Mount Claudionis plutonic complex, Egypt: Geochemistry and implications for a transitional oceanic- to a mature continental arc

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Mount Claudionis represents a large, volumetrically significant composite batholith occurring in the northern part of the Nubian Shield, Egypt. This Late Proterozoic batholith contains diorite, quartz-diorite and tonalite lithologic varieties, consisting of variable contents of quartz, sodic-calcic plagioclase, K-feldspar, calcic-amphibole and biotite, with accessory titanite, zircon, apatite, magnetite, rare ilmenite and minor secondary minerals (chlorite and epidote). It exhibits a wide range of SiO2 (58.8-73.7 wt%), Al2O3 (14.0-20.5 wt%), CaO (2.0-6.5 wt%), Na2O (3.3-6.0 wt%), Sr (75-968 ppm), Rb (11-71 ppm), Zr (73-231 ppm), and REE (sum REE, 43-130 ppm). The suite is depleted in Ti, K, Rb, Nb, Y, Hf, and HREE. Chondrite-normalized REE patterns mostly exhibit a small positive Eu-anomaly, and are moderately fractionated (Ce/Yb, 20-56). The calc-alkaline trend of this volumetrically significant suite, along with its REE patterns that are typical of arc-related rocks reflect the orogenic nature of magmatism. The suite contains strong arc geochemical signatures indicative of melting of a subducted oceanic crust. These include Nb and Ti depletions, large Ba enrichment, high Sr/Y ratios (58, on average), and Zr/Sm ratios (45, on average) that are greater than the chondritic value of 28. In addition, its relatively high Al2O3 and Na2O contents, along with its low K2O/Na2O ratios (0.38, on average) are also consistent with typical slab melts. The suite resulted first by the emplacement of a dioritic magma, derived by partial melting of a mafic crustal source above a Pan-African subduction zone, and fractionated (plagioclase, amphibole and magnetite) to give the more felsic varieties. The magma was developed at the syn-orogenic stage of the Pan-African compression - accretion event, possibly during a transitional phase from an oceanic-, to a mature continental arc.