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Scleractinian corals from the upper Aptian–Albian of the Garschella Formation of central Europe (western Austria; eastern Switzerland): The Albian

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2 Text-Figures, 2 Tables, 2 Plates

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Albian
western Austria
eastern Switzerland
Garschella Formation
Taxonomy
Scleractinia

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Abstract

For the first time, scleractinian corals are taxonomically described from Albian sediments of the Garschella Formation (lower Aptian–lower Cenomanian) of western Austria (Vorarlberg) and eastern Switzerland (Canton of Appenzell). Fifteen species belonging to eleven genera from seven families were determined: *Calamophylliopsis compressa* (d'Orbigny), *C.* cf. *cervina* (Étallon), *Cladocora* cf. *brevis* Seguenza, *Podoseris elongata* Duncan, *P. mammiliformis* Duncan, *P.* sp., *Synhelia gibbosa* (Münster, in Goldfuss), *Enallhelia* cf. *tubulosa* Becker, *Enallhelia* sp., *Caryophyllia koninckі* (Milne Edwards & Haime), *Stylocyathus* cf. *dentalinus* d'Orbigny, *Trochocyathus antsiranensis* Collignon, *Bathycyathus laevigatus* (Milne Edwards & Haime), *Fungiastraea cotteaui* (De Fromentel), and *Stephanophyllia plattenwaldensis* n. sp. The coral fauna of the Garschella Formation is composed nearly equally of solitary (eight species belonging to six genera) and colonial forms (seven species belonging to five genera). With regard to the colonial corals, with the exception of one thamnasterioid (-submeandroid) species, only branching forms were found. Among the solitary corals cupolate, patellate, and conical growth types were present.

Scleractine Korallen aus dem unteren Aptium–Albium der Garschella-Formation in Mitteleuropa (Westösterreich; östliche Schweiz): Das Albium

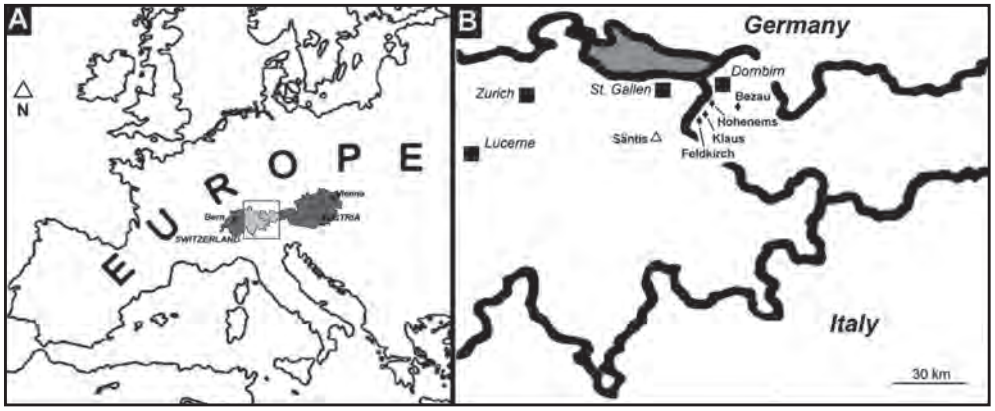
Zusammenfassung

Aus den Sedimenten des Albiums der Garschella-Formation (unteres Aptium bis unteres Cenomanium) in Westösterreich (Vorarlberg) und der östlichen Schweiz (Kanton Appenzell) werden erstmalig scleractine Korallen taxonomisch beschrieben. Insgesamt wurden fünfzehn Arten aus elf Gattungen und sieben Familien festgestellt: *Calamophylliopsis compressa* (d'Orbigny), *C.* cf. *cervina* (Étallon), *Cladocora* cf. *brevis* Seguenza, *Podoseris elongata* Duncan, *P. mammiliformis* Duncan, *P.* sp., *Synhelia gibbosa* (Münster, in Goldfuss), *Enallhelia* cf. tubulosa Becker, *Enallhelia* sp., *Caryophyllia koninckі* (Milne Edwards & Haime), *Stylocyathus* cf. *dentalinus* d'Orbigny, *Trochocyathus antsiranensis* Collignon, *Bathycyathus laevigatus* (Milne Edwards & Haime), *Fungiastraea cotteaui* (De Fromentel) und *Stephanophyllia plattenwaldensis* n. sp. Die Korallenfauna der Garschella-Formation setzt sich fast gleichmäßig aus solitären (acht Arten aus sechs Gattungen) und kolonialen Formen (sieben Arten aus fünf Gattungen) zusammen. Unter den kolonialen Korallen finden sich bis auf eine thamnasterioide (-submäandroide) Art nur ästige Formen. Bei den Einzelkorallen finden sich cupolate, patellate und konische Wuchsformen.

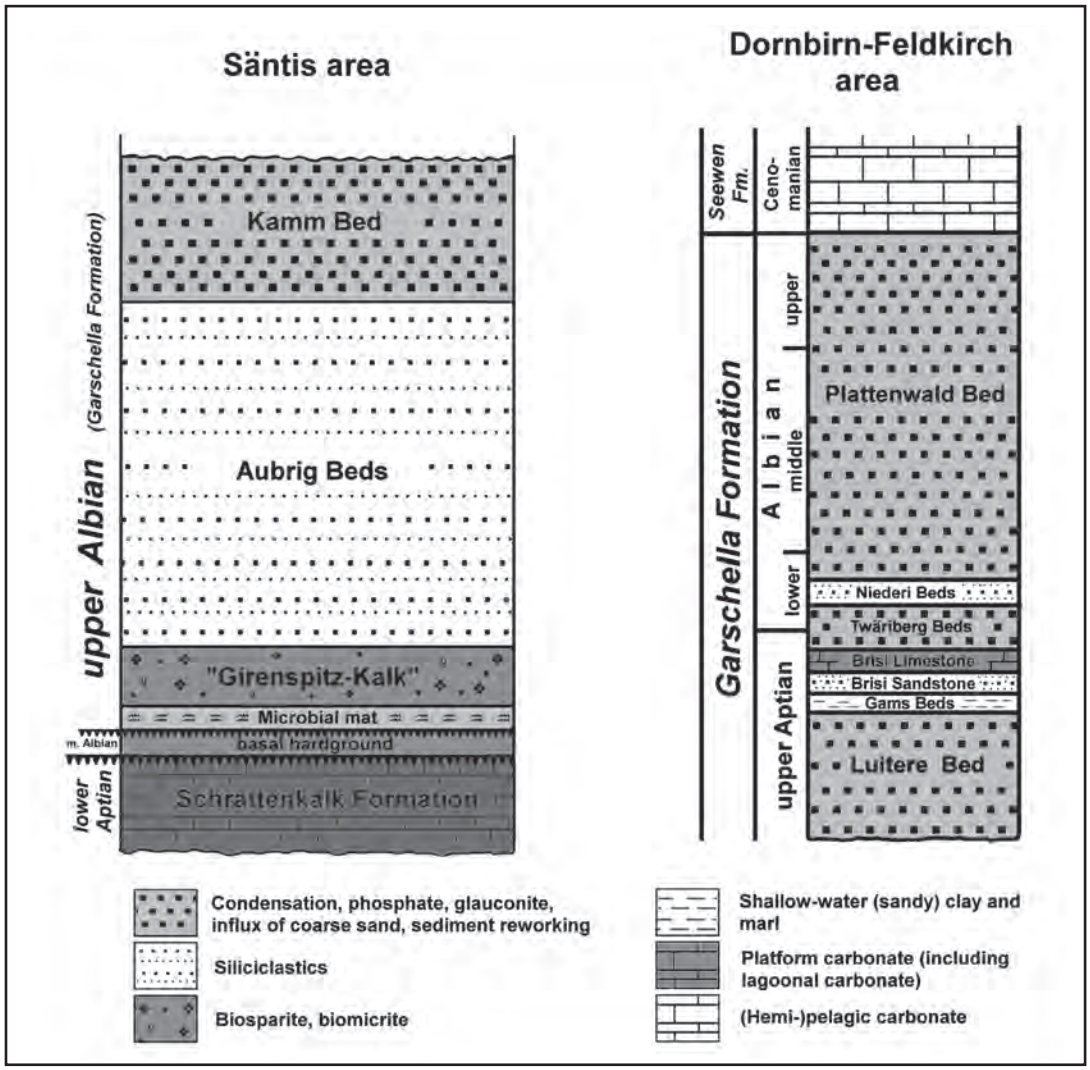
Introduction

Scleractinian corals from the Albian have been reported from various localities worldwide. They have been described from western Europe (Duncan, 1869; Baron-Szabo et al., 2010), southern Europe (Alloiteau, 1948; Baron-Szabo, 1993; Baron-Szabo & Fernández-Mendiola, 1997; Morycowa & Marcopoulou-Diacantoni, 2002; Löser, 2013; Löser et al., 2013), eastern Europe (Sikharulidze, 1979), North Africa (Abdel-Gawad & Gameil, 1995), North and Central America (Wells, 1933; Reyeros de Castillo, 1983; Baron-Szabo & González-León, 1999, 2003; Turnšek et al., 2003), South America (Wells, 1944), South Asia (Stoliczka, 1873; Baron-Szabo et al., 2003; Pandey et al., 2007), East Asia (Eguchi, 1951; Liao & Xia, 1994), Central Asia (Kuzmicheva, 1972), and Australasia (Squires, 1958).

