A brief synopsis on the history of sponge research in the Upper Triassic St. Cassian Formation (Dolomites, NE Italy)

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The St. Cassian Formation (Lower Carnian, Upper Triassic) of the Dolomites, northeastern Italy, has been the focus of wide scientific research since its discovery about 180 years ago. The main reason is the vast amount of well-preserved fossil invertebrates in the respective Fossil Lagerstätten. This is particularly important in case of Porifera since the fossil record of well-preserved specimens of this phylum is comparatively poor. Aim of this paper is therefore a brief outline of the history of research and a review of the current knowledge about fossil sponges in the St. Cassian Formation.

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Introduction

The St. Cassian Formation is geographically part of the Dolomites (Fig. 1). It was firstly termed *'Cassianer Schichten'* (i.e., Cassian Beds) by zu Münster (1841), referring to the town of San Cassiano in the province of Bolzano, and cartographically recognized by von Hauer (1858). Subsequently extensive stratigraphic, sedimentological, and palaeontological studies were conducted by various scientists (e.g., von Richthofen 1860; Stur 1868; von Mojsisovics 1879; Ogilvie 1893; Pia 1937; Leonardi 1961; Fürsich & Wendt 1977; Wendt & Fürsich 1980; Russo et al. 1991, 1997; Stanley & Swart 1995; Nützel et al. 2010; Bernardi et al. 2011; Kroh 2011; Kroh et al. 2011; Tosti et al. 2011). Fossil groups such as cnidarians (e.g., Volz 1896); echinoderms (e.g., Hagdorn 2011; Kroh 2011); mollusks (e.g., Bandel 2007), plants (Kustatscher et al. 2011) and vertebrates (Bernardi et al. 2011) have been reviewed.

Aim of this paper is a brief review of respective findings with particular focus on exceptionally well-preserved remains of fossil sponges in this formation. In order to honour Professor Reitner's great contributions to the palaeontology of sponges in the St. Cassian Formation, findings of his respective studies are outlined separately.

