GEOLOGICAL STRUCTURE IN BASALTIC TERRAIN NEAR THE MANMAD AREA MAHARASHTRA, INDIA

Gadekar Anil and Md. Babar

Department of Geology, Dnyanopasak College, Parbhani-431 401 (M.S.) India

Abstract: *In the present research different geological structure are identify in the basaltic terrain near the Manmad town and adjoining area in Nashik district, Maharashtra. There are two types of lava flows intruded in this area namely 'pahoehoe' and 'aa' flows. The geological structure observes in pahoehoe lava flows such as ropy lava, dyke, joints and pipe vesicles. In 'aa' lava flow the structures observed are pipe vesicles.*

Key words: Geological Structure, Basaltic terrain, dykes, ropy lava, Manmad

INTRODUCTION

Continental Flood Basalt (CFB) province is product of fissure type lava flow erupted about 65 million years ago. The thickness of Deccan volcanic province is well establishing Western Ghats section. The geology and lithology of Deccan traps it showing general flow toward southwards (Subbarao 1998; Godbole et al 1996). Total stratigraphic thickness varies from 2500 m to 3000 m western central part of Deccan volcanic province and it less than 100 m near margin of eastern side of Deccan trap area. In the present study area Jain and Gupta (2013) identified 18 lava flows in Manmad area. Sen (2017) observed two type of lava flows in the area dominant namely 'pahoehoe' and 'aa' type. On the basis of appearance pahoehoe lava flows showing a characteristic of smooth or ropy lava structure. Different lobes on the surface of ropy lava structure showing discontinuity from one lobe to other. Aa lava flow showing the auto brecciate crust and it forward sheet (Seif et al. 1998; Soule and Cashman, 2009). The ropy lava of pahoehoe flow have limited covering area; it may be most characteristic surface structure. The ropy type of pahoehoe also known as rim it's like more attractive (Wentworth and Macdonanld 1953), it is complicated and showing the bend like structure (Mishra and Mukharjee, 2015). In pahoehoe lava flow pipe vesicle characteristically expose in vertical section (Nichole 1936; Fink and Fletcher 1978), it indicates the decrease in the velocity with depth.

The basic dyke is common in Deccan traps its existence has been long record (Auden 1949). The dyke contributes the physical indicator to understand the mechanism of magma transported into the earth crust. The dyke can indicate pre or post tectonics, following structure impress within dykes controlling on their comparatively weakness to the rock metric (Mishra and Mukharjee 2015). Generally dyke showing high relief than surrounded rock its due to weathered in host rock. In basaltic dyke shows the horizontal columnar joint with sharp contact with

contrary rock. The origin of columnar and transverse joint due to tensile stress through the cooling of the lava (Mallel 1987; Iddings 1905; Spry 1962). Due to reduction of the volume during combination of the basic lava showing columnar and transverse joint (Lahee 1987). Babar et al documented the rheological contrast locally affected the emplacement of dykes, producing offset, the formation of sills, the curvature of dyke walls and finger-like intrusions. They also found the offset of dykes presumably caused by variations in local stress.

STUDY AREA

The Manmad town located within Nadgoan tahsil in Nasik district of Maharashtra. Near Manmad 93.8 sq km area is investigated in order to study the geological structure. The area is occupied with in latitude 20°11'14.152"N to 20°14'6.873" N and longitude 74°20' 23.152" E to 74°30'8.808" E in Survey of India (SOI) toposheet numbers 46L/7 and 47L/8 on the scale 1:50000.

