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Geochemistry and Petrogenesis of Dioritic-Granodioritic Rocks from Bundelkhand Craton: Implications for Precambrian Crustal Evolution in Central Indian Shield

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Abstract

Bundelkhand craton, in the central Indian region, grew during Meso-Archaean to early Proterozoic (ca. 2.5Ga). Unravelling its geochemical and petrogenetic history is a pre-requisite for elucidating the Precambrian evolution of continental crust in Central India. Crustal growth and secular evolution of the craton is distinguished by emplacement of tonalite-trondhjemite-granodiorite (TTG, ca. 3.3Ga) followed by a distinct tectono-magmatic event near the Archaean-Proterozoic boundary (~2.5Ga) resulting in voluminous magmatic (granitic-basaltic) activities. The studied granitoids from the Bundelkhand massif display a continuous series of evolution from more mafic to felsic compositions varying from dioritic to granodioritic rocks. They are mostly unscathed, massive, but at places, have undergone some deformation. Epidote-veins, quartz-veins and mafic magmatic enclaves (MMEs) are also visible, restricted along planes of weakness. Quartz, plagioclase and K-feldspar are amongst the essential minerals while, hornblende, biotite, pyroxenes, apatite, titanite, allanite, zircon and opaques form the accessory phases. The geochemical data on spatially close and petrologically consanguineous samples indicates that these are I-type, metaluminous and dominantly magnesian in character. The classical calc-alkaline differentiation trend displayed by most of these granitoids evinces subduction environment besides strong negative Nb, P, Ti anomalies, favouring collisional environment. The granodioritic samples show more enriched REE concentrations and slightly higher abundance of all the elements in the spider diagram as compared to the diorites. Difference in the trace elements and REE abundances indicates heterogeneous sources and large variation in the degree of partial melting and/or effect of crustal contamination. It is proposed that initially there was partial melting in the mantle wedge, which resulted in the generation of mafic magma that evolved to dioritic melts. The mafic magma then interacted with crustal/lithospheric sources and supplied the required additional heat and fluid flux, resulting in the generation of more felsic granodiorites with varying chemical characteristics.

Keywords: Bundelkhand craton, Central Indian Shield, Diorites, Granodiorites, Geochemistry, Trace elements