Preliminary paleomagnetic studies on the mafic dykes in Western Dharwar craton, South India.

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Mafic dykes of varying dimensions and ages are well exposed all along the Archean Dharwar craton of south India. The mafic dykes in the Eastern Dharwar craton (EDC) have been studied in detail by several researchers previously (French and Heaman, 2010; Kumar et al., 2012, Srivastava et al., 2014). However, limited information is available for the dyke in Western Dharwar craton (WDC) and is considered in the present study. Representative samples were collected from dykes in the WDC and detailed petrography and geochemistry were carried out. The thin section observation revealed two different types of dykes based on the mineral assemblage, texture and the degree of alteration. First category of dykes is dolerites with typical ophitic texture and lath-shaped plagioclase. The other group of dyke samples showed high degree of alteration and remnant ophitic textures with the preservation of very less plagioclase laths as well as original mineralogy. This group termed as meta-dolerites, because of the prominent metamorphism. The dolerites and meta-dolerites are found to exhibit different distribution of major oxides as well as distinct trace and rare-earth element concentrations (Silpa and Satish-Kumar, 2018). The difference in petrography and geochemistry between the dolerites and meta-dolerites can lead to a preliminary inference that these two suits of rocks might not be co-genetic.

Understanding paleo- positions in which the dykes were emplaced is key while correlating the present, spatially distant cratons. Paleomagnetic studies will help to understand the paleo-position of the cratons and mafic dykes are expected to provide excellent records of the earth’s magnetic field as they cool rapidly when emplaced (Belica et al., 2014). For the preliminary paleomagnetic analyses, 86 core specimens were prepared from 33 sites including both dolerite and meta-dolerites and progressive demagnetization experiment has been conducted to assess the stability of natural remanent magnetization (NRM). Pilot specimens were subjected to alternating-field or thermal demagnetization and the NRMs were measured with a spinner magnetometer. Dolerite specimens yielded better magnetic behaviors with stable magnetic components. On the other hand, meta-dolerites show magnetic components probably carried by pyrrhotite and the magnetic behaviors were very unstable. Fig. 1 shows demagnetization behaviors of dolerite sample plotted on orthogonal vector-endpoint diagrams and equal area stereonets.

Studying the dykes in the Dharwar craton is key to understanding the evolution of the mantle during the Precambrian, especially in the Archean to Proterozoic transitional period. Dykes are emplaced after the period of major continental crust formation at around 2.7 Ga and hence the variation in mantle composition through time can be constrained. The dykes can be a result of a plume activity or an indicator of large igneous province and hence the study of which will give valuable information about the mantle source, the degree of melting and the source regions where melting occurred. Dyke swarms and LIPs are the products of major magmatic events in the Earth’s history that probably was the driving force in the breaking up of supercontinents, and they provide clues regarding the cratonic evolution through time. Due to their wide distribution, geochemically coherent dykes can be found in many cratons, thus providing key information on the close proximity of now separated supercontinents.

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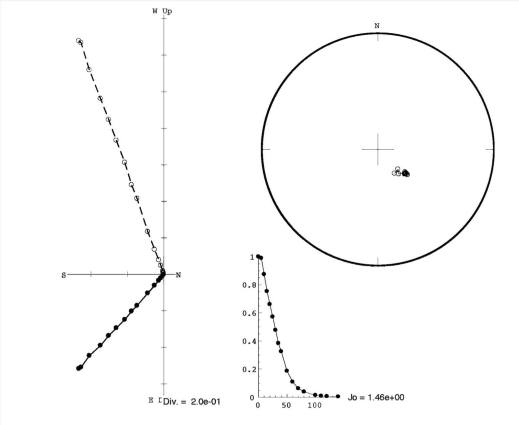

Fig. 1. Orthogonal vector plot, equal area stereonet and alternating-field demagnetization behavior for the dolerite showing typical characteristic remanent magnetization directions.

