ROSEMARIE CHRISTINE BARON-SZABO

SCLERACTINIAN CORALS FROM THE CRETACEOUS OF THE ALPS AND N DINARIDES

(HELVETIC UNIT; AUSTROALPINE UNITS; RHENODANUBIAN UNIT; N DINARIC PLATFORM; INNER DINARIDES), WITH REMARKS ON RELATED TAXA

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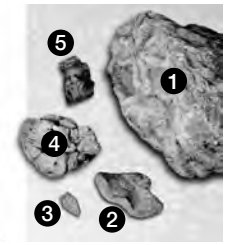

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Editorial

Since the year 2007, one of the main activities of the department of Paleontology at the Geological Survey of Austria is research on type specimens in the vast collections of our institution. The first documentation of this effort is a special volume of the yearbook of the survey published in 2010. It contains eight papers dealing with type material of different fossil groups and was dedicated to Herbert Stradner, one of the pioneers in calcareous nannoplankton research. In the following years, papers on Triassic, Jurassic and Cretaceous cephalopod specimens and an additional paper on brachiopods were printed in the same periodical. For most of these fossil groups there is no expertise anymore at the survey, and the situation gets worse and worse as the department lost half of its academic staff by retirement during the last few years. Therefore, we highly depend on the co-operation of external national and international researchers, and we gratefully acknowledge the wide commitment and continuing activity of many colleagues in this respect. The idea to the volume at hand arose from such co-operation.

I met Dr. Rosemarie Baron-Szabo two years ago. Rosemarie is one of the leading specialists in Cretaceous scleractian corals, and responsible for the planned volume on this group in the Treatise on Invertebrate Paleontology. She works as a Research Associate at the Smithsonian Institution (Washington, DC, USA) and as a Honorary Researcher at the Senckenberg Research Institute (Frankfurt, Germany). We are very pleased and happy that Rosemarie agreed to author a monograph on Cretaceous corals from the Eastern Alps and adjacent areas. This publication deals with about one third of all scleractinian genera known from the Cretaceous and will become an important reference publication for the Cretaceous marine fossil record of the area, and for the revised Treatise on Invertebrate Paleontology volume.

Many colleagues helped to accomplish this publication. In particular, I would like to express my gratitude to Monika Brüggemann-Ledolter for designing the envelope of the book, to Markus Kogler for lay-outing the entire publication, to Benjamin Sames and Christian Cermak for proof-reading the text, to Ilka Wünsche for assistance in the collections, and to Irene Zorn for preparing the specimens for study in our collection and for cross-checking the inventory numbers, the species names, the type status and the localities of GBA material.

Hans Egger

Head Department of Paleontology

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Scleractinian Corals from the Cretaceous of the Alps and Northern Dinarides with remarks on related taxa

by

ROSEMARIE CHRISTINE BARON-SZABO

22 Text-Figures, 88 Plates

Contents

Abstract

This study represents a compilation and revision as well as the documentation of new material of the scleractinian coral genera and species from the Cretaceous of the 1) Helvetic Unit (Berriasian–Albian of western Austria; Berriasian–Lower Aptian of central and eastern Switzerland; Upper Barremian–Lower Aptian of southern Germany); 2) Austroalpine Unit (Cenomanian–Maastrichtian of Austria; Santonian–Campanian of Slovenia); 3) Rhenodanubian Unit (Upper Cretaceous of Austria); 4) Northern Dinaric Platform (Valanginian–Albian of Slovenia); and 5) Inner Dinarides (Santonian–Campanian of Croatia). It deals with over 130 genera and subgenera, including over 600 species. A diagnosis is provided for each genus, as well as for each higher level taxonomic category, and issues concerning taxonomic assignments are discussed in detail. The descriptions are accompanied by illustrations (88 Pls. and 22 Text-Figs.) of representatives of nearly all genera and include illustrations of type or original material of the taxa concerned. Also included is an update of the stratigraphical and geographical ranges of the included species within the Cretaceous. For the first time, the following species are recorded from the geographic areas covered in this report: *Actinastrea tendagurensis* (DIETRICH, 1926), *A. infundibulum* ALLOITEAU, 1954a, *Calamophylliopsis compressa* (D'ORBIGNY, 1950), *Columnocoenia* cf. *girodi* (ÉTALLON, 1859), *Podoseris elongata* DUNCAN, 1869, *Turbinaria* cf. *cyathiformis* (BLAINVILLE, 1830), *Fungiastraea cotteaui* (DE FROMENTEL, 1857), *Pleurophyllia minuscula* RONIEWICZ, 1976, and *Cladophyllia crenata* (BLANCKENHORN, 1890). Lectotypes are designated for the species *Acrosmilia clavata* (REUSS, 1854), *Mesomorpha mammillata* (REUSS, 1854) and *Synastrea procera* (REUSS, 1854). Furthermore, scleractinian corals are taxonomically documented for the first time or new material is reported from the following Gosau localities: Tyrol: Ludoi Alp (= Pletzach Alp) (Coniacian); Lower Austria: Stollhof and Neue Welt at Grünbach (Upper Santonian–Lower Campanian), Neue Welt at Netting (Upper Santonian–Campanian), Ramsau at Hainfeld (Coniacian–Santonian), Neue Welt at Schneckengarten (Lower Campanian); Upper Austria: Brennetgraben at Bad Ischl (Coniacian–Santonian), Windischgarsten (Coniacian–Santonian), Tiefengraben (= Tauerngraben at Grabenbach, Pass Gschütt) (Santonian); Carinthia: Ettendorf at St. Paul (Weinberger homestead) (Lower Campanian); Salzburg: Fahrenberg at Strobl-Bad Ischl (Schmalnau Formation: Coniacian), Untersberg at Veitlbruch ([?Coniacian–] Santonian) and at Gaistischl (Upper Santonian). In addition, the first detailed records of Berriasian–Albian scleractinian corals from the Austrian state of Vorarlberg as well as Cenomanian coral material from the Northern Calcareous Alps ("Randcenoman") of the Austrian state of Tyrol are presented. A glossary and index to the genera and species are provided.

1. Acknowledgements

My thanks and gratitude go to Dennis OPRESKO (Knoxville, Tennessee), Dragica TURNŠEK (Slovenska Akademija Znanosti in Umetnosti, Ljubljana), Steve CAIRNS (Smithsonian Institution, Washington, DC, USA), and Bernard LATHUILIÈRE (Nancy, France) for many discussions on coral taxonomy.

Type material and additional study material was made accessible to me by Irene ZORN, Harald LOBITZER, Gerhard SCHUBERT, and the late Franz STOJASPAL (all Geologische Bundesanstalt [GBA], Vienna, Austria); Andreas KROH, Alexander LUKENEDER, Oleg MANDIC, and Thomas NICHTERL (all Naturhistorisches Museum, Vienna, Austria); Martin SANDER and Armin SCHMITT (both University of Bonn, Germany); Sylvain CHARBONNIER and Christine PERRIN (both Museum d'Histoire Naturelle de Paris, France); Dieter KORN (Naturhistorisches Museum ["Humboldt Museum"], Berlin, Germany); Wolfgang KIESSLING (University of Erlangen, formerly Naturhistorisches Museum "Humboldt Museum", Berlin, Germany); Helena ELIÁŠOVÁ (Prague, Czech Republic); Elžbieta MORYCOWA (University of Krakow, Poland); Ewa RONIEWICZ (Academy of Sciences, Warsaw, Poland); Georg FRIEBE ("Inatura", Dornbirn, Austria); Björn BERNING (Landesmuseum Linz, Austria); Karl FORCHER ("Haus der Natur", Salzburg, Austria); Winfried WERNER and Martin NOSE (both Bayerische Staatssammlung, Munich, Germany); Günther SCHWEIGERT (Staatliches Museum für Naturkunde, Stuttgart, Germany); Jill DARRELL (The Natural History Museum, London, UK); Chiara SORBINI and Giovanni BIANUCCI (both University of Pisa, Italy); and Riccardo MANNI (University of Rome, Italy). For providing photographic material of corals I wish to thank Dragica TURNŠEK (SAZU, Ljubljana, Slovenia), Helena ELIÁŠOVÁ (Prague, Czech Republic), Georg FRIEBE (Dornbirn, Austria), Georg OLESCHINSKI (Bonn, Germany), Istvan SZENTE (Natural History Museum, Budapest, Hungary), and Ilka WÜNSCHE (Geologische Bundesanstalt [GBA], Vienna, Austria). Updates of locality and stratigraphy data were provided by Hans EGGER (Geologische Bundesanstalt [GBA], Vienna, Austria), Georg FRIEBE (Dornbirn, Austria), Diethard SANDERS (University of Innsbruck, Austria), and Michael WAGREICH (University of Vienna, Austria). Special thanks to Hans EGGER (Geologische Bundesanstalt [GBA], Vienna, Austria) for his enthusiastic support and encouragement, and for his continuing assistance in helping get this project completed.

As a Research Associate of the Smithsonian Institution (SI) Washington, DC, USA, and an Honorary Researcher at the Research Institute Senckenberg, Frankfurt, Germany, the author would like to express her deep appreciation for the continuing support from these institutions. I am especially grateful for the financial support by both the Geological Survey of Austria, Vienna (GBA), and the Encyclopedia of Life (EOL).

2. Introduction

The scleractinian coral facies of the Cretaceous Alps-Dinarides area have been the focus of various studies for over two centuries. Scleractinian corals from the Upper Cretaceous of the Austrian Gosau-Group (Turonian–Maastrichtian) have been the subject of numerous taxonomic studies since their earliest documentations by GOLDFUSS (1826–33), SOWERBY (1832), and PETERS (1852). REUSS (1854) published the first monographic work, followed by extended re-evaluations by FELIX (1903a) and OPPENHEIM (1930a). Investigations carried out in more recent years have focused on: 1) morphological and ecological features (e.g., M. BEAUVAIS, 1982; HÖFLING, 1985, 1989; SANDERS & BARON-SZABO, 1997, 2008; BARON-SZABO, 1997, 1999, 2001, 2002, 2003a, b); 2) microstructural implications (e.g., BEAUVAIS et al., 1976; M. BEAUVAIS, 1982; SORAUF 1999; BARON-SZABO 2003a, b); as well as 3) species diversity of these corals (e.g., M. BEAUVAIS, 1964, 1982; HÖFLING, 1985 and 1989; BARON-SZABO, 1997, 1999, 2001, 2003a; SZENTE, et al., 2010). In addition, a small number of works have been published that focus on corals beyond the areas of major coral development, including a publication on the Rhenodanubian Unit (VETTERS, 1925: Upper Cretaceous of Austria "Northern Alpine Flysch"). Comparatively little has been known on the scleractinian corals from the Upper Cretaceous strata (Santonian–Campanian) of the Austroalpine development of Slovenia (Stranice) and the Inner Dinarides of Croatia (Mt. Medvednica area). While Upper Cretaceous corals from both areas were first mentioned in works published during the 19th century (e.g., REUSS, 1854; TELLER, 1889), detailed taxonomic studies on them began a century later (TURNŠEK, 1978, 1994, 1997; TURNŠEK & POLŠAK, 1978). Even less information has been known on the Lower Cretaceous scleractinian corals of the Dinaric Carbonate Platform of Slovenia (Barremian–Aptian at Osojnica and Banjška Planota; Aptian–Albian at Slovenski vrh, near Kočevje). Until now, the only taxonomic works on the corals from Osojnica and Banjška Planota were carried out by TURNŠEK & BUSER (1974, 1976), and TURNŠEK (1997). The only documentations of scleractinian corals from Slovenski vrh, near Kočevje are represented by the mentioning of 5 taxa by URŠIČ (1933; also see DOZET & ŠRIBAR, 1997: 159) and the comprehensive taxonomic works produced by TURNŠEK et al. (1992) and TURNŠEK (1997).

Scleractinian corals from Lower Cretaceous strata belonging to the Helvetic Zone found in Switzerland (Berriasian–Lower Aptian) and Germany (Upper Barremian–Lower Aptian) were briefly discussed (HEIM, 1921; ZACHER, 1973; RICHTER, 1984; BOLLINGER, 1988; SALOMON, 1987, 1989; CSÁSZÁR et al., 1994; KLOMPMAKER et al., 2012) but, up to now, only a small number of detailed taxonomic studies on them have been carried out (e.g., KOBY, 1896–1898; SCHOLZ, 1984; BARON-SZABO, 1997; MORYCOWA et al., 1995; MORYCOWA & DECROUEZ, 2006). In contrast, scleractinian corals from the Lower Cretaceous of the Austrian Helvetic Zone were never subjected to any taxonomic evaluation. The current work provides the first taxonomic documentation of corals from both Lower Cretaceous and Upper Cretaceous strata of Austria, including the Berriasian (Oehrli Formation), the Lower Aptian ("Schrattenkalk"), the Albian (Garschella Formation) of the Austrian state of Vorarlberg, and from the following Upper Cretaceous localities: Gosau Group of the Austrian States of Lower Austria (Stollhof, Grünbach, Netting, Ramsau at Hainfeld); Upper Austria (Brennetgraben at Bad Ischl, Tiefengraben [= Tauerngraben at Grabenbach]); Tyrol (Ludoi Alp [= Pletzach Alp]); Carinthia (Ettendorf at St. Paul [Weinberger homestead]); Styria (Gams-Hieflau-2), and Salzburg (Fahrenberg at Strobl-Bad Ischl [Schmalnau Formation], Veitlbruch and Gaistischl at Untersberg) (Text-Figs. 1 and 2).

The purpose of this work is to give an overview on the current state of knowledge of the scleractinian corals from the Lower and Upper Cretaceous of the Alps-Dinarides areas, provide discussions on their taxonomic position, and give the first taxonomic documentation of corals from both Lower and Upper Cretaceous strata of various States of Austria.

3. Material

Identifications in the literature without descriptions or illustrations which have not been subsequently confirmed in taxonomic publications are excluded from the current work. Because there was insufficient stratigraphic and geographic data provided for the specimens described by SÖHLE (1899), this material is only referred to in very general terms in the sections "Occurrences elsewhere" as "Upper Cretaceous of Germany".

The illustrated specimens are housed in the type collections of the following institutions:

BSPG. Bayerische Staatssammlung für Paläontologie und historische Geologie, Munich, Germany.

GBA. Geologische Bundesanstalt, Vienna, Austria.

GeoSZ. Geological Survey of Slovenia.

HAZU. Croatian Academy of Sciences and Arts, Zagreb, Croatia.

IPB. Geologisch-Paläontologisches Institut der Rheinischen Friedrich-Wilhelms Universität, Bonn, Germany.

LMLINZ. Oberösterreichisches Landesmuseum, Linz, Austria.

MNHN. Institut de Paléontologie du Museum d'Histoire Naturelle de Paris, France.

NHMW. Naturhistorisches Museum, Vienna, Austria.

NMNH. National Museum of Natural History, Smithsonian Institution, Washington, DC (formerly USNM).

PMB. Natural History Museum Beograd, Serbia, Yugoslavia.

SAZU. Slovenska Akademija Znanosti in Umetnosti, Ljubljana, Slovenia.

SMNS. Staatliches Museum für Naturkunde, Stuttgart, Germany.

SNM/Z. Slovakian Museum, Bratislava, Slovakia.

SZB. Haus der Natur, Salzburg, Austria.

UNIPI. University of Pisa, Italy.

USNM. now NMNH.

ÚÚG. Geological Institute, University of Prague, Czech Republic.

VNS. "*inatura*" Museum, Dornbirn, Vorarlberg, Austria.

ZMB. Zoologisches Museum Berlin, Germany.

ZSH. Zumsteinhaus, Kempten, Germany.

4. Stratigraphy and lithology of the localities of the Alps and Dinarides

4.1. Helvetic Unit

The Helvetic coral localities included in this work consist of strata found in Switzerland, Germany, and Austria (Text-Figs. 1 and 2):

4.1.1 Helvetic occurrences

Oehrli Formation

Berriasian of Switzerland (Oehrli Formation at Canton Uri: Schöner Culm) (TOBLER, 1899).

Berriasian of Austria (Oehrli Formation at Sibratsgfäll-Krähenberg; Vorarlberg) (pers. comm. and material provided by G. FRIEBE, 2013, also see FRIEBE, 2007).

"Schrattenkalk"

Upper Barremian and Lower Aptian of southern Germany (Lower and Upper Schrattenkalk at Allgäu: Lochbachalpe and various unspecified Allgäu localities) (SCHOLZ, 1979, 1984; BARON-SZABO, 1997).

Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Mitteleck, Upper Gottesackerwände, Kürenwald, Höflewald, Mahdtal, Windecksattel, Seealpe, Lower Gottesackerwände, Hoher Döllen, Schwarzenberg, Lochbachstrasse, Falkenberg, Engekopf, Lower Gundalpe, Brandalpe, Kürental, Gottesackerloch) (SCHOLZ, 1984; BARON-SZABO, 1997).

Lower Aptian of Austria (Upper Schrattenkalk at Vorarlberg: Götzis-Kalkofen, Sack at Schönenbach) (pers. comm. and material provided by G. FRIEBE, 2013; also see FRIEBE, 2007).

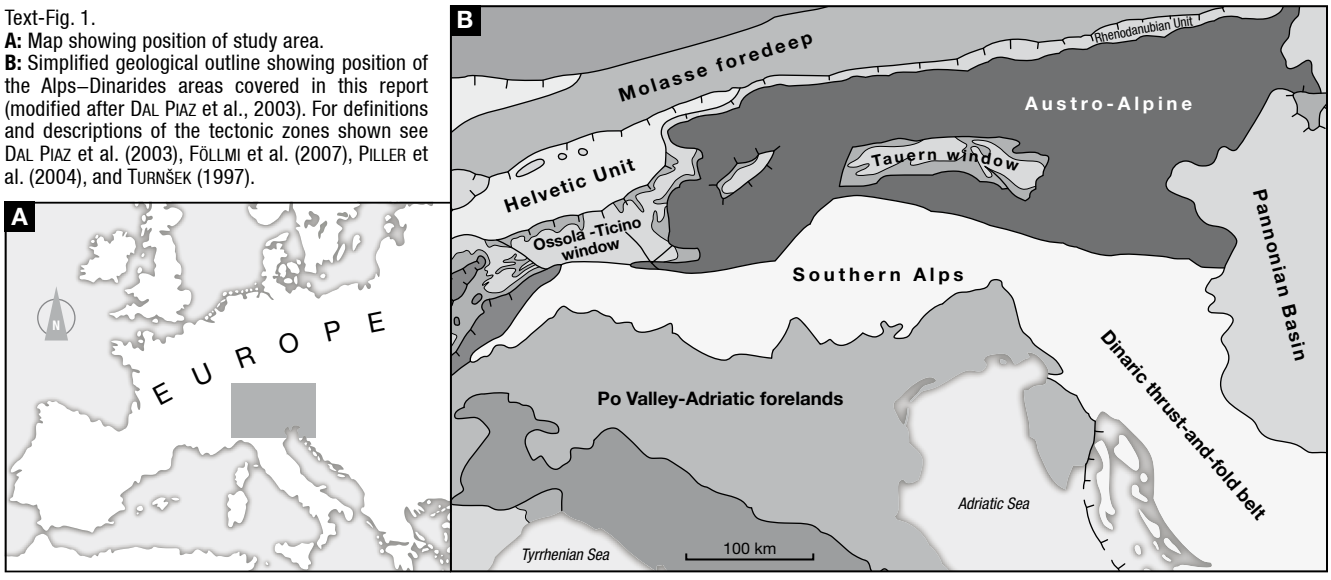
Lower Aptian of central Switzerland (Upper Schrattenkalk at the border region of the Cantons of Lucerne and Nidwalden: Hergiswil) (MORYCOWA & DECROUEZ, 2006).

Lower Aptian of central Switzerland (Rawil Member ["Lower Orbitolina Beds"] Canton of Berne: Rawil) (MORYCOWA et al., 1995).

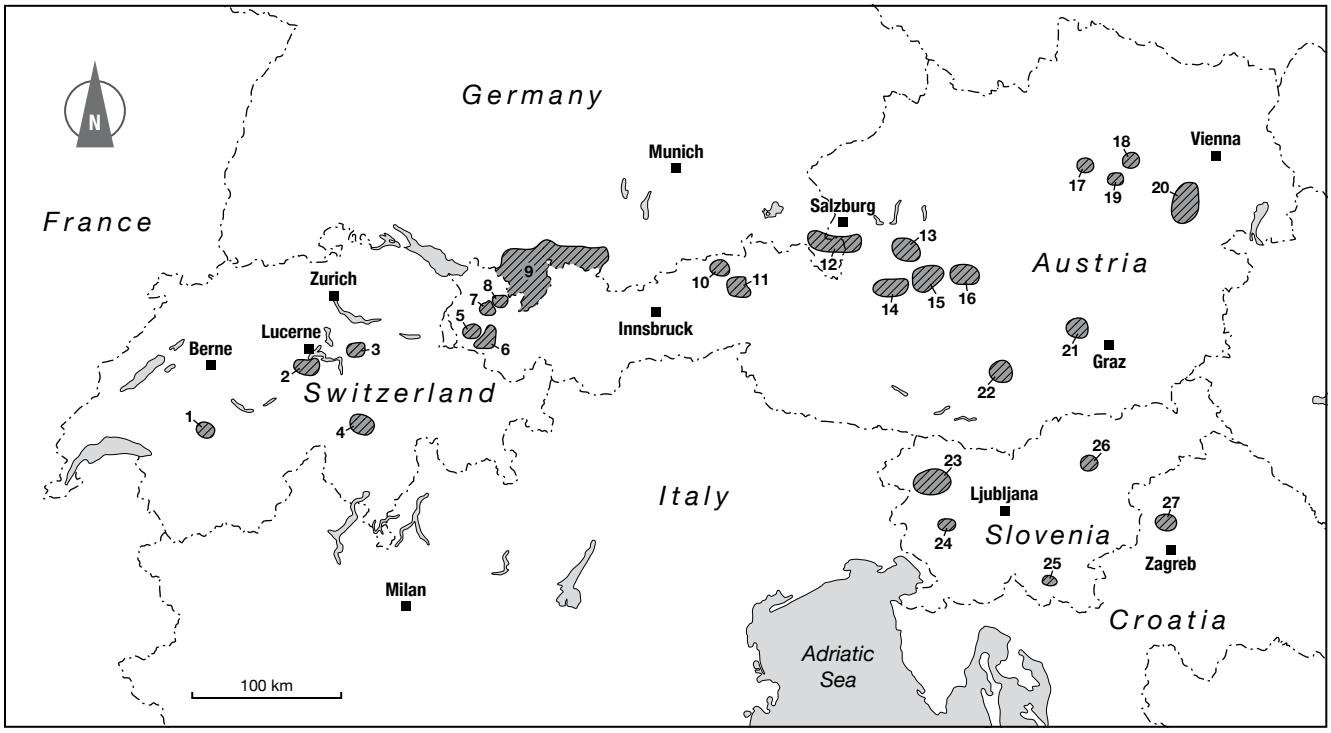
Lower Aptian of Switzerland (Upper Schrattenkalk at Drusberg, Käsernalp; Canton of Schwyz) (KOBY, 1896–1898).

Garschella Formation

Albian of Austria (Garschella Formation at Vorarlberg [Plattenwald Beds]; Dornbirn at Staufensee, Rhine River valley; Bezau at Bregenz Forrest; Klaus, Feldkirch district, Rhine River valley) (pers. comm. and material provided by G. FRIEBE, 2013; also see FRIEBE, 2007).



Text-Fig. 1.
A: Map showing position of study area.
B: Simplified geological outline showing position of the Alps–Dinarides areas covered in this report (modified after DAL PIAZ et al., 2003). For definitions and descriptions of the tectonic zones shown see DAL PIAZ et al. (2003), FÖLLMI et al. (2007), PILLER et al. (2004), and TURNŠEK (1997).



Text-Fig. 2.
Map marking the localities covered in this report. ***1–9: Helvetic occurrences:*** **1:** Rawil area; **2:** Hergiswil area; **3:** Käsernalp; **4:** Schöner Culm; **5:** Götzis–Kalkofen; **6:** area of the localities of the Garschella Formation, including Dornbirn at Staufensee, Rhine River valley; Bezau at Bregenz Forrest; Klaus, Feldkirch district, Rhine River valley; **7:** Sack at Schönenbach; **8:** Sibratsgfäll–Krähenberg; **9:** area of the Allgäu Schrattenkalk, including Lochbachalpe, Mitteleck, Upper Gottesackerwände, Kürenwald, Höflewald, Mahdtal, Windecksattel, Seealpe, Lower Gottesackerwände, Hoher Döllen, Schwarzenberg, Lochbachstrasse, Falkenberg, Engekopf, Lower Gundalpe, Brandalpe, Kürental, Gottesackerloch, and various unspecified Allgäu localities; ***10–16, 19–22, and 26: Austroalpine occurrences:*** **10:** Niederndorf–Hölzelsau ("Randcenoman" at northern Brandenberg area); **11:** Brandenberg area, including Mühlbach, Oberberg, Kreuthergraben, Sonnwendjoch, Haidach, Ludoi Alp [= Pletzach Alp]; **12:** Untersberg area, including Nagelwand, Veitlbruch [= Untersberg limestone], Wolfschwang, Gaistischl, Nierental; Salzburg–Bavaria region of "Krönner Reef"; **13:** St. Gilgen–Bad Ischl area, also including Kohlbachgraben, "Billroth", Brunnwinkel, Wolfgangsee, Sankt Wolfgang, Seeleiten, Strobl, "Theresienstein", Nussensee, Fahrenberg, Brennetgraben, Weissenbach, Ofenwand; **14:** Rußbach–Gosau–Abtenau area, also including Rußberg, Poschalm, Gamsfeld, Gosau town, Gosau basin, Hornegg, Streidegg–Graben, Kreuzgraben, Edelbachgraben, Pass Gschütt, Kaltwassergraben, Hohe Traunwand, Hofergraben [= Sattelgraben], Hochmoos–Grabenbach, Tiefengraben, Obergeschröpfalpfen, Oberstöckl, Randoschberg, Randograben, Stöcklwaldgraben, Zimmergraben, Neffgraben, Traunwandalm, Schattauergraben, Schrickpalfen, Brunstloch, Gschröpfalpfen, Wegscheidgraben, Finstergraben, Rigausbach; **15:** Hallstatt–Goisern–Aussee area, also including Goisernberg, Weissenbachalm; **16:** Gams–Hieflau area, including Gams–Hieflau–2, Windischgarsten, Unterlaussa, Weisswasser; **19:** Ramsau at Hainfeld; **20:** Neue Welt–Baden area, also including Piesting, Scharrergraben, Einöd quarry; Stollhof, Grünbach–Schneckengarten, Muthmannsdorf, Linzgraben, Netting; **21:** Kainach; **22:** Krappfeld area, also including Ettendorf at St. Paul [Weinberger homestead]; **26:** Stranice area, including Stranice quarry, Radana vas; ***17–18: Rhenodanubian occurrences:*** **17:** St. Peter in der Au–Ertl; **18:** Neulengbach area, including Ollersbach; ***23–25: Northern Dinaric occurrences:*** **23:** Osojnica–Banjška Planota area; **24:** Zavrh, Trnovski Gozd; **25:** Kočevje, including Slovenski vrh; **27:** Inner Dinaride occurrences: Mt. Medvednica area, including Donje Orešje, Vrabečka gora.

4.1.2 Lithology and paleoenvironment

In Switzerland, the ***Oehrli Formation*** is characterized by two phases of platform growth composed of shallow-water carbonates (FÖLLMI et al., 2007). The earlier one consists of calcareous pack- and grainstone, including peloids, green algae, benthic foraminifera, corals, and echinoderms. The later one shows an increased abundance of oolitic grainstone and the presence of small bioherms composed of corals, stromatoporoids, and bryozoans (FÖLLMI et al., 2007). The Vorarlberg Helvetic zone called the ***Örfla*** (***Oerfla***) ***Formation*** (WYSSLING, 1986; FRIEBE in PILLER et al., 2004) is considered to represent the lateral equivalent of the upper part of the ***Oehrli Formation*** by some authors (FÖLLMI et al., 2007), thus referring to the former as its younger synonym.

The ***Vorarlberg Oehrli Formation*** consists of grey to reddish-brown, massive to well-bedded fossiliferous limestones and oolites. In addition, intercalations of laminated, fine grained, siliciclastic sandstones, and marls occasionally occur (WYSSLING, 1986). Tempestites often contain macrofossil debris of bivalves, gastropods, brachiopods, and porifera. Locally, small patch reefs formed by corals are found. While ostracods prevail in the proximal limestone facies, foraminifera and calcareous algae are common throughout the limestone (FRIEBE in PILLER et al., 2004).

The ***Schrattenkalk Formation*** (Upper Barremian–Lower Aptian; including the ***Rawil Member***) represents shallow water platform developments that are characterized by patch-reefs. Lithologically, they closely correspond to the so-called Urgonian Facies type (sensu RAT, 1959), which is generally dominated by alternating layers of massive limestones, bioclastic limestones, and various types of silty-sandy layers. In addition to scleractinian corals, other macrofossils like, e.g., rudists, sclerosponges, bryozoans, and echinoderms often occur. Benthic foraminifers and dasycladacean algae are usually abundant (SCHOLZ, 1984; BOLLINGER, 1988; SALOMON, 1987, 1989; BARON-SZABO, 1997; MORYCOWA & DECROUEZ, 2006; STEIN et al., 2009).

The ***Garschella Formation*** (Upper Aptian–Albian; corals were collected from the Albian strata of the Kleinwalsertal

area in Vorarlberg, Austria) covers the entire Helvetic shelf, including inner shelf, shelf margin, and slope. Because it consists of different stages of stratigraphic condensation, its lithology includes glauconitic sandstones, marls, limestones, and phosphorites. Scleractinian corals are generally represented by small solitary or dendroid-branching types, both of which are preserved as molds ('steinkern').

4.2. Austroalpine-Unit

Austroalpine units included in this work consist of Austrian strata found in Tyrol, Salzburg, Lower Austria, Upper Austria, Styria, and Carinthia. They belong to sediments of the Gosau Group (Lower Gosau Subgroup, Turonian–Campanian; parts of Upper Gosau Subgroup, Upper Santonian–Maastrichtian) or represent pre-Gosau strata of the Northern Calcareous Alps (Tyrol, Cenomanian). In addition, strata formerly assigned to the Inner Dinarides and belonging to the Santonian–Campanian sediments of Slovenia ("Styrian Gosau Development" at Stranice) have been grouped with Austroalpine units (TURNŠEK, 1997) (Text-Figs. 1 and 2).

4.2.1 Cenomanian

Cenomanian of the Northern Calcareous Alps ("Randcenoman"), at Niederndorf-Hölzelsau; northern Brandenberg area, Tyrol (RAHMAN, 1966).

Lithology and paleoenvironment

The Cenomanian strata of the Tyrolean Brandenberg area ("***Randcenoman***"; see e.g., OBERHAUSER, 1963; MÜLLER, 1973) are characterized by both very constant texture and association of minerals. According to MÜLLER (1973; also compare OBERHAUSER, 1978), these rocks were sedimented into a uniform trough. The presence of series of low water-energy sediments indicate that they were deposited along the Alpine Depression during long time periods of stagnant waters with episodical interruptions. The occurrence of both clay minerals (kaolinite) and chromite-spinel minerals points to the existence of a large continent during this time in this area.

4.2.2 Turonian–Maastrichtian

Gosau Group in Austria and Bavaria. Material came from the following strata and localities (note that the Upper Cretaceous locality [Salzburg: Pinzgau, Zeller See] was excluded as there are no Gosau strata):

Turonian (Salzburg: Rußbach, Rußberg).

Turonian–?Coniacian (Salzburg: St. Gilgen, Kohlbachgraben, "Billroth").

Turonian–Campanian (Upper Austria: Rußbach, Poschalm).

Middle Turonian–Lower Coniacian (Tyrol: Brandenberg, Mühlbach).

Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang; Salzburg: St. Gilgen, Brunnwinkel; Styria: Gams-Hieflau).

Upper Turonian (Styria: Aussee, Weissenbachalm).

Upper Turonian (Salzburg: Strobl, Weissenbach, Ofenwand).

Upper Turonian (Tyrol: Brandenberg, Oberberg, Kreuthergraben, Sonnwendjoch).

Upper Turonian–Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten).

Upper Turonian–Coniacian (Styria: Aussee, Weissenbachalm).

Upper Turonian–Santonian (Upper Austria: Gosau town).

Upper Turonian–Santonian (Upper Austria: Goisernberg).

Upper Turonian–Santonian (Upper Austria: Hallstatt).

Upper Turonian–Campanian (Upper Austria: Gosau basin; Salzburg: Rußbach, Kaltwassergraben).

Lower Coniacian (Salzburg: Strobl, Sankt Wolfgang, "Theresienstein").

Lower Coniacian (Tyrol: Brandenberg, Haidach).

Lower Coniacian (Salzburg: Rußbach, Gamsfeld).

Coniacian (Tyrol: Ludoi Alp [= Pletzach Alp]).

Coniacian (Salzburg: Strobl, Nussensee).

Coniacian (Salzburg: Rußbach, Hornegg, Streidegg-Graben).

Coniacian (Salzburg: Untersberg, Nagelwand).

Coniacian (Salzburg: Strobl-Bad Ischl area, Fahrenberg [Schmalnau Formation]).

Coniacian (Upper Austria: Gosau, Kreuzgraben).

Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben).

Coniacian–Santonian (Lower Austria: Ramsau at Hainfeld).

Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt).

Coniacian–Santonian (Salzburg: Rußbach, Hohe Traunwand).

Coniacian–Santonian (Upper Austria: Bad Ischl, Brennetgraben; Windischgarsten; Gosau, Hofergraben [= Sattelgraben]).

Upper Coniacian (Upper Austria: Unterlaussa, Weisswasser).

?Coniacian–Santonian (Salzburg: Untersberg, Veitlbruch [= Untersberg Marble]).

Lower Santonian (Salzburg: Untersberg, Wolfschwang).

Santonian (Salzburg-Bavaria region: „Krönner Reef" area).

Santonian (Upper Austria: Pass Gschütt, Grabenbach, Tiefengraben).

Santonian (Styria: Gams-Hieflau-2).

Santonian (Upper Austria: Hochmoos-Grabenbach area, Gosau, Obergeschröfpalfen, Oberstöckl; Salzburg: Rußbach, Randoschberg, Randograben, Stöcklwaldgraben, Zimmergraben).

Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben,

Traunwandalm, Schattauergraben; Upper Austria: Gosau, Schrickpalfen, Brunstloch, Gschröfpalfen, Wegscheidgraben, Finstergraben).

Upper Santonian (Styria: Aussee, Weissenbachalm; Salzburg: Abtenau, Rigausbach; Untersberg, Gaistischl).

Upper Santonian–Lower Campanian (Lower Austria: Baden, Einöd quarry; Stollhof, Neue Welt, Grünbach-Schneckengarten).

Upper Santonian–Campanian (Lower Austria: Neue Welt, Muthmannsdorf, Linzgraben, Netting).

Upper Santonian–Campanian (Styria: Weissenbachalm).

Upper Santonian–Lower Maastrichtian (Styria: Kainach).

Lower Campanian (Carinthia: Ettendorf at St. Paul [Weinberger homestead]).

Upper Campanian (Carinthia: Krappfeld).

Campanian–Maastrichtian (Untersberg, Nierental).

Stratigraphy and locality data of the strata of the Gosau Group were extracted from KLINGHARDT (1944), BECK-MANNAGETTA (1964), KOLLMANN (1964), HÖFLING (1985), SUMMESBERGER (1985), WAGREICH (1988, 1998, 2003), TRÖGER & SUMMESBERGER (1994), SUMMESBERGER & KENNEDY (1996), SANDERS & BARON-SZABO (1997), SANDERS (1998), WAGREICH & FAUPL (1994), MOOSLEITNER (2004), PILLER et al. (2004), and SUMMESBERGER et al. (1999, 2009).

Lithology and paleoenvironment

Strata of the Gosau Group ("Gosauschichten") have been grouped according to their sedimentary and tectonic evolution. In the Northern Calcareous Alps, the Gosau Group is divided into two subgroups (WAGREICH & FAUPL, 1994; WAGREICH, 1998; also see WAGREICH in PILLER et al., 2004): Lower Gosau Subgroup (Upper Turonian–Campanian; Maastrichtian–Paleogene only in the southeastern area of the Northern Calcareous Alps) and the Upper Gosau Subgroup (Upper Santonian–Paleocene). Gosau Group sediments located south of the Northern Calcareous Alps, which include e.g., the strata of Kainach (Styria) and Krappfeld (Carinthia), formed independently from their northern counterparts. Their development probably began during the Santonian–Early Campanian and ended during the latest Campanian–Early Maastrichtian. Scleractinian corals occur in the sediments of both the Lower Gosau Subgroup and the Gosau Group formed south of the Northern Calcareous Alps. Sediments of both areas are often brownish-grey, matrix-rich wackestones to floatstones. Less common are packstones or grainstones. The matrix itself is generally clay-rich and sicilified. In addition to corals, macrofossils like rudists, molluscs, and echinoderms occur. Among the microfossils, calcareous algae and foraminifera are generally most common. In addition, small ostracods, bryozoans, and worms like, e.g. *Trympanites*, *Caulostreptis*, occur. The corals almost exclusively developed in lagoonal and subtidal environments (BARON-SZABO, 1997, 1999, 2003a; SANDERS & BARON-SZABO, 1997, 2008), where they lived in loosely arranged soft-bottom associations or, to a lesser extent, formed small, meter-sized build-ups. There are only few reports of reef development with corals as the main reef builder (e.g., "Theresienstein reef"; SANDERS et al., 1999; BARON-SZABO, 2001).

4.3 Santonian-Campanian of Slovenia

Santonian–Campanian of Slovenia ("Styrian Gosau Development" at Stranice) (TURNŠEK, 1978, 1989, 1992, 1994, 1997; TURNŠEK & POLŠAK, 1978).

Lithology and paleoenvironment

PLENIČAR (1993, 1994) coined the term "***Styrian Gosau Development***" for the biolithitic complex at Stranice and compared it with corresponding developments in southeastern Austria, southwestern Hungary, and northwestern Croatia. Coral build-ups belonging to this complex occupied larger geographic areas. Solitary forms inhabited the shallow lagoons. According to PLENIČAR, these biolithitic complexes represent shallow-water bioherms which compare well with both the biolithitic complexes of Donje Orešje at Mt. Medvednica (PLENIČAR, 1993, 1994), and the ones found in the Northern Calcareous Alps (HÖFLING, 1985). At Stranice quarry, reef building corals occur in three levels. Corals are most abundant in the lowermost level, less frequent in the level above, and sparsely occurring in the uppermost level. In the two lower levels, solitary corals like *Cunnolites* as well as other macrofossils like hippuritid and radiolitid rudists are rarely found. In contrast, in the uppermost level, colonial corals are rare but forms like *Cunnolites* are abundant. In addition, macrofossils like snails and urchins sparsely occur (TURNŠEK, 1994, 1997).

4.4 Rhenodanubian Unit

Upper Cretaceous of Austria. The redeposited coral material most likely was derived from the northern margin of the depositioned area of the Rhenodanubian Unit ("Northern Alpine Flysch"). Corals were found at two localities: Ollersbach near Neulengbach (Lower Austria) (Campanian–?Maastrichtian) and the area of 'St. Peter-in der Au-Ertl' (east of "Piringergut"; Lower Austria) (Upper Cretaceous).

Lithology and paleoenvironment

According to VETTERS (1925), the coral material was collected from sediments which closely correspond to the coarse-grained variety of the Greifenstein Formation. Corals found near Neulengbach were found in turbidite layers which consist of quartz sandstone, containing both rounded fragments of greyish, fine-grained, argillaceous sandstone and millimeter-sized fragments of igneous and metamorphic rocks. In addition to coral material, *Orbitoides* and *Lithothamnium* grit are found. The corals collected east of "Piringergut" came from sediments that correspond to a small strip of *Inoceramus*-dominated layers, located around 3 km off the flysch margin of the Rhenodanubian Unit. They represent coarse-grained calcareous sandstone which contain angular to rounded quartz grains and both centimeter-sized scraps of light-greyish marly limestone and greyish-blue calcareous sandstone.

4.5 Dinarides

The Dinaric coral occurrences included in this work consist of Lower Cretaceous strata found in Slovenia, and Upper Cretaceous sediments in Croatia. Because the corals reported from the Slovenian area of Banjška Planota by TURNŠEK & BUSER (1976) came from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, they are largely excluded from the present work. However, taxa which were found in blocks within the breccia which, according to TURNŠEK & BUSER (1976), could be defined as consisting of Barremian–Aptian strata ("*Barremian–Aptian blocks*") are included.

4.5.1 Northern Dinaric Carbonate Platform

Valanginian of Slovenia ("Reef Development"; Zavrh, Trnovski Gozd) (TURNŠEK & BUSER, 1974; TURNŠEK, 1997).

Barremian–Aptian of Slovenia ("Urgonian Facies Development"; Osojnica) (TURNŠEK & BUSER, 1974; TURNŠEK, 1997)

Barremian–Aptian of Slovenia ("Carbonate Shelf"; Banjška Planota) (TURNŠEK & BUSER, 1976; TURNŠEK, 1997)

Barremian–Albian of Slovenia ("Patch Reef Development"; Slovenski vrh, near Kočevje) (TURNŠEK et al., 1992; DOZET & ŠRIBAR, 1997; TURNŠEK, 1997).

Lithology and paleoenvironment

The Valanginian corals at ***Zavrh***, ***Trnovski gozd*** came from a 50 cm thick layer of white reefal limestone, containing corals, hydrozoans, and nerineas. In addition, other reef organisms like large tintinins were present.

Lithologically and paleoecologically, the sediments of the "***Urgonian Facies Development*** **at Osojnica** are closely related to the Schrattenkalk developments (see above under section "Schrattenkalk"). The reefal limestone in the Osojnica area consists of massive layers which are light to dark grey in color and contain calcareous micritic cement. Corals are the main reef builders. In addition, macrofossils like hydrozoans, chaetetids, as well as fragments of echinoids, caprinids, and nerineas are found. Microfossils are abundant, mainly consisting of orbitolinids and algae.

Because the coral association found in the "***Barremian–Aptian blocks***" ***at Banjška Planota*** very closely corresponds to the assemblage that was collected from the "Urgonian Facies Development" at Osojnica, TURNŠEK (in TURNŠEK & BUSER, 1976) assumed that they belonged to the same reefal development.

4.5.2 Inner Dinarides

Santonian–Lower Campanian of Croatia ("Biolithite Complex, Barrier Reef Type" at Donje Orešje at Mt. Medvednica, Zagreb region) (TURNŠEK, 1978; TURNŠEK & POLŠAK, 1978).

Santonian–Lower Campanian of Croatia ("Deep Subtidal Facies" at Vrabečka gora at Mt. Medvednica, Zagreb region) (TURNŠEK, 1978; TURNŠEK & POLŠAK, 1978).

Lithology and paleoenvironment

According to POLŠAK in TURNŠEK & POLŠAK (1978) the ***Biolithitic Complexes at Mt. Medvednica*** represent shallow-water bioherms which compare well with both the biolithitic complexes found in the Northern Calcareous Alps (HÖFLING, 1985) and the ones belonging to the "Styrian Gosau Development" at Stranice (PLENIČAR, 1993, 1994) (see above). In contrast, the coral facies at ***Vrabečka gora at Mt. Medvednica*** is characterized by non-reef building associations of solitary forms belonging to patellate, discoid, and various conical morphotypes. The corals occur in lithified marls, typical of a deep subtidal environment.

5. Glossary of morphological terms applied to corals

In general, the terminology of VAUGHAN & WELLS (1943) and WELLS (1956) is followed here. The focus, however, is on terms that apply to fossil rather than recent scleractinian corals. Palaeontological terms are given priority over biological expressions when possible.

Ahermatypic. Non reef-forming.

Ambulacrum. Trough of coenosteum separating collines on surface (as in e.g. *Astrogyra*).

Apophyses. Granulae-like, long, stretched trabecular extension. Here interpreted as synonym of epiphyses.

Archaeotheca. Transversely folded dissepimental wall (term rejected as imprecisely established and confusing; see discussion in *Remarks* under *Amphiastrea* and Amphiastreidae).

Astreoid. Peripheral ends of septa of adjacent corallites terminate without fusing or confluently passing into each other.

Auriculae. Crest-shaped axial ends of septa.

Axial structure (= Columella). Vertical structures in axial region of corallite.

Axially. Toward the center of the corallite.

Axis of divergence. Vertical or oblique line in septum from which trabeculae incline inward (axially) or outward (peripherally).

Basal plate. Initially formed part of corallite from which septa begin to build upward (greatly studied in solitary corals; usually not considered in colonial forms).

Bicuneiform. Wedge-shaped on both ends of a structure like, e.g., septum.

Calice. Oral surface of corallite, generally bowl-shaped.

Calicular pit. Depression in central part of calice, surrounded by calicular platform. Expression originally introduced for rugosan corals; later also used in scleractinian taxonomy.

Calicular platform. Part of calice floor having a subhorizontal plane or outwardly sloping.

Carinae. Flange-like vertical ridge on septal flanks; in cross section appearing as symmetrical granulae on both sides of septum.

Cateniform. Corallum with corallites united laterally like palisades which appear chainlike in cross section. Palisades commonly form a network.

Ceratoid. Slenderly conical, horn-shaped, solitary corallite.

Cerioid. Corallum in which walls of adjacent polygonal corallites are closely united (as frequently seen in e.g. *Actinastrea*). Also used in a more general sense referring to the polygonal shape of corallites as e.g., in *Thamnoseris*.

Circumoral budding. Type of budding, resulting in concentric calicinal series, arranged around central ('mother') corallite (as in, e.g., *Kobya* and *Dimorphastrea*).

Claviform. Club-shaped.

Coenenchyme. Collective term for both coenosarc (= the living tissue) and coenosteum (skeletal deposits by coenosarc).

Coenosarc. Common soft tissue connecting coral polyps in a colony.

Coenosteum. Skeletal deposits between individual corallites of a colony (as in e.g. *Pseudofavia*).

Collines. Plural of *Collis*. Elevated peripheral areas of corallites arranged in series, forming ridges. Pointed collines: tectiform (as e.g. in *Maeandrella*). Rounded collines: tholiform (as e.g. in *Valliculastraea*). Short collines: monticules (term rejected as imprecisely defined) (as in e.g. *Hydnophora*).

Columella. Calcareous axial structure formed by various modifications of inner edges of septa (e.g. the spongy and papillose types which represent trabecular columella, as e.g. in *Neocoenia*) or formed independently (e.g., the styliform to sublamellar type as in *Stylina* and *Heliocoenia*).

Compact. Solid, without pores.

Compound trabecula. See *Trabecula*.

Confluent. Septa continuous, connecting corallites.

Corallite. Exoskeleton formed by an individual coral polyp.

Corallum. Exoskeleton of a coral colony or solitary coral.

Costa. Prolongation of septum on outer side of corallite wall, forming the perithecal wall.

Costoseptum. Radial element consisting of septum and costa.

Cuneiform. Wedge-shaped. Term used to describe both shape of septum or solitary corallum.

Cunnolitid. See *Cupolate*.

Cupolate. Corallite with flat base and highly convex oral surface (as e.g. *Cunnolites*). The term 'cunnolitid shape' is interpreted as a synonym of cupolate.

Cylindrical. Nearly straight solitary corallite with subequal diameter except near base.

Dendroid. Irregularly branched corallum.

Dicentric. Type of corallite formed by polyp retaining distomodaeal condition permanently.

Dissepiment. Small domed plate forming a cyst-like enclosure.

Distomodaeal. see *Stomodaeal*.

Endotheca. Collective term for dissepiments inside the corallite wall.

Endothecal dissepiment. Partition inside the corallite.

Epiphyses. see *Apophyses*.

Epitheca. Corallite wall which represents an outer margin of the main skeletal structures of a corallite lacking a dark line. The epitheca has no ontogenetical relationship to septal growth (BENDUKIDZE & CHIKOVANI, 1971; STOLARSKI, 1995).

Essential columella. Axial structure rising directly from basal plate and forming independent of septa.

Exothecal dissepiment. Partition of the skeleton outside the corallite.

Exotheca. Collective term for dissepiments outside of the corallite wall.

Exsert septa. Expression mainly used in literature of the 19th century, probably to describe septa strongly projecting beyond the distal part of the corallite. Their relationship to the development of costae is unclear.

Folios. Type of corallum with laminar branches.

Fulturae. Bar-like structures which connect septa. Similar to synapticulae but have developments of trabecular granulations or spines (GILL, 1981).

Hermatypic. Reef-forming.

Holotheca. Wall enclosing the entire corallum of a colonial form having polyp integrations other than branching types by which individual corallites are produced (phaceloid, etc.). For the latter cases and solitary corals, the term epitheca is used.

Hydnophoroid. Type of corallum with corallite centers arranged around short collines.

Lonsdaleoid septa. Type of septum characterized by discontinuity toward peripheral edge of septum.

Margin. Edge of septa.

Meandroid. Corallum characterized by meandering rows of corallite series with walls only between the rows.

Menianae. Merged pennulae that are aligned in rows on septal flanks.

Monocentric. Type of corallite formed by polyp retaining monostomodaeal condition permanently.

Monticules. See *Collines*.

Nonconfluent. Septa discontinuous, not connecting corallites.

Pachythecaliine wall. Thick wall built of radially oriented equal-sized fascicles of fibers.

Pali. Plural of palus. Vertical lamella or pillar developed along axial edge of septum (as in e.g. *Columastrea*). Structurally more independent from septa than paliform lobes.

Paliform lobe. Detached trabecular offset from axial edge of septum (as in e.g. *Brachymeandra*). Structurally more closely connected to septa than pali.

Paratheca. Corallite wall formed by closely spaced dissepiments.

Parietal columella. Trabecular columella (see *Columella*).

Pennulae. Trabecular extensions on septal flanks which form complex balcony-like ledges, appearing as elevated structures encircling the trabecula center. A lot of taxonomic weight has been put on more or less corresponding structures (e.g., GILL & COATES, 1977; RONIEWICZ, 1982; MORYCOWA & RONIEWICZ, 1995a). In this work, however, lesser taxonomic importance is given to these developments, as features encircling a trabecula center and showing very similar longitudinal structures are typically seen in taxa of different suborders, like Fungiina (e.g., agariciids and siderastreids) and Microsolenina (e.g., latomeandrids and microsolenids). Even when based on a combination of a fairly large number of characters, like subcompact septa; presence of synapticulae; wall synapticulothecal, occasionally septothecal; trabecular, spongy-papillose columella; and the presence of endothecal dissepiments, siderastreid genera (e.g., *Siderocoenia*, *Siderofungia*) cannot be distinguished from the latomeandrids, regardless of the presence of pennular(-like) features.

Peritheca. Corallite wall formed by dissepiments connecting costae. It holds an intermediate position between endothecal and exothecal wall.

Phaceloid. Branching corallum having subparallel corallites.

Plocoid. Corallum in which the corallites have separated walls and are united by costae, dissepiments or coenosteum. Corallites typically rounded or elliptical in outline (as in e.g. *Actinacis* and *Neocoeniopsis*)

Pourtalès plan. Septal arrangement whereby septa of second and higher cycles bifurcate at their peripheral edges (= at corallite wall) but maintain their axial edges as one septum, creating a triangular space within which the next cycle of septa forms. This process may repeat, resulting in the higher/highest cycle septa being the shortest, and the other cycles being often curved, their axial edges joined in pairs (further details are given by CAIRNS, 2001).

Pseudotheca. see *Septotheca*.

Rhopaloid. Thickened, forming club-shaped or T-like structures in transverse view. Often used in the sense of a comparative of *claviform*.

Sclerodermites. Centers of calcification and surrounding clusters of calcareous fibers.

Scolecoid. Solitary corallite of cylindrical type but bent irregularly in worm-like manner.

Septum. Calcareous vertical element of corallite; porous (= fenestrate) or compact (= laminar).

Septal gemmation. Two opposite septa fuse dividing the corallite into two new ones. The fused septa become a part of the corallite wall from which new septa spring off.

Septotheca. Corallite wall formed by thickened outer parts of septa along axis of trabecular divergence. Secondarily in origin (= *Pseudotheca sensu* MORI et al., 1977).

Simple trabecula. See *Trabecula*.

Stomodaeal. Throat-like passage at the center of the oral surface of a coral polyp, which opens downwards into its main body cavity. Mono-; Di-; Tristomodaeal: Indicating number of stomodaea within the same corallite.

Subconfluent. Septa of adjacent corallites touch but do not form a continuous line.

Synapticula. Small rod or bar connecting opposing faces of adjacent septa (*compound synapticula*: formed by fusion of opposing ridges on adjacent septa; *simple synapticula*: formed by union of two opposed granules).

Synapticulotheca. Corallite wall formed by one or more rings of simple or compound trabeculae along axis of divergence.

Tabulate dissepiment. Horizontal partition of corallum (see *Dissepiment*).

Taschenknospung. New corallites develop in a pocket within the calice of the adult ('mother') corallite.

Tectiform. See *Collines*.

Tectura. Corallite wall composed of concentric layers of sclerenchyme (STOLARSKI, 1995).

Thamnasterioid. Corallum characterized by absence of corallite walls and by confluent septa that join neighboring corallites together (as in e.g. *Clausastrea*, *Corbastraea*, and *Aspidastraea*).

Tholiform. See *Collines*.

Trabecula (*sensu* WELLS, 1956). Pillar of radiating microscopic calcareous fibers. Simple trabecula: pillar with a single center of calcification; compound trabecula: pillar with more than one center of calcification.

Trabecular columella. = Parietal columella (see *Columella*).

Tricentric. Type of corallite formed by polyp retaining tristomodaeal condition permanently.

Trifid. Divided into three lobes.

Trochoid. Solitary, horn-shaped corallite with sides expanding from base at angle of about 40 degrees (as in e.g. *Trochosmilia*).

Turbinate. Solitary, horn-shaped corallite with sides expanding from base at angle of about 70 degrees (as in e.g. *Phragmosmilia*).

Vesicular dissepiment. Arched partition of corallum (see *Dissepiment*).

6. Classification

Until the classification system of the new Treatise project is completed, a taxonomic framework for assigning and arranging genera is used, which is based on a combination of several different proposed classifications, including those of Vaughan & Wells (1943), Alloiteau (1952a, 1957), Wells (1956), and later modifications, supplements, and emendations proposed by, e.g., Beauvais & Beauvais (1975), Roniewicz (1976), Morycowa & Roniewicz (1990, 1995b), Budd et al. (2012), and others.

7. Stratigraphical and geographical ranges

Information provided on the stratigraphical and geographical ranges are intended to give a comprehensive overview of the distribution within the Cretaceous of the taxa included and represents a compilation of data published until early 2013.

Stratigraphical and geographical information was obtained from the following references (for updates on stratigraphic information see www.paleodb.org):

Worldwide

Vaughan & Wells (1943), Alloiteau (1952a, 1957); Baron-Szabo (2002, 2006, 2008).

Mediterranean/ southern-central-western-northern Europe

Abdel-Gawad & Gameil (1995, Egypt and Greece), Alloiteau (1960a, Spain), Baron-Szabo (1993, 1998, Spain; 1997, Germany; 1999, 2001, 2003a, 2003b, Austria), Baron-Szabo & Fernandez-Mendiola (1997, northern Spain), Baron-Szabo & Steuber (1996, Greece), Bataller (1936, 1937a, b, 1945, Spain), M. Beauvais (1982, Austria), M. Beauvais et al. (1975, Portugal), M. Beauvais & M'Rabet (1977, Tunisia), Bover-Arnal et al. (2012, Spain); Eliášová (1995, 1997a, 1997b, 2004, Czech Republic), Geyer & Rosendahl (1985, southern Spain), Götz et al. (2005, Spain), Hackemesser (1936, Greece), Leloux (1999, 2004, The Netherlands), Löser (1989, 1994, Germany; 1998, Turkey; 2010a, southern France), Löser & Ferry (2006, southern France), Löser & Raeder (1995, Greece), Löser et al. (2010, eastern Spain), Masse & Morycowa (1994, France), Masse et al. (2009, southeastern France), Morycowa & Decrouez (2006, Switzerland 'Schrattenkalk'), Morycowa & Marcopoulou-Diacantoni (1997 and 2002, Greece), Morycowa & Masse (1998, 2007, 2009, France), Montanaro Gallitelli (1937, Italy), Pratz (1910, Serbia and Montenegro), Prever (1909, Italy), Reig Oriol (1988, 1989, 1991, 1992, 1994, 1997a and b, northern Spain), Sanders & Baron-Szabo (1997, 2008, Austria), Scheibner (1960, Slovakia), Schöllhorn (1998, northern Spain), Söhle (1897 and 1899, Germany), Szente et al. (2010, Austria), Tomás et al. (2008, eastern Spain), Turnšek (1978, 1992, Slovenia and Croatia), Turnšek et al. (1992, Slovenia), Turnšek (1994, 1997, Slovenia), Turnšek & Buser (1974, Slovenia), Turnšek & Polšak (1978, Croatia), Turnšek & Mihajlović (1981, Serbia), Valldeperas (2000, Spain), Vidal (1980, Spain), Wilmsen (1996, Spain).

Eastern Europe, Asia, and Pacific

Abed & El Asa'ad (1981, Saudi Arabia), Aliev & Kuzmicheva (1981, Azerbaijan, Georgia [in Caucasus], Armenia), Arkadiev & Bugrova (1999, Crimea), Baron-Szabo (2000, UAE/Oman), Baron-Szabo et al. (2003, Iran), Bendukidze (1956, 1961, Georgia [in Caucasus]), Bugrova (1989, 1990, 1997, Crimea), Cheshmedzhieva (1970, 1972, 1974, 1986, 1988, 1995a, 1995b, Bulgaria), Császár & Turnšek (1996, Hungary), Eguchi (1936, 1951, Japan), El Asa'ad (1990, Saudi Arabia), Gameil (2005, UAE/Oman), Idakieva (2001, 2007, Bulgaria), Karakash (1907, Crimea), Kołodziej et al. (2012, Bulgaria), Kolosváry (1954, Hungary), Krasnov (1983, Asia), Kuzmicheva (1966, Crimea; 1970, Caucasus; 1972a, Crimea; 1972b, Crimea, Lesser Caucasus, and Middle Asia; 1980, Soviet Carpathians; 1982, Uzbekistan; 1987a, Azerbaijan, Turkmenistan; 1987b, Turkmenistan), Kuzmicheva & Aliev (1988, Azerbaijan), Liao & Xia (1985, 1994, Tibet), Löser & Mohanti (2004, India), Maccagno (1942, Libya), Morycowa (1964, Poland; 1971, Romania), Pandey et al. (2007, Iran), Roniewicz (2008, Bulgaria), Sikharulidze (1979a, 1979b, 1980, 1985, Georgia [in Caucasus]), Stoliczka (1873, India), Suraru (1957, 1961, Romania).

Africa (non Mediterranean)

Alloiteau (1952b, Senegal; 1958, Madagascar), Dietrich (1926, Tanzania).

Americas and Atlantic

Baron-Szabo (2005, Caribbean), Baron-Szabo & González-León (1999, 2003, Mexico), Baron-Szabo et al. (2006, Mexico), Böse (1910, Mexico; 1928, USA and Mexico), Felix (1891, Mexico), Filkorn (2003, Mexico), Filkorn & Pantoja-Alor (2009, Mexico), Filkorn et al. (2005, Mexico), Fritzsche (1924, Chile), Löser et al. (2009, Jamaica), Prinz (1991, Chile), Turnšek et al. (2003, Mexican-US-border region), Von der Osten (1957, Venezuela), Wells (1932, 1933, USA; 1935, Jamaica; 1944, Venezuela).

Remarks. In the literature, especially in publications of the 19th and the first half of the 20th century, stratigraphic terms such as Neocomian, Urgonian, and Senonian were widely used. Except for the latter, these terms refer to both stratigraphic and lithographic information and can therefore mean nonuniform stratigraphic ranges for different localities. Generally, the Neocomian refers to the time range

of Valanginian–Barremian, the Urgonian to the Barremian–Middle Albian, and the Senonian to the Santonian–Maastrichtian (TRÖGER et al., 1984). Whenever possible the use of these terms is avoided and the terms have been replaced by reference to more precise ages.

It should be noted that the coral fauna described from central Greece by HACKEMESSER (1936) was originally reported to be Cenomanian in age. Later studies carried out by TH. STEUBER, formerly Bochum, Germany (STEUBER, pers. comm. 1997) of the rudists indicate that these deposits most likely represent a mixture of stratigraphically heterogeneous sediments (Aptian to Campanian). Therefore, in referring to the work by HACKEMESSER (1936) stratigraphical descriptions will be given as Cretaceous.

Originally, the Italian fauna described by PREVER (1909) was given as Cenomanian. Later investigations conducted by MASSE & MORYCOWA (1994) and later modified by STEUBER (pers. comm., 1998) on rudists have revealed a rather Aptian–Lower Albian age for the sediments.

Based on rudists and foraminifers the corals described by CHESHMEDZHIEVA (e.g. 1970, 1974, 1986) from Bulgaria and reported to be Maastrichtian in age have been ascribed to the Campanian (SWINBURNE et al., 1992). Stratigraphic assignments of the Bulgarian material described by TOULA (1889) and RONIEWICZ (2008) were updated using the work of ILCHEVA & MOTCHUROVA-DEKOVA (2011).

Corals from Jamaica that were documented and illustrated by BARON-SZABO (2002, 2006, and 2008) were collected from *Titanosarcolites*-bearing limestones and/or stratigraphically related sequences and are assigned to the Latest Maastrichtian (STEUBER et al., 2002).

8. Systematic Paleontology

The diagnosis for taxonomic levels higher than genus are based on information provided by VAUGHAN & WELLS (1943), and ALLOITEAU (1952a, 1957), except for taxa created later than 1957. In the latter cases the diagnoses have been taken from the original publications. Updates produced by the Working Group of the Scleractinian Treatise have been included (also visit www.corallosphere.org). In the discussions of the genera, the diagnoses are based on the original description, supplemented in many cases by re-examination of the type material.

Order Scleractinia BOURNE, 1900

Diagnosis. Solitary or colonial Zoantharia with calcareous external skeleton secreted by the ectodermal body layer, consisting essentially of radial partitions or septa, which are intermesenterial in position and formed within upward infoldings of the basal part of the polyp column wall, and attendant supporting structures: basal plate, epitheca, dissepiments, synapticulae, and mural structures; septa developed in ontogeny following pattern of mesenteries, additional septa after first 6 being inserted in all 6 primary mesenterial exocoeles in successive cycles of six, 12, 24, 48, and so on, in dorsoventral order.

Suborder Astrocoeniina VAUGHAN & WELLS, 1943

Diagnosis. Colonial, rarely solitary. Septa composed of relatively few (up to six or eight) simple or compound trabeculae, appearing as simple rudimentary spines to solid laminae, usually beaded, rarely smooth on margins. Sclerodermites regularly continuous or irregularly diverging along axis of trabeculae. Polyps small, rarely with more than 12 tentacles in a ring, with smooth stomodaea.

Family Actinastreidae ALLOITEAU, 1952a

Diagnosis. Colonial. Budding predominantly extracalicinal, occasionally intracalicinal. Corallites united by their septothecal wall or separated by a rudimentary peritheca. Wall generally compact or with a small number of lacunes (pores). Septa compact, beaded marginally, composed of a series of simple trabeculae, varying in diameter (up to 150 µm). Columella styliform to sublamellar, pali present or not. Endotheca sparsely developed, vesicular.

Genus *Actinastrea* D'ORBIGNY, 1849

Pl. 1, Figs. 1–4; Pl. 2, Figs. 1–7; Pl. 3, Figs. 1–3; Pl. 4, Figs. 4, 6–7

Type species. *Actinastrea goldfussi* D'ORBIGNY, 1850, Maastrichtian of The Netherlands (Maastricht) (subsequent designation by LÖSER, 2012a).

Diagnosis. Corallum colonial, massive, cerioid, subcerioid to subplocoid. Budding extracalicinal, extracalicinal-marginal, and intracalicinal. Corallites small and prismatic in outline, often directly united by their walls. No coenosteum. Columella styliform. Synapticular structures present peripherally. Paliform structures occasionally present. Endothecal dissepiments thin, sometimes arranged forming an inner-corallite ring which is complete or incomplete. Septa compact, generally non-confluent, radially or bilaterally arranged, beaded marginally, and composed of a series of simple trabeculae, varying in diameter (up to

150 µm). Septal flanks covered by spiniform granulae. Wall septothecal with occasionally occurring pores (lacunes).

Synonyms. *Araiocoenia* ALLOITEAU, 1949 (Type species. *Astrea decaphylla* MICHELIN, 1847, Upper Santonian of France); *Enallastraea* DE FROMENTEL, 1861 (Type species. *Astrocoenia ramosa* DE FROMENTEL, 1861, Turonian of France); *Aplosastrea* D'ORBIGNY, 1850 (Type species. *Astrea geminata* GOLDFUSS, 1828, Upper Maastrichtian of The Netherlands [St. Pietersberg, Limburg]), (subsequent designation LÖSER, 2012b); *Stelidioseris* TOMES, 1893 (Type species. *S. gibbosa* TOMES, 1893, Lower Jurassic of England; subsequent designation LÖSER, 2012b).

Subgenus. *Texastrea* WELLS, 1973 (Type species. *Texastrea catenata* WELLS, 1973, Albian (Edwards Formation) of Texas): Like *Actinastrea* but colony often forms imbricating palisades by extracalicinal-lateral budding covered by a holotheca. Corallites are prismatic and cerioid where clustered.

Cretaceous species reported from the Alps and Dinarides. *A. decaphylla* (MICHELIN, 1847; including its subspecies, see ALLOITEAU, 1954a); *A. elongata* ALLOITEAU, 1954a; *A. fromenteli* ALLOITEAU, 1954a; *A. hexacnema* (QUENSTEDT, 1881; including its subspecies); *A. hexaphylla* (QUENSTEDT, 1881); *A. infundibulum* ALLOITEAU, 1954a (first report of the species for the Brandenberg Gosau this paper); *A. konincki* (MILNE EDWARDS & HAIME, 1848d); *A. magnifica* (REUSS, 1854); *A. major* MORYCOWA, 1971; *A. orbignyi* (MILNE EDWARDS & HAIME, 1848d); *A. peroni* (M. BEAUVAIS, 1982); *A. polygonata* ALLOITEAU, 1954a (first report of the species [*cf.*-assignment] for the Brandenberg Gosau this paper); *A. ramosa* (SOWERBY, 1832) (= *A. reticulata* [REUSS, 1854]; = *A. tuberculata* [REUSS, 1854]; = *A. octolamellosa* [MICHELIN, 1847]; = *A. gorjanovici* [FELIX, 1925]; = *A. sowerbyi* ALLOITEAU, 1954a); *A. reticulata octophylla* (QUENSTEDT, 1880); *A. rigausensis* M. BEAUVAIS, 1982; *A. salisburgensis* (M. BEAUVAIS, 1982); *A. subdecaphylla* (OPPENHEIM, 1930a) (= *A. bellomontensis* ALLOITEAU, 1954 [excluding its subspecies]; = *A. menabensis* ALLOITEAU, 1954a); *A. tendagurensis* (DIETRICH, 1926; first report of the species for the Allgäu Schrattenkalk this paper); *A. tuberculata minimituberculata* ALLOITEAU, 1954a; *A.* sp. (first report of the genus for Neue Welt at Grünbach).

Remarks. The taxonomic relation between *Actinastrea* D'ORBIGNY and *Astrocoenia* MILNE EDWARDS & HAIME has been discussed for over a century. In 1848a, MILNE EDWARDS & HAIME described the genus *Astrocoenia* for cerioid colonial corals with small corallites. In the following year D'ORBIGNY proposed the genus *Actinastrea*. Because the appearance of the latter closely resembles that of *Astrocoenia* many authors did not make any distinction between the two. Following re-examination of the type material ALLOITEAU (1954a: 17) separated *Astrocoenia* from *Actinastrea* because it differs from the original description by MILNE EDWARDS & HAIME (1848a: 297) based on the development of 1) a completely compact wall, 2) the occurrence of numerous endothecal dissepiments, 3) the lack of ornamentation of septal flanks, 4) confluence of costosepta, and most importantly, 5) the lack of a columella. On the basis of the latter feature GEYER (1954) transferred all of the Jurassic species of *Astrocoenia* having a columella to the genus *Actinastrea*. The occurrence of forms of *Astrocoenia* remains mainly restricted to the Tertiary.

Texastrea most likely represents a morpho(sub-)genus of *Actinastrea*. The morphological changes are probably due to high-rate sediment influx and/or parasitic infestation.

Recently, works dealing with *Actinastrea* and the related genus *Stelidioseris* have been published which focus on both intraspecific issues and the relationship between these two genera (LÖSER, 2008, 2012a, 2012b). However, the intraspecific model applied in these works is excluded from consideration of current forms because it is flawed in that the same taxon has been assigned to different species: e.g., *Actinastrea pseudominima* (KOBY) as presented in MORYCOWA, 1964, was grouped simultaneously with both *Actinastrea kunthi* (BÖLSCHE) (see LÖSER, 2008: 38) and *Actinastrea tourtiensis* (BÖLSCHE) (see LÖSER, 2008: 40). The distinguishing of the genus *Stelidioseris* from *Actinastrea* by LÖSER is based on characteristics which allegedly occur in one but are absent in the other, like, e.g., certain thecal (lacunes) and septal structures (swollen external parts). In addition, characteristics are used to separate the two taxa which have been known to occur in various groups as a result of environmental factors: e.g., the presence vs. absence of a granulated coenosteum which can be present or absent in heterocoeniid, stylinid, actinaciid forms, and others. However, in the lectotype of the type species of *Actinastrea*, the feature of a granulated coenosteum is absent as the areas showing intercalicinal developments clearly represent initial stages of extracalicinal and extracalicinal-marginal budding. The structures which are interpreted as granulated coenosteum (LÖSER, 2012a) are actually septa of juvenile corallites, each set of which encircle a very prominent styliform columella. In colony areas not influenced by budding, the type of corallite wall is identical to the kind seen in *Stelidioseris*. In addition, in his revision on forms of the genus *Stelidioseris*, LÖSER (2012b) combines forms that seem to lack a coenosteum with specimens that clearly show exothecal developments (see LÖSER, 2012b: 282, Figs. B, E–F vs. Figs. C–D), and also includes forms that are characterized by dissociated (perithecal-) extracalicinal areas, typically seen as perithecal lamellae in *Columastrea* (also present in the holotype of *Columastrea paucipaliformis* BARON-SZABO & GONZÁLEZ-LEÓN, 1999), thus differing from *Stelidioseris*. Moreover, features are used to separate the two genera which generally represent specific but not generic characters (e.g., number of septa). Therefore, and based on the re-examination of type and original material, the genera *Actinastrea* and *Stelidioseris* are considered synonymous.

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk member 'Allgäu Schrattenkalk': Upper Gottesackerwände); Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil).

Austroalpine occurrences. *Gosau Group*: Reported from all Turonian–Campanian Gosau localities; "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Cretaceous of Greece and Italy, Lower Cretaceous of Romania, Valanginian–Lower Aptian of Tanzania, Hauterivian and Lower Aptian of Poland, Barremian of Bulgaria, Upper Cretaceous of Germany, Spain, and France, Turonian–Maastrichtian of India,

Upper Cenomanian–Senonian of the Czech Republic, Coniacian–Maastrichtian of Hungary, Senonian of ?Georgia (in Caucasus), Santonian–Maastrichtian of ?Italy, Campanian of Turkey and Serbia, Campanian–Maastrichtian of Tibet and Madagascar, Maastrichtian of Jamaica, Somalia, Libya, and the UAE/Oman border region.

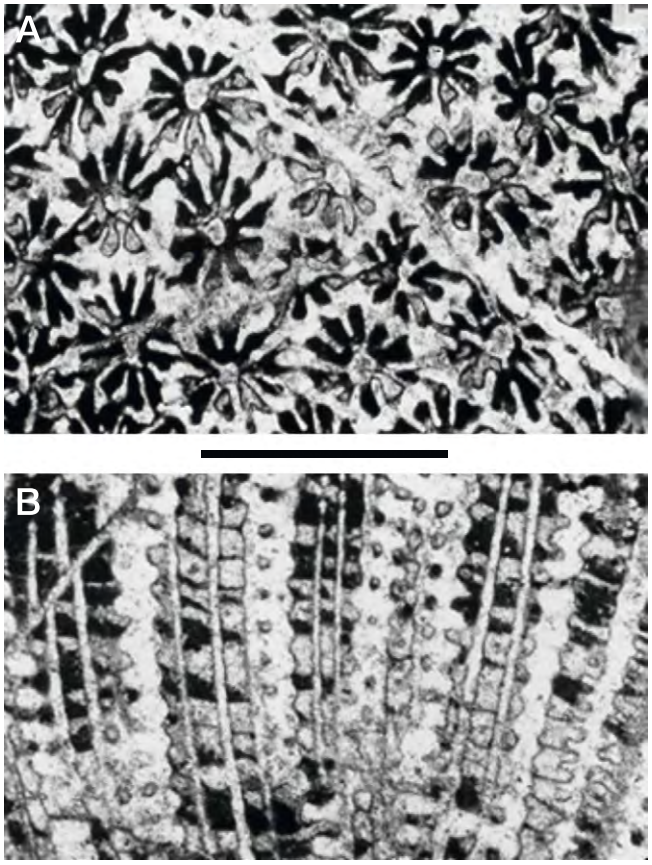
Genus *Columactinastrea* Alloiteau, 1952a

Pl. 1, Fig. 5; Pl. 4, Figs. 1–3, 5

Type species. *Columactinastrea rennensis* Alloiteau, 1952a, Upper Santonian of France (Aude).

Diagnosis. Colonial, massive, cerioid- subplocoid. Budding extracalicinal. Corallites polygonal in outline, generally directly united by their walls. Costosepta compact. Septal margins finely granulated. Columella styliform to sublamellar. Pali before septa of 1st cycle. Endothecal dissepiments thin, vesicular or subtabulate. Wall septothecal, parathecal to septoparathecal in early stages.

Synonyms. *Stephanastraea* De Fromentel, 1886 (Type species. *Stephanastraea mirabilis* De Fromentel, 1886, Lower Santonian of France); *Placocolumastrea* Reig Oriol, 1989 (Type species. *P. torallolensis* Reig Oriol, 1989, Campanian of Spain [Torallola]).



Text-Fig. 3.
Paretallonia bendukidzeae Sikharulidze, 1972; Lower Aptian (Schrattenkalk at Allgäu, Germany). A: thin section, cross view; scale bar: 3 mm; B: thin section, lateral view; scale bar: 2 mm.

Cretaceous species reported from the Alps and Dinarides. *C. formosa* (Goldfuss, 1829); *C. formosissima* (Sowerby, 1832); *C. intricata* (Quenstedt, 1881); *C. pygmaea* (Felix, 1903b); *C.* sp. (first report of the genus for Neue Welt at Grünbach, Ettendorf, and Veitlbruch at Untersberg).

Austroalpine occurrences. *Gosau Group*: Upper Turonian–Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten); ?Coniacian–Santonian (Salzburg: Untersberg, Veitlbruch [= Untersberg Marble]); Santonian (Hochmoos-Rußbach-area; Grabenbach); Santonian (Salzburg: Rußbach, Zimmergraben; Salzburg-Bavaria region: „Krönner Reef“ area); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben, Grünbach; Upper Austria: Gosau, Schrickpalfen; Salzburg: Neffgraben; Styria: Weissenbachalm); Santonian–Campanian (Salzburg: Untersberg); Upper Santonian–Campanian (Styria: Aussee, Weissenbachalm); Lower Campanian (Carinthia: Ettendorf at St. Paul [Weinberger homestead]); “*Styrian Gosau Development*”: Santonian–Campanian of Slovenia (Stranice).

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Cenomanian of Belgium, Turonian–Lower Campanian of France, Senonian of ?Hungary, ?Santonian–Campanian of Spain, Lower Campanian of Portugal, Upper Campanian–Maastrichtian of the UEA/Oman border region.

Family Acroporidae Verrill, 1902

Diagnosis. Forming massive or ramose colonies by extratentacular budding. Basal epitheca present. Corallites small, walls porous, synapticulothecate, merging with coenenchyme, pseudocostate. Septa nonexsert, in two cycles, composed of simple spiniform trabeculae projecting inward and upward from vertical wall trabeculae, often fusing to form laminae. Columella usually absent, or trabecular and weak. Endotheca and exotheca thin, tabular, when developed. Coenenchyme between corallites reticulate, flaky, usually spinose or striate on surface, light.

Remarks. The definition of this family includes characteristics described from recent forms: Polyps variable in color, in shades of brown, yellow, green, violet, and grey. Column wall infolding on retraction, nearly covering tentacles. In *Acropora* the tentacles are retractile and introvertible, with scattered nematocysts. Directive mesenteries present. Mesenteries in six pairs, all or in part filamentiferous, not extended perithecally. Coelentera of adjoining polyps united by ramified systems of canaliculae parallel to the surface, penetrating coenenchyme. Stomodaeum smooth.

Genus *Paretallonia* Sikharulidze, 1972

Text-Fig. 3

Type species. *Paretallonia bendukidzeae* Sikharulidze, 1972, Hauterivian of Georgia (in Caucasus).

Diagnosis. Colonial, massive, subcerioid. Budding extracalicinal. Septa compact, confluent to nonconfluent, granulated laterally. Synapticulae numerous, peripherally. Endothecal dissepiments tabulate, well developed. Perithecal wall rudimentary. Columella styliform, well developed. Wall synapticulothecal, porous.

Cretaceous species reported from the Alps. *P. bendukidzeae* SIKHARULIDZE, 1972; ?*P.* sp. (presented as *Etallonasteria minima* in MORYCOWA & DECROUEZ, 2006).

Remarks. By its macromorphological appearance, the genus *Paretallonia* SIKHARULIDZE closely resembles the genus *Stereocoenia* ALLOITEAU. However, the occurrence of generally confluent septa, a sparsely developed endotheca, and the general absence of a wall between the corallites in the latter clearly separates it from *Paretallonia*. Also see Remarks under *Holocoenia* below (see P. 86).

Recently, MORYCOWA & DECROUEZ (2006) described material from the Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil) as *Etallonasteria minima* (ÉTALLON, 1864), a genus which differs from *Paretallonia* only by the absence of a columella. However, while in some corallites of the Swiss material no columella can be observed, in other corallites of the same specimen, which appears to show a cross cut of a deeper level of the colony, substyliform to sublamellar columellar structures seem to be present. Therefore, the Swiss material might belong to *Paretallonia*.

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Mitteleck, Upper Gottesackerwände, Mahdtal, Seealpe); Lower Aptian of central ?Switzerland (Upper Schrattenkalk at Hergiswil).

Cretaceous occurrences elsewhere. Valanginian of Hungary, Hauterivian of Georgia (in Caucasus), Barremian of Poland, Upper Barremian of France, Lower Aptian of Spain, Lower Cenomanian of northern Spain.

Suborder Faviina VAUGHAN & WELLS, 1943

(= Astraeoina ALLOITEAU, 1952a; = Meandriina ALLOITEAU, 1952a)

Diagnosis. Solitary and colonial. Septa composed of one or more fan systems of simple or compound trabeculae, laminar and imperforate, with margins more or less regularly dentate. Dissepiments well developed. Synapticulae mostly absent. Polyps small to large, with ridged stomodaea and tentacles usually arranged in one or two rings.

Family Mussidae ORTMANN, 1890

(= Faviidae GREGORY, 1900b; = Hemiporitidae ALLOITEAU, 1952a, p.p.)

Diagnosis. Solitary and colonial; mostly intracalicular budding; meandroid (including circumoral budding), plocoid, cerioid, or phaceloid; septothecal, paraseptothecal, or parathecal; septa laminar, sometimes fenestrate, formed by one or more fan systems of trabeculae (simple and compound); septal teeth spinose or paddle-shaped, having well-developed secondary calcification axes and limited thickening deposits; spinose (pointed) granulation, often arranged in vertical rows; variable microstructure; sometimes forming paliform lobes; trabecular columella, often spongy; well-developed tabular or vesicular endotheca; peritheca costate or absent.

Genus *Eugyra* DE FROMENTEL, 1857

Pl. 5, Figs. 1–5

Type species. *Meandrina cottaldina* D'ORBIGNY, 1850 (= *Eugyra cotteaui* DE FROMENTEL, 1857), Hauterivian of France (Fontenoy).

Diagnosis. Colonial. massive, meandroid. Budding intracalicinal. Individual corallites generally indistinct. Isolated corallites occasionally present. Collines generally tholiform. Calicinal series often ramified. Ambulacra present occasionally. Costosepta compact, nonconfluent or subconfluent. Columella trabecular, rudimentary or absent. Long, tabulate endothecal dissepiments abundant. Short, vesicular dissepiments occur in the vicinity of the septothecal to septoparathecal wall. Trabeculae simple and branching, 35–150 µm in size.

Synonym. *Pseudomyriophyllia* MORYCOWA, 1971, (Type species. *P. carpathica* MORYCOWA, 1971, Lower Aptian of Romania [western Carpathians]).

Subgenus. *Felixigyra* PREVER, 1909, Type species. *F. deangelisi* PREVER, 1909, Aptian–Lower Albian of Italy: Like *Eugyra* but calicinal series short-meandroid (often having less than 20 septa) to hydnophoroid.

Synonym of subgenus *Felixigyra*. *Eohydnophora* YABE & EGUCHI, 1936, (Type species. *Eohydnophora tosaensis* YABE & EGUCHI, 1936, Albian to Lower Cenomanian of Japan [Okuminodani, Tosa province]).

Cretaceous species reported from the Alps and Dinarides. *E. clavisepta* MORYCOWA & DECROUEZ, 2006; *E. cotteaui* DE FROMENTEL, 1857; *E.* (*F.*) *crassa* (DE FROMENTEL, 1862); *E.* (*F.*) *duncani* (PREVER, 1909); *E.* (*F.*) *incerta* (MORYCOWA, 1971); *E. lanckoronesis* (MORYCOWA, 1964); *E.* (*F.*) *ovalis* (MASSE & MORYCOWA, 1994); *E.* (*F.*) *patruliusi* (MORYCOWA, 1971); *E.* (*F.*) *picteti* (KOBY, 1896); *E. pusilla* KOBY, 1896; *E. rariseptata* MORYCOWA, 1964 (new rank); *E. turnsekae* (BARON-SZABO in BARON-SZABO & STEUBER, 1996).

Helvetic occurrences. Upper Barremian of southern Germany (Lower Schrattenkalk at Allgäu: Lochbachalpe); Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Brandalpe, Kürental, Engekopf, Mahdtal, Upper Gottesackerwände, Windecksattel, Schwarzenberg); Lower Aptian of Switzerland (Canton of Schwyz) (Upper Schrattenkalk at Drusberg, Käsernalp) and central Switzerland (Upper Schrattenkalk at Hergiswil).

Dinaric occurrences. *Northern Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica); ("*Carbonate shelf*"): Barremian–Aptian of Slovenia (Banjška Planota).

Remarks. DE FROMENTEL established the genus *Eugyra* on the basis of *Meandrina cottaldina* D'ORBIGNY, 1850. As previously discussed in GREGORY (1930a: 201) the reasons for DE FROMENTEL to change the specific name to *'cotteaui'* remain unclear. Therefore, and in accordance with the ICZN, D'ORBIGNY'S *'cottaldina'* has priority.

Recently, LÖSER (2010b) carried out a revision on the genus *Felixigyra*. According to him, this genus differed from *Eohydnophora* by the presence of: 1) connected monticules; 2) very thick monticules; 3) swollen septal tips; 4) calicular centers; and 5) sparsely occurring isolated calices. However, because the holotype of the type species of *Eohydnophora* as presented by EGUCHI (1936: 143, figs. 1–3) frequently shows connected monticules, swollen septal tips, and calicular centers that closely correspond to the ones occasionally found in *Felixigyra*, these two genera are considered synonymous. Moreover, because in a hydnophoroid corallum, the structure of monticules represents the corallite wall, the characteristic of "very thick monticules" only refers to the size of the corallite wall but not to its structural development per se. Therefore, this feature cannot be used as a generic distinction if, as in the current case, the thecal structures themselves remain the same (here septothecal to septoparathecal).

A detailed work carried out on *Felixigyra* was provided by MORYCOWA (1997).

Cretaceous occurrences elsewhere. Cretaceous of Slovenia and Italy, ?Berriasian of Bulgaria, Valanginian of Hungary, Hauterivian–Lower Barremian of Georgia (in Caucasus), Hauterivian and Upper Barremian–Aptian of Poland, Lower Barremian of Turkmenistan, Barremian of Azerbaijan, Bulgaria, and France, Barremian–Aptian of Ukraine, Lower Aptian of Mexico and Romania, Lower Aptian–Albian of Greece, Aptian of Tibet and Serbia, Aptian–Albian of Spain and Iran, Lower Albian of Mexico, Lower Cenomanian of northern Spain.

Genus *Myriophyllia* D'ORBIGNY, 1849

Pl. 6, Figs. 1, 6

Type species. *Meandrina rastellina* MICHELIN, 1843, Upper Jurassic of France (Vosges).

Diagnosis. Colonial, massive and meandroid. Budding intracalicinal. Calices are distinct, rarely indistinct. Septa compact, confluent. Paliform structures present. Columella styliform. Endothecal dissepiments large, concave in the central parts of series, vesicular in the wall zone. Wall septothecal and septoparathecal.

Cretaceous species reported from the Alps. *M. propria* SIKHARULIDZE, 1979a; *M.* sp. (formerly assigned to *Microphyllia densecostata* SIKHARULIDZE in BARON-SZABO, 1997).

Remarks. The genus *Myriophyllia* D'ORBIGNY, 1849 shows close similarities to the *Eugyra–Pseudomyriophyllia* group. The separation of these taxa is due to differences in their thecal and microstructural developments (see MORYCOWA, 1997a: 292).

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Seealpe, Brandalpe).

Cretaceous occurrences elsewhere. Valanginian of Hungary, Lower Aptian and Albian of Georgia (in Caucasus) and Greece, Aptian–Albian of Mexico and Iran.

Genus *Cycloria* REUSS, 1854

Pl. 6, Figs. 2–5; Pl. 7, Figs. 1–11

Type species. *Leptoria patellaris* REUSS, 1854, Upper Santonian of Austria (Neue Welt, Piesting) (subsequent designation REUSS, 1854).

Diagnosis. Colonial, massive, meandroid. Intracalicinal-terminal and extracalicinal-marginal budding, producing long, straight or wavy, ramified calicinal series, separated by tectiform and tholiform collines. Calicinal centers mainly indistinct to subdistinct. Distinct corallite centers occasionally present. Costosepta compact, confluent, subconfluent, or non-confluent, finely granulated or strongly beaded laterally and have occasionally the tendency to produce crispate features costally and ?carinae laterally. Costae are bi- and trifurcated on outer edge. Ambulacra irregularly present, generally very reduced or absent. Endothecal dissepiment thin. Perithecal dissepiments vesicular. Exotheca absent. Columella lamellar, discontinuous. Wall parathecal and septothecal.

Synonyms. *Diplothecophyllia* ALLOITEAU, 1952a (Type species. *D. basseae* ALLOITEAU, 1952a, Thanetian of Madagascar); *Orbignygyra* ALLOITEAU, 1952a (Type species. *Diploria neptuni* D'ORBIGNY, 1850, Lower Coniacian of France [Les Corbières, Aude]); *Meandroria* ALLOITEAU, 1952a (Type species. *Meandrina radiata* MICHELIN, 1846, Turonian of France (Rennes-les-Bains); *Anisoria* VIDAL, 1917 (Type species. *Meandrina vidali* MALLADA, 1892, Maastrichtian of Spain); *Prohydnophyllia* REIG ORIOL, 1994 (Type species. *P. calzadai* REIG ORIOL, 1994, Campanian of northern Spain [Torallola, Lerida]); *Meandropsis* KRASNOV, 1964 (Type species. *Meandrina radiata* GOLDFUSS, 1826, labeled as "Jurassic [Malmian] of Germany [Giengen]" but preservation of material strongly suggests that it was collected from the Upper Cretaceous Gosau Group).

Affinities. Similar to *Dictuophyllia* BLAINVILLE, 1830, but differs from it in lacking an exotheca, and having both extracalicinal-marginal budding and distinct corallite centers.

Cretaceous species reported from the Alps. *P. danieli* (REIG ORIOL, 1994); *C. delicatula* (REUSS, 1854); *C. koninckі* (MILNE EDWARDS & HAIME, 1849b); *C. latisinuata* (FELIX, 1903a); *C. patellaris* REUSS, 1854; *C. radiata* (MICHELIN, 1846); *C. salisburgensis* (MILNE EDWARDS & HAIME, 1849b); *C. tenella* (GOLDFUSS, 1826).

Remarks. REUSS (1854: 110–111, pl. 14, figs. 9–12) described the form *Leptoria patellaris* and noted that it differed from the genus *Leptoria* in its septal and columellar developments. Therefore, he suggested to use it to create his new genus *Cycloria* ("… *Dürfte wohl den Typus einer eigenen Gattung bilden, die den Namen Cycloria führen könnte*."). Because this remark is hidden within the description of the species of *Leptoria patellaris*, it was overlooked by many workers for over a century. While REUSS' genus has hardly been ever used, it does, however, not fall under the *nomen oblitum* rule, as the type material of the type species is

available and it was used after the year 1899 by OPPENHEIM (1930a: 237, pl. 28, figs. 3–3b). Based on the development of costal, septal, and thecal features, REUSS' genus corresponds to the fairly well-known genus *Orbignygyra* ALLOITEAU, 1952a, over which it takes priority.

LÖSER (2011a) documented some specimens of *Anisoria* which also included one of the syntypes of this genus. In his description, however, he confounded calicinal series with exothecal developments. The corrected description of the diagnosis is as follows:

> Meandroid colony. Corallites are arranged in sinuous series, separated by tholiform collines and ambulacra. Corallite centers generally indistinct, but distinct corallites present occasionally. Costosepta compact, non-confluent to sub-confluent, finely granulated laterally. Their axial ends are generally cuneiform or claviform; rhopaloid axial ends are rarely observed. Developments of a lamellar columella seems to be present deeper in the corallum. Synapticulae absent. Endothecal dissepiments thin and vesicular. Perithecal dissepiments well developed, vesicular to subtabulate. Wall parathecal to septothecal. Microstructure consists of small trabecular developments, forming dark median lines.

Because the generic characters of *Anisoria* closely correspond to the ones of *Cycloria*, *Anisoria* is here considered a synonym of *Cycloria*.

Recently, BUDD et al. (2012) carried out studies integrating molecular and morphological data on several genera which have traditionally been considered 'faviid'. Based on their results by taking into consideration skeletal microstructure and septal ornamentation, the genus *Cycloria* shows a resemblance to *Manicina*. Therefore, it is transferred here to the family Mussidae.

Austroalpine occurrences. *Gosau Group*: Coniacian (Salzburg: Rußbach, Hornegg); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt; Upper Austria: Gosau, Hofergraben [= Sattelgraben]); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Santonian (Salzburg: Rußbach, Zimmergraben, Randograben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben; Upper Austria: Rußbach-Gosau, Hochmoos, Brunstloch).

Cretaceous occurrences elsewhere. Upper Aptian of Italy, Cretaceous of Greece, Upper Cretaceous of Bosnia, Turonian–Santonian of France and Georgia (in Caucasus), Turonian–Campanian of Georgia (in Caucasus), Coniacian–Maastrichtian of Hungary, Santonian of Spain, Upper Santonian of southern France, Upper Santonian–Lower Campanian of Romania, Campanian of Turkey and Slovakia, Campanian–Maastrichtian of ?Tibet, Maastrichtian of Bulgaria and the UEA/Oman border region, Middle–Upper Maastrichtian of Jamaica.

Genus *Liptodendron* ELIÁŠOVÁ, 1991a

Pl. 8, Figs. 1–4; Pl. 9, Figs. 1–5

Type species. *Liptodendron grossi* ELIÁŠOVÁ, 1991a, Eocene of Slovakia.

Diagnosis. Colonial, phacelo-dendroid to submeandroid-flabelliform. Budding lateral. Costosepta compact to subcompact, thin, sparsely granulated laterally. Columella parietal, generally feebly developed. Endothecal dissepiments vesicular, abundant. Wall parathecal, with occasional septothecal thickenings.

Cretaceous species reported from the Alps and Dinarides. *L. kocevjensis* (TURNŠEK in TURNŠEK et al., 1992); *L. nefiana* (OPPENHEIM, 1930a) (= *Rhabdophyllia quaylei* WELLS, 1934).

Remarks. In having compact to subcompact septa; a trabecular columella; a parathecal wall with occasional septothecal thickenings; and a lateral budding mode, the specimens described as *Thecosmilia nefiana* OPPENHEIM (1930a: 281ff) and *Procladocora kocevjensis* TURNŠEK (1992) correspond to the genus *Liptodendron* ELIÁŠOVÁ, 1991a (BARON-SZABO, 2006; also see Pl. 9, Figs. 2–5).

Austroalpine occurrences. *Gosau Group*: Upper Santonian (Salzburg: Rußbach, Neffgraben).

Dinaric occurrences. *Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Albian of Slovenia (Slovenski vrh, near Kočevje).

Cretaceous occurrences elsewhere. Maastrichtian of Jamaica.

Genus *Ovalastrea* D'ORBIGNY, 1849

Pl. 8, Figs. 8–9

Type species. *Astrea caryophylloides* GOLDFUSS, 1827, Upper Jurassic of Germany.

Diagnosis. Colonial, massive, plocoid, sub-cerioid, submeandroid. Budding generally intracalicinal, forming short series; extracalicinal budding present in a few places; costosepta compact, nonconfluent, dentate distally, granulated laterally; anastomosis present frequently; a small number of paliform structures irregularly present; columella spongy-papillose or lamellar; wall parathecal to septoparathecal, a small number of synapticulae seem to be present; endothecal and exothecal dissepiments very thin, abundant. Septal microstructural features seem to be similar to the kinds seen in *Favia* (polycentric and fibrose).

Synonyms. *Plesiofavia* ALLOITEAU, 1957 (Type species. *Phyllocoenia dubia* DE FROMENTEL, 1857, Lower Hauterivian of France (Haute-Marne); *Plesioovalastrea* REIG ORIOL, 1994 (Type species. *P. josepmariai* REIG ORIOL, 1994, Upper Santonian–Lower Campanian of northern Spain (Torallola, Lerida). *Pseudofavites* ALLOITEAU, 1958 (Type species. *P. collignoni* ALLOITEAU, 1958, Albian of Madagascar [Majunga]); *?Thalamocoenia* D'ORBIGNY, 1850 (Type species. *T. ornata* D'ORBIGNY, 1850, Lower Hauterivian of France [Yonne]); *Ambiguastraea* ALLOITEAU, 1952a (Type species. *Meandrina ambigua* MICHELIN, 1846, Cenomanian of France (Le Mans, Sarthe); *Favoidio–*

seris WELLS, 1933 (Type species. *F. fredericksburgensis* WELLS, 1933, Middle Albian of Texas [Bell County, USA]).

Cretaceous species reported from the Alps. *O. lorioli* (KOBY, 1897).

Remarks. Based on a re-investigation of the type material, ALLOITEAU (1957) postulated a generic concept for *Ovalastrea* that was different from the one which had been previously introduced by VAUGHAN & WELLS (1943), and WELLS (1956). The main differences between the two concepts are in the septal and thecal developments (according to ALLOITEAU septa in *Ovalastrea* are compact and not perforated, and the wall is septothecal and parathecal, but not synapticulothecal). Re-study of the holotype of the type species of *Ovalastrea* (*Astrea caryophylloides* GOLDFUSS, 1827; IPB no. 221, GOLDFUSS collection) in 2005 by BARON-SZABO confirmed the above mentioned characteristics for *Ovalastrea* (see Pl. 8, Figs. 8–9).

Re-study of type and original material of the genera *Plesiofavia* ALLOITEAU, 1957, and *Pseudofavites* ALLOITEAU, 1958, in the collections housed at the Natural History Museum Paris (MNHN) by the author of the current work during the years 1999 and 2009 revealed that they closely correspond to *Ovalastrea*. Therefore, their synonymy is suggested.

The genus *Thalamocoenia* D'ORBIGNY, 1850, represents a rather unknown taxon. Attempts to study the type material (B14277) at the Natural History Museum in Paris in 2009 by the author of the current work failed because the material could not be found. Up to now, the only authors who have provided some information regarding this taxon were MILNE EDWARDS & HAIME (1851b) and MILNE EDWARDS (1857). Based on their reports, *Thalamocoenia* D'ORBIGNY seems to closely correspond to *Ovalastrea*. Because the type material (MNHN, B14277) has been unavailable for study, its taxonomic assignment is only provisionally.

Also see Remarks under *Placastrea* STOLICZKA, 1873, in "Questionable taxa".

Helvetic occurrences. Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil).

Cretaceous occurrences elsewhere. Hauterivian of ?Ukraine, Lower Barremian of Georgia (in Caucasus), Urgonian of France, Barremian of Azerbaijan, Barremian–Lower Aptian of Poland, Lower Aptian of Romania.

Family Merulinidae VERRILL, 1865

Diagnosis. Colonial; extracalicular and intracalicular budding; cerioid, plocoid, meandroid (including circumoral budding), hydnophoroid, phaceloid. Corallites discrete (1–3 mouths), uniserial or organically united; walls with varying amount of coenosteum that may be costate or spinose, or walls fused and septothecal, paraseptothecal, parathecal, or trabeculothecal; septa laminar, formed by one or more fan systems of trabeculae (often compound and polyaxial); septal teeth spinose or lacerate; scattered spinose granulation; occasional carinae; microstructure often showing distinct median lines; well-developed paliform lobes are common; trabecular (often spongy) or lamellar columella; moderately well-developed tabular or vesicular endotheca; peritheca costate, vesicular, or absent.

Genus *Hydnophora* FISCHER VON WALDHEIM, 1807

Pl. 8, Figs. 5–7, 10; Pl. 9, Figs. 6–8; Pl. 10, Figs. 1–2, 9

Type species. *Madrepora excesa* PALLAS, 1766 (= *Hydnophora demidovii* FISCHER VON WALDHEIM, 1807), Recent, Indian Ocean.

Diagnosis. Colonial. Massive, lamellar or foliaceous, hydnophoroid. Budding intracalicinal. Collines often short, discontinuous. Septa compact, finely granulated laterally. Columella irregularly trabecular to lamellar, discontinuous. Endothecal dissepiments thin, vesicular. Wall septoparathecal.

Synonym. *Hydnophoraraea* OPPENHEIM, 1930a (Type species. *Monticularia styriana* MICHELIN, 1847, Turonian–Campanian of Austria [Gosau Group]).

Cretaceous species reported from the Alps. *H. aconus* (OPPENHEIM, 1930a); *H. ataciana* D'ORBIGNY, 1850 (= *H. parviconus* [OPPENHEIM, 1930a]; *H. grandiconus* (OPPENHEIM, 1930a); *H. kossmati* FELIX, 1903a; *H. longiconus* (OPPENHEIM, 1930a); *H. multilamellosa* REUSS, 1854; *H. ramosa* FELIX, 1903a; *H. rapulum* (OPPENHEIM, 1930a); *H. styriaca* (MICHELIN, 1847) (= *H. blancoensis* WELLS, 1932) (first report of the species for Ettendorf); *H.* sp. (first report of the genus for the Gosau Group at Neue Welt Grünbach).

Remarks. For discussion regarding the relationship between *Hydnophora*, *Monticulastraea* DUNCAN, 1880, and *Leptoria* MILNE EDWARDS & HAIME, 1848b, see BARON-SZABO (2006).

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Mahdtal, Lower Gundalpe, Brandalpe, Windecksattel).

Austroalpine occurrences. *Gosau Group*: Lower Coniacian (Tyrol: Brandenberg, Haidach); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Coniacian (Salzburg: Untersberg, Rußbach, Hornegg, Nagelwand); Upper Coniacian (Upper Austria: Unterlaussa, Weisswasser); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Santonian (Salzburg: Rußbach, Stöcklwaldgraben, Zimmergraben); Upper Santonian (Upper Austria: Gosau, Brunstloch, Gschröfpalfen, Finstergraben, Schrickpalfen, Wegscheidgraben; Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben, Schattauergraben); Upper Santonian–Lower Campanian (Lower Austria: Neue Welt, Grünbach); Lower Campanian (Carinthia: Ettendorf at St. Paul [Weinberger homestead]); Upper Campanian–Lower Maastrichtian (Lower Austria: Neue Welt, Muthmannsdorf); "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Cretaceous occurrences elsewhere. Barremian–Aptian of Bulgaria, Lower Aptian of Greece, Germany, Romania, Upper Aptian of Italy, Albian of the USA (Texas), Upper Cretaceous of Romania, Turonian–Lower Campanian of France, Coniacian–Maastrichtian of Hungary, Santonian–Campanian of Slovenia and Spain, Campanian of Serbia and Bulgaria, Maastrichtian of Italy and Spain.

Genus *Diplogyra* Eguchi, 1936

Text-Fig. 4

Type species. *Diplogyra lamellosa* Eguchi, 1936, Aptian–Lower Albian of Japan ('*Orbitolina* sandstone').

Diagnosis. Colonial, massive, meandroid. Budding intracalicinal, resulting in meandroid series separated by tholiform, sometimes tectiform collines, and ambulacra. Corallites generally indistinct. Costosepta compact, nonconfluent, spinose and ?carinate laterally. Columella absent. Endothecal dissepiments subhorizontal. Wall septoparathecal.

Affinities. Similar to *Eugyra* but shows montlivaltiid structures and has calicinal series that are separated by ambulacra.

Cretaceous species reported from the Dinarides. *D. eguchii* Morycowa, 1971 (new rank).

Dinaric occurrences. *Dinaric Carbonate Platform* ("*Carbonate Shelf*"): Barremian–Aptian of Slovenia (Banjška Planota).

Cretaceous occurrences elsewhere. Lower Aptian of Romania, Aptian–Albian of northern Spain.

Genus *Nefocoenia* Oppenheim, 1930a

Pl. 10, Figs. 3–8

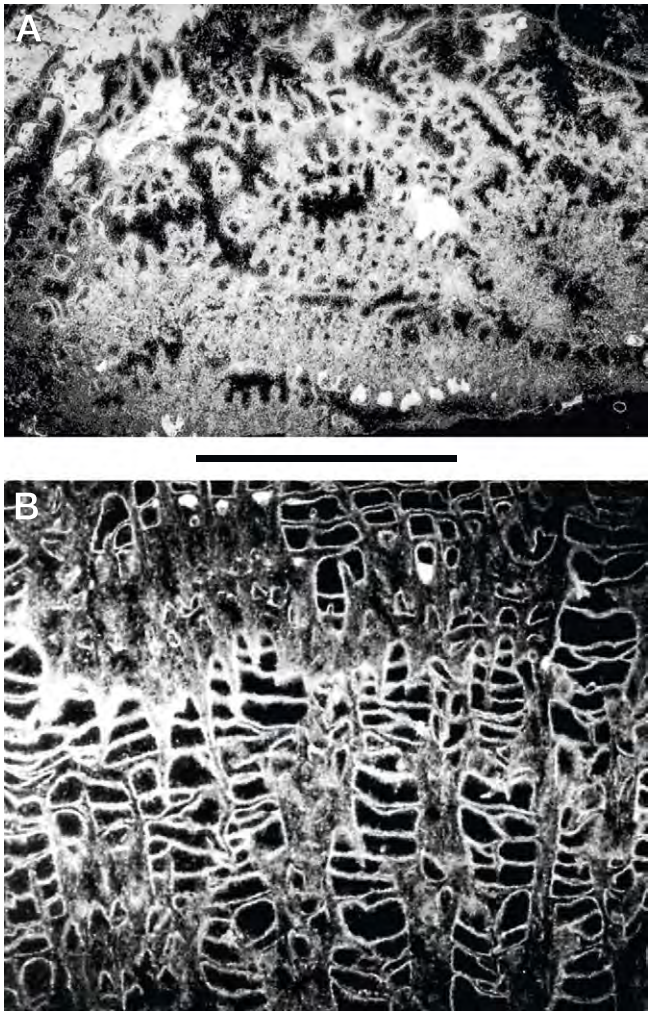
Type species. *Araeacis lobata* Reuss, 1854, Santonian of Austria (Gosau Group).

Diagnosis. Colonial, massive to lamellar-encrusting, plocoid. Budding extracalicinal. Costosepta compact to subcompact, nonconfluent, laterally spinose to granulated, marginally granulate. Columella feebly developed, lamellar or absent and replaced by trabecular extensions forming a pseudo-columella. Wall parathecal and septoparathecal with occasional pores. Endothecal dissepiments vesicular to subtabulate. Exothecal dissepiments large vesicular to cellular, porous.

Synonym. *Proplesiastraea* Oppenheim, 1930a (Type species. *Nefocoenia edelbachensis* Oppenheim, 1930a, Coniacian of Lower Santonian of Austria [Gosau Group at Edelbach]).

Cretaceous species reported from the Alps. ?*N. ambigua* (Sowerby, 1832); *N. edelbachensis* Oppenheim, 1930a; *N. exsculpta* (Reuss, 1854); ?*N. favosites* Oppenheim, 1930a; *N. lobata* (Reuss, 1854); *N. nefiana* Oppenheim, 1930a.

Remarks. Oppenheim (1930a: 426) created the form *Nefocoenia edelbachensis* and remarked that it showed close resemblance to some forms of *Plesiastraea* Milne Edwards & Haime. He ruled out that there could be a true genetic relationship of his newly created species with any form of *Plesiastraea* but suggested that the close affinities to *Plesiastraea* were the result of intra-generic variations within *Nefocoenia* that led to this type of convergence. Therefore, he decided to place the species *Nefocoenia edelbachensis* in a new subgenus, which he called *Proplesiastraea* (Oppenheim, 1930a: 427).



Text-Fig. 4.
Diplogyra eguchii Morycowa, 1971; Barremian–Aptian (Banjška Planota), Slovenia; A: thin section, cross view; scale bar: 7.5 mm; B: thin section, lateral view; scale bar: 6 mm. Photographs courtesy D. Turnšek.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang); Upper Turonian-Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten); Lower Coniacian (Tyrol: Brandenberg, Haidach); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Santonian (Salzburg: Rußbach, Randograben, Zimmergraben; Salzburg-Bavaria region: „Krönner Reef" area); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Upper Austria: Gosau, Brunstloch, Finstergraben, Wegscheidgraben; Salzburg: Abtenau, Rigausbach, Rußbach, Neffgraben, Schattauergraben, Traunwaldalm).

Cretaceous occurrences elsewhere. Cretaceous of Spain, Aptian of eastern Serbia, Upper Cretaceous of Germany, Turonian-Santonian of Georgia (in Caucasus), Turonian of France, Coniacian-Maastrichtian of Hungary, Santonian of France, Upper Santonian-Coniacian of Romania.

Genus *Cladocora* Ehrenberg, 1834

Pl. 11, Figs. 1–8

Type species. *Madrepora caespitosa* Linné, 1767 (= *Caryophyllia caespitosa* [Lamarck, 1816]), Recent, Mediterranean Sea.

Diagnosis. Colonial, variably branching, phaceloid-dendroid to subflabelloid, fasciculate, submassive. Budding mainly extracalicinal but also intracalicinal (polystomodaeal). Costosepta compact, variably granulated laterally, dentate marginally. Paliform swellings, that are often elongate in shape, can be present in front of S1 and S2. Axial structure is a variably formed columella or, more often, a pseudocolumella formed by trabecular extension of axial septal ends, irregularly parietal, spongy to papillose, sublamellar deeper in corallum. Wall septothecal and septoparathecal. Endothecal dissepiments thin, vesicular to subtabulate in corallite center, large vesicular in peripheral area. Epithecal wall often thin or reduced.

Synonyms. *Rhabdocora* De Fromentel, 1873 (Type species. *R. cretacea* De Fromentel, 1873, Lower Santonian of France [Aude]); *Procladocora* Alloiteau, 1952a (Type species. *Calamophyllia gracilis* d'Orbigny, 1850 [non *Calamophyllia gracilis* Milne Edwards & Haime, 1849b], Lower Coniacian of France [Aude]); *Haimesiphyllia* Alloiteau, 1957 (Type species. *Rhabdophyllia salsensis* Haime, 1854, Lower Campanian of France).

Cretaceous species reported from the Alps and Dinarides. *C. gracilis* (d'Orbigny, 1850) (pro *Calamophylliopsis*); *C. libidinum* Oppenheim, 1930a; *C. manipulata* Reuss, 1854; *C. tenuis* Reuss, 1854; *C.* sp. (first report of the genus for the Strobl-Bad Ischl area at Fahrenberg, Ramsau at Hainfeld, and Gams-Hieflau-2).

Remarks. The genus *Cladocora* Ehrenberg shows close affinities to the genus *Calamophylliopsis* Alloiteau, 1957, but is distinguished from the latter by a different wall development and axial structures (compact septa, septotheca to septoparatheca, and paliform swellings in *Cladocora* Ehrenberg; perforated septa, parietal columella, septothecal-synapticulothecal wall, generally well developed endotheca in *Calamophylliopsis* Alloiteau, 1952a).

The material recently described as *Madrepora* sp. from the Maastrichtian of Poland (Stolarski & Vertino, 2007) seems to represent fragments of a dendroid colony with corallites budding off at an angle which is characteristic of some forms of *Cladocora*. Together with characteristics like the presence of weakly developed costae; sparsely occurring endothecal dissepiments; and trabecular extensions of axial ends of septa reaching the axial region, forming irregular axial structures, the material shows affinities to the taxon *Cladocora gracilis* from the Maastrichtian of Jamaica (see Baron-Szabo, 2005: Figs. 2C, G; also compare information regarding ?*Cladocora antarctica* Filkorn, 1994: 77, figs. 29–30).

Pallas (1766: 315) documented material from the recent of the Mediterranean Sea which he assigned to the taxon *Madrepora flexuosa* Linnaeus, 1758. Because Linné's species was created for Palaeozoic forms, Linné used Pallas' material to descibe the species *Madrepora caespitosa* Linné, 1767. Later, this taxon was included by Ehrenberg (1834) in his new genus *Cladocora* and has been considered as the type species of this genus by later authors (e.g., Vaughan & Wells, 1943). According to Zibrowius (1980: 28–31, pls. 9–10), the species *Cladocora caespitosa* is characterized by short to long corallites, forming a variety of morphotypes, including bushy, stout, massive, and all variations in between; corallite diameters ranging between 4–5 mm; and a number of septa commonly ranging between 30–40, thus closely corresponding to the material documented here (Pl. 11, Figs. 1–5). Furthermore, because Zibrowius stated that the occurrence of the form *caespitosa* is restricted to the Mediterranean Sea, the material at hand is assumed to represent a topotype.

Austroalpine occurrences. *Gosau Group*: Turonian (Salzburg: Rußberg); Turonian–Campanian (Upper Austria: Rußbach, Poschalm); Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang; Salzburg: St. Gilgen, Brunnwinkel; Styria: Gams-Hieflau); Turonian–?Coniacian (Salzburg: St. Gilgen, Kohlbachgraben, "Billroth"); Middle Turonian–Lower Coniacian (Tyrol: Brandenberg, Mühlbach); Upper Turonian (Tyrol: Brandenberg, Oberberg, Kreuthergraben, Sonnwendjoch); Upper Turonian–Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten); Upper Turonian–Santonian (Upper Austria: Goisernberg); Coniacian (Salzburg: Strobl-Fahrenberg [Schmalnau Formation]; Tyrol: Ludoi Alp [= Pletzach Alp]); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Lower Austria: Ramsau at Hainfeld); Santonian (Hochmoos-Rußbach-area; Grabenbach, Oberstöckl, Stöcklwaldgraben; Styria: Gams-Hieflau-2; Salzburg-Bavaria region: „Krönner Reef" area); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Upper Austria: Gosau, Schrickpalfen, Brunstloch, Wegscheidgraben; Salzburg: Rußbach, Neffgraben, Traunwandalm); "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. ?Barremian and Turonian–Santonian of France, Upper Cretaceous of Germany, Coniacian–Santonian of Serbia, Santonian of Spain, Santonian–Lower Campanian and Lower Maastrichtian of Romania, Maastrichtian of Antarctica, Jamaica, Italy, and Poland.

Family Placocoeniidae Alloiteau, 1952a

Diagnosis. Colonial, massive. Corallites large, circular, separated by costae or by exotheca. Wall parathecal to septothecal, often thick. Costosepta exsert, their distal margins are covered by granules. Granules on septal flanks are sparse. Synapticulae ?sparse or absent. Columella lamellar. Trabeculae simple, arranged in divergent bundles. Sclerodermites large, aligned in a median line in the septa. Large and well-separated fibrose structures around the calcification centers.

Genus *Placocoenia* D'ORBIGNY, 1849

Pl. 12, Figs. 1–7; Pl. 13, Figs. 1–3

Type species. *Astrea macrophthalma* GOLDFUSS, 1826, Maastrichtian of the Netherlands (Maastricht).

Diagnosis. Colonial, massive, plocoid. Budding extracalicinal. Corallites subcylindrical, united by a perithecal wall. Costosepta compact, arranged radially or bilaterally. Septal margins beaded. Columella lamellar. Endothecal dissepiments vesicular to subhorizontal. Wall septoparathecal and septothecal.

Cretaceous species reported from the Alps and Dinarides. *P. decussata* (OPPENHEIM, 1930a); *P. dumortieri* DE FROMENTEL, 1879; *P. major* FELIX, 1903a; *P. microcalyx* OPPENHEIM, 1930a; *P. robusta* OPPENHEIM, 1930a; *P. turonensis* (DE FROMENTEL, 1884); *P.* sp. (referring to material described as *P. ndalakashensis* DIETRICH, 1926, in BARON-SZABO, 1997; see Remarks below).

Remarks. According to LÖSER (2012c), the material described as *Paraplacocoenia orbignyana* (REUSS, 1854) from the Upper Campanian–Maastrichtian of the UEA/Oman border region by BARON-SZABO (2000: 104, pl. 4, fig. 1) belongs to the genus *Placocoenia*. However, because the UEA/Oman material differs from *Placocoenia* in having paliform structures; a short lamellar columella with additional irregular trabecular structures in the corallites center; and rather short costae, it more closely corresponds to the *Neocoenia–Paraplacocoenia*-group.

BARON-SZABO (1997) assigned material from the Lower Coniacian of the Brandenberg Gosau to *P. ndalakashensis* DIETRICH, 1926. While the Brandenberg material corresponds to the genus *Placocoenia*, investigations of the holotype of *P. ndalakashensis* DIETRICH, 1926 (MB K.1595) by the author of the current work in 2009 revealed, however, that in having both lonsdaleoid septa and a columella that is either absent or substyliform to sublamellar formed by trabecular extensions of septal axial ends, DIETRICH'S material differs from *Placocoenia* but closely corresponds to the genus *Keriophyllia* ALLOITEAU, 1958.

Austroalpine occurrences. *Gosau Group*: Middle Turonian–Lower Coniacian (Tyrol: Brandenberg, Mühlbach); Upper Turonian (Tyrol: Brandenberg, Oberberg, Kreuthergraben); Upper Turonian–Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten); Lower Coniacian (Tyrol: Brandenberg, Haidach); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Lower Santonian (Salzburg: Wolfschwang, Untersberg); Santonian (Salzburg: Rußbach, Zimmergraben, Randoschberg; Hoch-moos-Rußbach-area; Stöcklwaldgraben; Salzburg-Bavaria region: „Krönner Reef" area); Upper Santonian (Upper Austria: Gosau, Schrickpalfen, Brunstloch, Wegscheidgraben, Finstergraben; Salzburg: Abtenau, Rigausbach, Neff-graben, Schattauergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Styria: Aussee, Weissenbachalm).

Cretaceous occurrences elsewhere. Lower Cretaceous of Iran. Aptian of Greece, Coniacian and Upper Santonian of France, Santonian–Campanian of northern Spain, Campanian of Bulgaria, Maastrichtian of Mexico.

Genus *Neocoenia* HACKEMESSER, 1936

Pl. 13, Figs. 4–6; Pl. 14, Figs. 1–2; Pl. 15, Figs. 1–8; Text-Fig. 5

Type species. *Neocoenia renzi* HACKEMESSER, 1936, Cretaceous of Greece.

Diagnosis. Colonial, massive, plocoid. Budding mainly extracalicinal. Corallites circular or subpolygonal. Costosepta compact, nonconfluent to confluent, granular, in the costal area dissociating into trabecular structures. Columella trabecular, spongy or made of twisted or lamellar trabecular processes and individual segments, well-developed. Columella often fused with trabecular extensions of axial ends of septa. Paliform structures irregularly before S1-S2 (and younger cycles?), or reduced, or trabecular extensions of axial ends of septa indistinguishably fused with columella. Wall parathecal, septoparathecal, and septothecal. Endothecal and exothecal dissepiments vesicular or subtabulate.

Remarks. This genus is tentatively kept in the Family Placocoeniidae (BARON-SZABO, in prep.).

Subgenus. *Placocaeniopsis* ALLOITEAU, 1952a (Type species. *P. arnaudi* ALLOITEAU, 1952a, Maastrichtian of France): Like *Neocoenia* but paliform structures reduced and columella generally small trabecular-lamellar, situated in between 2 opposing septa.

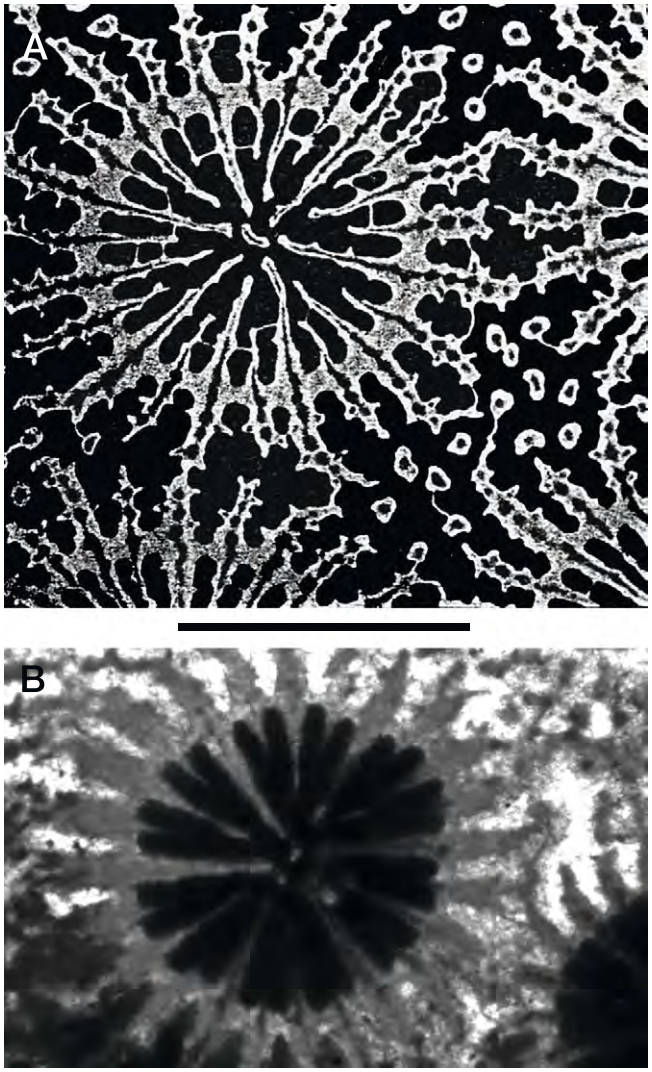
Synonyms of subgenus *Placocaeniopsis*. *Paraplacocoenia* M. BEAUVAIS, 1982 (Type species. *Placocoenia orbignyana* REUSS, 1854, Santonian of Austria [Gosau Group]); *Parastephanocora* REIG ORIOL, 1992 (Type species. *P. gallica* REIG ORIOL, 1992, Lower Coniacian of France [Les Corbières, Burgarach, Aude]).

Cretaceous species reported from the Alps and Dinarides. *N.* (*P.*) *arnaudi* (ALLOITEAU, 1952a); *N* (*P.*) *crassisepta* (M. BEAUVAIS, 1982); *N.* (*P.*) *kittliana* (FELIX, 1903a) (= *P. organum* OPPENHEIM, 1930a); *N. lepida* (REUSS, 1854); *N. lilli* (REUSS, 1854); *N.* (*P.*) *orbignyana* (REUSS, 1854); *N.* (*P.*) *pruvosti* M. BEAUVAIS, 1982; *N. renzi* HACKEMESSER, 1936; *N.* (*P.*) *rotula* (GOLDFUSS, 1828); *N. subpolygonalis* HACKEMESSER, 1936.

Remarks. According to REIG ORIOL (1992: 46–47), his newly created genus *Placocaeniopsis* has a septothecal wall and a styliform columella. However, in the original description of this genus, REIG ORIOL also documents areas showing parathecal wall structures and a rather short, lamellar columella. In addition to all other skeletal elements, the genus *Parastephanocora* REIG ORIOL is characterized by skeletal features that are identical to ones in *Neocoenia* (*Placocaeniopsis*).

M. BEAUVAIS (1982) stated that the type material of *Elasmocoenia kittliana* FELIX (here grouped with the subgenus of *Neocoenia*) was lost and designated a neotype. However, because there is syntype material of this taxon in the depository of both the Geological Survey of Austria, Vienna (GBA) and the Natural History Museum Vienna (see Pl. 15, Figs. 4, 6), BEAUVAIS' neotype is invalid.

Austroalpine occurrences. *Gosau Group*: Turonian–?Coniacian (Salzburg: St. Gilgen, Kohlbachgraben, "Billroth"); Lower Coniacian (Tyrol: Brandenberg, Haidach); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt; Upper Austria: Gosau, Hofergraben [= Sat-



Text-Fig. 5.
Neocoenia (*Placocaeniopsis*) *orbignyana* (REUSS, 1854); A: sketch based on the illustration in FELIX (1903a: 297); Upper Turonian–Campanian (Gosau area), Austria; scale bar: 3 mm;B: thin section, cross view; GBA 1999/089/0003/01 (BARON-SZABO coll.), Upper Santonian (Styria, Weissenbachalm), Austria; scale bar: 3 mm.

telgraben]); Lower Santonian (Salzburg: Wolfschwang, Untersberg); Santonian (Salzburg: Rußbach, Randograben, Zimmergraben; Salzburg-Bavaria region: „Krönner Reef" area); Upper Santonian (Salzburg: Abtenau, Rigausbach; Rußbach, Neffgraben; Upper Austria: Gosau, Brunstloch, Gschröfpalfen; Lower Austria: Neue Welt, Piesting, Scharrergraben); Upper Santonian–Campanian (Styria: Aussee, Weissenbachalm).

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Cretaceous of Greece, Aptian–Albian of Iran, Aptian–Cenomanian of Bosnia, Upper Cretaceous of Croatia, Germany, Serbia, and France, Cenomanian of Lebanon and Azerbaijan, Turonian of Italy, Coniacian–Maastrichtian of Croatia, Hungary, and Georgia (in Caucasus), Santonian–Campanian of Hungary, Spain, Serbia, and Romania, Santonian and Maastrichtian of ?Italy (Sicily), Campanian of Bulgaria, Upper Campanian–Maastrichtian of the UEA/Oman border region, Maastrichtian of Mexico and France, Upper Maastrichtian of The Netherlands and Jamaica.

