Geochronology of dykes


Joshua H. F. L. Davies, Larry M. Heaman and S. Andrew DuFrame

Anastasiya Gibsher, Vladimir Malkovets and Alexey Travin

M. A. Hamilton and D. G. Pearson

Michael A. Hamilton, K. L. Buchan and J. P. Hodych


Kamleshwar Ratre, Bert De Waele, Tapas Kumar Biswal and Suspa Sinha

Synplutonic mafic dykes

Ksenia Dokukina and Alexander Konilov

R. V. Gireesh, M. Jayananda, T. Miyazaki and T. Kano

M. Jayananda, T. Miyazaki, R. V. Gireesh, and T. Kano

B. C. Prabhakar and M. Jayananda

Santosh Kumar

G. Suresh, K. V. S. Reddy, T. Gopal Reddy, R. C. Hanumanthu and A. Anil Kumar

Ashraf Torkian

Alkaline dykes (including kimberlites, lamproites, lamprophyres and carbonatites)

N. V. Chalapathi Rao, B. Lehmann, D. Mainkar and B. Belyatsky
SHRIMP Geochronology for the 1450 Ma Lakhna Dyke Swarm: Its Implication for the Presence of Eoarchaean Crust in the Bastar Craton and 1450-517 Ma Depositional Age for Purana Basin (Khariar), Eastern Indian Peninsula

Kamleshwar Ratre¹*, Bert De Waele², T. K. Biswal¹ and Suspa Sinha¹

¹Department of Earth Sciences Indian Institute of Technology Bombay, Powai, Mumbai 400 076, India
²Principal Consultant (Geology), SRK Consulting, 10 Richardson Street, West Perth WA 6005, Australia
*E-mail: kratre@iitb.ac.in

Mesoproterozoic dyke swarm (Lakhna dyke swarm) has been reported in the NW margin of the Eastern Ghats in the Bastar craton of the Eastern Indian Peninsula. These dykes are having distinct petrological, geochemical characteristics and structural aspects for understanding the tectonic evolution of the Eastern Ghats and Purana basins. The Cratonic basement consists of the ca.3500 Ma old tonalite-trondjhemite gneisses (TTG) intruded by ca. 2500 Ma old potassic granite. Over the cratonic part several Proterozoic basins have been developed consisting of sandstone, shale and limestone formations which are known as Purana group of the rocks. The Bastar craton has been intruded by several dykes which vary in composition from rhyolite, trachyte, dolerite and gabbro to feldspar porphyry. The major structural trends of the dykes are N-S and NNE-SSW which show cross cut relationship with E-W and WNW-ESE trending dykes. The dolerites are medium grained with major minerals as plagioclase, olivine, and augite. Rhyolite is pink coloured, medium grained with alkali feldspar phenocrysts of amoeboid quartz grains and euhedral orthoclase phenocrysts have been embedded in a fine grained equigranular quartz-feldspathic matrix. At places micrographic texture, spherulitic and replacement textures has been defined. Trachyte is medium grained, light greenish coloured with well developed flow layers which are defined by needle shaped alkali feldspar grains. Glomeroporphyritic texture is developed due to segregation of multiple feldspar phenocrysts. Medium to coarse grained feldspar porphyry dykes occur with abundance of alkali feldspar phenocrysts within fine to medium grained matrix. The matrix show dark colour due to presence of fine grained amphiboles. These are quartz poor and rich in plagioclase and orthoclase and lie in basaltic andesite field in TAS diagram. Alkali gabbro dyke carries alkali feldspar in addition to plagioclase, augite and olivine. The three major dykes have been dated showing ages as: rhyolite 1450 ± 22 Ma, trachyte 1453 ± 19 Ma and gabbro 1442 ± 30 Ma; using zircon U-Pb SHRIMP method. The above age puts a lower time constraint on the sedimentary sequences of the Purana Basin (Khariar Basin) that have been deposited unconformably over the Bastar craton. The shale member of the Khariar Basin shows evidence of synsedimentary shearing suggesting that the sedimentation probably continued up to 517 Ma, the age of shearing and overthrusting of the granulite nappes of the Eastern Ghats Mobile Belt on the craton.
International dyke conferences: a brief history

