Heavy mineral assemblage of river sands along the Kaligandaki River, central Nepal and its application for Bengal Fan sediments

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The Bengal fan is the widest submarine fan in the world and was formed as a direct result of Himalaya by the Asia and Indian continental collision from the early part of the Cenozoic era. The huge amount of detritus from Himalaya was carried into the Indian Ocean by Ganges and Brahmaputra rivers. The International Ocean Drilling Program (IODP) Expedition 354 Bengal Fan provides the data set of the erosional history of Himalaya from Early Miocene to present days. We examined the heavy mineral assemblage and chemical composition of specific minerals in the river sediments in the Himalayan river and compared it to Bengal Fan deposits in order to clarify the provenance history recorded in the Bengal Fan deposits. The heavy minerals in modern river sediments are taken from the Kari Gandaki river-tributaries, in central Nepal.

The assemblage of heavy minerals in Kari Gandaki river tributaries clearly reflected the rock assemblage distributed in the catchment. The tributaries from the catchment area of the Tethys Himalaya zone shed ultra-stable minerals, such as zircon, tourmaline and rutile. The High Himalayan Crystalline zone provided metamorphic minerals, such as amphibole, sillimanite, kyanite, staurolite. The catchment consists of the Main Central Thrust zone (MCT zone) and the Lesser Himalayan zone carried the mica-rich detritus with oxidized iron minerals and amphiboles.

The detrital garnet compositions are also depending to geological units distributed in the catchment area; Tethys Himalaya area derives mainly almandine (Mg<20 mol %) garnets, whereas High Himalaya Crystalline produces Mg-rich (Mg>20 mol %) almandine garnets with specific amount of Ca-rich (Ca>20 mol %) almandine derived from calculous gneiss.

Comparison with Bengal Fan sediments which recovered in IODP Exp. 354, sillimanite and kyanite were found from Early Miocene sediments. The detrital amphiboles dramatically increased from the Middle Miocene (13 Ma), which is suggestive to initial major uplift of High Himalaya Crystalline started from this period. In addition, though Mg-rich garnets are minor components until the Early Miocene time, those are clearly increased from Late Miocene time (9.2 Ma). Several compositional fluctuations were detected in the Middle and Late Miocene sections in Bengal Fan sediments, above described compositional change, which is irreversible in the historical record of detrital garnet chemistry, suggests several stages of major uplift of the Himalaya during Miocene time.

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