Petrology and geochemistry of post-tectonic dykes in Tiptur area, Western Dharwar craton, Southern India

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Mafic dyke swarms are one of the major geologic features that represents crustal extension episodes during which basaltic material from the mantle is transferred to the continental crust. The study of these dykes will help to understand the nature and composition of the mantle source. The emplacement of dykes is regarded as one of the final stages of cratonization and hence the study of these dykes throws light into the accretionary history of the craton. In the Dharwar craton of Southern Peninsular India, mafic dykes are densely spread like other Precambrian terranes of the world. Although dykes are well distributed in Dharwar craton, only those of Eastern part of the craton have been extensively studied and less attention has been given to the detailed petrologic, geochemical and geochronological studies of the dykes in the Werstern Dharwar Craton (WDC). Studying the mafic dykes in the WDC will help to understand the activity of the craton during Late Archean to early Proterozoic and this will help to obtain a complete picture of the tectonic evolution of Dharwar craton.
One of the major dyke swarms in the WDC is Tiptur dyke swarm, where NE-SW as well as NW-SE dykes are densely distributed. Preliminary petrological studies were carried out to understand the nature and composition of this dyke swarm and the studied dykes falls into two distinct groups. The NW-SE trending dykes were unaltered, composed predominantly of plagioclase and pyroxenes with minor opaque minerals. The NE-SW trending dykes showed high degree of alteration with the preservation of only 50% or less remnant ophitic textures as well as original mineralogy. The bulk rock geochemical analysis using XRF has been conducted. Loss on ignition were found to be less than 1% for all the samples. In the wt% of major oxides, SiO_2, CaO, Fe_2O_3 and alkalies shows smaller variations whereas MgO and Al_2O_3 show large differences. The overall chemical composition of the dykes indicate sub-alkaline tholeiitic nature with the NE-SW dykes falling into basalt field and NW-SE dykes in basaltic andesite fields. In the trace element geochemical characteristics, an overall enriched pattern is observed. Primitive mantle-normalized multi-element diagram of NW-SE dyke samples showed an LILE enriched pattern. Significant negative Nb and Ta anomaly along with a negative correlation between Zr and Sr is observed which may indicate the interaction of continental/ oceanic materials through subduction process. NE-SW dykes shows a slight LILE enrichment. Chondrite-normalized REE diagram shows that the NW-SE dykes have an LREE enrichment and flat HREE pattern whereas a relatively flat pattern for both LREE and HREE for NE-SW dykes. The $(La/Lu)_N$ ratio for NW-SE dykes is >2, which indicate derivation from a more enriched source and for NE-SW dykes is <2 indicative of a depleted mantle source. Immobile incompatible element (Th-Yb-Nb) distribution also indicate an enriched mantle source for NW-SE dykes and a depleted or more primitive mantle source for NE-SW dykes.
Preliminary assessment of petrologic and geochemical features suggest that NW-SE dykes and NE-SW dykes may not be co-genetic, they might have formed from different mantle sources and might have emplaced in two different episodes. The NW-SE dykes of the present study is comparable to the dyke swarms in the eastern Dharwar craton which is linked to the global mafic magmatism at around 2.2 Ga that led to intracontinental rifting and related breakup of Archean continents. Based on mineralogy and alteration index the NE-SW dykes can be thought to be a part of an older event. WDC being older than the EDC, the NE-SW dykes might be older than the NW-SE dykes and might have emplaced prior to the amalgamation of the current eastern and western part of the craton, and carry important information on mantle dynamics in the Archean and Paleoproterozoic, although age dating of the dykes is essential to

confirm their temporal and spatial relations.

Keywords: Mafic dyke swarms, Precambrian, Dharwar craton