Albian corals from central Europe, however, were only mentioned in a very small number of works: Bechon et al. (1984) listed from the Swiss Cantons of Valais (southern Switzerland) and Vaud (western Switzerland) the solitary coral species *Trochocyathus conulus* (Phillips), and mentioned the solitary coral *Trochosmilia lorioli* Koby from the Swiss Canton of Valais (southern Switzerland). Recently, Bolliger (2015) illustrated from eastern Switzerland (Canton of St. Gallen) one solitary coral ("Einzelkoralle"), one colonial



Text-Fig. 1.
A: Map showing the general location of the study area. B: Map marking the localities in eastern Switzerland and western Austria, from which the material of the Garschella Formation was collected. *Locations in Vorarlberg*: The greater Dornbirn area includes Gütle-Beckenmann, Kraftwerk Ebensand, and Weißenfluhalpe; the greater Hohenems area includes Schuttannen and Strahlkopf; the greater Klaus area includes Plattenwald and Sattelberg (see text for further details).



Text-Fig. 2.
Schematic lithostratigraphic sections including the sediments of the Garschella Formation in the Säntis area in eastern Switzerland (modified from BOLLIGER, 2015) and the Dornbirn–Feldkirch area (modified from FÖLLMI et al., 2007). In the Säntis area, corals were collected from strata of the *inflatum* zone (lowermost upper Albian). In the Dornbirn–Feldkirch area, corals were collected from the Luitere (upper Aptian) and the Plattenwald Bed (Albian).

coral ("Korallenstock"), and a rock sample containing coral fragments. Information about scleractinian corals from Albian sediments of the Garschella Formation of Austria was only given in two publications: HEIM et al. (1934) mentioned the occurrence of an unspecific turbinoliid ("Turbinolide") solitary coral from various localities in the greater Dornbirn area in Vorarlberg and, most recently, the first more detailed taxonomic information was given by BARON-SZABO (2014), presenting one solitary and two colonial corals from the Albian of the Austrian Garschella Formation.

The purpose of this paper is to taxonomically describe for the first time the Albian coral fauna of the Garschella Formation of western Austria and eastern Switzerland, and provide a revision of the previously recorded corals of the Garschella Formation (Text-Figs. 1, 2, Tab. 1).

Material

In the current paper, 64 corals of the Albian sediments of the Garschella Formation from western Austria and eastern Switzerland were identified by examining the corallum surface, and using polished surfaces. The majority of the corals is present in mould or 'steinkern' preservation. The size of the specimens ranges between a few millimetres to several centimetres. Microstructural features are not preserved.

The corals of the Garschella Formation from western Austria were (most likely all) collected during the first part of the 20th century by the museum's founder Siegfried Fussenegger (1894–1966) who was a manufacturer's son and amateur paleontologist (FRIEBE, 1999). An informal determination of the material was carried out by the late Prof. Erik Flügel (1934–2004; University of Erlangen, Germany; formerly associated with the Natural History Museum of Vienna, Austria). The first illustrations of three of the corals from the Albian (Garschella Formation, Plattenwald Bed) of the Austrian state of Vorarlberg were presented by BARON-SZABO (2014). The Vorarlberg specimens illustrated in the current work are housed in the collections of the "*Inatura*" Museum, Dornbirn, Vorarlberg, Austria (inventory acronym **VNS**).

The corals of the Garschella Formation from eastern Switzerland and one specimen from the upper Aptian of the Garschella Formation of western Austria were collected fairly recently by various Swiss colleagues (Bolliger, Föllmi, Furrer, and Tschanz) and are housed at the following institutions: Paleontological Institute and Museum of the University of Zurich (inventory acronym **PIMUZ**) and the Natural Museum St. Gallen (inventory acronym **NMSG**).

Corals of the Garschella Formation Species [general type of corallite integration]		Geographical and stratigraphical distribution (excluding Albian occurrence of Garschella Formation)
western Austria	eastern Switzerland	
Calamophylliopsis compressa (D'ORBIGNY) [phaceloid]		Valanginian of Ukraine, lower Hauterivian of France, Hauterivian of Turkmenistan, Aptian of Switzerland, Aptian–lower Albian of Spain, Albian of Georgia (in Caucasus)
	Calamophylliopsis cf. *cervina* (ÉTALLON) [phaceloid]	Oxfordian of France and Switzerland, upper Oxfordian–lower Kimmeridgian of Portugal, upper Oxfordian–Kimmeridgian of Slovenia, upper Oxfordian–Tithonian of Poland, lower Tithonian of Germany, upper Tithonian of the Czech Republic, lower Aptian–lower Cenomanian (possibly from the upper Albian "Girenspitz-Kalk") of eastern Switzerland
	Cladocora cf. *brevis* SEGUENZA [phaceloid-dendroid]	Cenomanian of Italy
Podoseris elongata DUNCAN [solitary]		Middle to upper Albian of England
Podoseris mammiliformis DUNCAN [solitary]		Middle to upper Albian of England, Campanian–Maastrichtian of eastern Switzerland (this paper)
Podoseris sp. [solitary]		——
Synhelia gibbosa (MÜNSTER) [dendroid]		Cenomanian–Turonian of the Czech Republic and Germany, Turonian of England and Ukraine
Enallhelia cf. *tubulosa* BECKER [dendroid-sympodial]		Kimmeridgian of Portugal, lower Tithonian of Germany, Tithonian of Poland, upper Tithonian of the Czech Republic, upper Hauterivian–lower Barremian of Switzerland
Enallhelia sp. [dendroid-sympodial]		——
	Caryophyllia konincki (MILNE EDWARDS & HAIME) [solitary]	Senonian of England, upper Campanian of Bulgaria, Germany, Maastrichtian of Belgium, Senegal, the Netherlands, Libya, India, ?Germany, upper Maastrichtian of USA, Campanian-Danian of Pakistan, Paleocene of Egypt, Ukraine, Danian of Denmark, upper Danian of Poland, Turkmenistan
	Stylocyathus cf. *dentalinus* D'ORBIGNY [solitary]	Cenomanian of France
Trochocyathus antsiranensis COLLIGNON [solitary]		Cenomanian of Madagascar
Bathycyathus laevigatus (MILNE EDWARDS & HAIME) [solitary]		Turonian of Ukraine, Senonian of England
Fungiastraea cotteaui (DE FROMENTEL) [thamnasterioid (to submeandroid)]		Hauterivian of Ukraine, lower Aptian of eastern Serbia, upper Cenomanian of Germany
Stephanophyllia plattenwaldensis n. sp. [solitary]		Upper Aptian of western Austria (Vorarlberg; Garschella Fm.)

Tab. 1.
Corals of the Garschella Formation of western Austria (Vorarlberg) and eastern Switzerland (Canton of Appenzell) and their stratigraphical-geographical distributions.

Lithology and occurrence of the Garschella Formation

The Garschella Formation commonly overlies the Schrattenkalk Formation (Barremian–lower Aptian), starting with a hardground and/or phosphoritic crust (FÖLLMI & OUWEHAND, 1987; Text-Fig. 2). The Garschella Formation (lower Aptian–lower Cenomanian) covers the entire Helvetic shelf, including inner shelf, shelf margin, and slope (FÖLLMI & OUWEHAND, 1987; LINDER et al., 2006; FÖLLMI et al., 2007). 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.

In western Austria (Vorarlberg), coral-bearing sediments of the Garschella Formation are predominantly represented by the Albian Plattenwald Bed (FÖLLMI & OUWEHAND, 1987; FÖLLMI et al., 2007) (Text-Fig. 2). In the southwestern part of Vorarlberg (Feldkirch area), upper Aptian sediments (Luitere Bed) containing corals are found (FÖLLMI, 1986; FÖLLMI et al., 2007). Fossils are abundant in both the Luitere and Plattenwald Bed. In addition to scleractinian corals, ammonites, bivalves, gastropods, nautiloids, echinoids, brachiopods, sponges, fish remains, and others fossils have been reported (e.g., HEIM et al., 1934; FÖLLMI, 1986; SULSER & FRIEBE, 2002; FÖLLMI & OUWEHAND, 1987; BOLLIGER, 2015).

