KREEP-component in the extreme differentiates of the Kivakka layered intrusion (Northern Karelia, Russia)

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Noritic layered intrusions can be considered as terrestrial analogues of the magmatic ocean of the Moon. But in the terrestrial rocks KREEP component was found only in melt inclusions. The differentiation of magmatic melts does not lead to the formation of layers unusually rich in K, P, and incompatible REE compared to the norites and gabbro. Kivakka layered intrusion contain 4 types of rocks, which result the process of crystallization differentiation of basaltic magma. They form consistent layering from dunite to gabbronorite with thin layering, confined to change of cumulative paragenesis. In extreme differentiates of the top pegmatoid gabbronorites a lot of lens appeared, which composition is like Lunar KREEP rocks. There diameter is 10-15 sm and they have no sharp boundaries with the host gabbronorite. These lens are formed by quartz-orthoclase and quartz-orthoclase symplectite with apatite (CaCl), Ti-magnetite, zircon, baddeleite, amphibole and phlogopite, and are characterized by high concentrations of REE, K, P. LREE/HREE ratio in lens is higher than in host rocks. Eu/Eu* is negative, while in all norites and gabbronorites this ratio is positive. Sm/Eu is higher than both in intrusion rocks and in basalt at all. Its ratio to Sm close to such in KREEP rocks of the Moon. The compositions of minerals of researched lens are in good agreement with such in Lunar KREEP rock [Hiroshi, 1975]. Apatite, amphibole and phlogopite are characterized by high concentration of Cl. The formation of KREEP rocks can be explained as a residual melt from the magma differentiation or liquid immiscibility during the accumulation of volatile components. Those rocks are located in the extreme differentiates zone of Kivakka intrusion, so it is logical to assume that they are the result of magma differentiation. High concentrations of volatile components, such as Cl, may be the evidence of liquid immiscibility.

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