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Reconstructing reef accretion during the last deglacial sea-level rise : I.O.D.P. #310 expedition « Tahiti sea level ».

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The study of coral reef systems that developed during the last deglaciation (19,000-6,000 calendar years BP - cal. yr BP [1]) is of pivotal interest both for the reconstruction of climatic and environmental changes (e.g. nutrient concentrations, paleoproductivity, alkalinity, terrigenous and freshwater fluxes) associated with the sea-level rise and the evaluation of the impact of those combined changes on reef accretion (growth modes and reef geometry) and biological composition. Of special interest is the possibility of reef-drowning events [2] related to catastrophic sea-level rises during the deglaciation events [3,4]. However, the timing and the amplitude of such catastrophic events ($\sim$15-20 m of sea level rise in $<$ 300-500 yrs) remain to be confirmed.

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 review in [5]). Reef systems related to the early history of the last deglaciation have been poorly

documented because they are mostly stored on modern fore-reef slopes. Data obtained on the last deglacial reef sequences by dredging [6] and submersible sampling [e.g. 7,8] are typically fragmentary but have brought to light valuable information regarding the interpretation of morphological features, both accretionary (e.g. terraces, relict reefs) and erosional (e.g. cliffs, notches), in relation to sea-level changes. Only few continuous reef sequences that encompasses the Holocene-Pleistocene boundary have been documented by drilling (Barbados [3,4]; Papua New Guinea [9]; Tahiti [10 to 13]; Vanuatu [14]). However, both reef development patterns and environmental changes that accompanied the deglacial sea-level rise have barely been investigated so that the accurate reconstruction of the events is obscured; in particular, there are few studies that tackle the environmental changes recorded by changes in reef communities. Furthermore, most of those records are located in active subduction zones where apparent sea-level record may be biased by variations in the rates of uplift (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 environmental changes covering most of the last deglaciation.

600 m of reef cores with an exceptional recovery were retrieved from 37 holes by drilling the successive reef terraces along transects ranging from 40 to 117 m water depth in three regions distributed around the island (Faaa, Tiarei and Maraa) during the IODP Expedition #310 “Tahiti Sea Level” [15 to 17]. Those archives represent therefore an unique opportunity to investigate the impact of sea-level and environmental changes on reef development during the last deglaciation.

The objectives of the present study are :

- to analyse the internal reef geometry and structure based on sedimentological, paleobiological and CT-scan data coupled with downhole logging records;
- to reconstruct environmental changes based on sedimentological, mineralogical and geochemical data and the analysis of the paleobiological composition of reef systems;
- to reconstruct reef accretion and demise based on the dating (U/Th and ^{14}C) of the various components (microbialites, corals and coralline algae) of the reef frameworks and associated sediments;

- to model with various softwares (e.g. Gocad and Carbonate 3D) the reef response to sea-level and environmental changes.

The reconstruction of the last deglacial sea-level rise is the prime objective of another study, the preliminary results of which being presented by Deschamps et al. in the same session (CL36).

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