

TTG and the genesis of early continental crust: Insights from the Aravalli – Bundelkhand protocontinent, India

HIREDYA CHAUHAN^{1*}, ASHIMA SAIKIA¹, T. AHMAD², T. KAULINA³, T. BAYANOVA³

¹Department of Geology, University of Delhi, India
(*correspondence: hiredyageosci@gmail.com)

²Jamia Millia Islamia University, New Delhi, India

³Geological Institute of the Kola Science Center,
Apatity, Russia

The origin of tonalite-trondhjemite-granodiorite (TTG) is a matter of scientific debate. In the present study, TTGs of both the Aravalli and Bundelkhand craton show distinct groups at microscopic scale based on mineral assemblages though the geochemical results are almost similar. Geochemical data of TTGs from both the craton shows a wide spectrum of SiO₂ composition (65-75wt%), exhibiting peraluminous characteristics ($1 < A/CNK$) with a modal range from trondhjemite to granodiorites. The tectonic discriminant plot suggests a volcanic arc setting while REE pattern shows fractionation of Ti-bearing phases along with the involvement of crustal components. U-Pb TIMS Zircon chronology of Aravalli TTGs yield the discordant age of 2680 ± 30 Ma and is interpreted as an age of magmatic crystallization of tonalite for the Aravalli Craton. These zircons have moderate to high U contents (180-770 ppm) with low Th/U ratios (0.2-0.5), characteristic for magmatic zircons. While U-Pb SIMS Zircon chronology from Bundelkhand craton yields the older concordant age of 3327 ± 4.5 Ma (core) and younger concordant age of 3301 ± 2.2 Ma (rims). EPMA mineral chemistry data of biotite and calcic amphiboles from Bundelkhand granitoid, suggests that these granitoid formed from calc-alkaline magma produced in subduction environment, however, the geochemical proxies for slab-melts ($Sr/Y > 40$, $(La/Yb)_{n>20}$, $Mg \# > 50$) are solely not in favour of a slab melting origin for the Aravalli TTG rocks. In the given scenario, the evolution of the TTGs can be best explained by the episodic partial melting of the thickened mafic crust formed at variable depths.