtian, Leru-Okigwe.
Coll. no.: GBA 2007/146/0001/01.
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Holotype, lower Maastrichtian, Leru-Okigwe.
Coll. no.: GBA 2007/146/0001/06.

Figs. 1–16: FUCHS (1971).
Figs. 17–34: FUCHS (1973).
Figs. 35–37: GEBHARDT (1998).

Scale bars 0.1 mm.



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Manuskript bei der Schriftleitung eingelangt am 2. März 2010

**Ostracodal Type Specimens Stored in the Paleontological Collection
 of the Geological Survey of Austria**

IRENE ZORN*)

1 Table, 9 Plates

Ostracoda
Microfossils
Type Specimens
Palaeontological collection

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Ostracoden-Typen in der Sammlung der Geologischen Bundesanstalt in Wien

Zusammenfassung

In den Sammlungen der Geologischen Bundesanstalt in Wien befinden sich 44 valide und 2 invalide Holotypen sowie Paratypen zu Ostracodenarten. Sie stammen aus dem Karbon (Viseum) von Nötsch (SCHRAUT, 1996), Trias und Jura der Nördlichen und Südlichen Kalkalpen in Österreich und Italien (KOLLMANN, 1960b, 1963), Trias (Ladinium) des Iran (KRISTAN-TOLLMANN, 1991), Eozän (Lutetium) des Beckens von Pazin in Kroatien (KOLLMANN, 1962) sowie aus dem Miozän des Korneuburger Beckens (Karpatum; CERNAJSEK, 1971; ZORN, 1998), der Molassezone und des Wiener Beckens in Österreich (Sarmatium; CERNAJSEK, 1971, 1974). Elf Typuserien stellen die primären Typusexemplare von Typusarten dar. Darüberhinaus liegen Syntypen aus dem Miozän von Mähren (PROCHÁZKA, 1893) und dem Devon der Türkei (KAYSER, 1900) vor. Auf zum Großteil invalide und teilweise verloren gegangene Neotypen (CERNAJSEK, 1971, 1974) wird ebenfalls eingegangen. Es werden Details zu den Typen, ihre aktuelle Gattungszugehörigkeit sowie Original-Abbildungen geliefert.

Abstract

The collection of the Geological Survey of Austria contains 44 valid and 2 invalid ostracod holotypes and also paratypes. These were derived from the Carboniferous (Visean) of Nötsch (SCHRAUT, 1996), the Triassic and Jurassic of the Northern and Southern Calcareous Alps in Austria and Italy (KOLLMANN, 1960b, 1963), the Triassic (Ladinian) of Iran (KRISTAN-TOLLMANN, 1991), the Eocene (Lutetian) of the Pazin Basin, Croatia (KOLLMANN, 1962), and the Miocene of the Korneuburg Basin (Karpatum; CERNAJSEK, 1971; ZORN, 1998), the Molasse Basin and Vienna Basin in Austria (Sarmatian; CERNAJSEK, 1971, 1974). Eleven type series represent the primary type specimens of type species. Furthermore, several syntypes from the Miocene of Moravia (PROCHÁZKA, 1893) and the Devonian of Turkey (KAYSER, 1900) are also available. Neotypes (CERNAJSEK, 1971, 1974) which are mostly invalid and some of which have been lost, are also documented here. Details of the type specimens, their current classification, as well as original pictures, are presented.

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Introduction

The paleontological collection of the Geological Survey of Austria in Vienna contains a large number of published fossils, many originating back to the mid 19th century. Within this, there are several microfossil collections from that time, although historic ostracod material is rare and was mainly derived from the Miocene. The originally undetermined material mentioned in Čížek (1851) from Mauer, which today is part of the 23rd district of Vienna, is still extant. This was later partly determined by STUR (1867) to belong to *Cytheridea heterostigma* REUSS, 1850. Ostracods from a well drilled in Mollardgasse, in the 6th district (Mariahilf) of Vienna, mentioned in FUCHS & KARRER (1875) also are available. Further material was published by PROCHÁZKA in 1892 from Walbersdorf in Burgenland, in Austria, and in 1893 from Židlochovice (Seelowitz) in Moravia (Czech Republic). A large part of this material, including foraminifers and otoliths, came to light when the Geological Survey moved premises in 2004. Within the Moravian ostracods, PROCHÁZKA (1900) erected seven new species, four of which (*Cythere vejhonensis*, *C. oviformis*, *C. reussi* and *C. blucinensis*) are still extant as syntypes. However, the samples of *Cythere fragilis*, *C. obliquus* and *C. moravica* have been lost. The syntypes of *Beyrichia roemeri* KAYSER, 1890 from the Devonian of Turkey, were also deposited at the Geological Survey.

In the following, only publications, in which type specimens were introduced are mentioned. In the 1960s, KOLLMANN published a series of ostracod papers, material from four of these was deposited in the Geological Survey collection (KOLLMANN, 1960a, 1960b, 1962, 1963). Two of these dealt with the Eocene of Italy and Croatia (1960a, 1962) and two dealt with the Triassic of the Northern and, to a lesser extent, the Southern Calcareous Alps (1960b, 1963). In three of these publications (KOLLMANN, 1960b, 1962, 1963), 34 new species were introduced whilst in two publications (KOLLMANN, 1962, 1963), 11 new genera were introduced, for which the following species are type species:

Parabairdia ploechingeri KOLLMANN, 1960b
Ptychobairdia kuepperi KOLLMANN, 1960b
Urobairdia austriaca KOLLMANN, 1963
Lobobairdia salinaria KOLLMANN, 1963
Anisobairdia cincta KOLLMANN, 1963
Nodobairdia mammilata KOLLMANN, 1963
Mirabairdia pernodosa KOLLMANN, 1963
Dicerobairdia bicornuta KOLLMANN, 1963

Neobairdiolites placklesensis KOLLMANN, 1963
Carinobairdia triassica KOLLMANN, 1963
Medwenitschia ornata KOLLMANN, 1963.

Subsequently, KRISTAN-TOLLMANN (1970) declared *Neobairdiolites* to be a junior synonym of *Bairdiolites*. KOLLMANN species *Ptychobairdia medwenitschi*, *Urobairdia angusta*, *Carinobairdia alta* and *C. tenuicarinata* have also been cancelled by various authors (see below).

CERNAJSEK (1971a, b, 1974) worked on Miocene ostracods from the Molasse, Korneuburg and Vienna basins. In his dissertation (CERNAJSEK, 1971a) on the Hemicysteridae of Austria, he erected two new subspecies, namely *Aurila angulata teiritzbergensis* and *Hemicytheria reniformis maior*. These have the status of nomina nuda, since the descriptions have never been published and the names are only mentioned in a summarizing article (CERNAJSEK, 1971b). Furthermore, CERNAJSEK (1971a) erected 17 neotypes which are also not valid. Four of them are missing from the collection. In 1974 CERNAJSEK erected the species *Aurila kollmanni*, *Loxocconcha schmidi* and *Bythocypris ? pappi*. Furthermore, he chose neotypes for the following species: *Cypridina hispidula* REUSS, 1850, *C. notata* REUSS, 1850, *C. omphalodes omphalodes* REUSS, 1850, *Cythereis mehesi* ZALÁNYI, 1913 and *C. merita* ZALÁNYI, 1913. Unfortunately, neither the holotypes nor the neotypes of this publication have been found in the Geological Survey collection.

The 1990s brought new ostracodal type material to the collection. KRISTAN-TOLLMANN (1991) worked on Triassic (Ladinian) ostracods of Aghdarband in Iran, including the type series of two new species *Ptychobairdia ruttneri* and *Polycope aghdarbandensis*. SCHRAUT (1996) erected six new ostracod species from the Visean, in a monograph on the arthropods of the Carboniferous of Nötsch in Carinthia. Material from the Karpatian of the Korneuburg Basin (ZORN, 1998) was partly deposited in the Museum of Natural History in Vienna and partly in the Geological Survey. In the latter the holotypes and topotypic paratypes of *Callistocythere karpatiensis* and *Helicythere leobendorfensis* are housed, as well as paratypes of *Cyamocytheridea gracilis*.

In the following, details of the type specimens, their current classification, as well as the illustrations, have been presented. The selection of lectotypes or neotypes in case of syntypes and missing holo- or neotypes was beyond the aim of this publication. For the illustrations, the original Figures have been scanned and, where possible, digitally improved, to save the specimens from further handling.

List of Type Specimens

The holo-, neo- and syntypes in the following list are named as it was done by the original author. They are ordered alphabetically and chronologically, according to author and then year of publication. Within each publication, they are given according to the inventory number. Table 1 gives a short overview of the specimens and also includes all those which have been lost over the years. The informations on the type levels mostly follow the original authors. Additionally, remarks have been given if the specimens were published subsequently or if the generic or specific attributions have been changed. The index of KEMPF (1986, 1995) was taken into account when determining if the generic attributions have changed. For better retrieval of the species described in the text, an index list has been given at the end of the paper.

**CERNAJSEK, T. (1971a):
Die Entwicklung und Abgrenzung der Gattung
Aurila POKORNY im Neogen Österreichs. –
Unpubl. Thesis Univ. Vienna.**

Although this material was derived from an unpublished thesis and includes nomina nuda and invalid holo- and neotypes it has been included here, to present completely the types in the ostracod collection. For photographic documentation, the original plates, with SEM photos, from the archives of the Geological Survey were scanned and digitally improved. Due to the relatively old SEM photographic techniques used, the pictures of many specimens were optically distorted which resulted in a different height/width-ratio. Details of paratypes have been omitted. Although the neotypes of *Aurila hispidula* (REUSS, 1850), *A. notata* (REUSS, 1850), *A. similis* (REUSS, 1850) and *Hemicytheria hungarica* (MÉHES, 1908) have not been found, they have nevertheless been treated here and figured. The first two neotypes were included in the remarks of the specimens in CERNAJSEK (1974) in which neotypes of five hemicytherid species were also selected. For the current classification of the species proposed, subgenera were not taken into consideration.

***Aurila angulata teiritzbergensis* CERNAJSEK, 1971
(Pl. 1, Fig. 2)**

Coll. no.: GBA 1997/003/0007/07.

Type: holotype, right valve.

Type level: Miocene, Karpatian, Korneuburg beds.

Type locality: Teiritzberg near Stetten, Lower Austria, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 61, Pl. 14, Fig. 3.

Remarks: This holotype (nomen nudum) and its paratypes are reference material in ZORN (1998: p. 197) under the name *Aurila laryeyensis* MOYES, 1965?. ZORN (2003: Tab. 2) and AIELLO & SZCZECURA (2004: p. 30) confirmed this determination without question mark.

Current classification: ***Aurila laryeyensis* MOYES, 1965.**

***Aurila angulata angulata* (REUSS, 1850)
(Pl. 1, Fig. 1)**

Coll. no.: GBA 2009/003/0001.

Type: neotype, right valve.

Type level: Miocene, Badenian.

Type locality: Nußdorf, Kahlenbergerstraße 108, 19th district, Vienna, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 57, Pl. 14, Fig. 4.

Remarks: KUČEROVÁ (1986: p. 113) assigned the species to *Senesia*.

Current classification: ***Aurila angulata* (REUSS, 1850).**

***Aurila cicatricosa* (REUSS, 1850)
(Pl. 1, Fig. 3)**

Coll. no.: GBA 2009/003/0002/01.

Type: neotype, left valve.

Type level: Miocene, Badenian.

Type locality: Nußdorf, Kahlenbergerstraße 108, 19th district, Vienna, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 65, Pl. 14, Fig. 8.

Current classification: ***Aurila cicatricosa* (REUSS, 1850).**

***Aurila cinctella* (REUSS, 1850)
(Pl. 1, Fig. 4)**

Coll. no.: GBA 2009/003/0003.

Type: neotype, left valve.

Type level: Miocene, Badenian.

Type locality: Steinebrunn, Kalkofen (lime oven), Lower Austria, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 70, Pl. 14, Fig. 11.

Remarks: BRESTENSKÁ & JIŘÍČEK (1978: p. 409) assigned the species to *Senesia*.

Current classification: ***Senesia cinctella* (REUSS, 1850).**

***Aurila galeata* (REUSS, 1850)
(Pl. 1, Fig. 6)**

Coll. no.: GBA 2009/003/0004.

Type: neotype, right valve.

Type level: Miocene, Badenian.

Type locality: Freibühl, near Wildon, Styria, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 73, Pl. 14, Fig. 13.

Remarks: BRESTENSKÁ & JIŘÍČEK (1978: p. 410) assigned the species to *Senesia*.

Current classification: ***Senesia galeata* (REUSS, 1850).**

***Aurila haueri* (REUSS, 1850)
(Pl. 1, Fig. 5)**

Coll. no.: GBA 2009/003/0005.

Type: neotype, left valve.

Type level: Miocene, Badenian.

Type locality: Nußdorf, Kahlenbergerstraße 108, 19th district, Vienna, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 76, Pl. 14, Fig. 12.

Current classification: ***Aurila haueri* (REUSS, 1850).**

***Aurila hispidula* (REUSS, 1850)
(Pl. 1, Fig. 12)**

Type: neotype, female right valve, specimen missing.

Type level: Miocene, upper Sarmatian, Upper Ervilia beds – Lower Mactra beds.

Type locality: Rosenhügelstraße near SW cemetery, 23rd district, Vienna, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 83, Pl. 15, Fig. 4.

Remarks: Another female right valve was published in CERNAJSEK (1974) as a neotype (see below).

Current classification: ***Aurila hispidula* (REUSS, 1850).**

***Aurila mehesi* (ZALÁNYI, 1913)**

(Pl. 1, Fig. 10)

Coll. no.: GBA 2009/003/0007.

Type: neotype, left valve, female.

Type level: Miocene, lower Sarmatian, Rissoa beds.

Type locality: Siebenhirten near Mistelbach, Lower Austria, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 87, Pl. 15, Fig. 1.

Remarks: CERNAJSEK (1974) chose a new neotype (see below).

Current classification: ***Aurila mehesi* (ZALÁNYI, 1913).**

***Aurila notata* (REUSS, 1850)**

(Pl. 1, Fig. 11)

Type: neotype, left valve, specimen missing.

Type level: Miocene, upper Sarmatian, *Nonion granosum* Zone.

Type locality: Nexing, "Hühnerfutterberg", Lower Austria, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 96, Pl. 15, Fig. 7.

Remarks: CERNAJSEK (1974) chose a new neotype (see below).

Current classification: ***Aurila notata* (REUSS, 1850).**

***Aurila punctata* (MÜNSTER, 1830)**

(Pl. 1, Fig. 8)

Coll. no.: GBA 2009/003/0010/01.

Type: neotype, left valve.

Type level: Miocene, Badenian.

Type locality: Nußdorf, Kahlenbergerstraße 108, 19th district, Vienna, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 106, Pl. 14, Fig. 10.

Current classification: ***Aurila punctata* (MÜNSTER, 1830).**

***Aurila similis* (REUSS, 1850)**

(Pl. 1, Fig. 9)

Type: neotype, right valve, specimen missing.

Type level: Miocene, Badenian.

Type locality: Wetzelsdorf, Styria, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 113, Pl. 14, Fig. 6.

Current classification: ***Aurila similis* (REUSS, 1850).**

***Aurila trigonella* (REUSS, 1850)**

(Pl. 1, Fig. 7)

Coll. no.: GBA 2009/003/0012.

Type: neotype, left valve.

Type level: Miocene, Badenian.

Type locality: Steinebrunn, Kalkofen (lime oven), Lower Austria, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 116, Pl. 14, Fig. 5.

Remarks: BRESTENSKÁ & JIŘÍČEK (1978: p. 410) assigned the species to *Senesia*.

Current classification: ***Senesia trigonella* (REUSS, 1850).**

***Hemicytheria hungarica* (MÉHES, 1908)**

(Pl. 1, Fig. 13)

Type: neotype, left female valve, specimen missing.

Type level: Miocene, lower Pannonian B.

Type locality: Draßburg (Drassburg), sand pit, Burgenland, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 133, Pl. 15, Fig. 8.

Current classification: ***Hemicytheria hungarica* (MÉHES, 1908).**

***Hemicytheria omphalodes omphalodes* (REUSS, 1850)**

(Pl. 1, Fig. 14)

Coll. no.: GBA 2009/003/0016.

Type: neotype, left female valve.

Type level: Miocene, upper Sarmatian.

Type locality: Nexing or Hautzendorf, Lower Austria, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 136, Pl. 15, Fig. 6.

Remarks: In the text CERNAJSEK (1971: p. 136) mentioned the neotype being a female left valve from Nexing, but in the figure captions was written Hautzendorf. It has been assumed here that the figured specimen is the neotype and that Nexing is the correct locality. In 1974, CERNAJSEK chose a right valve from Nexing for the neotype (see below).

Current classification: ***Hemicytheria omphalodes* (REUSS, 1850).**

***Hemicytheria omphalodes loerentheyi* (MÉHES, 1908)**

(Pl. 1, Fig. 15)

Coll. no.: GBA 2009/003/0017.

Type: neotype, right valve.

Type level: Miocene, Pannonian B.

Type locality: Draßburg (Drassburg), Burgenland, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 142, Pl. 15, Fig. 10.

Current classification: ***Hemicytheria loerentheyi* (MÉHES 1908).**

***Hemicytheria reniformis reniformis* (REUSS, 1850)**

(Pl. 1, Fig. 17)

Coll. no.: GBA 2009/003/0018.

Type: neotype, left valve.

Type level: Miocene, Pannonian E.

Type locality: Brunn / Vösendorf clay pit, Lower Austria, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 146, Pl. 15, Fig. 14.

Current classification: ***Hemicytheria reniformis* (REUSS, 1850).**

***Hemicytheria reniformis maior* CERNAJSEK, 1971**

(Pl. 1, Fig. 16)

Coll. no.: GBA 2009/003/0019.

Type: holotype (nomen nudum), female left valve.

Type level: Miocene, Pannonian E.

Type locality: Wien, Karlsplatz bore hole, 34.5 m, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 151, Pl. 15, Fig. 15.

Current classification: ***Hemicytheria* cf. *reniformis* (REUSS, 1850).**

***Procythereis deformis* (REUSS, 1850)**

(Pl. 1, Fig. 19)

Coll. no.: GBA 2009/003/0022.

Type: neotype, right valve.

Type level: Miocene, Badenian.

Type locality: Nußdorf, Grünes Kreuz, 19th district, Vienna, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 166, Pl. 14, Fig. 14.

Remarks: RUGGIERI (1976: p. 34) assigned the species to *Pokornyella*.

Current classification: ***Pokornyella deformis* (REUSS, 1850).**

***Procythereis sulcatopunctatus* (REUSS, 1850)**

(Pl. 1, Fig. 18)

Coll. no.: GBA 2009/003/0023.

Type: neotype, right valve.

Type level: Miocene, Badenian.

Type locality: Freibühl near Wildon, Steiermark, Austria.

Type reference and figure: CERNAJSEK, T., 1971: p. 170, Pl. 14, Fig. 15.

Remarks: BONADUCE et al. (1986: p. 532, 534) assigned the species to *Tenedocythere*, but also erected a new species on topotypic material of *T. sulcatopunctatus*, namely *T. perplexa*, which has to be considered a junior synonym (see also GROSS, 2004: p. 68).

Current classification: ***Tenedocythere sulcatopunctata* (REUSS, 1850).**

CERNAJSEK, T. (1974):

Die Ostracodenfaunen der Sarmatischen Schichten in Österreich. – Chronostratigraphie und Neostratotypen, Bd. 4.

***Aurila hispidula* (REUSS, 1850)**

(Pl. 2, Fig. 1)

Type: neotype, right female valve, specimen missing.

Type level: Miocene, upper Sarmatian, Upper Ervilia beds– Lower Mactra beds, *Nonion granosum* Zone.

Type locality: Vienna, 13th district, Rosenhügelstraße near SW-graveyard, Austria.

Type reference and figure: CERNAJSEK, T., 1974: p. 462, Pl. 1, Fig. 1.

Remarks: CERNAJSEK (1971) had already chosen another neotype for *Cypridina hispidula* REUSS, 1850 from the same

locality (see above). Neither specimen is currently in the Geological Survey collection. Many paraneotypes from the type locality are available.

Current classification: ***Aurila hispidula* (REUSS, 1850).**

***Aurila kollmanni* CERNAJSEK, 1974**

(Pl. 2, Fig. 4)

Type: holotype, right valve, specimen missing.

Type level: Miocene, lower Sarmatian, Hernalser Tegel, *Elphidium reginum* Zone.

Type locality: Wien, 17th district, Gschwandnergasse 56, Austria.

Type reference and figure: CERNAJSEK, T., 1974: p. 463, Pl. 1, Fig. 2.

Remarks: This species is probably synonymous with *Aurila mehesi minor* JIŘÍČEK, 1974 which is a nomen nudum and was mentioned in the same volume (p. 447). Many paratypes from the type locality as well as from Siebenhirten near Mistelbach, Neckenmarkt bore hole and Großkrut-1 bore hole (103 m) are in the collection.

Current classification: ***Aurila kollmanni* CERNAJSEK, 1974.**

***Aurila mehesi* (ZALÁNYI, 1913)**

(Pl. 2, Fig. 2)

Type: neotype, left female valve (?), specimen missing.

Type level: Miocene, lower Sarmatian, Rissoa beds, *Elphidium reginum* Zone.

Type locality: Siebenhirten, near Mistelbach, Lower Austria, Austria (?)

Type reference and figure: CERNAJSEK, T., 1974: p. 465, Pl. 1, Fig. 3.

Remarks: In the type figure, a right valve from Gschwandnergasse is indicated as the neotype.

Current classification: ***Aurila mehesi* (ZALÁNYI, 1913).**

***Aurila merita* (ZALÁNYI, 1913)**

(Pl. 2, Fig. 3)

Type: neotype, right valve, specimen missing.

Type level: Miocene, lower Sarmatian, Rissoa beds, *Elphidium reginum* Zone.

Type locality: Vienna, 17th district, Gschwandnergasse 56, Austria.

Type reference and figure: CERNAJSEK, T., 1974: p. 466, Pl. 1, Fig. 4.

Current classification: ***Aurila merita* (ZALÁNYI, 1913).**

***Aurila notata* (REUSS, 1850)**

(Pl. 2, Fig. 5)

Type: neotype, left valve, specimen missing.

Type level: Miocene, upper Sarmatian, *Nonion granosum* Zone.

Type locality: Nexing, “Hühnerfutterberg”, Lower Austria, Austria.

Type reference and figure: CERNAJSEK, T., 1974: p. 467, Pl. 1, Fig. 6.

Remarks: CERNAJSEK (1971) had already chosen a neotype from the same locality (see above). Neither specimen is currently in the Geological Survey collection.

Current classification: ***Aurila notata* (REUSS, 1850).**

***Hemicytheria omphalodes omphalodes* (REUSS, 1850)**

(Pl. 2, Fig. 6)

Type: neotype, right valve, specimen missing.

Type level: Miocene, upper Sarmatian, *Nonion granosum* Zone.

Type locality: Nexing, "Hühnerfutterberg", Lower Austria, Austria.

Type reference and figure: CERNAJSEK, T., 1974: p. 468, Pl. 1, Fig. 7.

Remarks: CERNAJSEK (1971) had already chosen a neotype from the same locality (see above). This specimen is still extant in the collection.

Current classification: ***Hemicytheria omphalodes* (REUSS, 1850).**

***Loxocorncha schmidi* CERNAJSEK, 1974**

(Pl. 2, Fig. 7)

Type: holotype, left valve, specimen missing.

Type level: Miocene, lower Sarmatian, Hernalser Tegel, Rissoa beds, *Elphidium reginum* Zone.

