MORPHOLOGY, STRUCTURE AND EMPLACEMENT OF PAHOEHOE FLOWS FROM THE WESTERN DECCAN VOLCANIC PROVINCE

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EXTENDED ABSTRACT

The 64-65 Ma Deccan Volcanic Province (DVP) occupies more than 500,000 km^2 area in parts of western and central India and is one of the larger Continental Flood Basalt Provinces in the world. In the DVP, compound flows *sensu lato* are exposed along the Western Ghats and around an elliptical (Nashik-Igatpuri) region. The compound pahoehoe flows from the province display a variety of lava structures such as small-interconnected toes, lobes, tumuli, smooth-surfaced sheets and surface breakouts. Such features, cursorily studied in the province, are diagnostic in deciphering the emplacement mechanism of flows. At present, flood lava emplacement is of considerable interest because of the need to estimate magma discharge and eruption duration - important parameters in assessing eruption dynamics and atmospheric mass loading of hazardous volcanic gases. Such studies are all the more important to the DVP in light of the fact that it is closely associated with the Cretaceous-Tertiary mass extinctions.

Compound pahoehoe flows in the DVP range from the typical hummocky and sheet-flow types to the more viscous varieties like the rough- and slabby pahoehoe. Hummocky pahoehoe is characterized by the presence of toes, lobes and tumuli and by its metre-scale relief. Pahoehoe toes are 13-63 cm wide, 12-55 cm thick and 29-91 cm long. Pahoehoe lobes are 50-200 cm thick, 20-500 cm wide and 0.50 to 8.00 m long. Lobes are mostly of the P-type (pipe-vesicle bearing), but S-type (spongy) lobes are also present near Nashik. The flow-lobe tumuli from the western DVP have a positive relief and are characterized by 'lava-inflation clefts' occupied by squeeze-ups. The lengths of the flow-lobe tumuli ranges from 2.80 to 40.00 m and their widths range from 2.76 to 28.50 m. Evidences of pahoehoe toes and lobes coalescing laterally during inflation to form pahoehoe sheets are in plenty. Sheet-lobes have a typical flat upper surface that usually display cracks, inflation-clefts and squeeze-ups.

Detailed study of lobes, tumuli and sheets reveals considerable textural and petrographic variations related to emplacement dynamics. Internal structure of thick lobes and sheets reveals a three-tiered internal structure - an upper vesicular crust, a non-vesicular, dense (but jointed) core and a lower vesicular basal zone. The upper vesicular crust of most sheet lobes contains several horizontal vesicular zones and a few horizons of megavesicles. At the contact between the base of the upper crust and core, one or more horizontal vesicular sheets are present. Numerous vesicular cylinders are present in the core of sheet lobes. The basal zones invariably contain one or more levels of pipe vesicles. Using the existing empirical cooling model, the thickness of upper crust has been used to estimate the emplacement duration of lobes and sheets.

In the DVP, the rough pahoehoe and slabby pahoehoe occur as small flows with distinct surface morphologies. Slabby pahoehoe like the spiny, toothpaste and sharkskin varieties are lava types transitional to aa. Slabby pahoehoe forms when the curst completely disrupts due to high rate of lava flow that is too great for the crust to accommodate the shear strain plastically. Textural changes across such transitions include increase in vesicle deformation and microlite crystallinity.

The lava morphology and internal structure of compound pahoehoe flows from the western DVP display unambiguous evidences of inflation/endogenous growth and are consistent with slow and sustained eruptions. Field observations and morphometric studies reveal that the pahoehoe features in flows from the DVP display close similarity with their Hawaiian counterparts and points to a similarity in nature and style of eruption, at least in the western part of the DVP.

**Lecture delivered at the monthly meeting of the Geological Society of India at Bangalore on 27 November 2002.*