

Pillow lavas from Delhi Supergroup near Bambholai, Pali District, Rajasthan

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Abstract

Three flows have been delineated on the basis of quartzite and phyllite interbeds. The lowermost flow shows few isolated pillows enclosed in subaqueous breccia while the upper flows are mostly pillow breccia showing isolated and close-packed pillows. Well developed pillows are elliptical to circular in shape and show radial joints and chilled glassy crust of variable thickness. Vesicles, amygdules and geodes of variable shapes and sizes are quite common. The hyaloclastite, filling the interspaces between pillows, is composed of light brown to dark glassy fragments and grades to breccia with increase in size of the fragments.

Introduction

The Delhi Supergroup exhibits widely manifested synsedimentational basic volcanism in Rajasthan. The new finds of pillow lava near Bambholai ($25^{\circ}51'30''$: $73^{\circ}23'20''$) in Pali district (Banerjee and Singh, 1978) are additions. Volcanic episodes are recognised at two distinct stratigraphic levels during Delhi sedimentation, i.e, one within Raialo Group and the other within Ajabgarh Group. The Pali volcanics belong to the Ajabgarh Group. The volcanic rocks of the Ajabgarh Group consist mostly of tuffs and tuffaceous sediments with bands of vesicular and amygdaloidal amphibolites, some of which are near surface synsedimentational injections and some are lava flows. The Pali area volcanics exhibit vesicular lava flows, amygdaloids, subaqueous breccia, hyaloclastite and pillow breccia with inter-layered metasediments. They are exposed between Punagarh and Khamal (Fig. 1) in a peneplaned terrain, dotted with small hills.

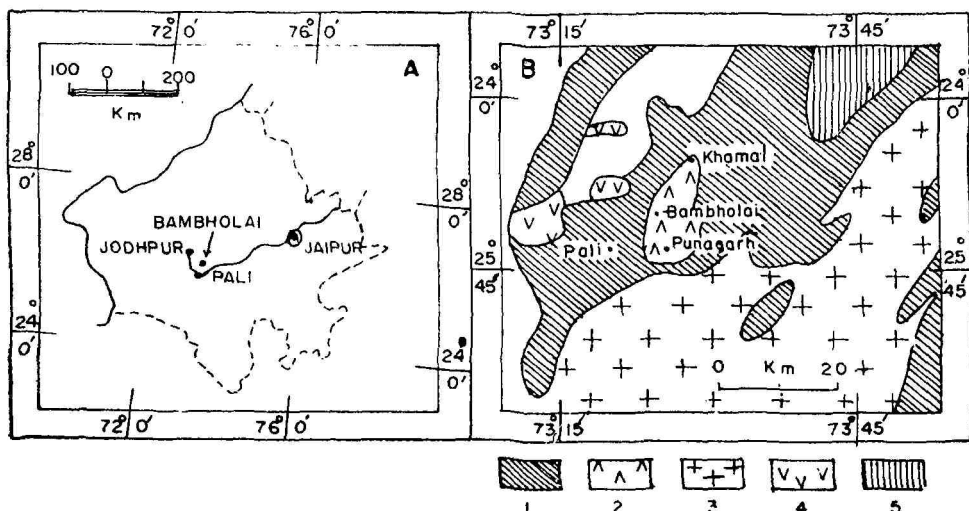


Figure 1A. Location of Bambholai area in Rajasthan.

Figure 1B. Geological map of Pali area.
 1. Delhi metasediments, 2. Pali volcanics,
 3. Post-Delhi granites, 4. Malani rhyolite,
 5. Marwar Supergroup.

