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SOME MORPHOLOGICAL VARIATIONS IN *SIPHONODENDRON* AND *DIPHYPHYLLUM* AS A RESPONSE TO ECOLOGICAL STIMULI

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In some species of the fasciculate rugosan, *Siphonodendron*, the morphology of the fossula, columella and connecting processes is controlled by ecological conditions. A colony in a turbulent environment would have numerous connecting processes, a strong columella and a well-marked fossula, with a preferential orientation of the corallites if the water movement was in the form of a persistent current. In a quiet environment, the connecting processes are generally absent, the cardinal fossula is indistinct and the columella is weak or absent. In some species of *Diphyphyllum*, the morphology of the fossula and the disposition of the corallites are also controlled by ecological conditions.

K e y w o r d s: corals, Rugosa, functional morphology, Viséan, Belgium.

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Many species of *Siphonodendron* show great morphological variability. From colony to colony the presence of columella, fossula and connecting processes is sporadic. In order to examine the reasons for this variability, a study has been made of large thin sections of some well-preserved colonies of *Siphonodendron martini* (Milne-Edwards et Haime) from the Middle and Upper Viséan of the Namur-Dinant Basin, Belgium. Three morphotypes have been recognized.

In the first morphotype (pl. 38: 2, 3; fig. 1) most of the corallites are twisted around their axes in order to dispose their calices so that their cardinal quadrants are statistically directed in a given direction, a direction which is also preferred by the numerous connecting processes. In this morphotype, the corallites generally have a distinct cardinal fossula and a strong columella, whereas diphymorph corallites are absent or uncommon.

In the *second* morphotype, the corallites are not twisted and the connecting processes, although numerous, are not sent out in a preferential direction. The cardinal fossula is sometimes well marked and the columella is strong. Diphymorph corallites are uncommon or absent.

In the *third* morphotype (pl. 38: 1), the corallites are more densely packed than in the other two, and they have no preferred arrangement. There are no connecting processes and the cardinal fossula is usually indistinct. Diphymorph corallites are common.

These three morphotypes never occur together but are always separated either stratigraphically or areally. Such morphotypes are not restricted to *Siphonodendron martini* or to other species of *Siphonodendron* such as *S.* sp. B (fig. 2), but are also present to some degree in *Diphyphyllum*. For example, *Diphyphyllum lateseptatum* Mc Coy and *D. furcatum* Hill (fig. 3), which, of course, have neither columella nor

