# Petrology and geochemistry of K-rich Paleoproterozoic Birimian granitoids of the West African Craton, northern Ghana: Petrogenesis and tectonic implications

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Granitoids of different generation intrude the Paleoproterozoic Birimian sedimentary basins and greenstone belts of the West African Craton. Intruding Bole-Nangodi belt, which is one of the Birimian greenstone belts, are potassic-rich granitoids. These K-rich granitoids are believed to be relatively younger compared to other granitoid intrusions of the Paleoproterozoic Birimian Supergroup. The K-rich granitoids may be classified broadly as granite, pegmatite/aplite associations, granodiorites and adamellites. They are composed of K-feldspar, quartz, ±plagioclase, ±hornblende, ±pyroxene, ±biotite and ±muscovite. Accessory minerals include opaque oxides/sulphides, titanite, zircon, epiodote, allanite, carbonate, fluorite and apatite. Potassium contents can be as high as 5 wt% with general high concentrations of Rb, Ba, Sr, Cr and Ni. The K-rich granitoids are calc-alkaline highly fractionated I-type granitoids. They are enriched in LILEs and depleted in HFSEs relative to early Proterozoic upper continental crust. Chondrite normalized rare earth element plot indicate fractionated LREE patterns (average $La_N/Sm_N$=5.05) and HREE patterns ($Gd_N/Yb_N$ = 4.56) with dominantly slight negative Eu anomalies (average $Eu/Eu^*$=0.75). The K-rich granitoids record $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$ ratios in a range of 0.7090-1.8622 and 0.5109-0.5129, respectively, with initial $^{87}Sr/^{86}Sr$ and initial $^{143}Nd/^{144}Nd$ ratios in the range of 0.5987-1.8115 and 0.5099-0.5101, respectively. $\varepsilon Ndt_{(2.1\ Ga)}$ values range from -1.0 to +8.3 with $Nd_{(TDM2)}$ model age of 2.2-1.7 Ga (for the older and younger rocks respectively). Petrological and geochemical characteristics of these rocks suggest that the K-rich granitoids are arc related, and emplaced under post-orogenic and syn-collisional tectonic settings, at temperatures of approximately 680-750°C and pressures of 3.4 kbar for the granites and 17.1 kbar for the adamelites. Thus, initial thickening of crust by arc-collision (continental), followed by slab subduction under high pressure and temperature conditions resulting in underplating of mafic magmas in shallow crustal levels is likely to have generated these K-rich granitoids.

**Keywords:** Paleoproterozoic, Birimian, potassium rich granitoids, petrology, geochemistry, petrogenesis