New observations on Scleractinian corals from Indonesia: 3. Species belonging to the Merulinidae with new records of *Merulina* and *Boninastrea*

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Key words: reef corals; Merulinidae; new records; taxonomical changes; Buginesia Programme; Snellius-II expedition; *Merulina*; *Boninastrea*.

Nine coral species belonging to four genera (one new for Indonesia) and their adaptation to different environmental conditions are discussed. The rare species *Merulina triangularis* (Veron & Pichon, 1979) and *Boninastrea boninensis* Yabe & Sugiyama, 1935 are recorded for the first time from Indonesia.

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Introduction

During the Snellius-II expedition in 1984 in the Eastern Indonesian Archipelago, several reef localities were visited (Best et al., 1989). One of the advantages of a ship-based expedition is the possibility to compare different reef habitats in a relatively small period of time.

Observations made on the various reef building coral species, revealed not only the presence of new species or new records of species, but also not yet known intra-specific growth forms, that may lead to another interpretation of some established coral species. The topic of the plasticity of coral species as a result of changing environmental parameters is well known and often discussed in literature (Best, 1972, Veron & Pichon, 1976, Best et al., 1984).

In this paper the topic of colony form adaptation to different environmental conditions is discussed for the Merulinidae, and taxonomical changes are made.

The coral species belonging to the Merulinidae Verrill, 1866 are characterized by the typical "merulinid" growth and therefore easy to recognize. The "merulinid" growth in the colony is the result of intratentacular polystomodaeal budding with centers linked by trabeculae.

The family Merulinidae is considered to have derived from the Faviidae in the late Tertiary (Wells,1956). Members of this family are characterized by small compound trabeculae produced by very irregular divergence of the sclerodermites. The merulinid growth is characteristic for all genera. The septa bear irregular, spinose dentations. The columella is not or weakly developed.

Within the Indonesian collections four genera and nine species of the family Merulinidae are recognized:

Hydnophora Fischer, 1807	*H. exesa* (Pallas, 1766)
	H. rigida (Dana, 1846)

	H. grandis (Gardiner, 1904)
	H. microconos (Lamarck, 1816)
Merulina Ehrenberg, 1834	*M. ampliata* (Ellis & Solander, 1786)
	M. scabricula (Dana, 1846)
	M. triangularis (Veron & Pichon, 1979)
Scapophyllia M.Edwards & Haime, 1848	*S. cylindrica* (M. Edwards & Haime, 1848)
Boninastrea Yabe & Sugiyama, 1935	*B. boninensis* Yabe & Sugiyama, 1935

The genus *Hydnophora* has been moved from the Faviidae to Merulinidae by Veron in 1986. We agree with this, because morphologically the species of *Hydnophora* resemble the species of the genera *Merulina* and *Scapophyllia* and have not much in common with the other genera of the Faviidae.

The three above mentioned genera are often mixed up in collections because of the extreme intraspecific variability, which makes the species difficult to identify without field data.

Hydnophora is characterized by its conical collines, called monticules or hydnae.

In *Merulina* the collines resemble those of *Hydnophora*, but they do not form hydnae. All three species have the typical merulinid growth, with continuous collines and unevenly thickened septa. They are mainly separated because of their different colonial forms, foliaceous or branching.

Scapophyllia is like *Merulina*, but massively columniform.

The very rare species of *Boninastrea* is massive.

Discussion of the species

Hydnophora exesa (Pallas, 1766)
(fig. 1)

Material.— Tukang Besi Is., Kaledupa: RMNH 20062, 20120; Sumba, Melolo: RMNH 20293; Komodo: RMNH 20366, 20388, 21435; Taka Bone Rate, Garlarang: RMNH 20653; Salayer, Bahuluang: RMNH 20945.

Synonymy.— See Best, 1972, 1976; Veron et al., 1977; Best et al., 1984; Veron, 1985; Best et al., 1989.

Characters and variability— The colonies are hydnophoroid with encrusting, flat or branching growth forms. The species with its intraspecific variability is well described by the above mentioned authors. The whole range of growth forms as described in literature is present in the Indonesian collection. The species has been found in most reefs studied in Indonesia and occurs in most reef habitats, hence the great variability (see Best et al. 1985).

