24. Salceda, V. M. and Anderson, W. W., *Proc. Natl. Acad. Sci. USA*, 1988, **85**, 9870–9874.
25. Anderson, W. W. and Brown, C. J., *Genetics*, 1984, **107**, 577–589.
26. Spieth, H. T. and Ringo, J. M., in *The Genetics and Biology of Drosophila* (eds Ashburner, M., Carson, H. L. and Thompson, J. N.), Academic Press, New York, 1983, vol. 3, pp. 223–284.
27. Chatterjee, S. and Singh, B. N., *Indian Rev. Life Sci.*, 1989, **9**, 101–135.
28. Singh, B. N., *Indian J. Exp. Biol.*, 1997, **35**, 111–119.

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Petrography of Lamprophyre Dikes from nunataks South of Schirmacher, Central Dronning Maud Land, East Antarctica

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A number of lamprophyre dikes intrude the ortho- and pelitic gneisses of Central Dronning Maud Land (cDML) in East Antarctica. In the four nunataks – Baalsrudfjellet, Starheimtind, Sonstebynuten and Pevikhornet, the lamprophyres exhibit three distinct mineral assemblages, biotite–clinopyroxene, biotite–clinopyroxene–olivine and biotite–clinopyroxene–hornblende. Ocelli are invariably feldspathic in composition (Type 2). Based on the mineral assemblage and composition of the ocelli, the dikes have been grouped under calc-alkaline lamprophyre clan.

CENTRAL Dronning Maud Land (cDML) represents a part of the East Antarctic Proterozoic Metamorphic Belt. The intrusion of lamprophyre dikes in the predominantly gneissic country of cDML, East Antarctica, represents the end phase of the ~ 600 Ma Pan-African event in the East Gondwana[1]. In the four nunataks–Baalsrudfjellet, Starheimtind, Sonstebynuten and Pevikhornet, lying 30-km south-east of Schirmacher Oasis in cDML (Figure 1), a number of lamprophyre dikes intrude the biotite–garnet–bearing orthogneiss and biotite–sillimanite–garnet-bearing pelitic gneiss. The occurrence of lamprophyres in these nunataks has been reported earlier[2] and this note describes the field and petrographic aspects of these lamprophyres.

The lamprophyres, trending NE-SW to ENE-WSW, with steep southerly to subvertical dips, occur as thin dikes (20–60 cm wide and 50–60 m long). They have sharp contact with the host gneisses and are devoid of chilled margins, suggesting that the melt channel-ways acted as long-lived feeders to lava, thus allowing gradual heating up of the country rocks.

Megascopically, all the lamprophyres are mesocratic to melanocratic, compact, fine-grained and show porphyritic texture. Phenocrysts are uniformly distributed and no zonation is observed. The dominant phenocryst biotite is set in greenish-grey to dark-grey matrix. Ocellar structures of 1–3 mm across (Figure 2) are observed in the lamprophyres of Baalsrudfjellet. The ocelli have lower colour index and sharp boundaries with the matrix. The lamprophyres from Sonstebynuten are slightly foliated with biotite phenocrysts defining crude foliation with elongated ocelli.

Panidiomorphic texture with pseudohexagonal and castellated phenocrysts (Figure 3) is well developed in these dikes. The lamprophyres from Baalsrudfjellet show two distinct phenocryst assemblages, biotite–clinopyroxene and biotite–clinopyroxene–olivine. Biotite is pale-yellow to dark-brown; clinopyroxene is mostly augite or diopsidic-augite, the latter being weakly pleochroic (pale-green to pale-brown). The matrix is composed of fine-grained biotite, clinopyroxene and dominantly K-feldspar and minor amounts of free quartz. In the olivine-bearing assemblage (No. 7/2-B8), euhedral olivine crystals show various stages of being pseudomorphed by pilite, an alteration assemblage of carbonate–chlorite–actinolite (Figure 4). The felsic rim around the crystals suggests the sinking of olivine crystals in immiscible felsic liquid[3]. The shape of the ocelli varies from perfectly rounded to subrounded globules as well as irregular patches grading into the hosts. The spherical and subrounded ocelli have biotite laths tangential to them (Figure 5). The mineralogy of ocelli is essentially felsic with feldspars, quartz, epidote and chlorite. Among the accessory phases,

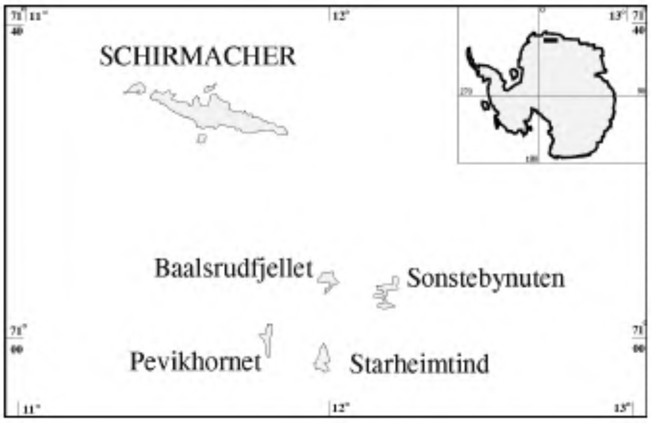

Figure 1. Location map showing the study area.

