Temporal variation in Sr and $^{87}$Sr/$^{86}$Sr of the Brahmaputra: Implications for annual fluxes and tracking flash floods through chemical and isotope composition

Santosh K. Rai and Sunil K. Singh

Physical Research Laboratory, Navrangpura, Ahmedabad, India (rksant@prl.res.in; sunil@prl.res.in)

[1] Temporal variations in dissolved Sr and its $^{87}$Sr/$^{86}$Sr in the Brahmaputra River were determined for the first time by analyzing biweekly samples collected over a period of about a year at Guwahati. Sr in the Brahmaputra range from 0.604 to 1.392 μM with $^{87}$Sr/$^{86}$Sr of 0.71594 to 0.71802. Sr concentration decreases in monsoon (except for the 15 June 2000 sample, which had anomalously high concentrations of Sr and major ions) compared to the nonmonsoon period. The decrease in elemental abundances, a factor of ~2, is not proportional to the increase in discharge, an order of magnitude, indicating enhanced weathering during monsoon. This can be a cumulative effect of an increase in drainage area and in physical weathering during monsoon. $^{87}$Sr/$^{86}$Sr and other proxies of silicate weathering show a relatively lower contribution from silicate weathering to the major ion and Sr budget during monsoon with a concomitant increase in carbonate weathering contribution. Shorter interaction time between water and minerals during monsoon coupled with the slower weathering kinetics of silicate compared to carbonate can be contributing factors to the seasonal changes in their relative contributions to the major ion budget. This study shows that the annual fluxes of various ions, $\Sigma$Cat and $\Sigma$all calculated on the basis of measured biweekly concentrations and monthly water discharge data are roughly within ±35% of those calculated using either the lowest or the highest concentrations and annual water discharge. This implies that a tropical region such as in India, where river discharge is governed mostly by monsoon rains, the annual elemental fluxes measured during monsoon would be a good approximation for their discharge weighted annual fluxes; however, an additional sampling during a drier period would be required to understand the weathering processes. The geochemistry of the 15 June 2000 sample is anomalous. The chemistry of this sample is similar to those from the Tibetan region, an inference consistent with reports of a flash flood in the Brahmaputra due to a natural dam burst in the Yigong River of Tibet. These results highlight the use of the chemical and isotopic composition of water samples to track and quantify the source and discharge of a flash flood.

Components: 6514 words, 8 figures, 3 tables.

Keywords: Brahmaputra; temporal variation; $^{87}$Sr/$^{86}$Sr; weathering; flash flood.

Index Terms: 0790 Cryosphere: Weathering (1625, 1886); 0330 Atmospheric Composition and Structure: Geochemical cycles (1030); 0454 Biogeosciences: Isotopic composition and chemistry (1041, 4870).

Received 15 February 2007; Revised 31 May 2007; Accepted 13 June 2007; Published 16 August 2007.