Non-conservative behavior of Strontium in the Changjiang Estuary

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The $^{87}Sr/^{86}Sr$ isotope ratio in seawater has long been used as a proxy in global climate change studies. Its considerable variation over geological time is thought to be associate with the balance in inputs and outputs between radiogenic Sr from continental weathering and unradiogenic Sr from hydrothermal exchange at mid-ocean ridges[1]. However, such key issues remain contentious due to imbalance of Sr sources. Recent field observations and experimental evidences have demostrated that riverine particulate material dissolution is likely to partially account for the imbalance between Sr sources to the ocean[2]. Moreover, nonconservative behavior of Sr has been observed in world large estuaries[2-5], which is thought to modify both flux and isotopic composition of Sr delivered to the ocean. The reactive mechanism behind has attracted much more interest and remains poorly constrained.

Here we present $^{87}Sr/^{86}Sr$ isotope data of water, suspended particulate, and sediment samples collected from a typical transect across the Changjiang Estuary and the East China Sea shelf. The deviations bewteen the observed and calculated two-component mixing $^{87}Sr/^{86}Sr$ ratios are significantly higher than the measurement error (±25 ppm), with a mean value of 154 (±18) ppm. This suggests that Sr is not strictly conservative and the sediment-water reaction plays an important role in Sr geochemistry. The quantitative estimates further indicate that, on a catchment scale, there exists small but considerable differences in both flux and isotopic composition of Sr in the Changjing estuary. Our findings also support the “Boundary Exchange” hypothesis, where significant realease of elements from riverine particulate material will greatly affect the maine elemental budgets.

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