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Os isotopic systematic of magmatic sulfides in abyssal peridotites

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Abyssal peridotites, though to be representative of the MORB source mantle, show a large range of Os composition ($0.115 \leq {}^{187}Os/{}^{188}Os \leq 0.160$). The reasons for such spread toward unradiogenic and radiogenic composition is still debated.

LA-ICP-MS study [1] recognized the coexistence of two magmatic sulfide populations in abyssal peridotites: one residual after melting showing low Pd/Ir and one representing a trapped Cu-Ni- rich sulfide melt having high Pd/Ir. In-situ determination of the Os isotopic composition by LA-MC-ICPMS [2] show that these two populations are characterized by unradiogenic (0.114-0.128) and radiogenic (0.129-0.159) Os composition, respectively. The mixing at the hand sample scale of these two sulfide populations, which coexist at the micrometer scale, fully explain the whole rock composition in term of PGE abundance and Os isotopic composition. This is also true in samples showing whole-rock ${}^{187}Os/{}^{188}Os > 0.130$. We also note that 1, altered sulfide show similar Os composition that their unaltered counterpart and 2, that Os content in hydrothermal sulfides is 3 order of magnitude lower than in magmatic sulfides.

Features which suggest that some of the radiogenic Os compositions of abyssal peridotites (i.e ≥ 0.127 [3,4]) are not due to sea water weathering or hydrothermalism.. Thus at least some of the radiogenic Os compositions shown by abyssal peridotites are inherited from the mantle. Consequently the 'isotopic gap' (e.g. [5]) between the MORB and their mantle source is now significantly reduced. Further, our study demonstrate that the isotopic heterogeneity of the abyssal peridotites worldwide is also found and preserved at the sample scale.

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Re-Os systematics in mid-Atlantic ridge abyssal peridotites: Preliminary results from ODP Leg 209

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The oceanic mantle carries a >1 Ga record of melt depletion, and is considered to be relatively homogeneous. Drilled cores from slow and ultra-slow spreading centres provide a unique opportunity to investigate geochemical heterogeneities at a number of scales providing a resolution not possible from dredged samples.

Here we present initial findings from Ocean Drilling Program Leg 209, Hole 1274A and investigate the short length scale variability of Re-Os systematics in abyssal peridotite and possible pertubations of this isotope system.

Initial findings reveal a systematic decrease in Os concentration approaching the seafloor surface. Up to 60% of the Os that would be expected in fertile upper mantle is systematically lost over the 156 m depth of the hole. Os concentration correlates well with major element abundance. This may be consistent with Os loss as a result of marine weathering as demonstrated by Snow & Dick [1]. ${}^{187}Os/{}^{188}Os$ ratios are exclusively subchondritic with the most unradiogenic sample having a ${}^{187}Os/{}^{188}Os$ ratio of 0.11691+/-0.00008. These ratios preclude substantial seawater interaction with abyssal peridote.

Rhenium depletion ages vary from 0.48 Ga to 1.49 Ga. which suggests that the Mid-Atlantic Ridge at 15°39' N is underlain by old mantle, consistent with the findings of Esperança et al [2].

However, ${}^{187}Re/{}^{188}Os$ ratios do not correlate with Os concentrations, ${}^{187}Os/{}^{188}Os$ or any major element which suggests a perturbation of Re systematics. This may be due to an addition of Re which must be late, due to the absence of radiogenic ingrowth, and of limited extent as the samples do not exhibit particularly elevated concentrations.

We will also present the results of an investigation into nature and extent of seawater / rock interaction by examining the Mg isotopic signatures of abyssal peridotite, seawater and unaltered lithospheric mantle.

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