

## **Preliminary field stratigraphy of Khongda Volcanics, Gavilgarh Hill range, Amravati District, Maharashtra, India**

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### **Abstract**

The ability to distinguish various flows and trace them in different field sections on a regional scale covering a large area is an important criterion in the stratigraphic studies of the Deccan basalts (Khadri, 1989). In this study, an attempt has been made to establish the preliminary flow by flow field stratigraphy by correlating and distinguishing various formations with the help of 10 field traverses giving due consideration to the traceability of the field characters. Mappable sequences of individual flows recognizable in the field were grouped in to the formations based on their similar field characters, major or minor physiographic breaks associated with the presence of marker horizon. A formation represents a thick sequence of lava pile comprising of simple and /or compound flows with comparably less evolved and more primitive type of flows at the bottom, which shows progressive evolution towards the top

In this study an attempt has been made to understand the nature of lava flows and their aerial extent in order to correlate the possible extension of these lava sequences in various traverses. The results indicate the pinching and swelling nature of these lava flows. This study has established the preliminary field stratigraphy of the Khongda region based on field mapping and geological, petrographic observations of individual lava flows and their extension in the surrounding regions.

Key words: Field stratigraphy, lava sequence, Flow correlation, formation, marker horizon

### **Introduction**

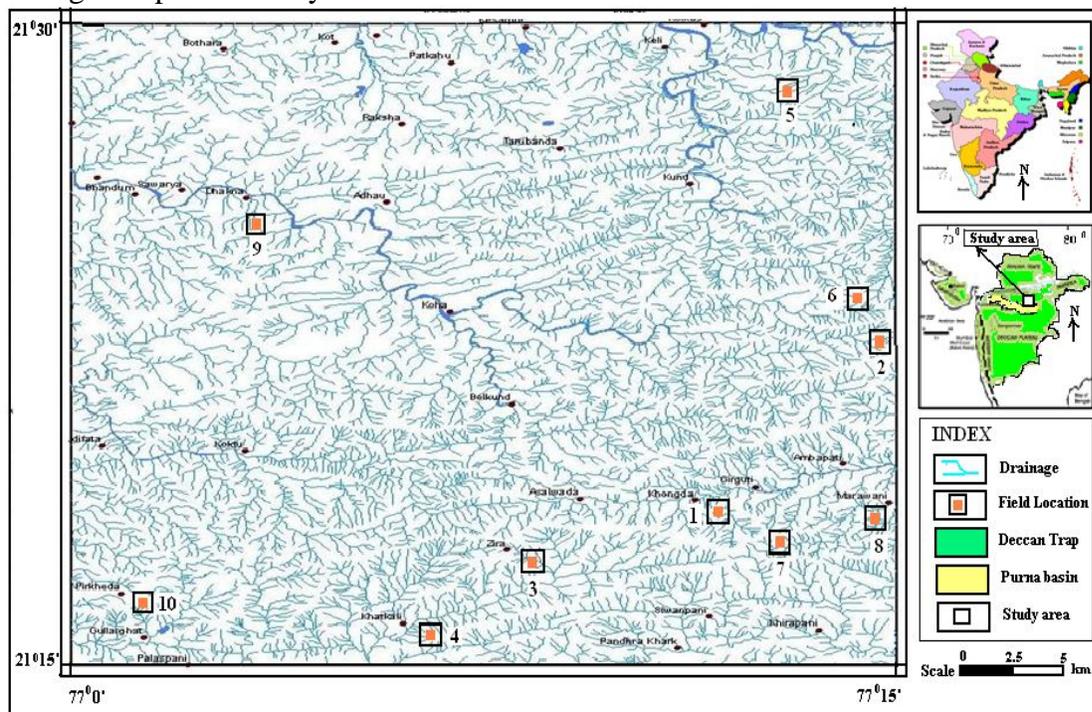
Deccan Traps form one of the largest accumulations of the continental flood basalts in the world with an estimated area of 518,000 Sq. km, in the western and Central India. Continental flood basalts are believed to result from plume activity in the mantle. Recent hypotheses for the origin of Deccan magmas is believed to have been triggered by a deep mantle plume whose remaining tail is presently causing volcanic eruptions on the island of Reunion in the Indian ocean (C.F. Duncan, 1978; Richards et al, 1989; Campbell and Griffiths, 1990). The dimensions of such plume, incubation period of the plume 'head' beneath or within the continental lithosphere, whether or not crustal extension and intrusive activities predated Deccan flood basalt eruption, eruption frequency and total duration of Deccan basalt eruption are intriguing topics that have been investigated in several recent studies .(Mahoney, 1988; Bean, 1988; Courtillot et al, 1988; Duncan and Pyle, 1988; Hooper, 1990; Kent et. al., 1992); Constraints on some of these parameters require good age control on the lavas and intrusive; however, Ar-loss has been a persistent problem in obtaining well constrained ages from various part of the Deccan. A few high-quality  $^{40}\text{Ar}/^{39}\text{Ar}$  ages have been reported from different parts of the Deccan, most of which are on the western Deccan lavas (Courtillot et al., 1988; Duncan and Pyle, 1988). These ages suggest that peak Deccan activity occurred around 65-69 Ma ago (Courtillot et al., 1988).)

