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Constraining mid to late Holocene sea level change of Society Islands, French Polynesia

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Abstract
In global average rising eustatic sea level of several centimeters per decade is predicted for the near future as a consequence of seawater warming and partial melting of the Greenland ice cap (Milne et al., 2009). Beside CO_2 induced ocean warming local sea-level amplitudes may also vary although no extra water has been added to or extracted from the ocean due to post-glacial geoid reorganization, as a consequence of the emergence of the once glaciated areas and the ocean siphoning effect (Milne et al., 2009; Mitrovica and Peltier, 1991; Mitrovica and Milne, 2002). However, previous research on sea level change was focused on sea-level rise that occurred between the "Last Glacial Maximum, LGM" ∼18ka before present (BP) and the so called "Holocene Sea Level Maximum, HSLM" ∼6ka BP. Information about sea-level change after the HSLM are rare because the Late Holocene was considered to be climatically stable with minor to negligible sea-level oscillations and amplitudes.
Here we present U/Th dated fossil corals from conglomerate reef platforms of three islands (Moorea, Huahine and Bora Bora) of the Society Islands, French Polynesia. The fossil coral data constrain the timing and amplitude of sea-level variations after the HSLM. We found that sea level reached a subsidence corrected minimum position of ∼1.5±0.2m above present sea level (apsl) at ∼5.4ka. Sea level then remained at this position with probably minor amplitudinal variations for ∼3ka and then dropped to the present position at ∼1.9ka. Note, that our study does not provide any data on sea-level position from ∼1.8ka to the Present. Theoretical predictions (Mitrovica and Milne, 2002) taking the ocean siphoning effect into account predicted a sea level of ∼3m apsl at ∼5ka and a constantly decreasing sea level from 5ka to the present. This is in contrast to our observations indicating a more or less constant sea level between 5ka and 1.9ka followed by a abrupt drop of sea level to the present position. Although theoretical predicted sea-level amplitude is in general agreement with our empirical findings, the theoretical predicted timing of sea-level change is pending future recalibration.

Key words: Sea level, conglomerate reef platform, Holocene.