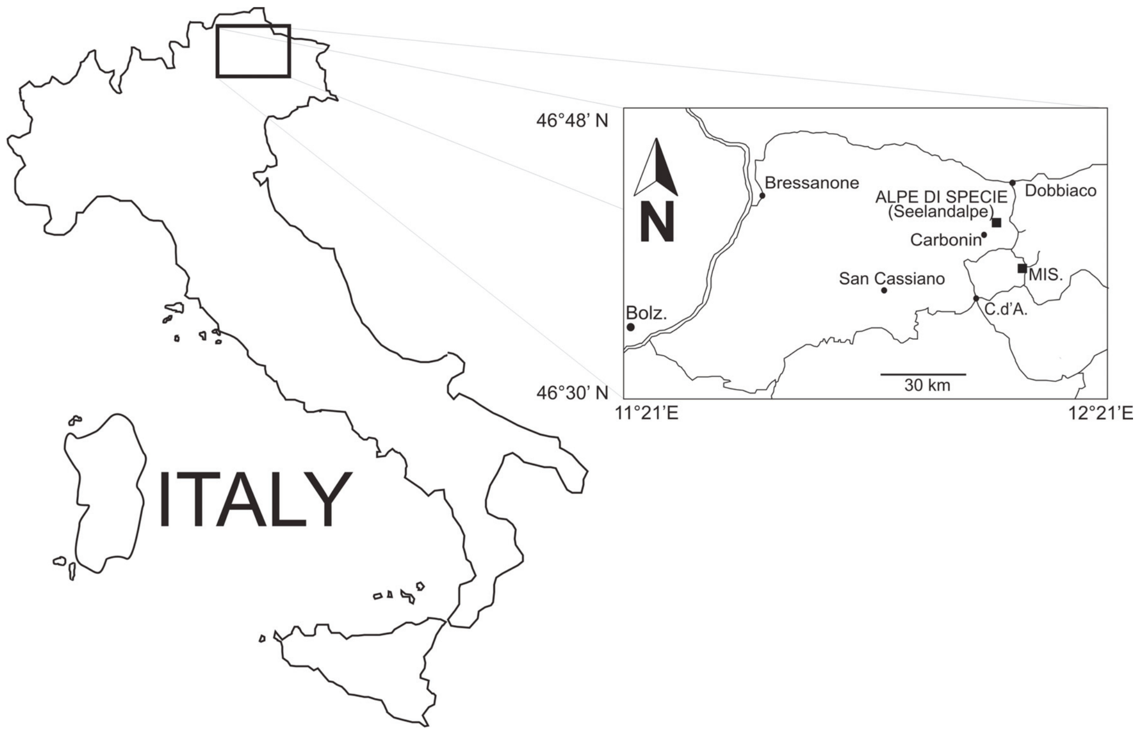

Fig. 1: Geographic positions of St. Cassian Formation outcrops. **Bolz.** = Bolzano; **C.d'A.** = Cortina d'Ampezzo; **Mis.** = Misurina [from Müller-Wille & Reitner 1993, modified].

Stratigraphy

The Carnian deposits of the Dolomites are represented by the huge carbonate platform sediments of the Cassian Dolomite and their contemporaneous basinal equivalents of the St. Cassian Formation (Russo et al. 1991). The St. Cassian Formation spans the time from the Middle to Upper Triassic (Ladinian–Carnian; Fig. 2) and comprises basin sediments (i.e., mostly marlstones and shales) deposited between carbonate buildups and locally back reef areas (Wendt & Fürsich 1980).

The first type section of the St. Cassian Formation was defined by Ogilvie (1893) by integration of several sections obtained between the regions of Stuores Wiesen and Pralongia. Ogilvie-Gordon (1929) later defined two subunits in the St. Cassian Formation. This division was later confirmed by Mutschlechner (1933), Pia (1937), and Urlichs (1974) in several areas. However, Bizzarini & Braga (1978) performed a division into three levels: a lower level comprising a pseudo-flysch facies superposed on the Wengen Formation, a middle level with a sandy-tuffaceous lithology and rare fossils, and an upper level consisting of marls and gray-brown marly limestones with many fossiliferous beds (*'Seelandschichten' sensu* Pia 1937). It is also important to take into account that other authors (Stur 1868; von Mojsisovics 1874) had assigned the marly and tuffitic Wengen Strata to the St. Cassian Formation. However, Müller-Wille & Reitner (1993) compiled a stratigraphical section of the St. Cassian Formation where they accept the original model from Urlichs (1974), and place the formation from the *aon* Zone in the Cordevolian to the *aonoides* and *austriacum* Zones in the Julian.

In the last two decades, some studies concerning the Carnian GSSP have been carried out (Gianolla et al. 1998; Broglio Loriga et al. 1999; Mietto et al. 2007, 2012). For the present work, the section of Müller-Wille & Reitner (1993) is taken as reference, considering that a deep stratigraphic review is not within the scope of this contribution.

Sedimentological considerations

A new stage of the research of the St. Cassian Formation started in the beginning of the 1960s. Leonardi (1961) recognized for the first time presence of lagoonal facies within an atoll/barrier. Baccelle (1965) described four Cassian lithofacies which she attributed to shallow water environments of narrow interreefal basins at the Sella Joch. Leonardi (1967) summarized the main outcrops where the authochthonous Cassian reef deposits can be found, which are mainly situated at Pralongia, Paso di Falzarego and Seiser Alm. However, based on investigations on some carbonate buildups, Bosellini & Rossi (1974) proposed that some of them may not have been ecological reefs in origin, but represent the indented edge of a broad shallow-water carbonate platform which had grown under cyclically repeated subtidal, intertidal and supratidal conditions. This conclusion was shared by Leonardi (1979) concerning the Marmolada and Latemar buildups. His observations were corroborated by Russo et al. (1997), Keim & Schlager (2001) and Emmerich et al. (2005), who recognized the abundance of micrite produced in place (automicrite) for the Punta Grohmann, the Sella Massif, and the Latemar buildup. Regarding the variability of facies in the Dolomites, the most extensive analyses of the St. Cassian Formation was conducted by Fürsich & Wendt (1976, 1977) and Wendt & Fürsich (1980), who recognized four depositional environments, mainly based on their biofacies: deeper and shallow basinal, slope and shallow water facies. These papers underlined the diversity and complexity of facies, and among them 'Cipit boulders' have been given special attention (e.g., Russo et al. 1991; Russo et al. 1997; Rech 1998; Sánchez-Beristain & Reitner 2008; see below).

