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High-resolution reconstruction of abrupt climate change during the late Quaternary in the Arabian Sea: grain-size analysis and end-member modelling as a tool to distinguish wind-blown dust and Indus-River sediments

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The Arabian Sea is surrounded by several sources of terrigenous sediments, i.e. the Indus River, the suspension sediment of which is enhanced by the melting of Himalayan ice (including Karakoram Mountains), and deserts, supplying eolian dust transported to the sea by at least five potential wind systems.
The fundamental feature of the Indian climate is the monsoon system, in particular: the southwest monsoon winds (June-August) cause an increase in river discharge, connected also with an increase in primary productivity in the ocean, whereas the winter monsoon winds (September-April) determine dry conditions and the predominance of dustfalls.
In general, variations in monsoon intensity on glacial timescales can be explained by the mechanism of precessional forcing, which affects the insolation of the Earth, even if also variations on sub-Milankovitch (i.e. millennial) timescales occur. Unfortunately, a clear explanation about the forcing mechanisms is not yet available.

Grain-size distribution modelling of the terrigenous fraction of the upper part of sediment core SO130-289KL (from 20 to 440 cm), drilled from the central Pakistan continental slope off the Indus Delta, allowed the reconstruction in a high-resolution detail (about 1 sample every 100 yrs) of paleoclimate changes in the continental areas surrounding the northeastern Arabian Sea.

This interval, composed predominantly by a mixture of hemipelagic mud and wind-blown sediments that are respectively proxies for continental humidity and aridity, represents the Late Quaternary, i.e. about the last 20 kyrs BP, and it was studied to check the possible teleconnections with climatic events recorded in the Northern Hemisphere, thus assessing the occurrence of common forcing agents.

The unmixing of multisourced basin fills based on the grain sizes resulted in the partition of the terrigenous fraction into four sediment subpopulations, two finer fluvial inputs, one due to the sediment load of the Indus River and the other to the enhancement of the discharge by the meltwater, and two types of wind-blown dust, related to "distal" and "proximal" sources.

In general, a partial teleconnection with the Northern Hemisphere climate changes can be pointed out, but unfortunately the provenance of the eolian dust and the causes that determined variations in terrigenous supply are still unknown: sea level changes? Orbital changes that drove variations in the monsoon system? Wind strength? Currents?