
Sediment Transport Processes and Rates in the Indus Submarine Fan, Arabian Sea

Peter D. Clift, Yuting Li, and Peng Zhou

Department of Geology and Geophysics, Louisiana State University,
E235 Howe-Russell, Baton Rouge, Louisiana 70803

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ABSTRACT

The Indus submarine fan is the second largest sediment body on Earth, comprising around 5,000,000 km³ of material largely eroded from the Himalaya and Karakoram. Recent scientific drilling by International Ocean Discovery Program in the Arabian Sea allows sediment accumulation to be reconstructed back to ~11 Ma. New zircon U–Pb ages indicate that erosion after 11 Ma was dominated by flux from the Indus suture zone, in particular the Karakoram, with a reversal after ~9 Ma towards more flux from the Himalayas, especially the Lesser Himalayas. This change reflects the progressive unroofing of that tectonic unit under the influence of a weakening summer monsoon system. Because ~2 Ma sediments deposited on lobes on the mid fan have had a provenance similar to the modern river, associated with strong monsoon rains, suggesting that most of the sediment reaching the deep basin was generated during interglacial times during a wet continental environment. Study of Quaternary sediments in the modern canyon shows that fine-grained material is largely derived directly from the river mouth, with a relatively direct connection between river discharge and the canyon. In contrast, zircon U–Pb ages of silt within the canyon shows a disconnect between the river mouth and the canyon. Sand has been ponded close to the river mouth during the Holocene. Movement of the river mouth relative to the head of the canyon is a key short-term control on the direct delivery of sediment into the canyon and shredding of erosional signals between the river and marine depocenter.