Genus *Astrogyra* FELIX, 1901

Pl. 16, Figs. 1–5

Type species. *Gyrosmilia edwardsi* REUSS, 1854, Santonian of Austria (Gosau Group).

Diagnosis. Colonial, massive, meandroid. Budding intracalicinal. Calicinal series forked, generally united by peritheca or exotheca. Ambulacra present, often narrow. Costosepta compact, non-confluent, laterally granulate and carinate. Columella lamellar, discontinuous. Endothecal dissepiments abundant. No synapticulae. Wall parathecal to septoparathecal.

Cretaceous species reported from the Alps. *A. edwardsi* (REUSS, 1854); *A. orbignyi* (DE FROMENTEL, 1873) (= *A. edwardsi* [REUSS, 1854] in OPPENHEIM, 1930a); *A. voracissima* (OPPENHEIM, 1930a).

Remarks. In having thick, compact costosepta and a well-developed exothecal wall, the material figured from the Aptian of Uzbekistan as *Astrogyra edwardsi* (REUSS, 1854) in KUZMICHEVA (1982) rather corresponds to the generic description of *Stiboriopsis* VAUGHAN, 1899.

According to M. BEAUVAIS (1982, vol. 1: 80), *A. edwardsi* (REUSS, 1854) in OPPENHEIM (1930a) represents a junior synonym of *A. orbignyi* (DE FROMENTEL, 1873).

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Tyrol: Brandenberg, Sonnwendjoch); Upper Turonian–Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten); Coniacian (Tyrol: Ludoi Alp [= Pletzach Alp]); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Santonian (Salzburg: Rußbach, Stöcklwaldgraben, Zimmergraben); Upper Santonian (Upper Austria: Gosau, Schrickpalfen, Brunstloch, Gschröfpalfen; Salzburg: Rußbach, Neffgraben; Styria: Aussee, Weissenbachalm); Upper Campanian (Carinthia: Krappfeld).

Cretaceous occurrences elsewhere. ?Aptian–Albian of Uzbekistan, Upper Cretaceous of Romania and Serbia, Turonian–Campanian of Georgia (in Caucasus), Santonian of Armenia, Santonian–Campanian of northern Spain (Catalonia) and southern France (Provence), Campanian of Bulgaria, Maastrichtian of the UEA/Oman border region.

Genus *Taxogyra* WELLS, 1937

(pro *Heterophyllia* D'ORBIGNY, 1850, non MCCOY, 1849)
Pl. 17, Figs. 1–2; Pl. 19, Figs. 1–2

Type species. *Meandrina macroreina* MICHELIN, 1847, Upper Santonian of France (Aude).

Diagnosis. Colonial, massive, meandroid. Budding intracalicinal (-polystomodaeal), resulting in long sinuous calicinal series, separated by flattened collines. Ambulacra absent. Costosepta compact, confluent, laterally granulate and carinate. Columella lamellar, discontinuous. Endothecal dissepiments abundant. No synapticulae. Wall parathecal to septoparathecal.

Affinities. The genus *Taxogyra* WELLS is closely related to *Astrogyra* FELIX, but is distinguished from the latter in lacking ambulacra.

Cretaceous species reported from the Alps. *T. macroreina* (MICHELIN, 1847).

Remarks. Because *Heterophyllia* D'ORBIGNY, 1850, represents a junior homonym of the Carboniferous coral *Heterophyllia* MCCOY, 1849, WELLS (1937) created the replacement taxon *Taxogyra* for D'ORBIGNY'S genus.

Austroalpine occurrences. *Gosau Group*: Upper Turonian–Campanian (Upper Austria: Gosau basin).

Cretaceous occurrences elsewhere. Upper Coniacian and Upper Santonian of France. Santonian of Spain.

Genus *Columnocoenia* ALLOITEAU, 1952a

Pl. 17, Figs. 3–4; Pl. 18, Figs. 4–5

Type species. *Columnocoenia lamberti* ALLOITEAU, 1957, Upper Santonian of France (Aude).

Diagnosis. Colonial, massive, plocoid. Budding extracalicinal and intracalicinal by various types of septal division, which can be initiated by e.g., the fusion of opposing septa with the columella (as in *Cladophyllia* or *Glenarea*), or the merging of adjacent first order septa which then begin to separate from the mother corallite, and others. Costosepta compact, arranged radially or irregularly radially-bilaterally. Columella lamellar. Endothecal dissepiments vesicular to tabulate. Pali or paliform structures before 1st and 2nd cycle septa. Wall synapticulothecal and septothecal.

Synonym. *Columnocoeniopsis* REIG ORIOL, 1989 (Type species. *C. eduardi* REIG ORIOL, 1989, Upper Santonian–Lower Campanian of Spain)

Cretaceous species reported from the Alps. *C.* cf. *giroldi* (ÉTALLON, 1859) (first report of the species for the Upper Schrattenkalk at Vorarlberg); *C. hofergrabensis* (M. BEAUVAIS, 1982); *C. ksiazkiewiczi* MORYCOWA, 1964; *C. oppenheimi* M. BEAUVAIS, 1982 (pro *Heliastraea lilli* REUSS in OPPENHEIM, 1930a); *C. reussi* (M. BEAUVAIS, 1982) (pro *Placocoenia coronata* REUSS in OPPENHEIM, 1930a).

Remarks. Recently, LÖSER (2011c) carried out a revision of the family Placocoeniidae which included the genus *Columnocoenia*. Because he based his revision on non-type material which significantly differs from the type material (e.g. type material shows pali and paliform lobes, very well-developed endotheca and peritheca' special budding types; material figured in LÖSER shows no pali, seems to have a rather sparsely developed endotheca and peritheca; range of budding types cannot be observed), the original diagnosis by ALLOITEAU, which is emended here based on the study of the holotype of the type species, is kept.

Helvetic occurrences. Lower Aptian of Austria (Upper Schrattenkalk at Vorarlberg: Götzis-Kalkofen); Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Gottesackerloch, Falkenberg); Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil).

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang); Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Upper Austria: Gosau, Wegscheidgraben; Salzburg: Rußbach, Neffgraben).

Cretaceous occurrences elsewhere. Valanginian of Hungary, Hauterivian–Barremian of Chile, Barremian of Ukraine, Poland, Azerbaijan, Turkmenistan, Upper Barremian–Lower Aptian of France, Aptian–Albian of Spain, Greece, and Iran, Lower Aptian of Switzerland and Romania, Middle Albian–Lower Cenomanian of Mexico, Cenomanian of Germany, Coniacian of Serbia and Montenegro.

Family Montlivaltiidae DIETRICH, 1926

Diagnosis. Solitary and colonial. Colony formation by various plans of complete and incomplete intratentacular budding. Where budding is incomplete, centers are linked by lamellae. Corallite wall septothecal or parathecal. Costosepta compact, bicuneiform, mostly free, sometimes anastomosing. Their distal edge has trifid or pyramidal teeth, diamond shaped in section. Septal flanks have vertical or arched carinae. Inner edges of larger septa are rhopaloid. Distance between centers of trabeculae range between 150 and 1,300 µm. Branching trabeculae produce two or more lateral axes that are projected in a plan including the trabecular axis and perpendicular to the septal plan. No synapticulae, no fulturae, columella usually absent; when present parietal or lamellar. Endotheca abundant. Exotheca in some colonial forms.

Subfamily Montlivaltiinae DIETRICH, 1926

Diagnosis. Montlivaltiids with columella absent or trabecular.

Genus *Montlivaltia* LAMOUROUX, 1821

Pl. 18, Figs. 1–2; Pl. 19, Figs. 3–4

Type species. *Montlivaltia caryophyllata* LAMOUROUX, 1821, Middle Jurassic (Upper Bathonian) of Calvados.

Diagnosis. Solitary, trochoid to subcylindrical, or turbinate. Septa compact, thin, exsert, in general numerous and crowded. Columella absent. Endothecal dissepiments abundant, vesicular. Epitheca membraniform.

Cretaceous species reported from the Alps. *M. ferculum* OPPENHEIM, 1930a; *M. hippuritiformis* (MICHELIN, 1846); *M. ignorata* OPPENHEIM, 1930a (pro *Montlivaltia reussi* MILNE EDWARDS & HAIME in FELIX, 1903a; *M. rudis* (SOWERBY, 1832); *M. salisburgensis* MILNE EDWARDS, 1857.

Remarks. Numerous forms of *Montlivaltia* have been described from various Gosau localities, most of which have been subsequently transferred to other genera like *Placos–*

milia, *Peplosmilia*, and others. Those few taxa which according to MILNE EDWARDS (1857), OPPENHEIM (1930a), and M. BEAUVAIS (1982) belong to *Montlivaltia* are all characterized by an almost non-existent epithecal wall which, in the case of, e.g., *M. salisburgensis* MILNE EDWARDS (1857: 314) only appears at the upper edge of the corallum.

Austroalpine occurrences. *Gosau Group*: Turonian (Salzburg: Rußberg); Upper Turonian–Coniacian (Styria: Aussee, Weissenbachalm); Upper Turonian–Campanian (Upper Austria: Gosau basin); Coniacian (Salzburg: Strobl, Nussensee); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Santonian (Salzburg: Rußbach, Stöcklwaldgraben, Zimmergraben; Salzburg-Bavaria region: „Krönner Reef" area); Upper Santonian (Upper Austria: Gosau, Finstergraben, Wegscheidgraben; Salzburg: Rußbach, Neffgraben; Lower Austria: Neue Welt, Grünbach, Gottes Schacht); Upper Campanian (Carinthia: Krappfeld).

Cretaceous occurrences elsewhere. Upper Cretaceous of Croatia, Turonian–Santonian of France, Coniacian–Santonian of Spain, Campanian of Hungary and Serbia, Maastrichtian of Iran and Spain.

Genus *Thecosmilia* MILNE EDWARDS & HAIME, 1848a

Pl. 18, Fig. 3

Type species. *Lithodendron trichotomum* GOLDFUSS, 1826, Upper Jurassic of Germany (see MILNE EDWARDS & HAIME, 1848a).

Diagnosis. Colonial, phaceloid. Budding polystomodaeal. Corallites remain in mono- to tricentric condition. Septa compact, beaded; columella absent. Endothecal dissepiments very abundant, vesicular.

Cretaceous species reported from the Alps. *T. rudis* DE FROMENTEL, 1870; *T. similis* OPPENHEIM, 1930a.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang; Styria: Gams-Hieflau; Tyrol: Brandenberg, Sonnwendjoch); Upper Turonian-Campanian (Upper Austria: Gosau basin); Coniacian (Tyrol: Ludoi Alp [= Pletzach Alp]); Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben).

Cretaceous occurrences elsewhere. Cretaceous of France, Santonian of Spain.

Genus *Clausastrea* D'ORBIGNY, 1849

Pl. 20, Figs. 1-4

Type species. *Clausastrea tesselata* D'ORBIGNY, 1849, Bajocian of France (Langres, Haute-Marne).

Diagnosis. Colonial, massive, subthamnasterioid to submeandroid. Costosepta compact, confluent, sometimes subconfluent. No holotheca. Budding mainly intracalicinal. Endothecal dissepiments numerous, tabulate and vesicular. No columella. No walls between the corallites. No synapticulae.

Cretaceous species reported from the Alps and Dinarides. *C. bolzei* ALLOITEAU, 1960b; *C. plana* (DE FROMENTEL, 1877).

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Windecksattel, Schwarzenberg, Mitteleck, Upper Gottesackerwände).

Dinaric occurrences. *Northern Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica); ("*Carbonate shelf*"): Barremian–Aptian of Slovenia (Banjška Planota).

Cretaceous occurrences elsewhere. Valanginian of Ukraine, Lower Barremian of Turkmenistan, Barremian–Lower Aptian of eastern Serbia, Lower Aptian of Greece, Poland, and Tunisia, Turonian of France.

Genus *Complexastrea* D'ORBIGNY, 1849

Pl. 20, Figs. 5–6; Pl. 21, Figs. 1–2

Type species. *Complexastrea subburgundiae* D'ORBIGNY, 1849, Jurassic ('Corallien') of France.

Diagnosis. Colonial, astreoid, plocoid to subcerioid. Budding intracalicinal and extracalicinal. Costosepta compact, nonconfluent, rarely confluent, granulated and carinate laterally. Their axial ends are often rhopaloid. Columella absent or formed by weakly parietal structures. No pali. Synapticulae absent. Endothecal dissepiments pass from one corallite to the next, they are vesicular, cellular, or tabuloid. Wall absent or paraseptothecal.

Synonym. *Platastraea* TOMES, 1885 (Type species. *Isastrea conybearii* MILNE EDWARDS & HAIME, 1851a, Middle Jurassic of Great Britain).

Subgenus. *Carcicocaenia* ALLOITEAU, 1953 (Type species. *C. pfenderae* ALLOITEAU, 1953, Cenomanian of France [Bouches-du-Rhone]): Like *Complexastrea* but rhopaloid axial ends of septa often dissociate forming paliform lobes.

Synonym of subgenus *Carcicocaenia*. *Complexastraeopsis* SIKHARULIDZE, 1985 (Type species. *Complexastraeopsis coronata* SIKHARULIDZE, 1985, Hauterivian of Georgia [Imereti]).

Cretaceous species reported from the Alps. *C. seriata* TURNŠEK, 1972 (first report of the species for the Berriasian of Vorarlberg, Austria); *C.* cf. *seriata* (referring to material described in BARON-SZABO [1997], and in SANDERS & BARON-SZABO [1997]); *C.* sp. (first report of the species for the Schrattenkalk at Vorarlberg).

Remarks. In a number of calices of the holotype of *Carcicocaenia pfenderae* ALLOITEAU, 1953, a lamellar columella seems to be present. However, the structure which appears to be a lamellar columella occurs in those calices that are most likely in the process of intracalicinal budding. Apparently, in *Carcicocaenia* intracalicinal budding takes place by septal division, whereby two opposite septa merge, resulting in the development of two new corallites. This is identical to the features observed in *Complexastraeopsis* SIKHARULIDZE, 1985, and *Platastraea* TOMES, 1885, the latter

of which is considered to be a junior synonym of *Complexastrea* D'ORBIGNY (LATHUILIÈRE, pers. comm., 2011).

Helvetic occurrences. Berriasian of Austria (Oehrli Formation at Vorarlberg: Sibratsgfäll-Krähenberg); Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Mahdtal) and Austria (Lower Schrattenkalk at Vorarlberg: Sack at Schönenbach).

Austroalpine occurrences. *Gosau Group*: Lower Coniacian (Tyrol: Brandenberg; Haidach).

Cretaceous occurrences elsewhere. Aptian–Albian of Spain.

Genus *Trochosmilia* MILNE EDWARDS & HAIME, 1848a

Pl. 23, Fig. 7

Type species. *Turbinolia cornicula* MICHELIN, 1846, Bartonian of France (Nice) (see MILNE EDWARDS & HAIME, 1848a).

Diagnosis. Solitary, trochoid, fixed, calice subcircular. Calicular pit elliptical and large. Wall septothecal or septoparathecal. Septa vertically discontinuous, beaded marginally. Columella spongy-papillose. Endothecal dissepiments thick, sparsely developed. Epitheca rudimentary or absent.

Synonyms. *Edwardsosmilia* ALLOITEAU, 1952a (Type species. *Trochosmilia faujasi* MILNE EDWARDS & HAIME, 1848d, Maastrichtian of France); *Strobilosmilia* ALLOITEAU, 1952a (Type species. *Trochosmilia granifera* HAIME, 1854, Upper Santonian of France [Les Corbières, Aude]); *Carantoseris* ALLOITEAU, 1952a (Type species. *Ellipsosmilia humilis* D'ORBIGNY, 1849, Lower Cenomanian of France [Charante-Maritime]); *Feddenia* DUNCAN, 1880 (Type species. *F. typica* DUNCAN, 1880, Paleocene of Pakistan).

Cretaceous species reported from the Alps. *T. boissyana* (MICHELIN, 1847); *T.* sp. (first report of the genus for Stollhof).

Remarks. According to GILL & RUSSO (1973) the microstructure of *Trochosmilia* MILNE EDWARDS & HAIME corresponds well with the montlivaltiid type.

Austroalpine occurrences. *Gosau Group*: Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Upper Santonian–Lower Campanian (Lower Austria: Neue Welt, Stollhof).

Cretaceous occurrences elsewhere. Turonian of Bulgaria, Lower Coniacian–Campanian of France, Santonian and ?Maastrichtian of Spain, Campanian of Serbia.

Genus *Dimorphocoenia* DE FROMENTEL, 1857

Text-Fig. 6

Type species. *Dimorphastrea crassisepta* D'ORBIGNY, 1850, Hauterivian of France (Haute-Marne).

Diagnosis. Colonial, massive, thamnasterioid, submeandroid in areas where circumoral feature has been lost during later stages of coral growth. Budding circumoral. Septa compact, confluent to subconfluent, granulated and carinate laterally. Columella absent. Endothecal dissepiments vesicular to subtabulate. No wall between the corallites.

Synonym. *Aphragmastraea* SOLOMKO, 1888 (Type species. *A. crassisepta* SOLOMKO, 1888, Lower Hauterivian of Ukraine) (= *Dimorphocoenia solomkoae* BENDUKIDZE, 1961).

Cretaceous species reported from the Alps. *D. crassisepta* (D'ORBIGNY, 1850).

Helvetic occurrences. Lower Aptian of Switzerland (Canton of Schwyz) (Upper Schrattenkalk at Drusberg, Käsernalp).

Remarks. SOLOMKO (1888: 19–20) based her new genus on the specimens that had been documented as *Astraea cristata* by DUBOIS DE MONTPEREUX (1843: 350). Later, BENDUKIDZE (1961) transferred SOLOMKO'S material to the genus *Dimorphocoenia*. Because the species name *crassisepta* had already been occupied for the genus *Dimorphocoenia*, she created the new species name *Dimorphocoenia solomkoae*.

Also see Remarks under the genus *Latiastrea*.

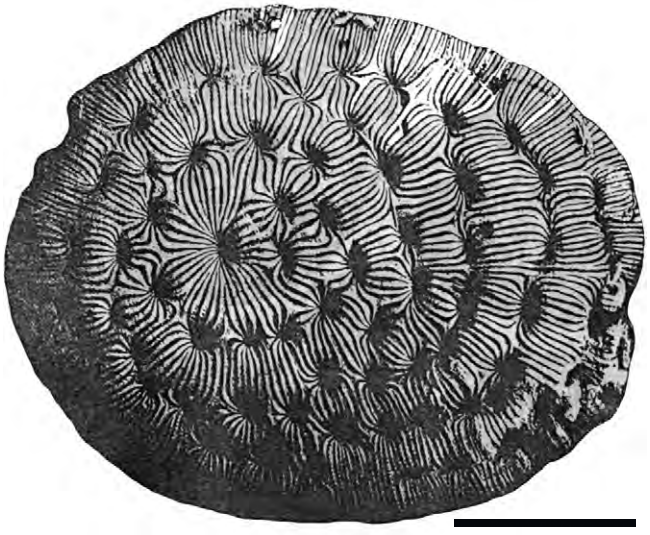
Cretaceous occurrences elsewhere. Lower Hauterivian and Barremian of France, Hauterivian of Spain, Barremian of Bulgaria, Lower Aptian of central Greece, Cenomanian of Germany.

Genus *Gyroseris* REUSS, 1854

Pl. 22, Figs. 1–6

Type species. *Gyroseris patellaris* REUSS, 1854, Upper Santonian of Austria (Neffgraben, Gosau Group).

Diagnosis. Solitary, patellate-subturbinate. Septa compact, distinctly granulated laterally, arranged radially in unequal systems. Columella papillose, well-developed. No synapticulae. Endothecal dissepiments thick, vesicular. Wall parathecal-epicostal.



Text-Fig. 6.
Dimorphocoenia crassisepta (D'ORBIGNY, 1850); based on the sketch in KOBY (1896: Pl. 16, Fig. 1); Lower Aptian of Switzerland (Canton of Schwyz) (Upper Schrattenkalk at Drusberg, Käsernalp); scale bar: 40 mm.

Synonyms. *Cyclastraea* ALLOITEAU, 1952a (Type species. *Cyclolites spinosa* DE FROMENTEL, 1870, Cenomanian of France [Le Beausset, Var]); *Pseudocycloseris* ALLOITEAU, 1957 (Type species. *P. uxacalcensis* ALLOITEAU, 1957, Upper Turonian of France [Uchaux, Vaucluse]); ?*Pachythecosmilia* REIG ORIOL, 1991 (Type species. *P. clarae* REIG ORIOL, 1991, Aptian of Spain [Castellvi de la Marca, Barcelona]).

Cretaceous species reported from the Alps. *G. patellaris* REUSS, 1854.

Remarks. WELLS (1956: F381) states that *Gyroseris* is a junior synonym of the genus *Trochoseris* MILNE EDWARDS & HAIME, 1849a. However, great differences can be seen in the development of both the septa and the wall. In *Trochoseris* synapticulae are abundant, forming a synapticulothecal wall and the septa are subcompact to porous (septa are compact and synapticulae are absent in *Gyroseris*).

According to GILL & RUSSO (1973), the genus *Cyclastraea* ALLOITEAU is a solitary montlivaltiid taxon that is characterized by the occurrence of a papillose columella and the lack of synapticulae, thus very closely corresponding to the genus *Gyroseris* REUSS. Therefore, their synonymy is suggested.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Salzburg: St. Gilgen, Weissenbach); Upper Santonian (Salzburg: Rußbach, Neffgraben).

Cretaceous occurrences elsewhere. Santonian of Spain, Upper Santonian of France.

Genus *Latiphyllia* DE FROMENTEL, 1861

Pl. 23, Figs. 1–6

Type species. *Latiphyllia neocomiensis* DE FROMENTEL, 1861, Hauterivian of France.

Diagnosis. Colonial, flabello-meandroid. Budding intracalicinal. Calicinal centers distinct, arranged in series. Costosepta compact, confluent in the same series, carinated laterally. Columella absent. Endothecal dissepiments numerous. Wall parathecal-epicostal.

Cretaceous species reported from the Alps and Dinarides. *L. deformis* (REUSS, 1854); *L. neocomiensis* DE FROMENTEL, 1877; *L. pulchella* (OPPENHEIM, 1930a).

Helvetic occurrences. Lower Aptian of Switzerland (Canton of Schwyz) (Upper Schrattenkalk at Drusberg, Käsernalp) and central Switzerland (Upper Schrattenkalk at Hergiswil).

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Salzburg: St. Gilgen); Coniacian (Salzburg: Untersberg, Nagelwand); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben, Traunwandalm).

Dinaric occurrences. *Inner Dinarides (Orešje at Mt. Medvednica):* Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Hauterivian of France, Coniacian–Santonian of France, Santonian–Campanian of Spain.

Genus *Meandrastrea* D'ORBIGNY, 1849

Text-Fig. 7

Type species. *Astrea pseudomeandrina* MICHELIN, 1841, Turonian of France (Uchaux).

Diagnosis. Colonial, massive, meandroid. Budding intracalicinal. Corallite centers distinct, arranged in meandroid series, separated by tectiform collines. Costosepta compact, confluent or nonconfluent, dentate, sometimes forming vertical carines. Columella parietal, spongy, lamellar in some corallites. Wall parathecal. Endothecal dissepiments numerous, vesicular.

Synonyms. *Mycetophylliopsis* OPPENHEIM, 1930a (Type species. *Mycetophyllia antiqua* REUSS, 1854, Upper Turonian–Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten); *Anisastraea* ALLOITEAU, 1957 (Type species. *Astrea lamellosissima* MICHELIN, 1841, Upper Turonian of France [Uchaux]); *Comophyllastraea* ALLOITEAU, 1957 (Type species. *C. corbariensis* ALLOITEAU, 1957, Lower Coniacian of France [Aude]).

Subgenus. *Sinaimeandra* ALLOITEAU, 1958 (Type species. *S. awadi* ALLOITEAU, 1958, Upper Albian–Cenomanian of Egypt [Halal Formation]): Like *Meandrastrea* but costae reduced

Text-Fig. 7.
Sketch of *Meandrastraea* cf. *crassisepta* as figured in FELIX (1903a, Pl. 23, Fig. 12), NHMW 1852/0001/1441, Upper Turonian–Campanian (Gosau basin), Austria; scale bar: 10 mm.

and parietal columella less variable (only parietal-spongy). In *Meandrastrea* costae are more distinctly developed and columella is parietal-spongy but also lamellar in some corallites.

Cretaceous species reported from the Alps and Dinarides. *M. antiqua* (REUSS, 1854); *M. crassisepta* D'ORBIGNY, 1850.

Remarks. In contrast to the original documentation by ALLOITEAU (1941: 31, pl. 11, fig. 4; pl. 12, figs. 4–5) and based on the re-investigation of the holotype of the type species *Astrea lamellosissima* MICHELIN (MNHN Mo0484), the genus *Anisastraea* ALLOITEAU, 1957, is characterized by: a massive corallum; corallites arranged in (subthamnasterioid-) meandroid series; corallite centers distinct, sometimes connected by lamellar linkages; budding intracalicinal; costo-septa compact, confluent and non-confluent, dentate laterally and marginally, sometimes forming vertical carines; costae well-developed or nearly completely reduced; columella is lamellar or consists of irregular or elongate trabecular segments; wall parathecal; and numerous endothecal dissepiments. Therefore, its synonymy with *Meandrastrea* is suggested.

MILNE EDWARDS & HAIME (1851a: 103) grouped the form *Astrea lamellosissima* MICHELIN (chosen as the type species of *Anisastraea* by ALLOITEAU, 1957) with their genus *Isastrea*. Later, ALLOITEAU (1941: 31) provisionally assigned the taxon *Astrea lamellosissima* MICHELIN to the genus *Reussastraea* DE FROMENTEL, 1886 (non D'ACHIARDI, 1875). Besides the fact that DE FROMENTEL'S genus represents a junior homonym of D'ACHIARDI'S taxon, ALLOITEAU (1941) already pointed out that the genus *Reussastraea* DE FROMENTEL was only mentioned by DE FROMENTEL (1886: 562, table) without giving any description of this genus other than that it belonged to the Family Astrees MILNE EDWARDS & HAIME, 1849b, and that it had a lamellar columella. In addition, ALLOITEAU stated that, by the nature of its walls, the form *Astrea lamellosissima* MICHELIN differed from both the *Astrea*-concept of MILNE EDWARDS & HAIME and the genus *Isastrea*. Later, after re-examination of the type material, ALLOITEAU (1957: 162–163) came to the conclusion that the taxon *Astrea lamellosissima* MICHELIN belonged to the Family Dendrogyridae and created the new genus *Anisastraea* using MICHELIN'S taxon as the type species. However, re-investigation by the author of the current work in 2010 revealed that by the presence of occasional carines, the genus *Anisastraea* showed close affinities to the montlivaltiids (see discussion in paragraph above).

In forming a massive, meandroid colony that has wide calicinal series with indistinct corallite centers which are generally united by peritheca or exotheca; showing ambulacra; and lacking a columella, the specimen described as *Meandrastrea antiqua* (REUSS) from the Santonian–Campanian of Greece by ABDEL-GAWAD & GAMEIL (1995) differs from the genus *Meandrastrea* but might be related to *Astrogyra* or *Taxogyra*. Therefore, it is excluded from the list of occurrences.

Austroalpine occurrences. *Gosau Group*: Middle Turonian–Lower Coniacian (Tyrol: Brandenberg, Mühlbach); Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang; Salzburg: St. Gilgen; Tyrol: Brandenberg, Oberberg, Kreuthergraben); Upper Turonian–Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten); Upper Turonian–Santonian (Upper Austria: Goisernberg); Upper Turonian–Campanian (Upper Austria: Gosau basin); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Upper Santonian (Salzburg: Rußbach, Neffgraben, Traunwandalm, Schattauergraben).

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Upper Albian–Santonian of France, Turonian–Campanian of Georgia (in Caucasus), Coniacian–Lower Santonian of Hungary, Santonian–Lower Campanian of Romania, Turonian and Campanian of Spain.

Subfamily Placosmiliinae ALLOITEAU, 1952a

Diagnosis. Montlivaltiids with lamellar columella.

Genus *Placosmilia* MILNE EDWARDS & HAIME, 1848a

Pl. 24, Figs. 1–5; Pl. 25, Figs. 1–5; Pl. 26, Figs. 1–7

Type species. *Turbinolia cymbula* MICHELIN, 1846, Santonian of France (Aude) (see MILNE EDWARDS & HAIME, 1848a).

Diagnosis. Colonial. Younger specimens flabellate, becoming meandroid in later ontogenetical stages. Budding intracalicinal, resulting in a single meandroid calicinal series. Costosepta compact, arranged bilaterally. Septal margins granular. Septal flanks often secondarily thickened which might cover granules and carines. Endothecal dissepiments well-developed, occurring throughout the whole corallum. Columella lamellar, continuous or formed by irregularly occurring lamellar segments. Trabecular extensions of axial septal ends often fuse with columellar structures. Wall parathecal to septoparathecal. Multilamellar epithecal wall sometimes present.

Synonyms. *Placosmiliopsis* M. BEAUVAIS, 1982 (Type species. *Trochosmilia saltzburgiana* MILNE EDWARDS & HAIME, 1848a, Turonian–Campanian of Austria [Upper Austria, Gosau Group]); *Fhragmosgyra* REIG ORIOL, 1994 (Type species. *F. torallolensis* REIG ORIOL, 1994, Upper Santonian–Lower Campanian of Spain); *Lasmogyra* D'ORBIGNY, 1849 (Type species. *Lobophyllia occitanica* MICHELIN, 1847, Upper Coniacian of France).

Cretaceous species reported from the Alps and Dinarides. *P. arcuata* MILNE EDWARDS & HAIME, 1848d; *P. bipartita* (REUSS, 1854); *P. columbella* OPPENHEIM, 1930a; *P. europhila* FELIX, 1903a; *P. fenestrata* (FELIX, 1903a); *P. gracilis* (FELIX, 1903a); *P. inflata* M. BEAUVAIS, 1982; *P. martini* (MICHELIN, 1847); *P. occitanica* (MICHELIN, 1847); *P. ogilviae* (OPPENHEIM, 1930a); *P. psecadiophora* (FELIX, 1903a); *P. saltzburgensis* (MILNE EDWARDS & HAIME, 1848a); *P. schattauerensis* (M. BEAUVAIS, 1982); *P. sinuosa* (REUSS, 1854); *P. turonensis* (DE FROMENTEL, 1873) (= *Lasmogyra irregularis* FELIX, 1901; = *Lasmogyra tortuosa* FELIX, 1903a); *P.* sp. (first report of the genus for the Gosau Group at Gams-Hieflau-2, Ettendorf, and Tiefengraben [Tauerngraben]).

Remarks. See Remarks under *Strotogyra*.

Austroalpine occurrences. *Gosau Group*: Reported from all Middle Turonian to Lower Campanian localities; "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Cretaceous occurrences elsewhere. Cretaceous of Hungary, Greece, and Bulgaria, Aptian of Serbia, Albian of Spain, Upper Cretaceous of France, Upper Cretaceous of Germany, Senonian of Slovakia, Santonian of Azerbaijan, Santonian–Campanian of Spain, Upper Santonian–Lower Campanian of Romania and Serbia, Upper Campanian–Maastrichtian of the UEA/Oman border region.

Genus *Peplosmilia* Milne Edwards & Haime, 1850

Pl. 27, Figs. 1–7

Type species. *Peplosmilia austeni* Milne Edwards & Haime, 1850, Upper Albian of England, UK (Haldon Hill, Exeter).

Diagnosis. Solitary, subcylindrical, fixed. Septa slightly exsert, compact, granulated laterally. Endothecal dissepiments abundant, vesicular. Columella lamellar, well developed. Epitheca membraniform.

Cretaceous species reported from the Alps and Dinarides. *P. depressa* De Fromentel, 1863; *P. fromenteli* Angelis d'Ossat, 1905; *P. latona* (Felix, 1903a) (= *Haplaraea diversicostata* Oppenheim, 1930a).

Remarks. Because the material described from the Upper Campanian–Maastrichtian of the UAE/Oman-border region as *Peplosmilia latona* in Gameil (2005) appears to be a non-scleractinian, it is excluded from the current work.

Dinaric occurrences. *Northern Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica); *Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Upper Aptian of Slovenia (Slovenski vrh, near Kočevje).

Austroalpine occurrences. *Gosau Group*: Middle Turonian–Lower Coniacian (Tyrol: Brandenberg); Upper Turonian (Salzburg: St. Gilgen); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Upper Austria: Gosau, Hofergraben [= Sattelgraben]); Santonian (Upper Austria: Gosau, Obergeschröfpalfen; Salzburg: Rußbach, Zimmergraben); Upper Santonian (Upper Austria: Gosau, Gschröfpalfen, Wegscheidgraben; Rußbach, Neffgraben).

Cretaceous occurrences elsewhere. Cretaceous of Hungary, Hauterivian and Aptian of Spain, Lower Barremian of Turkmenistan, Aptian of Tibet and Serbia, Aptian–Albian of Greece, Albian of England, Cenomanian of France.

Family Axosmiliidae Geyer, 1955a

(= Placophylliidae Eliášová, 1990)

Diagnosis. Solitary and colonial. Costosepta bicuneiform, compact, almost free, with strongly developed costal part. Costosepta arranged in regular cycles according to their length and thickness in many genera. Costae short and have no ornamentation. Lateral flanks of septa have unequal granules, irregularly disposed. Distal margins of septa have weakly developed ornamentations arranged in a zig-zag pattern. Lateral and distal ornamentations are more pronounced in thin septa. No pali. No synapticulae. Microstructure is characterized by a mid-septal zig-zag line. Original microstructural pattern obscured by secondary thickenings, resulting in smooth surfaces. Columella is essential, lamellar and continuous, with microstructures similar to the kind seen in septa. Endothecal dissepiments common, vesicular in perithecal areas. Wall formed by enlargement of costae. Wrinkled epitheca complete in younger stages, becoming incomplete in older stages.

Remarks. The diagnosis given for the family Axosmiliidae is largely based on observations made by Lathuilière (pers. comm., 2009) on the lectotype of the nominatform of the family.

Genus *Placophyllia* d'Orbigny, 1849

Pl. 28, Figs. 1–3

Type species. *Lithodendron dianthus* Goldfuss, 1827, Upper Jurassic of Germany (Giengen).

Diagnosis. Colonial, phaceloid, can be fasciculate with plocoid to cerioid polyp outlines in younger colonies. Budding extracalicinal and intracalicinal-marginal. Costosepta compact, septal flanks covered with small granules. Distal edge of septa smooth. In closely packed corallites costae may be subconfluent. Columella lamellar. Synapticulae and pali absent. Corallite wall parathecal, irregular. Endothecal dissepiments vesicular in peripheral corallite areas and subtabulate in axial corallite areas. Epithecal wall folded.

Cretaceous species reported from the Alps and Dinarides. *P. curvata* Turnšek in Turnšek & Buser, 1974; ?*P.* sp. (referring to material described as *Donacosmilia* sp. in Turnšek & Buser, 1974).

Remarks. L. Beauvais (1970) stated that the type specimen of *Placophyllia* has synapticulae in the vicinity of the wall. However, re-examination of the type specimen by the author of the current work in 1999 revealed the existence of occasionally thickened outer ends of dissepiments but no synapticulae (Baron-Szabo, 2002: 53). Later, Eliášová (1990) described the species *Placophyllia rugosa* from the Upper Jurassic–Lower Cretaceous of the Czech Republic as having a microstructure of the neorhipidacanth type. Because this microstructural feature is typical of forms of the Rhipidogyrina, she transferred *Placophyllia* from the faviid Placosmiliidae to her newly created Placophylliidae (placed in the suborder Rhipidogyrina). However, in the type material of the type species, *Placophyllia dianthus* Goldfuss, 1827, the microstructure corresponds to the faviid

type *sensu lato*. Recently, these observations by the author of the current work have been supported by re-investigations of the type material carried out by LATHUILIÈRE who, in addition, suggested that *Placophyllia* be grouped with the family Axosmiliidae (LATHUILIÈRE, pers. comm., 2011; also visit corallosphere.org). Consequently, the family Placophylliidae becomes the junior synonym of Axosmiliidae.

Dinaric occurrences. *Northern Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica).

Austroalpine occurrences. *Gosau Group*: Lower Coniacian (Tyrol: Brandenberg, Haidach).

Cretaceous occurrences elsewhere. Valanginian of Hungary, Hauterivian of Turkmenistan, Barremian–Lower Aptian of eastern Serbia, Aptian–Lower Albian and Campanian of northern Spain.

Genus *Kobyphyllia* BARON-SZABO, 1997

Pl. 28, Fig. 4; Pl. 29, Figs. 1–3

Type species. *Plesiophyllia recta* KOBY, 1884, Upper Jurassic of Switzerland (see BARON-SZABO in BARON-SZABO & FERNANDEZ-MENDIOLA, 1997).

Diagnosis. Solitary, cuneiform or turbinate, fixed. Costosepta compact, exsert, granulate. Axial ends of septa cuneiform to rhopaloid. Microstructural mid-septal line is straight, irregularly wavy, or zig-zag. Columella lamellar. Wall septothecal and parathecal. Endothecal dissepiments generally large vesicular.

Cretaceous species reported from the Alps. *K. acrisionae* (FELIX, 1903a).

Remarks. The genus name *Plesiophyllia* chosen by KOBY (1884) represented a junior homonym of *Plesiophyllia* MICHELOTTI in SISMONDA, 1871. Therefore, *Kobyphyllia* was created as the replacement taxon (BARON-SZABO in BARON-SZABO & FERNANDEZ-MENDIOLA, 1997).

The genus *Kobyphyllia* is closely related to the genus *Plesiosmilia* MILASCHEWITSCH, 1876, from the Upper Jurassic from Germany (Nattheim), but, based on the original documentation of the type material by MILASCHEWITSCH, differs from it in the apparent lack of septothecal developments. In addition, *Plesiosmilia* might have septal structures that differ from the kinds in *Axosmilia*: While LATHUILIÈRE (pers. comm., 2011) has provisionally assigned *Plesiosmilia* to the family Axosmiliidae, other authors (e.g., L. BEAUVAIS, 1964) grouped this genus with the Smilotrochidae.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Salzburg: St. Gilgen); Upper Santonian (Salzburg: Rußbach, Neffgraben); Upper Santonian–Lower Campanian (Lower Austria: Baden, Einöd quarry).

Cretaceous occurrences elsewhere. Lower Albian and Campanian of Spain.

Family Dermosmiliidae KOBY, 1887

(= Felixaraeidae M. BEAUVAIS, 1982)

Diagnosis. Solitary and colonial. Budding intracalicinal. Corallites free until reaching a large size. Septa sparsely and irregularly perforated. They consist of branching trabeculae arranged in regular series. Distance of trabeculae centers range between 30 and 200 µm. Septal flanks strongly ornamented by granules that vary in size and shape. Columella trabecular, spongy-papillose. Endothecal dissepiments mainly peripheral. Septa merging axially only. Wall parathecal or septothecal. Synapticulae sparse or absent.

Genus *Dermosmilia* KOBY, 1884

Pl. 29, Figs. 4–6

Type species. *Dermosmilia divergens* KOBY, 1884, Upper Jurassic (Rauracian) of Switzerland.

Diagnosis. Colonial, phaceloid-dendroid. Budding intracalicinal, complete. Corallites united only basally. Costosepta compact to subcompact, laterally granulated. Columella papillose. Synapticulae few in number except near the wall. Endothecal dissepiments thin, vesicular to subtabulate. Wall parathecal to parasynapticulothecal, secondarily thickened.

Cretaceous species reported from the Alps and Dinarides. *D. cretacica* TURNŠEK in TURNŠEK & BUSER, 1974.

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Seealpe, Kürenwald, Upper Gottesackerwände).

Dinaric occurrences. *Northern Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica).

Cretaceous occurrences elsewhere. Berriasian of Crimea, Hauterivian of Turkmenistan, Barremian–Aptian of Ukraine, Upper Barremian–Lower Aptian of Mexico, Lower Aptian of Greece, Aptian–Albian of Iran.

Genus *Calamophylliopsis* ALLOITEAU, 1952a

Pl. 30, Figs. 1–7; Text-Fig. 8

Type species. *Calamophyllia flabellata* DE FROMENTEL, 1861, Upper Jurassic (Oxfordian) of France.

Diagnosis. Colonial, phaceloid to dendroid. Budding intracalicinal-polystomodaeal. Extracalicinal appearance in places due to early detachment of new corallites. Centers permanently monocentric. Costosepta compact, subcompact, or irregularly perforated. Columella trabecular, often papillose. Synapticulae sparse, more frequently occurring near the wall. Endothecal dissepiments often well-developed, subtabulate. Small exothecal or perithecal dissepiments may be present between septotheca and epitheca. Wall septothecal, septoparathecal, and synapticulothecal,

tending to be solid secondarily and thickened. Epithecal developments present or absent.

Cretaceous species reported from the Alps and Dinarides. *C. compressa* (D'ORBIGNY, 1850) (first report of the species for the Albian at Vorarlberg); *C. fotisalensis* (BENDUKIDZE, 1961); *C. simonyi* (REUSS, 1854).

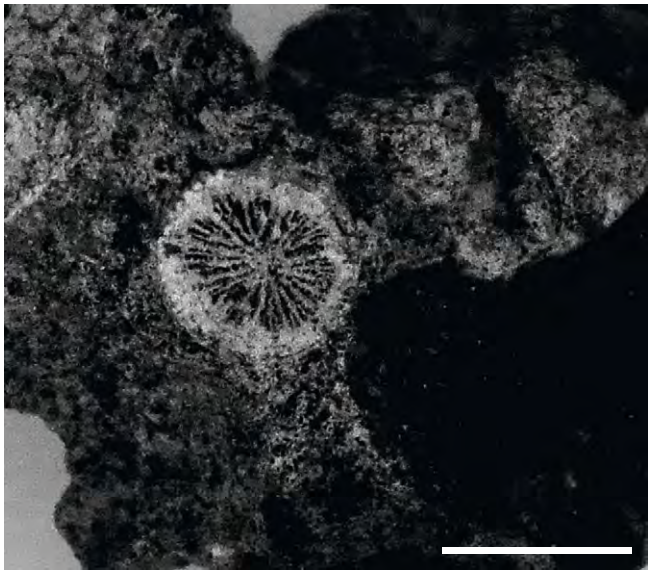
Remarks. The genus *Calamophylliopsis* ALLOITEAU, 1957, shows close affinities to the genus *Cladocora* EHRENBERG, 1834, but is distinguished from the latter by different wall developments and axial structures (perforated septa, parietal columella, synapticulothecal wall, well-developed endotheca in *Calamophylliopsis* ALLOITEAU; compact septa, septotheca, pseudo-columella, and paliform swellings in *Cladocora* EHRENBERG, 1834).

The material described from the Lower Aptian of Spain as *Procladocora* sp. by BOVER-ARNAL et al. (2012) is included here.

Regarding the relationship between *Calamophylliopsis* and *Calamophyllia*, see Remarks under *Calamophyllia* in the section "Questionable taxa" below.

Helvetic occurrences. Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil); Albian of Austria (Garschella Formation at Vorarlberg [Plattenwald beds]: Klaus, Feldkirch district, Rhine River valley).

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang; Styria: Gams-Hieflau); Coniacian (Salzburg: Untersberg, Nagelwand); Upper Coniacian (Upper Austria: Unterlaussa, Weisswasser); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Santonian (Salzburg: Rußbach, Zimmergraben; Salzburg-Bavaria region: „Krönner Reef" area); Upper Santonian (Upper Austria: Gosau, Brunstloch, Wegscheidgraben; Salzburg: Rußbach, Neffgraben); "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).



Text-Fig. 8.
Calamophylliopsis compressa (D'ORBIGNY, 1850); upper surface of colony fragment, cross view, partially polished; VNS P.24701, Albian (Garschella Formation at Vorarlberg), Austria; scale bar: 7 mm. Photograph courtesy G. FRIEBE.

Dinaric occurrences. *Dinaric Carbonate Platform* ("*Carbonate shelf*"): Barremian–Aptian of Slovenia (Banjška Planota); ("*Urgonian Facies Development*"): Aptian of Slovenia (Slovenski vrh, near Kočevje); *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Cretaceous of Slovenia, Berriasian–Valanginian of Ukraine, Hauterivian of Turkmenistan, Hauterivian–Barremian of France, Barremian–Lower Aptian of western Switzerland (Canton of Vaud), Aptian–Albian of Spain and Hungary, Albian of Greece and Georgia (in Caucasus), Campanian of Hungary, Upper Campanian–Maastrichtian of the UEA/Oman border region, Maastrichtian of ?Spain.

Genus *Epistreptophyllum* MILASCHEWITSCH, 1876

Pl. 31, Figs. 5–6

Type species. *Epistreptophyllum commune* MILASCHEWITSCH, 1876, Upper Jurassic of Germany (Nattheimer Schichten).

Diagnosis. Solitary, turbinate to cylindrical, attached. Costosepta subcompact, granulated laterally, irregularly dentated marginally. Granules of septal flanks extremely variable in size and shape (small spiniform, coarse, pennula-like, rounded, etc.). Columella spongy-papillose. Trabecular lobes present. Pali absent. Synapticulae abundant. Endothecal dissepiments vesicular.

Synonym. *Leptophyllaraea* ALLOITEAU, 1952a (Type species. *Leptophyllia granulata* DE FROMENTEL, 1867, Upper Cenomanian of France).

Cretaceous species reported from the Alps. *E. gigantea* (OPPENHEIM, 1930a); *E. irregularis* (REUSS, 1854); *E. pollicaris* (OPPENHEIM, 1930a); *E. reticularis* (OPPENHEIM, 1930a) (= *Stephanosmilia polydectes* KOLOSVÁRY, 1954).

Remarks. The skeletal structures seen in material described from the Alps correspond well with the kinds seen in specimens documented by PANDEY & LATHUILIÈRE (1997: e.g., fig. 7.7, fig. 8.11, and 9.12). Also see Remarks under *Truncoconus* TURNŠEK.

Austroalpine occurrences. *Gosau Group:* Upper Turonian (Salzburg: St. Gilgen), Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Santonian (Salzburg: Rußbach, Stöcklwaldgraben, Zimmergraben); Upper Santonian (Upper Austria: Gosau, Wegscheidgraben); Upper Campanian (Carinthia: Krappfeld); *"Styrian Gosau Development":* Santonian–Campanian of Slovenia (Stranice).

Cretaceous occurrences elsewhere. Santonian of France, Campanian of Spain and Hungary.

Genus *Truncoconus* TURNŠEK, 1981

Pl. 31, Figs. 1–4, 7–8

Type species. *Truncoconus inclinatus* TURNŠEK in TURNŠEK & MIHAJLOVIĆ, 1981, Barremian–Lower Aptian of Serbia.

Diagnosis. Solitary, truncated, ?free. Epithecal wall present, basally. Corallum narrows upwards and is truncated

in its upper part. Calicular pit elongated, in places filled with septa. Septa compact with rare pores, laterally covered with granulae varying in size and shape (pennula-like, rounded, small spiniform, and others). Costae short. Endothecal dissepiments subtabulate to cellular (corallite center) and vesicular (peripheral areas). Synapticulae sparse. Microstructure composed of simple trabeculae.

Synonym. *Felixaraea* M. BEAUVAIS, 1982 (Type species. *Haplaraea rennensis* ALLOITEAU, 1952a, Upper Santonian of France [Corbières]). For comparison, see Pl. 31, Figs. 3–4.

Cretaceous species reported from the Alps. *T. pratzi* (FELIX, 1903a).

Remarks. Originally, the genus *Truncoconus* TURNŠEK was placed in the family Haplaraeidae, the nominatform of which was traditionally viewed as a sister taxon of the genus *Epistreptophyllum*. Later, in their comprehensive work on *Epistreptophyllum*, PANDEY & LATHUILIÈRE (1997) documented the differences between *Haplaraea* and *Epistreptophyllum*. Subsequently, *Epistreptophyllum* was re-grouped with the family Dermosmiliidae (PANDEY & FÜRSICH, 2003). Regarding its septal ornamentation; the presence of septal pores; types of endothecal dissepiments; and the presence of synapticulae, the genus *Truncoconus* corresponds well to *Epistreptophyllum*, but is distinguished from it in having a well-developed endotheca, and axial structures that are significantly more solid and compact. The same applies to the holotype of the type species of *Felixaraea*, based on which it was interpreted to be synonymous with *Truncoconus* (BARON-SZABO, 2002: 105). Given the wide range of morphological appearances found in their sister taxon *Epistreptophyllum*, the genera *Truncoconus* and *Felixaraea* fit in well: *Truncoconus* closely resembles the forms representing the structurally more solid variations and tend to have less elaborate septal ornamentations. On the other side of the variation spectrum there is *Felixaraea* which fits well with the variations that show both rather coarse septal ornamentations and the tendency to form dissociating trabeculae. With the exception of the above mentioned differing characteristics, the holotype of the type species of *Truncoconus* closely corresponds to forms of *Epistreptophyllum* documented in PANDEY & LATHUILIÈRE (1997, Figs. 7.4; 7.8; 7.10), and PANDEY & FÜRSICH, (2003: Pl. 17, figs. 8a–b; pl. 18, fig. 6). The holotype of the type species of *Felixaraea* shows close resemblance to the forms of *Epistreptophyllum* documented in PANDEY & LATHUILIÈRE (1997: Figs. 8.8; 8.11), and PANDEY & FÜRSICH, (2003: Pl. 17, Fig. 2), thus underscoring the taxonomic affinities of *Truncoconus* and *Felixaraea*. Because *Truncoconus* shows affinities to *Epistreptophyllum*, it is grouped with the family Dermosmiliidae. Consequently, the family Felixaraeidae is regarded as a junior synonym of the family Dermosmiliidae.

M. BEAUVAIS (1982) based his genus *Felixaraea* on a specimen of the ALLOITEAU collection at the Natural History Museum Paris labeled as *Haplaraea rennensis*. The only specimen labeled as such is R.10953 which is also marked as 'type' and completely corresponds to the specimen in ALLOITEAU (1952a: Pl. 2, fig. 4). Because BEAUVAIS' documentation clearly points to the idea that he was only referring to a single specimen presented in ALLOITEAU'S work of 1952a, the material labeled as R.10953 is used as the holotype of the type species of the genus *Felixaraea*. In addition, because ALLOITEAU figured the material as 'holotype' and presented a description of the material on p. 657, fig. 110, he is the original author of this species.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang; Salzburg: St. Gilgen); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Santonian (Salzburg: Rußbach, Stöcklwaldgraben).

Cretaceous occurrences elsewhere. Lower Santonian of France.

Family Columastreidae ALLOITEAU, 1952a

Diagnosis. Colonial, massive as in Faviids and Heliastreids. Corallites directly united by a septothecal or perithecal wall. Peritheca vesicular or cellular, sparsely developed, upper surface beaded. Costosepta compact, granulated, consisting of relatively small trabeculae, often arranged in two divergent systems. Columella and pali present.

Remarks. Studies carried out on the type material of the type species of the nominatform of *Columastrea* (*C. striata*) by BARON-SZABO (2002; 2003a: 123–124) revealed that the size of the calcification centers in the septa were up to 20 µm and the distance of calcification centers were up to around 50 µm. In the wall, calcification centers of around 40 µm were observed.

Genus *Columastrea* D'ORBIGNY, 1849

Pl. 32, Figs. 1–4

Type species. *Astrea striata* GOLDFUSS, 1826, Senonian of Austria (Gosau Group).

Diagnosis. Colonial, massive, plocoid to subcerioid. Budding extracalicinal and ?intracalicinal. Perithecal dissepiments vesicular to subtabulate. Costosepta compact, arranged radially, mostly nonconfluent, but subconfluent to confluent in places. Superficially, costae extend over the coenosteum or are restricted to corallite wall. Septal margins finely granulated. Columella styliform to sublamellar, or made of a small number of papillae. Pali present before 1st cycle septa, 2nd cycle pali irregularly present, generally forming an incomplete ring. Pali of S2 frequently fuse with pali of S1, giving the impression of the occurrence of a smaller number of pali, as in those cases they appear as S1 pali only. Axial ends of septa that are irregularly connected with paliform structures form auriculae-like developments. Endothecal dissepiments thin, subtabulate. Wall parathecal to septothecal, with occasional pores. Perithecal wall consists of reduced costae or a series of reduced costae arranged in layers around the corallite (similar as in e.g., *Heliocoenia*).

Synonyms. *Polystephanastraea* ALLOITEAU, 1952a (Type species. *P. planialpici* ALLOITEAU, 1952a, Lower Santonian of France [Bouches-du-Rhône]); *Multicolumnastraea* VAUGHAN, 1899 (Type species. *Heliastraea cyathiformis* DUNCAN in DUNCAN & WALL, 1865, Campanian of Jamaica (Trout Hill) (see

DUNCAN & WALL, 1865); *Plesiastreopsis* CHEVALIER, 1954 (Type species. *Astrea vesparia* MICHELIN, 1841, Upper Turonian of France (Uchaux, Vaucluse) (also see ALLOITEAU, 1957: 124, pl. 9, figs. 6, 7).

Cretaceous species reported from the Alps and Dinarides. *C. corbarica* (D'ORBIGNY, 1850); *C. cyathiformis* (DUNCAN in DUNCAN & WALL, 1865); *C. dumortieri* (DE FROMENTEL, 1886); *C. striata* (GOLDFUSS, 1826) (= *C. mirabilis* [DE FROMENTEL, 1886]); *C. variolaris* (MICHELIN, 1847); *C. villaltai* (REIG ORIOL, 1995); *C.* sp. (first report of the genus for the Strobl-Bad Ischl area at Fahrenberg).

Remarks. Re-study of the holotype of the type species of *Polystephanastraea* ALLOITEAU, 1952a (MNHN, Paris, R.10973) by the author of the current work in 2010 revealed that it was strongly re-crystallized, due to which skeletal structures like corallite walls or septal structures of the polyps were over-emphasized. As a result, those structures appear more solid (e.g. "thick septotheca") than they do in areas of the colony that are in better preservation. The skeletal structures identified in the type specimen closely correspond to the ones in the genus *Columastrea*.

According to M. BEAUVAIS (1982), the species *C. mirabilis* (DE FROMENTEL, 1886) is a junior synonym of *C. striata* (GOLDFUSS, 1826).

The systematic position of *Multicolumnastraea* VAUGHAN has been much discussed: VAUGHAN & WELLS (1943) assigned it to the Faviidae; ALLOITEAU (1952a) transferred the genus to the Echinoporidae MILNE EDWARDS & HAIME 1857, and according to L. & M. BEAUVAIS (1975) it belongs in the Actinacididae VAUGHAN & WELLS, 1943. According to VAUGHAN (1899), the main differences between *Columastrea* and his genus were in the number of pali (6 pali in *Columastrea* and 12 pali in *Multicolumnastraea*) and in the generally reduced costae in *Multicolumnastraea*. On the basis of: 1) the development of peritheca; 2) the presence of compact septa and 3) special lateral ornamentation on the septa, BARON-SZABO (1998) placed this genus in the family Agatheliidae. Reinvestigation of type and original material revealed, however, that such structures (including both auriculae-like developments and corallites that have the same number of pali) are also present in type and original material of *Columastrea*. Therefore, the separation of these two genera does not seem to be justified. Furthermore, because the "auriculae" seen in the material appear to be different from the kind seen in the stylinids, this taxon is kept in the faviid group.

Austroalpine occurrences. *Gosau Group*: Reported from all Turonian to Upper Santonian localities.

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Upper Cretaceous of Greece, Germany, Tibet, France, Spain, and Romania, Turonian–Maastrichtian of Georgia (in Caucasus), Coniacian–Maastrichtian of Hungary, Campanian–Maastrichtian of Jamaica, and Tibet, Campanian–?Maastrichtian of northern Spain (Catalonia), Maastrichtian of Mexico.

Genus *Stephanaxophyllia* ALLOITEAU, 1957

Pl. 33, Figs. 1–5

Type species. *Stephanaxophyllia casterasi* ALLOITEAU, 1957, Upper Santonian of France (Corbières).

Diagnosis. Colonial, plocoid, cerioid, submeandroid. Budding extracalicinal and intracalicinal. Corallites isolated or arranged in short meandroid series. Costosepta compact, dentate laterally, nonconfluent to subconfluent, confluent during early budding stages. Columella variable, spongy-papillose, or formed by fused segments, appearing lamellar. Pali or paliform lobes present irregularly present before S1 and S2, sometimes fused with columellar structures. Wall septothecal and parathecal, (?pseudo-) synapticulothecal developments occasionally present. Endothecal dissepiments numerous, thin, vesicular. Exothecal dissepiments subtabulate.

Cretaceous species reported from the Alps. *S. hoernesi* (REUSS, 1854).

Austroalpine occurrences. *Gosau Group*: Upper Turonian–Campanian (Upper Austria: Gosau basin).

Cretaceous occurrences elsewhere. Cenomanian of India and ?Serbia.

Family Rhizangiidae D'ORBIGNY, 1851

(= Astrangiidae VERRILL, 1869)

Diagnosis. Colonial and solitary. Budding extracalicinal, from edge zone or stolon-like expansions of edge zone, polyps may or may not remain organically connected. Colonies commonly consisting of scattered corallites with no apparent connection, or united basally by coenosteum, or they form compact masses. Corallites small and low; septa composed of one fan system of simple or compound trabeculae. Irregular divergence of sclerodermites producing scattered lateral granulations and more or less marginal dentations. Columella spongy- or rarely solid-trabecular, or absent. Endothecal dissepiments thin.

Genus *Rhizangia* MILNE EDWARDS & HAIME, 1848b

Pl. 33, Fig. 6; Pl. 34, Fig. 6

Type species. *Astrea brevissima* DESHAYES in LADOUCETTE, 1834, Tertiary (Bartonian) of France (see MILNE EDWARDS & HAIME, 1848a).

Diagnosis. Colonial, tympanoid, reptoid. Budding extracalicinal. Costosepta compact, strongly dentate laterally. Anastomosis present. Columella parietal-papillose. Synapticulae present. Endothecal dissepiments sparse or absent. Wall synapticulothecal.

Cretaceous species reported from the Alps. *R. michelini* REUSS, 1854; *R. sedgwicki* REUSS, 1854; *R. trochiformis* OPPENHEIM, 1930a.

Austroalpine occurrences. *Gosau Group*: Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben).

Cretaceous occurrences elsewhere. Upper Santonian of France, Upper Santonian–Lower Campanian of Romania, Maastrichtian of Jamaica.

Family Curtoseriidae Melnikova, 1996

Diagnosis. Radial elements consisting of compact septa built of subvertically standing trabeculae. Lateral sides of septa ornamented with numerous robust pointed cone-shaped granules. Typical 'anastomosis' observed in septa arrangement – with 'diads' and 'triades' forming as a result of the fusion of the inner ends of third-order septa with adjacent first- and second-order septa. Interseptal apparatus as vesicular dissepiments. Columella styliform.

Genus *Mesomorpha* Pratz, 1882

Pl. 34, Figs. 1–5, 7

Type species. *Porites mammillata* Reuss, 1854, Santonian of Austria (Gosau Group at Randograben) (designation of lectotype herein).

Diagnosis. Colony massive, subthamnasterioid. Budding intracalicinal. Septa compact to subcompact (pores are generally restricted to axial ends of septa), subconfluent or confluent, sometimes anastomosing. Distal margin of septa ornamented with delicate denticles. Lateral surface of septa with spiniform granulae. Synapticulae abundant. Columella styliform. Endothecal dissepiments abundant. No wall between the calices. Septa composed of simple trabeculae.

Synonym. *Ahrdorffia* Trauth, 1911 (Type species. *Porites stellulata* Reuss, 1854, Senonian of Austria [Gosau Group]).

Cretaceous species reported from the Alps. ?*M. chaetetoides* (Trauth, 1911); *M. mammillata* (Reuss, 1854); *M. ornata* Morycowa, 1971; *M. stellulata* (Reuss, 1854).

Remarks. Re-investigation of the material described as *Thamnasteria hoffmeisteri* in Baron-Szabo (1998) from the Campanian of Spain revealed that, based on both septal and columellar developments, it rather corresponds to *Mesomorpha mammillata*. Therefore, it is included here.

According to M. Beauvais (1982, vol. II: 59ff.), the material of the type species of the genus *Mesomorpha* was lost. Therefore, he created a neotype. However, because there is original material of this taxon in the Reuss collection housed at the GBA (see Pl. 34, Figs. 1–3), Beauvais' neotype is invalid. The specimen figured on Pl. 34, Figs. 1–3 (GBA 1854/007/0125) is herein designated as the lectotype of *Mesomorpha mammillata* (Reuss, 1854).

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu); Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil).

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang); Lower Coniacian (Salzburg: Strobl, Sankt Wolfgang, "Theresienstein"); Coniacian (Salzburg: Rußbach, Hornegg); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Upper Austria: Gosau, Hofergraben [= Sattelgraben]); Santonian (Hochmoos-Rußbach-area; Grabenbach, Oberstöckl, Stöcklwaldgraben); Upper Santonian (Salzburg: Abtenau, Rigausbach, Rußbach, Neffgraben, Traunwandalm, Schattauergraben; Upper Austria: Gosau, Wegscheidgraben).

Cretaceous occurrences elsewhere. Valanginian of Hungary, Lower Hauterivian and Upper Barremian of France, Barremian–Lower Aptian of Ukraine, Lower Aptian of Serbia, France, and Romania, Aptian of Spain, Upper Aptian of Greece, Upper Aptian–Lower Albian of Mexico, Upper Cretaceous of Germany, Cenomanian–Santonian of the ?Czech Republic, Coniacian–Santonian of France, Santonian–Campanian of Spain, Upper Campanian–Maastrichtian of the UEA/Oman border region.

Family Meandrinidae Gray, 1847

(= Family Dendrogyridae Alloiteau, 1952a p.p.)

Diagnosis. Solitary and colonial. Budding intracalicinal. Polyp integration meandroid, phaceloid, flabello-meandroid, plocoid. Wall mostly septothecal and paraseptothecal, costate. Septa formed by one or more fan systems of simple trabeculae, often forming distinct median lines. Septal margins minutely dentate, septal flanks smooth or have scattered spinose granulation. Extensive thickening deposits. Columella lamellar or trabecular. No pali or paliform structures. Endothecal dissepiments well-developed. Exothecal dissepiments in some forms, solid or vesicular.

Subfamily Meandrininae Gray, 1847

(= Family Meandriidae Alloiteau, 1952a)

Diagnosis. Solitary and colonial. Colony formation by intratentacular polystomodaeal intramural budding. Colonies pedunculated or free. Walls septothecal and solid, or parathecal, covered with beaded costae, rarely epithecate. Septa laminar, composed of one fan system of simple, very small trabeculae, upper margins minutely dentate, finely granulated laterally. Columella is a thin lamella, usually continuous, very deep in the calice. Endotheca thin and vesicular. Exotheca developed in some genera.

Genus *Aulosmilia* ALLOITEAU, 1952a

Pl. 35, Figs. 1–7

Type species. *Trochosmilia archiaci* DE FROMENTEL, 1867, Santonian of France (Corbières).

Diagnosis. Solitary, trochoid, compressed, or flabellate. Costosepta compact, arranged in 2 or 3 irregular systems. Marginally granular. Columella lamellar. Endothecal dissepiments abundant. Wall septothecal and septoparathecal ("wall pattern B" *sensu* RONIEWICZ & STOLARSKI, 1999). Epithecal wall present or absent.

Cretaceous species reported from the Alps. *A. archiaci* (DE FROMENTEL, 1864); *A. aspera* (SOWERBY, 1832); *A. besairiei* (ALLOITEAU, 1936); *A. consobrina* (REUSS, 1854); *A. cristata* BEAUVAIS, 1982; *A. cuneiformis* (MILNE EDWARDS & HAIME, 1848d); *A. decora* (OPPENHEIM, 1930a); *A. marini* (BATALLER, 1936); *A. nysti* (MILNE EDWARDS & HAIME, 1848c); ?*A. pugaensis* (PAL et al., 1984); *A. salisburgensis* (MILNE EDWARDS & HAIME, 1848d).

Austroalpine occurrences. *Gosau Group*: Reported from all Turonian–Campanian localities; "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Cretaceous occurrences elsewhere. Cretaceous of Greece and Belgium, Aptian of Tibet, Upper Albian of England (Haldon), Upper Cretaceous of Germany, Lower Turonian and Coniacian–Santonian of Armenia, Turonian of Bulgaria and Italy, Turonian–Campanian of France, Turonian–Coniacian of Azerbaijan, Santonian of Madagascar, Santonian–Campanian of Spain, Campanian–Maastrichtian of ?India and Bulgaria, Maastrichtian of Jamaica, Madagascar, and Oman.

Genus *Phragmosmilia* ALLOITEAU, 1952a

Pl. 36, Figs. 1–2

Type species. *Trochosmilia inconstans* DE FROMENTEL, 1862, Upper Santonian of France (Aude).

Diagnosis. Solitary, trochoid, compressed, elliptical or subcircular in outline. Calicinal pit elongated. Costosepta compact, radial, in subequal systems. Granulated laterally. Columella lamellar, thin. Endothecal dissepiments vesicular, numerous. Wall septothecal. Multilamellar epitheca present or reduced.

Cretaceous species reported from the Alps and Dinarides. *P. inconstans* (DE FROMENTEL, 1862); *P. lineata* (GOLDFUSS, 1826).

Remarks. The genus *Phragmosmilia* ALLOITEAU shows close affinities to the genus *Aulosmilia* ALLOITEAU, but is distinguished from the latter by different endothecal and epithecal structures.

Austroalpine occurrences. *Gosau Group*: Upper Turonian–Santonian (Upper Austria: Gosau town); Santonian (Upper Austria: Gosau, Obergeschröfpalfen).

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Turonian of Bulgaria, Santonian–Campanian of France, Campanian of Spain, Upper Campanian of Oman, Campanian–Maastrichtian of Bulgaria.

Genus *Nefophyllia* WELLS, 1937

(pro *Platysmilia* FELIX, 1899, non DE FROMENTEL, 1873)
Pl. 36, Figs. 3–8

Type species. *Placosmilia angusta* REUSS, 1854, Upper Turonian–Campanian of Austria (Gosau Group).

Diagnosis. Colonial, phaceloid-dendroid. Budding extracalicinal. Costosepta compact, arranged radially and bilaterally, finely granulated laterally. Columella lamellar. Endothecal dissepiments thin and vesicular, abundant. Wall septothecal. Epithecal wall present.

Affinities. Similar to *Aulosmilia* ALLOITEAU, but has different wall structures and forms branching colonies.

Cretaceous species reported from the Alps. *N. angusta* (REUSS, 1854); *N. multicincta* (REUSS, 1854); ?*P. varians* (REUSS, 1854).

Remarks. In forming solitary coralla which lack both a lamellar columella and epithecal wall, and have (?porous) septa with smooth lateral faces, the specimens described as *Nefophyllia angusta* from the Cenomanian of Egypt by ABDEL-GAWAD & GAMEIL (1995) differ from the genus *Nefophyllia* and are, therefore, excluded from the list of occurrences.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Tyrol: Brandenberg, Sonnwendjoch; Salzburg: St. Gilgen, Strobl, Weissenbach); Upper Turonian–Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten); Coniacian (Tyrol: Ludoi Alp [= Pletzach Alp]); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt, Hohe Traunwand; Upper Austria: Gosau, Hofergraben [= Sattelgraben]); Upper Coniacian (Upper Austria: Unterlaussa, Weisswasser); Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Upper Austria: Gosau, Brunstloch, Wegscheidgraben; Salzburg: Abtenau, Rigausbach, Rußbach, Neffgraben, Traunwandalm); Upper Santonian–Lower Campanian (Lower Austria: Baden, Einöd quarry).

Cretaceous occurrences elsewhere. Upper Cretaceous of Romania, Coniacian of Serbia, Coniacian–Santonian of France, Coniacian–Maastrichtian of Hungary, Santonian–Campanian of Spain, Campanian of Bulgaria.

Genus *Phyllosmilia* DE FROMENTEL, 1862

Pl. 37, Figs. 1–7; Pl. 38, Figs. 1–5

Type species. *Turbinolia basochesi* DEFRANCE, 1828, Upper Santonian of France (Figuères).

Diagnosis. Solitary, compressed-flabellate, with costae forming continuous outer ridges. Costosepta compact, arranged in 2 or 3 size orders, bilaterally, granulated. Colu-

mella lamellar, continuous. Endothecal dissepiments thin, vesicular, forming a stereozone. Epitheca present. Wall septothecal.

Cretaceous species reported from the Alps and Dinarides. *P. aegiale* FELIX, 1903a; *P. basochesi* (DEFRANCE, 1828); *P. catalaunica* BATALLER, 1936; *P. cuneolus* (MICHELIN, 1847); *P. didymophila* (FELIX, 1903a); *P. diversicostata* FELIX, 1903a; *P. elegans* M. BEAUVAIS, 1982; *P. felixi* M. BEAUVAIS, 1982; *P. nefgrabensis* M. BEAUVAIS, 1982; *P. randoschbergensis* M. BEAUVAIS, 1982; *P. reussi* M. BEAUVAIS, 1982; *P. transiens* FELIX, 1899; *P. weissenbachensis* M. BEAUVAIS, 1982; *P.* sp. (first report of the genus for Tiefengraben [Tauerngraben], Brennetgraben at Bad Ischl, Gams-Hieflau-2, and Neue Welt at Grünbach-Schneckengarten).

Remarks. Some species of *Phyllosmilia* might be endemic to the Gosau Group (e.g., *P. randoschbergensis*, *P. reussi*, *P. nefgrabensis*, and *P. weissenbachensis*).

Austroalpine occurrences. *Gosau Group*: Reported from all Turonian to Campanian localities.

Dinaric occurrences. *Inner Dinarides* (*Vrabečka gora at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Upper Cretaceous of France, Turonian–Campanian of Georgia (in Caucasus), Coniacian–Maastrichtian of northern Spain, Santonian–Campanian of Greece, Upper Santonian–Lower Campanian of Romania, Upper Campanian–Maastrichtian of the Oman Mountains, Maastrichtian of the UAE.

Genus *Dasmiopsis* OPPENHEIM, 1930a

Pl. 39, Figs. 1–7

Type species. *Trochocyathus lamellicostatus* REUSS, 1854, Santonian of Austria (Gosau Group).

Diagnosis. Corallum solitary, trochoid. Outer surface of corallum strongly ribbed. Costae of first 2 cycles normal, those of higher cycles can be bent toward those of lower cycles and covered by stereome, giving appearance of fewer costae. Costosepta compact, arranged radially or bilaterally, finely granulated laterally and marginally. Columella thick, lamellar. Endothecal dissepiments abundant. Wall septoparathecal and parathecal, which is thickened by a dissepimental stereozone and covered by a multilamellar epitheca. Epithecal developments irregular.

Cretaceous species reported from the Alps. *D. lamellicostatus* (REUSS, 1854).

Remarks. According to WELLS (1956), the genus *Dasmiopsis* represents a desmophylliid taxon. However, in having a large number of endothecal dissepiments, a generally well-developed epithecal wall, a well-developed columella, septal flanks that are richly covered by spiniform to rounded granules, this genus differs from the desmophylliid group but corresponds to the meandrinids. In *Dasmiopsis*, the wall structures correspond to the kinds seen in the meandrinid forms *Flabellosmilia* and, to some extent, *Aulosmilia* and *Phragmosmilia* (also see ontogenetical study on *Dasmiopsis* [BARON-SZABO, 2003b]). In the nominatform of the subfamily Desmophyllinae VAUGHAN & WELLS, endothecal dissepiments are nearly absent, columellar structures are absent or rudimentary, and axial margins are smooth. Therefore, the genus *Dasmiopsis* is kept in the family Meandrinidae as previously proposed by M. BEAUVAIS (1982, vol. I: 234).

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Salzburg: Strobl, Weissenbach, Ofenwand); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Upper Austria: Gosau, Hofergraben [= Sattelgraben]); Santonian (Salzburg: Rußbach, Stöcklwaldgraben); "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Cretaceous occurrences elsewhere. None reported.

Genus *Diploctenium* GOLDFUSS, 1827

Pl. 39, Fig. 8; Pl. 40, Figs. 1–5; Pl. 41, Figs. 1–3

Type species. *Diploctenium cordatum* GOLDFUSS, 1827, Maastrichtian of the Netherlands (Maastricht).

Diagnosis. Colonial, pedunculated, flabelloid. Calicular series inclined or curved towards the base, in some cases the ends of the series meet or even pass each other. Costosepta compact, finely granulated laterally. Costae bifurcating and trifurcating. Columella lamellar, continuous. Endothecal dissepiments few in number, vesicular. Wall septothecal, forming a stereozone.

Cretaceous species reported from the Alps and Dinarides. *D. angusterimatum* OPPENHEIM, 1930a; *D. bipes* FELIX, 1925; *D. conjungens* REUSS, 1854; *D. contortum* REUSS, 1854; *D. cordatum* GOLDFUSS, 1827; *D. ferrumequinum* REUSS, 1854; *D. goldfussianum* D'ORBIGNY, 1850; *D. haidingeri* REUSS, 1854; *D. juvaviensis* BEAUVAIS, 1982; *D. lunatum* (BRUGIÈRE, 1792); *D. pavoninum* REUSS, 1854; *D. reussi* BEAUVAIS, 1982; *D.* sp. (first report of the genus for Tiefenbach [Tauerngraben]).

Remarks. PREVER (1909: 111, pl. 10, fig. 28) described the species *Diploctenium pavoninum* REUSS, 1854, from the Aptian of Italy. Based on the original documentation, however, the material seems to represent a meandroid-hydnophoroid form and not a pedunculated flabelloid type. Therefore, it is excluded from the list of occurrences.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Styria: Weissenbachalm, Gams-Hieflau; Upper Austria: Wolfgangsee, Sankt Wolfgang; Salzburg: St. Gilgen); Upper Turonian–Coniacian (Styria: Aussee, Weissenbachalm); Lower Coniacian (Salzburg: Rußbach, Gamsfeld); Coniacian (Salzburg: Untersberg, Nagelwand; Tyrol: Ludoi Alp [= Pletzach Alp]); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt; Upper Austria: Gosau, Hofergraben [= Sattelgraben]); Santonian (Hochmoos-Rußbach-area; Oberstöckl, Stöcklwaldgraben; Upper Austria: Gosau, Grabenbach, Brunstloch; Pass Gschütt, Tiefengraben; Salzburg: Rußbach, Zimmergraben); Upper Santonian (Salzburg: Rußbach, Neffgraben, Traunwandalm; Lower Austria: Neue Welt, Piesting, Scharrergraben); Upper Santonian–Lower Campanian (Lower Austria: Baden, Einöd quarry).

Dinaric occurrences. *Inner Dinarides* (*Vrabečka gora at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Upper Cretaceous of Italy, Romania, and France, Turonian–Campanian of Georgia (in Caucasus), Coniacian–Maastrichtian of Hungary, Santonian of Tunisia, Santonian–Campanian of Spain, Maastrichtian of The Netherlands, Oman, and the UAE.

Genus *Flabellosmilia* Oppenheim, 1930a

Pl. 41, Figs. 4–7; Pl. 42, Figs. 1–3, 9–10; Pl. 44, Figs. 6–7

Type species. *Flabellum bisinuatum* Reuss, 1854, Santonian of Austria (Gosau Group).

Diagnosis. Solitary. Flabelliform, free. In cross view, it is typically diamond-shaped. Costosepta compact, exsert, finely granulated laterally. Columella lamellar, thin, continuous. Endothecal dissepiments vesicular. Wall generally rather solid-septothecal over most of the corallum, becoming irregular at the upper edges, where it is formed by septothecal, parathecal, and irregular epithecal structures.

Cretaceous species reported from the Alps. *F. bisinuatum* (Reuss, 1854); *F. subcarinatum* (Reuss, 1854); *F.* sp. (first report of the genus for the Gosau Group at Gams-Hieflau-2).

Austroalpine occurrences. *Gosau Group*: Santonian (Hochmoos-Rußbach-area; Grabenbach, Oberstöckl, Stöcklwaldgraben, Zimmergraben; Styria: Gams-Hieflau-2); Upper Santonian (Upper Austria: Gosau, Brunstloch, Wegscheidgraben; Salzburg: Rußbach, Neffgraben).

Cretaceous occurrences elsewhere. Coniacian of ?Armenia, Campanian–Maastrichtian of ?Slovakia.

Genus *Strotogyra* Wells, 1937

Pl. 42, Figs. 4–8; Pl. 43, Figs. 1–3

Type species. *Rhipidogyra undulata* Reuss, 1854, Santonian of Austria (Gosau Group).

Diagnosis. Colonial. Budding intramural, linear, polystomodaeal, forming corallites arranged uniserially, contorted, free laterally. Corallite centers indistinct when positioned in linear series, subdistinct or distinct in areas where direction of series changes or at end of calicinal series. Septa exsert, numerous, compact, non-dentate on upper margins, granulated laterally. Costae bifurcating, distinct to base. Columella lamellar, discontinuous, often attached to processes from inner edges of septa. Endothecal dissepiments vesicular and subhorizontal. Wall septothecal, parathecal in earlier stages. Parathecal stereozone occurs irregularly. Multi-lamellar epitheca often present.

Cretaceous species reported from the Alps and Dinarides. *S. augusti* Turnšek in Turnšek et al., 1992; *S. decorata* (Oppenheim, 1930a); *S. poseidonis* (Felix, 1903a); *S. sinuosa* (Felix, 1903a); *S. subaequicosta* (Oppenheim, 1930a); *S. undulata* (Reuss, 1854) (= *Rhipidogyra lacertosa* Oppenheim, 1930a); ?*S.* sp. (possible first record for Neue Welt at Grünbach).

Remarks. Wells (1937: 73) created this genus to separate Upper Cretaceous species formerly placed in *Rhipidogyra* Milne Edwards & Haime, 1848a. According to him, the occurrence of the latter is confined to the Upper Jurassic and Lower Cretaceous and, together with several contemporary genera, forms a separate family group. Later investigations by several authors (e.g. Alloiteau, 1952a; Roniewicz, 1976) confirmed this separation by assigning *Strotogyra* to the meandrinid group and creating a suborder using *Rhipidogyra* as the nominate form (= *Rhipidogyrina* Roniewicz, 1976). The original description of *Strotogyra* Wells was later revised by M. Beauvais (1982, vol. 1: 191).

The genus *Strotogyra* is most closely related to the genera *Pachygyra* Milne Edwards & Haime, 1848a, and *Placosmilia* Milne Edwards & Haime, 1848a. The most important difference from *Pachygyra* lies in the colony formation which in *Pachygyra* is massive meandroid, whereas in *Strotogyra* corallites are arranged in laterally free meandroid series. Consequently, *Pachygyra* has the additional skeletal feature of exothecal developments between calicinal series. Moreover, it lacks a parathecal stereozone. *Strotogyra* shows the greatest similarities to the genus *Placosmilia*. The main differences are in the lack of both a septotheca and parathecal stereozone and the development of a monolinear flabellate to meandroid corallum with indistinct corallites in *Placosmilia*.

From the Cretaceous of Greece, Hackemesser (1936: 13) described material which he grouped with *S. sinuosa* (Felix). However, in lacking a lamellar columella, the Greek material differs from Felix's taxon. Therefore, it is excluded from the list of occurrences.

Austroalpine occurrences. *Gosau Group*: Turonian–?Coniacian (Salzburg: St. Gilgen); Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang; Tyrol: Brandenberg, Oberberg, Kreuthergraben); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Abtenau, Rigausbach, Rußbach, Neffgraben, Traunwandalm; Upper Austria: Gosau, Wegscheidgraben); Upper Santonian–Lower Campanian (Lower Austria: Baden, Einöd quarry; Neue Welt, Grünbach-Schneckengarten).

Dinaric occurrences. *Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Albian of Slovenia (Slovenski vrh, near Kočevje).

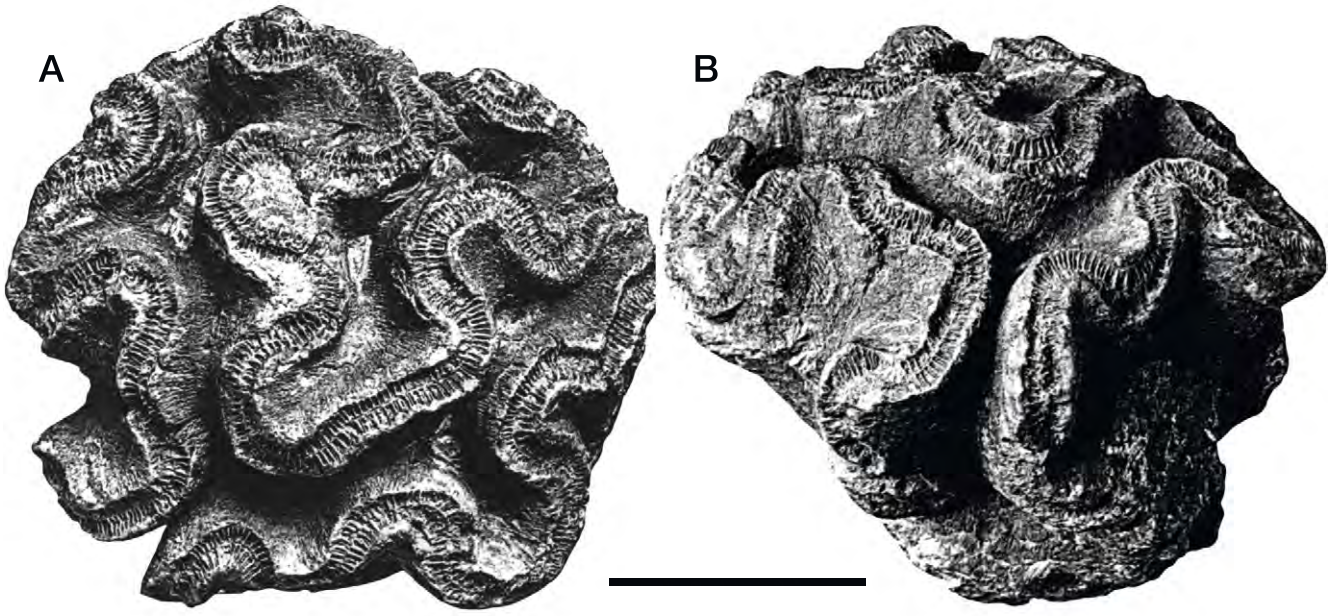
Cretaceous occurrences elsewhere. Turonian and Upper Santonian of France, Upper Santonian–Lower Campanian of Romania, Campanian of Spain.

Genus *Pachygyra* Milne Edwards & Haime, 1848a

Pl. 44, Figs. 1–5; Pl. 45, Figs. 1–3; Pl. 46, Fig. 1; Pl. 47, Fig. 1; Text-Fig. 9

Type species. *Lobophyllia labyrinthica* Michelin, 1847, Coniacian–Santonian of France (Aude) (see Milne Edwards & Haime, 1848a).

Diagnosis. Colonial, massive, subflabellate-meandroid. Budding intracalicinal, resulting in sinuous, non-ramified, calicinal series, which are separated by perithecal walls and ambulacra. Calicinal series are always projecting, their edges remain free. Calicinal centers indistinct. Costosep-



Text-Fig. 9.
Pachygyra labyrinthica (MICHELIN, 1847), sketches of lectotype (MNHN Mo1112), Coniacian–Santonian of France (Aude); based on the illustrations in ALLOITEAU (1941); A and B: upper surface of colony showing meandroid calicinal series which are only non–ramified, a feature which is charactristic of this genus; scale bar: 20 mm.

ta compact, finely granulated laterally. Septal anastomosis present. Columella lamellar, generally continuous. Wall septothecal. Perithecal and endothecal dissepiments thin, subtabulate.

Cretaceous species reported from the Alps. *P. crassolamellosa* (MILNE EDWARDS & HAIME, 1849b); *P. daedalea* REUSS, 1854; *P. krameri* OPPENHEIM, 1930a; *P. labyrinthica* (MICHELIN, 1847); *P. meandra* (REIG ORIOL, 1997a); *P. microphyes* FELIX, 1903a; *P. princeps* REUSS, 1854; *P. pusulifera* OPPENHEIM, 1930a.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Salzburg: St. Gilgen); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Santonian (Salzburg: Rußbach, Zimmergraben, Randograben); Upper Santonian (Salzburg: Rußbach, Neffgraben); "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Cretaceous occurrences elsewhere. Lower Cenomanian, Turonian, and Upper Santonian of France, Santonian–Maastrichtian of Spain.

Subfamily Euphylliinae ALLOITEAU, 1952a

Diagnosis. Columella absent or rudimentary parietal.

Genus *Rennensismilia* ALLOITEAU, 1952a

Pl. 43, Figs. 4–7; Pl. 46, Figs. 2–4; Pl. 47, Figs. 2–5

Type species. *Trochosmilia didyma* DE FROMENTEL, 1863, Upper Santonian of France (Aude) (see ALLOITEAU, 1952a).

Diagnosis. Solitary, turbinate to flabellate. Costosepta compact, bilaterally arranged, granulated. Columella absent but trabecular extensions of axial ends of septa may reach corallite center, forming a pseudo-columella. Endothecal dissepiments vesicular, mainly peripheral. Wall parathecal or paraseptothecal. Epitheca present.

Synonyms. *Meandrosmilia* ALLOITEAU, 1952a (Type species. *Trochosmilia flabellum* DE FROMENTEL, 1863, Lower Santonian of France); *Paraphyllum* ALLOITEAU, 1956 (Type species. *Epismilia africana* DE FROMENTEL, 1863, Cenomanian of Algeria).

Cretaceous species reported from the Alps and Dinarides. *R. chondrophora* (FELIX, 1903a); *R. complanata* (GOLDFUSS, 1826); *R. corbariensis* M. BEAUVAIS, 1982; *R. didyma* (DE FROMENTEL, 1863) (first report of the species for Netting); *R. dumortieri* (HAIME, 1854); *R. inflexa* (REUSS, 1854); *R. negreli* (ALLOITEAU, 1954b); ?*R. niobe* (KOLOSVÁRY, 1954); *R. protectans* (NÖTLING, 1897); *R. subinduta* (REUSS, 1854); ?*R. zuffardii* (MACCAGNO, 1942); *R.* sp. (first report of the genus for the Ludoi Alp); ?*R.* sp. (referring to material described as *Ellipsosmilia* sp. in TURNŠEK & POLŠAK, 1978).

Austroalpine occurrences. *Gosau Group*: Turonian (Salzburg: Rußbach, Rußberg); Upper Turonian (Styria: Weissenbachalm; Salzburg: St. Gilgen); Upper Turonian–Coniacian (Styria: Aussee, Weissenbachalm); Lower Coniacian (Salzburg: Rußbach, Gamsfeld); Coniacian (Salzburg: Strobl, Nussensee; Tyrol: Ludoi Alp [= Pletzach Alp]); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt; Upper Austria: Gosau, Hofergraben [= Sattelgraben]); Santonian (Salzburg: Rußbach, Stöcklwaldgraben; Upper Austria: Gosau, Grabenbach; Pass Gschütt, Tiefengraben); Upper Santonian (Upper Austria: Gosau, Brunstloch, Wegscheidgraben; Salzburg: Rußbach, Neffgraben, Traunwandalm; Lower Austria: Neue Welt, Piesting, Scharrergraben); Upper Santonian–Lower Campanian (Lower Austria: Baden, Einöd quarry); Upper Santonian–Campanian (Lower Austria: Neue Welt, Muthmannsdorf, Netting); "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Dinaric occurrences. *Inner Dinarides* (*Vrabečka gora at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Aptian–Albian of Iran, Upper Cretaceous of Germany, Turonian of southern India (Trichinopoly Group), Turonian–Santonian of Georgia (in Caucasus), Turonian–Campanian of France, Coniacian–Maastrichtian of Hungary, Senonian of Romania, Santonian–Campanian of northern Spain, Upper Campanian of Bulgaria, Campanian–Lower Maastrichtian of central Saudi Arabia, Campanian–Maastrichtian of India (Ladakh), Maastrichtian of Croatia, Madagascar, Pakistan, and ?Somalia.

Family Montastraeidae Yabe & Sugiyama, 1941

(= Montastraeinae Vaughan & Wells, 1943;
= Phyllocoeniidae Alloiteau, 1952a)

Diagnosis. Colonial; extracalicular budding; plocoid; trabeculothecal. ?Occasional synapticulae. Costosepta laminar, formed by one fan system of simple trabeculae. Pali absent. Septal teeth triangular, spinose granulations forming vertical rows, limited thickening deposits. Trabeculae consisting of discrete clusters of fibers. Trabecular columella, usually spongy. Well-developed tabular endotheca.

Genus *Montastraea* Blainville, 1830

Pl. 47, Figs. 6–8; Pl. 48, Fig. 1

Type species. *Astrea guettardi* Defrance, 1826, Miocene of Italy (Turin).

Diagnosis. Colonial, massive, incrusting, or subfoliaceous, plocoid. Budding extracalicinal. Costosepta compact, nonconfluent to subconfluent; regularly dentate marginally; septal flanks have irregularly scattered, rounded granules. Costae unequal. Columella variably trabecular or reduced. No pali. Wall septothecal to septoparathecal, occasionally parathecal. Endothecal dissepiments well-developed, tabular. Exothecal dissepiments generally well-developed, often vesicular to cellular.

Synonyms. *Actinocoenia* d'Orbigny, 1849 (Type species. *Astrea compressa* Michelin, 1847, Upper Coniacian of France [Aude]); *Heliastreopsis* Chevalier, 1954 (Type species. *H. alloiteaui* Chevalier, 1954, Miocene of France); *Phyllocoenia* Milne Edwards & Haime, 1848a (Type species. *Astrea radiata* Michelin, 1842 [= *Phyllocoenia irradians* Milne Edwards & Haime, 1848a], Tertiary of Italy); ?*Provinciastrea* Chevalier, 1954 (Type species. *P. moravica* var. *mazaugui* Chevalier, 1954, Santonian of France [Mauzaugues, Var]); *Phyllocoeniopsis* Chevalier, 1954 (Type species. *Astrea cribaria* Michelin, 1840, Turonian of France [Uchaux]).

Cretaceous species reported from the Alps and Dinarides. *M. corollaris* (Reuss, 1854); *M. simonyi* (Reuss, 1854); *M.* sp. 1 (referring to material described as *Neocoeniopsis excelsa* in Turnšek [1994] and Baron-Szabo [2003a]); *M.* sp. 2 (referring to material described as *Phyllocoenia cotteaui* in Turnšek & Buser, 1974); *M.* sp. 3 (referring to material described as *Phyllocoeniopsis pediculata* in Turnšek & Polšak, 1978).

Remarks. Modern members of the traditional genus *Montastraea* have been recently separated into *Montastraea* and *Orbicella* (restricted to the Atlantic) and *Phymastrea* (restricted to the Indo-Pacific) (Budd et al., 2012). These new outcomes also resulted in a shift regarding taxonomic relationships of forms that were originally assigned to genera that have now been placed as junior synonyms of *Montastraea* (e.g., *Heliastraea*, *Phyllocoenia*, and others). In the current work, the first re-assessment of the fossil distribution of *Montastraea* is presented, which, however, cannot be considered complete. Further re-investigations will be necessary to obtain a more comprehensive picture regarding the fossil occurrence of forms corresponding to *Montastraea*. The specimens presented in the current work show similarities to "morphotype #2" of the *Montastraea–annularis*-group as figured by Budd & Klaus (2001).

Austroalpine occurrences. *Gosau Group*: Middle Turonian–Lower Coniacian (Tyrol: Brandenberg); Santonian (Hochmoos-Rußbach-area; Salzburg: Zimmergraben); Upper Santonian (Styria: Aussee, Weissenbachalm); "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Dinaric occurrences. *Northern Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica); *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Lower Cenomanian of ?northern Spain, Santonian of ?France, Maastrichtian of northern Spain.

Suborder Dendrophylliina Vaughan & Wells, 1943

Diagnosis. Solitary and colonial. Wall synapticulothecal, irregularly porous. Septa structurally similar to the caryophylliids but usually secondarily thickened, more or less porous, with margins wholly smooth or partly dentate. Septa usually following the Pourtalès plan.

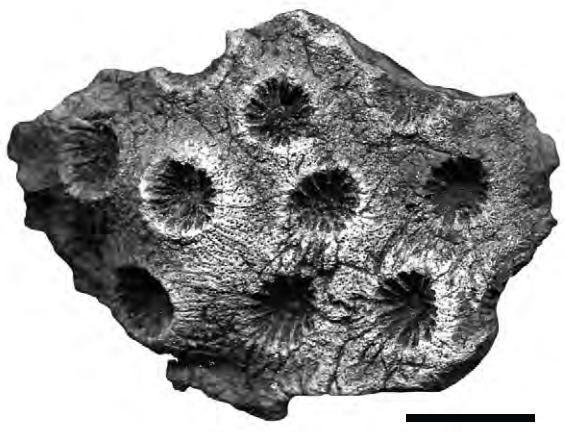
Remarks. This suborder was proposed for the reception of a single large family, the Dendrophylliidae. The microscopic structure of the septa, the morphology of the polyps, and the corallum habit are all characteristic of the Caryophylliina, but the porosity and thickening of the septa, due to irregular trabecular growth, and the perforate synapticulothecal wall are conditions of specialization unknown in that group; the latter features are more characteristic of the fungiid group. It was suggested that the group originated from a caryophylliid-like ancestor in which very irregular trabecular growth leads to septal thickening and perforation and replacement of septotheca by synapticulotheca, and these in turn broke up extratentacular mesenterial extensions into canaliculate prolongations of the coelenteron through and over the wall. Septa usually following the Pourtalès plan.

Family Dendrophylliidae Gray, 1847

(= Eupsammiidae Milne Edwards, 1857)

Diagnosis. Corallum solitary or colonial, free or attached, most azooxanthellate, sometimes reproducing by transverse division. Septa laminar, composed of one fan system of numerous, irregularly spaced simple trabeculae resulting in a smooth axial margin, at least in lower-cycle (S1-2) septa. Wall synapticulothecate, both wall and septa being somewhat porous. Endothecal dissepiments may be present. Septa usually hexameral, often arranged in a Pourtalès plan. Pali and columella present or absent.

Remarks. The family description is based on a revision and phylogenetic analysis of the genera of this family which was published by Cairns (2001). For further information on the family Dendrophylliidae see there.



Text-Fig. 10.
Turbinaria cf. *cyathiformis* (Blainville, 1830); upper surface of colony; SZB–10922, Lower Santonian (Wolfschwang, Untersberg), Austria. (Generic assignment confirmed by S. Cairns, Smithsonian Institution; pers. comm., 2013); scale bar: 4 mm.

Genus *Turbinaria* Oken, 1815

Text-Fig. 10

Type species. *Madrepora crater* Pallas, 1766, Holocene, East Indies.

Diagnosis. Colonial. Explanate or crateriform, contorted foliaceous, plocoid to fasciculate or phaceloid in exsertness. Budding extracalicinal and intracalicinal. Corallites embedded in extensive, porous coenosteum. Costosepta compact to subcompact, usually arranged normally in larger corallites, but occasionally some systems show remnants of Pourtalès plan arrangement. Columella usually well-developed, solid, spongy or labyrinthiform, occupying large percentage of relatively shallow fossa. Endothecal dissepiments sparse. Wall synapticulothecal to synapticuloparathecal, porous. Epitheca absent.

Cretaceous species reported from the Alps. *T.* cf. *cyathiformis* (Blainville, 1830).

Remarks. The genus was monographed by Cairns (2001) who included a phylogenetic analysis based on morphology of 14 species.

While the dimensions of corallite diameter (2.5–3 mm), corallite distance (around 3.5 mm), and number of septa (22–32) in the Austrian material correspond well to the species *T. cyathiformis* as documented by Chevalier (1961: 495–496), differences exist in that the septa are very irregular and not in 6 systems.

Austroalpine occurrences. *Gosau Group*: Lower Santonian (Salzburg: Wolfschwang, Untersberg).

Cretaceous occurrences elsewhere. None reported.

Genus *Rhabdopsammia* Alloiteau, 1952a

Pl. 48, Figs. 2–5; Pl. 49, Figs. 1–6

Type species. *Rhabdopsammia lanquinei* Alloiteau, 1952a, Santonian of France (Var).

Diagnosis. Solitary, cylindrical to turbinate (corallite diameter to around 18 mm) and colonial, arranged in phaceloid clumps. Solitary stage probably with a corallite height to 25 mm. Budding intracalicinal. Costosepta compact to subcompact, thick near the wall partly due to merging of adjacent septa (as in *Dasmiopsis*). Septal flanks covered with granules varying in size and shape (rounded, pointed, flat, crispate, etc.). Septa normally arranged or irregularly following Pourtalès plan. Endothecal dissepiments vesicular, numerous. Columella trabecular, appears in various spongy-papillose to lamellar segmented shapes. Synapticulae present. Wall synapticulothecal with sparsely occurring pores; in places secondarily thickened, forming a septotheca.

Remarks. Regarding its septal and thecal structures, the genus *Areopsammia* Dietrich, 1917, from the Maastrichtian of The Netherlands closely corresponds to *Rhabdopsammia* (Cairns, 2001: 11, pl. 1, figs. b–d; Baron-Szabo, 2002: 77, pl. 56, figs. 1–2). The only difference seems to lie in their types of polyp integration (e.g., solitary in *Areopsammia* and

branching in *Rhabdopsammia*). However, re-study of the holotype of the type species of *Areopsammia* by the author of the current work in 2005 revealed that it seems to show an additional corallite that is connected to the main corallite (also compare with documentation of the type material in CAIRNS, 2001, and BARON-SZABO, 2002). If further investigations support this idea, the possible synonymy with the genus *Rhabdopsammia* should be considered.

Synonym. *Elasmogyra* M. BEAUVAIS, 1982 (Type species. *Aplosmilia crucifera* FELIX, 1903a, Santonian of Austria [Gosau Group at Zimmergraben]).

Cretaceous species reported from the Alps. *R. crucifera* (FELIX, 1903a); *R.* sp. in BARON-SZABO (1999).

Remarks. In his revision of dendrophylliid genera CAIRNS (2001) states that, in having a non-perforate theca, dense corallum, and solid, thick septa, the type specimen of *Rhabdopsammia* is more suggestive of faviids or eusmiliids rather than to the dendrophylliids. However, re-investigation of the type material (BARON-SZABO, 2002: 78, pl. 56, figs. 3, 4) revealed that septa are present which are both normally arranged or in places follow an irregularly developed Pourtalès plan (comparable to the kind seen in, e.g., *Areopsammmia*) and that septa as well as wall seem to show irregular perforations. Therefore, the genus *Rhabdopsammia* ALLOITEAU has been provisionally kept within the family Dendrophylliidae GRAY by BARON-SZABO (2002).

Based on the species *Aplosmilia crucifera* FELIX, 1903a, M. BEAUVAIS (1982, vol. 2: 119) created the genus *Elasmogyra*. According to him, FELIX' material was characterized by fungiid (-funginellid) skeletal structures instead of rhipidogyrid features as were believed by FELIX (1903a) to be present (they are characteristic of the genus *Aplosmilia*). However, re-study of the type material by the author of the current work in 2013 revealed that in forming phaceloid-subflabellate clumps by intracalicinal budding; having septa that are thick near the wall (partly due to merging of adjacent septa) and have rounded to crispate ornamentations laterally; trabecular columellar structures that appear as irregular lamellar segments; a (septothecal-) synapticulothecal wall with occasional pores; and septa that are normally arranged or irregularly follow the Pourtalès plan, the genus *Elasmogyra* closely corresponds to the genus *Rhabdopsammia*. Therefore, their synonymy is suggested.

Austroalpine occurrences. *Gosau Group*: Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Styria: Aussee, Weissenbachalm).

Cretaceous occurrences elsewhere. None reported.

Genus *Balanophyllia* SEARLES WOOD, 1844

Pl. 50, Figs. 1–2

Type species. *Balanophyllia calyculus* SEARLES WOOD, 1844, Lower Pliocene of England (Norfolk) (Neotype established by CAIRNS, 2001).

Diagnosis. Solitary, variable conical, often trochoid, ceratoid, or turbinate. Base broad or narrow, attached or unattached. Asexual budding may occur from edge zone. Costae short, costosepta subcompact, Pourtalès plan present. Columella elongate, spongy. Wall synapticulothecal. Epitheca present or absent (see discussion on the taxon *Eupsammia* below).

Synonyms. *Eupsammia* MILNE EDWARDS & HAIME, 1848d (Type species. *Madrepora trochiformis* PALLAS, 1766, Eocene of France); *Ceratopsammia* ALLOITEAU, 1958 (Type species. *C. besairiei* ALLOITEAU, 1958, Campanian–Maastrichtian of Madagascar); *Ilerdosmilia* REIG ORIOL, 1997a (Type species. *I. vilellai* REIG ORIOL, 1997a, Campanian of northern Spain [Torallola, Lerida]).

Cretaceous species reported from the Alps. *B.* sp. in BARON-SZABO (2003a).

Recently, a discussion on the taxon *Eupsammia* was presented (BARON-SZABO, 2008: 42) as follows:

> "The validity of the taxon *Eupsammia* and its possible synonymy with *Balanophyllia* have been discussed since the early 20th century. In the generic revision and phylogenetic analysis of dendrophylliid genera, CAIRNS (2001) gave a detailed discussion of the taxonomic history of these two forms and provided descriptions for *Balanophyllia* and *Eupsammia*. While CAIRNS acknowledged the arguments that support the grouping of *Balanophyllia* with *Eupsammia* as its junior synonym (e.g., structurally they are identical, co-occurrence of the two forms in many regions since at least the Eocene), he separated the two forms on the basis of their attached or unattached living mode and differences in their early ontogenetical development, the latter idea of which had been proposed earlier by DURHAM (1949). According to DURHAM (1949: 139ff.) the taxon *Balanophyllia* shows a polycentric development (= "... formation of the adult corallum through two or more distinct stages ...") in its very first ontogenetical stages, whereas *Eupsammia* is considered to show a monocentric development in its earliest ontogenetical stages (= " ... formation of the adult corallum by direct conical enlargement of the prototheca ..."). However, recent investigations regarding ontogenetical stages of solitary and colonial scleractinians from Austria (Gosau Group, Upper Cretaceous) by BARON-SZABO (2003a, and unpublished data) indicate that different septal and wall developments in the earliest ontogenetical stages are the result of whether the polyp was attached or was free-living (see remarks regarding the presumed characteristic of *Cunnolites* to be "free in ephebic stage" in the chapter of the Family Cunnolitidae ALLOITEAU). The sediments of the Upper Cretaceous part of the Gosau Group are characterized by muddy, soft-bottom paleoenvironments that often contain bioclastics. As a result, unattached and attached corals occur side by side. In numerous outcrops, the author of this paper has observed specimens of the same taxa of, e.g., *Cunnolites*, that always showed the development of a single septal cycle in the earliest ontogenetical stage with no or only one poorly developed thecal ring, whereas in attached forms at least 2 or 3 cycles and generally well-developed thecal

structures were observed in the earliest stages that could be studied. This observation corresponds to the statement by DURHAM (1949: 143) regarding the attached form of *Balanophyllia elegans*: "No specimens representing the earliest stages of the corallum of *Balanophyllia elegans* were found ..." Therefore, it is assumed that *Balanophyllia* and *Eupsammia* represent only one taxon that has the ability to settle on soft and hard grounds, living attached and unattached, and that, resulting from this, the terms monocentric and polycentric have no taxonomic value for this genus. With the exception of terms monocentric and polycentric, which are considered to have no taxonomic value for this genus, the diagnosis given for *Balanophyllia* represents a combination of the two descriptions provided by CAIRNS (2001: 14, 17) for *Balanophyllia* and *Eupsammia*."

Austroalpine occurrences. *Gosau Group*: Santonian (Upper Austria: Hochmoos-Grabenbach area).

Suborder Rhipidogyrina RONIEWICZ, 1976

Diagnosis. Solitary and colonial. Costosepta composed of thin, ramified trabeculae. Apophysal and lonsdaleoid septa present, smooth distally, granular laterally. Septothecate and paraseptothecate. Columella lamellar or rudimentary, styliform or absent. Endothecal and perithecal dissepiments present. Budding intracalicinal and extracalicinal. Microstructure neorhipidacanth.

Family Rhipidogyridae KOBY, 1905

Diagnosis. Simple and colonial, fixed. Colony formation by various modes of intracalicinal and extracalicinal budding. Corallites usually united by solid peritheca whose surface is granulated. Costae delicate, in general subcristate, prominent only near calices or during early stages. Septa exsert, thick not numerous, with smooth upper margins. Endothecal dissepiments abundant. Columella lamellar, thin, continuous, deep in calice or calicular series. Epitheca absent. This family is marked by the heavy corallum, granular perithecal surface, rudimentary costae, and lamellar columella.

Genus *Barysmilia* MILNE EDWARDS & HAIME, 1848a

Pl. 50, Figs. 3–6; Pl. 51, Figs. 1–2; Pl. 52, Figs. 1–3

Type species. *Dendrophyllia brevicaulis* MICHELIN, 1841, Upper Turonian of France (Uchaux, Vaucluse) (see MILNE EDWARDS & HAIME, 1848d).

Diagnosis. Colonial, massive or subfasciculate (no lateral connection between some of the corallites), plocoid or subplocoid to subcerioid. Budding mainly intracalicinal, occasionally extracalicinal, resulting in permanent monocentric to tricentric conditions. Costosepta compact, nonconfluent, dentate and granulated laterally. Columella lamellar or rudimentary. Endothecal dissepiments vesicular to cellular. Exothecal dissepiments large, vesicular to subtabulate. Wall septothecal or septoparathecal.

Synonyms. *Placogyropsis* ALLOITEAU, 1957 (Type species. *P. corbariensis* ALLOITEAU, 1957, Lower Coniacian of France [Les Corbières, Burgarach]); *Dichocoeniopsis* ALLOITEAU, 1957 (Type species. *Stenosmilia proletaria* OPPENHEIM, 1930a, Santonian of Austria [Gosau Group at Zimmergraben]); *Cerione–focoenia* REIG ORIOL, 1995 (Type species. *C. iberica* REIG ORIOL, 1995, Campanian of Spain); *Pachynefocoenia* REIG ORIOL, 1989 (Type species. *P. danieli* REIG ORIOL, 1989, Campanian of Spain [Torallola]).

Cretaceous species reported from the Alps. *B. gigantea* (OPPENHEIM, 1930a); *B. irregularis* (REUSS, 1854) (= *Favia ammergensis* SÖHLE, 1899; = *Stenosmilia proletaria* OPPENHEIM, 1930a); *B. trechmanni* (WELLS, 1934); *B. tuberosa* (REUSS, 1854).

Remarks. According to REIG ORIOL (1989: 8), his newly created genus *Pachynefocoenia* is a plocoid colony that has compact costosepta in both radial and bilateral arrangement; septothecal and synapticulothecal walls; extracalicinal budding; twisted columella; tabulate exotheca. However, the images and figures of the type specimen clearly show a colony that is massive but also has polyps that are in subfasciculate (no lateral connection between some of the corallites), plocoid or subplocoid integration. In addition to extracalicinal budding, the presence of intracalicinal multiplication that leads to a submeandroid polyp integration type can be observed. Moreover, the skeletal structures that according to REIG ORIOL are supposed to show synapticulothecal developments, rather indicate septothecal to septoparathecal walls. In addition to the presence of a rather heavy coenosteum that is characteristic of the rhipidogyrids, the material very closely corresponds to *Barysmilia*. Therefore, their synonymy is suggested.

In forming a rather meandroid corallum as seen in taxa like *Microphyllia*, *Maeandrella*, and others, the material described from the Upper Aptian of Italy as *Barysmilia tuberosa* by PREVER (1909) differs from the genus *Barysmilia*. Therefore, it is excluded from the list of occurrences.

According to M. BEAUVAIS (1982, vol. 1: 181), the material described as *Barysmilia tuberosa* from the Upper Albian of England by TOMES (1885) belongs to *Baryphyllia*.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Salzburg: St. Gilgen; Styria: Gams-Hieflau); Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Salzburg: Rußbach, Neffgraben, Abtenau, Rigausbach).

Cretaceous occurrences elsewhere. Upper Cretaceous of Germany, Turonian–Coniacian of France, Santonian–Campanian of Spain, Upper Santonian–Lower Campanian of Romania, Campanian of Bulgaria, Upper Campanian–Maastrichtian of the UAE/Oman border region, Maastrichtian of Jamaica and Mexico.

Genus *Psilogyra* Felix, 1903a

Pl. 51, Figs. 3–6; Pl. 52, Figs. 4–5

Type species. *Psilogyra telleri* Felix, 1903a, Upper Santonian of Austria (Gosau Group at Neffgraben).

Diagnosis. Colony massive, meandroid. Budding intracalicinal. Individual corallites subdistinct to indistinct, rarely isolated, forming long calicinal series separated by tholiform but mainly tectiform collines, ambulacra, and exotheca. Septa thick, compact, nonconfluent, distal margin finely dentate, finely granulated to strongly beaded laterally. Costae generally short or absent. Auricula-like structures and lonsdaleoid septa present. Columella generally absent, but trabecular extensions of axial septal ends can form a pseudo-columella. Frequently, lamellar-substyliform columellar structures are present which are most likely remains of former lamellar linkages between corallites. Wall septothecal and parathecal. Endothecal dissepiments vesicular. Exotheca formed by large vesicular dissepiments, absent in some areas.

Cretaceous species reported from the Alps and Dinarides. *P. felixi* Oppenheim, 1930a; *P. telleri* Felix, 1903a.

Austroalpine occurrences. *Gosau Group*: Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Santonian (Salzburg-Bavaria region: ?„Krönner Reef“ area); Upper Santonian (Salzburg: Rußbach, Neffgraben).

Cretaceous occurrences elsewhere. Campanian of Serbia, Maastrichtian of Jamaica.

Genus *Rhipidomeandra* Morycowa & Masse, 1998

Pl. 53, Fig. 1

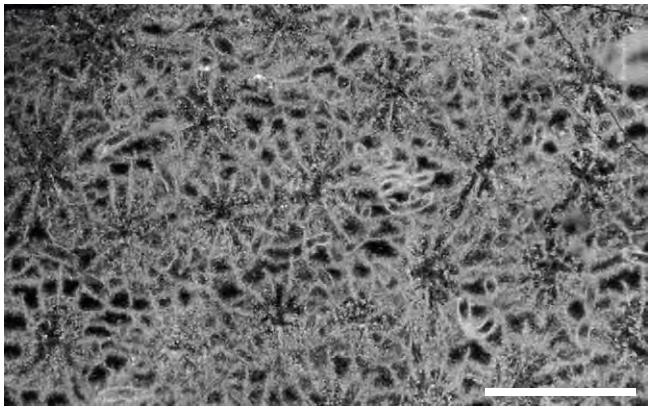
Type species. *Rhipidomeandra bugrovae* Morycowa & Masse, 1998, Uppermost Barremian or Lower Aptian of southern France [Vaucluse]).

Diagnosis. Colony massive, meandroid. Individual corallites subdistinct to indistinct, rarely isolated, forming long or short calicinal series, simple and diverging, separated by tholiform collines, and ?ambulacra. Septa compact, distal margin finely dentate, granulated laterally, finely granulated to strongly beaded laterally. Costae generally short or absent. Auriculae and lonsdaleoid septa present. Columella absent but trabecular extensions of axial ends of septa may form a pseudo-columella. Wall septothecal and parathecal. Endothecal dissepiments arched, raised in the vicinity of the wall.

Cretaceous species reported from the Alps. *Rhipidomeandra* cf. *bugrovae* Morycowa & Masse, 1998.

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Brandalpe).

Cretaceous occurrences elsewhere. Upper Barremian–Lower Aptian of France, Lower Aptian of Mexico.



Text-Fig. 11.
Ironella giseldonensis Krasnov & Starostina, 1970; thin section, cross view; SAZU P–487a, Valanginian of Slovenia (Zavrh, Trnovski Gozd); scale bar: 5.5 mm. Photograph courtesy D. Turnšek.

Genus *Ironella* Krasnov & Starostina, 1970

Text-Fig. 11

Type species. *Ironella giseldonensis* Krasnov & Starostina, 1970, Tithonian of Caucasus.

Diagnosis. Colonial, plocoid. Budding intracalicinal. Costosepta compact, generally thick, granular laterally. Lonsdaleoid septa present. Columella absent or rudimentary. Wall parathecal to septoparathecal. Endothecal dissepiments thin, tabulate. Exothecal and perithecal dissepiments vesicular, well-developed.

Cretaceous species reported from the Dinarides. *I. giseldonensis* Krasnov & Starostina, 1970 in Turnšek & Buser (1974).

Dinaric occurrences. *Dinaric Carbonate Platform* (“*Reef Development*”): Valanginian of Slovenia (Zavrh, Trnovski Gozd).

Cretaceous occurrences elsewhere. None reported.

Suborder Fungiina Verrill, 1865

Diagnosis. Solitary and colonial. Septa fenestrate, formed by simple or compound trabeculae united by simple or compound synapticulae, margins beaded or dentate.

Family Acrosmiliidae Alloiteau, 1952a

(= Family Leptophylliidae Vaughan, 1905;
= Family Brachyphylliidae Alloiteau, 1952a)

Diagnosis. Solitary or colonial fungiids. Costosepta subcompact to perforated, formed by compound trabeculae. In older septa perforations mainly restricted to the axial region, compact peripherally. Distal margins of costae

and septa predominantly moniliform. Lateral flanks of septa covered by rounded and spiniform to crispate granulae, small pennulae, and pennulae-like ornamentations. Columella trabecular, feebly or well-developed, often spongy-papillose. Endothecal dissepiments vesicular in peripheral areas becoming vesicular to subtabulate toward the corallite center. Synapticulae disposed throughout the corallum. Wall synapticulothecal, complete or incomplete.

Remarks. According to ALLOITEAU (1952a: 671), his newly created Family Brachyphylliidae is characterized by the following features:

> "Solitary and colonial. Budding extracalicinal. Septal perforations numerous and regular but sparse. Axial ends of septa not dissociated. Septa nonconfluent. Anastomosis absent. Endotheca dissepiments sparse. Synapticulae abundant. Wall synapticulothecal, incomplete, poorly defined. Columella well developed or rudimentary."

However, the re-study of the nominatform of this family, *Brachyphyllia* REUSS, revealed that it also shows additional features like intracalicinal (-marginal) budding which subsequently leads to the occurrence of confluent septa; septal axial ends that can be dissociated; frequently occurring septal anastomosis; septal pores which in some corallites occur much more frequently and irregularly, but are less abundant in others. Moreover, in many regards, the types of septal ornamentation in *Brachyphyllia* and *Acrosmilia* closely correspond to each other. Therefore, the family Brachyphylliidae is grouped with the family Acrosmiliidae.

Genus *Brachyphyllia* REUSS, 1854

Pl. 53, Figs. 2–6; Pl. 54, Figs. 1–4

Type species. *Brachyphyllia dormitzeri* REUSS, 1854, Upper Santonian of Austria (Gosau Group at Neffgraben) (subsequent designation by REUSS, 1864).

Diagnosis. Subplocoid-subfasciculate colony. Budding extracalicinal and intracalicinal-marginal. Juvenile corallites in solitary stage are tympanoid, cupolate, patellate, subdiscoid. Septa porous to subcompact, with strongly beaded margins and ornamented with granules and pennular-like structures laterally. Columella well-developed, spongy, or reduced consisting of a small number of trabecular papillae. Endothecal dissepiments thin. Synapticulae numerous, less abundant in juvenile stages. Wall synapticulothecal. Epitheca present or absent in juvenile stages.

Synonyms. ?*Neothecoseris* ELIÁŠOVÁ, 1994 (Type species. *N. circulus* ELIÁŠOVÁ, 1994, Cenomanian–Lower Turonian of the Czech Republic (Bohemia); ?*Miniphyllia* ELIÁŠOVÁ, 2004 (Type species. *Leptophyllia humilis* DE FROMENTEL, 1867, Santonian of France [Les Corbières, Sougraigne, Aude]).

Cretaceous species reported from the Alps. *B. depressa* REUSS, 1854; *B. dormitzeri* REUSS, 1854; *B. glomerata* REUSS, 1854; *B. felixi* BARON-SZABO, 2000; *B. thraciensis* (CHESHMEDZHIEVA, 1995b).

Remarks. The taxon described as *Neocoeniopsis thraciensis* CHESHMEDZHIEVA, 1995b, from the Maastrichtian of Bulgaria, differs from the genus *Neocoeniopsis* in forming a rather fasciculate colony by marginal budding and having abundant synapticulae that occur throughout the corallum (see pl. 15, fig. 1 in CHESHMEDZHIEVA, 1995b). In *Neocoeniopsis* the corallite integration is plocoid and synapticulae are sparse, mainly restricted to the vicinity of corallite wall. In addition, the septal apparatus of *Neocoeniopsis thraciensis*, as shown on pl. 15, fig. 1 in CHESHMEDZHIEVA (1995b), closely corresponds to the brachyphylliid type, but clearly differs from the kind developed in the pachyphylliids, to the latter of which, also in the opinion of CHESHMEDZHIEVA, *Neocoeniopsis* belongs.

In describing the new form *Brachyphyllia felixi*, BARON-SZABO (2000: 121, pl. 11, fig. 5; 2008: Pl. 20, fig. 5) documented specimens which showed both very early ontogenetical stages in which the polyps are still in solitary condition and coralla in an ontogenetically more advanced stage in which the first new polyps are visible. In forming solitary, subturbinate and fixed corallites which are characterized by a small, circular calicinal pit; irregularly perforated septa that have pennulae laterally and show anastomosis; have a generally small or very reduced columella; vesicular endothecal dissepiments; sparsely occurring synapticulae; a septoparathecal wall; and an epitheca that can be present, the specimens described as *Neothecoseris* and *Miniphyllia* by ELIÁŠOVÁ are identical to both the juvenile, solitary stage of *Brachyphyllia* and re-juvenation stages of individual *Brachyphyllia* corallites. Moreover, in some material of *Neothecoseris* (*N. fraterculus* ELIÁŠOVÁ, 2004: Fig. 15a, upper left) structures are present closely corresponding to the marginal budding type that is characteristic of *Brachyphyllia* (see e.g., syntype of *Brachyphyllia glomerata*, Pl. 54, Fig. 2). Furthermore, in material of *Miniphylia* (see e.g., *Miniphyllia tenuilamellosa* in ELIÁŠOVÁ, 2004: Fig. 8b, on the right), there appears to be an offspring at an angle of around 45°.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Tyrol: Brandenberg); Upper Turonian–Santonian (Upper Austria: Gosau town); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben; Upper Austria: Gosau, Wegscheidgraben).

Cretaceous occurrences elsewhere. Upper Aptian of northern Spain, Upper Cretaceous of Germany, Lower Coniacian of France, Campanian of Spain, Upper Campanian–Maastrichtian of the UEA/Oman border region, Maastrichtian of Bulgaria and Jamaica.

Genus *Dermosmiliopsis* ALLOITEAU, 1952a

Pl. 54, Figs. 5–6; Pl. 55, Figs. 1–2

Type species. *Dermosmiliopsis orbignyi* ALLOITEAU, 1952a, Santonian of France (Aude).

Diagnosis. Phaceloid to subdendroid colony. Budding extracalicinal-marginal. Corallites monocentric. Septa porous, with strongly beaded margins. Columella spongy-papillose. Endothecal dissepiments sparse. Synapticulae abundant. Wall synapticulothecal, often incomplete.

Cretaceous species reported from the Alps and Dinarides. *D. orbignyi* ALLOITEAU, 1952a; *D. tenuicosta* (REUSS, 1854).

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Tyrol: Brandenberg, Sonnwendjoch); Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang; Salzburg: St. Gilgen); Upper Turonian–Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten); Coniacian (Tyrol: Ludoi Alp [= Pletzach Alp]); Santonian (Salzburg: Rußbach, Oberstöckl, Zimmergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben; Upper Austria: Gosau, Brunstloch, Wegscheidgraben); Upper Santonian–Lower Campanian (Lower Austria: Baden, Einöd quarry); Upper Campanian (Carinthia: Krappfeld).

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Upper Cretaceous of Germany, Santonian of France, Upper Santonian–Lower Campanian of Romania, Maastrichtian of Jamaica and Mexico.

Genus *Brachycaulia* M. Beauvais, 1982

Pl. 55, Figs. 3–6

Type species. *Brachycaulia jacobi* M. Beauvais, 1982, Lower Coniacian of France.

Diagnosis. Colonial, plocoid, cerioid deeper in corallum. Budding intracalicinal. Corallites monocentric. Costosepta generally compact, porous peripherally, nonconfluent, ornamented with granules, denticles, and pennular-like structures laterally. Anastomosis occasionally present. Synapticulae abundant. Columella absent. Endothecal dissepiments sparse. Wall synapticulothecal, incomplete.

Cretaceous species reported from the Alps and Dinarides. *B. felixi* M. Beauvais, 1982 (pro *Brachyphyllia haueri* [Reuss] in Felix, 1903a); *B. jacobi* M. Beauvais, 1982.

Remarks. Alloiteau (1957: Pl. 2, fig. 6; pl. 11, fig. 2; pl. 19, fig. 10) documented the new form *Brachycaulia jacobi* without providing any description. Because M. Beauvais (1982, vol. II: 227) was the first author to have given a proper description, according the ICZN, he has to be considered the author of this taxon.

Austroalpine occurrences. *Gosau Group*: Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben).

Cretaceous occurrences elsewhere. Upper Santonian of France.

Genus *Acrosmilia* d'Orbigny, 1849

Pl. 55, Fig. 7; Pl. 56, Figs. 1–3

Type species. *Turbinolia cernua* Michelin, 1846, Coniacian of France (Aude).

Diagnosis. Solitary, turbinate to patellate. Costosepta compact peripherally, perforate inwardly and near upper margins, strongly beaded marginally, granular and (?pseudo-) pennular laterally. Columella feebly developed, parietal. Synapticulae abundant. Endothecal dissepiments thin, vesicular to subtabulate. Synapticulothecate. Septal microstructure consists of compound trabeculae.

Synonyms. *Leptophyllia* Reuss, 1854 (Type species. *L. clavata* Reuss, 1854, Upper Santonian of Austria [Gosau Group at Brunstloch]; lectotype designated herein); *Turbinoseris* Duncan, 1870 (Type species. *Turbinoseris defromenteli* Duncan, 1870, Lower Aptian of England [Lower Greensand, Isle of Wight]).

Cretaceous species reported from the Alps and Dinarides. *A. clavata* (Reuss, 1854) (= *Parasmilia bouei* Reuss, 1854); *A. conclavina* (Oppenheim, 1930a); *A. conica* d'Orbigny, 1850; *A. cycloides* (Oppenheim, 1930a); *A. discrepans* (Wells, 1941); *A. elongata* (Reuss, 1854); *A. flexuosa* (Oppenheim, 1930a); *A. reussi* (Milne Edwards, 1857).

