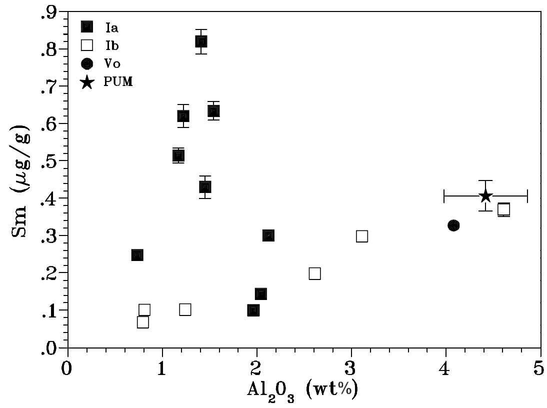
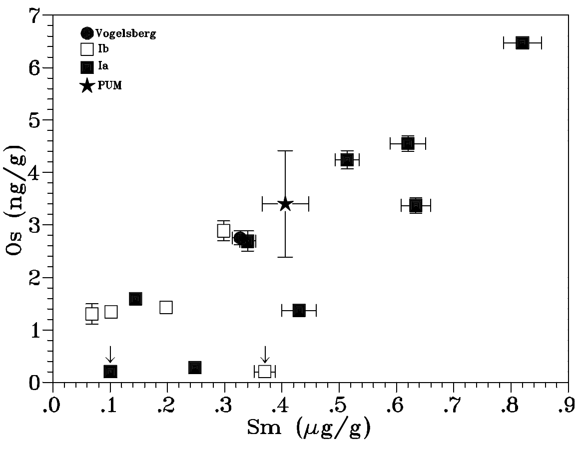
Redistribution of Platinum Group Elements in mantle xenoliths from the Eifel

Gerhard Schmidt[1,2], Gudrun Witt-Eickschen[1], Herbert Palme[1], Hans Seck[1], Jonathan Snow[3], Bernhard Spettel[3], Karl-Ludwig Kratz[2]
[1]Institut für Mineralogie und Geochemie, Universität zu Köln
[2]Institut für Kernchemie, Universität Mainz
[3]Max-Planck-Institut für Chemie, Mainz

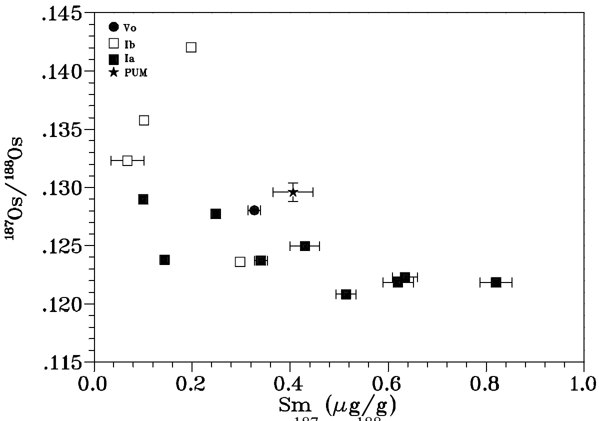
There are two groups of Eifel peridotites: (Ib) high temperature anhydrous xenoliths ranging from LREE-depleted to moderately enriched in LREE and MREE and low temperature, modally metasomatized xenoliths (Ia) that have experienced high enrichment in LREE and MREE by metasomatizing fluids [1].



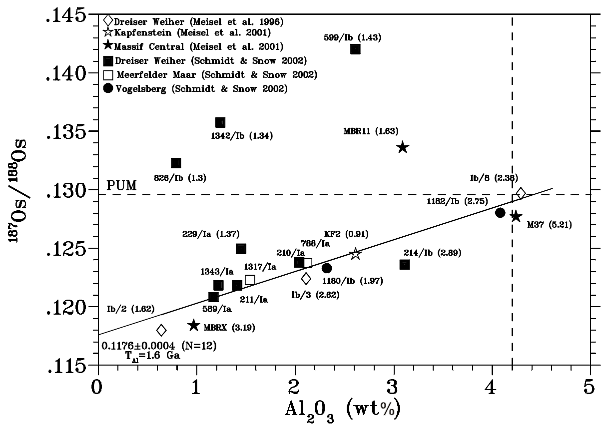
In Ib-xenoliths Sm and Al are well correlated, reflecting increasing depletions of Al and Sm with increasing degree of partial melting. Sample 196, high in Al and Sm has nearly PUM (primitive upper mantle) contents (4.45 wt.% Al_2O_3 and 406 ng/g Sm, McDonough and Sun [2]). The Ia-xenoliths show a large scatter for Sm unrelated to Al_2O_3 variations indicating Sm enrichment during aqueous fluids (Stosch and Seck [3]). High Sm in the Ia-xenoliths is associated with high Os and As contents. It is conceivable that the fluid phase that contained the Sm also delivered unradiogenic Os and As, perhaps by dissolving sulfides the most likely carrier phases of the PGE and As.



Ib- and Ia-xenoliths form a single correlation line in the $^{187}Os/^{188}Os$ vs Al_2O_3 diagram [4] suggesting that the metasomatic event occurred recently. Both, the Al_2O_3 content and the osmium isotope ratios are not affected by the metasomatism if Os was mobilized from a lithospheric source with an identical osmium isotope signature. Five samples do not plot on or near the



correlation line in the $^{187}Os/^{188}Os$ vs Al_2O_3 diagram. Three of them have superchondritic $^{187}Os/^{188}Os$ ratios. Their Os-isotopes must have grown in environments with comparatively high Re/Os ratios. Such environments could be produced by earlier Re-Os fractionations. For example, removal of the major fraction of Os with sulfides but retention of Re (which is much less affected by sulfide removal) could explain the Os isotopes in these rocks. There must however be sufficient time to produce the increase in ^{187}Os.



Variations in absolute Os contents of the majority of the Eifel xenoliths accompanied by parallel variations in absolute PGE contents points to maximum ages of a few 100 million years due to the lack of positive correlations between $^{143}Nd/^{144}Nd$ and Sm/Nd in the enriched clinopyroxenes from the hydrous xenoliths [5]. At least two independent events are required that have drastically changed the Re/Os ratios of Eifel peridotites. High $^{187}Os/^{188}Os$ rocks experienced redistribution of Os in high Re/Os environments formed earlier. In a late metasomatic event Os-isotopes were not affected.

[1] Schmidt G. et al. Chem. Geol., in press (2003).
[2] McDonough W.F., Sun S.-S., Chem. Geol., 120, 223-253 (1995).
[3] Stosch H.-G.,Seck H.A., GCA 44, 457-470 (1980).
[4] Schmidt G., Snow J., Contrib. Mineral. Petrol. 143. 694-705 (2002).
[5] Stosch H.-G., Fortschr. Mineral. 65, 49-86 (1987).