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Geochronology of mantle and crustal processes of Archaean rocks of the Kola region (Fennoscandian Shield)

Kudryashov, N.M., Mokrushin, A. V., Zozulya, D.R. and Lyalina, L.M.

Geological Institute of the Kola Science Centre of the RAS, Apatity, Russia. nik@geoksc.apatity.ru

The Kola region is a part of the Kola-Lapland-Karelian province, which represents the oldest part of the Fennoscandian Shield. Within the Kola region large Archaean domains - infracrustal terranes (Murmansk, Central-Kola, Keivy, Belomorian) and mobile belt - supracrustal terrane Kolmozero-Voronja are distinguished.

Murmansk granite-gneisses. U-Pb zircon age for biotite gneisses is 2724 ± 7 Ma. The zircon age of a xenolith from amphibolites was determined as 2739 ± 7 Ma. Plagiogranites from different parts of the investigated territory gave U-Pb ages of 2771 ± 10 Ma and 2748 ± 7 Ma, respectively. For diorites, the U-Pb zircon age 2717 ± 7 Ma was obtained. The given data testify to the Late Archaean time of formation of the investigated complexes of the Murmansk domain with ages limited to the interval 2.7-2.8 Ga.

Kolmozero-Voronja greenstone belt. The rocks of the Greenstone belt Kolmozero-Voronja were metamorphosed in amphibolitic facies and intruded by granodiorites, plagiomicrocline and tourmaline granites and pegmatitic veins. Within the belt there are rare metal, Cu, Mo, and Au deposits. The zircon from quartz porphyry of the Oleninskoe gold deposit yielded the U-Pb age of 2828 ± 8 Ma. The U-Pb age of 2825 ± 7 Ma was obtained for zircon from the quartz diorite of the Njalm-1 gold deposit. We interpret these data as an age of intrusive emplacement of quartz porphyry and quartz diorite at the final stage of the belt development.

Rare metal pegmatites. The pegmatite field of the Vasin Mylk deposit is located among amphibolites in the northwestern part of the Kolmozero-Voronja greenstone belt. The minerals of the columbite-tantalite group from Vasin Mylk deposit include microlite, simpsonite, and torolite, and are the oldest among different minerals represented by several generations in pegmatites under consideration. The U-Pb (TIMS) for seven measured microlite weights is characterized by upper intercepts with concordia at 2454 ± 8 Ma, which probably reflects the time of rare metal pegmatite crystallization.

Gabbroanorthosite magmatism. The gabbroanorthosite intrusions – Tzaginsky, Achinsky and Medvezhe-Schuchezersky – have the Neoarchaeon age of 2.7-2.6 Ga. The Patchemvarek and Severny gabbroanorthosite intrusions are located in the junction zone of the Kolmozero-Voronja greenstone belt and the Murmansk domain. U-Pb zircon dating established Mesoarchaeon ages of 2925 ± 7 and 2935 ± 8 Ma for the gabbroanorthosites of the Patchemvarek and Severny intrusions, respectively. The Mesoarchaeon gabbroanorthosites are characterized by positive $\epsilon_{Nd} = +2.77 - +1.66$ and Neoarchaeon gabbroanorthosites - $\epsilon_{Nd} = +1.78 - +0.26$ [1].

Sanukitoid magmatism: The Neoarchaeon polyphase Porosozero pluton belongs to sanukitoid magmatic series. Phase I is formed by the differentiated series: gabbro-diorite-quartz monzodiorite-granodiorite-plagiogranite; phase II - leucogranites and their veins; phase III - lamprophyre veins; phase IV - pegmatites. The U-Pb zircon age of quartz monzodiorite is 2734 ± 4 Ma, granodiorite - 2733 ± 6 Ma, leucogranites - 2712 ± 6 Ma. Their isotopic characteristics are: $\epsilon_{Nd} = +0.8 \div +1.6$. The Porosozero pluton formation is determined by the processes of mantle-crust interaction in suprasubduction conditions within the active continental margins [2].

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References:

[1] Kudryashov N and Mokrushin A (2011) *Petrology* 19: 169–184; [2] Kudryashov N et al. (2013) *Petrology* 21: 351–374

