Siderophile element geochemistry of restitic and cumulate xenoliths from the southeast province of the Kerguelen Archipelago

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Seven xenoliths from the SE Province (Val Phonolite, Mt. Tizard and Dome Rouge localities) of the Kerguelen Archipelago (KA), representing residues of high degree partial melt extraction (i.e. Type I dunite), and basaltic cumulates derived from the Kerguelen plume (i.e. Type II) have been analyzed for siderophile and chalcophile elements (incl. Ni, Cu, Zn, Sb, Os, Ir, Ru and Pt) to investigate their fractionation in plume environments. The Type I sample in this study has anomalously low PGE abundances and a highly non-chondritic Os/Ir (4.5) ratio, similar to other Type I dunites from the KA which have Os/Ir ratios between 0.89 to 2.5 (e.g. Lorand et al., 2004). Its highly subchondritic Pt/Ir ratio (0.6) overlaps with highly refractory cratonic and circum cratonic peridotites from southern Africa and Arctic Canada, and is intermediate compared to other refractory Type I dunites from below the KA which have Pt/Ir ratios between 0.3 and 4.8 (Lorand et al., 2004). In the basaltic cumulate xenoliths, all the PGEs (Os, Ir, Ru, Pt) appear to behave compatibly, concomitant with Ni, Mg and Cu, consistent with their high PGE contents (i.e. 0.96-3.1 ppb (Ru), 0.5-4.5 ppb (Os), 0.5-1.5 ppb (Ir) and 0.1-5.9 ppb (Pt)). The large range in Pt/Ir (0.2-9.3) at near constant Ir content is interpreted to result from the differentiation of a sulfide liquid, filter pressing effects in a crustal magma chamber, and the modal variability of clinopyroxene. Highly non-chondritic Os/Ir ratios (i.e. 0.5 and 2.2) in two of the cumulates likely result from syn-eruptive alteration and metasomatism. The alkali basaltic cumulate from Val Phonolite is anomalously enriched in Cu and Zn (Cu/Pt ~765, Zn/Ru ~401), relative to the basaltic cumulates from Mt. Tizard and Dome Rouge (Cu/Pt <11.5 and Zn/Ru <25), and likely suffered from the segregation of a sulfide liquid, reflected in negligible PGE abundances. The fractionation of PGEs in basaltic compositions in plume settings appears to be complicated by factors such as formation under sulphur saturated and undersaturated conditions, variably enriched sources, and the potential for magma mixing and extensive silicate mineral fractionation in magma chambers, and possible late stage metasomatism and re-equilibration.

Pb/Pb zircon age of Carrascal Massif, central Portugal

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The Carrascal Massif (CM) is a NW-SE elongated composite igneous intrusion of the Iberian Hercynian Terrain. It consists mainly of a biotite granite surrounded by a porphyritic biotite granite. They are calc-alkaline, slightly peraluminous, I-type granites. Large gabbro/dioritic outcrops and a few ultramafics occur mainly in the core of the intrusion. Breccia features are observed between the mafic and felsic rocks. Geochemical data suggest that they are derived from different pulses of magma, which are not related.

The zircon ages were obtained by $^{207}Pb/^{206}Pb$ stepwise evaporation method, Kober method, for one sample of gabbro and another of porphyritic granite. The age of 471±2 Ma was obtained for gabbro, but higher ages of ≤706 Ma were also found in a eccentric restitic core (Fig 1). The zircon cores from granite give 486±9 Ma and the rims yeild 468±4 Ma. These rims probably correspond to small overgrowths of zircon crystals due to the mafic intrusions.

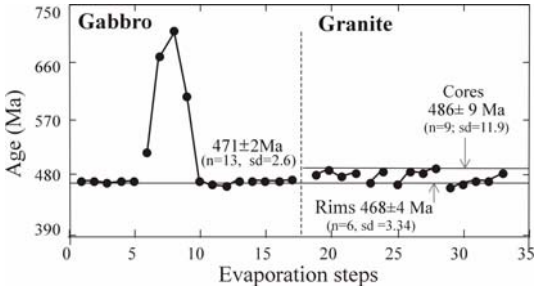

Fig. 1-Zircon ages of gabbro and porphyritic granite from CM

This mafic-felsic rock association is Ordovician of 471-486 Ma old, but showing Cadomian restitic ages recorded in zircon from the gabbro and suggesting a multi cycle history for some zircons. The low $(^{87}Sr/^{86}Sr)_0$ values of 0.7042–0.7057, ε_{Nd} of -0.75 to +2.93 and $\delta^{18}O$ of 6.06–8.52‰ for the mafic and felsic rocks of CM suggest mantle-derived igneous sources and probably mixed protholiths at the mantle/ lower-crust interface. The CM genesis is consistent with a magmatic arc in Iberian before the variscan orogeny.