

# Trace element concentrations in amphibole and/or clinopyroxene from composite mantle xenoliths of the West Eifel (Germany): an ion-microprobe study

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Geochemical studies of peridotite wall rocks adjacent to veins observed in composite mantle xenoliths and peridotite massifs, show that both the enrichment of incompatible elements in anhydrous peridotites (cryptic metasomatism) and the formation of amphibole (modal metasomatism) in the mantle lithosphere may sometimes be linked to a single event of peridotite-magma interaction, which can be modelled by chromatographic fractionation (e.g. Vasseur *et al.*, 1991; Nielson *et al.*, 1993). In order to get more knowledge of the nature of the metasomatism beneath the West Eifel (Germany) ion-microprobe analyses of amphibole and/or clinopyroxene were performed for 25 composite xenoliths showing 0.5–3 cm broad veins crosscutting spinel lherzolite or harzburgite hosts. Two types of xenolith are distinguished:

Type (I) is composed of amphibole-free, cryptically metasomatized, high temperature

(1120–1140°C, 15 kbar) peridotites adjacent to veins of coarse-grained clinopyroxenites. The clinopyroxenes of the veins yield a major element composition similar to diopsides of primitive lherzolites, but are distinctly richer in Ti (Witt-Eickschen *et al.*, 1993). Their REE patterns are convex-upward with a maximum at Nd and Sm which is typical of augites precipitated from basic melts. The diopsides of the peridotite hosts are more enriched in light REE than those from the veins.

Type (II) composite xenoliths are modally metasomatized and consist of pargasite-bearing peridotites in contact with micaceous hornblendite veins. From the chemical zoning observed in orthopyroxene it has been inferred that these xenoliths suffered a reheating from 900°C to about 1000°C (10 kbar). The trace element composition of the vein amphiboles is variable from sample to sample and ranges from patterns similar to megacrysts in equilibrium with basaltic melts to those highly enriched in light REE. Within a centimetre of the veins, the contents of high field strength elements (HFSE; e.g. Ti, Zr, Hf), Rb, and Ba are systematically elevated in diopside and pargasite grains within the host peridotite as a function of decreasing distance to the veins. In contrast, light REE values systematically decrease (Fig. 1). Moreover, amphiboles of some samples reveal a strong zonation of Ti, Al, Cr and trace elements (Fig. 2) matching the trends obtained from the spatial variation in the wall rock peridotites.

Although high quality partition coefficients which are needed to model and interpret the small-scale compositional variations observed are still lacking, diffusion models will be presented for REE and HFSE. From these calculations we infer that a single-stage process of metasomatism

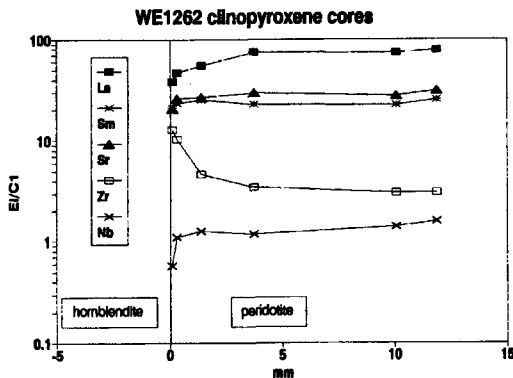


FIG. 1. Variation of trace elements in clinopyroxene cores from a type II xenolith as function of distance to a hornblendite vein.

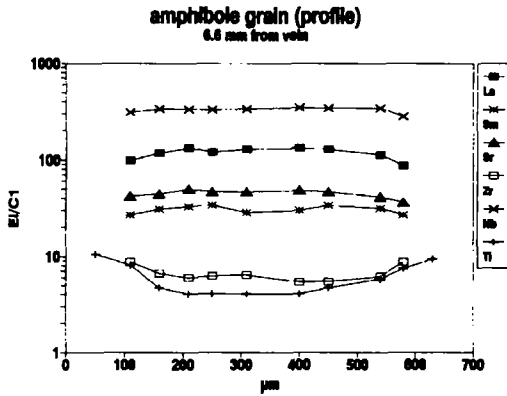


FIG. 2. Trace element distribution within a zoned pargasite of a type II xenolith (rim-core-rim profile) at a distance of 6.6 mm from the vein.

cannot be adopted for the trace element enrichment in the mantle beneath the West Eifel.

#### References

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