What are corals?

Douglas Fenner, Ph.D.

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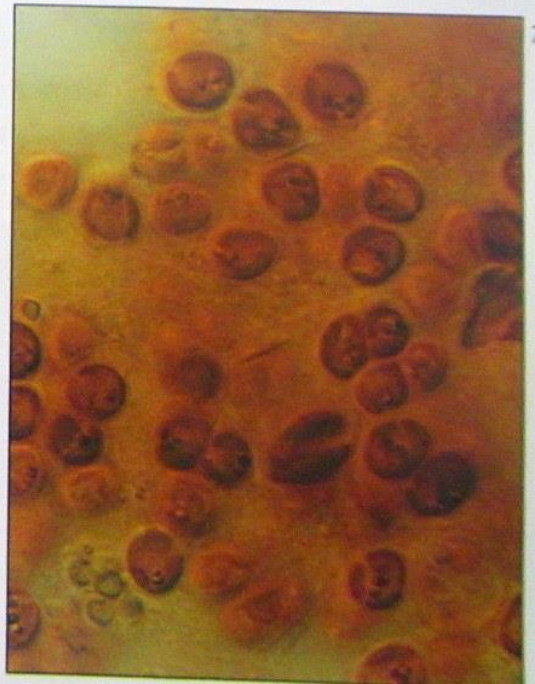

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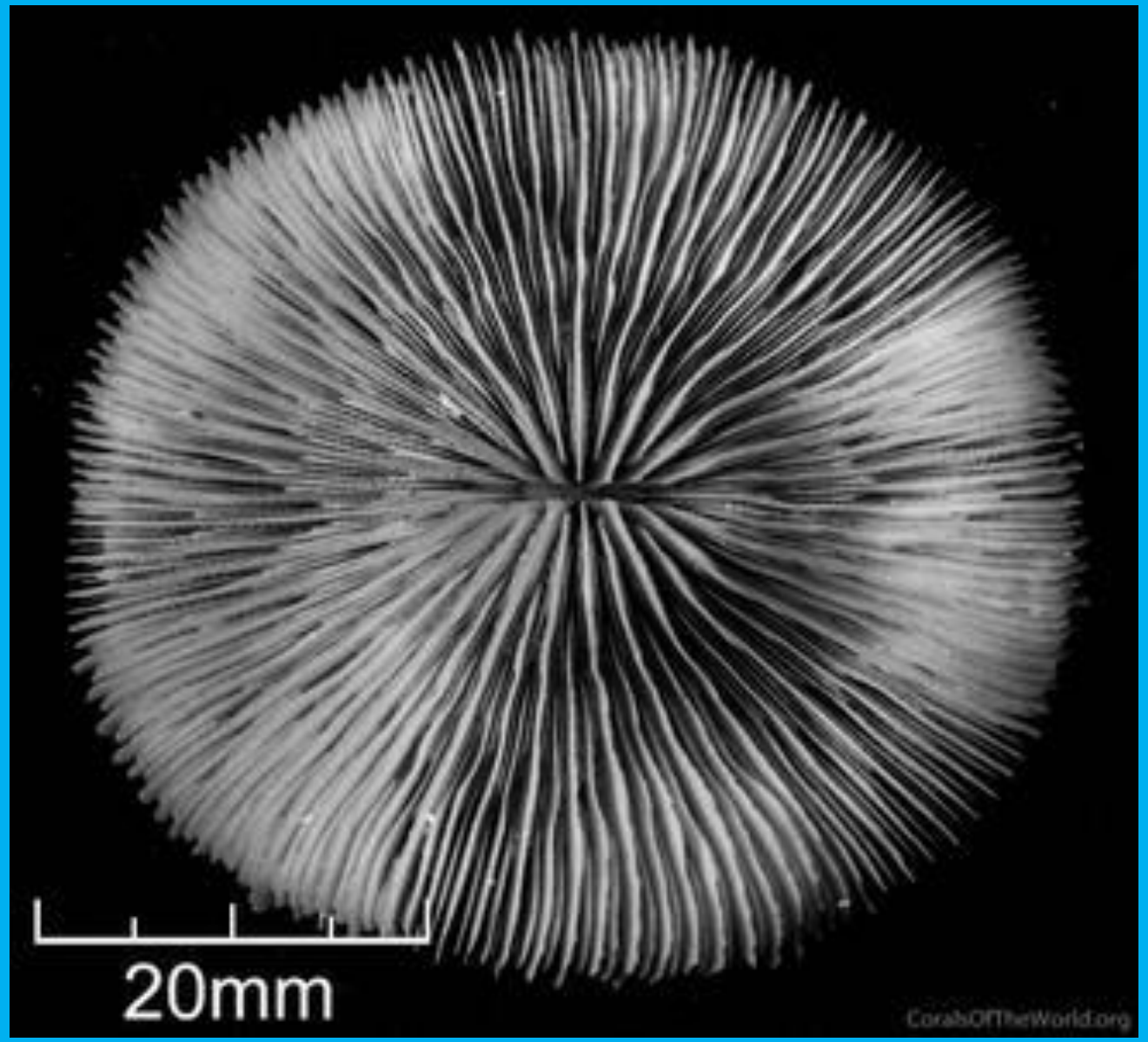
Skeleton: $CaCO_3$

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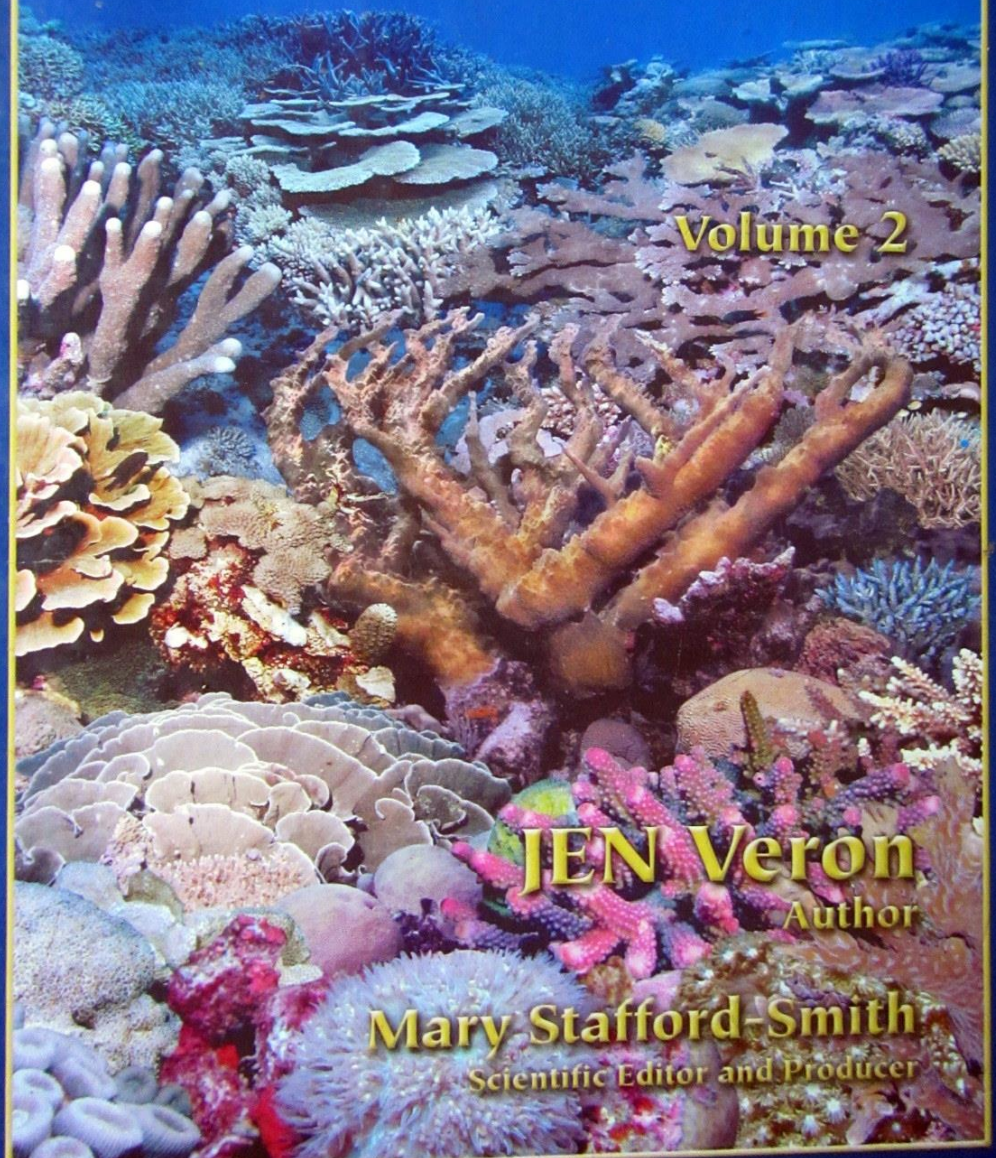
CORALS
of the world

Volume 2



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Author

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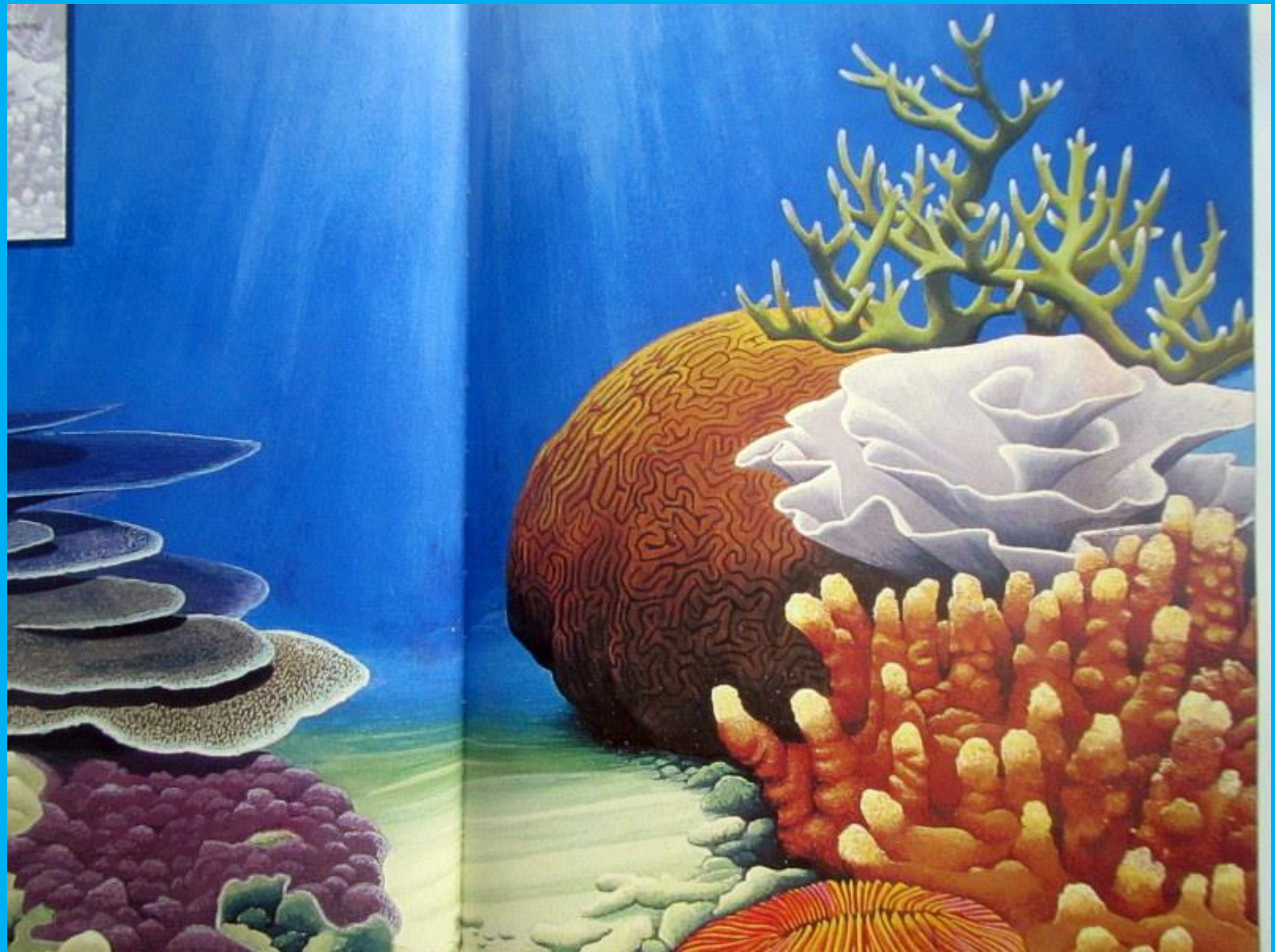

