



Physical Research Laboratory
Geosciences Division

Tuesday Seminar

Cratons to supracrustal belts: growth and unification of the Indian landmass

Abstract

Archean crustal terranes (4–2.5 Ga) consist of gray-gneisses referred to as the tonalite–trondhjemite–granodiorite (TTG) suite of rocks. These TTGs constitute > 50 % of the existing Archean crust and represent the oldest archetypical juvenile felsic components of cratons and marks the transition from a dominantly mafic to a more felsic crust. There is also considerable debate on the nature of the petrogenetic and geodynamic processes that generated the early continental crust. Whether conventional plate tectonics operated in the Archean, the way it switched over in Proterozoic, and when these came into existence remains unclear. The Singhbhum craton in eastern India is underlain by Paleo - to Mesoarchean TTGs and granites that formed in two pulses at 3.45–3.44 Ga and 3.35–3.32 Ga, followed by potassic granite activity at 3.1 Ga. Low heavy-REE concentrations, Sr/Y and Eu/Gd, and high Nb, Ta, and Y concentrations indicate they belong to the low HREE, medium- to low-pressure TTG type. Their compositions are similar to TTGs derived from chondritic source with amphibolitic residue, consistent with rutile-free and garnet-bearing metabasic source. The younger granites represent intracrustal melts of more potassic members of the Paleoproterozoic TTGs. The trace element characteristics of the granitoids reflect melt generation at different depths in a tectonic setting producing both TTGs as well as granites contemporaneously. Plausible geodynamic settings could be very hot subduction or “dripduction” regime involving shallow melting of delaminated mafic crust producing the 3.45 Ga juvenile TTGs and minor granites. Large-scale delamination and melting of mafic lower crust and felsic protocrust in a thickened crustal pile in a subduction-like regime could have produced granitoids with juvenile as well as recycled isotopic signatures. The Nd-Hf isotope data indicate that the Paleoproterozoic upper mantle was moderately depleted in response to a spurt in Paleoproterozoic continental growth.

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Date
15-September-2020

Time
16:00 Hrs

Venue
Online Platform

All are invited to attend and participate in discussion

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