

Controls of *P-T* path and element mobility on the formation of corundum pseudomorphs in Paleoproterozoic high-pressure anorthosite from Sittampundi, Tamil Nadu, India

PRIYADARSHI CHOWDHURY¹, MOUMITA TALUKDAR¹, PULAK SENGUPTA^{1,*}, SANJOY SANYAL¹ AND DHRUBA MUKHOPADHYAY²

¹Department of Geological Sciences, Jadavpur University, Kolkata 700032, India

²Department of Geology, University of Calcutta, 29, Ballygunge Circular Road, Kolkata 700019, India

ABSTRACT

The Archaean Sittampundi Layered Magmatic Complex (SLC) of south India is interpreted as a part of the oceanic crust that formed in a suprasubduction zone setting. The assemblage corundum + anorthite + amphibole (magnesiohornblende to tschermakite to pargasite) + clinozoisite (C₁PACz) developed in highly calcic anorthosite of the SLC at the culmination of a ca. 2.46 Ga tectonothermal event. Changing physicochemical conditions during this early Paleoproterozoic (Siderian) event produced spinel + anorthite + second generation amphibole through destabilization of corundum + first generation amphibole. Spinel retains the shape of the corundum that it replaces (spinel pseudomorphing corundum, SCP) and is surrounded by a rind of plagioclase that separates spinel from the matrix amphibole. Development of the assemblage chlorite + clinozoisite + secondary corundum after spinel + anorthite + amphibole marks the terminal metamorphic event in this area. Mass-balance calculations on pseudomorphs and modeling of preserved reaction textures show that Na, Mg, Ca, and silica were mobile during the formation of the SCP. Al and Fe were mobile at the grain scale but remained immobile in the scale of a thin section. Activity adjusted partial petrogenetic grid in the systems Na₂O-CaO-Al₂O₃-SiO₂-H₂O (NCASH) and Na₂O-CaO-MgO-Al₂O₃-SiO₂-H₂O (NCMASH) along with the mineralogy of the rocks that were co-metamorphosed with the anorthosite show that (1) the assemblage C₁PACz was formed during high-pressure metamorphism (11 ± 1 kbar and 725 ± 25 °C), (2) SCP and the plagioclase rind around it were formed during exhumation of these higher pressure rocks to lower pressure (7 ± 1 kbar, 675 ± 50 °C) along a steeply decompressive retrograde *P-T* path, and (3) post decompression cooling and hydration at near isobaric condition triggered the formation of the chlorite–clinozoisite–secondary corundum assemblage (6–8 kbar, <620 °C). The inferred *P-T* path is consistent with the view that the studied area that represents Archaean oceanic crust of SSZ affinity was subducted and subsequently exhumed during the early Paleoproterozoic orogeny.

Keywords: Sittampundi, anorthosite, corundum pseudomorph, oceanic crust, subduction zone