^{186}Os-^{187}Os signatures of pyroxenites and the core-mantle interaction debate

A. LUGUET, G.M. NOWELL, D.G. PEARSON AND S.T. DREHER

Dpt of Earth Sciences, University of Durham, UK;
ambre.luguet@durham.ac.uk,

There is growing evidence from major, trace elements and isotopic systematics (e.g. Nd, Pb, ^{187}Os) that pyroxenites are a significant constituant of oceanic basalt sources. A composite pyroxenite-peridotite mantle source has also been suggested as an alternative explanation for the coupled ^{186}Os-^{187}Os isotopic anomalies originally attributed to core-mantle interaction. In order to test this alternative hypothesis, we have analysed a large suite of pyroxenites from the Beni Bousera orogenic massif for highly siderophile elements (HSE) and ^{187}Os/^{188}Os ratios.

In Beni Bousera pyroxenites, Os, Pt and Re concentration ranges are 0.1-3 ppb, 0.8-7.2 ppb and 0.03-1.7 ppb respectively. These pyroxenites display a positive-sloped CI-chondrite-normalised HSE patterns from Ir to Re (Pt_N/Ir_N=0.65-10.22; Pt_N/Re_N=0.02-0.76). Measured^{187}Os/^{188}Os ratios range is 0.1308-0.6747. ^{186}Os/^{188}Os ratios calculated from Pt/Os values and a typical age of 1.3 Gyr range from chondritic to highly radiogenic values (0.119839-0.119897). We are in the process of measuring ^{186}Os/^{188}Os ratios via an ultra-low blank high pressure asher acid digestion techniques. The pyroxenite measured so far gives a slightly sub-chondritic ^{186}Os/^{188}Os ratio (0.119836±3, 2σ), within error of the predicted ratio (0.119839). This sample has a radiogenic ^{187}Os/^{188}Os ratio (0.178552±8, 2σ).

Half of the pyroxenites show a radiogenic ^{187}Os/^{188}Os but non-radiogenic or only slightly radiogenic ^{186}Os/^{188}Os. Mixing of such pyroxenites with peridotitic mantle could explain the ^{186}Os-^{187}Os systematics of the Hawaian picrites characterized by radiogenic ^{187}Os but chondritic ^{186}Os signatures. In contrast, four pyroxenites display both radiogenic ^{187}Os/^{188}Os and ^{186}Os/^{188}Os ratios. In particular, one sample shows a highly radiogenic ^{186}Os/^{188}Os ratio at moderatly radiogenic ^{187}Os/^{188}Os. A mixing line constructed between this sample and chondritic mantle fits very well the trend defined by the ^{186}Os enriched Hawaian and Noril'sk basalts but requires between 40-90% of pyroxenite in the source. This simple mixing model takes into account neither the speciation of Os and the other HSE within the pyroxenites nor the influence of this speciation on the Os isotopic signature transfer. Os is known to be hosted by highly fusible and therefore highly mobile base-metal sulfides able to generate isotopic heterogeneities at the micrometric scale