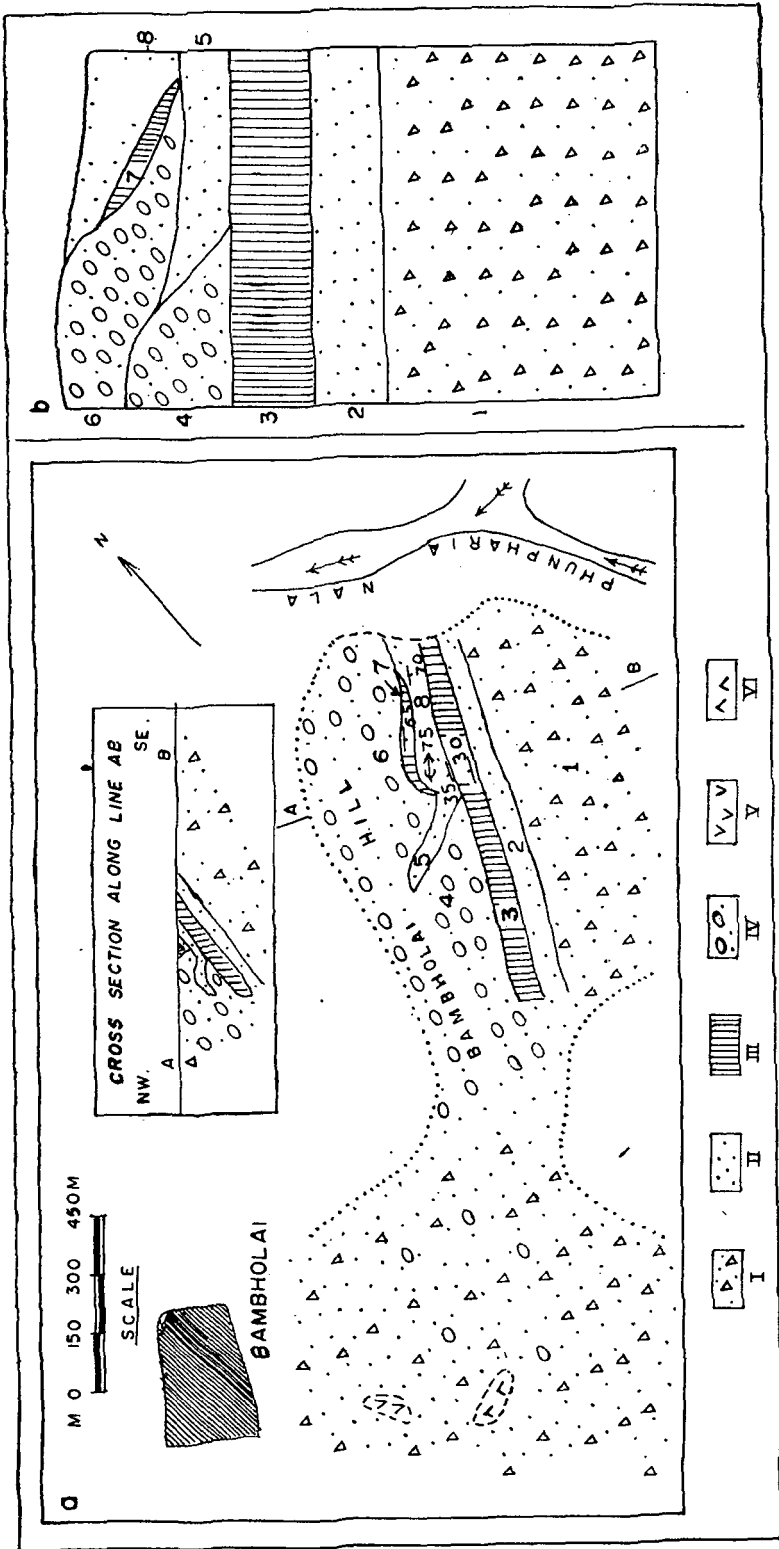


Figure 2b. Columnar section of Bambholai hill. Symbols same as Figure 2a.

Figure 2a. Geological map of Bambholai area. I. Pillow breccia, II. Quartzite, III. Phyllite, IV. Pillow lava, V. Rhyolite, VI. Pegmatite. Inset shows cross-section along line A-B.