In eastern Switzerland, coral-bearing Albian sediments of the Garschella Formation have been found in the Säntis

Species \ Epoch/Age	Upper Jurassic	Berriasian	Valanginian	Hauterivian	Barremian	Aptian	Albian	Cenomanian	Turonian	Coniacian	Santonian	Campanian	Maastrichtian	Paleocene
Calamophylliopsis compressa (D'ORBIGNY)			———			———								
Calamophylliopsis cf. *cervina* (ÉTALLON)	———					———								
Cladocora cf. *brevis* SEGUENZA							———							
Podoseris elongata DUNCAN							——							
Podoseris mammiliformis DUNCAN							——					———		
Podoseris sp.							——							
Synhelia gibbosa (MÜNSTER)							———							
Enallhelia cf. *tubulosa* BECKER	———			—			——							
Enallhelia sp.							——							
Caryophyllia konincki (MILNE EDWARDS & HAIME)							——				———			———
Stylocyathus cf. *dentalinus* D'ORBIGNY							———							
Trochocyathus antsiranensis COLLIGNON							———							
Bathycyathus laevigatus (MILNE EDWARDS & HAIME)							——		——		———			
Fungiastraea cotteaui (DE FROMENTEL)				—		–	——		–					
Stephanophyllia plattenwaldensis n. sp.						———								

Tab. 2.
Stratigraphical distributions of the corals of the Garschella Formation of western Austria (Vorarlberg) and eastern Switzerland (Canton of Appenzell).

area (Alpstein, Appenzell Alps; Text-Figs. 1, 2). Solitary and colonial scleractinians were collected from the so-called "Girenspitz-Kalk" (sensu BOLLIGER, 2015). The "Girenspitz-Kalk" represents isolated biosparitic-biomicritic lenses, containing phosphoritic peloids. In addition to scleractinian corals, a large number of fossils have been reported, including orbitolinids, sponges, bivalves, gastropods, echinoids, crustaceans, belemnites, serpulids, ammonites, nautiloids, and fish remains. These sediments also contain the ammonitid *Hysteroceras* cf. *varicosum*, indicating an upper Albian (*inflatum* zone) age for the "Girenspitz-Kalk" (BOLLIGER, 2015: 344–345, Tab. 2).

Albian scleractinian corals of western Austria and eastern Switzerland

Among the corals examined, fifteen species belonging to eleven genera from seven families were determined (Tab. 1). However, considering that over 30 % of coral fragments could not be taxonomically identified due to insufficient preservation but seemed to differ from the determined taxa (based on corallite integration and other skeletal elements), it is suggested that the actual taxonomic diversity of the Albian fauna is much higher. Noteworthy is the presence of patellate solitary forms, none of which, however, was preserved sufficiently enough to carry out a taxonomic determination.

The coral fauna of the Garschella Formation presented in the current work nearly evenly consists of solitary (eight species belonging to six genera) and colonial species (seven species belonging to five genera). In addition to the unidentified solitary patellate corals, the Garschella fauna is represented by cupolate (*Podoseris elongata*, *P.* sp., *P. mammiliformis*, and *Stephanophyllia plattenwaldensis* n. sp.) and conical forms (*Caryophyllia konincki*, *Stylocyathus* cf. *dentalinus*, *Trochocyathus antsiranensis*, and *Bathycyathus laevigatus*). With regard to the colonial corals, with the exception of one thamnasterioid (-submeandroid) species (*Fungiastraea cotteaui*), only branching forms were found (*Calamophylliopsis compressa, C.* cf. *cervina, Cladocora* cf. *brevis, Synhelia gibbosa, Enallhelia* cf. *tubulosa, Enallhelia* sp.).

The Garschella corals show affinities to corals that have only been reported from the Cretaceous period with the exception of three species (*Calamophylliopsis* cf. *cervina, Enallhelia* cf. *tubulosa*: both already occurred in the Upper Jurassic; and *Caryophyllia konincki*: has its latest occurrence in the Paleocene) (Tab. 2). Furthermore, 40 % (six out of the 15 species) of the Garschella corals were formerly known from strata younger than the Albian: *Cladocora* cf. *brevis, Synhelia gibbosa, Caryophyllia konincki*, *Stylocyathus* cf. *dentalinus*, *Trochocyathus antsiranensis*, and *Bathycyathus laevigatus*.

The scleractinian corals of the Albian sediments of the Garschella Formation were collected from the following localities:

Western Austria (State of Vorarlberg) *(Text-Fig. 1):*

Bezau: located about 15 km southeast of Dornbirn.

Gütle-Beckenmann: located in the outskirts of Dornbirn, about 4 km southeast of the city center of Dornbirn.

Hohenems: located about 5 km southwest of Dornbirn.

Kraftwerk Ebensand: located in the outskirts of Dornbirn, about 2.5 km southeast of the city center of Dornbirn.

Plattenwald: located in the outskirts of Klaus, about 0.4 km northwest of the city center of Klaus (= located about 20 km southwest of Dornbirn).

Sattelberg: located in the outskirts of Klaus, about 0.3 km west of the city center of Klaus (= located about 20 km southwest of Dornbirn).

Schuttannen: located in the outskirts of Hohenems, about 2 km east of the city center of Hohenems.

Strahlkopf: mountain peak in the Hohenems area, located about 3 km northeast of the city center of Hohenems.

Weißenfluhalpe: located in the outskirts of Dornbirn, about 6 km southeast of the city center of Dornbirn and about 10 km northeast of the city center of Hohenems.

Eastern Switzerland (Canton of Appenzell) *(Text-Fig. 1):*

Girenspitz: mountain peak at the northern flank of Säntis (see there).

Säntis (= mountain of the Appenzell Alps; Canton of Appenzell [-Innerrohden]): located about 18 km south of St. Gallen.

Systematic Paleontology

Order Scleractinia Bourne, 1900

Suborder Faviina Vaughan & Wells, 1943

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

Family Dermosmiliidae Koby, 1887

(= Felixaraeidae M. Beauvais, 1982)

Genus *Calamophylliopsis* Alloiteau, 1952a

Type species: *Calamophyllia flabellata* De Fromentel, 1861, Upper Jurassic (Oxfordian) of France.

Diagnosis: Colonial, phaceloid to dendroid. Budding intracalicular-polystomodaeal. Extracalicular 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 perithecal dissepiments may be present between epitheca *s.l.* and septotheca. Wall septothecal, septoparathecal, and synapticulothecal, tending to be solid secondarily and thickened. Epithecal *s.l.* developments present or absent.

Calamophylliopsis compressa (d'Orbigny, 1850)

Pl. 1, Fig. A

*1850 *Calamophyllia compressa*, d'Orb., 1849; d'Orbigny: 91 (vol. 2).

1857 *Calamophyllia compressa*; De Fromentel: 25, Pl. 2, Fig. 5.

1873 *Calamophyllia compressa*; De Fromentel 398, Pl. 75, Fig. 1.

1897 *Calamophyllia compressa*, d'Orbigny; Koby: 39, Pl. 9, Figs. 2–4.

1966 *Calamophyllia compressa,* d'Orb.; Kuzmicheva: 60.

1979 *Calamophylliopsis compressa* (d'Orbigny, 1850); Sikharulidze: 32–33, Pl. 20, Figs. 1a–b.

v1993 *Calamophylliopsis compressa* (d'Orbigny, 1850); Baron-Szabo: 164, Pl. 6, Fig. 4.

1997 *Calamophylliopsis compressa* (d'Orbigny, 1850); Bugrova: 33, Pl. 9, Figs. 2a–b.

v2014 *Calamophylliopsis compressa* (d'Orbigny, 1850); Baron-Szabo: 37, Text–Fig. 8.

Dimensions of skeletal elements: Diameter of corallite: 7 mm; number of septa: 60.

Description: Colony fragment. Costosepta are developed in five incomplete cycles, subequal in thickness, and regularly alternate in length. About 15 septa reach corallite center. Axial edges of septa fuse with small columella.

Distribution: Valanginian of Ukraine, lower Hauterivian of France (Yonne), Hauterivian of Turkmenistan, Aptian of Switzerland, Aptian–lower Albian of northern Spain, Albian of Georgia (in Caucasus) and western Austria (Garschella Formation).

Material: VNS–P.24701 (Plattenwald).

Remarks: According to De Fromentel (1857, 1873), the species *C. compressa* is characterized by corallite diameters of 5–7 mm and septa mainly numbering between 60 and 70 in monocentric corallites.

Calamophylliopsis cf. *cervina* (Étallon, 1864)

Pl. 1, Figs. B–C

*1864 *Rhabdophyllia cervina* Étallon in Thurmann & Étallon: 380, Pl. 54, Fig. 1.

v1997 *Calamophylliopsis cervina* (Étallon) 1864; Turnšek: 26, Figs. 28A–D (older synonyms cited therein).

2012 *Calamophylliopsis cervina* (Étallon, 1860); Morycowa: 22, Fig. 14B.

Dimensions of skeletal elements: Diameter of corallite: 5–8 (to around 10) mm; in areas of intense budding, the corallite diameter is around 4 mm; number of septa: 44 to around 50.

Description: Fragments of a branching colony. Costosepta are developed in four complete or incomplete cycles in six systems, alternating in length and thickness. About six septa reach corallite center. Axial edges of septa fuse with small columella.

Distribution: Oxfordian of France and Switzerland, upper Oxfordian–lower Kimmeridgian of Portugal, upper Oxfordian–Kimmeridgian of Slovenia, upper Oxfordian–Tithonian of Poland, lower Tithonian of Germany, upper Oxfordian–Tithonian of Poland, upper Tithonian of the Czech Republic (Štramberk), lower Aptian–lower Cenomanian (possibly from the upper Albian of "Girenspitz-Kalk") of eastern Switzerland (Garschella Formation, this paper).