Geographical distribution.— From the Red Sea to the Ellice Islands in the Pacific.

Remark.— It is well possible that *H. pilosa* Veron, 1985 from Australia, is also living in Indonesia. This has to be checked in more detailed fieldwork, where attention should be paid to the polyps.

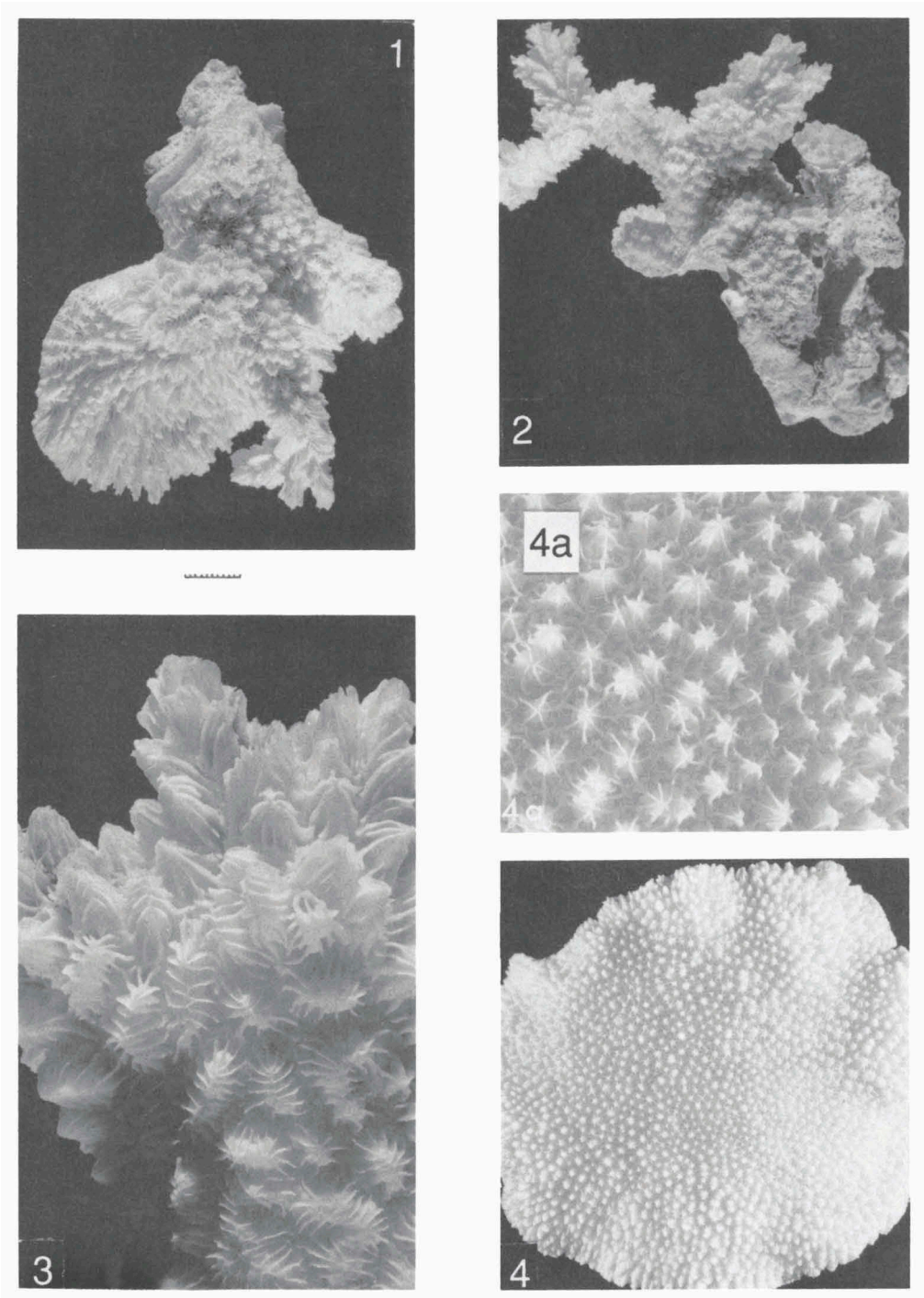


Fig. 1. *Hydnophora exesa* (Pallas) from Slawi bay, Komodo, RMNH 20366 (scale bar: 1 cm). Fig. 2. *H. rigida* (Dana) from Tarupa Besar, Taka Bone Rate, RMNH 20607 (scale bar: 1 cm). Fig. 3. *H. grandis* (Gardiner) from Gili Lawa Laut, Komodo, RMNH 21432 (scale bar: 0.5 cm. Fig. 4. *H. microconos* (Lamarck) from Bahuluang, SW Salayer, RMNH 20731 (scale bar: 2 cm), 4a, same specimen (scale bar: 0.5 cm).

