PETROGENESIS OF HIGHLY FRACTIONATED A-TYPE GRANITES IN THE NORTH ARABIAN-NUBIAN SHIELD; EGYPT: CONSTRAINTS FROM WHOLE-ROCK GEOCHEMISTRY AND Sr-Nd ISOTOPES

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The Neoproterozoic highly fractionated calc-alkaline granitoids are widespread in the North Arabian-Nubian Shield (ANS). An integrated study of minerology, whole-rock geochemistry and Sr-Nd isotopes was carried out for a Neoproterozoic granitoids of Gabal Abu-Diab in the Central Eastern Desert of Egypt, to investigate its petrogenesis and geological significances. Petrographically, Abu Diab batholith represent a multiphase pluton consists of two-mica granites (TMGs) as a main phase in the center followed by garnet bearing muscovite granites (GBMGs) and muscovite granites (MGs) at the margin, and intruded into older granodiorite and metagabbro-diorite rocks. The granites are slightly peraluminous with high SiO_2 (>75 wt.%), K_2O+Na_2O (9.3-8.7 wt.%). Petrographic and geochemical features show that they are highly fractionated A-type granites. The TMGs are enriched in light rare earth elements (LREEs) relative to heavy REEs, have weakly negative Eu anomalies and are depleted in Nb, Ba, P and Ti. In contrast, the GBMGs and MGs have tetrad-type REE patterns ($TE_{1,3} > 1.1$) with strongly negative Eu anomalies and are extremely depleted in Ba, Sr, P and Ti. The TMGs (583 ± 29 Ma) are characterized by relatively low initial $^{87}Sr/^{86}Sr$ ratios (0.70382-0.70337) that suggests their derivation from a depleted mantle source, with little contamination from the older continental crust. By contrast, the TMGs and MGs has very high $^{87}Rb/^{86}Sr$ and $^{87}Sr/^{86}Sr$ ratios that reflect the disturbance of the Rb-Sr isotopic system and may give an indication for the high temperature magma-fluid interaction. Abu-Diab granitoids are characterized by positive $\epsilon Nd(t)$ values (4.41-6.57), corresponding to young Nd-T_{DM2} ages ranging from 956 to 921 Ma, clearly reflect the juvenile crustal nature and preclude the occurrence of pre-Neoproterozoic continental crust in the ANS. We suggest that Gabal Abu-Diab granitoids were generated by partial melting of pre-existing calc-alkaline I-type granodiorites followed by subsequent fractionations.