Type locality: Vienna, 17th district, Gschwandnergasse 56, Austria.

Type reference and figure: CERNAJSEK, T., 1974: p. 479, Pl. 3, Fig. 4.

Remarks: Paratypes labelled with the name of the type locality, with Siebenhirten near Mistelbach or with Breitenbrunn quarry, as indicated in the publication are missing. Instead three carapaces and three right valves, including one juvenile, were found in a slide containing early Sarmatian ostracods, arranged by CERNAJSEK. Unfortunately the slide is not labelled. Also, on a SEM-stub, found amongst others, a left valve was found, but this is not identical with the holotype. One paratype from Neckenmarkt bore hole (103.8 m) exists in the collection. GROSS (2006) assigned the species to the genus *Loxocorniculum*.

Current classification: ***Loxocorniculum schmidi* CERNAJSEK, 1974.**

? *Bythocypris pappi* CERNAJSEK, 1974

(Pl. 2, Fig. 8)

Type: holotype, left valve, specimen missing.

Type level: Miocene, upper Sarmatian, *Parosonion granosum* Zone.

Type locality: Nexing, "Hühnerfutterberg", Lower Austria, Austria.

Type reference and figure: CERNAJSEK, T., 1974: p. 480, Pl. 3, Fig. 9.

Remarks: ZELENKA (1990) declared this species to be a synonym of *Phlyctenophora farkasi* (ZALÁNYI, 1913). The latter species was synonymized with *Ghardaglia pectinata* (HÉJJAS, 1894) by ZORN (1998). The following paratypes are in the collection: 1 carapace from the type locality, 4 right valves

and 1 left valve from Hölles, 6 right and 6 left valves and larval stages (2 right and 1 left valve) from Hautzendorf, 1 right valve from Heiligenberg, 2 right valves from the surroundings of Baden and 2 left and 2 right valves from Ebendorf, near Mistelbach (all Lower Austria).

Current classification: ***Ghardaglia pectinata* (HÉJJAS, 1894).**

KAYSER, E. (1900):

Devon-Fossilien vom Bosphorus und von der Nordküste des Marmara-Meeress (Zwischen Pendik und Kartal). – Beitr. Paläont. Geol. Österr.-Ung. Oriens, 12 (1899).

***Beyrichia roemeri* KAYSER, 1900**

(Pl. 3, Figs. 39–40)

Coll. no.: GBA 1900/002/0005.

Type: several syntypes on a rock (1 red indicated imprint with 3 artificial casts, 1 red indicated cast, 1 imprint).

Type level: Lower Devonian.

Type locality: Kanlydsa, Turkey.

Type reference and figure: KAYSER, E., 1900: p. 30, Pl. 1, Fig. 9.

Coll. no.: GBA 1900/002/0028.

Type: 1 syntype on a rock.

Type level: Lower Devonian.

Type locality: between Pendik and Kartal, Turkey.

Type reference and figure: KAYSER, E., 1900: p. 35, Pl. 1, Fig. 10.

Remarks: The specimens originate from the collection of Franz TOULA (collected 1895) and were originally deposited in the geological collection of the "K.k. technische Hochschule in Wien" (acquisition 1903). GROSS-UFFENORDE (1982) assigned *Beyrichia roemeri* to the genus *Zygobeyrichia*.

Current classification: ***Zygobeyrichia roemeri* (KAYSER, 1900).**

KOLLMANN, K. (1960b):

**Ostracoden aus der alpinen Trias Österreichs
I. *Parabairdia* n.g. und *Ptychobairdia* n.g. (Bairdiidae).
– Jb. Geol. Bundesanst., Sonderbd. 5.**

***Parabairdia ploechingeri* KOLLMANN, 1960b**

(Pl. 4, Figs. 1–3)

Coll. no.: GBA 2008/133/0001.

Type: holotype, carapace.

Type level: Triassic, Rhaetian, Zlambach marls.

Type locality: Grünbachgraben, Untersberg, Salzburg, Austria.

Type reference and figure: KOLLMANN, K., 1960b: p. 94, Pl. 23, Figs. 1–3.

Remarks: Genoholotype. In the original publication, the invalid coll. no. GBA/01 was given. BOLZ (1971: p. 141–144) interpreted the holotype to be a larval stage and placed the species in *Bairdia*, rejecting the genus *Parabairdia* through synonymy. KOZUR (1973: p. 21) kept the genus *Parabairdia*. Eight figured paratypes (coll. nos. GBA

2008/133/0002, 0005) inclusive 2 thin-sections (coll. nos. GBA 2008/133/0003, 0004) are in the collection.

Current classification: *Parabairdia ploechingeri* KOLLMANN, 1960b.

Ptychobairdia kuepperi KOLLMANN, 1960b

(Pl. 4, Figs. 4–5)

Coll. no.: GBA 2008/133/0006.

Type: holotype, carapace.

Type level: Triassic, Rhaetian, Zlambach marls.

Type locality: Grünbachgraben, Untersberg, Salzburg, Austria.

Type reference and figure: KOLLMANN, K., 1960b: p. 97, Pl. 24, Fig. 1, 4.

Remarks: Genoholotype. In the original publication, the invalid coll. no. GBA/06 was given. BOLZ (1971: p. 199) placed the species in *Triebelina* (*Ptychobairdia*). Later authors considered *Ptychobairdia* to have the rank of a genus (e.g. KRISTAN-TOLLMANN, 1990a: p. 174; SEPKOSKI, 2002). Three paratypes exist in the collection (coll. nos. GBA 2008/133/0008, 0009), but one (Pl. 24, Figs. 2–3) has been lost.

Current classification: *Ptychobairdia kuepperi* KOLLMANN, 1960b.

Ptychobairdia kristanae KOLLMANN, 1960b

(Pl. 4, Figs. 6–9)

Coll. no.: GBA 2008/133/0010.

Type: holotype, carapace.

Type level: Upper Triassic.

Type locality: Lanzing, base of the northern slope of the Hutberg, Lower Austria, Austria.

Type reference and figure: KOLLMANN, K., 1960b: p. 99, Pl. 25, Figs. 6–9.

Remarks: In the original publication, the invalid coll. no. GBA/010 was given. The holotype is reference material in KOLLMANN (1963: p. 181). BOLZ (1971: p. 210–211) placed the species in *Triebelina* (*Ptychobairdia*) and found the holotype to be a larval stage. KOZUR (1971: p. 10) named it *Triebelina kristanae kristanae* when erecting the subspecies *T. kristanae praecursor*, intending *Ptychobairdia* to be a junior synonym of *Triebelina*.

Current classification: *Ptychobairdia kristanae* KOLLMANN, 1960b.

Ptychobairdia medwenitschi KOLLMANN, 1960b

(Pl. 4, Figs. 10–13)

Coll. no.: GBA 2008/133/0011.

Type: holotype, carapace.

Type level: Upper Triassic.

Type locality: Hallstätter Salzberg, Upper Austria, Austria.

Type reference and figure: KOLLMANN, K., 1960b: p. 100, Pl. 26, Figs. 1–4.

Remarks: In the original publication, the invalid coll. no. GBA/011 was given. The holotype is reference material in KOLLMANN (1963: p. 181) sub *Ptychobairdia kristanae* (larval stage, species *P. medwenitschi* rejected). Six figured paratypes are in the collection (coll. no. GBA 2008/133/0012–0016a,b).

Current classification: *Ptychobairdia kristanae* KOLLMANN, 1960b.

Ptychobairdia oberhauseri KOLLMANN, 1960b

(Pl. 4, Figs. 14–15; Pl. 5., Figs. 1, 3)

Coll. no.: GBA 2008/133/0017.

Type: holotype, carapace.

Type level: Triassic, Rhaetian, Zlambach marls.

Type locality: Grünbachgraben, Untersberg, Salzburg, Austria.

Type reference and figure: KOLLMANN, K., 1960b: p. 98, Pl. 27, Figs. 1–4.

Remarks: In the original publication, the invalid coll. no. GBA/017 was given. BOLZ (1971: p. 208–210) placed the species in *Triebelina* (*Ptychobairdia*) and established that the holotype represents a larval stage. KOZUR (1971: p. 13) named it *Triebelina oberhauseri oberhauseri* when erecting the subspecies *T. oberhauseri hungarica*, intending *Ptychobairdia* to be a junior synonym of *Triebelina*.

Current classification: *Ptychobairdia oberhauseri* KOLLMANN, 1960b.

KOLLMANN, K. (1962):

Ostracoden aus dem mitteleozänen “Flysch” des Beckens von Pazin (Istrien, Jugoslawien). – Verh. Geol. Bundesanst., Jg. 1962 (2).

The reader will find remarks on old but nowadays invalid coll. nos. given by KOLLMANN (1962) in the Catalogue of ELLIS & MESSINA. The coll. nos. cited in the text of KOLLMANN are written on the slides. All mentioned paratypes are available.

Cytherella triestina KOLLMANN, 1962

(Pl. 3, Figs. 1–3)

Coll. no.: GBA 2008/134/0001.

Type: holotype, carapace.

Type level: Eocene, Lutetian.

Type locality: Triest, Faccononi quarry, Italy.

Type reference and figure: KOLLMANN, K., 1962: p. 210, Pl. 3, Figs. 6–8.

Remarks: The specimen was previously figured in KOLLMANN (1960a: 191, Pl. 7, Figs. 1–3) sub *Cytherella* sp./136 (this numbering system was used by KOLLMANN, 1962). Eighteen paratypes are in the collection (coll. no. GBA 2008/135/0033–0035), although KOLLMANN mentioned only eleven.

Current classification: *Cytherella triestina* KOLLMANN, 1962.

Cythereis ? pisinensis KOLLMANN, 1962

(Pl. 3, Figs. 4–6)

Coll. no.: GBA 2008/135/0020.

Type: holotype, carapace.

Type level: Eocene, upper Lutetian.

Type locality: Pazin, near the old bridge, Istria, Croatia.

Type reference and figure: KOLLMANN, K., 1962: p. 205, Pl. 6, Figs. 11–13.

Remarks: WHATLEY & COLES (1991: p. 124) assigned this species to *Trachyleberidea*. Four paratypes exist in the collection (coll. no. GBA 2008/135/0021, 0022).

Current classification: ***Trachyleberidea pisinensis* (KOLLMANN, 1962).**

***Trachyleberidea ? sikici* KOLLMANN, 1962**

(Pl. 3, Figs. 7–9)

Coll. no.: GBA 2008/135/0024.

Type: holotype, carapace.

Type level: Eocene, upper Lutetian.

Type locality: Zanetina, near the bridge, Istria, Croatia.

Type reference and figure: KOLLMANN, K., 1962: p. 206, Pl. 6, Figs. 7–9.

Remarks: Six paratypes (coll. no. GBA 2008/135/0025, 0026) exist.

Current classification: ***Trachyleberidea ? sikici* KOLLMANN, 1962.**

***Cytherella ventroinflata* KOLLMANN, 1962**

(Pl. 3, Figs. 10–12)

Coll. no.: GBA 2008/135/0030.

Type: holotype, left valve.

Type level: Eocene, upper Lutetian.

Type locality: Zanetina, near the bridge, Istria, Croatia.

Type reference and figure: KOLLMANN, K., 1962: p. 209, Pl. 2, Figs. 11–13.

Remarks: One paratype (coll. no. GBA 2008/135/0031) is in the collection.

Current classification: ***Cytherella ventroinflata* KOLLMANN, 1962.**

***Cytherella praeumilis* KOLLMANN, 1962**

(Pl. 3, Figs. 13–14)

Coll. no.: GBA 2008/135/0038.

Type: holotype, carapace.

Type level: Eocene, Upper Lutetian.

Type locality: Zanetina, near the bridge, Istria, Croatia.

Type reference and figure: KOLLMANN, K., 1962: p. 213, Pl. 4, Figs. 9–10.

Remarks: Two figured paratypes (coll. no. GBA 2008/135/0039) exist.

Current classification: ***Cytherella praeumilis* KOLLMANN, 1962.**

***Cytherella unguiformis* KOLLMANN, 1962**

(Pl. 3, Figs. 15–17)

Coll. no.: GBA 2008/135/0040.

Type: holotype, carapace.

Type level: Eocene, upper Lutetian.

Type locality: Zanetina, near the bridge, Istria, Croatia.

Type reference and figure: KOLLMANN, K., 1962: p. 214, Pl. 4, Figs. 13–15.

Remarks: One paratype (coll. no. GBA 2008/135/0041) exists.

Current classification: ***Cytherella unguiformis* KOLLMANN, 1962.**

KOLLMANN, K. (1963): Ostracoden aus der alpinen Trias. II. Weitere Bairdiidae. – Jb. Geol. Bundesanst., 106.

***Bairdia deformata* KOLLMANN, 1963**

(Pl. 6, Fig. 6)

Coll. no.: GBA 2008/136/0001.

Type: holotype, left valve.

Type level: Triassic, Rhaetian.

Type locality: Lanzing, Hohe Wand, NW Wiener Neustadt, Lower Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 165, Pl. 4, Fig. 4.

Remarks: In the original publication, the invalid coll. no. GBA/0142 was given. One paratype (coll. no. GBA 2008/136/0002) is in the collection.

Current classification: ***Bairdia deformata* KOLLMANN, 1963.**

***Urobairdia austriaca* KOLLMANN, 1963**

(Pl. 6, Figs. 16–19)

Coll. no.: GBA 2008/136/0003.

Type: holotype, carapace.

Type level: Triassic, upper Norian, lower Sevatian, Zlambach marls.

Type locality: Rossmoos, Bad Goisern, Upper Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 166, Pl. 6, Figs. 5–8.

Remarks: Genoholotype. In the original publication, the invalid coll. no. GBA/0144 was given. KOLLMANN did not mention paratypes and there are none in the collection, too, but he mentions the occurrence of this species in several other samples from various localities. BOLZ (1971: p. 144–148, 241) presented a new description of the species and proposed that the holotype is a female larval stage and placed the species in *Bairdia*, thus invalidating the genus *Urobairdia*. Later authors (KRISTAN-TOLLMANN, 1987: p. 238; CRASQUIN-SOLEAU & GRADINARU, 1996: p. 27) kept the name *Urobairdia austriaca*. In recent years, *Urobairdia* has also been interpreted as a subgenus of *Bairdia* (see CRASQUIN-SOLEAU et al., 2006: p. 60).

Current classification: ***Bairdia (Urobairdia) austriaca* KOLLMANN, 1963.**

***Urobairdia angusta* KOLLMANN 1963**

(Pl. 6, Figs. 12–15)

Coll. no.: GBA 2008/136/0004.

Type: holotype, carapace.

Type level: Triassic, upper Norian, lower Sevatian, Zlambach marls.

Type locality: Rossmoos, Bad Goisern, Upper Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 167, Pl. 6, Figs. 1–4.

Remarks: In the original publication, the invalid coll. no. GBA/0145 was given. There are no paratypes either in the collection or mentioned in the publication. BOLZ (1971: p. 144–148) found the holotype to be a male larval stage of *Bairdia austriaca*, and thus rejected the species *U. angusta*.

Current classification: ***Bairdia (Urobairdia) austriaca* KOLLMANN, 1963.**

***Cryptobairdia hians* KOLLMANN, 1963**

(Pl. 6, Figs. 1–3)

Coll. no.: GBA 2008/136/0005.

Type: holotype, carapace.

Type level: Triassic, Rhaetian.

Type locality: Lanzing, Hohe Wand NW Wiener Neustadt, Lower Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 168, Pl. 4, Figs. 1–3.

Remarks: In the original publication, the invalid coll. no. GBA/0146 was given. BOLZ (1971: p. 153–154) placed the species in *Bairdia*, for which he proposed *Cryptobairdia* as a junior synonym. In SEPKOSKI (2002) *Cryptobairdia* was a valid genus. From the type locality 4 paratypes (coll. No. GBA 2008/136/0006) are in the collection, but are not mentioned by KOLLMANN.

Current classification: ***Cryptobairdia hians* KOLLMANN, 1963.**

***Lobobairdia salinaria* KOLLMANN, 1963**

(Pl. 7, Figs. 1–4)

Coll. no.: GBA 2008/136/0007.

Type: holotype, carapace.

Type level: Triassic, Rhaetian, Zlambach marls.

Type locality: Hallstatt, Salzberg, Upper Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 169, Pl. 6, Figs. 9–12.

Remarks: Genoholotype. In the original publication, the invalid coll. no. GBA/0147 was given. One paratype exists (coll. no. 2008/133/0018) and was previously figured in KOLLMANN (1960b: p. 102, Pl. 27, Figs. 5–8) under the name *Ptychobairdia* ? sp.

Current classification: ***Lobobairdia salinaria* KOLLMANN, 1963.**

***Anisobairdia cincta* KOLLMANN, 1963**

(Pl. 6, Figs. 8–11)

Coll. no.: GBA 2008/136/0008.

Type: holotype, carapace.

Type level: Triassic, Rhaetian, Zlambach marls.

Type locality: Halleiner Salzberg, Salzburg, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 170, Pl. 5, Figs. 1–4.

Remarks: Genoholotype. In the original publication, the invalid coll. no. GBA/0148 was given. BOLZ (1971: p. 161–163) regarded the holotype as a larval stage and placed this (and the next species below) to *Bairdia*, for which he intended *Anisobairdia* to be a junior synonym. He revised one paratype from Grünbachgraben (coll. no. GBA 2008/136/0009)

to belong to his new species *Bairdia ventricosa* BOLZ, 1971. KRISTAN-TOLLMANN et al. (1987: 243, 1990b: 544) kept the genus *Anisobairdia*. Two figured paratypes (coll. nos. GBA 2008/136/0009–0010) exist.

Current classification: ***Anisobairdia cincta* KOLLMANN, 1963.**

***Anisobairdia salisburgensis* KOLLMANN, 1963**

(Pl. 6, Figs. 4–5)

Coll. no.: GBA 2008/136/0011.

Type: holotype, left valve.

Type level: Jurassic, Liassic, “Liasfleckenmergel”, Jakobbergseries ?

Type locality: Grünbachgraben, Untersberg, Salzburg, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 171, Pl. 4, Figs. 7–8.

Remarks: In the original publication, the invalid coll. no. GBA/0151 was given. BOLZ (1971: p. 167–170) placed the species in *Bairdia* (see above) and found the holotype to be a larval stage. There are no paratypes either in the collection or especially treated in the publication, but the occurrence of the species is also mentioned for the Triassic (Rhaetian).

Current classification: ***Anisobairdia salisburgensis* KOLLMANN, 1963.**

***Nodobairdia mammilata* KOLLMANN, 1963**

(Pl. 7, Figs. 8–11)

Coll. no.: GBA 2008/136/0012.

Type: holotype, carapace.

Type level: Triassic, upper Ladinian, Seeland beds = upper Cassian beds.

Type locality: Seelandalpe, Pragser Dolomiten, South Tyrol, Italy.

Type reference and figure: KOLLMANN, K., 1963: p. 174, Pl. 7, Figs. 9–12.

Remarks: Genoholotype. In the publication, the invalid coll. no. GBA/0152 was given. BOLZ (1971: p. 213) classified *Nodobairdia* to be a subgenus of *Triebelina*. This was not adopted by later authors (KRISTAN-TOLLMANN et al., 1980: p. 185; KRISTAN-TOLLMANN, 1990a: p. 174; see also SEPKOSKI, 2002). Three figured paratypes (coll. nos. GBA 2008/136/0013–0015) are in the collection.

Current classification: ***Nodobairdia mammilata* KOLLMANN, 1963.**

***Nodobairdia verrucosa* KOLLMANN, 1963**

(Pl. 7, Figs. 5–7)

Coll. no.: GBA 2008/136/0016.

Type: holotype, left valve.

Type level: Triassic, Carnian, lower Julian, “Halobien-schiefer”.

Type locality: Hohe Wand W Wiener Neustadt, Lower Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 176, Pl. 7, Figs. 1–3.

Remarks: In the original publication, the invalid coll. no. GBA/0156 was given. Two figured paratypes (coll. nos. GBA 2008/136/0017–0018) are available.

Current classification: ***Nodobairdia verrucosa* KOLLMANN, 1963.**

***Mirabairdia pernodosa* KOLLMANN, 1963**

(Pl. 7, Fig. 12)

Coll. no.: GBA 2008/136/0019.

Type: holotype, left valve.

Type level: Triassic, upper Ladinian, “Seeland beds = upper Cassian beds.

Type locality: Seelandalpe, Pragser Dolomiten, South Tyrol, Italy.

Type reference and figure: KOLLMANN, K., 1963: p. 177, Pl. 8, Fig. 1.

Remarks: Genoholotype. In the publication, the invalid coll. no. GBA/0159 was given. BOLZ (1971: p. 213) placed the species in *Triebelina* (*Nodobairdia*) and KOZUR (1971: p. 15) named it *Triebelina* (*Mirabairdia*) *pernodosa pernodosa* when erecting his new subspecies *Triebelina* (*Mirabairdia*) *pernodosa illyrica*. *Nodobairdia* and *Mirabairdia* are valid genera after SEPKOSKI (2002). Four figured paratypes (coll. nos. GBA 2008/136/0020–0023) exist.

Current classification: ***Mirabairdia pernodosa* KOLLMANN, 1963.**

***Ptychobairdia schaubegeri* KOLLMANN, 1963**

(Pl. 5, Figs. 2, 4–6)

Coll. no.: GBA 2008/136/0026.

Type: holotype, carapace.

Type level: Jurassic, Liassic, Jakobbergseries, “Liasfleckenmergel”.

Type locality: Hallein, Salzberg, Salzburg, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 179, Pl. 2, Figs. 1–2; Pl. 3, Figs. 1–2.

Remarks: In the original publication, the invalid coll. no. GBA/0165 was given. BOLZ (1971: p. 210) placed the species in *Triebelina* (*Ptychobairdia*) and KOZUR (1971: p. 15) in *Triebelina* for which he intended *Ptychobairdia* to be a junior synonym. *Ptychobairdia* is a valid genus after KRISTAN-TOLLMANN (1990a: p. 174–178). One figured paratype (coll. no. GBA 2008/136/0027) exists.

Current classification: ***Ptychobairdia schaubegeri* KOLLMANN, 1963.**

***Dicerobairdia bicornuta* KOLLMANN, 1963**

(Pl. 5, Figs. 7–9; Pl. 7, Fig. 13)

Coll. no.: GBA 2008/136/0028.

Type: holotype, left valve.

Type level: Triassic, Rhaetian.

Type locality: Plackleswiese, W Plackles, Hohe Wand, NW Wiener Neustadt, Lower Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 182, Pl. 1, Figs. 3–5; Pl. 9, Fig. 1.

Remarks: Genoholotype. In the original publication, the invalid coll. no. GBA/0167 was given. BOLZ (1971: p. 192–195) gave a new description of this species. He as-

signed all of KOLLMANN's (1963) *Dicerobairdia* species to *Triebelina* (*Triebelina*) whereby *Dicerobairdia* became a junior synonym of *Triebelina*. KRISTAN-TOLLMANN (1970: p. 289, 1990a: p. 173; KRISTAN-TOLLMANN et al., 1980: p. 186) continued using *Dicerobairdia* and also (1970: p. 292) erected the subspecies *Dicerobairdia bicornuta kollmanni* which BOLZ (1971: p. 195) did not accept. Two figured paratypes (coll. nos. 2008/136/0029–0030) are in the collection.

Current classification: ***Dicerobairdia bicornuta bicornuta* KOLLMANN, 1963.**

***Dicerobairdia ladinica* KOLLMANN, 1963**

(Pl. 7, Figs. 18–20)

Coll. no.: GBA 2008/136/0032.