The work done so far in establishing the stratigraphy, age relationship, and geochemical behavior of these flows and their petrogenetic aspects are very limited. The flows are horizontal to sub-horizontal showing dips between  $0^{\circ}$  to  $15^{\circ}$  degree (Krishnan 1960) but vast area are nearly horizontal with dips of 1 degree or less predominantly tholeiitic. The age determined is upper

Cretaceous to lower Eocene period. The Deccan (Derived from the Sanskrit word south or southern) comprises of thick succession of nearly flat lying sub laterally erupted lava flows at least some of, which are traceable for a distance of more than 100 km (Mohoney, 1988). In general, the thickness of the lava flows varies from 2000 m in western India to 200 m, in central India with its maximum critical thickness exposed is about 1645 m in Kalsubai hill (Khadri 1989).

### Study Area

The study area lies towards north western part of Amravati forming about 800 m thick sequence of lava flows covering of an area of 250 sq km near the Chikhaldara region covering the Survey of India toposheet number 55G/3 (Degree sheet 55G). It is located at about 100 km from Amravati between  $21^{\circ} 15''$  to  $21^{\circ} 30''$  N latitude and between  $77^{\circ} 0''$  and  $77^{\circ} 15''$  E Longitude (Fig.1). Adjacent to the study area, Chikhaldara is the pious hill station in the Satpura mountain ranges in Vidarbha region. It is situated at the height of 1118.6 m above the sea level on the southern spur of the Gawilgarh hills, in Amravati District of Vidarbha region in the Maharashtra state (Bhagat, 1999). In order to reach to the study area (Khongda) by road one has to travel from Amravati to Paratwada (Achalpur Camp) and Paratwada via Ghatang to Chikhaldara (Dharni-Burhanpur high way road), another option is from the Paratwada via Dhamangaon Gadhi to Motha and Motha to Chikhaldara. The study area (Khongda) is accessible from Chikhaldara (Eastern side of the study area) and Akot (Western side of the study area) through regular bus service. The site of present investigation, Khongda is situated about 95 Km. north east from the Chikhaldara and 58 Km. south east of Akot (Fig. 1). The published data on , southern and eastern site of the study area has also been utilized for obtaining a comprehensive stratigraphy and petrogenetic history of the Deccan Trap flows, in addition to the data obtained through the present study.



**Fig.1. Location map of the study area showing various field traverse.**

(1. Khongda.2.Vairat.3.Zira.4.Khatkali.5.Pili.6.Kund.7.Khongda-II 8.Tembrusonda 9.Dhakna 10.Pirkheda)

## **Physiography**

Physiographically, the study area lying towards west of Chikhaldara consisting of horizontal to sub horizontal lava flows bounded on all sides by steep escarpment. The area of investigation is characterized by the presence of erosional landforms with minor occurrences of depositional landforms. The topography is characterized by the presence of various landforms like lava plateau, lava hills, mesa, butte, and escarpment etc. The highest point exposed in the study area is Vairat Traverse (1177 m) whereas, the lowest point exposed is Dhakna (466) village. The average elevation exposed in the study area is 600 - 700 m and the plateau has a gentle northerly slope. Even though, the study area is traversed by tributary of Tapi such as river Gadga and its smallest streams, at most places the water is scarce, the climate is normal and variation in local temperature is high (10° to 45° C). The major source of rainfall is south - west monsoon. The hill slopes of the area are covered with the fairly dense open forests of teak and other trees. The study area is dominated by monotonous flat-topped terraced hills, which might have resulted from the lateral erosion of lava flows. Field Traverses and numerous spot checks have been carried out to trace the individual flows and flow sequence at detached outcrops. Morphometric analysis is carried out to understand the drainage characteristics and their role in the formation of present landscape. Geological field mapping and sampling was carried out to understand the aerial extent of lava flows. IRS-LISS-III imageries are studied to differentiate various geomorphic units, drainage pattern, regional geology, structural trends such as to locate various faults and lineaments. The remote sensed data was analyzed with the help of ARC-GIS 9.2 software in the RRSSC, Nagpur.

### **Correlation and distribution of lava:**

In order to understand the nature and aerial extent of various lava flows, 10 field sections were measured and correlated. It is noticed that with some exceptions, most of the flow sequences (formations) are traceable to a large extent with thickening and thinning appearance due to the pinching and swelling nature (Table1, Fig.2). In general, the study area is dominated by various lava flows showing horizontal nature with variable thickness. Some of the flow can be traceable for more than 100 km. horizontal distance. By utilizing topographic levels of a particular flow horizon, small dips of 0.5 to 1 degree are computed. The variation in the amount and direction of dip between individual flows and the presence or absence of some flow can be attributed to the thickening and thinning of individual lava flows. Yoder (1976) indicated some indicators for determining the flow movement. Columnar structure sometime indicates the possible direction of flow as seen along the Ambadoh nadi field traverse. However, due to the presence of irregularities within the flow, they are not trustworthy.

### **Field Geology**

The lava flows exposed in the study area can be grouped into compound (Pahoehoe) and simple ("aa") types (Raja Rao et.al., 1978). The compound flows are characterized by the presence of two or more flows with presence of vesicles on the top whereas, the simple flows show rough, Jaded, spinose and clinkery surfaces with upper portion, irregular vesicles stretched in the direction of flowage and central massive phase underlined by quite dense bottom portion. Many flows came out from the vents as pahoehoe and changed to 'aa' as they advance down slopes due to the increasing viscosity resulting from the loss of gas, cooling and progressive crystallizations and amount of string to which it is subjected (Macdonald, 1967). However, the study area is mostly dominated by simple flows with minor occurrence of compound (Pahoehoe) type. In general, higher the viscosity and more the string, greater is the tendency to change. In a simple flow, a portion that moves down smoothly and relatively gentle

slope may remain pahoehoe for many kilometers, whereas another portion that happens to plunge over the cliff area with simply a considerably steeper slope changes immediately to 'aa' and remain same for the rest of its course (Khadri, 1989).