Hydnophora rigida (Dana, 1846)
(fig. 2)

Material.— Sumba: RMNH 20239, Komodo: RMNH 20406; Taka Bone Rate, Tarupa Besar: RMNH 20607; Salayer, Guang: RMNH 20697; Salayer, Bahuluang: RMNH 20747.

Synonymy.— See Best, 1972, 1976; Veron et al., 1977; Veron, 1986; Best et al., 1989.

Characters and variability— The colonies are slenderly branching. The hydnae are small and pointed. *H. rigida* has often been confused with *Merulina scabricula* (Dana), which, however, has broader valleys and branches. The species and its intraspecific variability are well described by Veron et al., 1977.

Geographical distribution.— Central Indian Ocean to the Fiji Islands in the Pacific.

Hydnophora grandis (Gardiner, 1904)
(fig. 3)

Material.— Komodo, Gili Lawa Laut: RMNH 21432; Sumbawa: RMNH 18296, 21707; Taka Bone Rate, Tarupa Besar: RMNH 21229; S.W. Sulawesi, Kudingareng Keke: RMNH 18295.

Synonymy.— See Best, 1972, 1976; Chevalier, 1975; Veron & Hodgson, 1989; Best et al., 1989.

Characters and variability.— The coralla are flat or thickly branching, the hydnae are broad. The species does not show a large variability, because of its restricted occurrence on sheltered deeper reef habitats; this explains also why it is not common in collections.

Geographical distribution.— The species has only been recorded from the Indo-West Pacific (New Caledonia, Indonesia, Philippines).

Hydnophora microconos (Lamarck, 1816)
(figs. 4, 4a)

Material.— Lucipara Isl.: RMNH 21720; Tukang Besi: RMNH 21732; Komodo: RMNH 20425; Taka Bone Rate, Tinanja: RMNH 21827; Salayer, Bahuluang: RMNH 20731, 20769, 21819.

Synonymy.— See Best, 1972, 1976; Veron et al., 1977; Veron, 1985; Veron & Hodgson, 1989; Best et al., 1989.

Characters and variablity.— The colonies are massive, rounded to flat. The species is easily recognized by the small (2-3 mm) hydnae, that have a very regular appearance. There is little intraspecific variation.

Geographical distribution.— The species occurs throughout the Indo-Pacific from the Red Sea to the Cook Islands in the western Pacific.

Merulina ampliata (Ellis & Solander, 1786)
(figs. 5, 6)

