

## Two new species of *Flabellum* (Scleractinia: Flabellidae) from the Southwest Indian Ocean

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*Abstract.*—Two new species of *Flabellum* are described from the southwest Indian Ocean, representing extremes of morphological variation within the genus. One of them, *F. kerguelensis*, is the first scleractinian coral reported from the Kerguelen Plateau. *Flabellum* now consists of 44 extant species, making it the fifth most species-rich genus in the order.

**Keywords:** *Flabellum*, new species, Kerguelen, Heard Island, South Africa, Flabellidae

The two species described herein represent the extremes of morphology for the genus *Flabellum*, as represented by their corallum shape. One (*F. kerguelensis*) has a flattened, discoidal corallum with a GCD:H up to 5.25, whereas the other (*F. leptocoelus*) is elongate-conical with a GCD:H as low as 0.16. Although assigned to different subgenera, they are considered within the genus *Flabellum sensu lato*. This is the first report of a scleractinian coral from the Subantarctic Kerguelen Plateau.

### Material and Methods

The specimens of *Flabellum kerguelensis* on which this paper is based were collected on three cruises of the French vessel *Marion Dufresne* in 1974, 1975 and 1985 using a beam trawl (CP)(now housed in the MNHN), and one cruise of the Australian vessel *Aurora Australis* in 1990 (housed in the SAM). The specimens of *F. leptocoelus* were also collected by a variety of benthic trawls.

The terminology used in the descriptions is defined and illustrated in Cairns & Kitahara (2012).

This work has been registered in ZooBank with the registration numbers [LSID].

Abbreviations used in the text include:

AA RSV *Aurora Australis*

CP Beam Trawl

DC Charcot Dredge

DR Rock Dredge

GCD Greater calicular diameter of a corallum

GCD:H Ratio of greater calicular diameter to height of a corallum

GCD:LCD Ratio of greater to lesser calicular diameter of a corallum

MD *Marion Dufresne*

MNHN Muséum National d'Histoire Naturelle, Paris

NMNH National Museum of Natural History, Smithsonian, Washington DC, USA

SAM South Australian Museum, Adelaide, Australia (coral catalog numbers prefaced with H)

Sx-y Cycle of septa designated by numerical subscript

USNM United States National Museum  
(now the NMNH), Washington, DC, USA  
WoRMS World Registry of Marine Species  
(<http://www.marinespecies.org>)  
ZMC Zoologisk Museum, Copenhagen

#### Family Flabellidae Bourne, 1905

*Diagnosis.*—Corallum solitary; fixed, free, or transversely dividing. Wall epithelial (neotenic condition), sometimes secondarily thickened with stereome. Epitheca usually smooth, lacking costae. Septa imperforate, composed of a single fan system of numerous closely spaced trabeculae, which produces a smooth axial edge. Pali, dissepiments, and synapticulae absent; paliform lobes present in one genus. Columella usually rudimentary or absent, but in some genera lamellar, papillose, or fascicular. Exclusively azooxanthellate.

*Occurrence.*—Lower Cretaceous to Recent: worldwide, including off Antarctic, 0–3186 m.

*Remarks.*—The family was most recently revised by Cairns (1989) and more recently reviewed by Cairns (in press), who listed 14 genera in the family, including seven that are exclusively Recent, four exclusively fossil, and three that have both fossil and Recent species. *Flabellum* is the most speciose of the flabellid genera.

#### Genus *Flabellum* Lesson, 1831

*Flabellum* Lesson, 1831: 2.—Wells, 1956: F432.—Zibrowius, 1974: 18–20 (in part: groups 1 and 3).—Cairns, 1989: 44–46, Table 4 (more complete synonymy and discussion); 1995: 96–97.

*Ulocyathus* Sars, 1851: 141.

*Diagnosis.*—Corallum solitary; attached or free. Corallum shaped in a variety of ways, including ceratoid, campanulate, bowl-shaped, discoidal, or compressed-flabellate. Transverse division lacking. Base and lower pedicel not reinforced with

stereome. Wall epithelial, usually porcellaneous, without costae. Pali, dissepiments, and synapticulae absent. Columella rudimentary to absent, when present a simple fusion of lower axial edges of larger septa. Exclusively azooxanthellate.

*Type species.*—*Flabellum pavoninum* Lesson, 1831, by monotypy.

