Magama composition and crystallization conditions of the rare-metal granites from Khaldzan-Buregtei massif of peralkaline rare-metal igneous rocks

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New data are obtained on the mineralogical and chemical (major, trace, and volatile components) composition of melt inclusions in quartz from rare-metal granitoids in the Khaldzan-Buregtei Massif, Mongolia. The composition of melt inclusions was estimated with the use of an electron microprobe and ion probe.

The phases identified in the crystalline inclusions are tuhualite, albite, potassic feldspar, sphene, fluorite, zircon, gittinsite, pyrochlore, parisite and yttrocerite, and fluorite.

Melt inclusions in quartz are fully recrystallized, and their daughter minerals compose fine-grained aggregate of quartz, potassic feldspar, riebeckite, polylithionite, fluorite, zirconosilicate, and REE fluorcarbonate. We homogenized the melt inclusions in an autoclave at temperatures of 850 and 950ºC and a pressure of 3 kbar. The chemical composition of the homogeneous glasses was proved to be generally close to the composition of the rare-metal granites, including the concentrations of such components as SiO_2, FeO, MgO, Na_2O, and K_2O. The melts were characterized by high ZrO_2 concentrations (2-3 wt %). The F, H_2O, and CO_2 concentrations in the melts are 1.3-4 wt %, 1-3.4 wt %, and 1.56 wt %, respectively. The glasses of the melt inclusions are depleted in Ba and Sr and enriched in Be, Rb, Y, Nb, Hf, Th, and REE.

Our data indicate that the rare-metal granites were produced by a melt saturated with several trace elements and REE, which is consistent with the geochemical specifics of the rocks themselves. The melts were residual liquids that accumulated in the upper parts of the magma chamber after the fractionation of the alkaline granite magma, reached saturation with many ore components, first of all, Zr, Nb, and REE, and thus became ore-bearing magmas. The specifics of the rare-metal mineralization was predetermined by the high alkalinity of the melt (the agpaitic coefficient = 1.4) and the effects of fluorine and carbon dioxide, which resulted in the crystallization of such rare-metal phases as zircon, zirconosilicates, and REE fluorcarbonates.

Detrital monazite dating and trace-element compositions analysis by XRF-MilliProbe: Implication to provenance study within Ukrainian terrain

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Over 2000 detrital monazite grains from Devonian, Paleogene, Neogene, Quaternary sediments of Ukraine have been analysed by XRF Milliprobe for Th, U, Pb, Sr, Y, that as well has been used for Th-U total Pb dating of the monazites.

To apply these analytical and evaluated data for provenance investigation the distribution of above elements in monazites from the set of crystalline rocks of Ukrainian Shield (East European Craton) and Eastern Carpathians has been inferred using XRF measurements. Statistically proved analytical data have allowed distinguishing specific compositional features of monazite derived from (A) alkaline igneous rocks and carbonatites (low contents of Th, U, Y.); (B) granulites and charnockites (increased Th, Sr); (C) metamorphic rocks of amphibolite grade, granites and pegmatites (increased U, Y). The diagram in U/Th*Y/Th – Sr/Y coordinates represents above discrimination in graphic plot. In particular such regularities show systematic sensibility of monazite composition to P-T condition of host rock formation.

The generalized sources of detrital monazites seperated from the sediments within Ukrainian terrain were suggested by implication of the both geochemical and age criteria. Evidently the source of Archean-Proterozoic detrital monazite (>1500 Ma) are crystalline rocks of Ukrainian Shield. For these detrital "old" monazites the rock sources of (B) group prevail (≈2/3 of total amount) whereas ≈1/3 derived from the rocks of (C) group. The Precambrian rocks of (A) group yield insignificant part of the "old" detrital monazites in the studied sediments. Neoproterozoic-Palaeozoic 'young' (1100-400 Ma) population of detrital monazite apparently represents product of erosion of acid metamorphic rocks of relatively low grade, which have no direct analogues within Ukrainian Shields. Source area for this population could be Neoproterozoic terrains of EEC margin including ancient rocks of Marmarosh massive (Eastern Carpathians).