

Temporal Constraints on Sea Levels During Past Interglacials from U-Th Dated Hawai' i Corals

*Yueh-Yang Lee^{1,2}, Yusuke Yokoyama^{1,2,3,4}, Jody M Webster⁵, Marc Humblet⁶, Juan Carlos Braga⁷, Ana Christina Ravelo⁸

1. Atmosphere and Ocean Research Institute, The University of Tokyo, 2. Graduate Program on Environmental Sciences, The University of Tokyo, 3. Graduate School of Science, The University of Tokyo, 4. Research School of Physics, The Australian National University, 5. Geocoastal Research Group, School of Geosciences, The University of Sydney, 6. Graduate School of Environmental Studies, Nagoya University, 7. Department of Stratigraphy and Paleontology, University of Granada, 8. Ocean Sciences Department, University of California, Santa Cruz

Past interglacials that exceeded present-day temperatures, namely the Last Interglacial (Marine Isotope Stage (MIS) 5e) and MIS 11, which occurred around 120 ka and 400 ka respectively, provide opportunities to study how sea level and ice sheets responded to warmer conditions. Previous studies revealed significantly higher global mean sea levels exceeding 6 meters relative to present for both periods, with maximum estimates for MIS 11 reaching 13 meters. However, current results face large temporal and spatial uncertainties arising from dating methods, glacial isostatic adjustment (GIA) effects, and a lack of suitable fossil records spanning the past 500 kyr. As a result, accurate estimates of the height, timing, and rates of past sea level rise remain unresolved. Around the coast of Hawai' i, a far-field site located in the central Pacific Ocean, a sequence of drowned coral reefs spanning MIS 11 to modern day has been preserved underwater by continued subsidence. In this study, we conducted high resolution uranium-thorium (U-Th) dating on fossil coral specimens collected from the seabed surrounding Hawai' i. Using the collection depth of coral samples, their U-Th dates, and the subsidence rate of Hawai' i, which has been shown to be uniform under this timescale, we calculated a preliminary record of temporally resolved paleo sea levels with a focus on MIS 5e and MIS 11. This study provides improved temporal and quantitative constraints on sea level amplitude and rates of change, key parameters that can be incorporated into climate and ice sheet models. Using these results, we will discuss the possible sources of sea level rise during these key periods and its possible implications for ice sheet sensitivity under warmer past conditions, aiming to improve projections of future sea level responses.

Keywords: sea level, U-Th dating, coral, interglacial, MIS 11