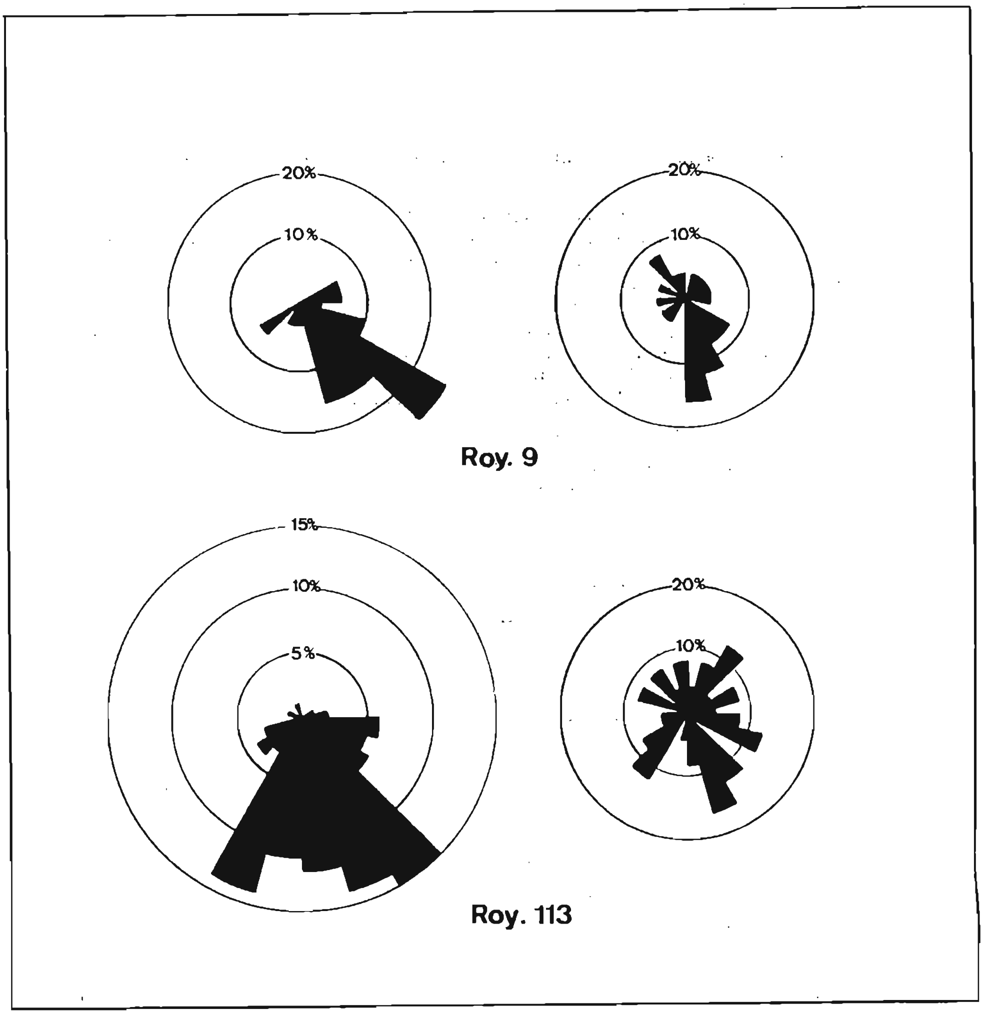

Fig. 1. Rose diagrams showing the frequency of orientation of counter-cardinal vectors (at left) and of orientation of connecting processes (at right) of two colonies of *Siphonodendron martini* (Milne-Edwards et Haime) measured with reference to an arbitrary direction.

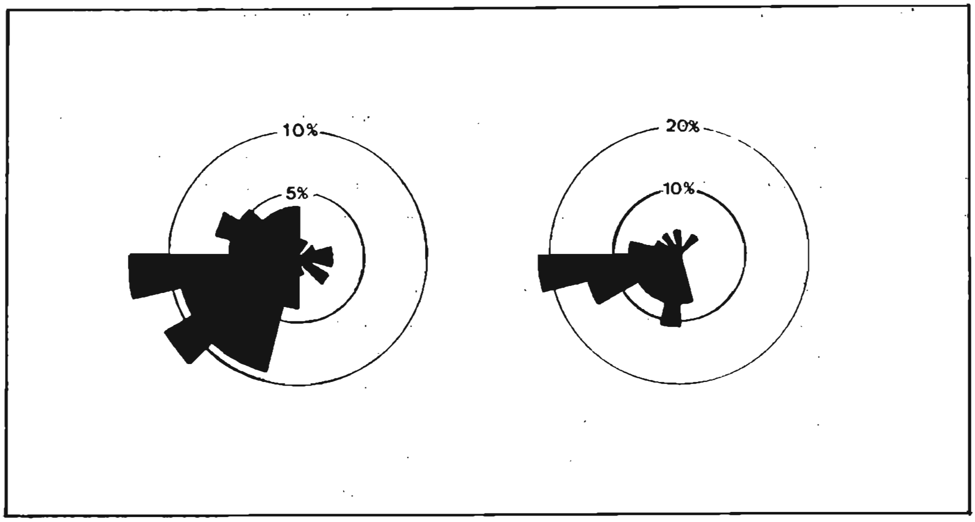

Fig. 2. Rose diagrams showing the frequency of orientation of counter-cardinal vectors (at left) and of connecting processes (at right) of a single colony of *Siphonodendron* sp. B, measured with reference to an arbitrary direction.