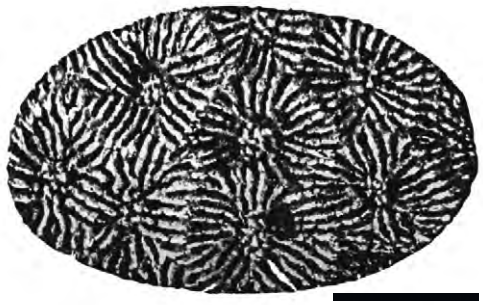
Remarks. Studies by Tomes (1885: 551) revealed that the type species *Turbinoseris defromenteli* Duncan of Duncan's genus *Turbinoseris* closely corresponded to *Leptophylla* (which is seen as a junior synonym of *Acrosmilia* by this author). In addition, Tomes realized that the species name *'defromenteli'* had been in use and was, therefore, unavailable. For that reason, Tomes created the species name *anglica* (= *Leptophyllia anglica*). Later, Tomes (1899: 306) revised his decision in that he concluded that Duncan's taxon was synonymous with *Leptophyllia clavata*, the type species of *Leptophylllia*.

Specimen NHMW 1864/0040/1317a of the syntype series of *Leptophyllia clavata* Reuss, 1854, from the Upper Santonian of Austria (Gosau Group at Brunstloch), is herein designated as the lectotype of the species as it corresponds the closest to the original documentation by Reuss (1854: Pl. 6, figs. 3–6).

Austroalpine occurrences. *Gosau Group*: Reported from all Turonian–Campanian Gosau localities; "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Cretaceous of Greece, Aptian–Albian of Iran, Lower Cenomanian–Santonian of France, Turonian–Campanian of Georgia (in Caucasus), Santonian of Spain, Upper Santonian–Lower Campanian of Romania, Campanian of Cuba, Upper Campanian of Bulgaria, Campanian–Lower Maastrichtian of central Saudi Arabia, Maastrichtian of Spain, Upper Maastrichtian of Jamaica.



Text-Fig. 12.
Sketch of *Parasynastraea tignaria* (OPPENHEIM, 1930a), based on the illustration of the type material in Oppenheim (1930a: Pl. 19, Fig. 3); upper surface of colony, cross view; Santonian (Zimmergraben), Austria; scale bar: 3 mm.

Genus *Parasynastraea* ALLOITEAU, 1957

Pl. 56, Figs. 4–7; Text-Fig. 12

Type species. *Parasynastraea cenomanensis* ALLOITEAU, 1957, Cenomanian of France (Le Mans, Sarthe).

Diagnosis. Colony thamnasterioid-cerioid. Budding intracalicinal. Calices isolated or arranged in short series. Wall synapticulothecate. Septa confluent, perforate, frequently anastomosing. Distal margin moniliform. Septal flanks are ornamented by granulae. Synapticulae more frequent in the region of the lumen. Endothecal dissepiments sparse. Columella spongy-subpapillose, often weakly developed. Microstructure made of simple and compound trabecular pillars.

Synonym. *Baksanophyllia* KUZMICHEVA, 1972b (Type species. *B. cylindrica* KUZMICHEVA, 1972b, Berriasian of Ukraine [Obl. Krymskaya]).

Cretaceous species reported from the Alps. *P. tignaria* (OPPENHEIM, 1930a); *P.* sp. (referring to material formerly ascribed to *Thamnasteria favrei* in BARON-SZABO, 1997).

Austroalpine occurrences. *Gosau Group*: Lower Coniacian (Tyrol: Brandenberg, Haidach); Santonian (Salzburg: Rußbach, Zimmergraben).

Cretaceous occurrences elsewhere. Cretaceous of Greece, Campanian of northern Spain (Catalonia).

Family Actinacididae VAUGHAN & WELLS, 1943

Diagnosis. Colonial; colony formation by intra- and extratentacular budding. Basal epitheca present. Corallites synapticulothecate. Septa relatively few, composed of one system of 3 to 5 nearly vertical simple trabeculae, with numerous pores, laterally united by simple synapticulae, the innermost trabeculae often differentiated as paliform lobes. Septocostae often scarcely distinguishable, even absent when the distal ends of the septa bifurcate and become lost in a coenenchyme composed of discontinuous vertical trabeculae united horizontally by simple synapticulae; coenenchyme spinose or vermiculate on the surface. Columella absent or composed of one or more trabecular pillars. Endotheca thin, subtabulate.

Genus *Actinacis* D'ORBIGNY, 1849

Pl. 57, Figs. 1–9

Type species. *Actinacis martiniana* D'ORBIGNY, 1850, Upper Santonian of France (Figuères).

Diagnosis. Colony plocoid. Colony formation by extracalicinal budding. Corallites are embedded in a porous to reticulate coenosteum. Costosepta have few, but large perforations. Anastomosis present. Septal flanks granular. Wall synapticulothecate, incomplete. Columella parietal or substyliform or formed by elongated segments. No pali. Synapticulae abundant. Endothecal dissepiments sparse. Skeletal microstructure consists of simple and compound trabeculae.

Synonym. *Neostroma* TORNQUIST, 1901 (Type species. *N. sumatraensis* TORNQUIST, 1901, Cretaceous [probably Late Cretaceous] of Indonesia [Langkat, Sekoendoer besar]).

Cretaceous species reported from the Alps and Dinarides. *A. cymatoclysta* FELIX, 1906; *A. elegans* REUSS, 1854; *A. haueri* REUSS, 1854 (= *A. cretacea* [UMBGROVE, 1925]); *A. mammillata* OPPENHEIM, 1930a; *A. martiniana* D'ORBIGNY, 1850 (= *A. parvistella* OPPENHEIM, 1930a; = *A. multilamellata* OPPENHEIM, 1930a; = *A. valverdensis* WELLS, 1933); *A. multipartita* OPPENHEIM, 1930a; *A. porosa* OPPENHEIM, 1930a; *A. quenstedti* TRAUTH, 1911; *A. remesi* FELIX, 1903a (= *A. sumatraensis* [TORNQUIST, 1901]); *A. reussi* OPPENHEIM, 1930a; *A.* sp. (first report of the genus for the Ludoi Alp).

Remarks. D'ORBIGNY'S (1850: 209) first remarks on the type species of the genus *Actinacis* were very short: 'Belle espèce rameuse à tiges grêles. Figuières'. Later works by M. BEAUVAIS (1982, vol. 2: 262ff.), BOSELLINI & RUSSO (1995), and BARON-SZABO (2003a, 2008) provided more detailed information, including systematic re-organizations of species within this group.

Originally described as a stromatoporid, the genus *Neostroma* TORNQUIST, 1901, from the (?Upper) Cretaceous of Indonesia was later transferred to the Scleractinia and grouped with *Actinacis* (e.g., GERTH, 1909; VAUGHAN & WELLS, 1943; FLÜGEL, 1961). In having a maximum corallite diameter of around 2.5 mm and a number of septa generally ranging between 17–20 (–24) (estimated based on the original documentation by TORNQUIST), the corresponding type species (*A. sumatraensis* [TORNQUIST, 1901]) is considered synonymous with *Actinacis remesi* FELIX, 1903b, and is, therefore, included in the species list.

Also see discussions under *Hydnophoromeandraraea* MORYCOWA.

Austroalpine occurrences. *Gosau Group*: Reported from all Turonian–Campanian localities of the Gosau Group; "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice); "*Rhenodanubian Unit*": Upper Cretaceous of Austria.

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Lower Barremian of ?Turkmenistan, Urgonian of ?Poland, Middle Albian of Texas, (?Upper) Cretaceous of Indonesia, Upper Cretaceous of Germany and the Netherlands Antilles (Bonnaire), Upper Cenomanian–Lower Santonian of the Czech Repub-

lic, Turonian–Senonian of Libya, Turonian–Coniacian and Upper Santonian of southern France, Senonian of Ukraine and Slovakia, Santonian of Georgia (in Caucasus), Santonian–Campanian of northern Spain (Catalonia), Maastrichtian of Mexico (Cardenas Formation), Italy, and Jamaica, Middle–Upper Maastrichtian of the UAE/Oman border region, Upper Maastrichtian of The Netherlands.

Genus *Bosnopsammia* Oppenheim, 1909

Pl. 58, Figs. 1–2, 4–5

Type species. *Bosnopsammia katzeri* Oppenheim, 1909, Upper Eocene of Croatia

Diagnosis. Colonial, submassive to lamellar, ploco-subthamnasterioid. Budding extracalicinal. Corallites embedded in a reticulate coenenchyme, often indistinct, and frequently connected by irregularly confluent septa. Costosepta reduced, subcompact to porous, granulate laterally. Columellar trabeculae, paliform structures, and synapticulae present. Endothecal dissepiments thin, vesicular. Wall synapticulothecal, always either incomplete or absent.

Synonym. *Elephantaria* Oppenheim, 1930a (Type species. *E. lindstroemi* Oppenheim, 1930a, Santonian of Austria (Gosau Group).

Affinities. Very similar to *Actinacis* but corallite wall always incomplete to absent; and has both paliform structures and frequently confluent septa.

Cretaceous species reported from the Alps. *B. lindstroemi* (Oppenheim, 1930a); *B. morycowai* (Reig Oriol, 1995); *B.* sp. (first report of the genus for Ettendorf).

Remarks. Because the material described as *Actinarea morycowai* by Reig Oriol (1995) from the Campanian of Spain shows an *Actinarea*-like form that, however, seems to have extracalicinal budding, it closely corresponds to the genus *Bosnopsammia*. In *Actinarea*, the budding mode is intracalicinal. With regard to the dimensions of skeletal elements (c-c: 5–9 mm; s/mm: 7/2), the Spanish material shows close affinities to *B. lindstroemi* (Oppenheim, 1930a), and is, therefore, considered synonymous with the latter and is included here.

Recently, on the basis of the extended description of *Bosnopsammia* provided by Oppenheim (1912: 106–108), Baron-Szabo (2008: 110) grouped the genera *Bosnopsammia* Oppenheim, 1909, and *Elephantaria* Oppenheim, 1930a, as subgenera. In his description, Oppenheim mentioned that *Bosnopsammia* showed affinities to *Actinacis* but emphasized the additional presence of both corallites that are nearly indistinguishable from the coenosteum in which they are embedded and costosepta that irregularly connect the corallites. On the one hand, this information strongly suggests a close relationship with *Elephantaria* while, on the other hand, the development of a more elaborate papillose columella with a more distinct development of paliform lobes in *Bosnopsammia* set them apart. However, examination of new material from the Lower Santonian of Austria (Gosau Group at Wolfschwang, Untersberg; see Pl. 58, Figs. 4–5) revealed that characteristics of both taxa can be present in the same specimens. Therefore, the genus *Elephantaria* is considered a junior synonym of *Bosnopsammia*.

Also see Remarks under *Polyphylloseris* De Fromentel.

Austroalpine occurrences. *Gosau Group*: Turonian–?Coniacian (Salzburg: St. Gilgen, Kohlbachgraben, "Billroth"); Lower Coniacian (Salzburg: Strobl, Sankt Wolfgang, "Theresienstein"); Lower Santonian (Salzburg: Wolfschwang, Untersberg); Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Upper Austria: Gosau, Gschröfpalfen, Wegscheidgraben; Salzburg: Rußbach, Neffgraben); Lower Campanian (Carinthia: Ettendorf at St. Paul [Weinberger homestead]).

Cretaceous occurrences elsewhere. Upper Cenomanian and Santonian–Campanian of Slovakia, Campanian of Spain, Maastrichtian of Jamaica.

Genus *Actinarea* d'Orbigny, 1850

Pl. 58, Fig. 3; Pl. 59, Figs. 1–2

Type species. *Agaricia granulata* Münster in Goldfuss, 1829, Upper Jurassic of Germany (Nattheim).

Diagnosis. Colonial, massive, thamnasterioid. Budding intracalicinal. Corallites embedded in a rather porous coenosteum. Costosepta few in number with irregular perforations, septal flanks granular. No paliform structures. Columella feebly developed, parietal. Synapticulae present. Endothecal dissepiments thin, tabulate. Wall absent or incomplete synapticulothecal.

Subgenus. *Camptodocis* Dietrich, 1926 (Type species. *C. brancai* Dietrich, 1926, Barremian–Lower Aptian of Tanzania): Like *Actinarea* but calices are not independent from perithecal colony tissue (similar as in *Actinacis*), corallites therefore with variably thamno-plocoid to thamno-cerioid integration.

Synonym of subgenus *Camptodocis*. *Actinaraeopsis* Roniewicz, 1968 (Type species. *A. araneola* Roniewicz, 1968, Middle Oxfordian of Poland).

Cretaceous species reported from the Alps and Dinarides. *A. tenuis* Morycowa, 1971.

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Lower Gundalpe, Mitteleck).

Dinaric occurrences. *Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Slovenski vrh, near Kočevje).

Austroalpine occurrences. *Gosau Group*: Lower Coniacian (Tyrol: Brandenberg, Haidach).

Cretaceous occurrences elsewhere. Valanginian of Hungary, Hauterivian of Georgia (in Caucasus), Barremian–Lower Aptian of Serbia, Lower Aptian of Romania, Albian of the USA (New Mexico), Lower Cenomanian of Spain.

Family Haplaraeidae VAUGHAN & WELLS, 1943

(= Astraraeidae M. BEAUVAIS, 1982)

Diagnosis. Solitary and colonial. Colony formation by intra- and extratentacular budding. Corallite wall synapticulothecal, poorly defined or absent, costate, usually epithecate, porous. Septa exsert, composed of one fan system of compound trabeculae, with vertical axis of divergence, irregularly porous and thick. Dissepiments thin. Columella absent or parietal or feebly developed.

Subfamily Haplaraeinae VAUGHAN & WELLS, 1943

Diagnosis. Solitary and colonial. Polyps rather large, with a wide base of attachment. Trabeculae thick. Synapticulae numerous. Columella parietal. Dissepiments thin, large.

Genus *Astraraea* FELIX, 1901

Pl. 59, Figs. 3–6; Pl. 60, Figs. 1–5; Pl. 61, Figs. 2, 4–5

Type species. *Thamnastrea multiradiata* REUSS, 1854, Santonian of Austria.

Diagnosis. Colonial, thamnasterioid to subcerio-thamnasterioid. Budding intratentacular mono- to polystomodaeal, resulting in temporary sub-meandroid series, and extracalicinal. In early astogenic stages, corallites are in circumoral arrangement. Corallites permanently monocentric, arranged in thamnasterioid or subcerioid-subplocoid integration. Radial elements biseptal with perforations arranged in vertical rows. Distal margin with rounded and subequal denticles. Lateral septal faces ornamented with rounded and irregularly shaped granulae. Synapticulae numerous. Columella parietal-papillose. Endothecal dissepiments sparse, thin. Wall absent or incomplete parasynapticulothecal.

Synonyms. *Trechmannaria* WELLS, 1935 (Type species. *Trechmannaria montanaroae* WELLS, 1935, Campanian of Jamaica [limestone at Mooretown)]; *Valliseris* ALLOITEAU, 1957 (Type species. *V. rennensis* ALLOITEAU, 1957, Upper Cenomanian of France [Les Corbières, Aude]).

Cretaceous species reported from the Alps and Dinarides. *A. media* (SOWERBY, 1832); *A. montanaroae* (WELLS, 1935); *A. multiradiata* (REUSS, 1854); *A. senessei* ALLOITEAU, 1939; *A. submedia* OPPENHEIM, 1930a.

Remarks. ALLOITEAU (1952a), WELLS (1956), and others state that the type species of *Astraraea* is *Thamnastrea media* (SOWERBY, 1832). However, in his first description of the genus FELIX (1901: 3) distinctly referred to *Thamnastrea multiradiata* REUSS as the first representative and the genotype of *Astraraea* ("... Bei der Untersuchung von *Thamnastrea multiradiata* REUSS fand ich, daß ... daher ist letztere [= referring to *Thamnastrea multiradiata*] ... als Vertreter einer neuen Gattung anzusehen, für welche ich den Namen *'Astraraea'* vorschlage."). In addition to *Thamnastrea multiradiata* REUSS, FELIX also included the form *Thamnastrea media* (SOWERBY, 1832) in the genus *Astraraea*.

Recently, BARON-SZABO (2008), grouped the genera *Trechmannaria* WELLS, 1935, and *Valliseris* ALLOITEAU, 1957, with *Astraraea*. For an extended discussion, see BARON-SZABO (2008: 113).

While previous taxonomic assignments of the material described in BARON-SZABO (1997, 2001) from various Gosau localities closely correspond to both Gosau material of some specimens of the FELIX collections assigned to *Thamnarea* (see FELIX, 1903a: 183, Text-Fig. 8) and the original documentation of the genus *Thamnarea* ÉTALLON in THURMANN & ÉTALLON (1864: 412, pl. 58, figs. 6a–c), the material, however, differs from the latest interpretation of *Thamnarea* which is based on one of the syntypes of the type species of this genus (*Thamnarea digitalis*; pers. comm. LATHUILIÈRE, see corallosphere.org, version of July 2, 2010). The differences between the Gosau material are especially due to polyp integration and the development of both coenosteum and axial features. Based on these results and reinvestigations of type and original material by the author of the current work during the years 2009 and 2013, the above mentioned Gosau material is transferred to the genus *Astraraea* FELIX.

Recently, LÖSER (2012b) merged some of the above mentioned Gosau material described as *Thamnarea cladophora* by BARON-SZABO (1997: 80, pl. 13, fig. 1) with material from the Campanian of Turkey which he assigned to the taxon *Astraeofungia siva* (STOLICZKA, 1873). However, because the Gosau material is characterized by a (subcerio-) thamnasterioid polyp integration and has polyps which are embedded in partly disintegrated coenosteum (see Pl. 60, Fig. 4), it clearly differs from the genus *Astraeofungia*. In *Astraeofungia*, the polyp integration is thamnasterioid and a corallite wall is absent. Also see Remarks under *Astraeofungia* ALLOITEAU.

Austroalpine occurrences. *Gosau Group*: Middle Turonian–Lower Coniacian (Tyrol: Brandenberg, Mühlbach); Upper Turonian (Tyrol: Brandenberg, Sonnwendjoch; Upper Austria: Wolfgangsee, Sankt Wolfgang; Styria: Gams-Hieflau, Haspelgraben); Lower Coniacian (Salzburg: Strobl, Sankt Wolfgang, "Theresienstein"; Tyrol: Brandenberg, Haidach); Coniacian (Salzburg: Rußbach, Streidegg-Graben; Tyrol: Ludoi Alp [= Pletzach Alp]); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Upper Coniacian (Upper Austria: Unterlaussa, Weisswasser); Santonian (Salzburg: Rußbach, Randograben, Stöcklwaldgraben, Zimmergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Upper Austria: Gosau, Schrickpalfen, Brunstloch, Gschröfpalfen, Wegscheidgraben; Salzburg: Abtenau, Rigausbach; Rußbach, Neffgraben, Traunwandalm, Schattauergraben); Upper Santonian–Lower Campanian (Lower Austria: Baden, Einöd quarry).

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Upper Cretaceous of Germany, Cenomanian of Azerbaijan, ?Turonian of northern Spain, Turonian–Coniacian and Upper Santonian of southern France, Santonian–Campanian of northern Spain (Catalonia), Lower Senonian of Curaçao, Campanian of

Hungary and eastern Serbia, Campanian–Maastrichtian of Jamaica, Maastrichtian of France, Middle–Upper Maastrichtian of the UAE/Oman border region.

Genus *Loboseris* M. Beauvais, 1982

Pl. 61, Fig. 6; Pl. 62, Figs. 1–6

Type species. *Mussa abbreviata* Reuss, 1854, Upper Santonian of Austria (Gosau Group at Neffgraben) (designation of lectotype by inference by M. Beauvais, 1982, vol. 2: 225–226).

Diagnosis. Colonial, massive, meandroid. Various types of intracalicinal budding. Calices monocentric or in wavy series. Peritheca consists of thin vesicular and tabular dissepiments. Septa subcompact to perforate, compact in older septa, nonconfluent, subconfluent deeper in corallum, marginally granular. Costae generally absent, occasionally present but reduced. Calicinal series separated by exothecal developments or ambulacra. Columella parietal-spongy. Synapticulae and endothecal dissepiments abundant. Wall synapticulothecal. No wall between calices of the same series.

Synonym. ?*Filkornia* Löser, 2012e (Type species. *F. parasolitaria* Löser, 2012e Maastrichtian of Mexico).

Cretaceous species reported from the Alps. *L. abbreviata* (Reuss, 1854).

Remarks. Originally, the genus *Loboseris* was placed in the family Latomeandridae together with genera that may or may not have pennulae (M. Beauvais, 1982, vol. 2: 260; Table II). However, in recent studies carried out by Lathuilière (pers. comm., 2009, also visit corallosphere.org), great emphasis was given on the occurrence of true pennulae in the nominatform of the family, *Latomeandra* d'Orbigny. Because the holotype of the type species of *Loboseris* lacks pennulae, it is here transferred to the family Haplaraeidae.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Salzburg: St. Gilgen); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Upper Santonian (Salzburg: Rußbach, Neffgraben).

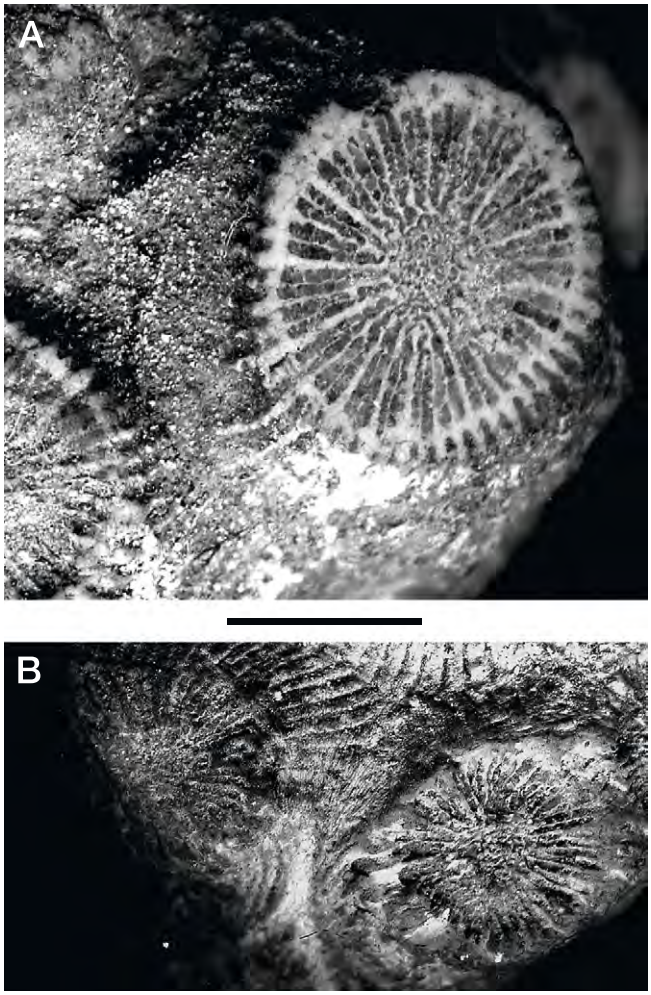
Cretaceous occurrences elsewhere. Cretaceous of ?Spain and ?Greece, Upper Santonian–Lower Campanian of Romania, Maastrichtian of Jamaica and Mexico.

Genus *Pleurocora* Milne Edwards & Haime, 1848a

Pl. 61, Figs. 1, 3; Text-Fig. 13

Type species. *Lithodendron gemmans* Michelin, 1846, Turonian of France (St. Croix) (see Milne Edwards & Haime, 1848a).

Diagnosis. Colonial, subplocoid to subphacelo-dendroid. Budding extracalicinal. Corallites cylindrical, very short, with coenosteum between them formed by costae and exothecal dissepiments. Septa compact or subcompact, granulated. Costae present, sometimes very short or ?absent. Pali irregularly occurring opposite all but last cycle, often merge with axial structures. Wall dense, synapticulothecal and (septo-) parathecal. Columella trabecular, papillose or formed by lamellar segments. Endothecal dissepiments thin.



Text-Fig. 13.
Pleurocora reussi Milne Edwards, 1857; lectotype, NHMW 1864/0040/1352a; Santonian (Gosau basin), Austria; A: upper surface of colony, partially polished; scale bar: 3 mm; B: upper surface of colony; scale bar: 6 mm.

Synonyms. *Psammiophora* De Fromentel, 1870 (Type species. *P. cenomana* De Fromentel, 1870, Lower Cenomanian of France [Charente-Maritime]); *Phyllohelia* Alloiteau, 1952a (Type species. *Pleurocora explanata* Milne Edwards & Haime, 1848d, Campanian–Maastrichtian of Belgium [Mons, Obourg]); *Latohelia* Löser, 1987 (Type species. *Synhelia reptans* Počta, 1887, Upper Cenomanian of the Czech Republic [Bohemia]); *Stylocorella* Delage & Herouard, 1901 (Type species. *Stylocora ferryi* De Fromentel, 1873, Santonian of France (Les Corbières, Salee, Aude).

Cretaceous species reported from the Alps and Dinarides. *P. arachnoides* (Knorr & Walch, 1777); *P. angelisi* Felix, 1906; *P. gemmans* (Michelin, 1846) (= *P. alternans* Milne Edwards & Haime, 1848d; = *P. circularia* [Baron-Szabo, 1998]; *P. ogilviae* [Felix, 1903a]); ?*P. gosaviensis* (M. Beauvais, 1982); *P. haueri* Milne Edwards & Haime, 1849b; *P. konincki* Milne Edwards & Haime, 1849b; *P. kuehnii* (Oppenheim, 1930a); *P. nefiana* Oppenheim, 1930a; ?*P. nordenskjoeldi* (Felix, 1909); *P. reussi* Milne Edwards, 1857 (= *Heliastraea tenuiseptata* Oppenheim, 1930a); *P. riemsdycki* (Milne Edwards & Haime, 1851a); *P. riemsdycki* var.

conica (UMBGROVE, 1925); ?*P. rudis* REUSS, 1854; *P. schlosseri* (FELIX, 1903a); *P. subgemmans* OPPENHEIM, 1930a (= *Pleurocora crassa* [REUSS] in TURNŠEK & POLŠAK, 1978).

Remarks. *Stylocorella* DELAGE & HEROUARD, 1901, is the replacement taxon for *Stylocora* DE FROMENTEL, which is a junior homonym of *Stylocora* REUSS, 1871. In the original description of *Stylocora*, DE FROMENTEL (1873: 430) already pointed out that his newly created genus showed very close affinities to *Pleurocora*. According to him, the only difference to *Pleurocora* was the lack of pali. However, because in the type material of *Pleurocora* the development of pali, while quite often preserved, can be indistinct/absent in some corallites, their synonymy is suggested. It should also be noted that, according DE FROMENTEL, the type material of his new genus consists of only a fragment with one single corallite.

Based on re-examination of the type material, the species *Pleurocora alternans* MILNE EDWARDS & HAIME, 1848b, *P. ogilviae* (FELIX, 1903a), and *P. circularia* (BARON-SZABO, 1998) have to be considered junior synonyms of *Pleurocora gemmans* (MICHELIN, 1846) which is characterized by a corallite diameter of 2–3.5 mm (juvenile around 1.5 mm), corallite distance of 3–5 mm, and septa numbering from 24–48, and developed in 6 systems.

In having a septal arrangement that appears to be dendrophylliid, the ramose coral described from the Albian of Greece in MORYCOWA & MARCOPOULOU-DIACANTONI (2002: 51, Figs. A–E) as *Pleurocora* aff. *alternans* MILNE EDWARDS & HAIME corresponds to the genus *Blastozopsammia* FILKORN & PANTOJA-ALOR, 2004. Therefore, it is excluded from the list of occurrences.

The systematic position of *Pleurocora reussi* MILNE EDWARDS, 1857, has been discussed for over a century. MILNE EDWARDS (1857: 602) based his new species on the material described as *Pleurocora haueri* in REUSS (1854: 112, pl. 6, figs. 26–27; see Text-Fig. 13), mentioning that it was a *Pleurocora* having very granulated septal flanks and a large, well-developed papillose columella. Subsequently, this species was transferred by some authors to the genus *Brachyphyllia* (e.g., BATALLER, 1937a) and to *Neocoeniopsis* by others (M. BEAUVAIS, 1982, vol. 2: 109). However, in lacking intracalicinal-marginal budding and occasionally having compact septa, this taxon differs from *Brachyphyllia*, whereas the presence of both subcompact septa and pali excludes this species from *Neocoeniopsis*. Because the species *reussi* shows all characteristics typical of *Pleurocora*, the original assignment by MILNE EDWARDS is kept.

Austroalpine occurrences. *Gosau Group*: Reported from all Turonian–Campanian localities of the Gosau Group.

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Upper Cretaceous of France, Upper Cenomanian of Germany, Uppermost Cenomanian of Egypt (Sinai), Senonian of Ukraine (Delyatin, Iwano-Frankowskaya), Upper Santonian–Lower Campanian of Romania, Campanian of northern Spain (Torallola), Campanian–Maastrichtian of Belgium (Obourg, Mons), Maastrichtian of The Netherlands (St. Pietersberg), Campanian–Maastrichtian of Antarctica (Seymour Island, Snow Hill Island).

Genus *Pseudofavia* OPPENHEIM, 1930a

(pro *Parastraea* FELIX, 1903a)
Pl. 63, Figs. 3–4; Pl. 64, Figs. 1–2

Type species. *Parastraea grandiflora* REUSS, 1854, Turonian–Campanian (possibly Santonian) of Austria (Gosau Group).

Diagnosis. Colonial, massive, plocoid to cerioid. Budding extracalicinal and intracalicinal-marginal. Corallites separated by a generally narrow vermiculate coenosteum. Costae often short or absent. Costosepta compact to subcompact, nonconfluent, granulated laterally. Anastomosis present. Columella trabecular. Synapticulae abundant, especially in the vicinity of the wall. Endothecal dissepiments vesicular, sparse. Wall synapticulothecal to parathecal, incomplete.

Synonym. *Cretastraea* KÜHN in KÜHN & ANDRUSOV, 1930 (Type species. *Parastraea grandiflora* REUSS, 1854, Santonian–Campanian of Slovakia).

Cretaceous species reported from the Alps. *P. grandiflora* (REUSS, 1854) (= *Isastrea latistallata* MILNE EDWARDS, 1857) (first report of this species for Nierental at Untersberg); *P.* sp. (first report of the genus for Ettendorf).

Remarks. When REUSS (1854) created the species *Parastraea grandiflora*, he made clear that he was referring to the genus *Parastraea* MILNE EDWARDS & HAIME, 1848a. FELIX (1903a: 181) was the first reviser who realized that the material by REUSS differed from the genus by MILNE EDWARDS & HAIME but he kept the genus name as *Parastraea* REUSS because, at that time, MILNE EDWARDS himself had grouped their *Parastraea* as a junior synonym with *Favia*. However, regardless of whether or not the senior *Parastraea* is an objective or subjective junior synonym of another genus, it remains an available genus name which has priority over any available subsequent taxon with the same name. In providing a discussion while clearly establishing a new genus, FELIX (1903a: 181) became the author of this new taxon that is *Parastraea* FELIX (with *Parastraea grandiflora* REUSS as its type species), which at the same time became the junior homonym of *Parastraea* MILNE EDWARDS & HAIME. Later, OPPENHEIM (1930a) used the holotype of the type species of *Parastraea* FELIX in order to create the replacement genus *Pseudofavia* OPPENHEIM, 1930a. At nearly the same time, KÜHN in KÜHN & ANDRUSOV (1930), created the genus *Cretastraea* based on the same specimen. Later, KÜHN himself (in KÜHN & ANDRUSOV, 1937) pointed out that OPPENHEIM'S genus was established several months earlier, thus acknowledging the priority of OPPENHEIM'S genus.

Austroalpine occurrences. *Gosau Group*: Upper Turonian–Santonian (Upper Austria: Gosau town); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Santonian (Salzburg: Rußbach, Zimmergraben; Upper Austria: Gosau, Obergeschröfpalfen); Upper Santonian (Upper Austria: Gosau, Brunstloch, Wegscheidgraben; Salzburg: Rußbach, Neffgraben); Lower Campanian (Carinthia: Ettendorf at St. Paul [Weinberger homestead]); Campanian–Maastrichtian (Salzburg: Untersberg, Nierental).

Cretaceous occurrences elsewhere. ?Upper Aptian of Spain, Turonian–Campanian of Georgia (in Caucasia), Senonian breccia (resediment) of Slovenia, ?Maastrichtian of Italy, Middle–Upper Maastrichtian of the UAE/Oman border region.

Genus *Podoseris* Duncan, 1869, emend. Baron-Szabo, 2013

Pl. 63, Figs. 1–2

Type species. *Podoseris mammiliformis* Duncan, 1869, Middle to Upper Albian of England (Hunstanton Cliff near Hunstanton, Norfolk).

Diagnosis. Solitary, forms cupolate, tympanoid to cylindrical with a corallite diameter to around 15 mm (in specimens corresponding to the species *mammiliformis*). Colonial forms arranged in reptoid (as in, e.g. *Rhizangia*) or subplocoid-subfasciculate, sometimes encrusting clumps (as in, e.g. *Brachyphyllia*), connected by a lamellar coenosteum that appears unstructured and dense, or ?vesicular. Solitary stage probably with a corallite height to 5 mm (in the specimens from the type locality), or, as a result of re-juvenation of the solitary stage, much higher (at least to 40 mm). Budding intracalicinal-marginal and extracalicinal. Costosepta generally compact with a small number of mainly axially occurring pores. Anastomosis present. Septal thickness ranges between 65 and around 600 µm. Septal flanks covered with granules varying in size and shape (e.g. rounded, pointed, flat, long and hook-like); laterally (conical to hook-like) and distally (rather regular teeth) ornamentations are similar to the kinds seen in the genus *Haplaraea*. Endothecal dissepiments vesicular, thin, irregularly disposed. Columella parietal. Synapticulae present. Wall parasynapticulothecal, porous.

Cretaceous species reported from the Alps. *P. elongata* Duncan, 1869 (first report of the species for a locality other than the type locality of the genus this paper).

Helvetic occurrences. Albian of Austria (Garschella Formation at Vorarlberg [Plattenwald beds]: Dornbirn at Staufensee [Power Plant Ebensand], Rhine River valley).

Cretaceous occurrences elsewhere. Middle–Upper Albian of England.

Genus *Summiktaraea* Alloiteau, 1952a

Pl. 64, Figs. 6–7

Type species. *Meandrastrea reticulata* d'Orbigny, 1850, Upper Turonian of France (Uchaux, Vaucluse) (see Alloiteau, 1952a).

Diagnosis. Colonial, meandroid. Budding intracalicinal-terminal, producing simple or forked calicinal series, separated by generally tectiform, occasionally tholiform collines. Collines long, occasionally short-hydnophoroid. Calicinal centers distinct, subdistinct, indistinct. Septa irregularly perforated, granulated laterally. Peripheral ends of septa irregularly bent upward. Columella parietal-subpapillose. Synapticulae abundant. Endothecal dissepiments sparse. Wall synapticulothecal, incomplete.

Affinities. Similar to *Meandrophyllia* but lacks costae and forms long calicinal series; similar to *Comoseris* but lacks pennulae and has a rather well-developed columella.

Cretaceous species reported from the Alps. *S. concentrica* (Reuss, 1854, non Morycowa, 1964); *S.* sp. (pro *Meandrarea oceani* [De Fromentel] in M. Beauvais, 1982).

Remarks. Alloiteau (1952a: 658) created the genus *Summiktaraea*, Later, he changed the spelling of this genus to *Summigaraea* (Alloiteau, 1957), thus producing a *nomen vanum*.

Austroalpine occurrences. *Gosau Group*: Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Abtenau, Rigausbach, Rußbach, Schattauergraben, Neffgraben).

Cretaceous occurrences elsewhere. Cenomanian of India, Lower Coniacian and Upper Santonian of France, Coniacian–Maastrichtian of Georgia (in Caucasus).

Subfamily Meandrophylliinae Roniewicz, 1976

Diagnosis. Polyps small. Budding intracalicinal. Costosepta confluent, except the collines. Columella trabecular, simple or papillose, feebly developed. Dissepiments tabulate. Trabeculae thin.

Remarks. Roniewicz (1976) did not give any specific information as to the size of polyps she referred to as 'small', but the dimensions of the corallites of the nominatform of the subfamily (*Meandrophyllia*) range from 2–4 mm in diameter.

Genus *Brachymeandra* Alloiteau, 1957

Pl. 64, Figs. 3–5; Pl. 65, Figs. 3–5

Type species. *Brachymeandra delphinensis* Alloiteau, 1957, Upper Turonian of France (Uchaux).

Diagnosis. Colonial, massive, thamnasterioid, plocoid to submeandroid superficially. Budding intracalicinal. Costosepta subcompact or porous, subconfluent or confluent. Marginally beaded, finely granulated laterally. Columella parietal-papillose. Paliform structures present. Synapticulae abundant. Endothecal dissepiments thin, subtabulate. Perithecal wall can be present. Generally no wall between the calices.

Synonyms. *Brachycoenia* M. Beauvais, 1982 (Type species. *Adelastraea leptophylla* Reuss, 1854, Upper Santonian of Austria); *Adelastraea* Reuss, 1854, *nomen vanum* (Type species. *Adelastraea leptophylla* Reuss, 1854, Upper Santonian of Austria).

Cretaceous species reported from the Alps. *B. leptophylla* (Reuss, 1854).

Remarks. Reuss (1854: 115) was of the opinion that, for linguistic reason, the genus *Confusastraea* d'Orbigny was invalid and, therefore, he created the genus *Adelastraea*. It should be noted that d'Orbigny himself (1849: 10) used the spelling of *Confusastrea*, while later authors like Milne

EDWARDS (1857) applied the different spelling of *Confusastraea*. However, in stating the following, REUSS made it undoubtedly clear that his genus *Adelstraea* was supposed to be the replacement-taxon for *Confusastrea* D'ORBIGNY, hence creating an unjustified emendation (*nomen vanum*):

> "Da der ursprüngliche Name *Confusastraea*, wie so viele andere D'ORBIGNY'sche Namen, z.B. *Latusastraea* etc., ganz sprachwidrig gebildet ist, so glaube ich denselben mit dem richtigeren Namen *Adelstraea* vertauschen zu müssen."

In addition to carrying out this unjustified emendation, REUSS also described the new species *Adelastraea leptophylla*. According to the ICZN (International Code of Zoological Nomenclature, 1999, www.iczn.org) [Article 33.2.3], "*an unjustified emendation represents a junior objective synonym of the name in the original spelling; it enters into homonymy …*". Consequently, the taxon *Adelastraea leptophylla* has to be treated as a species of *Confusastrea*, meaning *Confusastrea leptophylla*. Furthermore, investigations by M. BEAUVAIS (1982) revealed that REUSS' species differs from *Confusastrea* and represents a new genus. Therefore, he created the genus *Brachycoenia* using the type material of *Adelastraea leptophylla* REUSS, 1854. Later, BARON-SZABO (2002: 111; 2003a) grouped the genus *Brachycoenia* M. BEAUVAIS with the genus *Brachymeandra* ALLOITEAU (1957), providing the following reasons:

> "Based on the species *Adelastraea leptophylla* REUSS, 1854, M. BEAUVAIS (1982, vol. 2: 47) created the genus *Brachycoenia*, which differs only slightly from the genus *Brachymeandra* ALLOITEAU. BEAUVAIS mentioned the existence of paliform structures in *Brachymeandra* as the main difference between the two genera. However, later investigations of the type material of *Brachycoenia* (BARON-SZABO, 2002 and 2003a) revealed the occasional existence of paliform structures. Therefore, the separation of these taxa does not seem justified."

Recently, LÖSER (2013a) described material from the Upper Aptian of Greece which he assigned to *Adelastraea* cf. *leptophylla* REUSS. However, because in having pennulae and extracalicinal budding it differs from the species *leptophylla*. Therefore, it is excluded from the list of occurrences.

Austroalpine occurrences. *Gosau Group*: Turonian–?Coniacian (Salzburg: St. Gilgen, Kohlbachgraben, "Billroth"); Coniacian–Santonian (Upper Austria: Gosau, Hofergraben [= Sattelgraben]); Santonian (Upper Austria: Pass Gschütt, Grabenbach, Tiefengraben); Upper Santonian (Styria: Aussee, Weissenbachalm; Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben).

Cretaceous occurrences elsewhere. Turonian–Campanian of ?Georgia (in Caucasus), Upper Campanian of Bulgaria, Upper Campanian–Maastrichtian of the UEA/Oman border region.

Genus *Vallimeandra* ALLOITEAU, 1957

Text-Fig. 14

Type species. *Oroseris explanata* DE FROMENTEL, 1857, Lower Hauterivian of France (Yonne).

Diagnosis. Colonial, massive, meandroid. Budding intracalicinal-terminal, forming calicinal series separated by tectiform and tholiform collines. Calices distinct. Septa compact to subcompact, finely granulated laterally. Synapticulae numerous. Columella spongy-parietal. No wall between calicinal series. Endothecal dissepiments thin.

Cretaceous species reported from the Alps. *V. bayeri* BARON-SZABO, 2001; ?*V. douvillei* (FELIX, 1903a); *V.* sp. in MORYCOWA & DECROUEZ (2006).

Helvetic occurrences. Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil).

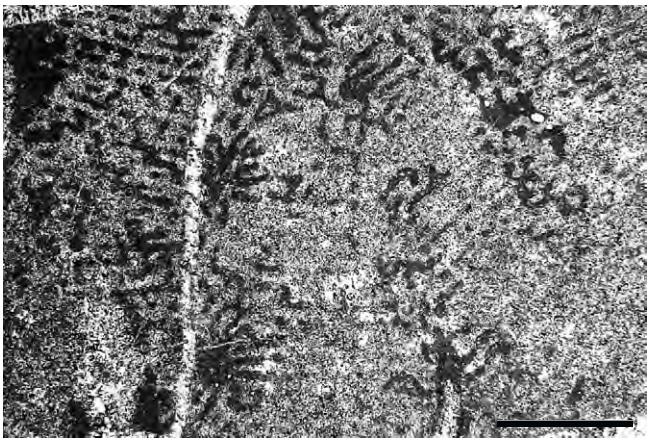
Austroalpine occurrences. *Gosau Group*: Lower Coniacian (Salzburg: Strobl, Sankt Wolfgang, "Theresienstein"); ?Santonian (Salzburg: Rußbach, Zimmergraben); ?Upper Santonian (Upper Austria: Gosau, Brunstloch; Salzburg: Rußbach, Neffgraben, Schattauergraben).

Cretaceous occurrences elsewhere. Upper Aptian of Italy, Cenomanian and Campanian of Spain, Turonian (–?Coniacian) of Caucasus, Lower Coniacian and Upper Santonian of France, Coniacian–Maastrichtian of Hungary.

Family Thamnasteriidae VAUGHAN & WELLS, 1943

(= Corbariastraeidae M. BEAUVAIS, 1982)

Diagnosis. Forming massive or ramose thamnasterioid colonies by intratentacular mono- to polystomodaeal budding. Common wall epithecate. Corallite walls absent, calicular boundaries sometimes marked by synapticular rings. Septa forming groups, confluent between centers, composed of one fan system of simple trabeculae in which the sclerodermites diverge laterally producing granulations



Text-Fig. 14.
Vallimeandra bayeri BARON–SZABO, 2001, holotype, cross view of colony, peel, NMNH sample TH–4M (BARON–SZABO coll.), Upper Turonian–Coniacian of Aus–tria (Theresienstein reef); scale bar: 1.5 mm.

or continuous ridges, occasionally porous, upper margins beaded. Columella styliform, small, or absent. Endotheca and exotheca vesicular to tabulate.

Remarks. Since the first description by ALLOITEAU (1952a: 676), the systematic position of the nominatform of the family Corbariastraeidae (*Corbariastraea*) has been the subject of discussion. ALLOITEAU placed it with the Agathiphylliidae. Later, M. BEAUVAIS (1982, vol. 2: 18) transferred it to his new family Corbariastraeidae. On the basis of 1) the intracalicinal budding mode, 2) the thamnasterioid integration of the corallites, 3) the absence of a corallite wall, and 4) the compact character of the septa, which become subcompact towards the corallite center, BARON-SZABO (2002: 115) transferred the genus *Corbariastraea* to the family Thamnasteriidae. Consequently, the family Corbariastraeidae is regarded as a junior synonym of the Thamnasteriidae.

Genus *Corbariastraea* ALLOITEAU, 1952a

Pl. 65, Figs. 1–2

Type species. *Corbariastraea rennensis* ALLOITEAU, 1952a, Upper Santonian of France (Aude) (see ALLOITEAU, 1952a).

Diagnosis. Colonial, thamnasterioid. Budding intracalicinal. Septa compact becoming subcompact by few perforations at the axial ends. Distal margin strongly ornamented. Septal flanks have granulae subperpendicular to the distal margin. Columella trabecular, forming a few papillae or lamellar segment, or absent. Synapticulae abundant. Endothecal dissepiments thick, sparse. No wall between the corallites. Microstructure granulo-lamellar.

Synonyms. *Delphinastraea* ALLOITEAU, 1952a (Type species. *D. jauberti* ALLOITEAU, 1952a, Upper Turonian of France [Uchaux]); *Saltastraea* ALLOITEAU, 1957 (Type species. *Thamnasteria saltensis* DE FROMENTEL, 1862, Lower Aptian of France [Sault, Vaucluse]).

Cretaceous species reported from the Alps. *C. exaltata* (REUSS, 1854); *C. junctiseptata* (OPPENHEIM, 1930a); *C. weissenbachalmensis* BARON-SZABO, 1999.

Remarks. According to ALLOITEAU (1957: 215–216), his newly created genus *Saltastraea* was characterized by structures that were comparable to the ones in *Clausastrea* D'ORBIGNY, *Complexastrea* D'ORBIGNY, and *Palaeastraea* KÜHN. However, the documentation of the type material regarding e.g. the type of septal granulation; thamnasterioid polyp integration; no wall between corallites; presence of synapticulae; thick dissepiments, suggest a close resemblance to forms of the family Thamnasteriidae, with close affinities to the genus *Corbariastraea* ALLOITEAU. Therefore, their synonymy is suggested.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Tyrol: Brandenberg, Sonnwendjoch); Coniacian (Tyrol: Ludoi Alp [= Pletzach Alp]); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Hohe Traunwand; Upper Austria: Gosau, Hofergraben [= Sattelgraben]); Upper Santonian (Upper Austria: Gosau, Schrickpalfen, Brunstloch, Gschröfpalfen; Salzburg: Rußbach, Neffgraben, Traunwandalm; Styria: Aussee, Weissenbachalm); Upper Santonian–Lower Campanian (Lower Austria: Baden, Einöd quarry).

Cretaceous occurrences elsewhere. Coniacian of western Serbia, Santonian–Campanian of Spain, Lower Campanian of Bulgaria.

Family Agariciidae GRAY, 1847

(= Lamellofungiidae ALLOITEAU, 1957)

Diagnosis. Solitary and colonial; hermatypic. Colony formation mainly by intratentacular budding. Wall absent or synapticulothecal, and usually becoming solid. Septa formed by one fan system of simple trabeculae, rarely porous, margins beaded, directly confluent between centers, united by some compound synapticulae. Endothecal dissepiments mostly absent. Columella trabecular or absent.

Genus *Lamellofungia* ALLOITEAU, 1957

Pl. 66, Figs. 1–6

Type species. *Lamellofungia rennensis* ALLOITEAU, 1957, Santonian of France (Aude).

Diagnosis. Colonial, massive, thamnasterioid. Budding intracalicinal. Costosepta radially or bilaterally arranged, compact with dissociated axial ends, confluent, subconfluent and nonconfluent. Septa have granules varying in size and shape, mainly including spiniform denticles, occasional carinae, and rounded granules. Coarsely granulated marginally. Columella absent or formed by irregular trabecular portions or lamellar segments. Synapticulae present, rare. Trabeculae thick. Endothecal dissepiments sparse. Wall synapticulothecal and parathecal, porous.

Synonym. *Hydnophorastraea* M. BEAUVAIS, 1982 (Type species. *Thamnastraea carinata* FELIX, 1903a, Upper Santonian of Austria [Gosau Group at Neffgraben]).

Affinities. Similar to *Cyathoseris*, but with confluent to nonconfluent septa, porous synapticulotheca and paratheca.

Cretaceous species reported from the Alps. *L. carinata* (FELIX, 1903a); *L.* cf. *carinata* FELIX, 1903 (pro *Protoseris* cf. *cretacea* FELIX, 1903a); *L.* sp. (first report of the genus for the Gosau Group at Brandenberg, Haidach, Strobl-Bad Ischl area at Fahrenberg, and ?Ettendorf).

Remarks. BEAUVAIS (1982, vol. 2: 135) placed his newly created genus *Hydnophorastraea* in the family Synastreidae. However, re-investigation of the type material by the author of the current work in 2013 revealed that it showed agariciid skeletal structures (see Pl. 66, Figs. 2–3, 5–6), corresponding to the kinds seen in *Cyathoseris* and closely resembling the ones in *Lamellofungia* ALLOITEAU, 1957.

Austroalpine occurrences. *Gosau Group*: Lower Coniacian (Tyrol: Brandenberg, Haidach); Coniacian (Salzburg: Strobl-Bad Ischl area, Fahrenberg [Schmalnau Formation]); Coniacian–Lower Santonian (Upper Austria: Gosau,

Edelbachgraben); Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben, Traunwandalm; Upper Austria: Gosau, Schrickpalfen, Brunstloch, Wegscheidgraben, Abtenau, Rigausbach); Lower Campanian (Carinthia: ?Ettendorf at St. Paul [Weinberger homestead]).

Cretaceous occurrences elsewhere. Coniacian–Maastrichtian of Hungary, Upper Santonian of France.

Genus *Trochoseris* Milne Edwards & Haime, 1849a

Text-Fig. 15

Type species. *Anthophyllum distortum* Michelin, 1844, Eocene of France (Auvert) (see Milne Edwards & Haime, 1849a).

Diagnosis. Solitary, turbinate or trochoid, fixed. Septa are subcompact to porous, beaded marginally. Columella papillose. Synapticulae abundant. Endothecal dissepiments thin, sparse or absent. Wall synapticulothecal.

Cretaceous species reported from the Alps. *T. lobata* Reuss, 1854.

Austroalpine occurrences. *Gosau Group*: Upper Turonian–Campanian (Upper Austria: Gosau basin).

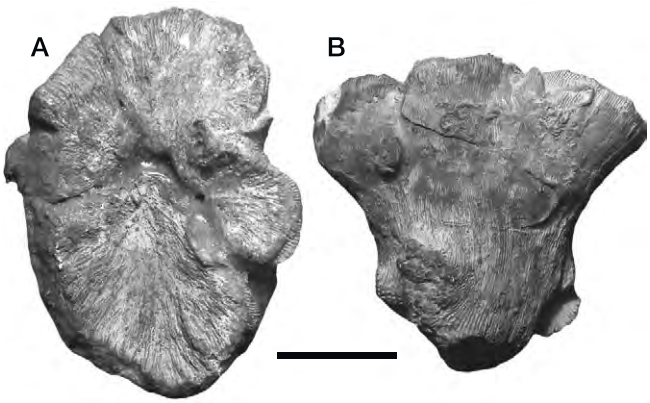
Cretaceous occurrences elsewhere. Campanian of northwestern Serbia, Campanian of Bulgaria.

Genus *Heterogyra* Reuss, 1868

Pl. 67, Figs. 1–3

Type species. *Heterogyra lobata* Reuss, 1868, Oligocene of Italy.

Diagnosis. Colonial, massive to flabelloid-subfasciculate, submeandroid-thamnasterioid. Budding intracalicinal (polystomodaeal budding with terminal forking). Calicinal series free laterally near summits or separated by tectiform to tholiform collines, discontinuous. Ambulacra present in places. Lamellar linkages between corallite centers absent or present. Costosepta compact, subconfluent to confluent, laterally finely granulated. Columella parietal-papillose, often weakly developed or reduced. Synapticulae abundant. Endothecal dissepiments thin, subtabulate to vesicular. Wall synapticulothecal.



Text-Fig. 15.
Trochoseris lobata Reuss, 1854; holotype, NHMW 1864/0040 (#63), Turonian–Campanian ("Gosau Group", exact locality not indicated by original author), Austria; A: upper surface, horizontal view; scale bar: 30 mm; B: upper surface, longitudinal view; scale bar: 40 mm.

Synonym. *Felixastraea* Oppenheim, 1930a (Type species. *Cyathoseris zitteli* Felix, 1903a, Upper Santonian of Austria [Gosau Group at Neffgraben]).

Cretaceous species reported from the Alps. ?*H. brachygyra* (Reuss, 1854); ?*H. haidingeri* (Reuss, 1854); ?*H. reussi* (Milne Edwards, 1857); *H. zitteli* (Felix, 1903a).

Remarks. Traditionally, the genus *Felixastraea* Oppenheim, 1930a (based on the species *Cyathoseris zitteli* Felix, 1903a, of the Upper Santonian of Austria) was placed in the suborder Fungiina because it was thought to have acrosmiliid (-leptophylliid) septa. While the majority of Felix' material which is stored at the Geological Survey of Austria, Vienna and the Natural History Museum, Vienna, seems to correspond to the acrosmiliid type, the type specimen of *Cyathoseris zitteli* Felix, 1903a, which is stored at the Bayerischen Staatssammlung Munich, shows different skeletal structures. Re-examination of the type material revealed that the septa are compact, and laterally beaded, and all other skeletal elements agree with the agariciid form *Heterogyra*.

Austroalpine occurrences. *Gosau Group*: Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben).

Cretaceous occurrences elsewhere. Turonian–Campanian of Georgia (in Caucasus), Upper Santonian of France, Campanian of ?Spain.

Genus *Ogilviastraea* Oppenheim, 1930a

Pl. 67, Figs. 4–9; Pl. 68, Figs. 1–4

Type species. *Placohelia bigemmis* Felix, 1903a, Santonian of Austria (Gosau Group at Zimmergraben).

Diagnosis. Colonial, dendroid. Budding extracalicinal and intracalicinal (bigemmation). Calices are subcircular or elliptical. Perithecal dissepiments abundant, vesicular. Costosepta compact, arranged radially or bilaterally, finely granulated laterally. Synapticulae present. Columella trabecular, thin and lamellar or variably spongy-papillose. Endothecal dissepiments vesicular. Wall synapticulothecal-septothecal, forming a stereozone.

Cretaceous species reported from the Alps and Dinarides. *O. bigemmis* (Felix, 1903a) (= *Synhelia gibbosa* in Reuss, 1854) (first report of the species for Veitlbruch at Untersberg); *O. crassa* (Reuss, 1854); *O. ornata* (Felix, 1903a).

Remarks. M. Beauvais (1982, vol. 1: 40–41) grouped the species *O. crassa* (Reuss, 1854) with the genus *Rhabdophyllia* Milne Edwards & Haime, 1851a. While there are similarities regarding their septal and axial developments, the Austrian material is distinguished from *Rhabdophyllia* in e.g., having extracalicinal budding and synapticulae; a well-developed endotheca; and a granular stereome. In *Rhabdophyllia*, endo-

thecal dissepiments seem to be rather sparse and synapticulae are absent; the budding type is intracalicinal; and a stereome is absent.

Austroalpine occurrences. *Gosau Group*: Upper Turonian–Coniacian (Styria: Aussee, Weissenbachalm); Upper Turonian–Santonian (Upper Austria: Gosau town); Upper Turonian–Campanian (Upper Austria: Gosau basin); Lower Coniacian (Salzburg: Strobl, Sankt Wolfgang, "Theresienstein"); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Upper Austria: Gosau, Hofergraben [= Sattelgraben]); ?Coniacian–Santonian (Salzburg: Untersberg, Veitlbruch [= Untersberg Marble]; Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Salzburg: Rußbach, Neffgraben, Abtenau, Rigausbach; Upper Austria: Gosau, Brunstloch, Wegscheidgraben; Lower Austria: Neue Welt, Piesting, Scharrergraben).

Cretaceous occurrences elsewhere. Campanian of northern Spain, Campanian–Maastrichtian of ?India, Lower Maastrichtian of ?Kazakhstan, Maastrichtian of Jamaica and ?Senegal.

Genus *Maeandrella* Oppenheim, 1930a

Pl. 68, Figs. 5–6; Pl. 69, Fig. 1

Type species. *Meandrina michelini* Reuss, 1854, Upper Turonian–Campanian (Upper Austria: Gosau basin).

Diagnosis. Colonial, meandroid. Budding intracalicinal. Calicinal series separated by tectiform collines. Ambulacra present. Costosepta compact, nonconfluent, finely granulated laterally. Columella lamellar, discontinuous. Synapticulae numerous. Endothecal dissepiments vesicular. Wall synapticulothecal-septothecal.

Synonyms. *Maeandrofungia* M. Beauvais, 1982 (Type species. *Meandrina michelini* Reuss, 1854, Coniacian–Lower Santonian of Austria [Gosau Group at Edelbachgraben]); *Astrogyropsis* Reig Oriol, 1995 (Type species. *A. wellsi* Reig Oriol, 1995, Campanian of Spain [Torallola]).

Cretaceous species reported from the Alps. *M. michelini* (Reuss, 1854).

Remarks. Oppenheim, 1930a, created the genus *Maeandrella* for the species *Meandrina michelini* Reuss, 1854. Later, M. Beauvais (1982) chose the same species as the type species of his new genus *Maeandrofungia*. Therefore, the latter represents an objective junior synonym of the genus *Maeandrella* Oppenheim, 1930a.

In 1956, Wells stated that *Maeandrella* Oppenheim, 1930a, represented a junior homonym. Later, he revised this statement and accepted Oppenheim's genus (Wells, 1986).

Reig Oriol (1995: 18, pl. 3, fig. 6, pl. 4, figs. 3–4) described the genus *Astrogyropsis* which he grouped with the family Placosmiliidae. However, in the original documentation, the type material shows both compact costosepta that are finely granulated laterally and synapticulae in the walls of the calinical series (not mentioned by Reig Oriol), both characters of which are atypical for the Placosmiliidae but correspond to the Agariciidae. Together with features like corallites that are arranged in meandroid series and separated by both tectiform collines and ambulacra; non-confluent costosepta; septothecal developments; and columellar structures that are lamellar, the genus *Astrogyropsis* closely corresponds to *Maeandrella*.

Austroalpine occurrences. *Gosau Group*: Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Santonian (Salzburg: Rußbach, Zimmergraben).

Cretaceous occurrences elsewhere. Santonian–Campanian of ?Spain.

Family Diploastreidae Chevalier & Beauvais, 1987

Diagnosis. Colonial. Budding extracalicinal. Corallite wall synapticulothecal. Costosepta laminar, formed by one fan system of compound trabeculae. Septal teeth triangular and large, with extensive thickening deposits. Scattered spinose granulations. Trabeculae consist of discrete clusters of fibers. Pali or paliform lobes absent or much reduced. Columella trabecular, spongy. Well-developed tabular endotheca.

Genus *Diploastrea* Matthai, 1914

Pl. 69, Figs. 2–5

Type species. *Astrea heliopora* Lamarck, 1816, Recent, from the waters off Australia.

Diagnosis. Colonial, massive, plocoid to cerioid. Budding extracalicinal. Costosepta subcompact to perforated, non-confluent, laterally granulated. Septa thick peripherally, thin internally, composed of compound trabeculae. Marginal dentations coarse. Paliform lobes much reduced, usually absent. Columella papillose. Wall synapticulothecal to septothecal.

Cretaceous species reported from the Alps. *D. crassa* Kuzmicheva, 1980 (referring to material presented as species of *Isastrea* in Scholz [1984] and Baron-Szabo [1997], as well as *Neocoeniopsis* in Baron-Szabo [1997]); *D. harrisi* Wells, 1932; *D.* sp. (first report of the genus for Ettendorf).

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Falkenberg, Windecksattel, Upper Gottesackerwände).

Austroalpine occurrences. *Gosau Group*: Lower Coniacian (Tyrol: Brandenberg, Haidach); Lower Campanian (Carinthia: Ettendorf at St. Paul [Weinberger homestead]).

Remarks. Re-investigation of the specimens assigned to various species of *Isastrea* from the "Allgäu Schrattenkalk" (Scholz, 1984; Baron-Szabo, 1997: 70, pl. 7, figs. 2, 4) by the author of the current work revealed that due to their problematic preservation, thecal and septal structures were misidentified in that skeletal elements were confounded with the filling matrix. The material most likely belongs to the genus *Diploastrea*, corresponding to *D. crassa* Kuzmicheva, 1980.

Re-investigation of the specimens assigned to *Neocoeniopsis corollaris* from the Allgäu Schrattenkalk (Baron-Szabo,

1997: 78, pl. 10, fig. 2) by the author of the current work revealed that it shows affinities to the genus *Diploastrea*, corresponding to *D. crassa* KUZMICHEVA, 1980. The previous assignment to the species *corollaris* was based on the study of material belonging to the FELIX collection which, however, differs from the genus *Neocoeniopsis*.

Cretaceous occurrences elsewhere. Barremian of Azerbaijan, Upper Barremian–Lower Aptian of Ukraine (Lushanka River basin), Lower Aptian of Greece, Aptian–Lower Albian of Spain, Aptian–Albian of Mexico, Aptian–Albian of Iran, Lower Albian of Texas, Turonian–Campanian of Georgia (in Caucasus), Santonian of Spain.

Family Poritidae GRAY, 1840

Diagnosis. Colonial; colony formation by extratentacular budding. Corallites (except *Napopora* and *Synaraea*) closely united without coenenchyme, bounded by one or more synapticular rings. Septa (except *Alveopora*) composed of 3 to 8 nearly vertical trabeculae, loosely united, with more or less regular pores. Innermost trabeculae of certain septa differentiated as pali. Septa ento- and ectocoelic. One columellar trabecula usually present.

Remarks. While the year 1842 (referring to GRAY in AGASSIZ, 1842–1847) has generally been used for the publication date of the family name Poritidae, it, however, had been already used two years earlier (GRAY, 1840). Furthermore, in the report by AGASSIZ (1842–1847), which was published as a combined work consisting of twelve fascicles, the term Poritidae GRAY first appeared on page 21 in the fascicle VIII corresponding to the year 1845 (not 1842).

Genus *Goniopora* BLAINVILLE, 1830

Pl. 70, Figs. 1–4

Type species. *Goniopora pedunculata* QUOY & GAIMARD in BLAINVILLE, 1830, Recent, New Guinea.

Diagnosis. Colonial, massive, columniform or ramose, rarely incrusting. Budding extracalicinal and extracalicinal-marginal. Corallites united closely or separated by a reticulate coenosteum. Septa subcompact to porous, arranged bilaterally. Pali present. Columella spongy or made of twisted segments. Synapticulae present. Endothecal dissepiments thin, few in number. Wall parathecal or synapticulothecal, incomplete.

Synonyms. *Litharaea* MILNE EDWARDS & HAIME, 1849b (Type species. *Astrea websteri* BOWERBANK, 1840, Eocene of England).

Subgenus. *Rothastrea* ELIÁŠOVÁ, 1989 (Type species. *Isastrea bieskidensis* TRAUTH, 1911, Upper Cenomanian–Lower Santonian of the Czech Republic); Like *Goniopora* but septa subcompact to compact.

Cretaceous species reported from the Alps and Dinarides. *G. elegans* (LEYMERIE, 1846); *G.* (*R.*) *tenuiseptata* (OPPENHEIM, 1930a); *G.* (*R.*). *vaughani* (FELIX, 1903a).

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Salzburg: St. Gilgen); Lower Coniacian (Salzburg: Strobl, Sankt Wolfgang, "Theresienstein"); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Salzburg: Rußbach, Neffgraben).

Cretaceous occurrences elsewhere. Upper Campanian–Maastrichtian of the UAE/Oman border region.

Family Pachyphylliidae M. BEAUVAIS, 1982

Diagnosis. Solitary and colonial. Costosepta compact, irregularly spinose laterally, margins beaded. Columella trabecular. Synapticulae and endothecal dissepiments sparse. Wall partly synapticulothecal.

Remarks. M. BEAUVAIS (1982, vol. 2: 101) created this family for taxa which combine characteristics of both the Thamnasteriidae VAUGHAN & WELLS, 1943, (upper septal margins beaded, sparsely occurring endothecal dissepiments and synapticulae) and the Agariciidae GRAY, 1847 (compact costosepta, margins beaded, partly developed synapticulothecal wall).

Genus *Neocoeniopsis* ALLOITEAU, 1957

Pl. 70, Figs, 5, 7–8

Type species. *Phyllocoenia excelsa* DE FROMENTEL, 1884, Santonian of France (Le Beausset, Var).

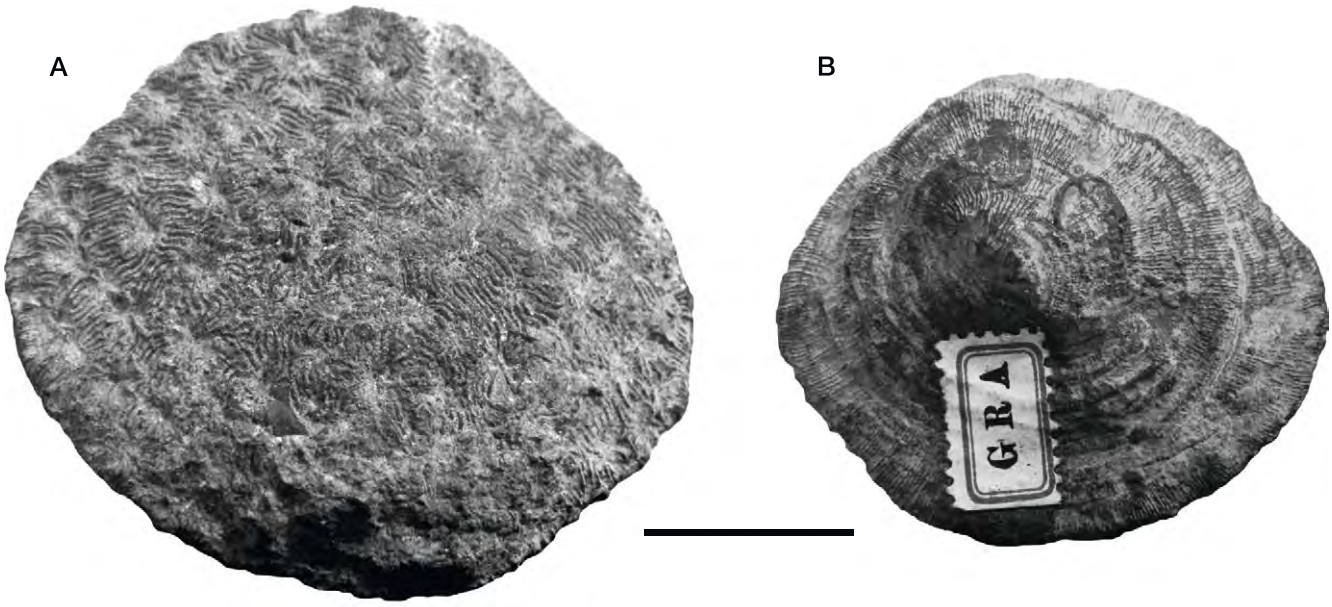
Diagnosis. Colonial, massive, plocoid. Budding extracalicinal and ?intracalicinal. Corallites circular, united by costae. Costosepta compact, nonconfluent, radially arranged, granulated laterally. Pali absent. Columella spongy-papillose or irregularly trabecular. Synapticulae and endothecal dissepiments sparse. Wall parasynapticulothecal, septothecal in places.

Synonym. *Phyllocoeniina* VIDAL, 1980 (Type species. *Heliastraea simonyi* [REUSS sp.] in BATALLER, 1937, Maastrichtian of northern Spain).

Cretaceous species reported from the Alps. *N. defromenteli* M. BEAUVAIS, 1982; *N. excelsa* (DE FROMENTEL, 1884); *N. salisburgensis* M. BEAUVAIS, 1982; *N.* sp. (first report of the genus for Ettendorf).

Austroalpine occurrences. *Gosau Group:* Upper Turonian (Styria: Gams-Hieflau); Coniacian (Tyrol: Ludoi Alp [= Pletzach Alp]); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt; Upper Austria: Gosau, Hofergraben [= Sattelgraben]); Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Salzburg: Rußbach, Neffgraben); Upper Santonian–Campanian (Styria: Weissenbachalm); Lower Campanian (Carinthia: Ettendorf at St. Paul [Weinberger homestead]); "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Cretaceous occurrences elsewhere. Santonian and Maastrichtian of northern Spain, Santonian of France, Campanian–Lower Maastrichtian of Bulgaria.



Text-Fig. 16.
Astraeofungia minor (FELIX, 1903a), paralectotype; GBA 1903/004/0032, Upper Santonian (Neffgraben), Austria; A: upper surface of colony; scale bar: 18 mm; B: base of colony; scale bar: 21 mm.

Family Siderastreidae VAUGHAN & WELLS, 1943

Diagnosis. Colonial, rarely solitary. Corallum shape encrusting, folios, and massive. Colony formation by intra- and extratentacular budding. Wall septothecal or synapticulothecal made of one or more synapticular rings, compact or perforated. Coenosteum present or absent. Septa composed of one fan system of small, simple or compound trabeculae. Septa strongly granulated laterally, compact or porous, margins beaded or dentate, laterally united by simple synapticulae. Axial ends of septa fuse, forming fan-like groups which resemble the septal arrangement of the Pourtalés plan. Costae absent or present. No pali. Columella variably trabecular or absent. Collines present or absent. Endothecal dissepiments present.

Genus *Astraeofungia* ALLOITEAU, 1952a

Pl. 70, Fig. 6; Pl. 71, Figs. 1–3; Text-Fig. 16

Type species. *Astrea decipiens* MICHELIN, 1841, Cenomanian of France (Le Mans, Sarthe) (see ALLOITEAU, 1952a).

Diagnosis. Colonial, massive, thamnasterioid. Budding extracalicinal. Septa compact with occasionally perforated axial ends, laterally granulate and carinate. Columella well-developed, spongy-papillose. Synapticulae present. Endothecal dissepiments thin, subtabulate. No wall.

Cretaceous species reported from the Alps and Dinarides. *A. gracilis* M. BEAUVAIS, 1982; *A. oppenheimi* M. BEAUVAIS, 1982 (pro *Synastrea pseudoleptophylla* OPPENHEIM, 1930a, p.p; = *Thamnastraea decipiens* [MICHELIN] in FELIX, 1903a); *A. raristella* (REUSS, 1854); *A. minor* (FELIX, 1903a) (pro *Dimorphastrea sulcosa minor* FELIX, 1903a; = *Astraeofungia felixi* M. BEAUVAIS, 1982).

Remarks. Recently, LÖSER (2012b) described material from the Campanian of Turkey which he assigned to the taxon *Astraeofungia siva* (STOLICZKA, 1873) and included the specimens *Isastrea neocomiensis* from the Lower Aptian of the Helvetic "Schrattenkalk" and the taxon *Thamnarea cladophora* from the Lower Coniacian of the Brandenberg Gosau at Haidach, both of which were reported by BARON-SZABO (1997). However, the Turkish material presented as belonging to *Astraeofungia* (LÖSER, 2012b: 28, figs. 2.11–12) differs from the genus in a frequently developed synapticulothecal (incomplete) wall (not mentioned by LÖSER); presence of costae; and ?intracalicinal budding (not mentioned by LÖSER). In *Astraeofungia*, costae and corallite walls are absent and the budding type is extracalicinal. Moreover, as explained above under the genus *Diploastrea*, the form previously assigned to *Isastrea neocomiensis* closely corresponds to *Diploastrea* as it shows a cerioid polyp integration; non-confluent (to subconfluent) septa; and costae (see Pl. 69, Fig. 3). Furthermore, the material described as *Thamnarea cladophora* (BARON-SZABO, 1997: 80, pl. 13, fig. 1) is characterized by a cerioid-subplocoid form that has polyps which are embedded in a porous-vermiculate coenosteum (see Pl. 60, Fig. 4), thus clearly differing from the genus *Astraeofungia*. Also see Remarks under *Diploastrea* and *Astraraea*.

FELIX (1903a) created the taxon *Dimorphastrea sulcosa minor* based on two specimens. According to M. BEAUVAIS (1982, vol. 2: 69), FELIX' material belonged to the genus *Astraeofungia*. In referring to the specimen that had been figured in FELIX (1903a: 212, pl. 19, figs. 10, 10a) as the holotype, he used FELIX' specimen to describe the new taxon *Astraeofungia felixi*. However, because FELIX' taxon has to be considered a subspecies [ICZN 45.6.4, e-version of January 1st, 2012: *a name is considered subspecific if first published before 1961 and its author expressly used one of the terms of "variety" or "form"*], the creation of the new name by M. BEAUVAIS is invalid. Furthermore, as a consequence of BEAUVAIS' action in creating a new species, he raised FELIX' taxon to the species level. Therefore, the valid name

for this taxon is *Astraeofungia minor* (FELIX, 1903a). In addition, in referring to one of the syntypes as the holotype, M. BEAUVAIS created a lectotype by inference which makes the other syntype the paralectotype [ICZN 74.61, e-version of January 1st, 2012].

Austroalpine occurrences. *Gosau Group*: Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Santonian (Salzburg: Rußbach, Randograben, Zimmergraben); Upper Santonian (Salzburg: Rußbach, Neffgraben; Lower Austria: Neue Welt, Piesting, Scharrergraben; Upper Austria: Gosau, Schrickpalfen).

Cretaceous occurrences elsewhere. Upper Cretaceous of France and Greece.

Genus *Pironastrea* D'ACHIARDI, 1875

Pl. 72, Figs. 1–8

Type species. *Pironastrea discoides* D'ACHIARDI, 1875, Eocene of Italy.

Diagnosis. Colonial, corallum massive, subramose, to lamellar, subthamnasterioid to submeandroid. Budding initially intracalicinal-circumoral. Corallites arranged in concentric rings or meandroid series, that are separated by tholiform collines (more common in lamellar and subramose colonies) or tectiform collines (more common in massive colonies). Corallites distinct to subdistinct. Septa confluent, compact to subcompact. Columella trabecular, spongy-papillose. Synapticulae disposed over the colony. Endothecal dissepiments vesicular. Wall synapticulothecal, incomplete; generally no wall between corallites of the same series.

Synonym. *Koilomorpha* ALLOITEAU, 1952a (Type species. *Meandrina arausiaca* MICHELIN, 1841, Upper Turonian of France (Uchaux) (see ALLOITEAU, 1952a).

Subgenus. *Siderocoenia* M. BEAUVAIS, 1982 (Type species. *Thamnarea lithodes* FELIX, 1903a, Upper Santonian of Austria [Gosau Group at Brunstloch]): Like *Pironastrea* but also has extracalicinal budding and occasional septothecal thickenings.

Cretaceous species reported from the Alps. *P. cyathosericites* (OPPENHEIM, 1930a); *P. edelbachensis* (M. BEAUVAIS, 1982); *P. (S.) lithodes* (FELIX, 1903a); *P. media* (DE FROMENTEL, 1873); *P. salisburgensis* (M. BEAUVAIS, 1982); *P. tenuisepta* (REUSS, 1854) (= *Meandrina arausiaca* MICHELIN, 1841).

Remarks. BEAUVAIS (1982, vol. 2: 219–220), created the siderastreid genus *Siderocoenia*. According to him, it is characterized by subthamnasterioid polyp integration; intracalicinal budding; subcompact and subconfluent to confluent costo-septa; abundant synapticulae; thin dissepiments; weakly developed parietal columella synpaticulo-septothecal wall which occurs deeper in the corallum; and septa that consist of simple and compound trabeculae. In addition to these features, however, the holotype of the type species (*Thamnarea lithodes* FELIX, 1903a) shows both corallites that are also arranged in short meandroid series which generally form tholiform collines and corallites that were formed by extracalicinal budding. Considering all these features, *Siderocoenia* closely corresponds to the genus *Pironastrea* D'ACHIARDI, 1875, but differs from the latter by also showing extracalicinal budding and occasional septothecal thickenings. Therefore, the genus *Siderocoenia* is placed as a subgenus of *Pironastrea* D'ACHIARDI.

Originally, the genus *Koilomorpha* ALLOITEAU, 1952, was placed in the Thamnasteriidae. Later, WELLS (1956: 381) provisionally grouped it as a junior synonym with *Microphyllia*, the latter of which many authors have placed in the Latomeandridae. However, because the type material of the type species is characterized by e.g., perforated septa, that are strongly beaded and dentated, as well as numerous synapticulae that form a synapticulothecal wall, the genus *Koilomorpha* rather belongs to the Siderastreidae and closely corresponds to the genus *Pironastrea* D'ACHIARDI (BARON-SZABO, 2008: 12, 159; also see Pl. 72, Fig. 5 for images of one of the syntypes of the type species of *Pironastrea*). For further information on the type material of the type species of *Pironastrea* see BARON-SZABO (2008: 160, pl. 14, fig. 6).

Austroalpine occurrences. *Gosau Group:* Middle Turonian–Lower Coniacian (Tyrol: Brandenberg, Mühlbach); Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang); Upper Turonian–Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Santonian (Salzburg: Rußbach, Stöcklwaldgraben, Zimmergraben; Salzburg-Bavaria region: „Krönner Reef" area); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben, Schattauergraben; Upper Austria: Gosau, Schrickpalfen, Wegscheidgraben, Finstergraben); Upper Santonian (Salzburg: Abtenau, Rigausbach).

Cretaceous occurrences elsewhere. Upper Cretaceous of Germany, Coniacian–Santonian of France, Campanian of Bulgaria and Spain, Maastrichtian of Italy.

Suborder Microsolenina MORYCOWA & RONIEWICZ, 1995a

Diagnosis. Radial elements costoseptal or biseptal in type, densely arranged, formed by compound trabeculae and structurally fenestrate. Trabeculae with longitudinal striation. Septal faces ornamented with pennulae which can fuse into menianae, or dissociate into lateral axes. Pennular edges ornamented. Synapticulae trabecular in origin, rod-like. Columella parietal or monotrabecular, if developed. Dissepiments vesicular, isometric or flat and wide, depending on family.

Family Microsolenidae KOBY, 1889

Diagnosis. Simple and colonial. Colony formation by intra- and extratentacular budding. Corallite walls absent or slightly delineated by synapticular rings. Epitheca complete but very thin. Septa thin, regularly fenestrate. Syn-

apticulae abundant, regularly distributed. Pennular edges directed upwards, ornamented with rounded, equal dentations. Endothecal and exothecal dissepiments thin, if developed. Columella parietal or styliform.

Remarks. The presence of regularly confluent septocostae constitute the principal distinction between this family and the more highly developed actinacidids.

Genus *Microsolena* Lamouroux, 1821

Pl. 73, Figs. 1–2

Type species. *Microsolena porosa* Lamouroux, 1821, Jurassic of France.

Diagnosis. Colony massive, incrusting, lamellar, or folios, thamnasterioid. Budding in a wide range of intracalicinal and circumoral types. Calices superficial. Septa confluent, regularly and entirely perforated. Synapticulae abundant. Endothecal dissepiments sparse. No wall between corallites. Columella (trabecular-) rudimentary or absent.

Synonym. *Dimorpharaea* De Fromentel, 1861 (Type species. *Microsolena koechlini* Haime in Milne Edwards, 1860, Middle Jurassic of France).

Cretaceous species reported from the Alps and Dinarides. *M. catalaunica* (Reig Oriol, 1995); *M. formosa* Morycowa & Decrouez, 2006; *M. guttata* Koby, 1898; *M. kobyi* Prever, 1909; *M. manchacanensis* (Wells, 1933); *M.* sp., (referring to material described in Turnšek & Buser (1974), Turnšek et al. (1992), Baron-Szabo (1997), and Morycowa & Decrouez (2006) as *Microsolena distefanoi* [Prever, 1909]; the original species by Prever was recently transferred to the genus *Polyphylloseris*, whereas the material included here corresponds to the genus *Microsolena*); *M* sp. *A*, *B*, and *C* in Morycowa & Decrouez (2006).

Remarks. The original documentation of *Microsolena* by Lamouroux (1821) indicated the absence of a columella. However, according to L. Beauvais (1964: 229ff) the existence of a (rudimentary) trabecular columella for *Microsolena* can be assumed.

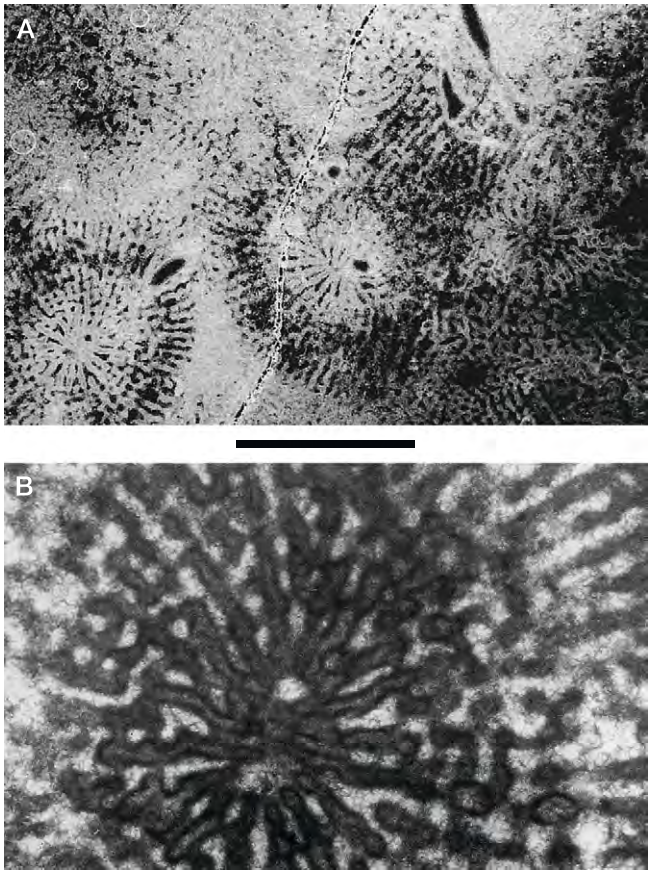
The form originally described as *Microsaraea distefanoi* by Prever (1909) belongs to the genus *Polyphylloseris* (Löser, 2011b).

According to Pandey & Fürsich (2003: 100), the genus *Dimorpharaea* De Fromentel represents a synonym of *Microsolena* Lamouroux.

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Brandalpe, Windecksattel, Lower Gundalpe); Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil).

Dinaric occurrences. *Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica); *Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Slovenski vrh, near Kočevje).

Austroalpine occurrences. *Gosau Group*: Lower Coniacian (Tyrol: Brandenberg, Haidach).



Text-Fig. 17.
Polyphylloseris convexa (d'Orbigny, 1850), SAZU P–504a, Barremian–Aptian (Osojnica), Slovenia; A: thin section, cross view; scale bar: 3.5 mm; B: close–up of A; scale bar: 900 µm. Photographs courtesy D. Turnšek.

Cretaceous occurrences elsewhere. Cretaceous of France, Berriasian–Hauterivian of Ukraine, Valanginian–Barremian of Turkmenistan, Hauterivian–Barremian of Georgia (in Caucasus), Barremian of Azerbaijan and Bulgaria, Aptian of Tibet and eastern Serbia, Aptian–Albian of Greece and Spain, Albian–Cenomanian of the USA (Texas), Turonian–Campanian of Georgia (in Caucasus). Regarding the material described as *M.* sp.: Taxa corresponding to the "Schrattenkalk" material have been reported from Lower Cretaceous strata of France, Hungary, Turkmenistan, Georgia (in Caucasus), Greece, and Poland.

Genus *Polyphylloseris* De Fromentel, 1857

Text-Fig. 17

Type species. *Polyphyllastrea convexa* d'Orbigny, 1850, Hauterivian of France.

Diagnosis. Colonial, thamnasterioid to subplocoid. Budding intracalicinal and extracalicinal. Corallites elevated, appearing mammelonate. Septa confluent, regularly perforated, pennular laterally. Columella trabecular, formed by a small number of papillae or elongate to lamellar segments. Columellar structures connected with or detached from septal axial ends. Synapticulae abundant. Endothecal dissepiments thin, vesicular, numerous. Wall generally

absent, but occasionally appears as an incomplete synapticulotheca.

Remarks. Traditionally, the genus *Polyphylloseris* has been considered to have intracalicinal budding and to lack a corallite wall. However, re-investigation of the type material of the type species of this genus (syntype MNHN A 29590) by the author of the current work in 2009 revealed that, in addition to intracalicinal budding, extracalicinal multiplication was observed as well. Furthermore, some corallites showed incomplete synapticulothecal wall developments.

Synonym. *Mastophyllia* Felix, 1891 (Type species. *M. conophora* Felix, 1891, Barremian of Mexico [Tehuacan, Est. Pueblo]).

Cretaceous species reported from the Alps and Dinarides. *P. convexa* (D'orbigny, 1850); *P.* cf. *microkothos* Baron-Szabo, 2008 (referring to material presented as *Eocomoseris raueni* in Baron-Szabo, 1997); *P. microstoma* (Oppenheim, 1930a); *P.* cf. *minima* (Prever, 1909) (referring to material presented as *Ovalastrea turbinata* in Turnšek & Buser, 1974).

Remarks. Forms of the genus *Polyphylloseris* have been reported mainly from Lower Cretaceous strata. The species documented by Oppenheim (1930a: 216–217) has so far been one of the few Upper Cretaceous taxa. Alloiteau (1957: 328) doubted that Oppenheim's material had porous but compact septa, and excluded it from *Polyphylloseris*. However, as clearly pointed out in the description of the species by Oppenheim (1930a: 216–217), this form is characterized by having distinctly porous septa. As a matter of fact, Oppenheim dedicates over one page talking about the highly porous character of the material. In addition, Oppenheim mentioned the occurrence of extracalicinal budding and pointed out the actinaciid character observed in his material. M. Beauvais (1982, vol. 3: 42) grouped Oppenheim's taxon with the stromatoporid genus *Actinostromaria*. However, while Beauvais states that he studied the original Oppenheim material, he (1982) presents a non-type specimen on pl. 58, figs. 6a–c as the species *microstoma* which significantly differs from both the original description and illustrations by Oppenheim. Furthermore, the material documented by Beauvais differs from both the stromatoporid genus *Actinostromaria* (pers. comm. Dragica Turnšek, 2013) and a scleractinian form (it might represent an octocoral). Therefore, and in following the original assessment, Oppenheim's species is considered a form of *Polyphylloseris*.

Dinaric occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk member 'Allgäu Schrattenkalk': Mahdtal); *Northern Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica).

Austroalpine occurrences. *Gosau Group*: Santonian (Salzburg: Rußbach, Zimmergraben).

Cretaceous occurrences elsewhere. Valanginian of Hungary, Hauterivian of Georgia, Hauterivian–Barremian of France, Barremian–Aptian of Mexico and Bulgaria, Lower Aptian of Romania and eastern Serbia, Aptian of Spain, and Greece.

Genus *Comoseris* d'Orbigny, 1849

Pl. 73, Figs. 3–4

Type species. *Pavonia meandrinoides* Michelin, 1843, Upper Jurassic of France (Meuse).

Diagnosis. Colonial, massive or foliaceous, thamnasterioid. Budding intracalicinal. Meandroid or parallel series of corallite centers enclosed between collines. Collines are tholiform to tectiform. Septa regularly perforated, pennular, thamnasterioid-like in the valleys, subconfluent to nonconfluent on the collines separating calicinal series. Columella spongy. Synapticulae present. No wall between the corallites. Endothecal dissepiments well-developed.

Synonyms. *Meandrarea* Étallon, 1859 (Type species. *M. marcouana* Étallon, 1859, Upper Jurassic (Kimmeridgian) of France (Valfin); *Latimaeandraraea* De Fromentel, 1861 (Type species. *L. corallina* De Fromentel, 1861, Jurassic of France).

Cretaceous species reported from the Alps and Dinarides. *C. aptiensis* Baron-Szabo, 2002; *C. bargyensis* Morycowa & Decrouez, 1993.

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Brandalpe, Mahdtal, Mitteleck, Lower Gundalpe); Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil).

Cretaceous occurrences elsewhere. Lower Barremian and Lower Aptian of France.

Genus *Eocomoseris* Melnikova in Melnikova et al., 1993

Type species. *Eocomoseris ramosa* Melnikova in Melnikova et al., 1993, ?Hettangian/ Lower Sinemurian of the Zurchirtsek Valley, SE Pamirs.

Diagnosis. Colonial, thamnasterioid-subcerioid. Budding intracalicinal and extracalicinal. Corallites of small dimensions. Columella monotrabecular. Radial elements of biseptal type, confluent to subconfluent, built of a few trabeculae and ornamented with thick menianes. Internal border of septa have terminal pennulae. Dissepiments expanded, abundant. Synapticulae rod-like, rare, constituting incomplete wall between calices.

Cretaceous species reported from the Alps. *E.* sp. in Morycowa & Decrouez (2006).

Helvetic occurrences. Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil).

Genus *Litharaeopsis* M. Beauvais, 1982

Pl. 73, Fig. 6; Pl. 74, Fig. 1

Type species. *Litharaea latistellata* Felix, 1903a, Upper Turonian of Austria (Gosau Group at St. Gilgen)

Diagnosis. Colonial, massive, cerioid to subplocoid. Budding extracalicinal and intracalicinal-marginal. Corallites

often indistinct. Corallites embedded in a porous-reticulate coenosteum. Costosepta short, thick, pennular and granular laterally, nonconfluent to subconfluent, rarely confluent, with few irregular perforations. Anastomosis rare. Trabecular lobes thin. Columella large, irregularly papillose. Wall synapticulothecal, incomplete. Endothecal dissepiments subhorizontal.

Synonym. *Larisolena* ELIÁŠOVÁ, 1995 (Type species. *L. bona* ELIÁŠOVÁ, 1995, Upper Cenomanian of the Czech Republic (Bohemia).

Affinities. Similar to *Eocomoseris* but corallum cerioid to subplocoid with indistinct corallites and nonconfluent to subconfluent costosepta.

Cretaceous species reported from the Alps. *L. latistellata* (FELIX, 1903a); *L. magnifica* (OPPENHEIM, 1930a).

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Salzburg: St. Gilgen); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Upper Austria: Gosau, Wegscheidgraben; Salzburg: Rußbach, Neffgraben).

Cretaceous occurrences elsewhere. Turonian–Santonian of Georgia (in Caucasus), Coniacian–Maastrichtian of Hungary.

Genus *Hydnophoromeandraraea* MORYCOWA, 1971

Pl. 73, Fig. 5

Type species. *Hydnophoromeandraraea volzi* MORYCOWA, 1971, Lower Aptian of Romania (eastern Carpathians).

Diagnosis. Colonial, massive, hydnophoroid. Budding circumoral and intracalicinal-terminal. Calices more or less indistinct. Calicinal series wavy, long, continuous. Collines tholiform, short, isolated between the calicinal series. Ambulacra present. Septa perforated, confluent to subconfluent, pennular laterally. Trabecular lobes present. Columella parietal, feebly developed. Synapticulae abundant. Endothecal dissepiments vesicular or horizontal. Wall synapticulothecal.

Cretaceous species reported from the Alps and Dinarides. *H. volzi* MORYCOWA, 1971.

Remarks. In forming a massive, hydnophoroid colony with intracalicinal-terminal budding; having calicinal series which are separated by collines that are tholiform, short, and isolated between the calicinal series; showing septa that are perforated, and confluent to subconfluent; having trabecular lobes and a parietal, feebly developed columella; having numerous synapticulae and a synapticulothecal wall, the material described as *Actinacis remesi* by KUZMICHEVA & ALIEV (1988: 175, pl. 8, figs. 1a, b) from the Barremian of Azerbaijan differs from *Actinacis* but closely corresponds to the genus *Hydnophoromeandraea* MORYCOWA. Based on the length of the isolated collines of up to around 4 mm and based on the number of 7 septa in 2 mm, the Barremian material shows close affinities to the species *H. volzi* MORYCOWA. Therefore, the Azerbaijan material is included in the list of occurrences.

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Mahdtal, Kürental, Windecksattel); Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil).

Cretaceous occurrences elsewhere. Barremian of Azerbaijan, Barremian–Lower Aptian of France, Lower Aptian of Romania, Albian of Greece.

Genus *Kobya* GREGORY, 1900b

Pl. 74, Figs. 2–3, 6

Type species. *Kobya crassolamellosa* GREGORY, 1900b, Middle Jurassic (Middle Bathonian) of India (Jumara Dome, Kachchh).

Diagnosis. Colonial, massive, thamnasterioid-dimorphastreid. Circumoral budding. Corallite centers distinct, arranged in concentric series. Septa confluent, regularly perforated. Pennulae present, forming menianae. Synapticulae common. Columella parietal-spongy, feebly developed. Endothecal dissepiments numerous, thin, vesicular. No wall between the corallites.

Synonym. *Gosaviaraea* OPPENHEIM, 1930a (Type species. *G. camerina* OPPENHEIM, 1930a, Coniacian–Lower Santonian of Austria [Gosau Group at Edelbachgraben]).

Cretaceous species reported from the Alps. *K. camerina* (OPPENHEIM, 1930a); *K. columellata* (OPPENHEIM, 1930a); *K. rigausensis* M. BEAUVAIS, 1982.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Salzburg: St. Gilgen); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt; Upper Austria: Gosau, Hofergraben [= Sattelgraben]); Upper Coniacian (Upper Austria: Unterlaussa, Weisswasser); Santonian (Salzburg: Rußbach, Zimmergraben); Upper Santonian (Styria: Aussee, Weissenbachalm; Salzburg: Abtenau, Rigausbach; Lower Austria: Neue Welt, Piesting, Scharrergraben; Upper Austria: Gosau, Wegscheidgraben).

Cretaceous occurrences elsewhere. Turonian–Campanian of Georgia (in Caucasus).

Family Synastreidae ALLOITEAU, 1952a

Diagnosis. Colonial. Costosepta exsert. Septal perforations near axial region and near upper margins. Septa strongly beaded marginally. Synapticulothecate. Endothecal dissepiments well-developed. Columella trabecular.

Genus *Synastrea* MILNE EDWARDS & HAIME, 1848b

Pl. 74, Figs. 4–5, 7; Pl. 75, Figs. 1–2

Type species. *Astrea agaricites* GOLDFUSS, 1826, Santonian of Austria (greater Salzburg area, Abtenau) (see MILNE EDWARDS & HAIME, 1848b).

Diagnosis. Colonial, massive, thamnasterioid. Budding intracalicinal. Septa confluent, perforated, marginally moniliform, granulated laterally. Columella subpapillose, rudimentary. Synapticulae abundant. Endothecal dissepiments thin, sparse.

Cretaceous species reported from the Alps and Dinarides. *S. agaricites* (GOLDFUSS, 1826); *S. agaricites* var. *tenuiseptata* OPPENHEIM, 1930a; *S. cladophora* (FELIX, 1903a); *S. excelsa* M. BEAUVAIS, 1982; *S. procera* (REUSS, 1854; lectotype designated herein); *S. provincialis* D'ORBIGNY, 1850; *S. splendida* DE FROMENTEL, 1886.

Remarks. M. BEAUVAIS (1982, vol. 2: 125–126) stated that the type material of the species *S. procera* (REUSS, 1854) was lost and created a neotype. However, because type material (= the original specimen of REUSS, 1854: 120, pl. 5, figs. 1, 2) was recovered in the collections of the Natural History Museum, Vienna, Austria, his neotype is invalid. The specimen NHMW 1864/0040/1370b is herein designated as the lectotype.

Austroalpine occurrences. *Gosau Group*: Reported from all Turonian–Lower Maastrichtian Gosau localities.

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Cretaceous of Greece, Turonian–Campanian of Georgia (in Caucasia), Turonian–Santonian of southern France (Corbières, Provence), Santonian–Maastrichtian of northern Spain (Catalonia), Upper Santonian–Maastrichtian of Romania, Campanian–Maastrichtian of The Netherlands, Upper Campanian of Bulgaria, Maastrichtian of Turkey and Mexico (Ocozocuautla Formation), Middle–Upper Maastrichtian of Jamaica.

Family Cunnolitidae ALLOITEAU, 1952a

(= ex Cyclolitidae D'ORBIGNY, 1851)

Diagnosis. Solitary and colonial, subdiscoid, patellate, or cupolate. Hermatypic. Colony formation by circumoral or intracalicinal budding. Corallite wall synapticulothecal. Epitheca present or absent. Costosepta as in Synastreidae. Septal perforations at inner ends and near upper margins. Septa strongly beaded marginally, perforations generally filled secondarily, axis of trabecular divergence inclined outward. Endothecal dissepiments and columella weak or absent. Homeomorphic with Fungiidae.

Remarks. BARON-SZABO (2002, 2008) gave priority to the family Cunnolitidae ALLOITEAU over D'ORBIGNY'S family Cyclolitidae (see extended discussions BARON-SZABO, 2002: 142–143, and 2008: 167). In order to avoid further confusion, the name *Cunnolites*, based on the type species *Cunnolites barrerei* ALLOITEAU, 1957, is tentatively accepted with all the consequences for higher taxonomic levels (e.g. giving the family name of Cunnolitidae ALLOITEAU, 1952a, priority over Cyclolitidae D'ORBIGNY, 1851).

According to VAUGHAN & WELLS (1943), WELLS (1956), and others, the Family Cunnolitidae ALLOITEAU, 1952a (= ex Cyclolitidae D'ORBIGNY, 1851) was characterized by solitary forms that were "free in ephebic stage". However, as has been documented by, e.g., SANDERS & BARON-SZABO (2008), forms of *Cunnolites* can very well stay attached throughout their whole life. Therefore, the characteristic "free in ephebic stage" was removed from the diagnosis of the family.

Genus *Cunnolites* ALLOITEAU, 1957

Pl. 75, Figs. 3–7

Type species. *Cunnolites barrerei* ALLOITEAU, 1957, Campanian of France.

Diagnosis. Solitary, cunnolitid (cupolate), free, circular or elliptical in outline. Base flat to concave. Calicular pit circular or elongate. Septa perforate (younger septa) to subcompact. Columella absent or feebly developed, trabecular. Synapticulae abundant. Endothecal dissepiments thin, few in number. Epitheca present or absent.

Synonyms. *Plesiocunnolites* ALLOITEAU, 1957 (Type species. *P. subcircularis* ALLOITEAU, 1957, Lower Campanian of France); *Plesiocunnolitopsis* M. BEAUVAIS, 1964 (Type species. *Fungia robusta* QUENSTEDT, 1880, Turonian–Campanian of Austria [Gosau Group]).

Cretaceous species reported from the Alps and Dinarides. *C. cancellatus* (GOLDFUSS, 1826); *C. choffati* (FELIX, 1903a; *C. conoideus* (STOLICZKA, 1873); *C. cycloides* (FELIX, 1903a); *C. cycloides fossaenobilis* (OPPENHEIM, 1930a); *C. debilior* (OPPENHEIM, 1930a); *C. depressus* (REUSS, 1854); *C. discoideus* (GOLDFUSS, 1826); *C. discus* (WU, 1975); *C. dispar* (QUENSTEDT, 1880); *C. ellipticus* (LAMARCK, 1816); *C. ellipticus subcircularis* (OPPENHEIM, 1930a); *C. eurystomus* (OPPENHEIM, 1930a); *C. excelsa* (DE FROMENTEL, 1863); *C. faecata* (STOLICZKA, 1873); *C. felixi* (BÖHM, 1927); *C. felixii* (OPPENHEIM, 1930a); *C. filamentosa* (FORBES, 1846); *C. fraterculus* (OPPENHEIM, 1930a); *C. gappi* (OPPENHEIM, 1930a); *C. gigantea* (D'ORBIGNY, 1850); *C. goldfussi* (ALLOITEAU, 1957); *C. gosavicus* (OPPENHEIM, 1930a); *C. hemisphaerica* (LAMARCK, 1816); *C. humilis* (QUENSTEDT, 1880); *C. krumbecki orfellensis* (MARINI, 1942); *C. ligeriensis* (MILNE EDWARDS & HAIME, 1851b); *C. longifossata* (CHESHMEDZHIEVA, 1974); *C. macrostoma* (REUSS, 1854); *C. medlicotti* (NÖTLING, 1897); *C. meringonensis* ALLOITEAU, 1957; *C. michelini* (OPPENHEIM, 1930a); *C. minimus* (DE FROMENTEL, 1863); *C. mitissimus* (OPPENHEIM, 1930a); *C. mitissimus muthmannsdorfensis* M. BEAUVAIS, 1982; *C. monacha*

(OPPENHEIM, 1930a); *C. nefianus* (OPPENHEIM, 1930a); *C. nummulus* (REUSS, 1854); *C. obliquosculum* (OPPENHEIM, 1930a); *C. orbiculus* (STOLICZKA, 1873); *C. orbignyi* (DE FROMENTEL, 1864); *C. placentus* (REUSS, 1854); *C. planialpici* ALLOITEAU, 1957; *C. planoelliticus* (OPPENHEIM, 1930a); *C. platystomus* (QUENSTEDT, 1880); *C. ploechingeri* (M. BEAUVAIS, 1982); *C. polygamus* (OPPENHEIM, 1930a); *C. polymorphus* (GOLDFUSS, 1826); *C. profundus* (OPPENHEIM, 1930a); *C. pseudonummulus* (OPPENHEIM, 1930a); *C. pulchellus* (OPPENHEIM, 1930a); *C. quenstedti* (OPPENHEIM, 1930a); *C. reussi* (DE FROMENTEL, 1863); *C. reussi portentosus* (OPPENHEIM, 1930a); *C. robusta* (QUENSTEDT, 1881); *C. scutellum* (REUSS, 1854); *C. sellatus* (QUENSTEDT, 1880); *C. sellatus nefgrabensis* M. BEAUVAIS, 1982; *C. senessei* ALLOITEAU, 1939; *C. sororius* (QUENSTEDT, 1880); *C. sororius profundus* M. BEAUVAIS, 1982; *C. subcircularis* (ALLOITEAU, 1957); *C. subcircularis sulcatus* M. BEAUVAIS, 1982; *C. tenuiradiatus* (DE FROMENTEL, 1863); *C. thomasi* (WELLS, 1935); *C. undulatiformis* (OPPENHEIM, 1930a); *C. undulatus* (GOLDFUSS, 1826); *C. undulatus muthmannsdorfensis* M. BEAUVAIS, 1982; *C. undulatus planus* (OPPENHEIM, 1930a); *C. undulatus robustus* (FELIX, 1903a); *C. undulatus rotundus* (QUENSTEDT, 1881); *C. weissermeli* (OPPENHEIM, 1930a); *C.* sp. (first report of the genus for Netting, Tiefengraben [Tauerngraben], Gams-Hieflau-2, Ettendorf, and Stollhof).

Remarks. During the last century, numerous revisions have been carried out on the genus *Cunnolites*, with species differentiated mainly on the basis of the relation of their skeletal dimensions such as corallite diameter/height of corallum, corallite diameter/size of calicular pit, etc. Recent studies on the ontogeny of *Cunnolites*, carried out by BARON-SZABO (2003a) strongly suggest that the specific characteristics are restricted to a combination of both the density of septa and the relation of minimum/ maximum corallite diameter (BARON-SZABO, 2008, Table 5). For information on morpho-variability and suggestions on the synonymy of *Cunnolites* species see GÉCZY (1954), M. BEAUVAIS (1964, 1982), and BARON-SZABO (2003a, 2008: 167–176).

Austroalpine occurrences. *Gosau Group*: Reported from all Turonian–Maastrichtian Gosau localities; "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Dinaric occurrences. *Inner Dinarides* (*Vrabečka gora at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Cretaceous of France, Hungary, eastern Slovenia (Dobrova), Romania, Jamaica, Italy, Syria, and Spain, Albian of England, Upper Cretaceous of Germany, Bulgaria, Turkey, and Tibet, Cenomanian of Ukraine, Turonian of Azerbaijan, Coniacian of Armenia, Senonian of Portugal, Campanian of eastern Serbia, Campanian–Maastrichtian of Saudi Arabia and Slovakia, Upper Campanian, Maastrichtian of The Netherlands, Libya, Oman, UAE, Somalia, Pakistan, Iran, and India.

Genus *Aspidastraea* KÜHN, 1933

Pl. 76, Figs. 1–6

Type species. *Aspidastraea orientalis* KÜHN, 1933, Senonian of Iran.

Diagnosis. Colony forming a cupolate corallum. Budding circumoral. Septa porous or subcompact, and covered with numerous granules and pennulae laterally. Synapticulae abundant. Columella feebly developed, trabecular, or absent. No wall between the corallites. Endothecal dissepiments sparse.

Synonym. *Paradimorphastraea* M. BEAUVAIS, 1982 (Type species. *Dimorphastrea waehneri* FELIX, 1903a, Upper Santonian of Austria [Gosau Group at Scharrergraben]).

Cretaceous species reported from the Alps. *A. orientalis* KÜHN, 1933; *A. waehneri* (FELIX, 1903a); *A.* sp. (first report of the species for the Ludoi Alp).

Austroalpine occurrences. *Gosau Group*: Coniacian (Tyrol: Ludoi Alp [= Pletzach Alp]); Santonian (Upper Austria: Hochmoos-Rußbach-area; Hochmoos Formation; Salzburg-Bavaria region: „Krönner Reef" area); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben).

Cretaceous occurrences elsewhere. Turonian of Armenia, Senonian of Iran, Santonian of France, Maastrichtian of the UEA, Upper Maastrichtian of The Netherlands.

Family Latomeandridae ALLOITEAU, 1952a

Diagnosis. Septa costate or biseptal, subcompact, made of simple or compound trabeculae. Perforations abundant and large, anastomosis frequent. Axial ends of septa give off trabecular extensions which join the columella. Septal flanks ornamented by true pennulae which are centered on trabecular axes. Distance between centers of trabeculae range between 200–500 µm. Endothecal dissepiments vesicular, generally abundant. Synapticulae sparse. Columella parietal, weak. Wall synapticulothecal or ?septothecal, present or absent.

Remarks. In recent studies carried out by LATHUILIÈRE (pers. comm., 2009, also visit corallosphere.org), great emphasis was given on the occurrence of true pennulae in the nominatform of the family, *Latomeandra* D'ORBIGNY. The family diagnosis given above is based on the results of his studies.

Genus *Dimorphastrea* D'ORBIGNY, 1850

Pl. 76, Fig. 7

Type species. *Dimorphastrea grandiflora* D'ORBIGNY, 1850, Lower Hauterivian of France (Haute-Marne) (subsequent designation by GREGORY, 1900a).

Diagnosis. Colonial, massive, thamnasterioid. Budding circumoral. Septa subcompact with increasing perforations toward the axial end of the septa. Septal margins granular, septal flanks granular and pennular. Columella papil-

lose. Synapticulae abundant. No wall between the corallites. Endothecal dissepiments thin, subhorizontal.

Synonym. *Leptophyllastraea* OPPENHEIM, 1930a (Type species. *L. regularis* OPPENHEIM, 1930a, Santonian of Austria (Gosau Group at Zimmergraben).

Cretaceous species reported from the Alps. *D. composita* (SOWERBY, 1832); *D. corbarica* (D'ORBIGNY, 1850); *D. cuneiformis* OPPENHEIM, 1930a; *D. felixi* (M. BEAUVAIS, 1982); *D. fungiformis* REUSS, 1854; *D. glomerata* REUSS, 1854; *D. haueri* REUSS, 1854; *D. leptophylla* (FELIX, 1903a); *D. ogilviae* OPPENHEIM, 1930a; *D. parvistella* OPPENHEIM, 1930a; *D. regularis* (OPPENHEIM, 1930a); *D. scutulum* OPPENHEIM, 1930a; *D. solida* UMBGROVE, 1925 (= *D.* aff. *sulcosa* REUSS in OPPENHEIM, 1930a); *D. stella* OPPENHEIM, 1930a; *D. sulcosa* REUSS, 1854).

Austroalpine occurrences. *Gosau Group*: Reported from all Middle Turonian–Lower Campanian Gosau localities; "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Cretaceous occurrences elsewhere. Cretaceous of Greece, Slovakia, and Spain, Upper Cretaceous of France and Germany, Turonian–Campanian of Georgia (in Caucasus), Coniacian of Madagascar, Campanian of Bulgaria, Maastrichtian of The Netherlands.

Genus *Fungiastraea* ALLOITEAU, 1952a

Pl. 76, Figs. 8–9; Pl. 77, Figs. 1–2, 5–7

Type species. *Fungiastraea laganum* ALLOITEAU, 1952, Upper Turonian of France (Uchaux, Vaucluse) (see ALLOITEAU, 1952a).

Diagnosis. Colonial, massive, thamnasterioid to submeandroid. Budding intracalicinal, occasionally extracalicinal. Calicinal centers distinct. Septa compact to subcompact, confluent, moderately granulated and pennulated laterally. Columella spongy. Pali absent. Synapticulae present. Endothecal dissepiments thin, vesicular to subtabulate. No wall between corallites.

Synonym. *Fungiastraeopsis* MORYCOWA, 1971 (Type species. *F. subpolygonalis* MORYCOWA, 1971, Lower Aptian of Romania).

Cretaceous species reported from the Alps and Dinarides. *F. acutidens* (REUSS, 1854); *F. columellaris* (HACKEMESSER, 1936); *F. cotteaui* (DE FROMENTEL, 1857) (first report of the species for the Garschella Formation); *F. crespoi* (FELIX, 1891); *F. exigua* (REUSS, 1854); *F. muelleri* ELIÁŠOVÁ, 1994; *F.* sp. 1 (referring to the material described as *Fungiastraea tendagurensis* in TURNŠEK & BUSER, 1974, and IDAKIEVA, 2001; while their material corresponds to the genus *Fungiastraea*, the species *F. tendagurensis* [DIETRICH, 1926] from the Lower Cretaceous of Tanzania closely corresponds to the genus *Dimorphastrea*).

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Brandalpe); Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil); Albian of Austria (Garschella Formation at Vorarlberg [Plattenwald-Schicht]: Bezau at Bregenz Forrest).

Dinaric occurrences. *Northern Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica).

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Styria: Weissenbachalm); Lower Coniacian (Tyrol: Brandenberg, Haidach; Salzburg: Strobl, Sankt Wolfgang, "Theresienstein"); Coniacian (Tyrol: Ludoi Alp [= Pletzach Alp]); Upper Santonian (Lower Austria: Neue Welt, Piesting; Salzburg: Rußbach, Neffgraben, Traunwandalm, Schattauergraben).

Cretaceous occurrences elsewhere. Lower Hauterivian and Barremian of France, Hauterivian of Ukraine, Barremian of Bulgaria, Barremian–Middle Albian of Mexico, Lower Aptian of Romania and eastern Serbia, Aptian of Trinidad and Tobago, Aptian–Cenomanian of Greece, Aptian–Albian of northern Spain (Vasco-Cantabrica), Tibet, and Iran, Cenomanian of Germany, Upper Cenomanian–Senonian of the Czech Republic, Santonian–Campanian of Slovakia, Upper Campanian–Maastrichtian of the UEA/Oman border region, Maastrichtian of Jamaica.

Genus *Periseris* FERRY, 1870

Type species. *Agaricia elegantula* D'ORBIGNY, 1850, Middle Jurassic of France (Langres, Haute Marne).

Diagnosis. Colonial, massive, often lamellar; thamnasterioid to meandroid with corallites that are arranged in irregular concentric series. Budding intracalicinal. Septa are subcompact, biseptal, arranged bilaterally. Septal flanks ornamented with pennulae. Septal anastomosis present. Columella styliform. Pali absent. Synapticulae present. Endothecal dissepiments vesicular. Wall absent. Epitheca absent or made of thick, concentrical wrinkles.

Cretaceous species reported from the Alps. *P. frondescens* (D'ORBIGNY, 1850).

Helvetic occurrences. Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil).

Cretaceous occurrences elsewhere. Lower Cretaceous (?Aptian) of Switzerland (Jura, Sainte-Croix), Valanginian–Hauterivian of ?Hungary, Hauterivian of France, Upper Aptian of Spain, Aptian–Albian of Greece, Lower Cenomanian of ?Germany and ?Greece.

Genus *Thamnoseris* DE FROMENTEL, 1861

Pl. 77, Figs. 3–4; Pl. 78, Figs. 1, 3

Type species. *Thamnoseris incrustans* DE FROMENTEL, 1861, Middle Jurassic of France (Chaumont, Saint Claude, French Jura).

Diagnosis. Colonial, massive, cerio-thamnasterioid. Budding extracalicinal-marginal. Costosepta confluent, irregularly perforated, granulate and probably pennulate laterally. Anastomosis frequently present. Columella parietal-papillose. Synapticulae numerous. Endothecal dissepiments vesicular, thin. Wall synapticulothecal, incomplete.

Cretaceous species reported from the Alps and Dinarides. *T. arborescens* (FELIX, 1891); *T. carpathica* MORYCOWA, 1971 (= ?*Complexastrea glenrosensis* WELLS, 1932); *T. morchella* (REUSS,

1854); *T.* sp (referring to material described as *Thamnoseris hoernesi* [REUSS] in TURNŠEK & POLŠAK, 1978); *T.* sp. (first report of this genus for Ramsau at Hainfeld, Ettendorf, and ?Windischgarsten).

Helvetic occurrences. Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil).

Austroalpine occurrences. *Gosau Group*: Reported from all Turonian–Lower Campanian localities; "*Styrian Gosau Development*": Santonian–Campanian of Slovenia (Stranice).

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Cretaceous occurrences elsewhere. Valanginian of Ukraine, Barremian of Mexico and Azerbaijan, Barremian of ?Hungary, Barremian–Lower Aptian of eastern Serbia and Venezuela, Lower Aptian of Romania, Middle Albian of ?Texas, Upper Cretaceous of Germany, Senonian breccia of Slovenia (resedimented), Santonian of France, Santonian-Campanian of northern Spain (Torallola).

Genus *Trigerastraea* ALLOITEAU, 1952a

Pl. 78, Figs. 2, 4

Type species. *Isastrea trigeri* DE FROMENTEL, Cenomanian of France (Le Mans, Sarthe) (see ALLOITEAU, 1952a)

Diagnosis. Colonial, massive, subplocoid-subcerioid and submeandroid. Budding intracalicinal. Calices monocentric or arranged in short series, separated by tectiform collines. Costosepta generally compact, confluent to nonconfluent. Septal flanks have fine dentations, flattened and rounded granules, and small ?pennulae. Columella spongy-papillose or made of irregular segments. Synapticulae numerous. Wall parasynapticulothecal, incomplete. Endothecal dissepiments abundant.

Affinities. Similar to *Thamnoseris* but colony formed by intracalicinal budding and calices with subplocoid-subcerioid to submeandroid integration.

Subgenus. *Dimorphomeandra* ALLOITEAU, 1958 (Type species. *D. besairiei* ALLOITEAU, 1958, Coniacian of Madagascar): Like *Trigerastraea* but forms thamnasterioid-meandroid series by circumoral budding followed by intracalicinal budding.

Cretaceous species reported from the Alps and Dinarides. *T.* (*D.*) *astraeoides* (REUSS, 1854); *T.* (*D.*) *confusa* (REUSS, 1854); ?*T. tenera* (SOWERBY, 1832); *T. tenerrima* (OPPENHEIM, 1930a); *T. tenuiseptata nefiana* (OPPENHEIM, 1930a); *T. tenuiseptata terebellum* (OPPENHEIM, 1930a).

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang); Upper Turonian–Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten); Upper Turonian–Coniacian (Styria: Aussee, Weissenbachalm); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Santonian (Salzburg: Rußbach, Randograben, Stöcklwaldgraben, Zimmergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben, Schattauergraben, Abtenau, Rigausbach; Upper Austria: Gosau, Brunstloch, Wegscheidgraben); Upper Santonian–Lower Maastrichtian (Styria: Kainach).

Dinaric occurrences. *Inner Dinarides* (*Orešje at Mt. Medvednica*): Santonian–Lower Campanian of Croatia.

Remarks. Traditionally, the genus *Trigerastraea* was placed in the family Andemantastraeidae. However, while investigations carried out by the author of the current work revealed that the genus *Trigerastraea* shows close affinities to latomeandrid forms, recent investigations by LATHUILIÈRE (pers. comm., 2011) revealed that the type material of the nominatform of this family, *Andemantastraea* ALLOITEAU, 1952a, very closely corresponds to the montlivaltiid genus *Isastrea*. Consequently, forms that have been previously assigned to *Trigerastraea* using a different family-concept of Andemantastraeidae will have to be re-assessed. The forms concerned were mainly reported from Jurassic strata.

Cretaceous occurrences elsewhere. Upper Cretaceous of Germany, Lower Coniacian and Upper Santonian of France, Santonian–Campanian of Spain, Coniacian–Maastrichtian of Hungary.

Genus *Valliculastraea* ALLOITEAU, 1957

Pl. 78, Figs. 5–6; Pl. 80, Figs. 3, 5

Type species. *Valliculastraea jauberti* ALLOITEAU, 1957, Turonian of France.

Diagnosis. Colonial, massive, thamnasterioid to submeandroid. Budding intracalicinal. Corallites isolated or arranged in short meandroid series, separated by tholiform collines. Septa confluent, generally biseptal, subcompact, perforations mainly restricted to their axial ends. Septal flanks granular and pennular. Columella papillose. Endothecal dissepiments thin, vesicular to subtabulate, abundant. Synapticulae present. No wall between corallites or series.

Cretaceous species reported from the Alps and Dinarides. *V. lophiophora* (FELIX, 1903a); *V. montuosa* (FELIX, 1903a); *V. oppenheimi* M. BEAUVAIS, 1982 (pro *Nefocoenia montuosa* OPPENHEIM, 1930a); *V. spinosa* (OPPENHEIM, 1930a); *V. texta* (OPPENHEIM, 1930a).

Austroalpine occurrences. *Gosau Group*: Upper Turonian–Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten); Upper Turonian–Santonian (Upper Austria: Goisernberg); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Upper Coniacian (Upper Austria: Unterlaussa, Weisswasser); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Santonian (Salzburg: Rußbach, Zimmergraben; ? Salzburg-Bavaria region: „Krönner Reef" area); Upper Santonian (Salzburg: Rußbach, Neffgraben, Schattauergraben, Abtenau, Rigausbach; Upper Austria: Gosau, Brunstloch; Lower Austria: Neue Welt, Grünbach; Styria: Aussee, Weissenbachalm).

Cretaceous occurrences elsewhere. Coniacian and Upper Santonian of southern France, Santonian of Spain.

Genus *Lophomeandra* M. Beauvais, 1982

Pl. 79, Figs. 7–8; Pl. 80, Figs. 1–2, 4

Type species. *Lophomeandra polygonata* M. Beauvais, 1982 (pro *Latimeandraraea tenuisepta* Reuss in Felix, 1903a), Upper Santonian of Austria (Gosau Group).

Diagnosis. Colonial, massive, thamnasterioid to meandroid. Budding intracalicinal-terminal. Corallites separated by tectiform or tholiform collines. Corallites distinct, subdistinct, indistinct. Costosepta confluent to nonconfluent, perforated, granular and pennular laterally. Columella parietal, papillose or made of irregular segments. Synapticulae present. Endothecal dissepiments abundant, vesicular. Wall incomplete, synapticulothecal, rarely septothecal.

Remarks. The diagnosis of *Lophomeandra* Beauvais given above is a revised description of the genus based on the study of the type material housed at the Natural History Museum Vienna (NHMW).

Synonym. *Hydnoseris* M. Beauvais, 1982 (Type species. *Meandrina agaricites* Goldfuss, 1829, Turonian–Campanian of Austria [Gosau Group]).

Cretaceous species reported from the Alps. *L. agaricites* (Goldfuss, 1829); *L. asperrima* (Reuss, 1854); *L. felixi* M. Beauvais, 1982 (pro *Latimaeandraraea ataciana* [Michelin] in Felix, 1903a); *L. gosaviensis* M. Beauvais, 1982; *L. hydnophylloides* (Oppenheim, 1930a); *L. polygonata* M. Beauvais, 1982 (pro *Latimaeandraraea tenuisepta* Reuss in Felix, 1903a); *L.* sp. (first report of the genus for Ettendorf).

Remarks. M. Beauvais (1982) stated that the type material of *Meandrina agaricites* Goldfuss, 1829, was lost. He designated a neotype, which he used to create his new genus *Hydnoseris* M. Beauvais, 1982. However, because the holotype of Goldfuss' species is in the depository of the Geological-Palaeontological Department, University of Bonn, Germany, under IPB 292, Goldfuss collection (see Pl. 80, Fig. 2), Beauvais' neotype is invalid.

Austroalpine occurrences. *Gosau Group*: Upper Turonian–Lower Coniacian (Upper Austria: Wolfgangsee, Sankt Wolfgang, Seeleiten); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben; Salzburg: Rußbach, Stöcklwaldgraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Upper Austria: Gosau, Brunstloch, Wegscheidgraben; Salzburg: Rußbach, Neffgraben, Abtenau, Rigausbach); Upper Santonian–Lower Campanian (Lower Austria: Baden, Einöd quarry); Lower Campanian (Carinthia: Ettendorf at St. Paul [Weinberger homestead]).

Cretaceous occurrences elsewhere. Upper Cretaceous of Germany, Upper Santonian of France, Coniacian–Maastrichtian of Hungary, Campanian of ?Spain.

Genus *Latiastrea* L. Beauvais, 1964

Pl. 80, Figs. 6–7

Type species. *Latiastrea foulassensis* L. Beauvais, 1964, Upper Jurassic (Kimmeridgian) of France (Valfin-les-Saint-Claude).

Diagnosis. Colonial, massive, cerioid. Budding intracalicinal. Corallites prismatic, elongate, monocentric, or temporarily dicentric (to ?polycentric) during budding processes, or arranged in meandroid series. Costosepta nonconfluent to subconfluent, with rare perforations on axial ends of septa. Anastomosis present. Rudimentary young septa alternate with old ones. Septal flanks are ornamented with large, spiniform granulae. Pennulae present. Distal margins covered with small, regularly developed rounded denticles. Synapticulae present. Columella parietal-spongy, sometimes forming elongate segments. Endothecal dissepiments thin, vesicular. Wall synapticulothecal and septothecal.

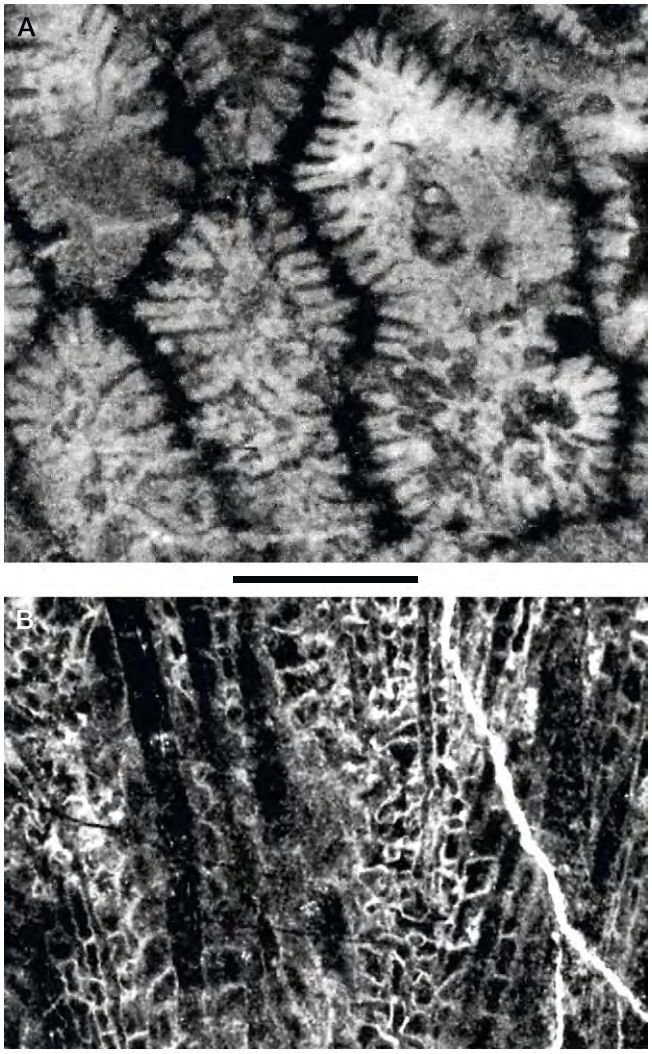
Cretaceous species reported from the Alps. *L. kaufmanni* (Koby, 1897).

