Evolution of garnet clinopyroxenites from a margin of Siberian craton in major and rare element viewpoint

T.A. ALIFIROVA[1]*, L.N. POKHILENKO[1] AND
L.A. TAYLOR[2]

[1] V.S. Sobolev Institute of Geology and Mineralogy, SB of RAS, 630090 Novosibirsk, Russian Federation (*correspondence: taa@igm.nsc.ru)
[2] Earth and Planetary Geosciences Institute, Department of Earth and Planetary Sciences, The University of Tennessee, Knoxville, TN 37996, USA

Clinopyroxenite mantle xenoliths from Obnazhënnaya kimberlite pipe, NE part of Siberian craton (Russia), preserve porphyroclastic clinopyroxene with no less than two generations of garnet and orthopyroxene lamellae, sometimes together with rutile. Their crystallographic relationships are consistent with an origin by solid-state exsolution. According to reintegrated major-element chemistry and datasets for natural systems the homogeneous high-Al clinopyroxenes were previously in equilibrium within a T range of ~1400–1500 ºC at a minimum P of 2 GPa. Ca and Al variations in a clinopyroxene assume exsolution to take place during a cooling accompanied by a compression. According to Al contents the growth of orthopyroxene lamellae in the rocks is continued down to ~850 ºC and 2.7 GPa. The xenoliths matrix assemblage of Cpx+Grt±Opx marks strain-induced recrystallization where the exsolution features in recrystallized minerals are absent. Later re-equilibration of the mineral assemblage occurred at 790–810 ºC and 3.0–3.2 GPa in the cratonic mantle prior to the removal of rocks by kimberlite melts; the reactions were controlled by the diffusion of Ca and Al in a pyroxene structure.

It was noted that Sr in clinopyroxenes (284–556 ppm) increases from core to rim together with V (149–226 ppm) and Ca, opposite to Al content higher in the center of Cpx porphyroclasts. A positive Eu anomaly is significant both in clinopyroxenes and garnets (Eu/Eu* = 1.5–1.8 and 1.3–2.0, respectively). Substitution of Al for Si in the pyroxene tetrahedral sites has allowed charging balance for the substitution of additional trivalent REE into the pyroxene M2 site [1]. The process has affected to the Sr^{2+}, Sm^{3+} and V^{3+} contents and Eu^{2+}/Eu^{3+} relations responsible for the presence of Eu anomaly in a pyroxene.

The work was supported by the grant of the President of the Russian Federation MK-2231.2017.5. The study with LAT was funded by NSF grant EAR-1144337.

[1] Shearer *et al* (2006) *Am Mineral* **91**, 1565-1573.