#### **Flow nature and classification:**

Flows can be recognized on the basis of their size and ability to withstand weathering, which is reflected in the breaks in slopes. Flows can be recognized based on the grain size variation, textural parameters (aphyric, microphyric to porphyritic, phenocrystic assemblages (Feldspar, Feldspar + mafics, mafics) as well as physiographic field signatures (Khadri etc., 1988). Each compound flow is characterized by the presence of smaller flow units, a few of which show limited areal extent. Each of flow unit has a top, which cooled significantly and solidified before another flow unit was superposed on it. Each flow unit is a separate unit although not necessarily cooled down.

Before its burial by another unit, compound flows generally have shield like form and are thought to develop when the rate of extrusion of lava is relatively slow (Walker, 1971). Compound flow shows striking variation not only in phenocryst content between one flow unit and another but also between top and bottom of the same unit. In general, the thickness of compound flow varies from a few meters to more than 100 m with aerial extent of 100 Kms. The flow units are characterized by the presence of pipe amygdales or spiracles at the base and ropy amygdaloidal or vesicular tops. Zeolitic alteration is conspicuous throughout the sequence. The flow contacts are often marked by the presence of red/green bole horizons and Giant plagioclase basalt (plate 3.1A) or by vesicular oxidized scoria with a thin glassy skin developed at place against the denser overlying base of the next flow, which may be enriched in the mafic phases like olivine and clinopyroxene.

Simple flows can be distinguished with one another on the basis of green bole horizons with variable thickness indicating time gap between successive lava flows. as seen in and spheroidal weathering indicating the role of pressure and temperate conditions near Zira field section, compound flow is exposed in field section. Simple flows are characterized by the absence of recognizable flow units with more uniformity in the field signatures with well developed to partly developed columnar jointing, showing partial developed entablature structure along the river section. The presence of pot holes on the top of the flow indicate fluvial erosion. The simple flow contain columnar joints showing colomnade at field section. The massive portion of simple flows are generally less vesicular than the compound flows. Extensive field mapping of the study area indicate the large aerial extent of many flows showing variable thickness due to the pinching and swelling nature. In Zira Ghat section well horizontal indistinctly vertical columnar joints are exposed.

#### **Field classification:**

Flows can be distinguished from one another on the basis of their aphyric and phyric nature, grain size and textural variations along with field expressions. The study area is dominated by the presence of simple flows certain flows are characterized by the presence of columnar jointing representing the base of the flow. The presence of red/green bole horizons vesicular and amygdaloidal nature of the flows along with weathering and jointing pattern may also help is identifying various flows.

Detailed geological mapping with the help of 10 field traverses has indicated the presence of 18 different lava flows showing wide aerial extent in a thick pile of 800 m. Based on filed characters, the lava flows can be broadly classified into aphyric and phyric types. However, a mix up of these types at place is not uncommon.

### **1. Aphyric flows:**

These are mostly fine grained in nature, without any significant proportion of microphenocrysts in them. These flows can be either vesicular or amygdaloidal in nature with the help of hand lens; sometimes it is possible to differentiate these aphyric flows with those containing considerably small microphenocrysts.

### **2. Phyric flows:**

These flows are essentially phyric in nature and are made up of either plagioclase or olivine or a mixture of clinopyroxene and olivine.

#### **(a) Plagioclase phyric flows:**

These are fine to medium grained with tabular laths of plagioclase. In some cases, the plagioclase content varies even within a flow. In most case they are arranged in one direction, indicating the direction of movement of the flow.

#### **(b) Olivine phyric flows:**

These flows are coarse to medium grained, highly weathered with mostly irregular topography. However, their typical weathering pattern makes it easier to distinguish them from other flows. Weathered olivine mostly occurs as iddingsite or serpentine. In general, these flows are associated with other mafic mineral like pyroxene and opaques. Both amygdaloidal and massive (non - vesicular) varieties are common in this flow, which has no systematic relationship as there is a considerable variation with in flow.

#### **(c) Mafic phyric flows:**

These are mostly medium to coarse grained with the presence of mostly pyroxene and olivine in variable proportions. In the field, it is not possible to identify these mafic mineral separately if they are occurring together. In general, these flows are dark colored, dense in nature with the presence of amygdaloidal and massive varieties.

#### **(d) Picritic flows:**

These are dense, massive, coarse grained with large Phenocryst of olivine, either fresh or weathered. Even though, it is difficult to differentiate an olivine picritic flow in field due to its Phenocryst content and typical weathering pattern, forming cliffs and bounders.

#### **(e) Giant Plagioclase Basalt (GPB):**

These are coarse grained, either massive or amygdaloidal basalts consisting of very big (3mm to 5mm) patchy Phenocryst of plagioclase, some times associated with the mafics. These flows are known as marker horizons as they are occurring mostly at or near the formation boundaries and have been effectively used for separating different formations.

