

Distribution of dissolved neodymium isotopes across the southern South Pacific

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The South Pacific is an important area of bottom and intermediate water formation, and a key location for the communication of the Pacific with the Indian and Atlantic Ocean basins. Despite its importance for the global ocean, the South Pacific is largely understudied with respect to the distribution of trace elements and their isotopes, and in particular neodymium isotopes ($^{143}\text{Nd}/^{144}\text{Nd}$, expressed in ϵ_{Nd}), for which only a limited database exists in the southeast Pacific [1].

Here we present dissolved Nd isotopes from 11 stations across the South Pacific between South America and New Zealand and between 46°S and 69°S. The transect samples South Pacific water masses east and west of the Pacific-Antarctic Ridge and north and south of the circum-Antarctic frontal system, affording insight into the spatial variation of the Nd isotopic composition of different water masses. We observe a clear difference in ϵ_{Nd} between bottom waters in the western basin within the Deep Western Boundary Current ($\epsilon_{\text{Nd}} = -9$) and the eastern basin just north of the Ross Sea ($\epsilon_{\text{Nd}} = -7$), suggesting that Antarctic Bottom Water from different source regions carries different isotopic signatures. Notably, bottom water formed in the Ross Sea (RSBW) can also be distinguished from overlying Circumpolar Deep Water, making ϵ_{Nd} a useful tracer for past changes in RSBW export into the southeast Pacific. Most profiles further show a shift towards less radiogenic ϵ_{Nd} at the depth of Upper Circumpolar Deep Water (UCDW) that is associated with a salinity maximum in the Southern Ocean. This negative shift is consistent with a higher component of unradiogenic North Atlantic Deep Water ($\epsilon_{\text{Nd}} \approx -13$) in UCDW. The results provide a good basis for an improved understanding of the distribution of Nd isotopes in the Pacific Ocean, and for the use of ϵ_{Nd} as a tracer of past circulation changes.

[1] Carter *et al* (2012), *Geochim. Cosmochim. Acta* **79**, 41-59.

High Precision measurements of sub nanogram levels of neodymium measured as NdO⁺ using Phoenix X62 Thermal Ionization Mass Spectrometer

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We have analysed sub nanogram amounts of the JNd-I Neodymium standard as NdO⁺ using the Phoenix X62 TIMS. Samples were loaded on single Re filaments with a TaF₅ activator. Ion/Atom detection efficiency increases with decreasing sample size, with efficiencies of up to 30% attained for sample sizes between 500 and 50pg. For sample sizes of 1-10ng efficiencies are about 10%. Similar efficiencies are also observed for Sr. The maximum detection efficiency is close to the transmission of the spectrometer, and that the TaF₅ activator is producing nearly 100% ionization off the filament for small samples of Sr and Nd, which have similar ionization potentials of 5.2 and 5.5eV respectively. This is much higher (by more than an order of magnitude) than Sr and Nd⁺ without the TaF₅ and probably indicates an increase due to close coupling with the very high work function fluorine atom. Using static multicollection and 1e¹¹ ohm resistors, the reproducibility of $^{143}\text{Nd}/^{144}\text{Nd}$ remains better than 20ppm 1RSD for sample sizes down to 100pg. It is possible that using a higher gain resistor will improve this since ion intensities for $^{143}\text{Nd}^{16}\text{O}$ are only 50mv.