



Mesoarchean Gabbroanorthosite Magmatism of the Kola Region

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The Kola peninsula is the region marked with development of anorthosite magmatism in the NE Baltic Shield. The Archaean gabbroanorthosites intrusions - Tsaginsky, Achinsky and Medvezhe-Schuchezhsky - have the age of 2.7-2.6 Ga (Bayanova, 2004). The Patchemvarek and Severny gabbroanorthosites intrusions are located in the junction zone of the Kolmozero-Voronja greenstone belt and the Murmansk domain. Age data for sedimentary-volcanogenic rocks of the Kolmozero-Voronja belt and Murmansk domain granitoids are 2.8-2.7 Ga. The gabbroanorthosites intrusions have more calcic composition (70–85% An) of normative plagioclase, and low contents of TiO₂, FeO, and Fe₂O₃. In terms of chemical composition, the gabbroanorthosites of the studied massifs are close to the rocks of the Fiskeneset Complex (Greenland) and to the anorthosites of the Vermillion Lake Complex (Canada). U–Pb zircon dating established Mesoarchean ages of 2925₇ and 2935₈ Ma for the gabbroanorthosites of the Patchemvarek and Severny massifs, respectively. It was shown that the gabbroanorthosites of the studied massifs have fairly low REE contents (Cen = 2.2–4.2, Ybn = 1.6–2.6) and distinct positive Eu anomaly. Comagmatic ultrabasic differentiates have practically unfractionated REE pattern, low total REE contents (Cen = 1.2, Ybn = 1.1, La/Ybn = 1.32), and no Eu anomaly. The studied samples of the Archean gabbroanorthosites are characterized by positive ¹⁴³Nd = + 2.68 for the gabbroanorthosites of the Severny Massif and from + 2.77 to + 1.66 for the Patchemvarek Massif. The rocks of the Severny and Patchemvarek massifs has 87Sr/86Sr = 0.70204₈ and 87Sr/86Sr = 0.70258₈, respectively. The oldest U–Pb zircon ages for the gabbroanorthosites of the Patchemvarek and Severny massifs marking the Mesoarchean stage in the evolution of region. The differences in the initial ¹⁴³Nd/¹⁴⁴Nd ratios between the Neoproterozoic and the Mesoarchean gabbroanorthosites suggest the existence of two mantle sources. One of them produced intrusions with an age of 2.67–2.66 Ga, while other was responsible for the formation of massifs with an age of 2.93–2.92 Ga. According to our calculations, the initial melt was an aluminous basalt, differentiation of which in the crust-mantle boundary resulted in the flotation of plagioclase with the formation of "crystalline porridge" at T = 1280 °C and a pressure of 7 kbar, which formed the anorthosite complexes. The gabbroanorthosites of the Patchemvarek and Severny massifs were presumably derived from MORB-type basalts of oceanic settings, while the Tsaginsky, Achinsky, and other anorthosite massifs of the Neoproterozoic age were generated from subalkaline magma formed in within plate anorogenic setting. The Sm-Nd isotope data suggest the existence of several mantle sources in the Kola region, which produced melts for different-age gabbroanorthosite massifs since Mesoarchean to the middle Paleoproterozoic.

References:

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