*Discussion.*—Two subgenera are recognized in the genus, the nominate subgenus, characterized by having a smooth calicular margin, and subgenus *Ulocyathus*, characterized by having a serrate or jagged calicular margin. The nominate subgenus contains 25 Recent species; *Ulocyathus* consists of 19 Recent species, for a total of 44 recent species (Cairns 1999, updated through WoRMS and [www.lophelia.org/coldwatercoralsbook](http://www.lophelia.org/coldwatercoralsbook)), including those described herein. *Flabellum* is thus the fifth largest genus by number of species among the approximately 240 extant scleractinian genera (Cairns 2016). The genus is also known from approximately 144 nominal fossil species known from as early as the Late Cretaceous. Its evolutionary success and broad distribution as a genus may be due to the extreme simplicity of its body plan, i.e., solitary corallum; lack of pali, dissepiments, synapticulae; simple wall structure; rudimentary columella.

*Distribution.*—*Flabellum* is one of five truly cosmopolitan scleractinian genera, having a depth range of 36–3186 m. The other four cosmopolitan genera are: *Fungiacyathus*, *Caryophyllia*, *Desmophyllum*, and *Javania*.

Subgenus *Flabellum* (*Ulocyathus*) Sars,  
1851

*Flabellum* (*U.*) *kerquelenensis*, new species  
urn:lsid:zoobank.org:act:60421DB-7525-4BE3-9028-A793757C7957

Fig. 1A–E

*Types.*—Holotype: AA 57, 52°12'S, 72°40'E, 430 m, 10 Jun 1990, SAM H2287. Paratypes: AA 51, 51°53'S, 73°51'E, 310 m, 9 Jun 1990, 2, SAM