### **Elevations and flow boundaries:**

The study area presents one of highest peaks in the Khongda Volcanics, constituting the Gawilgarh hill range with a maximum elevation of 758 m and minimum elevation of 200 m at Ambapani, pipliya. In general the lava pile is dividing into individual flows or closely related group of flows mainly based on textural character (aphyric microphyric to porphyritic), the Phenocryst assemblage (feldspar + mafics, only mafics) as well as field geomorphic expressions. Some flow contacts are identified by the presence of red or green bole, indicating a large time gap between successive flows. Pipe vesicles, vesicles cylinders or spiracles projecting upwards from the base, spheroidal weathering, presence of pot holes of the flow, due to the rising gases high degree of vesicularity of the upper part of the thick flows of pahoehoe or of the massive portion of the thick flows of 'aa', relative enrichment of the mafics at the bottom of the flow, rampant zeolitization, petrographic and conspicuous grain size variations. The top and bottom of the flow unit is glassy with less developed crystals while the middle part is well crystalline and

coarse grained. Before assigning a particular signature to flow and there by separating it from flows lying above or below, the tractability of the field characters in exposed sequence in a given field traverse is given due consideration. The use of oxidized and amygdaloidal horizons in separating one flow from other is found to be limit owing to the rarity of such horizons in the area north of Khongda and the presence of both sparsely amygdaloidal and highly amygdaloidal units within a simple flow. These criteria could not be used with in the same region in correlating flows of distant outcrops because they are not very consistent over large distance, hence making it difficult to correlate the flows merely on the basis of their physical and field characters. The occurrences of dykes are restricted to lower elevations in the west of Khongda area.

### **Formation:**

Mappable sequences of individual flows recognizable in the field are grouped into formations based on their similar field characters associated with the presence or marker horizons. A formation, in general represents a thick lava pile comprising of compound and simple flows with comparably less evolved and more primitive type of flows at the bottom, which shows progressive evolution towards the top. Mostly either a GPB or a brecciated horizon associated with major physiographic breaks is present at the top of each formation. It is not very much essential that the above characters should be represented by all the formation is divided into lower, middle or upper division wherever applicable. Each of this division is associated with two or more smaller divisions consisting of one or more flows. A single flow or sequence of flows occurring at the same stratigraphic level having similar physical characters is termed as a member

### **Marker horizons:**

These are the horizons, which have distinct and fairly uniform set of field characters that are traceable over large areas at approximately the same stratigraphic levels. The north of Khongda area is characterized by the presence of giant plagioclase basalts at the top of each formation, which has been effectively used as the marker horizon and was identified, traced in the field. Sometimes, brecciated horizons and red beds act as marker horizons.

### **Field Stratigraphy**

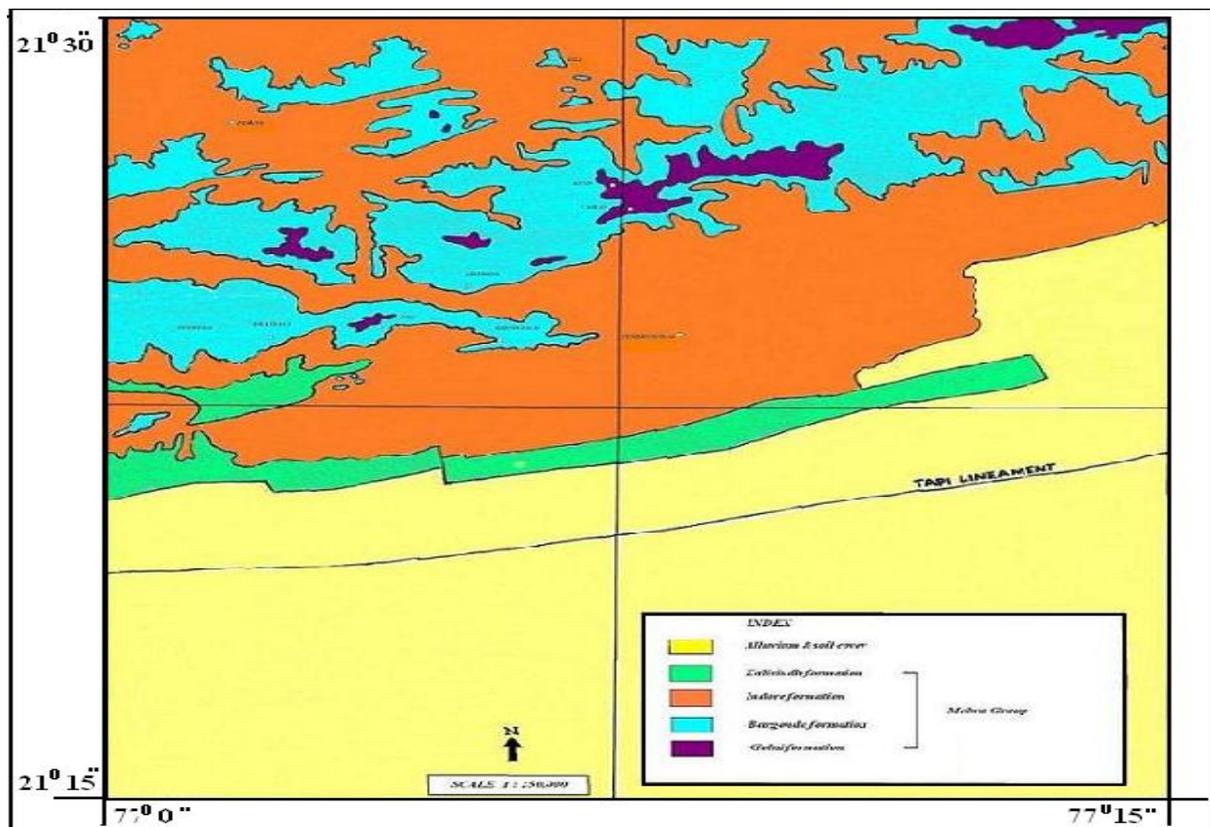
Four well-defined formations “Gulerghat” (oldest), “Chandpur”, “Khongda” and “Chikhaldara” (youngest) exposed in 18 flows have been identified. (Fig.2, Table 1). The present stratigraphic divisions are mainly based on distinct field characteristics, Phenocryst assemblage, major physiographic breaks and significant shifts or breaks in the elemental abundances and ratios particularly  $K_2O$ ,  $MgO$ ,  $TiO_2$ ,  $P_2O_5$ ,  $Mg$ ,  $Ba$ ,  $Sr$ ,  $Cr$ ,  $Zr$ ,  $TiO_2/P_2O_5$ ,  $Ba/Ta$ ,  $Ba/Sr$ ,  $Ba/Zr$ ,  $Zr/Ti$ ,  $Sr/Y$  and  $Zr/Y$ . Based on the above characters, each formation is further divided in to various members each of which consist of one or more flows. However, one or more member within formation shows similar chemical characteristics without a stratigraphic bias is identified as a chemical type (CT). The repeated occurrence of each of these CTs at various stratigraphic levels highlights their cyclic nature (Khadri et al. 1988).