Type: holotype, left valve.

Type level: Triassic, Ladinian, upper Cordevolian, upper Cassian beds = Falzarego beds.

Type locality: Settsass-Scharte, St. Cassian, South Tyrol, Italy.

Type reference and figure: KOLLMANN, K., 1963: p. 183, Pl. 9, Figs. 11–13.

Remarks: In the publication, the invalid coll. no. GBA/0171 was given. This is the only case for which KOLLMANN stated that there are no paratypes. Therefore it is a holotype by monotypy. BOLZ (1971: p. 183) did not mention the species, but placed it indirectly in *Triebelina* (*Triebelina*) because he declared the genus *Dicerobairdia* to be a synonym of *Triebelina* (see above).

Current classification: ***Triebelina ladinica* (KOLLMANN, 1963).**

***Dicerobairdia gruenbachensis* KOLLMANN, 1963**

(Pl. 7, Figs. 16–17)

Coll. no.: GBA 2008/136/0033.

Type: holotype, left valve.

Type level: Triassic, Carnian, lower Julian, “Halobien-schiefer”.

Type locality: Hohe Wand, Segen-Gottes-Schacht, W Wiener Neustadt, Lower Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 184, Pl. 9, Figs. 6–7.

Remarks: In the publication, the invalid coll. no. GBA/0172 was given. BOLZ (1971: p. 183) placed the species in *Triebelina* (*Triebelina*) (see above). KOZUR (1971: p. 10) erected the new subspecies *T. gruenbachensis tollmannae*. Two figured paratypes (coll. nos. GBA 2008/136/0034–0035) exist.

Current classification: ***Triebelina gruenbachensis* (KOLLMANN, 1963).**

***Dicerobairdia elegans* KOLLMANN, 1963**

(Pl. 7, Figs. 14–15)

Coll. no.: GBA 2008/136/0036.

Type: holotype, carapace.

Type level: Triassic, Carnian, lower Julian, “Halobien-schiefer”.

Type locality: Hohe Wand, Segen-Gottes-Schacht, W Wiener Neustadt, Lower Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 185, Pl. 9, Figs. 4–5.

Remarks: In the publication, the invalid coll. no. GBA/0175 was given. BOLZ (1971: p. 183) placed the species in *Triebelina* (*Triebelina*) (see above). Paratypes have not been found in the collection and were not mentioned by KOLLMANN (1963).

Current classification: *Triebelina elegans* (KOLLMANN, 1963).

***Bairdiolites semisculptus* KOLLMANN, 1963**

(Pl. 7, Figs. 26–29)

Coll. no.: GBA 2008/136/0037.

Type: holotype, carapace.

Type level: Triassic, Rhaetian, Zlambach marls.

Type locality: Hallstatt, Salzberg, Upper Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 188, Pl. 10, Figs. 6–9.

Remarks: In the publication, the invalid coll. no. GBA/0176 was given. The latin ending (-a) of the species name was corrected by KEMPF (1986: -us). There are no paratypes.

Current classification: *Bairdiolites semisculptus* KOLLMANN, 1963.

***Neobairdiolites placklesensis* KOLLMANN, 1963**

(Pl. 7, Figs. 21–25)

Coll. no.: GBA 2008/136/0038.

Type: holotype, carapace.

Type level: Triassic, Rhaetian, Zlambach marls ?

Type locality: Plackleswiese, W Plackles, Hohe Wand, NW Wiener Neustadt, Lower Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 190, Pl. 10, Figs. 1–5.

Remarks: Genoholotype. In the original publication, the invalid coll. no. GBA/0177 was given. KRISTAN-TOLLMANN (1970: p. 279) assigned the species to *Bairdiolites* declaring the monospecific *Neobairdiolites* to be a junior synonym of *Bairdiolites*. There are no paratypes.

Current classification: *Bairdiolites placklesensis* KOLLMANN, 1963.

***Carinobairdia triassica* KOLLMANN, 1963**

(Pl. 5, Figs. 15–16; Pl. 8, Fig. 5)

Coll. no.: GBA 2008/136/0039.

Type: holotype, left valve.

Type level: Triassic, Rhaetian, Zlambach marls ?

Type locality: Plackleswiese, W Plackles, Hohe Wand, NW Wiener Neustadt, Lower Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 191, Pl. 3, Figs. 5–6; Pl. 11, Fig. 1.

Remarks: Genoholotype. In the original publication, the invalid coll. no. GBA/0178 was given. BOLZ (1971: p. 228–229) assigned *C. triassica* and *C. umbonata* to the genus *Lobobairdia*. He rejected the genus *Carinobairdia*, which he synonymized partly with *Lobobairdia* and partly with *Triebelina* (*Nodobairdia*). This opinion stands in contrast with the works of KRISTAN-TOLLMANN (1969: p. 85; 1970: p. 295; 1990a: p.

173) and KRISTAN-TOLLMANN et al. (1979: p. 150, 1980: p. 182). URLICHS (1973: p. 676) first followed BOLZ's (1971) opinion, but later used *Carinobairdia* (in HILLEBRANDT et al., 2007: p. 10). KRISTAN-TOLLMANN (1970: p. 302) erected the subspecies *Carinobairdia triassica interrupta*. Two figured paratypes (coll. nos. GBA 2008/136/0040–0041) are at hand.

Current classification: *Carinobairdia triassica triassica* KOLLMANN, 1963

***Carinobairdia umbonata* KOLLMANN, 1963**

(Pl. 5, Figs. 12–14; Pl. 6, Fig. 7)

Coll. no.: GBA 2008/136/0042.

Type: holotype, left valve.

Type level: Triassic, Rhaetian, Zlambach marls ?

Type locality: Plackleswiese, W Plackles, Hohe Wand, NW Wiener Neustadt, Lower Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 193, Pl. 3, Figs. 10–12; Pl. 4, Fig. 9.

Remarks: In the original publication, the invalid coll. no. GBA/0181 was given. BOLZ (1971: p. 228) assigned the species to *Lobobairdia* and KRISTAN-TOLLMANN et al. (1979: p. 153, 1980: p. 184) to *Carinobairdia* (see above). There is one figured paratype (coll. no. GBA 2008/136/0043).

Current classification: *Carinobairdia umbonata* KOLLMANN, 1963.

***Carinobairdia alpina* KOLLMANN, 1963**

(Pl. 5, Figs. 10–11)

Coll. no.: GBA 2008/136/0044.

Type: holotype, right valve.

Type level: Triassic, Rhaetian, Zlambach marls.

Type locality: Grünbachgraben, Untersberg, Salzburg, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 194, Pl. 3, Figs. 3–4.

Remarks: In the original publication, the invalid coll. no. GBA/0183 was given. BOLZ (1971: p. 218) assigned the species to *Triebelina* (*Nodobairdia*) and KOZUR (1985: p. 75) to his new genus *Bolzibairdia*. KRISTAN-TOLLMANN et al. (1979: p. 150, 1980: p. 183), KRISTAN-TOLLMANN (1990a: p. 173) and URLICHS (in HILLEBRANDT et al., 2007: p. 10) followed the concept of *Carinobairdia*. The mentioned paratypes are still present (coll. nos. GBA 2008/136/0045–0046).

Current classification: *Carinobairdia alpina* KOLLMANN, 1963.

***Carinobairdia alta* KOLLMANN, 1963**

(Pl. 8, Fig. 6)

Coll. no.: GBA 2008/136/0047.

Type: holotype, left valve.

Type level: Triassic, Rhaetian.

Type locality: Lanzing, Hohe Wand, NW Wiener Neustadt, Lower Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 195, Pl. 11, Fig. 3.

Remarks: In the original publication, the invalid coll. no. GBA/0186 was given. BOLZ (1969: p. 427; 1971: p. 218)

and KRISTAN-TOLLMANN (1970: p. 297) declared *Carinobairdia alta* to be synonymous with *C. alpina* (see above), because the specimens are the left valves of this species. One figured paratype from the Hallstätter Salzberg (coll. no. GBA 2008/136/0048) exists.

Current classification: ***Carinobairdia alpina* KOLLMANN, 1963.**

***Carinobairdia tenuicarinata* KOLLMANN, 1963**

(Pl. 8, Figs. 7–8)

Coll. no.: GBA 2008/136/0049.

Type: holotype, carapace.

Type level: Triassic, Rhaetian.

Type locality: Dolomitenhütte, Lienzer Dolomiten, Tyrol, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 196, Pl. 11, Figs. 5, 7.

Remarks: In the original publication, the invalid coll. no. GBA/0188 was given. KRISTAN-TOLLMANN (1970: p. 301) and BOLZ (1971: p. 218) declared *Carinobairdia tenuicarinata* to be a synonym of *C. alpina* (see above) because all specimens represent larval stages of this species. Two figured paratypes (coll. nos. GBA 2008/136/0050–0051) exist in the collection.

Current classification: ***Carinobairdia alpina* KOLLMANN, 1963.**

***Medwenitschia ornata* KOLLMANN, 1963**

(Pl. 8, Figs. 1–4)

Coll. no.: GBA 2008/136/0052.

Type: holotype, carapace.

Type level: Triassic, Rhaetian, Zlambach marls.

Type locality: Hallstatt, Salzberg, Upper Austria, Austria.

Type reference and figure: KOLLMANN, K., 1963: p. 197, Pl. 10, Figs. 11–14.

Remarks: Genoholotype. In the original publication, the invalid coll. no. GBA/0191 was given. One figured paratype (coll. no. GBA 2008/136/0053) exists. BOLZ (1971: p. 195, 183) found more material of this species and described the inner characteristics of the valves for the first time. With this knowledge, he declared the monospecific genus *Medwenitschia* to be a junior synonym of *Triebelina* (*Triebelina*). At the same time, KRISTAN-TOLLMANN (1971: p. 73) erected a second species of *Medwenitschia*, based on one carapace, and kept the genus.

Current classification: ***Medwenitschia ornata* KOLLMANN, 1963.**

**KRISTAN-TOLLMANN, E. (1991):
Ostracods from the Middle Triassic Sina
Formation (Aghdarband Group) in NE-Iran. –
Abh. Geol. Bundesanst., 38.**

***Ptychobairdia ruttneri* KRISTAN-TOLLMANN, 1991**

(Pl. 8, Figs. 10–11)

Coll. no.: GBA 1985/005/0004.

Type: holotype, carapace.

Type level: Triassic, Ladinian, upper Langobardian (*Frankites regoledanus* Zone), Aghdarband Group, Sina Formation, Faqir Marl Bed.

Type locality: Aghdarband, E Mashad, Khorassan province, Iran.

Type reference and figure: KRISTAN-TOLLMANN, E., 1991: p. 196, Pl. 1, Fig. 4.

Current classification: ***Ptychobairdia ruttneri* KRISTAN-TOLLMANN, 1991.**

***Polycope aghdarbandensis* KRISTAN-TOLLMANN, 1991**

(Pl. 8, Fig. 9)

Coll. no.: GBA 1985/005/0011.

Type: holotype, single valve.

Type level: Triassic, Ladinian, upper Langobardian (*Frankites regoledanus* Zone), Aghdarband Group, Sina Formation, Faqir Marl Bed.

Type locality: Aghdarband E Mashad, province Khorassan, Iran.

Type reference and figure: KRISTAN-TOLLMANN, E., 1991: p. 197, Pl. 1, Fig. 11.

Current classification: ***Polycope aghdarbandensis* KRISTAN-TOLLMANN, 1991.**

PROCHÁZKA, V.J. (1893):

Miocaen Židlochovický na Moravě a jeho zvířena (Das Miocaen von Seelowitz in Moravia und dessen Fauna). – Rozpravy České Akad. Císaře Františka Josefa Pro Vědy, Slovesnost a Umění v Praze, ser. 2 (matematicko-Přírodnická), 2 (24).

PROCHÁZKA (1893) described seven new Miocene ostracod species from the surroundings of Židlochovice in Moravia, four of which have been found in the collection of the Geological Survey of Austria. However, the samples of *Cythere fragilis*, *C. obliquus* and *C. moravica* have been lost. These species are not treated in detail in the present paper, but the original drawings are presented on Plate 3.

***Cythere vejhonensis* PROCHÁZKA, 1893**

(Pl. 3, Figs. 36–38)

Coll. no.: GBA 2008/171/0001.

Type: 1 syntype, left valve.

Type level: Miocene, Badenian.

Type locality: Židlochovice (Seelowitz), Vejhonberg, Moravia, Czech Republic.

Type reference and figure: PROCHÁZKA, V.J., 1893: p. 54, 78, Taf. 1, Fig. 11a–c.

Locality details: quarry near the city waterworks (“Steinbruch nächst der städtischen Wasserleitung”).

Coll. no.: GBA 2008/171/0002.

Type: 1 syntype, right valve.

Locality details: clay pit opposite Hlinikstreet (“Tongrube gegenüber Hlinikgasse”).

Remarks: BONADUCE et al. (1988) assigned *Cythere vejhonensis* to their new genus *Heliocythere*. *Cythere moedlingensis* TOULA, 1915 is very probably identical with this species.

Current classification: ***Heliocythere vejhonensis* (PROCHÁZKA, 1893).**

***Cythere oviformis* PROCHÁZKA, 1893**

(Pl. 3, Figs. 30–32)

Coll. no.: GBA 2008/171/0003.

Type: 9 syntypes, 7 left valves (one larval stage), 2 right valves.

Type level: Miocene, Badenian, Leda beds.

Type locality: Židlochovice (Seelowitz), Vejhonberg, Moravia, Czech Republic.

Type reference and figure: PROCHÁZKA, V.J., 1893: p. 55, 78, Taf. 1, Fig. 9.

Remarks: Because there is only one complete right valve available, this one is presumed to be the figured syntype. All of the specimens belong to *Bosquetina carinella*. *Cythere oviformis* must be regarded to be a junior synonym.

Current classification: ***Bosquetina carinella* (REUSS, 1850).**

***Cythere reussi* PROCHÁZKA, 1893**

(Pl. 3, Figs. 18–20)

Type level: Miocene, Badenian.

Type locality: Židlochovice (Seelowitz), Vejhonberg, Moravia, Czech Republic.

Type reference and figure: PROCHÁZKA, V.J., 1893: p. 56, 79.

Coll. no.: GBA 2008/171/0004.

Type: 1 syntype, left valve.

Locality details: road cut, real “Schlier” (“Wegeinschnitt, echter Schlier”).

Coll. no.: GBA 2008/171/0005.

Type: 6 syntypes, 5 right and 1 left valve.

Locality details: road cut, fossil-rich layer (“Wegeinschnitt, fossilreiche Lage”).

Coll. no.: GBA 2008/171/0006.

Type: 7 syntypes, 2 right and 5 left valves.

Locality details: quarry near the city waterworks (“Steinbruch nächst der städtischen Wasserleitung”).

Coll. no.: GBA 2008/171/0007.

Type: 8 syntypes, 2 right and 6 left valves.

Locality details: hillside opposite the cross at the street (“Hang gegenüber dem Kreuze an der Straße”).

Remarks: PROCHÁZKA (1893: p. 16, 20, 25, 79) stated that he found *Cythere reussi* at Vejhonberg, in the beds that are rich in *Corbula gibba* and *Leda nitida*, in the real “Schlier”, in the clay pit opposite Hlinikstreet and in the fossil-rich layer. In the collection the syntypes from two of these localities are extant as is additional material from two other localities, for which he did not mention the occurrence (see above).

The figured specimens (PROCHÁZKA, 1893: Pl. 2, Fig. 1) cannot be identified among the 22 syntypes. TRIEBEL (1950) recognised that *Cythere reussi* PROCHÁZKA, 1893 is a homonym of *Cythere reussi* BRADY, 1869. He substituted the name with *Cnestocythere lamellicosta* n.n. All available syntypes belong to *Cnestocythere lamellicosta* TRIEBEL, 1950.

Current classification: ***Cnestocythere lamellicosta* TRIEBEL, 1950.**

***Cythere blucinensis* PROCHÁZKA, 1893**

(Pl. 3, Figs. 33–35)

Coll. no.: GBA 2008/171/0008.

Type: 1 syntype, right valve.

Type level: Miocene, Badenian.

Type locality: Židlochovice (Seelowitz), Kohlberg near Blucina, Moravia, Czech Republic.

Type reference and figure: PROCHÁZKA, V.J., 1893: p. 56, 79, Taf. 2, Fig. 3.

Remarks: PROCHÁZKA (1893: p. 30, 87) mentioned that *Cythere blucinensis* occur in the quarry near the city waterworks of Židlochovice and at Kohlberg. Only one syntype from Kohlberg is available and is probably the figured specimen. However, this belongs to *Nonurocythereis seminulum* (SEGUENZA, 1880). *Cythere blucinensis*, therefore, has to be regarded a junior synonym of this species.

Current classification: ***Nonurocythereis seminulum* (SEGUENZA, 1880).**

**SCHRAUT, G. (1996):
Die Arthropoden aus dem Unterkarbon von
Nötsch (Kärnten/Österreich). –
Abh. Geol. Bundesanst., 51.**

***Hollinella (Hollinella) bulbolobata* SCHRAUT, 1996**

(Pl. 9, Figs. 1–2)

Coll. no.: GBA 1996/002/0020.

Type: holotype, artificial cast of right male valve.

Type level: Carboniferous, upper Visean / lower Namurian, Erlachgraben Formation.

Type locality: Hermsberg, Oberhöher near Nötsch, Carinthia, Austria.

Type reference and figure: SCHRAUT, G., 1996: p. 66–67, Pl. 5, Fig. 2; Text-Fig. 54.

Remarks: Number of holotype in publication: T33 H1397. One figured paratype (number T33 K03206) exists.

Current classification: ***Hollinella (Hollinella) bulbolobata* SCHRAUT, 1996.**

***Knoxiiella? bicornuta* SCHRAUT, 1996**

(Pl. 9, Figs. 3–4)

Coll. no.: GBA 1996/002/0079.

Type: holotype, artificial cast of left valve.

Type level: Carboniferous, upper Visean, Nötsch Formation.

Type locality: Oberhöher, near Nötsch (locality SCHÖNLAUB 1), Carinthia, Austria.

Type reference and figure: SCHRAUT, G., 1996: p. 99–100, Pl. 7, Fig. 14; Text-Fig. 91.

Remarks: Holotypus monotypicus, number in publication: T19 S1253.

Current classification: ***Knoxiiella ? bicornuta* SCHRAUT, 1996.**

***Pseudobeyrichiopsis angustata* SCHRAUT, 1996**

(Pl. 9, Figs. 5–6)

Coll. no.: GBA 1996/002/0082.

Type: holotype, artificial cast of a female left valve.

Type level: Carboniferous, upper Visean, Nötsch Formation.

Type locality: Oberhöher, near Nötsch (locality SCHÖNLAUB 1), Carinthia, Austria.

Type reference and figure: SCHRAUT, G., 1996: p. 102–103, Pl. 8, Fig. 1; Text-Fig. 94.

Remarks: Holotypus monotypicus, number in publication: T22 S03109.

Current classification: ***Pseudobeyrichiopsis angustata* SCHRAUT, 1996.**

***Pseudobeyrichiopsis longispinosa* SCHRAUT, 1996**

(Pl. 9, Figs. 7–8)

Coll. no.: GBA 1996/002/0085.

Type: holotype, artificial cast of a male right valve.

Type level: Carboniferous, upper Visean, Nötsch Formation.

Type locality: Oberhöher, near Nötsch (locality SCHÖNLAUB 1), Carinthia, Austria.

Type reference and figure: SCHRAUT, G., 1996: p. 104–105, Pl. 8, Fig. 4; Text-Fig. 96.

Remarks: Number of holotype in publication: T5 K1468. Five paratypes (casts) exist.

Current classification: ***Pseudobeyrichiopsis longispinosa* SCHRAUT, 1996**

***Acratia dorsoangulata* SCHRAUT, 1996**

(Pl. 9, Figs. 9–10)

Coll. no.: GBA 1996/002/0102.

Type: holotype, artificial cast of left valve.

Type level: Carboniferous, upper Visean, Nötsch Formation.

Type locality: Oberhöher, near Nötsch (locality SCHÖNLAUB 1), Carinthia, Austria.

Type reference and figure: SCHRAUT, G., 1996: p. 127–128, Pl. 10, Fig. 9; Text-Fig. 109.

Remarks: Holotypus monotypicus, number in publication: T23 S03136.

Current classification: ***Acratia dorsoangulata* SCHRAUT, 1996.**

***Acratia reventralis* SCHRAUT, 1996**

(Pl. 9, Figs. 11–12)

Coll. no.: GBA 1996/002/0103.

Type: holotype, artificial cast of left valve.

Type level: Carboniferous, Upper Visean, Nötsch Formation.

Type locality: Oberhöher, near Nötsch (locality SCHÖNLAUB 1), Carinthia, Austria.

Type reference and figure: SCHRAUT, G., 1996: p. 128–129, Pl. 10, Fig. 10; Text-Fig. 110.

Remarks: Holotypus monotypicus, number in publication: T23 S03142.

Current classification: ***Acratia reventralis* SCHRAUT, 1996.**

ZORN, I. (1998):

Ostracoda aus dem Karpat (Unter-Miozän) des Korneuburger Beckens (Niederösterreich). – Beitr. Paläont., 23.

For this publication only the holo- and paratypes that are stored in the collection of the Geological Survey are documented. Further material is deposited at the Museum of Natural History in Vienna.

***Callistocythere karpatisensis* ZORN, 1998**

(Pl. 2, Figs. 9–10)

Coll. no.: GBA 1997/003/0004/04.

Type: holotype, female right valve.

Type level: Miocene, Karpatian, Korneuburg beds.

Type locality: Teiritzberg, near Stetten, Lower Austria, Austria.

Type reference and figure: ZORN, I., 1998: p. 183, Pl. 2, Fig. 1.

Remarks: The following paratypes from the type locality are in the collection: 1 figured female left valve (coll. no. GBA 1997/0003/004/05: Pl. 2, Fig. 2; Pl. 14, Fig. 1), 1 female right and 1 female left valve and 2 fragments (coll. no. GBA 1997/0003/004/06).

Current classification: ***Callistocythere karpatisensis* ZORN, 1998.**

***Heliocythere leobendorfensis* ZORN, 1998**

(Pl. 2, Figs. 11–12)

Coll. no.: GBA 1997/003/0011/18.

Type: holotype, carapace.

Type level: Miocene, Karpatian, Korneuburg Beds.

Type locality: Leobendorf, behind the school, Lower Austria, Austria.

Type reference and figure: ZORN, I. 1998: p. 201, Pl. 8, Figs. 7–8.

Remarks: The following paratypes from the type locality are in the collection: 1 figured right valve (coll. no. GBA 1997/003/0011/19: Pl. 8, Fig. 6; Pl. 18, Fig. 3), 1 left valve and 2 larval left valves (coll. no. GBA 1997/003/0011/20).

Current classification: ***Heliocythere leobendorfensis* ZORN, 1998.**

***Cyamocytheridea gracilis* ZORN, 1998**

Type and type reference: paratypes, ZORN, I. 1998: p. 187.

Type level: Miocene, Karpatian, Korneuburg beds.

Coll. nos.:

GBA 1997/003/0011/10: 1 right valve (Leobendorf, behind the school).

GBA 1997/003/0013/02: 3 right and 2 left valves Korneuburg-1 borehole: 102,0–104,6 m).

Current classification: ***Cyamocytheridea gracilis* ZORN, 1998.**

Acknowledgements

Many thanks are due to Helga PRIEWALDER, Monika BRÜGGEMANN-LEDOLTER and Ilka WÜNSCHE (Geologische Bundesanstalt) for their help in terms of scanning and digital imaging of the original plates.