This sequence, unconformably underlying the Phanerozoic sediments of Marwar Supergroup (Fig. 1b), is intruded by granites, pegmatites and quartz veins. Malani rhyolite also cuts across these rocks. On the basis of available geochronological data of the Post-Delhi granites, i.e. 850-1700 Ma (Crawford, 1970; Gopalan *et al* 1979, Choudhary *et al* 1981), the Pali Volcanics are older than 850 Ma.

The Bambholai Flows

In Bambholai hill section (Fig. 2) three flows have been delineated based on interflow metasediments (Fig. 2b). The lower flow 1. overlies the volcanogenic cherty quartzite and phyllite (not shown in section map) and is separated from the middle flow 4, by thin bands of grey jaspery quartzite 2, and greenish to purplish grey phyllite 3. The quartzite is traversed by jasper veins which, at places, replace the former. These are exposed to the east of the main hill (Fig. 2) and trend NNE-SSW with 30-35° dip towards northwest. The middle and upper flows 4 and 6, exposed in the main hill, are separated by a quartzite bed with thin layers of phyllite and siliceous marble 5. The upper flow is overlain by thin beds of phyllite 7, and quartzite 8. The younger two metasedimentary units 5, 7 and 8, overlap the immediately underlying flows and come to rest on the subsequent older metasedimentary interbed (Fig. 2). The upper two flows are also traversed by jasper veins. Quartz and pegmatite veins and rhyolite with cross-cutting relationship were observed to the south of the main hill.

Pillow Breccia

The Bambholai hill and the adjacent area to its east and south display well developed pillow breccia. The middle and upper flows, occupying the main hill, are composed of close-pack as well as isolated pillows, while the lower flow is mainly aphanitic to fine-grained with abundant patches of hyaloclastite and subaqueous breccia, enclosing a few ill-developed isolated pillows. Barytes globules and disseminations have been recorded in the groundmass of this breccia.

The middle flow shows gradation from close-pack pillows through incipient pillows to breccia towards south. In the upper flow also, such features are locally observed. The size and shape of pillows vary widely. Apart from common forms, barrel, bun, sack and big ball forms are seen. In cross-section pillows are elliptical to circular. In plan view these pillows are rounded, oval, oblate or elongated. The ratio of long to short axes does not exceed 2.5:1. Though majority of the pillows fall in the size range of 0.5 to 1.5 m across, the variation in size is from 15 × 10 × 7 cm to 280 × 250 × 70 cm and one pillow is as big as 6 m × 5 m in the longer cross-section. In this area pillows are rarely connected by a neck and majority of them are isolated (Figs. 3 and 4). However, close-packed pillows (Fig. 5) are not wanting. Pillows have brown to black glassy crusts of 0.5 to 2.5 cm thickness, some are as thick as 11 cm. The thicker crust shows two to three thin (1 cm) chilled, black, glassy rinds, alternating with comparatively thick (3 cm) aphanitic layers. Radial jointing is common (Fig. 6). Cracks and openings

EXPLANATION OF FIGURES

- Fig. 3. Isolated pillows exposed in three dimensional view. Upper flow, western flank of Bambholai hill.
- Fig. 4. Pillow breccia showing well developed isolated elliptical pillows of different sizes, set in granulated black glassy material. Middle flow, eastern flank of Bambholai hill.

