

Trace element fractionation during exsolution of garnet from clinopyroxene in an eclogite xenolith from Obnazhennaya (Siberia)

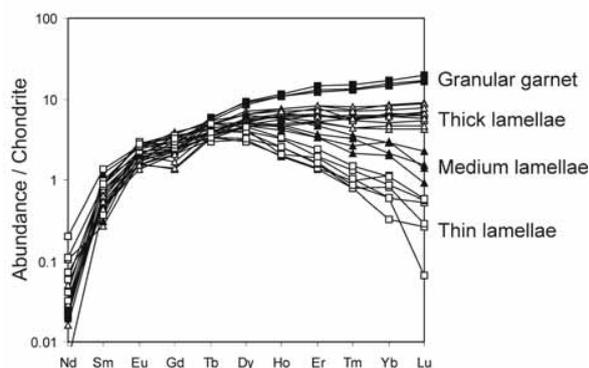
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A large (3 cm) Al-rich clinopyroxene megacryst from a bi-mineralic eclogite xenolith from Obnazhennaya kimberlite pipe contains 3 sets of garnet exsolution lamellae crystallized in sequence apparently as a result of slow cooling at depth. Thick lamellae (up to 1500 μm , $\text{Py}_{48}\text{Alm}_{30}\text{Gross}_{22}$) crystallized first and were followed by medium-sized ones (up to 500 μm , $\text{Py}_{40}\text{Alm}_{27}\text{Gross}_{33}$) and thin ones (50-100 μm , $\text{Py}_{34}\text{Alm}_{26}\text{Gross}_{40}$). LAM-ICP-MS analysis of the different generations of garnet lamellae indicates the progressive depletion of trace elements compatible with garnet (HREE, Y and Sc) during the course of exsolution (see figure below):



Variation of trace elements in the garnet lamellae and their host clinopyroxene suggests a diffusion-controlled trace element fractionation during cooling and garnet exsolution. The preservation of the fractionated trace element patterns in the exsolved garnets, as well as the diffusion gradients in the host clinopyroxene indicate that cooling and exsolution occurred shortly before the xenolith was entrained by the kimberlite melt.

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Partial melting and melt extraction in Acapulco-Lodran achondrites

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The differentiation of first planetary bodies at the metamorphism-partial melting transition, in the inner solar system, is an important petrological process that can help to understand the first stages of the Earth. This study is based on mineralogical, petrological, major and trace elements, melting models, and microstructural relationships. Mineralogical and modal composition of Lodran display that experienced high temperature (1150-1200°C) and extensive partial melting of silicates (30-35% for melt fraction), metal and sulfides. The silicate melts display dacitic compositions related to the breakdown of Na-Ca plagioclase, clinopyroxene and spinel. Using H or CR chondrites and Acapulco as precursor for Lodranite, melting models can't explain low-Ca pyroxene abundance. On the other hand, the systematic occurrence of "Fe-rich" olivine (Fa_{17}) as inclusion in low-Ca pyroxene in contrast with large tabular crystal of magnesian olivine (Fa_8) support the idea of a reaction between silicate melt with Fe-richest olivine to produce orthopyroxene associated with a reduction process before/during melt extraction. The heat source that initiated the melting was probably the short-lived radionuclides such as ^{26}Al . If we consider the extraction of dacitic melt from lodranites precursor then it can lead to a heterogeneous thermal evolution of these small bodies. To understand the melt extraction process, we analyse the lattice-preferred orientation (LPO) of silicates, sulfides and metal by EBSD technique. Indeed, mechanical processes must induced deformation and LPO. The result is that any LPO was observed except in troilite. We can conclude that silicate melt migrate at grain boundaries using surface tension and sulfide melt was interconnected. During cooling, formation of a single troilite crystal occurs and post-magmatic recrystallisation can explain the preservation of the high LPO in troilite.