PGE abundances and Os isotopes of the depleted mantle: constraints from ophiolite peridotites

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We investigated the behaviour of PGE and the variation of the Os isotope composition in a suite of peridotite, which show range in a degree of partial melting of oceanic mantle and include samples with compositions close to unmelted original DMM source.

Spinel lherzolites (SL) of Mamonia complex (Cyprus) show excellent correlation between parameters indicating the degree of melting – e.g. Fo content in olivine, Cr# (Cr/(Cr+Al)) of Cr-spinel, Al and HREE concentrations in clinopyroxene (CPX). The range of the degree of partial melting, as calculated by using Cr# of Cr-spinel (Batanova et al., GCA, 62, 853-866, 1998) varies from 0% to 11%. The compositions of CPX from SL show extreme depletion in LREE, suggesting that the peridotite represent the DMM. A fractional model can describe the melting scenario, without significant interaction with percolated melt.

PGE in SL show strong correlations with each other as well as with the degree of melting (Fig.1). The concentrations increase with the degree of melting and, hence, indicate a compatible behaviour. However, the increase of the PGE concentrations is much higher than allowed by the fractional melting model and requires some additional process.

PGE contents of DMM source estimated for 0% degree of melting are as follows (concentration in ppb):

Ir	Os	Ru	Pt	Pd
2.9	3.1	5.6	5.5	3.8

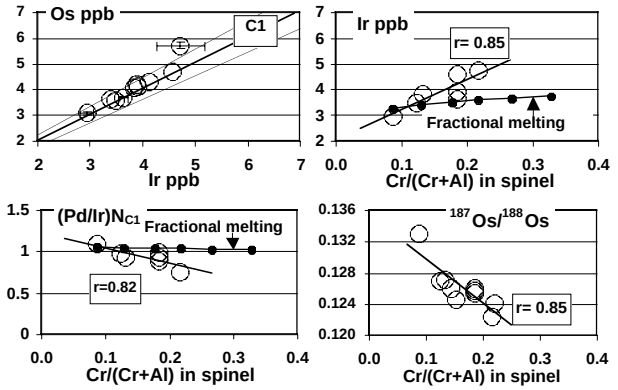

Figure 1.

Os isotopes in SL samples show wide range of ratios (^{187}Os/^{188}Os: 0.1224 to 0.1330), and correlate with Cr# of spinel (Fig. 1) The calculated present day ^{187}Os/^{188}Os ratio of the mantle at 0% melting is more radiogenic than previous estimations.

(U-Th)/He Dating and Thermotectonic Re-Evaluation of Red Sea Rift Development in Yemen

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We present new apatite (U-Th)/He data from the Red Sea margin in Yemen that demonstrate a need to re-evaluate accepted hypotheses of rift development for this region. 5 samples from a selection of apatite separates previously analysed by the fission track (FT) method were found to have high-quality euhedral apatite suitable for the rigorous requirements of (U-Th)/He dating. Thermal histories calculated for these samples using the FT annealing model of Laslett *et al.* (1987) have previously been used to argue that tectonic denudation along the margin of the southern Red Sea was rapid and peaked in a single episode early in the rifting process, between 25 and 19 Ma, in the vicinity of the developing rift. Taken together with the corresponding fission track ages, our new data favour relatively consistent cooling (which we infer to reflect similarly steady exhumation and tectonic activity) from Miocene to Recent time.

Critically, this alternative was *explicitly tested and rejected* in previous modelling studies of the fission track length distributions for these samples. Taken at face value, these (U-Th)/He results question the veracity of exisiting track length annealing models at very low temperatures. It is hoped that further application of the combined fission track and (U-Th)/He analytical approach to the Red Sea margin will provide an important natural example of the inter-relationships of FT annealing and helium diffusion in apatite, complementing laboratory experiments underway into this topic in the London Thermochronology Research Group.

References

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