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The Germanium isotopic composition of Earth's mantle: an oceanic basalt perspective

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Stable germanium isotopic compositions ($\delta^{74/70}$Ge) in mantle-derived lavas provide a novel tracer for planetary differentiation processes, yet the Bulk Silicate Earth (BSE) value and the magnitude of mantle heterogeneity remain poorly constrained[1,2]. Because garnet is a key host phase for Ge, increasing contributions from pyroxenite-derived melts can shift Ge elemental systematics in Mid-Ocean Ridge Basalts (MORBs) and Ocean Island Basalts (OIBs)[3], which may also translate into measurable equilibrium Ge isotope fractionation. Here, we present new high-precision $\delta^{74/70}$Ge data for 97 mantle-derived lavas (MORBs, back-arc basin basalts, OIBs, including picrites) processed through a novel double-stack chromatography and measured by hydride-generation coupled to a Neptune*Plus* MC-ICP-MS at CRPG-Nancy. Sample-standard bracketing relative to NIST 3120a yields ≤0.10‰ external reproducibility (2SD) using <50 ng Ge per triplicate[4].

Global MORBs define a tight, near-normal distribution with an average $\delta^{74/70}$Ge = 0.62 ± 0.11‰ (2SD; n=28) and show no resolvable trends with MgO, $Na_{8.0}$, or Ge/Si, indicating that fractional crystallization, degree of melting, and moderate upper-mantle source enrichment do not measurably fractionate Ge isotopes at our current precision. Global OIBs with various mantle source affinities have a MORB-like mean but a broader distribution, pointing to additional source components and/or processes. Pitcairn Island (EM-1) lavas are systematically light in $\delta^{74/70}$Ge and, together with independent evidence for sediment involvement[5], support incorporation of light sedimentary material into the plume source. Samples from the Galápagos Islands extend to higher $\delta^{74/70}$Ge and co-vary with primary $\delta^{57/54}$Fe, consistent with contributions from garnet-bearing pyroxenite/eclogite domains derived from recycled oceanic crust[6]. Isotopically heavier Ge can be potentially induced by magmatic degassing and will be further discussed. Overall, this expanded dataset refines the BSE baseline to $\delta^{74/70}Ge_{BSE}$ = 0.618 ± 0.014‰ (2SE; n=97).

[1] Luais, B. *Chemical Geology* 334, 295–311 (2012)

[2] Rouxel, O. J. *et al. Reviews in Mineralogy and Geochemistry* 82, 601–656 (2017)

[3] Yang, S. *et al. Science Advances* 6, eaba2923 (2020)

[4] Ahmad, Q. *et al. J. Anal. At. Spectrom.* (2026)

[5] Labidi, J. *et al. Earth and Planetary Science Letters* 584, 117422 (2022)

[6] Soderman, C. R. *et al. Science Advances* 9, eadd5030 (2023)