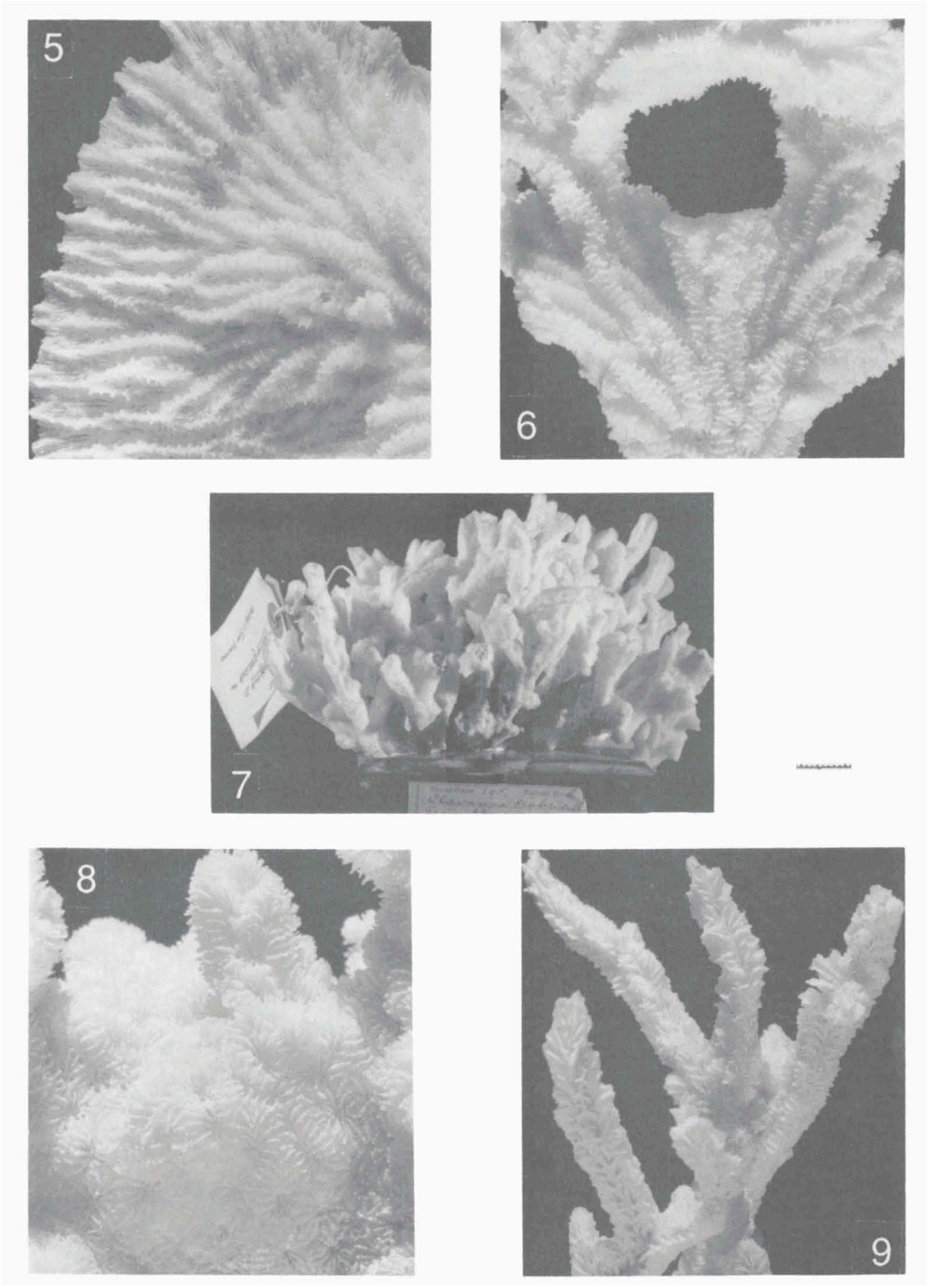


Fig. 5. *Merulina ampliata* (Ellis & Solander) from Bahuluang, SW Salayer, RMNH 20749 (scale bar: 0.5 cm). Fig. 6. *M. ampliata* (Ellis & Solander) from Kudingareng Keke, SW Sulawesi, RMNH 18029 (scale bar: 0.5 cm). Fig. 7. *M. scabricula* (Dana) holotype from Fiji Isl., USNM 165 (scale bar: 2 cm). Fig. 8. *M. scabricula* (Dana) from Malimbu, SW Salayer, RMNH 20849 (scale bar: 0.5 cm). Fig. 9. *M. triangularis* (Veron & Pichon) from Guang, SW Salayer, RMNH 18028 (scale bar: 0.5 cm).

Material.— Sumba, Melolo: RMNH 20267; Taka Bone Rate, Garlarang: RMNH 20632; Salayer, Guang: RMNH 21790; Salayer, Bahuluang: RMNH 20747; S.W. Sulawesi: RMNH 18029.

Synonymy.— See Veron & Pichon, 1979; Veron, 1986; Veron & Hodgson, 1986.

Characters and variability.— Colonies are in general foliaceous, arborescent to nodular. Different growth forms may occur in the same colony. These outgrowths are the result of different environmental factors. The flat branches may grow out and even anastomose (fig. 6). The species is common, especially in sheltered reef areas.

Geographical distribution.— The species has been recorded from the Red Sea to the eastern Pacific as far as Samoa.

