

Highly siderophile element geochemistry of upper mantle xenoliths from NE Bavaria

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Concentrations of highly siderophile elements (HSE) in upper mantle xenoliths reflect variable degrees of partial melting and melt/fluid metasomatism by the agents of variable compositions (e.g., basaltic, alkaline, carbonatitic). During melt percolation, HSE can be strongly fractionated between each other depending on sulphur saturation of the infiltrating melt and melt/rock ratios; this can also affect $^{187}\text{Os}/^{188}\text{Os}$.

Osmium isotope compositions coupled with HSE abundances are presented for a suite of spinel lherzolite/harzburgerite xenoliths from NE Bavaria, Bohemian Massif, that underwent variable degrees of partial melting (~4–18%) and subsequent pervasive metasomatism by alkaline–carbonatitic melts with a significant contribution of recycled crustal material.

The samples have highly variable Re–Os concentrations (9–123 ppt and 0.1–3.5 ppb, respectively) and display subchondritic to superchondritic $^{187}\text{Os}/^{188}\text{Os}$ (0.11348–0.13304). Primitive upper mantle-normalized patterns exhibit convex-upward shapes with significant I-PGE fractionation. Palladium contents are very low (0.09–2.07 ppb) whereas Pt contents vary greatly (0.16–6.4 ppb). Depletion ages (T_{RD}) for the whole suite scatter between 0.3 and 2.0 Ga suggesting variable perturbation of Re–Os system during metasomatism. However, the 2.0 Ga age obtained for the sample with the most depleted character appears to represent the age of the lithospheric mantle from the studied area.

While low Pd and Re contents can be explained by varying degrees of partial melting, the low I-PGE contents imply that they were removed during melt percolation of sulphur-undersaturated melt causing sulphide breakdown and I-PGE removal. On the other hand, subchondritic $^{187}\text{Os}/^{188}\text{Os}$ ratios in majority of samples suggest that metasomatism has only a collateral effect on Os isotopic compositions which, therefore, may provide reliable depletion ages even in pervasively metasomatized mantle.

Crystal/melt partitioning of volatiles during near-solidus melting of peridotite

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Concentrations of H₂O, F, Cl, C and S in experimentally produced peridotite phases (including clinopyroxene, orthopyroxene, olivine, garnet, amphibole, mica) and co-existing melts were analysed by secondary ion mass spectrometry (SIMS). The experiments were conducted at 1025–1190 °C and 1.0–3.0 GPa on hydrous nepheline basanite mixes. Mineral/melt partition coefficients calculated from the data indicate that there is a negative correlation between partition coefficients for H₂O and absolute H₂O concentrations in melts. Because of this, the relative compatibilities of H₂O and other (non-volatile) incompatible elements (e.g. La and Ce) also depend on H₂O concentrations in melts. This may explain some of the variability in H₂O/LREE found in undegassed MORB and OIB glasses. Cl appears to be less compatible than H₂O during peridotite melting, whereas F is more compatible. Neither C nor S is significantly retained in silicate minerals during peridotite melting but may be held in residual graphite and sulphides. Thus they may be relatively compatible during mantle fractionation. The experimental data have implications for the history of volatile recycling within the mantle and thus also for the development of MORB and OIB magmatism.