This study provides first hand information regarding the correlation of the lava flows with structurally controlled Gawilgarh fault. The investigation brings out multidisciplinary approach of the above mentioned problem. The prime objective of this study is to understand the nature of lava sequence and correlating the stratigraphic horizon to establish the regional stratigraphy of the lava flows and the water resources potential of the region by utilizing the latest available techniques. The basic aim of this study is to establish flow stratigraphy of the comprising of Deccan Traps and distinguish various flows with the help of 10 field sections of

the study area Khongda. With the help of and major and minor physiographic breaks, distinct variations in the field characters have been identified. Based on these studies, the 800 m thick lava pile has been divided into two different litho logical units. Each formation has been divided into various members consisting of one or more flows (Fig3, Table 1).

**Table 1: Field Stratigraphy of Khongda region.**

Group	Subgroup	Formation	Field Characteristics
Deccan Trap	Vidarbha	Chikhaldara	Hard, compact massive, fine grained ,aphyric massive basalt with minute amygdales
		Khongda	Hard, compact, massive, Hard, compact, massive, fine grained pl. mafic phyric basalt.
		Chandpur	Hard,compact,Fine grained, Pl.Phyric ,massive with amygdaloidal Basalt
		Gulerghat	Hard, compact massive, fine grained,pl.mafic-phyric basalt



**Fig. 2: Geological formation map of Khongda region and surrounding areas based on GSI Geological Quadrangle map, 1998.**

**LEGEND**

	Aphyric, Amygdaloidal
	Aphyric, massive
	Mafic-phyric
	Mafic-phyric-amygdaloidal
	Plagioclase-phyric
	Plagioclase & mafic-phyric
	Plagioclase-phyric, amygdaloidal
	Plagioclase & mafic-phyric amygdaloidal
	Gaint plagioclase phyric basalt
	Picrite
	Red / Green bole
	Plagioclase microphyric
	Mafic microphyric
	Fine grained
	Coarse grained
	Medium grained
	Vesicular basalt

Fig. 3: Legend for field section

**Correlation of individual flows and flow groups:**

Brief description of various flows recognized in different field traverses and their physical parameters are as follows.

**Vairat Traverse (Vrt1-Vrt40, Height 1177m, 55G/7) :**

The Vairat field traverse is at highest elevation represent succession of 9 lava flows exposed in this region. In this traverse, 9 lava flows belonging to Chikhaldara formation are recognized (Fig.4) . The formation C is characterized by the presence of aphyric amygdaloidal, plagioclase microphyric, aphyric massive basalt, plagioclase mafic microphyric amygdaloidal basalt. This is overlain by D formation is characterized by the presence of plagioclase phyric mafic microphyric , plagioclase phyric massive , aphyric amygdaloidal, plagioclase mafic phyric and the uppermost flow is aphyric amygdaloidal basalt. This traverse (V) is characterized by fine grained, hard, compact and aphyric basalt with minutely amygdaloidal nature.(Fig.4)

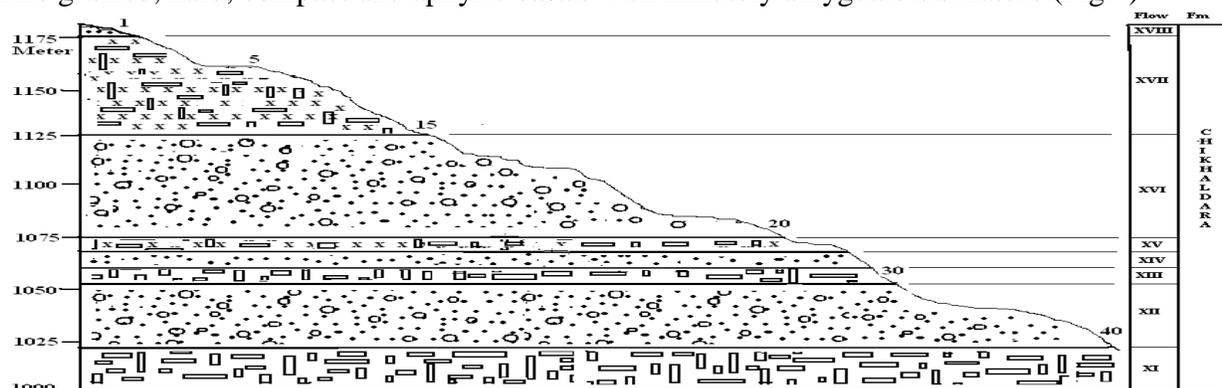


Fig. 4 Vairat traverse (Vrt1-Vrt40)

**Kund Traverse (Ku 1-Ku 60, Height 1000m 55 G/3) :**

This field traverse is characterized by the presence of 12 lava flows. The lower most flows is compact, massive fine-grained are plagioclase phyric basalt. This is overlain by compact, massive, aphyric basalt. The next flow is plagioclase phyric to giant plagioclase basalt. This flow is overlain by mafic phyric basalt with few vesicles. This is overlain by mafic flow further it is overlain by mafic phyric basalt with few amygdales, plagioclase mafic phyric, fine grained basalt, further more overlain by compact massive and aphyric basalt with amygdales.(Fig.5).