Remarks. Turnšek & Mihajlović (1981: 30) grouped the species *Latimaeandra kaufmanni* Koby, 1897, with the genus *Latiastrea*. This assignment has been subsequently accepted by several authors. Recently, in stating without providing evidence, Löser & Ferry (2006: 482) transferred Koby's taxon to the genus *Dimorphocoenia* and assigned material from the Barremian of France to their newly combined taxon *Dimorphocoenia kaufmanni* (Koby, 1897). However, in having polyps that occur in a fairly wide range of integration types including, e.g., isolated polyps that are cerioid to irregularly polygonal in outline or are arranged in meandroid series; and showing distinct corallite wall developments (Koby, 1897: 45–46, pl. 11, figs. 1–2), Koby's. taxon differs from the genus *Dimorphocoenia* but corresponds to the genus *Latiastrea*. Therefore, the assignment by Turnšek & Mihajlović (1981) is kept. Furthermore, in having polyps that are in plocoid to subcerioid integration; and showing both a weakly developed parietal columella in some corallites and nonconfluent septa, the French material differs from the genus *Dimorphocoenia* but shows similarities to the genus *Complexastrea* (possibly corresponding to *C. coronata* Sikharulidze, 1985]). Therefore, the French material is excluded from the list of occurrences.

All the material from the Lower Aptian of Spain assigned to *Thalamocoeniopsis* by Bover-Arnal et al. (2012) is included here.

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Mitteleck, Hoher Döllen, Brandalpe, Lochbachstrasse).

Cretaceous occurrences elsewhere. Berriasian of Ukraine, Hauterivian and Lower Aptian of eastern Serbia, Barremian of Bulgaria, Lower Aptian of Greece and Spain, Aptian–Albian of Iran, Upper Aptian–Lower Albian of Mexico, Lower Cenomanian of Spain.



Text-Fig. 18.
Microphyllia bachmayeri GEYER, 1955b; Valanginian of Slovenia (Zavrh, Trnovski Gozd); A: SAZU P–320a; thin section, cross view; scale bar: 2 mm; B: SAZU P675b; thin section, lateral view; scale bar: 2 mm. Photographs courtesy D. TURNŠEK.

Genus *Microphyllia* D'ORBIGNY, 1849

Text-Fig. 18

Type species. *Meandrina soemmeringi* MÜNSTER in GOLDFUSS, 1829, Upper Jurassic of Germany (Nattheim).

Diagnosis. Colonial, meandroid. Budding intracalicinal. Calicinal series separated by tectiform collines, continuous and discontinuous. Corallites indistinct or distinct, marked by synapticular wall. Corallites sometimes connected by lamellar linkages. Ambulacra present in places. Septa subcompact. Septal flanks have small spiniform granulae, pennulae, and menianae laterally. Synapticulae present. Columella parietal, feebly developed, absent in some corallites. Wall synapticulothecal, discontinuous. Endothecal dissepiments vesicular.

Synonyms. *Polyseris* ALLOITEAU, 1957 (Type species. *Latimaeandra massiliensis* DE FROMENTEL, 1873, ?Turonian [Figuières, Bouches-du-Rhone]); *Comophylliopsis* ALLOITEAU, 1957 (Type species. *Oulophyllia turbinata* D'ORBIGNY, 1850 [= *Latimeandra rustica* DE FROMENTEL, 1877], Lower Coniacian of France [Les Corbières, Aude]).

Cretaceous species reported from the Dinarides. *M. bachmayeri* GEYER, 1955b in TURNŠEK & BUSER, 1974; *M. undans* ÉTALLON, 1858 in TURNŠEK & BUSER, 1974.

Remarks. Re-investigation of the type material housed at the MNHN (Paris) by the author of the current work in 2009 revealed that the only syntype that could be found of the type series of the genus *Comophylliopsis* was A30256. This specimen is unrecognizably preserved. The documentation of the specimen that had been used by ALLOITEAU (1957) to describe the genus *Comophylliopsis*, however, seem to closely correspond to *Microphyllia* D'ORBIGNY, 1849. The latter specimen could not be found in the Paris collections.

The set of syntypes of the type species of *Polyseris* consists of specimens from different locations and are housed at MNHN (Paris) under B17597 (Lower Santonian) and M03776 (Turonian), the latter of which includes numbers of the 7100-series. ALLOITEAU (1957: 321) based the genus *Polyseris* on the specimen no. 7106, which might belong to the set of specimens under the inventory number M03776. In addition to their geographic and stratigraphic differences, the syntypes also seem to belong to different taxonomic groups. While the material that was used by ALLOITEAU (1957) seems to closely correspond to *Microphyllia* D'ORBIGNY, re-examination of the material by the author of the current work in 2000 and 2005 revealed that some other specimens of the set of syntypes are closely related to *Morphastrea* (e.g. no. 7100) or *Meandrophyllia* (specimens marked as M03776).

Dinaric occurrences. *Dinaric Carbonate Platform* ("*Reef development*"): Valanginian of Slovenia (Zavrh, Trnovski Gozd).

Cretaceous occurrences elsewhere. Upper Berriasian of southern Spain, Valanginian of southern Spain and Hungary, Hauterivian of Crimea, Barremian of Poland and Georgia (in Caucasus), Albian of Georgia (in Caucasus).

Suborder Caryophylliina VAUGHAN & WELLS, 1943

Diagnosis. Solitary and colonial. Septa laminar, composed of one fan system of simple, very small trabeculae; septal margins completely smooth. Dissepiments usually not developed. Polyps small to moderate in size, with ridged stomodaea, and tentacles arranged in 1 to 3 rings.

Family Caryophylliidae DANA, 1846

(= Caryophylliinae MILNE EDWARDS, 1857; = Parasmiliinae VAUGHAN & WELLS, 1943; = Parasmiliidae ALLOITEAU, 1952a)

Diagnosis. Solitary and colonial. Colony formation by extracalicinal (rarely intracalicinal) budding, forming phaceloid or dendroid colonies. Costae commonly covered by stereome or epitheca. Septa exsert. Columella absent or formed by curled trabecular laths, solid, spongy. Pali or paliform lobes common. Endothecal dissepiments developed in some groups.

Remarks. GRAY (1847) is commonly referred to as the first author to have described the family Caryophylliidae (e.g. MILNE EDWARDS, 1857; VAUGHAN & WELLS, 1943; ALLOITEAU, 1952a). However, as pointed out by CAIRNS (1989) one year prior to GRAY'S work the family Caryophylliidae was created by DANA (1846: 364), thus giving the latter priority of authorship.

Subfamily names are no longer used in the Family Caryophylliidae (see e.g., CAIRNS, 1997).

Genus *Parasmilia* MILNE EDWARDS & HAIME, 1848a

Text-Fig. 19

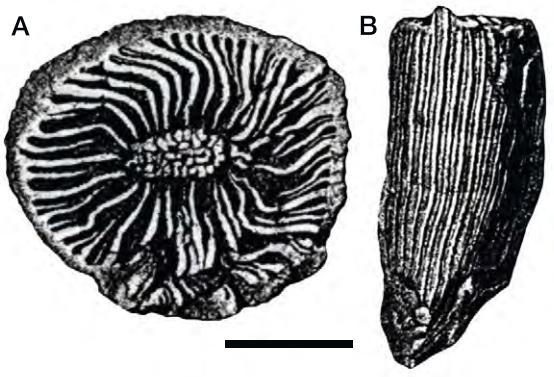
Type species. *Madrepora centralis* MANTELL, 1822, Campanian–Maastrichtian of England (Sussex) (see MILNE EDWARDS & HAIME, 1848a).

Diagnosis. Solitary, trochoid, fixed. Columella spongy. Costosepta compact. Septal margins smooth or slightly granular. Endothecal dissepiments few in number, developed deep in corallum. Wall septothecal to septoparathecal.

Synonyms. *Prototrochocyathus* KOLOSVÁRY, 1959 (Type species. *P. valanginicus* KOLOSVÁRY, 1959, Lower Cretaceous of Hungary [Baranya Megye]); *Cyclosmilia* D'ORBIGNY, 1849 (Type species. *Madrepora centralis* MANTELL, 1822, Campanian–Maastrichtian of England [Sussex], it is a *nomen vanum*); *Monocarya* LONSDALE, 1850 (Type species. *Madrepora centralis* MANTELL, 1822, Campanian–Maastrichtian of England [Sussex], it is a *nomen vanum*).

Cretaceous species reported from the Alps. *P. multicostata* OPPENHEIM, 1930a (= *P. cornucopiae* ALLOITEAU, 1939); *P.* sp. (first report of the genus for the Ludoi Alp).

Austroalpine occurrences. *Gosau Group*: Coniacian (Tyrol: Ludoi Alp [= Pletzach Alp]); Coniacian–Santonian (Upper Austria: Hofergraben [= Sattelgraben]); Santonian (Upper Austria: Gosau, Obergeschröfpalfen; Salzburg-Bavaria region: „Krönner Reef" area); Upper Santonian (Salzburg: Rußbach, Neffgraben).



Text-Fig. 19.
Sketch of *Parasmilia multicostata* OPPENHEIM, 1930a, based on the illustration of the holotype in OPPENHEIM (1930a: Pl. 27, Fig. 16); Upper Santonian (Neffgraben), Austria; A: upper surface, cross view; scale bar: 6 mm; B: upper surface, lateral view; scale bar: 16 mm.

Remarks. According to M. BEAUVAIS (1982, vol. 1: 254), the species *Parasmilia cornucopiae* ALLOITEAU, 1939, from the Upper Santonian of France represents a junior synonym of the Austrian species *P. multicostata* OPPENHEIM, 1930a.

Cretaceous occurrences elsewhere. Upper Santonian of France.

Genus *Trochocyathus* MILNE EDWARDS & HAIME, 1848c

Pl. 79, Figs. 3–4

Type species. *Turbinolia mitrata* GOLDFUSS, 1826, Campanian of Germany (Aachen, Zevenwegen beds) (see MILNE EDWARDS & HAIME, 1848c).

Diagnosis. Solitary, variably conical, often turbinate to ceratoid, or discoidal, fixed or free. Costosepta compact, finely granulated laterally. Pali or paliform lobes in 2 crowns opposite all but last cycle. Columella fascicular or spongy. Wall septothecal. Endothecal dissepiments vesicular. Epithecal wall absent or present.

Subgenus. *Platycyathus* DE FROMENTEL, 1862 (Type species. *Trochocyathus terquemi* MILNE EDWARDS, 1857, Lower Santonian of France): Like *Trochocyathus* but discoidal, free.

Synonyms. *Paratrochocyathus* ALLOITEAU, 1958 (Type species. *P. collignoni* ALLOITEAU, 1958, Albian–Cenomanian of Madagascar [Majunga]); *Protrochocyathus* ALLOITEAU, 1958 (Type species. *P. madagascariensis* ALLOITEAU, 1958, Albian of Madagascar); *Cyrtocyathus* ALLOITEAU, 1958 (Type species. *C. collignoni* ALLOITEAU, 1958, Maastrichtian of Madagascar); *Elasmosmilia* M. BEAUVAIS, 1960 (Type species. *E. padernensis* M. BEAUVAIS, 1960, Upper Santonian of France [Padern, Aude]); *Platytrochopsis* SIKHARULIDZE, 1975 (Type species. *P. lashensis* SIKHARULIDZE, 1975, Lower Albian of Georgia [in Caucasus, Lashe]); *Tethocyathus* KÜHN, 1933 (Type species. *Thecocyathus microphyllus* REUSS, 1871, Miocene of Moravia).

Cretaceous species reported from the Alps. *T. amphitrites* (FELIX, 1903a); *T. carbonarius* REUSS, 1854; *T. kangpaensis* (WU, 1975); *T. konincki* MILNE EDWARDS & HAIME, 1848c; *T. matleyi* WELLS, 1934; *T. microphyes* FELIX, 1903a; *T. mitrata* (GOLDFUSS, 1826); *T. septempartitus* (ALLOITEAU, 1958).

Remarks. The variability of a large number of characters (e.g. columella, pali, thickness of septa) in the genus *Trochocyathus* was previously recognized by MILNE EDWARDS & HAIME (1848c: 300). Later, ALLOITEAU (1958) used these features to divide *Trochocyathus* into three independent groups: *Trochocyathus*, *Protrochocyathus*, and *Paratrochocyathus*. According to KÜHN (1966: 339) these characteristics are not sufficient for a separation at the genus level. More recent studies carried out by CAIRNS (1997) support this idea. Based on a cladistic analysis of turbinoliid genera, CAIRNS (1997) concluded that less taxonomic weight should be given to characters such as columella and pali. Closely corresponding results were found for *Trochocyathus* based on the study of different stages of ontogeny seen in the same specimen (BARON-SZABO, 2000: Pl. 10, fig. 5 showing the juvenile stage, and Fig. 7 showing the adult stage of the same specimen). These results suggest that those skeletal elements are of minor taxonomic value, thus strongly supporting the idea proposed for *Trochocyathus* by

MILNE EDWARDS & HAIME. Therefore, BARON-SZABO (2002: 158–159, 2008: 55) grouped *Protrochocyathus* ALLOITEAU and *Paratrochocyathus* ALLOITEAU as younger synonyms of *Trochocyathus* MILNE EDWARDS & HAIME.

Regarding the relationship between *Trochocyathus* and *Tethocyathus*, BARON-SZABO (2008: 55) remarked:

> "The genus *Trochocyathus* has long been considered as lacking an epithecal wall. Re-examination of the type material of this genus, which consists of two syntypes, showed that, in general, an epithecal wall is not present (in the syntype figured in BARON-SZABO, 2002: Pl. 118, fig. 1, no epithecal wall seems to be present), but in the lower part of one of the two syntypes (the one figured in BARON-SZABO, 2002: Pl. 118, fig. 2) short strips of incomplete epithecal rings were observed. These short structures can be found only in a very few places, but they are wall developments sitting on top of the costae, which excludes them from being parts of the septothecal developments in this genus. Therefore, the generic diagnosis of *Trochocyathus* was emended in adding the statement "Epithecal wall absent or present" to the generic diagnosis.
>
> The genus *Tethocyathus* KÜHN, 1933, had been distinguished from *Trochocyathus* by the presence of both a narrow edge zone and an extensive epitheca (WELLS, 1956). Because the development of an epithecal wall is dependent on the presence of a narrow edge zone (pers. comm. S. CAIRNS 2008), it first of all means that the two genera are actually only distinguished by a single characteristic (= presence of a narrow edge zone). In addition, while it seems questionable whether the feature of a wide or narrow edge zone could be used to separate genera (pers. comm. S. CAIRNS, 2008), this distinguishing characteristic (= "epithecal wall absent in *Trochocyathus* but present in *Tethocyathus*") does not exist because the presence of an epithecal wall was observed in *Trochocyathus* (see remarks above)."

Austroalpine occurrences. *Gosau Group*: Turonian (Salzburg: Rußbach, Rußberg); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Upper Santonian–Campanian (Lower Austria: Neue Welt, Grünbach, Muthmannsdorf); Upper Santonian-Campanian (Lower Austria: Neue Welt, Muthmannsdorf, Linzgraben).

Cretaceous occurrences elsewhere. Upper Cretaceous of Germany and Romania, Campanian of Belgium and Hungary, Campanian–Maastrichtian of Tibet and Jamaica, Maastrichtian of the UAE/Oman border region, Madagascar, and Texas.

Genus *Smilotrochus* MILNE EDWARDS & HAIME, 1851b

Pl. 79, Figs. 1–2, 9–10

Type species. *Trochosmilia tuberosa* MILNE EDWARDS & HAIME, 1850 (= *Turbinolia compressa* MORRIS, 1843), Albian of England (Devonshire); original designation by MILNE EDWARDS & HAIME, 1851b.

Diagnosis. Solitary, trochoid or subturbinate, fixed. Costosepta compact, coarsely granulated laterally. Septa might be partially arranged in a pseudo-Pourtalés plan pattern. Columella absent but septal axial ends may fuse and form a pseudocolumella. Wall parathecal or septothecal. Endothecal dissepiments developed, but deep in corallum.

Synonyms. *Ceratosmilia* ALLOITEAU, 1957 (Type species. *C. arnaudi* ALLOITEAU, 1957, Lower Cenomanian of France [Charante-Maritime]); *Dungulia* OPPENHEIM, 1930b (Type species. *Coelosmilia milneri* GREGORY, 1898, Lower Eocene of Egypt (Dungul Wells); *Parasmiliopsis* ALLOITEAU, 1957 (Type species. *Trochosmilia cenomana* DE FROMENTEL, 1862, Cenomanian of France [Le Mans, Sarthe]).

Cretaceous species reported from the Alps. *S. costata* (DE FROMENTEL, 1862); *S. felixi* M. BEAUVAIS, 1982 (pro *Trochosmilia chondrophora* FELIX in OPPENHEIM, 1930a); *S. jacobi* ALLOITEAU, 1936 (= junior synonym of taxon *Coelosmilia* [= *Dungulia*] *milneri* GREGORY; see Remarks below. First report of the species for the pre-Gosau Brandenberg area, Tyrol).

Remarks. Because the material described from the Upper Campanian of the UAE/Oman-border region as *Smilotrochus jacobi* in GAMEIL (2005) has thecal and septal structures which appear to be rather closely related to the *Epistreptophyllum-Truncoconus*-group, it is excluded from the current work.

Regarding the taxon *Dungulia*, an extended discussion was recently provided (see BARON-SZABO (2008: 81):

> "GREGORY (1898) described the solitary species *Coelosmilia milneri* which, according to GREGORY (1898: 249), is distinguished from the genus *Smilotrochus* only by "less simple and less crowded septa", as well as "broader interseptal loculi". While it remains unclear what exactly GREGORY referred to as "simple" or "less simple" septa, respectively, the character of density of septa (GREGORY used the term "crowded septa", resulting in "narrower interseptal loculi") could be considered a specific but not a generic feature. Therefore, the species *Coelosmilia milneri* (type species of the genus *Dungulia*) is considered a species of *Smilotrochus*. Hence, because it is the type species of *Dungulia*, the latter represents a junior synonym of *Smilotrochus*.
>
> In creating the genus *Dungulia*, OPPENHEIM (1930b) used non-type material to prove and establish a relation to the dendrophylliid group of eupsammiids. Because in the original description of *Coelosmilia milneri*, GREGORY (1898) solely compared his new species with other caryophylliid species, a relation only with caryophylliid forms can be assumed. However, the presence of *Trochosmilia*-like septa (= rather thin, often finely granulated septa) which have the tendency to fuse was already documented by MILNE EDWARDS & HAIME (1850) and later included in the first generic description of *Smilotrochus* by MILNE EDWARDS (1857, vol. 2: 70). Especially in taxa of this genus which have flexuous septa, as already reported for the Maastrichtian form *Smilotrochus hagenowi* MILNE ED-

WARDS (1857, vol. 2: 71), the fusion of their axial ends can result in a septal pattern that resembles the dendrophylliid type" (compare specimens figured in BARON-SZABO, 2008: Pl. 7, figs. 5a and 6–8).

As previously indicated by KUZMICHEVA (1987b), the septal arrangement in *Smilotrochus* often shows a pseudo-dendrophylliid development (also compare BARON-SZABO, 2008: 80ff.). In addition, their axial septal ends might terminate in claviform, paliform-like, and/or irregularly trabecular extensions. Re-study of the (lecto-) type material of the type species of *Parasmiliopsis* (= the specimen that was described and illustrated by ALLOITEAU in 1957) by the author of the current work in 2009 revealed that it has skeletal structures that very closely correspond to those features. Therefore, its synonymy with *Smilotrochus* is suggested.

Austroalpine occurrences. *Pre-Gosau*: Cenomanian (Tyrol: Brandenberg area, Niederndorf at Hölzelsau); *Gosau Group*: Upper Turonian (Styria: Aussee, Weissenbachalm; Salzburg: St. Gilgen); Santonian (Upper Austria: Gosau, Obergeschröfpalfen).

Cretaceous occurrences elsewhere. Aptian of Greece, Turonian of Bulgaria, Lower Santonian of France, Upper Campanian–Lower Maastrichtian of Madagascar and Libya.

Genus *Conicosmilotrochus* TURNŠEK, 1978

Pl. 79, Figs. 5–6; Pl. 81, Figs. 1–5

Type species. *Conicosmilotrochus stranicensis* TURNŠEK, 1978, Santonian–Campanian of Slovenia (Stranice).

Diagnosis. Solitary, ceratoid, circular or flabellate in outline. Costosepta compact, granulated laterally. Columella absent, but septa may extend to the axial region and fuse, forming a pseudo-columella. Wall septothecal. Endothecal dissepiments absent.

Cretaceous species reported from the Alps. *C. dentatus* TURNŠEK, 1978; *C. stranicensis* TURNŠEK, 1978; *C. strictus* TURNŠEK, 1978.

Austroalpine occurrences. *Inner Dinarides* ("*Styrian Gosau Development*"): Santonian–Campanian of Slovenia (Stranice).

Cretaceous occurrences elsewhere. None reported.

Suborder Stylinina ALLOITEAU, 1952a

Diagnosis. Colonial. Budding predominantly extracalicinal, rarely intracalicinal. Polyps generally circular, wall parathecal or septothecal (latter often thickened by stereozone). Radial elements (septa or costosepta) always compact and consisting of simple trabeculae, arranged in a single series or in a divergent system. Distal septal margins have very delicate denticles, sometimes subobsolete or made of granulae. Lateral septal surfaces ornamented with granulae, which can be very delicate and are aligned parallel to the distal margin. Endotheca present, generally abundant and vesicular, sometimes tabulate. Peritheca nearly always present.

Family Stylinidae D'ORBIGNY, 1851

Diagnosis. Colonial; colony formation by intra- and extratentacular budding. Corallite walls septothecal, often thickened by stereome. Endotheca tabular when present, rarely vesicular. Septa (so far as is known) composed of a single fan system of simple trabeculae, with smooth upper margins and smooth or finely granulated lateral surfaces. Columella styliform, lamellar or absent.

Genus *Stylina* LAMARCK, 1816

Text-Fig. 20

Type species. *Stylina echinulata* LAMARCK, 1816, Sequanian (Jurassic) of France (Verdun).

Diagnosis. Colonial, massive, plocoid. Budding extracalicinal. Costosepta compact, laterally finely granulated. Costae confluent or nonconfluent. Columella styliform. Wall septothecal, paraseptothecal, parathecal. Synapticulae absent. Endothecal dissepiments tabular. Peritheca vesicular.

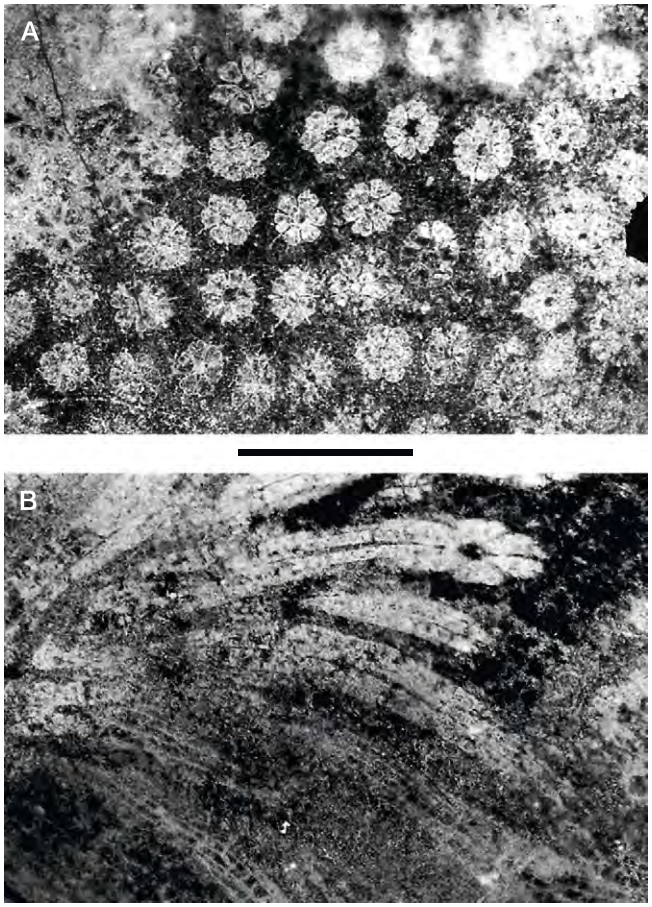
Synonyms. *Pseudocoenia* D'ORBIGNY, 1850 (Type species. *P. bernardiana* D'ORBIGNY, 1850, Jurassic of France); *Plesiostylina* ALLOITEAU, 1958 (Type species. *P. hourcqi* ALLOITEAU, 1958, Middle Jurassic of Madagascar); *Acanthocoenia* D'ORBIGNY, 1850 (Type species. *Acanthocoenia rathieri* D'ORBIGNY, 1850, Lower Cretaceous of France [Chenay]).

Cretaceous species reported from the Alps and Dinarides. *S. micropora* KOBY, 1896; *S. regularis* DE FROMENTEL, 1862.

Helvetic occurrences. Aptian of Switzerland (Canton of Schwyz) (Upper Schrattenkalk at Drusberg, Käsernalp; Morschfeld; Schwalmis); Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil).

Dinaric occurrences. *Northern Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica).

Remarks. D'ORBIGNY used the same species name to create *Enallhelia rathieri* D'ORBIGNY (1850, vol. 2: 91) and *Acanthocoenia rathieri* D'ORBIGNY (1850, vol. 2: 92). From his original descriptions it is clear that he was referring to generically different forms: *Enallhelia rathieri* is a branching form with external striations and *Acanthocoenia rathieri* D'ORBIGNY is a *Stylina* with a septal development in five systems and corallites slightly projecting as in *Phyllocoenia*. Because the latter features have been regarded as species-defining characteristics (like they have been for e.g. *Actinastrea*, *Agathelia*, *Placocoenia*, and many others), *Acanthocoenia* D'ORBIGNY is considered a junior synonym of *Stylina*.



Text-Fig. 20.
Stylina regularis DE FROMENTEL, 1862; Barremian–Aptian (Osojnica), Slovenia; A: thin section, cross view; scale bar: 5 mm; B: thin section, lateral view GeoSZ P–511; scale bar: 5 mm. Photographs courtesy D. TURNŠEK.

Regarding the genus *Pseudocoenia* D'ORBIGNY, see Remarks under *Cyathophora* MICHELIN.

Cretaceous occurrences elsewhere. Berriasian–Valanginian of Tibet, Hauterivian of Turkmenistan, Barremian of Georgia (in Caucasus) and Poland, Barremian–Aptian of France, Lower Aptian of Greece, Poland, and Romania, Aptian–Albian of Iran.

Genus *Heliocoenia* ÉTALLON, 1859

Pl. 81, Fig. 6

Type species. *Heliocoenia variabilis* ÉTALLON, 1859, Jurassic ("Dicerasian") of France.

Diagnosis. Colonial, plocoid. Budding extracalicinal. Corallites small, united by a flaky perithecal wall. Costosepta compact, arranged bilaterally. Auriculae present. Wall consists of a parathecal 'inner' wall and a septoparathecal 'outer wall' thickened by a stereozone. Columella short, lamellar. Endothecal dissepiments thin, vesicular to subtabulate.

Cretaceous species reported from the Alps. *H. carpathica* MORYCOWA, 1964.

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Gottesackerloch, Schwarzenberg Windecksattel, Mitteleck).

Remarks. Recently, LÖSER & FERRY (2006) transferred the taxon *Heliocoenia carpathica* to the genus *Stylina*. However, because the type material of the species *carpathica* differs from the genus *Stylina* in having, e.g., different perithecal developments (characteristic of *Heliocoenia*, see L. BEAUVAIS, 1994), the species *carpathica* is kept according to its original assignment.

Cretaceous occurrences elsewhere. Berriasian of Ukraine, Lower Barremian of Georgia (in Caucasus), Barremian of Poland, Barremian–Lower Aptian of eastern Serbia, Upper Barremian–Lower Aptian of France, Aptian–Albian of Iran, Albian of Georgia.

Family Cladophylliidae MORYCOWA & RONIEWICZ, 1990

Diagnosis. Colonial, phaceloid. Radial elements of septal type. Trabeculae branched, arranged in series. Diameter of main trabeculae from 50 to 90 µm. Thin secondary trabeculae expressed on septal surfaces in the form of sharp granulae. Inner septal edge ornamented with auriculae. Septotheca formed by well-developed and abortive septa. Columella essential. Intracalicinal budding through symmetrical division by septal wall.

Remarks. The authors of the family Cladophylliidae MORYCOWA & RONIEWICZ, 1990, consider the phaceloid growth form in *Cladophyllia* and *Apocladophyllia* a pseudocolonial development. However, because the individual polyps most likely are of the same genetical composition (as a result of intracalicinal budding) and because the polyps throughout their entire growth, remain a colony physically (branches develop from one first polyp and stay together like branches in a tree), the more traditional interpretation of phaceloid integration of the polyps as a colonial form is followed here.

Genus *Cladophyllia* MILNE EDWARDS & HAIME, 1851b

Pl. 81, Fig. 7; Pl. 82, Fig. 1–8; Pl. 83, Figs. 1–4

Type species. *Lithodendron dichotomum* GOLDFUSS, 1826, Upper Jurassic of Germany (Giengen) (see MILNE EDWARDS & HAIME, 1851b); subsequent designation by WELLS, 1933.

Diagnosis. Colonial, phaceloid, dendroid, subfasciculate. Corallites free, fused with walls, or connected by exothecal developments. Budding extracalicinal and intracalicinal by septal division with succeeding dichotomic forking of corallites. Extracalinical division results in branches standing off at an angle that is up to 90 degrees. Intracalicinal-septal division usually results in densely spaced branches which may or may not be connected by their walls and

exothecal developments. Symmetry radial or radiobilateral. Corallites subcircular in cross section. Calicular edge sharp, septa nonexsert. Septal faces with small and sharply pointed granulae. Inner edge with regular, auricular denticles. Interseptal anastomosis present. Costae present or absent. Columella monotrabecular, frequently fused with axial end of one septum. Endotheca composed of tabulate dissepiments (corallite center) and incomplete or complete ring of large peripheral dissepiments. Wall epithecal. Parathecal inner wall absent or present, sometimes secondarily thickened. Upper surface of corallite tubes are smooth or wrinkled. In places where epithecal wall is absent, upper surface is striated. Trabecular centers in septa between 30 and 80 µm in diameter.

Remarks. The first description given by MILNE EDWARDS & HAIME (1851b) was later revised by MORYCOWA & RONIEWICZ (1990) who provided a description of the type species, a discussion of the included species, and illustrations. Recently, LATHUILIÈRE (2000) provided a modern re-description, illustrations and a clarification of synonymy of the Lower Bajocian species *C. babeana* (D'ORBIGNY), representing stratigraphically the earliest known species of the genus. Based on re-investigations of the type material by the author of the current work, the diagnosis of the genus *Cladophyllia* is here emended accordingly.

Synonyms. *Cellulastraea* BLANCKENHORN, 1890 (Type species. *C. crenata* BLANKENHORN, 1890, Lower Aptian of Lebanon [Beirut]); ?*Apocladophyllia* MORYCOWA & RONIEWICZ, 1990 (Type species. *A. nowaki* MORYCOWA & RONIEWICZ, 1990, Upper Jurassic of Poland [Outer Carpathians]).

Cretaceous species reported from the Alps. *C. chaputi* (ALLOITEAU, 1939) in SCHOLZ (1984); *C. crenata* (BLANCKENHORN, 1890, described as *C.* cf. *rollieri* [KOBY, 1888] in BARON-SZABO [1997]).

Remarks. In having a corallite diameter of 2–3 mm and a number of septa corresponding to three complete or incomplete cycles in 6 systems, the material described as *C.* cf. *rollieri* (KOBY, 1888) from the "Allgäu Schrattenkalk" by BARON-SZABO (1997: 40, pl. 9, fig. 4) closely corresponds to the holotype of *C. crenata* (BLANCKENHORN, 1890) from the Lower Aptian of Lebanon. In *C. crenata*, the number of septa predominantly ranges between 14–18. In some corallites, three complete cycles of septa in 6 systems (24 septa) are present (in contrast to BLANCKENHORN'S diagnosis which mentions only a maximum number of 18 septa). The size of corallite diameters generally ranges between 2 and 3.2 mm (see Pl. 83, Figs. 1–4).

The systematic position of the genus *Cellulastraea* BLANCKENHORN, 1890, has long been discussed. Because of the presence of closely packed long individual corallites, it was believed to be a plocoid colony, belonging to the faviids or stylinids. Recently, it was grouped as a junior synonym of the genus *Stylina* (LÖSER et al., 2013: 11). Like BLANCKENHORN himself, FELIX (1913: 106–110) was of the opinion that this genus showed close affinities to forms of the *Cyphastrea-Solenastrea*-group. VAUGHAN & WELLS (1943: 174) interpreted it to be a junior synonym of *Solenastrea*, and WELLS (1956: F405) grouped it with *Montastraea*. However, investigations carried out by the author of the current work in 2013 revealed that by its thecal developments, *Cellulastraea* shows close affinities to the genus *Cladophyllia* EDWARDS & HAIME, 1851b. FELIX (1913) already pointed out such similarities, specifically referring to thecal developments seen in *Cladophyllia articulata* (MICHELIN). Because the holotype of the type species of *Cellulastraea* (*C. crenata*) is characterized by: 1) closely packed corallites in branching-phaceloid to subfasciculate integration; 2) has frequently but temporarily fused walls or is connected by exothecal developments (as seen e.g., in *C. minor* BEAUVAIS in NEGUS & BEAUVAIS, *C. conybearii* EDWARDS & HAIME, 1851b, and the type material of the type species of the genus *Cladophyllia* [*C. dichotoma*]); 3) has compact septa that have small and sharply pointed granulae; 4) shows tabulate endothecal dissepiments in the corallite center and seems to have large vesicular ones in the peripheral areas; 5) has a mainly styliform to sublamellar columella (not mentioned by BLANCKENHORN); 6) shows polyps in the process of septal division by fusion of opposite septa (typical of *Cladophyllia*; absent in *Stylina*); and 7) bears thecal developments which correspond to the type species of the genus *Cladophyllia*, *C. dichotoma* (see Pl. 82, Figs. 1–8), the genus *Cellulastraea* is considered synonymous with *Cladophyllia*.

Helvetic occurrences. Berriasian of Switzerland (Canton of Uri, Oehrli Formation); Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Mitteleck, Upper Gottesackerwände, Kürenwald, Höflewald, Mahdtal, Lower Gundalpe).

Cretaceous occurrences elsewhere. Lower Aptian of Lebanon.

Family Cyathophoridae VAUGHAN & WELLS, 1943

Diagnosis. Ramose or plocoid, rarely cerioid. Colony formation by extratentacular budding. Septa rarely in more than 2 cycles, slightly exsert. No columella. Endothecal dissepiments thin and tabulate. Coenosteum vesicular or tabular, surface spinose.

Genus *Cyathophora* MICHELIN, 1843

Pl. 83, Fig. 5

Type species. *Cyathophora richardi* MICHELIN, 1843, Upper Jurassic of France.

Diagnosis. Colonial, massive, plocoid; cerioid in areas of closely spaced corallites. Budding extracalicinal. Corallites circular to subpolygonal in outline, separated by a narrow costate peritheca. Costosepta compact, generally nonconfluent to subconfluent, occasionally confluent, radially arranged. Sizes of septa range from very short (less of a quarter of the lumen size) to half the lumen size, in which case septa reach the axial region where they sometimes fuse. Axial ends of S1 are vertically discontinuous. No columella. No synapticulae. No pali. Endothecal and exothecal dissepiments tabulate, well-developed. Wall parathecal and septothecal.

Synonyms. *Cyathophoropsis* ALLOITEAU, 1947 (Type species. *C. hupei* ALLOITEAU, 1947, Aptian [Gargasian] of Spain [Aragon,

Huesca]); *Pentacoenia* D'ORBIGNY, 1850 (Type species. *P. elegantula* D'ORBIGNY, 1850: Lower Hauterivian of France [Fontenoy, Yonne]); *Cryptocoenia* D'ORBIGNY, 1849 (Type species. *Astrea alveolata* GOLDFUSS, 1826, Upper Jurassic of Germany [Heidenheim]).

Cretaceous species reported from the Alps and Dinarides. *C. haysensis* WELLS, 1932; *C. miyakoensis* (EGUCHI, 1936); *C. pulchella* (D'ORBIGNY, 1850); *C. steinmanni* (FRITSCHE, 1924); *C. pygmaea* VOLZ, 1903.

Remarks. Recent re-study of the holotype of the type species of *Cryptocoenia* D'ORBIGNY by BARON-SZABO (2002: 184, pl. 127, fig. 5) revealed that it showed the following characteristics: Colonial, massive, plocoid; budding extracalicinal; costosepta compact, confluent to nonconfluent, arranged in varying systems (in juvenile stages 5 and 6; in adult stages 6 and 8), finely granulated laterally; columella absent; wall parathecal to septoparathecal; endothecal dissepiments vesicular to subtabulate. Because in *Pentacoenia* all these characteristic are present, it is considered a synonym of *Cryptocoenia*. Furthermore, according to LATHUILIÉRE (pers. comm; 2013), *Cryptocoenia* represents a junior synonym of *Cyathophora*, which, consequently places *Pentacoenia* in the synonymy of *Cyathophora* as well.

In 1850, D'ORBIGNY established the genus *Pseudocoenia* as a '*Cryptocoenia* with a septal development in 8 systems'. Because he did not assign a type specimen, WELLS (1936) designated a lectotype which, however, turned out to have all characteristics of the genus *Stylina* LAMARCK. Moreover, re-examination of the type material of *Cryptocoenia* D'ORBIGNY (BARON-SZABO, 2002: Pl. 127, fig. 5) shows that it has confluent to nonconfluent septa arranged in varying systems, thus overlapping with the generic concepts of the younger taxa *Pseudocoenia* D'ORBIGNY, 1850 and *Orbignycoenia* ALLOITEAU, 1948. Therefore, BARON-SZABO (2002: 184) concluded that many specimens described as *Pseudocoenia* D'ORBIGNY and *Orbignycoenia* ALLOITEAU most likely belong to the genus *Cryptocoenia* D'ORBIGNY, which has been assigned to the genus *Cyathophora* (see Remarks section above).

According to ALLOITEAU (1957: 200), *Cyathophoropsis* differs from *Cyathophora* in having intercalicular pillars. However, re-investigation of the type material of the type species (MNHN, Paris, R.10884) by the author of the current work in 2009 revealed that it showed no noticeable developments of intercalicular pillars, thus very closely corresponding to *Cyathophora*.

Remarks on *Pseudocoenia*. While, from the nomenclatural point of view, the genus *Pseudocoenia* represents a problematic case (see Remarks above), it has been in continuous use by several authors, who have separated *Pseudocoenia* from the *Cyathophora*-group by the presence of longer septa which are both a little more ornamented and vertically continuous (pers. comm., RONIEWICZ & LATHUILIÉRE, 2013). In having the latter characteristics, the genus *Pseudocoenia* might be closely related to the genus *Solenocoenia* RONIEWICZ & GILL in RONIEWICZ, 1976 (Type species. *Convexastrea semiradiata* ÉTALLON in THURMANN & ÉTALLON, 1864, Upper Jurassic of Switzerland [see RONIEWICZ, 1976]). Currently, the genus *Pseudocoenia* remains under investigation by the working group of Bernard Lathuiliére (see coralloSphere.org). In addition, the proposal regarding conservation of usage of the genus *Pseudocoenia* by the designation of a lectotype for the type species has been submitted to the commission of the ICZN. Until the commission has reached a decision, the genus is, in accordance with nomenclatural rules, considered as a junior synonym of *Stylina*.

Remarks on *Solenocoenia*. As pointed out above, *Solenocoenia* RONIEWICZ & GILL, in RONIEWICZ, 1976, shows close affinities to the genus *Pseudocoenia*. Macroscopically, however, *Solenocoenia* shows the very peculiar feature of corallites that are connected by a canal system that is horizontal to the surface of the colony. Investigations carried out by LAUXMANN (1991: 116) on over 100 specimens of the taxon *Astrea sexradiata* GOLDFUSS, 1829, which is structurally closely related to the type species of the genus *Solenocoenia*, revealed, however, that such canal developments occur very irregularly. According to LAUXMANN, in some colonies such developments are largely present, in others their occurrence is restricted to some parts of the colony, and are completely missing in yet other specimens. Based on re-investigations of some specimens of the same material in 2013, the author of the current work came to the same conclusions. These observations point to the idea that such canal developments might be the result of environmental influences like sediment-influx or parasitic infestation rather than a genetically controlled feature. For a different opinion see RONIEWICZ (1976).

Helvetic occurrences. Upper Barremian of southern Germany (Lower Schrattenkalk at Allgäu); Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Brandalpe, Falkenberg, Lower Gundalpe).

Dinaric occurrences. *Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica); ("*Patch reef Development*"): Barremian–Aptian of Slovenia (Slovenski vrh, near Kočevje); ("*Carbonate shelf*"): Barremian–Aptian of Slovenia (Banjška Planota).

Cretaceous occurrences elsewhere. Lower Cretaceous of Japan, Valanginian of Kazakhstan, Hauterivian–Barremian of Georgia (in Caucasus) and Chile, Hauterivian–Lower Aptian of Poland, Barremian of Azerbaijan, Turkmenistan, and Bulgaria, Barremian–Lower Aptian of eastern Serbia, France, and Romania, Aptian of Tibet, Lower Aptian of Greece, Aptian–Albian of Mexico, Aptian–Albian of Spain, Iran, Hungary, and Venezuela, Middle Albian of Texas, Cenomanian of Germany.

Family Agatheliidae L. & M. BEAUVAIS, 1975

(= Ficariastraeidae M. BEAUVAIS, 1982;
= Hemiporitidae ALLOITEAU, 1952a p.p.)

Diagnosis. Colonial, massive, plocoid. Budding mainly extracalicinal. Costosepta compact, radially or bilaterally arranged. Distal septal margin covered with small subequal denticles. Septal flanks ornamented with spiniform granulae aligned in a row that lies perpendicular to the distal margin. Auriculae-like structures irregularly present. Columella feebly or well-developed, very variably shaped, often parietal-spongy or lamellar. Endothecal dissepiments vesicular to subtabulate. Exothecal dissepiments vesicular, abundant. Wall septothecal or septoparathecal. Concen-

tric perithecal lamellae covering the corallite wall present or absent. Perithecal sheets with granulate surface that are separated by vesicular dissepiments well-developed or absent. When developed, their microstructural features correspond to the kinds seen in *Heliocoenia* ÉTALLON.

Genus *Agathelia* REUSS, 1854

Pl. 83, Figs. 6–9; Pl. 84, Figs. 1–7

Type species. *Agathelia asperella* REUSS, 1854, Upper Santonian of Austria (Neffgraben, Gosau Group).

Diagnosis. Colonial, massive, plocoid. Budding mainly extracalicinal. Costosepta compact, radially or bilaterally arranged. Distal septal margin covered with small subequal denticles. Septal flanks ornamented with spiniform granulae aligned in a row that lies perpendicular to the distal margin. Auriculae-like structures irregularly present. Columella feebly or well-developed, very variably shaped, often parietal-spongy or lamellar. Endothecal dissepiments vesicular to subtabulate. Exothecal dissepiments vesicular, abundant. Wall septothecal or septoparathecal. Concentric perithecal lamellae covering the corallite wall present or absent. Perithecal sheets with granulate surface that are separated by vesicular dissepiments well-developed or absent. When developed, their microstructural features correspond to the kinds seen in *Heliocoenia* ÉTALLON.

Synonyms. *Phyllastraea* DE FROMENTEL, 1879 (= *Ficariastraea* ALLOITEAU, 1952a) (Type species. *Phyllastraea hippuritorum* DE FROMENTEL, 1879, Upper Santonian of France [Figuières]); *Cenomanina* ALLOITEAU, 1952a (Type species. *Rhabdocora exiguis* DE FROMENTEL, 1877, Cenomanian of France [Le Mans, Sarthe]); *Placophora* DE FROMENTEL, 1870 (Type species. *P. neocomiensis* DE FROMENTEL, 1870, Lower Hauterivian of France [Haute-Marne]); *Pseudoheliastraea* ALLOITEAU, 1965 (Type species. *P. charollasi* ALLOITEAU, 1965, Barremian–?Lower Aptian of France [Bargy, Haute-Savoie]); *Hemiporites* ALLOITEAU, 1952a (Type species. *H. jacobi* ALLOITEAU, 1952a, Turonian of France).

Cretaceous species reported from the Alps. *A. asperella* REUSS, 1854 (= *A. urgonica* DIETRICH, 1926); *A. dendroides* (OPPENHEIM, 1930a); *A. edelbachensis* (M. BEAUVAIS, 1982).

Austroalpine occurrences. *Gosau Group*: Turonian–?Coniacian (Salzburg: St. Gilgen, Kohlbachgraben, "Billroth"); Lower Coniacian (Tyrol: Brandenberg, Haidach); Coniacian (Salzburg: Rußbach, Streidegg-Graben); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt; Upper Austria: Gosau, Hofergraben [= Sattelgraben]); Santonian (Upper Austria: Hochmoos-Rußbach-area; Grabenbach, Oberstöckl, Stöcklwaldgraben; Salzburg: Rußbach, Zimmergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben, Traunwandalm, Schattauergraben, Abtenau, Rigausbach; Upper Austria: Gosau, Schrickpalfen, Brunstloch, Gschröfpalfen, Wegscheidgraben); Upper Santonian–Lower Campanian (Lower Austria: Baden, Einöd quarry).

Remarks. According to BEAUVAIS & BEAUVAIS (1975: 577), the type material of *Agathelia asperella* was lost. Therefore, they created a neotype using a specimen of the REUSS collection housed at the Geological Survey of Austria (GBA) in Vienna. The specimen marked as neotype was presented in BEAUVAIS & BEAUVAIS (1975, Pl. 1, Fig. 2, pl. 2, Figs. 1–2), and later again documented in M. BEAUVAIS (1982, vol. 4: pl. 51, fig. 7, pl. 62, figs. 1–2) and BARON-SZABO (2002: pl. 129, figs. 3–4). However, in the years subsequent to the neotype designation, syntypes were found in the collections of the Natural History Museum, Vienna.

Recently, LÖSER (2008) grouped the taxon *Agathelia urgonica* DIETRICH, 1926, with the genus *Stylina*. Re-investigation of the type material of the DIETRICH collection housed in the Natural History Museum Berlin ("Humboldt Museum") by the author of the current work in 2009, however, confirmed earlier assignments in that the material shows all characteristics of *Agathelia*, closely corresponding to material of the species *asperella*. Therefore, it has been considered a junior synonym of *A. asperella* (BARON-SZABO, 2000: 108, 2008: 200).

Re-study of the holotype of the type species of *Pseudoheliastraea* ALLOITEAU (A30253 at MNHN, Paris) by the author of the current work in 2009 revealed that it is characterized by: plocoid to (sub-) fasciculate polyp integration; a well-developed perithecal wall, consisting of concentric lamellae; variably developed but mainly lamellar columella; extracalicinal budding; well-developed vesicular exotheca; thus very closely corresponding with the genus *Agathelia* REUSS. Therefore, their synonymy is suggested.

Because *Phyllastraea* DE FROMENTEL represents a junior homonym of *Phyllastraea* DANA, ALLOITEAU (1952a) created the genus name *Ficariastraea* for the former. M. BEAUVAIS (1982, vol. I: 246) provided a more detailed description of the genus *Ficariastraea*. Based on 1) the original documentation in DE FROMENTEL (1879); 2) the subsequent description given by M. BEAUVAIS (1982); and 3) study of original and type material from Gosau localities, it was suggested that *Ficariastraea* represented a junior synonym of *Agathelia* REUSS, 1854 (BARON-SZABO, 2002: 187; BARON-SZABO, 2003a: 118; also see following Remarks).

Recently, LÖSER (2012d) carried out a revision on the family Hemiporitidae ALLOITEAU. He presented images of the holotype of the type species of *Hemiporites* ALLOITEAU, according to which this genus is characterized by: 1) plocoid polyp integration; 2) extracalicinal budding; 3) compact costosepta, that are radially or bilaterally arranged; 4) septal flanks that have generally spiniform granulae; 5) a columella that is lamellar or very feebly developed parietal-spongy; 6) vesicular to subtabulate endothecal dissepiments; 7) numerous vesicular exothecal dissepiments; 8) septothecal wall with the occasional occurrence of stunted septa; and 9) fragments of concentric perithecal lamellae covering corallite wall present in a few places. In *Agathelia*, septal developments include both thin and delicate septa with trabeculae ranging from mini- (up to 50 µm) to medium-size (up to 80 µm) and thick septa which consist of trabeculae clusters that often range between 100–150 µm (BARON-SZABO, 1997: 35, pl. 1, figs 1, 3, 5; 2003a: 118, pl. 4, figs 7, 8; also see images on Pls. 83 and 84). In some colonies, septa of the more fragile types dominate (more closely corresponding to *Ficariastraea*, see e.g., BARON-SZABO, 2003a: Pl. 4, fig. 7; also see Pl. 84, Figs. 6–7), in others, septa of all trabecular developments occur (BARON-

SZABO, 1997: Pl. 1, figs. 1, 5, 2003a: Pl. 4, fig. 2; also see images of syntype on Pl. 84). In contrast to the statements by L. & M. BEAUVAIS (1975), and M. BEAUVAIS (1982), in *Agathelia* thick perithecal developments occur highly irregularly and are largely absent even in some corallites in the syntypes of the type species of this genus. Because such thecal thickenings are often seen in specimens which are known from rather bioclastic facies, whereas forms having thin, *Hemiporites*-like wall structures are found in low-energy environments (see e.g., Pl. 84, Fig. 7), these features are interpreted to be largely environmentally determined. Furthermore, as previously pointed out by OPPENHEIM (1930a), the appearance of thin, parathecal to septothecal walls also frequently occur in corallites that were formed by extracalicinal budding. Because closely corresponding features are found in the genus *Hemiporites*, which also include intercorallite areas that are partially covered by a granulate coenosteum, it is grouped with *Agathelia*.

Cretaceous occurrences elsewhere. Berriasian–Valanginian of Tibet, Valanginian–Hauterivian of Crimea, Upper Aptian of Tanzania, Albian–Cenomanian of Tibet, Upper Cenomanian of the Czech Republic, Senonian of Slovakia and Armenia, Campanian of Spain, Maastrichtian of the UAE.

Genus *Reussicoenia* M. BEAUVAIS, 1982

Pl. 84, Figs. 8–9

Type species. *Ulastrea edwardsi* REUSS, 1854, Senonian of Austria (Gosau Group).

Diagnosis. Colonial, massive, plocoid. Budding extracalicinal and extracalicinal-marginal. Costosepta compact, nonconfluent, arranged radially and bilaterally, spinose laterally, moniliform marginally. Columella spongy-papillose or formed by twisted segments. Synapticulae absent. Perithecal dissepiments sparse. Endothecal dissepiments vesicular, forming a stereozone. Wall parathecal (-septoparathecal), thick.

Cretaceous species reported from the Alps. *R. edelbachensis* M. BEAUVAIS, 1982; *R. edwardsi* (REUSS, 1854); *R. michelini* M. BEAUVAIS, 1982; *R. salisburgensis* M. BEAUVAIS, 1982.

Austroalpine occurrences. *Gosau Group*: Upper Turonian–Campanian (Upper Austria: Gosau basin); Upper Turonian (Styria: Gams-Hieflau); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Santonian (Salzburg: Rußbach, Zimmergraben; Salzburg-Bavaria region: „Krönner Reef“ area); Upper Santonian (Salzburg: Rußbach, Neffgraben; Upper Austria: Gosau, Wegscheidgraben).

Remarks. Originally, the genus *Reussicoenia* was placed in the Placocoeniidae. Re-investigation of the type material by the author of the current work in 2010 revealed, however, that it showed close affinities to the Family Agatheliidae. Based on the presence of: compact septa that have numerous spiniform granulae laterally and are beaded marginally; granulated peritheca formed by (incomplete) concentric lamellae; plocoid polyp integration; and septothecal developments that often consist of stunted septa, the genus *Reussicoenia* is here transferred to the family Agatheliidae.

Cretaceous occurrences elsewhere. Upper Cretaceous of Germany, Campanian of Serbia and Montenegro, Campanian–Maastrichtian of Tibet, ?Maastrichtian of Spain, Middle–Upper Maastrichtian of Jamaica.

Suborder Amphiastreina ALLOITEAU, 1952a

Diagnosis. Solitary and colonial. Wall is pachythecaliine (originally described as ‘archaeothecal’, see Remarks below). Septa arranged bilaterally, formed by simple, very small trabeculae aligned in a single row. Upper septal margins dentate, lateral surfaces granulate. Endothecal dissepiments tabulate (axially) and/or vesicular (peripherally). Budding extracalicinal and intracalicinal (septal devision and ‘Taschenknospung’).

Remarks. The term ‘archaeotheca’ was created by ALLOITEAU (1952a) to describe the transversely folded septo-dissepimental wall of the amphiastreids and other groups. Because this coral group does not develop a septo-dissepimental wall and, moreover, structurally different walls were later described using the term archaeotheca, STOLARSKI (1995) and RONIEWICZ & STOLARSKI (1999) proposed that this term be rejected as imprecisely established and confusing. They (RONIEWICZ & STOLARSKI, 2001) later described for the amphiastreids a pachythecaliine wall (= thick wall built of radially oriented equal-sized fascicles of fibers) (see Remarks under the family Amphiastreidae). A review on microstructural and taxonomical issues of the suborder Amphiastreina was provided by KOŁODZIEJ (1995).

Family Amphiastreidae OGILVIE, 1897

Diagnosis. Solitary and colonial, hermatypic. Epitheca present. Septa nonexsert, arranged bilaterally, margin smooth or finely dentate. One larger septum generally projects into the axial space. Outer ends of septa may be free from the corallite wall. Endothecal dissepiments well-developed, vesicular in peripheral regions, becoming tabulate toward the inner region of the corallite.

Remarks. The taxonomic position of the family Amphiastreidae OGILVIE has long been discussed. VAUGHAN & WELLS (1943) placed it in the suborder Caryophylliina VAUGHAN & WELLS, 1943. ALLOITEAU (1952a) transferred the family to his newly created suborder Amphiastreina, and WELLS (1956) grouped it in the suborder Faviina VAUGHAN & WELLS (1943). Later, KOŁODZIEJ (1995) expanded the definition of the suborder Amphiastreina which resulted in fusing this suborder with the suborder Heterocoeniina M. BEAUVAIS, 1977. The enlarged suborder contained the families Amphiastreidae OGILVIE, 1897, Donacosmiliidae KRASNOV, 1970, Carolastraeidae ELIÁŠOVÁ, 1976, Intersmiliidae MELNIKOVA & RONIEWICZ, 1976, and Heterocoeniidae OPPEN-

HEIM, 1930a. Based on recent cladistic analysis of amphiastreid groups, RONIEWICZ & STOLARSKI (2001) emended the diagnosis of the family Amphiastreidae OGILVIE by adding the characteristic of a pachythecaliine wall (= thick wall built of radially oriented equal-sized fascicles of fibers) and transferred the family to the suborder Pachythecaliina ELIÁŠOVÁ. For a discussion regarding relationships between amphiastreids, pachythecaliine, and rhipidogyrid groups see KOŁODZIEJ (2003).

Genus *Amphiaulastrea* GEYER, 1955b

Pl. 85, Figs. 1–3

Type species. *Aulastrea conferta* OGILVIE, 1897, Tithonian (Upper Jurassic)–Berriasian (Lower Cretaceous) of the Czech Republic (Štramberk) (see GEYER, 1955b).

Diagnosis. Colonial, massive, cerioid. Budding due to 'Taschenknospung'. Calices generally circular, embedded in vesicular dissepimental (coenenchymal) structures. Inner wall generally parathecal, often thickened by stereozone. Small number of corallites united laterally, covered by a shared wall. Radial elements (septa or costosepta) always compact and consist of simple trabeculae arranged in a single series or in a divergent system. S1 septa thicker than younger ones with columellar septum being the most dominant. Distal septal margins with very delicate denticles, sometimes subobsolete or granular. Lateral septal surfaces ornamented by granulae, which can be very delicate and are aligned parallel to the distal margin. Endotheca generally abundant and vesicular, sometimes tabulate (axial region of the corallite). Pachythecal external wall thick. This genus has characteristics of the genera *Amphiastrea* and *Aulastrea*.

Cretaceous species reported from the Alps. *A. conferta* (OGILVIE, 1897) in BARON-SZABO (1997); *A. rarauensis* (MORYCOWA, 1971).

Remarks. LÖSER (2008: 56) carried out a revision involving the genera *Amphiaulastrea* GEYER, 1955b, *Metaulastraea* DIETRICH, 1926, and *Pleurostylina* DE FROMENTEL, 1861. According to him, *Metaulastraea* DIETRICH, 1926, differed from the genus *Pleurostylina* DE FROMENTEL, 1861, in lacking a very prominent, thick, and rhopaloid main septum, but showed all characteristics of *Amphiaulastrea* GEYER, 1955b. Therefore, in accordance with the rule of priority, he grouped the latter as a junior synonym of *Metaulastraea* DIETRICH, 1926. Re-study of type and original material of all three genera housed at both the MNHN (Paris) (see BARON-SZABO, 2002, pl. 137, figs. 1–2 and 4), the Bavarian State Collection for Palaeontology and Geology (BSPG), and the Natural History Museum Berlin ("Humboldt Museum") (MB, Berlin) by the author of the current work during the years 1999 and 2009 revealed, however, that *Metaulastraea* DIETRICH differed from *Amphiaulastrea* GEYER in lacking a wide dissepimentarium, but showed skeletal structures that are identical to *Pleurostylina* DE FROMENTEL. In the type material of *Metaulastraea* a rather prominent main septum can be observed in some corallites when viewed in thin section, closely corresponding to the kind seen in *Pleurostylina*. It should be noted that in thin sections of the type material of both genera a main septum is not always visible, indicating that this character is highly variable. In addition, budding by 'Taschenknospung', which in *Metaulastraea* takes place by cutting off almost in a symmetrical fashion the corallite side that is opposite to the one with the main septum (a feature typically seen in *Pleurostylina* and similar to the kind seen in *Pleurophyllia*) can also be observed in the type material of *Metaulastraea*. In contrast, in *Amphiaulastrea* increase by 'Taschenknospung' seems to occur in a rather irregular manner, including both irregular separation of corallite centers and development of new corallites inside the dissepimentarium. Therefore, *Metaulastraea* DIETRICH is considered a junior synonym of *Pleurostylina* DE FROMENTEL and the genus *Amphiaulastrea* GEYER is kept as a valid taxon.

Helvetic occurrences. Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Brandalpe, Upper Gottesackerwände); Lower Aptian of central Switzerland (Upper Schrattenkalk at Hergiswil).

Cretaceous occurrences elsewhere. Cretaceous of Slovenia, Valanginian–Barremian of Turkmenistan, Barremian of Azerbaijan, Bulgaria, and Ukraine, Lower Aptian of Greece and Romania.

Text-Fig. 21.
Sketch of *Pleurophyllia tobleri* (KOBY, 1896), based on the illustration of the holotype in KOBY (1898: Pl. 7, Fig. 5); upper surface of colony; Berriasian of Switzerland (Canton of Uri, Oehrli Formation); scale bar: 10 mm.

Genus *Pleurophyllia* DE FROMENTEL, 1856

Pl. 85, Fig. 4; Text-Fig. 21

Type species. *Pleurophyllia trichotoma* DE FROMENTEL, 1856, Upper Jurassic of France (Mantoche).

Diagnosis. Colonial, phaceloid. Budding intracalicinal. Septa compact, smooth lateral, arranged bilaterally. One major septum extends to the axial region of the corallite. Septal cycles indistinct. Costae and columella absent. Endothecal dissepiments thin. Multilamellate ?epithecal wall present.

Cretaceous species reported from the Alps. *P. minuscula* RONIEWICZ, 1976; *P. tobleri* (KOBY, 1896); ?*P.* sp. 1 and 2, in BARON-SZABO (1997).

Helvetic occurrences. Berriasian of Switzerland (Canton of Uri, Oehrli Formation); Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Seealpe, Mitteleck, Mahdtal).

Austroalpine occurrences. *Gosau Group*: ?Lower Coniacian (Tyrol: Brandenberg, Haidach).

Cretaceous occurrences elsewhere. Upper Aptian of ?Spain, Cenomanian of ?Germany.

Family Heterocoeniidae Oppenheim, 1930a

(= Baryheliidae M. Beauvais, 1977; = Pachycoeniidae M. Beauvais, 1977; = Paronastraeidae M. Beauvais, 1977; = Aulastraeoporidae Alloiteau, 1957)

Diagnosis. Colonial. Budding generally extracalicinal, rarely intracalicinal (septa division), or due to 'Taschenknospung'. Septa formed by small trabeculae, dentate laterally, bilateral or radial. Lonsdaleoid septa present or absent. Columella generally absent. Endothecal dissepiments vesicular, developed in one or two zones. Exothecal dissepiments large, vesicular or tabulate, well developed, generally dense.

Heterocoenia - Latusastrea - group

Remarks. The genera *Heterocoenia* and *Latusastrea* represent forms that have been traditionally kept separate mainly with regard to the type of 1) polyp integration which in *Heterocoenia* is believed to be generally plocoid vs. generally cerioid and 'pocket-like' in *Latusastrea*; 2) thecal developments which in *Heterocoenia* and its related forms are believed to include various types of septotheca or pachytheca (depending on author) vs. septothecal or parathecal (depending on author). However, re-investigation by the author of the current work of the type material of the type species of both genera as well as additional species assigned to them revealed that 1) they show identical budding types; 2) have septal developments showing the same variation regarding their radial or bilateral arrangement in septal systems; and 3) have the same variation regarding their thecal developments, whereby forms that macrostructurally correspond to one genus have thecal developments that are also found in specimens that have been designated as type material of genera like e.g., *Heterocoenia*, *Pachycoenia*, and *Canleria*. All of these genera have a septothecal to parathecal wall consisting of (mainly) trabeculae with calcification centers ranging between 50 and 150 µm. This is well illustrated when comparing *Heterocoenia* sp. in Morycowa & Marcopoulou-Diacantoni, 2002: 17, figs. 11A–B vs. *Latusastrea exiguis* in Morycowa, 1980: Pl. 9; and viewing the form *Heterocoenia verrucosa* in Baron-Szabo (1998) which combines structures of *Heterocoenia* and *Latusastrea*. Regarding their types of polyp integration, subplocoid to cerioid types develop depending on both type and frequency of budding in combination with an environment, in which they tend to form small knobby or submassive to lamellar-encrusting morphotypes (Morycowa et al., 1995; Baron-Szabo, 1997). Fasciculate to subbranching types often occur in subtidal soft-bottom environments like the ones characteristic of the Gosau Group (Felix, 1903a; Oppenheim, 1930a; M. Beauvais, 1982; Baron-Szabo, 1997, 2003a), whereby the "nest-shape" of the corallites that is considered to be characteristic of *Latusastrea* rather corresponds to a variation of the fasciculate morphotype which is also seen in some forms traditionally considered to belong to *Heterocoenia*. Therefore, these genera should be considered synonymous. In the following, the two taxa are being treated as morphogenera, whereby forms are grouped with *Heterocoenia* based on their predominantly plocoid to subfasciculate growth. Forms which predominantly appear in cerioid to variably polygonal in outline are kept with *Latusastrea*.

Diagnosis. Colonial massive, foliaceous, or ramose, plocoid, cerioid, fasciculate; subphaceloid when exothecal developments reduced. Budding extracalicinal, extracalicinal-marginal, and intracalicinal by septal division. Corallites circular to elongate or irregularly polygonal in outline. They are directly united by their walls, or separated by extensive vesicular to dense coenosteum, or loosely connected by fragments of exotheca in form of traverses. Septa compact, arranged in various symmetries (e.g., trimerally, hexamerally, bilaterally, indistinct). One main septum, with remaining septa sometimes reduced to rudimentary spines. Costate zone present, weakly developed, or absent. Colony surface granulated or smooth. Columella absent. Endothecal dissepiments thin, vesicular to subtabulate. Exothecal dissepiments large vesicular, sometimes reduced. Wall thick, septothecal, parathecal, pachythecal. Microstructure of wall and septa mainly consists of simple trabeculae. Diameter of simple trabeculae mainly 20–60 µm in septa, up to around 150 µm in wall. Corallite wall tends to become more flaky, bubbly, and disintegrated during the process of budding.

Genus *Heterocoenia* Milne Edwards & Haime, 1848d

Pl. 85, Fig. 6; Pl. 86, Figs. 1–5, 11; Pl. 87, Figs. 1–2

Type species. *Lithodendron exiguum* Michelin, 1847, Santonian of France (see Milne Edwards & Haime, 1848d).

Morphogenic Diagnosis. Massive, ramose, or subfasciculate, plocoid to subcerioid; fasciculate, sometimes forming subbranching types with corallite tubes connected by exothecal traverses (as in e.g., *Bacillastraea*).

Synonyms of *Heterocoenia*. *Bacillastraea* Quenstedt, 1881 (Type species. *Gorgonia bacellaris* Goldfuss, 1826, Upper Maastrichtian of The Netherlands); *Cyclocoenia* d'Orbigny, 1849 (Type species. *C. rustica* d'Orbigny, 1849, Lower Cenomanian of France [Charante-Maritime]); *Hexasmilia* De Fromentel, 1870 (Type species. *H. ferryi* De Fromentel, 1870, Santonian of France); *Trinacis* Quenstedt, 1880 (Type species. *Stylina provincialis* Michelin, 1841, Upper Cretaceous of France [Angoumien, Uchaux]); *Miyakosmilia* Eguchi, 1936 (Type species. *M. densa* Eguchi, 1936, Lower Cretaceous of Japan [Hiraiga sandstone]).

Cretaceous species reported from the Alps. *H. bacellaris* (Goldfuss, 1826); *H. costata* Felix, 1903a; *H. crassolamellata* (Michelin, 1841); *H. dendroides* Reuss, 1854; *H. erecta* Felix, 1903a; *H. excentrica* De Fromentel, 1879; *H. exigua* (Michelin,

1847); *H. garumnica* VIDAL, 1921; *H. hilli* WELLS, 1932; *H. ocu–linaeformis* FELIX, 1903a; *H. pachypleura* M. BEAUVAIS, 1982; *H. provincialis* (MICHELIN, 1841) (pro *Heterocoeniopsis* ALLOITEAU, 1952a); *H. reussi* MILNE EDWARDS, 1857; *H. subramosa* REIG ORIOL, 1994; *H. verrucosa* REUSS, 1854.

Austroalpine occurrences. *Gosau Group*: Upper Turonian (Upper Austria: Wolfgangsee, Sankt Wolfgang; Salzburg: St. Gilgen; Tyrol: Brandenberg, Oberberg, Kreuthergraben, Sonnwendjoch); Lower Coniacian (Salzburg: Strobl, St. Wolfgang, "Theresienstein"; Tyrol: Brandenberg, Haidach); Coniacian (Tyrol: Ludoi Alp [= Pletzach Alp]); Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Santonian (Salzburg: Rußbach, Stöcklwaldgraben, Zimmergraben); Upper Santonian (Lower Austria: Neue Welt, Piesting, Scharrergraben; Salzburg: Rußbach, Neffgraben; Upper Austria: Gosau, Schrickpalfen, Brunstloch, Wegscheidgraben).

Cretaceous occurrences elsewhere. Cretaceous of Slovenia, Barremian–Aptian of Bulgaria, Aptian of Greece, Lower Albian of Mexico, Lower Cenomanian of Spain, Turonian–Santonian of France, Santonian of Armenia, Upper Santonian–Lower Campanian of Romania, Santonian–Maastrichtian of Spain, Campanian of Serbia, Lower Maastrichtian of Mexico, Upper Maastrichtian of The Netherlands.

Genus *Latusastrea* D'ORBIGNY, 1849

Pl. 85, Fig. 5; Pl. 86, Figs. 6–10, 12

Type species. *Explanaria alveolaris* GOLDFUSS, 1829, Upper Jurassic of Germany.

Morphogenic Diagnosis. Massive, knobby, ramose, encrusting, lamellar, subfasciculate ("nest-like"); cerioid to subplocoid.

Synonym of *Latusastrea*. *Pleurocenia* D'ORBIGNY, 1849 (Type species. *P. provincialis* D'ORBIGNY, 1849, Upper Turonian of France [Uchaux, Vaucluse]).

Cretaceous species reported from the Alps and Dinarides. *L. decipiens* (PREVER, 1909); *L. exigua* (DE FROMENTEL, 1862); *L. provincialis* (D'ORBIGNY, 1849) (= *L. xigazeensis* LIAO & XIA (1994); ?*L. schmidti* (KOBY, 1896).

Helvetic occurrences. Berriasian of ?Switzerland (Canton of Uri, Oehrli Formation); Lower Aptian of southern Germany (Upper Schrattenkalk at Allgäu: Lower Gundalpe, Hoher Döllen, Brandalpe, Mahdtal); Lower Aptian of central Switzerland (Rawil Member at Rawil and Upper Schrattenkalk at Hergiswil).

Dinaric occurrences. *Northern Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica).

Cretaceous occurrences elsewhere. Cretaceous of Slovenia, Upper Berriasian–Lower Albian of Spain, Hauterivian–Lower Albian of Poland, Ukraine and Georgia (in Caucasus), Barremian of Turkmenistan, Barremian–Lower Albian of Mexico, Lower Aptian of Romania, France, eastern Serbia, and Greece, Upper Aptian of Algeria, Cenomanian of Tibet, Turonian–Santonian of France.

Genus *Baryhelia* MILNE EDWARDS, 1857

Pl. 87, Figs. 3–7; Pl. 88, Figs. 1–6

Type species. *Baryhelia archiaci* MILNE EDWARDS, 1857, Cenomanian of Belgium.

Diagnosis. Colonial, massive or subfasciculate, subcerioid to plocoid or irregularly circular. Budding intracalicinal (septal division and 'Taschenknospung') and extracalicinal. Permanent condition monocentric. Costosepta compact, generally nonconfluent, occasionally subconfluent. Septal flanks have fine to coarse granules and apophysal extensions. Inner wall parathecal, often with septothecal thickenings. Outer wall septothecal, generally incomplete or reduced. Because of the irregularity regarding the development of the outer wall, intracorallite dissepiments may not be distinguished from exothecal dissepiments. Dissepimentarium present or absent. When absent, outer wall lies directly on inner wall, giving the appearance of a multi-layered corallite wall (similar to the situation in e.g. *Acanthogyra*). Columella absent but trabecular extensions of axial ends of septa might fuse in corallite center forming a pseudo-columella that is often substyliform to sublamellar is shape. One more dominant septum present or absent. Lonsdaleoid septa irregularly present or reduced. Endothecal dissepiments vesicular, forming a generally weak dissepimentarium between inner and outer wall. Endothecal dissepiments of lumen generally subtabulate to cellular.

Synonym. *Pachycoenia* ALLOITEAU, 1952a (Type species. *P. rugosa* ALLOITEAU, 1952a, Coniacian of France).

Subgenus. *Paronastraea* M. BEAUVAIS, 1977 (Type species. *P. preveri* M. BEAUVAIS, 1977 [= *Heterocoenia grandis* REUSS in PREVER, 1909, Upper Aptian of Italy [Abruzzi, L'Aquila]): Like *Baryhelia* but septa have well-developed apophysal extensions.

Synonym of subgenus *Paronastraea*. *Canleria* ELIÁŠOVÁ, 1996 (Type species. *C. clemens* ELIÁŠOVÁ, 1996, Upper Cenomanian of the Czech Republic [Bohemia]).

Affinities. Very similar to *Preverastraea* L. BEAUVAIS, 1976, but outer wall incomplete or absent, or fused with inner corallite wall, resulting in plocoid to subfasciculate polyp integration types.

Cretaceous species reported from the Alps. *B. fuchsi* (FELIX, 1903a); *B. grandis* (REUSS, 1854); *B. stachei* (FELIX, 1903a).

Austroalpine occurrences. *Gosau Group*: Coniacian–Lower Santonian (Upper Austria: Gosau, Edelbachgraben); Coniacian–Santonian (Salzburg: Rußbach, Pass Gschütt); Santonian (Salzburg: Rußbach, Randograben, Stöcklwaldgraben, Zimmergraben); Upper Santonian (Salzburg: Rußbach, Neffgraben; Upper Austria: Gosau, Schrickpalfen, Brunstloch, Gschröfpalfen, Wegscheidgraben).

Remarks. Studies carried out by the author of the current work on type material revealed that by their thecal and septal developments, the genera *Pachycoenia* ALLOITEAU, *Paronastraea* M. BEAUVAIS, and some forms assigned to the

genus *Preverastraea* L. BEAUVAIS closely correspond to *Baryhelia* (e.g., lectotype of *Preverastraea boehmi* [PREVER, 1909]). In all of these taxa, the inner wall is thin and parathecal, but also frequently septothecally thickened, and their outer walls and dissepimentaria around the corallites are often only preserved as fragments, typically seen in the genus *Baryhelia* (see, e.g., lectotype of *B. stachei* [FELIX, 1903a], Pl. 88, Figs. 3–6). Therefore, their synonymy is suggested. Interestingly, their septal developments often show a trimeral arrangment, especially in their juvenile stages, pointing to affinities to *Heterocoenia* and the aulastraeoporid genera *Aulastraeopora* PREVER, 1909, and *Preverastraea* L. BEAUVAIS, 1976. While in *Heterocoenia*, a trimeral septal development remains visible in various species, in the genera *Aulastraeopora* PREVER, 1909, and *Preverastraea* L. BEAUVAIS, 1976, the occurrence of such development is often restricted to their juvenile stages. However, the close relationship of *Baryhelia* with *Preverastraea* is emphasized by the fact that some forms of *Preverastraea*, e.g., *P. roverotoi* (PREVER, 1909) and *P. boehmi* (PREVER, 1909), represent mixed forms showing characteristics of both genera and can hardly be distinguished from *Baryhelia*.

Cretaceous occurrences elsewhere. Turonian–Santonian of Georgia (in Caucasus), Coniacian of France, Coniacian–Maastrichtian of Hungary.

9. Questionable taxa, not scleractinian, or taxonomic/stratigraphic position unclear

9.1. Genera

Genus *Astraeomorpha* REUSS, 1854

Type species. *A. goldfussi* REUSS, 1854, Norian of Austria.

Remarks. REUSS (1854: 127) described the genus *Astraeomorpha*. According to him, the material belonged to strata of the Gosau Group. Later, PRATZ (1882: 103) and FRECH (1890: 3) realized that the material was actually collected from the Triassic Zlambach beds.

Genus *Aulopsammia* REUSS, 1854

Type species. *A. murchesoni* REUSS, 1854, Turonian–Campanian of Austria.

Not a scleractinian. The genus *Aulopsammia* is a junior synonym of the octocoral *Epiphaxum* LONSDALE, 1850.

Genus "*Brachyseris* ALLOITEAU, 1952a"

Type species. *Latomeandra morchella* REUSS, 1854, Upper Santonian of Austria [Gosau Group]).

Remarks. ALLOITEAU, in HUPÉ & ALLOITEAU (1947), described the genus *Brachyseris* and assigned the form *Latimaeandraraea felixi* ANGELIS D'OSSAT, 1905, from the Lower Albian of Spain to his new taxon. In later works, starting in 1952 (ALLOITEAU, 1952a: 673), he began referring to *Latomeandra morchella* REUSS, 1854, from the Upper Santonian of Austria (Gosau Group at Neffgraben), as the type species of the genus *Brachyseris*. However, in assigning only one species when he first described his new genus, the type species of the genus *Brachyseris* was automatically defined by monotypy. Therefore, the type species of the genus *Brachyseris* is *Latimaeandraraea felixi* D'ANGELIS D'OSSAT, 1905, which has been transferred to the genus *Meandrophyllia*, placing the genus *Brachyseris* in its synonymy.

Genus *Calamophyllia* BLAINVILLE, 1830

Type species. *C. striata* BLAINVILLE, Miocene of France (Dax, Landes).

Remarks. A discussion was given by BARON-SZABO (2006: 57) and additional remarks were provided by LATHUILIÈRE (pers. comm. 2010, also visit corallospere.org):

> According to ALLOITEAU (1957: 174–176) the type specimen of the genus *Calamophyllia* BLAINVILLE, 1830, (with the type species *Calamophyllia striata* = *Calamites striée* GUETTARD, 1774) was lost. In addition, descriptions of the type material of this species given by GUETTARD (1774: 406), BLAINVILLE (1830: 312–313), and MILNE EDWARDS (1857: 345) differ significantly from each other. Therefore, the generic concept of the genus *Calamophyllia* BLAINVILLE is unclear. In addition, there has been some uncertainty regarding the type locality of the form *Calamophyllia striata* as BLAINVILLE mentioned the type locality of Dax, which is dominated by Maastrichtian strata, but at the same time referred to GUETTARD'S material, for which the Miocene locality of St. Paul lès Dax (Landes, France) was given.
>
> ALLOITEAU (1957) abstained from picking a specimen to create a neotype for the species *striata* but chose the form *Calamophyllia flabellata* DE FROMENTEL, 1861, which apparently resembled the original illustration of *Calamophyllia striata* in BLAINVILLE (1830), to create the new genus *Calamophylliopsis* and considered the genus *Calamophyllia* BLAINVILLE as *incertae sedis*. In subsequent works, several authors have used the name *Calamophyllia* for material from the Jurassic, Cretaceous, and Cenozoic. As the type specimen is lost and there are uncertainties regarding the type locality, the name *Calamophyllia* should be abandoned.

Genus *Columellogyra* Turnšek, 1976

Type Species. *C. lomensis* Turnšek in Turnšek & Buser, 1976.

Remarks. Because this genus was described using material that was collected from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, its stratigraphic position is unclear (Turnšek & Buser, 1976).

Genus *Cyathophyllum* Goldfuss, 1826

Type Species. *C. plicatum* Goldfuss, 1826.

Remarks. Goldfuss (1826: 51) created the genus *Cyathophyllum* in order to include many Paleozoic forms that had previously been assigned based on their general features like cone-shaped, ram horn-formed, and other morphological features. He combined material that had been published as *Turbinolia*, *Hippurites*, *Madreporites*, *Caryophyllide*, *Madrepora*, *Calamites*, and others. Goldfuss only included Paleozoic material in *Cyathophyllum*. Later, Cretaceous forms were assigned using this genus name. Those forms were subsequently transferred to scleractinian taxa like *Montlivaltia* and *Dimorphastrea*, e.g. the Gosau form *Cyathophyllum composita* Sowerby, 1832, which is now grouped with the latter. The only Cretaceous taxon that has retained its original assignment in *Cyathophyllum* is the species *C. posthumum* Eichwald 1865–69 from the Lower Cretaceous of Russia. Felix (1914: 77) listed this form under 'incertae sedis'. Because the depository location of the original Eichwald material is unknown, its taxonomic position cannot be clarified.

Genus *Holocoenia* Milne Edwards & Haime, 1851a

Type species. *Astrea micrantha* Roemer, 1841, Upper Valanginian–Lower Hauterivian of Germany (Lower Saxony).

Remarks. The original description of *Holocoenia* by Milne Edwards & Haime (1851a) is rather insufficient in that it only consisted of the remarks that this taxon differed from *Thamnasteria* in having a prominent styliform columella and entire septa. As a consequence from this definition, *Holocoenia* would have to show all characteristics of *Thamnasteria* with the exception of these two features, which would make *Holocoenia* a genus that is characterized by thamnasterioid polyp integration; extra- and intracalicinal budding; (non-costate) compact and confluent, entire septa; a prominent styliform columella; vesicular and tabulate endothecal dissepiments; and either no wall or an incomplete synapticulotheca present (see Roniewicz, 1982, and Bertling, 1993, for information on *Thamnasteria*). In 1857, De Fromentel provided the first more extensive description based on non-type material, in which he included the presence of characteristics like 'septocostae strongly granulated laterally', 'corallites united by their walls', appearing polygonal, and 'septa developed in 2 with a beginning third cycle'; the first two characteristics of which would have to be considered as differing from the generic concept by Milne Edwards & Haime. Recently, a revision on *Holocoenia* was carried out by Löser (2009). According to him, the holotype of the type species was lost and the type locality did not exist anymore. In his revision, he gave a generic description of *Holocoenia*, following both the model by Milne Edwards & Haime, 1851a, and the emended version provided by De Fromentel, 1857. Löser (2009: 96) gave the following generic diagnosis for *Holocoenia* based on non-type material from a locality other than the type locality: "Cerioid colony with small calices. Septa compact, in radial symmetry, and always in two generations. Septal face with few granules. Wall incomplete, made of synapticulae and septa. Columella styliform. Endotheca present, made of thin dissepiments. Budding extracalicinal. Septal microstructure unknown." In addition, Löser included material that has both costate and non-confluent septa, and shows incomplete septothecal walls. That means that his material differs from both of the generic concepts he says he is following: 1) In having a cerioid polyp integration, only extracalicinal budding, both costate and septothecal developments, the presence of non-confluent septa, and an unknown septal structure, it differs from the generic concept by Milne Edwards & Haime. Furthermore, it is inconclusive regarding one of the most important features defined by Milne Edwards & Haime – entire septa – in their original diagnosis for *Holocoenia*; 2) In having a maximum of 2 cycles of septa, that are not only confluent but also non-confluent, and are distinctly granulated laterally, it differs from the emended version provided by De Fromentel. In addition, Löser (2009) grouped the genera *Stereocoenia* Alloiteau, 1952a (= genus originally placed in the Thamnasteriidae) and *Paretallonia* Sikharulidze, 1972 (= genus originally placed in the Acroporidae), as junior synonyms of the genus *Holocoenia*. Moreover, he placed *Holocoenia* in the Thamnasteriidae. However, because of the fact that Milne Edwards & Haime mentioned in their original description that *Holocoenia* had 'entire septa', excludes this genus from the family Thamnasteriidae, which, consequently, excludes *Stereocoenia* from the synonymy with *Holocoenia*. In addition, because Löser's (2009) revision is based on 1) non-type material from localities other than the type locality (for *Holocoenia micrantha*), that 2) is in contradiction to both of the taxonomic models he is following, and 3) lacks the very necessary re-study of the type material of both *Stereocoenia* Alloiteau, 1952a, and *Paretallonia* Sikharulidze, 1972, it can only be concluded that: a) *Holocoenia* is an unrecognizable taxon which makes any decision regarding any junior synonyms impossible, b) the taxonomic position of the material described in Löser (2009) remains unknown, and c) the taxonomic information provided in the original documentations for *Stereocoenia* Alloiteau, 1952a, and *Paretallonia* Sikharulidze, 1972, remain valid because no information proving otherwise has been given. Baron-Szabo (2002: 81, 116) previously pointed out the morphological similarities between *Stereocoenia* Alloiteau and *Paretallonia* Sikharulidze, but made clear that they only applied to their macromorphological appearances. Furthermore, because the material described by Löser (2009) is inconsistent with what is known of the former name-bearing type including the original description and other sources (ICZN 75.3.5, e-version of January 1st, 2012), it disqualifies from being used as a potential candidate for a neotype.

Genus *Placastrea* Stoliczka, 1873

Type Species. *P. elegans* Stoliczka, 1873, Albian of India.

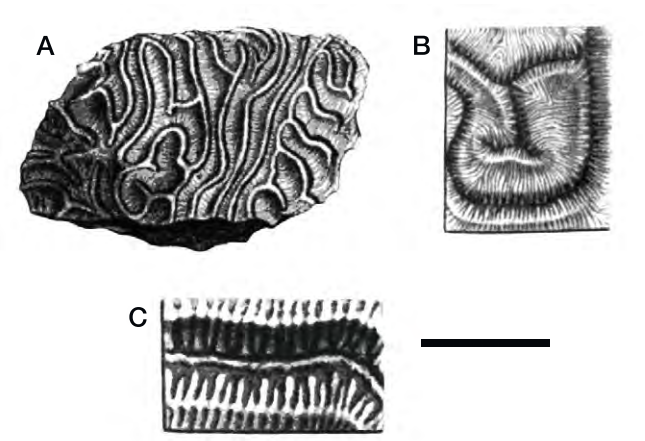
Remarks. According to Stoliczka (1873: 33), his newly created genus *Placastrea* had all characteristics of a 'true' *Astrea* but differed from it by the occurrence of a 'solid compressedly columnar columella' and 'denticles at inner ends of septa not enlarged'. This description is insufficient in that it remains unclear how *Placastrea* differed from faviid genera like e.g. *Favites* or *Ovalastrea*, or fungiid taxa like *Siderastrea*, or even mussid forms like *Acanthastrea*. Wells (1956) grouped *Placastrea* with *Isastrea*. Material that has recently been assigned to *Placastrea elegans* Stoliczka by Löser et al. (2009) shows close affinities to the genus *Ovalastrea*.

Genus *Valloria* Vidal, 1874

Type species. *V. egozcuei* Vidal, 1874, Uppermost Campanian of Spain [Tremp Formation]).

Remarks. The systematic position of the genus *Valloria* has long been discussed (Vaughan & Wells, 1943; Wells, 1956; Alloiteau, 1957; Baron-Szabo, 2002, 2008; and others). According to Vaughan & Wells (1943), it is a junior synonym of *Dictuophyllia*, Wells (1956) placed it under 'genera of uncertain systematic position', Alloiteau (1957) grouped it with the family Siderastreidae, and, based on the information provided by Bataller (1937a) and Alloiteau (1957), Baron-Szabo (2002, 2008) placed it in the Agariciidae. Recently, Löser (2013b) carried out a study on the genus *Valloria* Vidal. According to him, the type specimen is lost and there is no other specimen either belonging to type or original material. Therefore, he described a specimen from the type locality which he questionably grouped with the family Meandrinidae Gray, 1847. This specimen, however, may or may not correspond to the original material by Vidal (1874). The material Löser described is similar to the genus *Valloria* as presented in the original description by Vidal (1874: 39, pl. 7, figs. 44–44b), according to which this genus represents "a meandroid colony with ramified calicinal series which forms a massive, compressed or sometimes subhemispherical colony. Calicinal series are separated by flat, plateau-like ambulacra which have a width of 2 to 3 mm. Calicinal series are long, very wavy, forked, and narrow (1 mm wide), their edges are nearly sharp. Calicinal series are half a millimeter deep. Septa irregularly alternate; there are 66 septa in 10 mm. Columella lamellar, which cannot always be observed. When it is visible, it appears to be connected to the axial ends of septa. Axial ends of septa are cuneiform or swollen" (see Text-Fig. 22).

From this, it could be concluded that *Valloria* represents a junior synonym of the genus *Cycloria* Reuss, 1854. At the same time, however, it could not be ruled out that it belonged to other genera like, e.g., *Dictuophyllia* Blainville, 1830, as the description by Vidal is inconclusive regarding, e.g., thecal features like the presence or absence of an exotheca. Furthermore, because Vidal (1874: 39) himself stated that his genus belonged to the symphylliids, puts the genus-group assignment of *Valloria* even further into uncertainty as the symphylliid-group used to be placed in the Mussidae but has now been transferred to the recently established family Lobophylliidae Dai & Horng, 2009 (also see Budd et al., 2012). Because no original material is available to clarify the systematic position of *Valloria*, it is considered a questionable genus.



Text-Fig. 22.
Sketches of *Valloria egozcuei* Vidal, 1874, based on the original illustration of the type material in Vidal (1874: Figs. 44–44b), Maastrichtian of Spain [Isona, La Pose, Lerida). A: upper surface of colony; scale bar: 40 mm; B and C: close–up images of A; B: scale bar: 10 mm; C: scale bar: 3 mm.

9.2. Species

***Actinacis remesi* Felix, 1903a** in Turnšek & Buser (1976):

Dinaric occurrences. "Senonian Breccia", Banjška Planota, Slovenia.

Remarks. Because this taxon was described using material that was collected from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, its stratigraphic position is unclear (Turnšek & Buser, 1976).

***Amphiastraea aethiopica* Dietrich, 1926** in Turnšek & Buser (1976):

Dinaric occurrences. "*Senonian Breccia*", Banjška Planota, Slovenia.

Remarks. Because this taxon was described using material that was collected from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, its stratigraphic position is unclear (Turnšek & Buser, 1976).

***Calamophyllia fenestrata* Reuss, 1854**:

Austrian occurrence. Zlambach at Aussee.

Remarks. Reuss (1854: 105, pl. 5, figs. 20–21) described the form *Calamophyllia fenestrata*. According to him, the material belonged to strata of the Gosau Group. Later, Frech (1890: 3) realized that the material was actually collected from the Triassic Zlambach beds.

Calamophyllia stutzi **Koby, 1896**:

Helvetic occurrences. Lower Aptian of Switzerland (Canton of Schwyz) (Upper Schrattenkalk at Drusberg, Käsernalp): See Remarks under *Calamophyllia* in the "Questionable taxa" under Chapter 9.1.

Chomatoseris **sp.** in Turnšek & Buser (1976):

Dinaric occurrences. "*Senonian Breccia*", Banjška Planota, Slovenia.

Remarks. Because this taxon was described using material that was collected from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, its stratigraphic position is unclear (Turnšek & Buser, 1976).

Favia schmidti **Koby, 1896**:

Helvetic occurrences. Lower Aptian of Switzerland (Canton of Schwyz) (Upper Schrattenkalk at Drusberg, Käsernalp).

Remarks. According to Koby, this form has confluent septa, which excludes it from the genus *Favia*.

Fungiastraea tendagurensis **(Dietrich, 1926)** in Turnšek & Buser (1976):

Dinaric occurrences. "*Senonian Breccia*", Banjška Planota, Slovenia.

Remarks. Because this taxon was described using material that was collected from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, its stratigraphic position is unclear (Turnšek & Buser, 1976).

Glenarea cretacea **Počta, 1887** in Turnšek & Buser (1974):

Dinaric occurrences. *Northern Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica).

Remarks. The original description of the taxon *Glenarea cretacea* by Počta (1887: 25–26, text-figs. 9–10) from the Upper Cenomanian of the Czech Republic was based on insufficiently documented material which resulted in its uncertain taxonomic position for over one century. Wells (1956: F436) placed it in *incertae sedis*, Krasnov (1964: 71) grouped it with the family Amphiastreidae, the latter assignment of which was accepted by Turnšek & Buser (1974). Re-investigations by Eliášová (1991b: 99, pl. 1, figs. 1a–b) revealed that the type material was lost. She described a neotype using material from the Upper Cenomanian of the Czech Republic (Bohemia) which on the outer surface very closely corresponded to the original documentation of the type material by Počta. The structures seen deeper in the corallum by using thin sections, however, showed that it significantly differed from the original genus concept by, e.g., columella and endotheca absent, generally a maximum of five septa present according to Počta; lamellar columella, well-developed endotheca made of subtabulate and vesicular dissepiments, and a number of septa ranging between 12 and 18 in the neotype. Because the material from Osojnica by Turnšek & Buser (1974) corresponds to the old genus concept, it differs from *Glenarea* and might belong to the cyathophorids.

Heterocoenia grandis **Reuss, 1854** in Turnšek & Buser (1976):

Dinaric occurrences. "*Senonian Breccia*", Banjška Planota, Slovenia.

Remarks. Because this taxon was described using material that was collected from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, its stratigraphic position is unclear (Turnšek & Buser, 1976).

Hydnophora styriaca **(Michelin, 1847)** in Turnšek & Buser (1976):

Dinaric occurrences. "*Senonian Breccia*", Banjška Planota, Slovenia.

Remarks. Because this taxon was described using material that was collected from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, its stratigraphic position is unclear (Turnšek & Buser, 1976).

Isastrea **?** *geometrica* **Koby, 1897**:

Helvetic occurrences. Lower Aptian of Switzerland (Canton of Schwyz) (Fronalpstock area, Chälenberg section).

Remarks. According to Koby, this form has a holotheca; strongly anastomosing septa; seems to have septothecal developments (Koby, 1897: Pl. 14, fig. 4a); and a ?columella, all characters of which exclude it from the genus *Isastrea*.

Isastrea profunda **Reuss, 1854**:

Austrian occurrence. Zlambach at Aussee.

Remarks. Reuss (1854: 116, pl. 9, figs. 5–6) described the form *Isastrea profunda*. According to him, the material belonged to strata of the Gosau Group. Later, Frech (1890: 3) realized that the material was actually collected from the Triassic Zlambach layers.

Meandroria koninckí **(Milne Edwards & Haime, 1849b** in Turnšek & Buser (1976):

Dinaric occurrences. "*Senonian Breccia*", Banjška Planota, Slovenia.

Remarks. Because this taxon was described using material that was collected from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, its stratigraphic position is unclear (Turnšek & Buser, 1976).

Montlivaltia cupuliformis **Reuss, 1854**:

Austrian occurrence. Zlambach at Aussee.

Remarks. Reuss (1854: 102, pl. 6, figs. 16–17) described the form *Montlivaltia cupuliformis*. According to him, the material belonged to strata of the Gosau Group. Later, Frech (1890: 3) realized that the material was actually collected from the Triassic Zlambach layers.

Ovalastrea turbinata **(De Fromentel, 1857** in Turnšek & Buser (1976):

Dinaric occurrences. "*Senonian Breccia*", Banjška Planota, Slovenia.

Remarks. Because this taxon was described using material that was collected from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, its stratigraphic position is unclear (Turnšek & Buser, 1976).

Phyllocoenia decussata **Reuss, 1854**:

Austrian occurrence. Zlambach at Aussee.

Remarks. Reuss (1854: 99, pl. 13, figs. 2–3) described the form *Phyllocoenia decussata*. According to him, the material belonged to strata of the Gosau Group. Later, Frech (1890: 3) realized that the material was actually collected from the Triassic Zlambach layers.

Procladocora simonyi **(Reuss, 1854)** in Turnšek & Buser (1976):

Dinaric occurrences. "*Senonian Breccia*", Banjška Planota, Slovenia.

Remarks. Because this taxon was described using material that was collected from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, its stratigraphic position is unclear (Turnšek & Buser, 1976).

Pseudofavia grandiflora **(Reuss, 1854)** in Turnšek & Buser (1976):

Dinaric occurrences. "*Senonian Breccia*", Banjška Planota, Slovenia.

Remarks. Because this taxon was described using material that was collected from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, its stratigraphic position is unclear (Turnšek & Buser, 1976).

Pseudopistophyllum quinqueseptatum **Turnšek,** 1976:

Dinaric occurrences. "*Senonian Breccia*", Banjška Planota, Slovenia.

Remarks. Because this taxon was described using material that was collected from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, its stratigraphic position is unclear (Turnšek & Buser, 1976).

Siderastrea seneca **Morycowa, 1971** in Turnšek & Buser (1974):

Dinaric occurrences. *Northern Dinaric Carbonate Platform* ("*Urgonian Facies Development*"): Barremian–Aptian of Slovenia (Osojnica).

Remarks. In having compact septa; a styliform columella; and both an outer an inner corallite wall, the material from the Dinarides differs from *Siderastrea* but shows affinities to the genus *Diplocoenia*.

(?) ***Simplexastraea*** **sp.**:

Helvetic occurrences. Lower Aptian of central Switzerland (Upper Schrattenkalk of Hergiswil, Lucerne region).

Remarks. Morycowa & Decrouez (2006) questionably assigned fragmented material to this genus.

Sphenotrochus flabellum **Reuss, 1854**:

Austroalpine occurrences. Upper Turonian–Santonian from various localities of the Gosau Group, Austria.

Remarks. According to Reuss (1854: 80, pl. 8, figs. 15–16), his newly described species is characterized by a flabellate corallum that shows a bilateral septal arrangement with septa that are developed in size orders (not in systems). In addition, the septa have claviform axial ends which often fuse with the lamellar columella, thus differing from the genus *Sphenotrochus*. In *Sphenotrochus*, the corallum is cuneiform to subtympanoid, septa are arranged in (hexameral) systems (not in size orders), and axial ends of septa are cuneiform. The material described by Reuss most likely represents juvenile specimens of either *Flabellosmilia* or *Aulosmilia*.

Thamnasteria schmidti **Koby, 1898**:

Helvetic occurrences. Lower Aptian of Switzerland (Canton of Schwyz) (Upper Schrattenkalk at Drusberg, Käsernalp).

Remarks. According to Koby, this material has costosepta and septal structures that correspond to the kinds seen in the microsolenids and not in the genus *Thamnasteria*.

Thamnoseris morchella **(Reuss, 1854)** in Turnšek & Buser (1976):

Dinaric occurrences. "*Senonian Breccia*", Banjška Planota, Slovenia.

Remarks. Because this taxon was described using material that was collected from mixed strata which accumulated in a breccia that includes sediments from Upper Jurassic to Maastrichtian, its stratigraphic position is unclear (Turnšek & Buser, 1976).

Plates

Plate 1

Figs. 1–3: *Actinastrea goldfussi* d'Orbigny, 1850

Lectotype, IBP 233c#2, Maastrichtian of The Netherlands.

Fig. 1: upper surface of colony in 'steinkern' preservation (contrast inverted); photograph by Georg Oleschinski, Department of Geology, Mineralogy, and Paleontology, University of Bonn, Germany; scale bar: 4 mm.

Fig. 2: close-up of Fig. 1, showing early stage of new (cerioid) corallite due to extracalicinal-marginal budding (arrow). As typical of the actinastreid group (compare with situation in *Columactinatrea pygmaea*, Fig. 5), an unproportionally large styliform columella and protosepta in irregular systems are developed in early ontogenetical stages (Baron-Szabo, 2003a); scale bar: 1 mm.

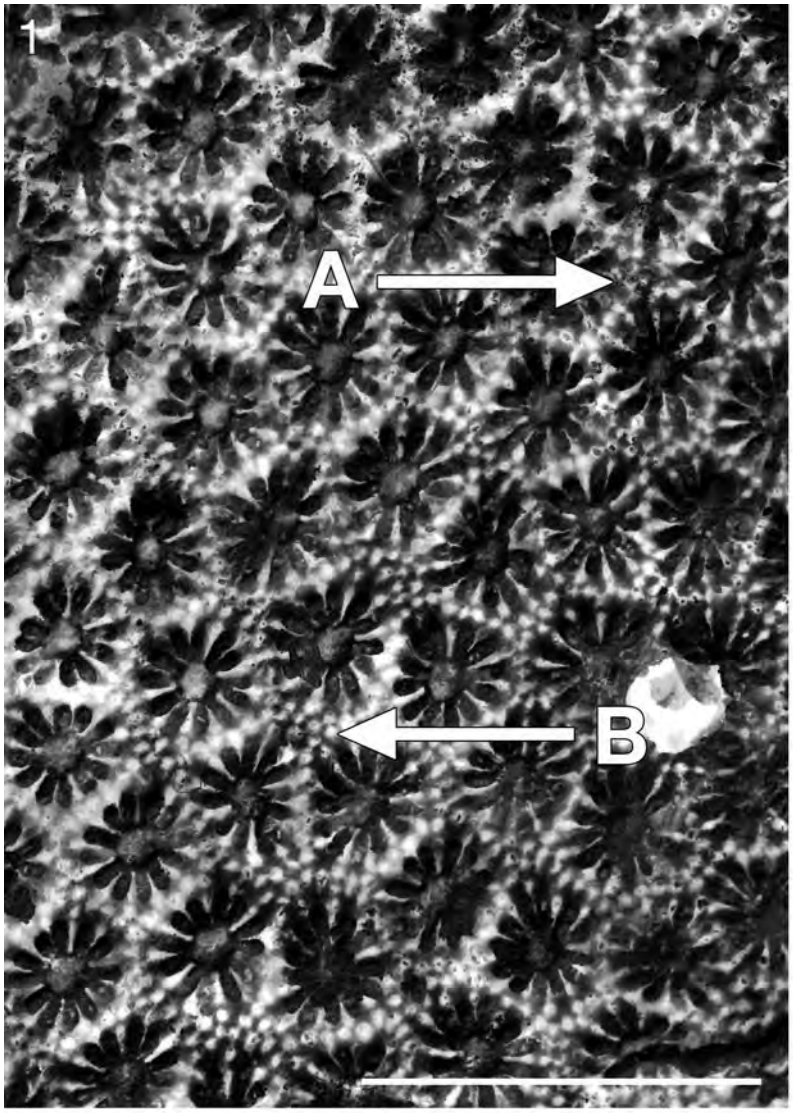
Fig. 3: close-up of Fig. 1, showing early stage of new (subcerioid-subplocoid) corallite due to extracalicinal (?-marginal) budding (arrow). As also seen in Fig. 2, an unproportionally large styliform columella and protosepta in irregular systems are developed in early ontogenetical stages; scale bar: 1 mm.

Fig. 4: *Actinastrea tendagurensis* (Dietrich, 1926)

First record from the geographic areas covered in this report; thin section, cross view; BSPG OG-296 (Baron-Szabo coll.), Lower Aptian (Schrattenkalk at Allgäu, Upper Gottesackerwände), Germany; scale bar: 2 mm.

Fig. 5: *Columactinastrea pygmaea* (Felix, 1903c)

Thin section, cross view, with new corallite showing unproportionally large styliform columella and protosepta in irregular systems (arrow) (also compare with Figs. 2 and 3); GBA 2003/023/0002/02 (Baron-Szabo-2003a coll.), Santonian (Gosau Group at Hochmoos-Grabenbach area), Austria; scale bar: 1 mm.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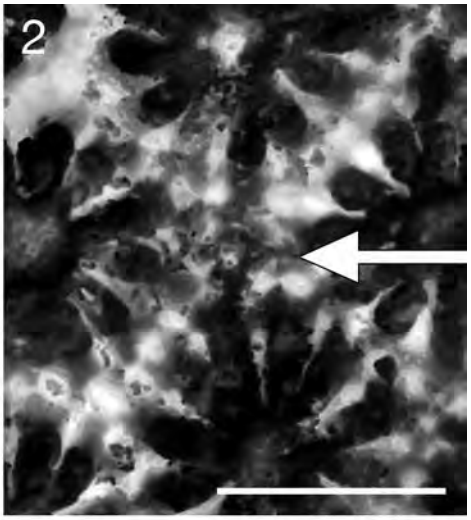
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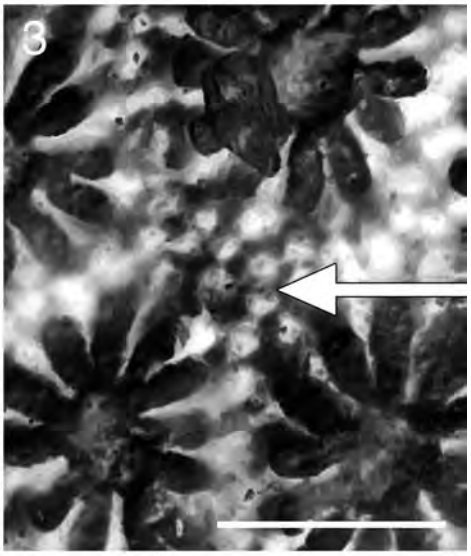
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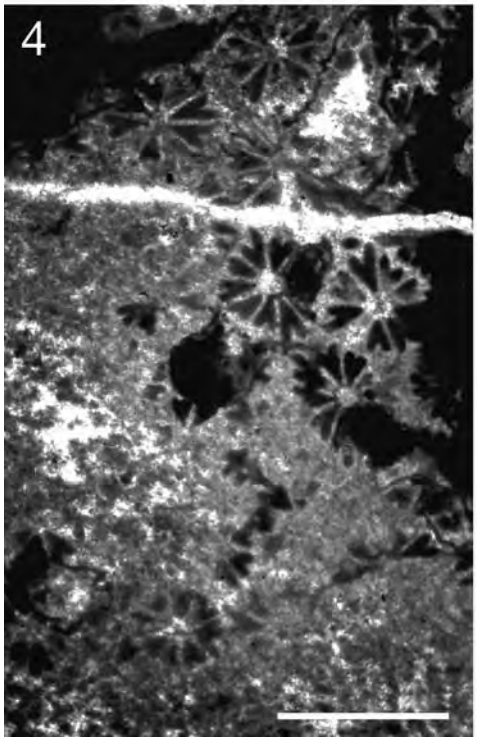
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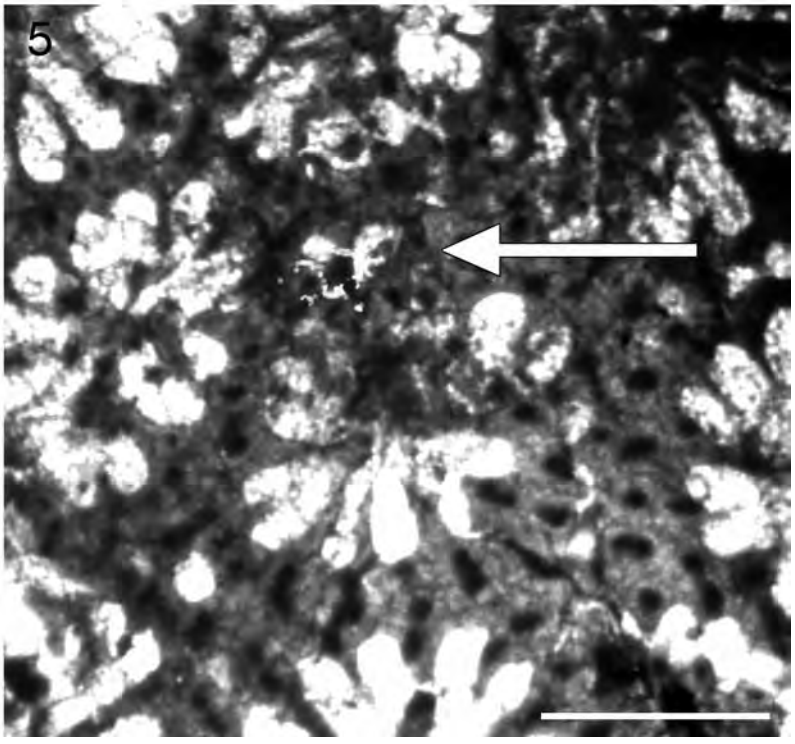
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Plate 2

Figs. 1, 3, 4, 6: *Actinastrea decaphylla* (MICHELIN, 1847)

Fig. 1: upper surface of colony; NHMW 2014/0106/0001; Turonian–Campanian (?Santonian) (Gosau Group at Gosau Basin), Austria; scale bar: 10 mm.

Fig. 3: thin section, lateral view; BSPG 23c/XVI (BARON-SZABO-1997 coll.); Lower Coniacian (Gosau Group at Brandenberg), Austria; scale bar: 1 mm.

Fig. 4: close-up of Fig. 1; scale bar: 3.5 mm.

Fig. 6: thin section, cross view; BSPG 23c/XVI (BARON-SZABO-1997 coll.); Lower Coniacian (Gosau Group at Brandenberg), Austria; scale bar: 2.5 mm.

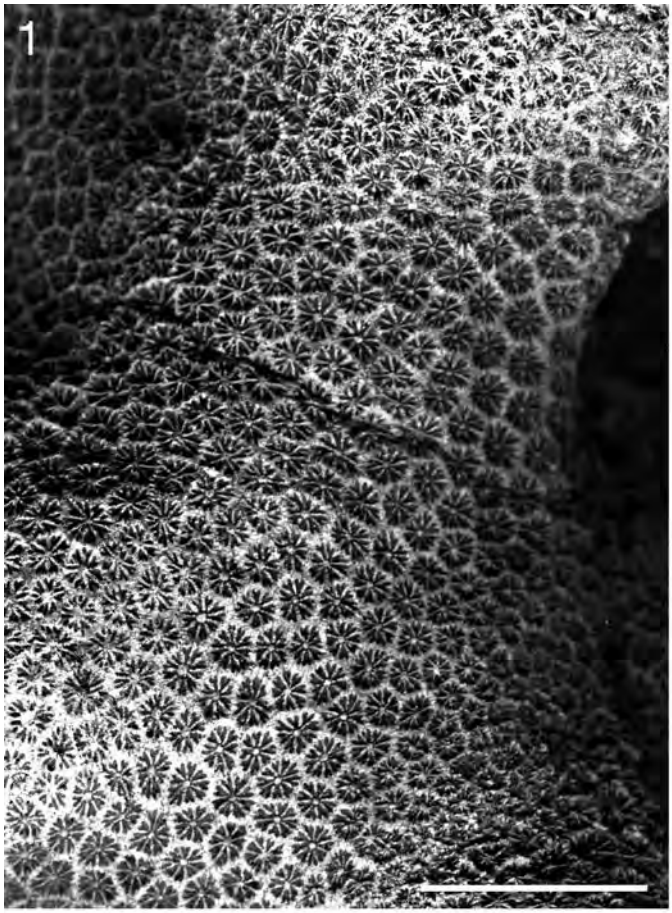
Fig. 2: *Actinastrea elongata* ALLOITEAU, 1954a

Thin section, cross view; GBA 2003/023/0001/01 (BARON-SZABO-2003a coll.); Santonian (Gosau Group at Hochmoos-Grabenbach area), Austria; scale bar: 3 mm.

Figs. 5, 7: *Actinastrea orbignyi* (MILNE EDWARDS & HAIME, 1848d)

Fig. 5: close-up of Fig. 7; scale bar: 3 mm.

Fig. 7: upper surface of colony; GBA 1903/004/0110/01, original material of FELIX (1903a, p. 317, referring to the material described as *Stephanocoenia formosa* in REUSS, 1854, p. 98, lines 4–8 of the uppermost paragraph); Turonian–Campanian (?Upper Santonian) (Gosau Group at greater Gosau-Rußbach area), Austria; scale bar: 10 mm.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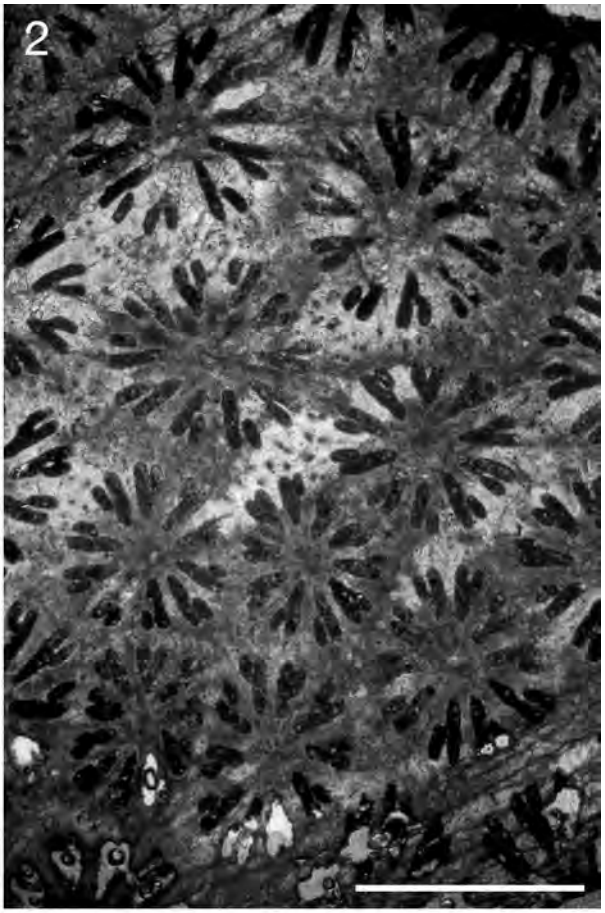
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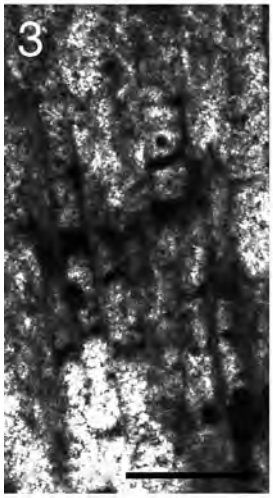
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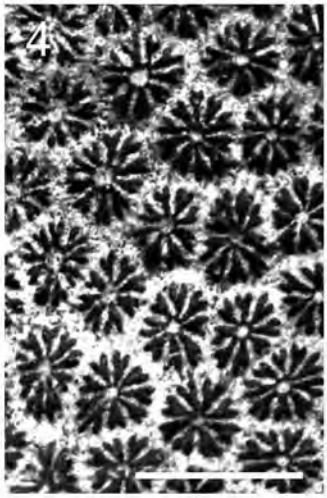
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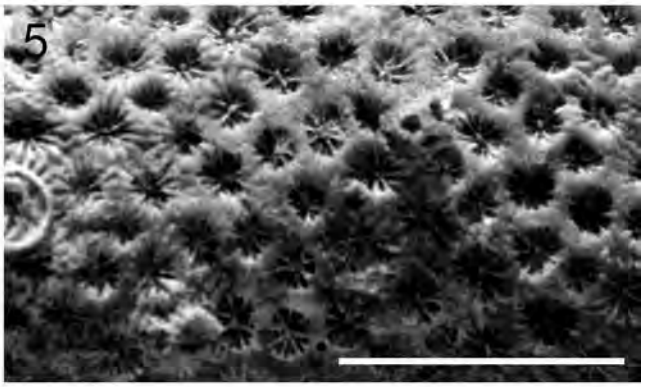
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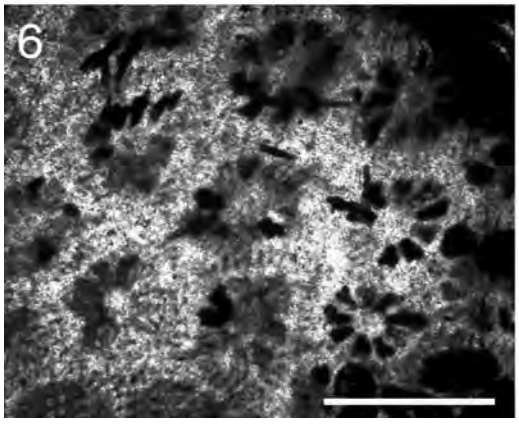
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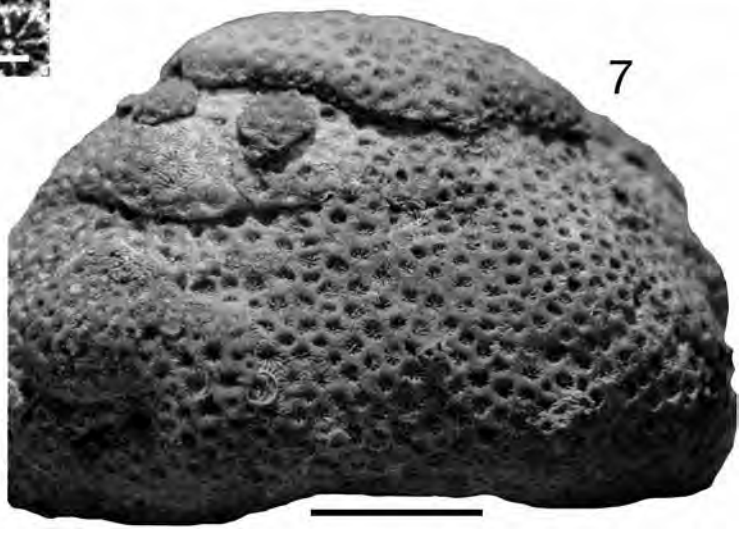
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Plate 3

Figs. 1–3: *Actinastrea decaphylla* (MICHELIN, 1847)

Fig. 1: cross view of colony, polished surface; GBA 1903/004/0108/01 (FELIX coll.), original material of FELIX (1903a, p. 315); Turonian–Campanian (Gosau Group, possibly at either Turonian at Seeleiten area or Santonian at Rußbach-Gosau area), Austria; scale bar: 11 mm.

Fig. 2: upper surface of colony; scale bar: 5 mm.

Fig. 3: lateral view of colony, polished surface; scale bar: 4 mm.

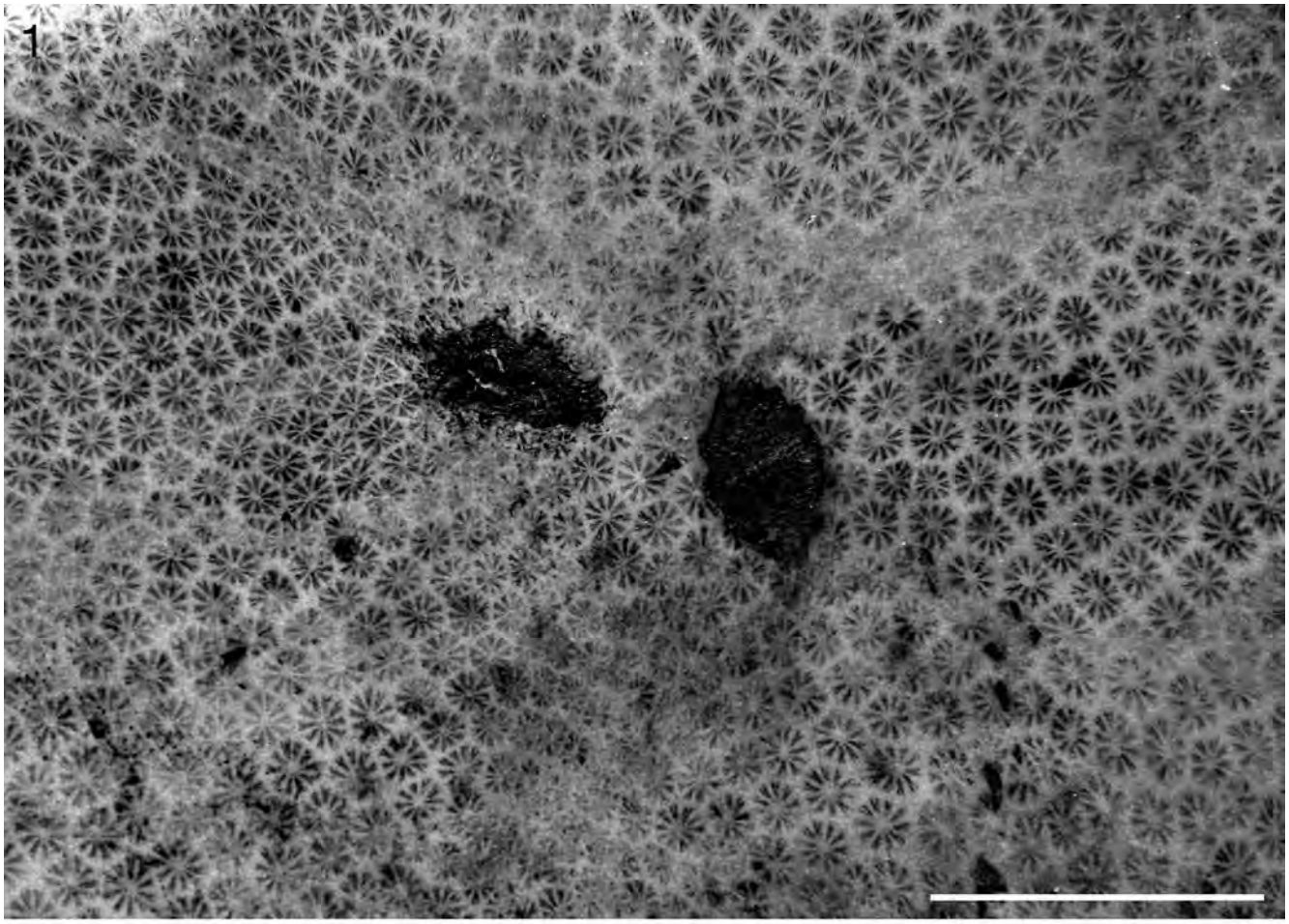
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Plate 4

Figs. 1, 3: *Columactinastrea pygmaea* (FELIX, 1903c)

Fig. 1: thin section, cross view; GBA 2003/023/0002/02 (BARON-SZABO-2003a coll.), Santonian (Gosau Group at Hochmoos-Grabenbach area), Austria; scale bar: 2 mm.

Fig. 3: thin section, lateral view, oblique; scale bar: 2 mm.

Figs. 2, 5: *Columactinastrea formosa* (GOLDFUSS, 1829)

Fig. 2: thin section, cross view; GBA 2003/023/0003/02 (BARON-SZABO-2003a coll.), Santonian (Gosau Group at Hochmoos-Grabenbach area), Austria; scale bar: 2 mm.

Fig. 5: upper surface of colony; reference material of FELIX (1903a, p. 318), GBA 1903/004/0111/01 (FELIX coll.), Coniacian–Santonian (Gosau Group at greater Rußbach-Gosau area) or Upper Santonian (Gosau Group at Piesting), Austria; scale bar: 7 mm.

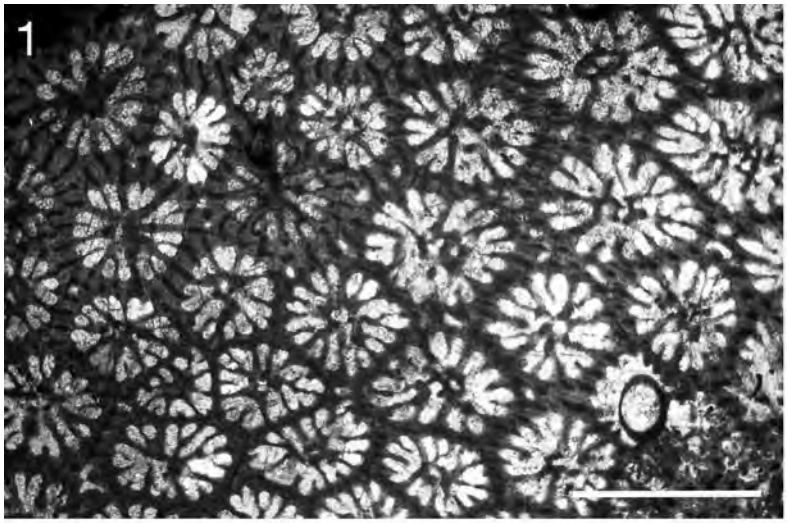
Figs. 4, 6: *Actinastrea ramosa* (SOWERBY, 1832) (= *A. octolamellosa* [MICHELIN, 1847])

Fig. 4: thin section, lateral view; SAZU I/24, Santonian–Campanian (Austroalpine unit at Stranice), Slovenia. Photograph courtesy D. TURNŠEK; scale bar: 3 mm.

Fig. 6: thin section, cross view; SAZU I/24, Santonian–Campanian (Austroalpine unit at Stranice), Slovenia. Photograph courtesy D. TURNŠEK; scale bar: 3 mm.