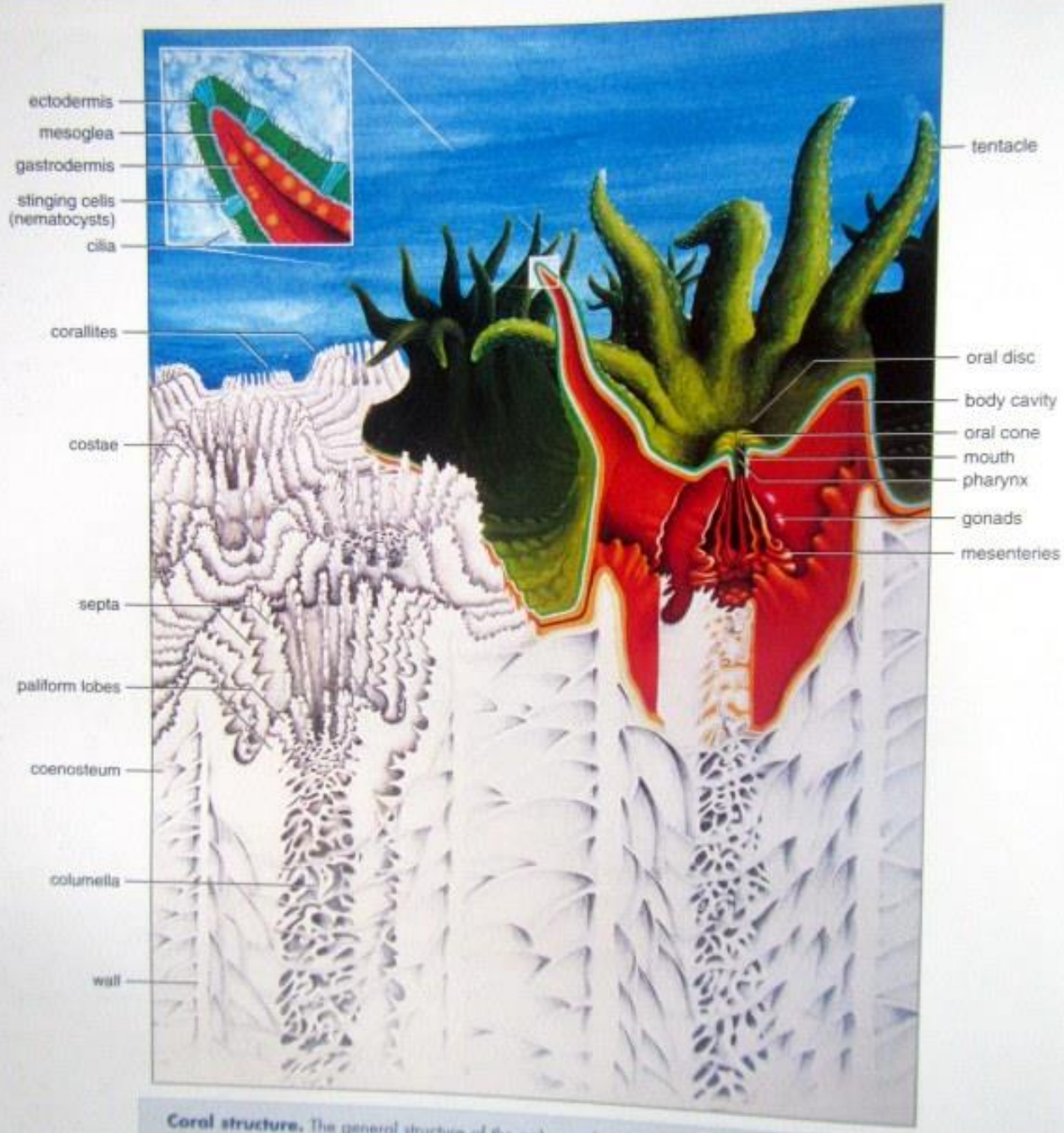

Coral structure. The general structure of the polyp and underlying skeleton. Painting: Cecil Kelley


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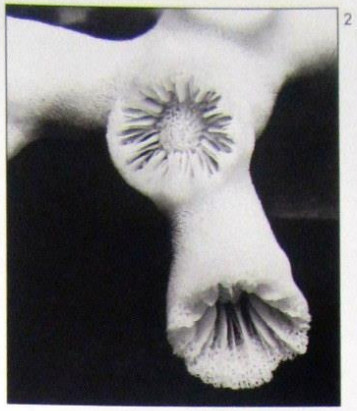
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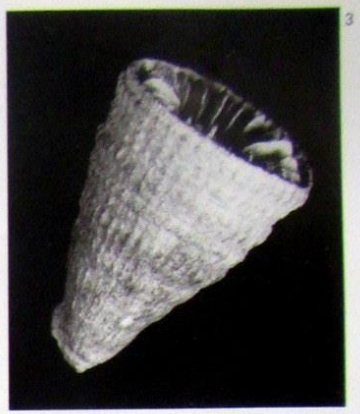
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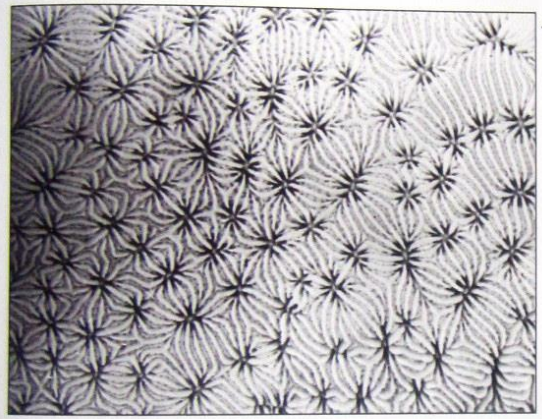
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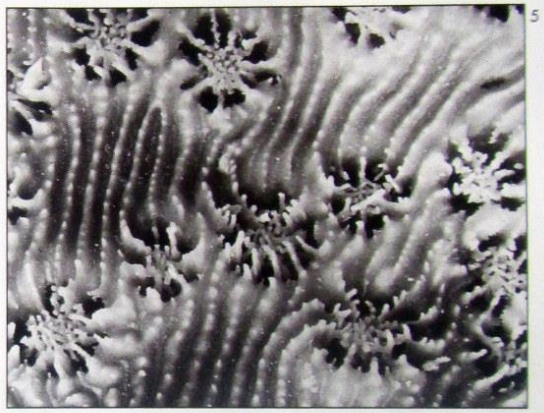
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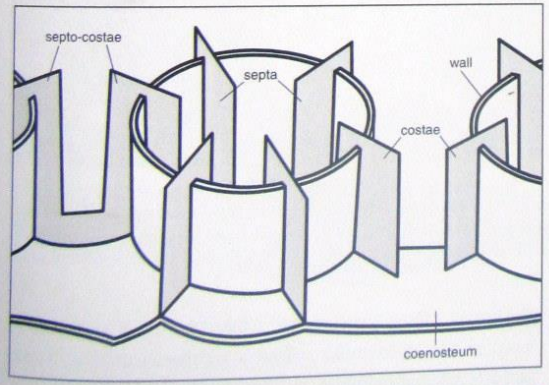
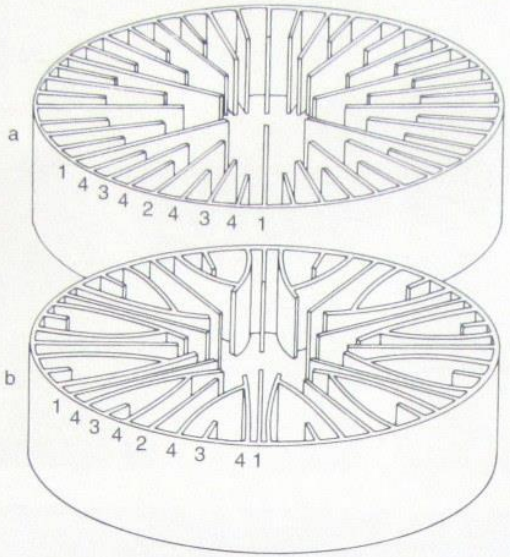


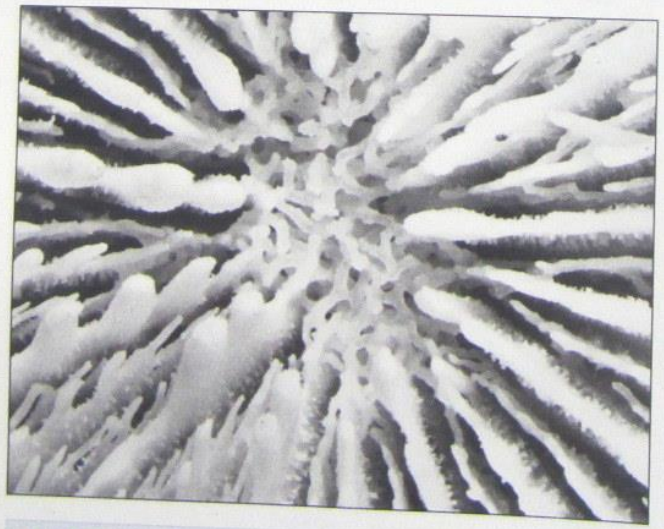
Skeletal elements. Diagrammatic representation of the basic skeletal elements of a coral.

1-5 Basic wall components. (1) The wall of this *Acanthastrea* is primarily composed of thickened septo-costae. This is best seen in families Faviidae and Mussidae, and also some Caryophylliidae. (2) The wall of this *Duncanopsammia* is primarily composed of sponge-like coenosteum. This is best seen in families Dendrophylliidae and Poritidae (except *Alveopora*). (3) The wall of this *Conotrochus* is partly composed of epitheca. This mostly occurs in azooxanthellate corals including the Flabellidae and some Caryophylliidae. (4) The wall of this *Pavona* is primarily composed of horizontal rods of synapticulae. This is best seen in families Siderastreidae, Agariciidae and Fungiidae. (5) The wall of this *Echinophyllia* is primarily composed of sterome. This is best seen in the Euphyllidae, Oculinidae, Meandrinidae and Pectiniidae. Other major families may have two equally dominant wall components: the Pocilloporidae and Acroporidae have walls of mixtures of thickened septo-costae and coenosteum; most Caryophylliidae have walls of mixtures of thickened septo-costae and epitheca.