Material: NMSG–SB-CE3a–1, –2 (BOLLIGER coll.) (["Girenspitz-Kalk"] Girenspitz, Säntis); PIMUZ–32195 (FURRER coll.) (Girenspitz area, Säntis).

Remarks: Because only fragments in oblique view are available, the exact corallite diameter cannot be determined. The material corresponds to specimens described from the upper Oxfordian–Kimmeridgian of Slovenia (TURNŠEK, 1997) and from the Tithonian of Poland (MORYCOWA, 2012).

Family Merulinidae VERRILL, 1865

Genus *Cladocora* EHRENBERG, 1834

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 extracalicular but also intracalicular (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 extensions 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 *s.l.* wall often thin or absent.

Cladocora cf. *brevis* SEGUENZA, 1882

Pl. 1, Fig. D

*1882 *Cladocora brevis* n. sp.; SEGUENZA: 197, Pl. 20, Fig. 13.

Dimensions of skeletal elements: Diameter of corallite: 2.5–4 mm; number of septa: 24 to around 40.

Description: Fragments of a branching colony. Corallites circular to slightly elliptical in outline. Costosepta are developed in 3–4 cycles in six systems, alternating in length and thickness. Paliform structures irregularly present in front of S1 and S2. Columella probably a pseudocolumella formed by trabecular extensions of axial septal ends.

Distribution*:* Upper Albian (["Girenspitz-Kalk"] at Girenspitz) of eastern Switzerland, Cenomanian of Italy (Palermo).

Material: NMSG–SB-CE3b1a, –b (BOLLIGER coll.) (["Girenspitz-Kalk"] Girenspitz, Säntis).

Remarks: According to SEGUENZA (1882: 197), the species *C. brevis* is characterized by corallite diameters generally ranging between 2–4 mm and "*3 complete cycles of septa*". SEGUENZA, however, did not provide any information regarding the type of systems in which the cycles are supposed to be developed. If it is assumed that SEGUENZA was referring to the very commonly found septal development in six systems, the species *C. brevis* would be characterized by 24 septa.

Suborder Fungiina VERRILL, 1865

Family Haplaraeidae VAUGHAN & WELLS, 1943

(= Astraraeidae M. BEAUVAIS, 1982)

Genus *Podoseris* DUNCAN, 1869,

emend. BARON-SZABO, 2013

Type species: *Podoseris mammiliformis* DUNCAN, 1869, middle to upper Albian of England (Hunstanton Cliff near Hunstanton, Norfolk).

Diagnosis: Solitary or colonial. Solitary forms cupolate, or 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 up to 40 mm). Budding intracalicular-marginal and extracalicular. 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); lateral ornamentations (conical to hook-like) and distal ones (rather regular teeth) are similar to the kinds seen in the genus *Haplaraea*. Endothecal dissepiments vesicular, thin, irregularly disposed. Columella parietal. Synapticulae present. Wall parasynapticulothecal, porous. Septothecal thickenings present or absent.

Podoseris elongata DUNCAN, 1869

Pl. 1, Figs. F, M–P

v*1869 *Podoseris elongata,* DUNCAN: 26, Pl. 9, Figs. 16–17.

v1885 *Rhizangia elongata,* DUNC. sp.; TOMES: 550, Pl. 14, Figs. 10–11.

v1889 *Podoseris elongata,* DUNCAN: 26, Pl. 5, Figs. 14–16.

v1889 *Podoseris jessoni,* sp. nov.; DUNCAN: 27, Pl. 5, Figs. 5–6.

v1934 *Turbinolide*; HEIM et al.: 203, 205, 209, 221.

v2013 *Podoseris elongata* DUNCAN, 1869; BARON-SZABO: 99, Pl. 1, Fig. 6, Pl. 2, Fig. 2.

v2014 *Podoseris elongata* DUNCAN, 1869; BARON-SZABO: 57, Pl. 63, Figs. 1–2.

Dimensions of skeletal elements: Diameter of corallites: up to 12 mm; number of septa: 40–48+s5.

Description: Steinkerns of cupolate coralla, generally circular in outline. In coralla of around 12 mm in diameter, septa arranged in four complete and some of the beginning 5th cycle in six irregular systems (in a corallite with a diameter of 9 mm, usually 50–60 septa are present).

Distribution: Middle to upper Albian of England, Albian (Garschella Formation) of western Austria.

Material: VNS–P.5297; –P.5313; –P.13506; –P.13507; –P.13603; –P.13607; –P.14532; –P.14533; –P.14534; –P.14536; –P.17298 (Bezau at Bregenz Forest); –P.9775; –P.12604; –P.12606; –P.12607; –P.12608; –P.12609; –P.12612; –P.12616 (Kraftwerk Ebensand); –P.9741 (Strahlkopf); –P.9706 (Gütle-Beckenmann); –P.24351 (Sattelberg); –P.23777; –P.24580; –P.24775 (Plattenwald); –P.16270; –P.16276; –P.16293 (Schuttannen).

Remarks: Recent studies carried out on type and original material of *P. elongata* by BARON-SZABO (2013: 99) showed that in corallites with diameters of up to 13 mm, there are septa arranged in four complete and some of the beginning 5th cycle in six irregular systems (= in a corallite with a diameter of 9 mm, usually 50–60 septa are present; in corallites ranging between 11.5 and 13 mm in diameter there are around 80 septa in six irregular systems).

Podoseris mammiliformis DUNCAN, 1869

Pl. 1, Figs. E, L

v*1869 *Podoseris mammiliformis,* DUNCAN: 25, Pl. 9, Figs. 2–15.

v1885 *Rhizangia mammiliformis,* DUNC. sp.; TOMES: 550, Pl. 14, Figs. 7–9.

1889 *Podoseris affinis,* sp. nov.; DUNCAN: 26, Pl. 5, Figs. 1–2 [topotypes studied].

v1889 *Podoseris anomala,* sp. nov.; DUNCAN: 27, Pl. 5, Figs. 3–4.

1889 *Podoseris brevis,* sp. nov.; DUNCAN: 28, Pl. 5, Figs. 7–8 [topotypes studied].

v1889 *Podoseris mammiliformis,* DUNC.; DUNCAN: 28–31, Pl. 5, Fig. 9.

1889 *Podoseris dubia* sp. nov.; DUNCAN: 28, Pl. 5, Figs. 12–13 [topotypes studied].

v1934 *Turbinolide*; HEIM et al.: 221.

v2002 *Podoseris mammiliformis* DUNCAN, 1869; BARON-SZABO: 105, Pl. 73, Fig. 4.

v2012 *Podoseris mammiliformis* DUNCAN, 1869; LÖSER: 8, Pl. 1, Figs. 1–6.

v2013 *Podoseris mammiliformis* DUNCAN, 1869; BARON-SZABO: 99, Pl. 1, Figs. 5, 7–8, Pl. 2, Figs. 1, 3–6.

v2015 "Einzelkoralle"; BOLLIGER: 347, Fig. 13.

Dimensions of skeletal elements: Diameter of corallites: 5.5–8 mm; height of corallites: 2–7 mm; number of septa: 40–96+s6.

Description: Steinkerns of cupolate coralla, generally circular in outline. In coralla of around 6 mm in diameter, septa arranged in four complete cycles in six irregular systems (= 48 septa).

Distribution: Middle to Upper Albian of England, Albian (Garschella Formation) of western Austria, upper Albian of eastern Switzerland ("Girenspitz-Kalk"), Campanian–Maastrichtian of eastern Switzerland (Schörgisknorren ["Schörgisknorren-Bank"] at Oberriet [referring to specimen NMSG–7B.34.33, KÜRSTEINER coll.]; this paper).

Material: VNS–P.5300 (Weißenfluhalpe); –P.13604; –P.13606; –P.17299 (Bezau at Bregenz Forest); –P.10296; –P.10298; –P.23852; –P.23939 (Plattenwald); –P.12605; –P.12611 (Kraftwerk Ebensand); –P.24442; –P.24830 (Sattelberg); –P.14413 (Hohenems); NMSG–SB-DIV9 (BOLLIGER coll.) (Säntis).

Remarks: Recent studies carried out on type and original material of *P. mammiliformis* by BARON-SZABO (2013: 99) showed that in corallites with diameters of 5–7 mm, there are usually four complete cycles of septa in six irregular systems (= 48 septa); in corallites with diameters of around 10 mm, there are around 80 septa; and in corallites that have a diameter of 12 mm and larger, there are at least five complete cycles of septa in six irregular systems (96 or 96+s6 septa). In some specimens, however, five complete cycles in six systems are already developed in a corallite diameter of around 8 mm. In such cases the number of septa does not or only very little increase any further even though the corallite diameter can increase.

Podoseris sp.

Pl. 1, Figs. G–H

Dimensions of skeletal elements: Diameter of corallite: around 19 mm; number of septa: around 60.

Description: Steinkern of cupolate solitary coral. Septa long, thin, and straight, subequal in thickness. They are developed in 4–5 size orders.

Distribution: Albian (Garschella Formation; this paper) of western Austria.

Material: VNS–P.24350 (Sattelberg).

Remarks: Because the material from western Austria is preserved as an incomplete "steinkern", the total range of the dimensions of its skeletal elements cannot be identified. However, based on the fact that the number of septa of around 60 occurring in a rather large corallite of at least 19 mm differs from the known species of the genus *Podoseris*, the current specimen might belong to a new species.

