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ULTRAMAFIC XENOLITHS (?) IN LAMPROPHYRE DYKES FROM MURUD-JANJIRA, RAIGARH DISTRICT, MAHARASHTRA, INDIA.

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THE ultramafic xenoliths described in the present paper occur in lamprophyre dykes from Murud-Janjira (18°16′N and 18°21′N and 72°55′E and 73°E) situated about 160 km south of Bombay. Though earlier workers have reported occurrence of lamprophyres from Bombay[1,2] and from Murud-Janjira[3], there has so far been no report of ultramafic xenoliths in lamprophyres from this area.

The area is predominantly occupied by tholeiitic basalts which have been classified as Upper Traps[4]. The exposed basalt flows have a total thickness of 304 m within which four flows varying in thickness from 50 to 100 m can be recognised. The basalts are intruded by a dyke swarm represented by dolerites, lamprophyres and nepheline syenites[5]. The lamprophyres are exposed along a wave-cut platform developed in the second flow from the bottom and they are not seen to traverse the overlying flow. They are best exposed around Bacon Hill and Rajpuri where they can be traced for hundreds of metres. They trend in general in N-S direction and vary in thickness from 10 cm to a maximum of 1.5 m. Pinching and swelling along the trend is common. In all, six lamprophyre dykes have been mapped. The thicker dykes show the presence of xenoliths (figure 1). Within the same dyke xenoliths of felsic and ultramafic material have been encountered. The xenoliths of felsic material range in size from 2 cm to a maximum of 15 cm. The ultramafic xenoliths vary between 2 cm and 8 cm.

The lamprophyre is a dark-coloured, hard and compact rock composed of a very fine grained matrix. Three dykes out of the six mapped, were found to contain big rounded flakes of biotite in a fine grained matrix. In microsections, the former exhibit porphyritic texture with microphenocrysts of diopside, biotite and brown amphibole-kaersutite? in a matrix made up of the same mineral species in addition to analcime and some glass. The remaining dykes show panidimorphic texture with idiomorphic prisms of diopside, kaersutite, biotite and in some cases serpentinised olivine in a groundmass of microlites of diopside, kaersutite, granular iron ore and analcime (figure 2).

Three distinct types of phenocrystic phases can be recognised. These can be broadly designated as microphenocrysts, xenocrysts and late stage topometasomatic minerals. The microphenocrysts of clinopyroxene have a resorbed, green pleochroic core that may be rich in iron, and a colourless border zone. Such crystals are idiomorphic and have sharply defined contacts with the enclosing groundmass. Under xenocrysts, are included all types of phases that are apparantly out of equilibrium with the enclosing groundmass judged by the presence of resorption with rounded, embayed outlines and/or spongy texture. Out of the six lamprophyres examined in thin section, two contained easily identifiable xenocrysts. On the basis of modal composition, the lamprophyres can be classified as monchiquites.