Septa. (a) Normal cycles of septa, (b) pourtàles plan. Numbers indicate cycles.

Pali. A vertical section of a corallite divided into horizontal layers to show the origin of pali. The single palus (arrowed) is part of two fused 4th cycle septa at the bottom of the diagram, but appears to be part of a single 3rd cycle septum at the top. *Drawing: Marty Eden*



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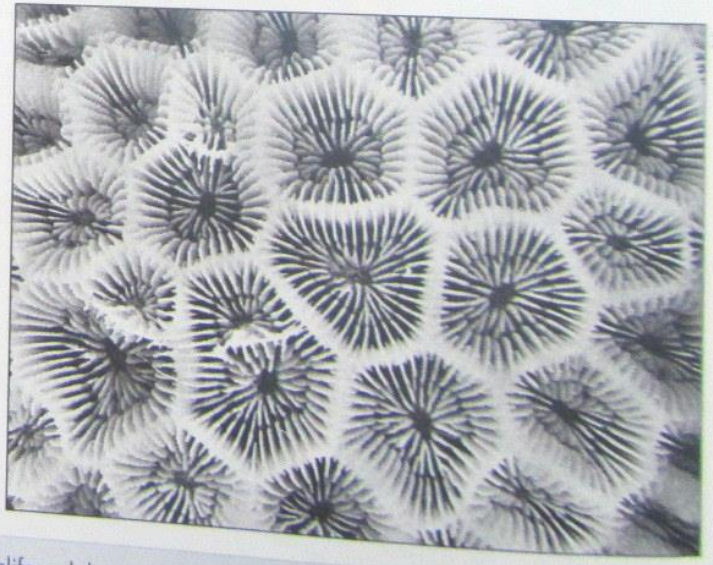

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1, 2 Skeletal structures. The appearance of the columella and paliform lobes. (1) A [illegible] columella composed of a tangle of spines from th[illegible]


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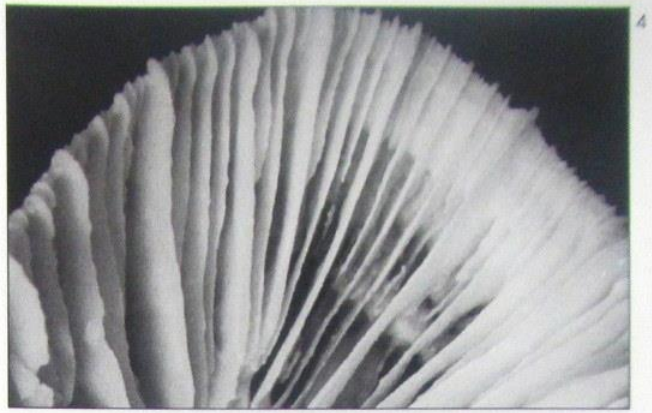
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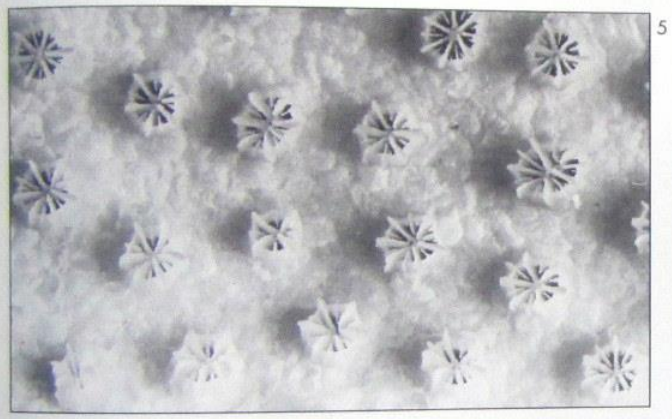
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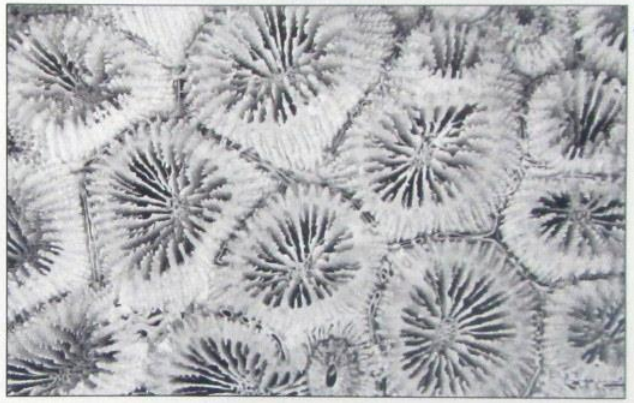
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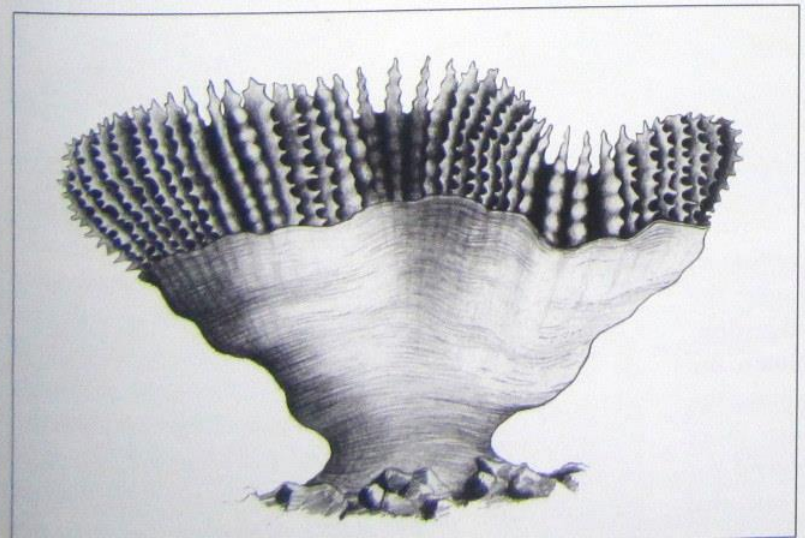
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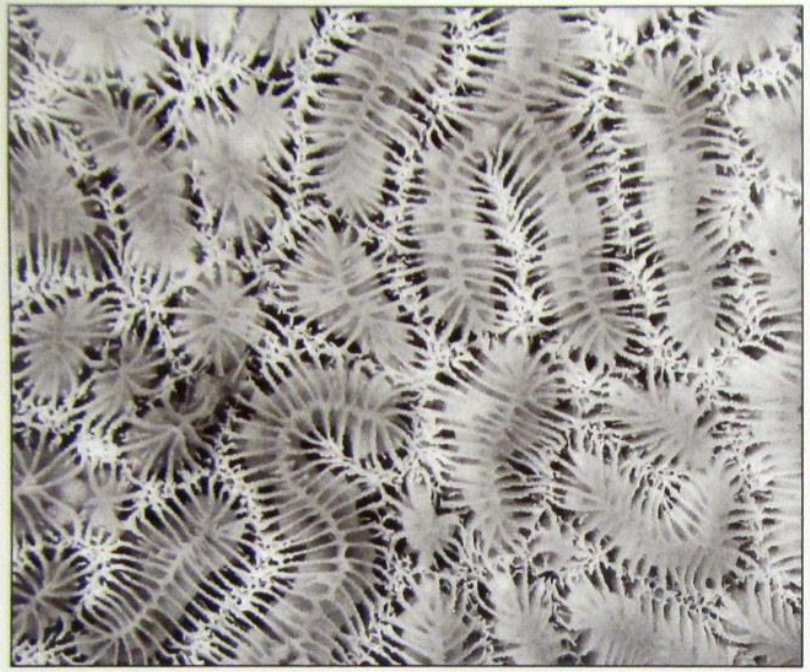
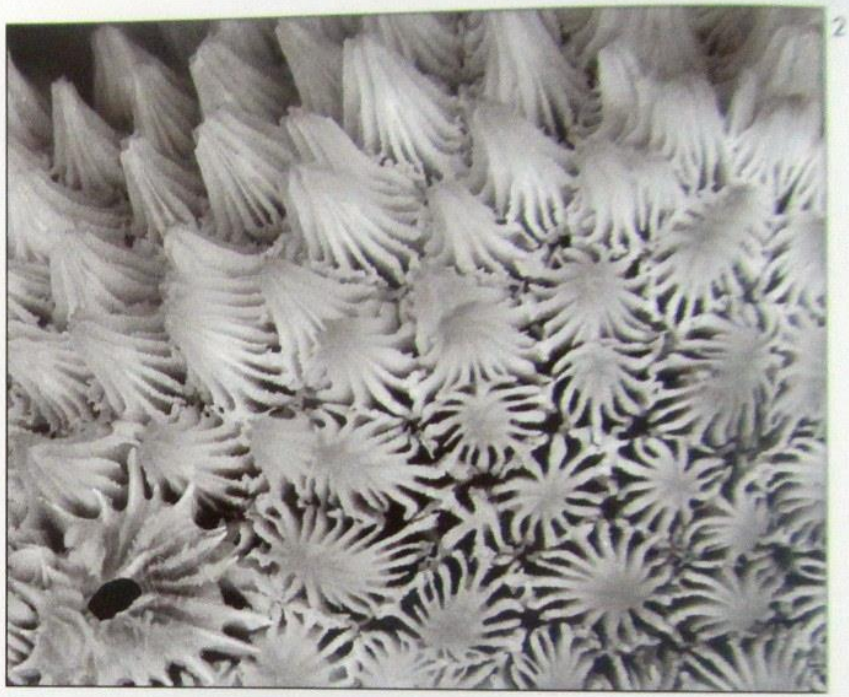
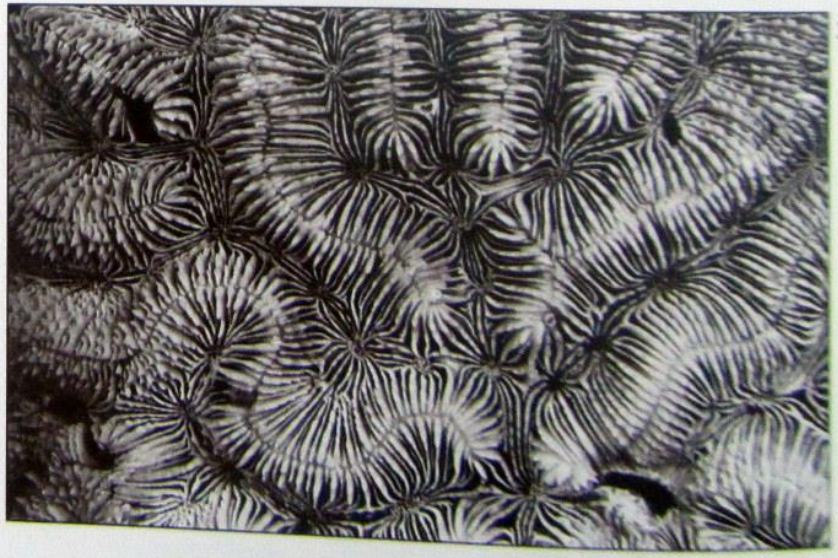
3-7 Skeletal structures. (3) Corallite walls and the skeleton between the corallites of this *Turbinaria* skeleton consist of a sponge-like matrix, the coenosteum. (4) The smooth skeleton between the septa of this *Catalaphyllia* skeleton is the sterome. (5) The fine blisters of skeletal material between the corallites of this *Galaxea* are the dissepiments. (6) Fine skeletal structures between the corallites of this *Montastrea* are called 'groove-and-tubercle' structures and are composed of epitheca. (7) The skeletal layer covering the outside of this *Trachyphyllia* is the epitheca. *Drawing: Geoff Kelley*