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(Sub-)species with holo- (H), neo- (N) or syntypes (S) in GBA-collection				Coll. no./remarks	Chronostratigraphy	
CERNAJSEK (1971)	<i>Aurila</i>	<i>angulata angulata</i>	(REUSS, 1850)	N	2009/003/0001	Miocene, Badenian
	<i>Aurila</i>	<i>angulata teiritzbergensis</i>	CERNAJSEK, 1971	H	1997/003/0007/07	Miocene, Karpatian
	<i>Aurila</i>	<i>cicatricosa</i>	(REUSS, 1850)	N	2009/003/0002/1	Miocene, Badenian
	<i>Aurila</i>	<i>cinctella</i>	(REUSS, 1850)	N	2009/003/0003	Miocene, Badenian
	<i>Aurila</i>	<i>galeata</i>	(REUSS, 1850)	N	2009/003/0004	Miocene, Badenian
	<i>Aurila</i>	<i>haueri</i>	(REUSS, 1850)	N	2009/003/0005	Miocene, Badenian
	<i>Aurila</i>	<i>hispidula</i>	(REUSS, 1850)	N	specimen missing	Miocene, Sarmatian
	<i>Aurila</i>	<i>mehesi</i>	(ZALÁNYI, 1913)	N	2009/003/0007	Miocene, Sarmatian
	<i>Aurila</i>	<i>notata</i>	(REUSS, 1850)	N	specimen missing	Miocene, Sarmatian
	<i>Aurila</i>	<i>punctata</i>	(MÜNSTER, 1830)	N	2009/003/0010/1	Miocene, Badenian
	<i>Aurila</i>	<i>similis</i>	(REUSS, 1850)	N	specimen missing	Miocene, Badenian
	<i>Aurila</i>	<i>trigonella</i>	(REUSS, 1850)	N	2009/003/0012	Miocene, Badenian
	<i>Hemicytheria</i>	<i>hungarica</i>	(MÉHES, 1908)	N	specimen missing	Miocene, Pannonian
	<i>Hemicytheria</i>	<i>omphalodes omphalodes</i>	(MÉHES, 1908)	N	2009/003/0016	Miocene, Sarmatian
	<i>Hemicytheria</i>	<i>omphalodes loerentheyi</i>	(MÉHES, 1908)	N	2009/003/0017	Miocene, Pannonian
	<i>Hemicytheria</i>	<i>reniformis maior</i>	CERNAJSEK, 1971	H	2009/003/0019	Miocene, Sarmatian
	<i>Hemicytheria</i>	<i>reniformis reniformis</i>	(REUSS, 1850)	N	2009/003/0018	Miocene, Pannonian
	<i>Procythereis</i>	<i>deformis</i>	(REUSS, 1850)	N	2009/003/0022	Miocene, Badenian
	<i>Procythereis</i>	<i>sulcatopunctatus</i>	(REUSS, 1850)	N	2009/003/0023	Miocene, Badenian
CERNAJSEK (1974)	<i>Aurila</i>	<i>kollmanni</i>	CERNAJSEK, 1974	H	specimen missing	Miocene, Sarmatian
	<i>Loxoconcha</i>	<i>schmidi</i>	CERNAJSEK, 1974	H	specimen missing	Miocene, Sarmatian
	<i>Bythocypris</i> ?	<i>pappi</i>	CERNAJSEK, 1974	H	specimen missing	Miocene, Sarmatian
	<i>Aurila</i>	<i>hispidula</i>	(REUSS, 1850)	N	specimen missing	Miocene, Sarmatian
	<i>Aurila</i>	<i>mehesi</i>	(ZALÁNYI, 1913)	N	specimen missing	Miocene, Sarmatian
	<i>Aurila</i>	<i>merita</i>	(ZALÁNYI, 1913)	N	specimen missing	Miocene, Sarmatian
	<i>Aurila</i>	<i>notata</i>	(REUSS, 1850)	N	specimen missing	Miocene, Sarmatian
	<i>Hemicytheria</i>	<i>omphalodes omphalodes</i>	(REUSS, 1850)	N	specimen missing	Miocene, Sarmatian
KAYSER (1900)	<i>Beyrichia</i>	<i>roemeri</i>	KAYSER, 1890	S	1902/002/0005	Devonian
	<i>Beyrichia</i>	<i>roemeri</i>	KAYSER, 1890	S	1902/002/0028	Devonian
KOLLMANN (1960b)	<i>Parabairdia</i>	<i>ploechingeri</i>	KOLLMANN, 1960	H	2008/133/0001	Triassic, Rhaetian
	<i>Ptychobairdia</i>	<i>kuepperi</i>	KOLLMANN, 1960	H	2008/133/0006	Triassic, Rhaetian
	<i>Ptychobairdia</i>	<i>kristanae</i>	KOLLMANN, 1960	H	2008/133/0010	Late Triassic
	<i>Ptychobairdia</i>	<i>medwenitschi</i>	KOLLMANN, 1960	H	2008/133/0011	Late Triassic
	<i>Ptychobairdia</i>	<i>oberhauseri</i>	KOLLMANN, 1960	H	2008/133/0017	Triassic, Rhaetian
KOLLMANN (1962)	<i>Cytherella</i>	<i>triestina</i>	KOLLMANN, 1962	H	2008/134/0001	Eocene, Lutetian
	<i>Cythereis</i> ?	<i>pisinensis</i>	KOLLMANN, 1962	H	2008/135/0020	Eocene, Lutetian
	<i>Trachyleberidea</i> ?	<i>sikici</i>	KOLLMANN, 1962	H	2008/135/0024	Eocene, Lutetian
	<i>Cytherella</i>	<i>ventroinflata</i>	KOLLMANN, 1962	H	2008/135/0030	Eocene, Lutetian
	<i>Cytherella</i>	<i>praehumilis</i>	KOLLMANN, 1962	H	2008/135/0038	Eocene, Lutetian
	<i>Cytherella</i>	<i>unguiformis</i>	KOLLMANN, 1962	H	2008/135/0040	Eocene, Lutetian

(Sub-)species with holo- (H), neo- (N) or syntypes (S) in GBA-collection				Coll. no./remarks	Chronostratigraphy	
KOLLMANN (1963)	<i>Bairdia</i>	<i>deformata</i>	KOLLMANN, 1963	H	2008/136/0001	Triassic, Rhaetian
	<i>Urobairdia</i>	<i>austriaca</i>	KOLLMANN, 1963	H	2008/136/0003	Triassic, Norian
	<i>Urobairdia</i>	<i>angusta</i>	KOLLMANN, 1963	H	2008/136/0004	Triassic, Norian
	<i>Cryptobairdia</i>	<i>hians</i>	KOLLMANN, 1963	H	2008/136/0005	Triassic, Rhaetian
	<i>Lobobairdia</i>	<i>salinaria</i>	KOLLMANN, 1963	H	2008/136/0007	Triassic, Rhaetian
	<i>Anisobairdia</i>	<i>cincta</i>	KOLLMANN, 1963	H	2008/136/0008	Triassic, Rhaetian
	<i>Anisobairdia</i>	<i>salisburgensis</i>	KOLLMANN, 1963	H	2008/136/0011	Jurassic, Liassic
	<i>Nodobairdia</i>	<i>mammilata</i>	KOLLMANN, 1963	H	2008/136/0012	Triassic, Ladinian
	<i>Nodobairdia</i>	<i>verrucosa</i>	KOLLMANN, 1963	H	2008/136/0016	Triassic, Carnian
	<i>Mirabairdia</i>	<i>pernodosa</i>	KOLLMANN, 1963	H	2008/136/0019	Triassic, Ladinian
	<i>Ptychobairdia</i>	<i>schaubergeri</i>	KOLLMANN, 1963	H	2008/136/0026	Jurassic, Liassic
	<i>Dicerobairdia</i>	<i>bicornuta</i>	KOLLMANN, 1963	H	2008/136/0028	Triassic, Rhaetian
	<i>Dicerobairdia</i>	<i>ladinica</i>	KOLLMANN, 1963	H	2008/136/0032	Triassic, Ladinian
	<i>Dicerobairdia</i>	<i>gruenbachensis</i>	KOLLMANN, 1963	H	2008/136/0033	Triassic, Carnian
	<i>Dicerobairdia</i>	<i>elegans</i>	KOLLMANN, 1963	H	2008/136/0036	Triassic, Carnian
	<i>Bairdiolites</i>	<i>semisculptus</i>	KOLLMANN, 1963	H	2008/136/0037	Triassic, Rhaetian
	<i>Neobairdiolites</i>	<i>placklesensis</i>	KOLLMANN, 1963	H	2008/136/0038	Triassic, Rhaetian
	<i>Carinobairdia</i>	<i>triassica</i>	KOLLMANN, 1963	H	2008/136/0039	Triassic, Rhaetian
	<i>Carinobairdia</i>	<i>umbonata</i>	KOLLMANN, 1963	H	2008/136/0042	Triassic, Rhaetian
	<i>Carinobairdia</i>	<i>alpina</i>	KOLLMANN, 1963	H	2008/136/0044	Triassic, Rhaetian
<i>Carinobairdia</i>	<i>alta</i>	KOLLMANN, 1963	H	2008/136/0047	Triassic, Rhaetian	
<i>Carinobairdia</i>	<i>tenuicarinata</i>	KOLLMANN, 1963	H	2008/136/0049	Triassic, Rhaetian	
<i>Medwenitschia</i>	<i>ornata</i>	KOLLMANN, 1963	H	2008/136/0052	Triassic, Rhaetian	
KRISTAN-T. (1991)	<i>Ptychobairdia</i>	<i>ruttneri</i>	KRISTAN-TOLLMANN, 1991	H	1985/005/0004	Triassic, Ladinian
	<i>Polycope</i>	<i>aghdarbandensis</i>	KRISTAN-TOLLMANN, 1991	H	1985/005/0011	Triassic, Ladinian
PROCHÁZKA (1893)	<i>Cythere</i>	<i>fragilis</i>	PROCHÁZKA, 1893	S	specimens missing	Miocene, Badenian
	<i>Cythere</i>	<i>obliquus</i>	PROCHÁZKA, 1893	S	specimens missing	Miocene, Badenian
	<i>Cythere</i>	<i>vejhonensis</i>	PROCHÁZKA, 1893	S	2008/171/0001-2	Miocene, Badenian
	<i>Cythere</i>	<i>moravica</i>	PROCHÁZKA, 1893	S	specimens missing	Miocene, Badenian
	<i>Cythere</i>	<i>oviformis</i>	PROCHÁZKA, 1893	S	2008/171/0003	Miocene, Badenian
	<i>Cythere</i>	<i>reussi</i>	PROCHÁZKA, 1893	S	2008/171/0004-7	Miocene, Badenian
	<i>Cythere</i>	<i>blucinensis</i>	PROCHÁZKA, 1893	S	2008/171/0008	Miocene, Badenian
SCHRAUT (1996)	<i>Hollinella</i> (<i>Hollinella</i>)	<i>bulbolobata</i>	SCHRAUT, 1996	H	1996/002/0020	Carboniferous, Visean
	<i>Knoxella</i> ?	<i>bicornuta</i>	SCHRAUT, 1996	H	1996/002/0079	Carboniferous, Visean
	<i>Pseudobeyrichiopsis</i>	<i>angustata</i>	SCHRAUT, 1996	H	1996/002/0082	Carboniferous, Visean
	<i>Pseudobeyrichiopsis</i>	<i>longispinosa</i>	SCHRAUT, 1996	H	1996/002/0085	Carboniferous, Visean
	<i>Acratia</i>	<i>dorsoangulata</i>	SCHRAUT, 1996	H	1996/002/0102	Carboniferous, Visean
	<i>Acratia</i>	<i>rectiventralis</i>	SCHRAUT, 1996	H	1996/002/0103	Carboniferous, Visean
ZORN (1998)	<i>Callistocythere</i>	<i>karpatiensis</i>	ZORN, 1998	H	1997/003/0004/04	Miocene, Karpatian
	<i>Heliocythere</i>	<i>leobendorfensis</i>	ZORN, 1998	H	1997/003/0011/18	Miocene, Karpatian

Table 1.

List of holo-, neo- and syntypes of ostracod species stored in the collection of the Geological Survey of Austria (paratypes are only mentioned in the text). Dark grey underlayed species are genotypes and light grey underlayed specimens are from an unpublished thesis. Names of species are in the spelling of the author who introduced the type specimens.

Plate 1

Unpublished holo- and neotypes from CERNAJSEK (1971). The original SEM photos were usually optically distorted compared to the dimensions of the specimens. They have been scanned and if possible only revised in quality.

Fig. 1: *Aurila angulata angulata* (REUSS, 1850).
"Neotype".
Coll. no.: GBA 2009/003/0001.

Fig. 2: *Aurila angulata teiritzbergensis* CERNAJSEK, 1971.
"Holotype".
Coll. no.: GBA 1997/003/0007/07.

Fig. 3: *Aurila cicatricosa* (REUSS, 1850).
"Neotype".
Coll. no.: GBA 2009/003/0002/01.

Fig. 4: *Aurila cinctella* (REUSS, 1850).
"Neotype".
Coll. no.: GBA 2009/003/0003.

Fig. 5: *Aurila haueri* (REUSS, 1850).
"Neotype".
Coll. no.: GBA 2009/003/0005.

Fig. 6: *Aurila galeata* (REUSS, 1850).
"Neotype".
Coll. no.: GBA 2009/003/0004.

Fig. 7: *Aurila trigonella* (REUSS, 1850).
"Neotype".
Coll. no.: GBA 2009/003/0012.

Fig. 8: *Aurila punctata* (MÜNSTER, 1830).
"Neotype".
Coll. no.: GBA 2009/003/0010/01.

Fig. 9: *Aurila similis* (REUSS, 1850).
"Neotype".
Specimen missing.

Fig. 10: *Aurila mehesi* (ZALÁNYI, 1913).
"Neotype".
Coll. no.: GBA 2009/003/0007.

Fig. 11: *Aurila notata* (REUSS, 1850).
"Neotype".
Specimen missing.

Fig. 12: *Aurila hispidula* (REUSS, 1850).
"Neotype".
Specimen missing.

Fig. 13: *Hemicytheria hungarica* (MÉHES, 1908).
"Neotype".
Specimen missing.

Fig. 14: *Hemicytheria omphalodes omphalodes* (REUSS, 1850).
"Neotype".
Coll. no.: GBA 2009/003/0016.

Fig. 15: *Hemicytheria omphalodes loerentheyi* (MÉHES, 1908).
"Neotype".
Coll. no.: GBA 2009/003/0017.

Fig. 16: *Hemicytheria reniformis maior* CERNAJSEK, 1971.
"Holotype".
Coll. no.: GBA 2009/003/0019.

Fig. 17: *Hemicytheria reniformis reniformis* (REUSS, 1850).
"Neotype".
Coll. no.: GBA 2009/003/0018.

Fig. 18: *Procythereis sulcatopunctatus* (REUSS, 1850).
"Neotype".
Coll. no.: GBA 2009/003/0023.

Fig. 19: *Procythereis deformis* (REUSS, 1850).
"Neotype".
Coll. no.: GBA 2009/003/0022.

Magnifications of all Figures = x 50.

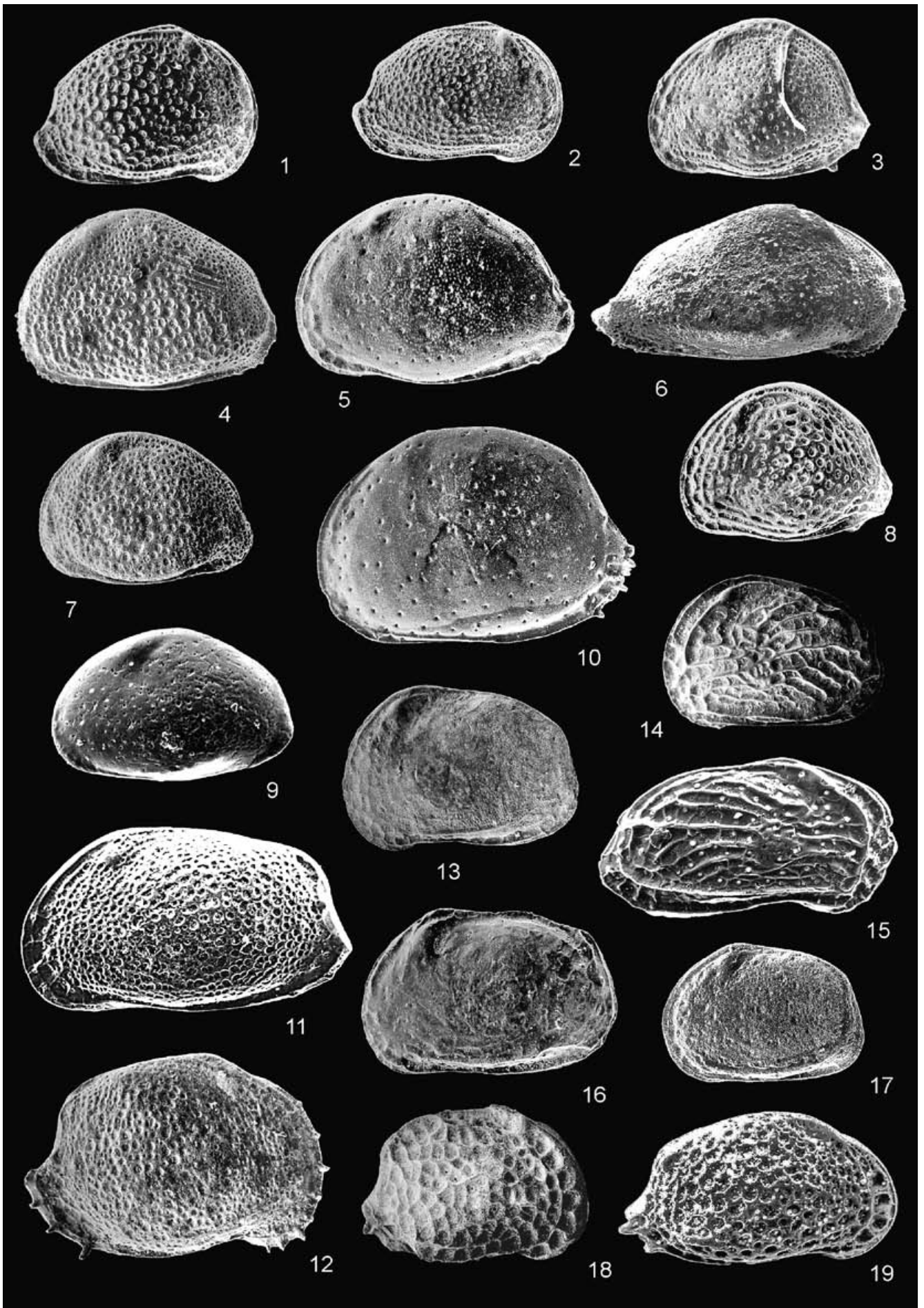


Plate 2

Type specimens published in CERNAJSEK (1974) and ZORN (1998).

- Fig. 1: *Aurila hispidula* (REUSS, 1850).
Neotype.
Specimen missing.
- Fig. 2: *Aurila mehesi* (ZALÁNYI, 1913).
Neotype.
Specimen missing.
- Fig. 3: *Aurila merita* (ZALÁNYI, 1913).
Neotype.
Specimen missing.
- Fig. 4: *Aurila kollmanni* CERNAJSEK, 1974.
Holotype.
Specimen missing.
- Fig. 5: *Aurila notata* (REUSS, 1850).
Neotype.
Specimen missing.
- Fig. 6: *Hemicytheria omphalodes omphalodes* (REUSS, 1850).
Neotype.
Specimen missing.
- Fig. 7: *Loxoconcha schmidi* CERNAJSEK, 1974.
Holotype.
Specimen missing.
- Fig. 8: *Bythocypris pappi* CERNAJSEK, 1974.
Holotype.
Specimen missing.
- Figs. 9–10: *Callistocythere karpatiensis* ZORN, 1998.
Fig. 9: Holotype.
Coll. no.: GBA 1997/003/0004/04.
Fig. 10: paratype, inner view.
Coll. no.: GBA 1997/003/0004/05.
- Figs. 11–12: *Heliocythere leobendorfensis* ZORN, 1998.
Holotype.
Coll. no.: GBA 1997/003/0011/18.

Magnifications: Figs. 1–8: not given by original author, Figs. 9–10 = x 100, Figs. 11–12 = x 80.

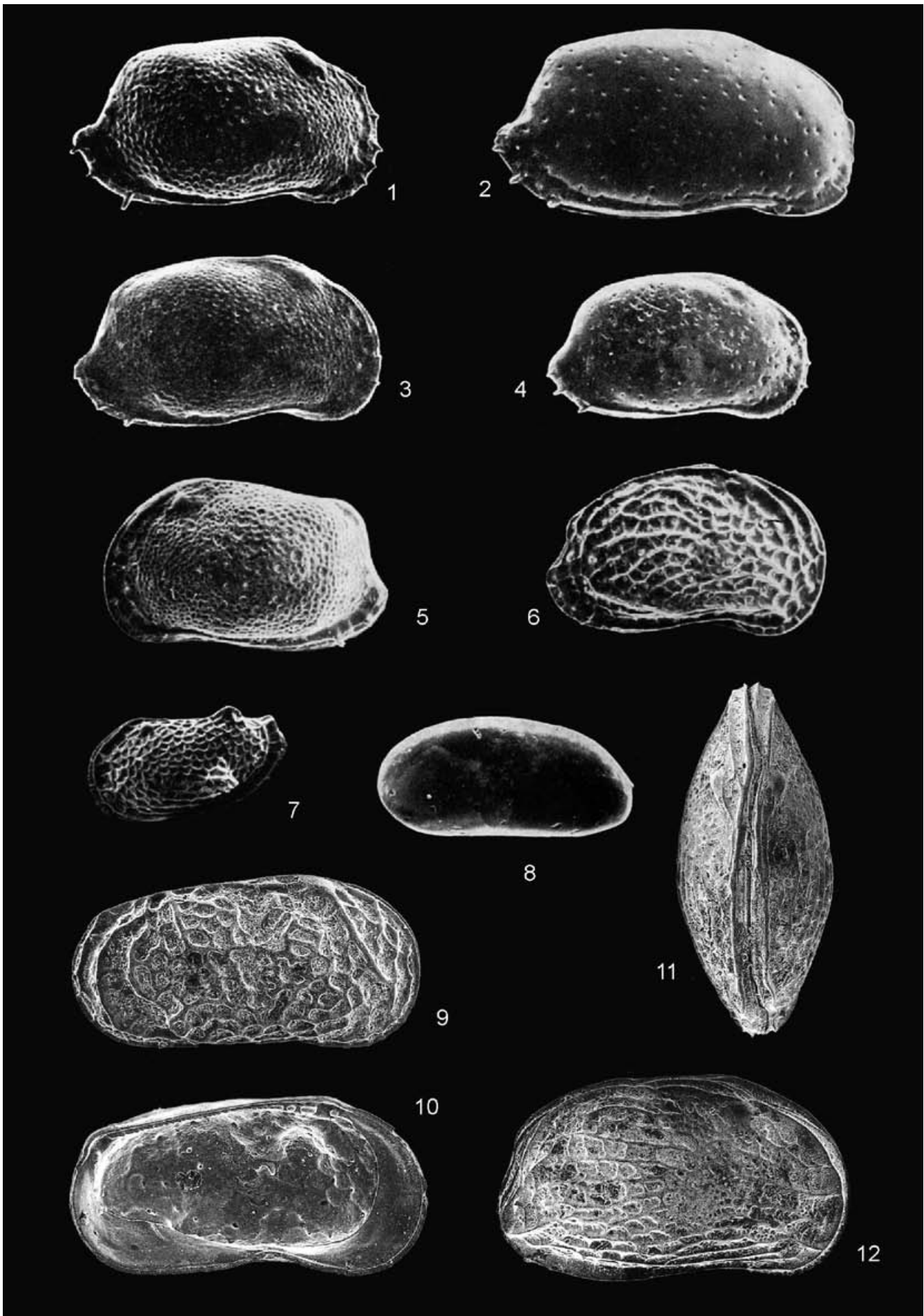


Plate 3

- Figs. 1–3: *Cytherella triestina* KOLLMANN, 1962.
Holotype.
Coll. no.: GBA 2008/134/0001, 1: left side, 2: anterior view, 3: dorsal view.
- Figs. 4–6: *Cythereis ? pisinensis* KOLLMANN, 1962.
Holotype.
Coll. no.: GBA 2008/135/0020, 4: right side, 5: dorsal view, 6: ventral view.
- Figs. 7–9: *Trachyleberidea ? sikici* KOLLMANN, 1962.
Holotype.
Coll. no.: GBA 2008/135/0024, 7: right side, 8: dorsal view, 9: ventral view.
- Figs. 10–12: *Cytherella ventroinflata* KOLLMANN, 1962.
Holotype.
Coll. no.: GBA 2008/135/0030, 10: lateral view, 11: anterior view, 12: dorsal view.
- Figs. 13–14: *Cytherella praehumilis* KOLLMANN, 1962.
Holotype.
Coll. no.: GBA 2008/135/0038, 13: left side, 14: dorsal view.
- Figs. 15–17: *Cytherella unguiformis* KOLLMANN, 1962.
Holotype.
Coll. no.: GBA 2008/135/0040, 15: left side, 16: dorsal view, 17: anterior view.
- Figs. 18–20: *Cythere reussi* PROCHÁZKA, 1893.
Syntype.
Specimen missing.
- Figs. 21–23: *Cythere blucinensis* PROCHÁZKA, 1893.
Syntype.
Coll. no.: GBA 2008/171/0008.
- Figs. 24–26: *Cythere fragilis* PROCHÁZKA, 1893.
Syntype.
Specimen missing.
- Figs. 27–29: *Cythere obliquus* PROCHÁZKA, 1893.
Syntype.
Specimen missing.
- Figs. 30–32: *Cythere oviformis* PROCHÁZKA, 1893.
Syntype.
Coll. no.: GBA 2008/171/0003.
- Figs. 33–35: *Cythere moravica* PROCHÁZKA, 1893.
Syntype.
Specimen missing.
- Figs. 36–38: *Cythere vejhonensis* PROCHÁZKA, 1893.
Syntype.
Coll. no.: GBA 2008/171/0001.
- Fig. 39: *Beyrichia roemeri* KAYSER, 1900.
Syntype.
Coll. no.: GBA 1900/002/0005.
- Fig. 40: *Beyrichia roemeri* KAYSER, 1900.
Syntype.
Coll. no.: GBA 1900/002/0028.