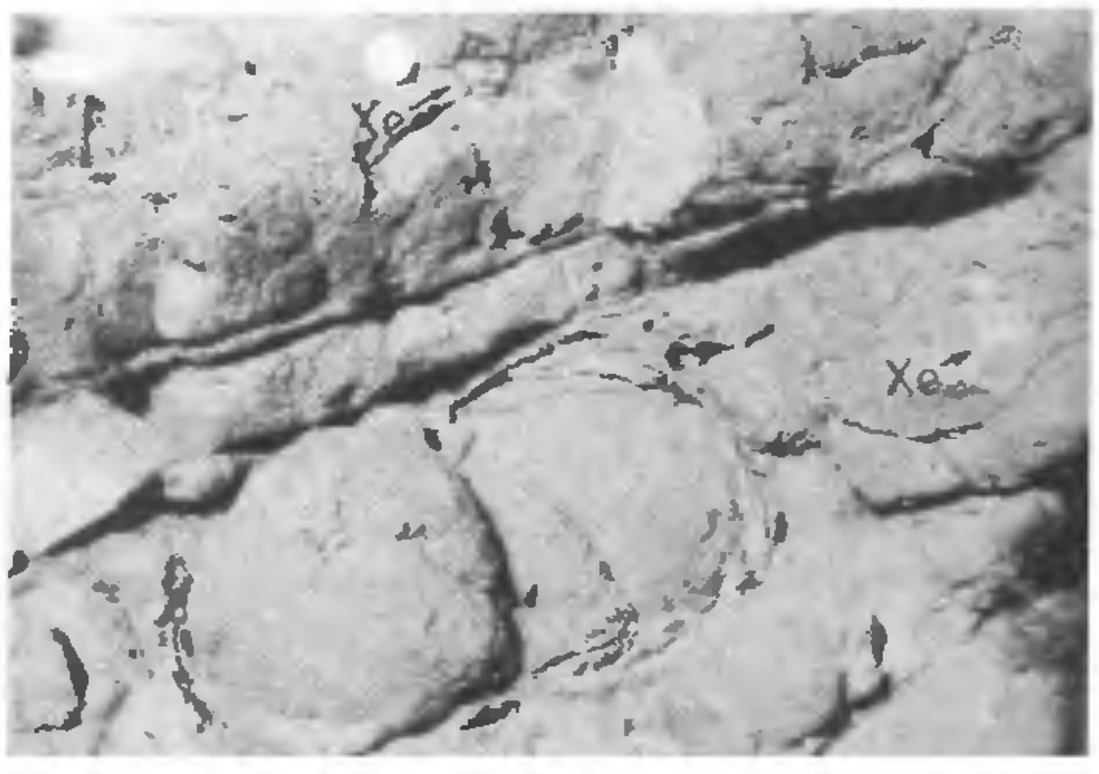

Figure 1. Lamprophyre dyke from Murud-Janjira showing felsic and ultramafic xenoliths.

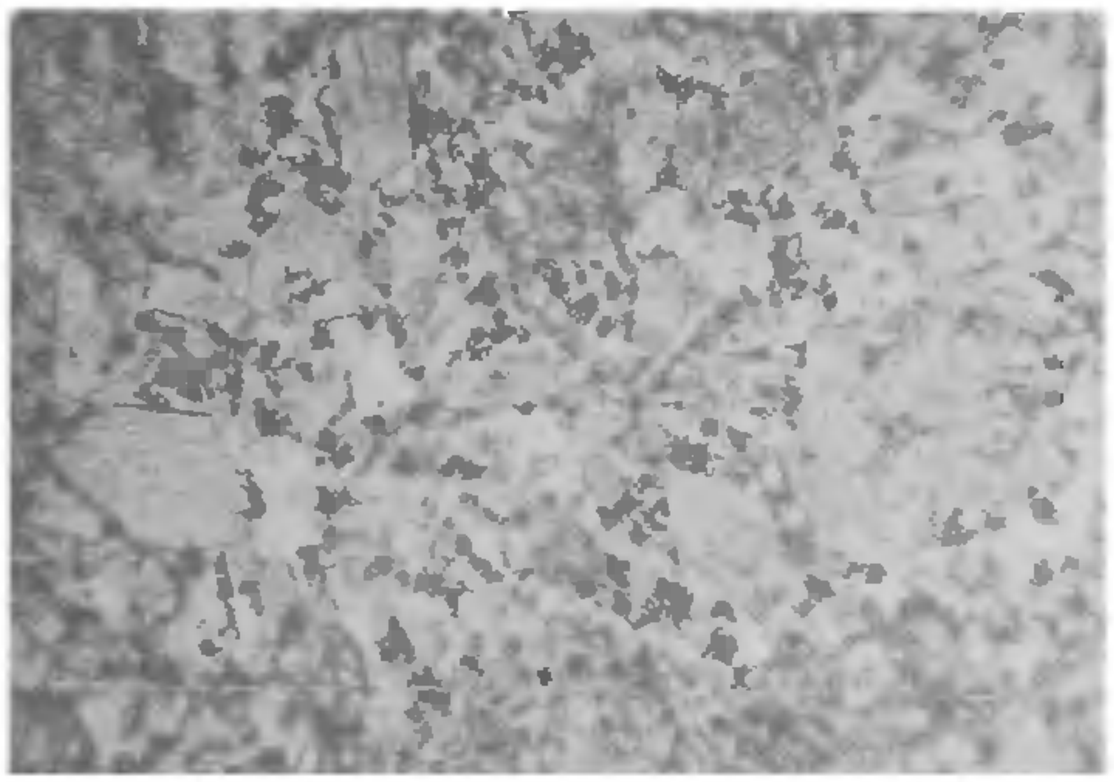

Figure 2. Photomicrograph of lamprophyre from Murud-Janjira showing idiomorphic prisms of diopside in a groundmass of microlites of diopside, kaersutite, granular iron ore and analcime. (Between crossed Nicols × 80).