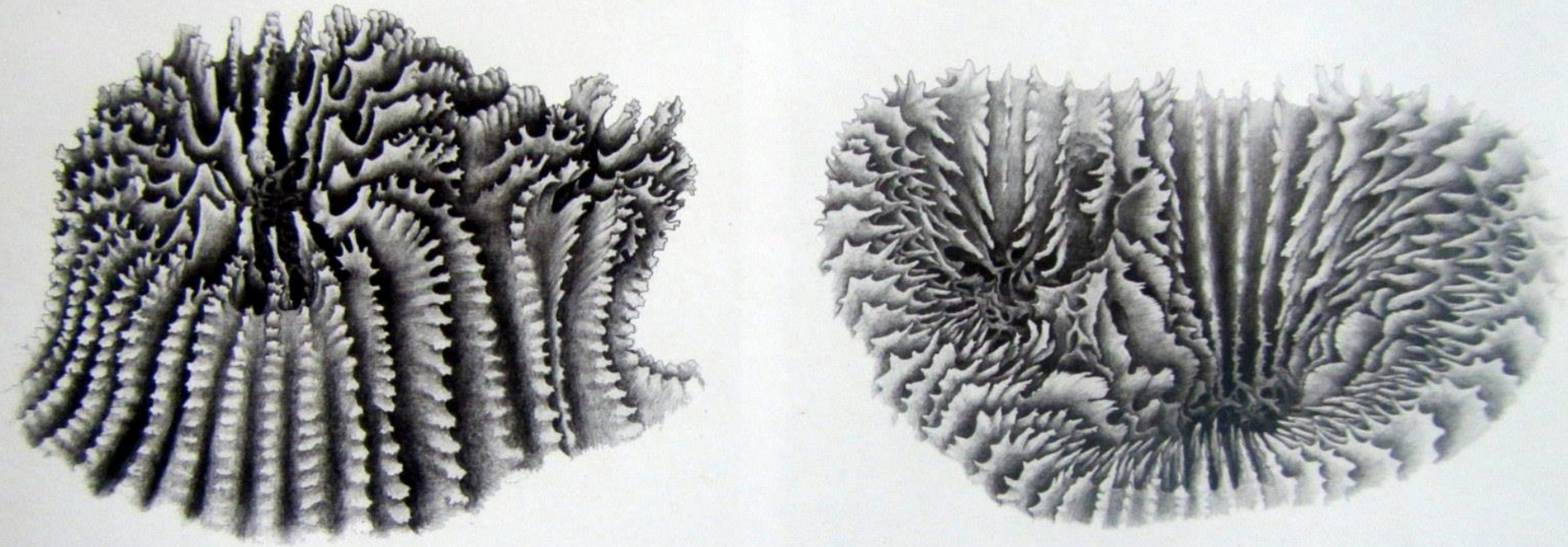




The polyp tissues. The sac-like body cavity of the coral polyp is the coelenteron (p48), which has a single opening to the outside. The coelenteron of one polyp is linked to those of adjacent polyps by tubes through which water circulates and nutrients are transported. The coelenteron serves many functions including digestion and the circulation of fluids for respiration and nutrition. The mouth leads to a short tube, the pharynx, which opens into the body cavity. In most corals it is short, in others (notably *Goniopora* and *Alveopora*) it is extraordinarily extendable, allowing the mouth and tentacles to protrude far beyond the skeleton to aid food capture. The coelenteron is a complex structure, made so by the skeletal structures,



Tentacles are tubul

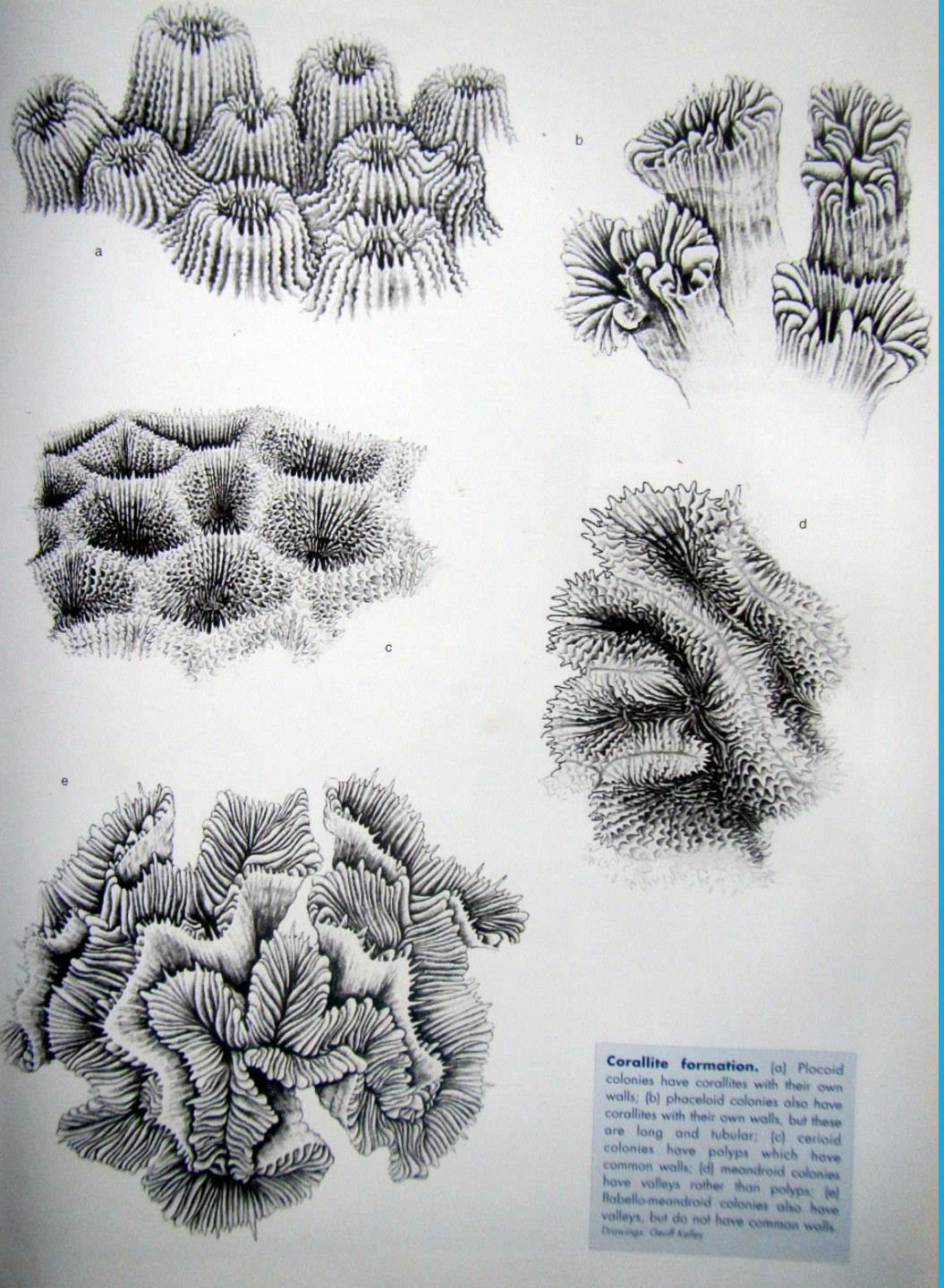


Types of corallite budding. Extratentacular budding (left) and intratentacular budding (right) in faviid colonies. *Drawings: Geoff Kelley*

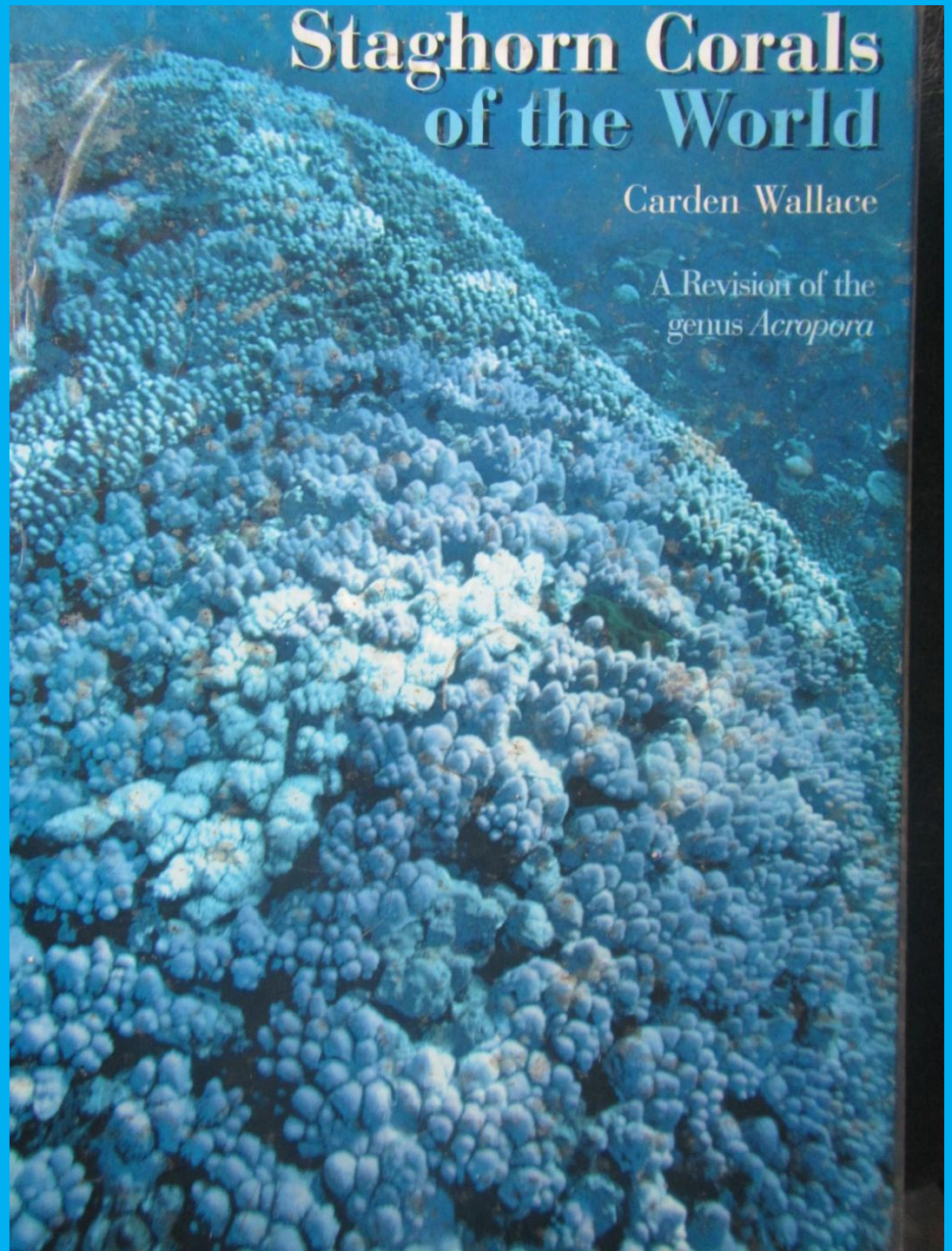
Colony formation. In most corals, the overall appearance of a colony is not a direct outcome of the way its corallites multiply. However, in the Family Faviidae, the type of budding may determine the type of colony that results. In this family, the terms used to

as seen in colonies with valleys. Some colonies have both intra- and extratentacular buds.

