



Lamprophyres from Turiy Cape and Kandalaksha Devonian dykes (Kola peninsula, Russia) : petrography, geochemistry and mineral composition

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Study of phenocryst and megacryst mineral associations of alkali rocks is the key to understanding an evolution and a source of the rocks.

In the Devonian Kola alkaline province (KAP) along with large mafic-ultramafic massifs there are several synchronous swarms of lamprophyre dykes. The dyke swarms occur mainly in the Kandalaksha graben. As suggest, their compositional diversity is caused by fractional crystallization and crustal contamination and a primary melt of lamprophyre was generated from a common source.

We have studied two dykes of the Turiy Cape swarm and the Kandalaksha swarm in the vicinity of the Kandalaksha town. The aim of study was to determine the source of lamprophyre melts based on petrography, geochemistry and detailed investigation of clinopyroxene and olivine.

Two principal petrographical types: alkali lamprophyres (Cb-Anl monchiquite) and ultramafic lamprophyres (Cpx ailikites and mela-alikites) in the Kandalaksha swarm were observed. Alkali lamprophyres contain medium size (0.3 – 1 cm) phenocrysts of olivine, clinopyroxene, magnetite, phlogopite. A groundmass contains analcime, clinopyroxene, various amounts of carbonate (from 0 to 30-40 %), pyrite, apatite, ilmenite.

Ultramafic lamprophyres contain medium size (0.5 – 1 cm) phenocrysts of olivine, clinopyroxene, phlogopite and amphibole. A groundmass contains phlogopite, carbonate, apatite, clinopyroxene, garnet, titanite and opaque minerals.

The most important chemical features of the alkali lamprophyres are undersaturation of SiO₂ (31.04-40.54 wt%), high alkali contents (3.86 – 6.47 wt% K₂O+Na₂O) and their sodium specification (K₂O/Na₂O - 0.36-0.68), whereas ultramafic lamprophyres have lower alkali contents (1.73-3.39 wt% K₂O+Na₂O), and potassium specification (K₂O/Na₂O - 1 -2.31). They also contain less SiO₂ (27.73 – 34.11 wt%).

The Turiy Cape dykes are characterized by only a single petrographic type - alkali lamprophyres (Cb-Anl and Ne-Anl monchiquites). They contain small and medium size (0.1 – 1 cm) phenocrysts of

olivine, clinopyroxenes, amphiboles, magnetite, phlogopite. A groundmass contains analcime, nepheline, aegirine, phlogopite, garnet, perovskite, apatite and opaque minerals.

Rocks of the Turiy Cape dykes are SiO₂ undersaturated (33.93 - 41.86 wt%), and contain extremely high alkalis (5.62-14.51 wt% K₂O+Na₂O) and all of them have sodium specification (0.11-0.68 K₂O/Na₂O).

The most primitive core of clinopyroxenes in the Kandalaksha dykes are high magnesian (#Mg - 0.76 - 0.87), low titanian (0.5 - 1.09 wt% TiO₂) and contains chromium (0.1-1.1 wt% Cr₂O₃). The clinopyroxenes of the Turiy Cape dykes have high magnesian core (#Mg 0.79-0.83, 1.48-2.05 wt% TiO₂, 0.12-0.4 wt% Cr₂O₃).

Olivines in the Kandalaksha lamprophyres have more primitive composition in comparison with olivines from the Turiy Cape ones. The #Mg of Kandalaksha olivines varies from 0.84 to 0.87, nickel concentration varies from 1500 to 2500 ppm and the #Mg of Turiy Cape olivines varies from 0.82 to 0.85, nickel concentration varies from 500 to 1000 ppm.

Based on composition of primary minerals we suggest that compositional diversity of both dyke swarms were formed due to crystal fractionation processes. Though, the significant difference in chemistry of whole rocks and clinopyroxene and olivine composition do not support a common source for of the Turiy Cape and Kandalaksha dykes.

This work was supported by the Russian Science Foundation under Grant No. 19-17-00024.