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Scientific Ocean Drilling and the Evolution of the Asian Monsoon

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Although not unique as a land-ocean climatic system the Asian monsoon is the strongest such system on the Earth and dominates the environmental conditions of the world's largest continental mass. Scientific ocean drilling has played a key role in reconstructing the evolving intensity of this system, dating back to the pioneering exploration of ODP Leg 117, which established an intensification of upwelling on the Oman margin after 8 Ma. Because this upwelling is now linked to summer monsoon strength this implied at initial intensification of the summer monsoon at this time. ODP coring on the distal Bengal Fan also showed a shift to more smectite-rich chemical weathering at the same time, which together with changes in terrestrial carbon isotopes linked to flora and the accumulation of the eolian loess in northern China pointed to an 8 Ma strengthening. Curiously however, this shift correlated with falling sedimentation rates on the Bengal Fan, when much Quaternary evidence suggests that erosion would be expected to increase as summer rains strengthened. Drilling by ODP Leg 184 in the South China Sea now allows reconstructions of monsoon intensity to be extended to at least 25 Ma, crucially pre-dating the exhumation of the Greater Himalaya. Chemical weathering proxies on the northern margin of the South China Sea indicate an initial intensification after $\sim$23 Ma, reaching a peak in the Middle Miocene during the Mid Miocence climatic optimum. In this scenario strong summer monsoons correlate with periods of rapid mass flux to the ocean and clastic mass accumulation. Monsoon intensity instead falls at 8 Ma, causing more chemical weathering in the Bay of Bengal because of slower sediment transport. Observations of orogenic exhumation in the recent past suggest a close linkage between Greater Himalayan history and the summer rains. At present no deep-penetrating record spanning the erosional onset of this range exists to test this hypothesis over tectonic timescales. Proposed drilling on the Bengal and Indus Fans back to the Eocene now holds out the hope of providing the first detailed record of how the planet's largest mountains and intense climatic phenomenon have co-evolved over tens of millions of years.