The Cipit boulders

Because of the abundance of publications dealing with calcareous blocks that originated from the Cassian carbonate platforms it is necessary to define and delineate the terms used in reference to these blocks. The term *'Kalkstein von Cipit'* (i.e., 'limestone from Cipit') was first used by von Richthofen (1860) to name calcareous blocks deposited within tuffitic marine beds in the Cassian Beds at the Seiser Alm. He described them as brown, partially crystallized bituminous limestones of an extraordinary tenaciousness, which he attributed to the abundant presence of celestine. The assignment of the name is toponymic and refers to the typical locality for such masses is in the vicinity of the Tschapit (*'Ciapit'*) Creek. He also pointed out that such blocks stratigraphically correspond to the base of the St. Cassian Formation. Later, von Mojsisovics (1875) applied von Richthofen's definition to a wider assortment of limestones, including regularly deposited limestone strata (*'Kalkbänke'*) in the Cassian Beds as well as isolated blocks. However, he assigned the term reefstone (*'Riffstein'*) to most of the isolated blocks.

Subsequent studies were increasingly focused on the genetic interpretation of the isolated blocks. Ogilvie (1893) and Salomon (1895) interpreted these blocks as autochthonous remains of small coral patch reefs from a shallow water zone, and the same idea was presented by Nöth (1929), van Houten (1930), and Valduga (1962). However, Cros (1967, 1974) and Cros & Lagny (1972) proposed an allochthonous origin of the blocks. This was subsequently confirmed by Fürsich & Wendt (1977). Because of distinct microfacial features observed in these blocks (e.g., Fe-hydroxide crusts and solution cavities cutting primary textures) these authors concluded that the blocks slid from shallow water carbonate platforms into the basin after subaerial erosion.

One important characteristic of most Cipit boulders is an early diagenetic cementation and an absence of dolomitization (Fürsich & Wendt 1977; Biddle 1981). This observation was explained by complete lithification of limestones before they slid into the basin during the emersion and karstification of the platforms (Cros 1974; Biddle 1981). Since dolomitization in the autochthonous shallow water facies was destructive, the exceptional preservation of the Cipit boulders provides rare insights into facies and biota of the shallow water environments (Russo et al. 1991) With regard to sedimentary facies, Cipit boulders are predominantly composed of algal biolithites and less commonly of coral limestones, which are associated with pelletal or micritic limestones, and these are attributed to reef- or reef-like environments of the platforms (Fürsich & Wendt 1977). Furthermore, there are also some blocks at the Seelandalpe and in Misurina, which may have originated from larger reef knolls (Fürsich & Wendt 1977). Finally, reef building/dwelling faunal associations known from Cassian patch reefs were also identified in blocks at the Seelandalpe/Alpe di Specie (Wendt 1982).

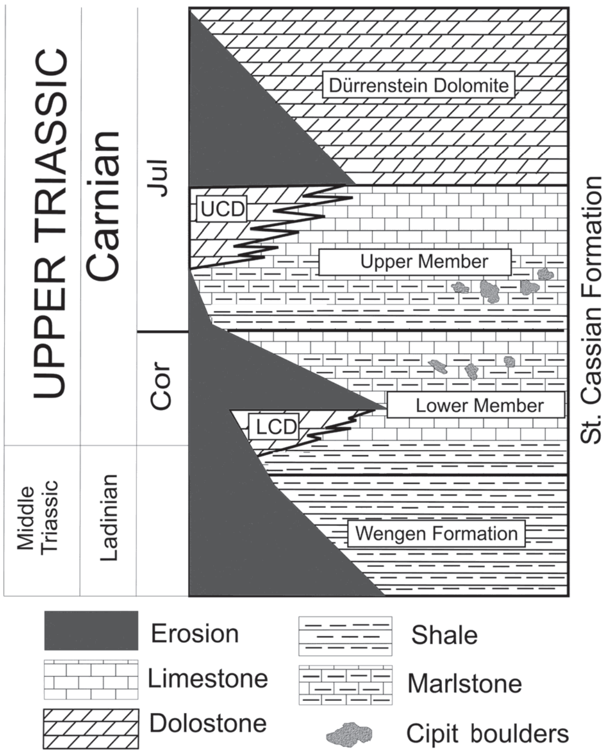

Fig. 2: Stratigraphic section of the St. Cassian Formation at Seelandalpe and Misurina. Abbreviations: **Cor** = Cordevolian; **Jul** = Julian; **LCD** = Lower Cassian Dolomite; **UCD** = Upper Cassian Dolomite [from Müller-Wille & Reitner 1993, modified].