Magnifications: Fig. 1–17 = x 50, Fig. 18–38 = x 24.

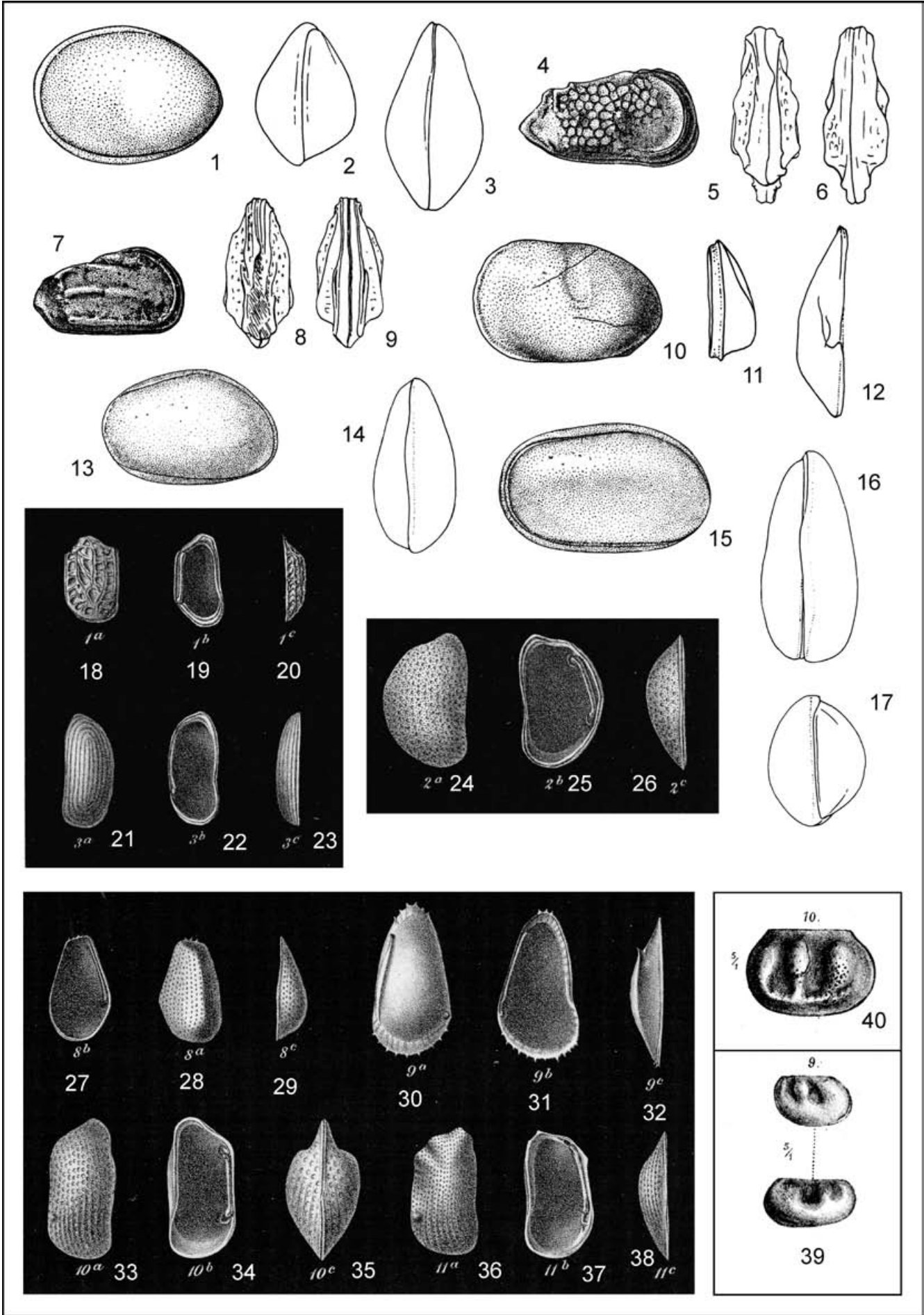


Plate 4

- Figs. 1–3: *Parabairdia ploechingeri* KOLLMANN, 1960b.
Holotype.
Coll. no.: GBA 2008/133/0001.
- Fig. 1: dorsal view.
Fig. 2: left side.
Fig. 3: right side.
- Figs. 4–5: *Ptychobairdia kuepperi* KOLLMANN, 1960b.
Holotype.
Coll. no.: GBA 2008/133/0006.
- Fig. 4: left side.
Fig. 5: anterior view.
- Figs. 6–9: *Ptychobairdia kristanae* KOLLMANN, 1960b.
Holotype.
Coll. no.: GBA 2008/133/0010.
- Fig. 6: left side.
Fig. 7: right side.
Fig. 8: dorsal view.
Fig. 9: anterior view.
- Figs. 10–13: *Ptychobairdia medwenitschi* KOLLMANN, 1960b.
Holotype.
Coll. no.: GBA 2008/133/0011.
- Fig. 10: left side.
Fig. 11: right side.
Fig. 12: dorsal view.
Fig. 13: anterior view.
- Figs. 14–15: *Ptychobairdia oberhauseri* KOLLMANN, 1960b.
Holotype.
Coll. no.: GBA 2008/133/0017.
- Fig. 14: left side.
Fig. 15: right side.

Magnification of all Figures = x 50.

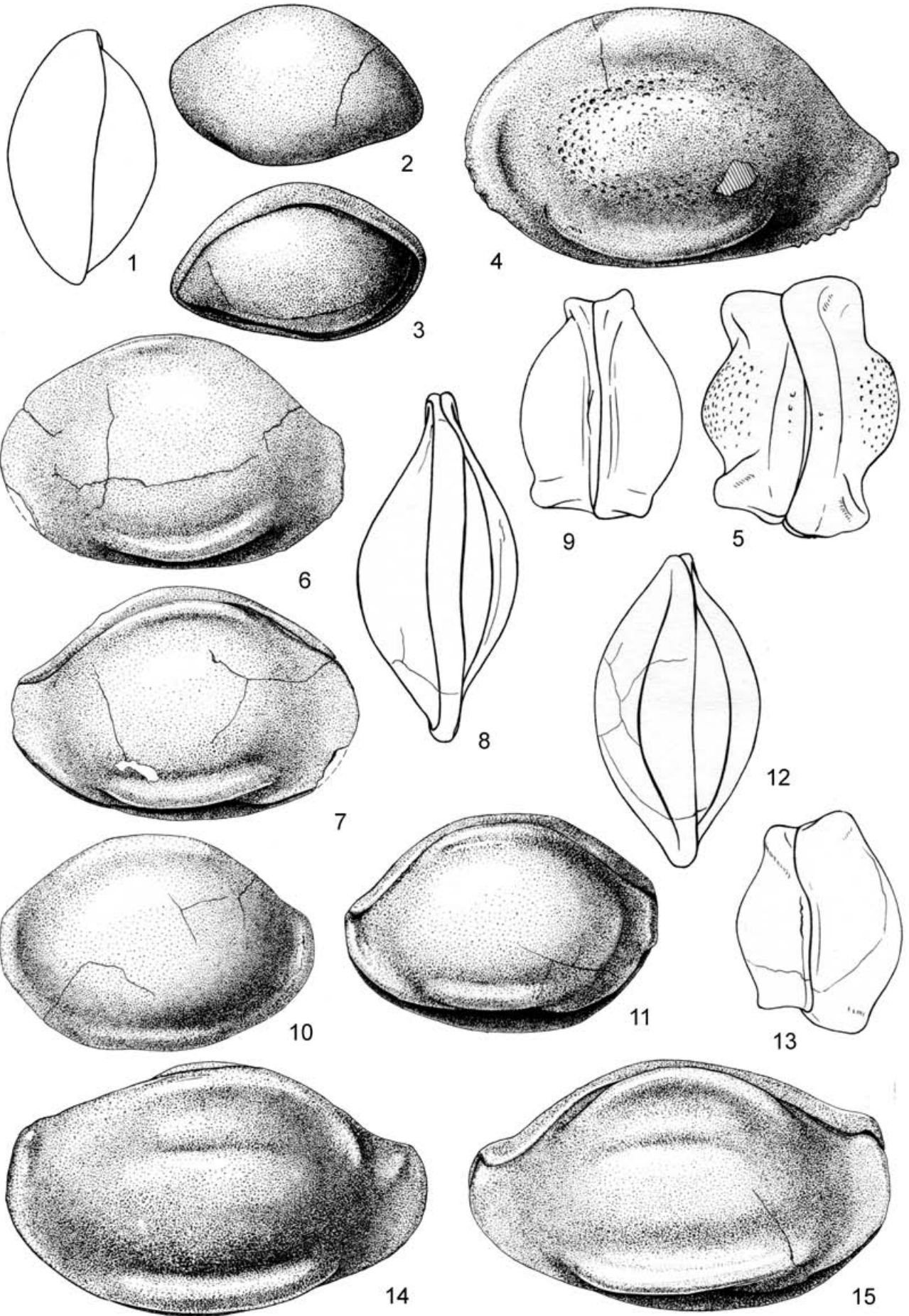


Plate 5

- Figs. 1, 3: *Ptychobairdia oberhauseri* KOLLMANN, 1960b.
Holotype.
Coll. no.: GBA 2008/133/0017.
- Fig. 1: dorsal view.
Fig. 3: anterior view.
- Figs. 2, 4–6: *Ptychobairdia schaubergeri* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0026.
- Fig. 2: dorsal view.
Fig. 4: anterior view.
Fig. 5: left side.
Fig. 6: right side.
- Figs. 7–9: *Dicerobairdia bicornuta* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0028.
- Fig. 7: left valve from outside.
Fig. 8: left valve from inside.
Fig. 9: dorsal view.
- Figs. 10–11: *Carinobairdia alpina* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0044.
- Fig. 10: right valve.
Fig. 11: dorsal view.
- Figs. 12–14: *Carinobairdia umbonata* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0042.
- Fig. 12: left valve from outside.
Fig. 13: left valve from inside.
Fig. 14: dorsal view.
- Figs. 15–16: *Carinobairdia triassica* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0039.
- Fig. 15: left valve from outside.
Fig. 16: left valve from inside.
- Magnifications: Figs. 1, 3, 5–16 = x 50 and Figs. 2, 4 = x 42.

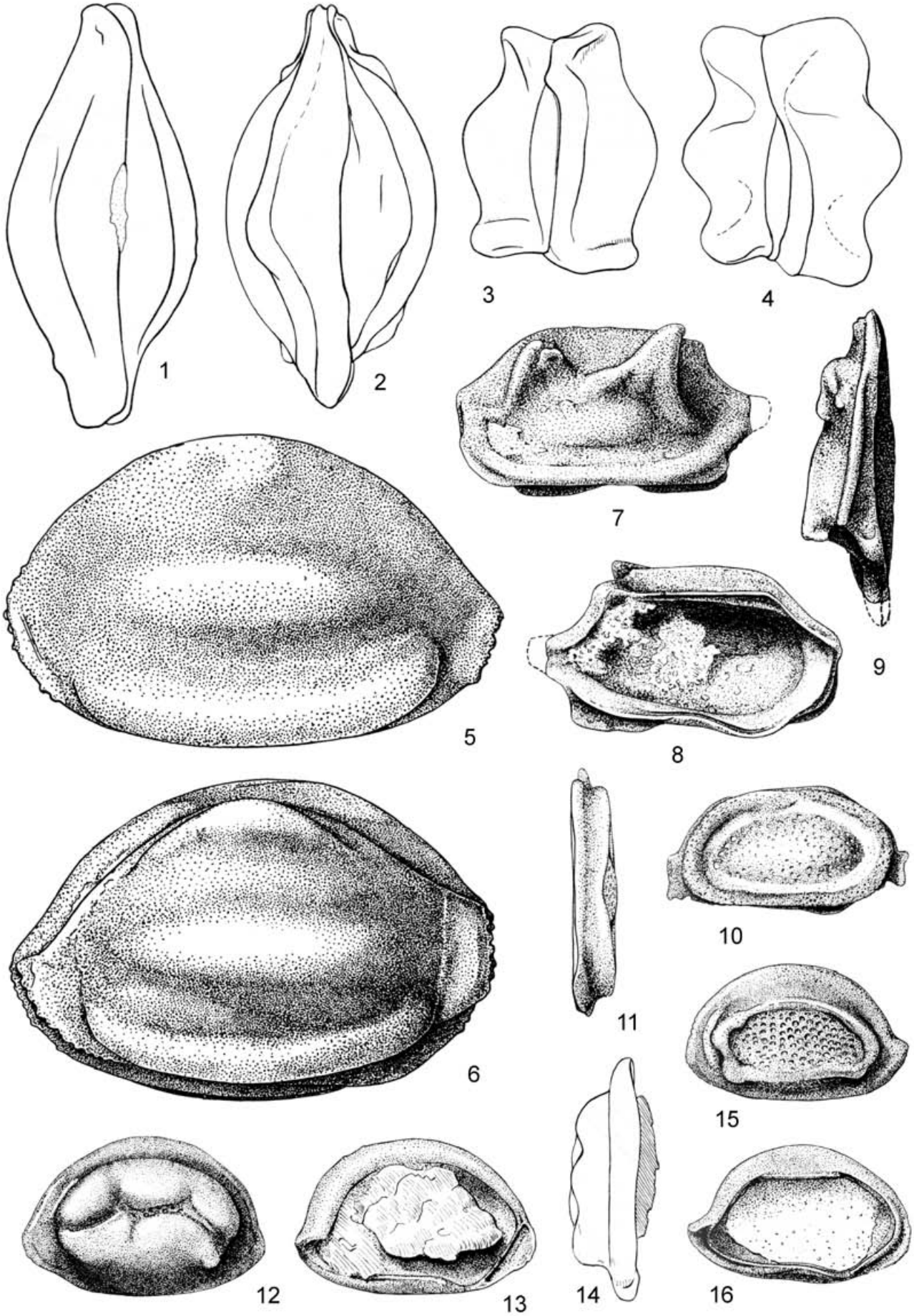


Plate 6

- Figs. 1–3: *Cryptobairdia hians* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0005.
- Fig. 1: left side.
Fig. 2: right side.
Fig. 3: ventral view.
- Figs. 4–5: *Anisobairdia salisburgensis* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0011.
- Fig. 4: left valve from outside.
Fig. 5: left valve from inside.
- Fig. 6: *Bairdia deformata* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0001.
- Fig. 7: *Carinobairdia umbonata* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0042.
- Figs. 8–11: *Anisobairdia cincta* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0008.
- Fig. 8: dorsal view.
Fig. 9: ventral view.
Fig. 10: left side.
Fig. 11: right side.
- Figs. 12–15: *Urobairdia angusta* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0004.
- Fig. 12: left side.
Fig. 13: right side.
Fig. 14: dorsal view.
Fig. 15: ventral view.
- Figs. 16–19: *Urobairdia austriaca* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0003.
- Fig. 16: left side.
Fig. 17: anterior view.
Fig. 18: dorsal view.
Fig. 19: ventral view.

Magnification of all Figures = x 50.

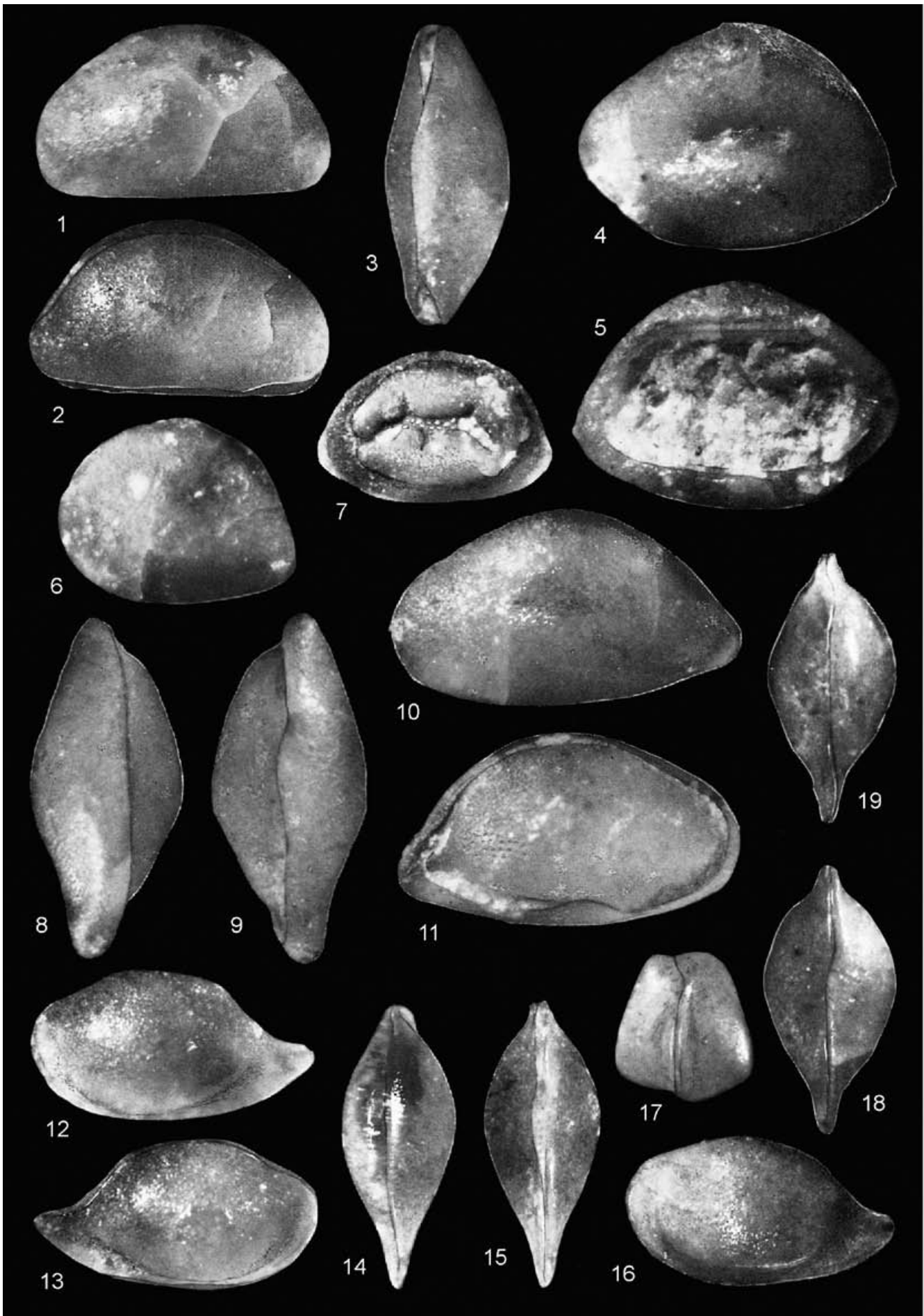


Plate 7

- Figs. 1–4: *Lobobairdia salinaria* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0007.
- Fig. 1: right side.
Fig. 2: left side.
Fig. 3: dorsal view.
Fig. 4: ventral view.
- Figs. 5–7: *Nodobairdia verrucosa*, KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0016.
- Fig. 5: dorsal view.
Fig. 6: left valve from outside.
Fig. 7: left valve from inside.
- Figs. 8–11: *Nodobairdia mammilata* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0012.
- Fig. 8: left side.
Fig. 9: right side.
Fig. 10: ventral view.
Fig. 11: dorsal view.
- Fig. 12: *Mirabairdia pernodosa* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0019.
- Fig. 13: *Dicerobairdia bicomuta* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0028.
- Figs. 14–15: *Dicerobairdia elegans* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0036.
- Fig. 14: left side.
Fig. 15: dorsal view.
- Figs. 16–17: *Dicerobairdia gruenbachensis* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0033.
- Fig. 16: left valve from outside.
Fig. 17: left valve from inside.
- Fig. 18–20: *Dicerobairdia ladinica* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0032.
- Fig. 18: dorsal view.
Fig. 19: left valve from outside.
Fig. 20: left valve from inside.
- Figs. 21–25: *Neobairdiolites placklesensis* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0038.
- Fig. 21: left side.
Fig. 22: right side.
Fig. 23: posterior view.
Fig. 24: dorsal view.
Fig. 25: ventral view.
- Figs. 26–29: *Bairdiolites semisculptus* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0037.
- Fig. 26: left side.
Fig. 27: right side.
Fig. 28: dorsal view.
Fig. 29: ventral view.

Magnification of all Figures = x 50.