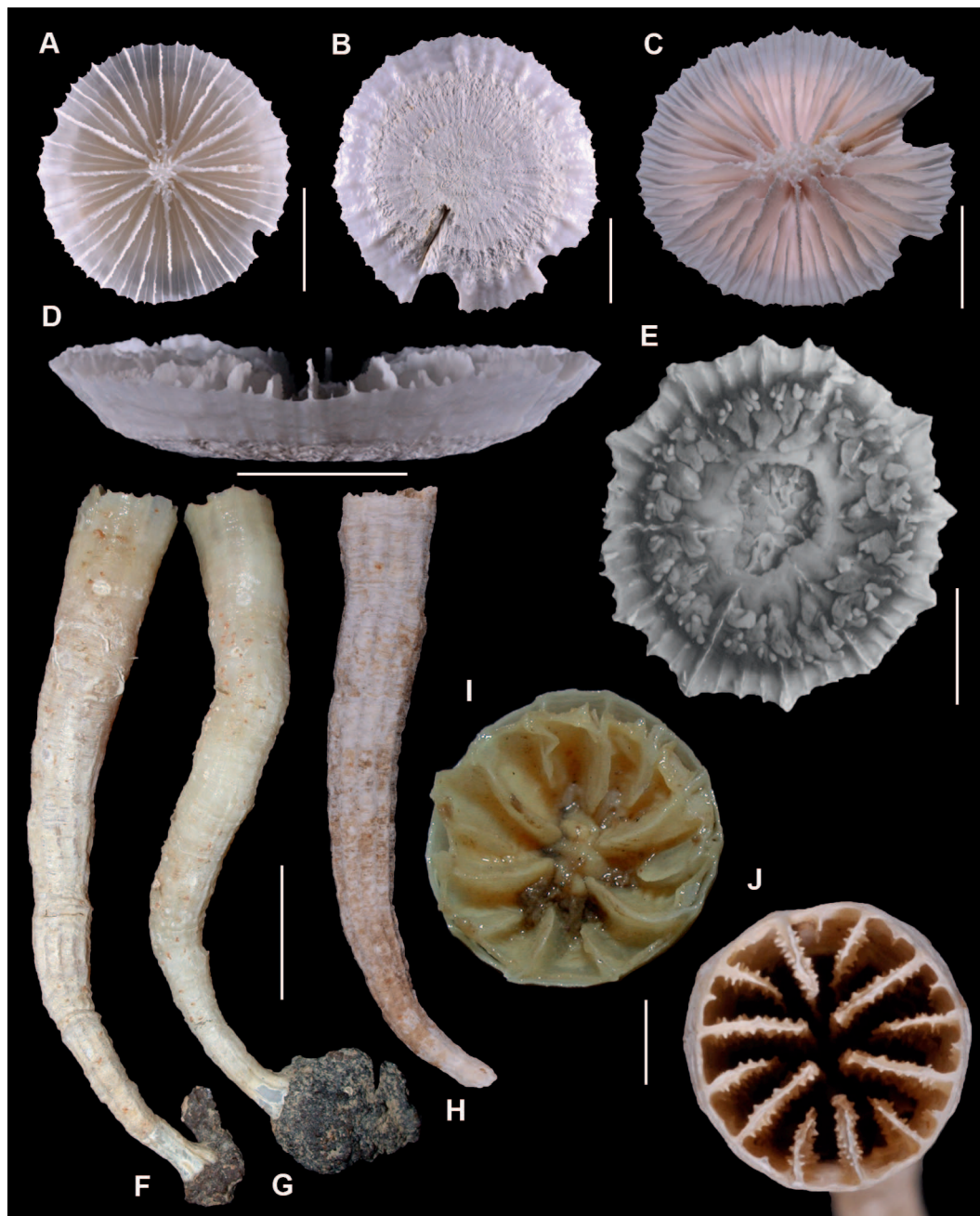


Fig. 1. A–E, *Flabellum kerguelensis*. A, calicular view of paratype, USNM 1292843; B–D, basal, oblique calicular, and lateral views of holotype; E, paratype with tissue, MD04 I106-CP258. F–J, *Flabellum leptocoelus*. F–G, lateral view of two attached paratypes, ZMUC-ANT-001040ZMC; H, J, lateral and calicular views of holotype; I, paratype with tissue, ZMUC-ANT-001040ZMC. Scale bars: A–E, 20 mm; F–H, 10 mm; I–J, 2 mm.

H2289; AA 57, type locality, 1, SAM H2288, 2, USNM 1292843; AA 62, 52°40'S, 72°31'E, 300 m, 11 Jun 1990, fragments, SAM H2290; AA 64, 52°18'S, 72°50'E, 265 m, 12 Jun 1990, 4, SAM H2291, 2, USNM 1292844; AA 79, 52°32'S, 73°16'E, 225 m, 20 Jun 1990, 1, SAM H2292; MD03-3-11-CP2, 46°25.4'S, 71°51.7'E, 620–650 m, 5 Apr 1974, 6, MNHN; MD03-6-20-CP3, 50°37.9'S, 71°35.8'E, 565 m, 6 Apr 1974, 30, MNHN; MD03-7-22-CP4, 52°12.7'S, 75°38.4'E, 525–560 m, 7 Apr 1974, 2, MNHN; MD03-18-52-CP11, 47°42.2'S, 68°07.1'E, 243 m, 15 Apr 1974, 2, MNHN; MD03-21-57-CP14, 48°29.7'S, 70°55.4'E, 345–360 m, 15 Apr 1974, 229, MNHN, 4, USNM 61748; MD04-C24-DR58, 50°04.0'S, 68°20.0'E, 195 m, 25 Feb 1975, 2, MNHN; MD04-G67-CP161, 47°08.8'S, 68°44.6'E, 395 m, 6 Mar 1975, 1, MNHN; MD04-G70-CP169, 47°42.2'S, 68°56.5'E, 204 m, 7 Mar 1975, 9, MNHN; MD04-H95-DC233, 47°09.6'S, 70°28.1'E, 195 m, 11 Mar 1975, MNHN; H98-CP243, 46°47.7'S, 70°30.2'E, 1218 m, 12 Mar 1975, 27, MNHN; MD04-I104-DC254, 48°46.8'S, 71°00.0'E, 507–562 m, 13 Mar 1975, 1, MNHN; MD04-I106-CP258, 48°43.5'S, 71°06.5'E, 925–937 m, 14 Mar 1975, 5, MNHN; MD42-2-CP9, 52°48'S, 72°20'E, 600 m, 13 Jan 1985, 15, MNHN; MD42-3-CP18, 52°33'S, 74°46'E, 385 m, 14 Jan 1985, 2, MNHN; MD42-4-CP25, 53°11'S, 74°04'E, 285 m, 15 Jan 1985, 1, MNHN.

*Type locality*.—AA 57: 52°12'S, 72°40'E (Kerguelen Plateau between Kerguelen and Heard Islands), 430 m.

*Description*.—The corallum is discoidal to shallow bowl-shaped, with a flat base and gently upturned calicular edge (Fig. 1A–D). The calice is almost circular (GCD:LCD = 1.02–1.07), the axis aligned with the elongate columella being slightly longer. The corallum is quite low (flattened, Fig. 1D), the GCD:H ranging from 2.85–5.25. The largest specimen (*Aurora Australis* 51) is 65.9 mm in GCD and 14.1 mm in height, the holotype being slightly

smaller, measuring 62.5 × 59.6 mm in calicular diameter and 12.1 mm in height. The calicular edge is finely serrate, a short (1.5–2.0 mm in height) equilaterally triangular apex corresponding to the 12 S1–S2, a slightly lower (1.3–1.5 mm tall) and broader apex corresponding to the 12 S3, and an even smaller apex corresponding to the S4; if present, the S5 apices are about 0.5 mm in height. The theca and septa are quite fragile, easily broken when collected; the theca is white and porcellaneous in texture except for the center of the base of the corallum, which is invariably worn (Fig. 1B). The center of the base reveals six protosepta.

