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Geochemical and Sr-Nd isotopes characteristics of Ediacaran rare metal granites in the Central Eastern Desert of Egypt

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The mineralogical, geochemical and Sr-Nd isotopes of the alkali-feldspar granites (AFGs) from El-Ineigi pluton and garnet bearing muscovite granites (GMGs) from Abu-Diab pluton in the Central Eastern Desert of Egypt, north Arabian-Nubian Shield, were discussed. Several magmatic rare metal minerals including Mn-and Fe- columbite, fergusonite-(Y), spessartine-rich garnet, rutile, zircon, ilmenorutile, monazite and thorite were recorded in these granites. The granites are metaluminous, to slightly peraluminous, highly fractionated calc-alkaline with A-type affinity. They contain high amounts of HFSE (e.g. Rb, Nb, Y, U, Th and Ta) and extremely depleted in Sr and Ba, typical of rare metal granites worldwide. Their REE pattern shows negatively pronounced Eu anomaly and tetrad effect (TE_{1-3}) which indicate that these granites were affected by late- to post- magmatic stage fluids during their magmatic differentiation. Moreover, they are characterized by extremely high $^{87}Rb/^{86}Sr$ and $^{87}Sr/^{86}Sr$ ratios reflecting the clear disturbance of the Rb-Sr isotopic system and may give an indication for the high temperature magma-fluid interaction. Both granites have a positive εNd(t) and young Nd-T_{DM2} ages reflecting the juvenile crustal nature of El-Ineigi and Abu-Diab pluton and precluding the occurrence of pre-Neoproterozoic continental crust in the Arabian-Nubian Shield. The AFGs granites were generated by partial melting and fractionation of Nb- and Ta-rich amphibole and/or biotite of the lower crust, while, Abu-Diab GMGs were formed by extensive fractional crystallization process. During post-colliosional stages of the Arabian-Nubian Shield, the lithospheric delamination processes cause upwelling of the asthenospheric mantle that underplated and enhanced partial melting of the uppermost mantle and lower crust. The result melts could interplated through faults to middle crustal levels and resulted in partial melting of granodiorites followed by extensive fractional crystallization to produce these highly fractionated rare metal granites.