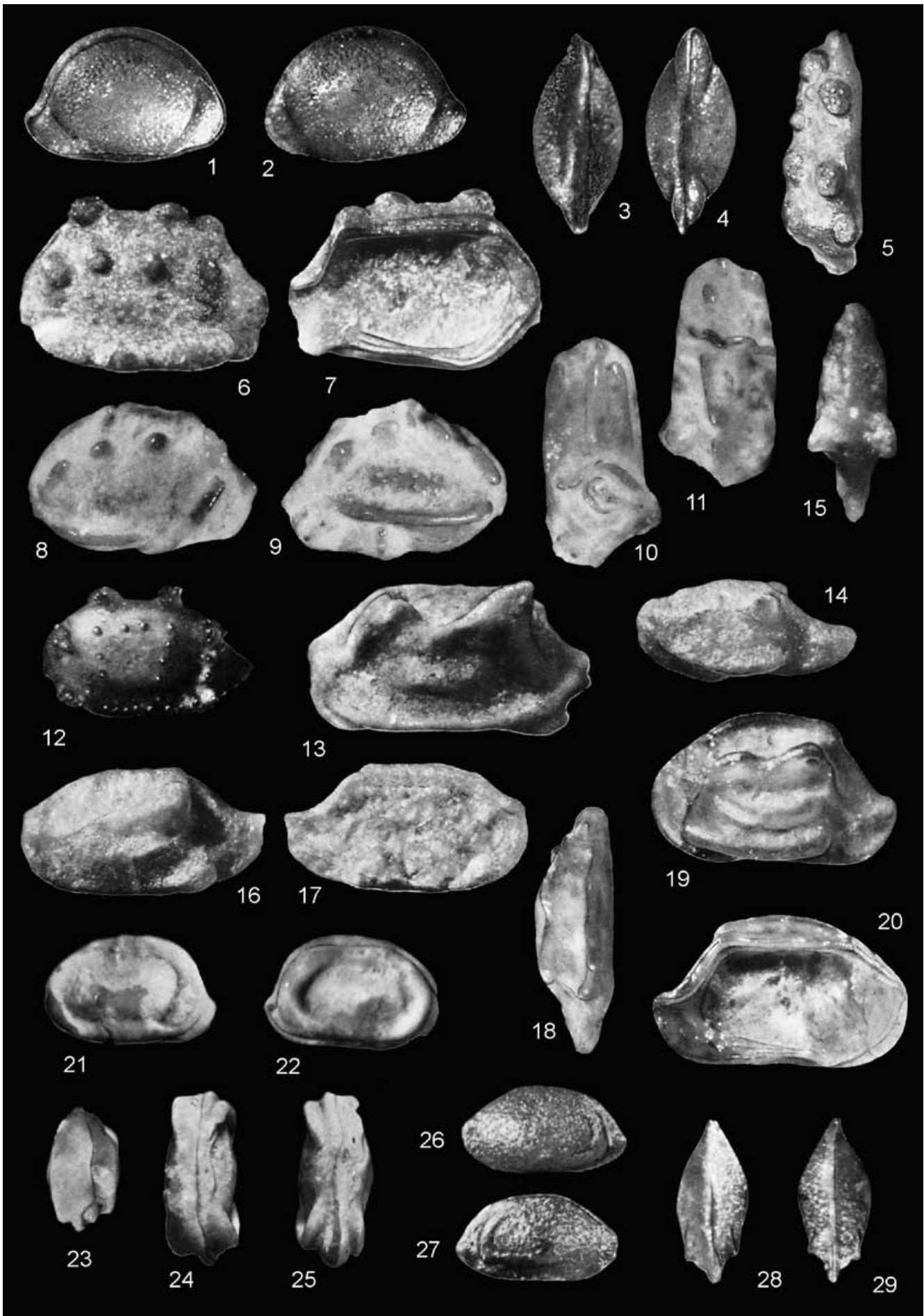


Plate 8

- Figs. 1–4: *Medwenitschia ornata* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0052.
- Fig. 1: left side.
Fig. 2: right side.
Fig. 3: dorsal view.
Fig. 4: ventral view.
- Fig. 5: *Carinobairdia triassica* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0039.
- Fig. 6: *Carinobairdia alta* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0047.
- Figs. 7–8: *Carinobairdia tenuicarinata* KOLLMANN, 1963.
Holotype.
Coll. no.: GBA 2008/136/0049.
- Fig. 7: left side.
Fig. 8: right side.
- Fig. 9: *Polycope aghdarbandensis* KRISTAN-TOLLMANN, 1991.
Holotype.
Coll. no.: GBA 1985/005/0011.
- Figs. 10–11: *Ptychobairdia ruttneri* KRISTAN-TOLLMANN, 1991.
Holotype.
Coll. no.: GBA 1985/005/0004.
- Fig. 10: left side.
Fig. 11: right side.

Magnification of Figures 1–8 = x 50. Scale bars of Figures 10–11 not defined by original author.

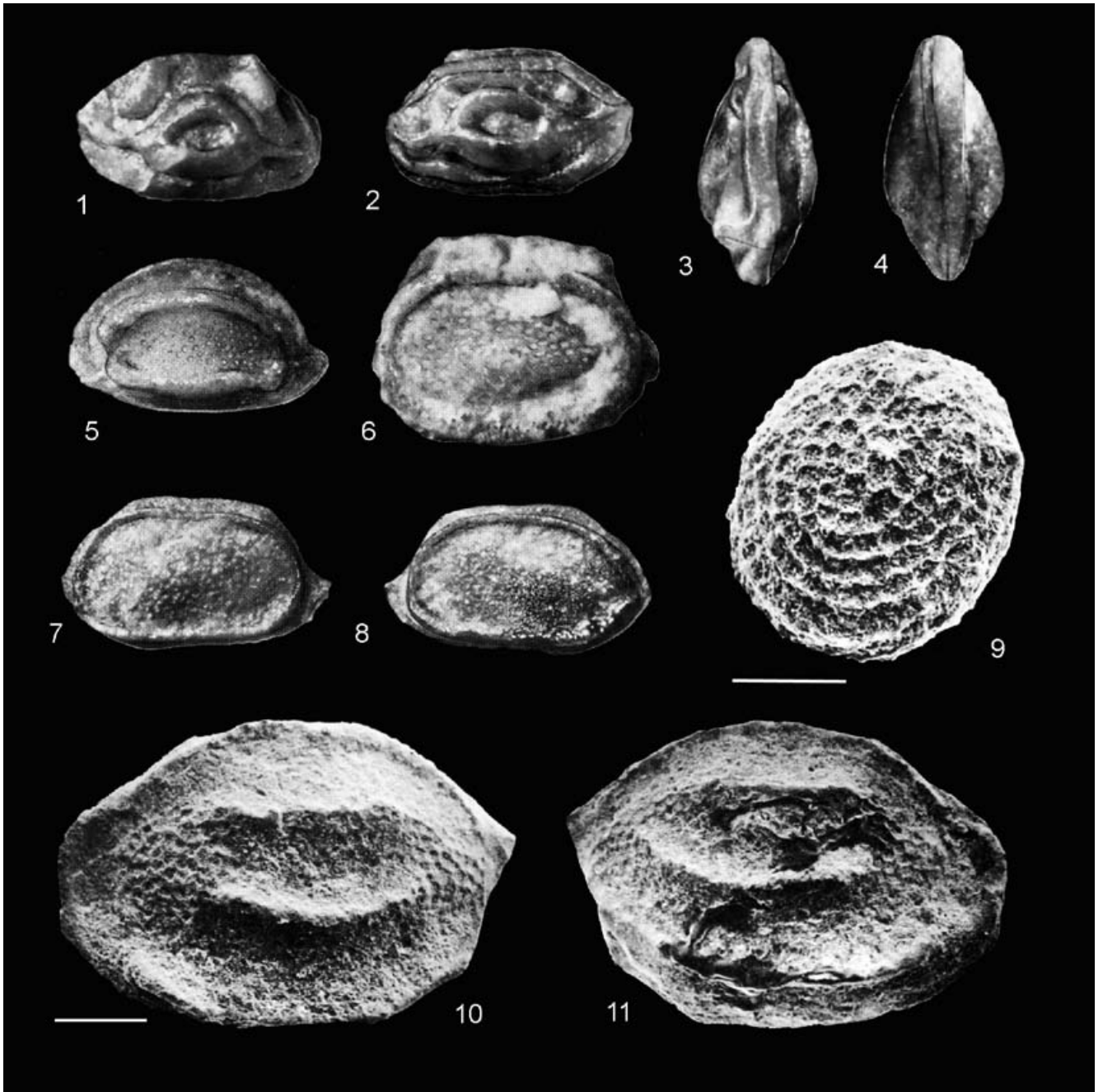
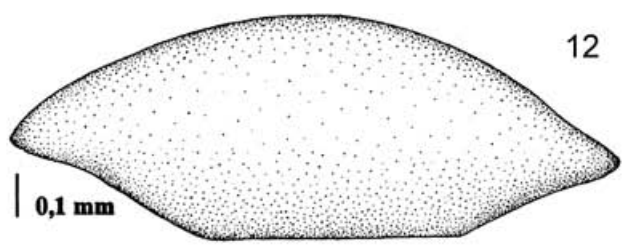
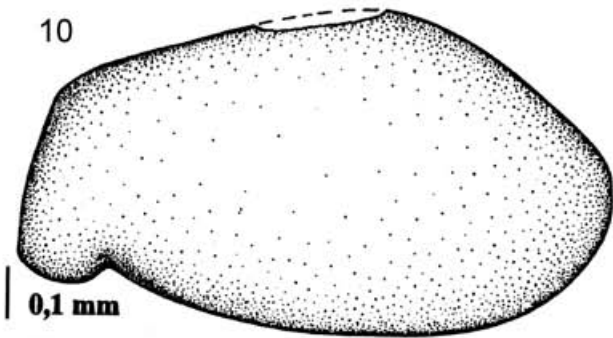
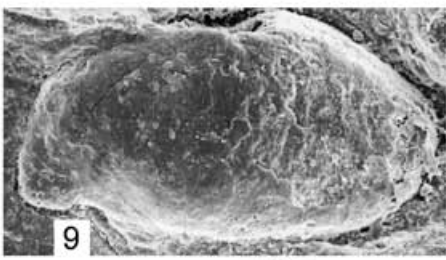
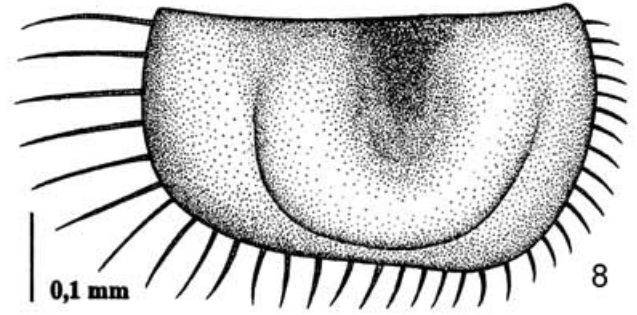
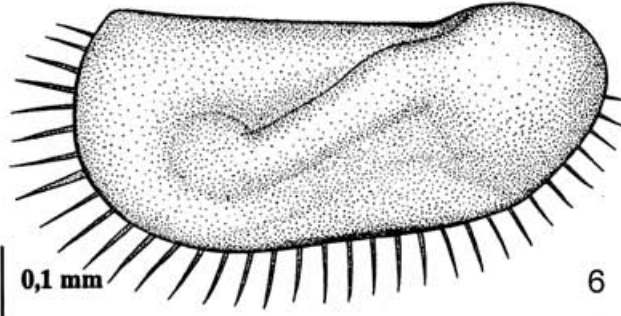
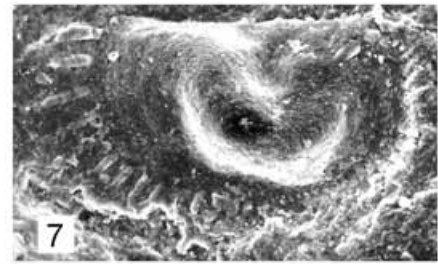
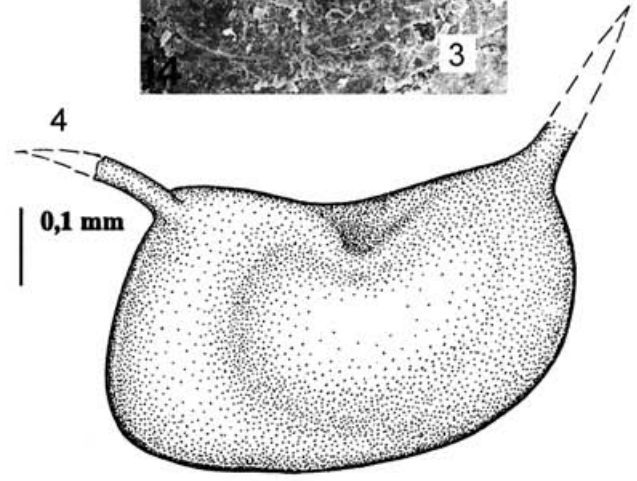
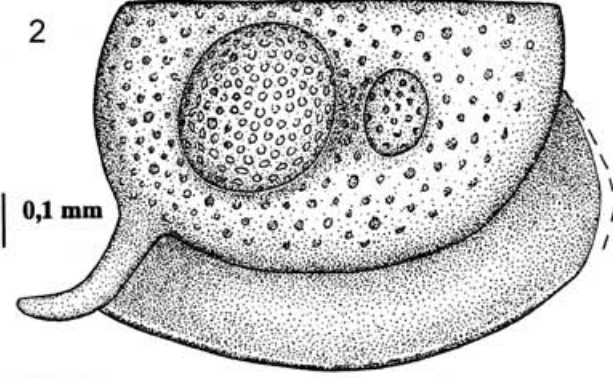
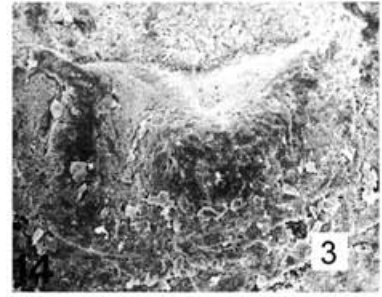


Plate 9

- Figs. 1–2: *Hollinella (Hollinella) bulbolobata* SCHRAUT, 1996.
Holotype.
Coll. no.: GBA 1996/002/0020.
- Figs. 3–4: *Knoxella ? bicornuta* SCHRAUT, 1996.
Holotype.
Coll. no.: GBA 1996/002/0079.
- Figs. 5–6: *Pseudobeyrichiopsis angustata* SCHRAUT, 1996.
Holotype.
Coll. no.: GBA 1996/002/0082.
- Figs. 7–8: *Pseudobeyrichiopsis longispinosa* SCHRAUT, 1996.
Holotype.
Coll. no.: GBA 1996/002/0085.
- Figs. 9–10: *Acratia dorsoangulata* SCHRAUT, 1996.
Holotype.
Coll. no.: GBA 1996/002/0102.
- Figs. 11–12: *Acratia rectiventralis* SCHRAUT, 1996.
Holotype.
Coll. no.: GBA 1996/002/0103.
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Catalogue of the Triassic and Lower Jurassic Brachiopod Holotypes of Alexander BITTNER in the Collections of the Geological Survey of Austria

MILOŠ SIBLÍK*)

1 Text-Figure, 4 Plates

*Brachiopoda
 Mesozoic
 Eastern Alps
 Type Specimens
 Paleontological collection*

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Katalog der Brachiopoden-Holotypen von Alexander BITTNER aus der Trias und dem Unter-Jura in den Sammlungen der Geologischen Bundesanstalt

Zusammenfassung

Die vorliegende Arbeit ist ein Bestandsverzeichnis der 44 an der Geologischen Bundesanstalt in Wien aufbewahrten Brachiopoden-Holotypen von Alexander BITTNER (1850–1902) aus der Trias und dem Unter-Jura.

Abstract

This paper gives an inventory of the 44 Triassic and Lower Jurassic brachiopod holotypes established by Alexander BITTNER (1850–1902) and currently deposited in the collections of the Geological Survey of Austria, in Vienna.

Introduction

This catalogue is the first part of a planned catalogue of all Mesozoic brachiopod holotypes deposited in the collections of the Geological Survey in Vienna, including the Triassic and Lower Jurassic holotypes of species established by Alexander BITTNER (1888, 1890, 1892, 1894, 1896, 1903). The bulk of BITTNER's type material of the Alpine Mesozoic brachiopods was deposited in Vienna: the greater part in the Geological Survey (Geologische Bundesanstalt) and a smaller part in the paleontological collection of the Natural History Museum. This paper deals with species which are all based on one specimen only; that is, they are holotypes by monotypy, each being a holotypus monotypicus.

After World War II, the major part of the brachiopod material was identified and the nearly complete original type

collection put in order (SIEBER, 1981). This collection was used as fundamental material for the catalogue of the Austrian Triassic brachiopod fauna (SIBLÍK, 1988, 2001).

The holotypes have been initially divided into Triassic or Lower Jurassic ones and then sorted by the year of publication, within which they have been listed by their inventory numbers. The description has been divided as follows: the original name given in the publication of BITTNER, the reference to the plate and figure in the present catalogue, the inventory number, name of the collector if known, stratigraphic level, type locality, number of plate and figure in the original publication, remarks, and the valid name according to present knowledge (this last was mostly adopted from SIBLÍK, 1988).

Missing holotypes are listed at the end of the catalogue.

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Text-Fig. 1.
BITTNER'S original handwriting is preserved at some labels in the brachiopod collection.

List of Type Specimens

Triassic

BITTNER, A. (1890): Brachiopoden der alpinen Trias. – Abhandlungen der k. k. Geologischen Reichsanstalt, 14.

Rhynchonella teutonica BITTNER, 1890 (Pl. 1, Fig. 1)

Coll. no.: GBA 1890/002/0026.
Leg.: BITTNER, 1881.
Type level: Middle Triassic.
Type locality: Road from Fantoni to Caili near Recoaro, Italy.
Type figure: BITTNER, A., 1890: p. 49, Pl. 31, Fig. 26.
Remark: Generic attribution by DAGYS, 1974.
***Volirhynchia teutonica* (BITTNER).**

Terebratula laricimontana BITTNER, 1890 (Pl. 1, Fig. 2)

Coll. no.: GBA 1890/002/0031.
Leg.: FUGGER, 1888.
Type level: Middle Triassic, Schreyeralm Beds.
Type locality: Lärcheck near Berchtesgaden, Bavaria, Germany.
Type figure: BITTNER, A., 1890: p. 39, Pl. 33, Fig. 21.
“*Terebratula*” laricimontana BITTNER.

Rhynchonella productifrons BITTNER, 1890 (Pl. 1, Fig. 3)

Coll. no.: GBA 1890/002/0037.
Type level: Middle Triassic, Schreyeralm Beds.

Type locality: Schreyeralm near Hallstatt, Upper Austria, Austria.

Type figure: BITTNER, A., 1890: p. 41, Pl. 31, Fig. 18.

Remark: Generic attribution by DAGYS, 1974.

***Volirhynchia productifrons* (BITTNER).**

Rhynchonella cimbrica BITTNER, 1890 (Pl. 1, Fig. 4)

Coll. no.: GBA 1890/002/0052.
Leg.: BITTNER, 1881.
Type level: Middle Triassic.
Type locality: Val Asnicar near Recoaro, Italy.
Type figure: BITTNER, A., 1890: p. 48, Pl. 31, Fig. 24.
Remark: The species most probably belongs to *Volirhynchia* DAGYS, 1974.
“*Rhynchonella*” cimbrica BITTNER.

Thecidium gryphaeatum BITTNER, 1890 (Pl. 1, Fig. 5)

Coll. no.: GBA 1890/002/0082.
Type level: Triassic, San Cassiano Formation.
Type locality: St. Cassian, Italy.
Type figure: BITTNER, A., 1890: p. 68, Pl. 1, Fig. 17.
Remark: Generic attribution obscure.
“*Thecidea*” gryphaeata (BITTNER).

Spiriferina tyrolensis BITTNER, 1890 (Pl. 1, Fig. 6)

Coll. no.: GBA 1890/002/0089.
Donation: KLIPSTEIN.
Type level: Triassic, San Cassiano Formation.
Type locality: St. Cassian, Italy.
Type figure: BITTNER, A., 1890: p. 75, Pl. 2, Fig. 5.
“*Spiriferina*” tyrolensis BITTNER.

Spiriferina badiotica BITTNER, 1890 (Pl. 1, Fig. 7)

Coll. no.: GBA 1890/002/0090.
Type level: Triassic, San Cassiano Formation.
Type locality: St. Cassian, Italy.
Type figure: BITTNER, A., 1890: p. 75, Pl. 2, Fig. 3.
“*Spiriferina*” badiotica BITTNER.

Spiriferina impressula BITTNER, 1890 (Pl. 1, Fig. 8)

Coll. no.: GBA 1890/002/0092.
Type level: Triassic, San Cassiano Formation.
Type locality: St. Cassian, Italy.
Type figure: BITTNER, A., 1890: p. 76, Pl. 40, Fig. 23.
Remark: Generic attribution according to DAGYS, 1974.
***Sinuocosta* (?) impressula (BITTNER).**

***Retzia ladina* BITTNER, 1890**

(Pl. 1, Fig. 9)

Coll. no.: GBA 1890/002/0108.

Type level: Triassic, San Cassiano Formation.

Type locality: St. Cassian, Italy.

Type figure: BITTNER, A., 1890: p. 92, Pl. 3, Fig. 1.

***“Retzia” ladina* BITTNER.**

***Rhynchonella Blaasii* BITTNER, 1890**

(Pl. 2, Fig. 2)

Coll. no.: GBA 1890/002/0120.

Type level: Triassic, San Cassiano Formation.

Type locality: St. Cassian, Italy.

Type figure: BITTNER, A., 1890: p. 104, Pl. 3, Fig. 24.

Remark: Generic attribution according to DAGYS, 1974.

***Veghirhynchia (?) blaasi* (BITTNER).**

***Amphiclina scitula* BITTNER, 1890**

(Pl. 1, Fig. 10)

Coll. no.: GBA 1890/002/0131.

Type level: Triassic.

Type locality: “Falzaregostraße” W of Cortina d’Ampezzo, Italy.

Type figure: BITTNER, A., 1890: p. 119, Pl. 30, Fig. 19.

***Amphiclina scitula* BITTNER.**

***Amphiclina aptera* BITTNER, 1890**

(Pl. 1, Fig. 12)

Coll. no.: GBA 1890/002/0137.

Type level: Triassic.

Type locality: Sela above Podmelec (Podmeuz), SE of Tolmin (Tolmein), Slovenia.

Type figure: BITTNER, A., 1890: p. 122, Pl. 30, Fig. 20.

***Amphiclina aptera* BITTNER.**

***Amphiclina coarctata* BITTNER, 1890**

(Pl. 1, Fig. 11)

Coll. no.: GBA 1890/002/0189.

Leg.: BITTNER, 1887.

Type level: Triassic, *Cardita* Beds.

Type locality: Lieglergraben SE of Gußwerk, Styria, Austria.

Type figure: BITTNER, A., 1890: p. 149, Pl. 30, Fig. 18.

***Amphiclina coarctata* BITTNER.**

***Rhynchonella salinaria* BITTNER, 1890**

(Pl. 2, Fig. 3)

Coll. no.: GBA 1890/002/0239.

Type level: Upper Triassic, Zlambach Beds.

Type locality: Zlambach, Bachwirth, Upper Austria, Austria.

Type figure: BITTNER, A., 1890: p. 169, Pl. 37, Fig. 30.

***“Rhynchonella” salinaria* BITTNER.**

***Waldheimia (Aulacothyris) dualina* BITTNER, 1890**

(Pl. 2, Fig. 1)

Coll. no.: GBA 1890/002/0260.

Type level: Triassic, Hallstatt Limestone, Beds with *Cochloceras fischeri*.

