Solute paricle interactions in the Ganga (Hooghly) river estuary, India: Enhanced supply of barium to the oceans

SAUMIK SAMANTA[1] AND TARUN K. DALAI[1]

[1]Department of Earth Sicences, Indian Institute of Science Education and Research Kolkata, Mohanpur 741246, INDIA (saumik1215@iiserkol.ac.in; dalai@iiserkol.ac.in)

The Ganga river supplies large amount of fresh water (>1% of global discharge) and suspended sediment (ca. 4% of global discharge) to the Bay of Bengal. A geochemical investigation of several trace elements have been carried out on the dissolved, suspended and bed load samples of the Ganga (Hooghly) river estuary collected seasonally over two years, 2012 and 2013.

Dissolved Ba vs. salinity (S) plots indicate removal of dissolved Ba at S<0.3, whereas in the low to middle salinity (3<S<11) zone, release of dissolved Ba can be observed as a Ba hump. Majority of the samples plot above the conservative mixing lines, suggesting an internal source of Ba in the estuary. "Excess" Ba, defined as the difference between concentrations of measured Ba and Ba expected from conservative mixing, was estimated to be as high as >400 nM in the water samples.

Data of suspended sediments provide support for desorption of Ba to the dissolved phase. Analogous to Ba, particulate Mg/Al also show a peak in the low to middle salinity zone. Ba/Mg ratios in the suspended sediments show significant negative correlation with Al during non-monsoon seasons. These results together suggest release of Ba from the particulate matter via ion-exchange reaction with dissolved Mg. Calculations show that the flux of desorbed Ba from the Hooghly river is significantly higher than that transported in the dissolved load of the river. This study brings out the importance of solute-particle interactions in supplying large quantity of Ba which is commonly used as a tracer of freshwater contributions to the coastal oceans.