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Insights into the Nature of the Easter-Salas y Gomez Plume and East Pacific Rise Mantle Sources from Heavy Noble Gas Isotopes

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Noble gases (He, Ne, Ar, Kr, Xe) are a versatile toolset for investigating the nature of geochemical heterogeneities in the Earth's interior. Because the noble gases are volatile, they trace the paths of compounds essential to planetary habitability and mantle dynamics (e.g., H_2O, CO_2); however, they are chemically inert, simplifying their behavior in planetary systems. Primordial and radiogenic isotopic noble gas signatures from ocean island and mid-ocean ridge basalts (MORBs) record information about the origins of mantle heterogeneities, including early-formed heterogeneities recorded by short-lived systems (^{129}I-^{129}Xe and ^{244}Pu-Xe), and their preservation through time in plume and MORB source reservoirs. Despite the wealth of information locked in the noble gas record, few heavy noble gas measurements of mantle-derived melts exist due to extensive syn- to post-eruptive atmospheric contamination [1-3].

The Easter Seamount Chain (ESC) represents approximately 23 myr of hotspot volcanism attributed to a deep mantle source [4]. Its western end intersects with the East Pacific Rise (EPR), where a breakdown in age relationships along the hotspot track and enriched isotopic signatures along the ridge suggest exchange of material between the plume and the spreading center [5-6]. We present noble gas isotopic data from basalt glasses from the ESC and adjacent EPR to investigate the nature and long-term evolution of their mantle sources. ESC lavas exhibit He and Ne isotopic signatures indicating a less-degassed mantle source compared to the upper mantle, and Ar isotopic compositions resolved from modern atmosphere. He and Ne data from the ESC-EPR intersection range from typical depleted mantle to less-degassed signatures, reflecting plume influence along the ridge. Ar and Xe isotopic signatures in EPR MORBs are distinct from modern atmosphere, and record both early-formed heterogeneities and the extent of long-term degassing and regassing of the EPR mantle source, which we discuss in comparison with other upper mantle and plume signatures.

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