Sources of Dissolved Sr to the Brahmaputra River System

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Sources of dissolved Sr in the Himalayan Rivers are a matter of considerable debate. Much work has been done to address this issue in the Ganga whereas in the Brahmaputra, there is a lack of systematic study despite the fact that erosion rates are much higher in its watershed. Further there exist systematic differences between the Sr isotope compositions of the two river systems the Brahmaputra being less radiogenic compared to that of the Ganga. A detailed study to determine the downstream variations in Sr isotope compositions of Brahmaputra River System (BRS) and the factors contributing to it was undertaken. Towards this, water samples from the Brahmaputra main stream (from Pasighat to Dhubri) and tributaries from the Eastern, Himalayan and Southern regions were analysed for their dissolved Sr and its isotope compositions. $^{87}Sr/^{86}Sr$ of the Brahmaputra main channel vary from 0.7151 to 0.7300, whereas those for the Himalayan, Eastern and Southern tributaries range from 0.7157-0.7597, 0.7149-0.7160 and 0.7148-0.7196 respectively with Sr abundances in the range of 250-1034 nM (Fig. 1).

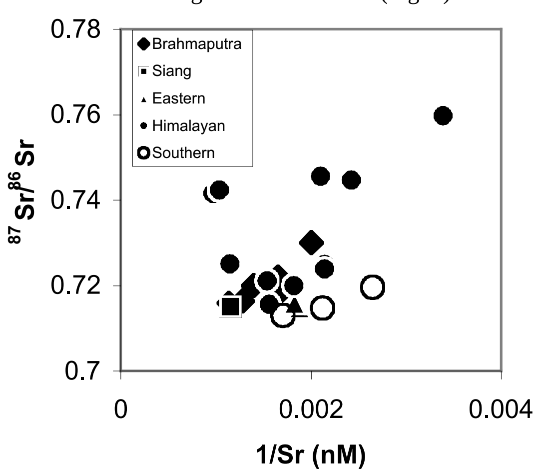

Fig. 1: $^{87}Sr/^{86}Sr$ vs 1/Sr of the BRS

Fig. 1 shows that $^{87}Sr/^{86}Sr$ of the Brahmaputra River System is defined by three sources. High radiogenic Sr of this system is derived from the silicates of the Higher and the Lesser Himalaya whereas less radiogenic Sr is supplied from rocks of the Transhimalayan Plutonic Belt (TPB) and the carbonates of the Lesser Himalaya. Unlike the Ganga, the Brahmaputra and its Eastern Tributaries are draining through the mafic and ultramafic rocks of TPB around the eastern syntaxis and in the Mishmi hills. These lithologies seem to control the Sr isotopic budget of the Brahmaputra River System.

Alkalic through tholeiitic shield-stage development of Kilauea, Hawaii

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A major result of the 1998-2002 JAMSTEC cruises to the Hawaiian Islands was discovery of a comprehensive record of the magmatic development of Kilauea volcano. Kilauea's magmatic history falls into four progressively younger stages: strongly alkalic, alkalic, transitional, and tholeiitic, with ages estimated by $^{40}Ar/^{39}Ar$ dating. The earliest strongly alkalic stage (275 to >130 ka) saw eruption of nephelinites, basanites, hawaiites, alkali basalts, some transitional basalts, and rare phonotephrites and benmoreites. Products of this stage only have been found as bedded volcaniclastic debris of the Hilina bench and were chiefly erupted shallower than 3000 m water depth (high-S but low-CO_2 in glasses). Fractionated compositions reflect a cold, poorly-integrated trans-lithospheric magma-conduit system. The succeeding alkalic phase (~150 ka) is exposed above the Hilina bench as in-place weakly alkalic pillow lavas and interstratified volcaniclastic sandstones containing partly-degassed (S 400-700 ppm) basanitic glass grains. Higher-SiO_2, lower-alkali in-place pillow lavas, with compositions slightly on the tholeiitic side of the Macdonald-Katsura dividing line, represent the succeeding transitional stage (currently undated). Transitional pillow lavas are exposed to the east of and above the alkalic rocks and mark the early growth of Kilauea's east rift zone and Puna Ridge, perhaps triggered by greatly increased magma production. The modern tholeiitic stage forms most of the Puna Ridge and the subaerial shield. However, rare transitional lavas continued to erupt in the Holocene. Fractionation-adjusted abundances of some trace elements are consistent with an approximate doubling in degree of melting from alkali basalts to modern tholeiites, with melts extracted from shallow in the garnet stability field. Evidence also points to a progressive change in source as magmas became tholeiitic: strong increases in Zr/Nb without commensurate decreases in Ce/Y or Zr/Y (expected for garnet-facies melting) signal increasing involvement of Mauna Loa- or Koolau-like (high-Zr/Nb) sources. Likewise, Pb isotopic ratios of modern Kilauea tholeiite are displaced toward the Koolau Hawaiian endmember relative to (SIMS) Pb ratios of strongly-alkalic-stage glass grains. Unlike Pb in glass grains, Sr and Nd isotopic ratio of early Kilauea rocks are uniform (Kimura et al., this meeting).