Merulina scabricula (Dana, 1846)
(figs. 7, 8)

Material.— Fiji Islands: USNM no.165 (holotype), (fig.7); Sumbawa: RMNH 20849; S.W. Sulawesi: RMNH 20849.

Synonymy.— See Veron & Pichon, 1979; Veron, 1986.

Characters and variability— The species resembles *Merulina ampliata*, but has a branching colony. Veron & Pichon (1979:223) stated this species not to be present in the Australian waters. Later, Veron (1986:437) records the species from Australia, but his photographs show two *Merulina ampliata* specimens. Specimens we have collected in Indonesia resemble the type specimen from Fiji (cf. figs.7 and 8). Because this branching *Merulina* has often been confused with the branching form of *Hydnophora rigida*, there is confusion in the literature about its status. Based on the Indonesian material and data we conclude that we are dealing here with a separate *Merulina* species. It is certainly close to growth forms of *Merulina ampliata* and *Hydnophora rigida*, but they exclude each other ecologically. Further field work should provide more detailed data. The species is apparently rare.

Geographical distribution.— The only area from where the species has reliably been recorded is the Central-Indo-West Pacific (Sumbawa, Sulawesi) to the Fiji Islands.

Merulina triangularis (Veron & Pichon, 1979)
(fig. 9)

Material.— Komodo, Gili Lawa Laut: RMNH 21436; Sumbawa, Sanggar Bay: RMNH 21611; Taka Bone Rate, Tinanja: RMNH 21048; Salayer, Guang: RMNH 18028, Salayer, Bahuluang: RMNH 18027, 20748, 20941; S.W. Sulawesi: RMNH 18026.

Synonymy.— See Veron & Pichon, 1979; Veron, 1986.

Characters and variability.— The colonies are formed by thin, anastomosing, branches. In Indonesia, the species has only been found in shallow, sheltered reef habitats; large colonies are formed in bays and lagoons. The intraspecific variability is

therefore little. We agree with Veron & Pichon (1979) that this bushy *Merulina* species is a distinct species, but to place it in a separate genus *Clavarina* Veron & Pichon, 1979 or *Paraclavarina* Veron, 1986, is not realistic if only based on the triangular form of the branches. *Merulina triangularis* branches show a triangular form at the periphery, but so do the branches in *Merulina scabricula*. *Merulina triangularis* is restricted to protected shallow reef areas where it can be found together with *Merulina scabricula*.

Geographical distribution.— The species is only reported from eastern Australia and the Indonesian archipelago.

Scapophyllia cylindrica (M. Edwards & Haime, 1848)
(fig. 10)

Material.— S.W. Sulawesi: RMNH 15122, 18298, 18299.

Synonymy.— See Veron & Pichon, 1979; Veron, 1986.

Characters and variability.— The monospecific genus *Scapophyllia* forms large columns, constructed by meandroid, merulinid corallites. The valleys are long, in contrast to the short ones of the closely related genus *Merulina*. *S. cylindrica* occurs in turbid backreef habitats and is rare in Indonesia.

Geographical distribution.— The species has been reported from the Central-Indo-West Pacific.

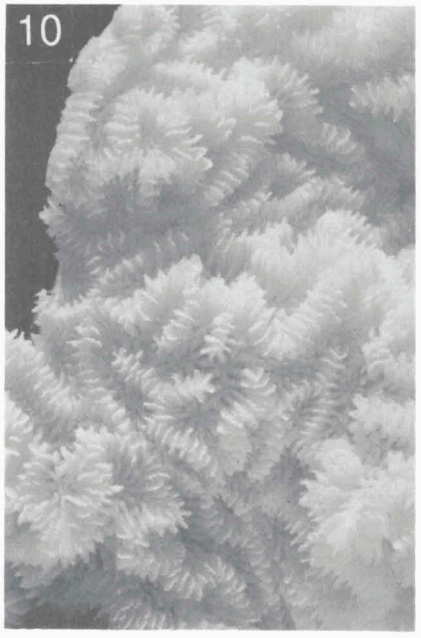
Boninastrea boninensis Yabe & Sugiyama, 1935
(figs. 11, 12, 13)

Material.— Japan, Ogasaware Gunto (Bonin Islands), Tohuku University (fig.11); Sumbawa, Teluk Sanggar: RMNH 18030, 18297.

