



Geochemistry and fluid evolution of the peralkaline rare-metal granite, Gabal Gharib, Eastern Desert of Egypt

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Abstract:

The Neoproterozoic pluton of Gabal Gharib granite Eastern Desert of Egypt is intruded in subduction-related calcalkaline granitic rocks of granodiorite to adamellite composition. A zone of metasomatized granite was developed along the contacts at the expense of the calc-alkaline granite. The granite of Gabal Gharib is hypersolvus, composed mainly of orthoclase-microperthite, quartz, and interstitial arfvedsonite. Fluorite, zircon, ilmenite, allanite, and astrophyllite are the main accessories. Pegmatite pods as well as miarolitic cavities (mineral-lined cavities) are common and ranging in size from a few millimeters to 50 cm. Rare-metal minerals such as columbite, cassiterite, and fluorite have been identified from the miarolitic cavities. Geochemical studies revealed that Gabal Gharib granite is a highly fractionated granite, homogeneous in composition, with high contents of SiO₂, and alkalis, high Ga/Al, and Fe/Mg ratios, and low concentrations of Al, Mg, and CaO relative to granodiorite–adamellite country rocks. Gabal Gharib granite is metaluminous to peralkaline with ASI (0.94–1.07). Trace element characteristics of Gabal Gharib granite include abundances of Rb, Nb, Ta, Sn, Th, U, Y, Ga, Zn, rare earth elements (REEs, except Eu), and F, and depletion in Sr, and Ba relative to granodiorite–adamellite country rocks. It has the geochemical characteristic of anorogenic A-type granite. The uniform trends of differentiation, normal REE distribution patterns, and low calculated tetrad effects of REE (600°C) were also reported. Petrographic, geochemical, and fluid inclusion studies constrain that the peralkaline anorogenic granite of Gabal Gharib was derived from highly evolved magma probably originated by fractional crystallization of mantle source.

Keywords:

Rare-metal granite . Miarolitic cavities . Melt inclusions . Fluid inclusions

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