

Archean crust-mantle evolution: constraints from the Singhbhum Craton, eastern India

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The continental crust is the record book of the Earth's geological history. Its origin and evolution is still a matter of considerable debate. One of the major difficulty in investigating Precambrian crustal processes is that exposed Archean cratons account for only ~5% of the total continental surface area [1]. Later multiple tectonothermal overprinting of the rocks makes the study of Archean crustal evolution even more challenging.

The Singhbhum Craton in eastern India has extensive occurrences of Paleoproterozoic crust and is of potential geological significance for Archean crust-mantle evolution studies. The craton exposes large regions of well preserved, a very old (mostly 3.5-3.3 Ga) sialic crust that was cratonized at around 3.1 Ga [2]. The Singhbhum granite batholith (SGB) covers most of the craton. Enclaves of metasedimentary rocks commonly referred as Older Metamorphic Group (OMG) and TTG gneisses referred to as Older Metamorphic Tonalite Gneisses (OMTG) can be found within the SGB. The emplacement of SGB has occurred in two episodes at 3.45-3.44 Ga and 3.35-3.32 Ga. The tonalites and trondjemites of the OMTG were emplaced at ca. 3.45-3.44 Ga and granites belonging to OMTG were emplaced at ca. 3.35-3.32 Ga [3].

The granites and TTG show enriched LREE and depleted HREE pattern which is typical for Archean upper crust. Lead isotopes from leached K-feldspar mineral separates from different felsic igneous rocks of SGB and OMTG reveal a homogeneous relatively undepleted mantle source and pristine character of the rocks. The Sr and Nd isotopes are very close to the chondritic values. The combined isotope characteristics indicate that only minor mantle depletion occurred before this major crust formation episode and only very small regions of enriched continental crust existed prior to 3.5 Ga or were mixed back into the mantle during the Early Archean.

[1] Nisbet (1987) Allen&Unwin, Boston

[2] Roy & Bhattacharya (2012) JGSI **80**, 445-469

[3] Upadhyay et al. (2014) Precambrian Research **252**, 180-190