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THE PRESENCE OF SCLERACTINIAN CORALS AND THEIR MEANS OF ADAPTING TO A MUDDY ENVIRONMENT : THE "GAIL BANK"

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ABSTRACT

Some forty species of scleractinian corals live in a particular, very muddy, environment situated in the south-western lagoon of New Caledonia between 25 and 30 metres' depth.
The seabed is caracterised by the topography of ridges valleys and bumps and appears to be formed of accumulated mollusc shells, scleractinian skeletons and fine particles. The presence on the soft bottom of these various hard substrata allows the scleractinian larvae to establish themselves. In order to survive, these corals have developed various growth strategies which are designed to offset some unfavourable factors such as hypersedimentation and the species' sinking they become heavier as they grow. The majority of the corals found on this site are species with well-developed polyps that are able to reject sedimentary particles. The other species survive by growing, probably very rapidly, vertically or horizontally, or else by increasing their area of contact with the sediment, accompanied by an abundant secretion of mucus.
Lastly, a few species are present because they have found a hard support that is raised higher than the surrounding bottom.

GEOMORPHOLOGICAL DESCRIPTION

The "Gail bank" (1) is a very muddy zone of the south-western lagoon of New Caledonia. Its originality lies in the fact that its specific feature is the presence of relatively well-developed coral communities that have adapted themselves in unusual ways to this unfavourable environment. It is situated between latitudes 22°20' and 22°25' South and longitudes 166°35' and 166°45' East. Its boundary on the North and North-East are the inshore water of three bays into which the "Pirogues", "Plum", "la Coulée", and "N'Go" rivers flow: these rivers, and particularly the "Pirogues" river, carry lateritic material which is deposited in the lagoon (figure 1). To the West and South-West, the "Gail bank" extends as far as the coral cays "Kae", "Nakae" and "Tarety". Average depth is 30m. The bottom relief comprises three types of structure (figure 2) :
- a succession of ridges and valleys following no precise direction, between which there are differences of level of 2 to 4 metres (about 70% of the area),
- small hills with gentle slopes, reaching 6 to 10m in height (about 20% of the area),
- flat zones (about 10% of the area).
The origin of this relief is not known. In an endeavour to ascertain it, a cut about 1m deep was made in the side of a hill, near the summit, using a suction sampler (figure 3). The material thus extracted was composed, in volume, of the following : 50% oyster shells, 25% scleractinian coral skeletons , 25% various types of coarse and

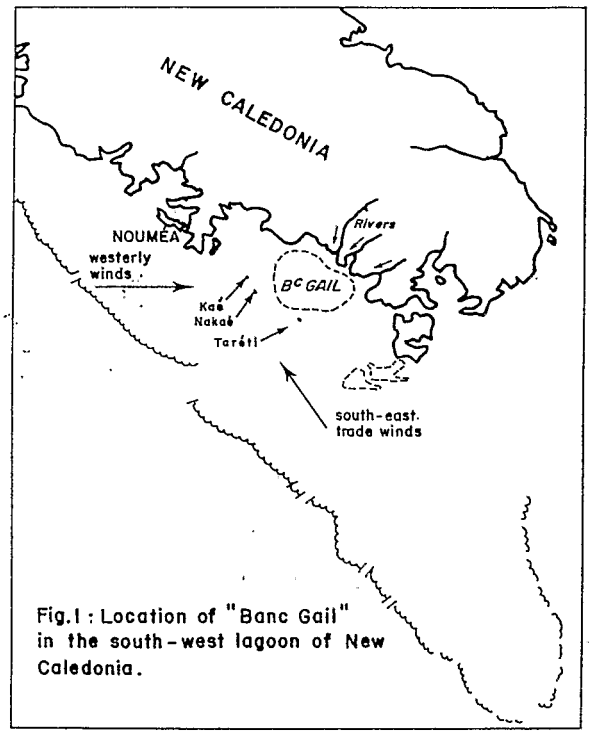


Fig.1 : Location of "Banc Gail" in the south-west lagoon of New Caledonia.

some fine particles. Furthermore, it is clear that the sessile life is concentrated on the highest parts of the ridges and hills; it includes algae (Chlorophyceae), sponges, Actiniaria, Scleractinia with modified growth forms, Alcyonaria, a few Gorgonacea, worms, molluscs (mostly Isognomon and Crassostrea oysters) and Ascidia. Among the scleractinian corals fluorescent specimens are much more numerous here than anywhere else (Catala, 1958, 1964; Magnier 1979).
In the present stage of our knowledge, to which it is hoped to add soon (1), the following hypothesis regarding the origin of these formations may be generated. The ridges could be progressive accumulations of coral structures that first settled on the hard substratum formed by oyster shells, although the speed of growth of the corals would have been barely rapid enough to offset the sedimentation and sinking into the sediment. The ridges and the hills might be the result of successive accumulations of communities of bivalves in clusters, while the valleys and the flat parts would represent areas where the communities were less dense.

