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Noble gas composition of the Réunion hotspot: Inferences for global mantle noble gas systematics

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The Réunion mantle plume source is geochemically characterized by a very homogeneous source composition in He and Ne. The $^{3}He/^{4}He$-ratios of 13±0.5 Ra (1 Ra = atmospheric ratio) are in between the values found for the MORB-reservoir (8±1 Ra) and for more primitive hot spots like Loihi (Hawaii) (up to 40 Ra). This intermediate composition is also reflected in the (air corrected) $^{21}Ne/^{22}Ne$ ratio [1,2,3] corresponding to an intermediate contribution of nucleogenic ^{21}Ne. Thus, Réunion is an attractive locality for noble gas studies: (1) the homogeneity points to a well mixed mantle reservoir (single component system) and (2) the intermediate character can serve as a connecting link between the composition of Loihi-like plume sources and the MORB-reservoir, that any successful global model regarding mantle noble gases has to account for.

The isotopic composition of Ar and especially Xe is less well constrained. In this study we reanalyse samples, which previously showed a high contribution of mantle Ne [2]. A relatively high precision in Ne isotope composition is aspired as a precondition to discriminate for atmospheric components in Ar and Xe. First results give a mantle $^{40}Ar/^{36}Ar$ ratio of about 10,000 (extrapolated to a mantle $^{20}Ne/^{22}Ne$ ratio of 12.5). Xe isotopes follow the mantle trend [3], with $^{129}Xe/^{130}Xe$ and $^{136}Xe/^{130}Xe$ values up to 6.93 and 2.36, respectively. In the light of our results, we will discuss the implications for current models in mantle noble gas geochemistry.

References

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