Synonymy.— See Yabe & Sugiyama, 1935; Yabe & Sugiyama, 1936; Veron, 1986.

Characters and variability.— Corallum compound, massive, constructed by short meandroid, merulinid corallites. Because the specimens from Indonesia fit the original description of Yabe & Sugiyama we site their wording. "Calices numerous, subpolygonal,irregular in shape and arrangement oblique; usually one to three or more in number circumscribed in group by incomplete, oblique collines. Occasionally several of the groups are further bounded by prominent incomplete, oblique ridges. In each group calices connected by trabecular bridges instead of toothed lamellae. Septa not numerous, up to three cycles, those of the first and some of the second cycles more stout and more prominent than others; their free ends strongly divided in irregular manner, to filiform processes. Surface of septa minutely granulated." (Yabe & Sugiyama, 1935: 402). No columella. The polyps are yellowish green. In Indonesia only a few, massive colonies were collected from the north coast of Sumbawa in a shallow backreef area.

Geographical distribution.— The species has only been found in Ogasawara Gunto (Bonin Islands) Japan, and Sumbawa, Indonesia.



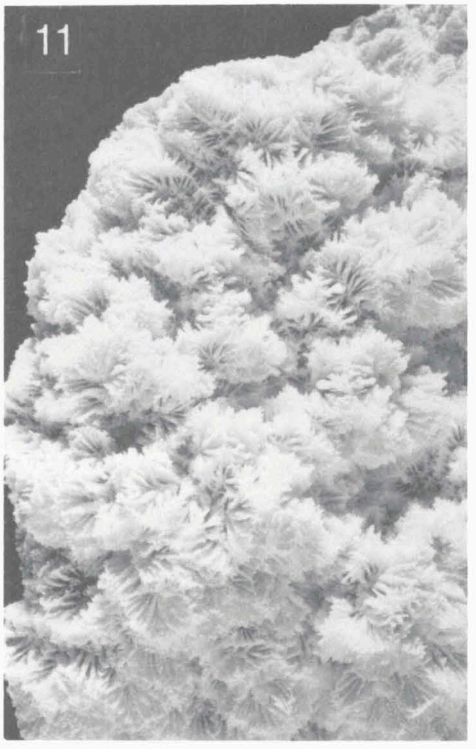


Fig. 10. *Scapophyllia cylindrica* (M. Edwards & Haime) from Kudingareng Keke, SW Sulawesi, RMNH 18298 (scale bar: 0.5 cm). Fig. 11. *Boninastrea boninensis* (Yabe & Sugiyama) holotype from Japan, Tohoku University (scale bar: 1 cm). Fig. 12. *B. boninensis* (Yabe & Sugiyama) from Teluk Sanggar, Sumbawa, RMNH 18030 (scale bar: 1 cm). Fig.13. same, but scale bar: 0.5 cm.

Concluding remarks

The coral species grouped in the family Merulinidae, are considered to have derived in the late Tertiary from the much older and larger family of the Faviidae (Wells, 1956). They are characterized by small, compound trabeculae produced by a very irregular divergence of the sclerodermites. The representatives of this group of corals all have the meandroid growth in common.The intratentacular polystomodaeal budding with centers linked by trabeculae and dentations that are spinose and very irregular, make the "merulinid" appearance. The genus *Hydnophora* shows the same variation in colony form from massive (*H. microconos*) to flat, nodular or thick branching (*H. exesa, H. grandis*) to thin branching (*H. rigida*). The same can be observed in the genus *Merulina*: massive to flat (*M. ampliata*), thick branching (*M. scabricula*) to thin branching (*M. triangularis*).

There is a general tendency in the evolution of scleractinian corals, that are in recent reefs the framework builders of this marine ecosystem, to form, beside solid, more slowly growing massive forms, also quickly growing colonies by extratentacular budding and branching growth. This helps the corals to survive in the competition for space in the highly diverse coral reef (Lang & Chornesky, 1990).

The genera *Hydnophora* and *Merulina* both have developed branching species that can form large colonies in a sheltered, protected reef environment. The monospecific genera *Scapophyllia* and *Boninastrea* show only massive growth forms.

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