Projects: Re 665/8 „Steuernde Funktionen und Erhaltungspotentiale moderner und fossiler Porifera", Project Leader: J. Reitner (Göttingen)

"Living fossil" sphinctozoan coralline sponge colonies in shallow water caves of the Osprey Reef (Coral Sea) and the Astrolabe Reefs (Fiji Islands)

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Area of Study: Osprey Reef (Coral Sea), North and Great Astrolabe Reef (Fiji Islands)
Environment: Coral reef, reef cave
Stratigraphy: Recent
Organisms: Coralline demosponges
Depositional Setting: Shallow water reef cave
Constructive Processes: Reef-building capability of demosponges
Destructive Processes: Bioerosion
Preservation: —
Research Topic: Ecology and biocalcification of coralline sponges

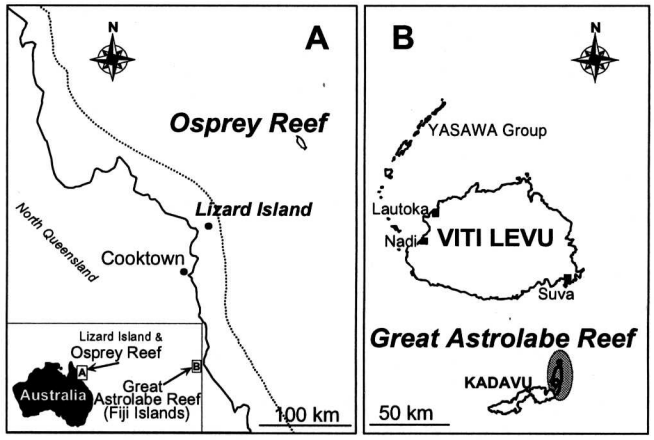


Fig. 1: Maps showing the location of the Osprey Reef off the North Queensland coast (Australia) (Map A) and the Great Astrolabe Reef north of the island of Kadavu in the Fiji Islands (Map B).

Abstract

Three new types of a Recent colonial sphinctozoan coralline sponge are presented. All types show close relationships to the taxon *Vaceletia crypta*, a non colonial form from Indo-Pacific reef caves. The first two types were discovered in shallow water reef caves of the Osprey Reef, which is located on the northern Queensland Plateau in the Coral Sea. The sponges are common in these caves. The third type of a colonial sphinctozoan was found only at three localities at the North Astrolabe Reef and Great Astrolabe Reef of the Fiji Islands. The third type shows similarities with a previously described deep water variation of *Vaceletia* from New Caledonia.

1 Introduction

Sphinctozoan sponges were reef building organisms in the Permo-Triassic. They are chambered calcified sponges with morphological similarities to Cambrian archaeocyaths (DEBRENNE & VACELET 1984). The *Vaceletia*-type of coralline sponges occurred first in the Middle/Late Triassic (*Stylothalamia*, OTT 1967). The sphinctozoans were considered to be rare since the end of the Triassic. They were thought to be extinct since the end of the Cretaceous until the "living fossil" *Vaceletia crypta* (cf. Pl. 1/4) was discovered by VACELET (1977).

The solitary, non colonial form *Vaceletia crypta* has no reef building potential and is only sparsely found in the darker areas of Indo-Pacific reef caves. It is not as common as *Astrosclera willeyana* LISTER or *Spirastrella (Acanthochaetetes) wellsi* HARTMAN & GOREAU, which are abundant in most reef caves investigated during our projects (see REITNER et al. 1996).

The newly found colonial variations of *Vaceletia* from shallow water reef caves retain a colonial growth mode and a reef building capability. They provide therefore clues for the understanding of the modalities of skeletal construction and biocalcification as well as the ecology of Permo-Triassic sphinctozoan sponges.

2 Methods

All specimens were sampled by SCUBA diving. The specimens from the Osprey Reef were sampled during two one week expeditions with the Research Vessel "Gwendoline May" (DPI Cairns) in 1995 and 1996. The specimens from the North- and Great Astrolabe Reef were sampled during a one week field trip to the Field Station of the University of South Pacific, located at Dravuni Island inside the lagoon of the Great Astrolabe Reef (Fig. 3).