The septa are hexamerally arranged in up to five complete cycles in larger specimens (S1–S2 > S3 > S4 > S5), the number of septa a function of the calicular diameter. The S4 begin to appear at a GCD of about 17 mm, the fifth at a GCD of 35–40 mm, and a full fifth cycle (96 septa) only at a GCD above 60 mm. There are exceptions to this general rule, the largest corallum having only 91 septa, and some coralla of the same calicular diameter differing by as many as 22 septa. The S1–S2 extend from the calicular edge to the center of the corallum, their upper edges slightly sinuous and axial edges consisting of small, convoluted paliform trabeculae, which together with the other S1–S2, form a crispate columella up to 19 × 7 mm in diameter in the holotype. The convolutions of the axial edges appear to compartmentalize the similarly shaped mesenterial filaments. The S3 also extend to the columella, but their upper edges are straight and their axial edges are attenuated and do not contribute to the columella. The S4 are about half the width of the S3, and the S5 even smaller, both cycles of septa being quite low. The order of insertion of the S5 is irregular and does not always occur in pairs, the S5 having a tendency to first form adjacent to the S1–S2. The corallum is so shallow that a fossa does not exist.

*Comparisons.*—*Flabellum (Ulocyathus) kerguelensis* is easily distinguished from the other 18 species in the subgenus by its flattened discoidal shape (and corresponding high GCD:H ratio). Only two species, *F. angulare* Moseley, 1876 and *F. apertum* Moseley, 1876, have coralla of remotely similar shape, i.e., open bowl-shaped, but their calices are compressed flabellate in shape and they have a GCD:H on the order of 1.2–1.8. *F. apertum*, however, is one of the species found in the southern Indian Ocean.

*Remarks.*—No scleractinian corals had previously been reported from Kerguelen or Heard Islands (Cairns 1982), although species of another five genera are known to occur there having been collected but not yet reported from the *MD* cruises.

Within the cold-temperate and sub-Antarctic waters of the southern Indian Ocean, the closest archipelago to the Kerguelen Plateau is Amsterdam and St. Paul Islands, about 950 km to the northeast. Twenty-two genera of azooxanthellate Scleractinia have been reported from this island group (Zibrowius 1974, 1990); however, no species of *Flabellum* has been listed. Approximately 1280 km to the northwest lie the Crozet Islands, from which no Scleractinia have ever been reported (Cairns 1982), however among the *MD* cruises mentioned herein at least seven azooxanthellate genera occur in this island group, including *F. apertum*. Nine hundred km to the west lie the Prince Edward Islands, at which two species have been previously recorded (Cairns, 1982), including *F. apertum*, and another four azooxanthellate genera are known among the *MD* collections. Finally, Bouvet Island, technically in the southeast Atlantic Ocean and about 3000 km west of Kerguelen, is known to have one species (Cairns 1982) as well as an unreported species of *Flabellum* from the *MD* cruises, but not *F. kerguelensis*. Thus, although some of the adjacent island archipelagos host

azooxanthellate Scleractinia, some even of the genus *Flabellum*, no other island group is known to host *F. kerguelensis*, which is thus assumed to be endemic to the Kerguelen Plateau.

Keller (1978) suggested that the flat bases and thus broad calicular region of deep-water flabellid corals was an adaptation to increase the surface area to receive food in an otherwise poor feeding environment. On the other hand, Tokuda et al. (2010) suggested that this shape helped prevent corals from sinking into soft substrates; however substrate type and food concentration were not sampled along with the specimens collected and thus these hypotheses cannot be tested.

The holotype appears to have an ascithoracidan crustacean gall incorporated into its columella.

*Etymology.*—Named for the Kerguelen Plateau, where it appears to be a relatively common species.

*Distribution.*—Kerguelen Plateau, surrounding Kerguelen and north of Heard Island, 195–1218 m.

Subgenus *Flabellum (Flabellum)* Lesson, 1831

*Flabellum (F.) leptoconus*, new species  
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Fig. 1F–J

*Flabellum sibogae* sensu Gardiner, 1904: 98.—Cairns & Keller 1993: 220, 221.

*Adkinsella* sp. Boshoff, 1981: 34.