Fig. 7: *Actinastrea infundibulum* ALLOITEAU, 1954a

First record from the geographic areas covered in this report; thin section, cross view; BSPG 48/IV (BARON-SZABO-1997 coll.), Lower Coniacian (Gosau Group at Brandenberg), Austria; scale bar: 2 mm.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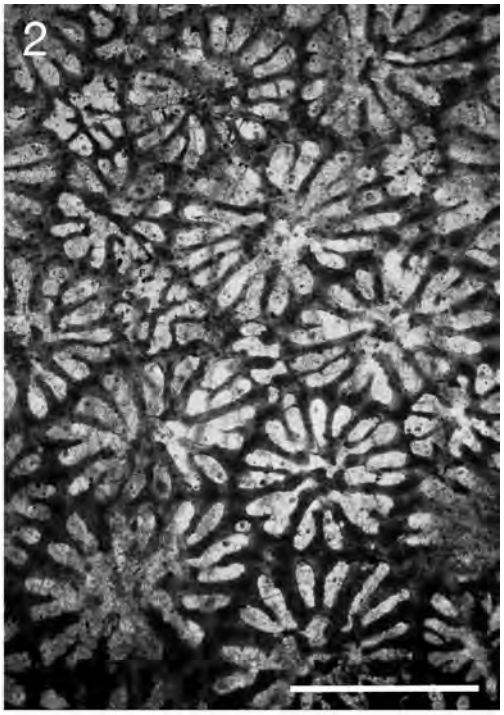
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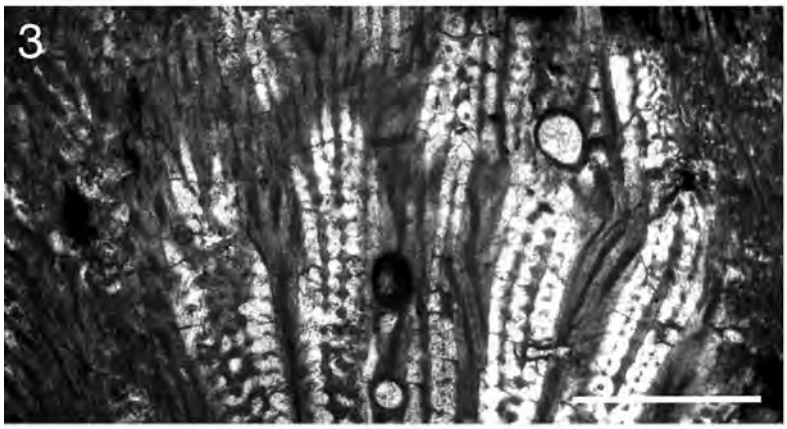
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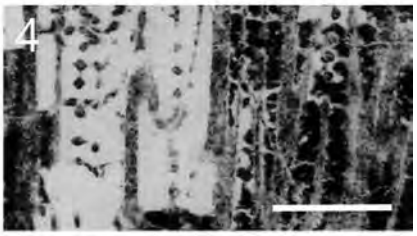
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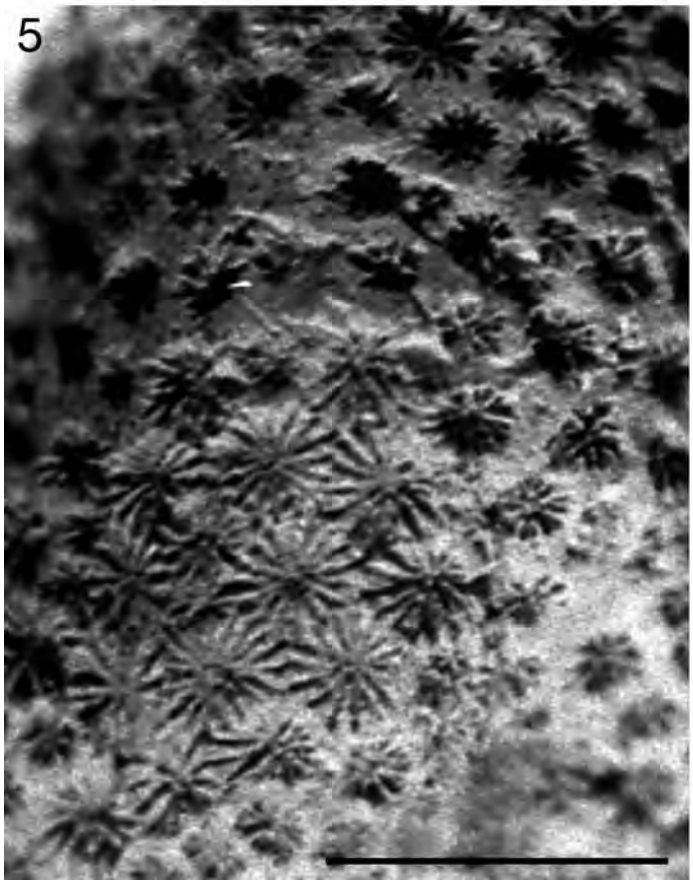
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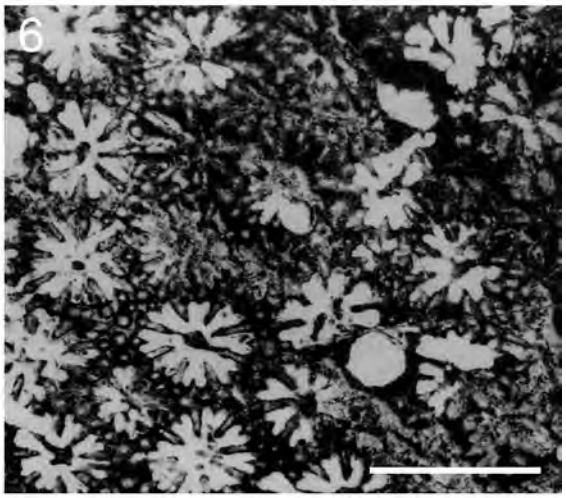
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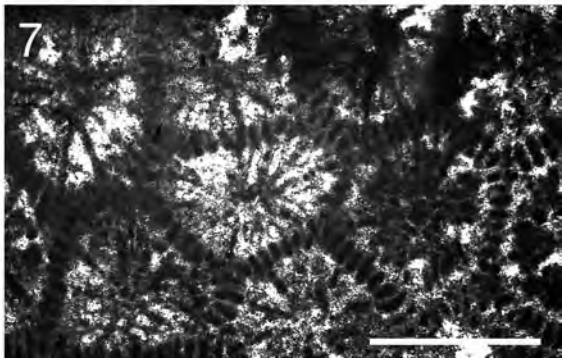
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Plate 5

Figs. 1, 2: *Eugyra lanckoronesis* (MORYCOWA, 1964)

Fig. 1: thin section, cross view; BSPG MAT 217 (BARON-SZABO coll.), Lower Aptian (Schrattenkalk at Allgäu, Mahdtal), Germany; scale bar: 1 mm.

Fig. 2: close-up of Fig. 1; scale bar: 1 mm.

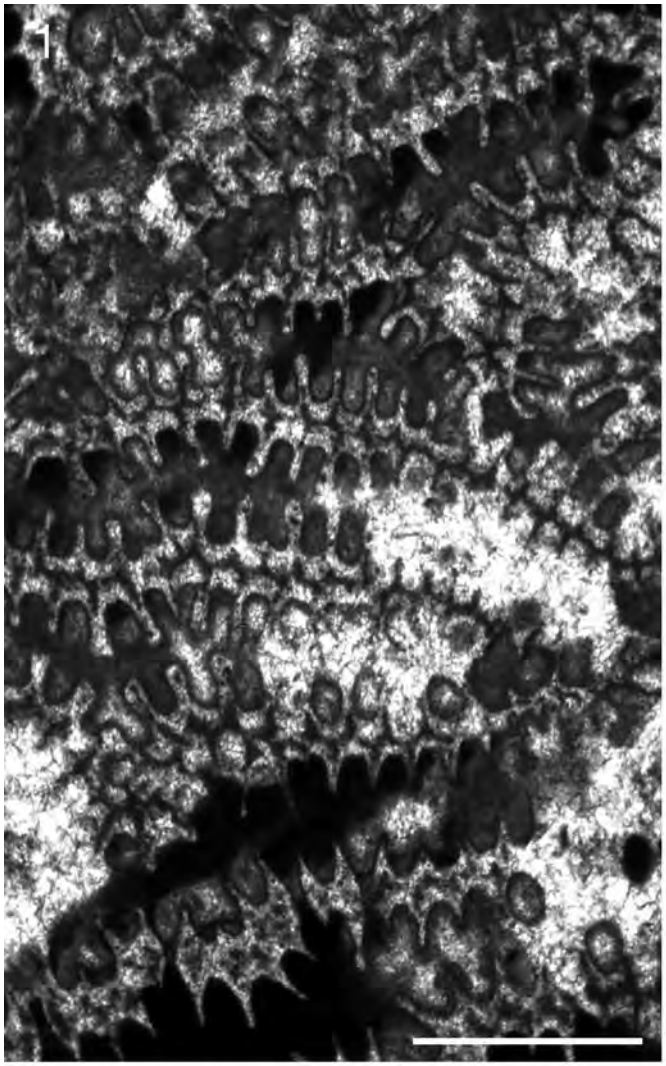
Fig. 3: *Eugyra* (*Felixigyra*) *patruliusi* (MORYCOWA, 1971)

Thin section, cross view; BSPG OG-226 (BARON-SZABO coll.), Lower Aptian (Schrattenkalk at Allgäu, Upper Gottesackerwände), Germany; scale bar: 4 mm.

Figs. 4, 5: *Eugyra* (*Felixigyra*) *ovalis* (MASSE & MORYCOWA, 1994)

Fig. 4: thin section, cross view; BSPG BA-2b (BARON-SZABO coll.), Lower Aptian (Schrattenkalk at Allgäu, Brandalpe), Germany; scale bar: 2 mm.

Fig. 5: thin section, lateral view; scale bar: 2 mm.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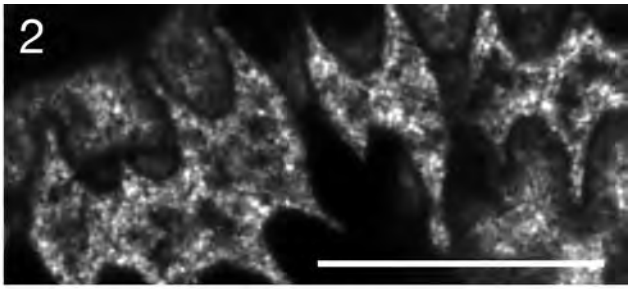
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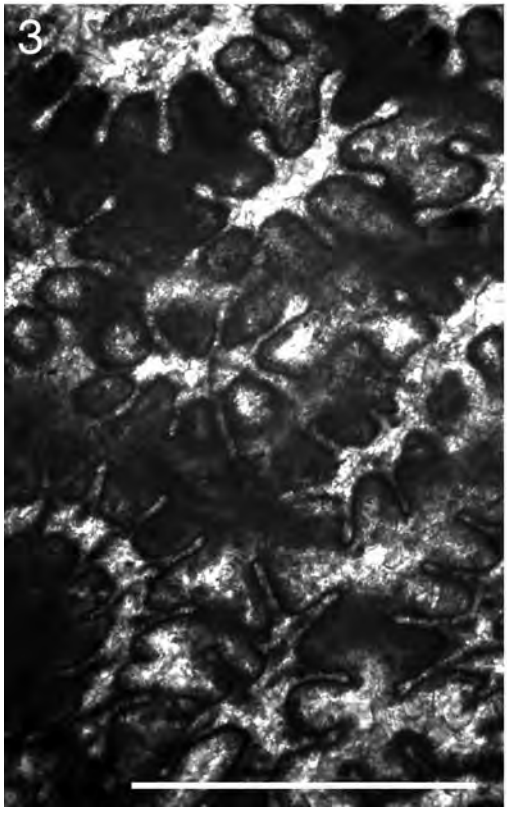
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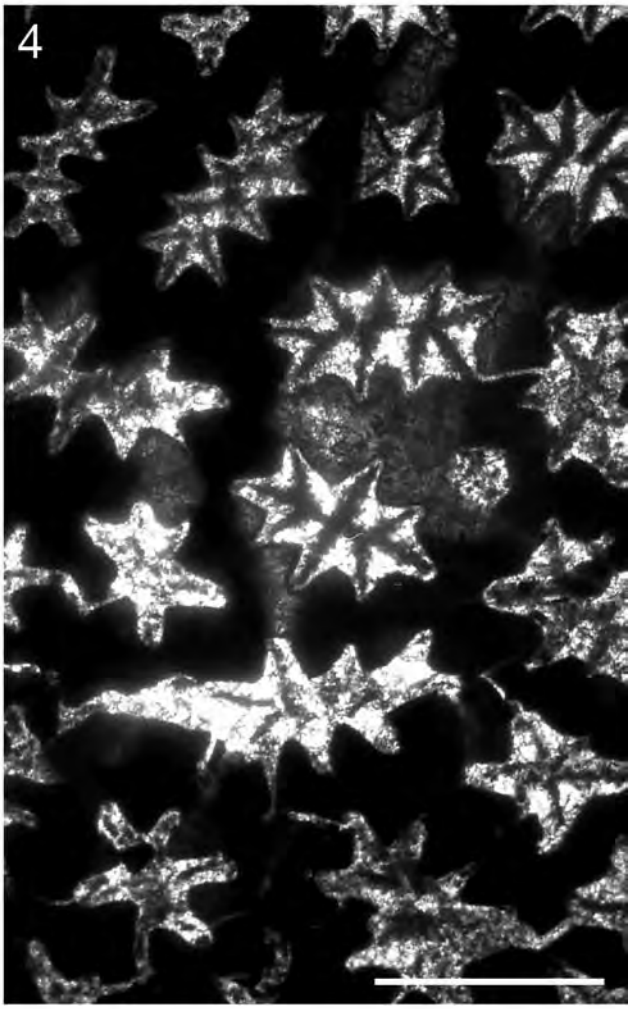
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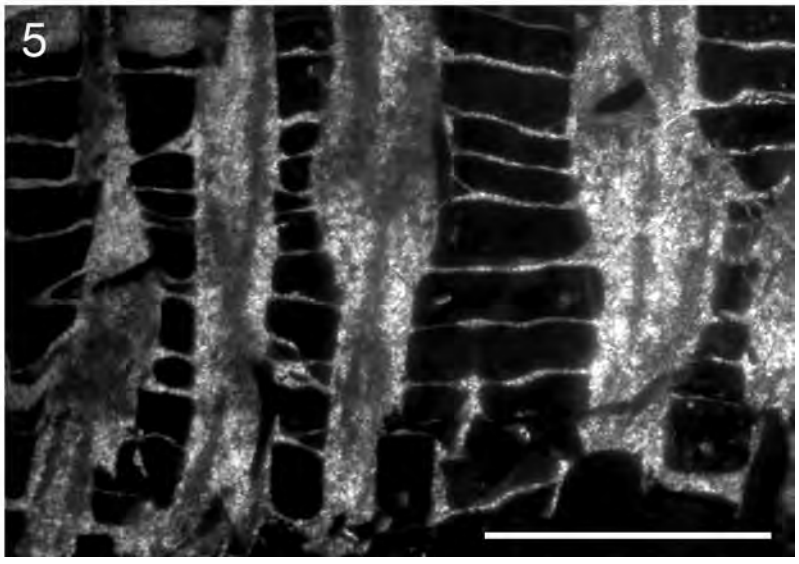
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Plate 6

Figs. 1, 6: *Myriophyllia propria* SIKHARULIDZE, 1979

Fig. 1: thin section, cross view; BSPG BA-7cI (BARON-SZABO coll.), Lower Aptian (Schrattenkalk at Allgäu, Brandalpe), Germany; scale bar: 2 mm.

Fig. 6: thin section, cross view, oblique; BSPG BA-7cIII (BARON-SZABO coll.), Lower Aptian (Schrattenkalk at Allgäu, Brandalpe), Germany; scale bar: 2 mm.

Figs. 2, 3, 5: *Cycloria patellaris* (REUSS, 1854)

Syntype, NHMW 1864/0040/1343, Upper Santonian (Gosau Group at Piesting), Austria.

Fig. 2: upper surface of colony; scale bar: 9 mm.

Fig. 3: close-up of Fig. 2, showing parts of the colony with structures that are characteristic of the genus *Meandroria* ALLOITEAU, 1952a; scale bar: 3 mm.

Fig. 5: close-up of Fig. 2; scale bar: 4 mm.

Fig. 4: *Cycloria tenella* (GOLDFUSS, 1826)

Thin section, cross view; GBA 2003/023/0021/01 (BARON-SZABO-2003a coll.), Santonian (Gosau Group at Hochmoos-Grabenbach area), Austria; scale bar: 3 mm.

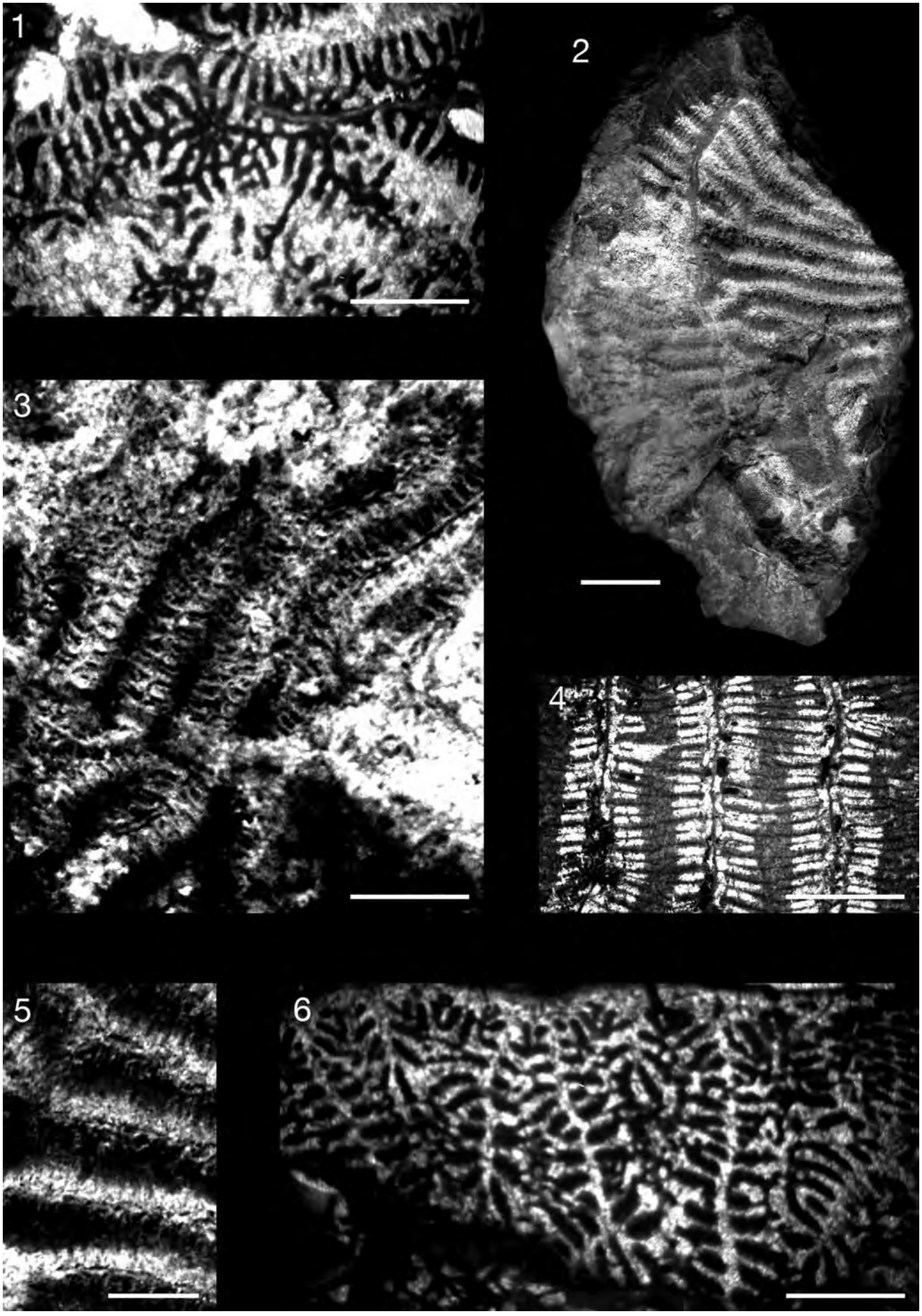
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Plate 7

Figs. 1–3: *Cycloria tenella* (GOLDFUSS, 1826)

Holotype, IPB 211 (GOLDFUSS coll.), Turonian–Campanian (Gosau Group, unidentified locality), Austria.

Fig. 1: upper surface of colony, polished; scale bar: 30 mm.

Fig. 2: close-up of Fig. 1, showing wavy, meandroid series; scale bar: 7 mm.

Fig. 3: close-up of Fig. 1, showing long, parallel series; scale bar: 3 mm.

Figs. 4, 5, 8: *Cycloria konincki* (MILNE EDWARDS & HAIME, 1849b)

NHMW 1864/0040/1341 (REUSS coll.), Coniacian–Santonian (Gosau Group at Rußbach-Gosau area) or Upper Santonian (Gosau Group at Piesting area), Austria.

Fig. 4: upper surface of colony; scale bar: 20 mm.

Fig. 5: close-up of Fig. 4; scale bar: 5 mm.

Fig. 8: upper surface of colony, polished; scale bar: 5.5 mm.

Figs. 6, 9, 10: *Cycloria salisburgensis* (MILNE EDWARDS & HAIME, 1849b)

NHMW 1864/0040/1335 (REUSS coll.), original material of REUSS (1854, p. 109, Pl. 15, Figs. 12, 13), Santonian (Gosau Group at Randograben) or Upper Santonian (Gosau Group at Piesting), Austria.

Fig. 6: upper surface of colony; scale bar: 20 mm.

Fig. 9: close-up of Fig. 6; scale bar: 7 mm.

Fig. 10: thin section, cross view; GBA 2003/023/0021/02 (BARON-SZABO-2003a coll.), originally figured as *Orbignygyra tenella* (GOLDFUSS, 1826), Santonian (Gosau Group at Hochmoos-Grabenbach area), Austria; scale bar: 3 mm.

Fig. 7: *Cycloria patellaris* (REUSS, 1854)

Syntype, NHMW 1864/0040/1343, Upper Santonian (Gosau Group at Piesting), Austria; upper surface of colony; close-up of Fig. 2 on Pl. 6, showing parts of the colony with structures that are characteristic of the genus *Orbignygyra* ALLOITEAU, 1952a (see Fig. 11 on this plate); scale bar: 2 mm.

Fig. 11: *Cycloria neptuni* (D'ORBIGNY, 1850)

Lectotype, MNHN Mo3774, upper surface of colony; Turonian, France (Aude); scale bar: 10 mm.

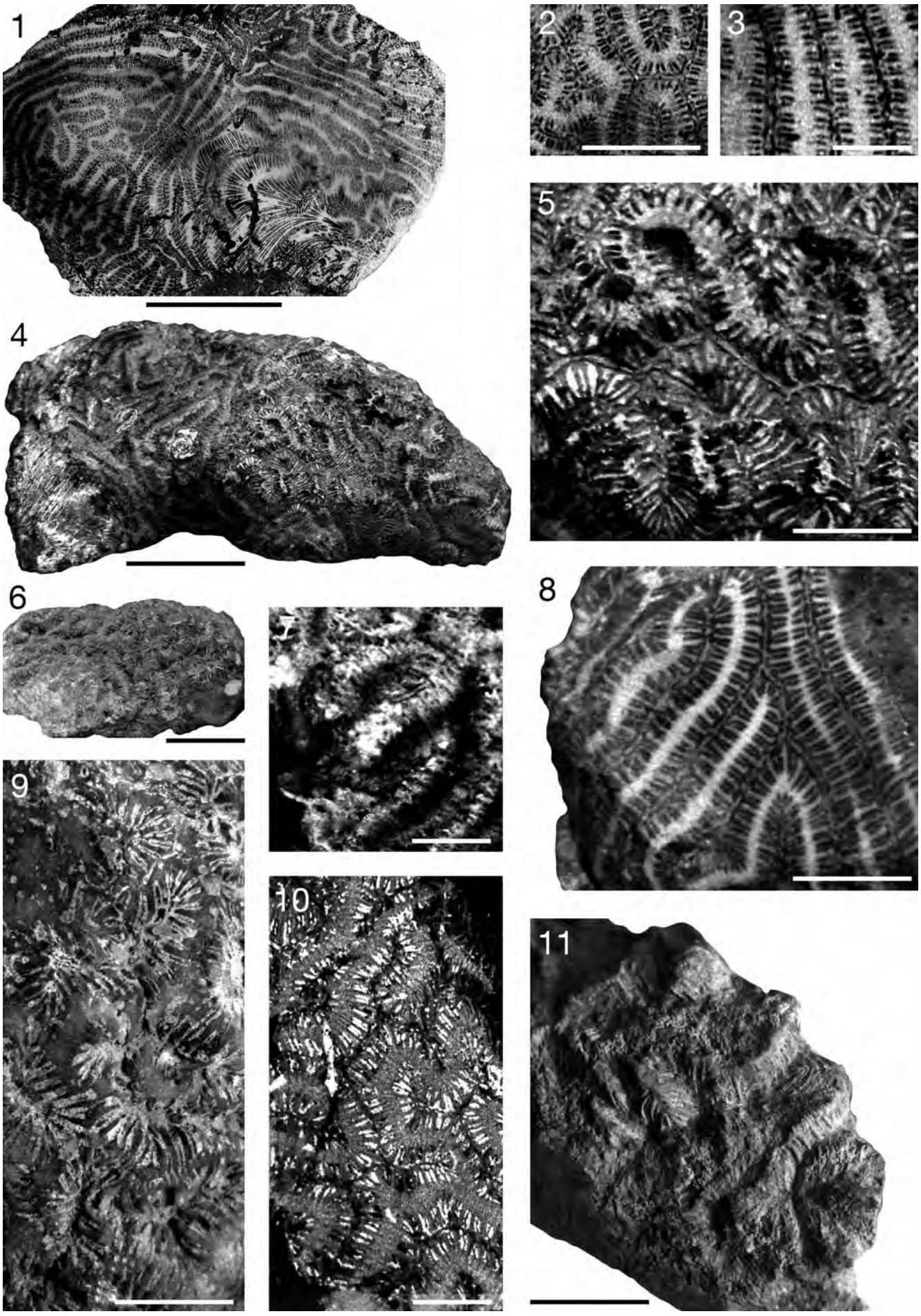
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Plate 8

Figs. 1–3: *Liptodendron nefiana* (OPPENHEIM, 1930a)

NHMW 1854/0040/1317, Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area), Austria.

Fig. 1: polished upper surface, cross view; scale bar: 5 mm.

Fig. 2: upper surface, lateral view; scale bar: 4 mm.

Fig. 3: polished surface of base of corallum, cross view; scale bar: 3.5 mm.

Fig. 4: *Liptodendron grossi* ELIÁŠOVÁ, 1991a

Holotype of the type species of the genus *Liptodendron*, SNM/Z 20657, thin section, cross and lateral view, oblique; Eocene of Slovakia. Photograph courtesy H. ELIÁŠOVÁ; scale bar: 4 mm.

Figs. 5, 7: *Hydnophora styriaca* (MICHELIN, 1847)

BSPG 78/I (BARON-SZABO coll.), Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria.

Fig. 5: close-up of Fig. 7; scale bar: 3.5 mm.

Fig. 7: thin section, cross view; scale bar: 4.5 mm.

Figs. 6, 10: *Hydnophora ataciana* D'ORBIGNY, 1850

Fig. 6: thin section, cross view; SAZU I/23b, Santonian–Campanian (Austroalpine unit at Stranice), Slovenia. Photograph courtesy D. TURNŠEK; scale bar: 3 mm.

Fig. 10: thin section, lateral view, oblique; SAZU I/12b, Santonian–Campanian (Austroalpine unit at Stranice), Slovenia. Photograph courtesy D. TURNŠEK; scale bar: 7 mm.

Figs. 8, 9: *Ovalastrea caryophylloides* (GOLDFUSS, 1827)

Holotype of the type species of the genus, IPB 221 (GOLDFUSS coll.), Jurassic of Germany.

Fig. 8: upper surface of colony, cross view; scale bar: 7 mm.

Fig. 9: upper surface, lateral view, oblique; scale bar: 13 mm.

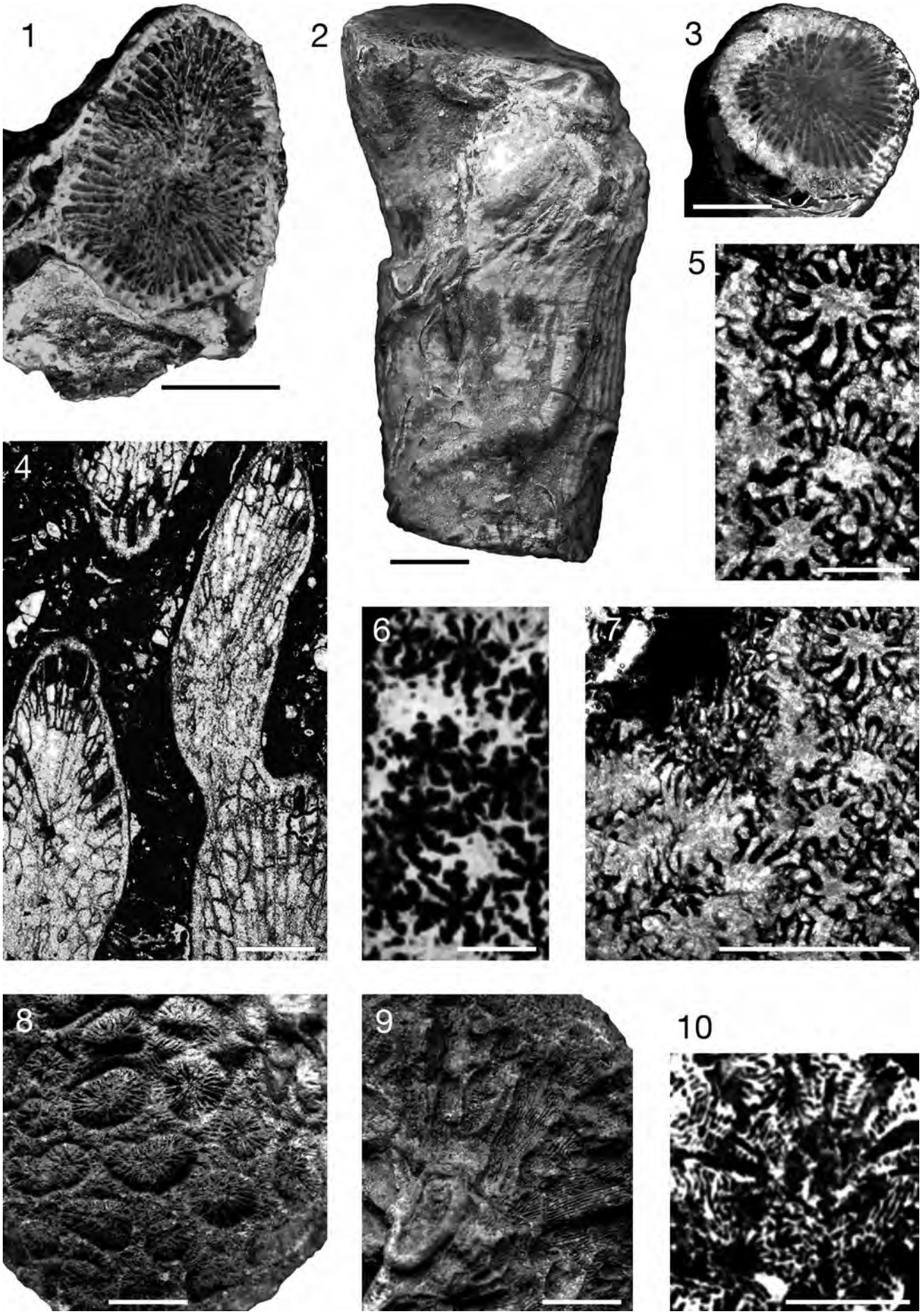
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Plate 9

Fig. 1: *Liptodendron grossi* ELIÁŠOVÁ, 1991a

Holotype of the type species of the genus *Liptodendron*, SNM/Z 20657, thin section, cross view; Eocene of Slovakia. Photograph courtesy H. ELIÁŠOVÁ; scale bar: 8 mm.

Figs. 2–5: *Liptodendron kocevjensis* (TURNŠEK, 1992)

Holotype, SAZU Sv-E/8, Albian (Dinaric occurrence at Slovenski vrh), Slovenia.
Photographs courtesy D. TURNŠEK.

Fig. 2: thin section, cross view; SAZU Sv-E/8b; scale bar: 3 mm.

Fig. 3: close-up of Fig. 2; scale bar: 1.7 mm.

Fig. 4: upper surface of colony, lateral view; SAZU Sv-E/8; scale bar: 20 mm.

Fig. 5: thin section, lateral view; SAZU Sv-E/8c; scale bar: 3.5 mm.

Figs. 6, 7: *Hydnophora multilamellosa* REUSS, 1854

SAZU St-1/18, Santonian–Campanian (Austroalpine unit at Stranice-quarry), Slovenia.
Photographs courtesy D. TURNŠEK.

Fig. 6: thin section, lateral view; SAZU St-1/18b; scale bar: 3.5 mm.

Fig. 7: thin section, cross view; SAZU St-1/18a; scale bar: 6.5 mm.

Fig. 8: *Hydnophora multilamellosa* REUSS, 1854

Syntype, NHMW 1864/0040/1349; upper surface of colony; for polished part of colony, see Fig. 9 on Pl. 10; Upper Turonian–Campanian (Gosau Group at “Gosau Basin”), Austria; scale bar: 6.5 mm.

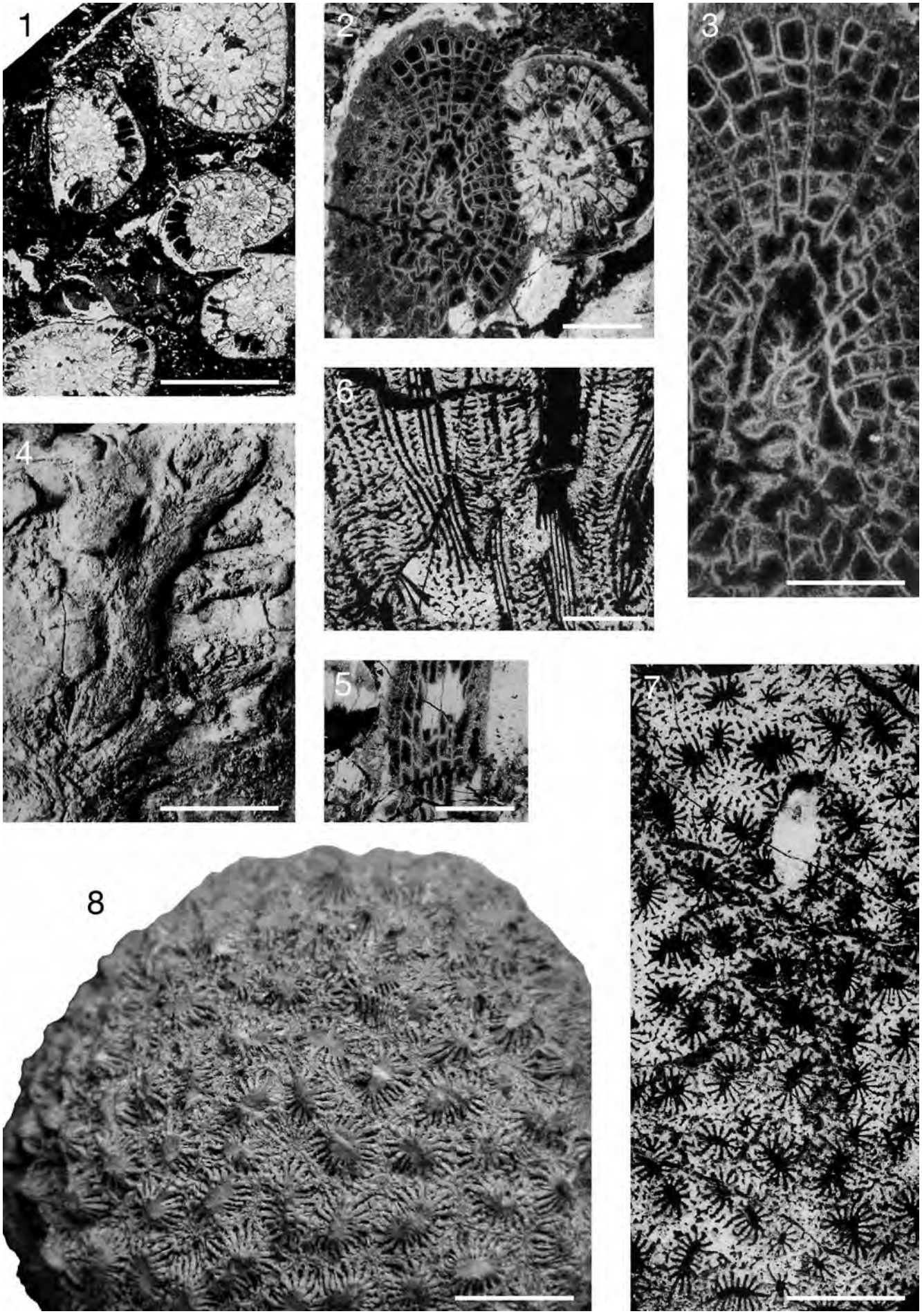
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Plate 10

Figs. 1, 2: *Hydnophora styriaca* (MICHELIN, 1847)

Fig. 1: thin section, lateral view, oblique; BSPG 78/I (BARON-SZABO coll.), Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria; scale bar: 3 mm.

Fig. 2: thin section, cross view; BSPG UG-45X (BARON-SZABO coll.), Lower Aptian, Schrattenkalk at Allgäu (Lower Gottesackerwände), Germany; scale bar: 1 mm.

Figs. 3, 4: *Nefocoenia edelbachensis* OPPENHEIM, 1930a

BSPG 35/XIII (BARON-SZABO coll.), Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria.

Fig. 3: thin section, cross view; scale bar: 2 mm.

Fig. 4: thin section, lateral view; scale bar: 1 mm.

Figs. 5–8: *Nefocoenia lobata* (REUSS, 1854)

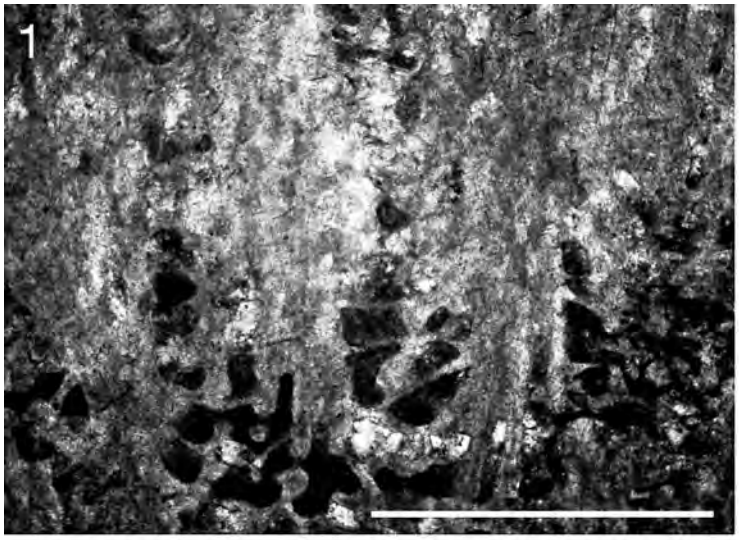
NHMW 1864/0011/1221, Santonian (Gosau Group at Randograben) or Upper Santonian (Gosau Group at Neffgraben), Austria.

Fig. 5: upper surface of colony; scale bar: 9 mm.

Figs. 6–8: close-up pictures of Fig. 5. Fig. 6: scale bar: 2 mm; Fig. 7: scale bar: 2.5 mm; Fig. 8: scale bar: 1.5 mm.

Fig. 9: *Hydnophora multilamellosa* REUSS, 1854

Syntype, NHMW 1864/0040/1349; cross view of colony, partially polished; Upper Turonian–Campanian (Gosau Group at "Gosau Basin"), Austria; scale bar: 3.5 mm.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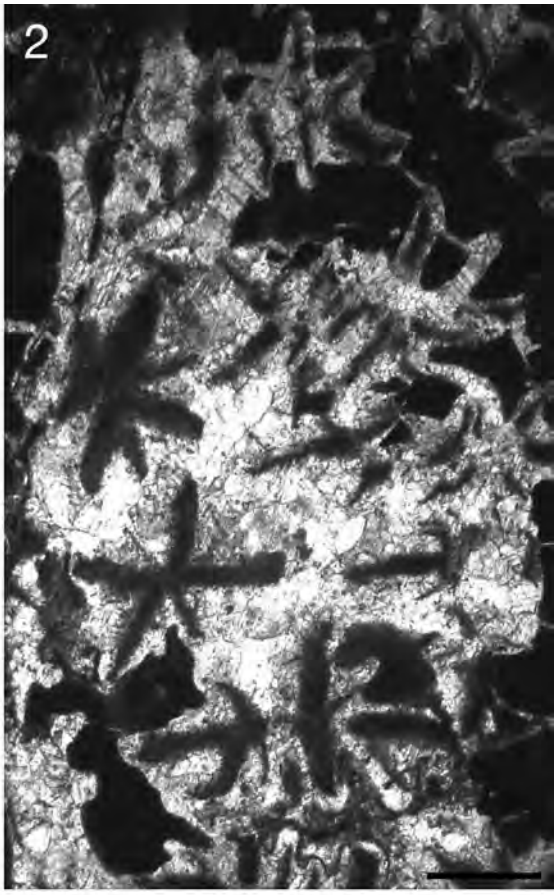
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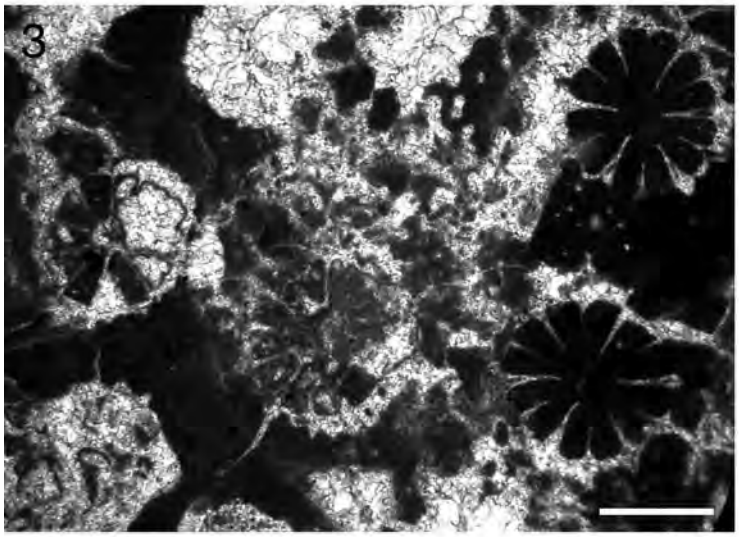
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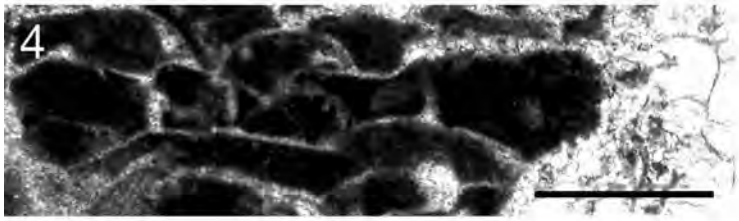
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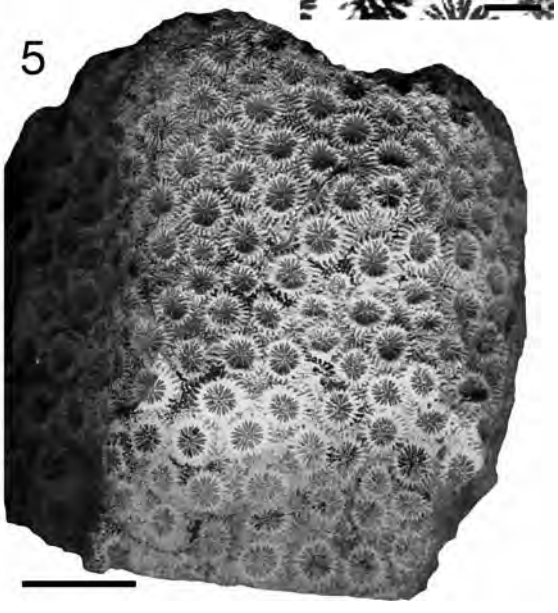
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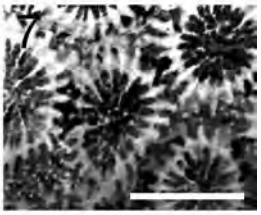
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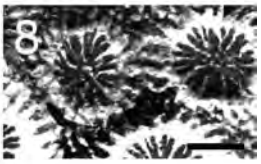
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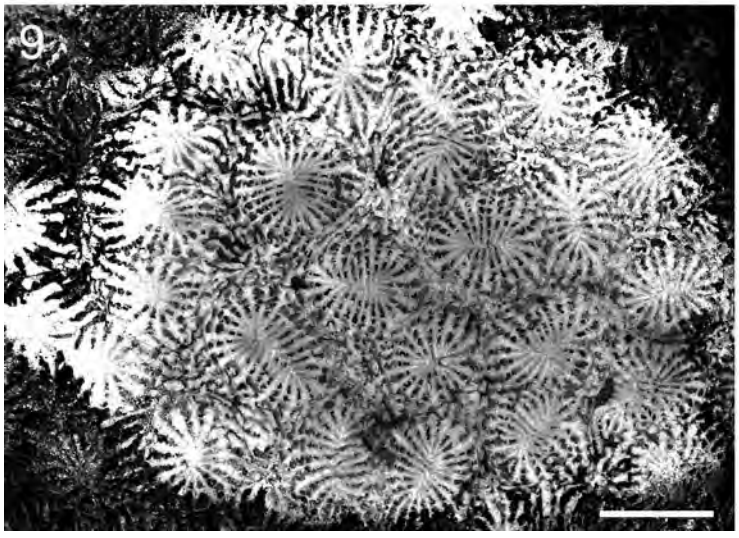
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Plate 11

Figs. 1–5: *Cladocora caespitosa* (LINNÉ, 1767)

Chronotype, ZMB Cni 743 (Gerresheim, coll.), recent, probably Mediterranean Sea.

Fig. 1: upper surface of colony; scale bar: 30 mm.

Fig. 2: close-up of Fig. 1; scale bar: 6 mm.

Fig. 3: upper surface, cross view of adult corallite, slightly oblique; scale bar: 2 mm.

Fig. 4: upper surface, cross view of juvenile corallite, slightly oblique; scale bar: 2 mm.

Fig. 5: upper surface, lateral view of part of branch; scale bar: 2 mm.

Figs. 6–8: *Cladocora gracilis* (D'ORBIGNY, 1850)

Fig. 6: thin section, cross view; GBA 2003/023/0008/01 (BARON-SZABO-2003a coll.); Santonian (Gosau Group at Hochmoos-Grabenbach-area), Austria; scale bar: 1 mm.

Figs. 7, 8: GBA 2013/007/0001 (SZENTE coll.); Turonian–?Coniacian (Gosau Group at St. Gilgen, "Billroth"), Austria. Photographs courtesy I. SZENTE.

Fig. 7: thin section, cross view of colony; scale bar: 3.5 mm.

Fig. 8: upper surface of colony, lateral view; scale bar: 8 mm.

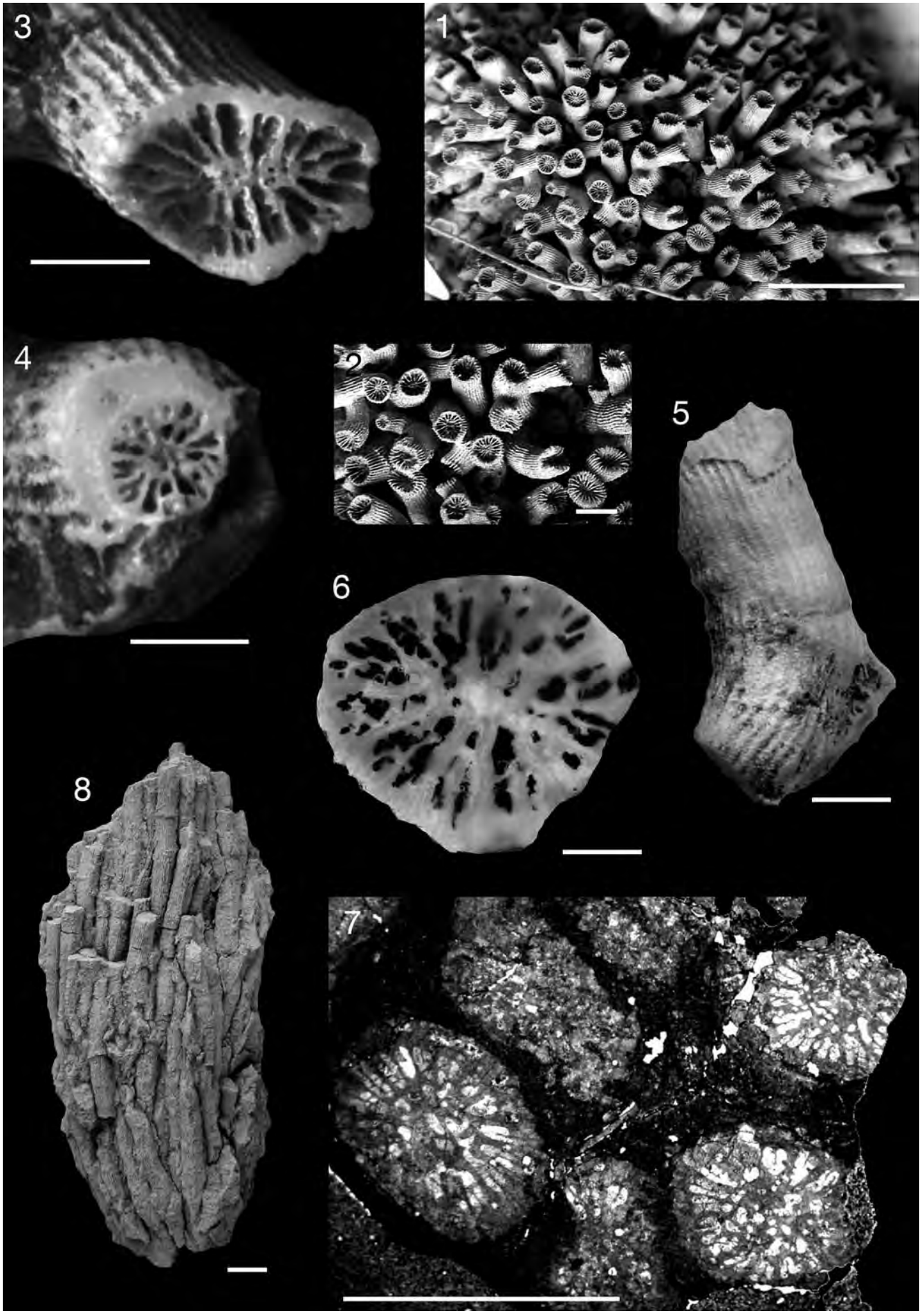
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Plate 12

Figs. 1–3, 6: *Placocoenia microcalyx* OPPENHEIM, 1930a

Fig. 1: upper surface, cross view; SZB-15718, Lower Santonian (Gosau Group at Untersberg, Wolfschwang), Austria; scale bar: 12 mm.

Fig. 2: upper surface, polished, lateral view; SZB-15718, Lower Santonian (Gosau Group at Untersberg, Wolfschwang), Austria; scale bar: 10 mm.

Fig. 3: thin section, cross view; BSPG KA4-4 (previously figured as *P. major* in BARON-SZABO, 1997), Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria; scale bar: 2 mm.

Fig. 6: close-up of Fig. 1; scale bar: 4 mm.

Figs. 4, 5, 7: *Placocoenia major* FELIX, 1903a

Fig. 4: upper surface of colony; syntype, GBA 1903/004/0096/01, Turonian–Campanian (Gosau Group, possibly at greater Rußbach-Gosau area or Brandenberg), Austria; scale bar: 9 mm.

Fig. 5: upper surface of colony; syntype, NHMW 1864/0001/0684, Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area), Austria; scale bar: 9 mm.

Fig. 7: close-up of Fig. 5; scale bar: 5 mm.

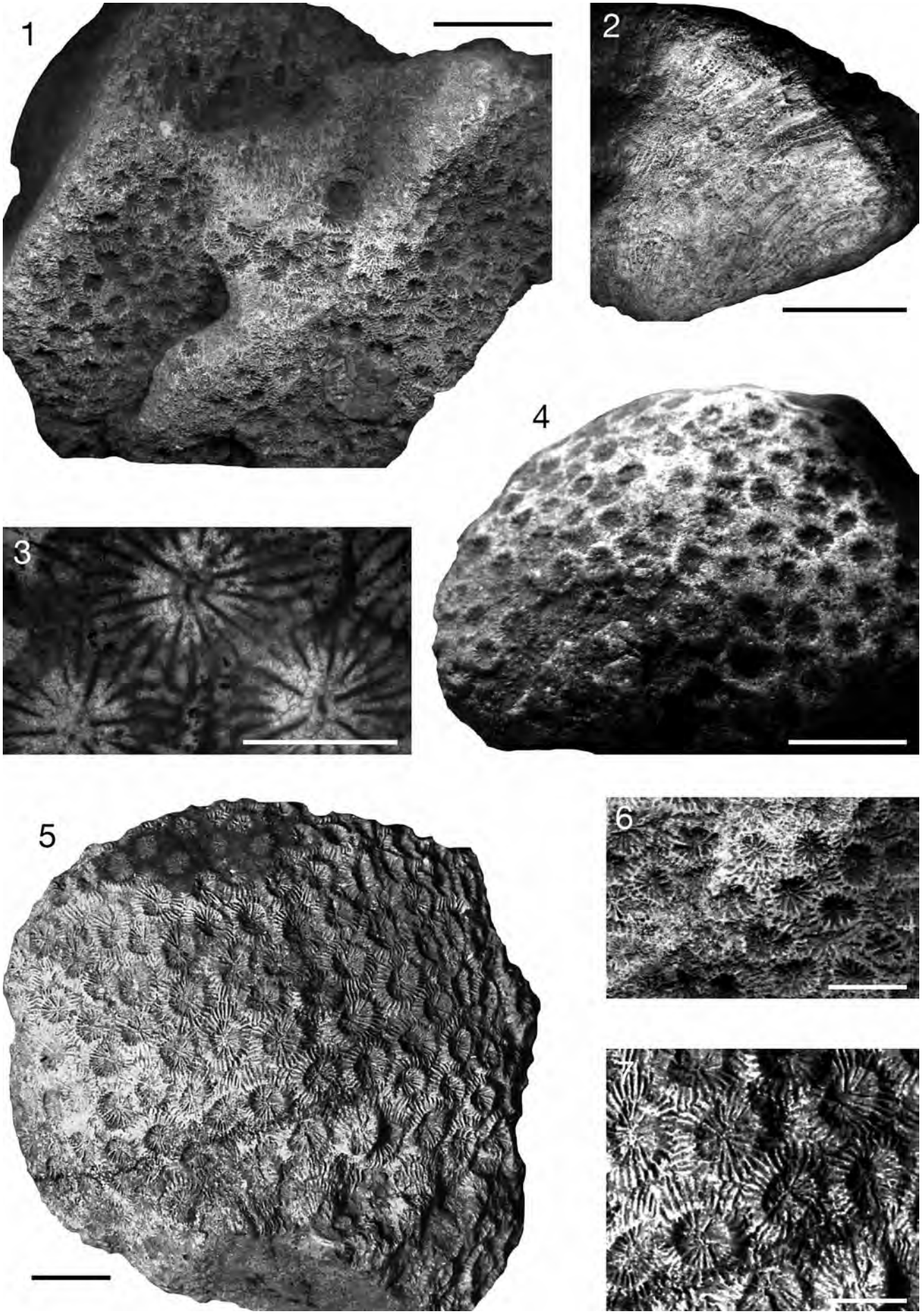
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Plate 13

Figs. 1–3: *Placocoenia major* FELIX, 1903a

GBA 1999/089/0004/02 (BARON-SZABO-1999 coll.), Upper Santonian (Gosau Group at Styrian Weissenbachalm), Austria.

Fig. 1: thin section, cross view; scale bar: 6 mm.

Fig. 2: thin section, lateral view; scale bar: 8 mm.

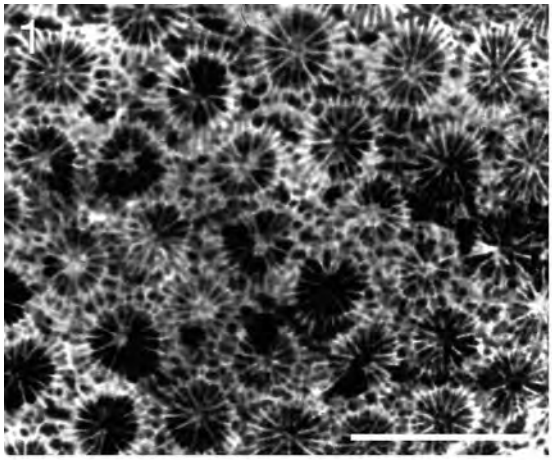
Fig. 3: close-up of Fig. 1; scale bar: 3 mm.

Figs. 4–6: *Neocoenia lepida* (REUSS, 1854)

Fig. 4: thin section, cross view, showing various columellar types; BSPG KA4-5 (BARON-SZABO coll.), Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria; scale bar: 1.5 mm.

Fig. 5: thin section, cross view; BSPG KA2-1 (BARON-SZABO coll.), Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria; scale bar: 3 mm.

Fig. 6: thin section, cross view; GBA 1999/089/0021/04 (BARON-SZABO-1999 coll.), Upper Santonian–Campanian (Gosau Group at Styrian Aussee, Weissenbachalm), Austria; scale bar: 2.5 mm.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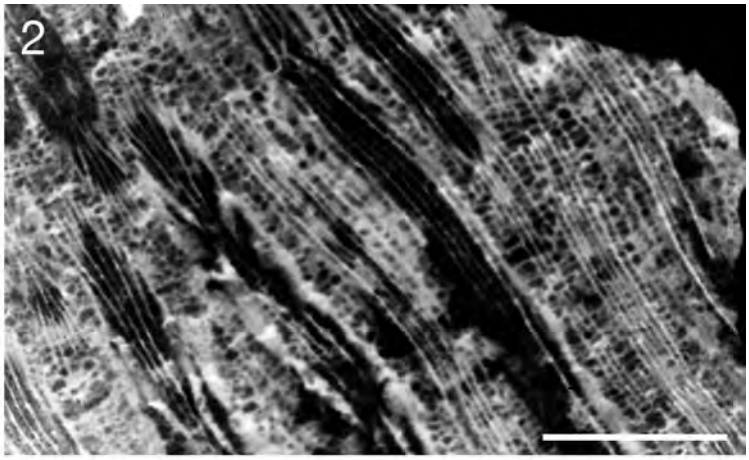
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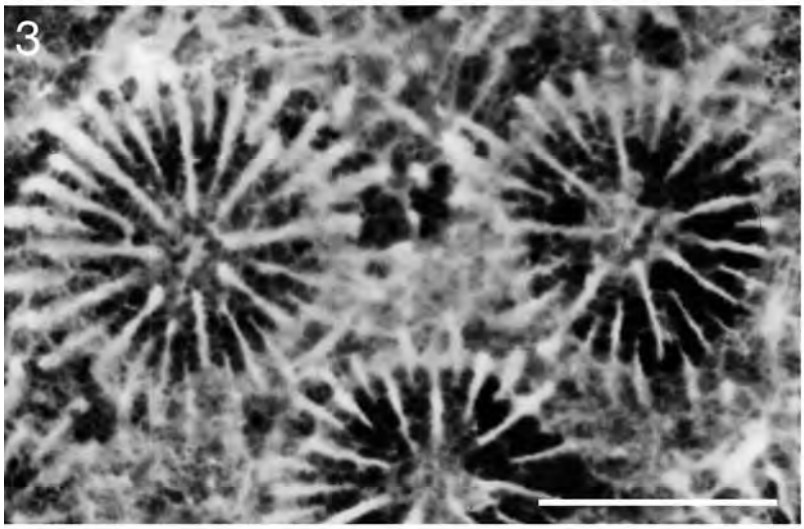
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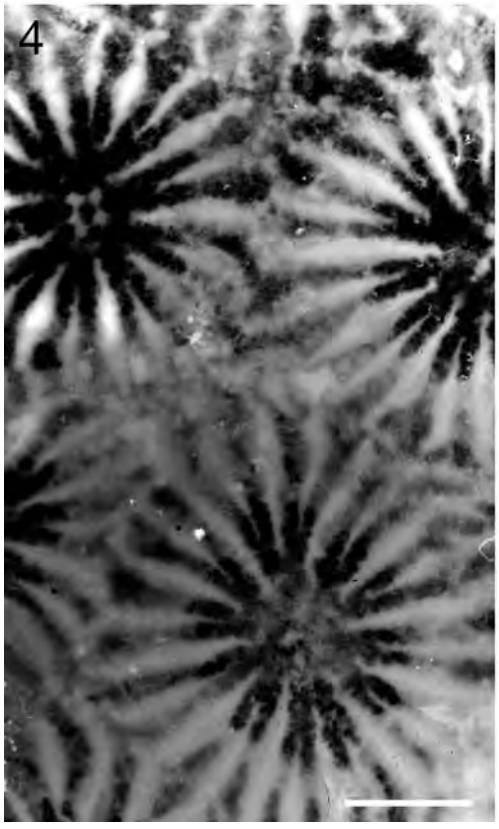
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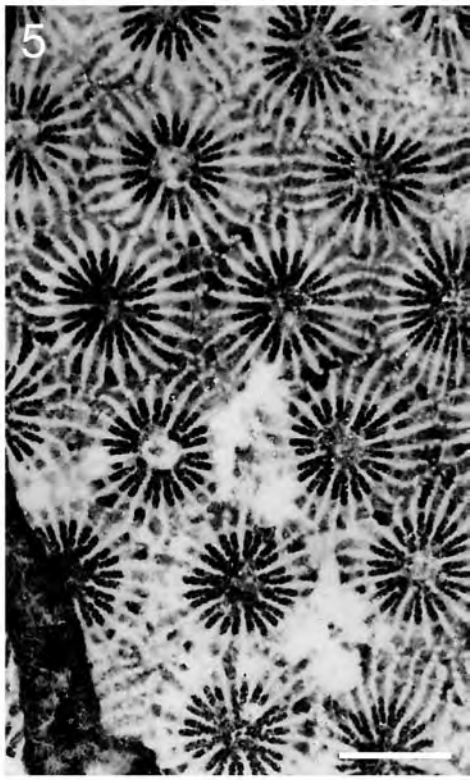
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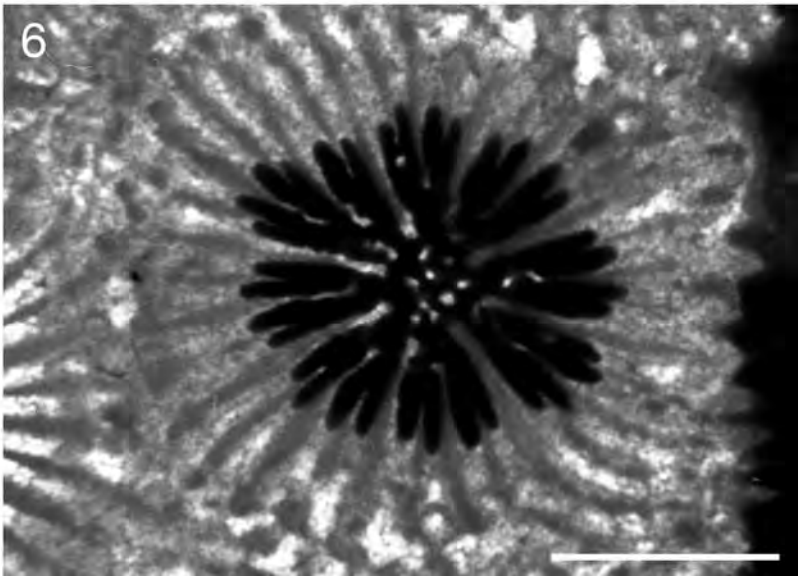
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Plate 14

Figs. 1, 2: *Neocoenia lepida* (REUSS, 1854)

GBA 1903/004/0095/01 (FELIX coll.), original material of FELIX (1903a, p. 297, presented as *Placocoenia dumortieri* DE FROMENTEL), Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area; according to FELIX, 1903a, material might have come from the Upper Santonian at Neffgraben), Austria.

Fig. 1: upper surface of colony, cross view; scale bar: 10 mm.

Fig. 2: upper surface of colony, polished, lateral view; scale bar: 10mm.

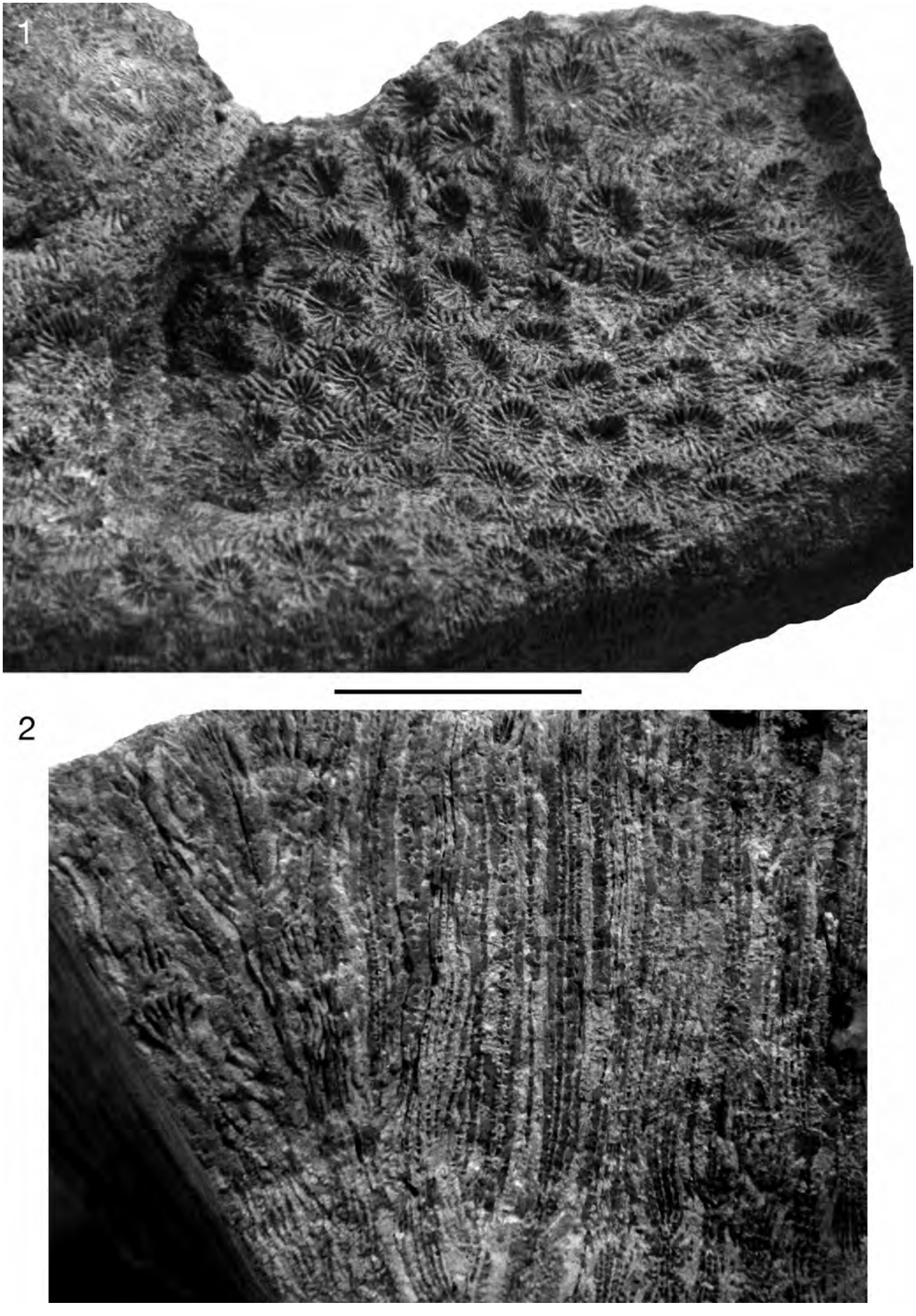
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Plate 15

Figs. 1–8: *Neocoenia* (*Placocaeniopsis*) *kittliana* (FELIX, 1903a)

Figs. 1, 7: Fig. 1: thin section, cross view; scale bar: 1.5 mm; Fig. 7: scale bar: 2 mm; BSPG 36/VIII (BARON-SZABO coll.), Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria.

Figs. 2, 4, 8: Figs. 2 and 8: upper surface, cross view; close-up pictures of Fig. 4; syntype, GBA 1903/004/0098 (FELIX coll.), Upper Santonian (Gosau Group at Neffgraben), Austria; Fig. 2: scale bar: 3 mm; Fig. 4: scale bar: 13 mm; Fig. 8: scale bar: 1.8 mm.

Figs. 3, 5: Fig. 3: upper surface of colony, cross view; Fig. 5: lateral view; SZB-7367, Lower Santonian (Gosau Group at Untersberg, Wolfschwang), Austria; Fig. 3: scale bar: 14 mm; Fig. 5: scale bar: 5 mm.

Fig. 6: polished surface of colony, cross view; syntype, NHMW 1886/018/0080 (FELIX coll.), Upper Santonian (Gosau Group at Neffgraben), Austria; scale bar: 15 mm.

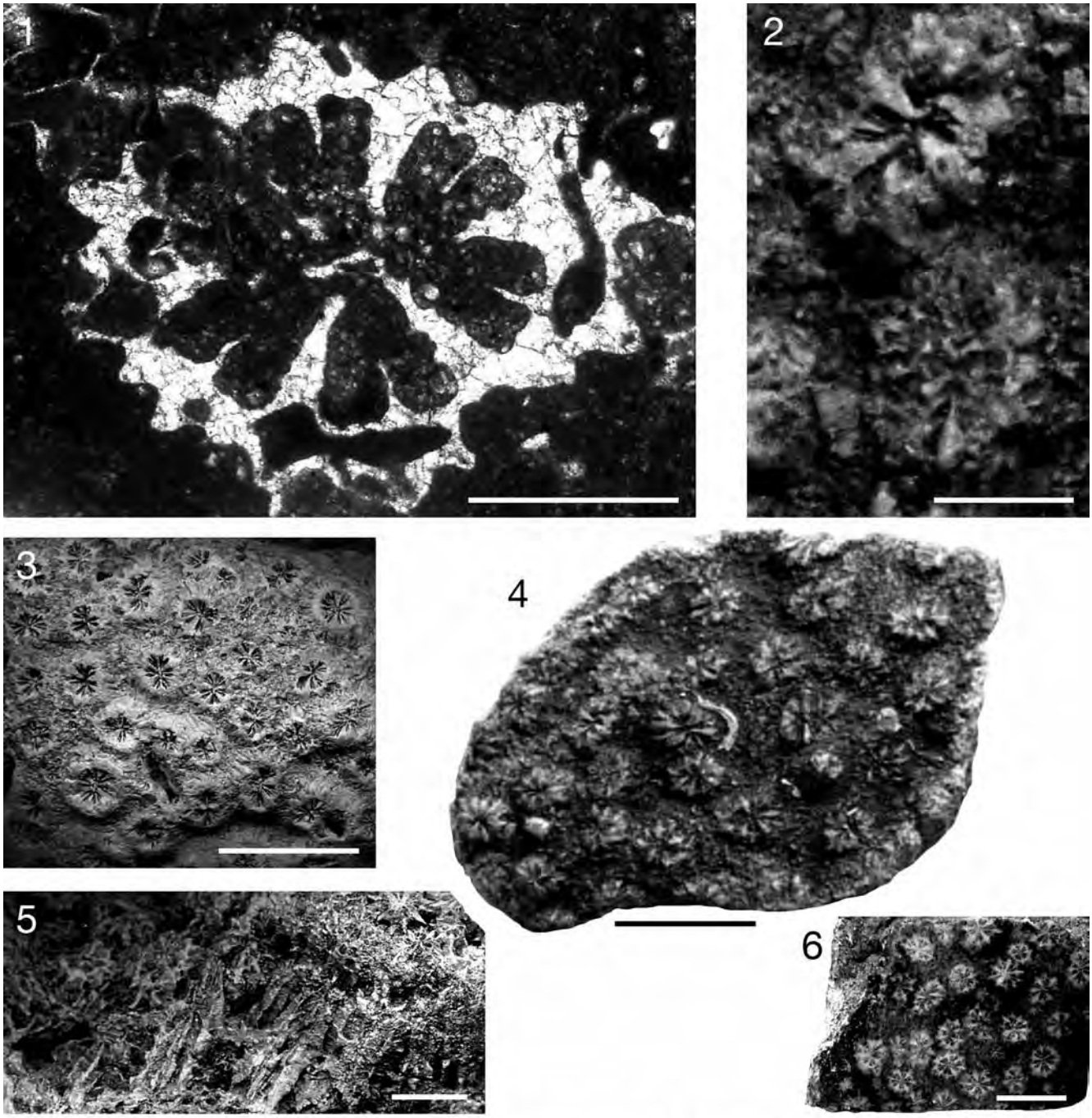
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Plate 16

Figs. 1, 2: *Astrogyra edwardsi* (REUSS, 1854)

Holotype, GBA 1854/007/0030 (REUSS coll.), Turonian–Campanian "Gosau Group" (according to FELIX, 1903a, occurrence possibly restricted to Santonian localities of the Rußbach area), Austria.

Fig. 1: upper surface of colony, cross view; scale bar: 20 mm.

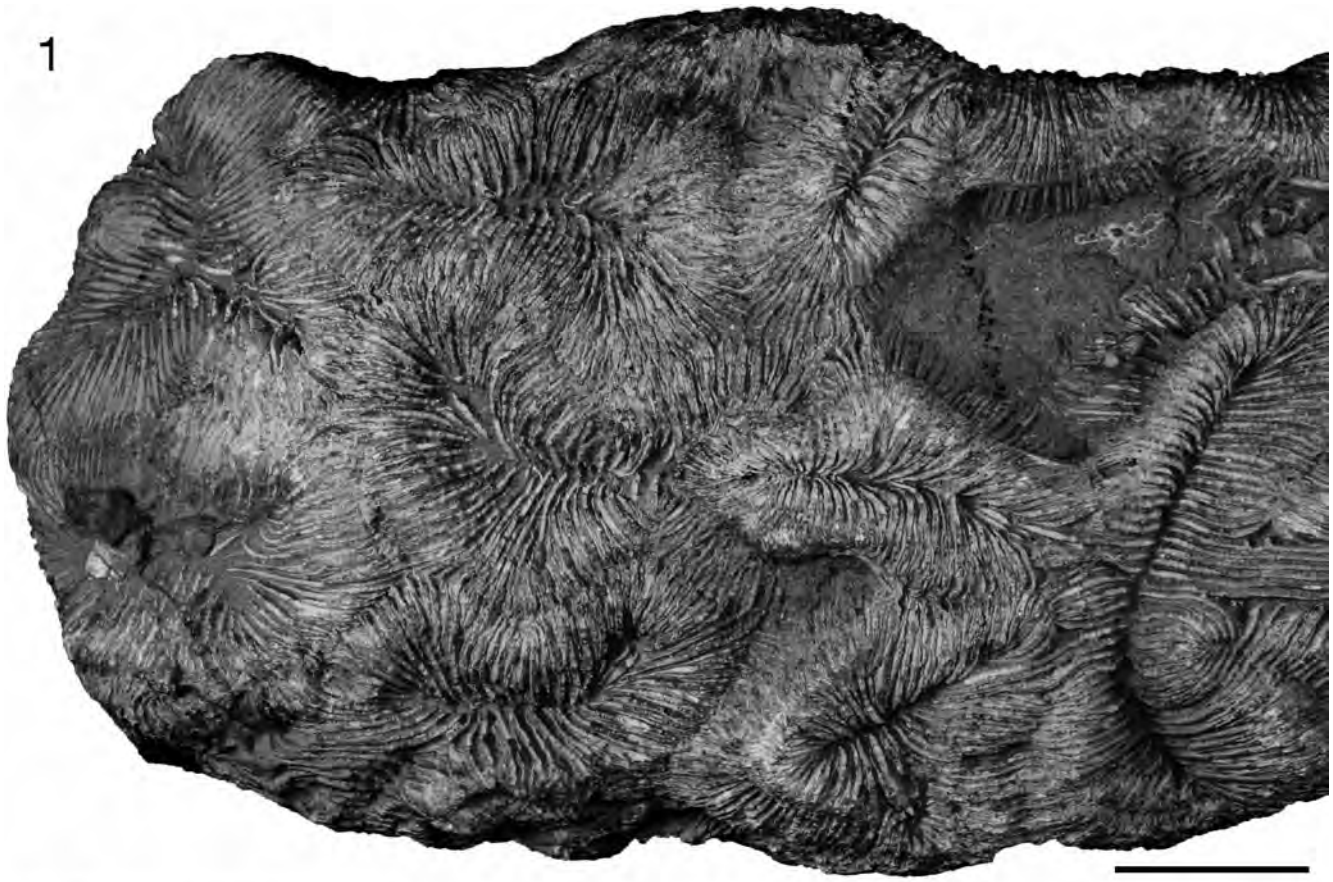
Fig. 2: lateral view, polished surface; scale bar: 15 mm.

Figs. 3–5: *Astrogyra orbignyi* (DE FROMENTEL, 1873)

GBA 1999/089/0005/02 (BARON-SZABO-1999 coll.), Upper Santonian (Gosau Group at Styrian Aussee, Weissenbachalm), Austria.

Figs. 3, 5: Fig. 3: thin section, cross view, close-up of Fig. 5; scale bar: 2.5 mm; Fig: 5: scale bar: 5 mm.

Fig. 4: thin section, lateral view; scale bar: 2 mm.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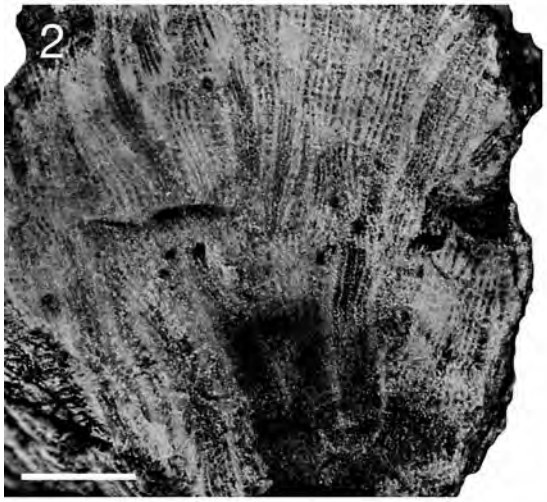
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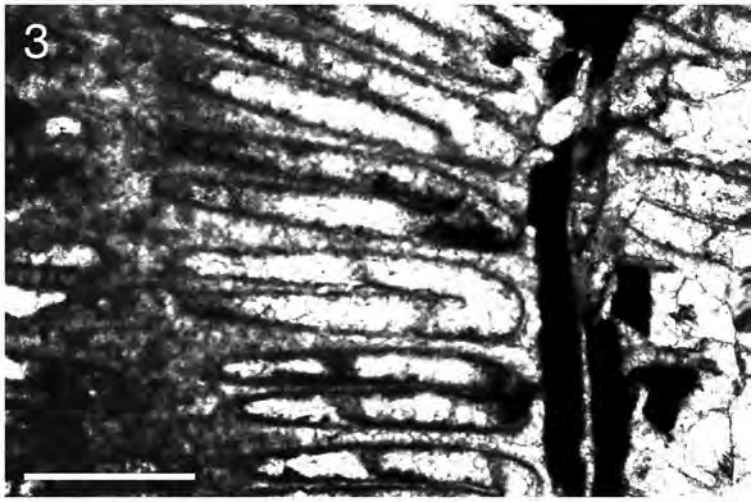
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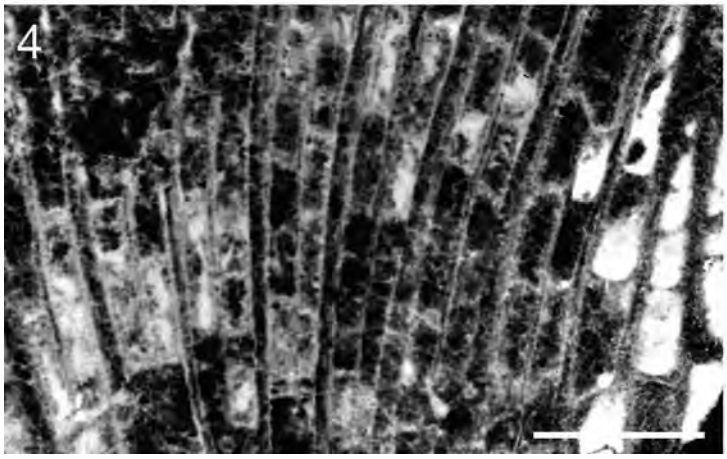
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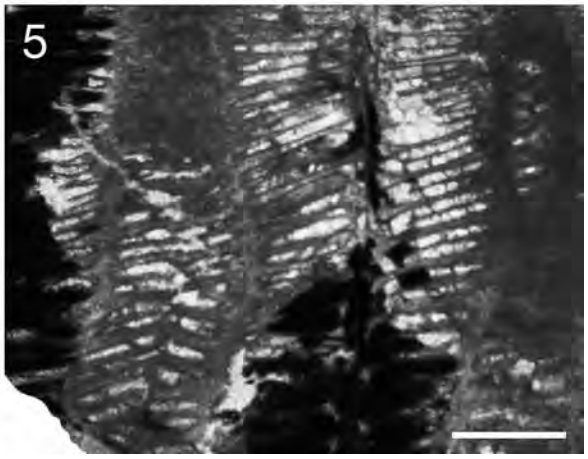
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Plate 17

Figs. 1, 2: *Taxogyra macroreina* (MICHELIN, 1847)

GBA 1903/004/0067 (FELIX coll.), original material of FELIX (1903a, p. 253, Pl. 23, Fig. 13), Turonian–Campanian (according to FELIX, 1903a, specimen possibly collected from the Gosau Group at Brunstloch, Upper Santonian), Austria.

Fig. 1: upper surface of colony; scale bar: 27 mm.

Fig. 2: close-up of Fig. 1; scale bar: 6.5 mm.

Figs. 3, 4: *Columnocoenia ksiazkiewiczi* MORYCOWA, 1964

ZSH H-KU 793 (SCHOLZ coll.), Lower Aptian (Schrattenkalk at Allgäu: Falkenberg), Germany.

Fig. 3: polished surface, lateral view, oblique; scale bar: 4.5 mm.

Fig. 4: polished surface, cross view; scale bar: 6 mm.

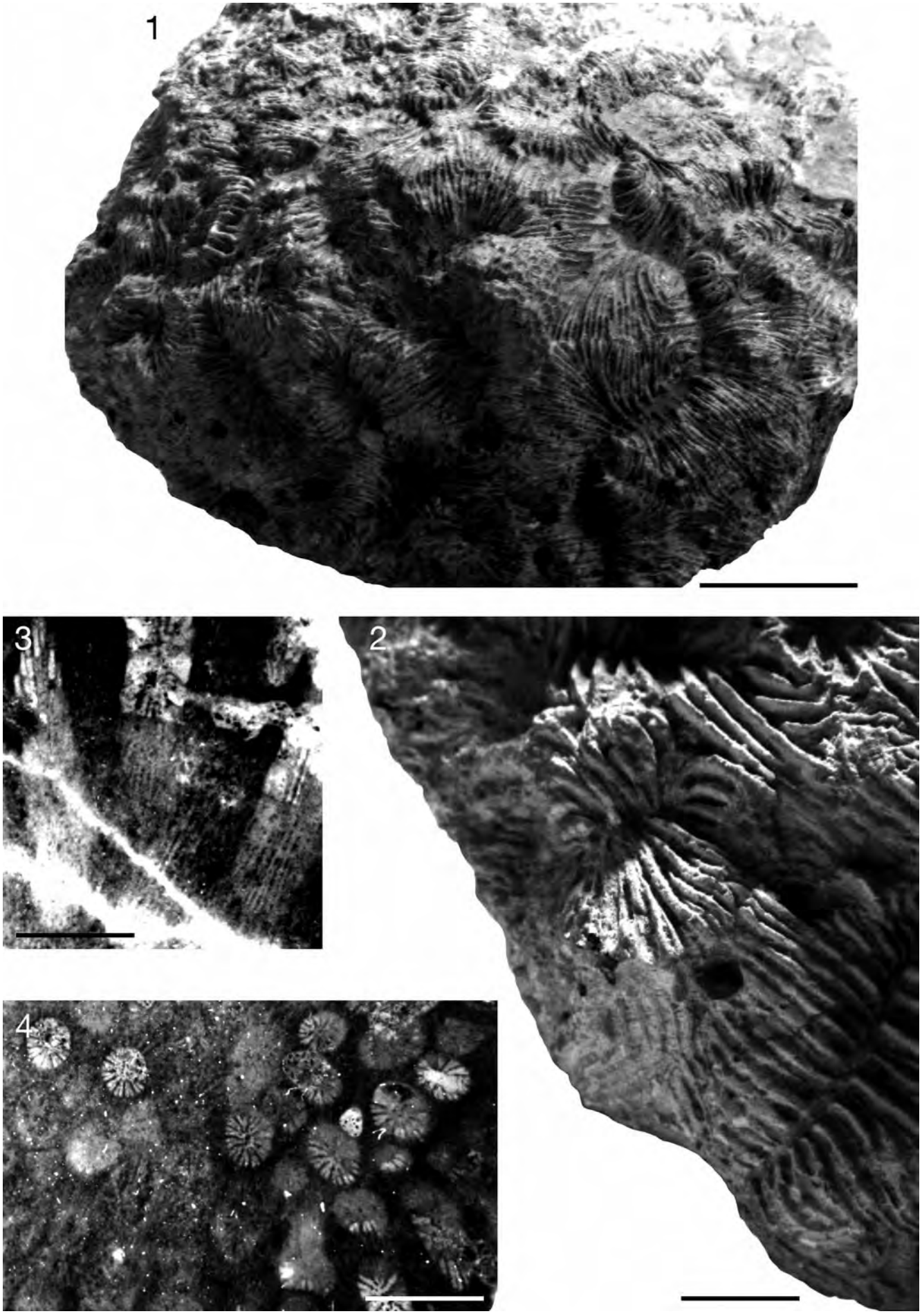
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Plate 18

Figs. 1, 2: *Montlivaltia salisburgensis* Milne Edwards, 1857

NHMW 1848/0001/0139 (Felix coll.), material labeled as *Montlivaltia acidalia*; Turonian–Campanian (Gosau Group, probably at greater Rußbach-Gosau area), Austria.

Fig. 1: upper surface, cross view; scale bar: 10 mm.

Fig. 2: upper surface, lateral view; scale bar: 10 mm.

Fig. 3: *Thecosmilia similis* Oppenheim, 1930a

Thin section, cross view; BSPG KA3-10a (Baron-Szabo coll.), Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria; scale bar: 5 mm.

Figs. 4, 5: *Columnocoenia* cf. *girodi* (Étallon, 1859)

VNS P.24967, Lower Aptian (Upper Schrattenkalk at Götzis-Kalkofen, Vorarlberg), Austria.
Photographs courtesy G. Friebe.

Fig. 4: upper surface of colony; scale bar: 15 mm.

Fig. 5: close-up of Fig. 4; scale bar: 2 mm.

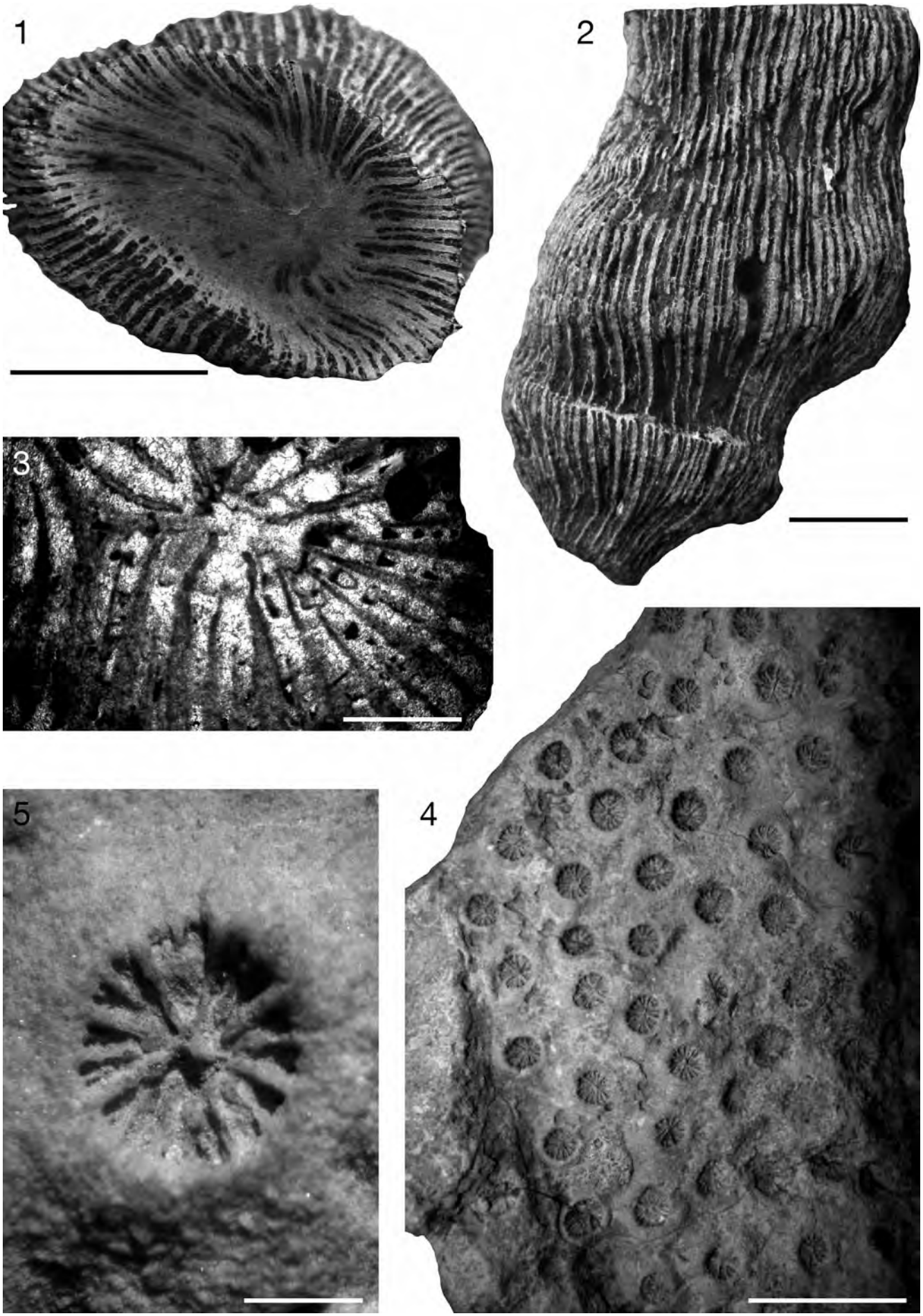
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Plate 19

Figs. 1, 2: *Taxogyra macroreina* (MICHELIN, 1847)

GBA 1903/004/0067 (FELIX coll.), original material of FELIX (1903a, p. 253, Pl. 23, Fig. 13), Turonian–Campanian (Gosau Group, according to FELIX, 1903a, material possibly collected from Brunstloch, Upper Santonian), Austria; both figures are close-up pictures of Fig. 1, Pl. 17; Fig. 1: scale bar: 9 mm; Fig. 2: scale bar: 9.5 mm.

Figs. 3, 4: *Montlivaltia salisburgensis* MILNE EDWARDS, 1857

NHMW 1848/0001/0136, original material of FELIX (1903a, Pl. 22, Fig. 1); Turonian–Campanian (Gosau Group, probably at greater Rußbach-Gosau area), Austria.

Fig. 3: upper surface of corallum; scale bar: 11 mm.

Fig. 4: close-up of Fig. 3: scale bar: 2.5 mm.

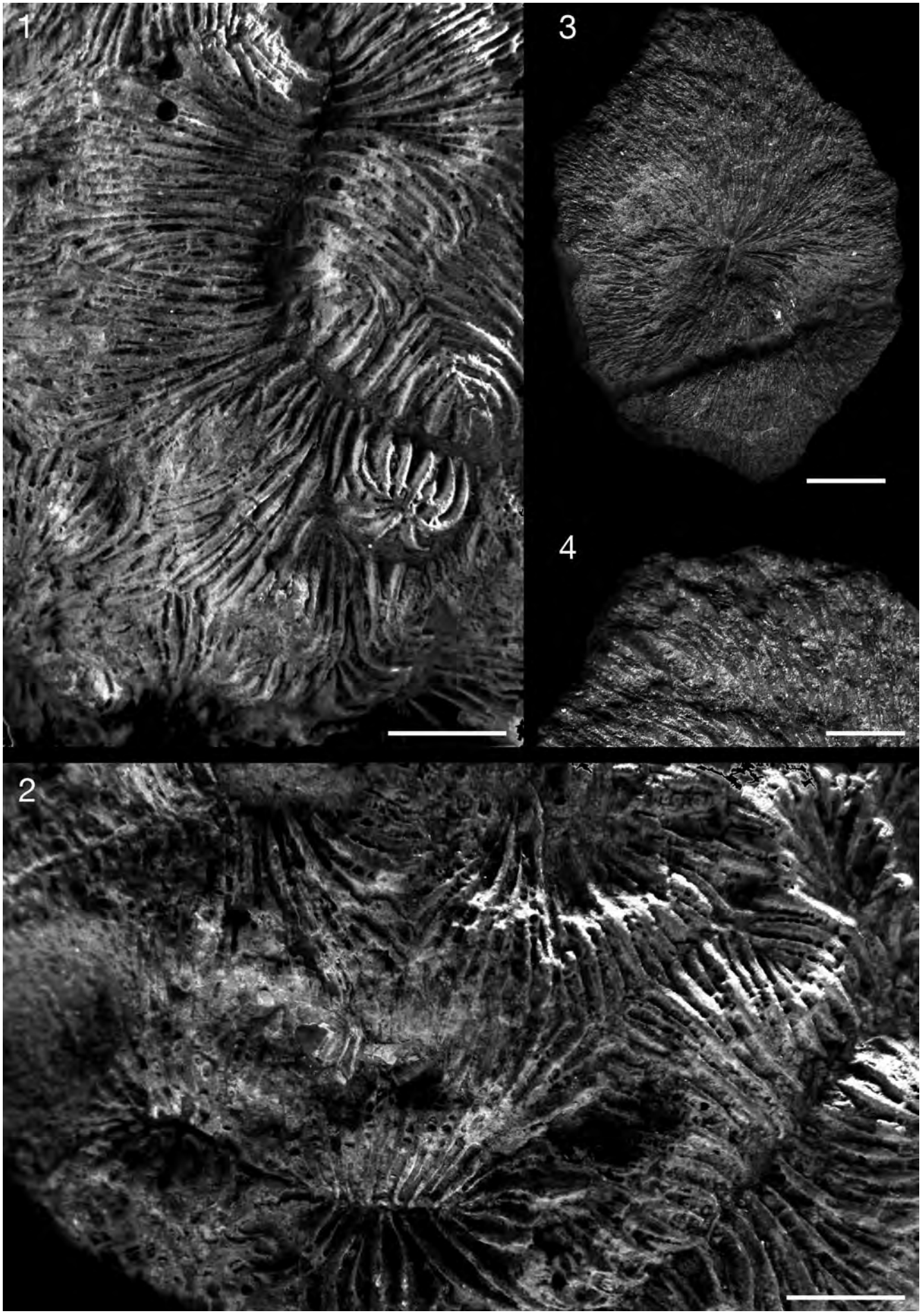
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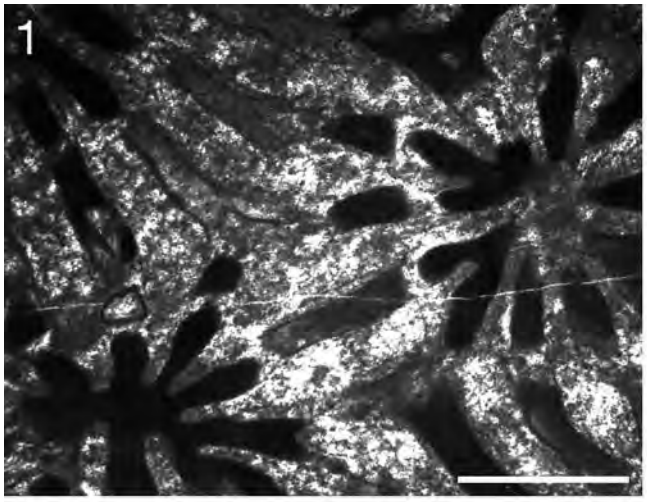
Plate 20

Figs. 1, 2: *Clausastrea plana* (De Fromentel, 1877)
BSPG WS 8g (Baron-Szabo coll.), Lower Aptian (Schrattenkalk at Allgäu, Windecksattel), Germany.
Fig. 1: thin section, cross view; scale bar: 2.5 mm.
Fig. 2: thin section, lateral view; scale bar: 2.5 mm.

Figs. 3, 4: *Clausastrea bolzei* Alloiteau, 1960
Barremian–Aptian of Slovenia (Dinaric occurrence at Osojnica). Photographs courtesy D. Turnšek.
Fig. 3: thin section, lateral view; GeoSZ 7398/b; scale bar: 5 mm.
Fig. 4: thin section, cross view; SAZU P-508b; scale bar: 5 mm.

Figs. 5, 6: *Complexastrea* cf. *seriata* Turnšek, 1972
Lower Aptian (Schrattenkalk at Allgäu, Mahdtal), Germany.
Fig. 5: thin section, lateral view, oblique; BSPG MAT 217f (Baron-Szabo coll.); scale bar: 4 mm.
Fig. 6: thin section, cross view, oblique; BSPG MAT 217d (Baron-Szabo coll.); scale bar: 2.5 mm.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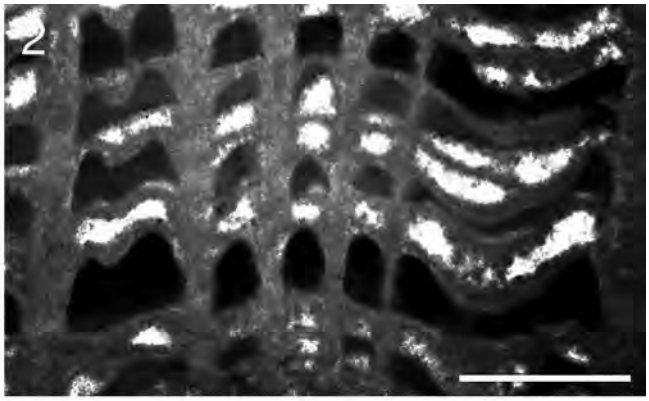
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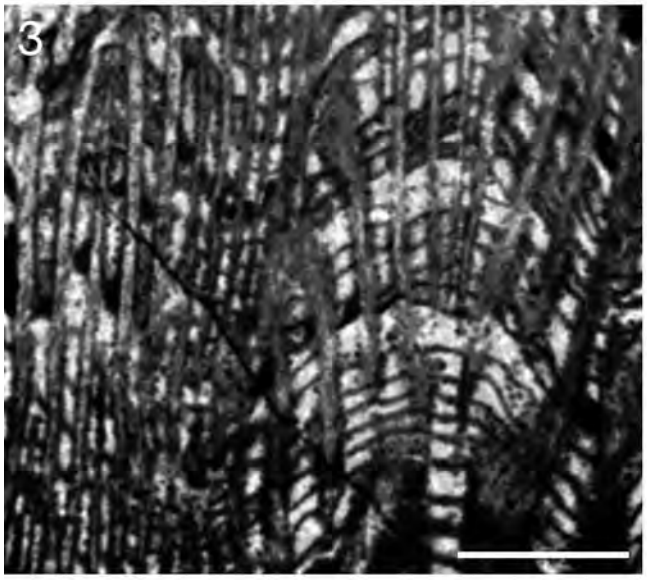
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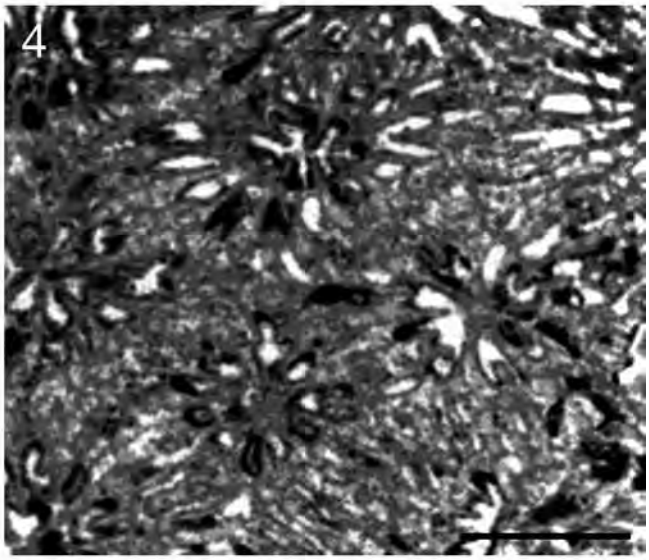
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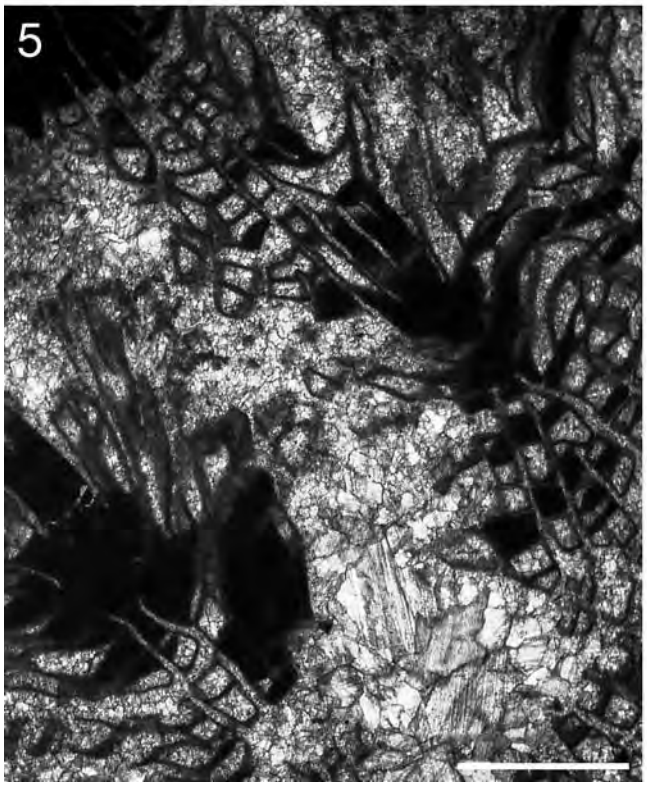
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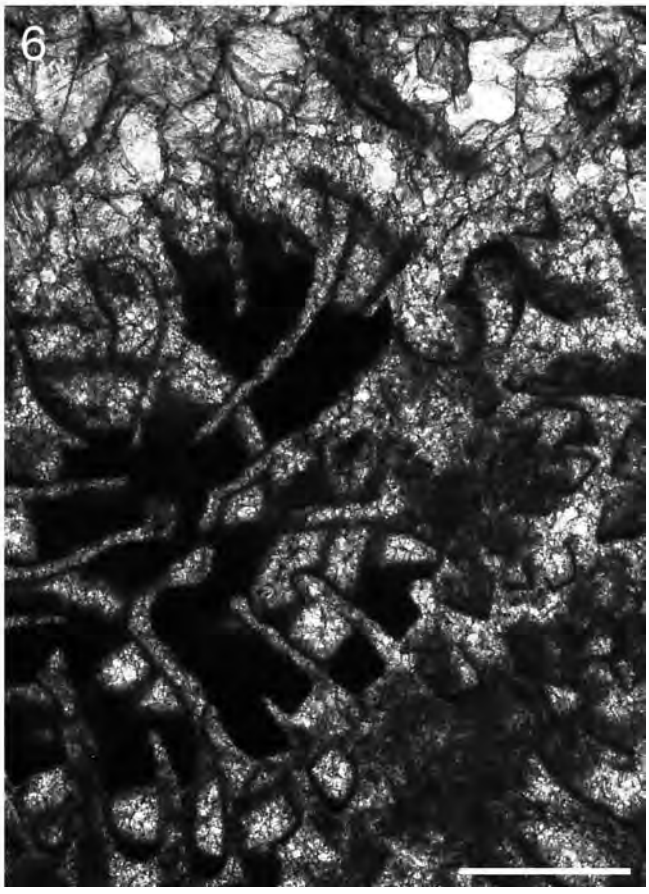
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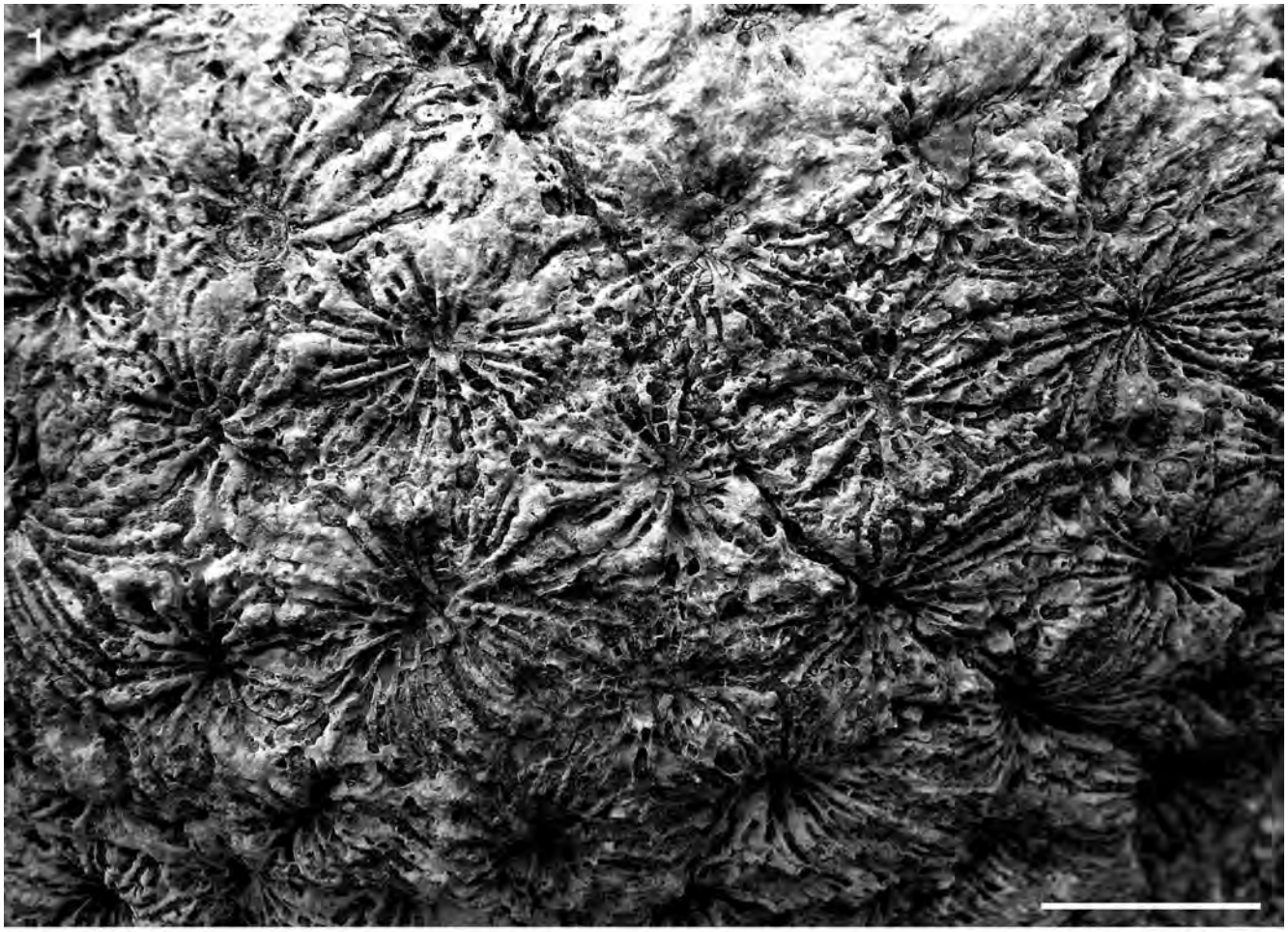
Plate 21

Figs. 1, 2: *Complexastrea seriata* TURNŠEK, 1972

VNS P.10024, Berriasian (Oehrli Formation at Sibratsgfäll-Krähenberg, Vorarlberg), Austria. Photographs courtesy G. FRIEBE.

Fig. 1: close-up of Fig. 2; scale bar: 15 mm.

Fig. 2: upper surface of colony; scale bar: 20 mm.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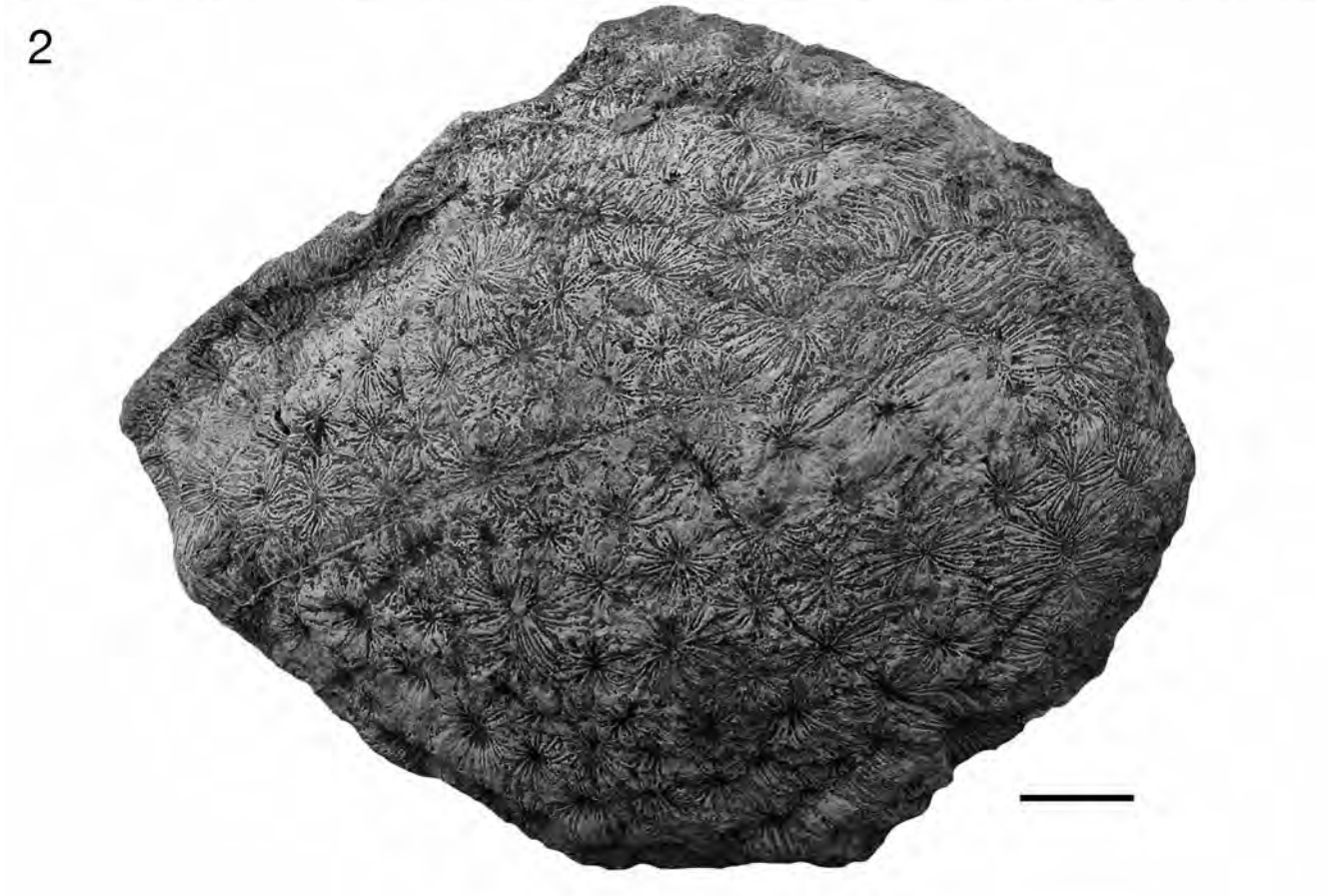
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Plate 22

Figs. 1–6: *Gyroseris patellaris* REUSS, 1854

Figs. 1, 2: syntype, NHMW 1864/0040/1431/01; Upper Santonian (Gosau Group at Neffgraben), Austria.

Fig. 1: upper surface, cross view; scale bar: 10 mm.

Fig. 2: upper surface, lateral view; scale bar: 10 mm.

Fig. 3: polished surface, cross view; syntype, NHMW 1864/0040/1431/02, Upper Santonian (Gosau Group at Neffgraben), Austria; scale bar: 8 mm.

Fig. 4: upper surface, cross view; syntype, NHMW 1864/0040/1431/03, Upper Santonian (Gosau Group at Neffgraben), Austria; scale bar: 10 mm.

Fig. 5: upper surface, cross view; GBA 1903/004/0046/01 (FELIX coll.), Turonian (Gosau Group at St. Gilgen) or Upper Santonian (Gosau Group at Neffgraben) (locality data according to Felix, 1903a), Austria; scale bar: 8 mm.

Fig. 6: upper surface, cross view; GBA 1903/004/0046/02 (FELIX coll.), Turonian (Gosau Group at St. Gilgen) or Upper Santonian (Gosau Group at Neffgraben) (locality data according to Felix, 1903a), Austria; scale bar: 11 mm.

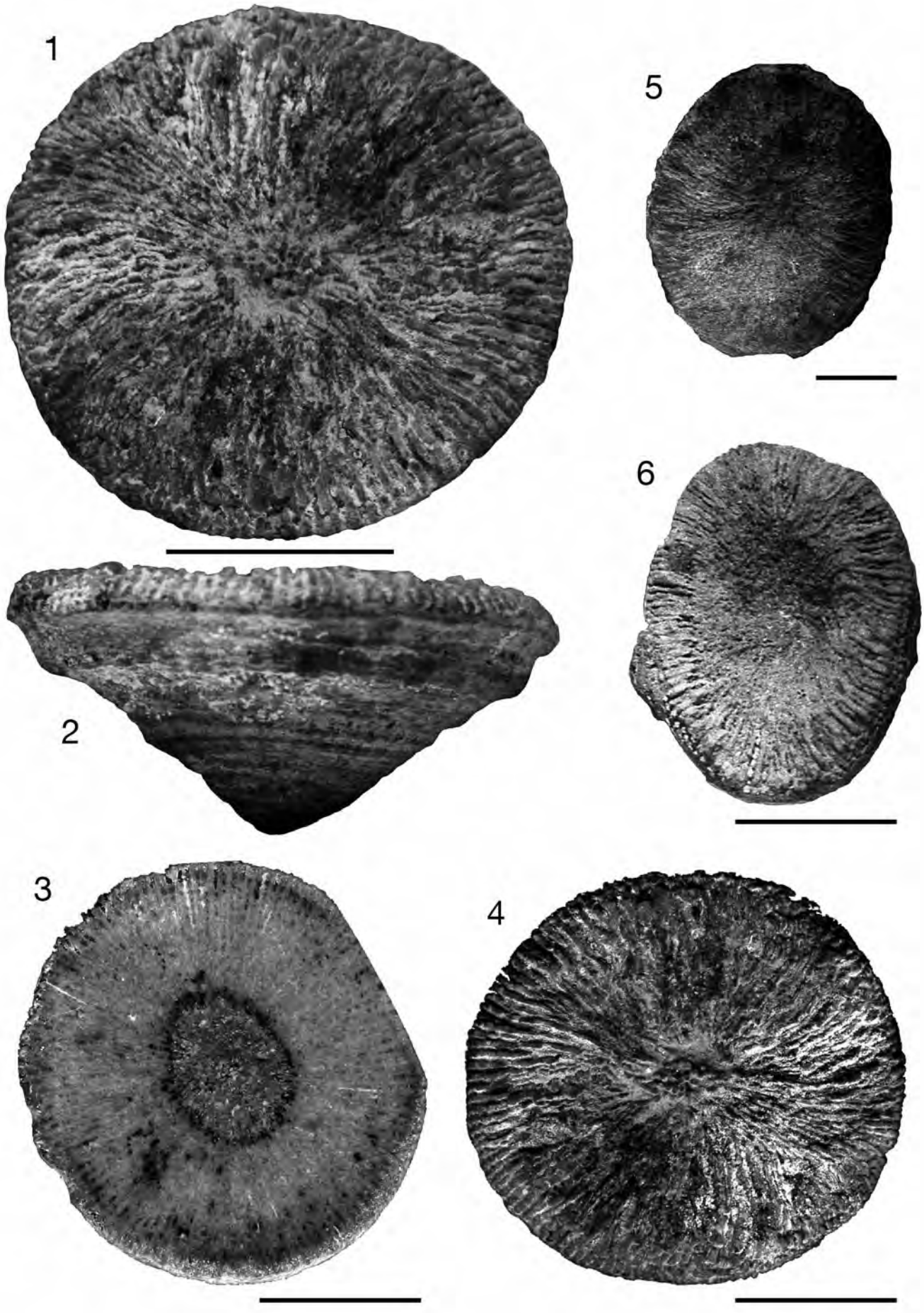
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Plate 23

Figs. 1–6: *Latiphyllia deformis* (REUSS, 1854)

Paralectotypes NHMW 1864/0040/1297 (designation by M. BEAUVAIS, 1982); Turonian–Campanian (Gosau Group, probably at greater Rußbach-Gosau area), Austria.

Figs. 1–3: NHMW 1864/0040/1297/01.

Fig. 1: upper surface, cross view, partially polished; scale bar: 7.5 mm.

Fig. 2: upper surface, lateral view; scale bar: 7 mm.

Fig. 3: base of colony, partially polished; scale bar: 6.8 mm.

Figs. 4–6: NHMW 1864/0040/1297/02.

Fig. 4: upper surface, cross view; scale bar: 10 mm.

Fig. 5: upper surface, lateral view; scale bar: 10 mm.

Fig. 6: base of colony, partially polished; scale bar: 13 mm.

Fig. 7: *Trochosmilia boissyana* (MICHELIN, 1847)

NHMW 2013/0573/0001; upper surface, lateral view; Turonian–Campanian (Gosau Group, probably at Bad Aussee area), Austria; scale bar: 10.5 mm.

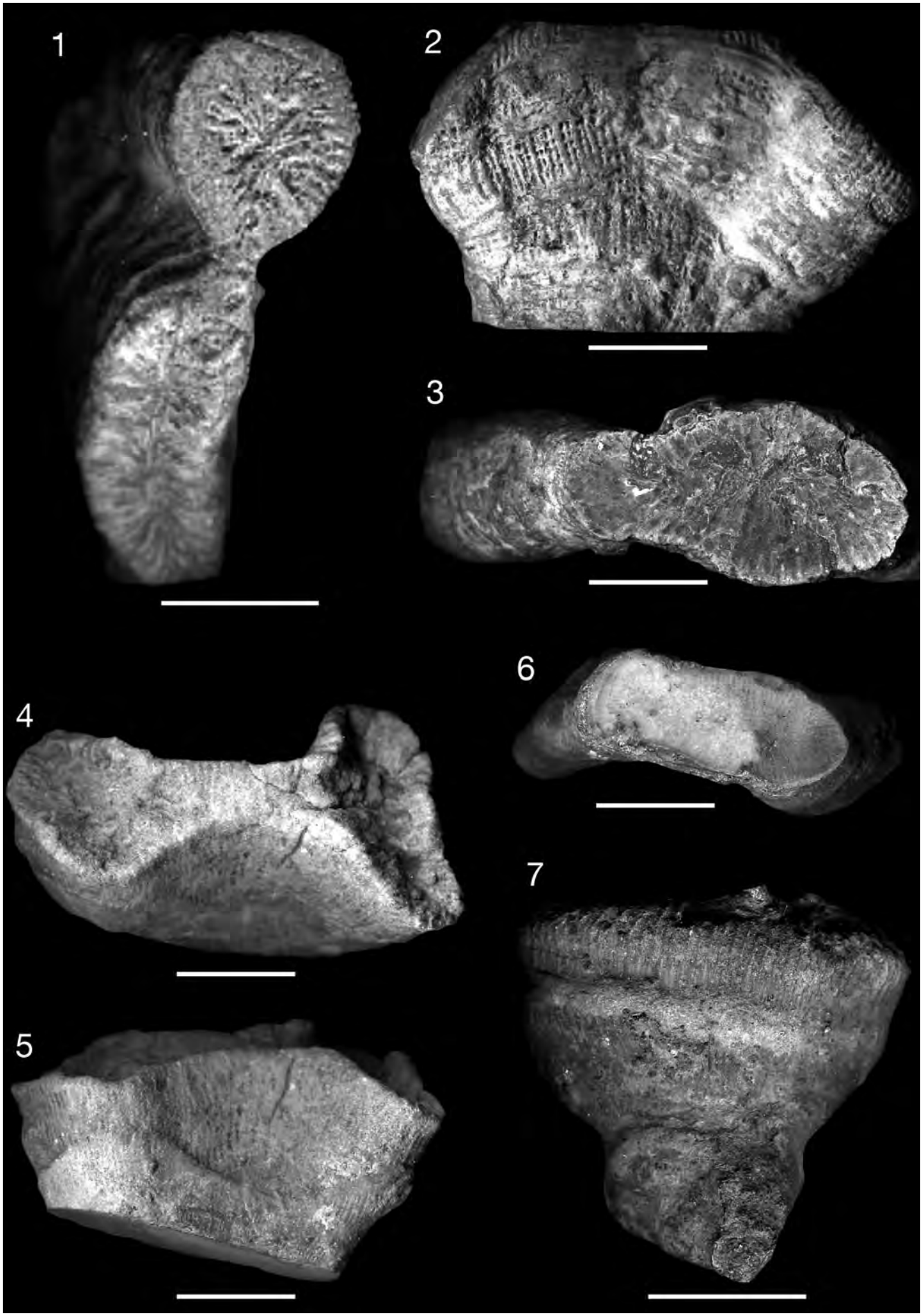
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Plate 24

Figs. 1, 2, 4, 5: *Placosmilia gracilis* (FELIX, 1903a)

(FELIX coll.), original material of FELIX (1903: p. 246, Pl. 21, Figs. 4, 4a,b).

Figs. 1, 2: syntype GBA 1903/004/0062/01, Fig. 1: upper surface, lateral view; Fig. 2: upper surface, cross view; Upper Turonian–Campanian (Gosau Group at "Gosau Basin"), Austria; Figs. 1 and 2: scale bar: 20 mm.

