



Sediment Source-to-Sink Processes in the Indus River since the Last Glacial Maximum

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The Indus River drains the western Himalaya and Karakoram and feeds sediment to the second largest submarine sediment body on Earth. Erosion in the catchment is controlled by rock uplift rates but also by climatic variability that has caused erosional patterns to migrate as the SW monsoon first strengthened then weakened during the Holocene. The tributaries of the Indus have incised the flood plain extending >500 km from the mountain front since 10 ka recycling older deposits. This erosion accounts for about 20% of the total flux to the ocean. Much greater volumes were released from river terraces in the mountains, especially along the major river valleys and from the region within 100 km of the Nanga Parbat syntaxis. Very little new bedrock erosion is required to account for the sediment flux. About half the sediment load has been deposited onshore either in the delta or under the southern flood plains where the river sits on a major accretionary ridge. The remainder of the sediment is in the upper canyon and shelf clinoforms because no sediment has reached the deep sea since at least 7 ka. Comparison of different provenance proxies shows that zircon grains travel slowly through the river, taking 5–10 k.y. longer to travel to the river mouth than clays or micas, whose transport times are within the uncertainties for the dating methods. This slower bed load transport introduces a lag time between a change in erosion patterns and the appearance of the sediment at the river mouth. A further lag of at least 7 ka is assumed for sediments in the Indus Canyon and >11 ka for the upper fan.