Family Siderastreidae Vaughan & Wells, 1943

Genus *Synhelia* Milne Edwards & Haime, 1849

Type species: *Lithodendron gibbosum*: Münster, in Goldfuss, 1829, Cenomanian of Germany (Bochum, North Rhine-Westphalia).

Diagnosis: Colonial, dendroid. Budding extracalicular. Corallites circular, elliptical, or polygonal in outline, slightly projecting. Peritheca granulated on the upper surface. Costosepta compact, confluent or subconfluent. Columella styliform, slightly compressed, or made of a small number of fused papillae. Endothecal dissepiments thin, sparse. Synapticulae present. Wall parasynapticulothecal.

Synhelia gibbosa (Münster, in Goldfuss, 1829)

Pl. 1, Figs. I–K

v*1829 *Lithodendron gibbosum*; Münster, in Goldfuss: 106, Pl. 27, Fig. 9.

1850 *Synhelia Sharpeana*; Milne Edwards & Haime: 53, Pl. 9, Figs. 3–3a.

v1887 *Synhelia gibbosa* Goldf. sp.; Počta: 50, Pl. 2, Fig. 12, Text-Fig. 27.

1987 *Synhelia sharpeana* Edwards & Haime, 1851; Kuzmicheva: 93, Pl. 10, Fig. 1.

v1992 *Synhelia gibbosa* (Goldfuss 1829); Eliášová: 409–410, Pl. 8, Figs. 1–5.

v1994 *Synhelia gibbosa* (Goldfuss 1829); Löser: 62–64, Pl. 9, Fig. 1, Text-Fig. 50 (older synonyms cited therein).

v1997 *Synhelia gibbosa* (Goldfuss 1827); Eliášová: 248ff., Text-Figs. 10.

v2002 *Synhelia gibbosa* (Goldfuss 1829); Baron-Szabo: 133, Pl. 93, Figs. 3–4.

Dimensions of skeletal elements: Diameter of corallites (including wall): 4.5–6.5 mm, (lumen) 3.5–5.5 mm; distance of corallite centers: 5–6.5 mm; number of septa: 20 up to around 30.

Description: Dendroid colony. Corallites are circular to polygonal in outline. Costosepta developed in 3–4 size orders in unclear symmetry.

Distribution: Albian of western Austria (this paper), Upper Albian of eastern Switzerland ("Girenspitz-Kalk"; this paper), Cenomanian–Turonian of the Czech Republic and Germany, Turonian of England (Dover, Kent) and Ukraine.

Material: VNS–P.24576 (Plattenwald); NMSG–SB-DIV 1 (Bolliger coll.) (Säntis).

Genus *Enallhelia* d'Orbigny, 1849

Type species: *Lithodendrum compressum* Münster, in Goldfuss, 1829, Upper Jurassic of southern Germany (Heidenheim area).

Diagnosis: Colonial, dendroid. Budding extracalicular-sympodial, lateral and more or less regularly alternating, branches covered by granulation of trabecular peritheca. Corallites cylindrical. Costosepta compact, with smooth distal edges. Axial edges of septa have auriculae. Lateral flanks of septa have acute granules. Pali and synapticulae absent. Columella styliform. Wall probably paraseptothecal. Peritheca well developed or not.

Enallhelia cf. *tubulosa* Becker, 1875

Pl. 2, Fig. A

v*1875 *Enallhelia tubulosa* Becker; Becker: 132–133, Pl. 36, Figs. 1a–c.

1904 *Enallohelia tubulosa,* Becker; Koby: 2–3, Pl. 1, Figs. 2–2a.

v1991 *Enallhelia tubulosa* Becker, 1875; Lauxmann: 131–132, Pl. 3, Fig. 2 (older synonyms cited therein).

1995 *Enallhelia* cf. *tubulosa* Becker, 1875; Nose: 119, Fig. 86.

2012 *Enallhelia tubulosa* Becker, 1875; Morycowa: 10–11, Figs. 3E–F.

Dimensions of skeletal elements: Diameter of corallite: 2–3 mm; number of septa: 16+s; width of branch: 4.5–7 mm.

Description: Dendroid-sympodial corallum, some parts of which are preserved as 'steinkern' while others are present as moulds. In some corallites that are preserved as 'steinkern', structures of a styliform columella can be seen. Septa appear to be arranged in 2–3 cycles in eight systems.

Distribution: Kimmeridgian of Portugal, lower Tithonian of Germany, Tithonian of Poland, upper Tithonian of the Czech Republic (Štramberk), upper Hauterivian–lower Barremian (Tierwis Formation, Altmann Member) of eastern Switzerland (Alpstein, Appenzell Alps, NMSG–AS-O-0009 [Tschanz coll.]; this paper), Albian of western Austria (this paper).

Material: VNS–P.25401 (Bezau at Bregenz Forest).

Enallhelia sp.

Description: Fragments and steinkerns showing dendroid-sympodial coralla, typical of the genus *Enallhelia*. Corallite diameters ranging between 3.5–4 mm; number of septa: 16 to around 20; width of branch: 4.5 to around 6 mm. Because of the insufficient preservation of the material, a specific determination cannot be made.

Distribution: Albian of western Austria (this paper).

Material: VNS–P.6686 (?and –P.24583) (Plattenwald).

Family Micrabaciidae Vaughan, 1905

Genus *Stephanophyllia* Michelin, 1841

Type species: *Fungia elegans* Bronn, 1838, Miocene of Italy (Milne Edwards & Haime, 1849).

Diagnosis: Solitary, cupolate with flat base. Corallum porous but sturdy. Costae have two rows of aligned granules; granules equal to or thicker than intercostal spaces. Septa of all cycles fuse with nearest ones of former cycle. Septa lamellar and perforate only near base. Marginal shelf narrow, developed regularly or irregularly, absent in some places. Synapticulae present. Pali absent. Columella solid and compact, lamellar or lenticular. Wall probably a marginotheca.

Stephanophyllia plattenwaldensis n. sp.

Pl. 2, Figs. B–C, F

v1986 *Trochocyathus* sp.; Föllmi: 372.

Holotypus: VNS–P.24623, designated here.

Derivatio nominis: Refers to the location from which the material was collected (Plattenwald, Vorarlberg, Austria).

Locus typicus: Plattenwald, Vorarlberg, Austria.

Stratum typicum: Garschella Formation, Plattenwald Bed, Albian.

Diagnosis: *Stephanophyllia* having 96 septa, half of which (48) occur in the central part of the corallum. Corallite diameter ranging between 13–18 mm, corallite height up to around 8 mm.

Description: Cupolate corallum, partially in "steinkern" preservation, irregularly circular to subpolygonal in outline. Marginal shelf narrow (usually less than 2 mm wide) occurs irregularly, absent in places. In peripheral areas, septa irregularly alternate in thickness (often ranging between 300–650 µm). Toward corallite center they become nearly equal in thickness and much thinner (generally ranging between 150–300 µm). About 20 septa reach axial part of corallite where their axial ends fuse with lamellar segments of the columella.

Dimensions of skeletal elements: Diameter of (complete?) corallite: 18 mm; height of corallum: 8 mm; number of septa: 96.

Comparison: In having a corallite diameter of 18 mm and 96 septa, the new species differs from both *S. indica* Duncan, 1880, which has only around half the number of septa (48 [?+s5]) in corallites ranging from 15–18 mm, and from *S. lanquinei* Alloiteau, 1936, which has 96 septa in a corallite of up to 11 mm in diameter. In both of the latter species, the number of septa occurring in the central part of the corallite is significantly less than half of the number occurring in the peripheral area of the corallum (around 12 septa in *S. indica* and around 30 in *S. lanquinei*).

Material: VNS–P.24623 (Plattenwald) (holotype); additional specimen (paratype): PIMUZ–32194 (Föllmi coll.) (Luitere Bed, Brisi Member, Feldkirch, Vorarlberg, Austria; see Text-Figs. 1 and 2).

Distribution: Upper Aptian (Garschella Formation at Ill Gorge, Margarethenkapf, Feldkirch) to Albian (Plattenwald Bed, Garschella Formation) of western Austria.

Remarks: From the upper Aptian of the Garschella Formation in the Feldkirch area (Ill Gorge at Margarethenkapf, Vorarlberg, Austria), an additional specimen (paratype) having a diameter of around 13 mm was collected that closely corresponds to the holotype of *S. plattenwaldensis* in having both the same corallite shape and septal developments.

Suborder Caryophylliina Vaughan & Wells, 1943
Family Caryophylliidae Dana, 1846

Genus *Caryophyllia* Lamarck, 1801

Type species: *Madrepora cyathus* Ellis & Solander, 1786, Recent, Mediterranean Sea.

Diagnosis: Solitary, turbinate or cylindrical, fixed or free. Costosepta laminar, compact. Septal margins smooth or nearly smooth. Pali opposite third cycle of septa or before 2nd group of septa where hexameral symmetry is lost. Columella formed by twisted trabecular segments. Endothecal dissepiments few in number or absent. Wall septothecal.

Caryophyllia koninckii (Milne Edwards & Haime, 1848)

Pl. 2, Fig. I

v*1848 *Cyathina Koninckii*; Milne Edwards & Haime: 290.

v1850 *Cyathina cylindrica*; Milne Edwards & Haime: 45.

v1850 *Cyathina Bredae*; Milne Edwards & Haime: 46.

1850 *Cyathina Debeyana*; Milne Edwards & Haime: 46.

v1863 *Caryophyllia decemplex*; De Fromentel: 168, Pl. 21, Figs. 2–2b.

1873 *Caryophyllia arcotensis* Stoliczka: 7, Pl. 1, Figs. 1–10 (non Forbes, 1846).

1880 *Caryophyllia compressa, Duncan*; Duncan: 17, Pl. 1, Figs. 1–4.

1880 *Caryophyllia Indica, Duncan*; Duncan: 17, Pl. 1, Figs. 5–7.

1880 *Caryophyllia Feddeni, Duncan*; Duncan: 18, Pl. 1, Figs. 8–10.

v1933 *Caryophyllia stephensoni* n. sp.; Wells: 124, Pl. 12, Figs. 6–7, Pl. 14, Figs. 15–18.

v1933 *Caryophyllia mississippiensis* n. sp.; Wells: 126, Pl. 14, Figs. 19–20.

1952b *Cylindrocyathus popenguinensis* nov. sp.; Alloiteau: 11, Pl. 1, Figs. 3–4.

1955 *Caryophyllia kongieli* n. sp.; Rozkowska: 251, Pl. 1, Figs. 1–2, Pl. 2, Fig. 4, Text-Figs. 7–8.

1970 *Caryophyllia aegyptiaca* sp. nov.; Hassan & Salama: 82, Pl. 2, Figs. 1a–c.

1970 *Caryophyllia phanerocosta* sp. nov.; Hassan & Salama: 83, Pl. 3, Figs. 3a–b, Text-Fig. 6.

1970 *Caryophyllia quadragenaria* var. *vigentipali* var. nov.; HASSAN & SALAMA: 84, Pl. 2, Figs. 4a–b.

1970 *Asterosmilia decapali* sp. nov.; HASSAN & SALAMA: 89, Pl. 3, Figs. 5a–c.

1972 *Caryophyllia andreasi* sp. n.; FLORIS: 40, Pl. 2, Figs. 1A–5.

1975 *Caryophyllia matesovae* sp. nov.; KUZMICHEVA: 23, Pl. 2, Figs. 8–9.

?1995 *Caryophyllia koninckі* (EDWARDS & HAIME, 1847); TCHÉCHMÉDJIÉVA: 55, Pl. 10, Fig. 10.

1995 *Caryophyllia cylindrica* (EDWARDS & HAIME, 1850); TCHÉCHMÉDJIÉVA: 56, Pl. 11, Fig. 7, Pl. 12, Fig. 1.

1995 *Caryophyllia debeyana* (EDWARDS & HAIME, 1850); TCHÉCHMÉDJIÉVA: 57, Pl. 12, Figs. 2–3.

1995 *Caryophyllia bredae* (EDWARDS & HAIME, 1850); TCHÉCHMÉDJIÉVA: 57, Pl. 12, Fig. 4.

1996 *Caryophyllia jasmundi* WANNER, 1902; SCHUSTER: 80.

v2002 *Caryophyllia decemplex* FROMENTEL, 1863; BARON-SZABO: 157, Pl. 117, Figs. 4, 7.

v2002 *Caryophyllia stephensoni* WELLS, 1933; BARON-SZABO: 157, Pl. 117, Figs. 5–6.

2005 *Caryophyllia danica*; BERNECKER & WEIDLICH: 16ff., Fig. 7A, Figs. 7 (2–3).

v2008 *Caryophyllia koninckі* (MILNE EDWARDS & HAIME, 1848); BARON-SZABO: 48–51, Text-Figs. 2A–I (older synonyms cited therein).

Dimensions of skeletal elements: Diameter of corallite: 5 mm; height of corallum: about 3 mm; number of septa: 24+s6.

Description: Solitary corallum, nearly circular in outline. Costosepta are developed in four incomplete cycles in six systems.

Distribution: Upper Albian of eastern Switzerland ("Girenspitz-Kalk"; this paper), Senonian of England (Northfleet), Upper Campanian of Bulgaria and Germany, Maastrichtian of Belgium (Ciply), the Netherlands, Libya (Sofeggin), India (Arrialoor Group), ?Germany, and Senegal, Upper Maastrichtian of the USA (Navarro Formation, Mustang River, Texas), Campanian–Maastrichtian (Ladakh) and Danian of Pakistan (Laki Range, Sind), Paleocene of Egypt and Ukraine, Danian of Denmark (Greenland and Faxe [formerly Fakse]), Upper Danian of Poland and Turkmenistan.

Material: NMSG–SB-DIV 7h (BOLLIGER coll.) (Säntis).

Remarks: For extensive discussion on the species *C. koninckі* including ontogenetical features see BARON-SZABO (2008: 48–51).

Genus *Stylocyathus* D'ORBIGNY, 1850

Type species: *Stylocyathus dentalinus* D'ORBIGNY, 1850, Cenomanian of France (Le Mans, Sarthe).

Diagnosis: Solitary corallum, turbinate or ceratoid-subtrochoid, fixed or free. Costosepta compact. Pali in one irregular crown opposite first two cycles. Columella trabecular, substyliform to lamellar, or formed by a small number of twisted to sublamellar laths. Endothecal dissepiments sparse. Wall septothecal.

Stylocyathus cf. *dentalinus* D'ORBIGNY, 1850

Pl. 2, Figs. K–L

v*1850 *Stylocyathus dentalinus* D'ORB., 1849; D'ORBIGNY: 181 (vol. 2).

1862 *Stylocyathus dentalinus*; DE FROMENTEL: Pl. 5, Figs. 3–3a.

1863 *Stylocyathus dentalinus*; DE FROMENTEL: 188.

1881 *Stylocyathus dentalinus*; QUENSTEDT: 930–931, Pl. 179, Figs. 43, 43X.

v2002 *Stylocyathus dentalinus* D'ORBIGNY, 1850; BARON-SZABO: 160, Text-Fig. 59.

Dimensions of skeletal elements: Diameter of corallites: 4–6.5 mm; height of corallum: up to around 5 mm; number of septa: 40–50.

Description: Solitary, turbinate, elliptical in outline. Costosepta developed in 4–5 irregular size orders. Columella made of a small number of sublamellar segments.

Distribution: Upper Albian of eastern Switzerland ("Girenspitz-Kalk"; this paper), Cenomanian of France (Le Mans, Sarthe).

Material: NMSG– SB-DIV 7b, –c; SB-DIV 8 (BOLLIGER coll.) (Säntis).

Remarks: For comparison, a sketch of the cross view of the holotype of *Stylocyathus dentalinus* D'ORBIGNY (Natural History Museum, Paris [MNHN], Mo3643) is provided on Plate 2, Figure J.

Genus *Trochocyathus* MILNE EDWARDS & HAIME, 1848

Type species: *Turbinolia mitrata* GOLDFUSS, 1826, Campanian of Germany (Aachen, Zevenwegen beds) (see MILNE EDWARDS & HAIME, 1848).

Diagnosis: Solitary, variably conical, often turbinate to ceratoid, or discoidal, fixed or free. Costosepta compact, finely granulated laterally. Pali or paliform lobes in two crowns opposite all but last cycle. Columella fascicular or spongy. Wall septothecal. Endothecal dissepiments vesicular. Epithecal s.l. wall present or absent.

Trochocyathus antsiranensis COLLIGNON, 1931

Pl. 2, Fig. G

v*1931 *Trochocyathus Antsiranensis* nov. sp.; COLLIGNON: 52, Pl. 1, Figs. 16–19.

v1958 *Trochocyathus antsiranensis* COLLIGNON; ALLOITEAU: 153.

v2002 *Trochocyathus antsiranensis* COLLIGNON, 1931; BARON-SZABO: 158, Pl. 118, Figs. 7–8.

Dimensions of skeletal elements: Diameter of corallite: 7.5–8.5 mm; number of septa: 40–48.

Description: Solitary corallum, circular in outline. Costosepta developed in four size orders irregularly alternating in length and thickness.

Distribution: Albian of western Austria (this paper), Cenomanian of Madagascar.

Material: VNS–P.10476 (Plattenwald); –P.17297 (Bezau at Bregenz Forest).

Remarks: Regarding both the dimensions of skeletal elements and axial structure developments, the material from the Garschella Formation very closely corresponds to the type material of the Madagascan species.

Genus *Bathycyathus* Milne Edwards & Haime, 1848

Type species: *Bathycyathus chilensis* Milne Edwards & Haime, 1848, Recent, Pacific Ocean (off the coast of Chile).

Diagnosis: Solitary, turbinate or variably conical, fixed or free. Often circular in outline in juvenile stages, becoming compressed in later ontogenetical stages. Costosepta laminar, compact. Septal margins smooth or nearly smooth. Pali not distinct from columellar laths. Columella formed by twisted trabecular segments. Endothecal dissepiments few in number. Wall septothecal, septoparathecal when not properly thickened.

Bathycyathus laevigatus (Milne Edwards & Haime, 1848)

Pl. 2, Figs. D–E

*1848	*Cyathina laevigata*; Milne Edwards & Haime: 290.
1850	*Cyathina laevigata*; Milne Edwards & Haime: 44–45, Pl. 9, Figs. 1–1d.
1987	*Bathycyathus laevigatus* Edwards & Haime, 1850; Kuzmicheva: 120–121, Pl. 19, Fig. 8, Pl. 20, Figs. 1a–2, Text-Fig. 23A.
2002	*Bathycyathus laevigata* (Milne Edwards & Haime, 1848); Baron-Szabo: 158.

Dimensions of skeletal elements: Diameter of corallite: 8 mm; number of septa: 42.

Description: Mould of a solitary corallum, circular in outline. Costosepta are developed in four incomplete cycles in six systems. S1–S3 are nearly equal in length, slightly alternating in thickness. S4 are much thinner and shorter, about half the length of septa of first three cycles. Columella large, occupying around a third of the corallum.

Distribution: Albian of western Austria (this paper), Turonian of Ukraine, Senonian of England (Wiltshire).

Material: VNS–P.23942 (Plattenwald).

Suborder Microsolenina Morycowa & Roniewicz, 1995

Family Latomeandridae Alloiteau, 1952a

Genus *Fungiastraea* Alloiteau, 1952a

Type species: *Fungiastraea laganum* Alloiteau, 1952a, Upper Turonian of France (Uchaux, Vaucluse).

Diagnosis: Colonial, massive, thamnasterioid to submeandroid. Budding intracalicular, occasionally extracalicular. 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. Generally no wall between corallites.

Fungiastraea cotteaui (De Fromentel, 1857)

Pl. 2, Fig. H

*1857	*Thamnastraea Cotteaui*; De Fromentel: 60, Pl. 9, Fig. 2.
1886	*Thamnastraea Cotteaui*; De Fromentel: 599, Pl. 176, Figs. 1–1b.
1961	*Thamnasteria cotteaui* Fromentel; Bendukidze: Pl. 3, Figs. 1a–b, Pl. 6, Fig. 1.
1981	*Thamnasteria cotteaui* Fromentel 1857; Turnšek & Mihajlović: 35, Pl. 39, Figs. 1–2.
non1994	*Thamnasteria cotteaui* de Fromentel; Liao & Xia: 127, Pl. 32, Figs. 6–7.
1998	*Fungiastrea* cf. *cotteaui* (Fromentel, 1857); Löser: 180.
v2014	*Fungiastraea cotteaui* (De Fromentel, 1857); Baron-Szabo: 70, Pl. 76, Figs. 8–9.

Dimensions of skeletal elements: Distance of corallite centers: 6–10 mm, in areas of intense budding as low as 5 mm; number of septa (monocentric corallites): 16–20.

Description: Mould of a thamnasterioid to submeandroid colony. Septa are thin, straight to slightly wavy, nearly equal in thickness.

Distribution: Lower Hauterivian of France (Yonne), Hauterivian of Ukraine, lower Aptian of eastern Serbia, Albian of western Austria (this paper), upper Cenomanian of Germany.

Material: VNS–P.21604 (Bezau at Bregenz Forest).

Remarks: According to De Fromentel (1857: 60), the species *F. cotteaui* is characterized by a corallite diameter ranging from 8–10 mm and 16–20 septa. However, based on the original illustration of the holotype in De Fromentel (1857: Pl. 9, Fig. 2), the range of corallite diameters seems to be larger than that given by him. If it is assumed that the largest corallite shown in the illustration is 10 mm, the smallest corallites would have to be as small as about 6 mm. In addition, in a few corallites the maximum number of septa appears to be up to 22 and 24?, respectively. Because repeated attempts to track down the type material of De Fromentel's species in the collections of the Natu-

ral History Museum Paris by the author of the current work failed, the dimensions of skeletal elements of *F. cotteaui* are assumed to be as found in the original illustration of the type material (De Fromentel, 1857: Pl. 9, Fig. 2).

In having corallite diameters of mainly 5 mm (full range of corallite diameters of 3–7 mm), the material described from the upper Aptian–Albian of Tibet by Liao & Xia (1994) differs from the species *cotteaui* and is, therefore, excluded.

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Plate 1

Fig. A: *Calamophylliopsis compressa* (D'ORBIGNY, 1850)

VNS–P.24701; upper surface of colony fragment, cross view, partially polished (photograph courtesy GEORG FRIEBE); Albian (Garschella Formation at Plattenwald, Vorarlberg), western Austria; scale bar: 7 mm.

Figs. B–C: *Calamophylliopsis* cf. *cervina* (ÉTALLON, 1864)

Fig. B: PIMUZ–32195 (FURRER coll.); cross view of corallite, slightly oblique, polished surface (photograph courtesy HEINZ FURRER); lower Aptian–lower Cenomanian (Garschella Formation at southwestern flank of Girenspitz, Säntis), eastern Switzerland; scale bar: 2.5 mm.

Fig. C: NMSG–SB-CE3a–1a (BOLLIGER coll.); cross view of corallite, oblique, polished surface (photograph courtesy THOMAS BOLLIGER); upper Albian (Garschella Formation ["Girenspitz-Kalk"] at Girenspitz, Säntis), eastern Switzerland; scale bar: 4 mm.

Fig. D: *Cladocora* cf. *brevis* SEGUENZA, 1882

NMSG–SB-CE3b1a (BOLLIGER coll.); cross view of corallite, polished surface (photograph courtesy THOMAS BOLLIGER); upper Albian (Garschella-Formation ["Girenspitz-Kalk"] at Girenspitz, Säntis), eastern Switzerland; scale bar: 1 mm.

Figs. E, L: *Podoseris mammiliformis* DUNCAN, 1869

Fig. E: VNS–P.23939; "steinkern", cross view of corallum; Albian (Garschella Formation at Plattenwald, Vorarlberg), western Austria; scale bar: 2 mm.

Fig. L: VNS–P.24830; "steinkern", cross view of corallum; Albian (Garschella Formation at Sattelberg, Vorarlberg), western Austria; scale bar: 2.5 mm.

Figs. F, M–P: *Podoseris elongata* DUNCAN, 1869

Fig. F: VNS–P.24580; "steinkern", oblique view of corallum; Albian (Garschella Formation at Plattenwald, Vorarlberg), western Austria; scale bar: 2.5 mm.

Figs. M–N: VNS–P.12616; Albian (Garschella Formation at Kraftwerk Ebensand, Vorarlberg), western Austria.

Fig. M: "steinkern", lateral view of corallum; scale bar: 4.5 mm.

Fig. N: "steinkern", cross view of corallum; scale bar: 4.5 mm.

Figs. O–P: VNS–P.23777; Albian (Garschella Formation at Plattenwald, Vorarlberg), western Austria.

Fig. O: "steinkern", oblique view of corallum; scale bar: 5 mm.

Fig. P: "steinkern", cross view of corallum; scale bar: 5 mm.

Figs. G–H: *Podoseris* sp.

VNS–P.24350; Albian (Garschella Formation at Sattelberg, Vorarlberg), western Austria.

Fig. G: "steinkern", cross view of corallum; scale bar: 5 mm.

Fig. H: contrast inverted image of Figure G.

Figs. I–K: *Synhelia gibbosa* (MÜNSTER, in GOLDFUSS, 1829)

NMSG–SB-DIV 1 (BOLLIGER coll.); upper Albian (Garschella Formation ["Girenspitz-Kalk"] at Girenspitz, Säntis), eastern Switzerland.

Fig. I: upper surface of colony, polished; scale bar: 4.5 mm.

Fig. J: close-up of Fig. I; scale bar: 3.5 mm.

Fig. K: close-up of Fig. I; scale bar: 3.5 mm.