The felsic xenoliths are leucocratic, hollocrystalline and exhibit hypidiomorphic-granular texture. They are predominantly composed of potash felspar, plagioclase, clinopyroxene and opaques. The potash felspars are represented by orthoclase, microcline and perthites. These are followed in order of abundance by plagioclase. The clinopyroxene is aegerine augite, pleochroic in shades of yellowish green to green, optically positive and has a 2V of 50° to 60° with $c \wedge z$ varying between 20° to 40°.

The ultramafic xenoliths are principally composed of diopside which makes up more than 90% by volume. It is followed by Fe-Ti oxides. Olivine was detected in only one sample, the rest of the samples being free of it. The xenoliths are characterised by a texture that is transitional between protogranular and porphyroclastic. The diopside is distinctly of two generations, as large elongated crystals that are oriented in a preferred direction to define a weak plane of foliation. Such grains, at places, show weak deformation lamellae, polygonisation and recrystallisation. Individual grains present typically curvilinear grain-boundaries except where recrystallisation has taken place from polygonisation. The recrystallised pyroxene neoblasts are much smaller in grain size, free of deformation lamellae, are equant, polygonal, mosaic shaped with distinct straight lined boundaries. The Fe-Ti oxides occur as vermicular and interstitial grains in between the clinopyroxenes. At places the former typically have curvilinear boundaries and they are mostly located at triple points.

It is now widely accepted that the ultramafic xenoliths in alkaline basaltic rocks represent fragments of earth's upper mantle[6–8]. However, O'Hara and Mercy[9] and O' Hara[10] report that the xenoliths represent cumulates, crystallised from their host rocks. The textural differences between the lamprophyres and the xenoliths preclude the possibility that, the xenoliths are cumulates of early crystallised material from the lamprophyre magma. The protogranular/porphyroclastic texture exhibited by the xenoliths can be interpreted as due to intracrystalline gliding[11]. More recently this interpretation has received experimental support[12]. The mosaic texture exhibited by the grains present by the side of porphyroclasts is either due to syntectonic recrystallisation[13] or subsequent annealing[14].

The existence of hydrous lamprophyric magma with its unusual reverse zoned diopside phenocrysts and xenocrysts occurring along side normal phenocrysts and xenolith assemblage is not simply explained. The xenocrysts may have crystallised at some considerable depth from a magma that was more evolved than that which precipitated the normal phenocrysts. They were then incorporated into the more basic lamprophyric magma in which they are now found. This inference is supported by the occurrence of rare felsic syenite xenoliths found within lamprophyres. The syenites apparantly formed from intermidiate to salic ('evolved') magma. Thus the xenocrysts were resorbed, rimmed by colourless pyroxene and were transported to the surface along with the ultramafic xenoliths. These observations suggest that the xenocrysts are accidental.

The complex association of xenoliths, reverse (?) zoned phenocrysts, xenocrysts and the lamprophyre groundmass constituents, is not amenable to a simple explanation. As in all similar cases, precise relationship between these components is arguable.

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All samples analysed revealed the presence of *P. aeruginosa*. Detection was carried out in the asparagine enrichment broth at 37°C after 24 or 48 hr of incubation by viewing the fluorescence under the long wave ultraviolet light (366 nm) and subsequently by the confirmatory test with acetamide broth. A colour transformation from orange to pink confirmed the presence of *P. aeruginosa*.

The cell numbers of *P. aeruginosa* computed using the MPN technique show that *P. aeruginosa* was present in all the hospital samples, though the numbers vary considerably (figure 1a). *P. aeruginosa* was least abundant in hospital No. 12 and the level was 7×10^5/100 ml. The highest number (9.2×10^8/100 ml) (figure 1a) was found in the effluent collected from hospital No. 9.

Of the domestic samples examined, *P. aeruginosa* was again present in all the samples with considerable variation in the number. Least abundance of

ECOLOGY OF *PSEUDOMONAS AERUGINOSA* (SHROETER) MIGULA IN HOSPITAL AND DOMESTIC EFFLUENTS OF MADRAS CITY

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PSEUDOMONAS AERUGINOSA is a water-borne bacterium, pollutant and a human pathogen[1–6]. In this study an attempt has been made to study the quantitative distribution of the organism in domestic and hospital effluents collected from different locations of Madras city.

Two types of tests (presumptive and confirmative tests[7]) were routinely used in the detection and enumeration of *P. aeruginosa* from the effluent samples.