*Types.*—Holotype: 31°23'S, 29°54'E, 409–440 m (*Adkinsella* sp. of Boshoff, 1981), USNM 62498. Paratypes: type locality, 1 specimen, (*Adkinsella* sp. of Boshoff, 1981), USNM 1284583; *Anton Bruun* 7–358A, 29°19'S, 32°00'E, 366 m, 4, USNM 91721; *Vema* 19–28, 35°40'S, 21°59'E, 165 m, 1 small pedicel, USNM 87645.—Mortensen's Java-South African Expedition of 1929–1930, Station 25, off Durban, 424 m, 26 Aug 1929, 5 specimens, ZMUC-ANT-001040ZMC.—24 km north

of Buffalo River (28°43'S, 30°28'E), 567 m, 24 Apr 1901, 2 specimens (= *Flabellum sibogae* of Gardiner, 1904), SAM.—SST57Q (34°40'S, 21°39'E), 80 m, 5 specimens (*Adkinsella* sp. of Boshoff, 1981), SAM.

*Type locality*.—31°23'S, 29°54'E (south of Natal region, S. Africa), 409 m.

*Description*.—The corallum is elongate-conical, essentially subcylindrical to ceratoid, the edges of the theca diverging at an angle of 7–9° (Fig. 1F–H). The holotype measures 44.2 mm in length and 7.08 × 6.49 mm in calicular diameter, thus having a GCD:H of only 0.16 (i.e., about six times longer than broad). The coralla are rarely straight, but often slightly bent near the base. The calice is almost circular (GCD:LCD = 1.01–1.09) and the thecal edge is smooth. The theca and septa are quite fragile, the theca about 0.2 mm in thickness. The epitheca is sometimes longitudinally ribbed corresponding to the S1–S2, the space between the low ribs traversed by very fine epithecal striations. The pedicel narrows to 1.8–2.3 mm in diameter and then expands into an encrusting base up to 3.7 mm in diameter (Fig. 1F–G); the basal sections contains six protosepta.

In most specimens the septa are hexamerally arranged in two cycles (S1 > S2) resulting in 12 septa, but in the larger holotype there is a rudimentary and incomplete third cycle of septa, resulting in 22 septa (Fig. 1J). The S1 have vertical and slightly sinuous axial edges, which almost meet in the center of the fossa. The S2 are about half the width of the S1 and also slightly sinuous. If present, the S3 are rudimentary, consisting of a short, non-continuous rows of spines. The fossa is quite deep and narrow, the bottom not visible in an intact corallum.

*Comparisons*.—Like *F. (Ulocyathus) kerguelensis*, *F. (Flabellum) leptocoelus* is easily distinguished from the other 24 species in its subgenus but in this case by the subcylindrical shape of its corallum and the low number of septa in its

corallum. The most similarly-shaped species is *F. floridanum* Cairns, 1991 (western Atlantic), which has a ceratoid corallum resulting in a GCD:H of about 0.6 (vs 0.16–0.20), and furthermore, has four cycles of septa (48 vs 12–22 septa).

*Remarks*.—Gardiner (1904) reported two specimens of *F. leptocoelus* from 15 miles (24 km) north of the Buffalo River, Natal, identifying them as *Desmophyllum alabastrum* Alcock, 1902, an Indonesian species. But he realized that his specimens were of the genus *Flabellum*, which meant he had to create the new combination *Flabellum alabastrum* (Alcock, 1902). However, he also realized that *F. alabastrum* (Alcock, 1902) would be a junior homonym of *Flabellum alabastrum* Moseley, 1873, and thus proposed a replacement name for it, i.e., *Flabellum sibogae*. Subsequently (Cairns & Zibrowius 1997), *Flabellum alabastrum* sensu Alcock (1902) was determined to belong to the genus *Javania*, and probably the species *J. lamprotichum*. Thus the specimens reported by Gardiner (1904) as *Flabellum sibogae* represent a new species of *Flabellum* (as stated by Cairns and Keller 1993), which requires a new name, as *F. sibogae* is not available due to its previous use as a replacement name.

Boshoff (1981) reported this species to be found on a substrate consisting of mud or coarse shell and sand. In gross morphology, it is the opposite to that of *F. kerguelensis* described above, which might imply that it is adapted to a shallower, hard substrate in a region of high productivity.

*Etymology*.—From the Greek *leptos* (thin or slender) + the Greek *konos* (cone), used as a noun in apposition, and meaning a slender cone.

*Distribution*.—Agulhas Bank to Natal region of South Africa, 80–567 m.

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