The samples were fixed and preserved as described by REITNER (1993) and WÖRHEIDE et al. (in press)

3 Results

3.1 Colonial *Vaceletia*: Type 1 (Osprey Reef) (Pl. 1/1a, b)

The discovery of the first type of colonial *Vaceletia* was previously mentioned by REITNER & WÖRHEIDE (1995). It was first found near the entrance to the lagoon of the Osprey Reef (Fig. 2). It lives in the darker parts of a shallow water reef cave (10-15 m), solitary *Vaceletia crypta* also occurs in this cave.

The colonies exhibit a branching shape and grow up to 30 cm in diameter. Most of the colony consists of dead calcareous skeleton. The blue-gray living parts of the sponge

REITNER, J., NEUWEILER, F. & GUNKEL, F. (eds., 1996): Global and Regional Controls on Biogenic Sedimentation. I. Reef Evolution. Research Reports. – Göttinger Arb. Geol. Paläont., **Sb2**, 145-148, Göttingen

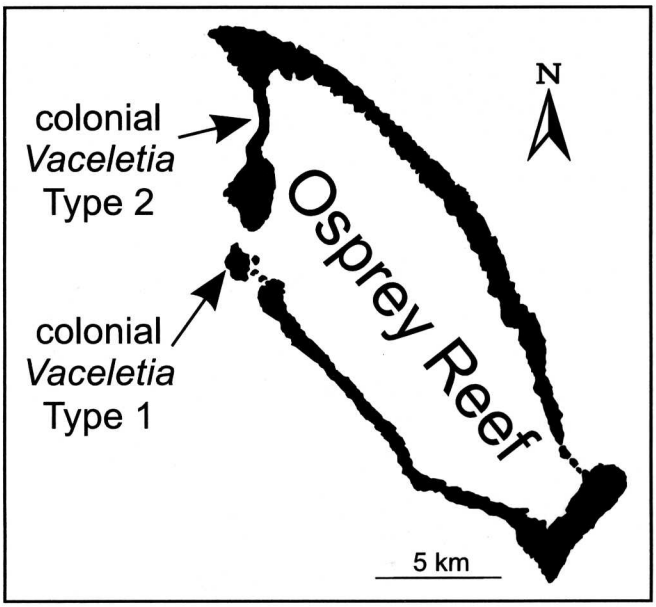


Fig. 2: Location of sample sites at Osprey Reef (Coral Sea) where the new types of colonial *Vaceletia* were found.

are restricted to the tips of the branches. The branches have a mostly regular diameter of 5 mm. Imprints of growth steps (previously build chambers) are poorly developed.

The living tips of the branches and the newly formed chambers have a constant diameter of 5-6 mm and a maximum height of 5 mm. The shape of the living tips is mostly round to oval. Sometimes, two individual tips fuse together but each tip shows a prominent central oscular pore about 0.5 mm in diameter.

3.2 Colonial *Vaceletia*: Type 2 (Osprey Reef) (Pl. 1/2)

The second type of colonial *Vaceletia* was found in 1996 at the north-western side of the Osprey Reef (Fig. 2). It lives also in a shallow water cave in a depth of 10 m, but occurs in semi-dark conditions. One sampled colony was partly encrusted by coralline red algae.

The mode of growth is similar to the colonial *Vaceletia* Type 1, but some differences are obvious. The size of the colonies is equal to Type 1, but the dimensions of the branches and tips are smaller than in Type 1. The diameter of the branches is mostly constant with 3-4 mm. The maximum diameter of the living tips is 3 mm with a height of 3-4 mm. The central oscular pore has a diameter of 0.1-0.2 mm. No imprints of growth steps are visible. The color of the living chambers is dark gray.

3.3 Colonial *Vaceletia*: Type 3 (North and Great Astrolabe Reef, Fiji Islands) (Plate 1/3)

The third variation of colonial *Vaceletia* was found only at one locality at the Great Astrolabe Reef (North of Usborne Passage) and at two localities at the North Astrolabe Reef (Fig. 3). The colonies were living in shallow water caves in a depth of 10-15 m.

