

## Recent 'Sphinctozoa', Order Verticillitida, Family Verticillitidae Steinmann, 1882

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'Sphinctozoans' (Demospongiae, Verticillitida) represent a polyphyletic assemblage of chambered calcified sponges, which were long believed extinct at the end of the Cretaceous. An extant representative, genus *Vaceletia* Pickett, 1982 displays no precise affinity with any extant order of Demospongiae, although it has relationships with the subclass Ceractinomorpha. It is classified in the fossil family Verticillitidae Steinmann, 1882, which contains several fossil genera not treated in this chapter. *Vaceletia* has a chambered skeleton in aragonite and is devoid of spicules.

**Keywords:** Porifera; Demospongiae; Ceractinomorpha; 'Sphinctozoa'; 'chambered sponges'; Verticillitida; Verticillitidae; *Vaceletia*.

### DEFINITION, DIAGNOSIS, SCOPE

#### Synonymy

Order: Verticillitida Termier & Termier in Termier *et al.*, 1977. Family: Verticillitidae Steinmann, 1882. Neocoeliidae Hartman, 1982. Vaceletiidae Reitner & Engeser, 1985.

#### Definition

Skeleton composed of aragonite with irregular structure, with or without siliceous spicules, and trabecular internal structure (from Senowbari-Daryan, 1991).

#### Scope

Verticillitidae (type genus *Verticillites* DeFrance, 1829) contains several fossil genera (not treated in this chapter, see Senowbari-Daryan & Garcia-Bellido, this work) and a Recent genus, *Vaceletia*.

#### History and biology

The extant genus *Vaceletia* is the only Recent representative of the polyphyletic group 'Sphinctozoa' or chambered sponges. The genus is presently classified in the fossil family Verticillitidae, on the basis of the characters of the chambered skeleton. A classification in a proper family, Vaceletiidae, has been proposed (Reitner & Engeser, 1985) on the basis of the absence of a canal system in the siphon wall. This is not followed here, awaiting a necessary revision of the fossil representatives from families Verticillitidae, Cryptocoeliidae and Stylothalamiidae. The absence of siliceous spicules, and the characters of the living tissue in this genus does not allow an allocation to a precise order of extant Demospongiae. An allocation to the order Haplosclerida (Reitner, 1992) is possible, although it does not appear to have an obvious solid basis. However, the mode of reproduction with a parenchymella larva indicates affinities with the subclass Ceractinomorpha.

### VACELETIA PICKETT, 1982

#### Synonymy

*Vaceletia* Pickett, 1982. [*Neocoelia*] Vacelet, 1977b (preoccupied). *Wienbergia* Clausen, 1982.

#### Type species

*Neocoelia crypta* Vacelet, 1977b (by monotypy).

#### Definition

Verticillitidae, 'sphinctozoan' grade of organization, with a chambered skeleton of the siphonate type composed of an irregular arrangement of aragonite crystals, without spicules. Inhalant opening in the outer wall of the porate type, with simple exopores provided with spines extending towards the centre of the aperture. Exowall, interwall and endowall with the same pattern of perforation. Exhalant canal siphonate, sometimes with a longitudinal dividing wall. Regular, pillar-like filling structures in the chambers.

#### Previous reviews

Vacelet, 1979a; Reitner, 1992.

