



Geochemical and Geochronological Studies on Titanites from the Granitoid Rocks of the Eastern Dharwar Craton, South India

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Titanite is an accessory mineral which occurs in most granitoid and intermediate igneous and metamorphic rocks. Titanite accommodates geologically significant trace elements such as the REEs and actinides. Higher abundance of U and Th compared to Pb makes it possible to date igneous and metamorphic events using titanites. The elevated REE concentration in titanites makes it an important phase to consider in geochemical modeling of granitoid petrogenesis.

The Dharwar Craton in south India is composed of Peninsular gneisses interspersed with several Archean greenstone belts, Proterozoic basins and younger granitic batholiths. It is subdivided into an eastern and a western cratonic domain by a shear zone that forms the eastern boundary of the Chitradurga schist belt. The Eastern Dharwar Craton is known for the presence of several Au-bearing schist belts such as the Kolar, Ramagiri and Hutti Schist Belts, which are surrounded by Late Archean granitoid rocks. U-Pb isotope studies on titanites and zircons from the granitoids of Hutti have been carried out to date crystallization and metamorphic histories of granitoid rocks. The REEs and geochemically important trace elements such as Y, Nb, Ba, Sr, U and Pb from the titanites from the granitoid rocks of Kolar and Ramagiri have been studied to understand the petrogenesis of these granitoids.

U-Pb systematics of titanites separated from Hutti granitoids the Hutti schist were studied to obtain time constraints on their petrogenesis. The northern pink granodiorites from Golapalle and Yelagatti yielded U-Pb ages of 2577 ± 9 Ma and 2532 ± 3 Ma, respectively. The western gray granodiorites are 2555 ± 3 Ma old and the eastern granitoids from Watgal and Gajalagatta are 2549 ± 3 Ma and 2544 ± 11 Ma old. These titanite ages are indicative of different phases of granitoid intrusion around the Hutti Schist Belt.

The titanites from granitoids of the Kolar and Ramagiri schist belts show pronounced variations in the REE concentrations in titanites depending on rock type. The results obtained on the titanites from granitoids of Kolar show predominantly light-REE depleted and middle-REE enriched patterns. However, three samples show severe Eu depletion and no light-REE depletion when normalized to their whole rock. The titanites from granitoids surrounding Ramagiri schist belt show middle-REE enriched and light-REE depleted patterns with negative Eu anomalies when normalized to their whole rock. Titanites from migmatized granitoids have higher REE abundance and more pronounced Eu anomalies compared to other granitoids. Presence of titanites as residual or fractionating phase during partial melting or fractional crystallization will significantly deplete the REEs in the derived magmas.