Whole-reef approach to reconstructing deglacial sea level change and MWP-1A timing in submerged Hawaiian Coral Reefs

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Geologically rapid sea level rise is a direct manifestation of periods of global warming, such as the last deglaciation, and is one of the most impactful aspects of likely future anthropogenic global climate change. We report here on results of an ongoing study of Hawaiian deglacial sea level change using large, continuous drowned coral reef archives to discover and study sea level rise records since the last ice age from natural climate change. Tropical coral reefs offer one of the best/most complete sea level indicators and are easily dated by radiometric methods to construct relative sea level (RSL). Such records are used in global models to understand ice-melting and global/local sea level impacts. This phase of our study focuses on RSL reconstruction in the central Hawaiian Islands (Oahu to Lanai), especially of climatically important glacial melt water pulses. We are using submersible observations of coral colony morphology, and ecology coupled to radiometric U-series age determinations of grab samples from 11 submersible dives at two sites, and a high resolution sea bed DEM to understand the timing of sea level change, the magnitude of globally-observed sea level events such as Meltwater pulse 1A (MWP-1A), and the impacts on coral reef accretion and community structure. We are using coral community structure on nearby modern reefs as analogs to reconstruct paleodepth and water conditions. The absolute timing of MWP-1A relative to the Bolling warming remain controversial, and yet is an important constraint on the timing and source of melt water during this critical time period. Current coral reef estimates for the start of MWP-1A vary over about 1.5 ka, including the Barbados record (13.61-14.08 ka, Peltier and Fairbanks, QSR, 2006), a Tahiti record (14.31-14.65 ka, Deschamps et al., Nature, 2012) and an age estimate inferred from the flooding of a now 150-m deep reef structure on the rapidly subsiding Big Island of Hawaii (14.62-15.45 ka; Webster et al., Geology, 2012). While the amplitude of the local RSL jump will vary regionally in response to the locations of meltwater source(s), the timing at far-field sites should not vary significantly. We will discuss our estimate for the initiation and duration of this and other deglacial sea level events in Hawaii, our continuing efforts to refine them, and their implications for the ongoing debate regarding the role of MWP-1A in ice age climate change.