Petrogenesis and Geochronology of the late-Archean Na-rich A Type granite from the Bundelkhand Craton, India: Implication for tectonic and crustal evolution

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Tonalite-trondhjemite-granodiorite gneisses (TTG) are the oldest litho-units of the Bundelkhand craton. The supracrustal rocks include variable deformed mafic volcanics and Banded Iron Formation. Magmatic zircons from the TTG’s yield an upper intercept of ~ 3590 Ma. The TTG’s gradually grades to a Na-feldspar rich A type porphyric granite towards the south. In this abstract, we report mineralogical, geochemical, and geochronological information of high silica- low Ca - high Na A-type granite from Bundelkhand craton.

In the TAS diagram, the studied samples plot in the field of granite and have a metaluminous affinity with high Ga/Al and Ce + Y + Nb + Zr values typical of A-type granites. In a primitive normalized multi-element spider diagram, the studied samples exhibit negative Nb, Ti, and P anomalies characteristics of a subduction zone setting. The chondrite normalized REE’s exhibit a strong fractionated pattern with negative Eu anomaly; the LREE are enriched and the HREE depleted with moderate to high (La/Yb)CN ratios ranging from 11.12 to 26.24 ppm. The studied samples have plagioclase compositions that vary from \( X_{Ab} = 0.980-0.997 \) and chlorite compositions varying from \( X_{Mg} = 0.309-0.469 \).

Phase equilibria modeling yield an emplacement temperature of 700-750°C, at 1.0 GPa. Most of the zircon grains are prismatic with visible cores and rims in optical examinations. In a U-Pb concordia diagram, the grains yield an upper intercept of 2536.6 ± 1.8 Ma. The geochemical and geochronological data taken together, indicate the Na-rich A-type granite generated by the high temperature and high-pressure partial melting of Archaean supracrustal rocks.