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Flow Mapping and Correlations of the Deccan Basalt Lava Flows, North-East Maharashtra, India

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Abstract: Flow mapping has been carried out with the help of five field traverses of Rajura-Indla area, Eastern part of Amravati district, Maharashtra, India. Rajura-Indla area comprises Chirodi hill ranges representing moderate hilly terrain and entirely covered by Deccan basalt lava flows. Flow mapping has been carried out to understand the field characteristics of individual flows, their thickness and possible correlations. Various flows are identified on the basis of difference in grain size, mineral content, presence of phenocrysts, physiographic breaks and presence of red bole horizons. Section maps for each traverses has been prepared on the basis of field characteristics. There are in all three lava flows exposed as mafic plagioclase microphyric basalt, plagioclase phyric basalt and plagioclase mafic microphyric basalt with different field characteristics. Flow correlation has been carried out by considering the logs of individual traverses. On the basis of present study coupled with existing palaeomagnetic data, exposed lava pile has been divided into two different formations with preparation of comprehensive geological map of the area.

Keywords: *Deccan basalt, Traverses, Lava flows, Correlation, Palaeomagnetism*

1. Introduction

Deccan Basalt Volcanic Province of India is best preserved and presently occupying 5,18000 Sq.km. area of Western and central India. Information is available regarding volcanic types, distribution, morphology, petrography, palaeomagnetism and geochemistry of lava flows but most of the investigations by previous workers were confined to the thick sections of lava pile of the Western Ghats, Bene et.al.,1988[1]; Bodas et.al.1988[2];Cox and Hawkesworth,1984[4] and 1985[5]; Deshmukh, S.S.et.al., 1996[8]; Deshmukh, M.S., et.al.2012[6] and 2013[7]; Devey and Lightfoot,1986 [9]; Godboleet.al.,1996[11] and Khadri et.al.1988[12]. Considering large aerial extent of the Deccan Traps, very limited work has been carried out in other parts beside Western Ghats. In this paper an attempt has been made to study Eastern lava flows exposed at Tapovan area, their thickness and possible correlation. Study area comprises 10 Sq. km area of Eastern part of Amravati city and located 150 km West of Nagpur district, Maharashtra State, India. It is included in the Survey of India toposheet 55H/13. Figure 1 shows location map of the study area with various field traverses.

2. Methodology

Detailed flow mapping was carried out with collection of seventy one rock samples from the five field traverses for the identification of individual lava flows, petrological investigations and lithological correlations. The samples are collected from each lava flow exposed in different traverses at different elevations, so that they could represent the whole lava pile exposed in the study area. These traverses are selected by considering the highest to lowest elevation in the area. Rock samples are collected from the top towards the lowest elevation in the area. Various flows are identified on the basis of difference in grain size, minerals content, presence of phenocrysts, physiographic breaks in the rock strata and presence of red bole horizons. Finally results are coupled with existing palaeomagnetic data to divide the lava pile into different formations, with preparation of comprehensive geological map of the area.

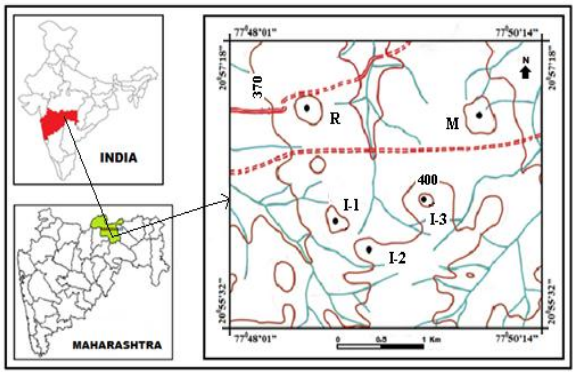

Figure 1: *Location map showing various field traverses*

3. Geology of the Area

The entire area comprises Deccan basalt lava flows and the individual flows varies from 10 to 40 meter in thickness. Thin bands of red bole having thickness

0.30m to 0.70 meter are well developed at the contact of the flows. The major lineament of the area is extending for 18 kilometer distance, trending N80^{0}E-S80^{0}W, Bhusari B.,1989[3]. Five different traverses studied in detail are one field traverse from Rajura area, three field traverses from Indla area and one field traverse from Mardi area. Rajura field traverse exposes lava pile of 46 meters comprising three lava flows between the altitudes 390 to 436 meters above mean sea level (amsl). The exposed flows are, lowermost fine grained, mafic plagioclase microphyric basalt (Flow I), overlain by medium to coarse grained, plagioclase phyric basalt (Flow II) and topmost fine grained, plagioclase mafic microphyric basalt (Flow III). Figure 2 represents Rajura field traverse. Indla Field Traverse (I_1) exposes lava pile of 37 meters comprising two lava flows between the altitude of meters 388 to 425 meters amsl. The exposed flows are lowermost medium to coarse grained, plagioclase phyric basalt (Flow II) which is overlained by fine grained, mafic plagioclase microphyric basalt (Flow III).