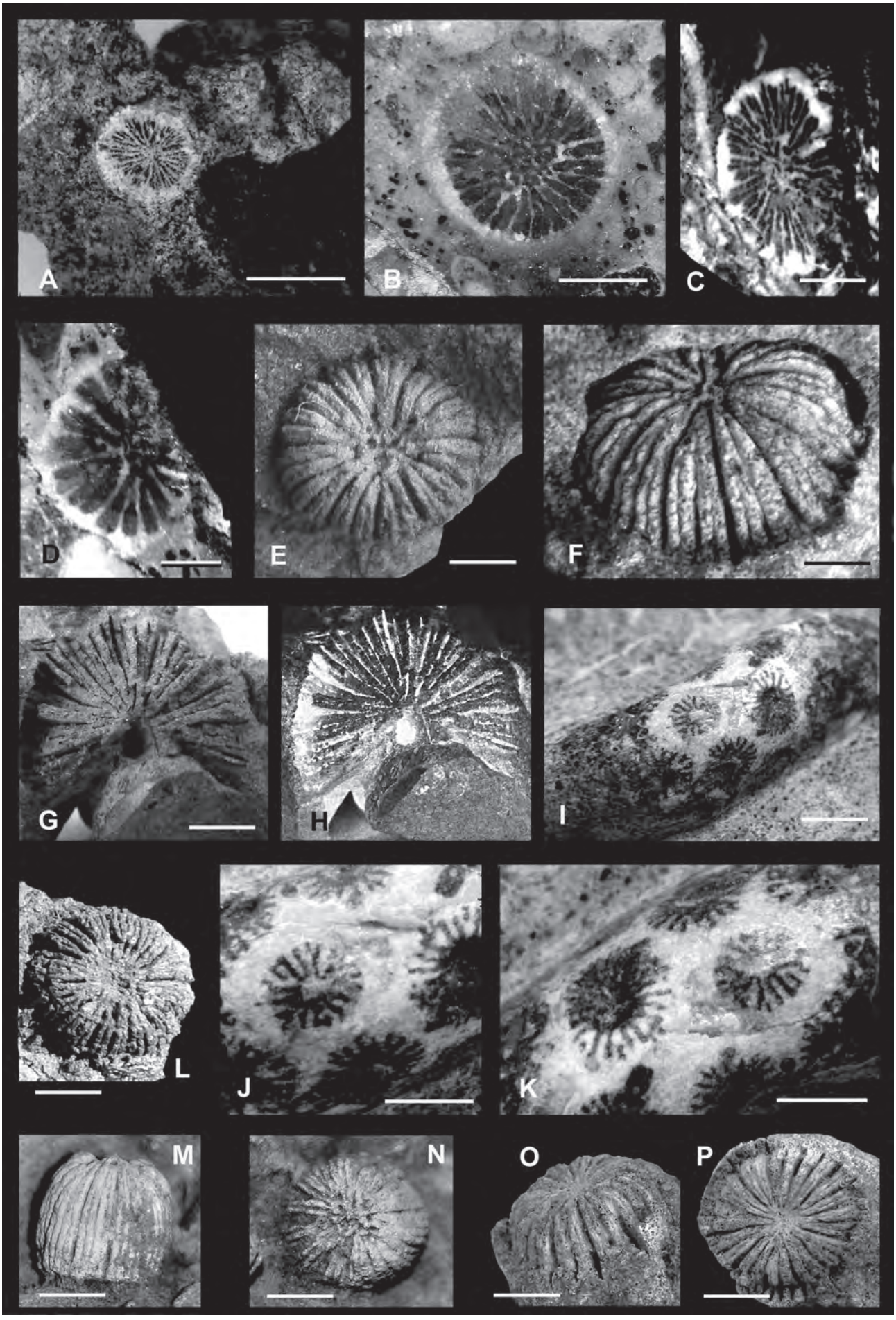
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Plate 2

Fig. A: *Enallhelia* cf. *tubulosa* BECKER, 1875

VNS–P.25401; lateral view of colony, preserved either as "steinkern" or as mould; Albian (Garschella Formation at Bezau, Bregenz Forest, Vorarlberg), western Austria; scale bar: 6 mm.

Figs. B–C, F: *Stephanophyllia plattenwaldensis* n. sp.

VNS–P.24623, holotype; Albian (Garschella Formation at Plattenwald, Vorarlberg), western Austria.

Fig: B: lateral view of corallum; scale bar: 7 mm.

Fig: C: cross view of corallum; scale bar: 7 mm.

Fig: F: lateral view of corallum; scale bar: 6.5 mm.

Figs. D–E: *Bathycyathus laevigatus* (MILNE EDWARDS & HAIME, 1848)

VNS–P.23942; Albian (Garschella Formation at Plattenwald, Vorarlberg), western Austria.

Fig. D: mould of corallum, cross view; scale bar: 4 mm.

Fig. E: contrast inverted image of Figure D.

Fig. G: *Trochocyathus antsiranensis* COLLIGNON, 1931

VNS–P.17297; cross view of corallum; Albian (Garschella Formation at Bezau, Bregenz Forest, Vorarlberg), western Austria; scale bar: 3 mm.

Fig. H: *Fungiastraea cotteaui* (DE FROMENTEL, 1857)

VNS–P.21604; mould, cross view of colony; Albian (Garschella Formation at Bezau, Bregenz Forest, Vorarlberg), western Austria; scale bar: 7.5 mm.

Fig. I: *Caryophyllia konincki* (MILNE EDWARDS & HAIME, 1848)

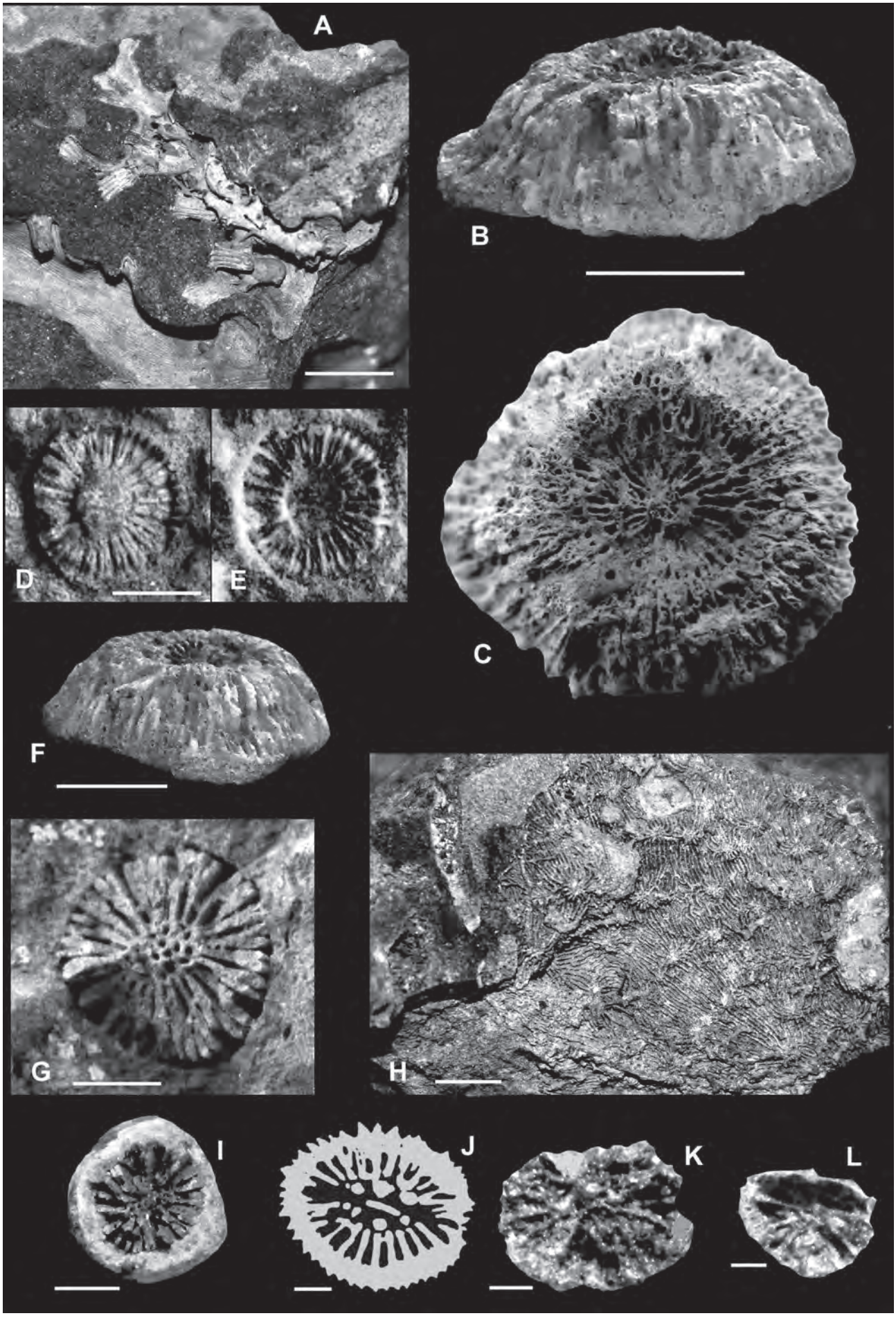
NMSG–SB-DIV 7h (BOLLIGER coll.); cross view of corallite; upper Albian (Garschella Formation ["Girenspitz-Kalk"] at Girenspitz, Säntis), eastern Switzerland; scale bar: 2 mm.

Figs. J–L: *Stylocyathus* cf. *dentalinus* D'ORBIGNY, 1850

Fig. J: Sketch of cross view of holotype of *Stylocyathus dentalinus* D'ORBIGNY, 1850 (Natural History Museum, Paris [MNHN], Mo3643) (adapted from BARON-SZABO, 2002: 160, Text-Fig. 59); scale bar: 1 mm.

Fig. K: NMSG–SB-DIV 7b (BOLLIGER coll.); cross view of corallum; upper Albian (Garschella Formation ["Girenspitz-Kalk"] at Girenspitz, Säntis), eastern Switzerland; scale bar: 1.5 mm.

Fig. L: NMSG–SB-DIV 7c (BOLLIGER coll.); cross view of corallum; upper Albian (Garschella Formation ["Girenspitz-Kalk"] at Girenspitz, Säntis), eastern Switzerland; scale bar: 1 mm.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