Geochemistry and evolution of the Neoproterozoic granitoid magmatisms in the Wadi El Sheikh-Gabal Saint Katherine area, Southwestern Sinai, Egypt

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Abstract

Older and younger granitoids are widespread throughout the basement rocks of NE Egypt. Therefore, they are played a significant role in the evolution of the Pan-African crust. The Wadi El Sheikh-Gabal Saint Katherine area comprise three distinctive magmatic granitoid suites, namely: (1) calc-alkaline older quartz monzodiorite-tonalite suite (COG), (2) calc-alkaline younger monzogranite suite (CYG), and (3) alkali feldspar granites suite of Gabal Saint Katherine (AFG). The calc-alkaline I-type granitoids are exposed in Wadi El Sheikh area. They exhibit geochemical characteristics of arc-related magmatism such as enrichment in LILE (Ba, Sr and K) coupled with depletion in Nb and Y. The AFG are characterized by high SiO_2, alkalies, Nb, Rb and Y and low contents of CaO, MgO, TiO_2, P_2O_5, Sr and Ba. They display geochemical attributes of A-type granites, which are emplaced in a post-collision regime. The chemical change in composition of biotite from the calc-alkaline granitoids to the AFG suite (i.e. become Fe-rich) reflects considerable variations in amount of oxgen fugacity during magmatic crystallization of those rocks.

Field relationships and geochemical evidences of the studied granitoid suites indicate that those rocks were derived from independent magma sources. The COG were originated by partial melting of a basic magma source in arc-related environment. Where, the quartz monzodioritic magma was evolved to tonalite by fractional crystallization of biotite. The younger granitic melt of the CYG was generated through partial melting of an early Neoproterozoic mafic lower crust due to crustal thickening associated with magma underplating and/or orogenic compression. The high temperature and chemical characteristics of the AFG reflect that they were derived from a highly fractionated mantle source. However, the AFG were produced from a residual granitic melt of mantle-deived mafic magma through extreme fractional crystallization process.