Insights into a HIMU mantle source: a combined noble gas and halogen study of La Palma, Canary Islands

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La Palma, along with El Hierro, is the youngest manifestation of the Canary Island hotspot. Previous studies have reported both HIMU (high $^{238}U/^{204}Pb$ (μ)) signatures and $^{3}He/^{4}He$ >8 Ra (e.g., Gurenko et al., 2006; Hilton et al., 2000). High $^{3}He/^{4}He$ ratios suggest the involvement of a primordial mantle reservoir and are at odds with the explanation that HIMU represents the involvement of ancient (~2Ga) oceanic crust in the plume source, which would have a low $^{3}He/^{4}He$. In order to further evaluate the components contributing to the OIB source we present new noble gas isotopic compositions for a variety of samples from La Palma. Xenoliths and scoria samples were obtained from the main shield volcano, Taburiente (~0.7 Ma), and the younger eruptive centres (Holocene to recent) of the Cumbre Vieja. The xenoliths have been petrographically characterised and include examples of dunites, harzburgites and pyroxenites. Noble gasses were extracted by crushing ~1g of olivine and CPX separates in vacuum, using a hydraulic press. Noble gas concentrations and isotopic compositions were measured on a Helix MC+ mass spectrometer. A geothermal gas sample, collected from a cold, bubbling spring inside the Taburiente caldera, yielded the highest $^{3}He/^{4}He$ ratio reported thus far for La Palma; 10.1 Ra. The noble gas data is presented alongside halogen concentrations (NI-NGMS), trace element, and $\delta^{11}B$ compositions (SIMS), obtained for the same samples. This multifaceted approach enables us to shed light on the nature and evolution of the OIB mantle source.