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The Himalaya-Bengal Fan source to sink system – new insights by correlation of re-processed seismic data and IODP Expedition 354 results

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The Bengal Fan, hosted in the northern Indian Ocean, is the largest submarine fan on Earth. Fan evolution started in the Early Eocene as a direct response to the collision of India with the Asian continent in Middle Paleocene times. Subsequently the Himalayan plateau uplift was initiated. Thereby generated interactions with the regional climate caused the evolution of the Indian monsoonal system. Drained by the rivers Ganges and Brahmaputra, ∼ 80% of eroded Himalayan sediments are deposited in the Bengal Fan. Hence, the Fan provides the most complete record of the Himalayan history and is well suited to investigate the direct link between the tectonic uplift and the climate evolution of the region.

Sediments are transported onto the deep sea fan by turbidity currents building up chan-nel-levee systems. These channel-levee systems are the main architectural elements of the Bengal Fan and are suspected to have their onset in Late Miocene times. Frequent channel avulsion on the upper fan led to the abandonment of old channels and formation of new channel-levee systems or even channel-reoccupation. This complex erosional/depositional system involves lateral depocenter migration, probably on millennial timescales. Conse-quently, investigations of the Himalaya as sediment source begins with a comprehensive understanding of transport, deposition and modification within the Bengal Fan sediment sink.

In February/March 2015 the IODP Expedition 354 drilled at 7 sites along a ∼320 km long E-W transect at 8° N. Aiming at the recovery of pre-fan deposits and deposits of the Pliocene and Upper Miocene Fan evolution, three deep sites (900 – 1200 mbsf) were realized. These where complemented by four shallow sites (200-300 mbsf) for a detailed study of the depos-its of the last 1-2 million years, including the latest known channel activities (Holocene times). Several channel-levee systems and inter-channel deposits were drilled, active at different times of Fan evolution.

To connect the sites of the drilling transect by means of seismo-stratigraphic analysis a large seismo-acoustic dataset gathered during cruises SO93 (1994), SO125/126 (1997) and SO188 (2006), all carried out in cooperation between the University of Bremen and the BGR, Hannover, is available. The dataset contains multichannel seismic data acquired with differ-ent seismic sources (GI-Gun/Watergun) to achieve differing subbottom pene-tration/resolution ratios. Although most of the pre-site survey data were already processed, major improve-ment could be gained by thoroughly (re) processing using new processing techniques and software developments. First processing results show significantly enhanced S/N ratio, reso-lution and reflector coherency. Full processing of the Watergun data was conducted for the first time. This high vertical resolution data has so far never been investigated and comple-ments the database, especially for a more detailed study of the upper few hundred meters of Bengal Fan deposits. First examinations of the watergun data in combination with drilling results proved them to be beneficial for the crucial borehole – seismic correlation and the investigations of the internal levee architecture, especially for the latest active channel-levee system.