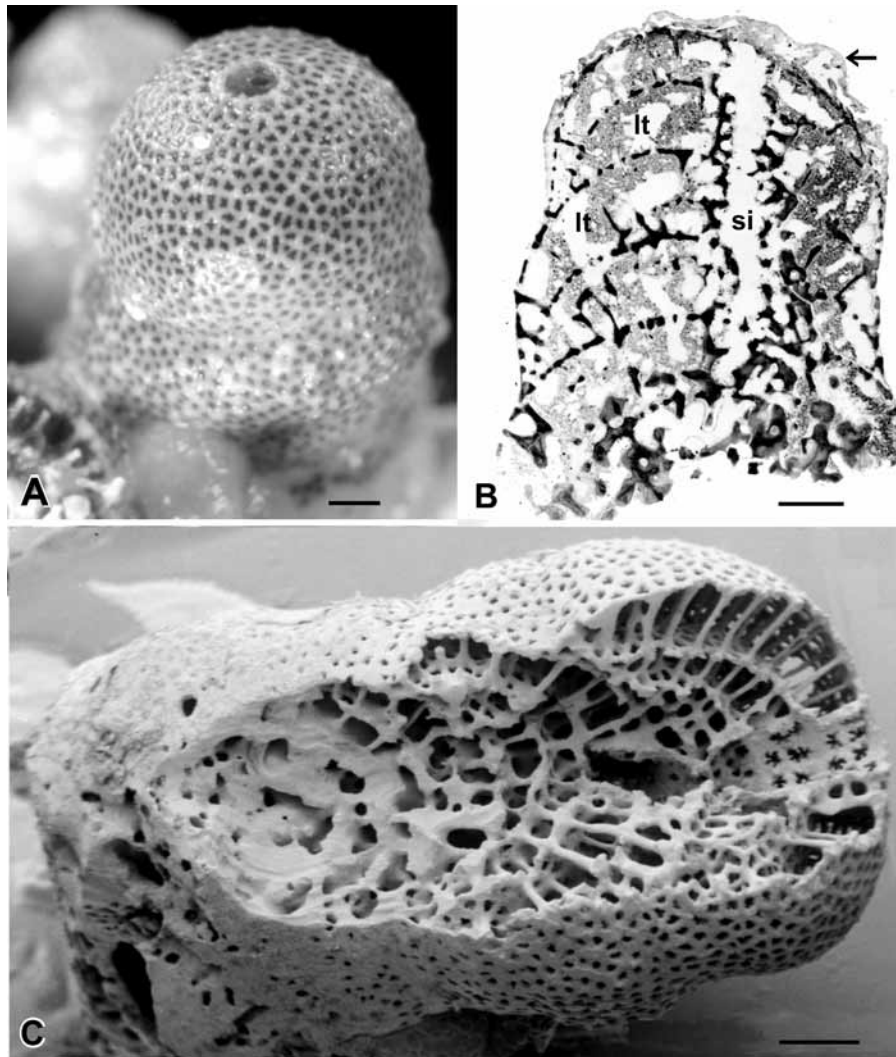
#### Description of type species

*Vaceletia crypta* (Vacelet, 1977b) (Fig. 1).

**Synonymy.** *Neocoelia crypta* Vacelet, 1977b: 509.

**Material examined.** Holotype: MNHN DJV39. Other material. Numerous specimens from the Indo-Pacific.

**Description.** Subcylindrical growth form, with irregular swellings and constrictions marking the junctions of successive chambers, solitary or irregularly branching. Living part 5–9 mm high and 3 mm in diameter. Dead basis of the same diameter, with a variable development, often covered by a thin epitheca and filled in with a secondary deposit. Colour of the living tissue grey in life and in alcohol, skeleton white. Skeleton of the living part made of a series of thin-walled, crescent shaped chambers, 0.6 mm high near the center, traversed by a cylindrical central canal (siphon or atrium), 0.7–0.9 mm in diameter, with a proper wall. Dome-shape



**Fig. 1.** *Vaceletia*. A, specimen from the Indian Ocean. B, section through the skeleton and the living tissue of a specimen building a new chamber (abbreviations: arrow, organic template of a new chamber; si, siphon; lt, living tissue with aquiferous canals and choanocyte chambers). C, SEM view of the skeleton of the same specimen as A (from Vacelet, 1979b, scale 500  $\mu\text{m}$ ).

walls of the chamber supported by regular pillars, 40–50  $\mu\text{m}$  in diameter, perpendicular to the wall and regularly spaced. Walls from chamber and atrium all 50  $\mu\text{m}$  thick, bearing apertures regularly arranged, 100  $\mu\text{m}$  in diameter, with a variable number of short radial spines. Spicules absent, both in skeleton and in living tissue. Living tissue located inside the chambers, except a thin pinacoderm lying on the surface of the outer wall and bearing the ostia. Osculum apical, 0.5–0.8 mm in diameter. Ostia 25–50  $\mu\text{m}$  in diameter, unique in the center of each aperture of the outer chamber wall. Choanocyte chambers aphodal, 40–45  $\mu\text{m}$  in diameter, with a short aphodus. Tissue containing a high density of morphologically diverse intercellular bacteria. Microstructure of the skeleton a feltwork of aragonite crystals, organized into nodules with non-calcified centre (Gautret, 1985). Skeleton secreted as an organic template which is subsequently mineralized. Reproduction viviparous, by incubated parenchymella (Vacelet, 1979b).

**Distribution and Ecology.** Large distribution throughout the Indo-Pacific area, in semi-closed cavities of coral reefs, front reef caves and bathyal environments, 10–530 m depth.

**Remarks.** In bathyal environments and in some reef caves specimens retain the building capabilities of their fossil counterparts, having a branching, colonial mode of growth and being able to build large aggregates up to 30 cm in diameter and probably more (Vacelet *et al.*, 1992; Wörheide & Reitner, 1996). Their skeleton is more heavily calcified, with thicker pillars and chambers walls, and a longitudinal wall dividing the central canal. These variations, as well as other presently undescribed, may either be specific, meaning that there are several species of living ‘Sphinctozoa’, or indicate a large morphological plasticity which could have implications in the interpretation of fossil species.

#### Distribution

Recent: Indian Ocean, West and Central Pacific. Two fossil species known from Tertiary remains from Australia and Denmark (Clausen, 1982; Pickett, 1982).