Type locality: Steinbergkogel, Hallstatt, Upper Austria, Austria.

Type figure: BITTNER, A., 1890: p. 200, Pl. 5, Fig. 18.

***Aulacothyris dualina* BITTNER.**

? *Nucleatula styriaca* BITTNER, 1890

(Pl. 2, Fig. 5)

Coll. no.: GBA 1890/002/0271.

Leg.: BITTNER, 1885.

Type level: Triassic, Hallstatt Limestone, “*Subbullatus*” Beds.

Type locality: Bergstein near Landl/Enns, Styria, Austria.

Type figure: BITTNER, A., 1890: p. 210, Pl. 7, Fig. 8.

***Nucleatula styriaca* BITTNER.**

***Terebratula (Propygope) Hagar* BITTNER, 1890**

(Pl. 2, Fig. 4)

Coll. no.: GBA 1890/002/0272/1.

Leg.: BITTNER, 1887.

Type level: Upper Triassic, Hallstatt Limestone.

Type locality: Neun Kögerln, SE of Gußwerk-Mariazell, Styria, Austria.

Type figure: BITTNER, A., 1890: p. 210, Pl. 5, Fig. 24.

Remark: Genoholotype (BITTNER, 1890).

***Propygope hagar* BITTNER.**

***Rhynchonella intermixta* BITTNER, 1890**

(Pl. 2, Fig. 6)

Coll. no.: GBA 1890/002/0290.

Leg.: BITTNER, 1877.

Type level: Upper Triassic.

Type locality: Mühltal, Lower Austria, Austria.

Type figure: BITTNER, A., 1890: p. 225, Pl. 13, Fig. 10.

***Austriellula intermixta* (BITTNER).**

***Rhynchonella Mojsisovicsii* BITTNER, 1890**

(Pl. 2, Fig. 7)

Coll. no.: GBA 1890/002/0292.

Type level: Upper Triassic, Hallstatt Limestone.

Type locality: Steinbergkogel, Hallstatt, Upper Austria, Austria.

Type figure: BITTNER, A., 1890: p. 226, Pl. 13, Fig. 8.

***“Rhynchonella” mojsisovicsi* BITTNER.**

***Amphiclina ambigua* BITTNER, 1890**

(Pl. 2, Fig. 10)

Coll. no.: GBA 1890/002/0316.

Type level: Upper Triassic, “Weisser Crinoidenkalk”.

Type locality: Steinbergkogel, Hallstatt, Upper Austria, Austria.

Type figure: BITTNER, A., 1890: p. 238, Pl. 16, Fig. 20.

***Amphiclina ambigua* BITTNER.**

***Amphiclina unguлина* BITTNER, 1890**

(Pl. 2, Fig. 9)

Coll. no.: GBA 1890/002/0317.

Leg.: GEYER.

Type level: Upper Triassic, Hallstatt Limestone.

Type locality: Lieglergraben below Tonion, near Gußwerk, Styria, Austria.

Type figure: BITTNER, A., 1890: p. 238, Pl. 30, Fig. 21.

***Amphiclina unguлина* BITTNER.**

***Amphiclinodonta magna* BITTNER, 1890**

(Pl. 3, Fig. 2)

Coll. no.: GBA 1890/002/0322.

Leg.: BITTNER, 1877.

Type level: Upper Triassic.

Type locality: Klausserriegel, Dürrenbach near Waldegg, Piesting Valley, Lower Austria, Austria.

Type figure: BITTNER, A., 1890: p. 242, Pl. 16, Fig. 23.

***Amphiclinodonta magna* BITTNER.**

***Spirigera Cislensis* BITTNER, 1890**

(Pl. 3, Fig. 6)

Coll. no.: GBA 1890/002/0334.

Leg.: VACEK.

Type level: Triassic, "Cislon Dolomite".

Type locality: Monte Cislone, Neumarkt/Etsch (Egna, Trentino), Italy.

Type figure: BITTNER, A., 1890: p. 255, Pl. 29, Fig. 32, 33 (Fig. 33 is the external mould of Fig. 32).

Remark: The original specimen – pedicle valve – was described and figured by POLIFKA erroneously under *Rhynchonella quadriplecta* MÜNST. (1886: p. 604, Pl. 8, Fig. 14). After its further isolation from the rock, the complete specimen with both valves revealed "spirigerid" characters (see notice 2 in: BITTNER, 1890 at the bottom of page 103).

***Tetractinella cislensis* (BITTNER).**

***Terebratula Sturi* var. *juvavica* BITTNER, 1890**

(Pl. 3, Fig. 4)

Coll. no.: GBA 1890/002/0337.

Leg.: BITTNER, 1882.

Type level: Upper Triassic, Dachstein Limestone.

Type locality: Putzenköpfl N of Dürrenberg, Hallein, Salzburg, Austria.

Type figure: BITTNER, A., 1890: p. 257, Pl. 28, Fig. 1.

"*Terebratula*" *sturi juvavica* BITTNER.

***Waldheimia (Aulacothyris ?) patricia* BITTNER, 1890**

(Pl. 3, Fig. 3)

Coll. no.: GBA 1890/002/0339.

Leg.: BITTNER, 1884.

Type level: Upper Triassic, Dachstein Limestone.

Type locality: Putzenköpfl N of Dürrenberg, Hallein, Salzburg, Austria.

Type figure: BITTNER, A., 1890, p. 258, Pl. 26, Fig. 20.

***Aulacothyropsis patricia* (BITTNER).**

***Waldheimia (Aulacothyris) reflexa* BITTNER, 1890**

(Pl. 2, Fig. 8)

Coll. no.: GBA 1890/002/0340.

Leg.: BITTNER, 1884.

Type level: Upper Triassic, Dachstein Limestone.

Type locality: Tristlwand, Hagengebirge, Salzburg, Austria.

Type figure: BITTNER, A., 1890: p. 258, Pl. 26, Fig. 21.

Remark: Genoholotype of *Aulacothyropsis* DAGYS, 1959.

***Aulacothyropsis reflexa* (BITTNER).**

? *Waldheimia festiva* BITTNER, 1890

(Pl. 3, Fig. 1)

Coll. no.: GBA 1890/002/0342.

Leg.: BITTNER, 1884.

Type level: Upper Triassic, Dachstein Limestone.

Type locality: Putzenköpfl N of Dürrenberg, Hallein, Salzburg, Austria.

Type figure: BITTNER, A., 1890: p. 259, Pl. 26, Fig. 22.

Remark: The specimen is named ?*Waldheimia (Aulacothyris) festiva* in the explanation to Plate 26. In the description of the species (p. 259) one more specimen is included, coming from Oberseeland (Zgornje Jezersko) in Slovenia. However, it was introduced by BITTNER, 1890: p. 137 as ?*Waldheimia (Aulacothyris) cfr. festiva*.

***Ornatothyrella festiva* (BITTNER).**

***Rhynchonella Lillii* BITTNER, 1890**

(Pl. 3, Fig. 5)

Coll. no.: GBA 1890/002/0349.

Leg.: BITTNER, 1882.

Type level: Upper Triassic, Dachstein Limestone.

Type locality: Putzenköpfl N of Dürrenberg, Hallein, Salzburg, Austria.

Type figure: BITTNER, A., 1890: p. 262, Pl. 27, Fig. 23.

"*Rhynchonella*" *lillii* BITTNER.

***Rhynchonella spreta* BITTNER, 1890**

(Pl. 3, Fig. 8)

Coll. no.: GBA 1890/002/0358.

Type level: Upper Triassic.

Type locality: Hohe Wand, Frankenhof, Lower Austria, Austria.

Type figure: BITTNER, A., 1890: p. 266, Pl. 27, Fig. 27.

Remark: DAGYS (1963) connected this species with *Septaliphoria* LEIDHOLD.

"*Rhynchonella*" *spreta* BITTNER.

***Rhynchonella uncinulina* BITTNER, 1890**

(Pl. 3, Fig. 9)

Coll. no.: GBA 1890/002/0362.

Type level: Upper Triassic, Dachstein Limestone.

Type locality: Putzenköpfl N of Dürrnberg, Hallein, Salzburg, Austria.

Type figure: BITTNER, A., 1890: p. 267, Pl. 24, Fig. 20.

***“Rhynchonella” uncinulina* BITTNER.**

***Rhynchonella pusillula* BITTNER, 1890**

(Pl. 4, Fig. 2)

Coll. no.: GBA 1890/002/0364.

Leg.: BITTNER, 1887.

Type level: Upper Triassic.

Type locality: Tonionalpe, Lechnergraben near Gußwerk, Styria, Austria.

Type figure: BITTNER, A., 1890: p. 268, Pl. 24, Fig. 18.

Remark: SULSER (1993) mentioned this species as *Norella* ? *pusillula*.

***“Rhynchonella” pusillula* BITTNER.**

***Retzia latiuscula* BITTNER, 1890**

(Pl. 4, Fig. 3)

Coll. no.: GBA 1890/002/0381.

Leg.: BITTNER, 1877.

Type level: Upper Triassic.

Type locality: Brunner Eben, Wr. Neustadt, Lower Austria, Austria.

Type figure: BITTNER, A., 1890: p. 275, Pl. 29, Fig. 16.

***“Retzia” latiuscula* BITTNER.**

BITTNER, A. (1892): Brachiopoden der alpinen Trias. Nachtrag I. – Abhandlungen der k. k. Geologischen Reichsanstalt, 17/2.

***Rhynchonella vulnerata* BITTNER, 1892**

(Pl. 4, Fig. 1)

Coll. no.: GBA 1892/001/0085.

Leg.: BITTNER, 1891.

Type level: Triassic, “Korallenkalke der Raxalpe”.

Type locality: Preinerwand, Raxalpe, Lower Austria, Austria.

Type figure: BITTNER, A., 1892: p. 32, Pl. 4, Fig. 34.

***“Rhynchonella” vulnerata* BITTNER.**

***Waldheimia (Aulacothyris) integrella* BITTNER, 1892**

(Pl. 4, Fig. 4)

Coll. no.: GBA 1892/001/0095.

Type level: Triassic, “Korallenkalke des Schneeberges”.

Type locality: Kuhschneeberg, Schneeberg, Lower Austria, Austria.

Type figure: BITTNER, A., 1892: p. 35, Pl. 2, Fig. 24.

***Aulacothyris integrella* BITTNER.**

BITTNER, A. (1896): Neue Brachiopoden und eine neue Halobia der Trias von Balia in Kleinasien. – Jahrbuch der k. k. Geologischen Reichsanstalt, 45/2–3 (1895).

***Rhynchonella Baliana* BITTNER, 1896**

(Pl. 3, Fig. 10)

Coll. no.: GBA 1896/003/0003

Leg.: MANZAVINOS.

Type level: Triassic.

Type locality: Memisch-Oglou near Balia-Maaden, Turkey.

Type figure: BITTNER, A., 1896: p. 251, Pl. 11, Fig. 4.

***Caucasorhynchia* (?) *baliana* (BITTNER)** according to DAGYS, 1963 and SULSER, 1993.

BITTNER, A. (1903): Brachiopoden und Lamelli-branchiaten aus der Trias von Bosnien, Dalmatien und Venetien. – Jahrbuch der k. k. Geologischen Reichsanstalt, 52 (1902).

***Aulacothyris praevaliana* BITTNER, 1903**

(Pl. 3, Fig. 7)

Coll. no.: GBA 2008/115/0005.

Type level: Middle Triassic, Muschelkalk, “Helle Crinoidenkalke”.

Type locality: Počmin, Spizza, South Dalmatia, Montenegro.

Type figure: BITTNER, A., 1903: p. 500, Pl. 19, Fig. 5.

***Aulacothyris praevaliana* BITTNER.**

***Aulacothyris simulatrix* BITTNER, 1903**

(Pl. 4, Fig. 5)

Coll. no.: GBA 2008/115/0007.

Type level: Middle Triassic, Muschelkalk.

Type locality: Grkova voda Valley, South Dalmatia, Montenegro.

Type figure: BITTNER, A., 1903: p. 525, Pl. 19, Fig. 18.

***Aulacothyris simulatrix* BITTNER.**

***Aulacothyris Geyeri* BITTNER, 1903**

(Pl. 4, Fig. 8)

Coll. no.: GBA 2008/115/0008.

Type level: Triassic.

Type locality: Monte Cucco near Paluzza, Friaul, Italy.

Type figure: BITTNER, A., 1903: p. 528, Pl. 19, Fig. 19.

***Aulacothyris geyeri* BITTNER.**

***Waldheimia planoconvexa* BITTNER, 1903**

(Pl. 4, Fig. 6)

Coll. no.: GBA 2008/115/0013.

Type level: Middle Triassic, Muschelkalk.

Type locality: Monte Cucco near Paluzza, Friaul, Italy.

Type figure: BITTNER, A., 1903: p. 530, Pl. 21, Fig. 7.

***Aulacothyris planoconvexa* (BITTNER).**

***Rhynchonella Bukowskii* BITTNER, 1903**

(Pl. 4, Fig. 7)

Coll. no.: GBA 2008/115/0019.

Leg.: BUKOWSKI.

Type level: Middle Triassic, Muschelkalk.

Type locality: between Stanišić and Grkova voda Valley, Budva, South Dalmatia, Montenegro.

Type figure: BITTNER, A., 1903: p. 524, Pl. 21, Fig. 18.

***“Rhynchonella” bukowskii* BITTNER.**

***Spirigera (Anisactinella) matutina* var. *euplecta* BITTNER, 1903**

(Pl. 4, Fig. 9)

Coll. no.: GBA 2008/115/0031.

Leg.: BUKOWSKI.

Type level: Middle Triassic, Muschelkalk.

Type locality: between Stanišić and Grkova voda Valley, Budva, South Dalmatia, Montenegro.

Type figure: BITTNER, A., 1903: p. 523, Pl. 24, Fig. 20.

***Anisactinella matutina euplecta* BITTNER.**

Lower Jurassic

BITTNER, A. (1888): Über Koninckiniden des alpinen Lias. – Jahrbuch der k. k. Geologischen Reichsanstalt, 37/2.

***Koninckina styriaca* BITTNER, 1888**

(Pl. 4, Fig. 10)

Coll. no.: GBA 1888/01/0002.

Leg.: BITTNER, 1884.

Type level: Lower Jurassic.

Type locality: Gams near Landl/Enns, Styria, Austria (“Annerlbauerkogel, links vom Ausgange der sogenannten ‘Noth’ bei Gams unweit Landl a. d. Enns”).

Type figure: BITTNER, A., 1888: p. 286, Pl. 14, Fig. 6.

Remark: Generic affiliation according to VÖRÖS (2003).

***Koninckodonta styriaca* (BITTNER).**

***Amphiclinina (Amphiclinodonta) liasina* BITTNER, 1888**

(Pl. 4, Fig. 11)

Coll. no.: GBA 1888/001/0003.

Leg.: BITTNER, 1883.

Type level: Lower Jurassic, Sinemurian, Hierlatz Limestone.

Type locality: Kratzalm (Gratzalpe, Kratzalpe) SW of Golling/Salzach, Salzburg, Austria.

Type figure: BITTNER, A., 1888: p. 288, Pl. 14, Fig. 7.

Remark: Genoholotype of *Amphiclinodonta* BITTNER, 1888. Specimen strongly damaged.

***Amphiclinodonta liasina* BITTNER.**

BITTNER, A. (1894): Neue Koninckiniden des alpinen Lias. – Jahrbuch der k. k. Geologischen Reichsanstalt, 43/1.

***Koninckina (Koninckodonta) Geyeri* BITTNER, 1894**

(Pl. 4, Fig. 12)

Coll. no.: GBA 1894/003/0005.

Type level: Lower Jurassic, Sinemurian, Hierlatz Limestone.

Type locality: Schafberg, N of Wolfgangsee, Upper Austria, Austria.

Type figure: BITTNER, A., 1894: p. 140, Pl., 4, Fig. 10.

***Koninckodonta geyeri* BITTNER.**

Holotypes described by BITTNER and previously held in the collection of the Geological Survey, but now missing.

***Rhynchonella Hecuba* BITTNER, 1890**

Type level: Upper Triassic, Zlambach Beds.

Type locality: Lupitsch near Bad Aussee, Styria, Austria.

Type figure: BITTNER, A., 1890: p. 169, Pl. 40, Fig. 28.

***“Rhynchonella” hecuba* BITTNER.**

? *Koninckella norica* BITTNER, 1890

Type level: Upper Triassic, Hallstatt Limestone.

Type locality: Steinbergkogel near Hallstatt, Upper Austria, Austria.

Type figure: BITTNER, A., 1890: p. 237, Pl. 16, Fig. 18.

***Koninckella norica* BITTNER.**

? *Koninckella sellaris* BITTNER, 1890

Type level: Upper Triassic, Dachstein Limestone.

Type locality: Tristlwand, Hagengebirge, Salzburg, Austria.

Type figure: BITTNER, A., 1890: p. 269, Pl. 29, Fig. 21.

Remark: The specimen is missing, the box with label and number GBA 1890/002/0367 only.

***Koninckella (?) sellaris* BITTNER.**

***Amphiclinodonta lepidula* BITTNER, 1890**

Type level: Upper Triassic, Hallstatt Limestone.

Type locality: Sandling, Salzkammergut, Austria.

Type figure: BITTNER, A., 1890: p. 241, Pl. 40, Fig. 12.

***Amphiclinodonta lepidula* BITTNER.**

***Amphiclinodonta Manzavinii* BITTNER, 1896**

Type level: Upper Triassic.

Type locality: Kyzyl-Tepe near Balia-Maaden, Turkey.

Type figure: BITTNER, A., 1896: p. 252, Pl. 11, Fig. 7.

***Amphiclinodonta manzavinii* BITTNER.**

(?) *Spirigera trisulcata* BITTNER, 1890

Leg.: TELLER.

Type level: Upper Triassic, *Cardita* Beds.

Type locality: between Mežica and Crna (Miess and Schwarzenbach), Slovenia.

Type figure: BITTNER, A., 1890: p. 141, Pl. 37, Fig. 29.

***Euractinella trisulcata* (BITTNER).**

Aulacothyris redunca BITTNER, 1903

Leg.: GEYER.

Type level: Middle Triassic, Muschelkalk.

Type locality: Monte Cucco near Paluzza, Friaul, Italy.

Type figure: BITTNER, A., 1903: p. 529, Pl. 19, Fig. 26.

***Aulacothyris redunca* BITTNER.**

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<i>blaasi</i>	p. 303	<i>norica</i>	p. 306
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Acknowledgements

Thanks are due to Hans EGGER who initiated the work on the catalogue and to Irene ZORN who provided access to the collections and gave kind assistance, they both permanently supported my study. The photographs were made by Ilka WÜNSCHE (Vienna) and technical support was provided by Mr. J. BROŽEK (Prague). My work (in agree-

ment with the Research Program of the Institute of Geology v.v.i., Academy of Sciences of the Czech Republic AVOZ 30130506) also profited from the inventory card catalogue in the collections of the Geological Survey started in the past by Franz STOJASPAL.

Plate 1

- Fig. 1abc: *Volirhynchia teutonica* (BITTNER).
GBA 1890/002/0026.
x 2.
- Fig. 2abc: "*Terebratula*" *laricimontana* BITTNER.
GBA 1890/002/0031.
x 2.5.
- Fig. 3ab: *Volirhynchia productifrons* (BITTNER).
GBA 1890/002/0037.
x 2.
- Fig. 4abc: "*Rhynchonella*" *cimbrica* BITTNER.
GBA 1890/002/0052.
x 2.5.
- Fig. 5abc: "*Thecidea*" *gryphaeata* (BITTNER).
GBA 1890/002/0082.
x 5.
- Fig. 6abc: "*Spiriferina*" *tyrolensis* BITTNER.
GBA 1890/002/0089.
x 2.5.
- Fig. 7abc: "*Spiriferina*" *badiotica* BITTNER.
GBA 1890/002/0090.
x 6.
- Fig. 8abc: *Sinucosta* (?) *impressula* (BITTNER).
GBA 1890/002/0092.
x 8.
- Fig. 9abc: "*Retzia*" *ladina* BITTNER.
GBA 1890/002/0108.
x 2.5.
- Fig. 10ab: *Amphiclina scitula* BITTNER.
GBA 1890/002/0131.
x 2.5.
- Fig. 11ab: *Amphiclina coarctata* BITTNER.
GBA 1890/002/0189.
x 2.5.
- Fig. 12ab: *Amphiclina aptera* BITTNER.
GBA 1890/002/0137.
x 3.
-

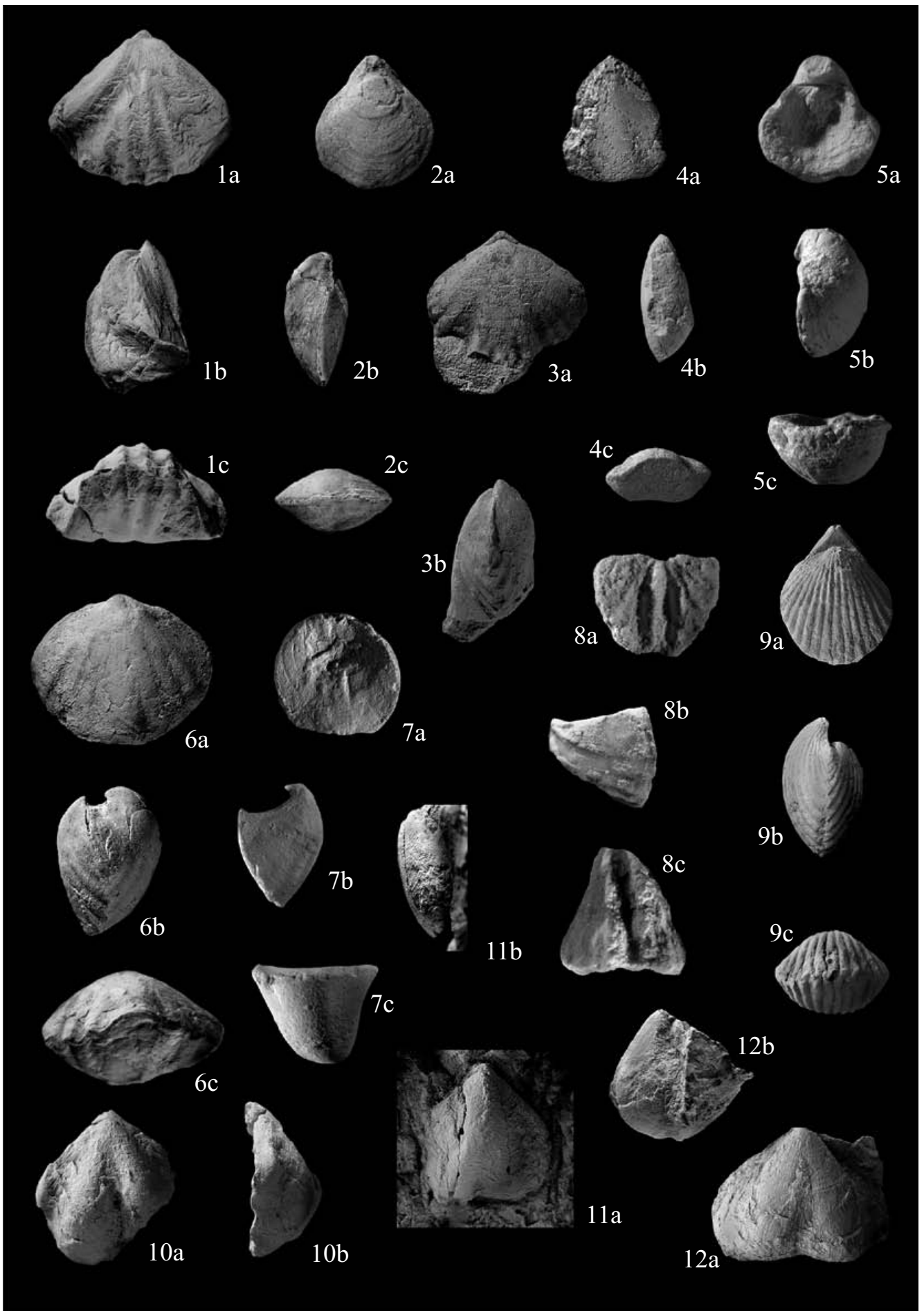


Plate 2

- Fig. 1abc: *Aulacothyris dualina* BITTNER.
GBA 1890/002/0260.
x 4.
- Fig. 2abc: *Veghirhynchia* (?) *blaasi* (BITTNER).
GBA 1890/002/0120.
x 3.
- Fig. 3abc: "*Rhynchonella*" *salinaria* BITTNER.
GBA 1890/002/0239.
x 3.
- Fig. 4abc: *Propygope hagar* BITTNER.
GBA 1890/002/0272/1.
x 3.
- Fig. 5abc: *Nucleatula styriaca* BITTNER.
GBA 1890/002/0271.
x 3.
- Fig. 6abc: *Austriellula intermixta* (BITTNER).
GBA 1890/002/0290.
x 2.
- Fig. 7abc: "*Rhynchonella*" *mojsisovicsi* BITTNER.
GBA 1890/002/0292.
x 2.
- Fig. 8abc: *Aulacothyropsis reflexa* (BITTNER).
GBA 1890/002/0340.
x 2.
- Fig. 9abc: *Amphiclina unguina* BITTNER.
GBA 1890/002/0317.
x 3.
- Fig. 10abc: *Amphiclina ambigua* BITTNER.
GBA 1890/002/0316.
x 4.
-