Fossil Porifera

The St. Cassian Formation and its fauna has almost uninterruptedly been studied since the work of zu Münster (1834). Georg Graf zu Münster (1841) published the first encompassing monograph on the Cassian fauna and reported a total of 79 genera and 422 species, mostly marine invertebrates. Von Klipstein (1843) and Laube (1864) provided encompassing revisions including several new taxa. Laube (1864) conducted the first study entirely focussed on the sponge fauna of the St. Cassian Formation. Many of the poriferan taxonomical classifications used by these authors are still valid. Loretz (1875) pinpointed the fossil richness of the Seelandalpe, highlighting the poriferan content, and Zittel (1879) took substantially into account sponge material from this locality for his work. Steinmann (1882) described also two new sponge species in the Cassian Beds (*Thaumastocoelia cassiana* and *Cryptocoelia zitteli*). Ogilvie-Gordon (1900) published an extensive list of fossils from various Cassian taxa from Falzarego Valley along with their stratigraphical distribution, though she did not include any poriferan.

An apparent gap in Cassian poriferan palaeontology exists from the beginning of the last century until the end of the 1960s, when Dieci et al. (1968) published a monograph on the sponges from the Cassian Formation. 23 species of "Inozoans" and "Sphinctozoans" are described here, including 10 new species. This publication represents a watershed for the investigation of Cassian poriferans. Following studies (e.g., Bizzarini & Braga 1978; Russo 1981) also account for some of the diversity of Cassian poriferans but they rather develop new trends in morphology and preservation of fossil sponges. Montanaro-Galitelli (1973) describes for the first time the microstructure of numerous Cassian corals. Dieci et al. (1974) perform studied the microstructure of selected poriferans from the Seelandalpe, distinguishing micritic, penicillate (clinogonal) and sphaerulitic types. Research on this issue continued to expand, and Cuif (1973, 1974) provided additional new descriptions and emphasized the role of the aragonitic sponges within the Triassic reefal fauna. However, some revolutionary issues emerged since Dieci et al. (1977) first reported the occurrence of spicules in Cassian chaetetids and ceratoporellids, thus assigning them to the "Sclerospongia". Parallel to these investigations, Wendt (1974) identified an orthogonal type (*sensu* Hudson 1959**)** as further microstructure for Cassian sponges. Moreover, he emphasized the extraordinary preservation of the aragonitic skeletons and included observations of spicules within their secondary skeletons, proposing for the first time the existence of such features within Cassian genera such as *Leiospongia*. Wendt (1975) determined the microstructural arrangement of Cassian stromatoporoids, which are, with exception of the sphaerulitic type, the same as in case of the poriferans. This topic was further discussed with regard to the stratigraphic distribution, associated diagenetic patterns, and comparability with recent forms (Wendt 1976, 1979, 1984; Veizer & Wendt 1976). Scherer (1976, 1977) achieved important breakthroughs in the geochemical analysis of Cassian samples and compared corals, sponges, and especially cements. In addition, he provided the first insights into the isotopic $\delta^{13}C$ and $\delta^{18}O$ records for Cassian sponges, by assessing the first temperature data from these organisms, based on their excellent preservation state. They obtained temperatures ranging from 27 to 29°C, which are consistent with data obtained more recently from St. Cassian bivalves (Nützel et al. 2010) who reported a very high seasonal fluctuation of sea surface water temperatures based on high resolution sclerochronology of aragonitic bivalves.

Fürsich & Wendt (1977) performed the first encompassing quantitative palaeoecological analysis in the St. Cassian Formation. These authors described several associations and assemblages and characterized them with regard to palaeoecology. A particular feature of this study is the demonstration of specific and proportional abundances for each taxon, and that associations are referred to certain marine settings, ranging from shallow water to pelagic and basinal environments. Subsequently, Wendt & Fürsich (1980) carried out an exhaustive deep facies analysis, underlining the importance of poriferans in Cassian reefs. This was further pinpointed by Wendt (1982), who defined four community-types from the Cassian patch reefs from which one is dominated by poriferans, and by Russo (2005), who performed a study on the facies evolution within the Triassic platforms in the Dolomites. He also emphasized on the importance of sponges.

