Relative sea level highstands of the Yucatán Peninsula, Mexico, constrained by speleothem growth periods

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The loading of the North American continent with ice sheets causes a geomorphologic response. As a result of this process, a NW-SE gradient of relative sea level developed in the Caribbean during periods of glaciation. In order to distinguish geomorphologic and eustatic contributions it is important to resolve timing and amplitude of relative sea level at different positions in the Caribbean.

The cave systems around Tulum, Quintana Roo, Mexico are presently submerged and well-connected to the nearby Atlantic with a low hydraulic head gradient. Speleothems must have formed during periods of lower sea level, thus providing constraints on the maximum elevation of relative sea level for given periods of time. Conversely, periods of growth cessation could have been caused by sea level rise thus indicating minimum relative sea level during highstands.

Here, we present 230Th/U dated submerged speleothems that grew during MIS5a-d as well as MIS1/2, MIS6 and MIS11/12.

Growth of a single stalagmite (QUE01) at -10.8±0.1m (relative to today's sea level) was interrupted twice. Petrographical studies and trace element analysis indicate that submergence caused millennial-scale growth stops in QUE01 during MIS5. The proposed highstands are between 109.4±0.3ka and 105.0±0.3ka as well as between 104.5±0.4ka and 96.9±0.4ka. While a previous study [1] constrains the amplitude to <9.9m, this study further improves the timing. This is the first record in this area that yields bracketing ages for those highstands from a speleothem that is very close to the peak height. In order to reconstruct a Caribbean sea level gradient, the combined Yucatán record acts as a counterpiece to a similar study from the northern end of the Caribbean sea level gradient which reports highstands at that time with a higher relative sea level [4].

Speleothem growth during MIS1/2 (19-8ka) relates to conflicting local sea level markers [2,3] and contains century-scale growth stops. Samples dating back to MIS6 and MIS11/12 highlight the
potential for sea level reconstruction in this area before MIS5.