

The Asian Monsoon and its Impact on Weathering and Erosion in the Western Himalaya since the Miocene

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The Asian monsoon is controlled in part by the evolution of topography in Asia that has since the start of collision of India with mainland Asia, likely around 50–60 Ma. Feedbacks between the solid Earth and climate have been suggested to govern the structural and tectonic evolution of the mountains, and in particular the exhumation of the Greater Himalayas and the formation of the Lesser Himalayan duplex. New marine sediment cores from the Arabian Sea collected by IODP Expedition 355 now allow the relationships between climate and erosion to be investigated since 11 Ma spanning the critical climatic transition after 8 Ma. There is a coherent change in bulk sediment Nd isotopes to more primitive, Karakoram-derived sediment between 20 and ~9 Ma followed by a long term trend to more Himalayan values from that time to the present. This may reflect the progressive exhumation of the Lesser Himalayan Crystalline Series after weakening of summer monsoon rains, beginning at 8 Ma. This environmental change is reconstructed from the carbon isotope character of plant waxes, consistent with similar data from the foreland basin. Detrital zircon U-Pb data confirm the general shift of relative erosion away from the Karakoram towards the Lesser Himalaya since the Miocene. Sands deposited on the submarine fan since 2 Ma are very similar to those in the river mouth at the present time, but not during the LGM, which instead is more similar to the older Miocene sediments. Hematite/goethite values derived from spectral analysis of the core steadily increase after ~8 Ma and especially after 6 Ma, suggestive of drying climate with a reversal to wetter conditions starting ~1.5 Ma.

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