The bacterial numbers from these tests were estimated by the most probable number (MPN) technique. Twenty hospital and twenty non-hospital (domestic) locations in the city were chosen for sampling. The samples from hospitals were collected from the common sewage out-let. The domestic samples were collected from outlets of kitchen or toilet. The samples were collected by the grab sampling method[8].

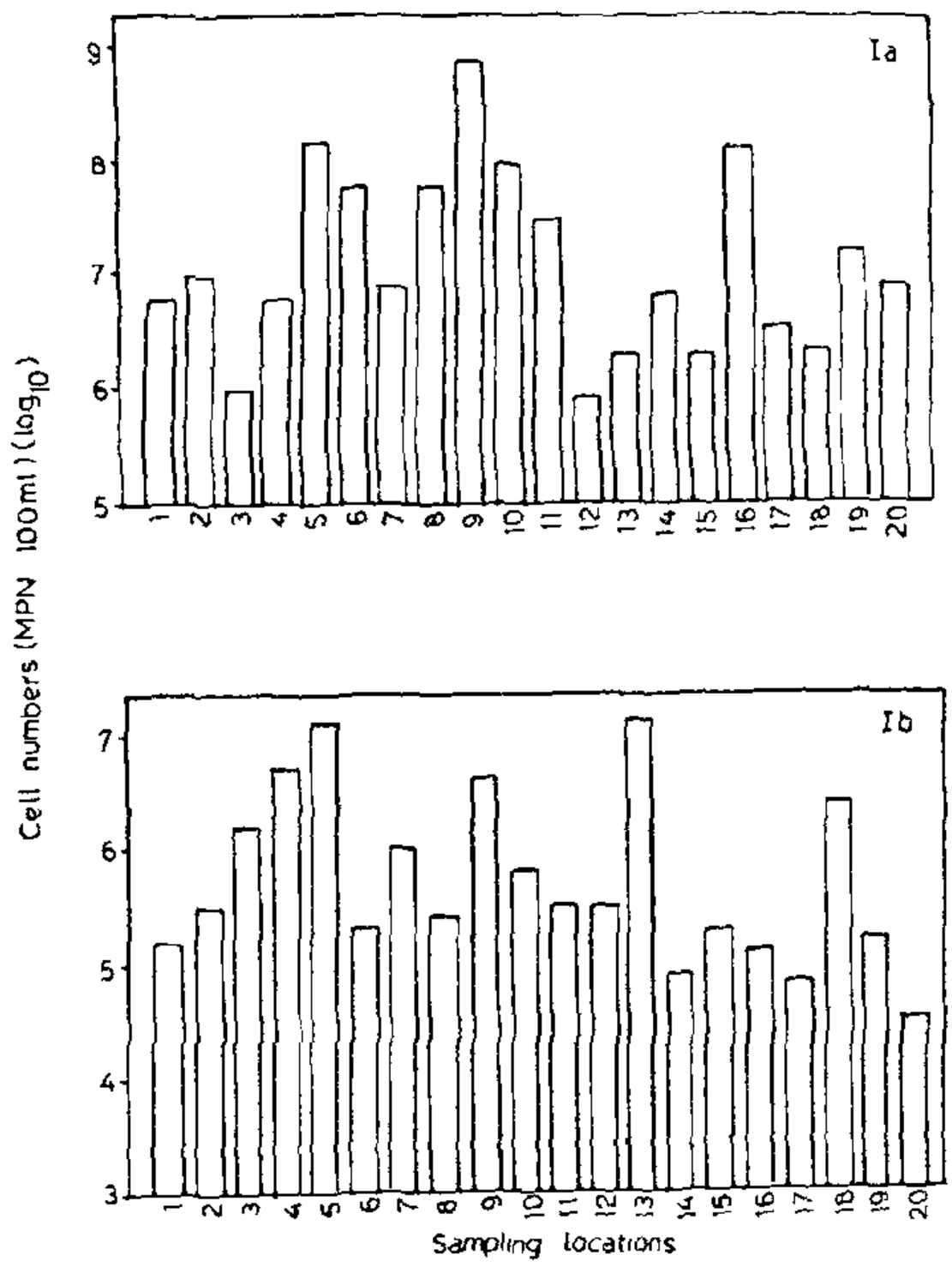

Figure 1. Population of *Pseudomonas aeruginosa* in hospital (**a**) and non-hospital (**b**) effluent samples. Cell numbers were estimated using the MPN technique on selective media.