Figs. 4, 5: syntype GBA 1903/004/0062/02, Fig. 4: upper surface, lateral view, scale bar: 14 mm; Fig. 5: upper surface, cross view, scale bar: 15 mm; Upper Santonian (Gosau Group at Neffgraben), Austria.

Fig. 3: *Placosmilia turonensis* (DE FROMENTEL, 1873)

Thin section, cross view; GBA 1999/089/0006/02 (BARON-SZABO-1999 coll.), Upper Santonian (Gosau Group at Styrian Weissenbachalm), Austria; scale bar: 10 mm.

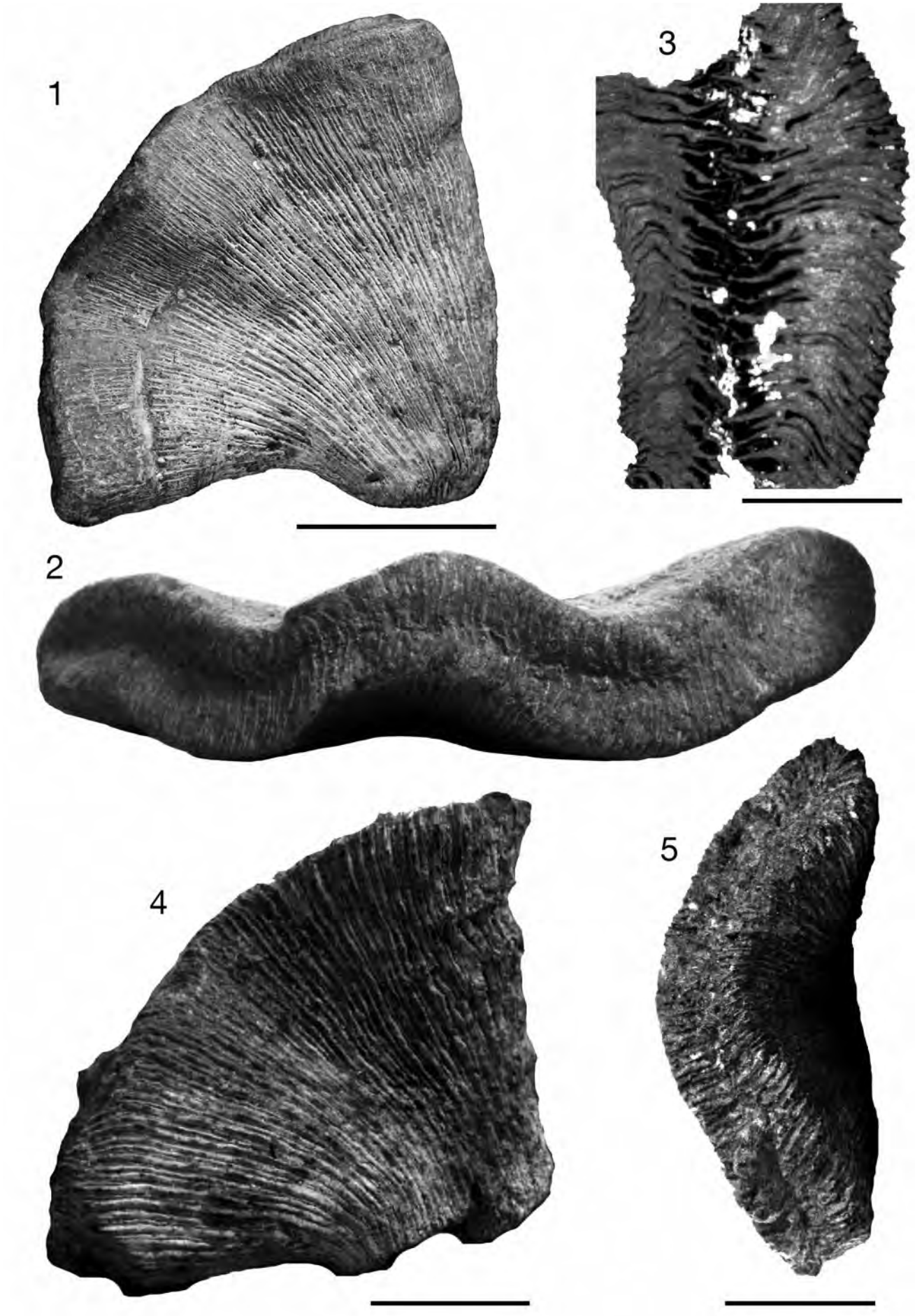
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Plate 25

Figs. 1–3: *Placosmilia tortuosa* (FELIX, 1903a)

Syntypes, GBA 1903/004/0063/01-02 (FELIX coll.), Upper Santonian (Gosau Group at Scharrergraben), Austria.

Fig. 1: upper surface, lateral view; GBA 1903/004/0063/01; scale bar: 20 mm.

Fig. 2: upper surface, cross view; GBA 1903/004/0063/01; scale bar: 12 mm.

Fig. 3: upper surface, polished, cross view; GBA 1903/004/0063/02; scale bar: 8 mm.

Figs. 4, 5: *Placosmilia arcuata* MILNE EDWARDS & HAIME, 1848d

GBA 1903/004/0121/01 (FELIX coll.), original material of FELIX (1903a, p. 339), Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area), Austria.

Fig. 4: upper surface, lateral view; scale bar: 15 mm.

Fig. 5: upper surface, cross view, partially polished; scale bar: 10 mm.

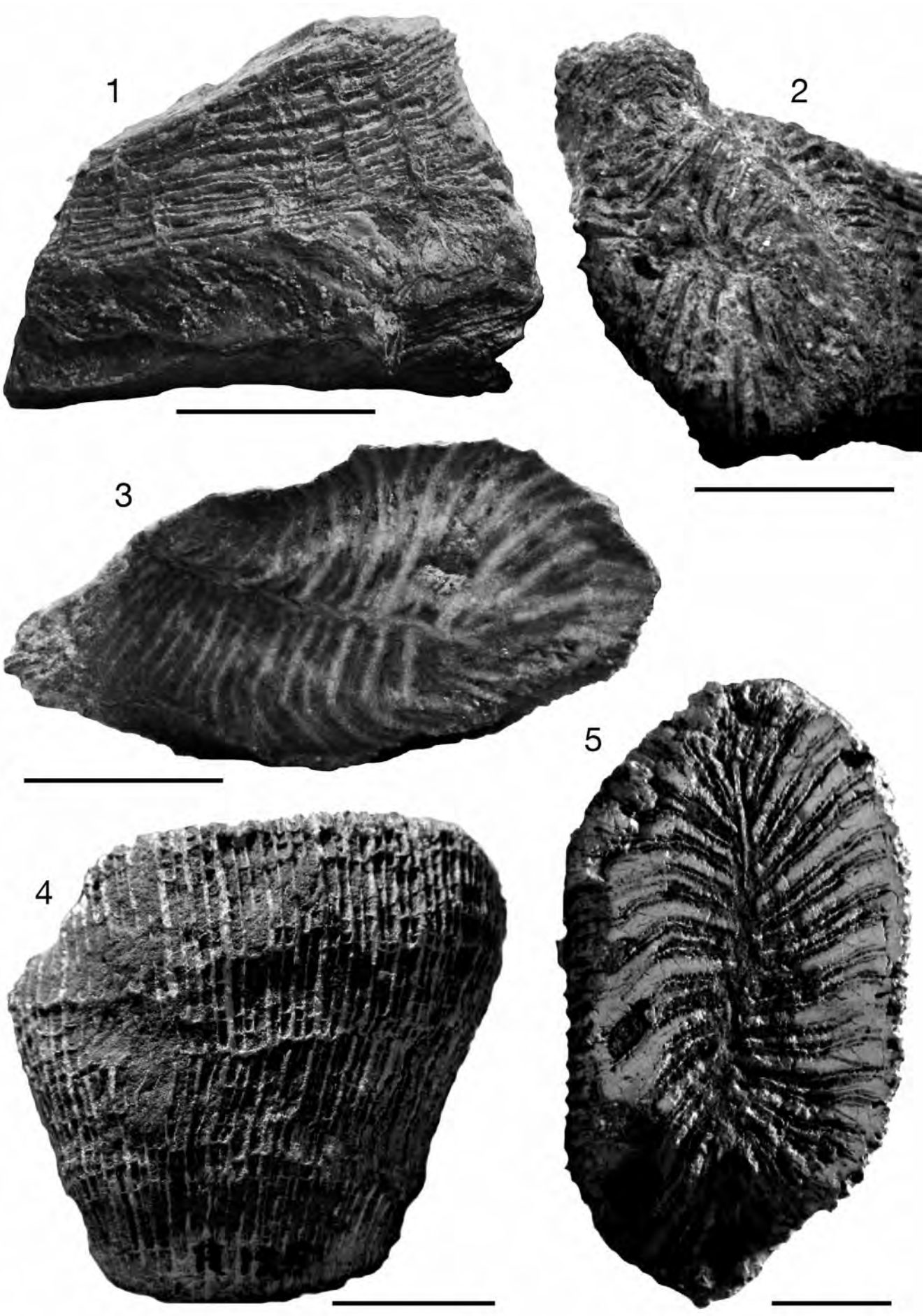
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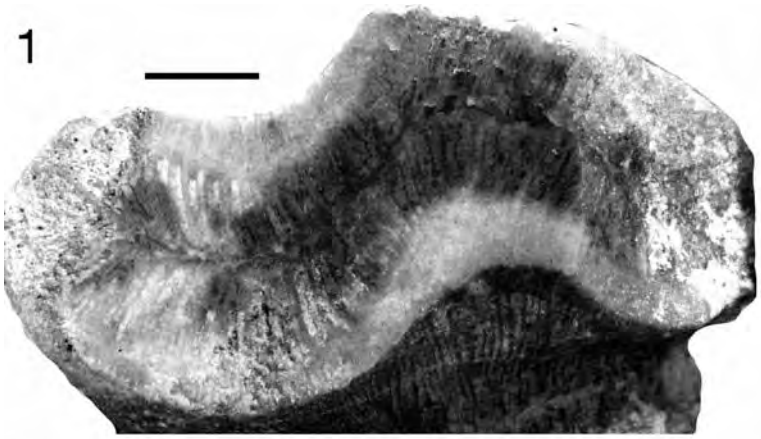
Plate 26

Figs. 1, 2: *Placosmilia sinuosa* (REUSS, 1854)
GBA 1903/004/0102/03 (FELIX coll.), Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area), Austria.
Fig. 1: upper surface, polished, cross view; scale bar: 5 mm.
Fig. 2: upper surface, lateral view; scale bar: 5 mm.

Figs. 3–5: *Placosmilia martini* (MICHELIN, 1847)
GBA 2003/023/0012/02 (BARON-SZABO-2003a coll.), Santonian (Gosau Group, Hochmoos Formation), Austria.
Fig. 3: thin section, cross view, close-up of Fig. 5, showing granulation of septa; scale bar: 2 mm.
Fig. 4: thin section, cross view, close-up of Fig. 5, showing lamellar columella and axial ends of septa that are free or connected to the columella; scale bar: 2 mm.
Fig. 5: thin section, cross view of corallum; scale bar: 8 mm.

Figs. 6, 7: *Placosmilia fenestrata* (FELIX, 1903a)
BSPG KA-F (BARON-SZABO coll.), Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria.
Fig. 6: thin section, cross view; scale bar: 3 mm.
Fig. 7: close-up of Fig. 6; scale bar: 1 mm.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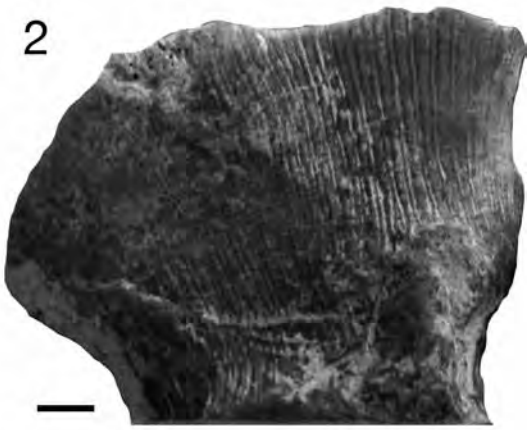
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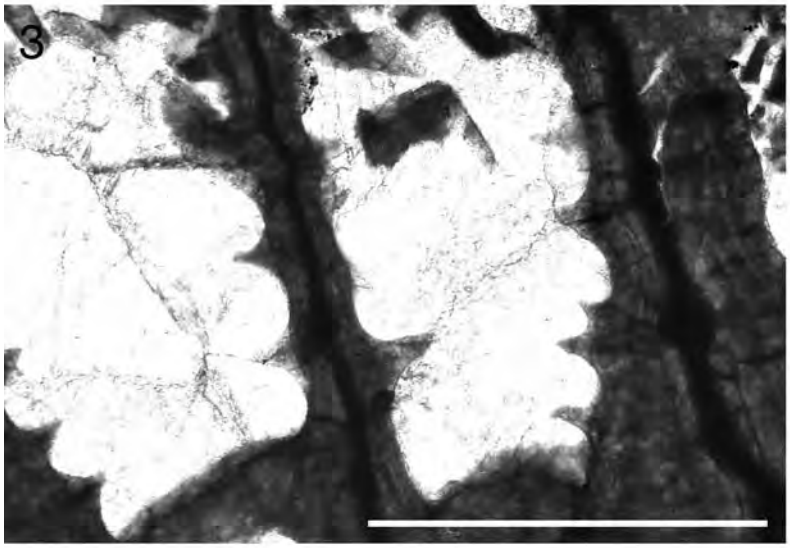
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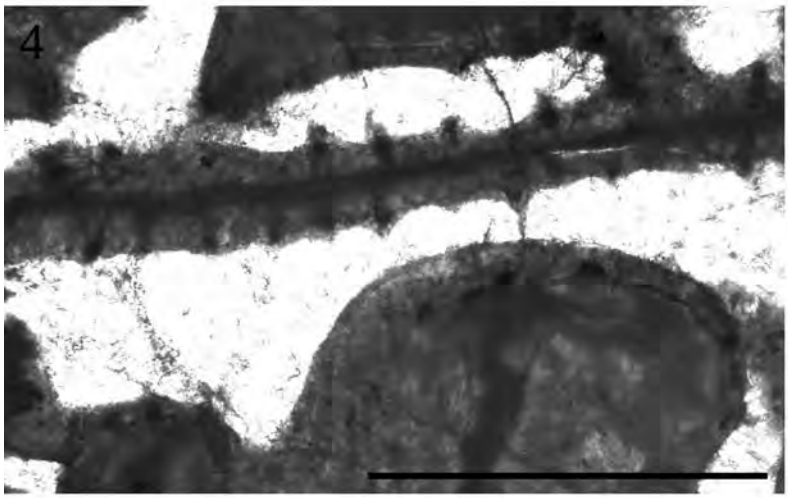
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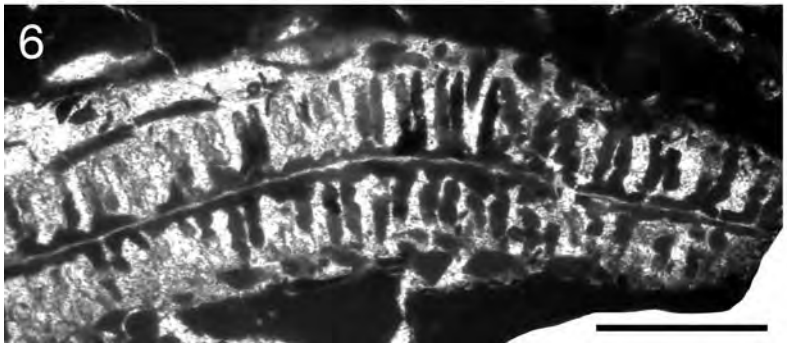
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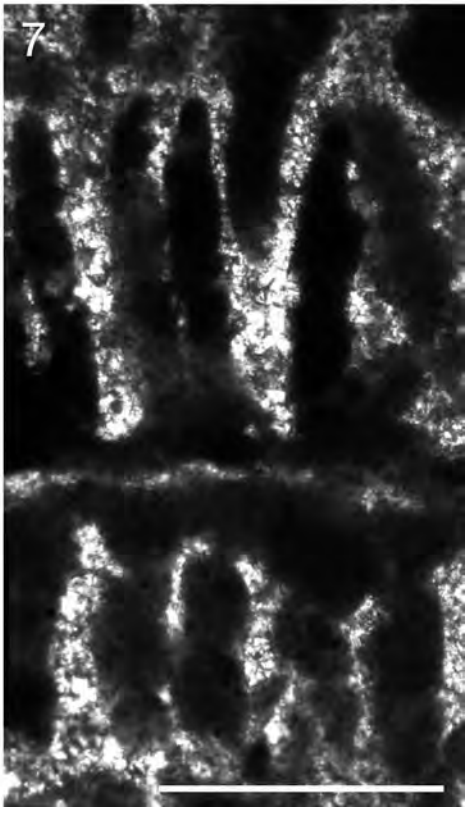
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Plate 27

Figs. 1–6: *Peplosmilia latona* (FELIX, 1903a)

Figs. 1, 2: syntype, NHMW 1864/0040/1244, Turonian–?Coniacian (Gosau Group at St. Gilgen area) or Upper Santonian (Gosau Group at Edelbachgraben), Austria.

Fig. 1: upper surface, cross view; scale bar: 11.5 mm.

Fig. 2: upper surface, lateral view; scale bar: 11.5 mm.

Figs. 3–6: GBA 2003/023/0011/01 (BARON-SZABO-2003a coll.), Santonian (Gosau Group at Hochmoos-Grabenbach-area), Austria.

Fig. 3: upper surface of corallum, lateral view; entire specimen cut into thin sections for microscopic examination (see Figs. 4-6); scale bar: 10 mm.

Fig. 4: thin section, cross view, showing development of corallite wall and septa in ontogentically latest stage of corallum; scale bar: 1 mm.

Fig. 5: thin section, cross view, juvenile stage; scale bar: 4 mm.

Fig. 6: thin section, cross view, ontogenetically intermediate stage; scale bar: 3 mm.

Fig. 7: *Peplosmilia fromenteli* ANGELIS D'OSSAT, 1905a

Thin section, cross view; BSPG KA3-10 (BARON-SZABO coll.), Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria; scale bar: 5 mm.

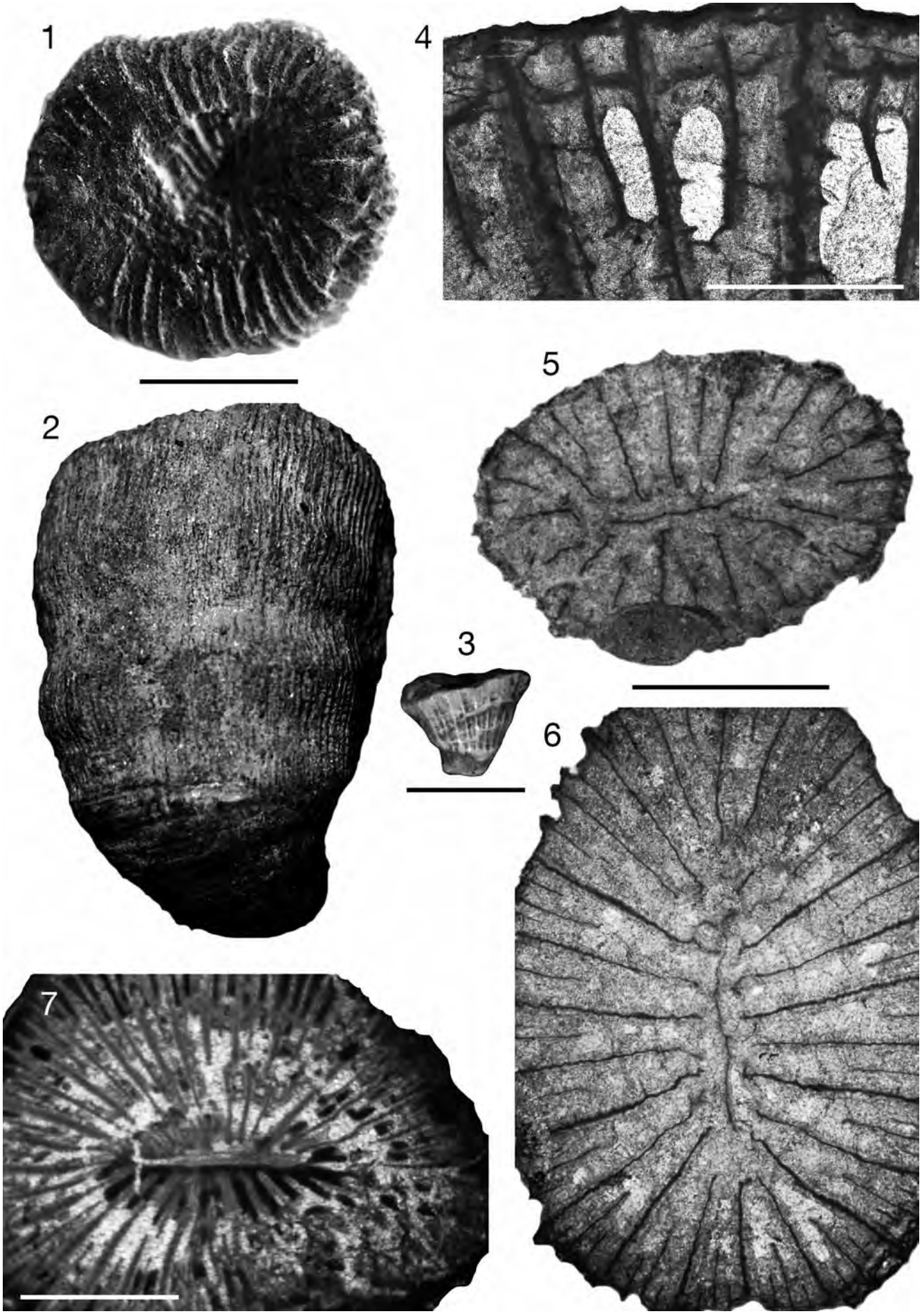
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Plate 28

Figs. 1–3: *Placophyllia curvata* TURNŠEK in TURNŠEK & BUSER, 1974

Holotype, SAZU P-514; Barremian–Aptian of Slovenia (Dinaric occurrence at Osojnica).
Photographs courtesy D. TURNŠEK.

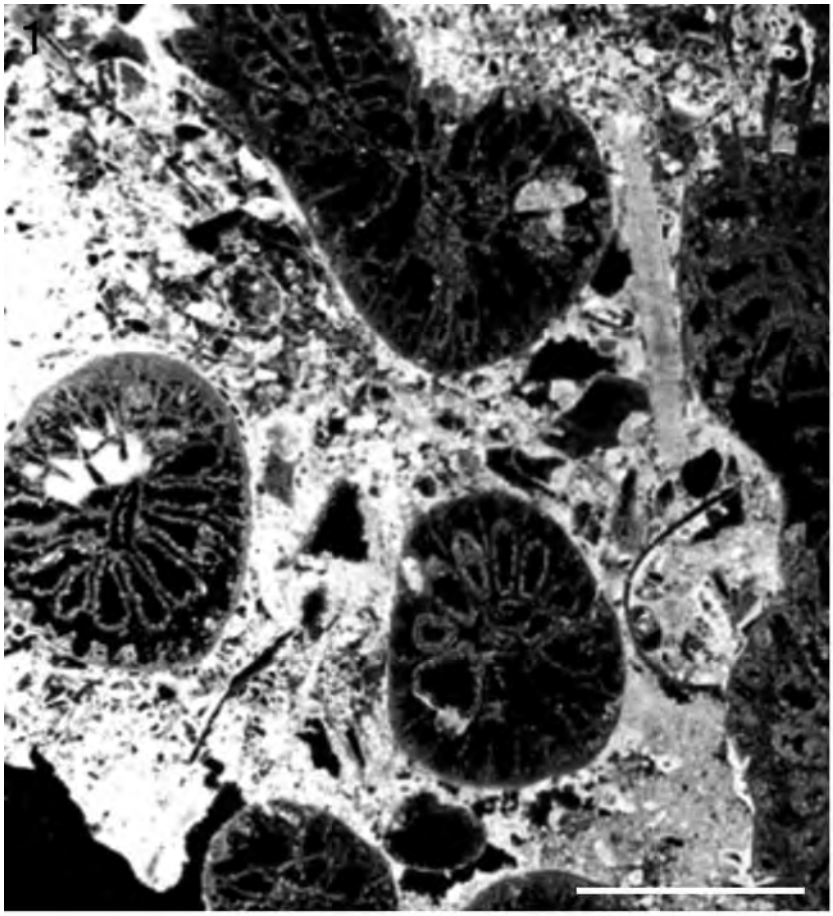
Fig. 1: thin section, cross view; SAZU P514b; scale bar: 6.5 mm.

Fig. 2: thin section, lateral view; SAZU P514a; scale bar: 6.5 mm.

Fig. 3: close-up of Fig. 1; SAZU P514b; scale bar: 4.5 mm.

Fig. 4: *Kobyphyllia acrisionae* (FELIX, 1903a)

Lectotype, NHMW 1859/0050/0355a; upper surface, polished, cross view; Upper Santonian (Gosau Group at Neff-graben), Austria; scale bar: 11 mm.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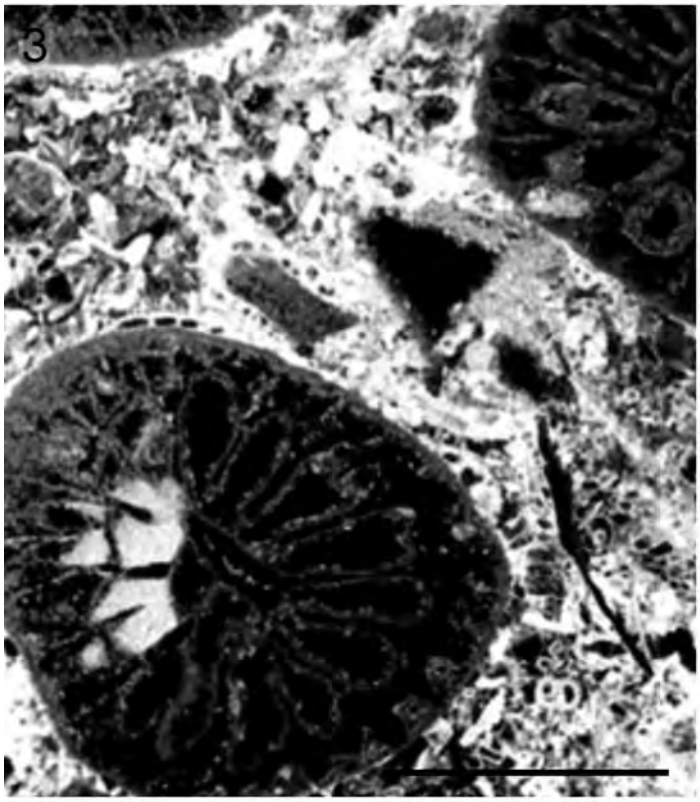
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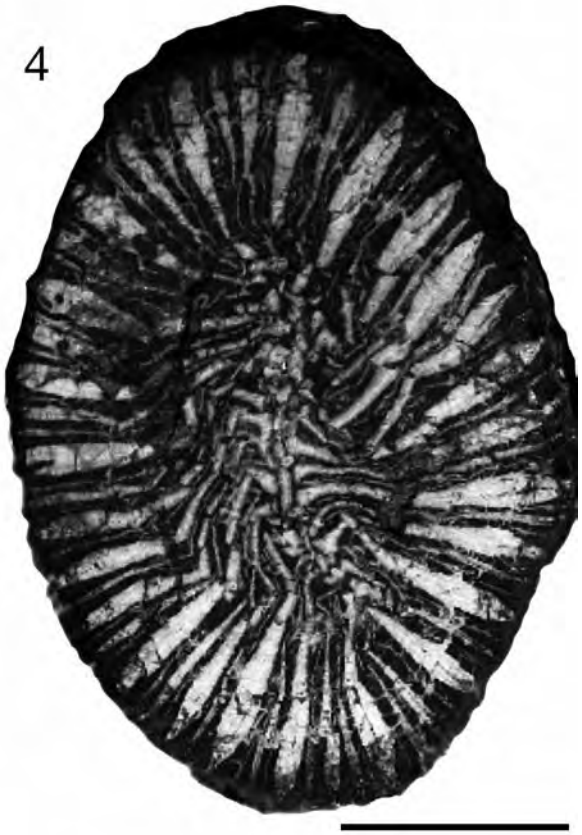
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Plate 29

Figs. 1–3: *Kobyphyllia acrisionae* (FELIX, 1903a)

Figs 1, 2: paralectotype, NHMW 1859/0050/0355b; Turonian–?Coniacian (Gosau Group at St. Gilgen area), Austria.

Fig. 1: upper surface, partially polished, cross view; scale bar: 5 mm.

Fig. 2: upper surface, lateral view; scale bar: 5.5 mm.

Fig. 3: close-up of Fig. 4, Pl. 28; lectotype, NHMW 1859/0050/0355a; upper surface, polished, cross view; Upper Santonian (Gosau Group at Neffgraben), Austria; scale bar: 10 mm.

Figs. 4–6: *Dermosmilia cretacica* TURNŠEK in TURNŠEK & BUSER, 1974

Fig. 4: thin section, cross view; BSPG SEA 65a2 (BARON-SZABO coll.); Lower Aptian (Schrattenkalk at Allgäu, See-alpe), Germany; scale bar: 3 mm.

Figs. 5, 6: holotype, SAZU P-523; Barremian–Aptian of Slovenia (Dinaric occurrence at Osojnica).
Photographs courtesy D. TURNŠEK.

Fig. 5: thin section, cross view; SAZU P-523b; scale bar: 5.5 mm.

Fig. 6: thin section, lateral view; SAZU P-523a; scale bar: 5.5 mm.

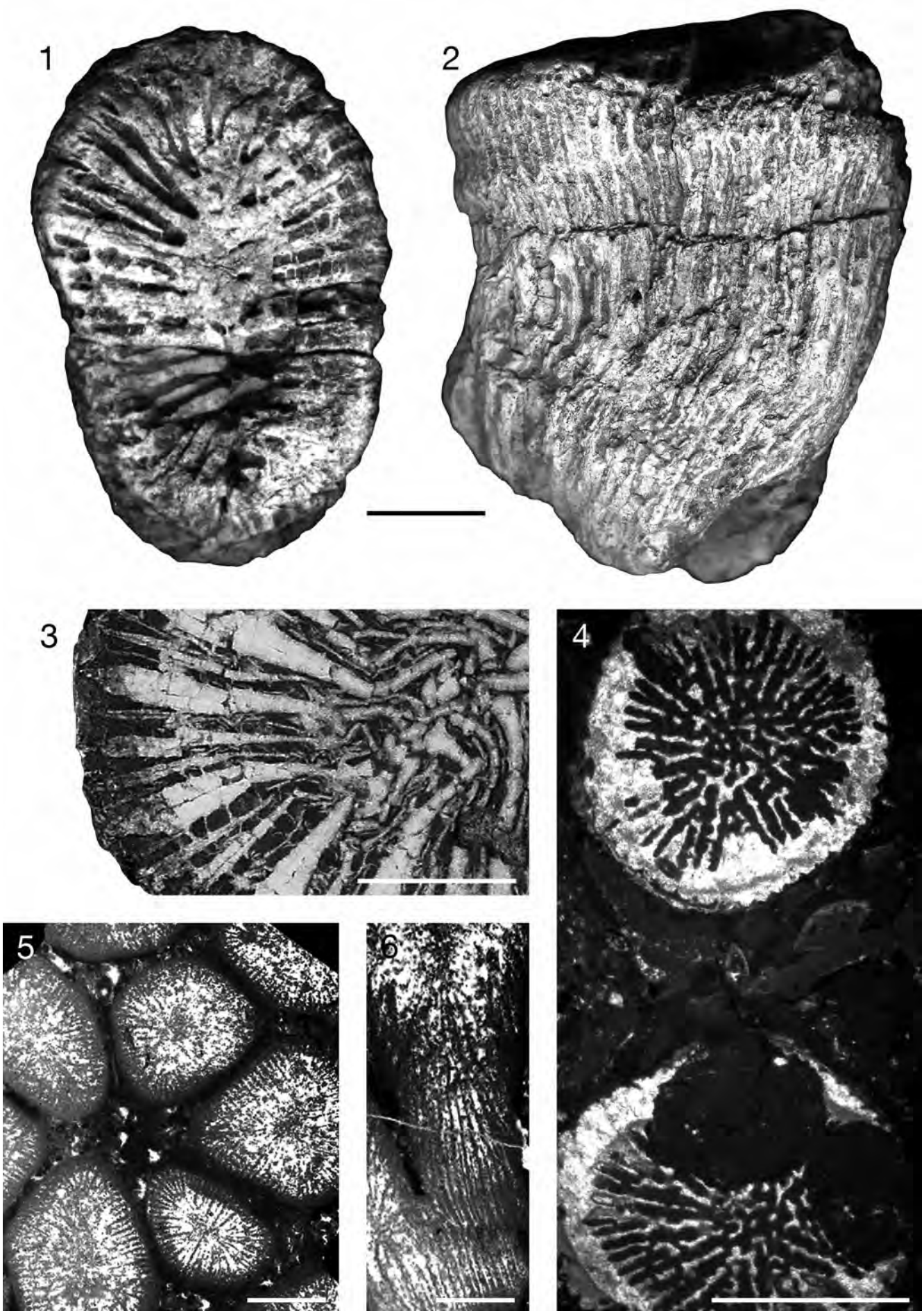
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Plate 30

Figs. 1–7: *Calamophylliopsis simonyi* (REUSS, 1854)
Syntype, GBA 1854/007/0076; Upper Turonian (Gosau group at Gams, Hieflau), Austria.
Photographs by I. WÜNSCHE (Paleontological collections, GBA).

Figs 1, 4: overview of colony, partially polished; Fig. 1: scale bar: as in Fig. 4.

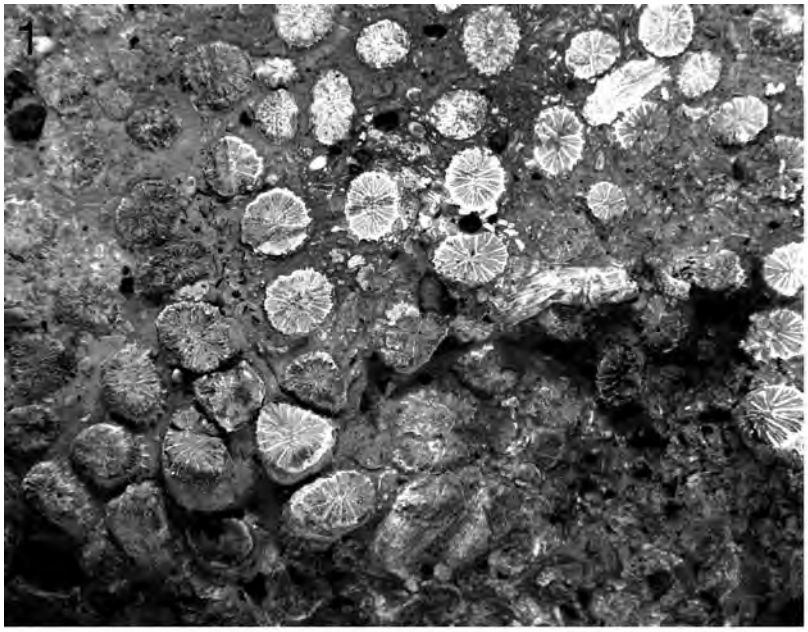
Fig. 2: close-up of Fig. 4, showing cross view of polished corallite with parts of epithecal wall; scale bar: 2.5 mm.

Fig. 3: close-up of Fig. 4, lateral view of corallite, polished, oblique; scale bar: 2.5 mm.

Fig. 5: close-up of Fig. 1, cross view of corallite, polished; scale bar: 2.5 mm.

Fig. 6: close-up of Fig. 4, cross view and new corallite by extracalicinal budding; scale bar: 3.5 mm.

Fig. 7: cross view, slightly oblique, partially polished; scale bar: 5.5 mm.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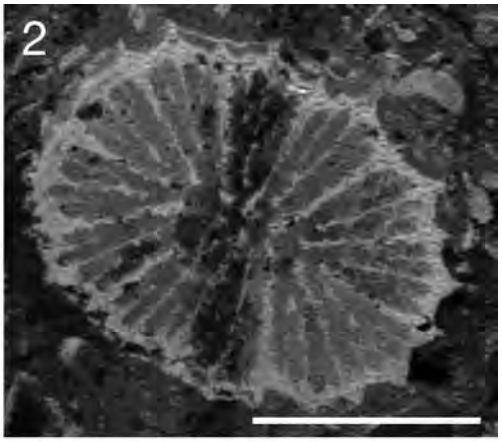
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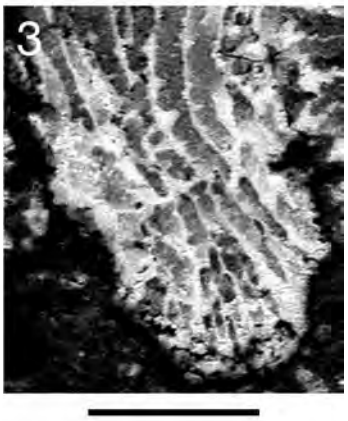
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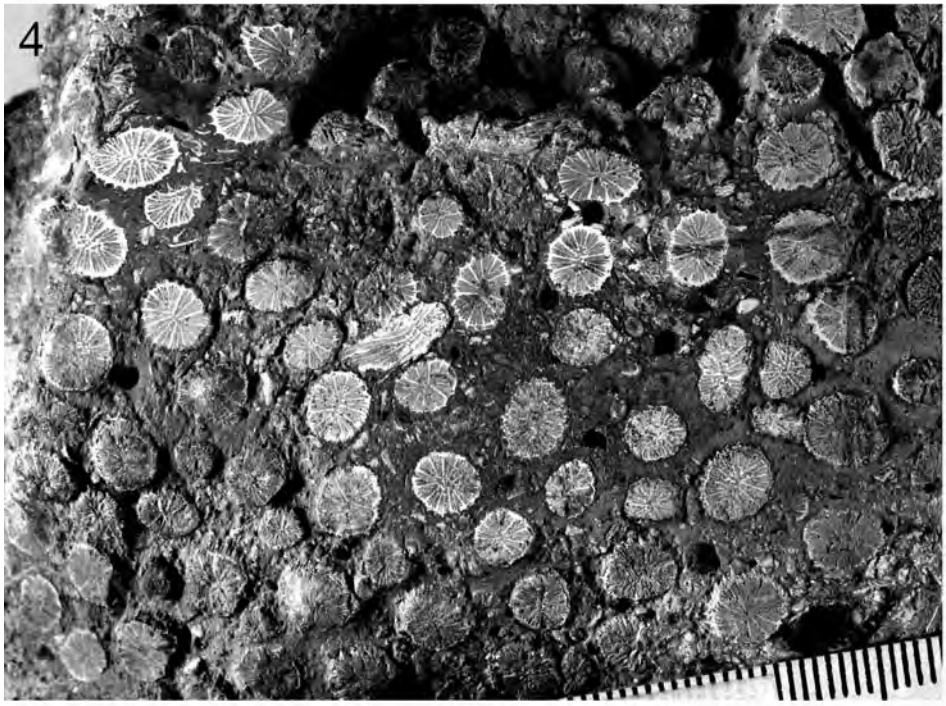
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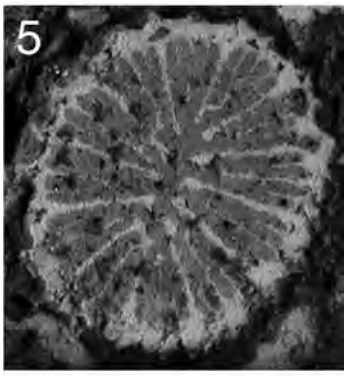
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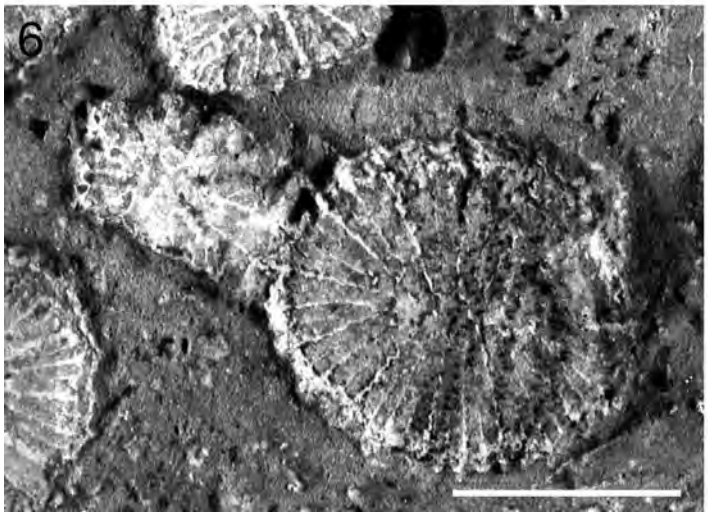
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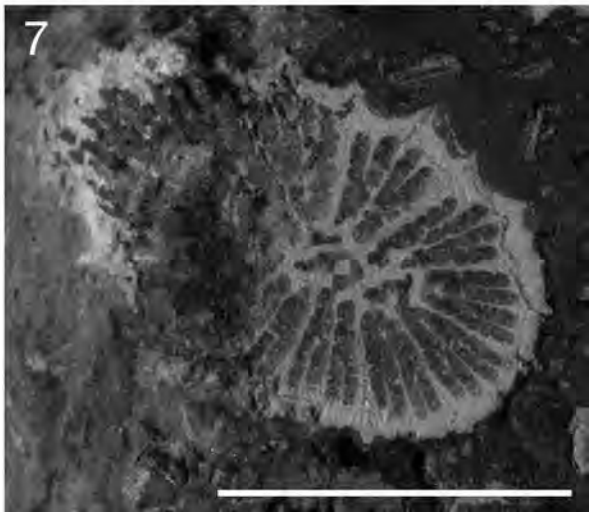
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Plate 31

Figs. 1, 2: *Truncoconus inclinatus* Turnšek in Turnšek & Mihajlović, 1981

Holotype of the type species of the genus *Truncoconus*, PMB M 2897; Barremian–Lower Aptian of Serbia. Photographs courtesy D. Turnšek.

Fig. 1: thin section, cross view; scale bar: 8.5 mm.

Fig. 2: thin section, lateral view; scale bar: 8.5 mm.

Figs. 3, 4: *Truncoconus rennensis* (Alloiteau, 1952a)

Holotype of the type species of the genus *Felixaraea*; MNHN R.10953, original of Alloiteau (1952a, pl. 2, fig. 4); Upper Santonian of France (Corbières).

Fig. 3: cross view, polished surface; scale bar: 12 mm.

Fig. 4: upper surface, lateral view; scale bar: 12 mm.

Figs. 5, 6: *Epistreptophyllum irregularis* (Reuss, 1854)

Lectotype (designation by inference, M. Beauvais, 1982, vol. 2, p. 209), NHMW 1864/0040/1312 (Reuss coll.); Turonian–Campanian (?Santonian) (Gosau Group at "Gosau Basin"), Austria.

Fig. 5: upper surface, cross view; scale bar: 17 mm.

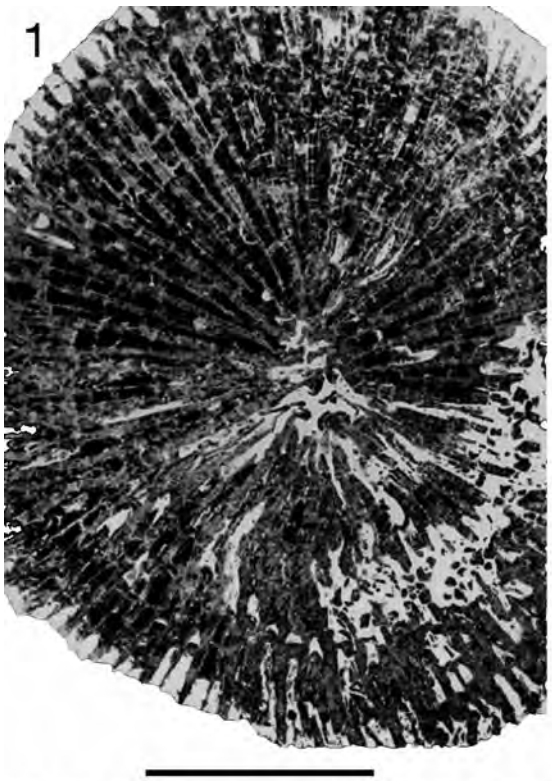
Fig. 6: upper surface, lateral view; scale bar: 17 mm.

Figs. 7, 8: *Truncoconus pratzi* (Felix, 1903a)

Neotype (designation by M. Beauvais, 1982, vol. 2, p. 25), BSPG 1878 XI 413; Turonian–?Coniacian (Gosau Group at St. Gilgen area), Austria.

Fig. 7: cross view, polished surface; scale bar: 10 mm.

Fig. 8: upper surface, lateral view; scale bar: 11.5 mm.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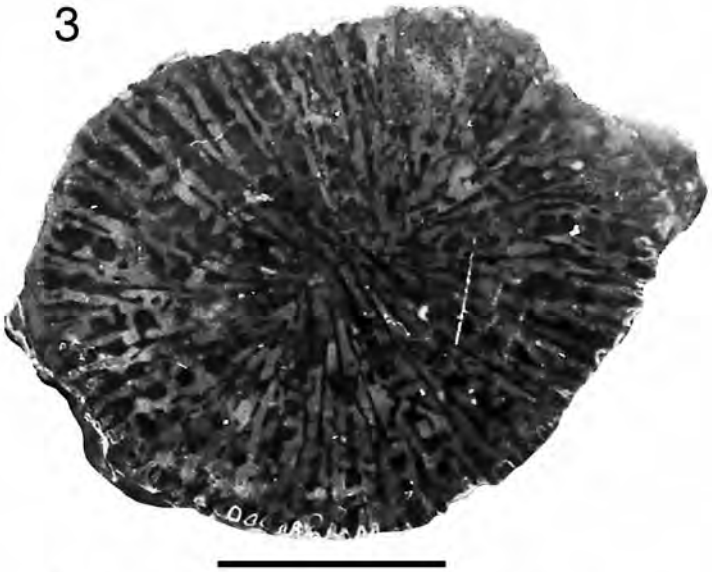
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Plate 32

Figs. 1–4: *Columastrea striata* (GOLDFUSS, 1826)

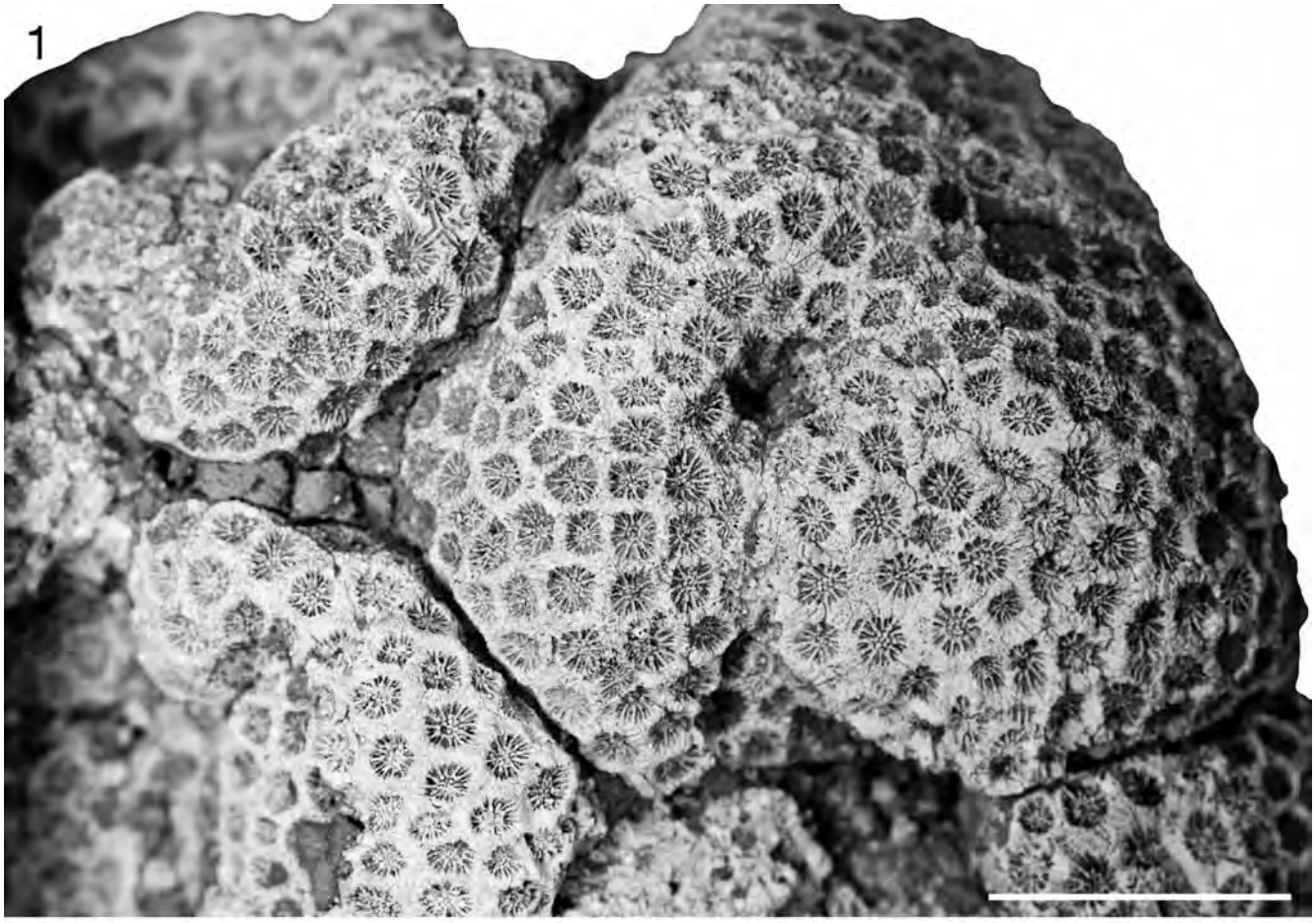
Fig. 1: upper surface of colony; GBA 1903/004/0112/01 (FELIX coll.); Lower Santonian (Gosau Group at Untersberg, Wolfschwang), Austria; scale bar: 15 mm.

Figs. 2, 4: syntype; IPB 297 (GOLDFUSS coll.); Senonian (Gosau Group at greater Rußbach-Gosau area), Austria.

Fig. 2: upper surface; scale bar: 9 mm.

Fig. 4: close-up of Fig. 2; scale bar: 4 mm.

Fig. 3: thin section, cross view, slightly oblique; GBA 2003/023/0010/02 (BARON-SZABO-2003a coll.); Santonian (Gosau Group at Hochmoos-Grabenbach-area), Austria; scale bar: 3.5 mm.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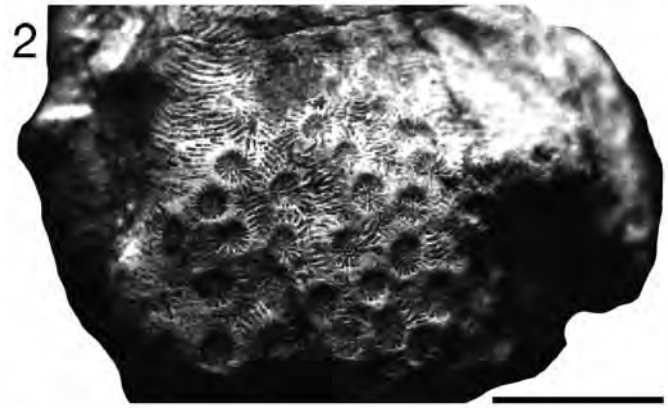
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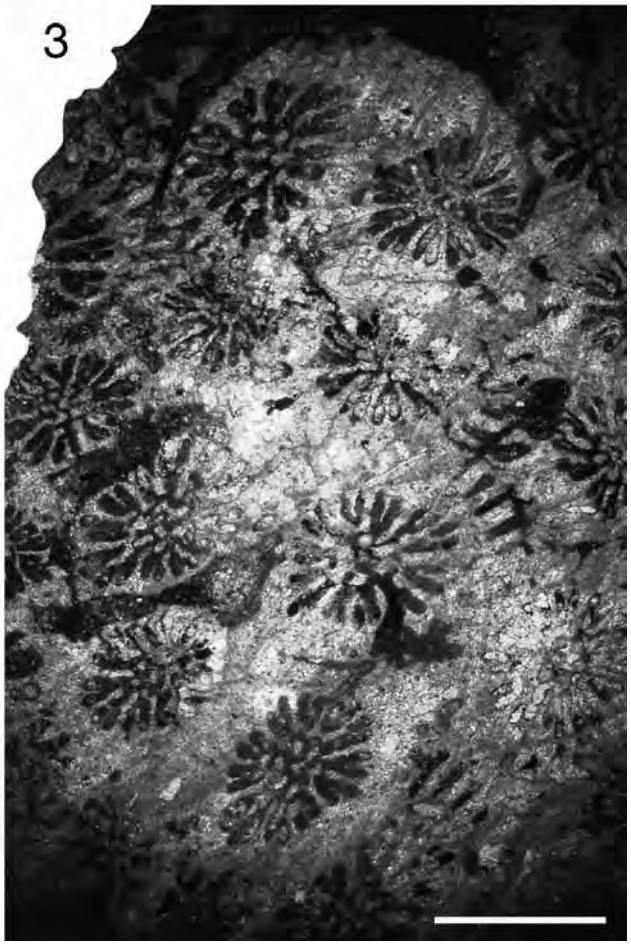
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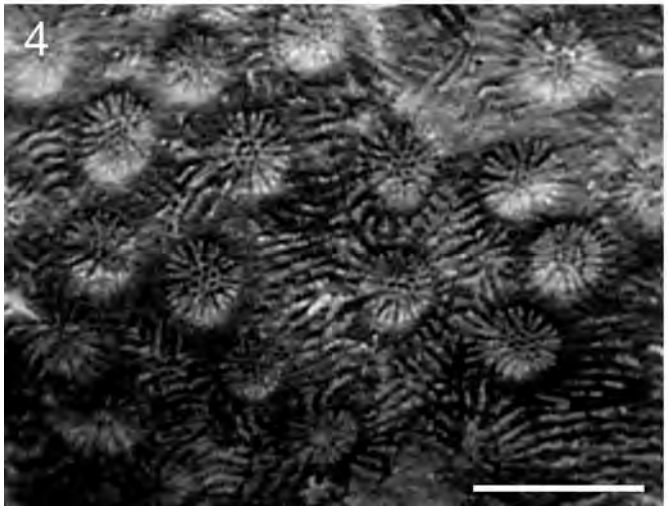
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Plate 33

Figs. 1–5: *Stephanaxophyllia hoernesi* (REUSS, 1854)

Syntype, GBA 1854/007/0086 (REUSS coll.), Turonian–Campanian (Gosau Group, probably at greater Rußbach-Gosau area), Austria.

Fig. 1: upper surface of colony; scale bar: 15 mm.

Fig. 2: lateral view, oblique, partially polished; scale bar: 7.8 mm.

Fig. 3: close-up of Fig. 1; scale bar: 9.5 mm.

Fig. 4: upper surface, lateral view, oblique; scale bar: 5.5 mm.

Fig. 5: upper surface, lateral view, oblique, scale bar: 7.8 mm

Fig. 6: *Rhizangia sedgwicki* REUSS, 1854

?syntype NHMW 1864/0040/1414; upper surface, cross view; Turonian–Campanian (Gosau Group, possibly at greater Rußbach-Gosau area or Piesting area), Austria; scale bar: 2.5 mm.

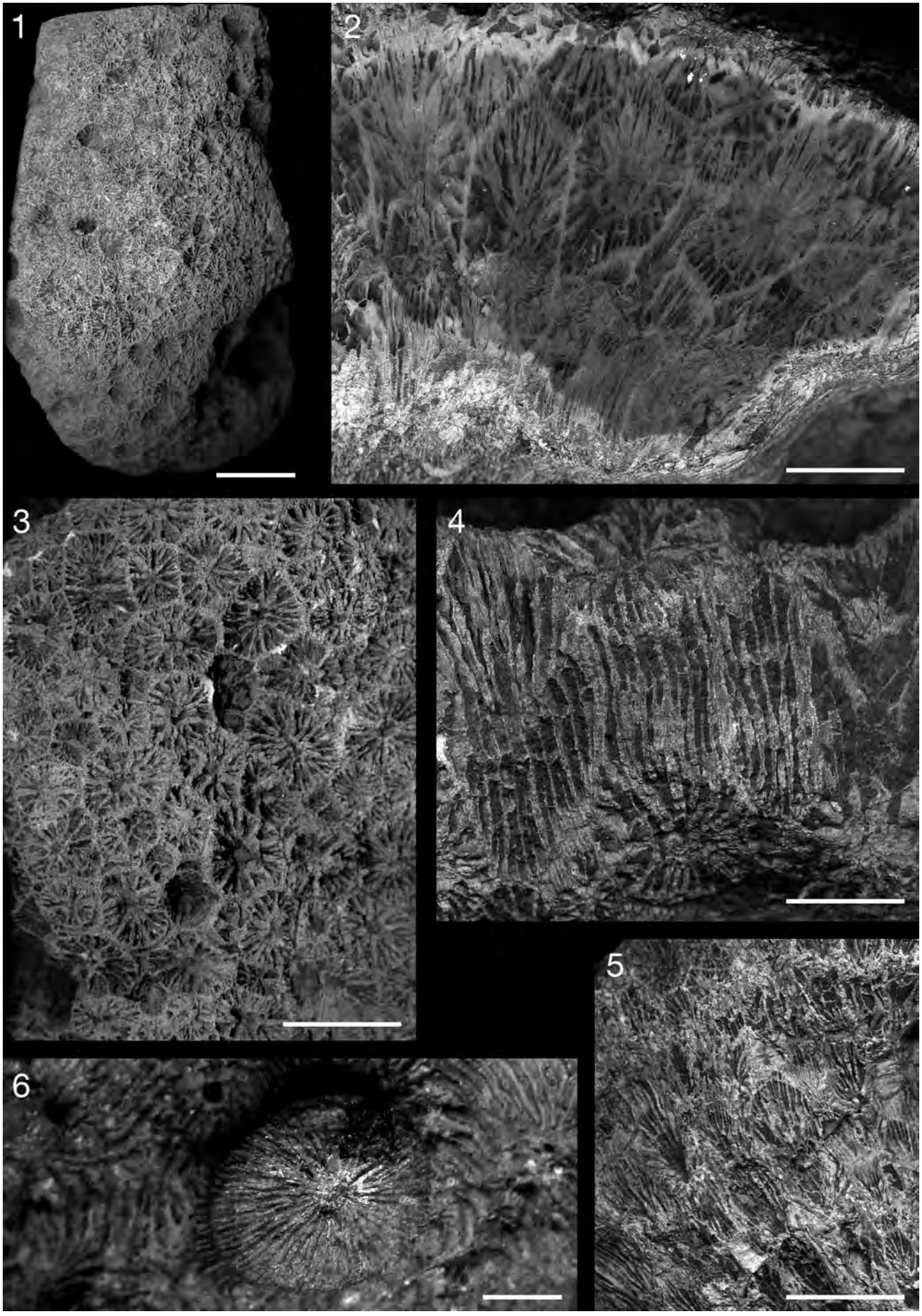
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Plate 34

Figs. 1–3, 7: *Mesomorpha mammillata* (REUSS, 1854)

Figs. 1–3: lectotype, designated herein, GBA 1854/007/0125 (REUSS coll.); Santonian or Upper Santonian (Gosau Group at Neffgraben), Austria.

Fig. 1: upper surface; scale bar: 11 mm.

Fig. 2: close-up of Fig. 1; scale bar: 2 mm.

Fig. 3: close-up of Fig. 1; scale bar: 3 mm.

Fig. 7: NMNH TH-8k (BARON-SZABO coll.); cross view, peel; Lower Coniacian (Gosau Group at Salzburg, "Theresienstein"), Austria; scale bar: 1.5 mm

Figs. 4, 5: ?*Mesomorpha chaetetoides* (TRAUTH, 1911)

Fig. 4: upper surface; GBA 1903/004/0005/01 (FELIX coll., paralectotype of *Thamnarea cladophora* FELIX, 1903a); Santonian (Gosau Group at Randograben), Austria; scale bar: 9 mm.

Fig. 5: upper surface; GBA 1903/004/0005/02 (FELIX coll., paralectotype of *Thamnarea cladophora* FELIX, 1903a); Santonian (Gosau Group at Randograben), Austria; scale bar: 7.5 mm.

Fig. 6: *Rhizangia michelini* REUSS, 1854

Syntype, NHMW 1864/0040/1413; corallites encrusting upper surface of *Cunnolites* specimen; Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area), Austria; scale bar: 10 mm.


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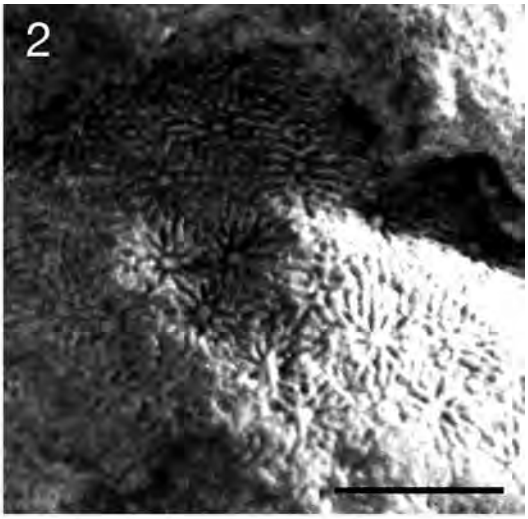
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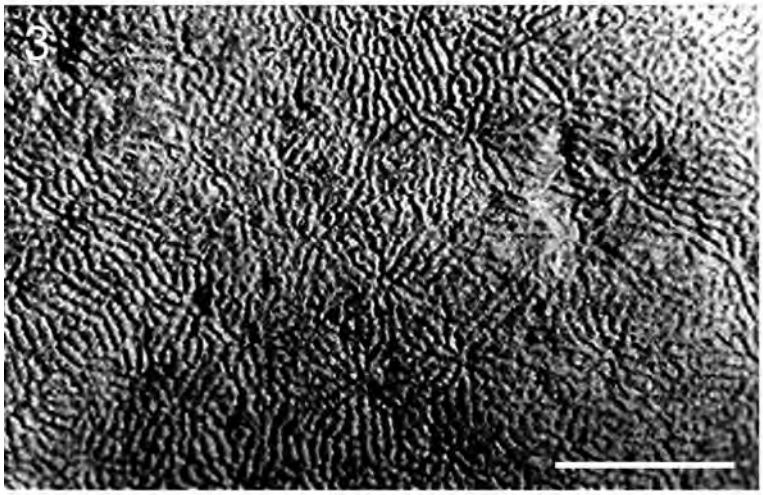
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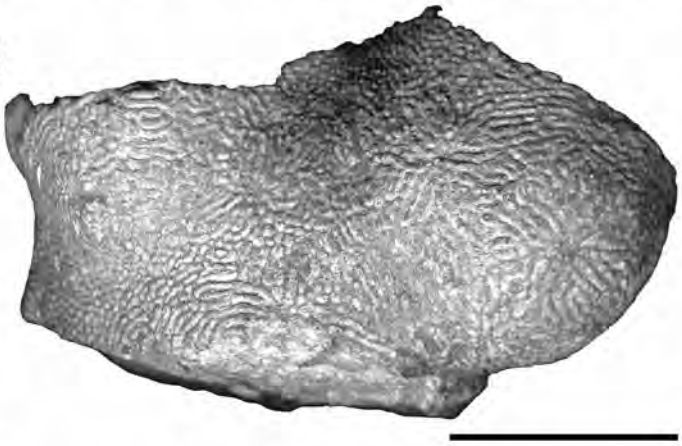
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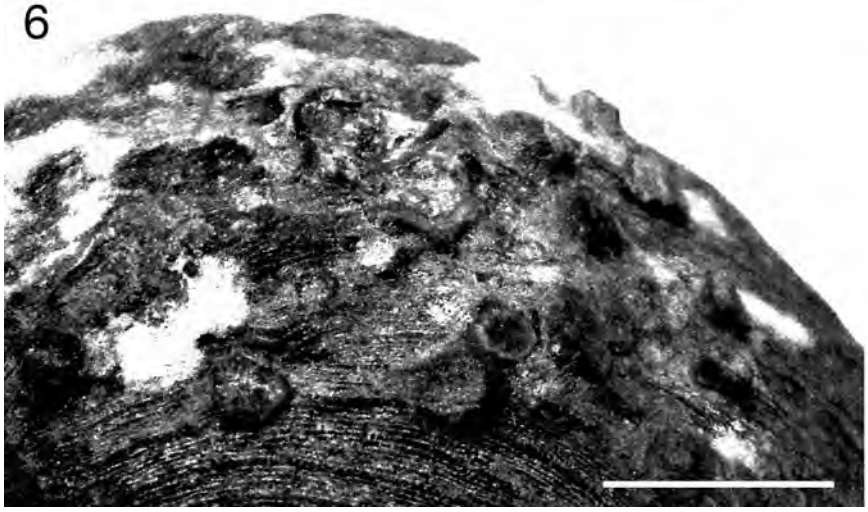
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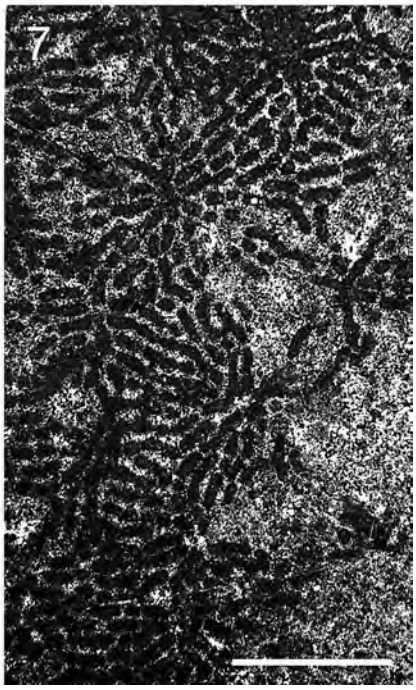
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Plate 35

Figs. 1, 2, 5, 6: *Aulosmilia aspera* (SOWERBY, 1832)

Figs. 1, 2: holotype; NHM R.7090; Turonian–Campanian (Gosau Group, possibly at greater Rußbach-Gosau area), Austria.

Fig. 1: upper surface, polished, cross view; scale bar: 8 mm.

Fig. 2: upper surface, lateral view; scale bar: 8 mm.

Figs. 5, 6: GBA 2003/023/0014/02 (BARON-SZABO-2003a coll.), Santonian (Gosau Group at Hochmoos-Grabenbach-area), Austria.

Fig. 5: thin section, cross view of juvenile stage; scale bar: 2 mm.

Fig. 6: thin section, cross view of adult stage; scale bar: 2 mm.

Figs. 3, 4: *Aulosmilia consobrina* (REUSS, 1854)

Syntype, NHMW 1864/0040/1227; Turonian–Campanian (Gosau Group, possibly at greater Rußbach-Gosau area), Austria.

Fig. 3: upper surface, cross view; scale bar: 10 mm.

Fig. 4: upper surface, lateral view; scale bar: 10 mm.

Fig. 7: *Aulosmilia cuneiformis* (MILNE EDWARDS & HAIME, 1848d)

GBA 1999/089/0009/02 (BARON-SZABO-1999 coll.); thin section, cross view; Upper Turonian (Gosau Group at Styrian Weissenbachalm), Austria; scale bar: 8.5 mm.

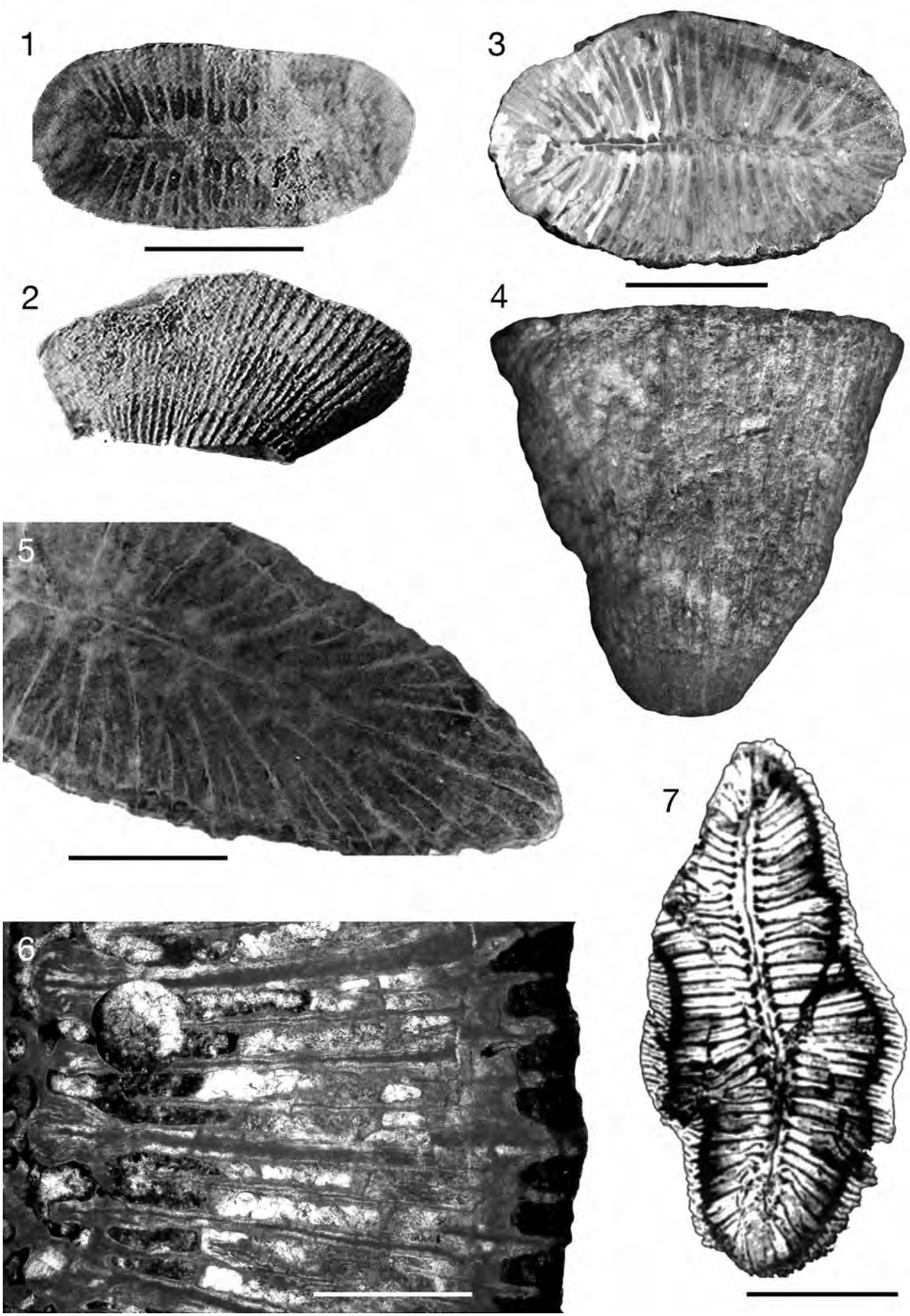
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Plate 36

Figs. 1, 2: *Phragmosmilia lineata* (GOLDFUSS, 1826)

Holotype, IPB 290 (GOLDFUSS coll.), Upper Turonian–Santonian (Gosau Group at Gosau town), Austria.

Fig. 1: upper surface, cross view; scale bar: 10 mm.

Fig. 2: upper surface, lateral view; scale bar: 11.5 mm.

Figs. 3–8: *Nefophyllia angusta* (REUSS, 1854)

Figs. 3, 6: NHMW 1859/0050/0579 (FELIX coll.), original material of FELIX (1903a, p. 287, Pl. 20, Fig. 9); Upper Santonian (Gosau Group at Brunstloch), Austria.

Fig. 3: upper surface, cross view; scale bar: 6 mm.

Fig. 6: upper surface, lateral view; scale bar: 9 mm.

Figs. 4, 5, 7, 8: NHMW 1864/0040/1239 (FELIX coll.), original material of FELIX (1903a, p. 287, Pl. 20, Figs. 7–8); Turonian–Campanian (Gosau Group, probably at Rußbach-Gosau area), Austria.

Fig: 4: upper surface, lateral view; scale bar: 8.5 mm.

Fig. 7: upper surface, polished, cross view of Fig. 4; scale bar: 5 mm.

Fig. 5: upper surface, lateral view; scale bar: 11.5 mm.

Fig. 8: upper surface, polished, cross view of Fig. 5; scale bar: 7.5 mm.

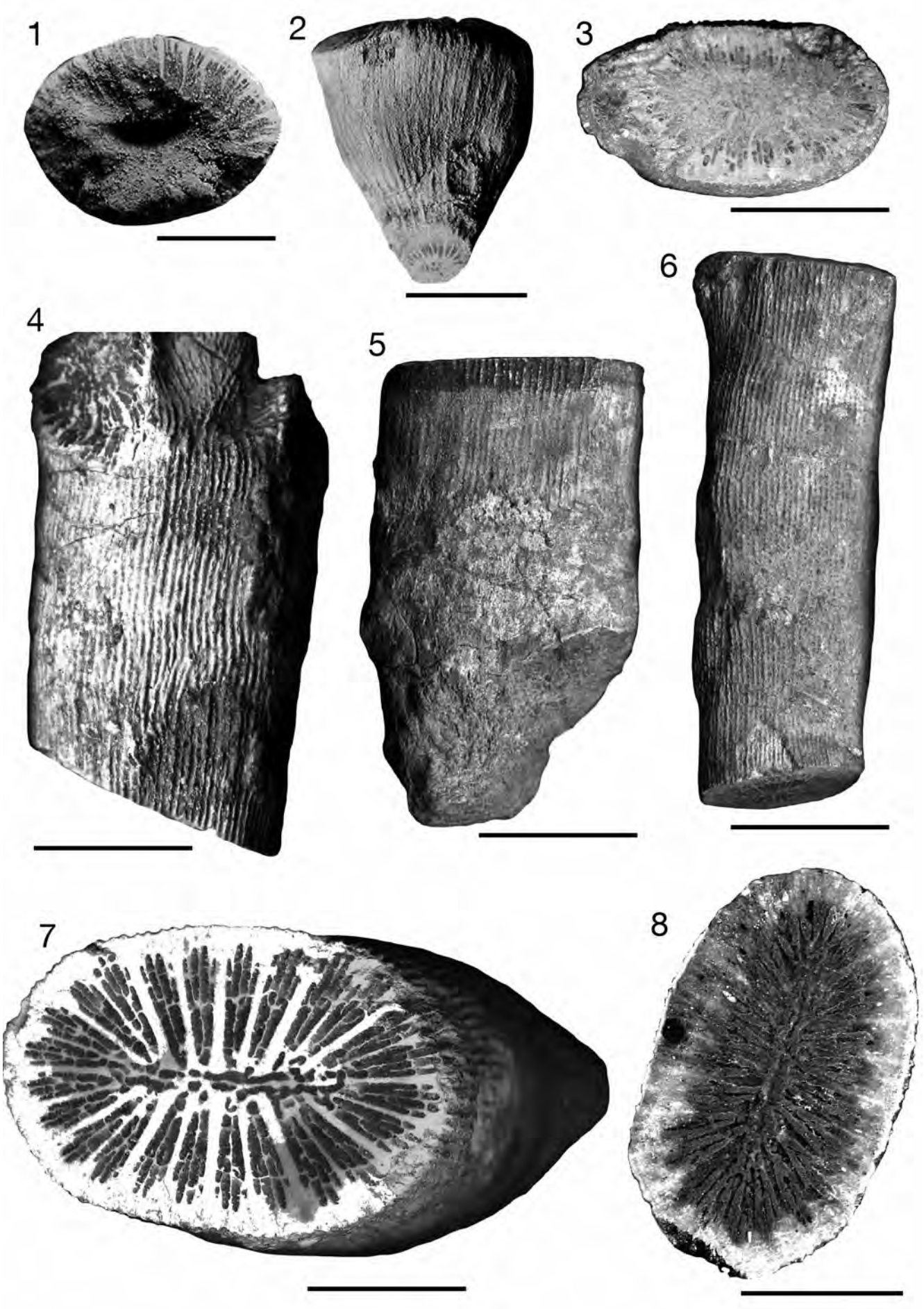
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Plate 37

Figs. 1, 2: *Phyllosmilia diversicostata* Felix, 1903a

Syntype, NHMW 1889/0008/0004 (Felix coll.); Santonian (Gosau Group at Stöcklwaldgraben), Austria.

Fig. 1: upper surface, polished, cross view; scale bar: 11.5 mm.

Fig. 2: upper surface, lateral view; scale bar: 10 mm.

Figs. 3, 4: *Phyllosmilia transiens* Felix, 1899

Syntype, GBA 1903/004/0123/07 (Felix coll.); Upper Turonian–Campanian (Gosau Group at "Gosau Basin"), Austria.

Fig. 3: upper surface, cross view; scale bar: 21 mm.

Fig. 4: upper surface, lateral view; scale bar: 21 mm.

Figs. 5, 6: *Phyllosmilia aegiale* Felix, 1903a

Syntype, NHMW 1859/0040/0286 (Felix coll.), original material of Felix (1903a, 346, Pl. 24, Fig. 10), Upper Santonian (Gosau Group at Tiefengraben), Austria.

Fig. 5: upper surface, lateral view; scale bar: 15 mm.

Fig. 6: upper surface, partially polished, cross view; scale bar: 10 mm.

Fig. 7: *Phyllosmilia nefgrabensis* M. Beauvais, 1982

SZB 7377; polished upper surface, cross view; Upper Santonian (Gosau Group at Untersberg, Gaistischl), Austria; scale bar: 20 mm.

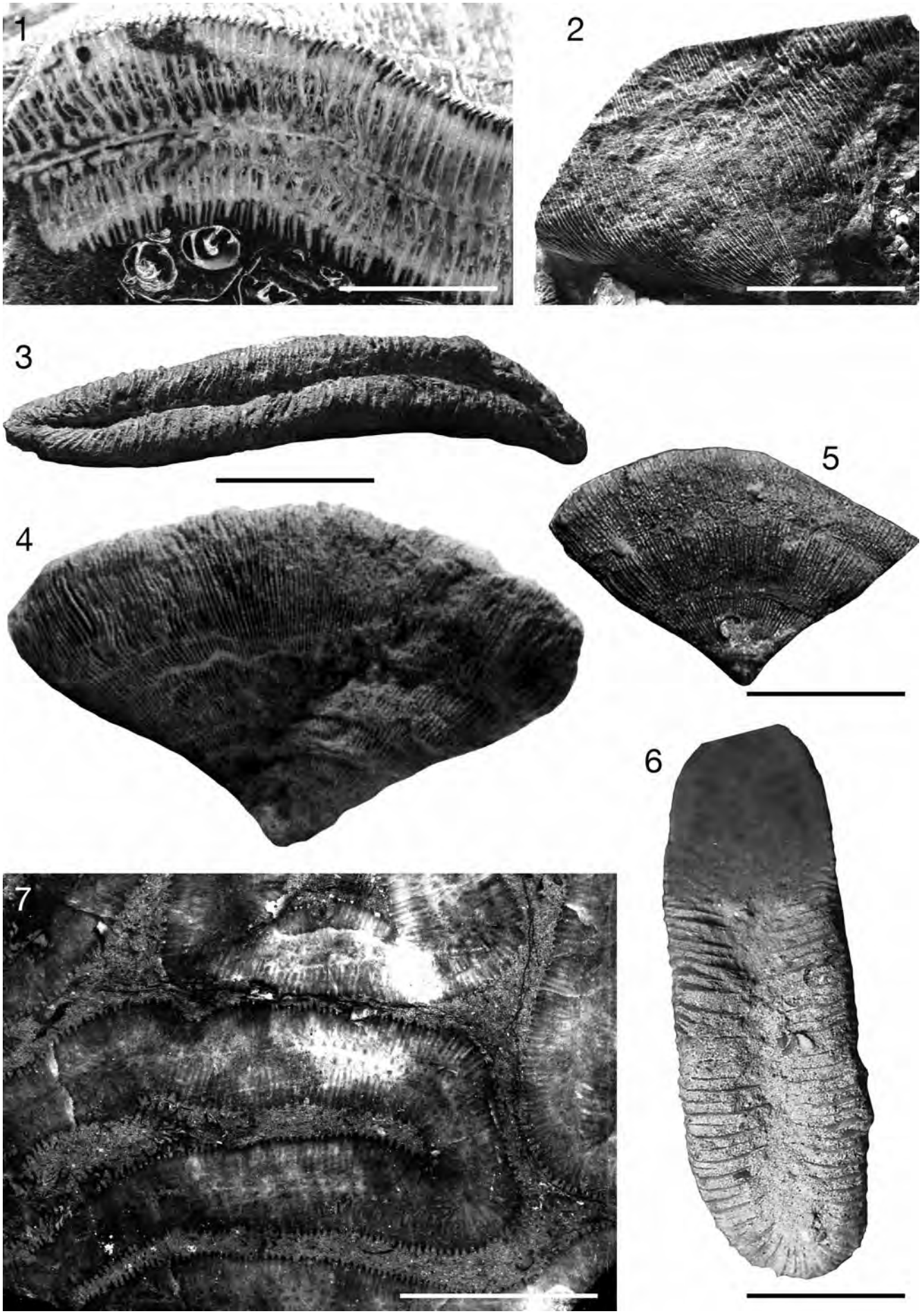
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Plate 38

Figs. 1–3: *Phyllosmilia didymophila* (FELIX, 1903a)
Santonian (Gosau Group at Hochmoos-Grabenbach-area), Austria.
Fig. 1: thin section, cross view; GBA 2003/023/0015/01 (BARON-SZABO-2003a coll.); scale bar: 2.5 mm.
Fig. 2: thin section, cross view; GBA 2003/023/0015/08 (BARON-SZABO-2003a coll.); scale bar: 6.5 mm.
Fig. 3: close-up of Fig. 2, showing thickened axial ends of septa, sometimes fusing with columella; scale bar: 1 mm.

Figs. 4, 5: *Phyllosmilia nefgrabensis* M. BEAUVAIS, 1982
SZB 15386; Upper Santonian (Gosau Group at Untersberg, Gaistischl), Austria.
Fig. 4: upper surface, cross view; scale bar: 20 mm.
Fig. 5: polished upper surface, cross view; scale bar: 12 mm.

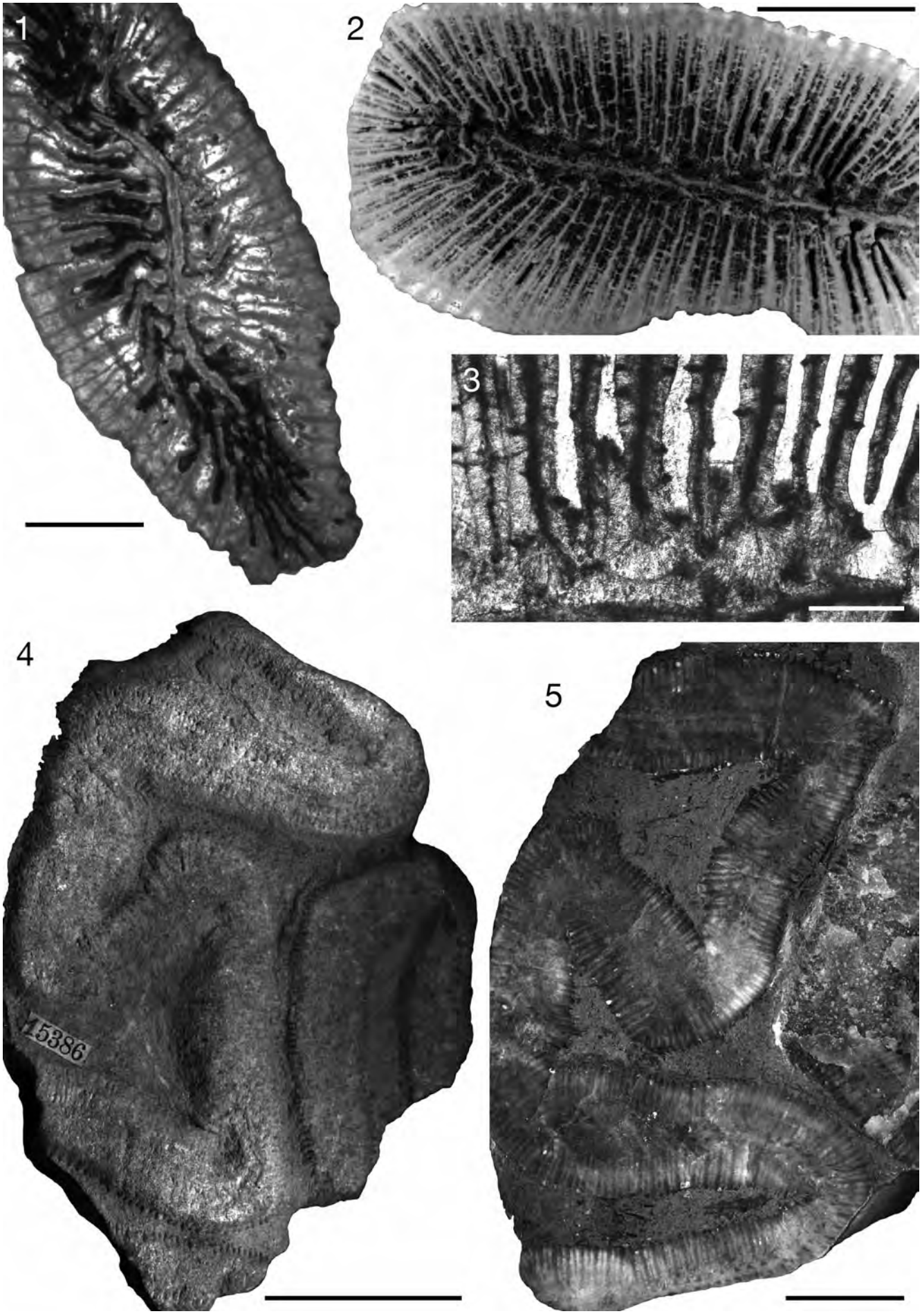
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Plate 39

Figs. 1–7: *Dasmiopsis lamellicostatus* (REUSS, 1854)

Figs. 1, 2: GBA 2003/024/0001; Coniacian–Santonian (Gosau Group at Hofergraben), Austria.

Fig. 1: upper surface, lateral view; scale bar: 11 mm.

Fig. 2: upper surface, polished, cross view; scale bar: 8.5 mm.

Figs. 3, 4: GBA 2003/024/0003; Coniacian–Santonian (Gosau Group at Hofergraben), Austria.

Fig. 3: upper surface, polished, cross view of incomplete corallite; scale bar: 8 mm.

Fig. 4: upper surface, lateral view; scale bar: 8 mm.

Fig. 5: cross view, polished surface; lectotype, NHMW 1864/0040/1214 (designation by M. BEAUVAIS, 1982, vol. I, p. 236, Pl. 20, Figs. 6a, b, using original material of REUSS, 1854, p. 79, Pl. 13, Fig. 18); Turonian–Campanian (Gosau Group, probably at greater Rußbach-Gosau area), Austria; scale bar: 5.5 mm.

Fig. 6: upper surface, lateral view; paralectotype, NHMW 1864/0040/1211a; Upper Turonian–Santonian (Gosau Group at Gosau town area), Austria; scale bar: 10.5 mm.

Fig. 7: thin section, cross view; SAZU Stranice-quarry #78; Santonian–Campanian (Austroalpine unit at Stranice), Slovenia; scale bar: 5 mm.

Fig. 8: *Diploctenium contortum* REUSS, 1854

Holotype, NHMW 1864/0040/1249 (REUSS coll. #3185); upper surface, lateral view; Upper Santonian (Gosau Group at Neffgraben), Austria; scale bar: 20 mm.

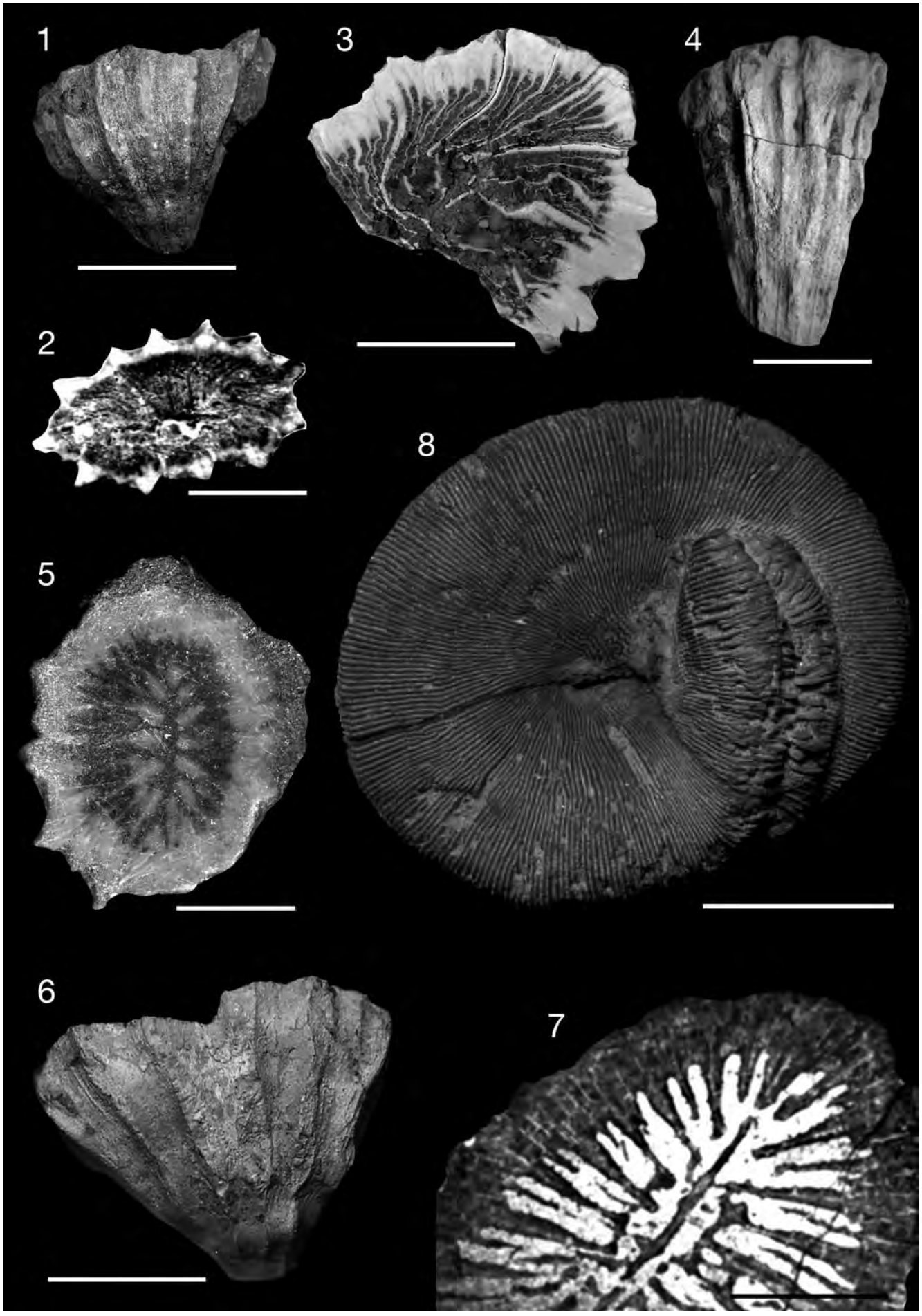
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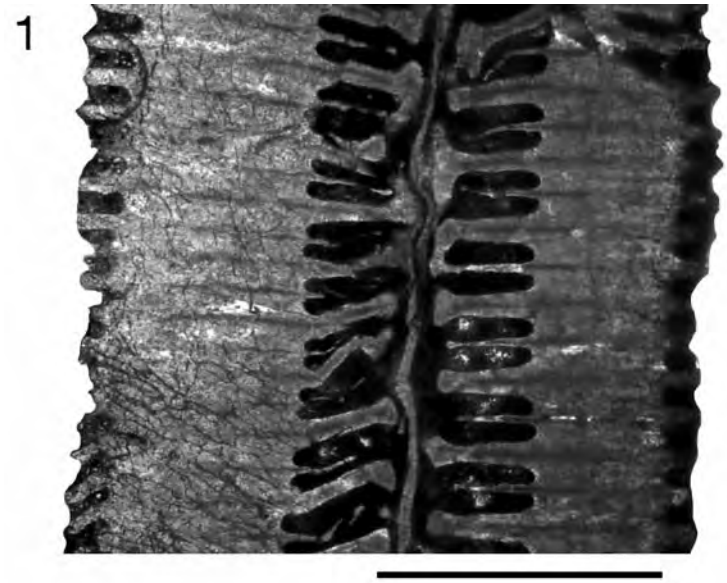
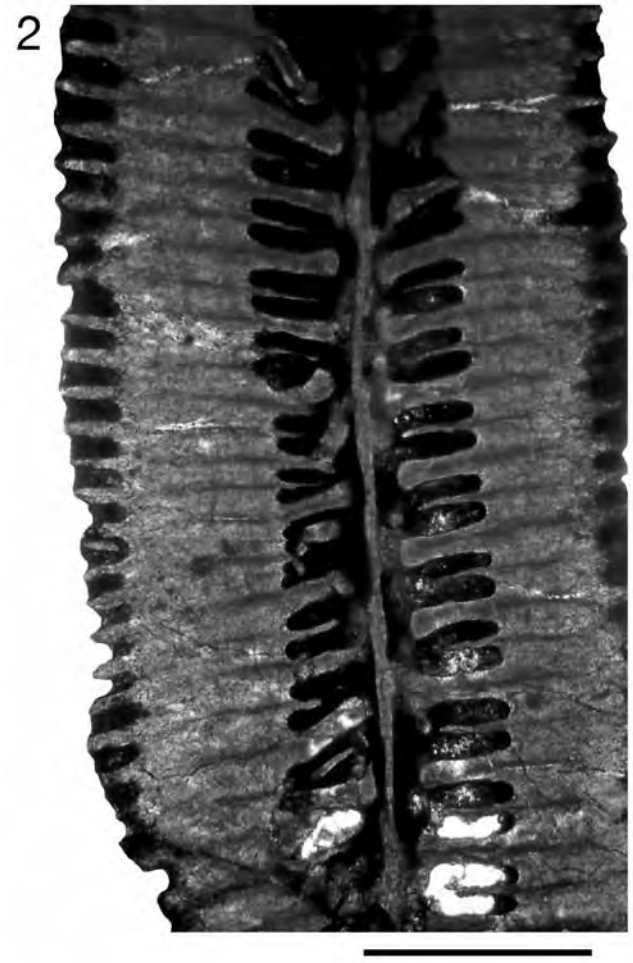
Plate 40

Figs. 1–4: *Diploctenium ferrumequinum* Reuss, 1854
GBA 2003/023/0016/02 (Baron-Szabo-2003a coll.); Santonian (Gosau Group at Hochmoos-Grabenbach-area), Austria.
Fig. 1: thin section, cross view, adult stage; scale bar: 3.5 mm.
Fig. 2: thin section, cross view, ontogenetically intermediate stage; scale bar: 4.5 mm.
Fig. 3: thin section, cross view, advanced juvenile stage; scale bar: 3.5 mm.
Fig. 4: thin section, cross view, juvenile stage; scale bar: 4 mm.

Fig. 5: *Diploctenium* sp.
GBA 1999/089/0009/02 (Baron-Szabo-1999 coll.); thin section, lateral view, oblique; Upper Turonian (Gosau Group at Styrian Weissenbachalm), Austria; scale bar: 2 mm.





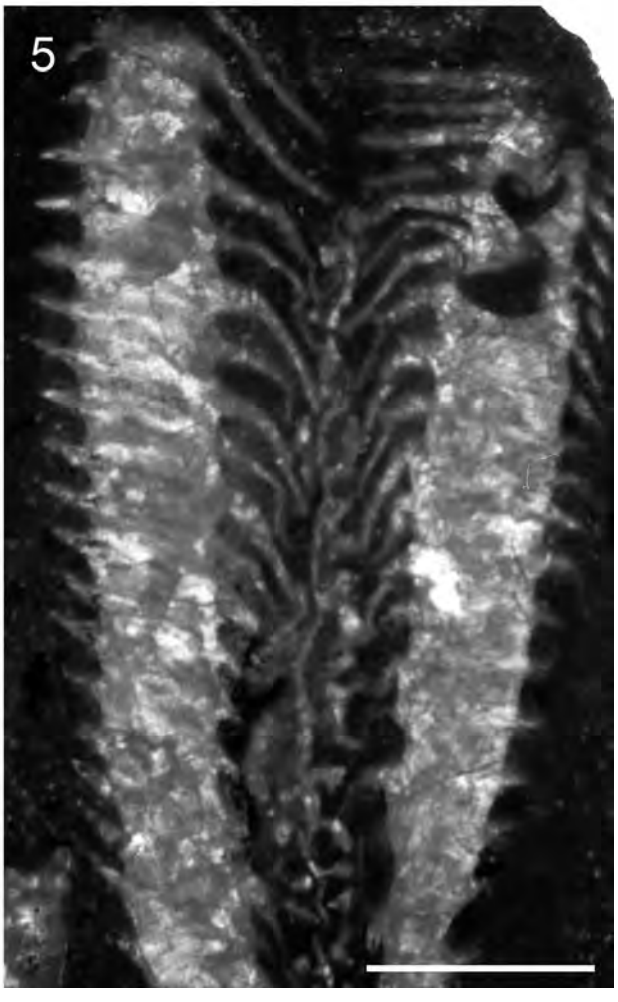


Plate 41

Fig. 1: *Diploctenium haidingeri* Reuss, 1854

Syntype, NHMW 1864/0050/0064; upper surface, lateral view; Upper Santonian (Gosau Group at Neffgraben), Austria; scale bar: 21 mm.

Figs. 2, 3: *Diploctenium pavoninum* Reuss, 1854

Syntype, NHMW 1864/0050/1254; Turonian (Gosau Group at St. Gilgen), Austria.

Fig. 2: upper surface, lateral view; scale bar: 6.5 mm.

Fig. 3: upper surface, cross view; scale bar: 6 mm.

Figs. 4, 5: *Flabellosmilia bisinuatum* (Reuss, 1854)

Syntype, NHMW 1864/0030/1213; Upper Turonian–Santonian (Gosau group at Gosau town), Austria.

Fig. 4: upper surface, cross view; scale bar: 15 mm.

Fig. 5: upper surface, lateral view; scale bar: 15 mm.

Figs. 6, 7: *Flabellosmilia bisinuatum* (Reuss, 1854)

GBA 2003/023/0017/02 (Baron-Szabo-2003a coll.); Santonian (Gosau Group at Hochmoos-Rußbach-area), Austria.

Fig. 6: thin section, cross view of juvenile stage of corallum; scale bar: 2 mm.

Fig. 7: thin section, cross view of adult stage of corallum; scale bar: 3.5 mm.

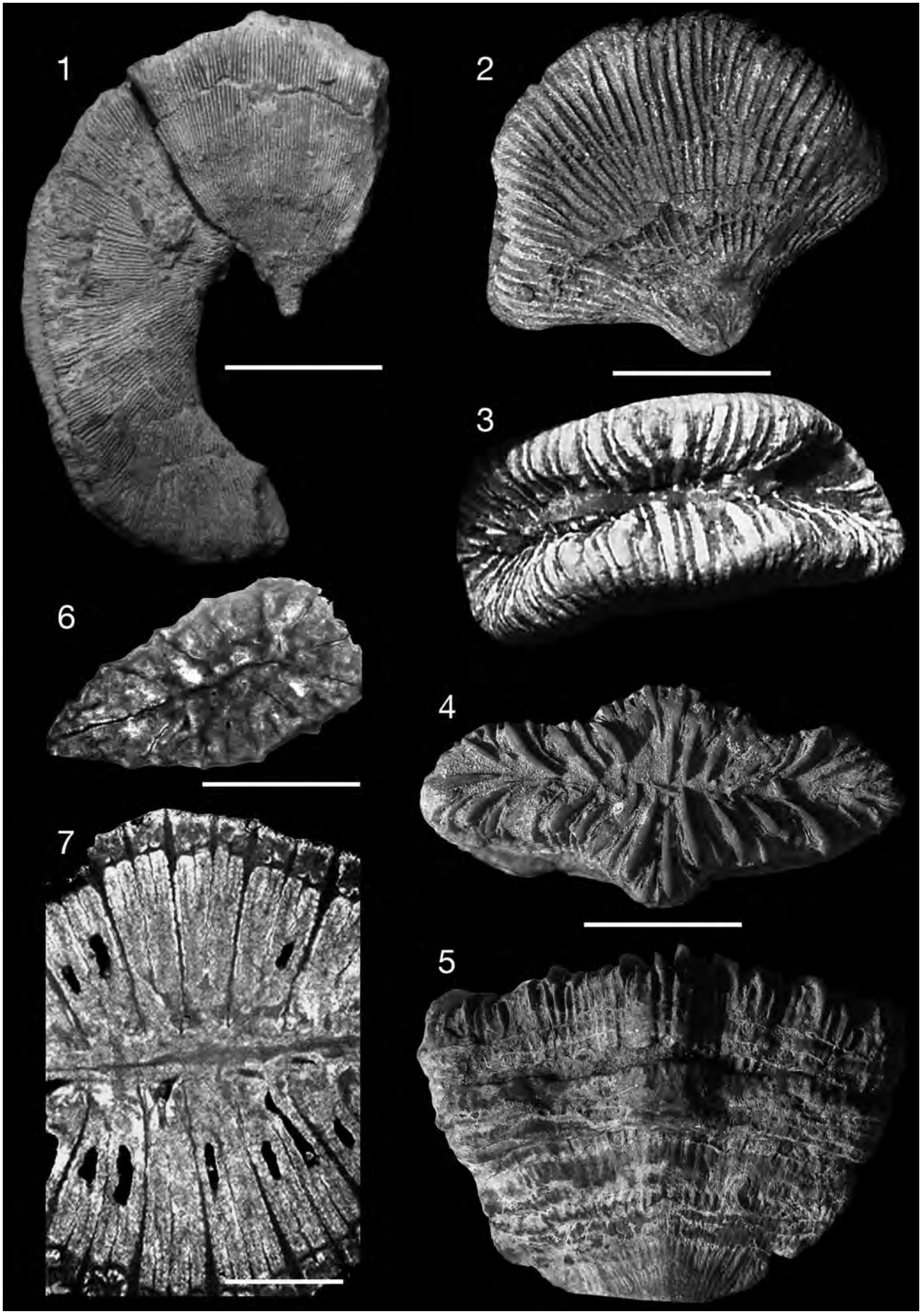

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Plate 42

Figs. 1–3: *Flabellosmilia bisinuatum* (REUSS, 1854)
GBA 2003/023/0017/01 (BARON-SZABO-2003a coll.); Santonian (Gosau Group at Hochmoos-Rußbach-area), Austria.
Fig. 1: thin section, cross view of adult stage of corallum; scale bar: 3.5 mm.
Fig. 2: thin section, cross view of ontogenetically intermediate stage of corallum; scale bar: 4 mm.
Fig. 3: thin section, cross view of juvenile stage of corallum; scale bar: 1 mm.

Figs. 4–8: *Strotogyra undulata* (REUSS, 1854)
Figs. 4, 5: paralectotype; NHMW 1864/0001/0681 (REUSS coll.); Upper Santonian (Gosau Group at Rußbach area or Piesting area), Austria.
Fig. 4: upper surface, cross view; scale bar: 12 mm.
Fig. 5: upper surface, lateral view; scale bar: 15 mm.
Figs. 6–8: lectotype; NHMW 1864/0040/1260 (REUSS coll.); Upper Santonian (Gosau Group at Neffgraben), Austria.
Fig. 6: upper surface, polished, cross view; scale bar: 12.5 mm.
Fig. 7: cross view of base, polished; scale bar: 8.5 mm.
Fig. 8: polished surface, cross view of part between top part and base of colony; scale bar: 11 mm.

Figs. 9, 10: *Flabellosmilia subcarinatum* (REUSS, 1854)
Syntype, GBA 1854/007/0005; Upper Santonian (Gosau Group at Brunstloch), Austria.
Fig. 9: upper surface, cross view; scale bar: 10 mm.
Fig. 10: upper surface, lateral view; scale bar: 10 mm.

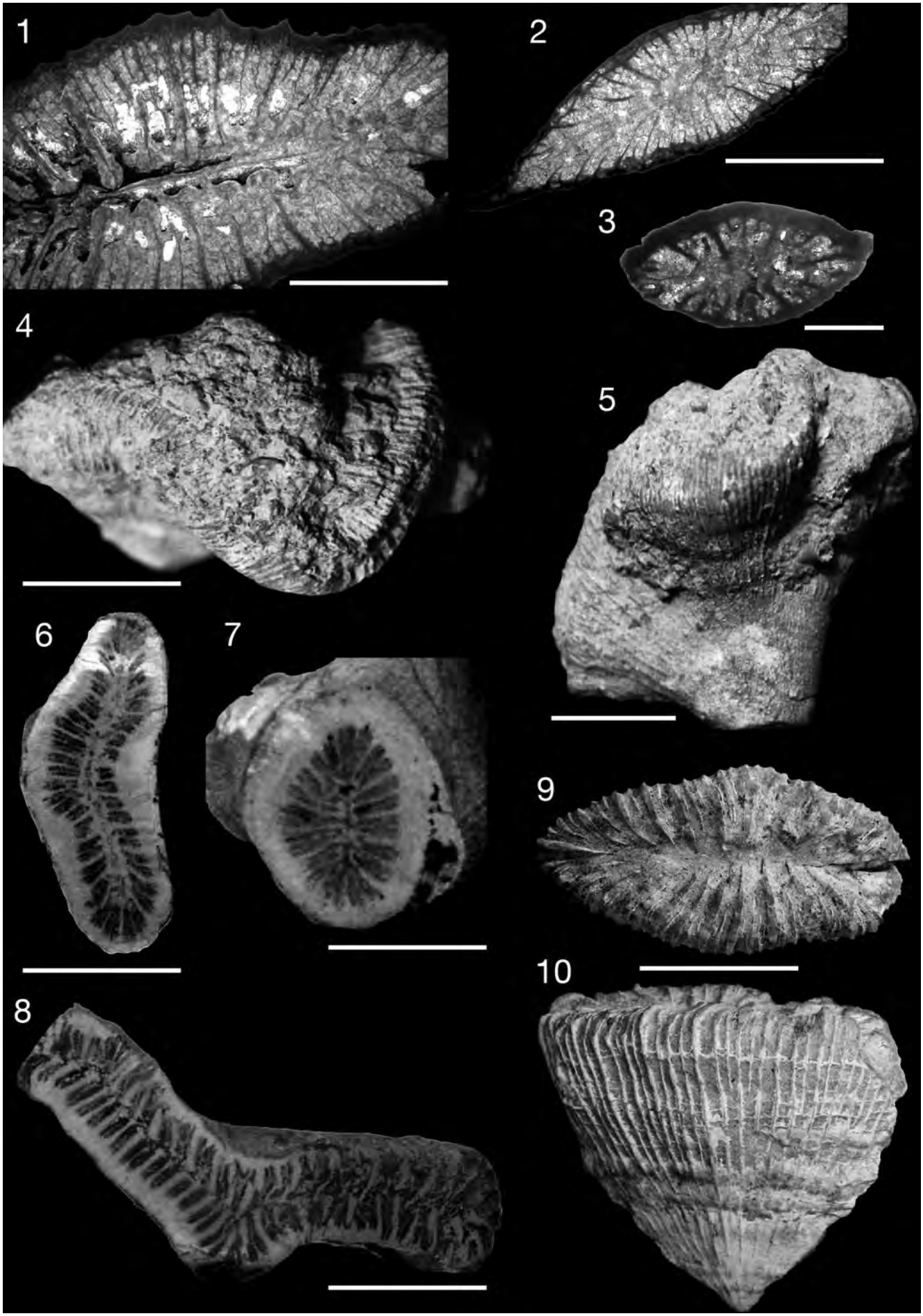
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Plate 43

Figs. 1–3: *Strotogyra augusti* TURNŠEK, 1992
Holotype, SAZU Sv-E/6, Albian (Dinaric occurrence at Slovenski vrh), Slovenia; photographs courtesy D. TURNŠEK.
Fig. 1: thin section, cross view; SAZU Sv-E/6a; scale bar: 2.5 mm
Fig. 2: thin section, lateral view; SAZU Sv-E/6b; scale bar: 2.5 mm.
Fig. 3: upper surface, cross view, oblique; SAZU Sv-E/6; scale bar: 15 mm.

Figs. 4, 5: *Rennensismilia complanata* (GOLDFUSS, 1826)
NHMW 1859/0050/0619, Coniacian–Santonian (Gosau Group at Traunwand), Austria.
Fig. 4: upper surface, cross view; scale bar: 9 mm.
Fig. 5: upper surface, lateral view; scale bar: 9 mm.

Figs. 6, 7: *Rennensismilia subinduta* (REUSS, 1854)
SAZU W-11, Santonian–Campanian (Austroalpine unit at Stranice-Radana vas), Slovenia.
Fig. 6: upper surface, lateral view; scale bar: 8.5 mm.
Fig. 7: upper surface, cross view; scale bar: 8 mm.

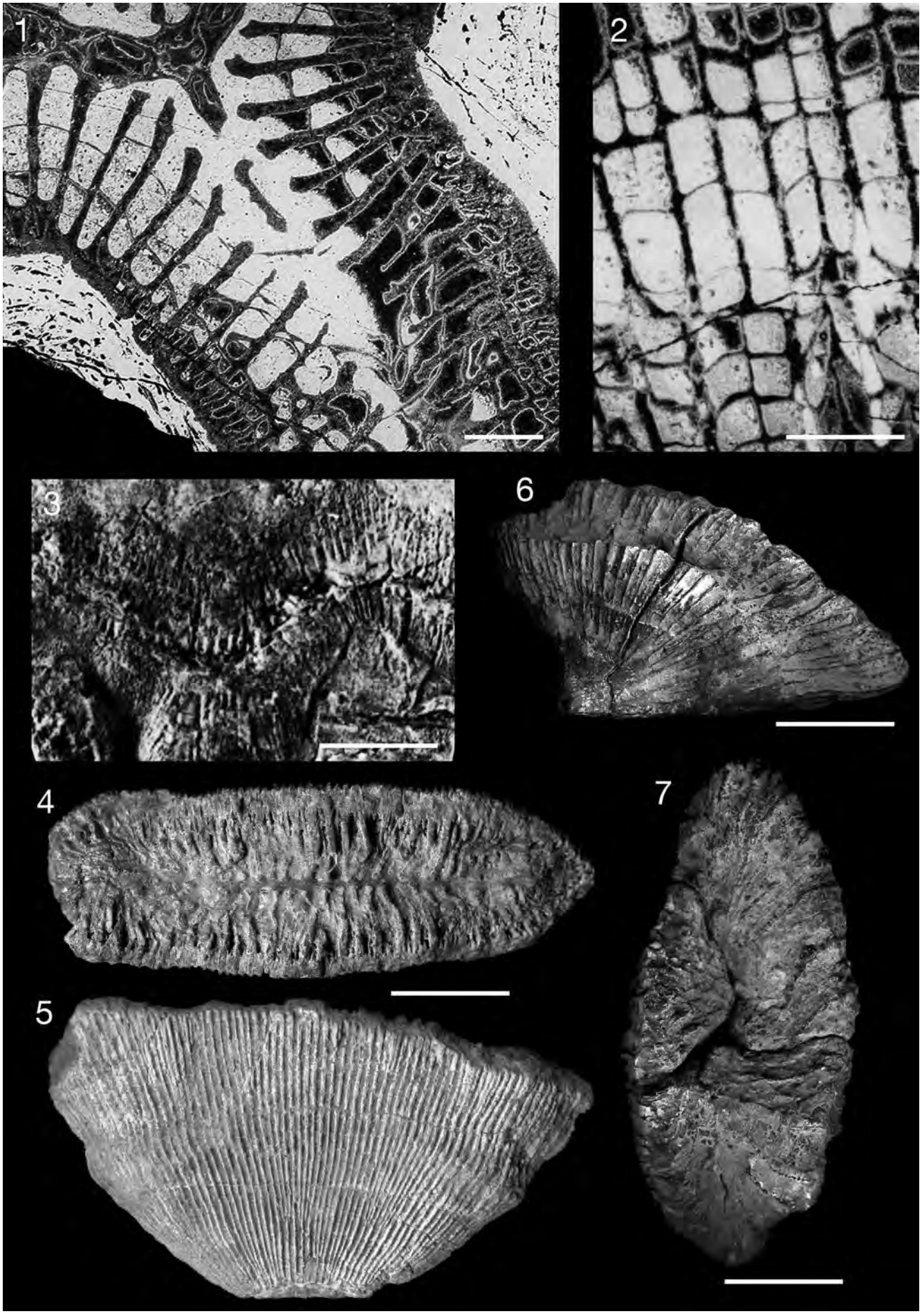
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Plate 44

Figs. 1, 2, 5: *Pachygyra crassolamellosa* (MILNE EDWARDS & HAIME, 1849b)

NHMW 1864/0040/1339, original material of REUSS (1854, p. 109, Pl. 15, Figs. 9, 10); Santonian or Upper Santonian (Gosau Group at Rußbach area), Austria.

Fig. 1: upper surface of colony; scale bar: 13 mm.

Fig. 2: close-up of Fig. 1; scale bar: 8 mm.

Fig. 5: upper surface of colony, lateral view, oblique; scale bar: 16 mm.

Fig. 3: *Pachygyra princeps* REUSS, 1854

Reference material, NHMW 1859/0050/4720; upper surface of colony; Santonian (Gosau Group at Randograben), Austria; scale bar: 30 mm.

Fig. 4: *Pachygyra daedalea* REUSS, 1854

Holotype, GBA 1854/007/0034; upper surface of colony; Upper Santonian (Gosau Group at Neffgraben), Austria; scale bar: 15 mm.

Figs. 6, 7: *Flabellosmilia subcarinatum* (REUSS, 1854)

Determination by FELIX, NHMW 1854/0001/0349 (REUSS coll.); Upper Turonian–Santonian (Gosau Group, possibly at Upper Santonian of Neffgraben or Brunstloch), Austria.

Fig. 6: upper surface, cross view; scale bar: 7 mm.

Fig. 7: upper surface, lateral view; scale bar: 7 mm.

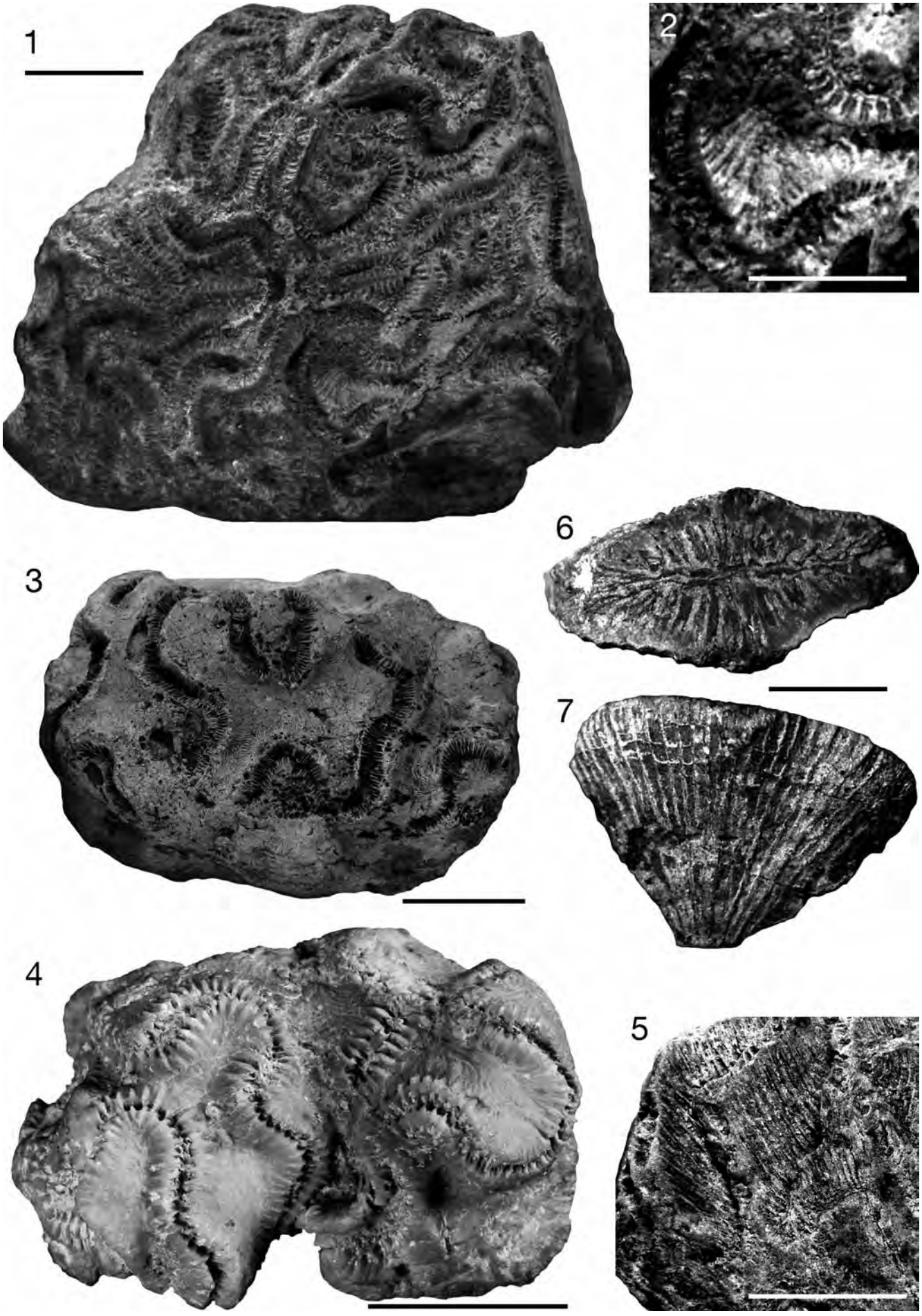
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Plate 45

Figs. 1–3: *Pachygyra princeps* REUSS, 1854

Holotype, GBA 1854/007/0033; Upper Santonian (Gosau Group at Neffgraben), Austria.

Fig. 1: upper surface of colony; scale bar: 45 mm.

Figs. 2, 3: close-up pictures of Fig. 1. Photographs by I. WÜNSCHE (Paleontological collections, GBA); Figs. 2 and 3: scale bar: 15 mm.


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Plate 46

Fig. 1: *Pachygyra princeps* REUSS, 1854

Holotype, GBA 1854/007/0033; close-up of Fig. 1 on Pl. 45. Photograph by I. WÜNSCHE (Paleontological collections, GBA); Upper Santonian (Gosau Group at Neffgraben), Austria; scale bar: 5.5 mm.

Figs. 2–4: *Rennensismilia inflexa* (REUSS, 1854)

Figs 2, 3: syntype, GBA 1854/007/0014; Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area or Linzgraben at Muthmannsdorf), Austria.

Fig. 2: upper surface, polished, cross view; scale bar: 10 mm.

Fig. 3: upper surface, lateral view; scale bar: 22 mm.

Fig. 4: thin section, cross view; GBA 1999/089/0008/02 (BARON-SZABO-1999 coll); Upper Turonian (Gosau Group at Styrian Weissenbachalm), Austria; scale bar: 8.5 mm.

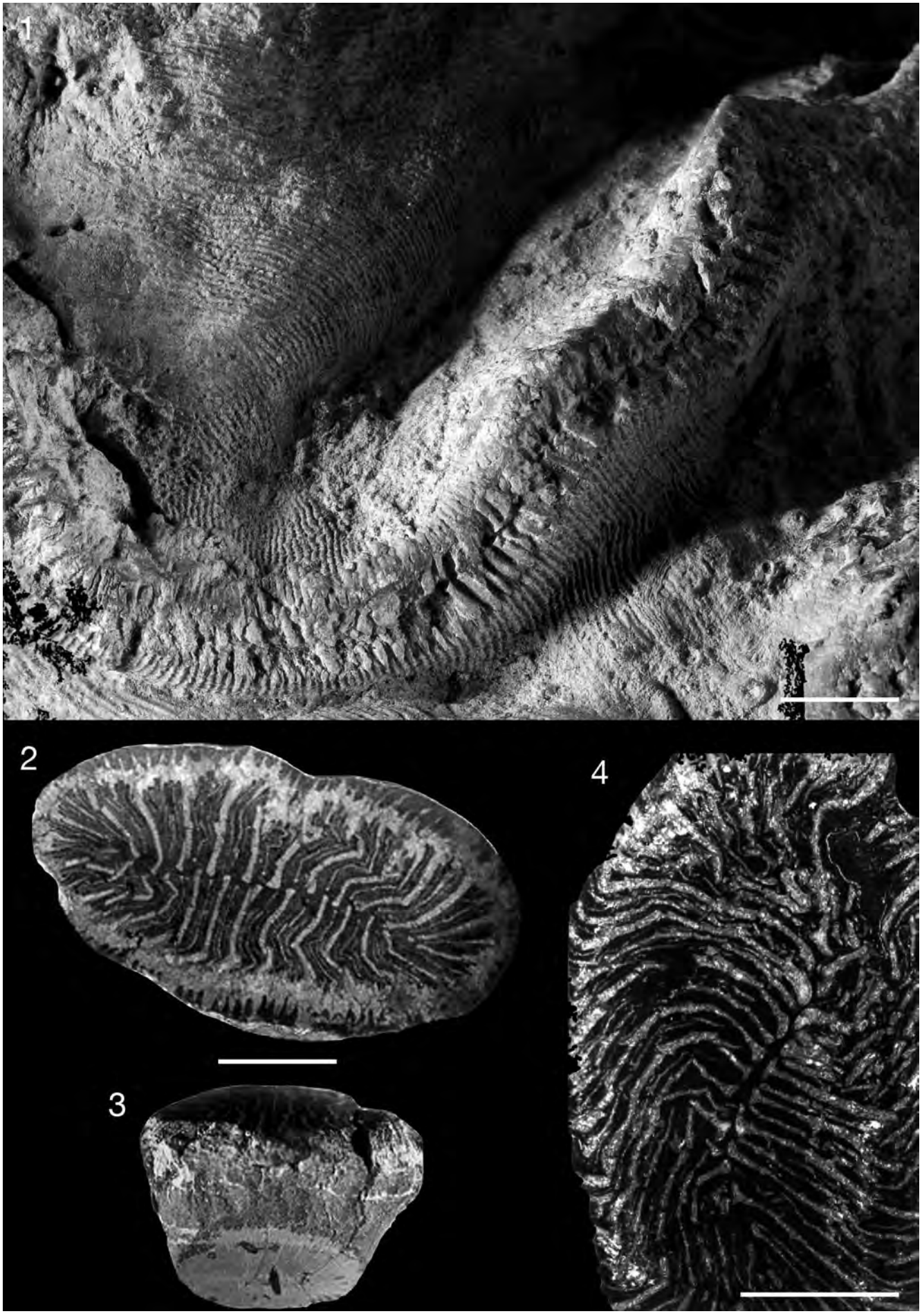
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Plate 47

Fig. 1: *Pachygyra princeps* Reuss, 1854

BSPG (no inventory #; ?original material of Oppenheim, 1930a, Pl. 32, Figs. 1, 1a; documented as *Lasmogyra tortuosa* from the Upper Santonian Gosau Group at Brunstloch, Austria); upper surface, cross view; Upper Santonian (marked on label as Gosau Group at Neffgraben), Austria; scale bar: 13.5 mm.

