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Impact of chemical weathering and sedimentary processes on the geochemical makeup of sediments in the Brahmaputra River, India

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The large tropical rivers are the major conduit for the discharge of dissolved solutes and sediments to the marginal marine basins. The weathering of source rocks, erosion of sediments and the sedimentary processes occurring in the fluvial environment affect the nature and the geochemical composition of sediments. The Brahmaputra River which drains orogenically active Himalaya forms large braided channel in the foreland basin. The watershed drains heterogenous lithologies of Lahasa block, Himalayan range, Mishmi ranges, Indo-Burman range and Shillong plateau. The samples were collected for analysing geochemical and sedimentological characteristics to understand the nature and geochemical makeup of the sediments that are being discharged to the Bay of Bengal. In this study, the major, trace and rare earth elements (REEs) have been analysed in the bed sediments, bank sediments and suspended particulate matters (SPM) from the Brahmaputra River and its tributaries. The sediments exhibit distinct chemical weathering characteristics in the northern, eastern and southern tributaries, with Chemical Index of Alteration (CIA) of 71.88 ± 7.44% southern tributaries, 61.09 ± 5.53% of northern tributaries and CIA = 54.30 ± 2.37% eastern tributaries. The sediment provenance in the Brahmaputra River basin exhibits felsic to intermediate composition with higher chondrite normalized La/Sm = 3.73 ± 0.59 and Gd/Yb=2.08 ± 0.27 ratios. The REE_{UCC} patterns suggests intermediate composition of the tributaries with felsic composition of Eastern tributaries with intermediate composition in Brahmaputra main channel throughout the course in foreland basin. The ICV values of channel sediments suggests compositional immaturity (3.2-1.5). The results suggests that the chemical weathering and hydrodynamic sorting of sediments bring significant geochemical fractionation in southern, eastern and northern tributaries of Brahmaputra River. The northern tributaries of Brahmaputra River bring less chemically altered and recycled (polycyclic) sediments, while southern tributaries bring chemically altered sediments (first cycle) to Brahmaputra Floodplain. The results from this study have an important implication for interpreting the marine margin sedimentary archives.