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euhedral (both prismatic and hexagonal crystals) apatites are abundant, indicating the volatile-rich nature of the magma in general.

In the lamprophyres from Sonstebynuten nunatak, biotite–clinopyroxene and biotite–clinopyroxene–hornblende assemblages are observed. Kinked and bent crystals of biotite with yellow to dark-brown pleochroic colours are present. Diopside and augite make up the clinopyroxene population; hornblende is yellowish-green to pale-green and is of common hornblende variety. Ocelli are mainly feldspathic and epidotization is less. Most of the ocelli are elongated and all of them have delimiting biotites. Biotite, clinopyroxene feldspars and minor amounts of free quartz constitute the matrix assemblage. The ferro-magnesian minerals in both the assemblages of Sonstebynuten show alignment.

The lamprophyres from Starheimtind nunatak have only biotite–clinopyroxene assemblage. Biotite is phlogopite and clinopyroxene is augite to diopsidic-augite. Kinked and bent crystals of biotite are present. Interestingly, ocelli are conspicuous by their absence. Further, apatite, which represents the volatile component of the magma, is also less in abundance, compared to the lamprophyres from other nunataks. A minor amount of free quartz is noticed in the feldspar-dominated matrix.

The nunatak Pevikhornet has lamprophyres with biotite–hornblende–clinopyroxene assemblage. Biotite shows yellow to reddish-brown pleochroism and hornblende, pale-yellow to green and green to blue-green pleochroism. Both biotite and hornblende are panidiomorphic. Ocelli are elongated and rounded as well as irregular shaped, and are feldspathic with epidote and chlorite. Biotite, clinopyroxene, feldspar and minor amounts of quartz constitute the matrix.

In general, in the lamprophyres of the nunataks mapped, it is observed that biotite is of phlogopite variety, and amphibole, wherever present is common hornblende. Staining of polished chips and thin sections reveals that K-feldspar dominates over plagioclase feldspar, both in the matrix and the ocelli. This is also consistent with the fact that epidote is a minor component in the ocellar mineral assemblage.

Figure 2. Lamprophyre from Baalsrudfjellet, showing biotite phenocrysts and subrounded and oval-shaped leucocratic ocelli set in a greenish-grey matrix. Diameter of the coin is 2.3 cm.

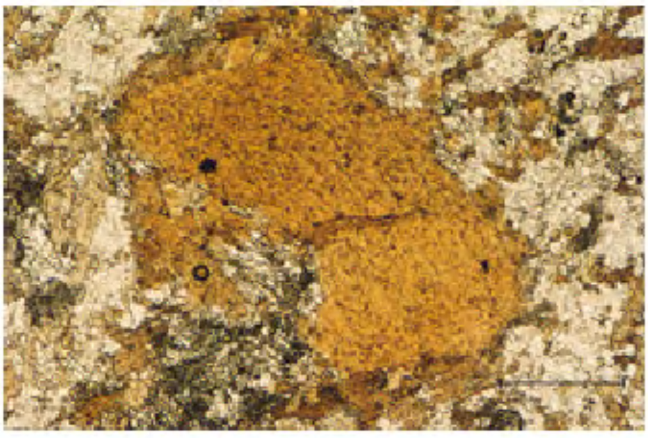

Figure 3. Photomicrograph showing panidiomorphic biotite phenocrysts. Ground mass consists of K-feldspar, minor amounts of quartz, clinopyroxene, biotite and apatite. The sample is from Sonstebynuten. (Under plane polarized light; scale bar is 0.45 mm).

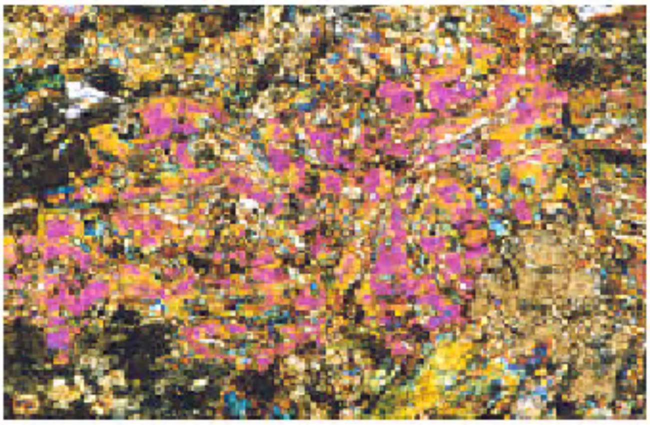

Figure 4. Photomicrograph shows an olivine phenocryst being pseudomorphed by pilite, an alteration assemblage of carbonate–chlorite–actinolite. The remnant olivine crystal is recognizable by its high-order interference colours. The sample is from Baalsrudfjellet. (Under crossed nicols; scale bar is 0.45 mm).

