Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MIS022-05 Room:201B Time:May 23 09:30-09:45

Sea-level change, climate variability and reef development during the last deglaciation

Yasufumi Iryu[1*], Gilbert Camoin[2]

[1]Nagoya University, Japan, [2]CEREGE, France

Integrated Ocean Drilling Program (IODP) Expedition 310 ”Tahiti Sea Level” was conducted from October to November 2005 (Offshore Party) and from February to March 2006 (Onshore Party) (Camoin, Iryu et al., 2007, Sci. Drill., 5, 4-12). The objectives of this expedition were : 1) to establish the course of postglacial sea-level rise in Tahiti, 2) to define variations in sea surface temperature for the region during the 10-20 ka time window, and 3) to analyze the impact of sea-level and environmental changes on reef growth and geometry. In this presentation, we show summaries of scientific results of the objectives (2) and (3).

The response of coral reefs to sea-level and environmental changes during the last deglacial sea-level rise at Tahiti has been reconstructed from chronological, sedimentological and paleontological analyses of drill cores obtained by drilling the relict reefs occurring beneath the modern fore-reef slopes. Changes in the composition of coralgal assemblages coincide with variations in reef growth rates and therefore characterize the response of the upward-growing reef pile to a non-monotonous sea-level rise and coeval environmental changes. Reefs accreted continuously, mostly through aggradational processes, at mean growth rates of 10mm/year during the 16-10ka period, indicating the lack of any catastrophic impact on reef development such as the temporary break or cessation of reef growth. An incipient drowning and a general backstepping of the reef complex have been evidenced during the 14.6-13.9ka time window, coeval with the MWP-1A, implying that reef growth gradually lagged behind sea-level rise (Camoin et al., in review, Geology) . Paleontological analysis of cored material allowed to identify twenty-six coral species, twelve coral genera and twenty-eight coralline algal species. Based on these data, and in comparison with modern and fossil analogs, seven coral and four algal assemblages have been identified in the deglacial reef sequences, each representing a specific environment (Abbey et al., 2011, Glob. Planet. Change, doi:10.1016/j.gloplacha.2010.11.005). Reef initiation pattern and timing varied at sites based on the available substrate, and early colonizers suggest water conditions at all sites were unfavorable to sensitive corals, such as Acropora, prior to ca. 12.5 ka. Mainly shallow water (i.e. less than 10?15 m water depth) corals and coralline algal assemblages developed continuously at all sites from 16 ka to ˜8 ka, suggesting that changes in coralgal assemblages were more influenced by factors such as turbidity and water chemistry than sea-level rise alone.

Sr/Ca ratios and oxygen isotopes of fossil Tahiti corals suggest that a shift toward lower temperature by ˜1.5 degrees Celsius and higher oxygen isotope composition by ˜0.2 per mill at the sea surface from 14.2 to 12.4 ka (Asami et al., 2009, EPSL, 288, 96-107). Along with previously published deglacial coral records, our results provide new evidence for a significant cooling of the western to central tropical South Pacific Ocean during the Northern Hemisphere Younger Dryas episode, which are not consistent with foraminiferal Mg/Ca-derived sea surface temperature records from the equatorial Pacific Ocean. Higher Ba/Ca ratios and Cd content together with lower reconstructed SSTs using U/Ca ratios in the coral specimens between 12.7 and 9.8 cal ka compared to around 15 cal ka suggest that upwelling and/or entrainment of subsurface water into mixed layer was enhanced around Tahiti during this period. This finding is consistent with previous reports and supports the idea that the South Pacific was characterized by La Nina-like conditions at least from 12.7 to 9.8 cal ka.

Keywords: Integrated Ocean Drilling Program, Sea-level change, Paleoclimate, Coral reef, Last deglaciation, Tahiti