Mineralogy and Geochemistry of the Mahi River Sediment: A Case Study of Deccan Trap Rocks Weathering and Role of Climate and Tectonics

SHARMA A, SENSARMA S, KUMAR K, KHANNA PP AND SAINI NK

anupam110367@gmail.com, sensarma2009@gmail.com
kamleshk2508@gmail.com, ppkhanna42@rediffmail.com
saini_nk@wihg.res.in

The average geochemical composition of Upper Continental Crust (UCC) is in fairly good agreement with the composition suggested by Taylor and McLennan 1985 and others. However, the values of certain trace elements (Co, Cr etc.), largely concentrated in mafic rocks, and often show discrepancies with UCC compositions (McLennan 2001). Therefore, large igneous provinces (LIPs) spreading in million km^2 are likely to control global sediment production and distribution and also help in resolving discrepancies in upper continental crust (UCC) compositions. More so, the contributions from LIPs are likely to be underestimated and need to be relooked.

The present work addresses the texture, mineralogy, and compositions of fine sand/silt deposited by a medium-sized river (the Mahi River) flowing in the western sector of India. The region is tectonically active, semi-arid and lithologically dominated by the Deccan Traps (one of the largest LIPs in the world). The Mahi sediments fall under the lithiarenite category and mostly composed of quartz and basalt fragments with lesser pyroxene, biotite, feldspar, calcite and clay minerals (smectite ± illite). The Mahi sediments have higher TiO_2 (2.41 wt.%), Al_2O_3 (15.2 wt.%), FeO^t (10.9 wt.%), Co (≤36 ppm), Cr (≤737 ppm), Cu (≤107 ppm) than the UCC and PAAS; Ni (≤54 ppm) higher than the UCC (33.5 ppm), but similar to PAAS (60 ppm). The low Chemical Index of Alteration (CIA 37–59) values and presence of basalt fragments and smectite in the samples suggest incipient weathering in the semi-arid Mahi catchment. In agreement with the mineralogy, the UCC normalized LREE depleted patterns (LREE/HREE < 1; figure below) in the Mahi sediments confirm Deccan basalt contributions from the provenance with about 70–75% basalts and 25–30% Archean biotite-rich granitoids of the Aravalli ranges.

Similarly limited depletion of Ba, K and Ca (Ba ≥ K > Ca) in incipiently weathered Mahi (aver CIA 47.5) systems indicate their climate insensitivity. At the same time, more Ba depletion than Ca is new for the Deccan Traps River. Also the decoupling of Ca and Sr, however, could be mineralogy controlled.