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Preliminary data on mantle xenoliths from the Feldstein basalt (Thuringia, Germany)

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Feldstein is an isolated outcrop of columnar basaltic rock nearby Themar, located 60 km south-west of Erfurt (Thuringia, Germany). The Feldstein alkali basalt (ca. 16.3 Ma) belongs to the Heldburger Gangschar subset of the Central European Volcanic Province (Abratis et al. 2007). The Feldstein alkali basalt contains peridotitic xenoliths, which were the subject of our study.

Two groups of spinel peridotite xenoliths occur in the Feldstein basalt. Group A spinel peridotite (2 xenoliths) is characterized by protogranular texture with typical grain size of 2 – 3 mm (max 8 mm). It consists of olivine (90.28 – 91.36 % Fo, 0.35 – 0.45 wt. % NiO), orthopyroxene (mg# 0.91 – 0.92, Al 0.09 – 0.18 a pfu), clinopyroxene (mg# 0.93 – 0.95, Al 0.06 – 0.21 a pfu) and spinel (cr# 0.20 – 0.41, mg# 0.66 – 0.78). The mg# and Al content in clinopyroxene are negatively correlated following the depletion trend after variable degrees of partial melting of the same source. One of the studied samples contains clinopyroxene that does not plot on the general depletion trend but has significantly higher Al (0.15 – 0.21 a pfu) for similar mg # 0.93 – 0.94 with clinopyroxenes from this trend. However the primitive mantle normalized clinopyroxene REE patterns (concave upwards with LaN/YbN=0.11) indicate that they are the residues after elevated degrees of partial melting. The most magnesian clinopyroxene that is Ca-rich and Al-poor has REE abundances, typical for strongly depleted spinel peridotites. It has concave upwards primitive mantle normalized pattern and LaN/YbN=0.61. A slight increase of LaN and CeN with inflection point at PrN has been observed as well.

The group B spinel peridotites have protogranular texture (3-4 mm, max 7 mm grains) and some of them contain several melt pockets of basaltic composition. It consists of olivine (88.95 – 91.32 % Fo, 0.34 – 0.47 wt.% NiO), orthopyroxene (mg# 0.90 – 0.93, Al 0.04 – 0.16 apfu) and clinopyroxene (mg# 0.90 – 0.93, Al 0.10 – 0.20 a pfu). The clinopyroxenes as can be inferred from their high LaN/YbN ratio (7.07 to 38.32),have been strongly but variably affected by metasomatic processes. Furthermore in the primitive mantle normalized trace element diagrams the majority of the studied samples have prominent Ti, Zr and Hf negative anomalies when compared to their neighbor elements. The LaN/SmN ratio changes gradually from 1.56 to 75.24 suggesting melt percolation. The xenoliths with the lowest LaN/SmN ratio should be closer to the melt percolating front and those with the highest LaN/YbN ratio should be located in a longer distance from the melt front.

In conclusion: the group A of peridotites records strong melt extraction with evidence for minor metasomatic influence whereas the spinel peridotites from the group B have been variably affected by percolating melts.

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