The size of the colonies is restricted to not more than 10 cm in diameter and they show a branching growth mode similar to the previously described ones. The diameter of

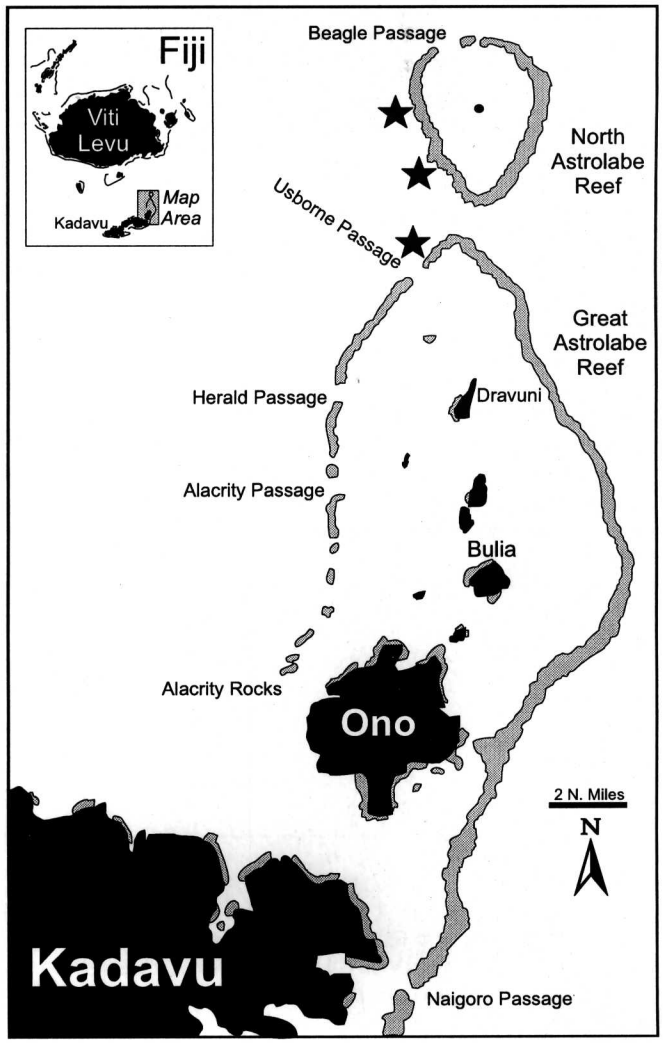


Fig. 3: Location of sampling sites of the new colonial Vaceletia Type 3 at the North and Great Astrolabe Reef, Fiji Islands. Sites are indicated by stars.

the branches varies between 3 and 4 mm. Very well developed imprints of growth steps are visible. The living tips of the branches have a white color, a size of 3-4 mm in diameter and height, and show sometimes a globular or dome-like shape. The central oscular pore has a diameter of 0.3-0.5 mm and is very large compared to the diameter of the chamber.

