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Mapping the Dyke Swarms Emplaced within the Different Archean Cratons of the Indian Shield Using Google™ Earth Images and ArcGIS™ Techniques

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The Indian shield comprises a number of Archean–Paleoproterozoic cratonic blocks and predominantly Meso –Neoproterozoic mobile belts with Archean protoliths. All these ancient cratons were thought to be integral parts of the various supercontinents that have existed back through Earth's history. Dykes are very conspicuous throughout entire Indian shield, but are especially common in its component Archean cratons. Dykes can be grouped into distinct swarms on the basis of trend, emplacement age, composition, and paleomagnetic direction. It is also now established that many large dyke swarms form integral parts of Large Igneous Provinces (LIPs), which represent large volume, short duration (or pulsed) igneous events of intraplate character that provide a record of intraplate mantle melting events through time and may be correlated to mantle plumes, continental rifting and supercontinent break-up.

We provide a progress report on our efforts to map and characterize the distinct dyke swarms of the different Archean cratons in the Indian shield, viz. Aravalli, Bundelkhand, Bastar, Singhbhum, eastern & western Dharwar, and Southern Granulite Terrain (SGT), using Google™ earth images and ArcGIS™ techniques. Besides showing the distribution of the swarms, the Google™ earth images are also used reveal relative swarm ages through cross-cutting relationships. The distinct mafic dyke swarms being identified in this study can potentially be linked with coeval magmatic events on other cratons around the globe to identify reconstructed LIPs and constrain continental reconstructions.

In general, the eastern and western Dharwar cratons, and also the SGT, have a shared history of mafic dyke emplacement and related magmatism. These widespread events include the (i) NE–SW to E-W trending 2.36-2.37 Ga Bangalore swarm, (ii) N-S to NNW-SSE trending 2.21 -2.22 Ga Kunigal swarm, (iii) NW-SE to WNW-ESE trending ~2.18 Ga Mahbubnagar swarm, (iv) newly identified N-S to NNE-SSW trending ~2.08 Ga Devarakonda swarm (Demirer, K., 2012: Master's thesis in Geology at Lund University; Kumar et al., 2015: Precamb Res, 266, 490-505*), and (v) 1.88-1.89 Ga NE-SW to E-W trending Bastar (BD2)-Dharwar swarm along with mafic sills of the Cuddapah basin (i.e. the Bastar-Dharwar LIP). Some Cretaceous dykes are also emplaced in coastal region of Kerala (a part of the SGT), and are linked to the 90 Ma Madagaskar LIP. Several distinct mafic dyke swarms, most of them trending NW-SE, are also identified in the Bastar craton. The southern and central parts of the Bastar craton comprise three NW-SE trending mafic dyke swarms viz. ~2.7 Ga BD1, 2.4-2.5 Ga BN, and 1.88-1.89 Ga BD2 swarms. The northern part of the Bastar craton has a different pattern consisting of four swarms viz. NW-SE trending Paleoproterozoic (~2.7? Ga) North Bastar swarm, ENE-WSW trending Paleoproterozoic Dongargarh-Chhura swarm, ENE-WSW trending ~1.42 Ga Bandalimal swarm, and N-S trending 1.44 Ga Lakhna swarm. Some Cretaceous dykes, related to Deccan magmatism, are also known from the Bastar craton.

The northern Singhbhum craton, i.e. Chhotanagpur Gneissic Complex, hosts a E-W to WNW-ESE trending Mesoproterozoic swarm and two Cretaceous mafic swarms viz. NE to ENE trending ~65 Ma high-Ti dolerites and NNW to WNW trending ~110-115 Ma low-Ti dolerites. The latter are likely related to the early Cretaceous Rajmahal magmatism (the Kerguelen Plume) and the former are related to the late Cretaceous Deccan LIP (the Reunion plume). On the other hand, the main part of the Singhbhum craton, i.e. Singhbhum Granite Complex, consists of four mafic dyke swarms viz. (i) 1.76

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-1.77 Ga NW-SE to WNW-ESE trending Pipilia swarm, (ii) 2.25 Ga NE-SW to ENE-WSW trending Kaptipada swarm, (iii) early Paleoproterozoic N-S to NNW-SSW trending Gobardhana-Sankiri swarm, and (iv) ~2.6-2.7 Ga NNE-SSW trending Keshargaria swarm. Two major mafic dyke swarms are identified in the Bundelkhand craton. These include the NW–SE trending ~1.98 Ga Bundelkhand swarm and ENE–WSW to NE–SW trending ~1.11 Ga Mohaba dyke swarm. These swarms are also thought to continue (more sparsely) into the Aravalli craton. Some Neoproterozoic (~750 Ma) mafic dykes are also encountered in the Aravalli craton.

*Kumar et al. (2015) has used the K. Demirer age in his paper together with his ages.