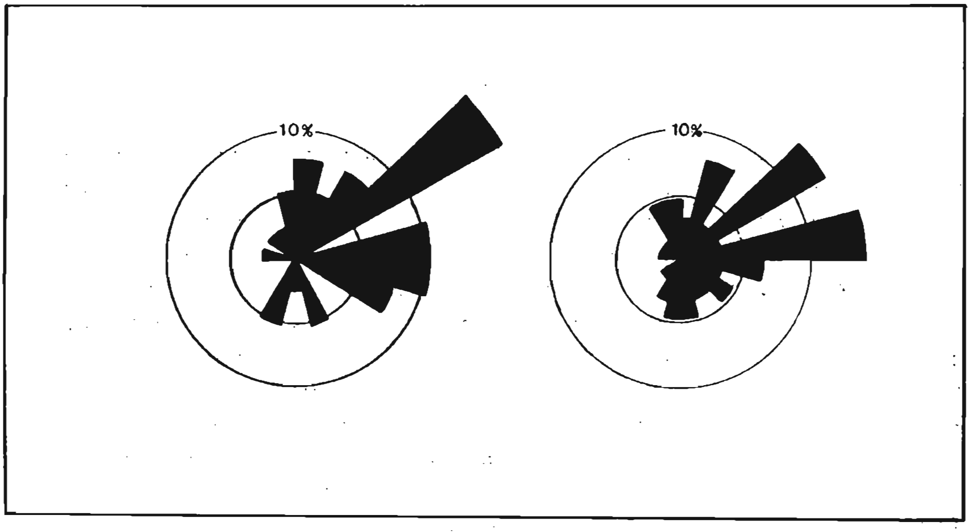

Fig. 3. Rose diagrams showing the frequency of orientation of counter-cardinal vectors of two colonies of *Diphyphyllum furcatum* Hill, measured with reference to an arbitrary direction.

connecting processes, sometimes have corallites which are twisted so that their calices are preferentially disposed. In these corallites the cardinal fossula is generally well developed.

Orientation of the connecting processes. — In many corals, the connecting processes are occasional lateral projections from some corallites towards their neighbours (pl. 39: *b*) or, sometimes, from two neighbouring corallites towards each other (pl. 39: *a*). We follow the general belief that they serve to strengthen the corallites laterally. The statistically uniform direction in which they are sometimes sent out, suggests a response to an orientated energy stream such as a current. In that case, the formation and the number of connecting processes depend on ecological conditions. The fact that the connecting processes are not sent out at random but in the direction of another corallite suggests that contact was made between neighbouring polyps before their connecting processes were sent out. This could explain the observed statistical divergences.

Twisting of the corallites. — A relation seems to exist between the twisting of the corallites and the production of oriented connecting processes. If that is so, the twisting is also a response to currents. That would imply that a polyp finding itself in a current was able to respond by taking up a position characterized by the orientation of the counter quadrants upstream and of the cardinal downstream.

Characters of the cardinal fossula and of the columella. — If the above-mentioned ecological interpretation is correct, the morphology of the cardinal fossula and of the columella also appear to be dependent on ecologic conditions. Thus, in corallites of a colony in a turbulent situation, the fossula tends to be well-marked and the columella to be present and strong, whereas in a quiet environment, the cardinal fossula is generally indistinct and the columella weak and sometimes absent (diphymorph corallites).

Conclusions

The study of the morphology and spatial disposition of the corallites, connecting processes, fossula and columella in some *Siphonodendron* species shows that these characters are probably controlled by ecological conditions. A colony in a turbulent environment would have numerous connecting processes, a strong columella and a well-marked fossula. If the water movement was in the form of a persistent current, the corallites are twisted (taking up a preferential orientation characterized by the upstream disposition of their counter quadrants and the downstream disposition of their cardinal quadrants) and their connecting processes project downstream. In contrast, in a quiet environment, the corallites are numerous but never twisted; connecting processes are generally absent, the cardinal fossula is indistinct and the columella is weak or absent. These relationships should be considered when species of *Siphonodendron* or of another genus of the same family, such as *Diphyphyllum*, are to be determined or described.

