

The Paleo-Brahmaputra signature found from the Lower Miocene of Bengal Fan deposits, IODP Exp. 354

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The Bengal Fan is the largest submarine fan in the world. It has developed as a result of the collision of India with Asia, reflecting the orogeny of the Himalayas. The changes in the mineral assemblages of fan sediments record the uplift history of the Himalayan orogenic system. In the deepest site, U1451A and B of IODP Expedition 354, a complete sequence of fan deposits from the Oligocene was recovered (France-Lanord et al., 2015). The sediments drilled at this site consisted of mica and quartz-rich sand, silt, and clay, with the exception of the lower Oligocene-Eocene section. In this study, we examined the heavy mineral assemblage in the sediments in the Bengal Fan with chemistry of detrital garnets, amphibole and chromian spinels.

It is already reported that the heavy mineral assemblage of the Early Miocene silt-sands mainly was characterized by the predominance of garnet and amphibole grains with a small amount of kyanite, sillimanite and staurolite by Yoshida et al. (2016). The most sand layers in the lower Miocene contain tourmaline, apatite, rutile and hornblende grains with high Mg garnets correlatable to the metamorphic garnets in the High Himalaya Crystallines. However, several sand layers contain sodic amphiboles and chromian spinels, which show very low TiO₂ content (<0.05wt%) suggestive of depleted ultra-mafic rock origin. The detrital garnet grains, which are included in these sand layers with chromian spinels, mainly consisted of low-Mg almandine garnets. In the Middle Miocene sequence, most of the sand layers are scarce of sodic amphibole and chromian spinels, though the Pliocene and Pleistocene sands include both sodic amphiboles and chromian spinels.

The sand layers including both sodic amphibole and chromian spinels were possibly derived from Yarlung Tsangpo suture zone and the ophiolite zone in the Burman mountain ranges. Garzanti et al. (2010, 2011) reported the predominance of chromian spinels in the upper stream of the Brahmaputra river, which is indicative that the sand layers including sodic amphiboles and chromian spinels were carried by "paleo-Brahmaputra river" and supplied to Bengal Fan. Though the Ganges river, which carried the most of detritus from central and western Himalayas, constantly supplied a large amount of detritus into Bengal Fan, the paleo-Brahmaputra river could supply the detritus from eastern Himalaya and Burman mountain ranges in the early Miocene period. The detritus originated from the paleo-Brahmaputra river's discharge in the early Miocene was considered to be derived from the collision orogen among the eastern edge of Indian continent, southeastern part of Tibet block and Burman block in late Oligocene to early Miocene period. The predominance of the sodic amphiboles and chromian spinels in Pliocene and Pleistocene sands is thought to be caused by strong uplift around Eastern Himalaya syntaxis.

References

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