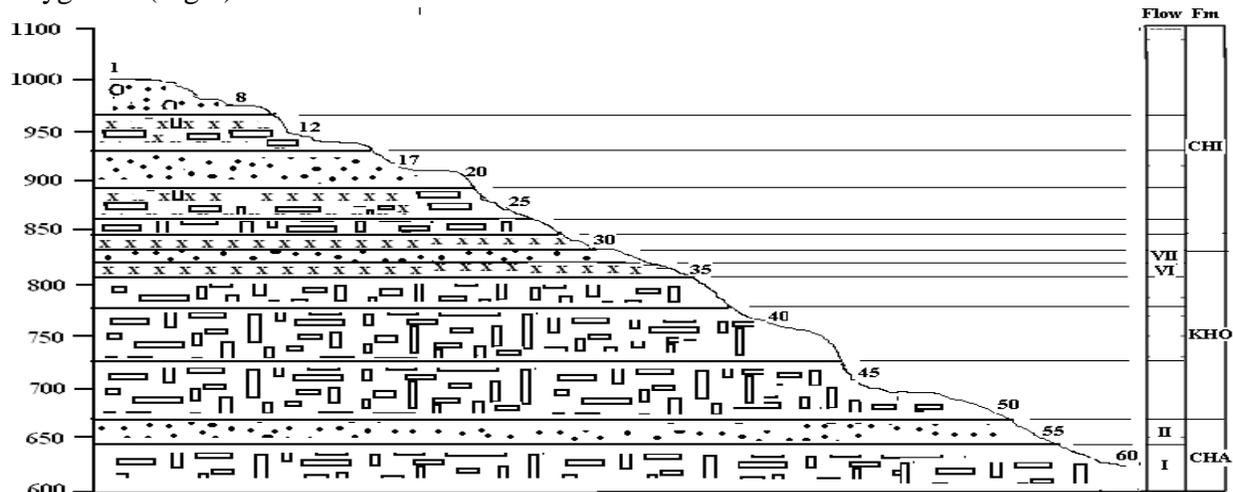


Fig. 5: Kund Traverse.(Ku 1-Ku-60)

**Dhakna Traverse (Dhk 1-Dhk 46, Height 600 m, 55 G/3) :**

This field traverse is characterized by the presence of a formation in which 3 lava flows are seen. The lowermost flow is fine grained, aphyric. Basalts which are followed by plagioclase microphyric massive basalt and uppermost is aphyric basalt. . The upper most of the this field section is characterized by fine grained, massive, hard and compact, aphyric basalt , with the presence of amygdales.(Fig.6).

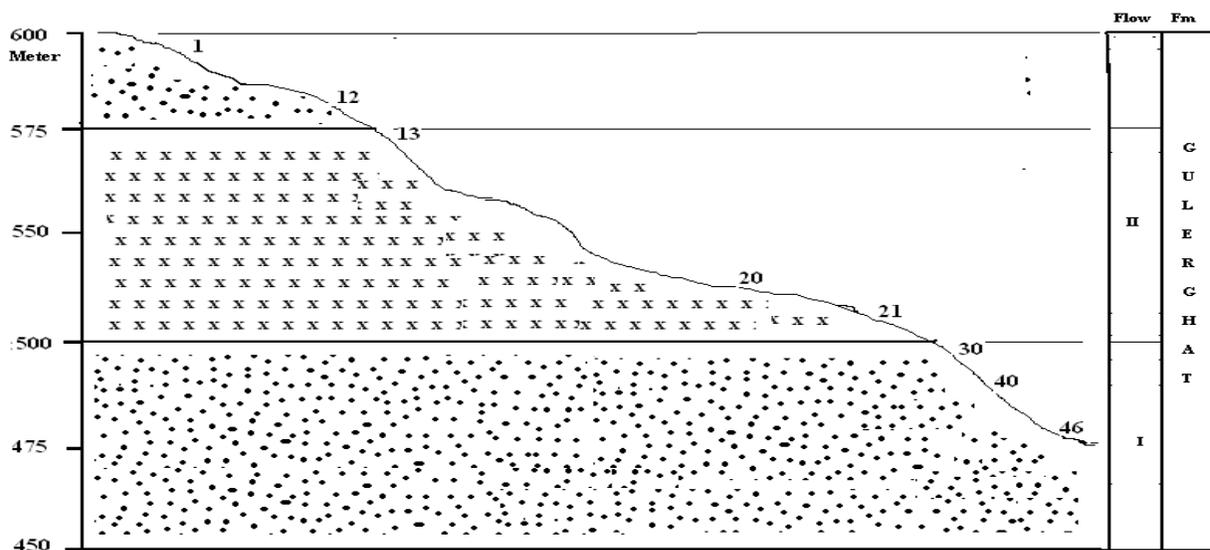


Fig. 6 Dhakna traverse (Dhk 1-Dhk 46)