Engeser & Taylor (1989) reviewed the Klipstein collection at the British Museum of Natural History. They reassigned six poriferan type-specimens originally classified as bryozoans.

Finally, Belvedere & Bizzarini (2006) reported for the first time the occurrence of eleven sponge taxa from the St. Cassian outcrops of the Sappada area, in Veneto. Six of these taxa are included in the "Inozoa", whereas three are classified as "sphinctozoans" and two as "sclerosponges". Table 1 shows a list of type sponge species from the St. Cassian Formation.

J. Reitner's contributions to the palaeontology of Cassian sponges

Joachim Reitner has been working in the St. Cassian Formation since almost thirty years. He has described ten species of fossil poriferans mainly from Misurina (in the Rimbianco Valley) and the Seelandalpe (Alpe di Specie) near the town of Carbonin (Fig. 1). These species are: *Cassianothalamia zardinii* Reitner (Figs. 3–4), *Aka cassianensis* Reitner & Keupp (Fig. 5), *Murania kazmierczaki* Reitner (Fig. 6), *Hispidopetra triassica* Reitner (Fig. 7), *Ceratoporella breciacanthostyla* Reitner (Fig. 8), *Murania megaspiculata* Reitner (Fig. 9), *Hymedesmia mostleri* Reitner, *Chaetosclera klipsteini* Reitner & Engeser, *Petrosistroma stearni* Reitner and *Thalamnohaliclona amblysiphonelloides* Reitner. References to these species, as well as repository information can be found in Table 2.

Table 1: Overview of type-fossil Porifera from the St. Cassian Formation.

Species	Primary reference	Collection
Amblysiphonella loerentheyi	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Amblysiphonella strobiliformis	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Amblysiphonella timorica	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Atrochaetetes lagaaiji	Engeser & Taylor 1989	British Museum of Natural History
Atrochaetetes tamnifer	Engeser & Taylor 1989	British Museum of Natural History
Cassianochaetetes gnemidius	Engeser & Taylor 1989	British Museum of Natural History
Cassianochaetetes milleporatus	Engeser & Taylor 1989	British Museum of Natural History
Cassianochaetetes orbignyanus	Engeser & Taylor 1989	British Museum of Natural History
Celyphia submarginata	zu Münster 1841	Bayerische Staatssammlung für Paläontologie und Geologie
Colospongia dubia	zu Münster 1841	Bayerische Staatssammlung für Paläontologie und Geologie
Cryptocoelia zitteli	Steinmann 1882	Goldfuß-Museum, Bonn
Cystothalamia polysiphonata	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Enoplocoelia armata	von Klipstein 1843	British Museum of Natural History
Eudea polymorpha	von Klipstein 1843	British Museum of Natural History
Euepirrhysia montanaroae	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Euepirrhysia pusilla	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Leiospongia alpina	Laube 1865	British Museum of Natural History
Leiospongia polymorpha	Engeser & Taylor 1989	British Museum of Natural History
Leiospongia verrucosa	Laube 1865	British Museum of Natural History
Peronidella loretzi	Zittel 1879	Bayerische Staatssammlung für Paläontologie und Geologie
Peronidella rosetta	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Peronidella subcaespitosa	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Precorynella astroites	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Precorynella auriformes	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Precorynella capitata	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Precorynella pyriformis	von Klipstein 1843	British Museum of Natural History
Prosiphonella amplectens	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Sestrostomella aureolata	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Sestrostomella robusta	Zittel 1879	Bayerische Staatssammlung für Paläontologie und Geologie
Stellispongia manon	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Stellispongia subsphaerica	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Stellispongia variabilis	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Thaumastocoelia cassiana	Steinmann 1882	Goldfuß-Museum, Bonn
Zardinia perisulcata	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo
Zardinia platithalamica	Dieci et al. 1968	Museo Paleontologico “Rinaldo Zardini”, Cortina d’Ampezzo

Table 2: Overview of fossil Porifera from the St. Cassian Formation described by Joachim Reitner [GZG = depository Geoscience Museum Göttingen].

