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Geochemical characteristics of recent fluvial sediments of sandy-braided Brahmaputra-Jamuna River, Bangladesh

Mohammad A. H. Bhuiyan[1*], Md. Julleh Jalalur Rahman[2], Samuel B. Dampare[1], Shigeyuki Suzuki[1]

[1]Okayama University, [2]Jahangirnagar University

The Brahmaputra-Jamuna is the largest sandy-braided fluvial system in the world, flowing through the southeastern Himalayas and entering Bangladesh at Kurigram. It travels 2900 km from Tibet Himalayans to Ganges-Jamuna confluence at Aricha, Bangladesh, maintaining the mean width of 10 km in Bangladesh part. The sediments of Brahmaputra-Jamuna floodplain are contributed from the higher and eastern Himalayas by Brahmaputra River. Besides, a significant contribution of sediments in this system also comes from the Tista River, which originates from the middle part of lesser Himalayan and joins to Brahmaputra-Jamuna River at Kurigram. To date, few works have been conducted on the Ganges River sediments which cover the southwestern territory of Indian Himalaya. Moreover, the geochemical characteristics of sediments from the southeastern Himalayas have received very little attention. This present study evaluates the geochemistry of recent fluvial sand of 120 km study reach from upstream (Kurigram) to downstream (Sirajganj-Tangail) parts the Brahmaputra-Jamuna River with the aim of evaluating their provenance and tectonic setting. Thirty sediment samples were collected from sandbars and different facies units (such as St, Sp, Fl, Fsc, Sr and Sl) of the braided system, and analyzed by lithium metaborate/tetraborate fusion Inductively Coupled Plasma (ICP) and Inductively Coupled plasma Mass Spectrometry (ICP-MS) for their chemical compositions. The Brahmaputra-Jamuna sands are rich in SiO2 contents (average 75%). The mean concentrations of Al{2}O{3}, Fe{2}O{3} (as total Fe), MgO, CaO, Na{2}O and TiO{2} are 11.00 wt.%, 3.90 wt.%, 1.35 wt.%, 2.00 wt.%, 1.97 wt.% and 0.48 wt.%, respectively. Compared to the average sandstone values, the Brahmaputra-Jamuna sands are depleted in CaO and enriched in Al{2}O{2}, Fe{2}O{3} and Na{2}O. According to geochemical classification and compositional maturity, the samples fall in the field of lithic arenite. The Chemical Index of Alteration (CIA) values are relatively low (CIA range: 51?62, mean: 53), suggesting that these sediments are chemically immature and suffered low weathering effects. In A-CN-K ternary diagram, most of the samples are plotted close to plagioclase feldspars and indicate the higher Himalayan source rock. Hence, the bedload geochemistry is controlled mostly by mechanical breakdown of lithic fragments and subsequent preferential attrition of muscovite > albite > quartz. According to the plots of tectonic discrimination and tectonic setting diagrams together with Th/U vs. Th and Th/Sc vs. Zr/Sc, the sediments mostly fall in active continental margin and preserve the signature of a quartzose sedimentary provenance. Moreover, the Eu/Eu* (~0.66), La/Lu (CN) (~11.01), La/Sc (~3.70), Th/Sc (~1.47), La/Co (~4.20), Th/Co (~1.67), and Cr/Th (~3.70) ratios as well as chondrite-normalized REE patterns with flat HREE, LREE enrichment, and negative Eu anomalies indicate derivation of the sediments of Brahmaputra-Jamuna from felsic rock sources of upper continental crust. The geochemical analyses also show that there are no significant compositional variations among the different facies units.

Keywords: Bangladesh, Brahmaputra-Jamuna River, fluvial sediments, geochemistry