

Boron isotope geochemical study of the Huanghe River: Source of the abnormally high boron concentration

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It has been demonstrated that boron (B) isotopes are fractionated during river erosion, so the researches of boron isotope were reported for some large river basins. The Huanghe River, one of the world largest rivers, is characterized by high load of sediments and high concentrations of major ions. This study systematically investigated the boron concentration and boron isotopic composition of the dissolved load from the Huanghe River.

Our results show that the abnormally high concentration of the dissolved boron in the Huanghe River was likely originated from the Loess Plateau area. The B concentration increased from $\sim 64(\pm 14)$ $\mu\text{g/L}$ ($n=24$) for upstream (Tangnaihai hydrometric station) to $241(\pm 40)$ $\mu\text{g/L}$ ($n=24$) for downstream (Wuzhi hydrometric station). The highest $\delta^{11}\text{B}$ values ($+10\text{‰}$ to $+17.6\text{‰}$) were observed from the midstream samples, while most of the samples from upstream and downstream have $\delta^{11}\text{B}$ values lower than $+10\text{‰}$. The strong positive relationship of B concentration with the concentrations of Na, Cl and Li indicates the control of evaporation on the dissolved B in water of the Huanghe River. Groundwater samples from Ninxia and Neimenggu Autonomous Regions, the extremely drought region of Huanghe basin, are all characterized by high salinity and high concentration of boron, similar to those of seawater but with $\delta^{11}\text{B}$ values lower than $+20\text{‰}$. This indicates that in the arid region, the high-salinity groundwater may be a potential source of dissolved load to the water of Huanghe River.

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