A rare, circular, pipe-shaped structure in the Deccan Trap lava flows in the Girna River section near Malegaon, Nashik District, Maharashtra, India

Towards the end of the Cretaceous, West–Central India experienced one of the largest volcanic eruptions in the world. According to Misra[1], the Deccan and associated volcanics were generated mainly due to decompressional melting caused by extensional tectonics along major geological structures, including graben and rifts; faults; lineaments and tectonic zones. In the last two decades, based on aerial photographs and field-based mapping, the Geological Survey of India (GSI) was able to delineate many physical volcanological features from Saurashtra, Kutch, and western and eastern Maharashtra.

Pahoehoe lavas is relatively fluid-like with low viscosity and advance downslope in a smooth, rolling motion forming lobes or toes. The extent and shape of these lobes depends largely on the viscosity and head of the lava in the feeder flow[2].

In the present study, at many places along the Girna River section pahoehoe lava flows were commonly observed (Figure 1). The overriding pahoehoe lava flows were found to be have been broken along the top and sides to produce some sort of compound flows, composed of many lobes, which have chilled against one another (Figure 2). Towards the top and across these lava flows, circular, pipe-shaped structures were observed. In longitudinal section, the pipe-shaped structures were found to be around 15–20 cm long and exhibited chilled margins (Figure 3). This pipe-shaped structure was devoid of any vescicularity and was found to end up on the top of the lava flows as circular to oval-shaped forms, ranging 4–6 cm in diameter, and exhibiting highly vesicular to amygdaloidal forms (Figure 4 *a* and *b*). The structure could be observed within isolated basalt flow and was restricted to a few square metres, with the lower contacts difficult to observe.

Thin-section analysis of the host rock and the pipe-shaped structure did not show significant difference in their petrological character. The rock was fine-grained and consisted of a find aggregate of plagioclase feldspar, pyroxene, glass, and opaque. The plagioclase laths were found to be randomly oriented in the pipe-shaped structure, while in the host rock, at places the plagioclase laths were found as aggregates. Glass occurred as irregular patches within the crystal mush, and had devitrified to a yellowish-brown mass. The pipe-shaped structure exhibited large vesicles and at places these vesicles were seen to coalesce into large spherical vesicles. The vesicle walls were invariably lined by green chlorophacite (Figure 5 *a* and *b*).

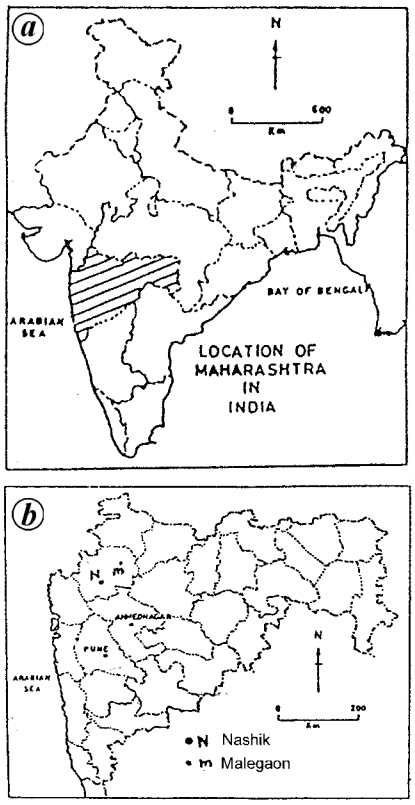

Figure 1 *a*, *b*. Location map of the area near Malegaon, Nashik District, Maharashtra.

Figure 2. A typical overriding pahoehoe lava flow with many lobes at the Girna River section near Malegaon.

Figure 3. Elongated, pipe-shaped structure exhibiting perfect chilled margins.

Figure 4. Rounded to oval-shaped structures exhibiting highly vesicular to amygdaloidal structure.

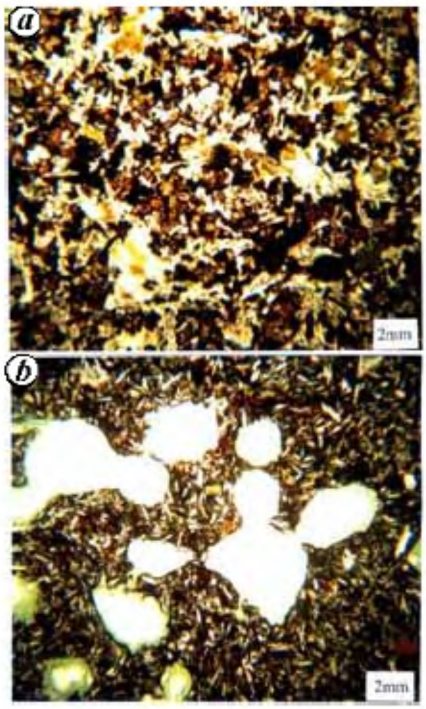

Figure 5. ***a***, Photomicrograph of host rock in plain-polarized light exhibiting a fine aggregate of plagioclase feldspar, pyroxene, glass and opaque. Note the glass has been devitrified to a yellowish-brown mass. ***b***, Thin section of the circular, pipe-shaped structure in plain-polarized light exhibiting randomly oriented plagioclase feldspar laths, pyroxene, glass and opaque. Note the large, spherical vesicles lined by green chlorophacite.

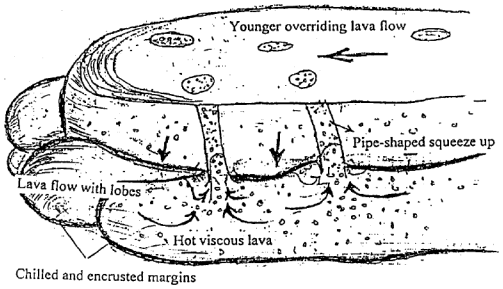

Figure 6. Schematic diagram representing the probable nature of the formation of the circular-to-oval, pipe-shaped structure at Girna River section.

It is probable that, the emerging basaltic lava flow must have advanced down slope in a smooth rolling motion. This lava flow would quickly chill over on its exposed outer margins. A similar explanation is being provided for the inflated lava flows of the Sangamner area of the Western Deccan Province by Bondre *et al.*[3] A new successive thick basaltic flow from the source would override the former flow, exerting overlying pressure onto the chilled and encrusted margins below, causing it to rupture. The rupturing thus channelizes the entrapped gases of the lower flow to be released together through the overriding younger flow, creating a path for a pipe-shaped squeeze-up (Figure 6).

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2. Green, J. and Short, N. M., *Volcanic Landforms and Surface Features: A Photographic Atlas and Glossary*, 1971, Springer–Verlag, Berlin, p. 514.
3. Bondre, N. R., Dole, G., Phadnis, V. M., Duraiswamy, R. and Kale, V. S., *Curr. Sci.*, 2000, **78**, 1004–1007.

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