(1) This bank has been dedicated to René GAIL, an ORSTOM marine biologist who lost his life while diving.

(1) There is a project for making digging 3 m deep.

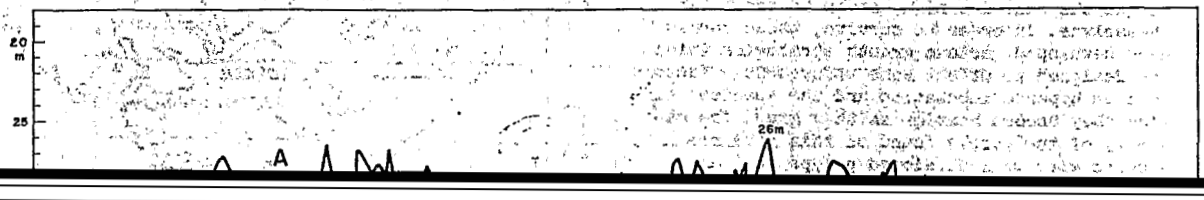
ADAPTATION OF SCLERACTINIAN CORALS TO A MUDDY ENVIRONMENT

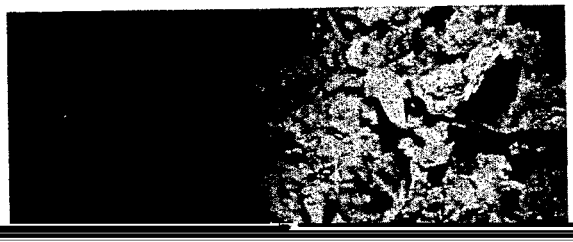
Light is an essential factor to coral growth. Despite surface layers of brackish water, hypersedimentation and temporary turbidity on the bottom resulting from heavy rainfall, the light intensity is always sufficient to allow normal calcification. Indeed, at the height of the rainy season, on 28 March 1988 at 11.0 a.m., when the sky was quite clear, the Secchi disk's disappearance was recorded at - 19 m., despite all the unfavourable factors mentioned above.

Cynarina lacrymalis, Fungia sp., Diaseris distorta). The second requirement is that each of the species present has had to develop an individual strategy to counteract both subsidence in the mud and hypersedimentation.

SCLERACTINIAN CORAL ADAPTATIVE STRATEGIES

(a) Most of the species present on this site have very well-developed polyps capable of removing any sediment received : Goniopora, Euphyllia, Catalaphyllia, Plerogyra, Caulastrea, Blastomussa, Cynarina, Trachyphyllia, Fungia, Scolymia, Lobophyllia (figure 7).





