Hf-Nd isotope decoupling in the mantle: a brief review and new geodynamic perspectives

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Since the early 1980's, the combined application of the Lu-Hf and Sm-Nd isotope systems to oceanic lavas has significantly contributed to understanding the Earth's crust-mantle system, from magma genesis to sediment recycling. With the democratization of MC-ICP-MS, Hf-isotope studies of peridotites have increasingly reported the preservation of highly depleted, possibly ancient residues, in agreement with Re-Os data, and the decoupling of Hf and Nd isotopes.

To provide a comprehensive view on this topic, we have compiled all Hf-Nd isotope data published to date on abyssal, orogenic and ophiolitic peridotites and pyroxenites, and basalt- and kimberlite-borne mantle xenoliths. We review the mechanisms accounting for their isotopic signature. Decoupled compositions are common (~ 40 % of data have $\Delta\varepsilon_{Hf} > 10$), with little regard of the tectonic settings, and particularly associated with LREE enrichment, reflecting the dominant role of melt-peridotite interaction. Nd-isotope compositions are often completely reset, resulting in a wide range of ε_{Hf} at nearly constant $\varepsilon_{N.}$ The geochronological significance of this large variability for radiogenic Hf is not straightforward as it may result from variously depleted and/or ancient protoliths, and from the partial resetting of Hf.

The dataset is used along with the Global Lithospheric Architecture Mapping (GLAM) systematics [1] to envisage further geodynamic perspectives. We use a discrimination based on the tectonothermal age (*i.e.* Tecton, Proton, Archon, etc.) to suggest that the ubiquity of highly radiogenic Hf compositions decoupled from Nd may reflect the preservation of ancient (Archean) mantle, variously reworked by arc magmatism during successive subduction-collision episodes. It may also provide an alternative to explain the slight shift observed (if any) between the Hf-Nd mantle array and Bulk Silicate Earth, commonly ascribed to a "missing component". The extent to which such depleted domains can contribute (potentially as melts) to basalt genesis is also discussed.

[1] Begg *et al*., 2009, *Geosphere* **5**, 23-50.