PETROLOGY AND GEOCHEMISTRY OF ECLOGITE XENOLITHS FROM THE EKATI KIMBERLITES AREA

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Eclogite xenoliths from the Ekati area kimberlites (Grizzly, Leslie, Pigeon, Sable) have been studied in terms of major and trace elements, oxygen isotopes as well as Rb-Sr, Sm-Nd and Lu-Hf isotopic systems.

The Ekati eclogites and garnet pyroxenites are a petrographically very diverse suite, with olivine ($Fo_{69.7}$), apatite, rutile and ilmenite occurring as minor phases or accessories either as discrete grains or included in garnet and cpx. A wide range of equilibration temperatures between 725°C and 1438°C and obtained for the samples reflects this diversity. Garnet compositions range between $Py_{69}Alm_{18}Gross_{13}$ and $Py_{18}Alm_{63}Gros_{19}$, clinopyroxenes are between Jd_2Di_{98} and $Jd_{44}Di_{56}$ (Fung, 1998). Garnets in some of the samples from Grizzly, Leslie and Pigeon exhibit distinctly higher (5-10 wt%) MgO rim and lower MgO core compositions, similar to eclogites described from the Lac de Gras area (Griffin et al., 1999).

In contrast, oxygen isotopic values are relatively uniform, ranging between 4.6 to 5.7‰ and do not show a significant deviation from values for the unchanged Earth´s mantle (5.5 ± 0.4‰; Mattey et al. 1994). Measured ε_{Nd} values range between -22 to +141, Sr isotopic values are between 0.70125-0.70628, well within the large range observed for mantle eclogites worldwide.

Only in one sample (from Leslie) are cpx and garnet in isotopic equilibrium at the time of kimberlite eruption (53.9 ± 2 Ma, Armstrong et al., 1998), all others yield variable internal ages significantly predating the host kimberlite which is not uncommon in mantle eclogites. Neodymium model ages are, however, predominantly proterozoic (1300 to 1400 Ma).

Reconstructed bulk trace element characterics of a part of the sample suite exhibit prominent positive Eu and Sr anomalies combined with a flat heavy rare earth pattern that are typical for metamorphosed plagioclase-rich rocks and argue for a low-pressure origin of the eclogite precursor rocks.

Rims and cores of MgO zoned garnets show parallel REE patterns with lower contents in the rims.

Several samples both from Leslie and Grizzly contain apatite as elongated, oriented inclusions in garnet and cpx. Leaching experiments aimed at dissolving an apatite component without affecting the host silicates yielded identical isotopic compositions for leachates and silicate residues, showing that the apatites are in isotopic equilibrium with their host minerals and are indeed exsolutions rather than accidental inclusions.

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