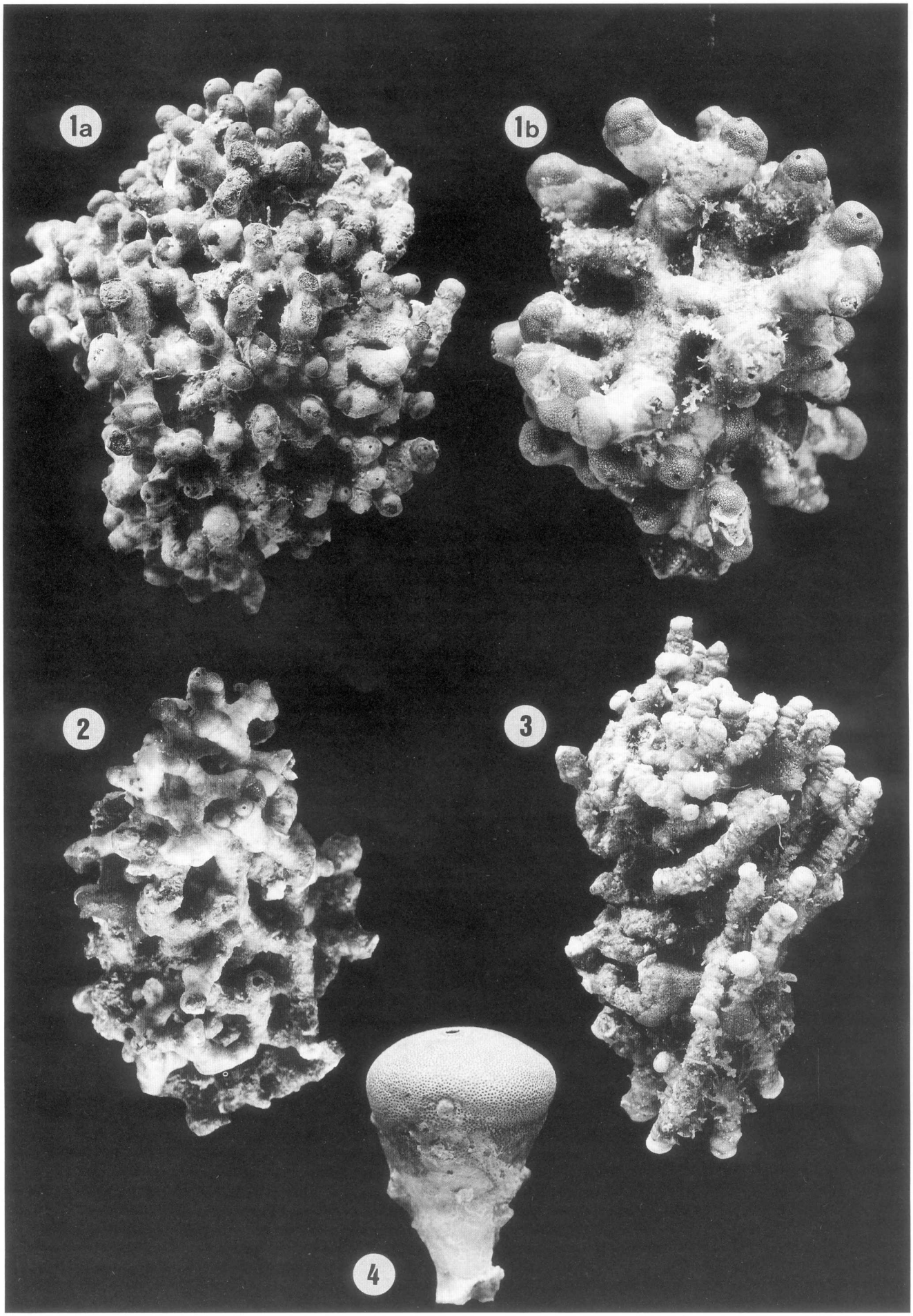
This variation is similar to the variation of *Vaceletia* described by VACELET (1988) and VACELET et al. (1992, Plate 1/1) from the bathyal off New Caledonia.

4 Conclusions

The first two variations of colonial *Vaceletia* from the Osprey Reef show more similarities to the cryptic, non-colonial form *Vaceletia crypta* from reef caves of the Great Barrier Reef and reefs of the Indo-Pacific (VACELET 1977, 1979, REITNER 1992, 1993, GAUTRET et al. in press) than to the

Plate 1: New colonial *Vaceletia* from the SW-Pacific.

Fig. 1: a) Colonial *Vaceletia*: Type 1. Osprey Reef, Coral Sea. Vertical Size of colony 10.5 cm, natural size. b) Colonial *Vaceletia*: Type 1. Osprey Reef, Coral Sea. Vertical Size of colony 5.6 cm.
Fig. 2: Colonial *Vaceletia*: Type 2. Osprey Reef, Coral Sea. Vertical Size of colony 7 cm.
Fig. 3: Colonial *Vaceletia*: Type 3. Great Astrolabe Reef, Fiji Islands. Vertical Size of colony 7.5 cm.
Fig. 4: *Vaceletia* cf. *crypta* (VACELET 1979), Alacrity Rocks, Great Astrolabe Reef, Fiji Islands. Vertical size 1.5 cm


1a
1b
2
3
4

deep-water colonial species described by VACELET (1988) and VACELET et al. (1992) from New Caledonia. The third variation from the Astrolabe Reefs of the Fiji Islands is more similar to this deep water variation from New Caledonia. All three variations will be described elsewhere in detail, investigations are in progress.

The discovery of this three new colonial variations from shallow water reef caves of the SW Pacific shows that the environment of this colonial sphinctozoan sponges is not restricted to the deep water zones as stated by VACELET (1988) and VACELET et al. (1992). The occurrence in shallow water gives us the chance for further detailed studies on ecology and biocalcification processes of this "living fossil" and provides therefore information on the understanding of the ecology and growth modalities of fossil sphinctozoans like *Stylothalamia*.

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