

Geochemistry and Petrogenesis of High-K Calc-Alkaline Granitic Rocks of Song, Hawal Massif, N. E. Nigeria

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Abstract : The global downfall in fossil energy prices and dwindling oil reserves in Nigeria has ignited interest in the search for alternative sources of foreign income for the country. Solid minerals, particularly Uranium and other base metals like Lead and Zinc have been considered as potentially good options. Several occurrences of this mineral have been discovered in both the sedimentary and granitic rocks of the Hawal and Adamawa Massifs as well as in the adjoining Benue Trough in northeastern Nigeria. However, the paucity of geochemical data and consequent poor petrogenetic knowledge of the granitoids in this region has made exploration works difficult. Song, a small area within the Hawal Massif, was mapped and the collected samples chemically determined in Activation Laboratory, Canada through fusion dissolution technique of Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Field mapping results show that the area is underlain by Granites, diorites with pockets of gneisses and pegmatites and that these rocks consists of microcline, quartz, plagioclase, biotite, hornblende, pyroxene and accessory apatite, zircon, sphene, magnetite and opaques in various proportions. Geochemical data show continuous compositional variation from diorite to granites within silica range of 52.69 to 76.04 wt %. Plot of the data on various Harker variation diagrams show distinct evolutionary trends from diorites to granites indicated by decreasing CaO, Fe₂O₃, MnO, MgO, Ti₂O, and increasing K₂O with increasing silica. This pattern is reflected in trace elements data which, in general, decrease from diorite to the granites with rising Rb and K. Tectonic, triangular and other diagrams, indicate high-K calc-alkaline trends, syn-collisional granite signatures, I-type characteristics, with CNK/A of less than 1.1 (minimum of 0.58 and maximum of 0.94) and strong potassic character ($K_2O/Na_2O > 1$). However, only the granites are slightly peraluminous containing high silica percentage (68.46 to 76.04), K₂O (2.71 to 6.16 wt %) with low CaO (1.88 on the average). Chondrite normalised rare earth elements trends indicate strongly fractionated REEs and enriched LREEs with slightly increasing negative Eu anomaly from the diorite to the granite. On the basis of field and geochemical data, the granitoids are interpreted to be high-K calc-alkaline, I-type, formed as a result of hybridization between mantle-derived magma and continental source materials (probably older meta-sediments) in a syn-collisional tectonic setting.

Keywords : geochemistry, granite, Hawal Massif, Nigeria, petrogenesis, song

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