If the corallites of a colony all have their own wall



Corallite formation. (a) Plocoid colonies have corallites with their own walls; (b) phaceloid colonies also have corallites with their own walls, but these are long and tubular; (c) cerioid colonies have polyps which have common walls; (d) meandroid colonies have valleys rather than polyps; (e) flabello-meandroid colonies also have valleys, but do not have common walls.
Drawings: Geoff Kelley


Staghorn Corals
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Carden Wallace
A Revision of the
genus Acropora

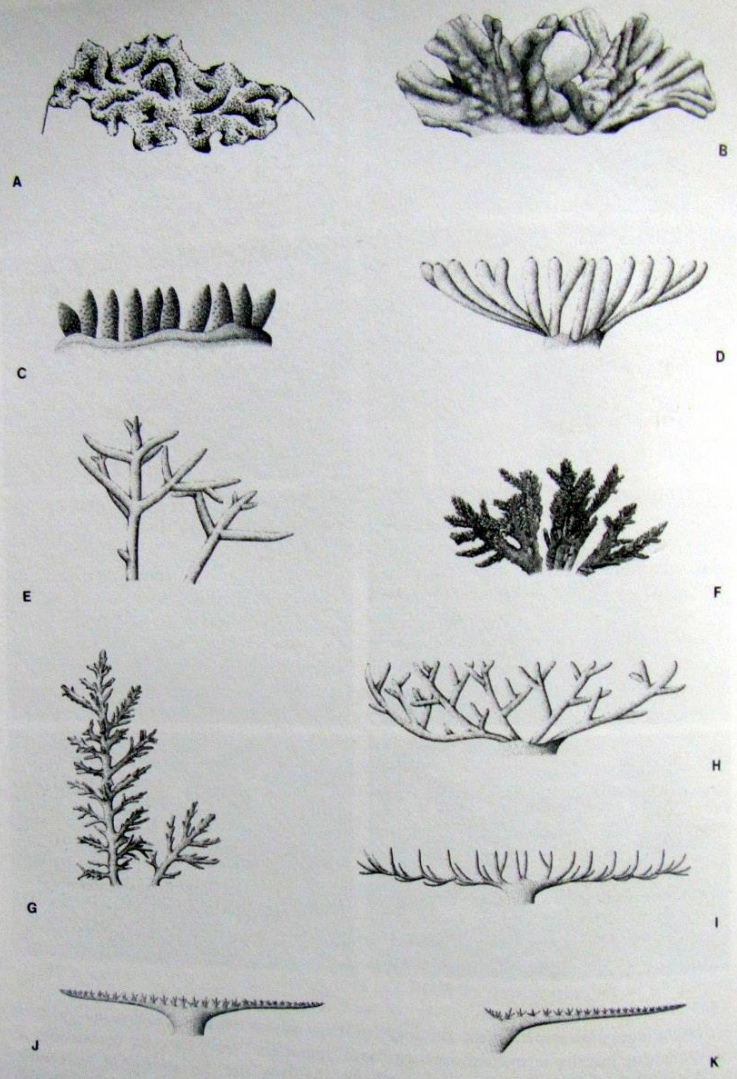


FIGURE 29 Categories commonly used to describe the colony shapes of *Acropora* species. (A) encrusting (B) cuneiform (C) digitate (D) corymbose (E) arborescent (F) caespitose (G) hispidose (H) caespito-corymbose (I) arborescent table (J) table (K) plate (artwork L. Belbin/M. Lee).

lites are the central corallites that make up the axis of an *Acropora* branch. They occur either singly, as in *A.* (*Acropora*), or in groups of two or more, as in *A.* (*Isopora*) (Figure 30). They are longer than the radial corallites, which are budded off from below the extending tip of the axial corallite. While usually recognisable as such, axial corallites can sometimes be confused with radial corallites, for example when many incipient branches occur (e.g. in *A. loripes*), or in hispidose branching species where few radial corallites are developed (e.g. *A. echinata*), or in species where the radial corallite is cylindrical and long (e.g. in *A. abrolhosensis*). In a few species (e.g. *A. multiacuta*, *A. suharsonoi*) the branch consists of an axial corallite that is bare except for a very small number of radial corallites around its base.

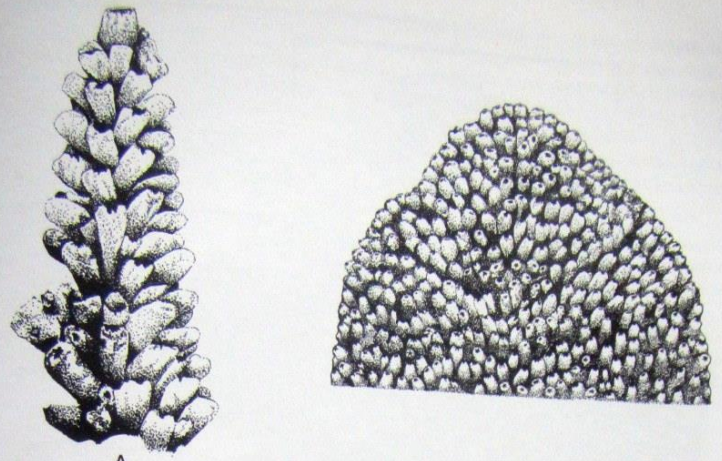


FIGURE 30 Diagram illustrating the distinction between branch development (A) around a single axial corallite, as in *Acropora* (*Acropora*) and (B) around several axial corallites, as in *A.* (*Isopora*) (artwork M. Lee).

The wall of the axial corallite is formed by synapticular rings, their number varying from a single ring to several. Sometimes the number is difficult to determine (Figure 31). Four synapticular rings develop in the process of wall-formation in the axial corallite of *A. cervicornis* (Ricart y Menendez, 1977; Gladfelter, 1982). In addition to proximal linear extension, the axial corallite adds aragonite to its distal skeleton by an infilling process (Gladfelter, 1982). The overall contribution by the axial corallite to the bulk and diameter of a branch varies among species, from a condition where the branch diameter is formed mainly by the bulk of the axial corallite (e.g. in the *A. robusta* and *A. humilis* species groups), to one in which the radial corallites contribute the major component of branch diameter (e.g. *A. nasuta* group). In

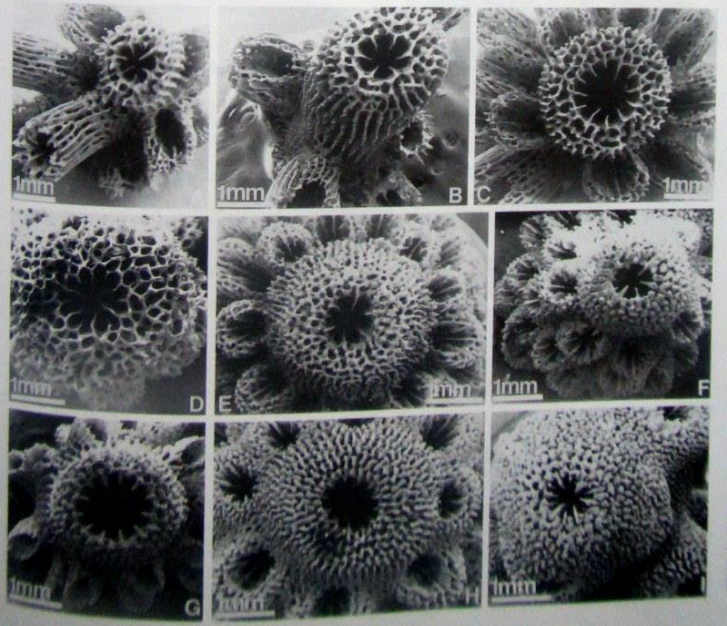
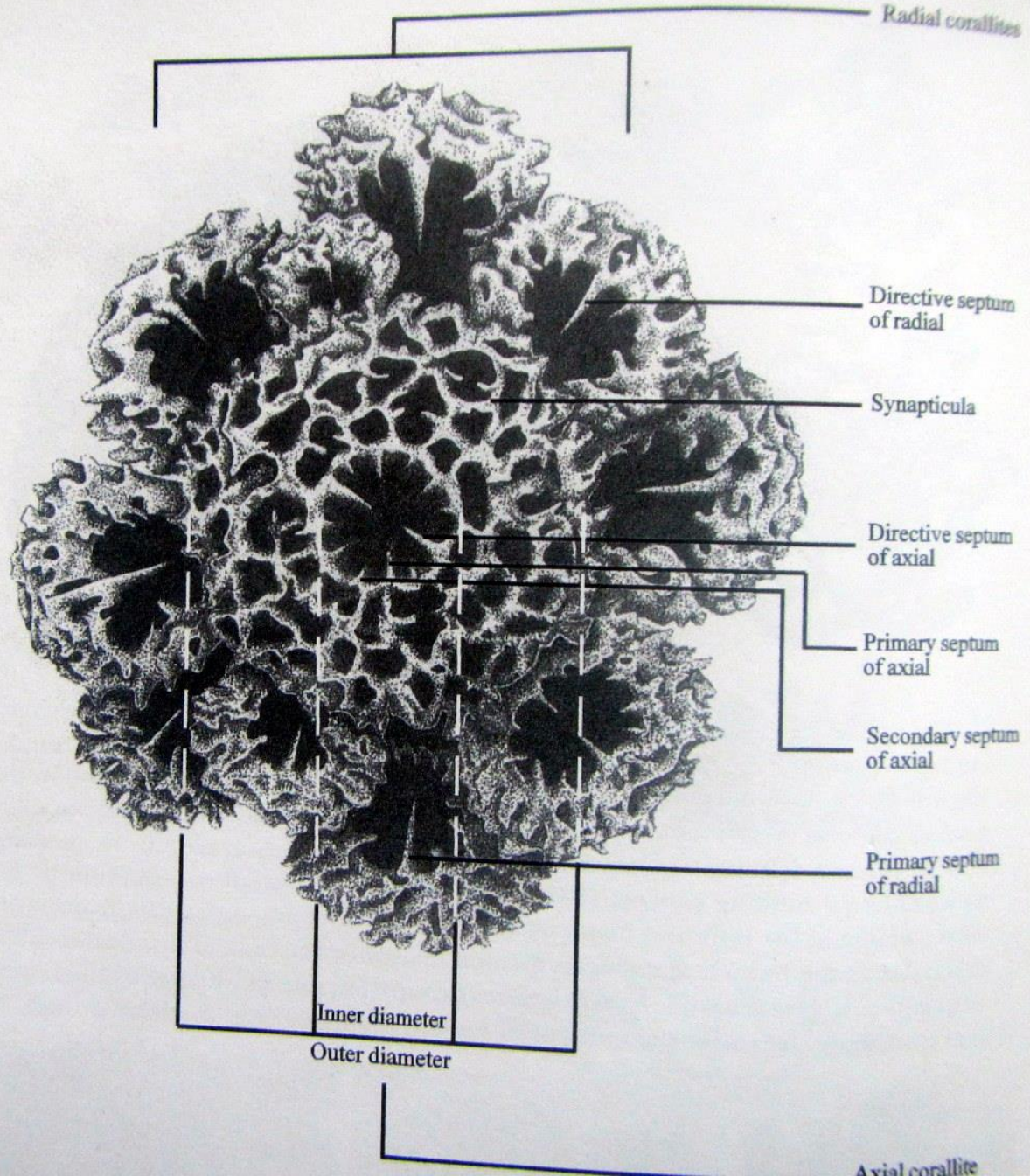


FIGURE 31 Axial corallites of various *Acropora* species (scanning electron micrographs):
(A) *A. cytherea*
(B) *A. aculeus*
(C) *A. intermedia*
(D) *A. vaughani*
(E) *A. pulchra*
(F) *A. microphthalma*
(G) *A. muricata*
(H) *A. humilis*
(I) *A. longicyathus*. All specimens from the Great Barrier Reef except (D) from Enewetak, Marshall Islands.