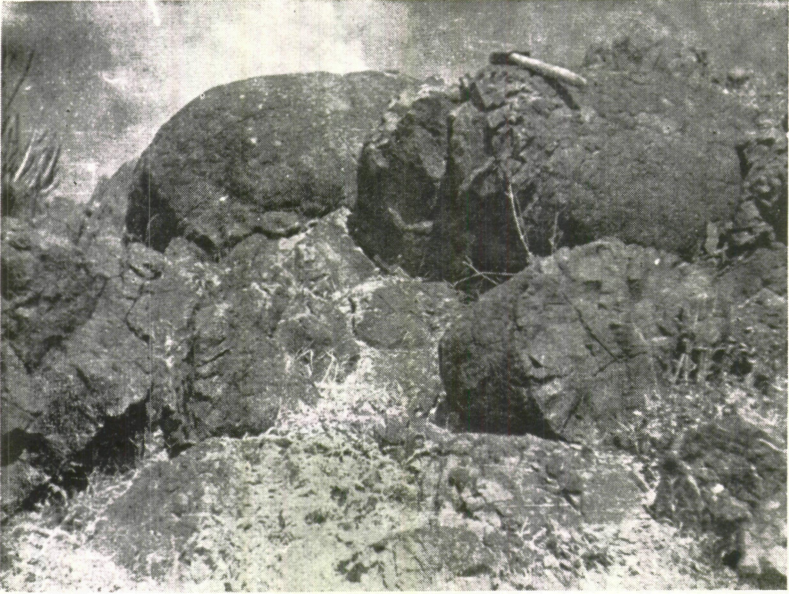


Figure 3.



Figure 4.

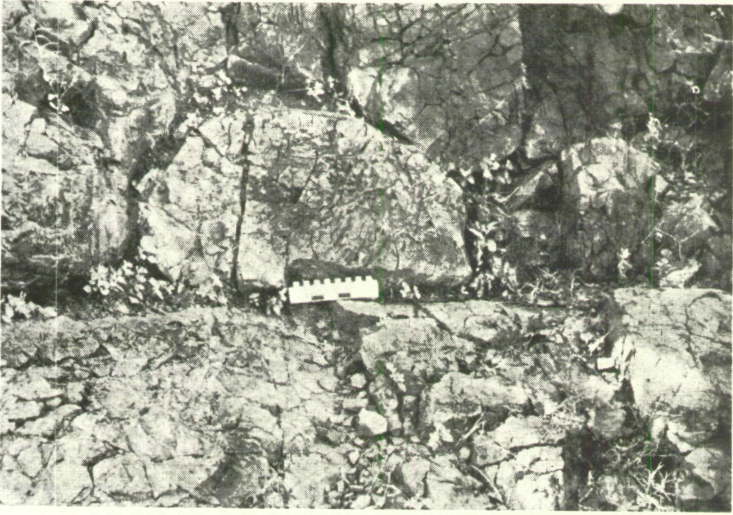


Figure 5.



Figure 6.



Figure 7.

developed on the outer surfaces of the pillows are sometimes filled with calcareous material. Most of the pillows show sparsely distributed fine spheroidal vesicles. Quartz and calcite fill the vesicles. Geodes of different shapes and sizes are abundant in the pillows.

The hyaloclastite and subaqueous breccia grade into each other. At places banded flow mass showing alternate layers of finely granulated black glassy material and aphanitic lava is enclosed within the breccia mass (Fig. 7). Origin of such banding may be similar to that of the different rinds of pillow crust.

The pillow lava is yellowish to light brown and aphanitic to fine-grained while the breccia is light to dark grey and brownish in colour. The glassy material constitutes most of the smaller fragments of the breccia matrix between pillows and aphanitic to fine-grained basalt makes up the larger fragments. The pillow basalt is composed of olivine, plagioclase, clinopyroxene, glass, iron oxides and secondary quartz. Texture is porphyritic, hyalo-ophitic, intergranular and intersertal. Olivine and plagioclase occur as phenocrysts. Plagioclase laths form triangles and subtriangles, the interspaces of which are filled with glass, palagonite, iron oxide, altered clinopyroxene, crystallites of clinopyroxene and secondary quartz. Skeletal habit of plagioclase is common. Zeolite, quartz and calcite constitute amygdules.

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EXPLANATION OF FIGURES

- Fig. 5. Photograph showing cross-sectional view of closepacked pillows. The scale is kept on a giant pillow. Middle flow, eastern flank of Bambholai hill. Photo by R. Ravindra.
- Fig. 6. Cross sectional view of a pillow showing radial jointing. Middle flow, eastern flank of the Bambholai hill.
- Fig. 7. Flow showing banding of brown aphanitic material (white) and black granulated glassy material (dark). Upper flow, western flank of the Bambholai hill.