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Anatomy of post-glacial reefs at Tahiti (French Polynesia): I.O.D.P. #310 expedition « Tahiti sea level »

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The development of drilling capabilities and radiometric dating techniques in the last 30 years has greatly increased the knowledge of the growth history of Holocene coral reefs including reef growth rates and the distribution of biofacies (e.g. see [1,2]). Only few reef systems related to the early history of the last deglaciation have been documented by drilling (Barbados [3,4]; Papua New Guinea [5]; Tahiti [2, 6, 7]; Vanuatu [8]). These studies focus on sea-level reconstructions, but both reef development patterns and reef anatomy have barely been investigated. Furthermore, most of those records are located in active subduction zones where apparent sea-level record may be biased by variations in uplift rates (Barbados; Papua New Guinea and Vanuatu). Such records are inadequate for a proper analysis of the impact of rapid sea-level and related environmental changes on reef growth and geometry.

Tahiti is a volcanic island characterized by slow and regular subsidence rates and located at a considerable distance from the major former ice sheets and corresponds, therefore, to an ideal site to obtain an unbiased continuous record of reef accretion and anatomy covering most of the last deglaciation. The 600 m of reef cores with an exceptional recovery (>90 % of the carbonate rocks) that were retrieved from 37 holes along transects ranging from 40 to 117 m water depth by drilling the successive reef terraces from a dynamically positioned vessel (*DV/DP Hunter* ; IODP Expedition #310 “Tahiti Sea Level” [9 to 11]) in three regions distributed around the island (Faaa, Tiarei and Maraa) therefore represent an unique opportunity to investigate the impact

of sea-level and environmental changes on reef development and anatomy during the last deglaciation.

The objectives of this study are : 1) to analyse the combined effects of sea-level and environmental changes on reef composition and architecture, and 2) to quantify the contribution of each reef component (i.e. corals, associated encrusting organisms - algae and/or foraminifers - and microbialites) to the reef framework during the post-glacial sea-level rise.

Post-glacial reefs from Tahiti are mostly composed of coralgal frameworks heavily encrusted with microbialites. Corals are well preserved and form six distinctive coral assemblages characterized by various morphologies (branching, robust branching, massive, tabular, foliaceous, and encrusting) that determine distinctive framework internal structure. Microbialites correspond to a late stage of encrustation of the dead parts of coral colonies, or more commonly, of related encrusting organisms (coralline algae and crustose foraminifers). They develop within the primary cavities of the reef framework and their abundance depend on the amount of initial framework porosity controlled by coral growth forms.

Three main types of internal structures are observed:

- dense frameworks mainly composed of massive corals (e.g., *Porites*) locally encrusted by thin microbialite crusts;

- intermediate frameworks formed by robust branching (e.g., *Pocillopora* and *Acropora*) and, to a lesser extent, tabular (e.g., *Acropora*) corals which are usually thickly encrusted with nongeniculate coralline algae and microbialites, vermetid gastropods and serpulids are locally associated with coralline algae;

- loose frameworks comprise thin branching corals (e.g., *Porites*) thinly coated with coralline algae and heavily encrusted by microbialites.

Reef anatomy during some critical time windows is reconstructed based on dating results (U-series and ^{14}C AMS) carried out on the various reef components, sedimentological and paleobiological analysis of reef cores and related thin sections, and 3D analysis of reef architecture based on CT-scan data which allow an estimate both of the volume of different reef components and of initial and residual porosities.

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