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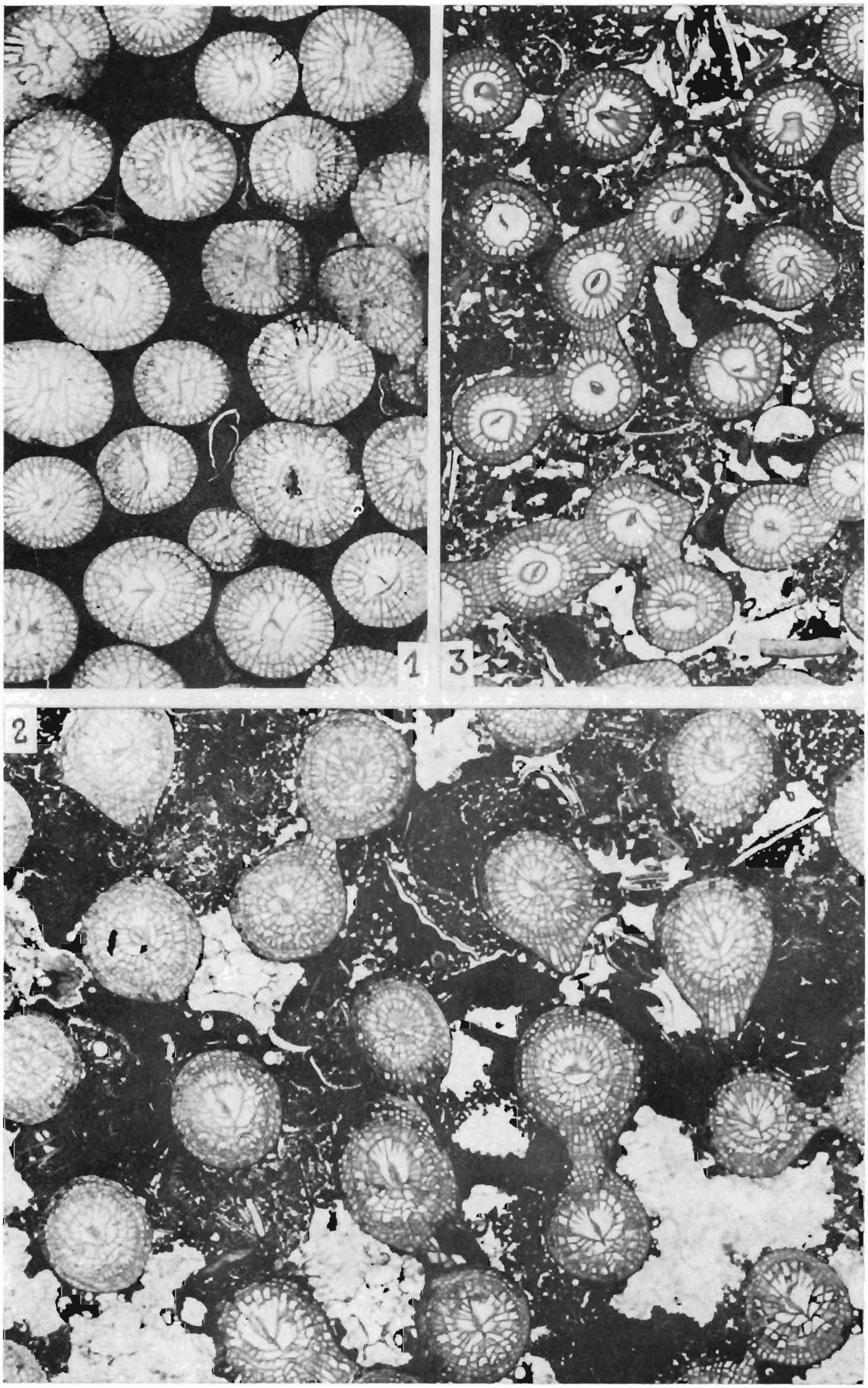
EXPLANATION OF THE PLATES 38 AND 39