Species	Reference	Figure	Repository
Cassianothalamia zardinii	Reitner 1987	3-4	GZG
Aka cassianensis	Reitner & Keupp 1991	5	GZG
Murania kazmierczaki	Reitner 1992	6	GZG
Hispidopetra triassica	Reitner 1992	7	GZG
Ceratoporella breviacanthostyla	Reitner 1992	8	GZG
Murania megaspiculata	Reitner 1992	9	GZG
Hymedesmia mostleri	Reitner 1992		GZG
Chaetoslcera klipsteini	Reitner & Engeser 1989		GZG
Petrosiastroma stearni	Reitner 1992		GZG
Thalamnohaliclona amblysiphonelloides	Reitner 1992		GZG

Reitner (1987) noted for the first time the presence of spicules within sphinctozoans in the Cipit boulders from the St. Cassian Formation. The new 'sphinctozoan' species, *Cassianothalamia zardinii*, was thus assigned to the order Hadromerida due to the presence of aster microscleres and occasional monoaxonid megascleres. Keupp et al. (1989) firstly reported a Triassic hexactinellid in Cipit boulders.

Reitner & Engeser (1989) reported a chaetetid in the Cipit boulders. Because of its sphaerulitic microstructure and a primary skeleton with megascleres the authors assigned it to the *Halichondrida* Vosmaer *sensu* Levi. Later Reitner & Keupp (1991) described the new species *Aka cassianensis*. As later shown by Sánchez-Beristain (2010), this species is ecologically important with regard to the destruction and erosion of reef and reef-like communities from the St. Cassian Formation.

Summarizing, these findings contributed in a crucial way to the reassessment of organisms, formerly classified as 'sphinctozoans', 'chaetetids' and encrusting 'sclerosponges', to different families within the class Demospongiae. Since Reitner (1992) proposed his taxonomical-phylogenetical approach on coralline sponges, these terms are no longer valid. Based on cladistics (Hennig 1966) and several microscopical, histological and geochemical procedures, Reitner described seven new species of Cassian poriferans in this work (Table 2). Nevertheless, some St. Cassian taxa described by Reitner, such as *Cassianothalamia zardinii* are not considered as valid (Senowbari-Daryan 1990).

The work of Joachim Reitner on St. Cassian poriferans is not limited to taxonomy. Müller-Wille & Reitner (1993) described in detail the palaeobiology of four sponge taxa: *Cryptocoelia zitteli, Cassianothalamia zardini, Amblisyphonella strobiliformis* and *Thaumastocoelia cassiana*. This palaeobiological work is the first one dealing with the palaeobiology of St. Cassian sponges overall.

Reitner has furthermore been focused on the geobiology of Cassian sponges. He noted the presence of microbial crusts associated to some sclerosponges from the Cipit boulders. These microbial crusts/organomicrites (*sensu* Reitner 1993) are very important characteristics of many Cipit boulders (Brachert & Dullo 1994), and they are often closely associated with the sponge communities (Neuweiler & Reitner 1995). Due to the exceptional preservation of the material, it has even been possible to determine the presence of original organic matter in such organomicrites and even in sponges, such as *Cryptocoelia zitteli*, by means of epifluorescence microscopy at the surface of a *Cryptocoelia zitteli* specimen to detect organic matter.

Finally, Sánchez-Beristain & Reitner (2012) described the palaeoecological features of three sponge taxa: *Murania kazmierczaki, M. megaspiculata* and *Ceratoporella breviacanthostyla*. These encrusting 'coralline' sponges played an important role in the binding processes of the St. Cassian frameworks, along with microencrusters such as *Koskinobullina socialis*, *'Tubiphytes'* cf. *T. obscurus* and *Ladinella porata*.

Conclusions

The history of research at the St. Cassian Formation spans a time period of ca. 180 years. In the beginning, research was focused on the general geology and the description of fossil taxa. In the first third of the 20th century, research focused more on geological and stratigraphical issues, though the study of fossil fauna was never abandoned. Regarding reef-building taxa, sponges constitute a considerable part. Joachim Reitner's contributions comprise the description of ten species of poriferans from the St. Cassian Formation as well as important findings about the taxonomy, palaeoecology palaeobiology, and even biogeochemistry of fossil sponges.

