MINERALOGICAL AND GEOCHEMICAL FEATURES OF NEW PROVINCE OF ALKALI-ULTRAMAFIC LAMPROPHYRES, LAMPROITES AND KIMBERLITES OF THE KOLA PENINSULA AND NORTHERN KARELIA

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New province of dikes and explosion pipes of alkali-ultrabasic lamprophyres, lamproites and kimberlites of the southern part of the Kola Peninsula and of the Northern part of Karelia are described. In this region dikes of alkali-ultrabasic compositions are classified into dikes associated with massifs, and autonomous, the second ones are considered in the present abstract. The main fields of the alkali-ultrabasic lamprophyres and explosion pipes occured on the irelands of the Kandalaksha Bay, Tersky coast, as well as in southeastern areas surrounding the Khibiny and the Kovdor massifs. Lamproites occured in the North Karelia near the Kostomuksha iron deposit and the Poriya Bay region. Most of Kola lamprophyres and kimberlite bodies are spatially coincide distributed in Onega-Kandalaksha graben. Formation of this structure was associated with formation of on the Baltic Shield crust. Their geological setting was controlled by the major deep structures in the region. The time of their emplacement corresponded to the final stage of alkali magmatism in the Karelian-Kola region (Paleozoic).

Main mass of lamprophyres plot in the fields of ultramafic lamprophyres - ailikites and alnoites and in the field of alkaline lamprophyres, Karelian lamproites plot in the field of lamproites, according to a ratio of SiO_2 and total amount of alkalis (Fig.1 and 2). Lamprophyres according to its petrochemical characteristics - Al_2O_3, TiO_2, ΣFeO, MgO contents are similar to alkaline-ultrabasic analogies: melilitic picrites of the Nenoksa and picrites of the Zimny Shore (Arkhangelsk district), lamprophyres of Maimecha-Kotuiskaya province of Yakutiya, Cretaceous diatrems of the Syrian rift and alkaline dikes of the Alno. Main petrochemical features of alkaline-ultrabasic lamprophyres of the Kola Peninsular are higher Ti, Fe and alkaline contents, which increases with basicity decreases. They are predominantly sodium-rich rocks. Reverse dependence between total amount of alkalis and MgO is recorded in them. Karelian lamproites by the geochemistry and mineral composition are similar to Australian lamproites from Ellendail Field. Kimberlites of the Kola Peninsular according to the SiO_2/MgO ratio are similar to mica kimberlite.

More than 100 analyses of olivines, pyroxenes, garnets, chromites, ilmenites, rutiles, micas, sulfides and native elements were studied on microprobe analyses.

Olivine, as a rule, is rarely preserved due to its replacement by secondary minerals. In lamprophyre olivines, the content of fayalite component range from 6 to 16 w.%. Impurity contents vary in following intervals: Cr_2O_3 from 0.07 to 0.34 w.%, CaO from 0.12 to 0.29 w.%, TiO_2 up to 0.3% and MnO up to 0.4w.%. Olivine from kimberlites contain 94-95% of fayalite component, higher content of Cr_2O_3 (from 0.14 to 0.4 w.%) and lower content of CaO (from 0.09 to 0.16 w.%) By MgO and CaO contents lamproite olivines correspond to kimberlite ones.

Clinopyroxene is mainly represented by diopside, transitional difference to omphacite-diopside and diopside-augites, rare to titanium-augites. Low-alumina and aluminiferous varieties can be distinguished among them. The former are frequently enriched in chromium and depleted in iron. High ratio Fe^{+3}/Na characterize all diopsides. In kimberlites chrome diopside of emerald-green color was described, characteristic for high-pressure xenocrysts of diamond-bearing kimberlites. Its composition is characterized by low alumina content with Cr_2O_3 up to 2.4 w.% and Na_2O up to 1.5 w.% (Kalinkin et al.,1993).

Garnet is represented by almandine-pyrope-grossular variety with predomination of almandine , Cr_2O_3 exceed 2.56 w.%. Most analyses are corresponded to garnets of kimberlitic pipes of USA, Aldan shield, Greenland and from Syrian lamprophyres (Fig. 3). Pyrope occur in kimberlites as debris of round violet and crimson grains up to 5 mm across. Pyrope content in it reache 80%, almandine - 9%, grossular - 14%, andradite - 5%, Cr_2O_3 is more than 6 w.% . These compositions correspond to garnets of diamond association of Siberia kimberlites (Bagdasarov et al, 1980). The same pyrope were founded in Kostomuksha lamproites.

Rather high-chromium low-alumina picrochromites as well as chromites were founded in lamprophyres. Presence of 2-3 w.% of TiO_2 are characteristic for all varieties. Chromites of similar composition are widely distributed in kimberlites from Arkhangelsk and Yakutya province, where they represented minerals of main mass and also in picrites and lamprophyres of many alkaline complexes. Maximum Cr_2O_3 content in chrom spinelides reaches 55.76 w.% with TiO_2 content in 2.32 w.%. These chrom spinelides correspond to spinel-pyrope and coesite facies of depth (Sobolev, 1977). High-chromium and high-magnesium chromites were founded in Tersky kimberlite pipes. Cr_2O_3 content reache 63.56 w.% with TiO_2 0.37 w.%. These compositions correspond to chromites from diamond parageneses and from diamondiferous Siberian kimberlites. Both types of chromites were founded in Karelian lamproites.

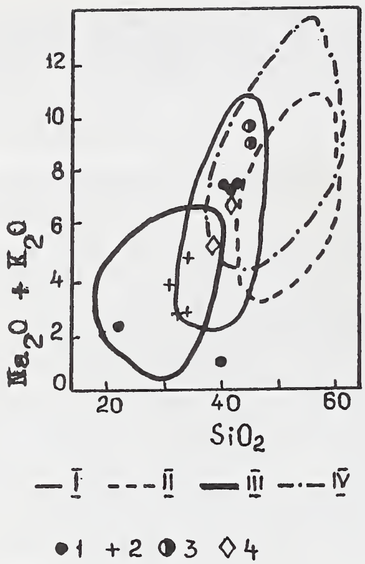

Fig.1. Rock's (1986) diagram for separation of the lamprophyres (ultramafic, alkaline and line-alkaline). Lamprophyres: I - alkaline, II - line-alkaline, III - ultramafic, IV- lamproites, 1 - Kandalaksha dike complex, 2 - dike of Vuoriyarvy massif, 3- Khibiny massif, 4 - Karelian lamproites.

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