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Quaternary coastal evolution of Oman (Arabian Peninsula) – a quantitative approach

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The paper reviews the Quaternary coastal evolution of Oman. Emphasise is put on quantifying the different forcing factors. The plate tectonic setting, the Quaternary climate evolution, the sea-level history and the impact of natural hazards are identified as key factors of coastal evolution.
The Arabian Plate is characterized by a northward movement forming a continent-continent collision zone in the west and the Makran Subduction Zone in the east. As a result differential land movement is observable in Oman. The Quaternary climate evolution is well understood. Besides other proxies notably spelothems and aeolian deposits allow to draw a consistent picture. It is understood that changes in the position of the intertropical convergence zone result in intensity-changes of the summer monsoon. These changes are related to global atmospheric circulation patterns. Data on the sea-level history are sparse; despite general assumptions of a sea-level lowstand, correlating with the last glacial maximum, resulting in terrestrial conditions within the Arabian Gulf. Furthermore, a mid-Holocene sea level highstand in the range of +2m is documented in several locations. The coastlines of Oman are affected by tsunami and hurricanes. However, almost no instrumental or historical data on the impact of such natural hazards are available due to the isolation of the country in the past.
Several Quaternary deposits have been investigated in a reconnaissance survey. There is sound geological evidence for a tsunami to have affected the coastline in 1945, with the possibility of older tsunami events being also recorded in the geological record. There is strong evidence of differential land movement along the coastline; locally indicated by marine terraces in elevations of up to 400m (Rupprechter at al. 2012). By quantifying the differential land movement for numerous sites, the sea-level history will be revealed. Ultimately the data will be utilized to form the base of a modeling approach. Furthermore, a sedimentary archive of past precipitation events is documented which will allow reconstructing frequency and intensity of precipitation events and may indicate the impact of past hurricanes.
It is concluded that the geological archives are suitable to quantify the forcing factors of Quaternary coastal evolution on different time scales and that the recurrence intervals of natural hazards will be revealed. Proxy data will be gained in subsequent investigations. This allows a scientific based holistic approach for an integrated coastal zone management that helps to formulate adaptation strategies with regard to global warming and expected environmental changes.

References:
Rupprechter, M. et al. (2012): Differential GPS measurements as a tool to quantify Late Cenozoic crustal deformation (Oman, Arabian Peninsula). Abstract EGU 2012