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THE DROWNED BARRIER REEF OF MARQUESAS ISLANDS : Scenario for a killing and for an "island effect"

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When compared with other tropical islands of the central and western Pacific which are surrounded by outcropping barrier reefs, the high islands of Marquesas Archipelago lack any thick coral building. The absence of a barrier reef has lead several authors to assert that regional oceanic properties would be unpropitious to massive coral settlement.

Results of hydrological surveys made with the *R.V. Marara* allow us to depict oceanic features around Marquesas Archipelago, from offshore waters to inner bays of Nuku Hiva island. It appears that although the thermo–haline mean patterns are similar to those of the Equatorial Current, these coastal waters are significantly richer in dissolved nutrients and in chlorophyll–a. The presence of these plankton–rich green waters can be viewed as resulting from an "island effect", the mechanism of which was unknown.

In the same cruises, echo soundings and dredgings have confirmed the presence of a subhorizontal platform at 95 ± 5 m depth, all around that island. This carbonate structure is prolonged offshore by a 50 % slope very similar to barrier and atoll reef slopes. This platform, (also detected around the others islands of the archipelago), can then be considered as a drowned barrier reef, without any living algo–coral ecosystem, due to the lack of sufficient light at such considerable depth.

In order to explain the present position of this dead drowned reef we have used sea–level transgression curves (Bard et al., 1990) and paleoclimatic data of the CLIMAP project. Our scenario emphasizes the fact that melting of Chilean glaciers during the last oceanic transgression (from – 20 ky) produced huge volume of cold surface water injected in the Peru–Chili current, whose north–west extension (Equatorial Current) reaches the Marquesas zone. Regional temperature were lowered beneath 18° C, causing a lethal cooling shock to barrier reefs circling Marquesas islands. These killed barrier reefs were then unable to follow the on going 95 meters rapid sea level rise (end of transgression, – 6 ky). Today these drowned barrier reefs continue to be sites of geothermal endo–upwelling (Rougerie et al., 1992) but there is no endosymbiotic coral algae to use the seeping nutrients : they are consumed by oceanic phytoplankton, causing the greening of Marquesas coastal waters. This model provides an explanation for the spectacular "Island effect".

Bard E., Hamelin B., and Fairbanks R., 1990.– NATURE, 346 – p. 456–458.

Rougerie F., Fagerstrom, A. and Andrié Ch., 1992.– Continental Shelf Research, Vol. 12, p. 785–798.