**Pirkheda Traverse (Pir 1-Pir 62, Height 1003 m, 55 G/3):**

This field traverse is characterized by the presence of nine lava flows falling into two formations, Khongda and Chikhaldara. In the lower formation, the lowermost flow (flow no I) is fine grained, aphyric basalt. This is overlain by next flow consisting of aphyric to mafic microphyric, plagioclase phyric massive basalts, aphyric amygdaloidal, plagioclase phyric massive basalts. The uppermost formation where aphyric to mafic microphyric, plagioclase phyric amygdaloidal massive basalt overlain by plagioclase microphyric, aphyric basalts are observed. This is overlain by next flow of mafic phyric and amygdaloidal in nature is followed by mafic phyric and aphyric amygdaloidal flow. In the upper formation, Chikhaldara, most flow of this formation is characterized by fine grained, hard and compact, massive mafic-phyric, amygdaloidal to aphyric amygdaloidal basalt. This field section is characterized by the presence of nine different lava flows forming around 400 m thick pile. (Fig.7)

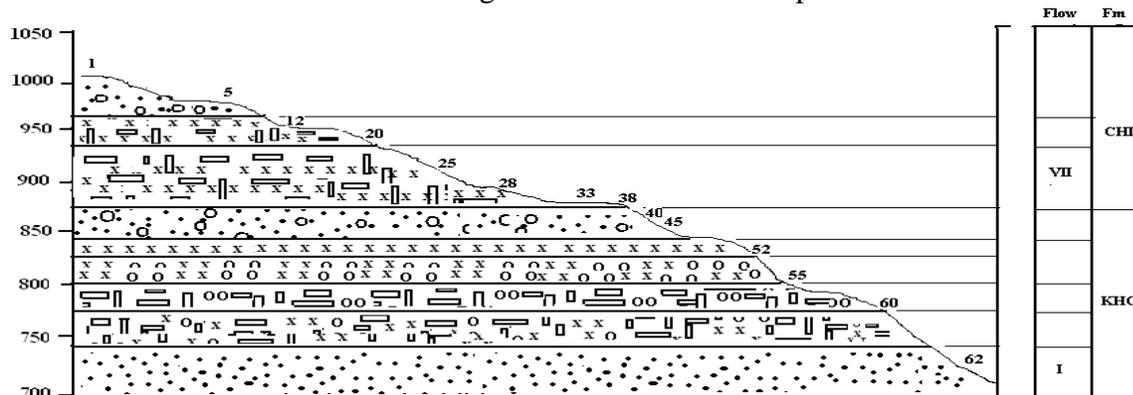


Fig. 7: Pirkheda Traverse.(Pir 1-Pir-62)

**Khatkali Traverse (Khk 1-Khk 51, Height 1078 m, 55 G/3)**

This field traverse is characterized by the presence of 9 lava flows falling into two formations. In the formation first, Khongda, lowermost (flow no I) is plagioclase mafic-phyric amygdaloidal massive basalts and the above flow (flow no. II) is fine grained aphyric massive basalts. This flow is overlain by next flow consisting of plagioclase mafic-phyric massive basalt followed by next flow which is plagioclase mafic phyric amygdaloidal massive basalts further it is followed by next flow which is mafic phyric massive basalts overlain by fine grained aphyric massive basalt. The uppermost formation is Chikhaldara is characterized by two flows which are hard, compact and fine grained, with the presence of amygdaloides. This field section is characterized by the presence of nine different lava flows forming 400 m thick pile (Fig.8).

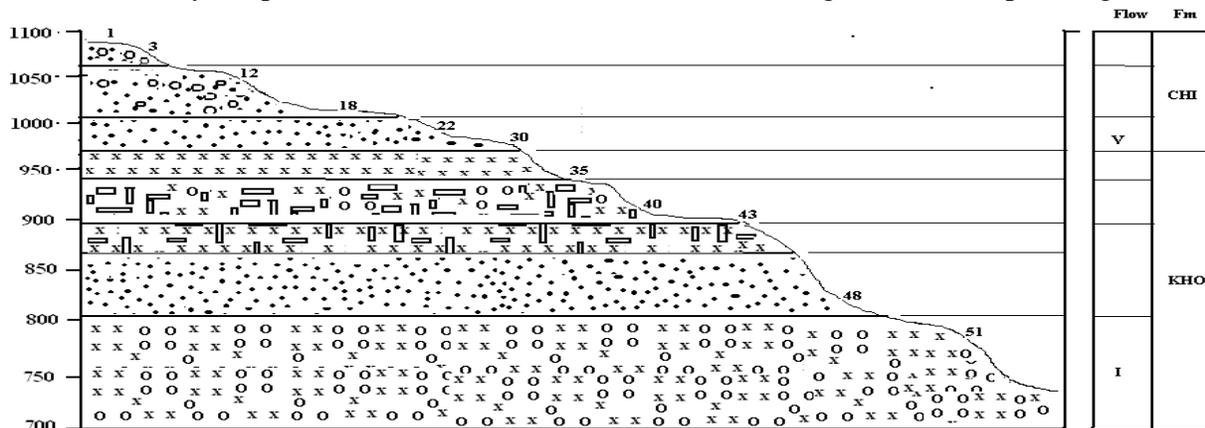


Fig. 8: Khatkali Traverse. (Khk 1-Khk-51)

**Tembrusonda Traverse (Tem 1-Tem 30, Height 1078 m, 55 G/3)**

This field traverse is characterized by the presence of eight lava flows falling into two formations, namely Gulerghat and Chandpur. In the lower formation, the lowermost flow (flow no I) is fine grained, 1 aphyric basalt. 2 This is overlain by next flow consisting of aphyric to mafic aphyric massive basalts. The uppermost two flows are repeated which have an alternate sequence of the flow underlined by them having more or less thickness. This is overlain by next flow of plagioclase mafic phyric and minutely amygdaloidal in nature. In the upper formation, Chandpur, most flow of this formation is characterized by fine grained, hard and compact, massive mafic-phyric, amygdaloidal to aphyric amygdaloidal basalt. This field section is characterized by the presence of eight different lava flows forming 320 m thick pile (Fig.9).