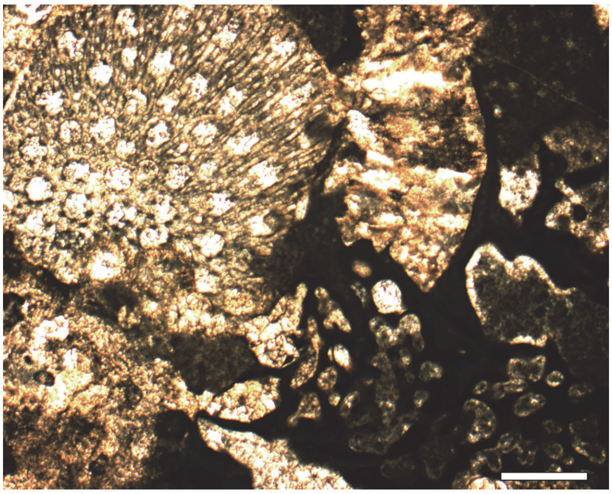

Fig. 3: The thalamid sponge *Cassianothalamia zardinii* Reitner (right), encrusting on top of a bryozoan. Cipit boulder from Seelandalpe. Thin section code: JRCas-22. Scale bar = 500 µm.

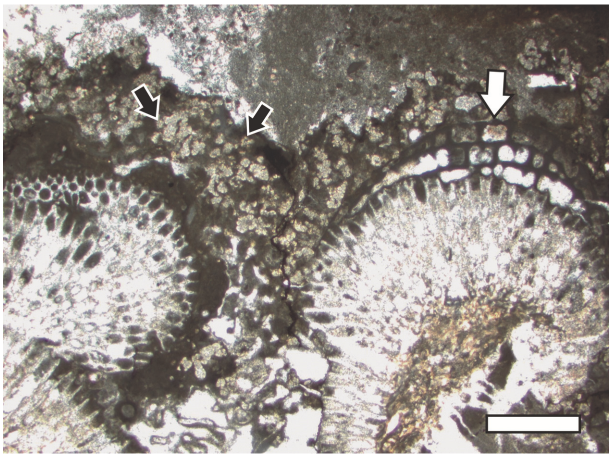

Fig. 4: *Cassianothalamia zardinii* Reitner (white arrow) on top of a ceratoporellid sponge. Black arrows point at the microencruster *Baccanella floriformis*, which are immerse in peloidal microbialite. Cipit boulder from Seelandalpe. Thin section code: CG-I-5. Scale bar = 5 mm.

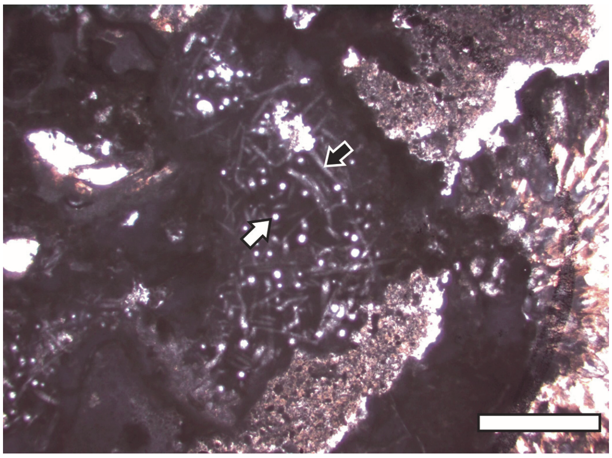

Fig. 5: The boring sponge *Aka cassianensis* Reitner & Keupp, revealed by the occurrence of monoaxonic spicules in longitudinal and transverse sections (black and white arrows, respectively), dwelling on peloidal microbialite. Cipit boulder from the Rimbianco Valley, Misurina. Thin section code: FSM-VI-11. Scale bar = 2 mm.

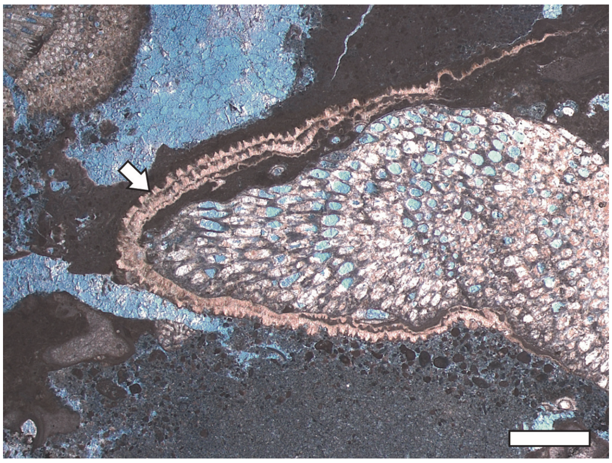

Fig. 6: The encrusting 'coralline' sponge *Murania kazmierczaki* Reitner (arrow), on top of an encrusting complex made of microbialite and foraminifers, all atop of a chaetetid sponge. Cipit boulder from the Rimbianco Valley, Misurina. Thin section code: FSM-IX-3. Scale bar = 2 mm. [from Sánchez-Beristain & Reitner 2012, modified]