Fig. 2: *Rennensismilia complanata* (Goldfuss, 1826)

GBA 1999/089/0007/02 (Baron-Szabo-1999); thin section, cross view; Upper Turonian (Gosau Group at Styrian Weissenbachalm), Austria; scale bar: 6 mm.

Fig. 3: *Rennensismilia inflexa* (Reuss, 1854)

Syntype, NHMW 1864/0040/1234; upper surface, polished, cross view; Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area or Linzgraben at Muthmannsdorf), Austria; scale bar: 11.5 mm.

Figs. 4, 5: *Rennensismilia subinduta* (Reuss, 1854)

Syntype, NHMW 1864/0040/1242; Turonian–Campanian (Gosau Group, probably at greater Rußbach-Gosau area), Austria.

Fig. 4: upper surface, cross view; scale bar: 10 mm.

Fig. 5: upper surface, lateral view; scale bar: 10 mm.

Figs. 6, 8: *Montastraea corollaris* (Reuss, 1854)

Fig. 6: upper surface of colony; GBA 1903/004/0088/01, (Felix coll.); Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area), Austria; scale bar: 10 mm.

Fig. 8: syntype; upper surface of colony; NHMW 1864/0040/1402; Coniacian (Gosau Group at Hornegg) or Santonian (Gosau Group at Rußbach-Gosau area), Austria; scale bar: 12 mm.

Fig. 7: *Montastraea* sp.

GeoSZ 7398/20 (originally described as *Phyllocoenia cotteaui* De Fromentel in Turnšek & Buser, 1974); thin section, cross view; Barremian–Aptian (Dinaric occurrence at Osojnica), Slovenia.
Photograph courtesy D. Turnšek; scale bar: 4.5 mm.

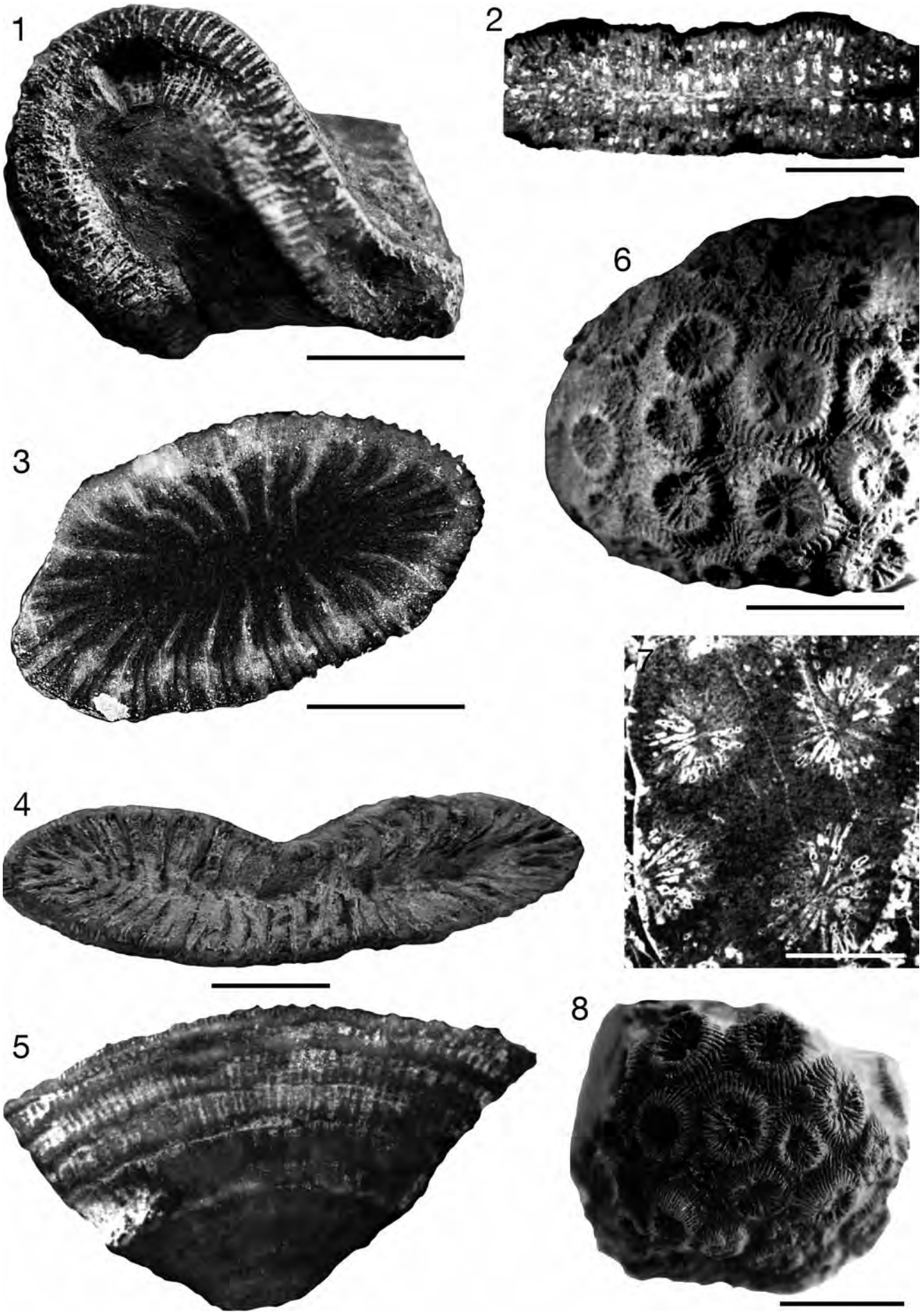
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Plate 48

Fig. 1: *Montastraea corollaris* (REUSS, 1854)
Syntype; close-up of Fig. 8 on Pl. 47; NHMW 1864/0040/1402; Coniacian (Gosau Group at Hornegg) or Santonian (Gosau Group at Rußbach-Gosau area), Austria; scale bar: 3 mm.

Figs. 2, 3: *Rhabdopsammia lanquinei* ALLOITEAU, 1952a
Holotype of the type species of *Rhabdopsammia*; Santonian (Var), France.
Fig. 2: upper surface, lateral view; scale bar: 10.5 mm.
Fig. 3: upper surface, cross view; scale bar: 10 mm.

Figs. 4, 5: *Rhabdopsammia* sp.
GBA 1999/089/0015/02 (BARON-SZABO-1999 coll.); Upper Santonian (Gosau Group at Styrian Weissenbachalm), Austria.
Fig. 4: thin section, cross view; scale bar: 11.5 mm.
Fig. 5: close-up of Fig. 4, showing the septal development of the area of two adjacent corallites; scale bar: 1.5 mm.

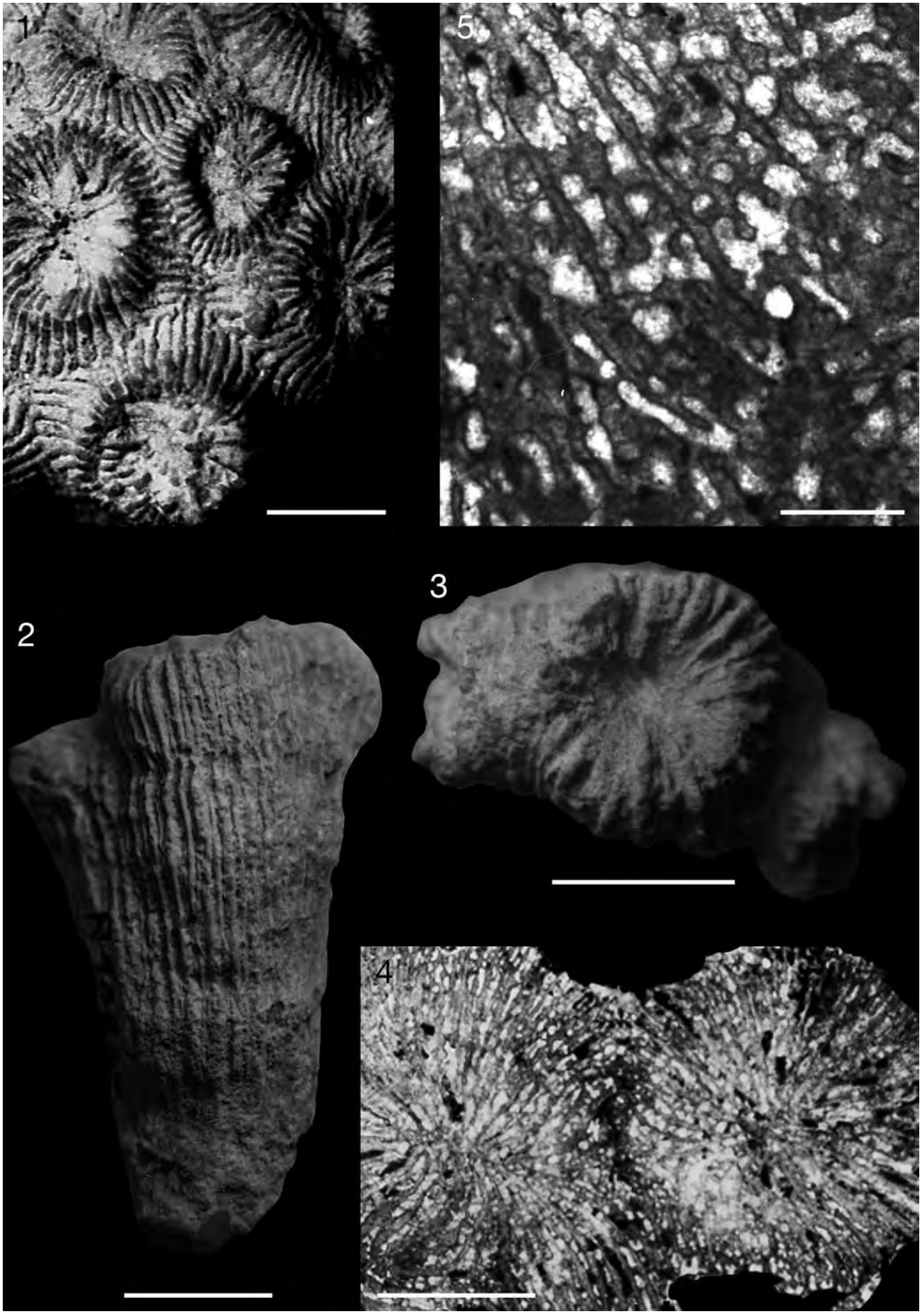
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Plate 49

Figs. 1–6: *Rhabdopsammia crucifera* (FELIX, 1903a)

Figs. 1, 2: paralectotype, GBA 1903/004/0099/02 (FELIX coll.); Upper Turonian–Campanian (Gosau Group at "Gosau Basin"), Austria.

Fig. 1: upper surface, cross view; scale bar: 6 mm.

Fig. 2: upper surface, lateral view; scale bar: 6 mm.

Figs. 3, 4: paralectotype, GBA 1903/004/0099/03 (FELIX coll.); Upper Turonian–Campanian (Gosau Group at "Gosau Basin"), Austria.

Fig. 3: upper surface, cross view, oblique; scale bar: 3 mm.

Fig. 4: upper surface, lateral view, oblique; scale bar: 3 mm.

Figs. 5, 6: lectotype, GBA 1903/004/0099/01 (FELIX coll.); Upper Turonian–Campanian (Gosau Group at "Gosau Basin"), Austria.

Fig. 5: upper surface, cross view; scale bar: 3.5 mm.

Fig. 6: upper surface, lateral view; scale bar: 3.5 mm.

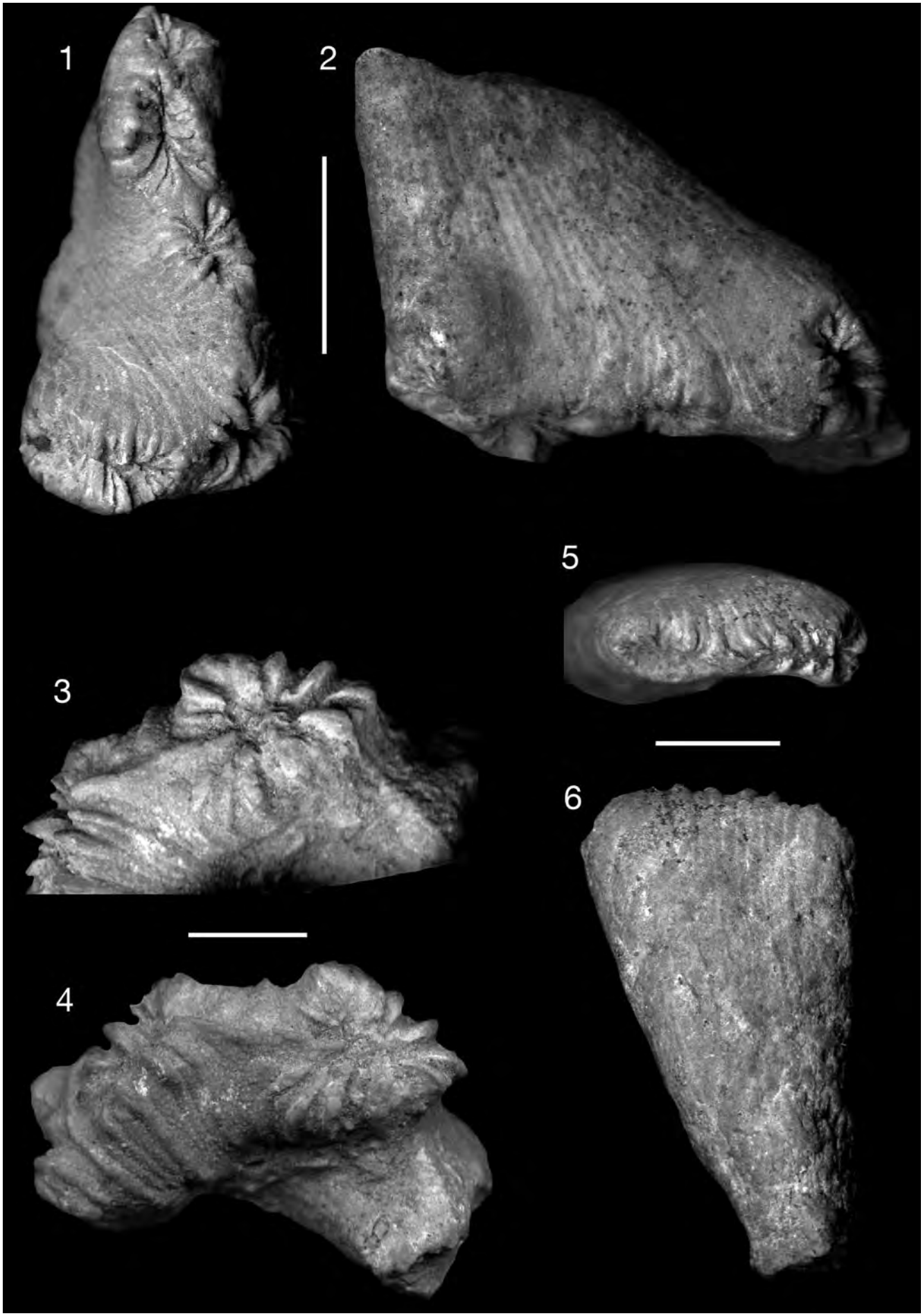
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Plate 50

Figs. 1, 2: *Balanophyllia* sp.

GBA 2003/023/0006 (BARON-SZABO-2003a coll.); Santonian (Gosau Group at Hochmoos-Grabenbach-area), Austria.

Fig. 1: thin section, cross view, adult stage; scale bar: 2.5 mm.

Fig. 2: thin section, cross view, pre-adult stage; scale bar: 3 mm.

Figs. 3, 4: *Barysmilia tuberosa* (REUSS, 1854)

NHMW 1864/0040/1256 (REUSS coll.); Upper Santonian (Gosau Group at Neffgraben, according to REUSS, 1854, p. 91–92), Austria.

Fig. 3: upper surface of colony; scale bar: 8 mm.

Fig. 4: close-up of Fig. 3; scale bar: 5.5 mm.

Figs. 5, 6: *Barysmilia* cf. *irregularis* (REUSS, 1854)

GBA 1903/004/0097 (FELIX coll.), original material of FELIX (1903a, p. 300); Upper Santonian (Gosau Group at Neffgraben), Austria.

Fig. 5: upper surface of colony; scale bar: 5 mm.

Fig. 6: upper surface of colony, partially polished; scale bar: 5.5 mm.


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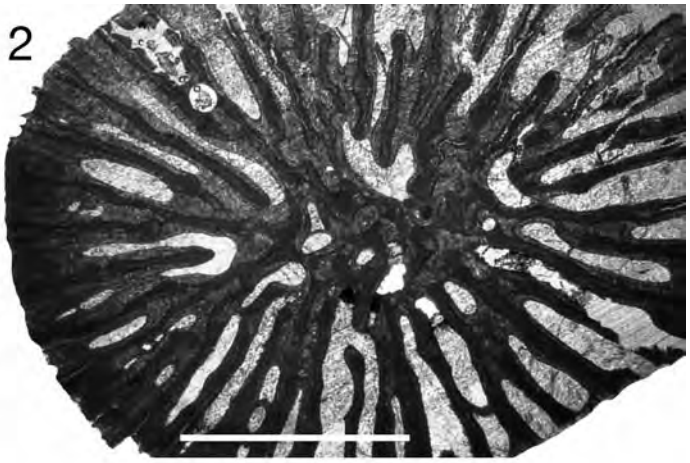
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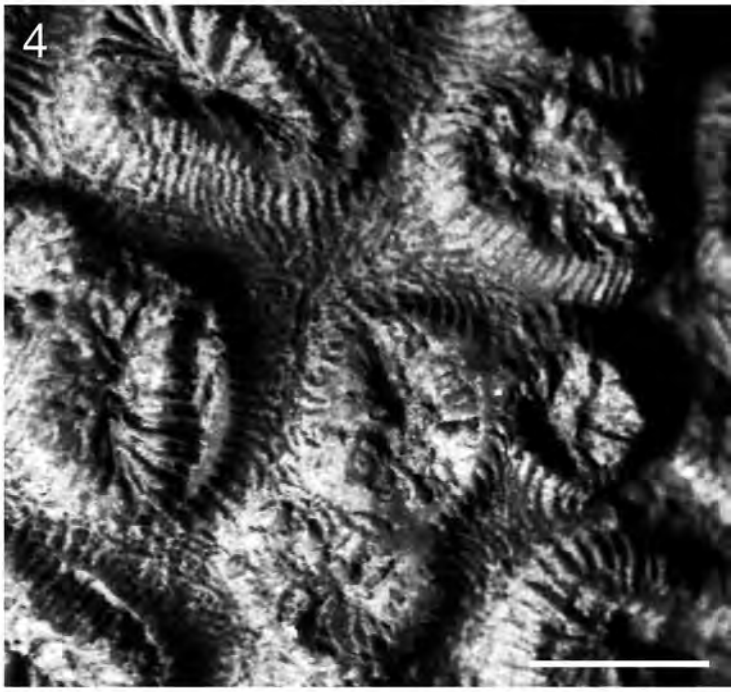
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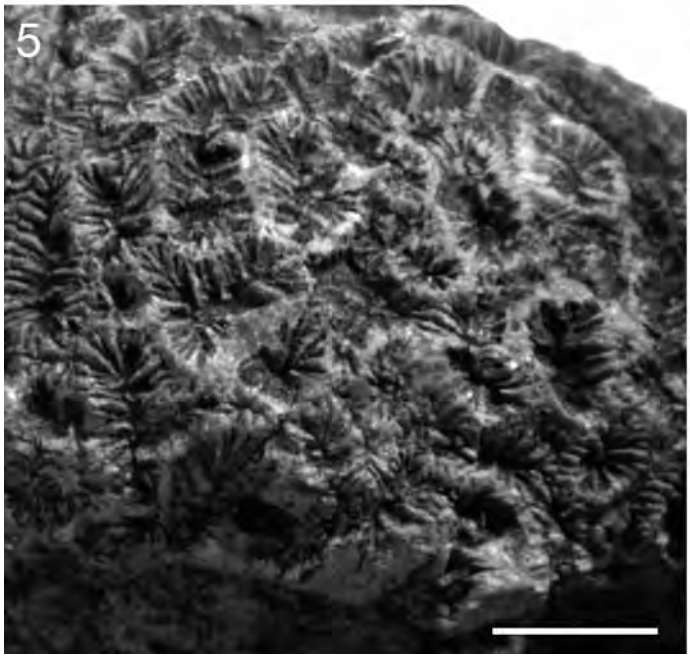
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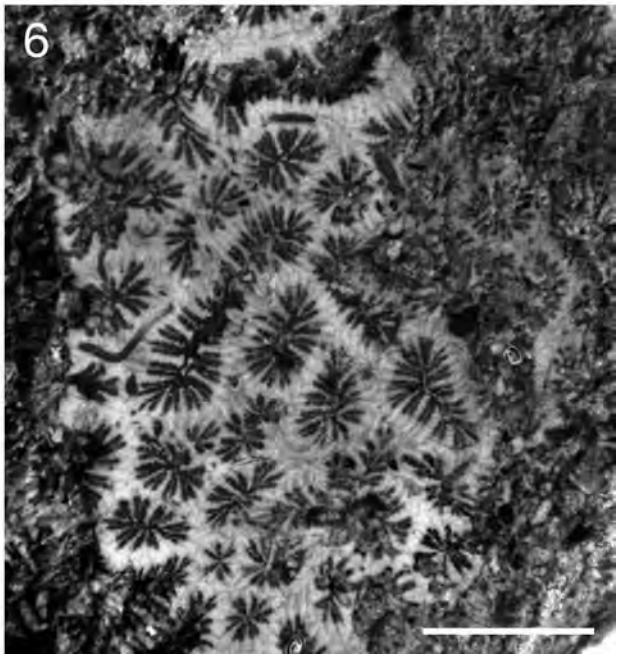
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Plate 51

Figs. 1, 2: *Barysmilia irregularis* (REUSS, 1854)

NHMW 1886/018/0087 (FELIX coll.), original material of FELIX (1903a, p. 300, Pl. 20, Fig. 14); Upper Santonian (Gosau Group at Neffgraben), Austria.

Fig. 1: upper surface of colony; scale bar: 9.5 mm.

Fig. 2: upper surface of colony, partially polished; scale bar: 9.5 mm.

Figs. 3–6: *Psilogyra telleri* FELIX, 1903a

Syntype, GBA 1903/004/0103 (FELIX coll.); Upper Santonian (Gosau Group at Neffgraben), Austria.

Fig. 3: upper surface of colony; scale bar: 9 mm.

Figs. 4, 5: close-up pictures of Fig. 3; Fig: 4: scale bar: 6 mm; Fig. 5: scale bar: 7 mm.

Fig. 6: upper surface, lateral view; scale bar: 6 mm.

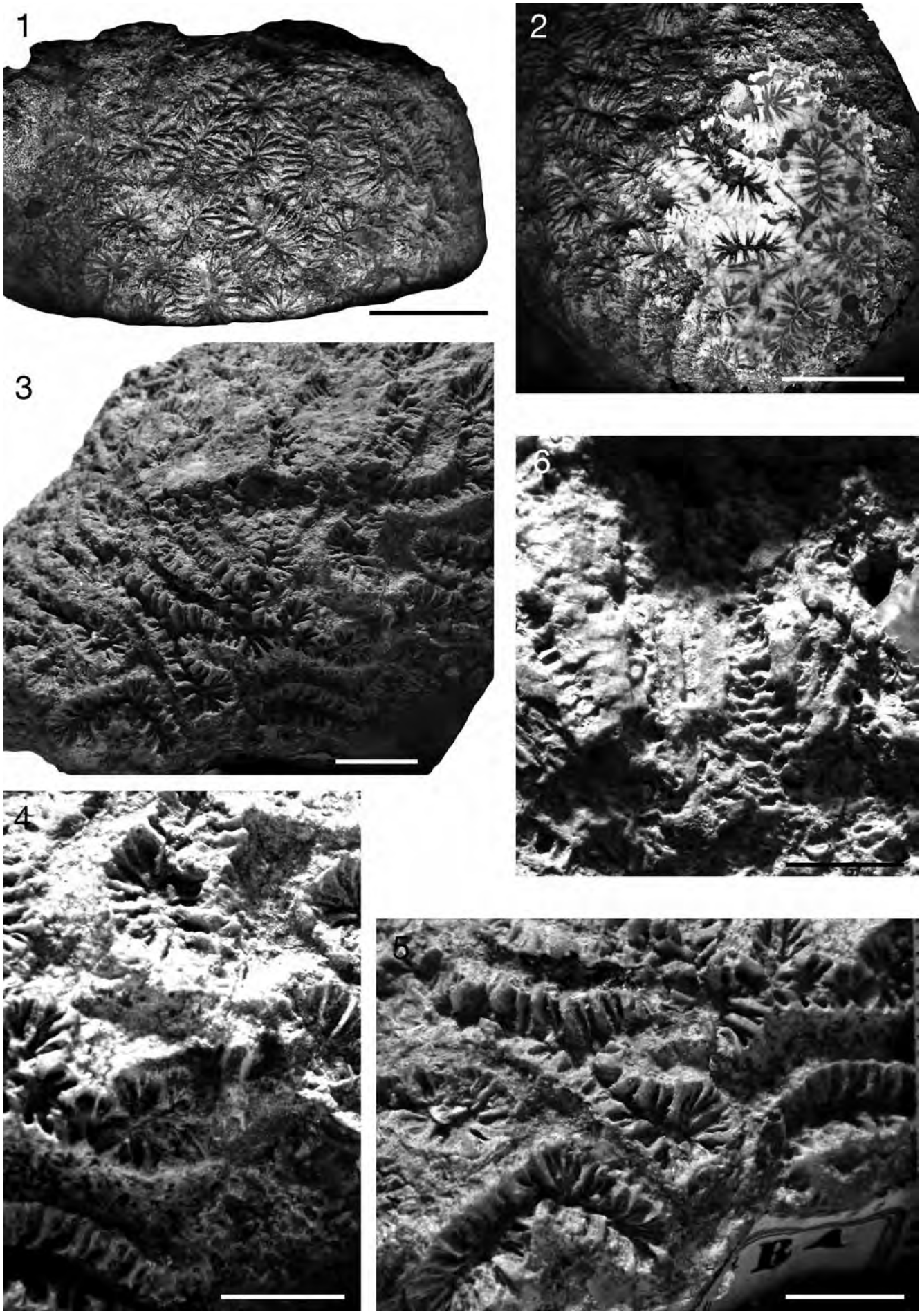
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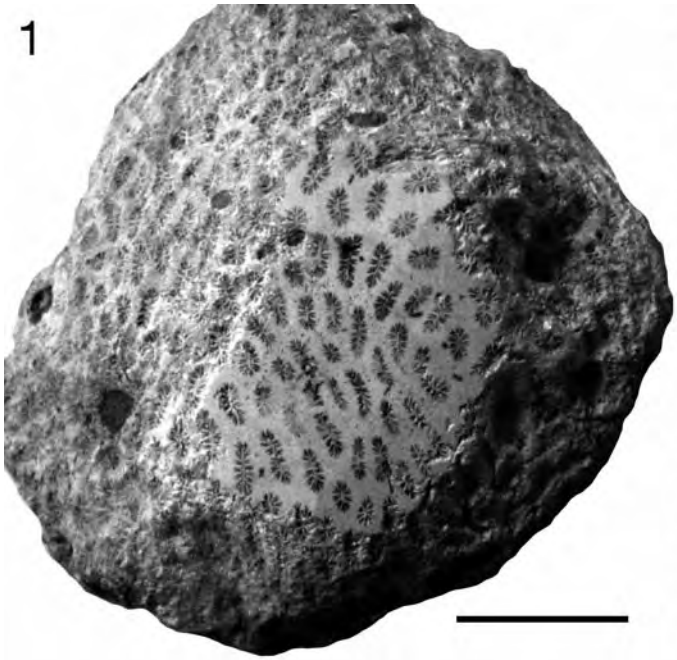
Plate 52

Figs. 1–3: *Barysmilia irregularis* (REUSS, 1854)
Syntype, NHMW 1864/0040/1283, REUSS coll.; Upper Santonian (Gosau Group at Neffgraben), Austria.
Fig. 1: upper surface of colony, partially polished; scale bar: 26 mm.
Figs. 2, 3: close-up pictures of polished areas of Fig. 1; Fig. 2: scale bar: 11 mm; Fig. 3: scale bar: 7.5 mm.

Figs. 4, 5: *Psilogyra telleri* FELIX, 1903a
Syntype, GBA 1903/004/0103 (FELIX coll.); Upper Santonian (Gosau Group at Neffgraben), Austria.
Fig. 4: close-up of Fig. 3 on Pl. 51; scale bar: 4 mm.
Fig. 5: upper surface, lateral view, polished; scale bar: 4.5 mm.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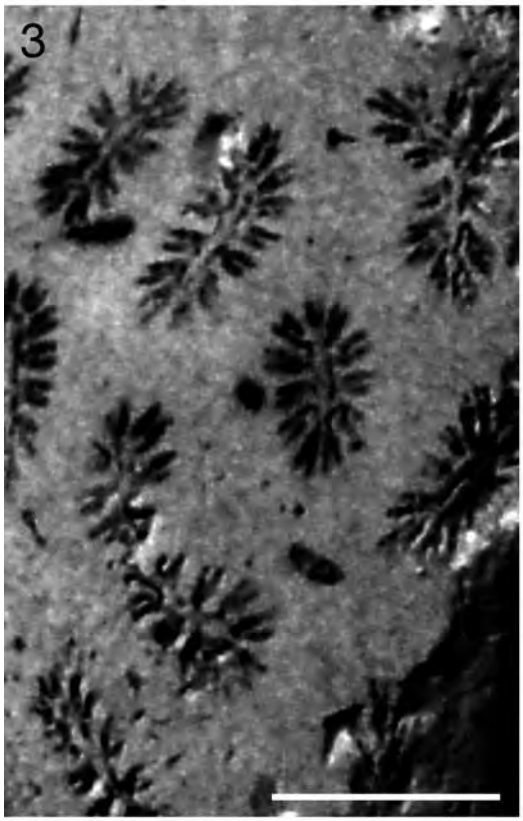
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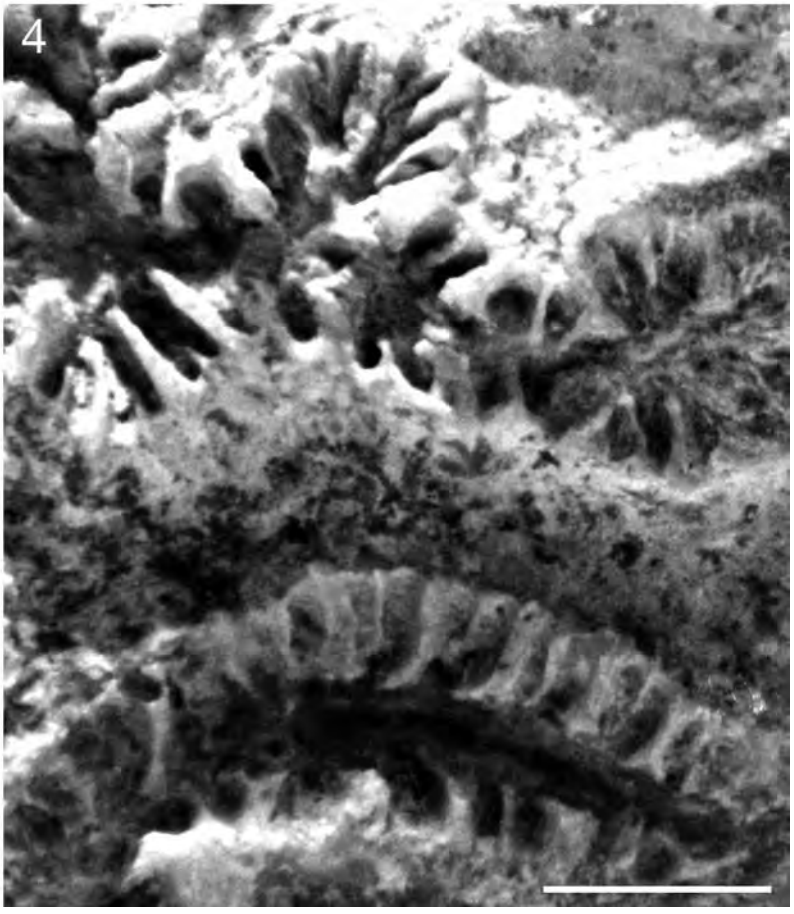
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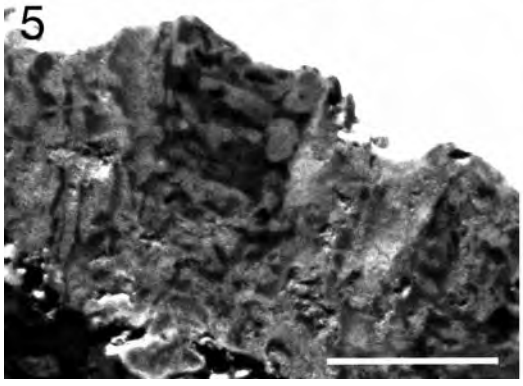
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Plate 53

Fig. 1: *Rhipidomeandra* cf. *bugrovae* MORYCOWA & MASSE, 1998

BSPG BA-8 (BARON-SZABO coll.); thin section, cross view; Lower Aptian (Schrattenkalk at Allgäu, Brandalpe), Germany; scale bar: 2 mm.

Figs. 2, 4–6: *Brachyphyllia depressa* REUSS, 1854

Fig. 2: ?syntype; upper surface of colony; NHMW (REUSS coll. #5); Upper Santonian (Gosau Group at Piesting), Austria; scale bar: 18 mm.

Figs. 4–6: syntype; NHMW 1864/0040/1304, (REUSS coll.); Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area or at Piesting area), Austria.

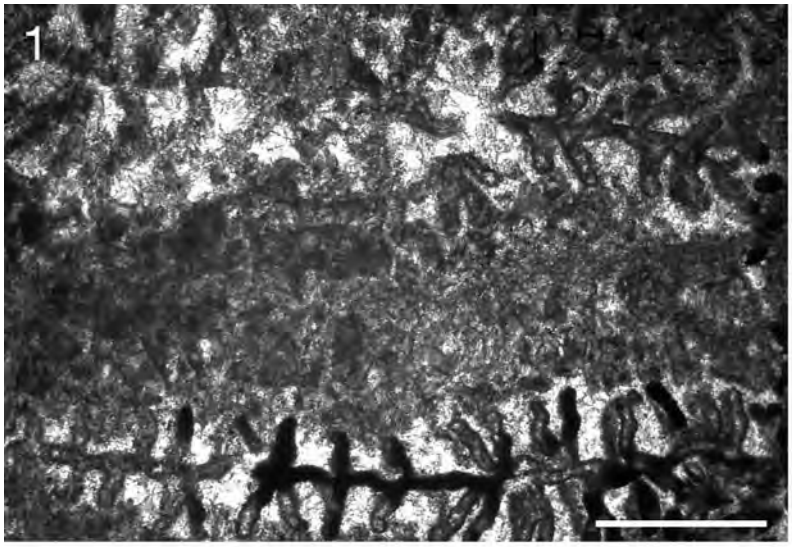
Fig. 4: upper surface of colony; scale bar: 15 mm.

Fig. 5: part of polished corallite, cross view; scale bar: 5 mm.

Fig. 6: base of colony; scale bar: 20 mm.

Fig. 3: *Brachyphyllia dormitzeri* REUSS, 1854

Syntype NHMW 1864/0040/1305 (REUSS coll.); upper surface of colony; Upper Santonian (Gosau Group at Neffgraben), Austria; scale bar: 6.5 mm.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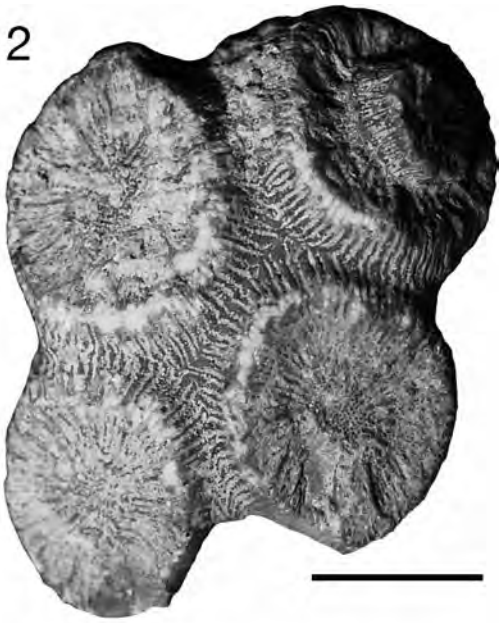
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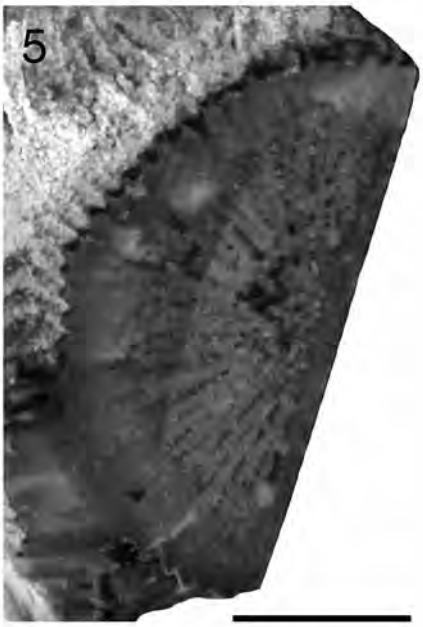
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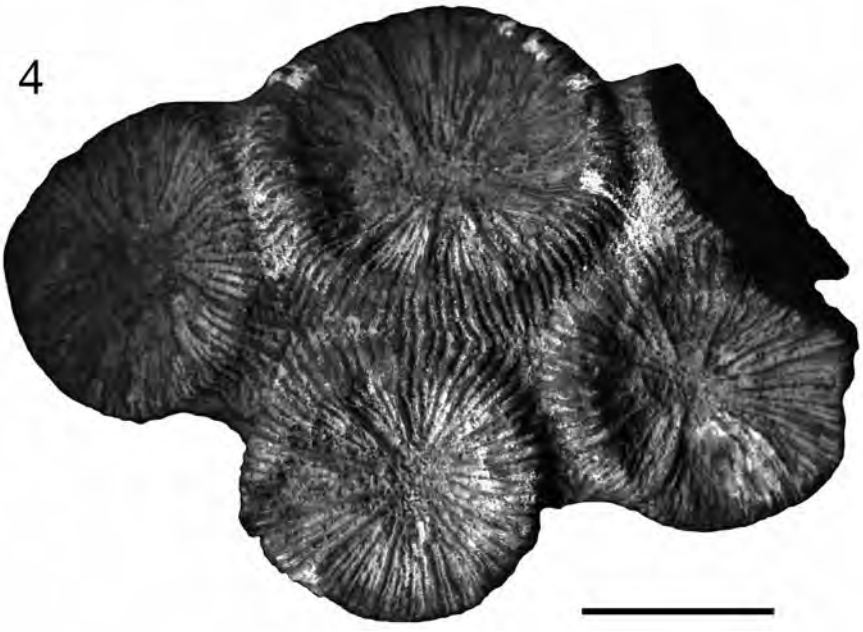
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Plate 54

Figs. 1–4: *Brachyphyllia glomerata* REUSS, 1854

Syntype, NHMW 1864/0040/1306; Turonian–Campanian (Gosau Group, probably at greater Rußbach-Gosau area), Austria.

Fig. 1: upper surface of colony; scale bar: 8 mm.

Fig. 2: close-up of Fig. 1, showing new corallite forming by extracalicinal budding; scale bar: 5 mm.

Fig. 3: upper surface of colony, oblique lateral view; scale bar: 7 mm.

Fig. 4: close-up of Fig. 3, showing polished upper surface of corallite, cross view; scale bar: 3 mm.

Figs. 5, 6: *Dermosmiliopsis orbignyi* ALLOITEAU, 1952a

Santonian–Campanian (Inner Dinarides at Orešje), Croatia. Photographs courtesy D. TURNŠEK.

Fig. 5: thin section, cross view of corallite; HAZU Orešje N-5a; scale bar: 2.5 mm.

Fig. 6: thin section, part of corallite, cross view; HAZU Orešje O-11-1 Bj; scale bar: 8 mm.

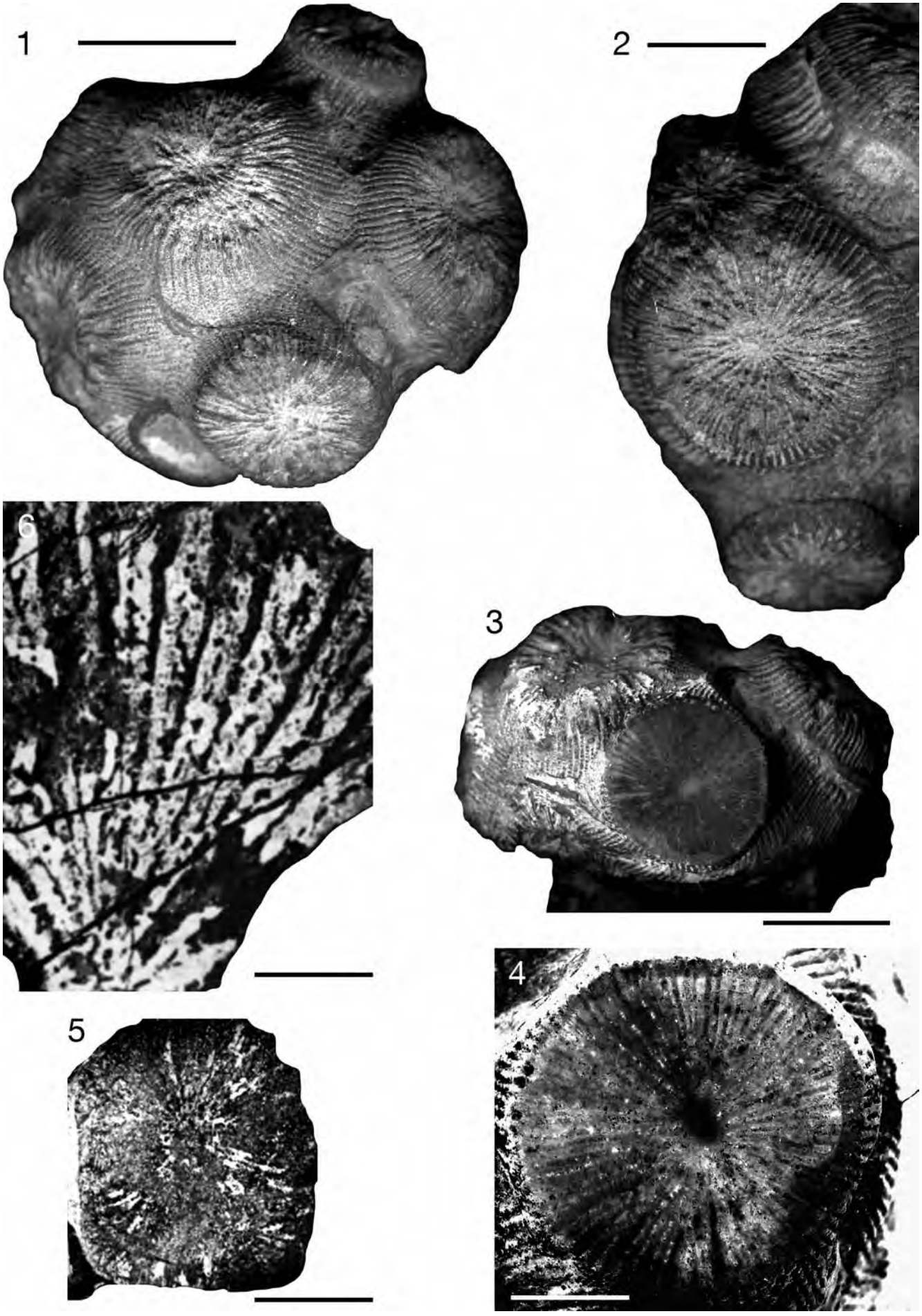
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Plate 55

Figs. 1, 2: *Dermosmiliopsis tenuicosta* (REUSS, 1854)

HAZU Orešje J-1a; Santonian–Campanian (Inner Dinarides at Orešje), Croatia.
Photographs courtesy D. TURNŠEK.

Fig. 1: thin section, cross view of colony; scale bar: 8 mm.

Fig. 2: close-up of Fig. 1; scale bar: 4 mm.

Figs. 3–6 *Brachycaulia felixi* M. BEAUVAIS, 1982

Holotype, GBA 1903/004/0072, original material of FELIX (1903a, p. 261, Pl. 20, Figs. 15, 15a) (FELIX coll.); Upper Santonian (Gosau Group at Scharrergraben), Austria.

Fig. 3: upper surface of colony; scale bar: 8.5 mm.

Fig. 4: upper surface of colony; scale bar: 4.5 mm.

Fig. 5: close-up of Fig. 4, showing lateral view of corallite; scale bar: 2 mm.

Fig. 6: close-up of Fig. 3, showing cross view of corallite, polished surface; scale bar: 4 mm.

Fig. 7: *Acrosmilia conica* D'ORBIGNY, 1850

GBA 1999/089/0020/02 (BARON-SZABO-1999 coll.); thin section, cross view; Upper Santonian (Gosau Group at Styrian Weissenbachalm), Austria; scale bar: 6 mm.


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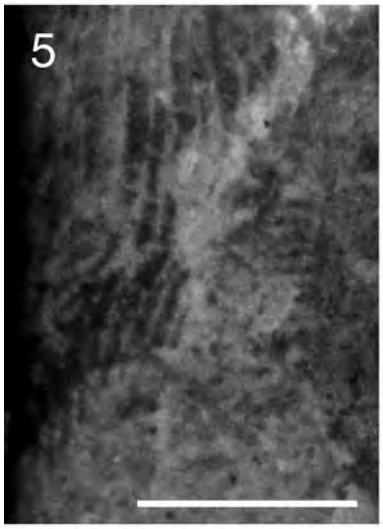
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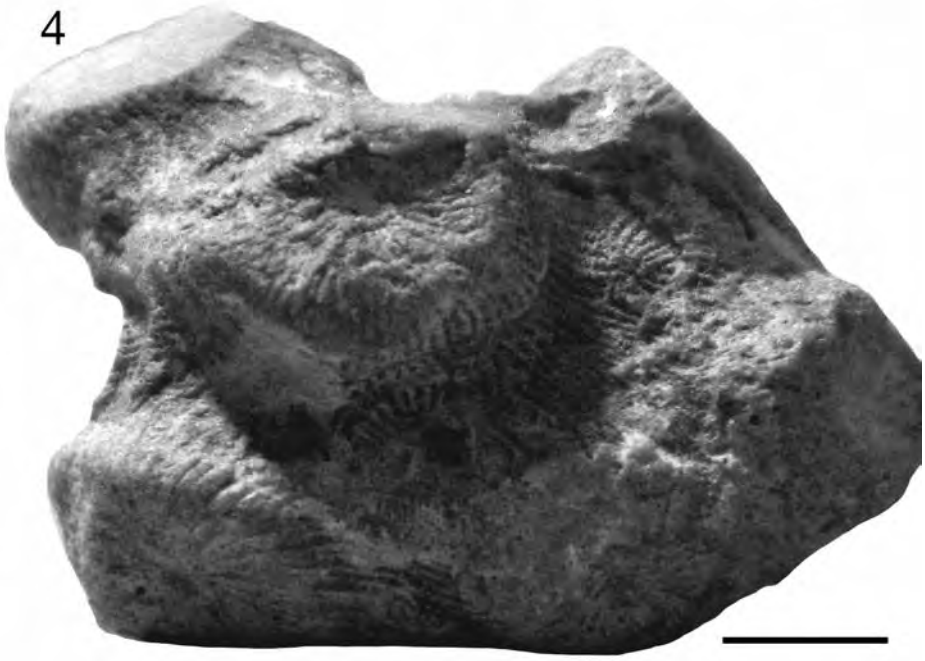
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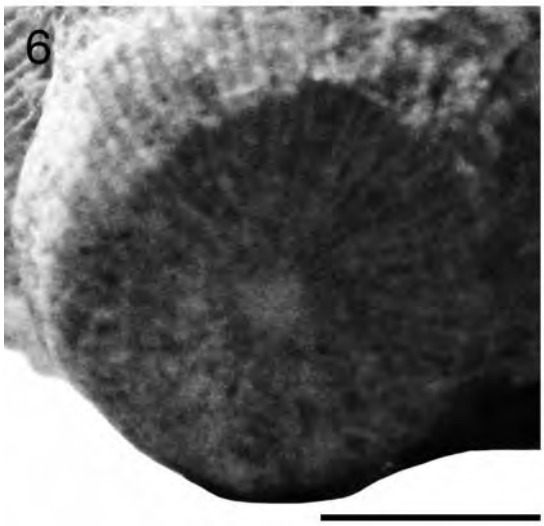
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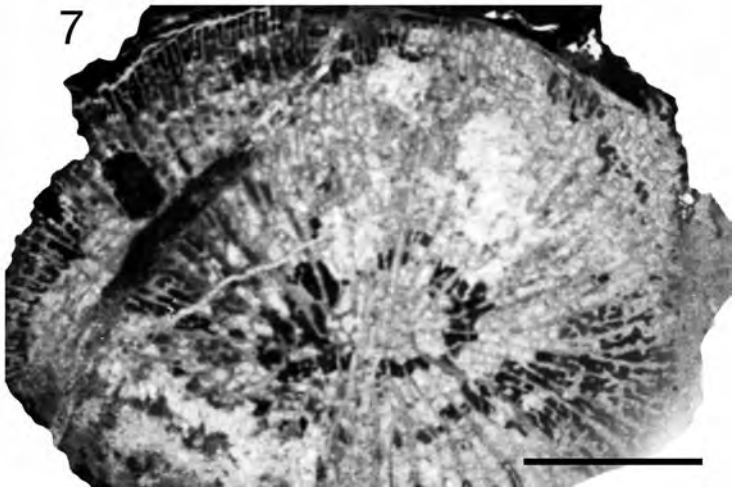
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Plate 56

Figs. 1–3: *Acrosmilia clavata* (REUSS, 1854)
Lectotype, designated herein, NHMW 1864/0040/1317a; Upper Santonian (Gosau Group at Brunstloch), Austria.
Fig. 1: upper surface, cross view; scale bar: 5 mm.
Fig. 2: base of corallum, cross view, polished; scale bar: 4 mm.
Fig. 3: upper surface, lateral view; scale bar: 9 mm.

Figs. 4, 5: *Parasynastraea tignaria* (OPPENHEIM, 1930a)
BSPG 38/III (BARON-SZABO coll.); Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria.
Fig. 4: thin section, cross view; scale bar: 4.5 mm.
Fig. 5: close-up of Fig. 4; scale bar: 1.3 mm.

Figs. 6, 7: *Parasynastraea* sp.
BSPG 35/XVI (BARON-SZABO coll.); Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria.
Fig. 6: thin section, cross view; scale bar: 2.2 mm.
Fig. 7: thin section, lateral view; scale bar: 900 µm.

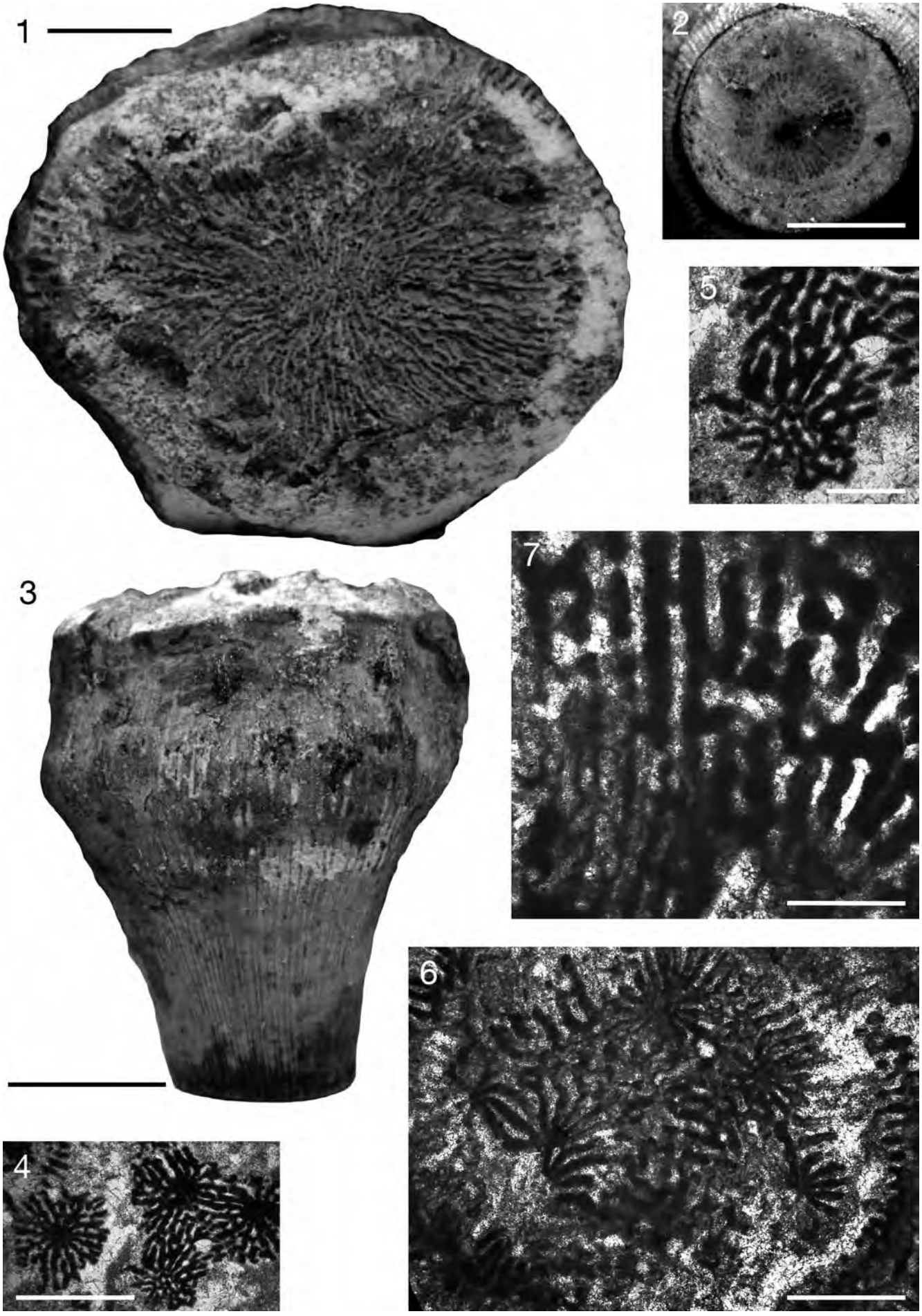
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Plate 57

Figs. 1, 6–8: *Actinacis martiniana* d'Orbigny, 1850

Fig. 1: upper surface of colony; GBA 1903/004/0002/01 (Felix coll.), original material of Felix (1903a, p. 177); Turonian–Campanian (Gosau Group, exact locality not indicated by original author), Austria; scale bar: 2 mm.

Fig. 6: upper surface of colony; NHMW 1852/0001/1465, Felix coll. (determination by Felix); Turonian–Campanian (Gosau Group, exact locality not indicated by original author), Austria; scale bar: 7.5 mm.

Fig. 7: upper surface of colony; GBA 1903/004/0002/03 (Felix coll.), original material of Felix (1903a, p. 177); Turonian–Campanian (Gosau Group, exact locality not indicated by original author), Austria; scale bar: 5 mm.

Fig. 8: close-up of Fig. 7; scale bar: 2 mm.

Figs. 2, 3, 9: *Actinacis parvistella* Oppenheim, 1930

Figs. 2, 3: GBA 2003/023/0023/02 (Baron-Szabo-2003a coll.); Santonian (Gosau Group at Hochmoos-Grabenbach area), Austria.

Fig. 2: thin section, cross view; scale bar: 1.5 mm.

Fig. 3: thin section, early astogenic stage of colony; scale bar: 1.5 mm.

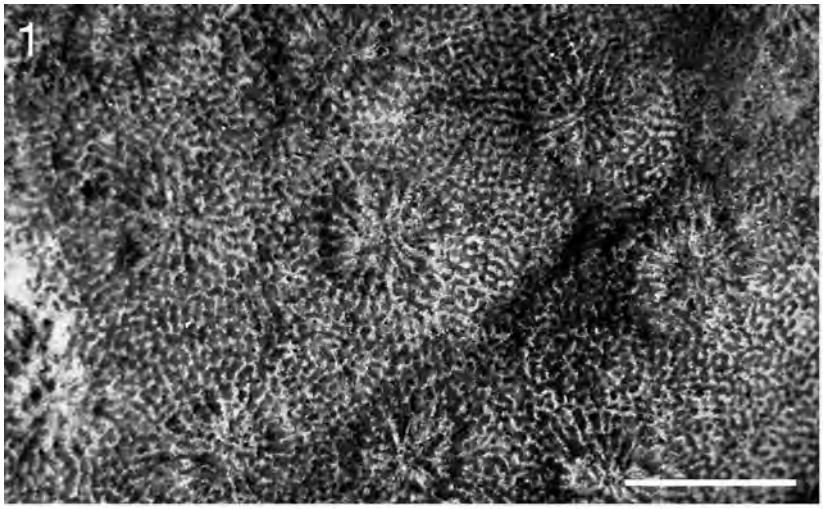
Fig. 9: close-up of Fig. 2; scale bar: 500 µm.

Fig. 4: *Actinacis reussi* Oppenheim, 1930

SAZU Stranice quarry 3/1; thin section, cross view; Santonian–Campanian (Austroalpine unit at Stranice), Slovenia. Photograph courtesy D. Turnšek; scale bar: 6 mm.

Fig. 5: *Actinacis elegans* Reuss, 1854

GBA 1903/004/0003/01 (Felix coll.); upper surface of colony; Santonian (Gosau Group at Randograben), Austria; scale bar: 3.5 mm.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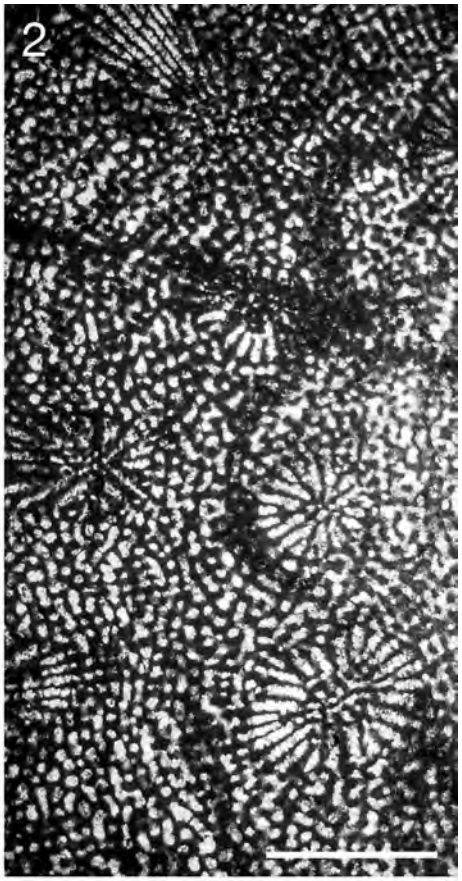
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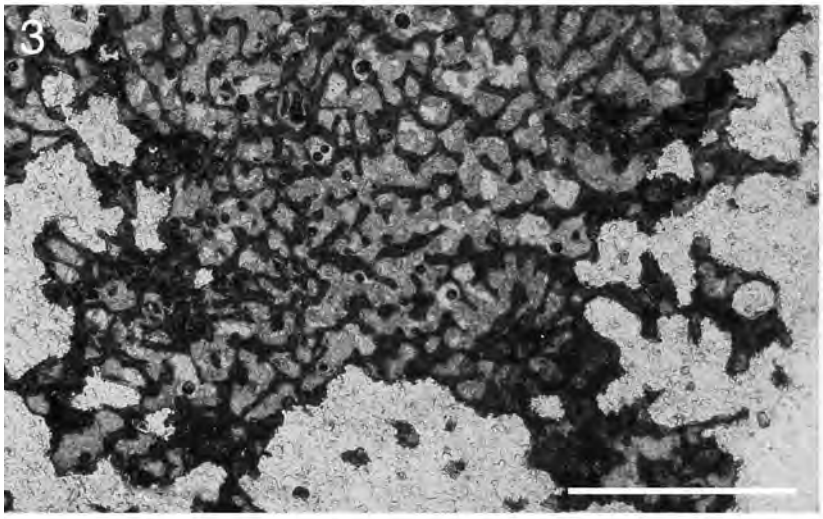
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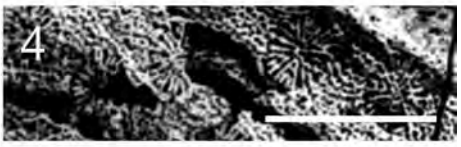
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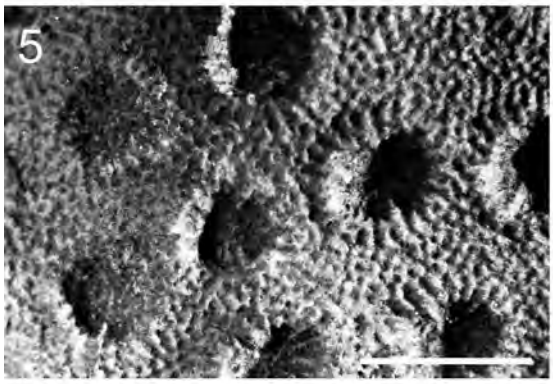
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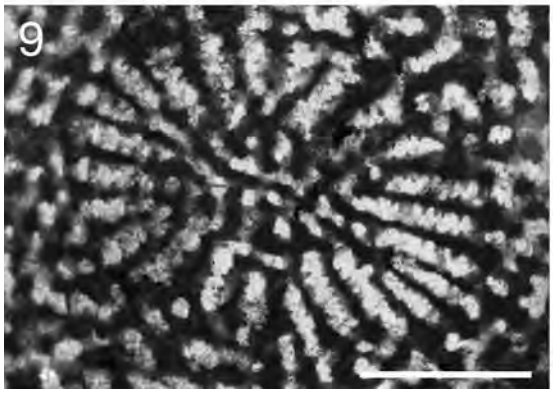
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Plate 58

Figs. 1, 2, 4, 5: *Bosnopsammia lindstroemi* (OPPENHEIM, 1930a)

Fig. 1, 2: GBA 1999/089/0019/02 (BARON-SZABO-1999 coll.); Upper Santonian (Gosau Group at Styrian Weissenbachalm), Austria.

Fig. 1: thin section, cross view; scale bar: 6.5 mm.

Fig. 2: close-up of Fig. 1; scale bar: 3 mm

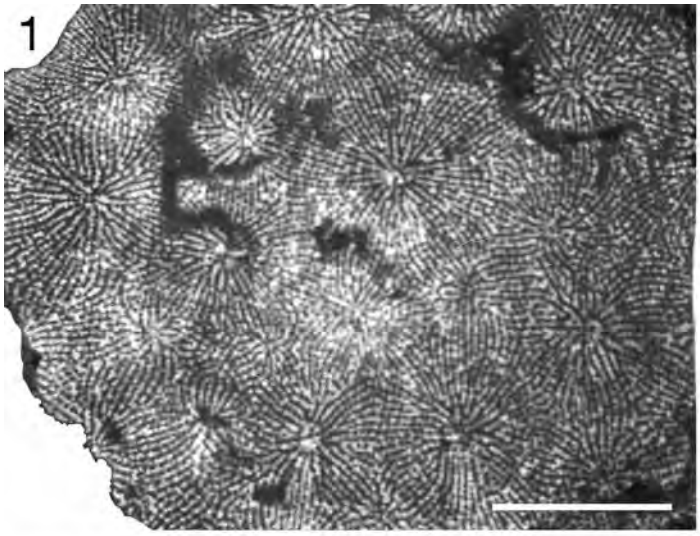
Figs. 4, 5: upper surface of colony; SZB 5006 (III); Lower Santonian (Gosau Group at Untersberg, Wolfschwang), Austria.

Fig. 4: upper surface of colony; scale bar: 17 mm.

Fig. 5: cross view of colony of Fig. 4, polished surface; scale bar: 10 mm.

Fig. 3: *Actinarea tenuis* MORYCOWA, 1971

BSPG BA-2a-II (BARON-SZABO coll.), Lower Aptian (Schrattenkalk at Allgäu, Brandlape), Germany; scale bar: 2.5 mm.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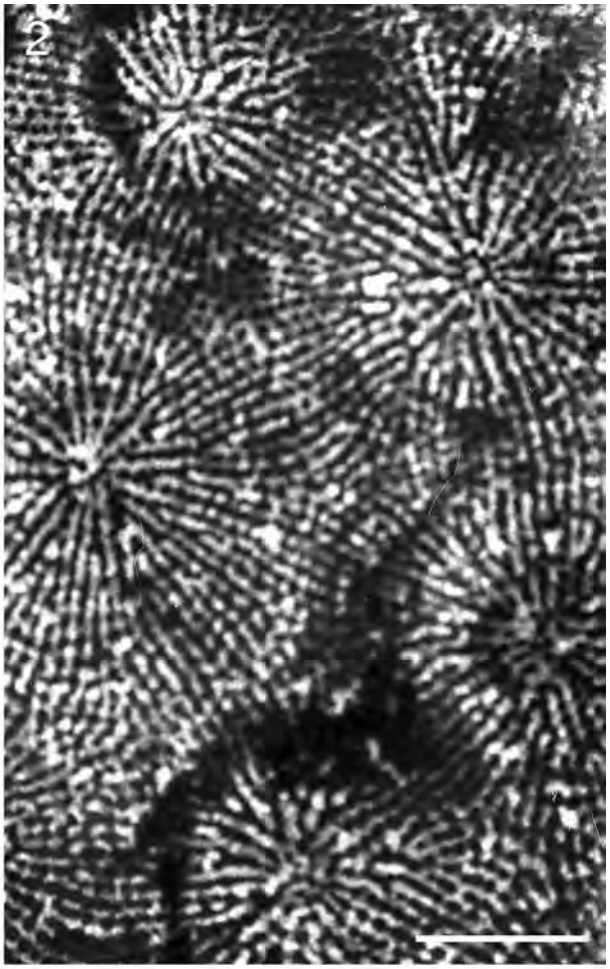
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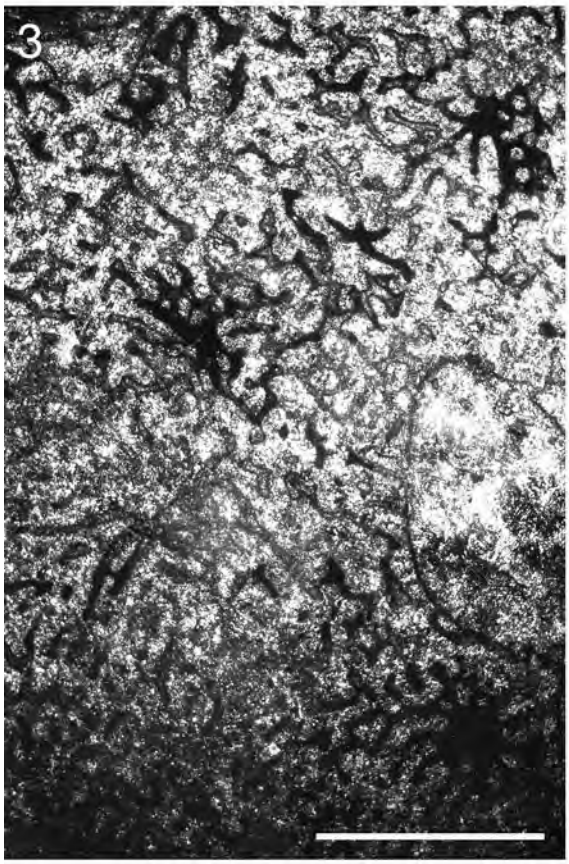
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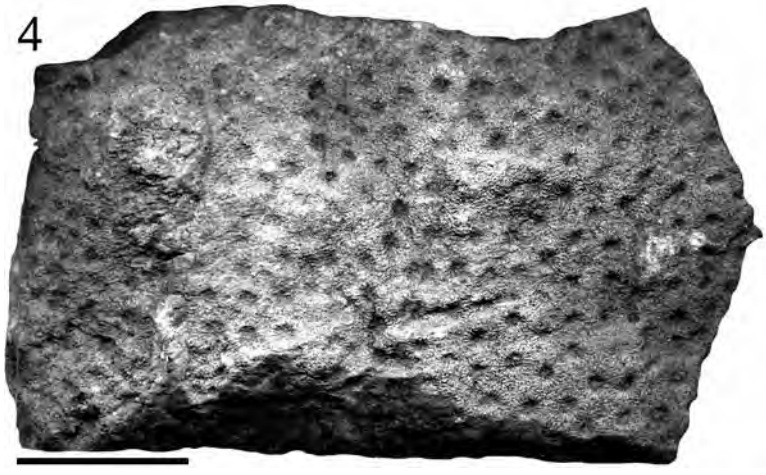
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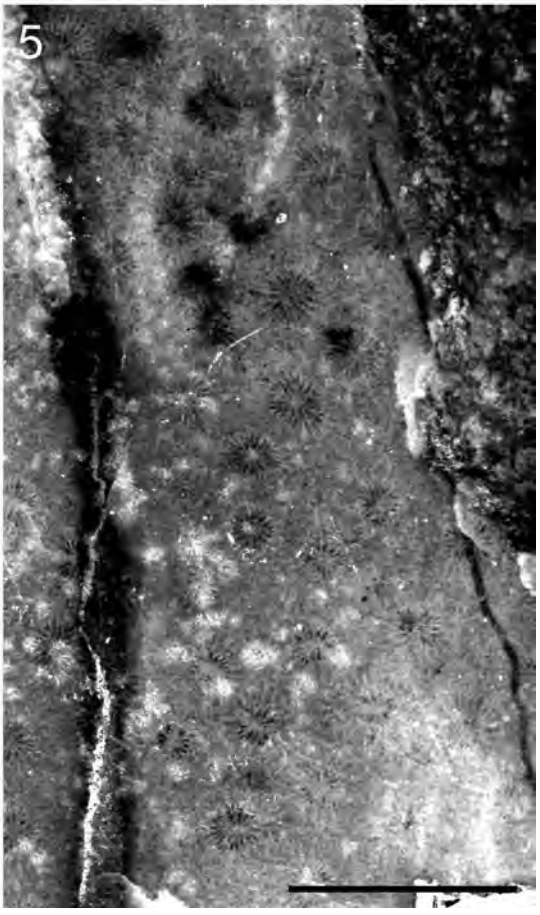
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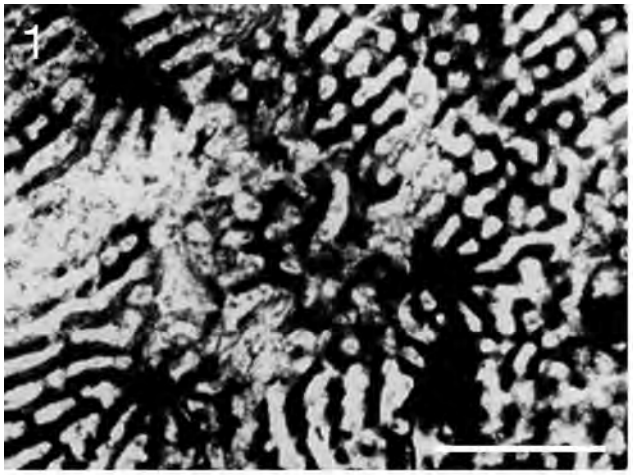
Plate 59

Figs. 1, 2: *Actinarea tenuis* MORYCOWA, 1971
BSPG ME-158 (BARON-SZABO coll.), Lower Aptian (Schrattenkalk at Allgäu, Mitteleck), Germany.
Fig. 1: thin section, cross view; scale bar: 2.5 mm.
Fig. 2: thin section, lateral view; scale bar: 2 mm.

Figs. 3, 5, 6: *Astraraea multiradiata* (REUSS, 1854)
Syntype, NHMW 1864/0040/1364; Santonian (Gosau Group at Rußbach area), Austria.
Fig. 3: upper surface of colony; scale bar: 23 mm.
Fig. 5: upper surface of colony, lateral view; scale bar: 16 mm.
Fig. 6: close-up of Fig. 3; scale bar: 11 mm.

Fig. 4: *Astraraea multiradiata* (REUSS, 1854)
NHMW 1864/0040/1365 (KRAUS & KITTLE coll.); polished surface of colony; Turonian–Campanian (Gosau Group at unidentified locality), Austria; scale bar: 7 mm.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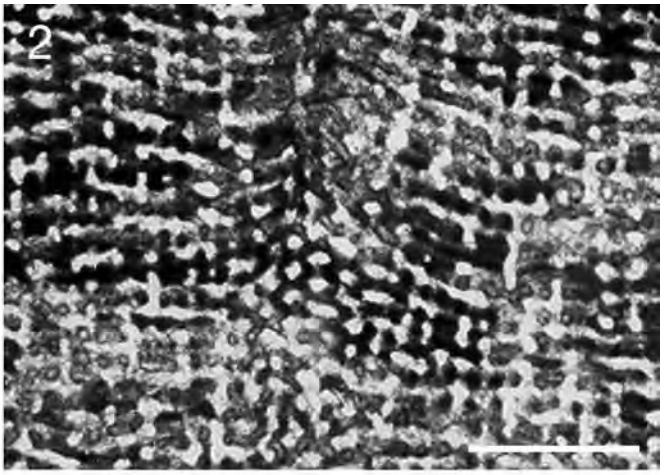
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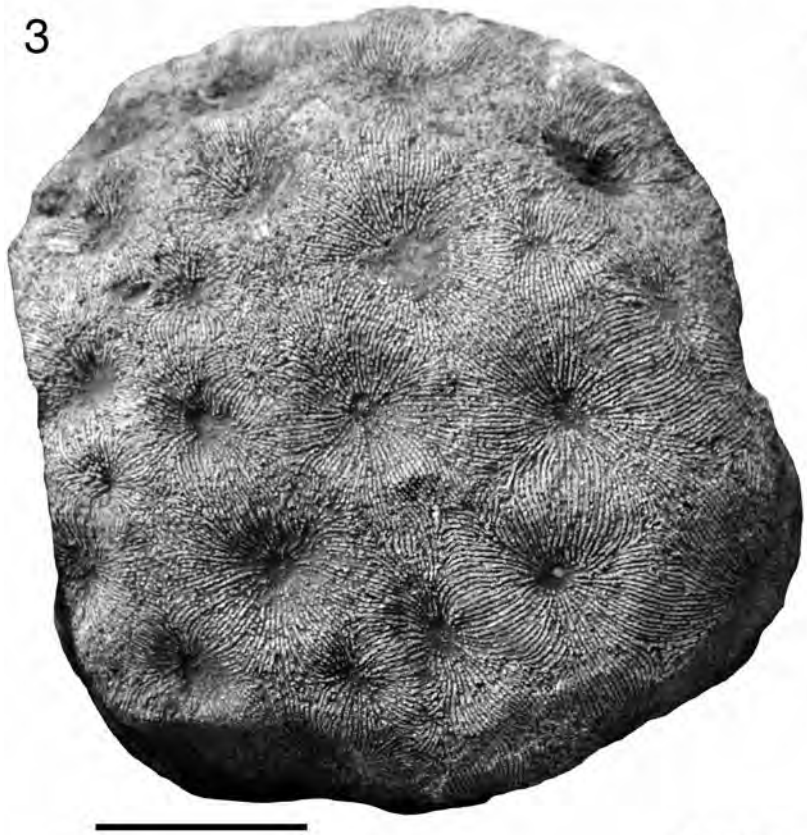
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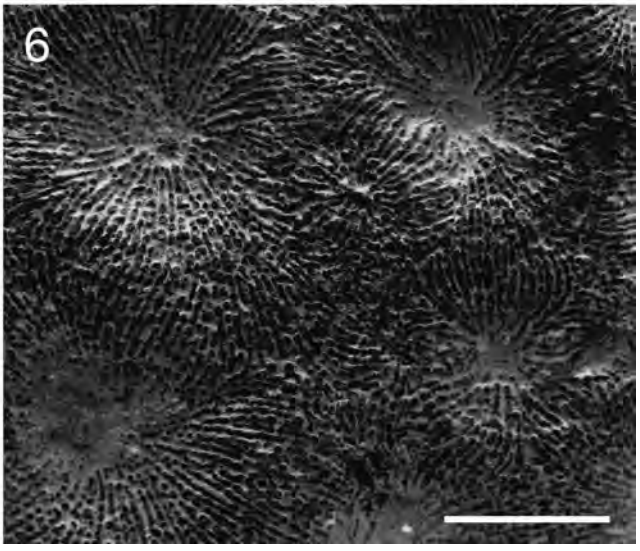
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Plate 60

Fig. 1: *Astraraea multiradiata* (REUSS, 1854)

Syntype, NHMW 1864/0040/1364; upper surface, cross view, partially polished; Santonian (Gosau Group at Rußbach area), Austria; scale bar: 10 mm.

Figs. 2, 3, 5: *Astraraea media* (SOWERBY, 1832)

NHMW 1864/0040/1320b (REUSS coll.) (determination by FELIX); Coniacian–Upper Santonian (Gosau Group at Rußbach area), Austria.

Fig. 2: upper surface of colony; scale bar: 8.5 mm.

Fig. 3: close-up of Fig. 2; scale bar: 2.5 mm.

Fig. 5: basal part of colony, polished; scale bar: 6.5 mm.

Fig. 4: *Astraraea media* (SOWERBY, 1832)

BSPG B1/17 (BARON-SZABO coll.); thin section, cross view; Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria; scale bar: 4 mm.

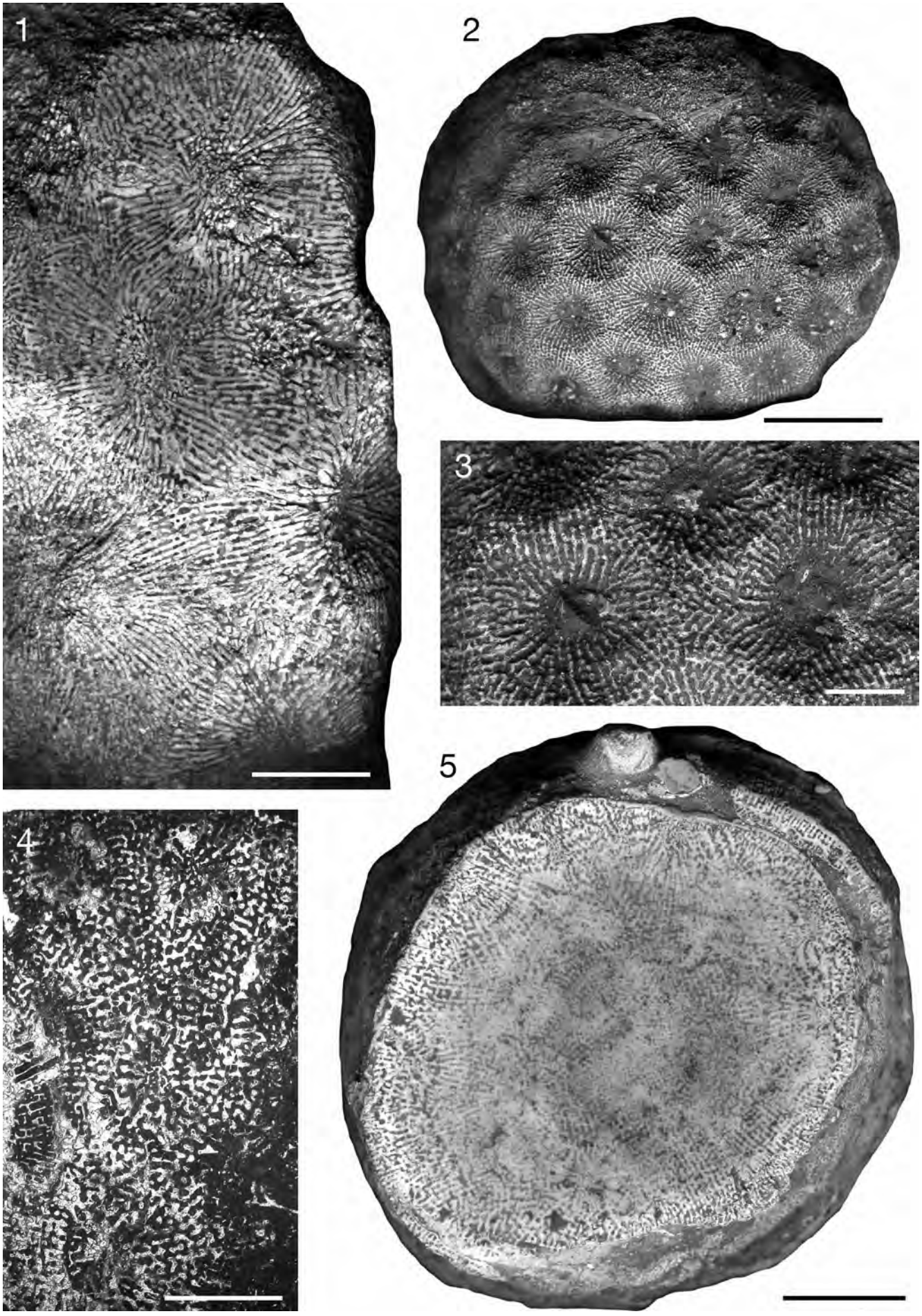
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Plate 61

Figs. 1, 3: *Pleurocora gemmans* (MICHELIN, 1846)

Fig. 1: thin section, cross view; BSPG KA1-3 (BARON-SZABO coll.); Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria; scale bar: 1.5 mm.

Fig. 3: thin section, cross view; BSPG 23a/VIII (BARON-SZABO-1997 coll.); Lower Coniacian (Gosau Group at Brandenberg), Austria; scale bar: 2 mm.

Figs. 2, 4, 5: *Astraraea media* (SOWERBY, 1832)

Fig. 2: upper surface of colony; GBA 1903/004/0006/01 (FELIX coll.), original material of FELIX (1903a, p. 187); Santonian (Gosau Group at Randograben), Austria; scale bar: 10 mm.

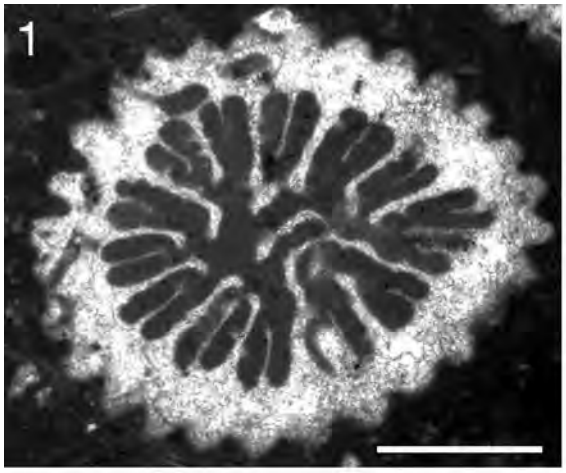
Figs. 4, 5: thin section, cross view, early astogenic stage of colony; BSPG 23c/XIII (BARON-SZABO-1997 coll.); Lower Coniacian (Gosau Group at Brandenberg), Austria

Fig. 4: thin section, cross view; scale bar: 1.5 mm.

Fig. 5: thin section, lateral view; scale bar: 800 µm.

Fig. 6: *Loboseris abbreviata* (REUSS, 1854)

Holotype, GBA 1854/007/0050 (REUSS coll.); upper surface of colony; Turonian-Campanian (Gosau Group at greater Gosau-Rußbach area), Austria; scale bar: 12 mm.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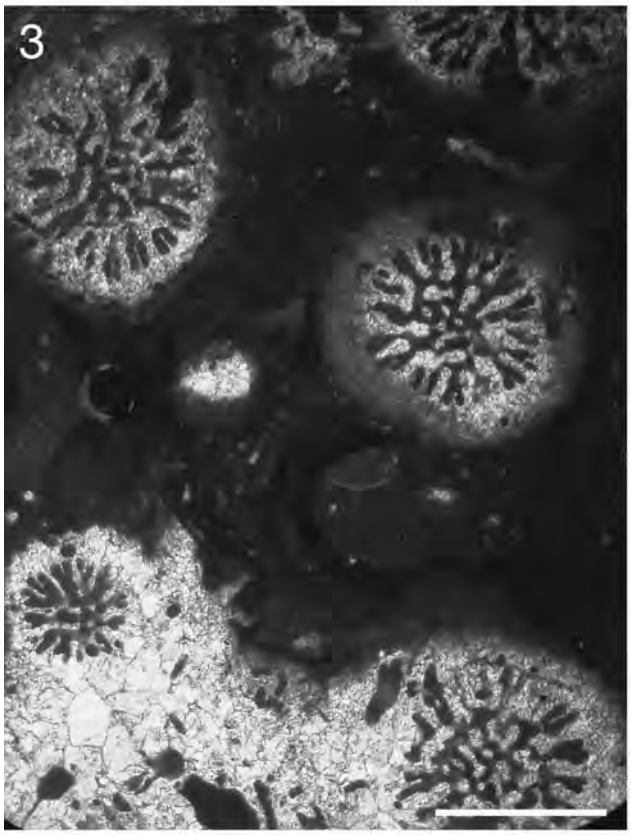
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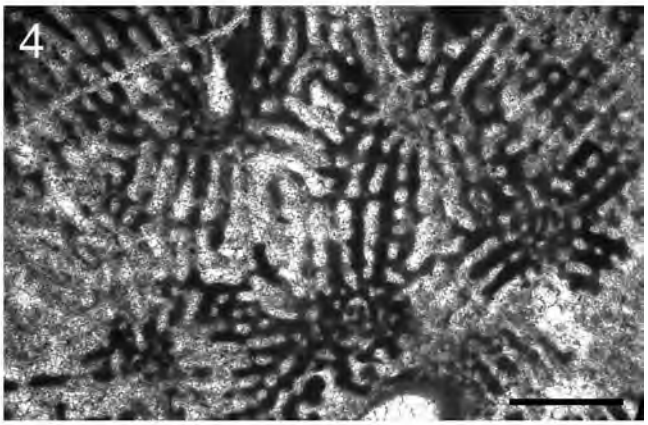
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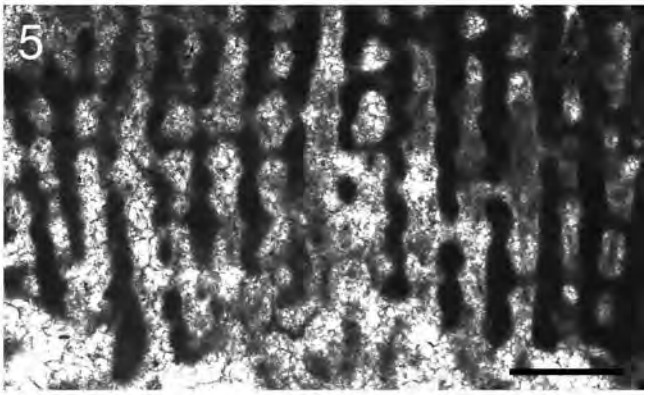
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Plate 62

Figs. 1–6: *Loboseris abbreviata* (REUSS, 1854)

Lectotype (designation by M. BEAUVAIS, 1982), GBA 1854/007/0050 (REUSS coll.); upper surface of colony; Turonian-Campanian (Gosau Group at greater Gosau-Rußbach area), Austria.

Fig. 1: upper surface of colony; scale bar: 14 mm.

Fig. 2: upper surface of colony; scale bar: 21 mm

Fig. 3: close-up of Fig. 2; scale bar: 10 mm.

Fig. 4: close-up of Fig. 6, lateral view of corallite; scale bar: 5.5 mm.

Fig. 5: close-up of Fig. 6, cross view, oblique; scale bar: 12 mm.

Fig. 6: upper surface of colony, partially broken revealing septal and thecal structures; scale bar: 20 mm.

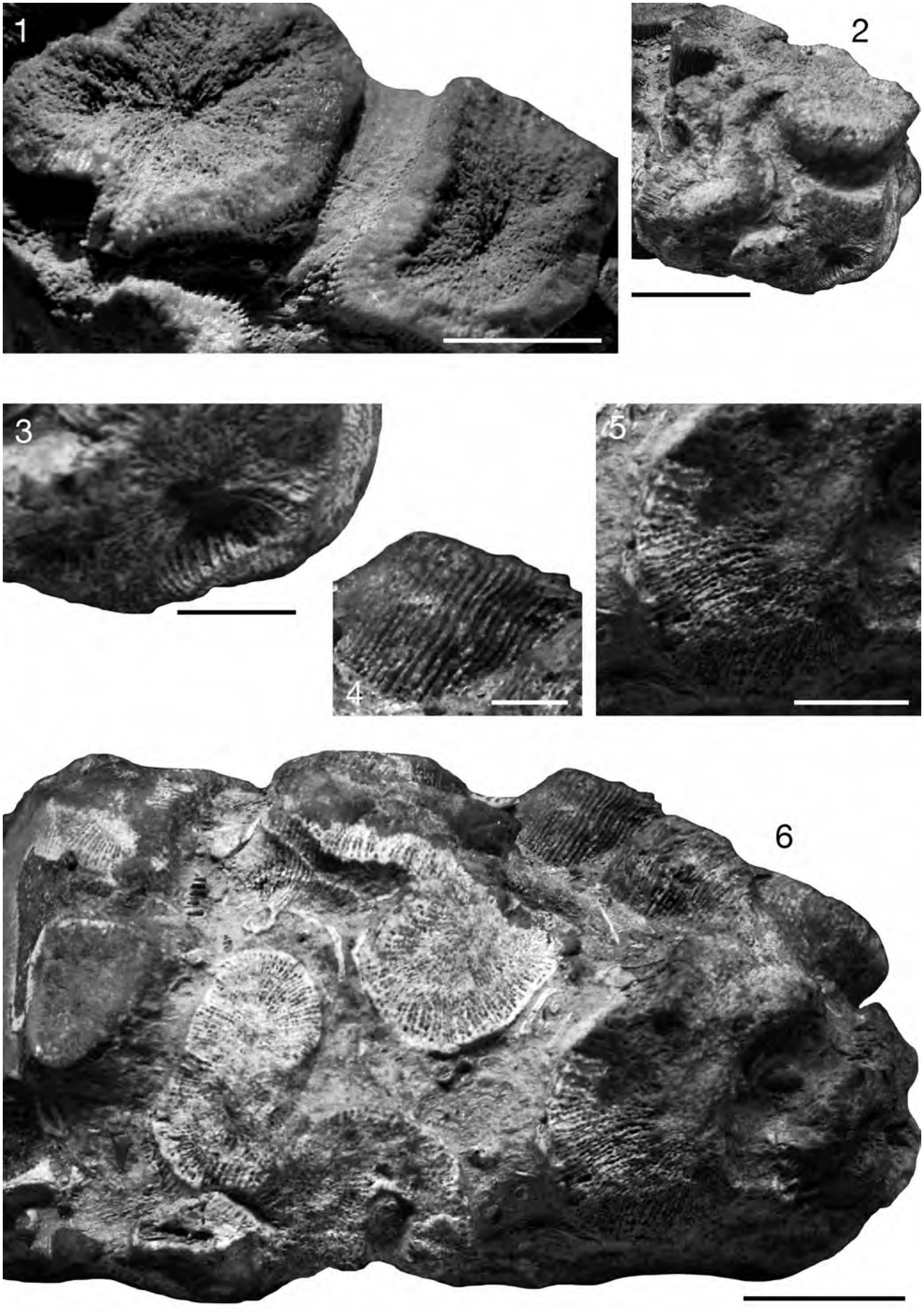
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Plate 63

Figs. 1, 2: *Podoseris elongata* DUNCAN, 1869

Corallum in 'steinkern' preservation; VNS P.12616; Albian (Garschella Formation [Plattenkalk beds] at Dornbirn at Staufensee-Power Plant Ebensand, Rhine River valley), Austria. Photographs courtesy G. FRIEBE.

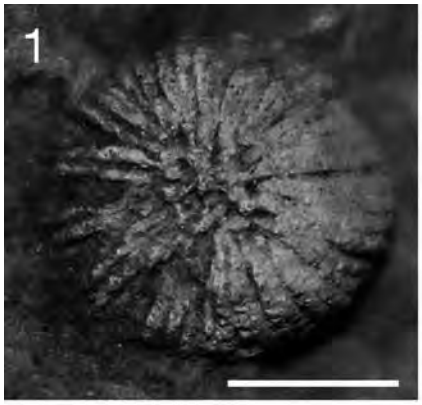
Fig. 1: upper surface, cross view; scale bar: 5 mm

Fig. 2: upper surface, lateral view; scale bar: 5 mm.

Figs. 3, 4: *Pseudofavia grandiflora* (REUSS, 1854)

Fig. 3: upper surface of colony; syntype, NHMW 1864/0040/1395; Turonian–Campanian (Gosau Group at the greater Rußbach-Gosau area; according to FELIX, 1903a, material was possibly collected from the Upper Santonian at Neffgraben), Austria; scale bar: 10 mm.

Fig. 4: upper surface of colony; SZB-217RU, Campanian–Maastrichtian (Gosau Group at Untersberg, Nierental), Austria; scale bar: 10 mm.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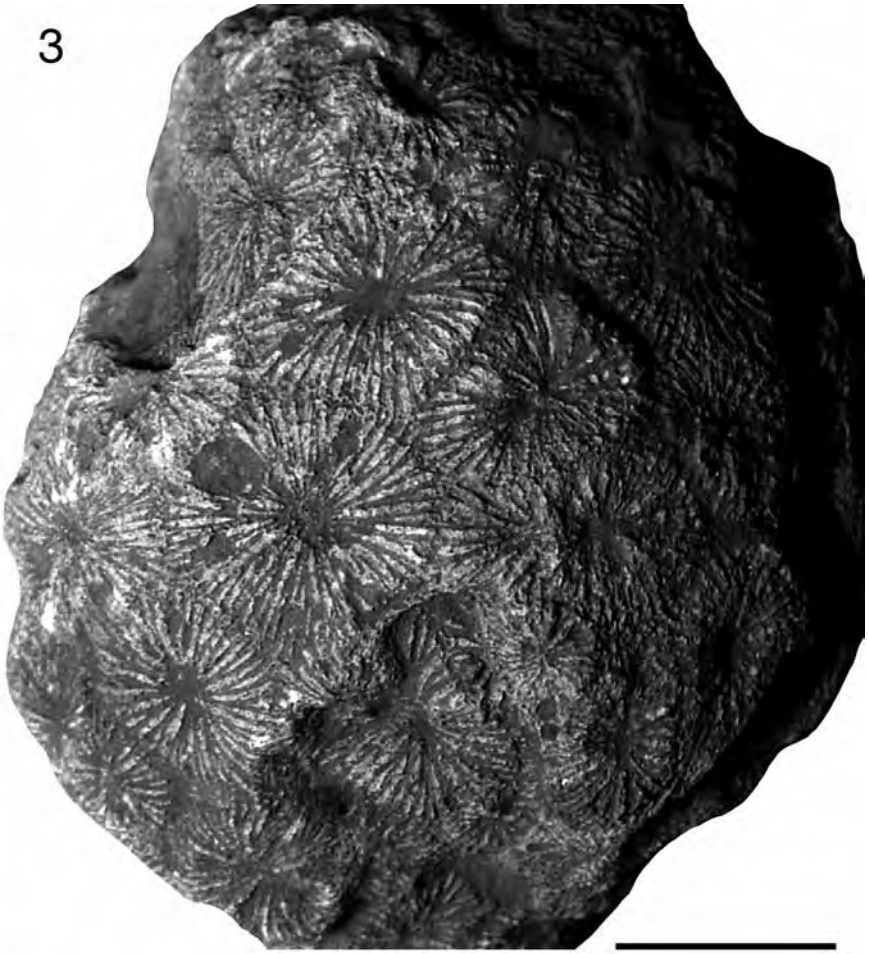
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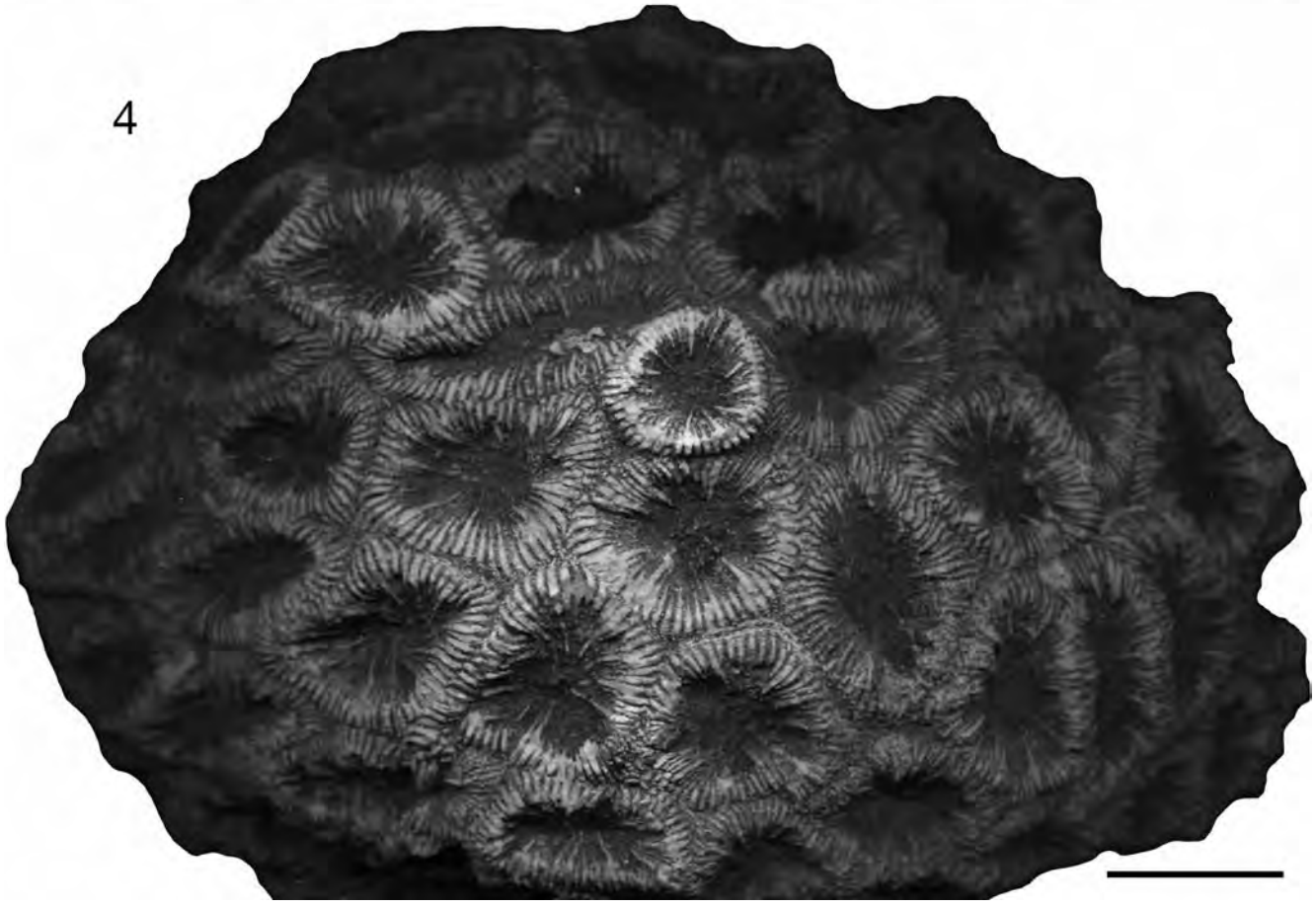
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Plate 64

Figs. 1, 2: *Pseudofavia grandiflora* (REUSS, 1854)
GBA 1903/004/0004/01 (FELIX coll.); Upper Santonian (Gosau Group at Neffgraben), Austria.
Fig. 1: upper surface, cross view, polished; scale bar: 12.5 mm.
Fig. 2: upper surface, lateral view, polished; scale bar: 17 mm.

Figs. 3–5: *Brachymeandra leptophylla* (REUSS, 1854)
GBA 2003/023/0024/02 (BARON-SZABO-2003a coll.); Santonian (Gosau Group at Hochmoos-Grabenbach area), Austria.
Fig. 3: thin section, cross view of colony; scale bar: 5 mm.
Fig. 4: close-up of Fig. 3; scale bar: 2.5 mm.
Fig. 5: thin section, lateral view; scale bar: 1.5 mm.

Figs. 6, 7: *Summiktaraea concentrica* (REUSS, 1854)
Syntype, NHMW 1864/0040/1327; upper surface of colony, cross view; Upper Santonian (Gosau Group at Piesting), Austria.
Fig 6: upper surface of colony; scale bar: 30 mm
Fig. 7: close-up of Fig. 6; scale bar: 5 mm.

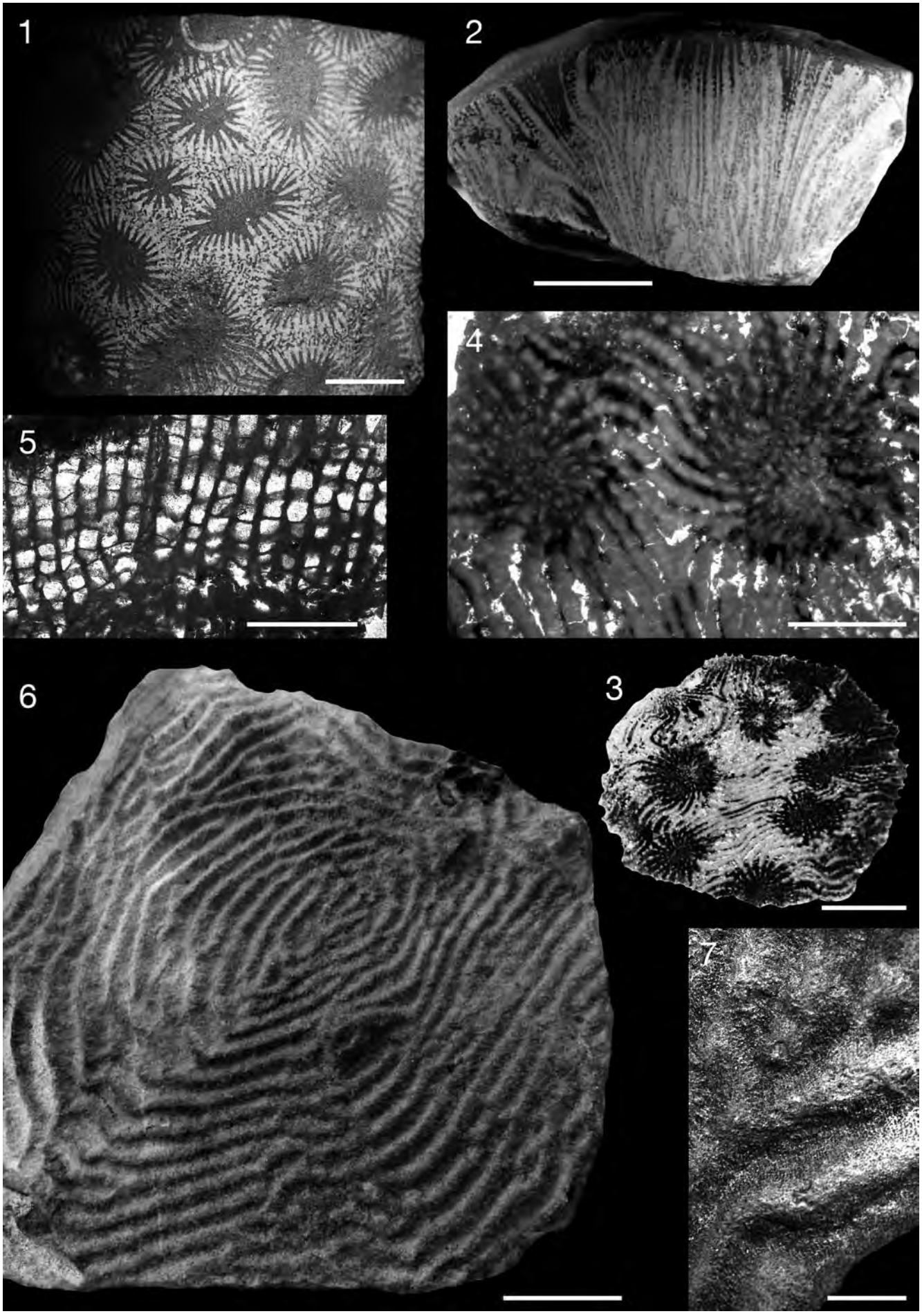
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Plate 65

Figs. 1, 2: *Corbariastraea weissenbachalmensis* BARON-SZABO, 1999

Figs. 1, 2: holotype, GBA 1999/089/0025/02 (BARON-SZABO-1999 coll.); Upper Santonian (Gosau Group at Styrian Weissenbachalm), Austria.

Fig. 1: thin section, cross view; scale bar: 6 mm.

Fig. 2: close-up of Fig. 1; scale bar: 2 mm.

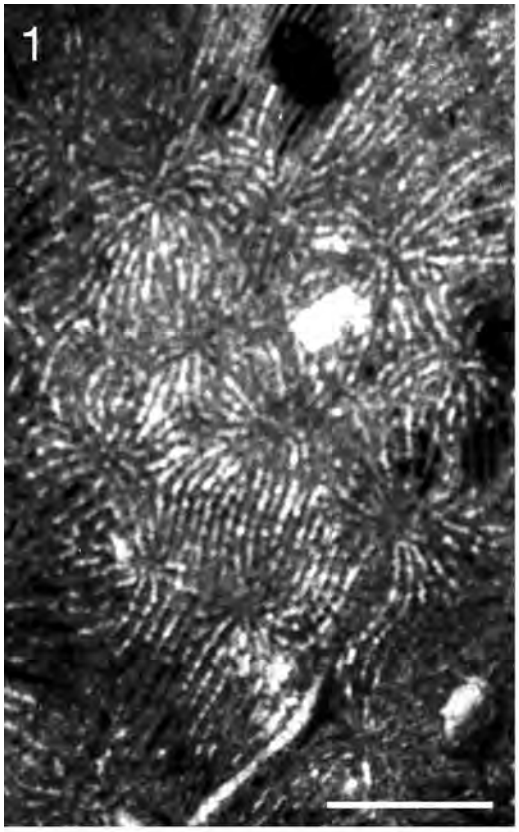
Figs. 3–5: *Brachymeandra leptophylla* (REUSS, 1854)

Figs. 3, 4: paralectotype, NHMW 1859/0050/0858 (REUSS coll.); Upper Santonian (Gosau Group at Neffgraben), Austria.

Fig. 3: close-up of Fig. 4; scale bar: 19 mm.

Fig. 4: upper surface of colony; scale bar: 9.5 mm

Fig. 5: upper surface of colony, coated with ammonium-chloride; GBA 2013/007/0007, sample kb3-1 (SZENTE coll.); Turonian–?Coniacian (Gosau Group at St. Gilgen, "Billroth"), Austria. Photograph courtesy I. Szente; scale bar: 7.5 mm.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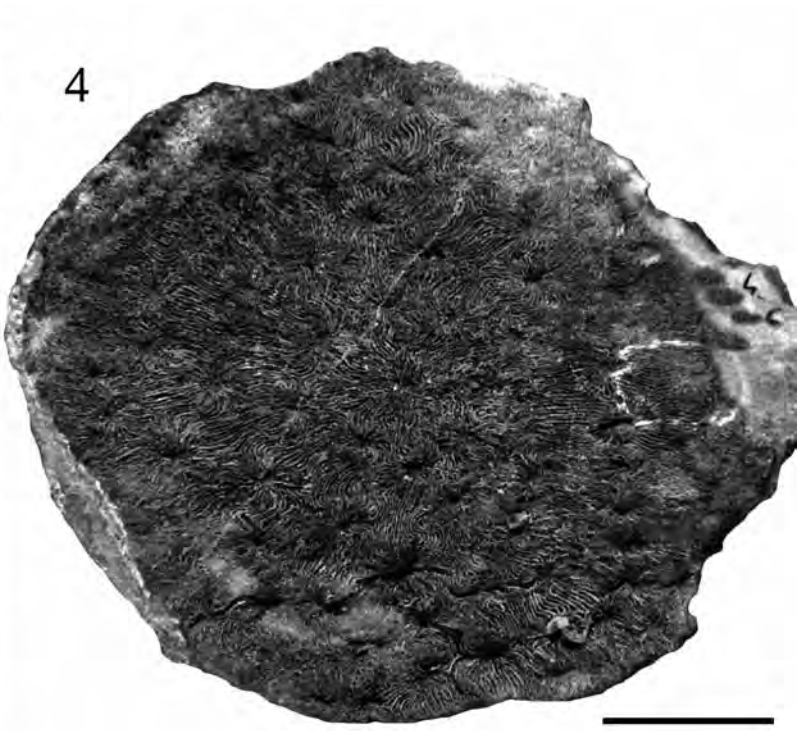
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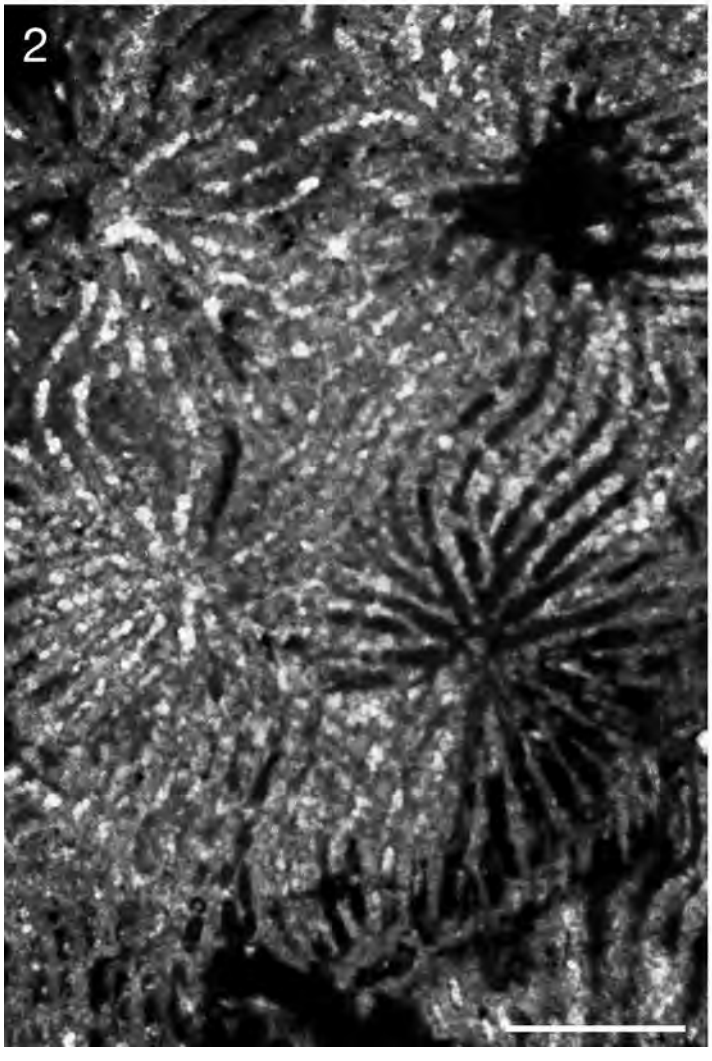
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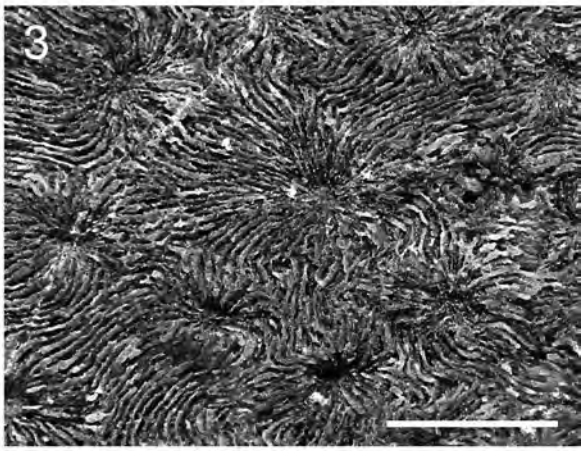
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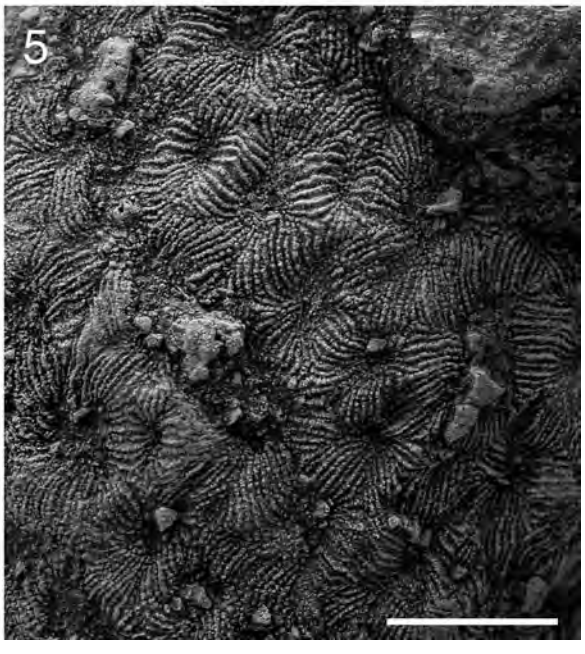
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Plate 66

Fig. 1: *Lamellofungia* sp.

BSPG 134/II (BARON-SZABO coll.); thin section, cross view; Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria; scale bar: 1.5 mm.

Figs. 2, 3, 5, 6: *Lamellofungia carinata* (FELIX, 1903a)

Paralectotype, NHMW 1864/0040/1379; Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area; according to FELIX, 1903a, material was possibly collected from the Upper Santonian at Neffgraben), Austria.

Fig. 2: upper surface of colony; scale bar: 20 mm.

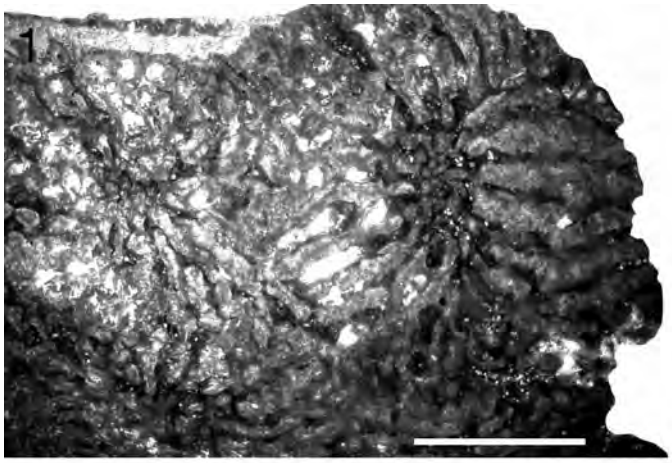
Fig. 3: close-up of Fig. 2 of partially polished area; scale bar: 6 mm.

Fig. 5: close-up of Fig 2; scale bar: 9 mm.

Fig. 6: base of colony; scale bar: 10 mm.

Fig. 4: *Lamellofungia* cf. *carinata* (FELIX, 1903a)

NHMW 1859/0050/0622 (originally documented as *Protoseris* cf. *cretacea* FELIX, 1903a, p. 228); upper surface of colony; Upper Santonian (Gosau Group at Rußbach, Traunwand), Austria; scale bar: 7 mm.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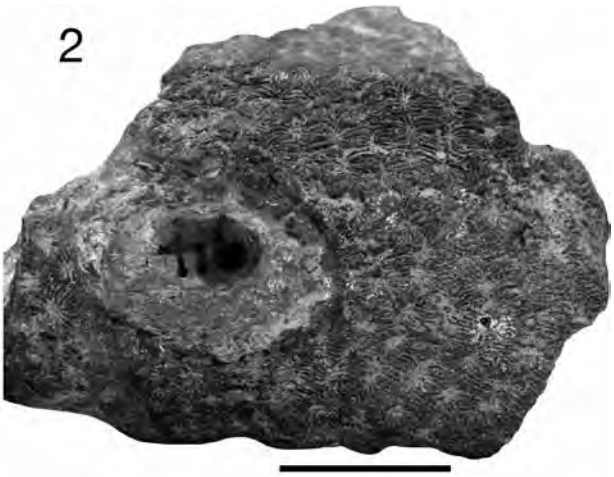
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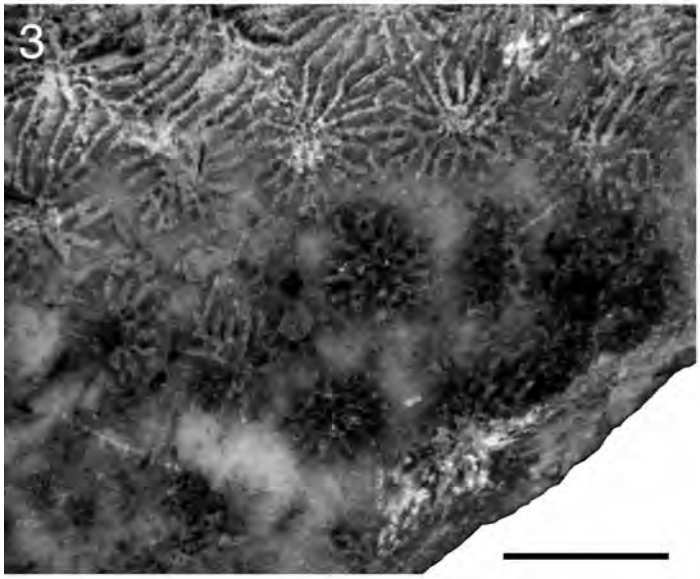
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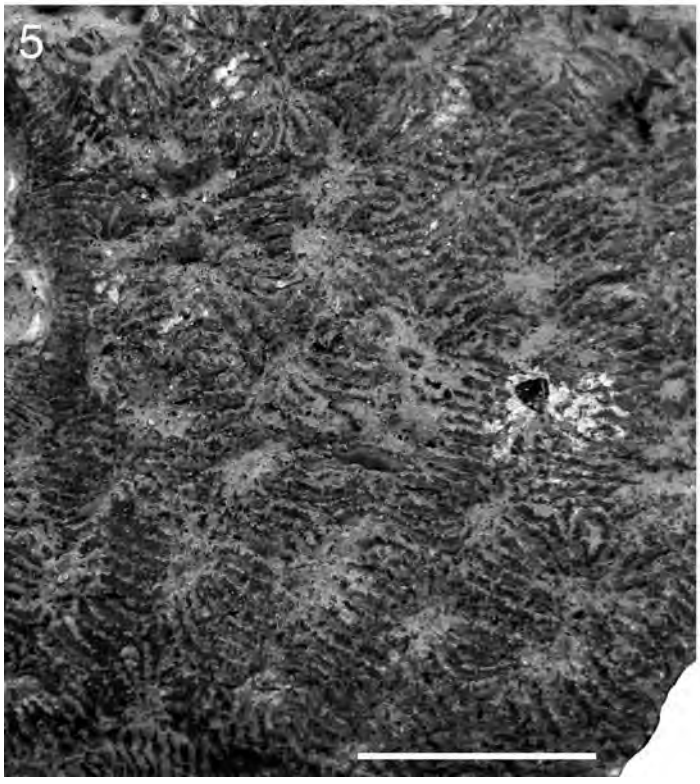
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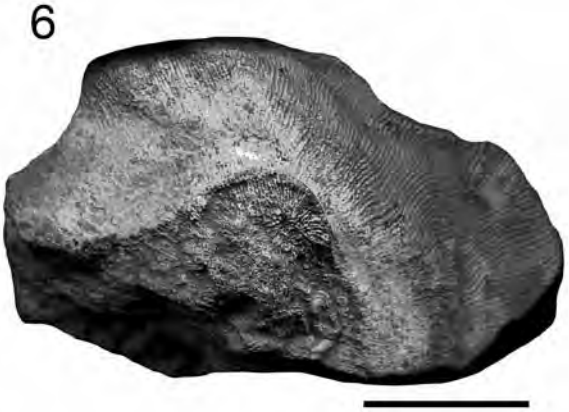
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Plate 67

Figs. 1–3: *Heterogyra zitteli* (FELIX, 1903a)
Holotype, BSPG 1895 X B501; Upper Santonian (Gosau Group at Neffgraben), Austria.
Fig. 1: upper surface of colony; scale bar: 15 mm.
Figs. 2, 3: close-up pictures of Fig. 1; Fig. 2: scale bar: 7 mm; Fig. 3: scale bar: 5.5 mm.

Figs. 4, 5, 9: *Ogilviastraea bigemmis* (FELIX, 1903a)
Syntype, GBA 1903/004/0113/01 (FELIX coll.); Coniacian–Santonian (Gosau Group at Hofergraben), Austria.
Fig. 4: upper surface of colony; scale bar: 5 mm.
Fig. 5: juvenile corallite at base of corallum; scale bar: 2.5 mm.
Fig. 9: close-up of Fig. 4; scale bar: 3 mm.

Figs. 6, 7: *Ogilviastraea crassa* (REUSS, 1854)
?syntype, NHMW 1864/0040/1354 (REUSS coll.); Upper Turonian–Coniacian (Gosau Group at Styrian Aussee area, Weissenbach valley), Austria.
Fig. 6: upper surface, cross view, polished; scale bar: 4 mm.
Fig. 7: upper surface, lateral view; scale bar: 4 mm.

Fig. 8: *Ogilviastraea* cf. *bigemmis* (FELIX, 1903a)
NMNH TH-8a (BARON-SZABO coll.); cross view of part of a corallite, peel; Lower Coniacian (Gosau Group at Salzburg, "Theresienstein"), Austria; scale bar: 1.3 mm.