FIGURE 32 Diagram of axial and radial corallites, indicating the measurements used in species descriptions (artwork M. Lee).



by functional dimorphism is not known as yet. Soong & Lang (1992) found that small

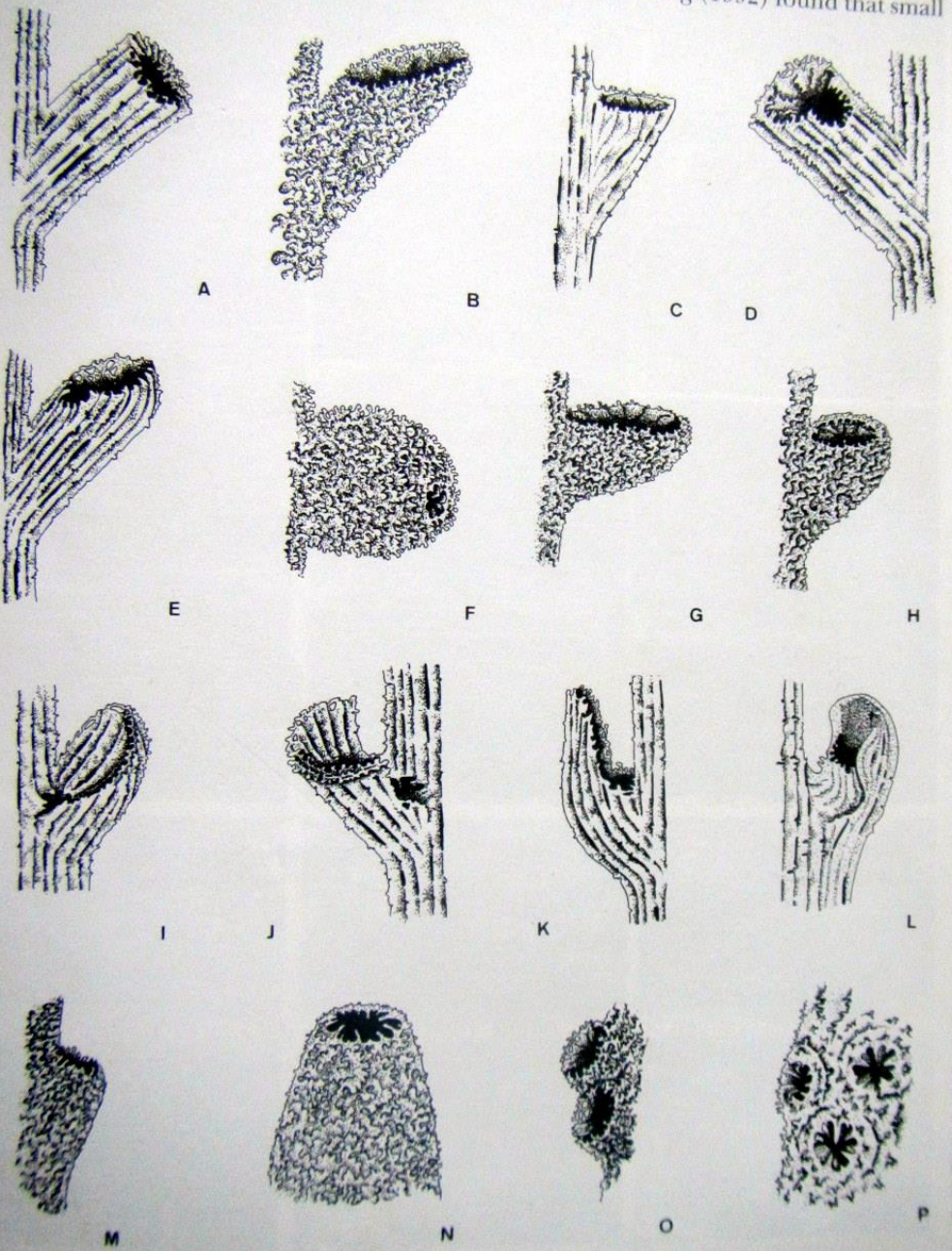


FIGURE 33 Categories commonly used to describe the radial corallites of *Acropora* (A) tubular, round opening (B) tubular, oblique opening (C) appressed tubular (D) tubular, dimidiate opening (E) tubular, nariform opening (F) rounded tubular (G) nariform, elongate opening (H) nariform, round opening (I) labellate, rounded lip (J) labellate, flaring lip (K) labellate, straight lip (L) cochleariform (M) appressed tubular (N) conical (O) sub-immersed (P) immersed (artwork M. Lee).

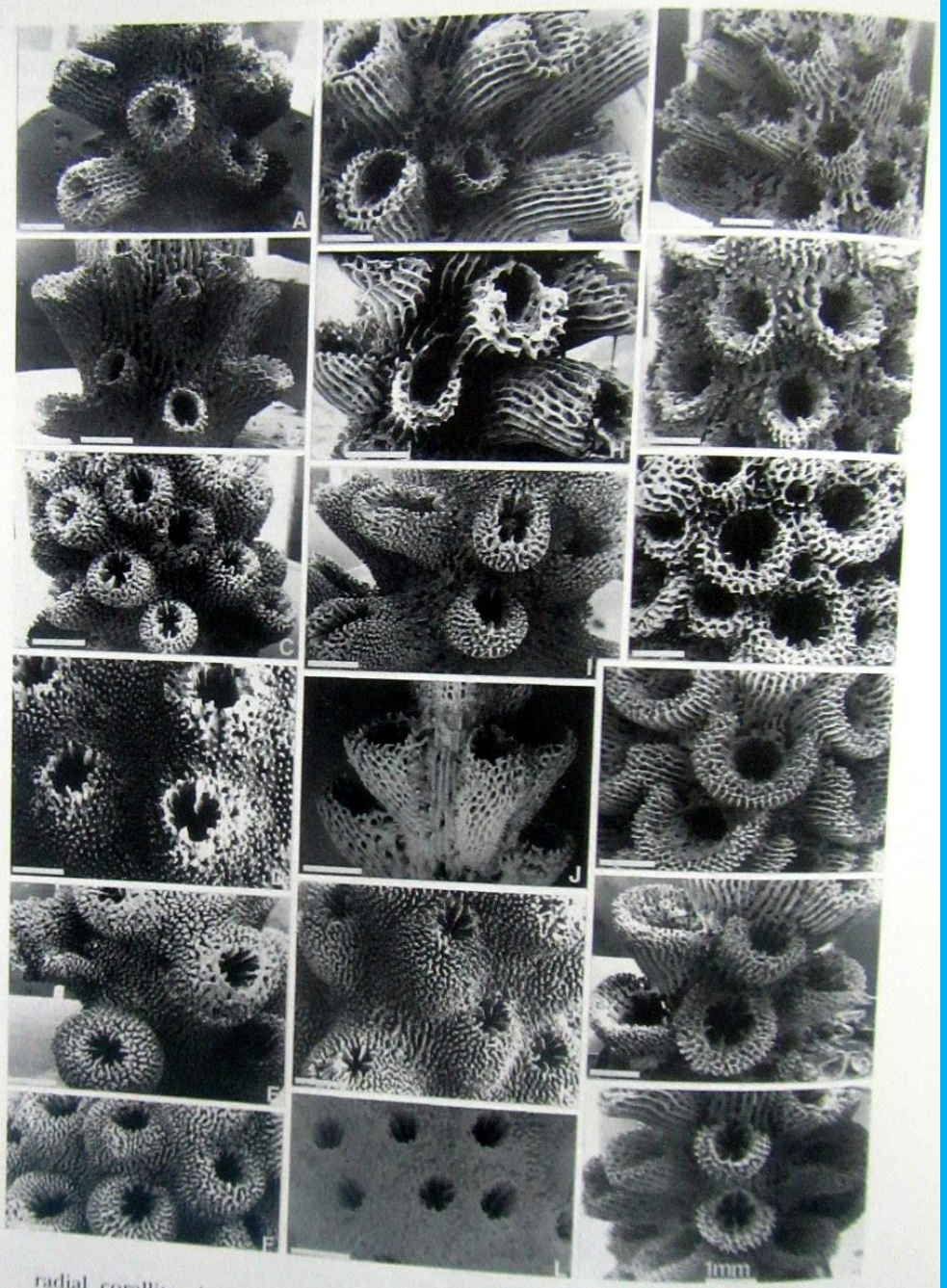


FIGURE 34 Examples of radial corallite shape categories, used in species descriptions (A) tubular, round openings (B,C) tubular, oblique openings (D) conical (E) rounded tubular (F) appressed tubular (G,H) tubular, dimidiate openings (I) nariform, elongate openings (J) nariform, round openings (K) appressed tubular (L) immersed (M,N) labellate, straight lip (O,P) labellate, rounded lip (Q,R) cochleariform.

radial corallites in *A. palmata* were non-reproductive or pre-mature (i.e. lower fecundity).

