

Degree of homogeneity of seawater Sr isotope ratios in the Pacific Ocean

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Strontium has a long residence time in the ocean and its radiogenic isotope ratio ($^{87}\text{Sr}/^{86}\text{Sr}$) is considered to be homogeneous. Although recent technical developments allow Sr isotope ratios to be measured with high precision, the concept of homogeneous oceanic Sr isotopic composition has not been well tested by the recent ppm-order precision data. Recent analyses have reported vertical $^{87}\text{Sr}/^{86}\text{Sr}$ variations of up to 37 ppm in the North Pacific (Huang et al., 2011), while others have reported that samples from the Pacific, Atlantic and Indian Oceans, and the Labrador Sea have indistinguishable $^{87}\text{Sr}/^{86}\text{Sr}$ ratios with a precision of 8 ppm (Mokadem et al., 2015). In order to assess the homogeneity of Sr isotope ratios in the Pacific Ocean, we performed high-precision $^{87}\text{Sr}/^{86}\text{Sr}$ analyses on 27 seawater samples from 7 sites in the Pacific, including 2 depth profiles.

Strontium isotope ratio was measured by Triton TIMS in dynamic multi-collection mode. The measured $^{87}\text{Sr}/^{86}\text{Sr}$ ratio was normalized to NIST 987 using $^{87}\text{Sr}/^{86}\text{Sr} = 0.710248$ (McArthur et al., 2001). All the samples were measured 6 times and a weighted average value was calculated. Seawater standards (IAPSO, NASS-6 and BCR-403) analyzed in this way give 0.7091742 ± 0.0000013 (2SD, $n = 26$).

All the samples from the Pacific agreed within analytical uncertainties and were indistinguishable from the seawater standards, all from the Atlantic. Among the analyzed samples, site OP-5, collected during the KH-22-7 cruise of the R/V Hakuho Maru, is located in the subtropical North Pacific where $^{87}\text{Sr}/^{86}\text{Sr}$ variations have been reported. However, the depth profile of the OP-5 site showed no $^{87}\text{Sr}/^{86}\text{Sr}$ variation over the analytical uncertainty. Our results support the concept of homogeneous Sr isotopic composition of seawater in an open ocean.