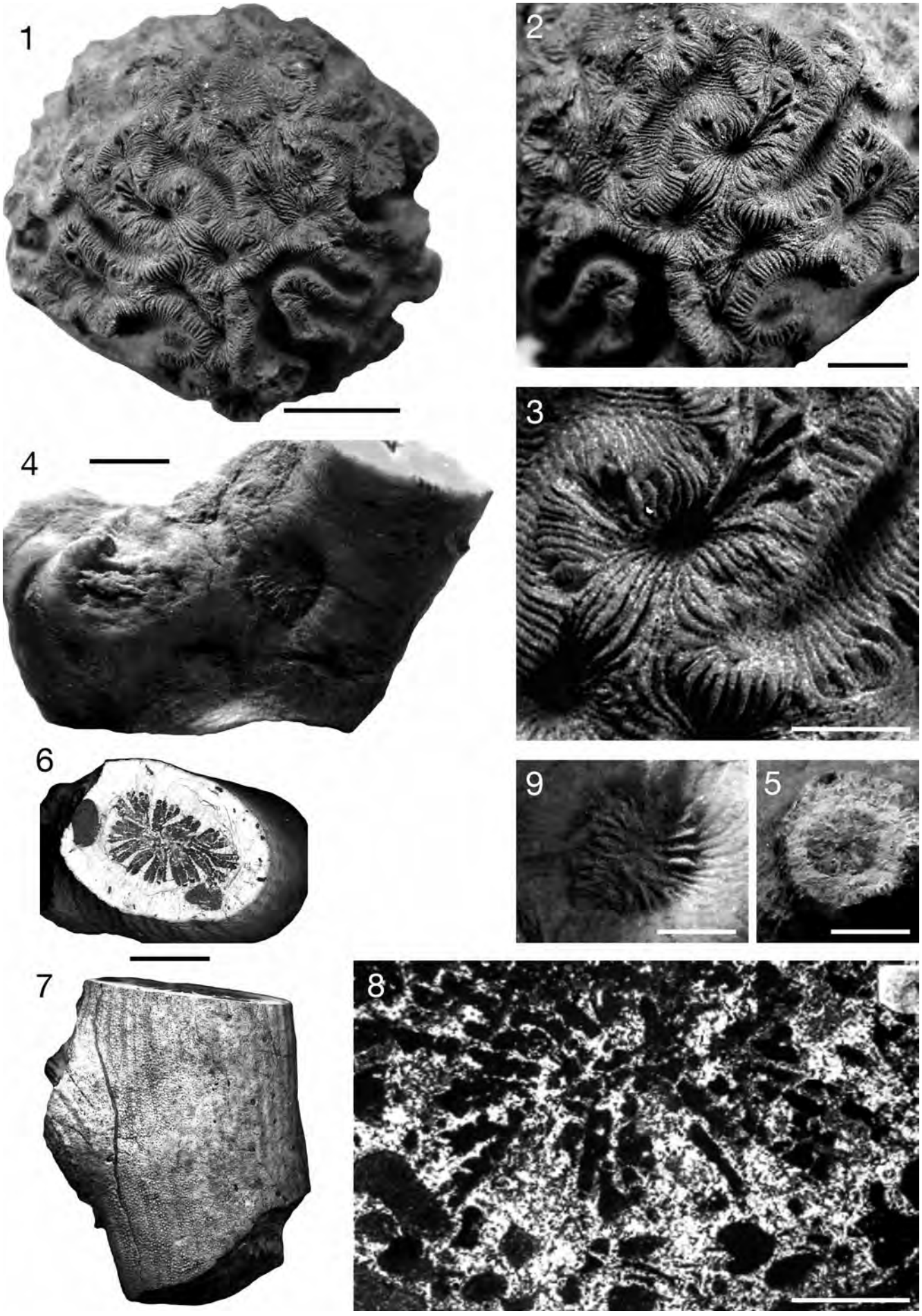
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Plate 68

Figs. 1–4: *Ogilviastraea bigemmis* (FELIX, 1903a)

Figs. 1, 2: syntype, NHMW 1859/0050/3130, Upper Santonian (Gosau Group at Wegscheidgraben), Austria.

Fig. 1: base of colony, polished surface; scale bar: 6 mm.

Fig. 2: upper surface of colony, lateral view; scale bar: 3.5 mm.

Figs. 3, 4: GBA 2014/009/0001, ?Coniacian–Santonian (Gosau Group at Untersberg, Veitlbruch; "Untersberg Marble"), Austria.

Fig. 3: close-up of Fig. 4: scale bar: 3.5 mm.

Fig. 4: polished surface, cross view; scale bar: 7 mm.

Figs. 5, 6: *Maeandrella michelini* (REUSS, 1854)

Holotype, GBA 1854/007/0067 (REUSS coll.); upper surface of colony; Upper Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area), Austria.

Figs. 5, 6: close-up pictures of Fig. 1 on Pl. 69;

Fig. 5: upper surface of colony; scale bar: 3.5 mm;

Fig. 6: upper surface of colony; scale bar: 8 mm.

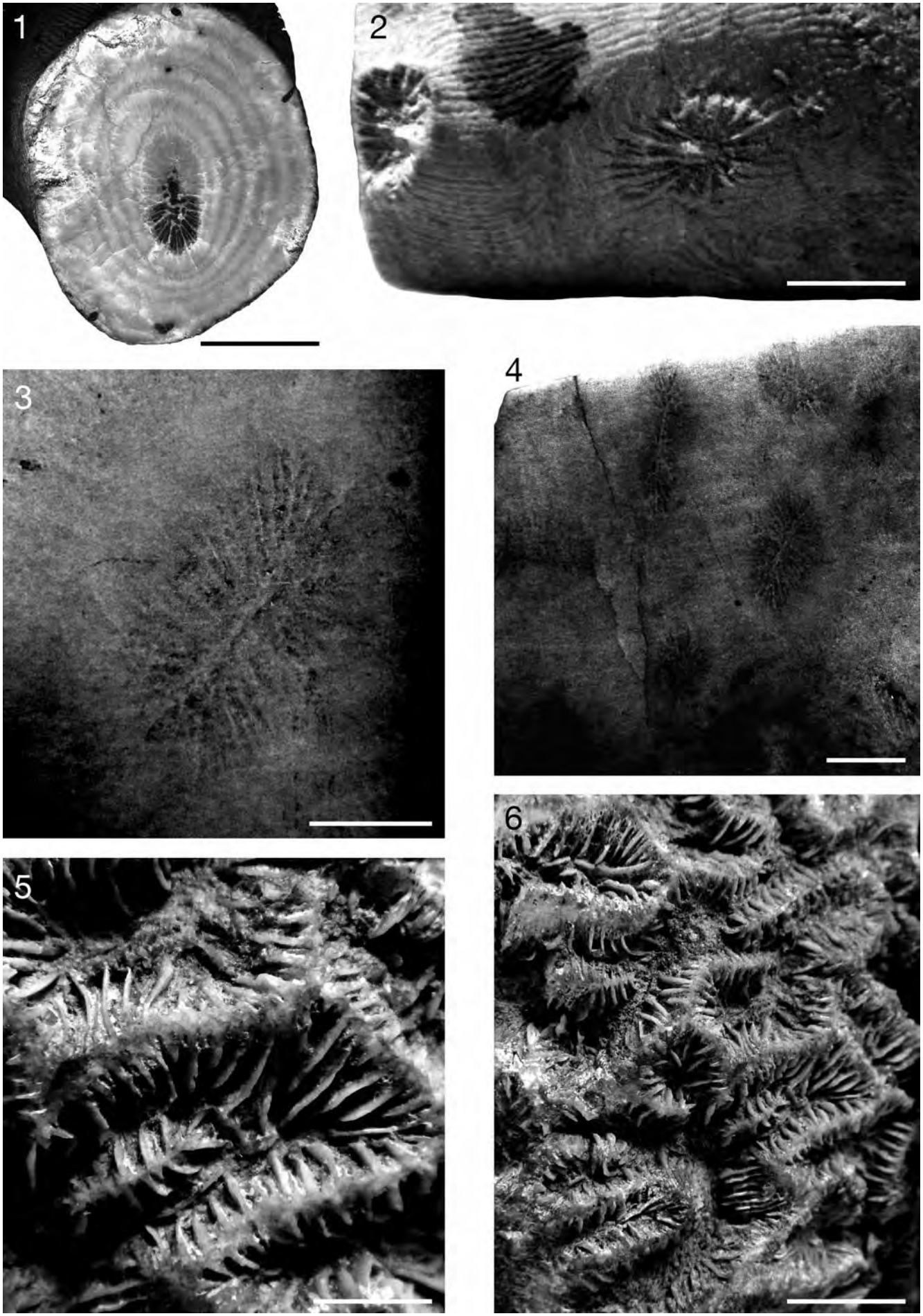
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Plate 69

Fig. 1: *Maeandrella michelini* (REUSS, 1854)
Holotype, GBA 1854/007/0067 (REUSS coll.); upper surface of colony; Upper Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area), Austria; scale bar: 30 mm.

Figs. 2, 3: *Diploastrea crassa* KUZMICHEVA, 1980
ZSH H-KU 784 (SCHOLZ coll.); Lower Aptian of (Schrattenkalk at Allgäu, Falkenberg), Germany.
Fig. 2: polished surface, lateral view; scale bar: 9 mm.
Fig. 3: polished surface, cross view; scale bar: 11 mm.

Figs. 4, 5: *Diploastrea harrisi* WELLS, 1932
BSPG KA-Q (BARON-SZABO coll.); Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria.
Fig. 4: thin section, cross view; scale bar: 4.5 mm.
Fig. 5: close-up of Fig. 4; scale bar: 2 mm.


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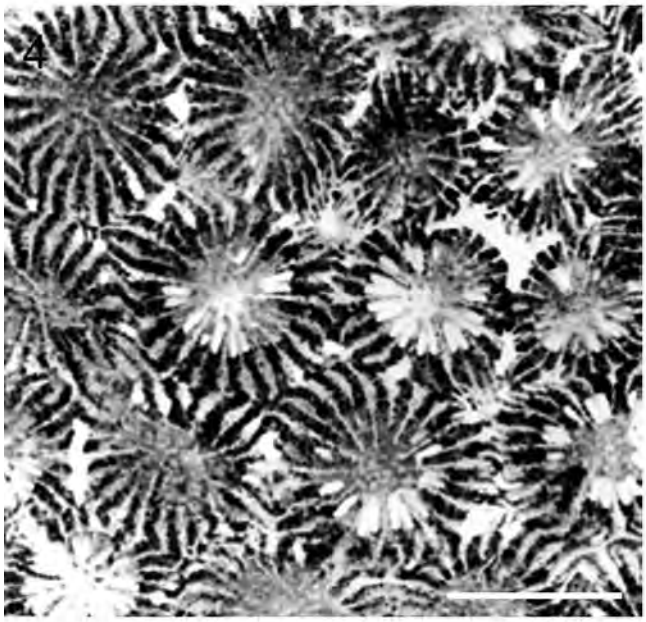
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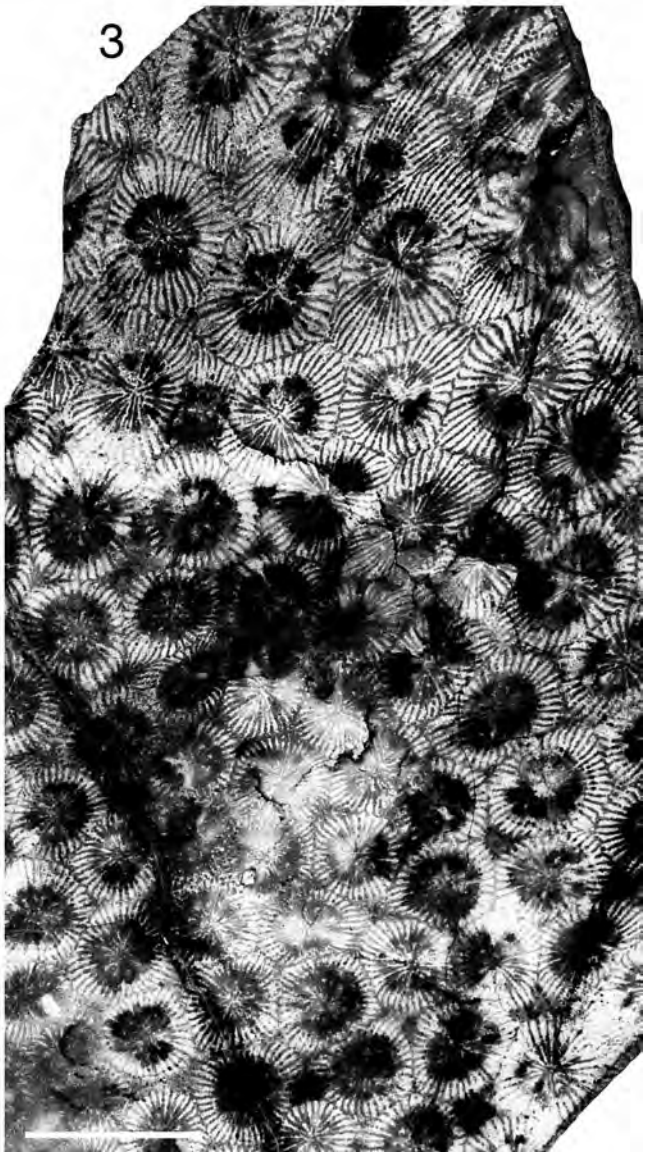
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Plate 70

Figs. 1–3: *Goniopora* (*Rothastrea*) *vaughani* (FELIX, 1903a)

Figs. 1, 2: holotype, BSPG 1878 XI 387; Turonian (Gosau Group at St. Gilgen), Austria.

Fig. 1: upper surface; scale bar: 9 mm.

Fig. 2: upper surface, cross view, polished; scale bar: 13 mm.

Fig. 3: thin section, cross view; field number 83/I (BARON-SZABO-2003a coll.); Santonian (Gosau Group at Hochmoos-Grabenbach area), Austria; scale bar: 3 mm.

Fig. 4: *Goniopora elegans* (LEYMERIE, 1846)

NMNH TA-6 (BARON-SZABO coll.); cross view, peel; Lower Coniacian (Gosau Group at Salzburg, "Theresienstein"), Austria; scale bar: 1.5 mm.

Figs. 5, 7, 8: *Neocoeniopsis excelsa* (DE FROMENTEL, 1884)

GBA 1903/004/0069/01 (FELIX coll.) (originally presented as *Orbicella coronata* [REUSS] in FELIX, 1903a); Middle Turonian–Lower Coniacian (Gosau Group at Brandenberg), Austria.

Figs. 5, 8: close-up pictures of Fig. 7; Fig. 5: scale bar: 9 mm; Fig. 8: scale bar: 4.5 mm.

Fig. 7: upper surface of colony; scale bar: 15 mm.

Fig. 6: *Astraeofungia raristella* (REUSS, 1854)

Holotype, GBA 1854/007/0118 (REUSS coll.); upper surface of colony; Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area), Austria; scale bar: 12 mm.

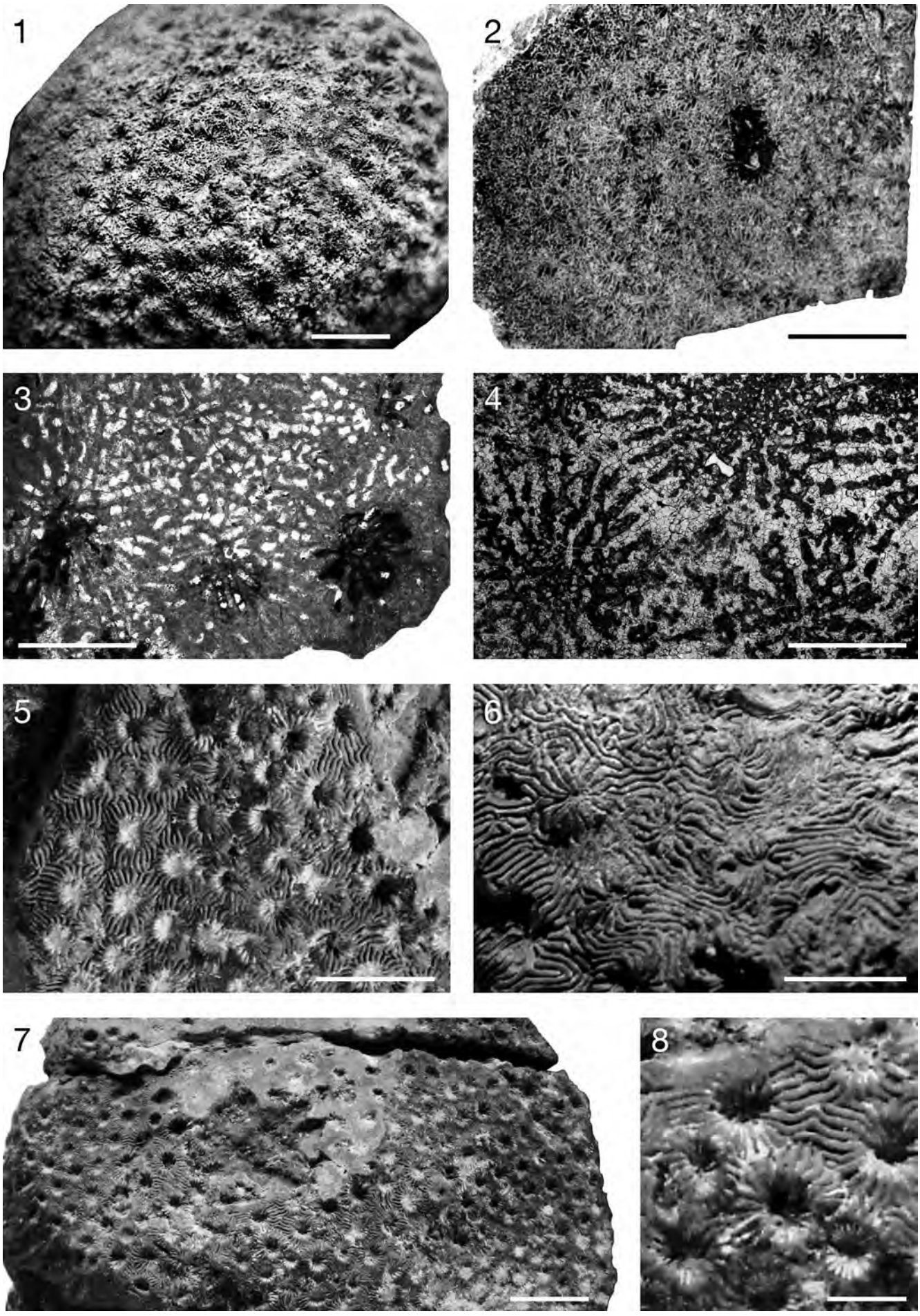
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Plate 71

Figs. 1–3: *Astraeofungia oppenheimi* M. BEAUVAIS, 1982

GBA 1903/004/0027/01 (FELIX coll.); originally presented as *Thamnastraea decipiens* (MICHELIN) in FELIX, 1903a; Santonian (Gosau Group at Rußbach-Gosau area), Austria.

Fig. 1: upper surface of colony; scale bar: 16 mm.

Fig. 2: close-up of Fig. 1; scale bar: 6 mm.

Fig. 3: upper surface, cross view, polished; scale bar: 5.5 mm.


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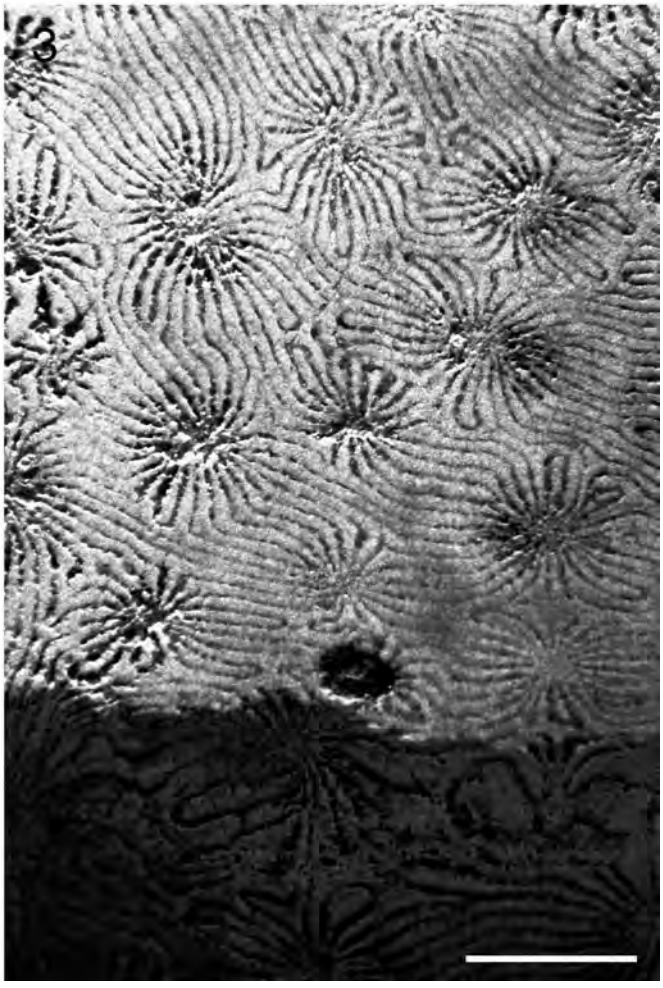
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Plate 72

Figs. 1, 2: *Pironastrea arausiaca* (MICHELIN, 1841)

Holotype of the type species of the genus *Koilomorpha* ALLOITEAU, 1952a; MNHN Mo1114; Upper Turonian (Uchaux), France.

Fig. 1: upper surface of colony; scale bar: 20 mm.

Fig. 2: close-up of Fig. 1; scale bar: 8 mm.

Figs. 3, 4: *Pironastrea tenuisepta* (REUSS, 1854)

NHMW 1864/0040/1325 (FELIX coll.), original material of FELIX (1903a, p. 217, Pl. 18, Fig. 1); Santonian (Gosau Group at Rußbach-Gosau area), Austria.

Fig. 3: upper surface of colony; scale bar: 15 mm.

Fig. 4: polished surface of colony, cross view; scale bar: 7 mm.

Fig. 5: *Pironastrea discoides* D'ARCHIARDI, 1875

Syntype of the type species of the genus *Pironastrea* D'ARCHIARDI, 1875; MPUR D'ARCHIARDI coll.; upper surface of colony; Eocene of Italy; scale bar: 8.5 mm.

Figs. 6–8: *Pironastrea* (*Siderocoenia*) *lithodes* (FELIX, 1903a)

Paralectoype of the type species of the genus *Siderocoenia* M. BEAUVAIS, 1982; NHMW 1864/0040/1325; Upper Santonian (Gosau Group at Brunstloch), Austria.

Fig. 6: upper surface of colony, partially polished; scale bar: 9.5 mm.

Fig. 7: polished surface, showing cut through ramose branch of colony; scale bar: 6.5 mm.

Fig. 8: close-up of polished surface of Fig. 6; scale bar: 4 mm.

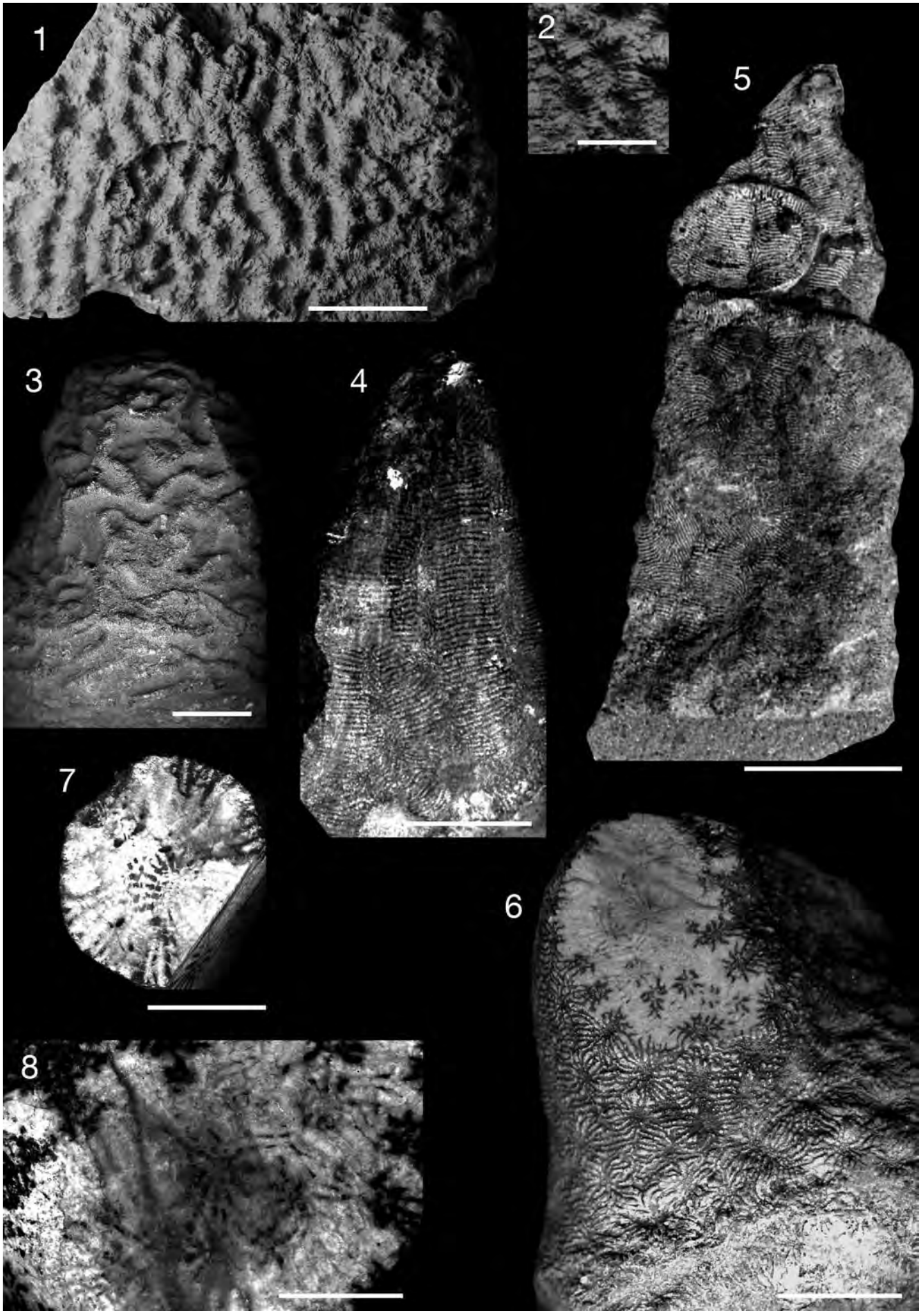
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Plate 73

Figs. 1, 2: *Microsolena* sp.

Fig. 1: thin section, cross view; BSPG B5/15 (BARON-SZABO coll.); Lower Aptian, (Schrattenkalk at Allgäu, Brandalpe), Germany; scale bar: 2.5 mm.

Fig. 2: thin section, cross view; BSPG 35/VI (BARON-SZABO coll.); Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria; scale bar: 2.8 mm.

Figs. 3, 4: *Comoseris aptiensis* BARON-SZABO, 2002

Holotype, BSPG ME-158H (BARON-SZABO coll.); Lower Aptian, (Schrattenkalk at Allgäu, Mitteleck), Germany.

Fig. 3: thin section, cross view; scale bar: 6 mm.

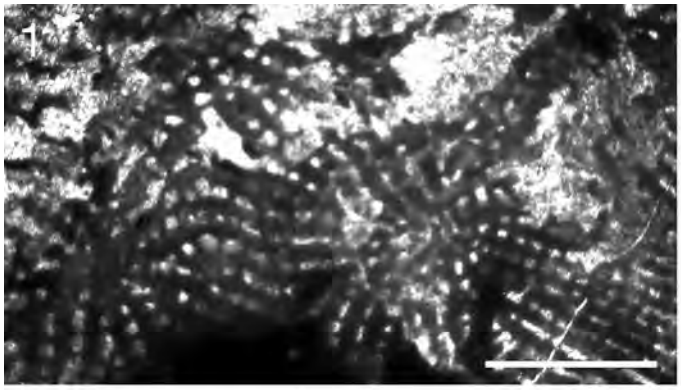
Fig. 4: thin section, lateral view; scale bar: 2.6 mm.

Fig. 5: *Hydnophoromeandraraea volzi* MORYCOWA, 1971

BSPG MAT 217b (BARON-SZABO coll.); thin section, cross view (determination confirmed by E. MORYCOWA); Lower Aptian, (Schrattenkalk at Allgäu, Mahdtal), Germany; scale bar: 5 mm.

Fig. 6: *Litharaeopsis latistellata* (FELIX, 1903a)

Holotype, BSPG 1878 XI 388; upper surface of colony; Turonian (Gosau group at St. Gilgen), Austria; scale bar: 10 mm.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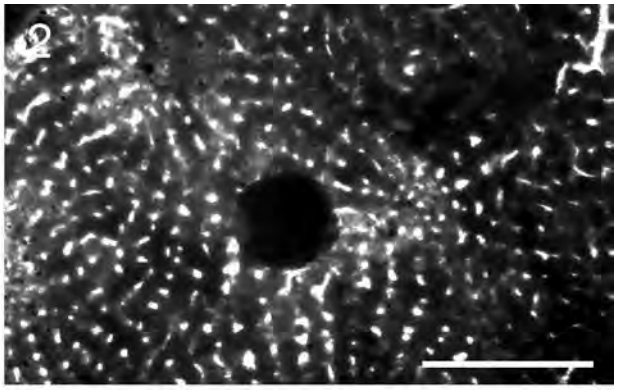
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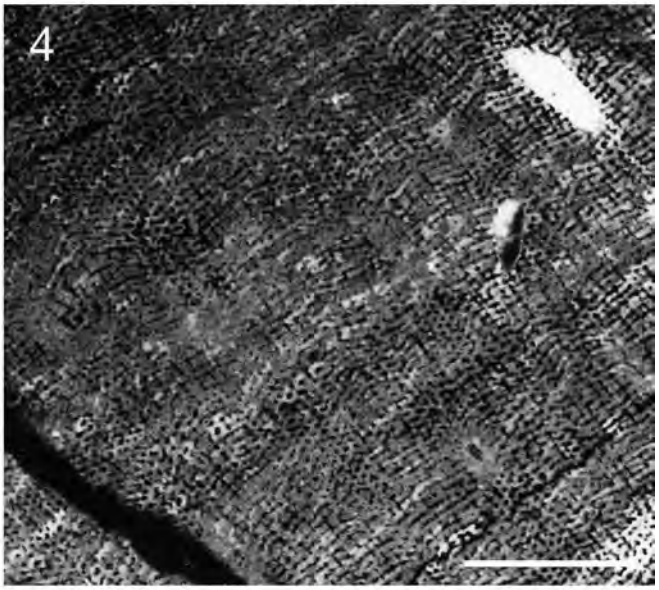
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Plate 74

Fig. 1: *Litharaeopsis latistellata* (FELIX, 1903a)

Holotype, BSPG 1878 XI 388; upper surface of colony, polished; Turonian (Gosau Group at St. Gilgen), Austria; scale bar: 8 mm.

Figs. 2, 3, 6: *Kobya rigausensis* M. BEAUVAIS, 1982

GBA 1999/089/0026/02 (BARON-SZABO-1999 coll.); Upper Santonian (Gosau Group at Styrian Weissenbachalm), Austria.

Fig. 2: thin section, cross view of colony; scale bar: 9 mm.

Fig. 3: close-up of Fig. 2; scale bar: 2.5 mm.

Fig. 6: thin section, lateral view; scale bar: 1.5 mm.

Figs. 4, 5: *Synastrea agaricites* (GOLDFUSS, 1826)

Holotype, IPB 223 (GOLDFUSS coll.); Santonian (Gosau Group at Abtenau), Austria.

Fig. 4: upper surface of colony; scale bar: 11 mm.

Fig. 5: upper surface of colony, partially polished; scale bar: 6 mm.

Fig. 7: *Synastrea procera* (REUSS, 1854)

Lectotype, designated herein, NHMW 1864/0040/1370b (REUSS coll.), original material of REUSS (1854, p. 120, Pl. 5, Figs. 1, 2); upper surface of colony; Turonian–Lower Coniacian (Gosau Group at St. Wolfgang, Seeleiten) or Upper Santonian (Gosau Group at Neffgraben), Austria; scale bar: 20 mm.

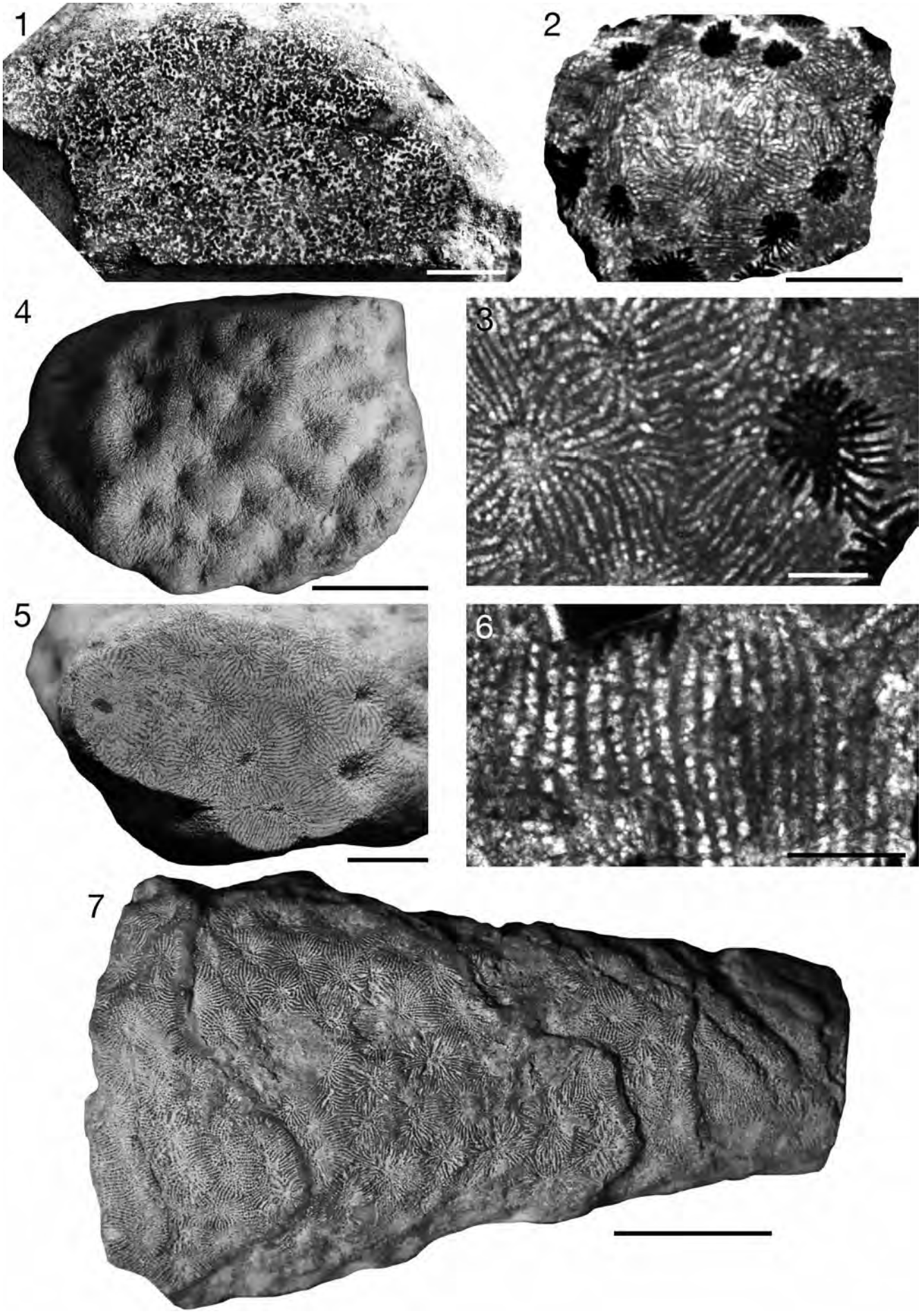
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Plate 75

Fig. 1: *Synastrea cladophora* (FELIX, 1903a)

Paralectotype, BSPG AS I 1969, original material of FELIX (1903a, p. 183, Pl. 17, Fig. 11); upper surface of colony; Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area; according to FELIX, 1903a, p. 183, material might have been collected from either Edelbachgraben [Coniacian] or Randograben [Santonian]), Austria; scale bar: 9.5 mm.

Fig. 2: *Synastrea procera* (REUSS, 1854)

GBA 2003/023/0033/02 (BARON-SZABO-2003a coll.); thin section, cross view of colony; Santonian (Gosau Group, Hochmoos Formation), Austria; scale bar: 1.5 mm.

Fig. 3: *Cunnolites undulatus* (GOLDFUSS, 1826)

Syntype, IPB 173 (GOLDFUSS coll.); upper surface of corallum; Turonian–Campanian (Gosau Group, probably at greater Rußbach-Gosau area), Austria; scale bar: 15 mm.

Fig. 4: *Cunnolites undulatus* var. *robustus* (FELIX, 1903a)

Holotype, NHMW 1864/0040/1424 (REUSS coll.); upper surface of corallum; Upper Santonian (Gosau Group at Neffgraben), Austria; scale bar: 22 mm.

Fig. 5–7: *Cunnolites polymorphus* (GOLDFUSS, 1826)

Fig. 5: thin section, cross view, early ontogenetical stage of corallum; field number R/I (BARON-SZABO-2003a coll.); Santonian (Gosau Group at Hochmoos-Grabenbach-area), Austria; scale bar: 500 µm.

Fig. 6: upper surface of corallum; GBA 2003/023/0034/01 (BARON-SZABO-2003a coll.); Santonian (Gosau Group at Hochmoos-Grabenbach-area), Austria; scale bar: 7 mm.

Fig. 7: SEM picture of base of corallum; GBA 2003/023/0034/235 (BARON-SZABO-2003a coll.); Santonian (Gosau Group at Hoch-moos-Grabenbach-area), Austria; scale bar: 500 µm.


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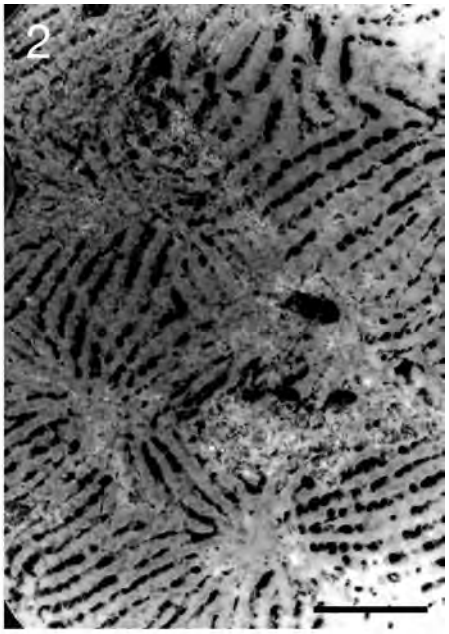
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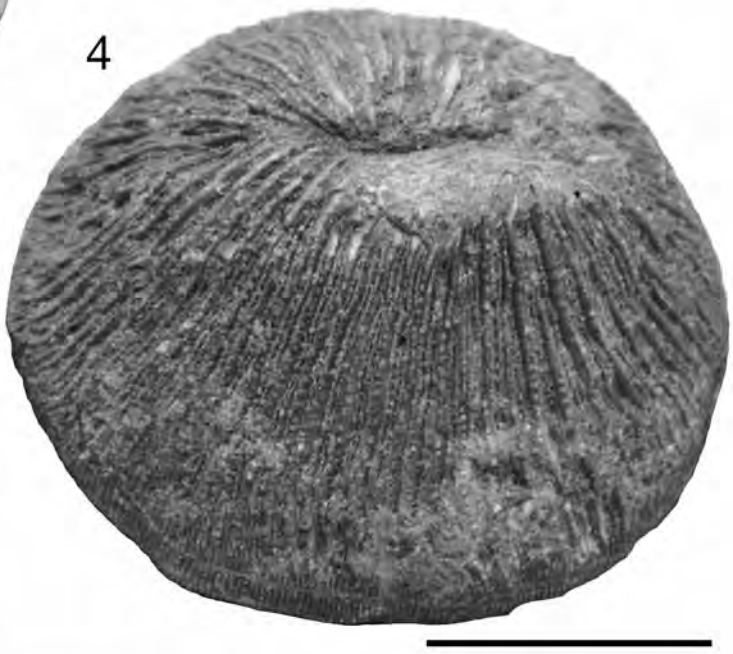
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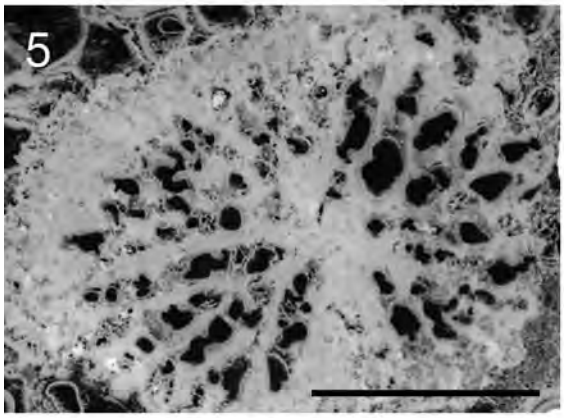
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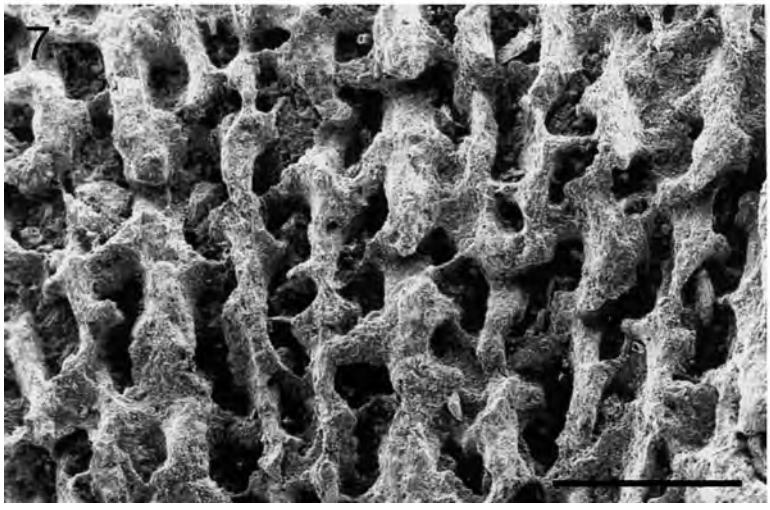
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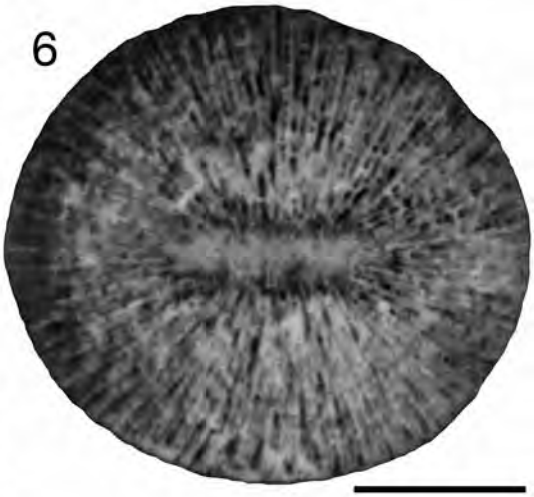
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Plate 76

Figs. 1–3: *Aspidastraea orientalis* KÜHN, 1933

GBA 2003/023/0035 (BARON-SZABO-2003a coll.); Santonian (Gosau Group at Hochmoos-Grabenbach-area), Austria.

Fig. 1: thin section, cross view, early ontogenetical stage of corallum; scale bar: 1.5 mm.

Fig. 2: thin section, cross view, intermediate ontogenetical stage of corallum; scale bar: 2.5 mm.

Fig. 3: thin section, cross view, adult stage of corallum; scale bar: 6 mm.

Figs. 4–6: *Aspidastraea waehneri* (FELIX, 1903a)

Fig. 4: close-up of Fig. 5; scale bar: 15 mm.

Fig. 5: upper surface of colony, holotype, NHMW 2014/0107/0001, FELIX coll.; Upper Santonian (Gosau Group at Scharrergraben), Austria; scale bar: 25 mm.

Fig. 6: upper surface of colony; GBA 1903/004/0033/01 (FELIX coll.), originally presented as *Dimorphastrea glomerata* REUSS in FELIX, 1903a, p. 213; Upper Santonian (Gosau Group at Rußbach area), Austria; scale bar: 20 mm.

Fig. 7: *Dimorphastrea haueri* REUSS, 1854

Syntype, NHMW 1864/0040/1385; upper surface of colony; Upper Santonian (Gosau Group at Rußbach area), Austria; scale bar: 7.5 mm.

Figs. 8, 9: *Fungiastraea cotteaui* (DE FROMENTEL, 1857)

VNS P.21604; mould preservation, contrast inverted; Albian (Garschella Formation at Bezau, Bregenz Forrest), Austria. Photographs courtesy G. FRIEBE.

Fig. 8: base of colony; scale bar: 14 mm.

Fig. 9: upper surface of colony; scale bar: 16 mm.

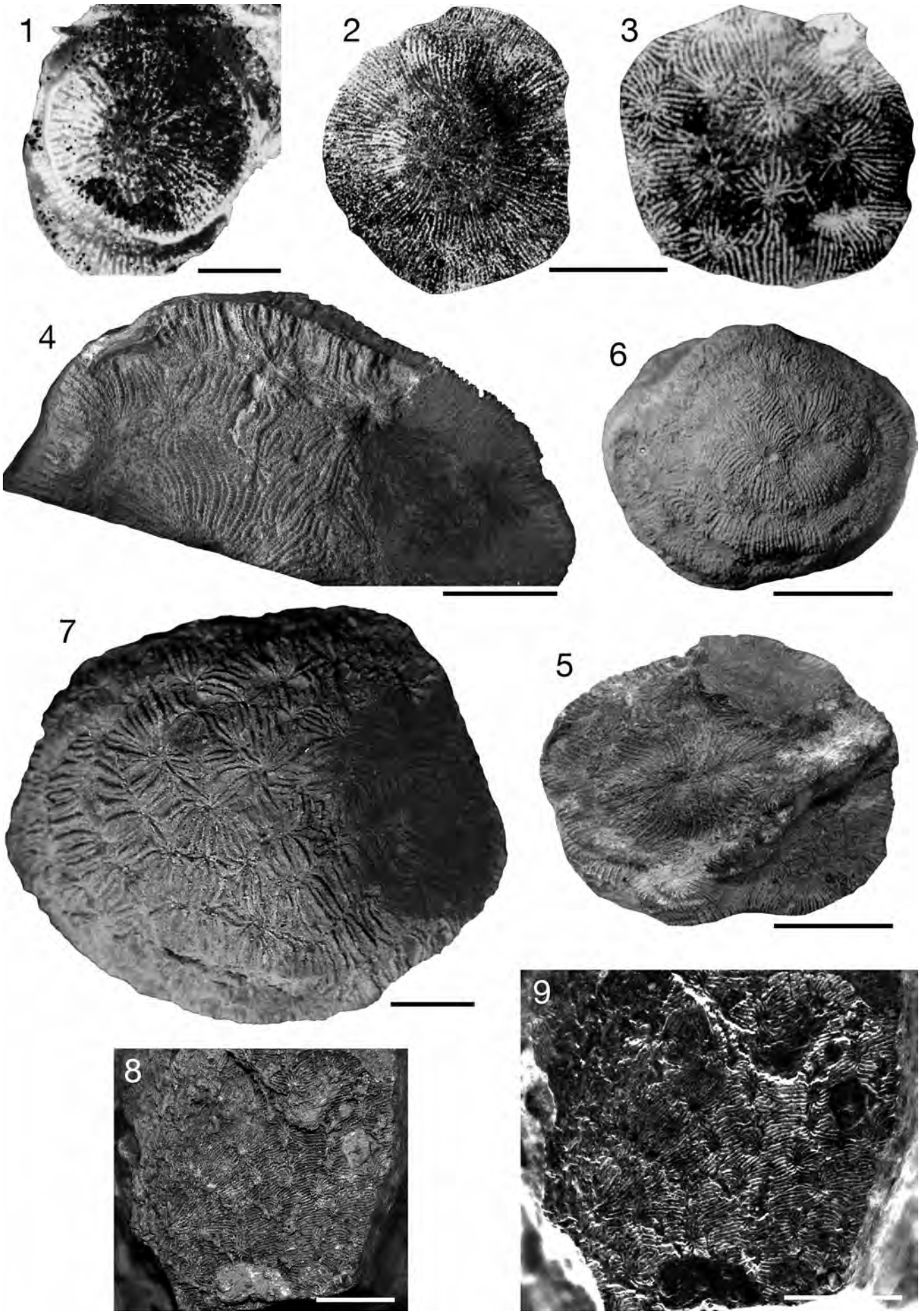
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Plate 77

Figs. 1, 2: *Fungiastraea acutidens* (REUSS, 1854)

Neotype (designated by M. BEAUVAIS, 1982), GBA 1982/020/0001 (= *Thamnastrea acutidens* REUSS); Upper Santonian (Gosau Group at Scharrergraben), Austria.

Fig. 1: upper surface of colony; scale bar: 6 mm.

Fig. 2: upper surface, partially polished; scale bar: 6 mm.

Figs. 3, 4: *Thamnoseris morchella* (REUSS, 1854)

GBA 2003/023/0032/02 (BARON-SZABO-2003a coll.); Santonian (Gosau Group at Hochmoos-Grabenbach-area), Austria.

Fig. 3: thin section, cross view; scale bar: 5 mm.

Fig. 4: close-up of Fig. 3; scale bar: 1.5 mm.

Figs. 5–7: *Fungiastraea exigua* (REUSS, 1854)

Fig. 5: thin section, cross view; GBA 2003/023/0030/01 (BARON-SZABO-2003a coll.); Santonian (Gosau Group at Hochmoos-Grabenbach-area), Austria; scale bar: 2 mm.

Figs. 6, 7: syntype, GBA 1854/007/0099 (REUSS coll.); Coniacian (Gosau Group at Hornegg) or Santonian (Gosau Group at Randograben), Austria.

Fig. 6: upper surface of colony; scale bar: 11 mm.

Fig. 7: upper surface, partially polished; scale bar: 6.5 mm.

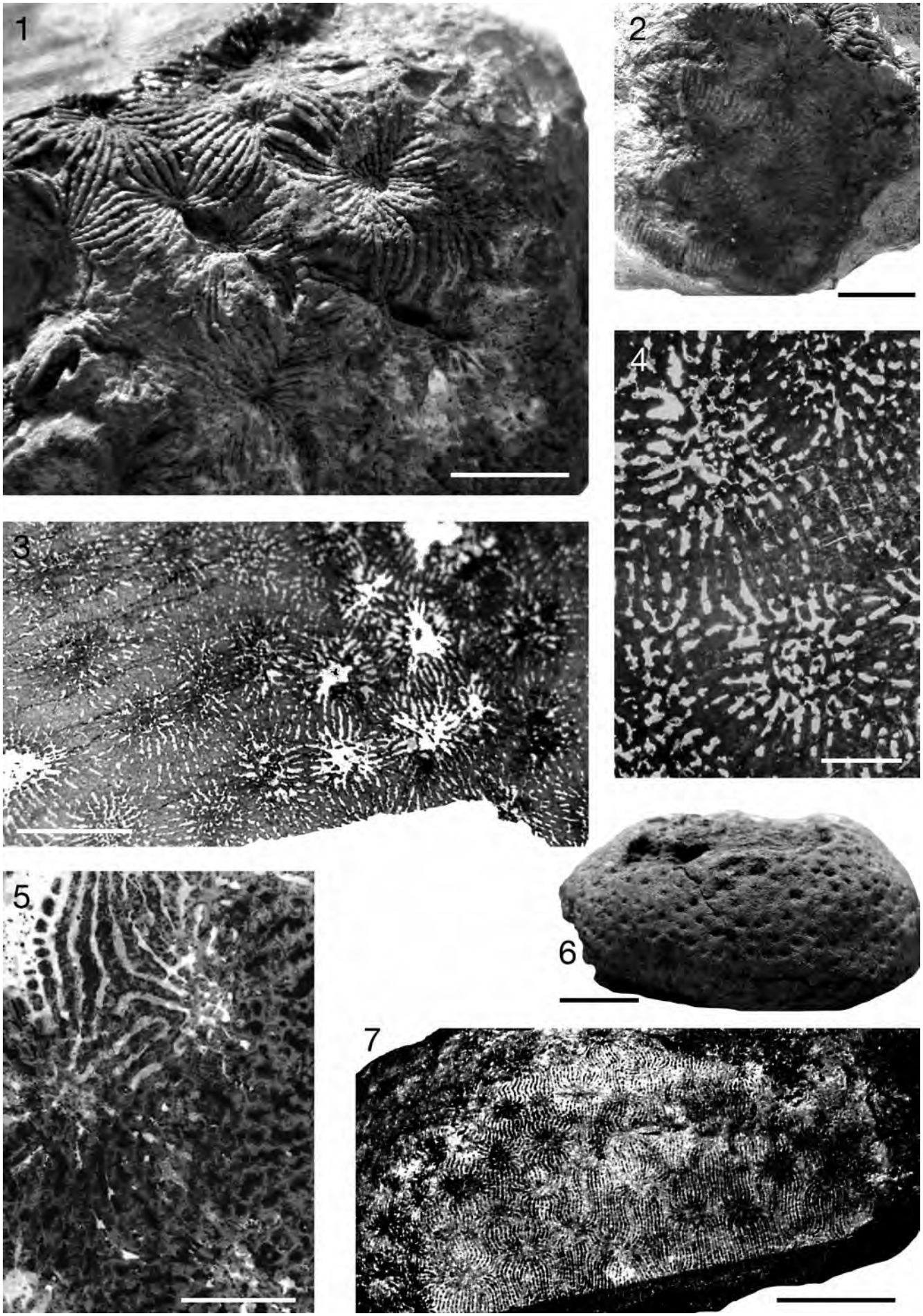
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Plate 78

Figs. 1, 3: *Thamnoseris morchella* (REUSS, 1854)

Syntype, NHMW 1864/0040/1321; upper surface of colony; Upper Santonian (Gosau Group at Neffgraben), Austria.

Fig. 1: upper surface of colony; scale bar: 7 mm.

Fig. 3: close-up of Fig. 1; scale bar: 6 mm.

Figs. 2, 4: *Trigerastraea* (*Dimorphomeandra*) *astraeoides* (REUSS, 1854)

Fig. 2: BSPG AS I 1970; upper surface of colony; Turonian (Gosau Group at Streiteck), Austria; scale bar: 11 mm.

Fig. 4: ?syntype, NHMW 1864/0040/1320c; upper surface of colony; Turonian–Santonian (Gosau Group at Rußbach-Gosau area, Seeleiten, or Weissenbach-Aussee area), Austria; scale bar: 7 mm.

Fig. 5 *Valliculastraea montuosa* (FELIX, 1903a)

Syntype, GBA 1903/004/0026/01 (FELIX coll.), original material of FELIX (1903a, p. 204, Pl. 17, Fig. 8) and M. BEAUVAIS (1982, vol. 2, p. 130, Pl. 61, Fig. 1); upper surface of colony; Upper Santonian (Gosau Group at Neffgraben), Austria; scale bar: 17 mm.

Fig. 6: *Valliculastraea texta* (OPPENHEIM, 1930a)

GBA 1999/089/0022/02 (BARON-SZABO-1999 coll.); thin section, cross view; Upper Santonian (Gosau Group at Styrian Weissenbachalm), Austria; scale bar: 3 mm.

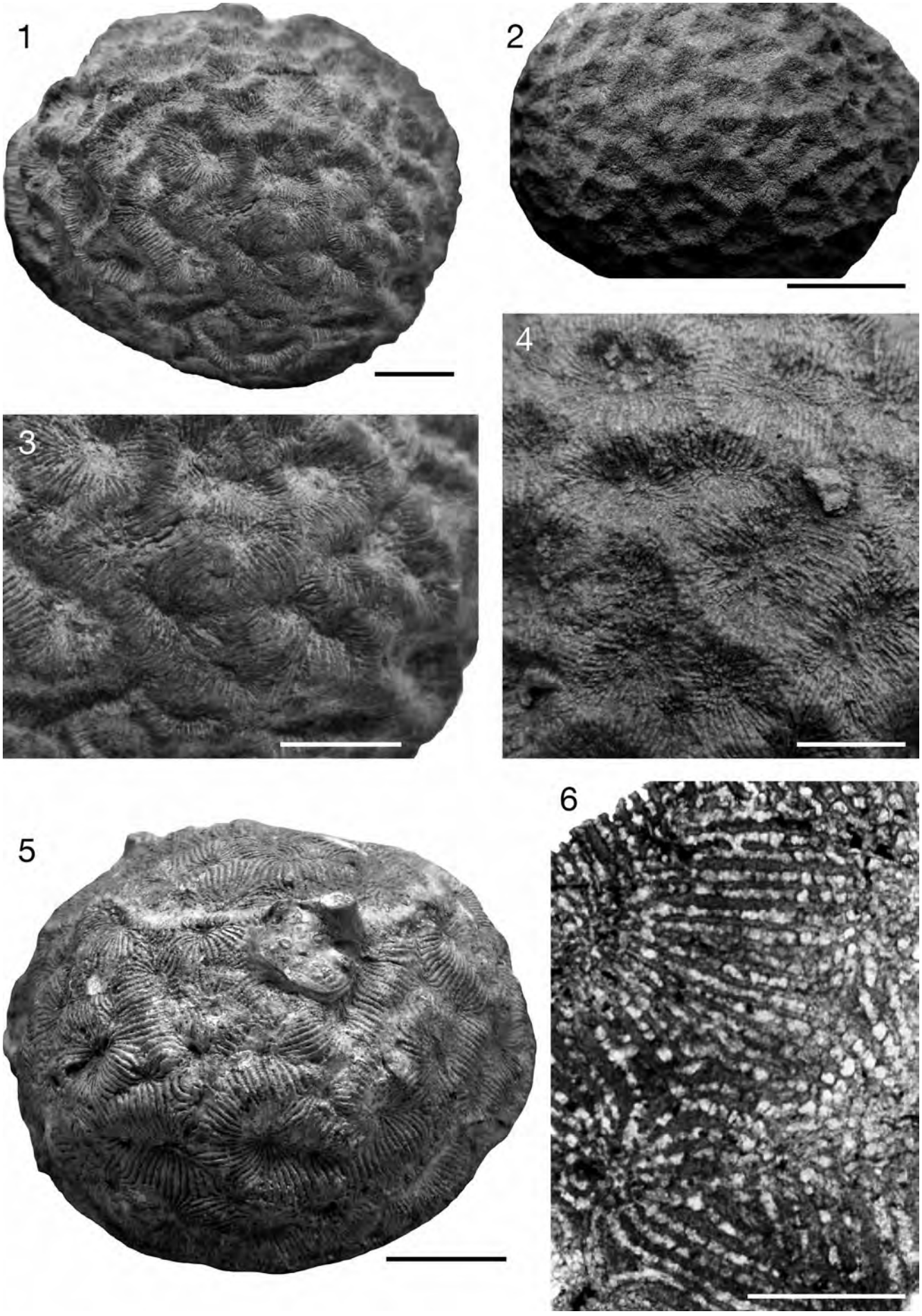
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Plate 79

Figs. 1, 2: *Smilotrochus milneri* (GREGORY, 1898)

BSPG 1956 XVII 21 Cenomanian ("Randcenoman" at Hölzelsau), Austria.

Fig. 1: cross view, polished surface; scale bar: 5.5 mm.

Fig. 2: upper surface, lateral view; scale bar: 5.5 mm.

Figs. 3, 4: *Trochocyathus microphyes* FELIX, 1903a

Syntype, NHMW 1861/0001/0167, Coniacian–Lower Santonian (Gosau Group at Edelbachgraben), Austria.

Fig. 3: upper surface, cross view; scale bar: 1.8 mm

Fig. 4: base of corallum; scale bar: 1.8 mm.

Figs. 5, 6: *Conicosmilotrochus stranicensis* TURNŠEK, 1978

Reference material, NHMW 1980/2159/2003; Santonian–Campanian (Austroalpine unit at Stranice-Radana vas), Slovenia.

Fig. 5: upper surface, cross view; scale bar: 3 mm.

Fig. 6: upper surface, lateral view; scale bar: 4 mm.

Figs. 7, 8: *Lophomeandra felixi* BEAUVAIS, 1982 (pro *Latimaeandraraea ataciana* [MICHELIN] in FELIX, 1903a)

Fig. 7: thin section, cross view; GBA 2003/023/0029/01 (BARON-SZABO-2003a coll.), Santonian (Gosau Group at Hochmoos-Grabenbach-area), Austria; scale bar: 3 mm.

Fig. 8: lectotype, NHMW 1903/004/0039 (FELIX coll.); upper surface of colony; Upper Santonian (Gosau Group at Scharrergraben), Austria; scale bar: 5.5 mm.

Figs. 9, 10: *Smilotrochus milneri* (GREGORY, 1898)

GBA 1999/089/0011/02 (BARON-SZABO-1999 coll.); Upper Turonian (Gosau Group at Styrian Weissenbachalm), Austria.

Fig. 9: thin section, cross view; scale bar: 4 mm.

Fig. 10: thin section, lateral view; scale bar: 3.5 mm.

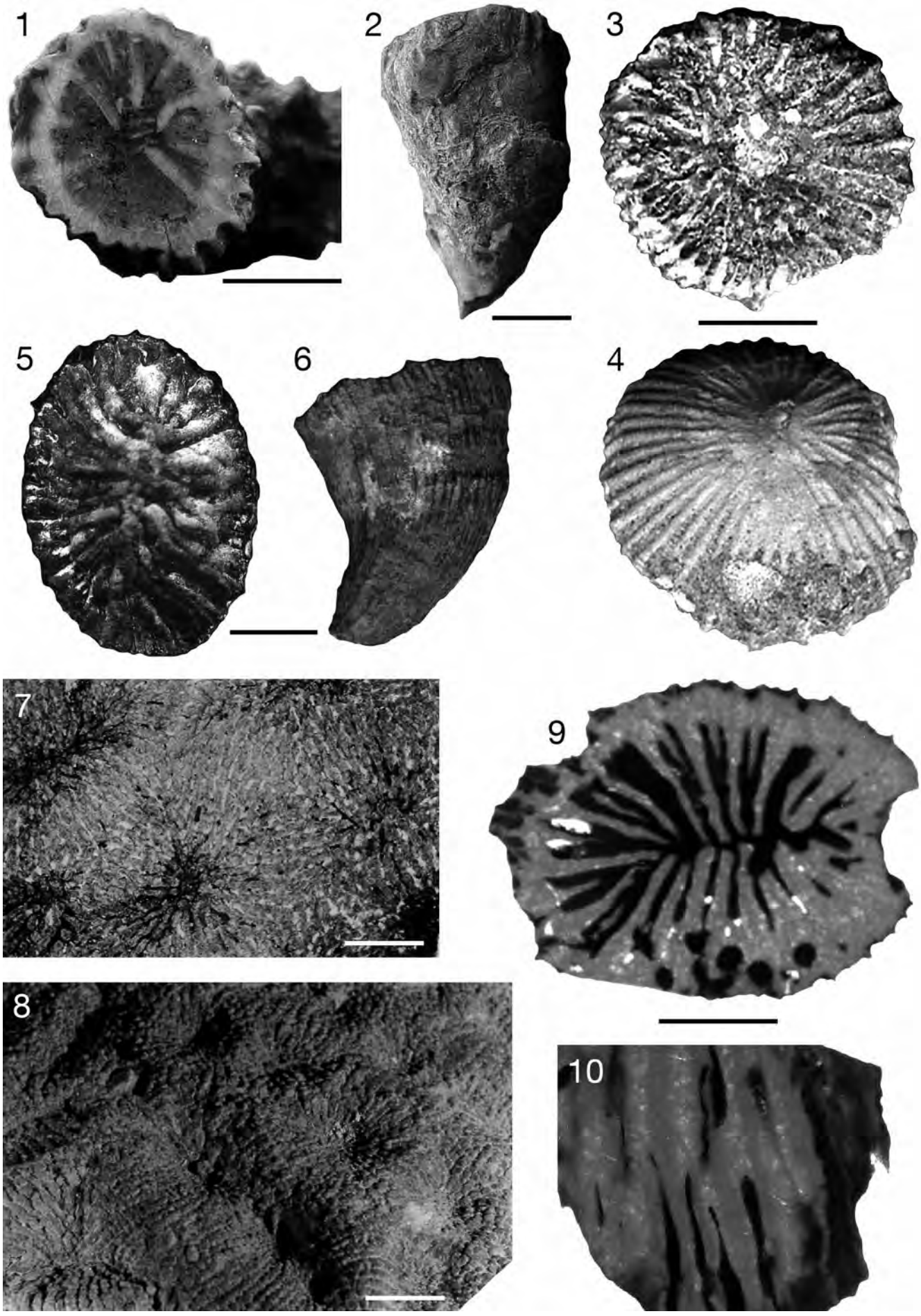
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Plate 80

Fig. 1: *Lophomeandra polygonata* M. BEAUVAIS, 1982 (pro *Latimeandraraea tenuisepta* REUSS in FELIX, 1903a)

NHMW 1864/0040/1325 (FELIX coll), original material of FELIX (1903a, p. 217, Pl. 18, Fig. 1); upper surface of colony; Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area, possibly from the Upper Santonian at Neff-graben), Austria; scale bar: 17 mm.

Fig. 2: *Lophomeandra agaricites* (GOLDFUSS, 1829)

Holotype, IPB 292, GOLDFUSS coll.; upper surface of colony; Turonian–Campanian (Gosau Group, possibly at greater Rußbach-Gosau area), Austria; scale bar: 8 mm.

Figs. 3, 5: *Valliculastraea lophiophora* (FELIX, 1903a)

Syntype, NHMW 1864/0040/1234; Turonian–Campanian (Gosau Group, possibly at area of northeastern Alps), Austria.

Fig. 3: upper surface, partially polished, cross view; scale bar: 7 mm.

Fig. 5: upper surface of colony; scale bar: 18 mm.

Fig. 4: *Lophomeandra felixi* BEAUVAIS, 1982 (pro *Latimaeandraraea ataciana* [MICHELIN] in FELIX, 1903a)

Paralectotype, NHMW 1864/0001/0699, original material of FELIX (1903a, p. 219, Pl. 18, Fig. 5); upper surface of colony; Upper Santonian (Gosau Group at Scharrergraben), Austria; scale bar: 16 mm.

Figs. 6, 7: *Latiastraea kaufmanni* (KOBY, 1897)

BSPG BA-8b-I (BARON-SZABO coll.); Lower Aptian (Schrattenkalk at Allgäu, Lochbachstrasse), Germany.

Fig. 6: close-up of Fig. 7; scale bar: 2 mm.

Fig. 7: thin section, cross view; scale bar: 9 mm.


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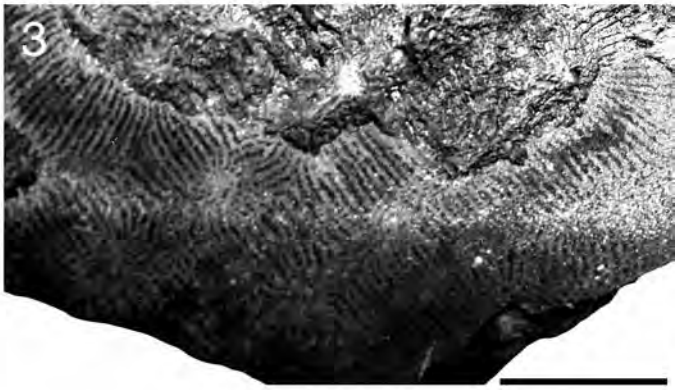
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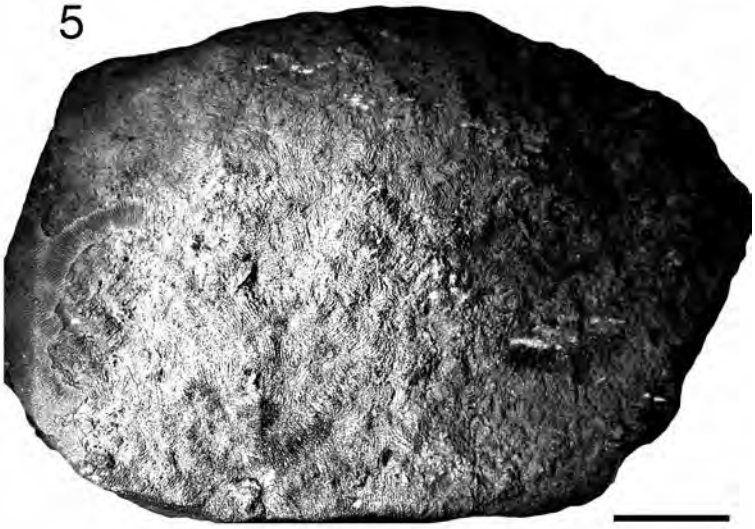
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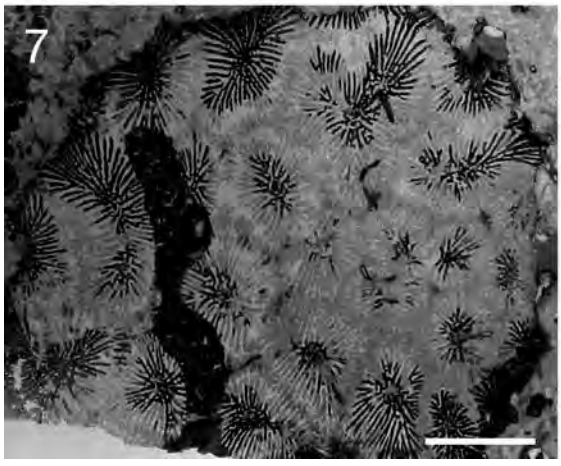
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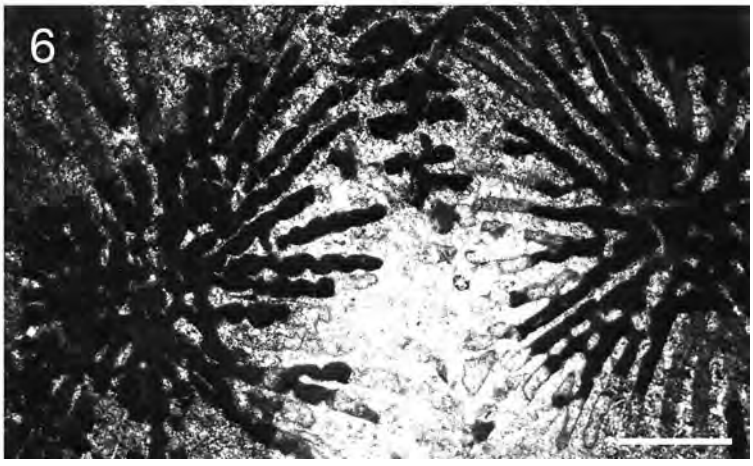
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Plate 81

Figs. 1–3: *Conicosmilotrochus stranicensis* TURNŠEK, 1978

Holotype, SAZU St-77; Santonian-Campanian (Austroalpine unit at Stranice), Slovenia.
Photographs courtesy D. TURNŠEK.

Fig. 1: thin section, cross view of ontogenetically intermediate stage of corallum; scale bar: 2.25 mm.

Fig. 2: close-up of Fig. 3; scale bar: 1 mm.

Fig. 3: thin section, cross view of adult stage of corallum; scale bar: 3 mm.

Figs. 4, 5: *Conicosmilotrochus dentatus* TURNŠEK, 1978

Holotype, SAZU St-73; Santonian–Campanian (Austroalpine unit at Stranice), Slovenia.
Photographs courtesy D. TURNŠEK.

Fig. 4: thin section, cross view of adult stage; scale bar: 3 mm.

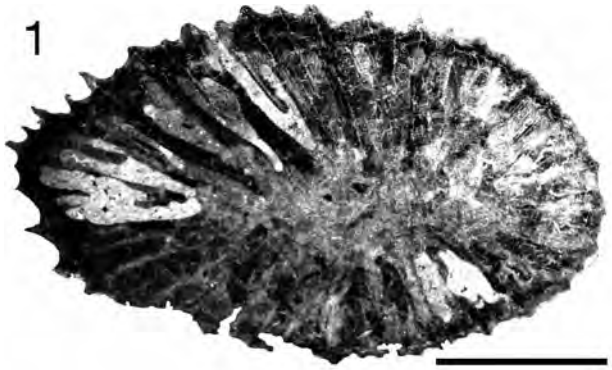
Fig. 5: thin section, cross view of ontogenetically intermediate stage of corallum; scale bar: 1.5 mm.

Fig. 6: *Heliocoenia carpathica* MORYCOWA, 1964

BSPG GL 257a (BARON-SZABO coll.); thin section, cross view; Lower Aptian (Schrattenkalk at Allgäu, Gottesackerloch), Germany; scale bar: 3 mm.

Fig. 7: *Cladophyllia crenata* (BLANCKENHORN, 1890)

BSPG OG 786 (BARON-SZABO coll.), first record from the geographic areas covered in this report; thin section; thin section, cross view; Lower Aptian (Schrattenkalk at Allgäu, Upper Gottesackerwände), Germany; scale bar: 2 mm.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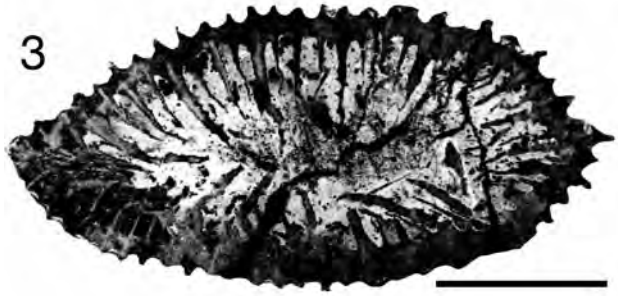
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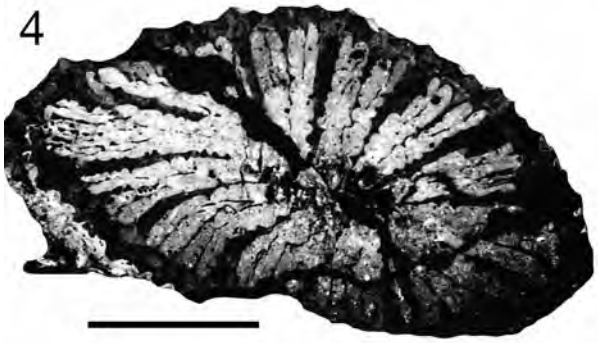
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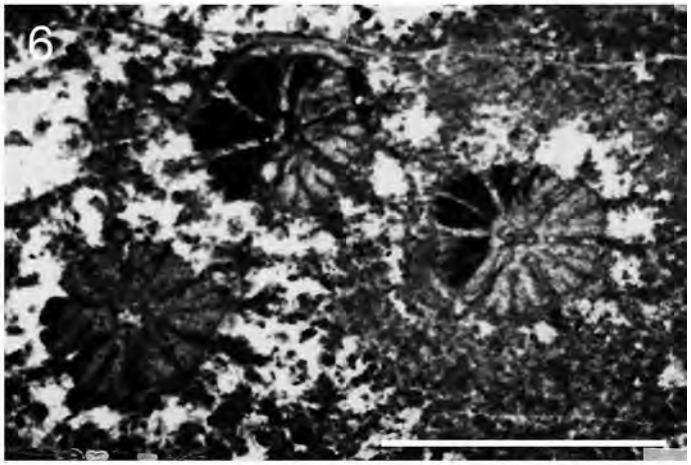
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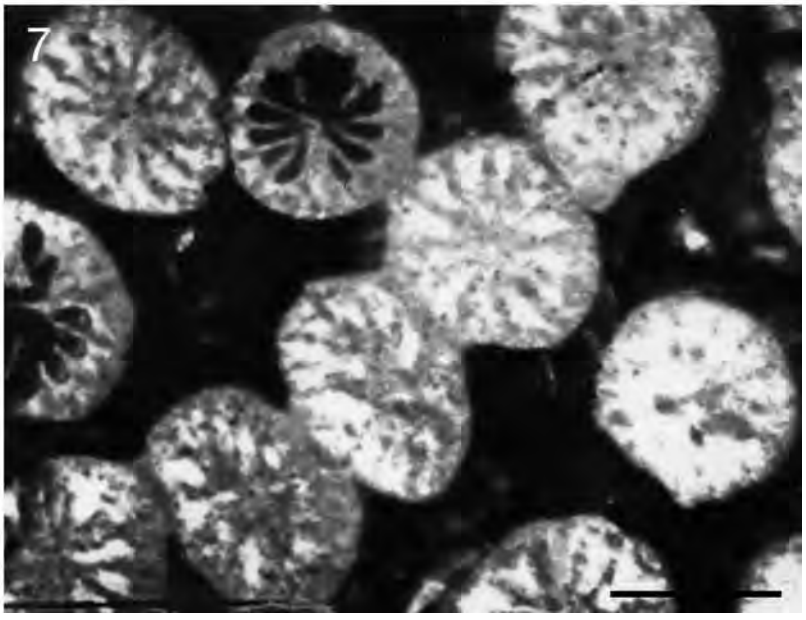
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Plate 82

Figs. 1–8: *Cladophyllia dichotoma* (GOLDFUSS, 1826)
Syntypes of the type species of the genus, IPB 155a and 155b (GOLDFUSS coll.); Upper Jurassic (Giengen), Germany.
Figs. 1–4: syntype 155a.
Fig. 1: upper surface of colony, cross view; scale bar: 3.5 mm.
Fig. 2: upper surface of colony, lateral view; scale bar: 17 mm.
Fig. 3: close-up of Fig. 2; scale bar: 10 mm.
Fig. 4: close-up of Fig. 1; scale bar: 1.5 mm.
Figs. 5–8: syntype 155b.
Fig. 5: close-up of Fig. 8, showing cross view of corallite; scale bar: 2.5 mm.
Fig. 6: close-up of Fig. 7, showing lateral view of corallite formed by extracalicinal budding; scale bar: 6.5 mm.
Fig. 7: upper surface of colony; scale bar: 14 mm.
Fig. 8: upper surface, close-up of Fig. 7; scale bar: 8.5 mm.


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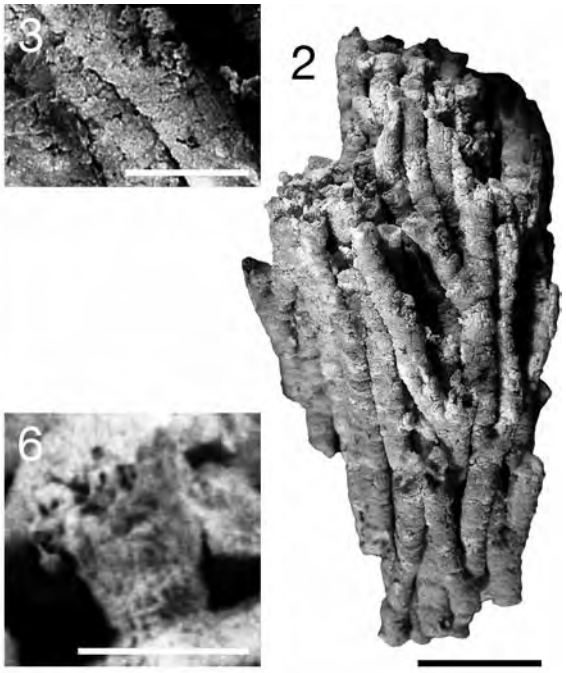
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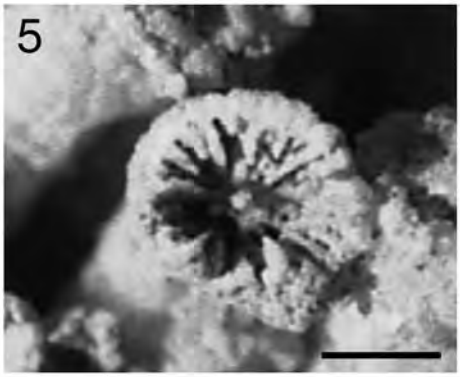
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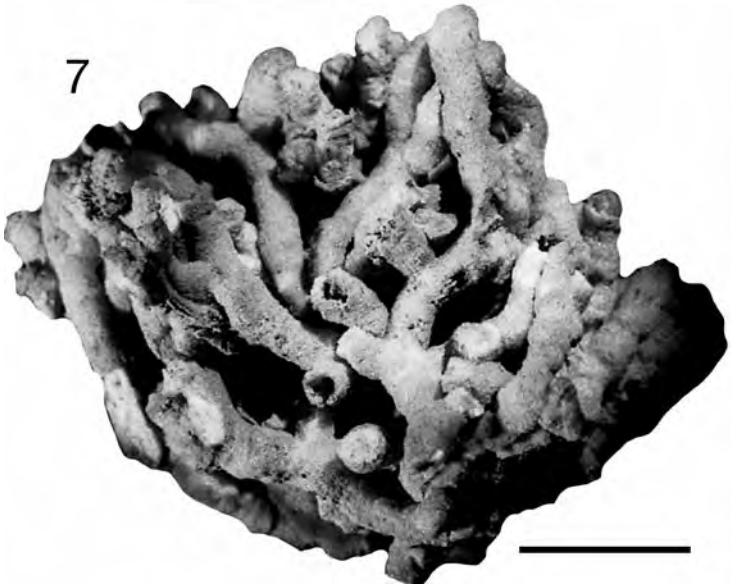
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Plate 83

Figs. 1–4: *Cladophyllia crenata* (BLANCKENHORN, 1890)

Holotype, SMNS 60381; Lower Aptian (Beirut), Lebanon.

Fig. 1: upper surface of colony, cross view; scale bar: 5 mm.

Fig. 2: upper surface of colony, lateral view; scale bar: 40 mm.

Fig. 3: close-up of Fig. 1, showing corallite in the process of septal division, typically seen in *Cladophyllia* but absent in other stylinid forms like *Stylina*; scale bar: 1.4 mm.

Fig. 4: close-up of Fig. 2, showing lateral striations of corallite tubes. Corallite tubes are connected by exothecal traverses; scale bar: 2.8 mm.

Fig. 5: *Cyathophora haysensis* WELLS, 1932

BSPG BA-2cII (BARON-SZABO coll.); thin section, cross view; Lower Aptian (Schrattenkalk at Allgäu, Brandalpe), Germany; scale bar: 2.5 mm.

Figs. 6–9: *Agathelia asperella* REUSS, 1854

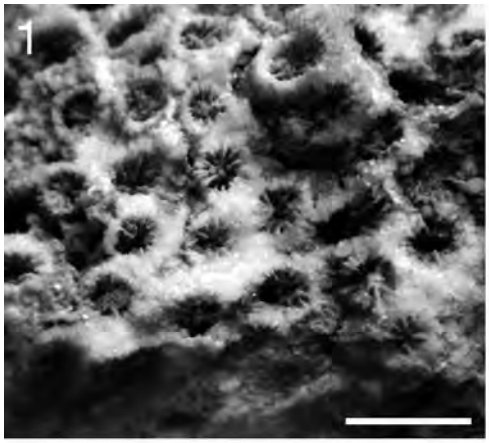
Fig. 6: syntype, NHMW 1864/0040/1220; upper surface, showing corallite in cross view; Upper Santonian (Neffgraben), Austria; scale bar: 4 mm.

Figs. 7, 9: BSPG KA3-5 (BARON-SZABO coll.); Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria.

Fig. 7: thin section, cross view; scale bar: 2.5 mm.

Fig. 8: thin section, cross view, slightly oblique; BSPG B7 (BARON-SZABO coll.); Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria; scale bar: 4.5 mm.

Fig. 9: thin section, lateral view; scale bar: 1 mm.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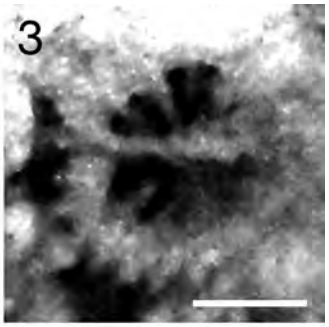
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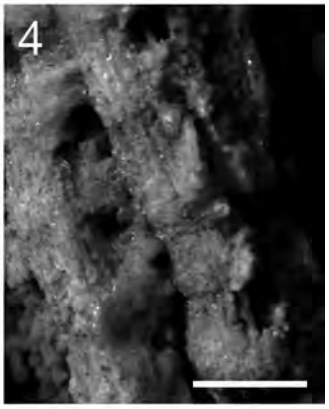
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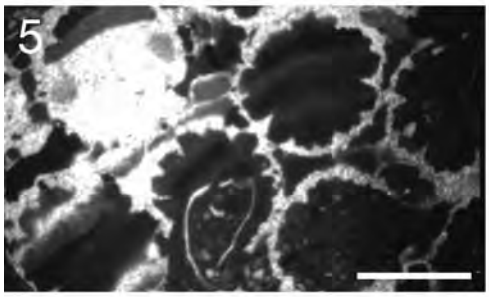
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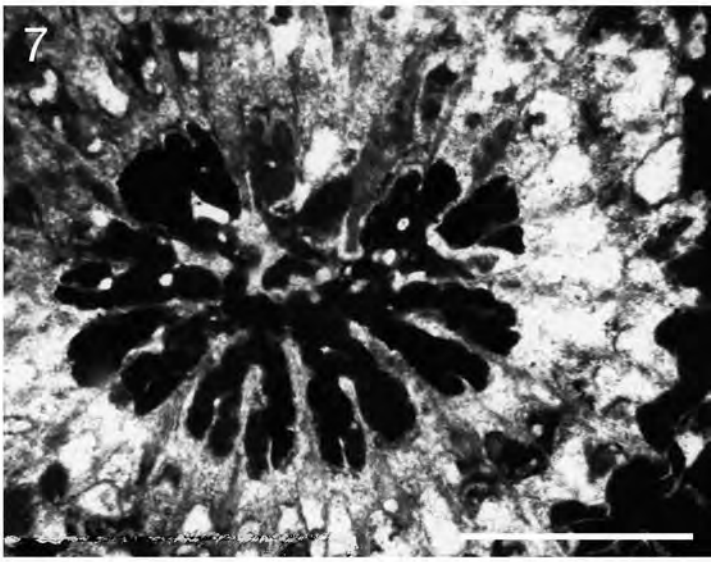
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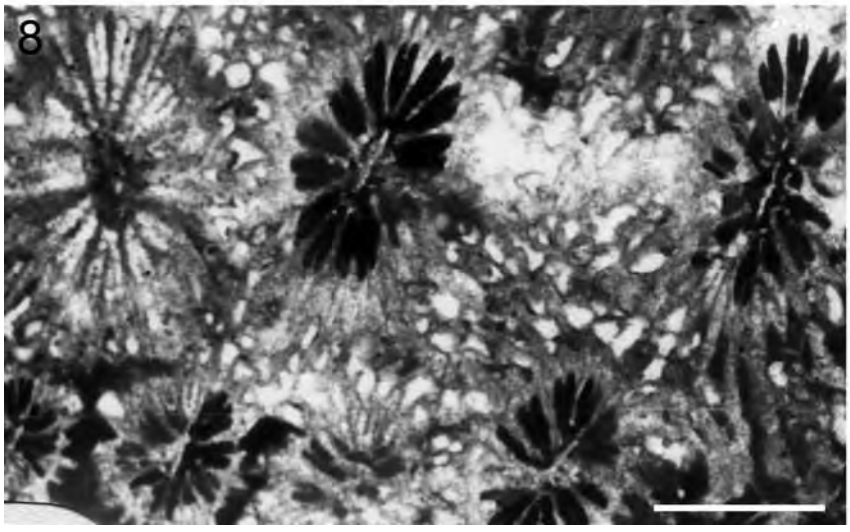
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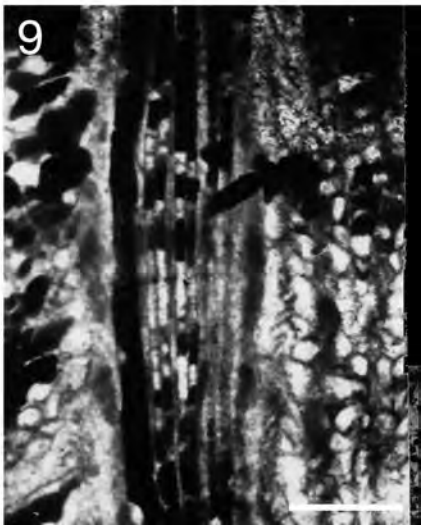
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Plate 84

Figs. 1–7: *Agathelia asperella* REUSS, 1854

Figs. 1, 3: BSPG B7 (BARON-SZABO coll.); Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria.

Fig. 1: thin section, cross view, slightly oblique; scale bar: 5 mm.

Fig. 3: close-up of Fig. 1; scale bar: 2 mm.

Figs. 2, 4–6: syntype, NHMW 1864/0040/1220; Upper Santonian (Gosau Group at Neffgraben), Austria.

Fig. 2: upper surface, showing corallites in cross view; scale bar: 1.5 mm.

Fig. 4: upper surface, showing parts of corallite wall; scale bar: 800 µm.

Fig. 5: upper surface, showing corallite in cross view; scale bar: 1.25 mm.

Fig. 6: upper surface of colony, partially polished; scale bar: 6.5 mm.

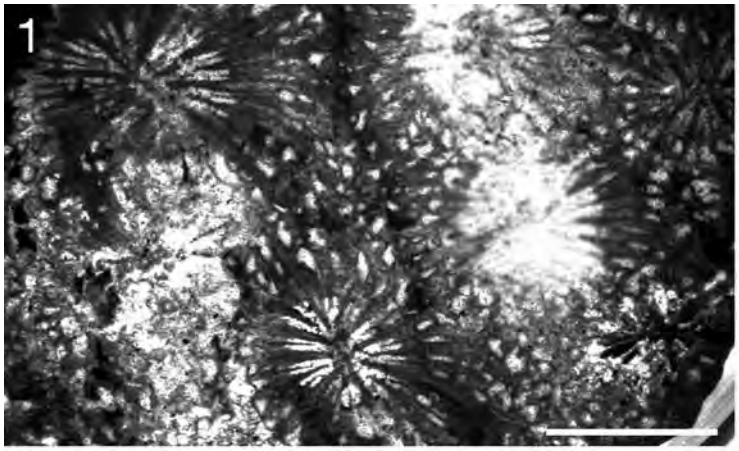
Fig. 7: thin section, cross view; BSPG B7 (BARON-SZABO coll.); Lower Coniacian (Gosau Group at Brandenberg, Haidach), Austria; scale bar: 1.2 mm.

Figs. 8, 9: *Reussicoenia edwardsi* (REUSS, 1854)

Holotype, LMLINZ 21/1990; Senonian (Gosau Group at Upper Austria), Austria.

Fig. 8: upper surface of colony; scale bar: 6.5 mm.

Fig. 9: upper surface, polished cross view, slightly oblique; scale bar: 6.5 mm.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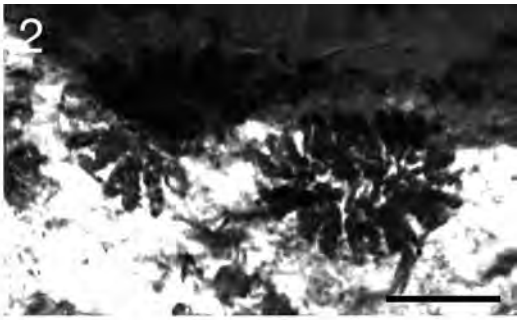
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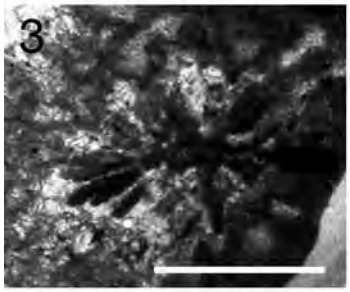
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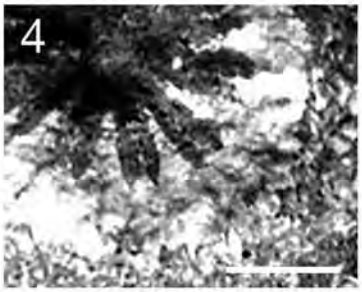
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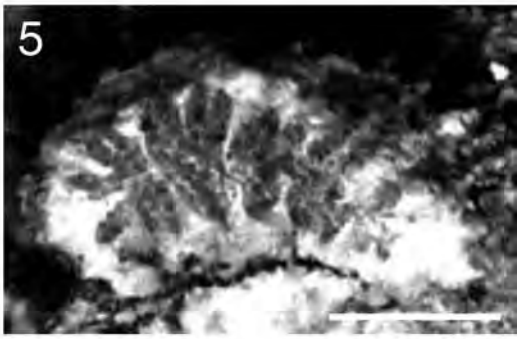
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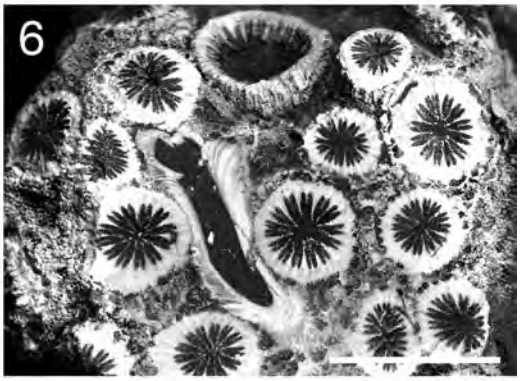
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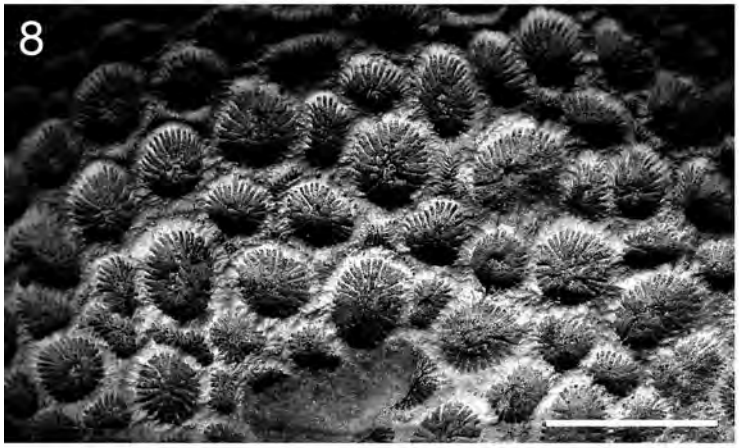
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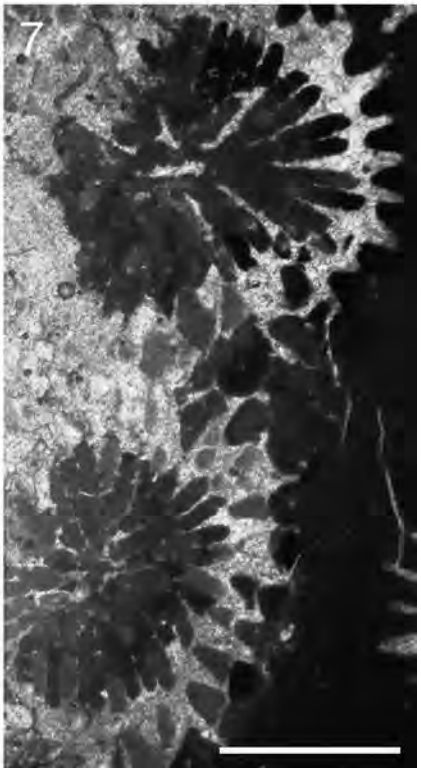
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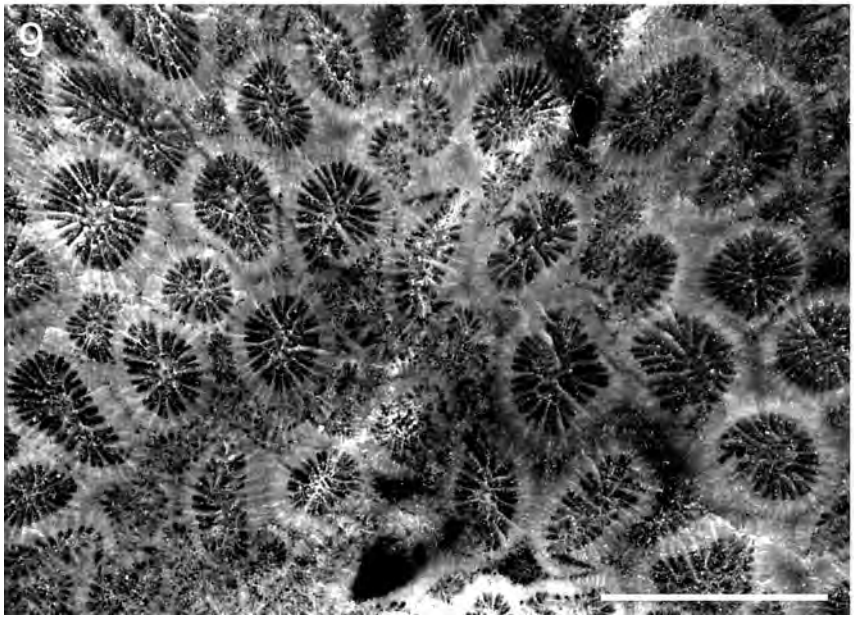
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Plate 85

Figs. 1–3: *Amphiaulastrea conferta* (OGILVIE, 1897)

BSPG BA-7b (BARON-SZABO coll.); Lower Aptian, (Schrattenkalk at Allgäu, Brandalpe), Germany.

Fig. 1: thin section, cross view; scale bar: 4.5 mm.

Fig. 2: close-up of Fig. 1; scale bar: 3 mm.

Fig. 3: thin section, lateral view; oblique; scale bar: 5 mm.

Fig. 4: *Pleurophyllia minuscula* RONIEWICZ, 1976

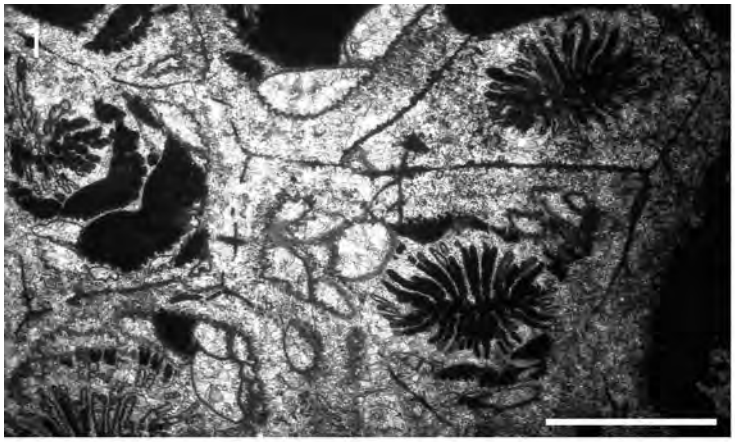
BSPG ME-286a (BARON-SZABO coll.), first record from the geographic areas covered in this report; thin section, cross view; Lower Aptian, (Schrattenkalk at Allgäu, Mitteleck), Germany; scale bar: 3.5 mm.

Fig. 5: *Latusastrea alveolaris* (GOLDFUSS, 1829)

Syntype of the type species of the genus *Latusastrea*, BSPG AS VII 1911; upper surface of colony; Upper Jurassic, Germany; scale bar: 28 mm.

Fig. 6: *Heterocoenia exigua* (MICHELIN, 1847)

Lectotype of the type species of the genus *Heterocoenia*, MNHN A29767 (MICHELIN coll.); upper surface of colony; Santonian, France; scale bar: 10 mm.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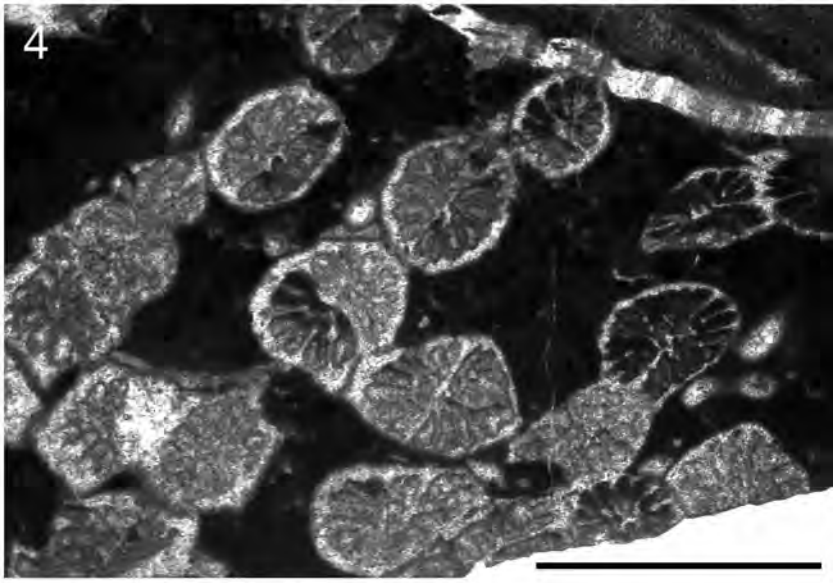
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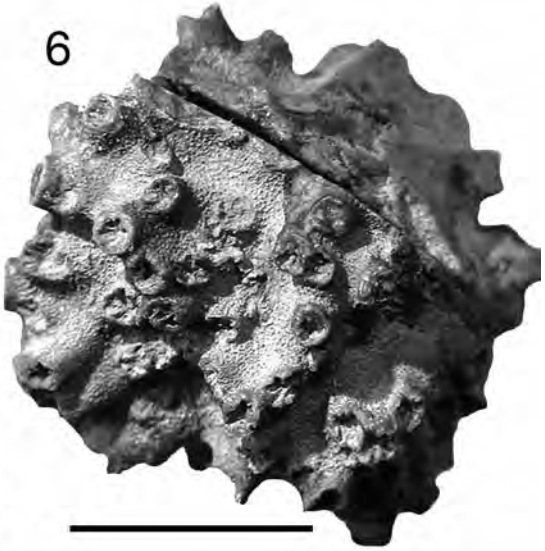
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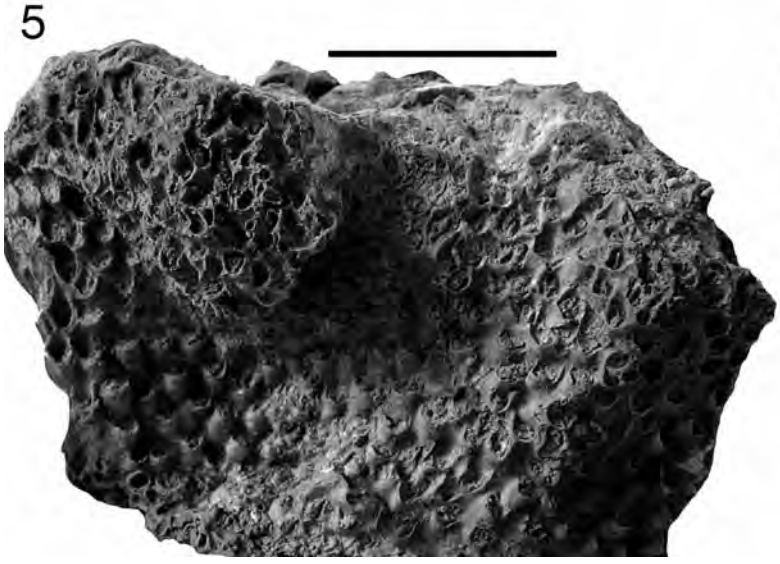
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Plate 86

Figs. 1–5: *Heterocoenia exigua* (MICHELIN, 1847)

Lectotype of the type species of the genus *Heterocoenia*, MNHN A29767 (MICHELIN coll.); Santonian, France.

Fig. 1: upper surface, showing corallites in a trinity-arrangement as a result of septal division; scale bar: 1.8 mm.

Fig. 2: upper surface, showing corallites in a subfasciculate to 'nest-like' poly integration, traditionally interpreted to be characteristic of *Latusastrea*; scale bar: 2 mm.

Fig. 3: close-up of Fig. 6 on Pl. 85; scale bar: 4 mm.

Fig. 4: upper surface, showing polyp in the initial stage of septal division which results in the trinity-arrangement (see Fig. 1); scale bar: 1 mm.

Fig. 5: upper surface, showing cerioid polyp, traditionally interpreted to be characteristic of *Latusastrea*; scale bar: 1.4 mm.

Figs. 6–10 *Latusastrea alveolaris* (GOLDFUSS, 1829)

Syntype of the type species of the genus *Latusastrea*, BSPG AS VII 1911; Upper Jurassic, Germany. Photographs of figures 8–10 courtesy B. LATHUILIÈRE.

Fig. 6: upper surface of colony, polished; scale bar: 10 mm.

Fig. 7: close-up of Fig. 5 on Pl. 85, showing corallites in a trinity-arrangement as a result of septal division; scale bar: 2.5 mm.

Fig. 8: close-up of Fig. 5 on Pl. 85, showing corallites in 'nest-like' polyp integration, traditionally interpreted to be characteristic of *Latusastrea*; scale bar: 4.5 mm.

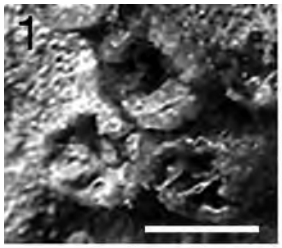
Figs. 9, 10: close-up pictures of Fig. 6, showing plocoid to subplocoid polyp integration, traditionally interpreted to be characteristic of *Heterocoenia*; Fig. 9: scale bar: 3 mm; Fig. 10: scale bar: 2.5 mm.

Fig. 11: *Heterocoenia reussi* MILNE EDWARDS, 1857

GBA 1903/004/0051/01 (FELIX coll.), original material of FELIX (1903a, p. 235); upper surface of colony; Upper Santonian (Gosau Group at Rußbach-Gosau area), Austria; scale bar: 6 mm.

Fig. 12: *Latusastrea provincialis* (MICHELIN, 1841)

BSPG MAT 217f-II (BARON-SZABO coll.); thin section, cross view; Lower Aptian (Schrattenkalk at Allgäu, Mahdtal), Germany; scale bar: 2.5 mm.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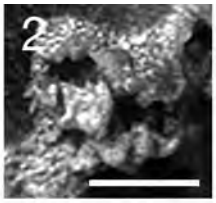
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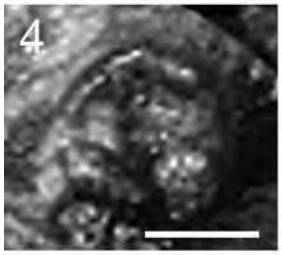
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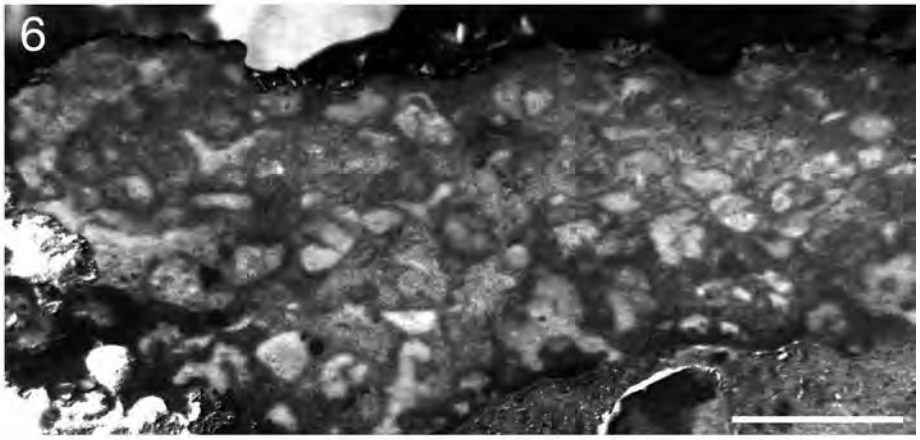
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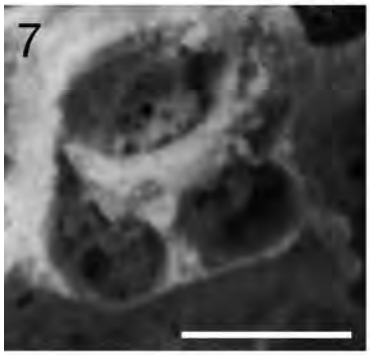
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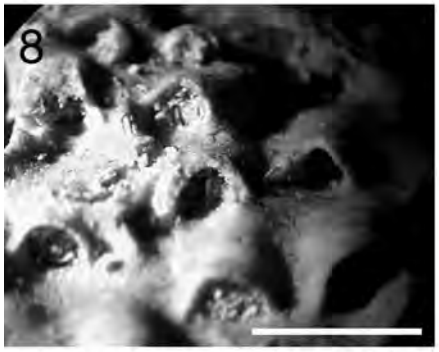
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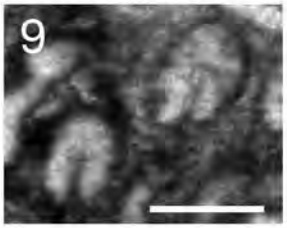
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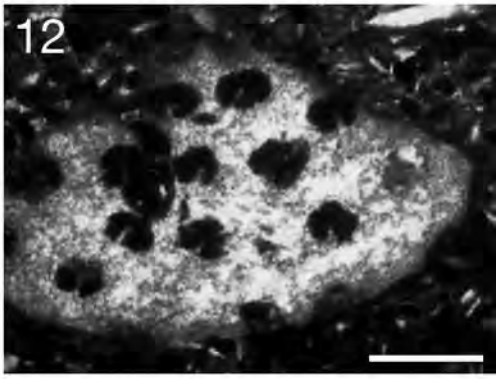
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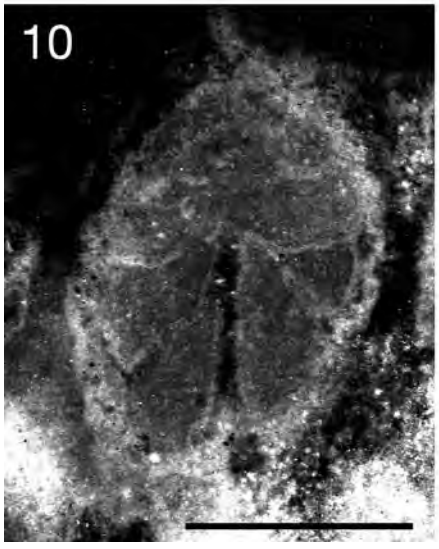
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Plate 87

Fig. 1: *Heterocoenia verrucosa* REUSS, 1854

GBA 2003/023/0018/02 (BARON-SZABO-2003a coll.); thin section, cross view; Santonian (Gosau Group at Hochmoos area), Austria; scale bar: 2.5 mm.

Fig. 2: *Heterocoenia exigua* (MICHELIN, 1847)

GBA 2003/023/0020/02 (BARON-SZABO-2003a coll.); thin section, cross view; Santonian (Gosau Group at Hochmoos area), Austria; scale bar: 2.5 mm.

Fig. 3: *Baryhelia grandis* (REUSS, 1854)

GBA 1903/004/0048 (FELIX coll.), original material of FELIX (1903a, p. 229, Pl. 19, Fig. 7); upper surface of colony; Upper Santonian (Gosau Group at Scharrergraben), Austria; scale bar: 6 mm.

Figs. 4–7: *Baryhelia fuchsi* (FELIX, 1903a)

Syntype, NHMW 1886/018/0064; Upper Santonian (Gosau Group at Neffgraben), Austria.

Fig. 4: upper surface of colony; scale bar: 7 mm.

Figs. 5, 6: close-up pictures of Fig. 7; Fig. 5: scale bar: 7 mm; Fig. 6: scale bar: 5 mm.

Fig. 7: upper surface of colony, polished, cross and oblique views; scale bar: 8 mm.

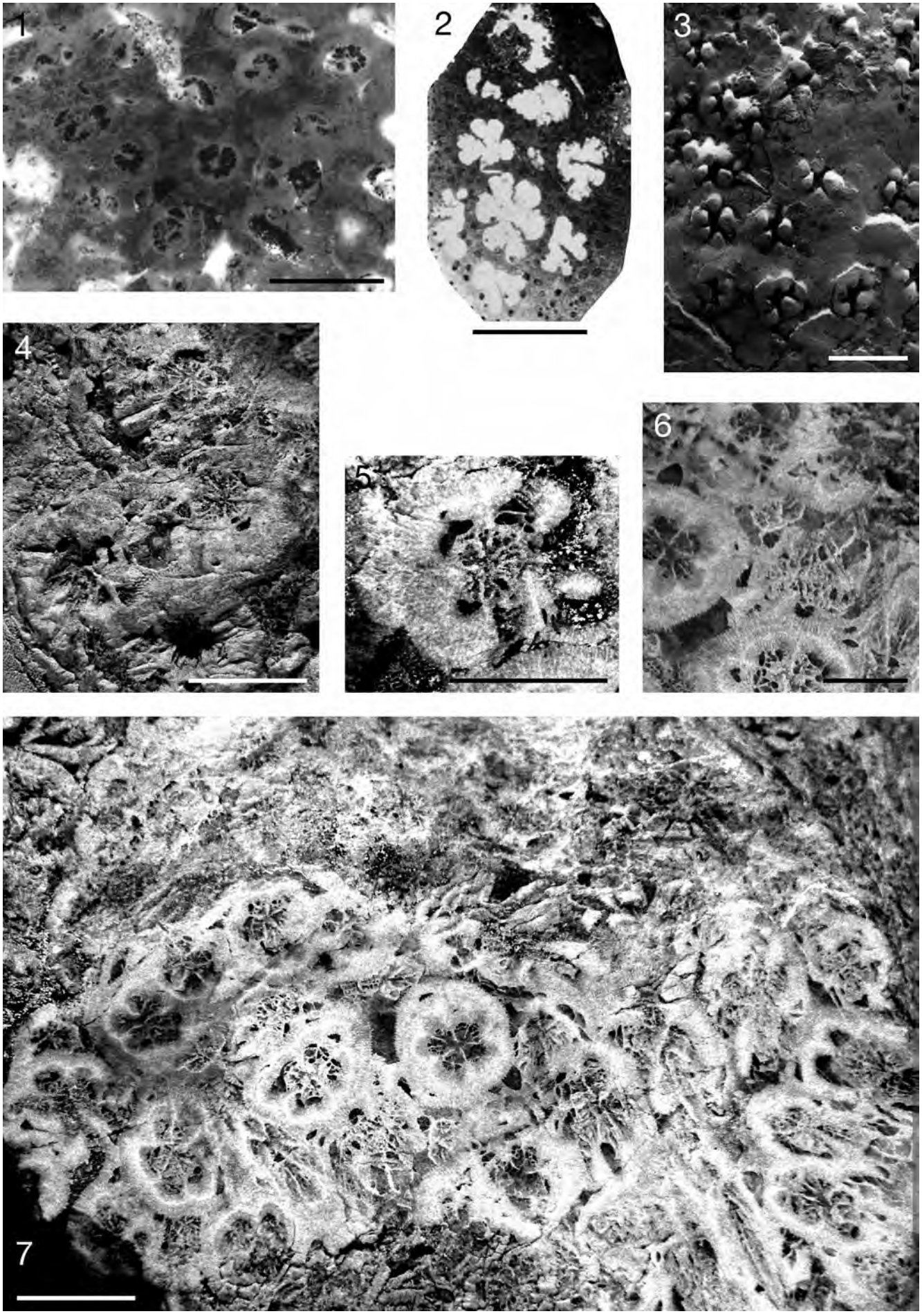
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Plate 88

Figs. 1, 2: *Baryhelia grandis* (REUSS, 1854)

GBA 1854/007/0037 (REUSS coll.); Santonian (Gosau Group at Wegscheidgraben-Stöckelwaldgraben area [near Gosau town]), Austria.

Fig. 1: close-up of Fig. 2; scale bar: 6.5 mm.

Fig. 2: upper surface of colony, partially polished; scale bar: 14 mm.

Figs. 3–6: *Baryhelia stachei* (FELIX, 1903a)

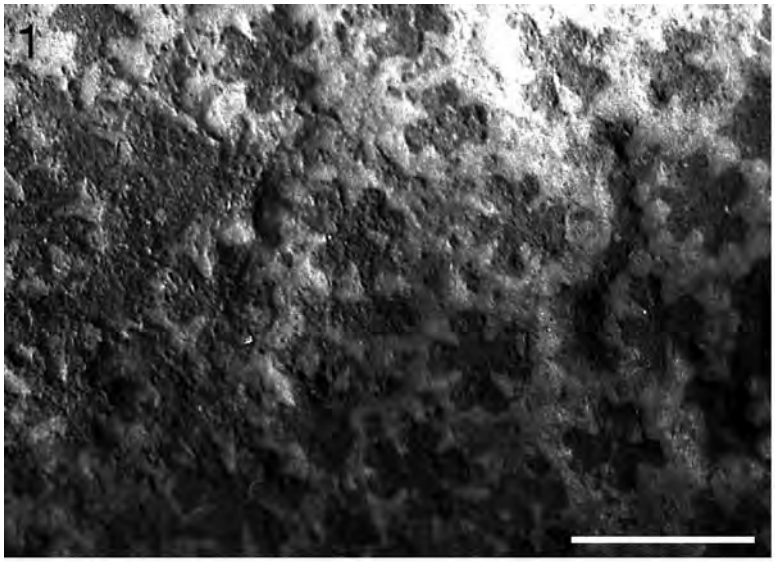
Paralectotype (designated by M. BEAUVAIS, 1982), GBA 1903/004/0050/02 (FELIX coll.); Turonian–Campanian (Gosau Group at greater Rußbach-Gosau area), Austria.

Fig. 3: close-up of Fig. 5; scale bar: 5 mm.

Fig. 4: polished surface, lateral view, oblique; scale bar: 5.5 mm.

Fig. 5: polished surface, cross view; scale bar: 18 mm.

Fig. 6: upper surface of colony; scale bar: 19 mm.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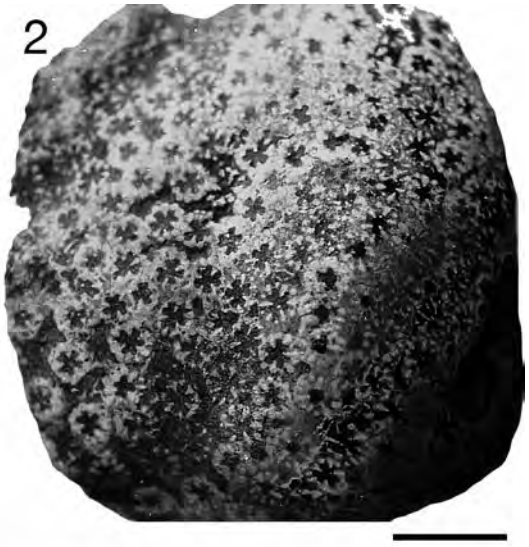
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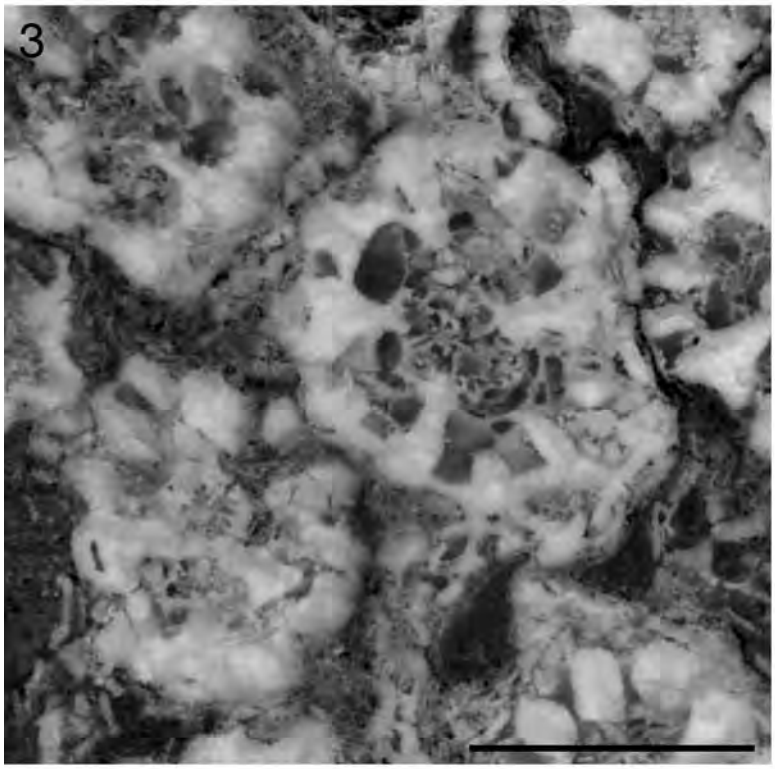
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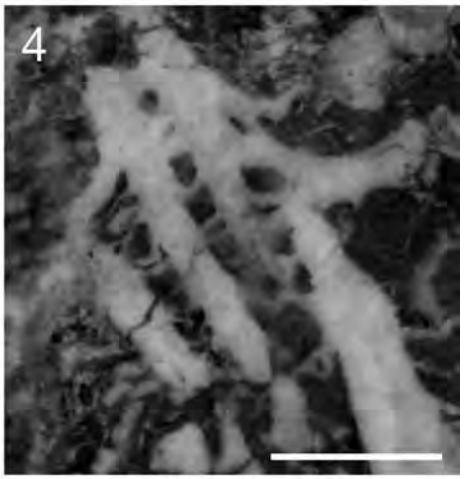
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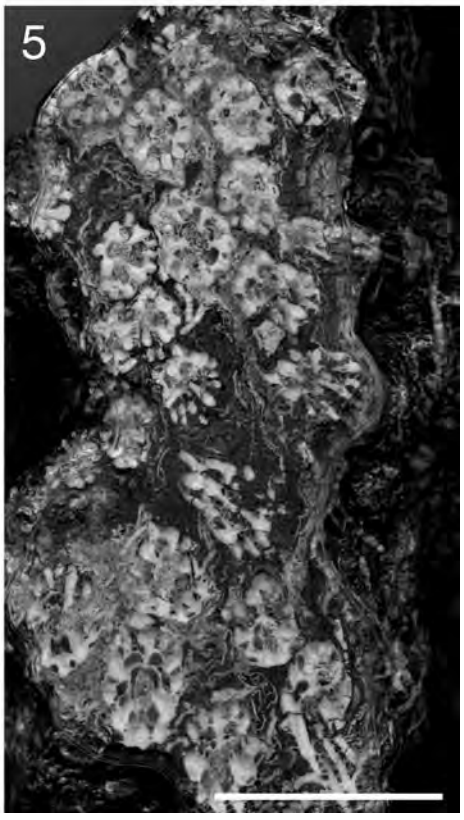
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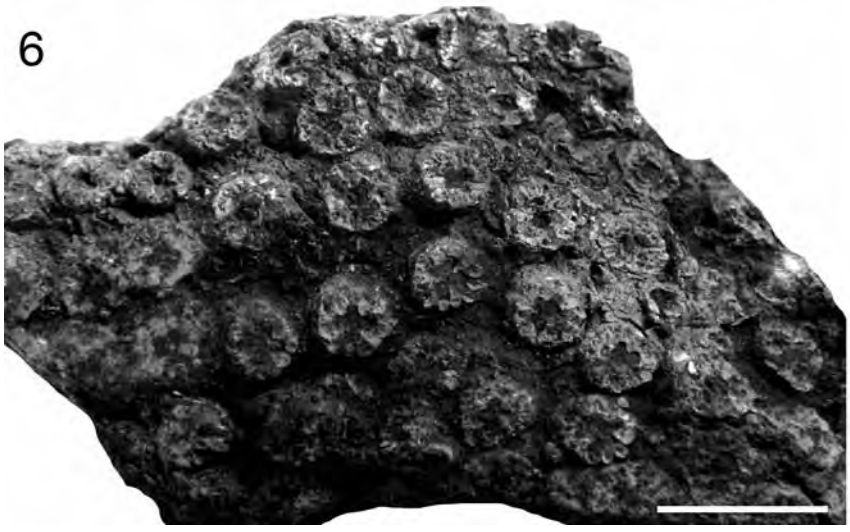
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