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Laminated Sediments of the Northern Arabian Sea: Tracking Climatic and Human Impacts on Late Holocene Erosion and Weathering Intensities in SW Asia

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In the face of recent climate change, the need of understanding the mechanisms of climate variability increases continuously. However, most palaeo-climatic and -oceanographic records are restricted to timescales that have too low resolutions to take immediate appeal. Besides tree ring, speleothem and coral records, laminated lacustrine and marine sediments offer the required temporal resolution of decadal and also interannual scales to decipher climatic changes properly. Laminated sediments of the northern Arabian Sea provide such an excellent high-resolution archive for marine and terrestrial environmental changes. Fluvial and aeolian transported detritus are the major constituents of the sediment succession and give good indications of natural climatic and human impact by integrating precipitation and erosion signals of large continental areas of SW Asia.
We present data of the seasonal laminated sediment core SO130-275KL (Lat 24°82', Lon 65°91'; 782 mbsl) from the oxygen minimum zone (OMZ) off Karachi, eastern Pakistan. The sediment core is well dated by varve counting and AMS 14C methods, and comprises the late Holocene period (ca. 5,000 years). We applied grain-size analysis in combination with the chemical index on alteration (CIA) on the lithogenic matter portion of the sediment in order to investigate the regional impact of climatic variability and human land use change on soil erosion, soil transport, and silicate weathering. Our data implies a significant distal and proximal aeolian dust contribution to both lithotypes, which were probably re-deposited in combination with riverine sediment load. In doing so, strong aeolian-fluvial interactions as observed in other semi-arid and arid environments of today are very obvious. Fluvial mud and distal aeolian dust percentages show a near-parallel increase after ca. 2,700 years B.P. in combination with reduction of coastal dune activity. Therefore, we assume an increase in winter precipitation intensity due to combined strengthening and southward shifting of the mean subtropical jet stream position in winter, starting close to the transition from the overall warmer Subboreal to the colder Subatlantikum period.
Further significant erosion intensifications could be observed during the little ice age period (600-100 years B.P.), whereas warmer periods like the Roman (1,550-1,200 years B.P.) and the Medieval warm period (1,000-700 years B.P.) are characterized by erosion decreases. These trends are also reflected by the CIA weathering values with intensification during colder, and reduction during warmer periods. Our data testifies no striking impact by the Indian summer monsoon on regional erosion or weathering intensity for the late Holocene period, challenging former palaeo-environmental studies from the same location.