

Strontium isotopic evidence for Submarine Groundwater Discharge (SGD) in Bay of Bengal water

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The Bay of Bengal (BoB) is a highly stratified tropical basin with distinct water masses identified at different depths and a shallow mixed layer. It receives high fresh-water fluxes from five of the world's 50 largest rivers. The Ganges-Brahmaputra (G-B) rivers, draining the Himalayas, deliver radiogenic $^{87}\text{Sr}/^{86}\text{Sr}$ to the BoB, which over the last 40 Ma has resulted in the increase in the $^{87}\text{Sr}/^{86}\text{Sr}$ of global seawater. It has been suggested that subsurface flowing groundwater in the Bengal Basin, with Sr concentrations 10 times higher than the G-B rivers, is also a major contributor of Sr to the BoB [1] which has implications for the marine Sr budget. However, the estimates of the submarine groundwater discharge (SGD) to the BoB have been questioned [2].

To better evaluate the contribution of the Bengal basin SGD to the marine Sr budget, we measured salinity, Sr concentrations and $^{87}\text{Sr}/^{86}\text{Sr}$ in water samples (n=56) from northern BoB. These samples were collected aboard ORV Sagar Nidhi from 21 locations over a span of ~3 years during both monsoon and non-monsoon months. Water samples were collected primarily from 0 m and 100 m depths with few samples collected from upto 1500 m depth. Salinity of the water samples were measured on-site. Strontium concentrations were measured using a Thermo Fischer X-Series II ICPMS while $^{87}\text{Sr}/^{86}\text{Sr}$ was measured using a Thermo Fischer Triton Plus TIMS in pre-acidified (pH = 2) water samples. $^{87}\text{Sr}/^{86}\text{Sr}$ in the BoB water samples range from 0.70918 to 0.70937 (± 30 ppm) compared to the average global seawater composition (~ 0.7092) [c.f., 1]. Most of the isotopic and salinity variability in BoB water samples can be explained by mixing with the G-B, Irrawaddy, and Mahanadi river waters. Relatively high Sr and radiogenic $^{87}\text{Sr}/^{86}\text{Sr}$ in several samples can only be explained by mixing of seawater with groundwater from the Bengal basin [2] thereby providing direct evidence of SGD in the BoB.

[1] Basu et al., 2001, Science, 293, 1470-1473 [2] Harvey, 2002, Science, 296, 1563.