ZOOLOGISCHE VERHANDELINGEN

UITGEGEVEN DOOR HET RIJKSMUSEUM VAN NATUURLIJKE HISTORIE TE LEIDEN

(MINISTERIE VAN WELZIJN, VOLKSGEZONDHEID EN CULTUUR)

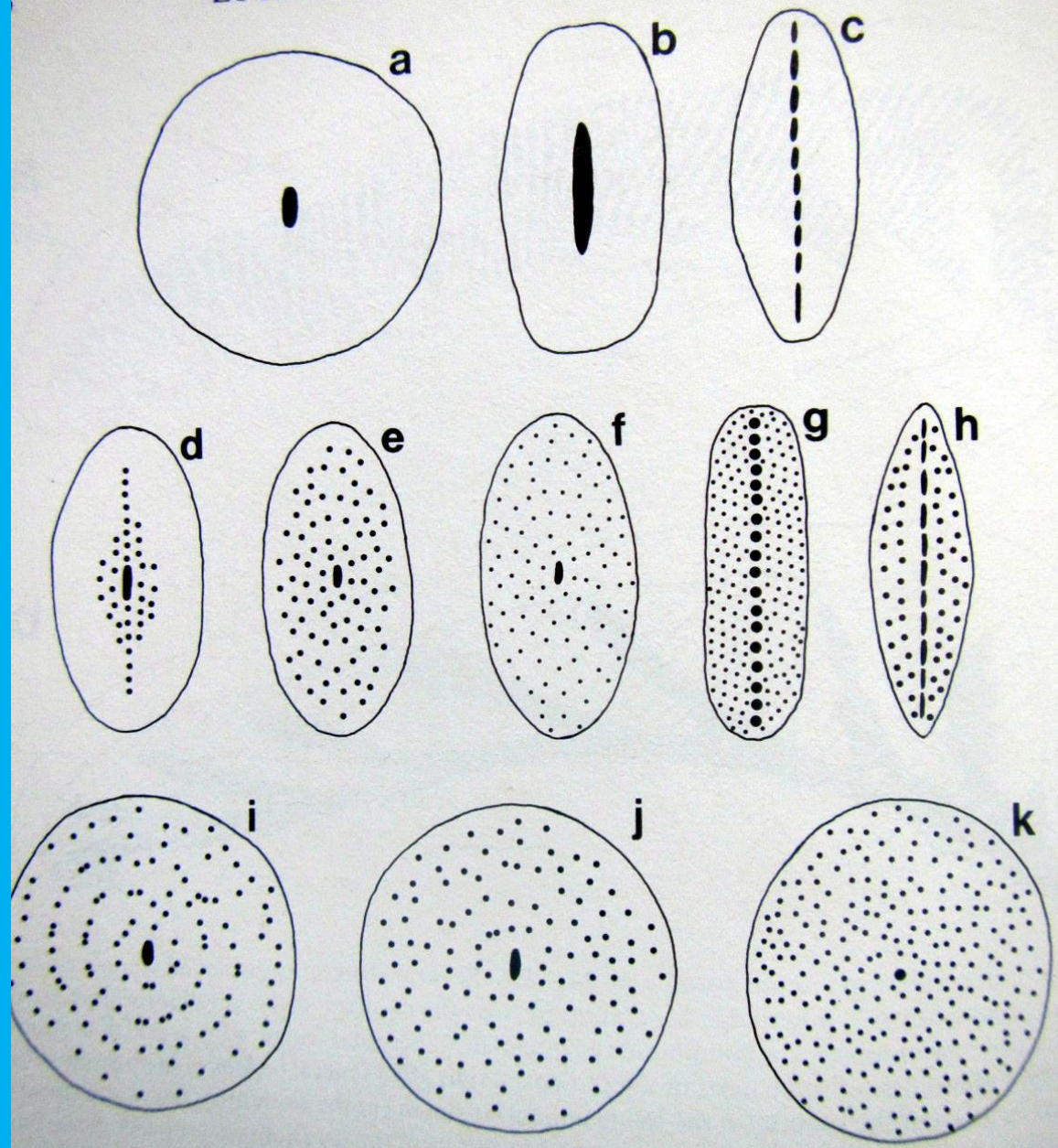
No. 254

TAXONOMY, PHYLOGENY AND BIOGEOGRAPHY OF MUSHROOM CORALS (SCLERACTINIA: FUNGIIDAE)

by

BERT W. HOEKSEMA

LEIDEN
24 november 1989
ISSN 0024-1652



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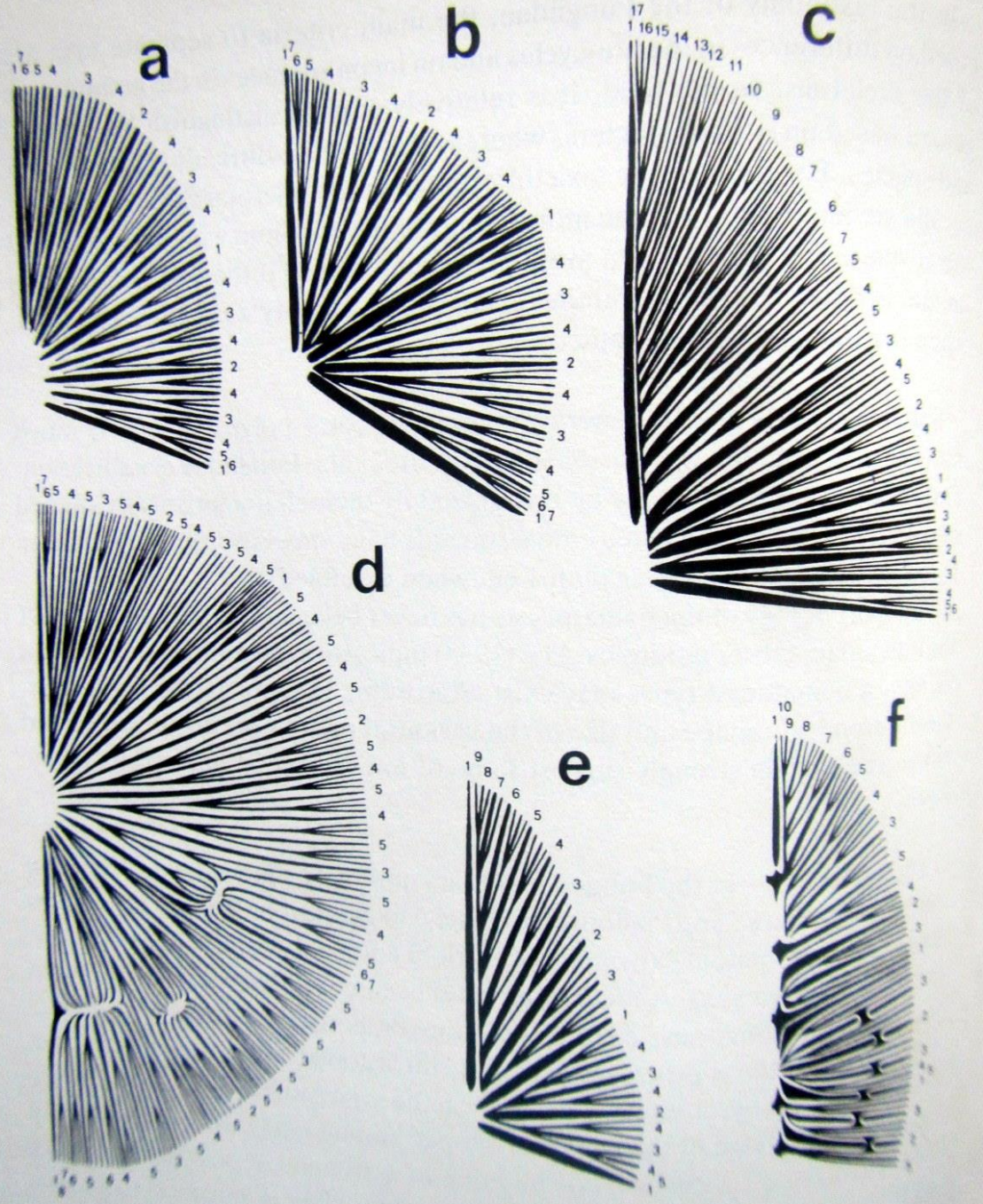
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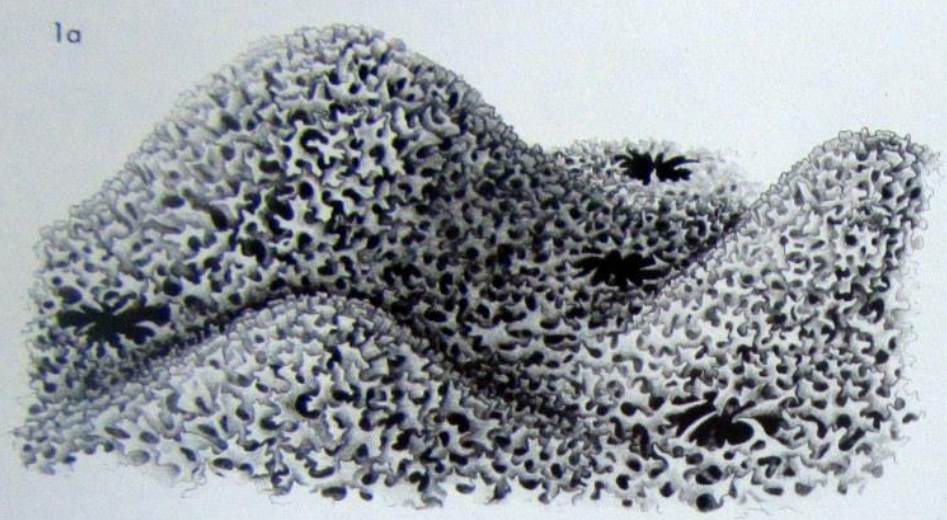
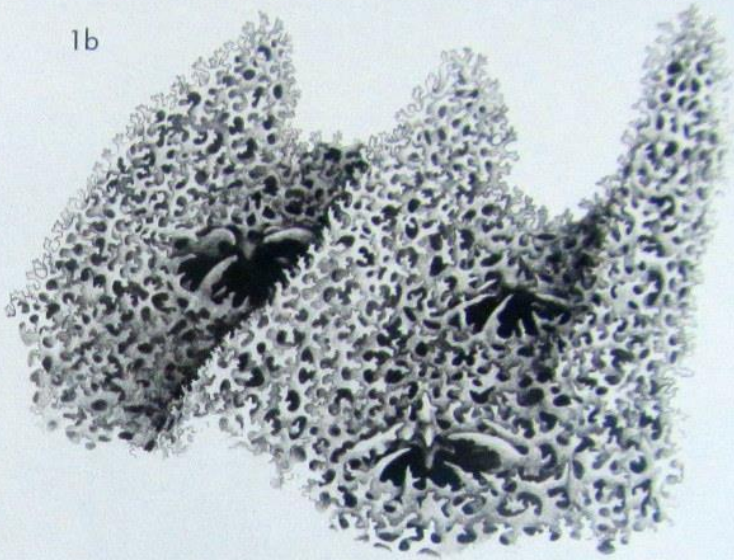
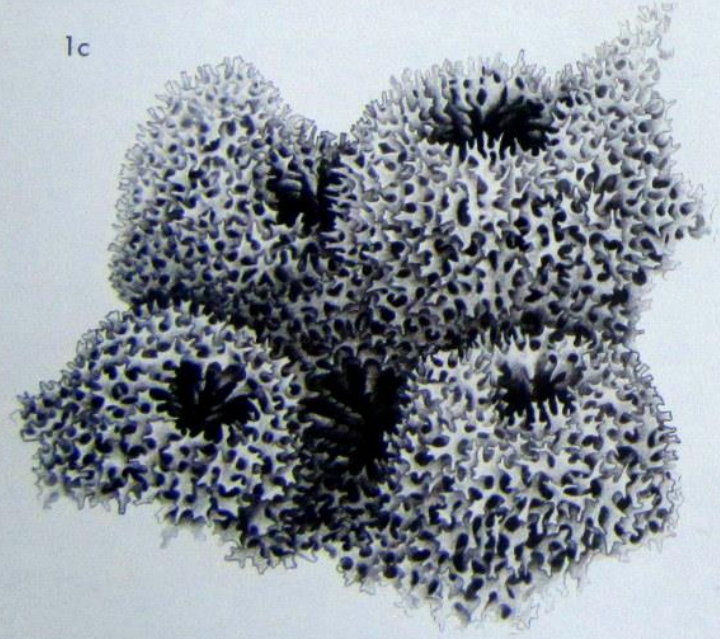
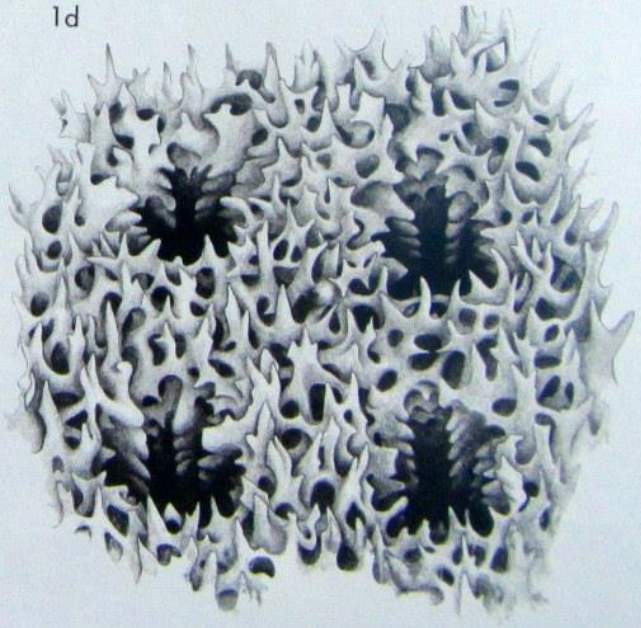
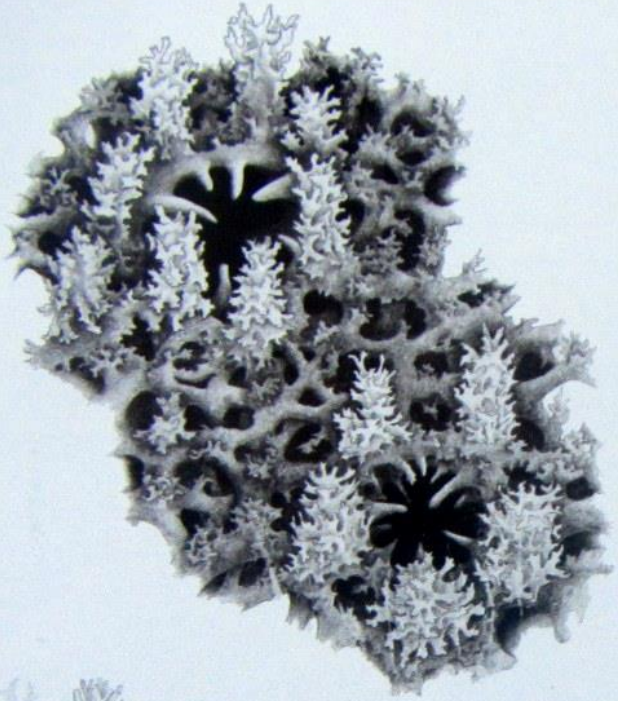