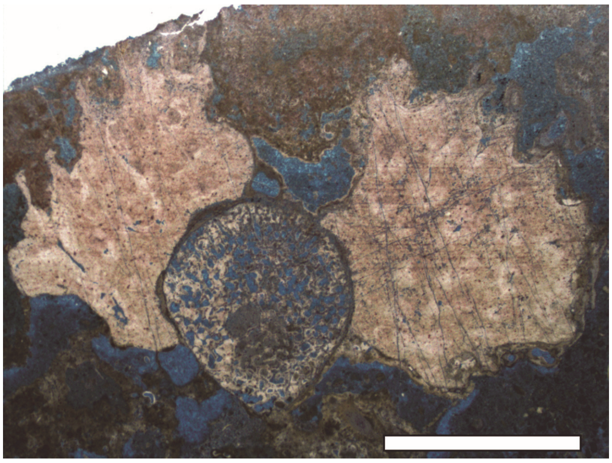

Fig. 7: The 'coralline' sponge *Hispidopetra triassica* Reitner, encrusting on a chaetetid? sponge. Cipit boulder from Seelandalpe. Thin section code: FSSA-V-4L. Scale bar = 5 mm.

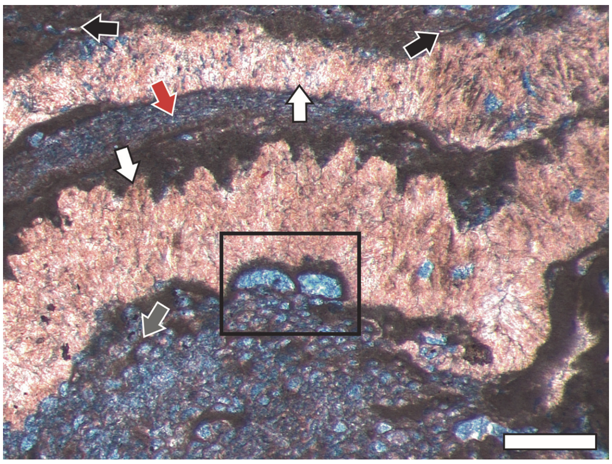

Fig. 8: The 'coralline' sponge *Ceratoporella breviacanthostyla* Reitner (white arrows), as a part of an encrusting complex consisting of colonies of *Koskinobullina socialis* (grey arrow), *Wetheredella*-like encrusters (red arrow), borings of *Microtubus communis* (black arrows) in peloidal microbialite, and thalamid sponges (black square). Cipit boulder from Seelandalpe. Thin section code: JRSA-19. Scale bar = 500 µm.

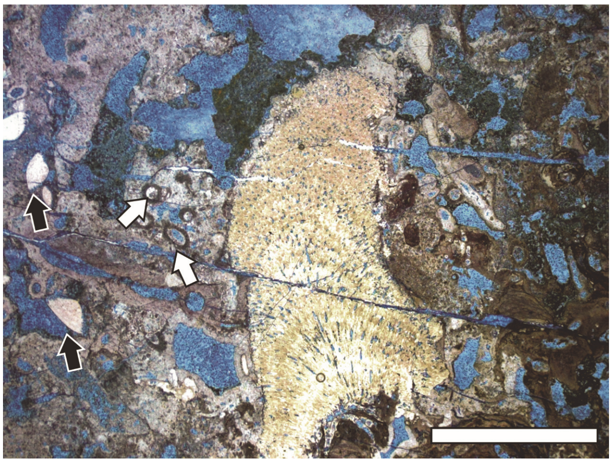

Fig. 9: The 'coralline' sponge *Murania megaspiculata* Reitner, as a part of a microbialitic boundstone where elements as *Terebella* cf. *lapilloides* (white arrows) and *Lamelliconus cordevolicus* (black arrows) can be seen. Cipit boulder from the Rimbianco Valley, Misurina. Thin section code: IP FUB J R/ 1992-PR-I-13. Scale bar = 1 mm.

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