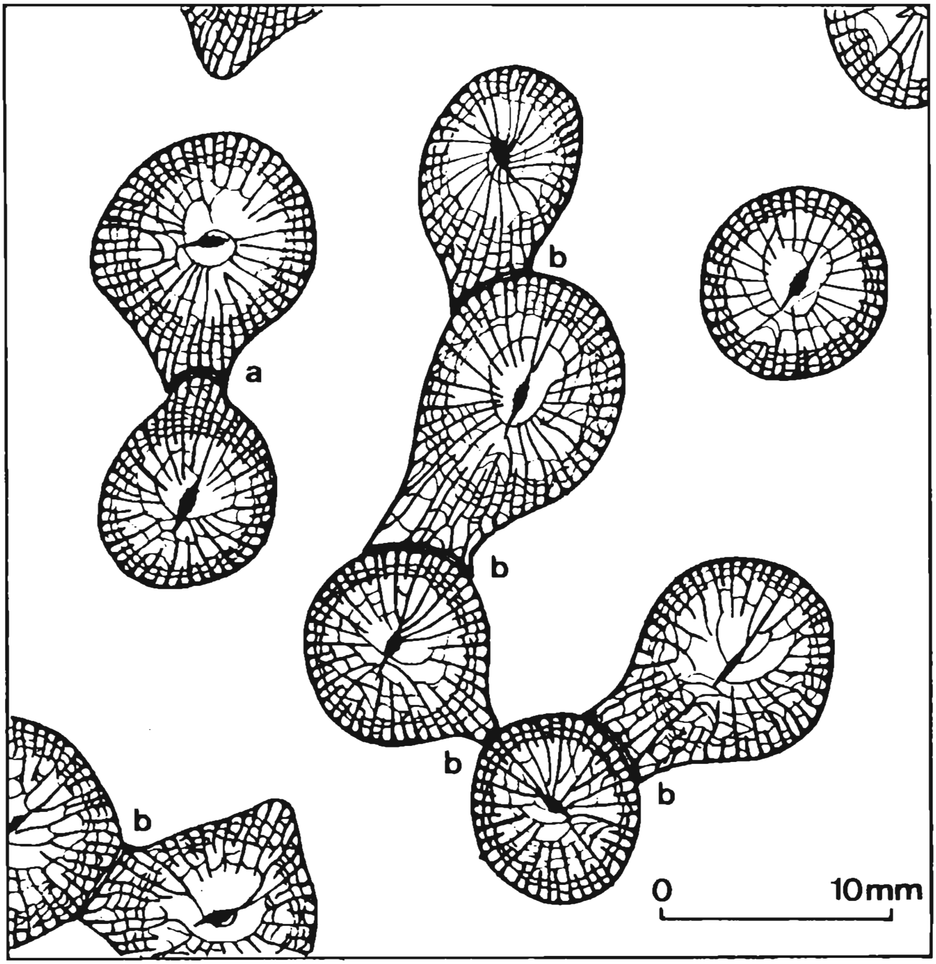
Plate 38

1. *Siphonodendron martini* (Milne-Edwards et Haime). Colony with some diphymorphe corallites and without connecting processes (third morphotype). Middle Viséan; Engihoul, Belgium. ×2.
2. *Siphonodendron martini* (M.-E. et H.). Colony with oriented corallites and connecting processes and without diphymorphe corallites (first morphotype). Upper Viséan; Royseux, Belgium. ×2.
3. *Siphonodendron* sp. B. Colony with oriented corallites and connecting processes and without diphymorphe corallites (first morphotype). Upper Viséan; Royseux, Belgium. ×2.

Plate 39

Transverse section of a colony of *Siphonodendron martini* (Milne-Edwards et Haime) showing two different types (*a* and *b*) of connecting processes.


1
3
2


a
b
b
b
b
b
0
10mm