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The ^{142}Nd signature of the modern global depleted mantle

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The short-lived ^{146}Sm-^{142}Nd decay system is a powerful tool to investigate primordial geochemical signatures residing in the Earth's mantle because it is sensitive to magmatic fractionation processes that occurred in the silicate Earth during the Hadean Eon. Although most studies on modern mantle-derived rocks report μ^{142}Nd values (defined as $(((^{142}Nd/^{144}Nd)_{sample}/(^{142}Nd/^{144}Nd)_{standard} - 1) \times 10^6)$ indistinguishable from the terrestrial standard, small but resolvable μ^{142}Nd heterogeneity has been reported in modern ocean island basalts, which reflects a relic of Hadean-aged processes [1]. In addition, Xe isotope compositions of mid-ocean ridge basalts (MORB) suggest that the depleted mantle also contains a spatially variable primitive component [2]. These findings, among others (e.g., ^{182}W anomalies in modern rocks), suggest that Hadean-aged mantle domains may be present throughout Earth's mantle. Thus, there may also be previously undetected ^{142}Nd variations preserved in the global depleted mantle. Additionally, a global perspective on the ^{142}Nd composition of the depleted mantle is a critical component of a representative calculation of the bulk Earth ^{142}Nd signature. Pioneering ^{142}Nd studies that included MORB did not provide evidence for the existence of variable ^{142}Nd compositions in the modern upper mantle. However, so far missing is a comprehensive approach that focuses exclusively on MORB and applies a global perspective by covering all major mid-ocean ridge systems.

In this study, MORB samples originating from major mid-ocean ridge systems will be analyzed for their ^{142}Nd compositions using high-precision mass spectrometry. The samples were selected to represent the total range of normal MORB compositions for each ridge system based on isotopic data collected in previous studies. Preliminary results, encompassing measurements of one MORB sample from the Pacific-Antarctic Ridge and three leach cuts of the same sample, yielded ^{142}Nd compositions similar to the terrestrial standard (average μ^{142}Nd of +1.3 ± 5.4, 2 s.d.; n = 4) and suggest that the depleted MORB mantle possesses a ^{142}Nd that is very close to the terrestrial standard.

[1] Horan et al. (2018). *Earth Planet. Sci. Lett*. 484, 184–191.

[2] Tucker et al. (2012). *Earth Planet. Sci. Lett*. 355–356, 244–254.