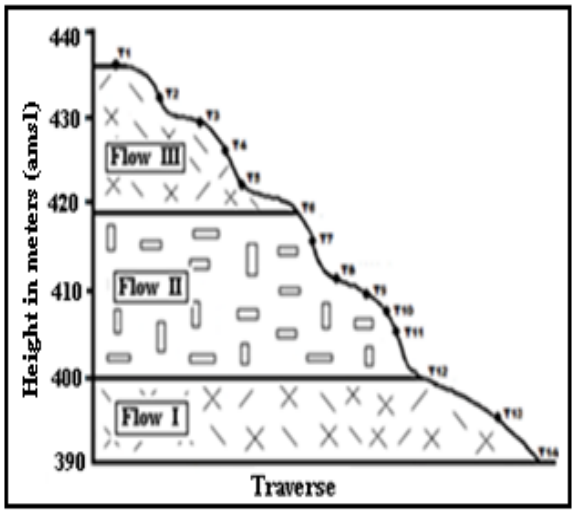

Figure 2: *Rajura Field Traverse(T)*

Indla Field Traverse (I_2), exposed lowermost medium to coarse grained, plagioclase phyric basalt flow (Flow II), overlained by fine grained, plagioclase mafic microphyric basalt (Flow III) betwween 440 meters 402 meters amsl. Figure 3 represents Indla Field Traverse (I_3) exposed lowermost fine grained, plagioclase phyric basalt (Flow II) overlained by fine grained, plagioclase mafic microphyric basalt (Flow III) between the altitude of 460 meters to 410 meters. Mardi Field Traverse (M) exposed 38 meters basaltic pile between the altitude of 390 to 440meters, comprising medium to coarse grained, plagioclase phyric basalt (Flow II) at bottom, overlain by fine grained, plagioclase mafic microphyric basalt (Flow III). In the District Resource Map (DRM) published by Geological Survey of India, the study area is designated as Karanja formation, GSI, DRM, 2001[10].

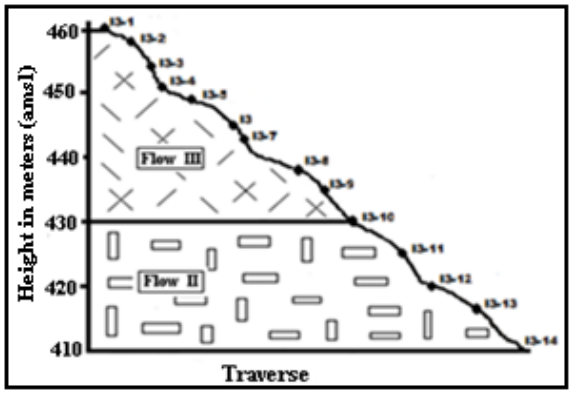

Figure 3: *Indla Field Traverse (I-3)*

4. Correlation of the Lava Flows

The lava flows exposed in these five different traverses are correlated with each other. Five vertical sections have been prepared for the correlation purpose. The vertical axis represent the elevation of the traverses in meters and horizontal axis represent the different traverses. In Rajura field traverse(R) mafic Plagioclase microphyric flow(Flow III) exposed at 419 meter altitude can be correlated with the (Flow III) in the other traverses i.e, Indla field traverse I_1, Indla field traverse I_2, Indla field traverse I_3, and Mardi field traverse(M) at an altitude of 418 m, 429 m, 430 m and 409 meter (amsl) respectively. Similarly in Rajura field traverse, Plagioclase Phyric (Flow II) correlated with (Flow II) exposed in the other traverses i.e, Indla field traverse (I_1), Indla field traverse (I_2), Indla field traverse (I_3), and Mardi field traverse (M).The lava flows exposed in these five different traverses are correlated with each other. Figure 4 represents flow correlations of different traverses.

