Sediment sources and transport in the Ganga-Brahmaputra basin: information from Os isotopes

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We present Re-Os isotopic results for sediments (bank deposits, suspended matter and bedload) collected in various locations in the Ganga-Brahmaputra basin. A radiogenic signature ($^{187}Os/^{188}Os \approx 2.8$) is observed for Himalayan tributaries (Gomati, Ghaghara, Gandak, Kosi), underscoring the importance of weathering of Lesser Himalaya black shales [1]. $^{187}Os/^{188}Os$ increases markedly in the downstream direction along the Ganga (from 1.3 – 1.5 at Varanasi Ghat, India, to 2 – 2.5 at Harding bridge, Bangladesh) suggesting a large contribution of radiogenic osmium from Himalayan tributaries. For the Brahmaputra, our new results confirm the non-radiogenic signature determined by Singh et al. [2], indicating a significant contribution from ultrabasic rocks.

Two tidal rivers (Pussur and lower Meghna) were also analyzed. The Pussur sediments, influenced only by the Ganga, have a mean $^{187}Os/^{188}Os$ ratio of 1.7. This value is substantially lower than that of the nearest measured Ganga sediments (2 – 2.5), suggesting remobilization and/or exchange with seawater osmium ($^{187}Os/^{188}Os \sim 1.05$). The $^{187}Os/^{188}Os$ ratio of the lower Meghna sediments (≈ 1.1) is consistent with both mixing between Ganga, Brahmaputra and Meghna river sediments, with a dominant contribution from the Brahmaputra, and a seawater contribution.

Depth profiles of suspended matter were carried out at Harding bridge (Ganga) and at Sirajganj (Brahmaputra). Both profiles demonstrate a systematic $^{187}Os/^{188}Os$ variation with depth. However, $^{187}Os/^{188}Os$ ratios decrease with depth in the Ganga, but increase with depth in the Brahmaputra. This suggests that in the Ganga, the finest particles are enriched in material derived from Lesser Himalaya black shales. In contrast, in the Brahmaputra, the finest particles are enriched in the erosional products of mafic and ultramafic terrains. More generally, a better understanding of the Os isotopic variation between suspended and bed loads will allow a more accurate characterization of the composition of detrital Os delivered to the ocean.

References

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[2] Singh S.K., Reisberg L., and France-Lanord C. (2003) *GCA* **67**, 4101-4111.