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Petrological features of mantle xenoliths from Handler Ridge, Northern Victoria Land (NVL) , Antarctica

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A petrological study of ultramafic xenoliths from Handler Ridge has been carried out, in order to characterize the lithospheric mantle domain of the Western Antarctic Rift System, from Mt Melbourne (74°21'S 164°42'E) to Handler Ridge (72°31'167°18'E).
Samples are mainly anhydrous spinel (sp)-bearing lherzolites, but few wehrlites also occur. Two textures were recognized: i) medium to coarse grained and ii) fine grained types. Evidences of melt/rock interaction (secondary clinopyroxene cpx2, cpx spongy and cloudy rims, glassy patches) can be also observed.
Olivine (ol) is forsteritic in composition with Fo varying from 87.5 to 91.0. Within lherzolites a more fertile group can be recognized with Fo ranging between 87.5 and 88.6. In wehrlites ol varies from Fo 84.5 to 86.1. NiO ranges from 0. 28 to 0.44 wt% for lherzolites, while it has a lower content for wehrlites (0.20-0.40 wt%)
As for ol, orthopyroxene (opx) in the most fertile lherzolites presents mg# from 88.1 to 88.3, while it varies from 88.3 to 91 in the residual lherzolitic group. None differences in $Al2O_3$ and TiO_2 contents between the two groups were recognized. In chondrite-normalized incompatible element patterns opx is depleted in light REE (LREE), with remarkable Ti and Zr positive anomalies.
In lherzolites mg# of primary clinopyroxene (cpx1) varies between 87.6 and 92.1. As for ol and opx, two groups can be recognized, although some overlap exists for two samples. $Al2O_3$ and TiO_2 vary from 3.68-6.51 wt% and from 0.19 to 0.71 wt% respectively. Secondary cpx (cpx2) is generally richer in FeO, TiO_2 and N2O with respect to cpx1. In wehrlites cpx is characterized by very low mg# (84.3-88.6) and higher TiO_2 contents (0.69-1.39 wt%) than lherzolites. Irrespective to the lithology, chondrite-normalized incompatible trace element cpx1 patterns are variable enriched in Th, U, Nb, and Ta with negative Sr, Zr and Hf anomalies. Two trends can be recognized. The first one with (La/Yb)N varying from 1.28 to 9.72 and very low HREE content (Ybn = 1.76-2.00), while the second group shows (La/Yb)N between 0.75 and 3.59 but higher HREE values (YbN 7.15-11.45). Glasses are SiO_2 -rich ($\geq$55.50 wt%) with TiO_2 contents between 0.60 and 1.88 wt% and Na2O/K2O ratio in the range 0.80-2.02. Glass chondrite-normalized trace elements patterns are variable enriched in Ba, Rb, Th, U, and LREE at almost constant HREE values ($\sim$10). Major and trace element contents of cpx, opx, and sp suggest partial melting as main evolution processes with a degree varying between 7 and 18%.
Mg/Fe partitioning between ol, opx and sp indicate equilibrium conditions, thus T and fO_2 are calculated following the formalism of Ballhaus et al. (1991). At P assumed of 15 kbar, T varies between 978 and 1028 °C and fO_2 from -0.26 to 0.39 ΔFMQ. Compared with the other anhydrous and hydrated mantle xenolith populations occurring in NVL these xenoliths present the highest T and the more oxidized conditions.

Ballhaus et a., (1991) CMP 106, 27-40