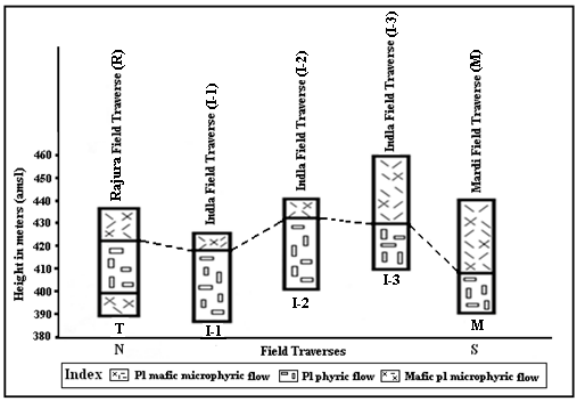

Figure 4: *Flow correlation diagram of various traverses*

The existing palaeomagnetic studies of the lava flows exposed in the study area indicates the presence of Normal–Reverse sequence as shown in Figure 5. 'Normal' geomagnetic polarity shown by top most two flows i.e. plagioclase phyric flow (flow II) and plagioclase mafic microphyric flow (flow III) and 'Reverse' geomagnetic polarity by lowermost mafic

plagioclase microphyric flow (flow I) (Deshmukh,M.S. et.al., 2013).

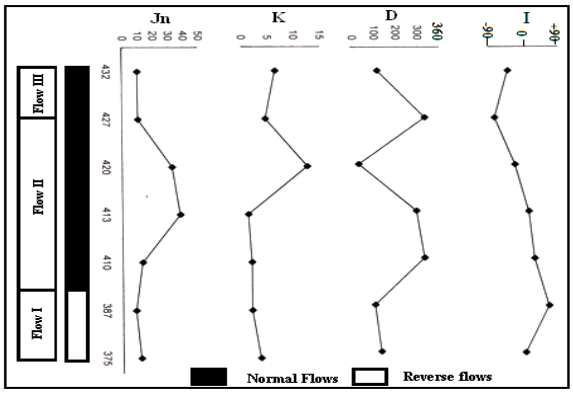

Figure5: *Magnetostratigraphy of the study area (after Deshmukh, M.S.et.al., 2013)*

On the basis of above flow mapping and correlation of the lava flows coupled with existing palaeomagnetic data, the basaltic lava pile of the area has been divided into two different formations , Deshmukh et.al., 2013[7] i.e. Indla and Rajura basalt formations and accordingly final geological map of the area has been prepared shown in Figure 6.

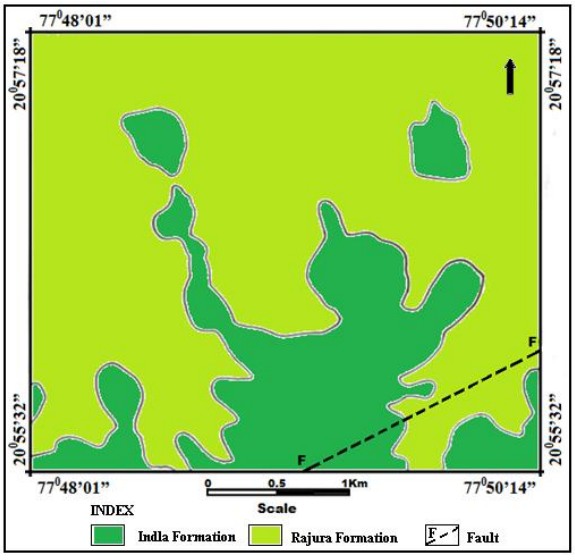

Figure 6: *Geological map of the study area showing basalt Formations*

5. Conclusion

During detailed flow mapping of basaltic terrain, different basaltic lava flows exposed in the Rajura and Indla area are identified, mapped and correlated with each other. The Five representative field traverses were selected for mapping purpose, exposed between the altitude of 460 meter to 388 meters. Flow mapping represents three basaltic lava flows i.e. Plagioclase mafic microphyric basalt, Plagioclase phyric basalt and mafic plagioclase microphyric basalt. Total thickness of basaltic lava pile exposed in one field traverse of Rajura area, three field traverses of Indla area and one field traverse of Mardi area are 46 meters, 37 meters, 38 meters, 50 meters and 30 meters respectively. Three individual basaltic lava flows exposed in these five different traverses are correlated with each other. Finally on the basis of present study coupled with palaeomagnetic studies carried out by Deshmukh et.al., 2013[7] indicating the presence of Normal–Reverse palaeomagnetic polarity, the lava flows has been divided in to two different basaltic formations with preparation of comprehensive geological map of the area.

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