Tropical/subtropical South Pacific Climate Reconstruction from Last Deglacial Corals: Results from IODP Exp. 310 Tahiti Sea Level

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Massive Porites corals, living in tropical/subtropical shallow waters, have annually-banded aragonite skeletons with high- and low-density increments and grow rapidly (up to about 25 mm/year), which can provide chronological control and allow high-resolution (daily-to-seasonal) sampling. Ages of fossil corals can be determined accurately using radiocarbon and U-series dating methods. Oxygen isotope composition and Sr/Ca ratio in coral skeletons has been most widely used as paleoclimate proxies in many studies. In general, coral oxygen isotope composition reflects temperature and oxygen isotope composition of seawater, the latter of which is related to salinity associated with evaporation-precipitation balance, upwelling of deeper water, and river discharge. Coral Sr/Ca ratio is mainly controlled by seawater temperature. Coupled determinations of oxygen isotope composition and Sr/Ca ratio from the same coral sample can yield independent datasets of sea surface temperature and salinity. Despite their great advantages for paleoclimate reconstruction, previously published fossil coral records are few and spatially limited because most ancient coral reefs during the glacial and subsequent transgressive periods are distributed below the present-day sea surface as a result of the sea-level rise of about 120 m or more caused by ice sheets melting.

The Integrated Ocean Drilling Program (IODP) Expedition 310 -Tahiti Sea Level-, a mission-specific platform expedition conducted by the European Consortium for Ocean Research Drilling Science Operator, cored the successive drowned reef terraces around Tahiti Island of French Polynesia in the central tropical/subtropical South Pacific Ocean during October-November, 2005. During the expedition, massive in-situ coral colonies, mostly of the genus Porites, with total length of 30 m were recovered from 630 m of cores at water depths of about 40-120 m. Herein, we show results of monthly resolved oxygen isotope composition and Sr/Ca ratio from fossil Tahiti corals with well-preserved aragonite skeletons from cores obtained during the expedition. We will also present coral-based climate reconstructions of thermal and hydrologic changes at the tropical/subtropical South Pacific sea surface for selected time windows during the last deglaciation. This study can allow a better understanding of climate changes in the Pacific Ocean associated with sea-level rise during the last deglaciation, which will advance the main objectives of the expedition.