Frequency of torrential rainstorms during a regional late Holocene
drought inferred from a Dead Sea sediment record

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Reconstructing the paleoclimate along the Dead Sea Transform and the hydrological evolution of the Dead
Sea watershed is crucial to validate climate model simulations predicting enhanced aridity in the region due to
global warming. Identifying climates favoring extreme weather phenomena is a primary aim of paleoclimate and
paleohydrological research. Here, we present a well-dated, late Holocene Dead Sea sediment record of debris
flows covering 3.3 to 1.9 cal ka BP.

Twenty-three graded layers deposited in shallow waters near the western Dead Sea shore were identified
by microfacies analysis. These layers represent distal subaquatic deposits of debris flows triggered by torrential
rainstorms over the adjacent western Dead Sea escarpment. Modern debris flows on this escarpment are induced
by rare rainstorms with intensities exceeding >30 mm h⁻¹ for at least one hour and originate primarily from the
Active Red Sea Trough (ARST) synoptic pattern. The observed late Holocene clustering of such debris flows
during a regional drought indicates an increased influence of ARST resulting from a shift in synoptic atmospheric
circulation patterns. Regional droughts in the Levant are caused by reduced frequency of eastern Mediterranean
(EM) cyclones. The shift into drier conditions is characterised by decreased passages of such winter cyclones,
but favored localised rainstorms triggered by the ARSTs. This is in accord with present-day meteorological data
showing an increased frequency of torrential rainstorms in regions of drier climate. Hence, this study provides a
rare conclusive evidence for a shift in synoptic atmospheric circulation patterns during a late Holocene drought.

Within the framework of the DFG ICDP priority program SPP1006, the PALEX (Paleoclimate in the Eastern
Mediterranean Region – Levante: Paleohydrology and Extreme Flood Events) research project joins
sedimentologists, hydrologists, meteorologists and geochemists from Germany and Near East. This research joins
experts to apply a multidisciplinary approach to link modern meteorological and hydrological observations of
recent flash flood events using state-of-the-art technologies with flood reconstructions obtained from sediment
records. These observations are combined with modern analogues to constrain the strength and frequency of
flood time-series obtained from the thousands years long Dead Sea sediment records. The long sediment cores
of the ICDP Dead Sea Deep Drilling Program (DSDDP) recovered an unique archive from the deep basin of the
Dead Sea that allows the reconstruction of the natural hydroclimatic variability in this region over the past 220 kyr.

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