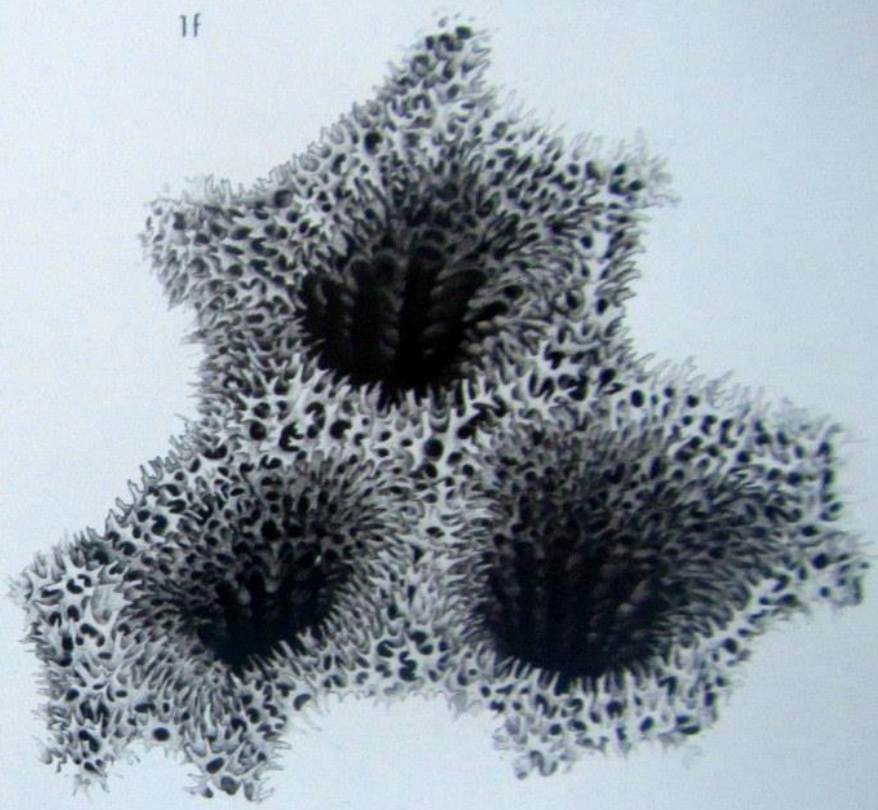


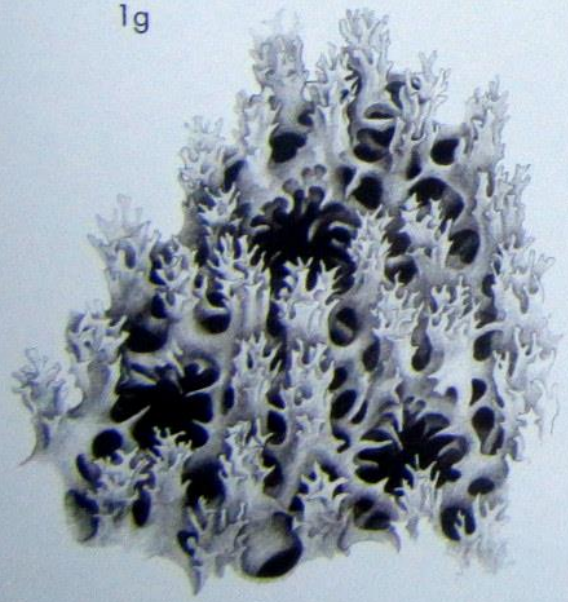




The structure and identification of *Montipora* species







1 Fine skeletal elements of *Montipora*: (a) showing coenosteum tuberculae (*M. danae*), (b) showing coenosteum ridges (*M. foliosa*), (c) showing thecal tuberculae (*M. nodosa*), (d) showing glabrous coenosteum with immersed corallites (*M. spongodes*), (e) showing thecal papillae (*M. grisea*), (f) showing foveolate corallites (*M. foveolata*), (g) showing coenosteum papillae (*M. informis*). *Drawings: Geoff Kelley*

2 Thicket of branching *Montipora*. There are five species in this photograph. RYUKYU ISLANDS, JAPAN *Photograph: author*

identification are:

ion and have variable
), each corallite has one
our lateral pairs of septa
ther side of the ventral
, form the triplet. The
the latter case they may
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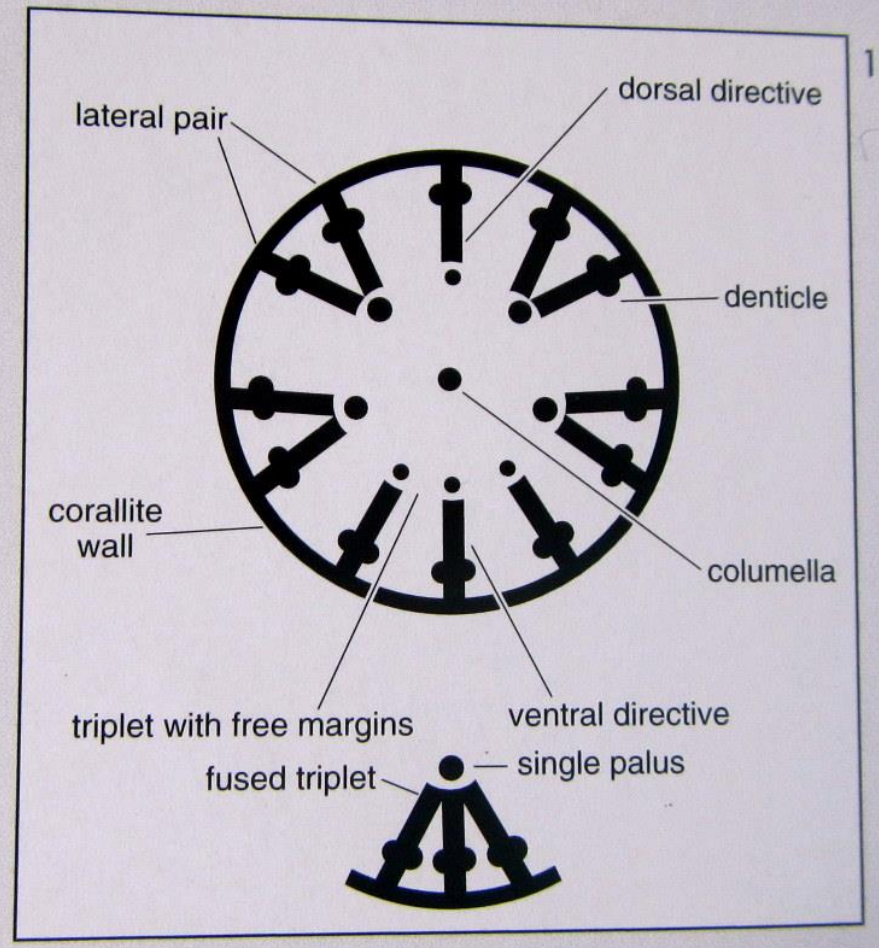
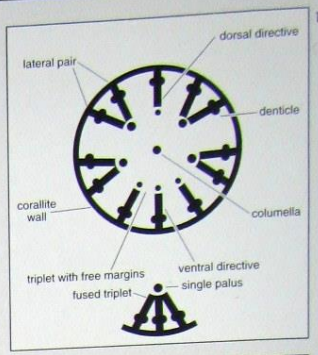


The corallite structures commonly used in species identification are:

septa: These are named according to a convention and have variable development in different species. As illustrated (right), each corallite has one dorsal directive and one ventral directive septum, four lateral pairs of septa arranged symmetrically and two more septa, one either side of the ventral directive which, together with the ventral directive, form the triplet. The inner margins of the triplet may be free or fused. In the latter case they may be fused along their inner margins or each outer septum may be fused to the sides of the ventral directive by a cross bar forming a trident.



pali: The pali are vertical pillars positioned as illustrated right. These have variable development in different species. The four pali associated with the lateral pairs of septa are usually the largest. A fifth palus is usually associated with the dorsal directive septum. One, two or three pali may be associated with the triplet; one palus if the triplet is fused, two pali if they are fused by a cross bar and three pali if the triplet is not fused.

denticles: These are vertical pillars resembling pali and are arranged along the top of the septa at fixed intervals. The pali and denticles may form concentric circles.

walls: These may be thick but commonly consist of three rows of denticles as in *P. australiensis*, illustrated page 277.

columellae: Some species do not have columellae. (Some specimens may have the columella missing from some or all corallites: this appears to be due to the activities of parasitic worms occupying the corallites and removing all skeletal elements from their centres.)

Other corallite structures (not illustrated above) sometimes used in species identification are:

radii: These usually occur deep within the corallite and connect the pali to the columella. The columella, pali and denticles are all covered with granules and may be similar in appearance (see, for example, page 287).

synapticular rings: There may be two synapticular rings deep within the corallite. The inner ring links the pali and is joined to the columella by the radii. The outer ring is usually less visible and occurs near the corallite wall.