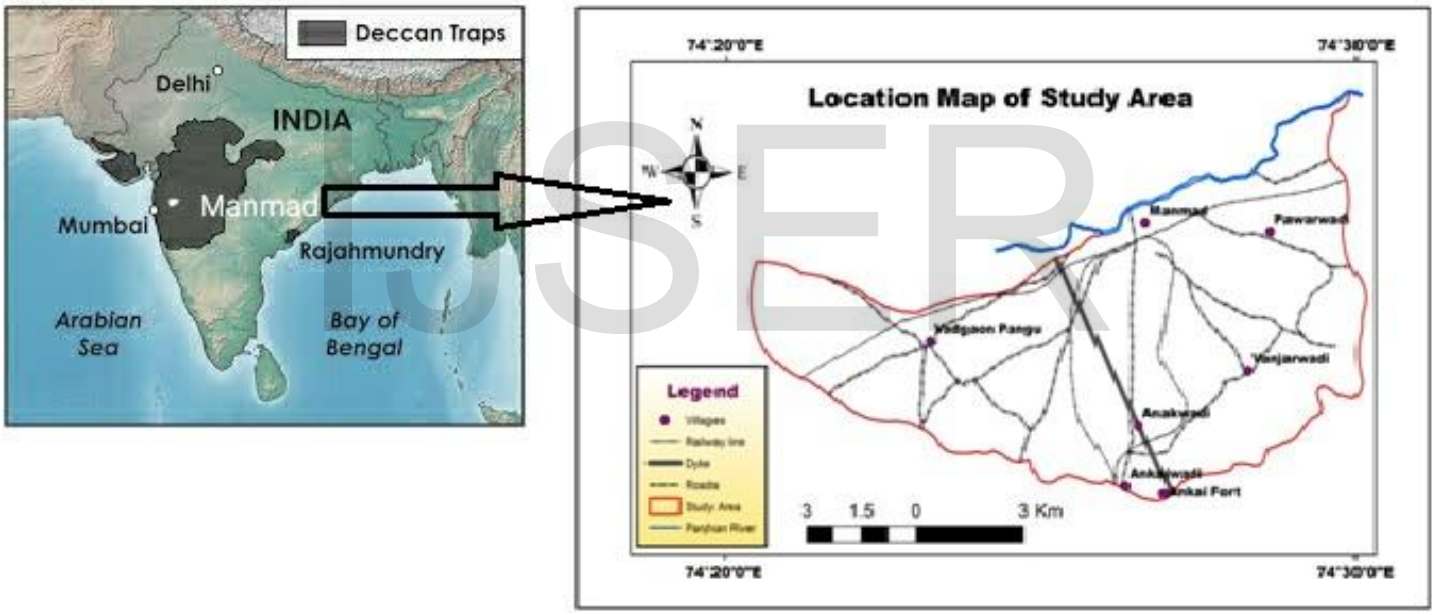

Figure no. 1 Location map of study area

GEOLOGICAL STRUCTURE IN DECCAN BASALT

Primary geological structures discussed are ropy lava, pipe vesicles and pipe amygdaloidal, dykes and jointing pattern.

Ropy lava

It is the top chilled surface of the basalt lava flow. Macdoland (1972) suggested that in pahoehoe lava flow the ropy structure is found but it is of a very limited extension and showing distinguish characteristics on the surface. Limited extension of ropy lava structure is as illustrated in Fig. 2. The ropy part of pahoehoe lava flow is also known as ‘carded’ it is like the

decoration (Wentworth and Macdolnald 1995), which is showing complicated and bending like shape on ropy surface (Fielder 1975).

Fig. 2 a) Limited extension of Ropy lava. b) Rim like structure developing ropy surface.

Pipe vesicles and Pipe Amygdaloidal

The pahoehoe flows generally show pipe vesicles and amygdules at the base of the lava flow. In the Pahoehoe lava flow spherical vesicle are found, which indicating the gas exists at the time of formation (Macdonald 1972). In the Hawaiian basalt flows pipe vesicles are present at the base of the lava flow (Walkar 1940). In Fig. 3 the pipe vesicles are observed at the base and dimensions of the pipe vesicles is 2-4 mm and length is nearly 5-6 cm. In Fig. 3 b pipe vesicles are found to be partially or completely filled with secondary minerals.

Fig. 3 a) The pipe vesicle are present at the base of lava flow. b) Secondary minerals filled in pipe vesicles showing formation of pipe amygdaloidal.

Dyke

The observation of basaltic dyke is seen in vertical intrusion of compact basalt showing a horizontal columnar joint. In individual dyke could be combination of fracture order in the geometrical term. Fig.4 a and b showing different fracture system in dyke. Fracture is parallel to

the structure plain of weakness in host rock. In present study we observe dyke near Ankai Fort showing trend N315° and width of dyke is 1.4m.

Bifuracation of the dyke

In the nala (stream) the exposure of dyke in middle part is found divided into two parts. This structure look like bifurcation of dyke (Fig. 5). It is observed that the bifurcated dyke structure has width of east side 2 m and west side is 1.5 m. The trend of the dyke is N48°W - S48°E.

Transverse joints in dyke

Fig. 6 (a and b) showing the dyke in the well section having trend is N 53°W- S 53° E and width of dyke is nearly 5-6 m. The middle of the dyke shows intrusion is present. Columnar joint is incline look like transverse joint. In the joint of dyke and host rock percolation of water. Figure no. 5 g south side of well it thickness is 2-3 intrusion are present.

Fig. 4 a) Dyke showing the horizontal columnar joint with contact of compact basalt; b) Different fracture develops in dyke; c) Small intrusion in dyke; d) Horizontal columnar joint of dyke four- six sides columns.

Fig. 5 The bifurcation like structure in dyke.

Fig. 6 a) Transverse joints in dyke showing inclined joints. b) Horizontal joints in dyke and also possess nearly 0.6 meter thick intrusion of calcareous material.

DISCUSSION

In the present study area we observed different geological structures such as ropy lava, pipe vesicle, joints and dykes. The surface of ropy structure on pahoehoe lava flow show well developed trend of wrinkles in several mm in height and the inclination axis are perpendicular to the direction of flow (Fink and Fletcher 1978). Fig. 2 (a) and (b) represent the ropy lava structures. Fig. 3 (a) represents pipe vesicles occurring at the base and it indicate upward flow direction of pipe vesicle. Fig. 3 (b) shows the presence of secondary minerals filled in pipe vesicles viewing formation of pipe amygdales.

Fig. 4 (a) to (d) trend of dyke is N 45° W - S 45° E the thickness of dyke is 1.4 m, dyke also shows columnar surface fracture developed orthogonal patterns. Dykes also show week

plain fractures and calcareous intrusion developed in upper and lower part is because of percolation of water along the fractures in dykes. Dykes also showing horizontal columnar joint of dyke four- six side columns. In the nala due to weathering dyke is visible to be separated into two part (Fig. 5). The trends of dyke in this location is N 48° W- S 48° E and the width in one part is 2 m and other is 1.5 m. Fig. 6 in well structure the dyke is divided into two part due to joints. Besides horizontal joints the transverse joints are clearly seen in the dykes.

CONCLUSIONS:

In the Manmad and adjoining localities, the area is covered by two types of lava flows namely ‘pahoehoe’ and ‘aa’ flows. In present study the structures like ropy lava, pipe vesicles and pipe amygdaloidal, dykes and jointing pattern are observed in basaltic lava flows. In pahoehoe lava flow ropy structure are formed due to low viscosity of the magma. The pipe vesicles in the aa type basalt are form due to escape of gases in lava flows. The dyke shows columnar joint showing orthogonal fracture pattern.

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