The first International Dyke Conference (IDC) was held in June 1985 at the University of Toronto, Mississauga Campus, Canada. It attracted over 120 scientists from 20 countries. The meeting was held in response to my realization (Halls 1982) that dyke swarms were key elements to further understanding geodynamic processes. The meeting was unique in that scientists from all parts of the world, especially from countries that had Precambrian shields, had been asked to bring compilation maps of their dyke swarms. The maps were prepared in a uniform format. In the days when only airmail and telex existed, the organization of these maps and arranging the attendance for scientists from distant and hard-to-contact countries was quite formidable! Subsequently a book “Mafic Dyke swarms” (Halls and Fahrig 1987) was published based on the conference proceedings. Shortly after, an IGCP project, number 275, “Precambrian Dyke Swarms” was launched and kept the momentum going in terms of bringing dykes to the attention of the scientific community and a further session “Giant Radiating Dyke Swarms and Mantle Plumes”, that I organized at a 1991 Geological Association of Canada meeting in Toronto, raised the profile of dyke swarms as fundamental expressions of older Large Igneous Provinces, many of which are believed today to represent plume centres. During IGCP 257 the idea was born and finally realized that an International Dyke Conference should be held every five years. An important feature of all IDC meetings is that one or more field trips are held, both before and after the scientific sessions. The second IDC meeting was held in Adelaide, Australia in September 1990 and organized by Peter Rickwood, Dave Tucker and John Parker. It resulted in a volume of the proceedings (Parker et al., 1990). The meeting included a fieldtrip to view dykes in the centre of the Australian outback. Amazingly, despite deep weathering and the often ruinous state of the host granites, the dykes were virtually pristine, testifying to the dryness of the weathering process! The third conference was held in Jerusalem, Israel, in September 1995, where the principal organizer was Gideon Baer and again an excellent Proceedings Volume was produced (Baer et al.1995). A highlight of this meeting was a superb field trip that illustrated the mechanics of dyke intrusion and especially the phenomena arising when baked host rocks are fluid-filled sediments. The fourth meeting was held June 2001 in a game reserve in KwaZula, Natal, South Africa and organized by Mike Watkeys. Again, excellent field trips were organized including ones to the Karoo dolerites and the Rooi Rand dyke swarm along the Indian Ocean coast. Other highlights of IDC4 included a game safari and a wild Zulu dance during the final banquet, featuring the meeting organizers themselves, in flesh-revealing traditional costumes! IDC5 was held July - August 2005 in Rovaniemi, in the centre of Finland, and organized by Jouni Vuollo and Lauri Pesonen. It included a wonderful field trip that crossed the border into Russia, ending in the Kola Peninsula. Many dykes and dyke swarms were revealed for the first time to the participants and stimulated furious reconstructions of paper continental cut-outs by some of them immediately after the trip! A volume of conference papers (Hanski et al. 2006), was subsequently published, including contributions from IDC4.

Throughout the last 25 years I should acknowledge the tremendous efforts of Richard Ernst and Ken Buchan for their monumental map compilations of dyke swarms, not only within Canada but throughout the world and for their efforts to integrate studies of dyke swarms into the wider context of Large Igneous Provinces and continental reconstructions. Tables that provide summaries of all known dyke swarms (e.g. Ernst and Buchan 2001) are also key publications that stitch the various IDC meetings together. Their efforts in helping to publicize studies of dykes through a web site (www.manteplumes.org) are also enthusiastically acknowledged!

The sixth International Dyke Conference, convened by Rajesh Srivastava, is to take place in historic Varanasi, India. The meeting has been preceded by a timely publication on Indian dykes (Srivastava et al. 2008) that has undoubtedly helped to advertise IDC6 which has over 150 abstracts, the largest ever for an IDC meeting! Fieldtrips both before and after the scientific sessions will surely maintain the high tradition of previous IDC meetings. This meeting celebrates the quarter century of the first meeting in Canada and will focus attention upon the dyke swarms of India and the key role that they promise to play for reconstructing continental configurations in the geological past. I wish Rajesh and the conference organizing committee my very best wishes for an outstanding and scientifically-rewarding meeting.

References: