Halogen and noble gas evolution along the Emperor Seamount Chain

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The Emperor Seamount Chain (ESC) preserves the earliest known record of volcanism emanating from the Hawaiian Hotspot (85 to 42 Ma). Isotopic data from these seamounts have shown a temporal evolution of the hotspot's magmatism, with $^{3}He/^{4}He$ ratios steadily increasing from a MORB-like signature (10 R_A) to ratios (24 R_A) which are indistinguishable from the current Hawaiian Islands [1]. The evolution of the seamounts chemistry could reflect a change in the hotspot source over time or could be a result of interaction with other mantle reservoirs. In order to better constrain the early evolution of the hotspot source; olivine samples from three seamounts which span 27 Ma have been analysed for their halogen and noble gas content.

Preliminary data suggests there is a trend of increasing I/Cl and Br/Cl ratios as the seamounts get younger; with an evolution from a MORB-like signature within the oldest seamount (Detroit) to a more enriched value in the younger seamounts (Suiko and Koko). There is also a variation within the K/Cl ratios of the samples. Detroit has an average K/Cl ratio of 11.4 similar to that of the MORB value (12.8), whilst Suiko and Koko have ratios of 40.1 and 20.8 respectively.

Although the overall trend is that Suiko and Koko are distinct from the MORB-like Detroit seamount, there is no clear trend with decreasing age as Suiko (65 Ma) has twice the K/Cl ratio of the younger Koko (49 Ma) whilst maintaining similar $^{3}He/^{4}He$ ratios. The MORB-like signature within Detroit is most likely a result of the proximity of the plume head to a spreading ridge during the Cretaceous [2], whilst the younger seamounts are more representative of the hotspot source. The higher I/Cl ratios within the younger seamounts is further evidence of a primitive mantle signature within the Hawaiian source which is masked in the older seamounts by the influx of MORB material. This suggests that there is no clear linear evolution of the Hawaiian hotspot source through time and any fluctuations in chemical composition are a function of the tectonic setting.

[1] Keller *et al* (2004) *Geochem, Geophys, Geosyst*, **v5**, n12
[2] Regelous *et al* (2003) *JPet*, **v44**, n1, 113 – 140