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Source Lithology of the St. Helena HIMU end-member

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The HIMU (high time-integrated $\mu = {}^{238}U/{}^{204}Pb$) mantle end-member is represented by volcanic rocks from St. Helena (Atlantic) and the Cook-Austral Islands (Mangaia and Tubuai, Pacific). These type localities, however, exhibit a distinct radiogenic isotope signature. Interestingly, the St. Helena HIMU end-member seems to be globally distributed [1] and the uniform isotopic composition indicates a common source. In general, the HIMU source is linked to long-term mantle processes, including subduction-driven recycling of oceanic crust [2] and lithospheric mantle metasomatized by carbonatitic fluids/melts [3]. However, despite extensive research, the exact source lithology, melting processes and origin of the HIMU component(s) remain debated.

To further constrain the nature of the St. Helena HIMU source, we obtained new olivine major and trace element and oxygen isotope data from St. Helena and the Chatham Islands. Our preliminary olivine data from St. Helena point toward a hybrid source of predominantly peridotite mixed with a minor recycled crust-derived (pyroxenitic/eclogitic) melt component, that is distinct from the Cook-Austral HIMU end-member. Cook-Austral olivines indicate a source most likely formed of peridotitic, carbonatite-metasomatized subcontinental lithospheric mantle [3]. New whole rock and olivine chemistry from Late Cretaceous volcanics from the Chatham Islands (~ 900 km east of New Zealand, South Pacific) with a Sr-Nd-Pb-Hf isotopic signature similar to that of the St. Helena HIMU end-member, provides evidence for a pyroxenitic/eclogitic source lithology, aligning with the classical ocean crust recycling model. This suggests that while both St. Helena and the Chatham Islands exhibit similar HIMU isotopic signatures, their mantle source compositions and lithologies may differ, implying variations in the recycling and melting processes responsible for their HIMU isotopic signatures.

References: [1] Homrighausen, S. et al. (2018) *Earth-science reviews* 182, 85. [2] Hofmann, A. and W. White (1982). *EPSL*, 57(2), 421. [3] Weiss, Y. et al. (2016). *Nature* 537(7622), 666.