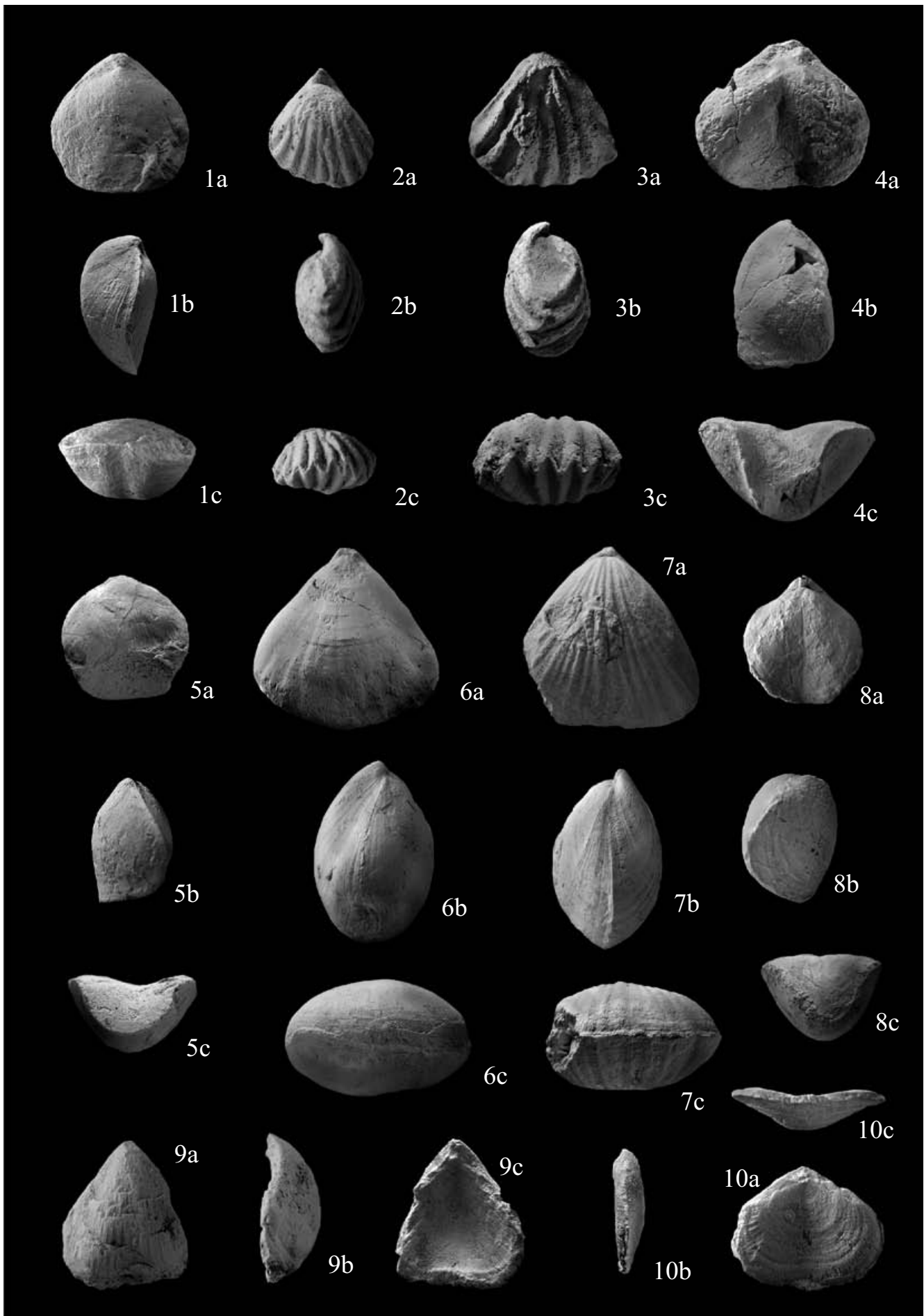


Plate 3

- Fig. 1abc: *Ornatothyrella festiva* (BITTNER).
GBA 1890/002/0342.
x 2.
- Fig. 2ab: *Amphiclinodonta magna* BITTNER.
GBA 1890/002/0322.
x 2.
- Fig. 3abc: *Aulacothyropsis patricia* (BITTNER).
GBA 1890/002/0339.
x 2.
- Fig. 4abc: "*Terebratula*" *sturi juvenica* BITTNER.
GBA 1890/002/0337.
x 2.
- Fig. 5abc: "*Rhynchonella*" *lillii* BITTNER.
GBA 1890/002/0349.
x 2.
- Fig. 6abc: *Tetractinella cisionensis* (BITTNER).
GBA 1890/002/0334.
x 4.
- Fig. 7abc: *Aulacothyris praevaliana* BITTNER.
GBA 2008/115/0005.
x 4.
- Fig. 8abc: "*Rhynchonella*" *spreta* BITTNER.
GBA 1890/002/0358.
x 2.
- Fig. 9abc: "*Rhynchonella*" *uncinulina* BITTNER.
GBA 1890/002/0362.
x 2.
- Fig. 10abc: *Caucasorhynchia* (?) *baliana* (BITTNER).
GBA 1896/003/0003.
x 2.
-

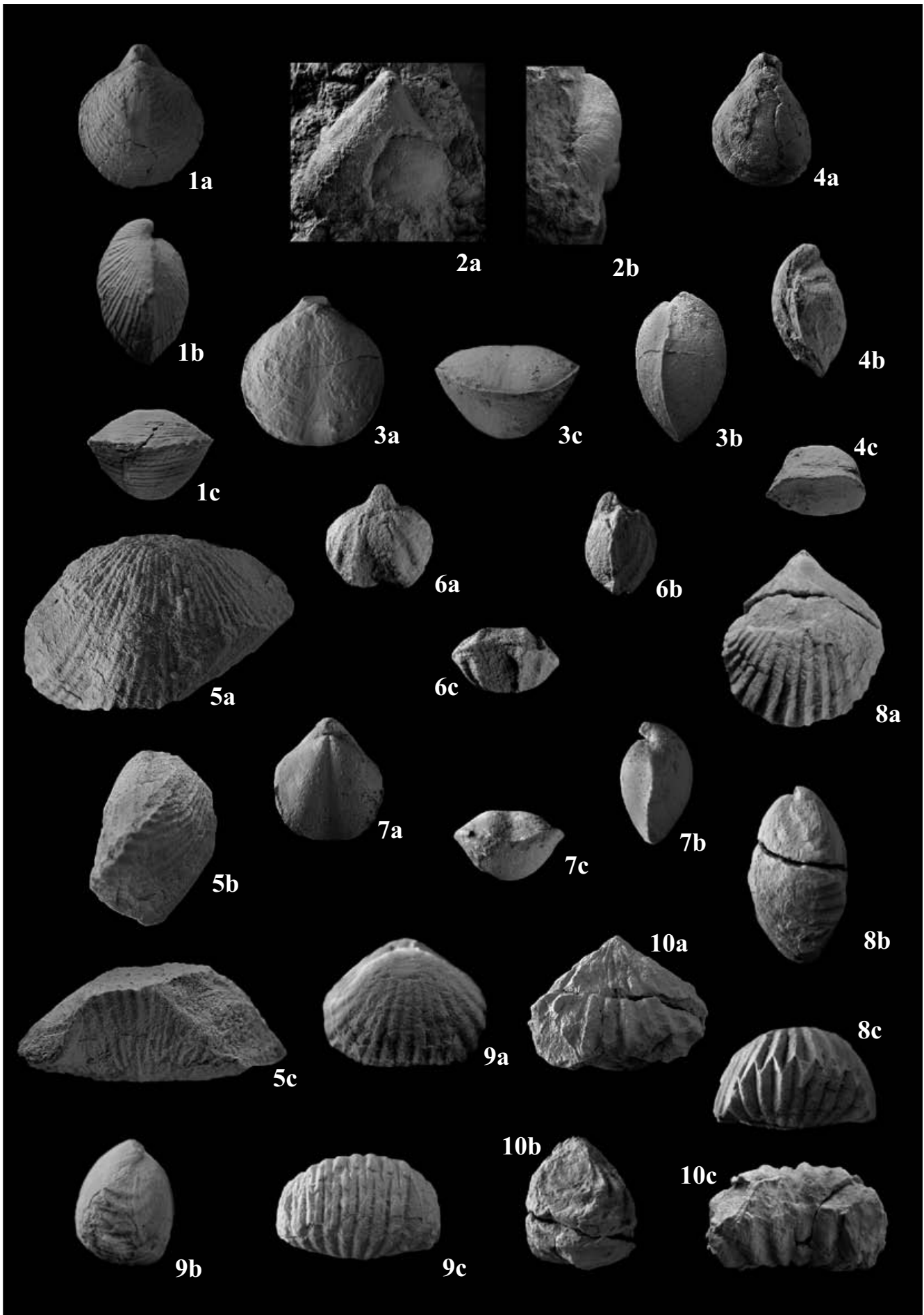
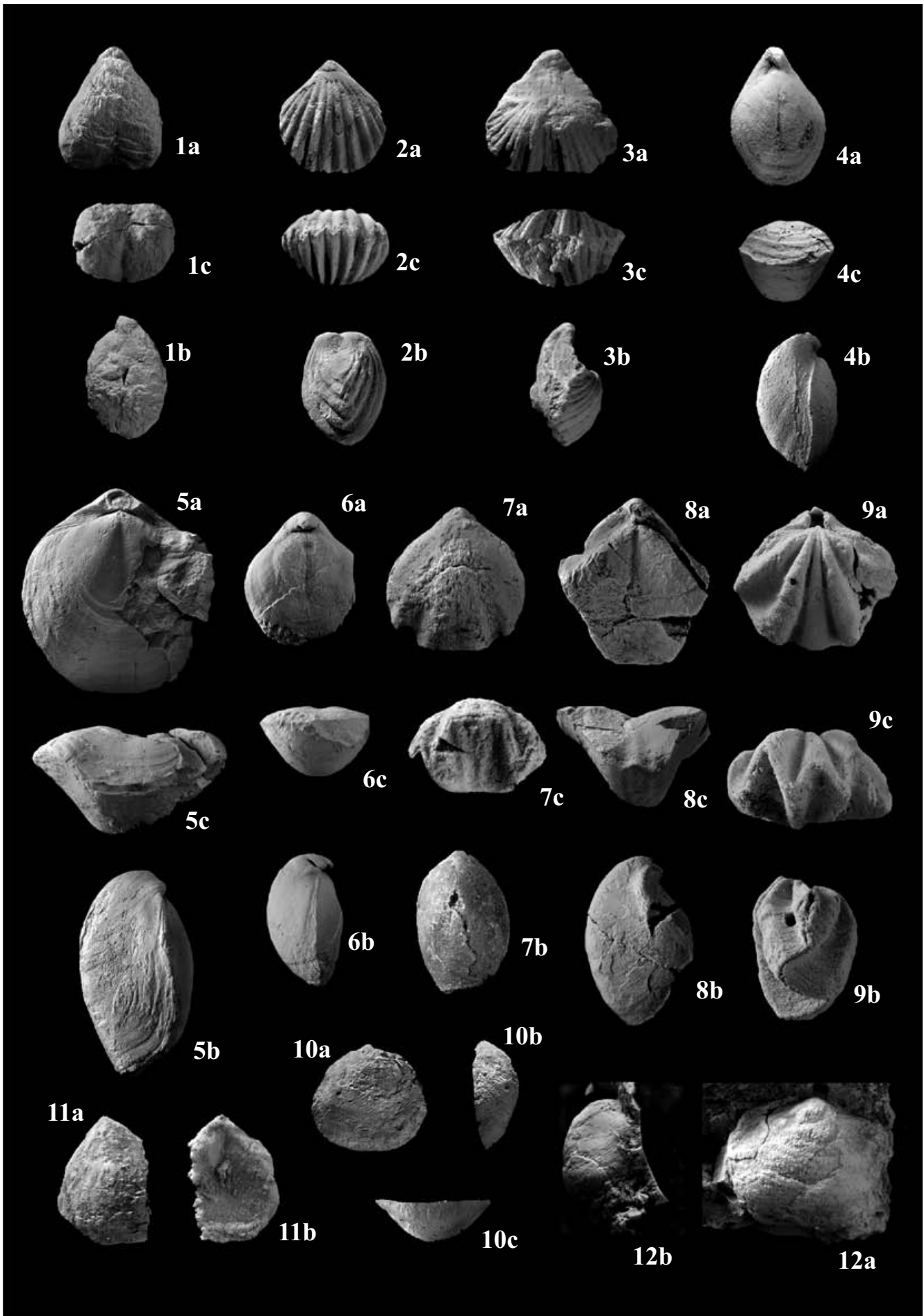


Plate 4

- Fig. 1abc: *"Rhynchonella" vulnerata* BITTNER.
GBA 1892/001/0085.
x 3.
- Fig. 2abc: *"Rhynchonella" pusillula* BITTNER.
GBA 1890/002/0364.
x 4.
- Fig. 3abc: *"Retzia" latiuscula* BITTNER.
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- Fig. 4abc: *Aulacothyris integrella* BITTNER.
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- Fig. 5abc: *Aulacothyris simulatrix* BITTNER.
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- Fig. 6abc: *Aulacothyris planoconvexa* BITTNER.
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- Fig. 7abc: *"Rhynchonella" bukowskii* BITTNER.
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x 5.
- Fig. 8abc: *Aulacothyris geyeri* BITTNER.
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x 2.
- Fig. 9abc: *Anisactinella matutina euplecta* BITTNER.
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x 4.
- Fig. 10abc: *Koninckodonta styriaca* (BITTNER).
GBA 1888/01/0002.
x 3.
- Fig. 11ab: *Amphiclinodonta liasina* BITTNER.
GBA 1888/001/0003.
x 4.
- Fig. 12ab: *Koninckodonta geyeri* BITTNER.
GBA 1894/003/0005.
x 3.
-



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Manuskript bei der Schriftleitung eingelangt am 2. März 2010

Book Reviews

Book Reviews

SPENCER, G. LUCAS [Ed.] (2010): The Triassic Timescale. – Geological Society, Spec. Publ. 334, 514 pgs., ill., London. ISBN: 978-1-86239-296-0; £ 120.00.

This recently published book “reviews the state-of-the-art of the Triassic timescale” (p. 2). After an introduction by the editor 14 chapters deal with the wide range of (bio)stratigraphy and the present day situation of the broad research aiming for a better definition of the triassic timescale.

In fact the 50-million-year-long Triassic period is a major juncture in Earth history at the beginning of the Mesozoic. At this time the vast Pangaeian supercontinent was completed and then step by step transgressed by the shallow marine realm of the Tethys. The continuous transgression and deepening of the Tethys was the basis for a lot of global biota, which diversified and modernized after the end-Permian mass extinction. Many of them, such as conodonts, ammonoids or bivalves are used for worldwide correlation and biostratigraphy.

Each of the chapters gives a historical overview before introducing the present situation and finally showing the necessity of future research. Although the subdivision of the Triassic into series (Lower, Middle, Upper) has never been debated since the 19th century, much discussion arose about stages and especially substages (see the chapter: Spencer G. LUCAS: “The Triassic timescale: an introduction”).

All details from the first mentioning of the word “Trias” by Friedrich von Alberti in 1834 are explained in the second contribution by LUCAS (“The Triassic chronostratigraphic scale: history and status”). There is a special focus on the Alpine marine Triassic and its most important researcher of the 19th century, Eduard v. Mojsisovics (1839–1907). Mojsisovics published his ideas in a series of huge monographs within the “Abhandlungen der k.k. geologischen Reichsanstalt”. There he did not only describe Alpine ammonoids, but also ammonoids from Siberia and many other countries. Besides Mojsisovics Leonard F. Spath (1888–1957) from the British Museum and E.T. Tozer (*1928) from Canada were the most important contributors for triassic stratigraphic subdivisions.

The next chapters, like those from Roland MUNDIL, Jozsef PÁLFY, Paul R. RENNE & Peter BRACK (“The Triassic timescale: new constraints and a review of geochronological data”) or from Mark W. HOUNSLOW & Giovanni MUTTONI (“The geomagnetic polarity timescale for the Triassic: linkage to stage boundary definitions) and finally the two con-

tributions from Lawrence H. TANNER (“The Triassic isotope record” and “Cyclostratigraphic record of the Triassic: a critical examination”) deal with some abiotic aspects of Triassic stratigraphy.

The major part of the book focuses on biostratigraphic aspects of the Triassic starting at page 139 with microfossils. Michael J. ORCHARD describes “Triassic conodonts and their role in stage boundary definition”. In seven plates important key conodonts are figured, thus helping stratigraphic workers to distinguish the most important microfossils of the Triassic. Luis O’DOHERTY, Elizabeth S. CARTER, Spela GORICAN & Paulian DUMITRICA show “Triassic radiolarian biostratigraphy” in detail.

Macrofossils are described by Christopher A. MCROBERTS (“Biochronology of Triassic bivalves”). Marco BALINI, Spencer G. LUCAS, James F. JENKS & Justin A. SPIELMANN deal with the most classic group of Triassic fossils, the cephalopods (“Triassic ammonoid biostratigraphy: an overview”). Heinz W. KOZUR & Robert E. WEEMS point out their work (p. 315–417) “The biostratigraphic importance of conchostacans in the continental Triassic of the northern hemisphere”.

The field of palynology is represented by the contributions of Wolfram M. KÜRSCHNER & G.F. WALDEMAAR HERNGREEN (“Triassic palynology of central and northwestern Europe: a review of palynofloral diversity patterns and biostratigraphic subdivisions”) and Simonetta CIRILLI (“Upper Triassic – lowermost Jurassic palynology and palynostratigraphy: a review”).

Finally Hendrik KLEIN & Spencer G. LUCAS show aspects of “Tetrapod footprints – their use in biostratigraphy and biochronology of the Triassic”. The title of the last chapter by Spencer G. LUCAS might sound like pointing at a rather young aspect of future research: “The Triassic timescale based on nonmarine tetrapod biostratigraphy and biochronology”.

In conclusion: An excellent overview of the current research situation of Triassic stratigraphy. The whole book (514 pages), as well as each of the single contributions show the development of research from the 19th century up to the 21st century. The huge number of references will help researchers find easy access to literature. Congratulations to the team of contributors and to those whose works are cited within the references!

THOMAS HOFMANN

Peter K. SWART (Ed.), Gregor EBERLI (Ed.) & Judith A. McKenzie (Ed.): Perspectives in Carbonate Geology. – Int. Ass. of Sedimentologists (IAS), Spec. Publ. 41, Wiley-Blackwell, 387 pgs, ill., 2009, ISBN: 978-1-4051-9380-1, € 92.00.

The full title of this book – “Perspectives in Carbonate Geology: a tribute to the Career of Robert Nathan Ginsburg” – makes clear, that a great variety of works / contributions are included. Thus this volume comprises 22 scientific papers dedicated from more than 50 authors to one of the most important researchers in carbonate sedimentology. The articles were mostly presented at a symposium to honor the 80th birthday of Robert N. Ginsburg at the meeting of the Geological Society of America (GSA) in Salt Lake City in 2005. The majority of the papers are connected with the study of modern carbonate sediments. Robert N. Ginsburg was one of the pioneers using the concept of comparative sedimentology, by using the modern to compare to and relate to and understand the ancient. These studies are concerned with his favorite fields: coral reefs and sea-level; submarine cementation and formation of beach rock; surface sediments on the Great Bahama Bank and other platforms; origin of ooids; coastal sediments; formation of stromatolites; impact of storms on sediments, and the formation of dolomite.

The works have a wide thematic and stratigraphic range. The book starts with works focusing on the situation of reefs (*Depth-related and species-related patterns of Holocene reef accretion in the Caribbean and western Atlantic: a critical assessment of existing models*) and concentrates on the Bahamas with a number of articles like: *A re-evaluation of facies on Great Bahama Bank I: new facies maps of western Great Bahama Bank* or *A re-evaluation of facies on Great Bahama Bank II: variations in the $\Delta^{13}\text{C}$, $\Delta^{18}\text{O}$ and mineralogy of surface sediments*). Another aspect focuses on the

recent destruction by hurricanes (*A tale of two storms: an integrated field, remote sensing and modelling study examining the impact of hurricanes Frances and Jeanne on carbonate systems, Bahamas*).

But not only articles dealing with the Bahamas are included in this opus; some deal with Australia (*Calcareous epiphyte production in cool-water carbonate seagrass depositional environments – southern Australia*) others with the situation in Brazil (*Microbial dolomite precipitation under aerobic conditions: results from Brejo do Espinho Lagoon (Brazil) and culture experiments*).

Although there is a focus in recent carbonate sedimentology, there are also articles building a bridge between the present and the past (*Markov models for linking environments and facies in space and time (recent Arabian Gulf, Miocene Paratethys)*) and some others dealing with the geological past like the Tertiary (*Karst sub-basins and their relationship to the transport of Tertiary siliciclastic sediments on the Florida Platform*), the Mesozoic in Switzerland (*Controls on facies mosaics of carbonate platforms: a case study from the Oxfordian of the Swiss Jura*) or in the Dolomites (*The allocyclic interpretation of the “Latemar Cycles” (Middle Triassic, the Dolomites, Italy) and implications for high-frequency cyclostratigraphic forcing*). But even the Paleozoic (*The Cincinnati Arch: a stationary peripheral bulge during the Late Ordovician*) and the Proterozoic (*Reinterpreting a Proterozoic enigma: Conophyton–Jacutophyton stromatolites of the Mesoproterozoic Atar Group, Mauritania*) are represented in this book.

The title of the article “Layering: what does it mean?” is a reminder of a personal comment of Ginsburg some 40 years. He turns out to be “a master at asking the right, mostly simple questions (What? Why? So What?) after making observations”, as Wolfgang Schlager characterizes Ginsburg in his dedication at the beginning of the book.

THOMAS HOFMANN