Lake level changes in the Dead Sea during the late Pleistocene recorded by fossil lake shorelines

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High-resolution records of lake-level changes are crucial to elucidate the impact of local and global climatic changes in lacustrine basins. The Late Quaternary evolution of the Dead Sea has been characterized by substantial variability apparently linked with global climatic changes, being subject of many research efforts since decades. Previous studies have defined two main lake phases, the Lake Lisan and the Dead Sea, the earlier was a highstand period that lasted between ~70 and ~15 ka, the latter was the lowstand period that persisted until the present. Here we focus on the switch between Lake Lisan and Dead Sea studying fossil lake shorelines, a sequence that comprises dozens of levels exposed along the rims of the Dead Sea, containing abundant fossil stromatolites that we dated by mean of radiocarbon and U-decay series. We determined 90 radiocarbon and 35 U-Th ages from stromatolites from almost every shoreline level. We compared U-Th and radiocarbon ages to estimating a radiocarbon reservoir between 0.2 and 0.8 ka, used to correct the remaining radiocarbon ages before calibration. The resulting ages range between ~45 and ~20 ka. Dating was complemented with analysis of stable oxygen and carbon isotopes. Furthermore, we applied a distributed hydrological balance model to constrain past precipitation and temperature conditions. Our results suggest that the duration of the last Lake Lisan highstand was shorter than previously estimated. Taking this at face value, the switch between Lake Lisan and Dead Sea occurred at ~28 ka, ~10 ka earlier than previously suggested. Oxygen and carbon isotopes show a consistent pattern, displaying a switch between wet and dry conditions at ~28 ka. Preliminary results from the hydrological model indicate a much stronger sensitivity of the lake level to precipitation amounts than to temperature. From our results we can’t observe a clear link between global temperature variations and lake-level changes in the Lisan/Dead Sea lakes.
Similar non-linear response to northern hemisphere climatic changes have been also documented in Holocene Dead Sea paleoclimatic records, suggesting that global climatic variations may lead to variable lake-level responses. The results of this study adds further complexity to the understanding of factors controlling climate variability in the Dead Sea.