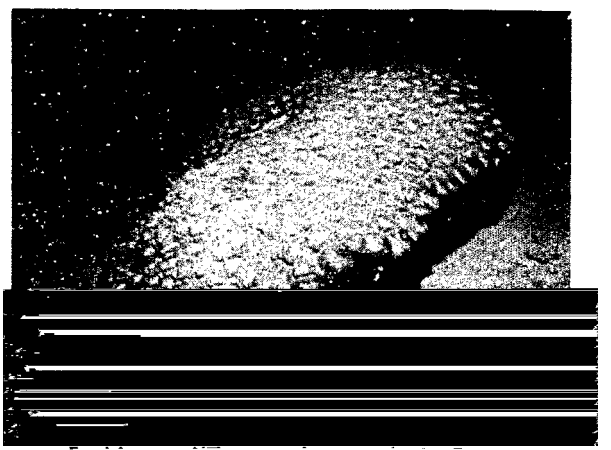


Fig. 9 - Growth continues on the outer edge of

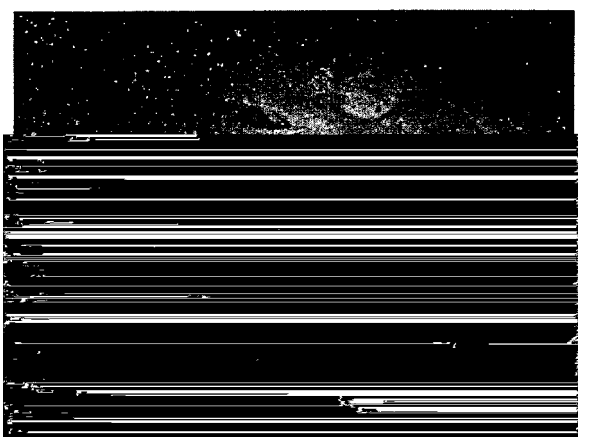


Fig. 10 - This *Pachyseris speciosa* has a flat shape growth. The colony is slanted, while one edge is burried, the opposite edge develops.

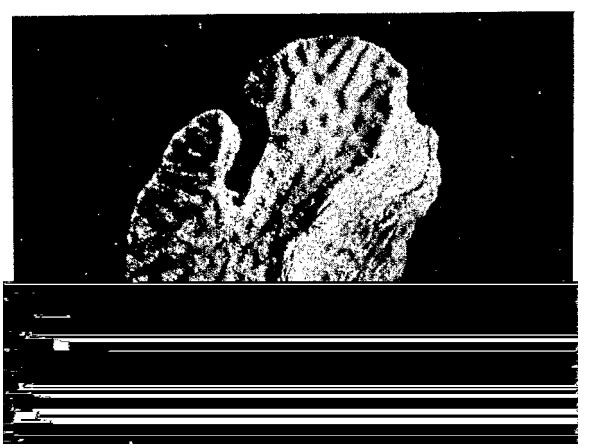
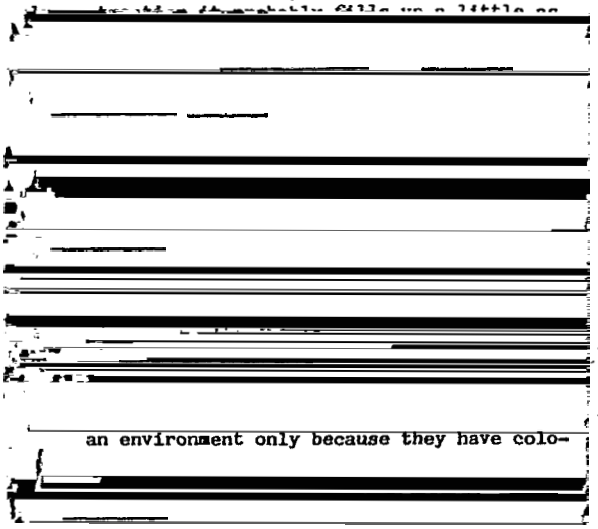


Fig. 11 - This Favidae, normally growing as a massive edony, takes here a wide conical shape in order to slow down sinking.

Fig. 12 - *Catalaphyllia jardinei* prevents sinking by resting up on its turgescent polyps.

Fig. 13 - *Fungia sp.* : the only representative of this genus is extra flat. It possesses also a polyp which expands well over the edge thus allowing slight displacements and the removal of sedimentary particles.

(g) Trachyphyllia geoffroyi appears to have polyps that are much better developed here than elsewhere. During the night, these polyps become particularly swollen and rest on the sediment, preventing their conical skeleton from becoming silted. When the indentation thus made is partially freed after



an environment only because they have colo-

CONCLUSION

Despite all the strategies they employ, many species of scleractinian corals appear not to be very long - lived. Small sizes are the rule in most colonies and many of them are partially buried.

The madrepores that seem best able to withstand the difficult conditions of this environment are : Catalaphyllia jardinei, Cynarina lacrymalis, Trachyphyllia geoffroyi, Plerogyra sinuosa, Euphyllia glabrescens, Blastomussa merleti, Goniopora lobata, Fungia sp., Diaseris distorta and Scolymia vitiensis.

Although scleractinian corals are characteristically fragile organisms that require specific conditions of light and substratum, they are also able to survive in a hostile environment by adapting themselves. In the scale of evolution corals are regarded as being little organised in their anatomical structure. To achieve the abovementioned adaptations they have (individually or in colonies) means of perceiving the environment and of reacting to it. It may well be however that here the balance thus achieved is very precarious.

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