Archean crustal evolution in the Bundelkhand Craton, India: constraints from whole rock Sr-Nd and zircon U–Pb/Hf isotopes

K. BATUK JOSHI1*, SUNIL K. SINGH1, STEPHANIE LASALLE2, PENELPE J. LANCASTER2, CRAIG D. STOREY2, MIKE FOWLER2, TALAT AHMAD3, JAANA HALLA4, VINAI K. RAI1

1Geoscience Division, Physical Research Laboratory, Ahmedabad, India; kr.batukjoshi@gmail.com
2School of Earth and Environmental Sciences, University of Portsmouth, UK
3Vice Chancellor Office, Jamia Millia Islamia, Delhi, India
4University of Helsinki, Finland

The formation and reworking of the continental crust is of great importance for understanding the early evolution of the Earth. Combining U-Pb/Hf isotopes in zircons with whole rock geochemical and Sr–Nd isotopic data can provide new insights on petrogenetic mechanisms, timing of magmatic events, crust-mantle interactions and magma sources for crustal material. Here we present a combined dataset of in situ zircon U–Pb and Hf as well as whole-rock Sr and Nd analyses for Archean TTGs and geochemically variable high-K granitoids from the Bundelkhand Craton, India. U–Pb zircon ages reveal that the TTGs were emplaced at 3.42 Ga, 3.33 Ga and 2.72 Ga, while the high-K granites, including sanukitoids, were emplaced between 2.57 Ga and 2.54 Ga. The high-K granitoids have higher initial $^{147}$Sr/$^{86}$Sr isotope ratios than the TTGs. They also display a lower range in initial $\varepsilon$Nd and $\varepsilon$Hf values (from -8 to -1 and -8.9 to +0.4, respectively) compared with the TTGs (from -4 to -1.2 and -1.6 to +4.4, respectively). The Hf depleted mantle model ages calculated for high-K granitoids are 3.19–2.86 Ga and for TTGs 3.71–3.48 Ga. The U–Pb ages and chondritic to superchondritic $\varepsilon$Hf values of the TTGs provide evidence for a long-term episodic growth of juvenile crust from depleted mantle reservoirs between 3.4 and 2.7 Ga. The strongly negative $\varepsilon$Nd and $\varepsilon$Hf values of the high-K granitoids, together with geochemical features (variable compatible and incompatible elements) indicate that they were a result of multi-stage reworking of the Paleo- to Neorarchean crust and mixing with magmas extracted from an enriched mantle source during a relatively short-lived tectonic event at the end of the Archean.