Figure 5. Photomicrograph showing a subrounded ocellus with tangential biotites. The sample is from Baalsrudfjellet. (Under plane polarized light; scale bar is 0.45 mm).

The observed mineral assemblages – phenocryst + matrix + volatile phases + ocelli – in the lamprophyres from the nunataks of cDML suggest that these dikes belong to calc-alkaline lamprophyre clan. The presence of Type 2 ocelli, though points more towards the alkaline nature of the magma[4], the preliminary whole-rock geochemical data available for these dikes confirm the calc-alkaline nature of the dikes. The absence of any carbonate phase – primary or secondary (except in one sample, No. 7/2-B8, wherein carbonate phase forms the part of the pseudomorph assemblage of olivine), suggests CO_2-poor nature of the magma. The absence of zoning in any of the phenocrysts and lack of corona around olivine, indicate rapid crystallization of the phenocryst phases in the volatile-rich magma and hence do not represent the liquidus phase. It is interesting to note that a positive correlation exists between the incidence of the dominant volatile phase – apatite and ocelli. The lamprophyres from Starheimtind nunatak contain no ocelli and apatite is almost absent. The absence of the volatile phase suggests a relatively high viscosity for the magma, which in turn may have been a factor influencing the solidification of lamprophyric magma before the immiscibility field was encountered[3] and hence the absence of ocelli. On the other hand, the presence of ocelli with sharp contacts with the matrix and the volatile phases in the lamprophyres from three other nunataks from cDML suggest their evolution by slower cooling vis-à-vis solidification along the composition–temperature slope of silicate–silicate immiscibility field. Although difference of opinion exists as to the origin of different types (Types 1, 2 and 3)[4] of ocelli, the Type 2 ocelli in the lamprophyres from the nunataks of cDML, by nature of their composition and shape, suggest that they are globules of immiscible felsic liquid in the mafic alkaline magma and the feldspathic nature of the ocelli is indeed a case of the silicate–silicate liquid immiscibility, as suggested by Philpotts[5].

The deformed nature (foliation and elongated ocelli) of the lamprophyres of Sonstebynuten may be due to the slight early emplacement of the dikes compared to the dikes in other nunataks, when the deformation regime of the Pan-African event was in the waning stage.

A few dikes from Sonstebynuten and Baalsrudfjellet chemically analysed by earlier workers[2] suggest that they have shoshonitic affinity. Both calc-alkaline and alkaline lamprophyres have been reported from nearby Schirmacher Oasis and have been shown to be derived from same source region – in a continental within-plate tectonic setting during Pan-African collision event of west and east Gondwana and consequent generation of alkaline magma[1]. Dayal and Hussain[6] have obtained Rb–Sr whole-rock/mineral isochron ages of 455 ± 12 Ma and 458 ± 6 Ma for two lamprophyre dikes from Schirmacher Oasis. The spatial and temporal (based on field relations) association of the calc-alkaline lamprophyres in the nunataks with those of Schirmacher Oasis[1], thus suggests that the tectonic model proposed for the Schirmacher Oasis may hold good for the whole of cDML as well.

1. D'Souza, M. J. and Chakraborty, S. K., *J. Geol. Soc. India*, **56**, 593–604.
2. Singh, R. K., Mukherji, S., Jayaram, S., Srivastava, D. and Kaul, M. K., *Dep. Ocean Dev. Tech. Publ.*, 1988, 5, 109–119.
3. Philpotts, A. R., *Principles of Igneous and Metamorphic Petrology*, Prentice Hall of India Publ., 1994, p. 498.
4. Rock, N. M. S., *Lamprophyres*, Blacky Publ., London, 1991, p. 285.
5. Philpotts, A. R., *Am. J. Sci.*, 1976, **276**, 1147–1177.
6. Dayal, A. M. and Hussain, S. M., *J. Geol. Soc. India*, 1997, **50**, 457–460.

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In vitro rooting of *Decalepis hamiltonii* Wight & Arn., an endangered shrub, by auxins and root-promoting agents

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In the present study micropropagation of an endangered shrub, *Decalepis hamiltonii* Wight & Arn., optimization and standardization of efficient methods for rooting of *in vitro*-derived micro-shoots by using phloroglucinol (PG), activated charcoal and $CoCl_2$ have been achieved. Transfer of *in vitro*-derived shoots to MS medium supplemented with 8.8 μM indole-3-butyric acid (IBA) and 1.43 μM indole-3-acetic acid resulted in root induction. In another treatment, IBA was found to be a good root-promoting agent, wherein dipping of explants in 4.4 μM IBA for 30 min and subsequent inoculation on MS basal medium was also beneficial for root induction. Successful field transfer was accomplished in rooted plantlets.

DECALEPIS *hamiltonii* Wight & Arn. (Swallow root) is a monogeneric climbing shrub endemic to the Deccan peninsula, which is used as a culinary spice due to its

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