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Architecture and growth patterns of last deglacial reefs. IODP Expedition #310, Tahiti (French Polynesia).

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The study of coral reef systems that developed during the last deglaciation (23,000-6,000 cal. yr BP) is of pivotal interest both for the reconstruction of climatic and environmental changes, and the evaluation of the impact of those combined changes on reef accretion, growth modes and architecture. However, those features have been poorly documented because they are mostly stored on modern fore-reef slopes, at depths greater than 100 m.
The present study, based on the sedimentological and chronological analysis (14C AMS dating) of drill cores carried out on the successive terraces occurring on the modern reef slopes from Tahiti (IODP Expedition #310 « Tahiti Sea Level »), provides a comprehensive data base to investigate the microbialite growth patterns (e.g. growth rates and habitats), to analyze their roles in the reef frameworks, to reconstruct the evolution of the reef framework architecture and to better constrain the changing environmental conditions through time.
The last deglacial reefs from Tahiti are composed of two distinctive biological communities which were characterized by a similar scenario of development throughout the sequence, involving a diachronous development and a lack of direct competition. The coralgal communities composed of seven assemblages characterized by various growth forms (branching, robust branching, massive, tabular and encrusting) formed the initial frameworks, while microbialites developed in the primary cavities of those frameworks, a few meters below the living reef surface, where they heavily encrusted the coralgal assemblages. The offset between the growth of coral assemblages and the development of microbialite crusts ranges from 300 to 700 years.
The development of microbial crusts was controlled by the volume and the shape of the primary cavities of the initial reef frameworks determined by the morphology and the packing of coral colonies. The highest microbialite development occurred in frameworks dominated by branching, thin encrusting, tabular and robust branching coral colonies which built loose and open frameworks typified by a high porosity (> 50%). In contrast, their development is minimal in compact and low porosity (30%) coral frameworks formed by massive and thick encrusting corals where primary cavities could not host a significant microbialite development. The reconstruction of the evolution of reef architecture and growth patterns through time is of prime importance to reconstruct accurately the reef response to sea-level variations and environmental changes.

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