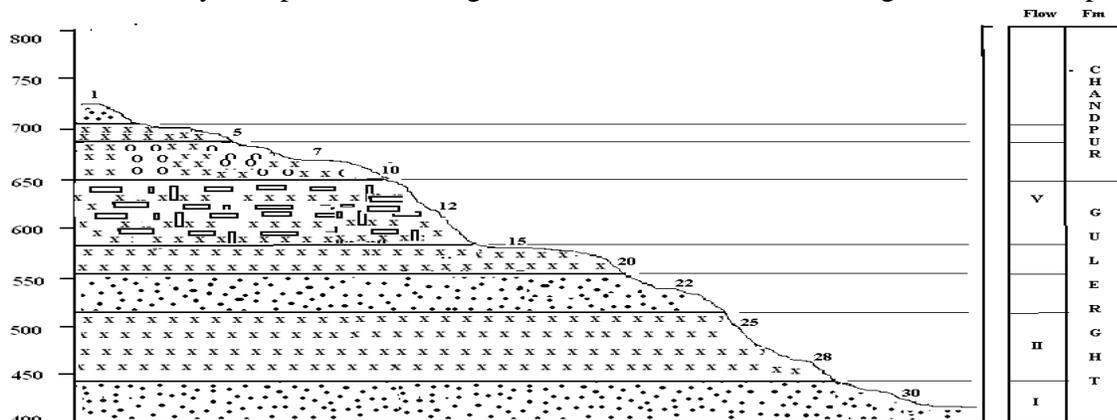


Fig. 9: Tembrusonda Traverse. (Tem 1-Tem-30)

**Zira Traverse (Zr 1-Zr 42, Height 924 m, 55 G/3):**

Stratigraphically, this traverse is made by three formations Chandpur, Khongda and Chikhaldara. This field traverse is characterized by the presence of 8 lava flows. The lower most flows is compact, massive fine-grained are plagioclase aphyric basalt. This is overlain by compact, massive, vesicular basalt. The next flow is plagioclase phyric to mafic phyric basalt. This flow is overlain by aphyric basalt with few vesicles and amygdaloidal. This is overlain by plagioclase mafic phyric, fine grained basalt, further more overlain by compact massive and mafic phyric basalt with amygdales. Last and uppermost flow is characterized by amygdaloidal in nature with aphyric massive. This field section is characterized by the presence of eight different lava flows forming 325 m thick pile (Fig.10).

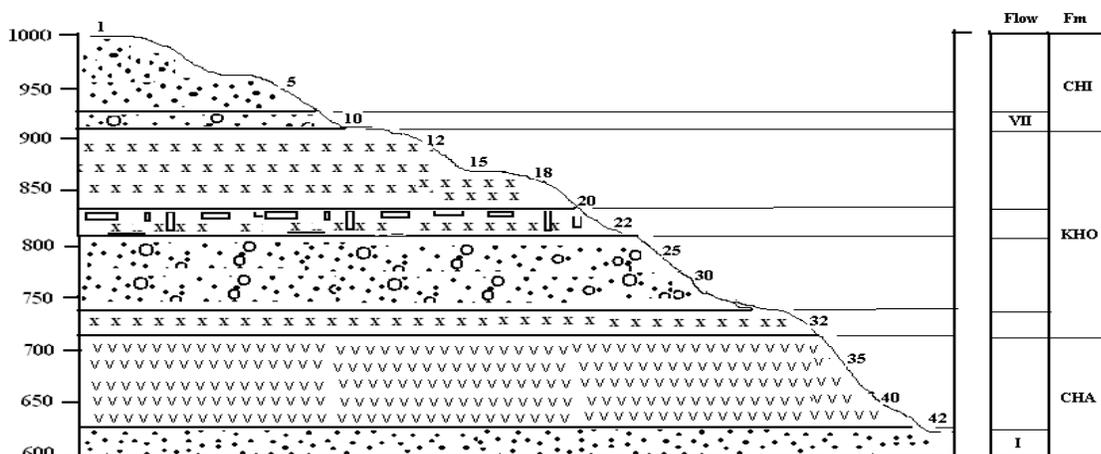


Fig. 10: Zira Traverse.(Zr 1-Zr-42)

**Khongda Traverse (Kh 1-Kh- 64, Height 1103 m, 55 G/3):**

This field traverse is characterized by the presence of 10 lava flows. In the lower formation, the lowermost flow is fine grained, aphyric massive basalt. This is overlain by next flow consisting of plagioclase mafic phyric, massive basalts. The uppermost formation where aphyric amygdaloidal, plagioclase aphyric massive overlain by plagioclase, aphyric basalts are observed. Further this is overlain by aphyric massive basalt. This field section is characterized by the presence of ten different lava flows forming 120 m thick pile. Next flow is characterized by fine grained, highly weathered, mafic phyric amygdaloidal basalt overlain by aphyric flow. Over this flow there exist another two flow having the characteristics of plagioclase phyric to plagioclase mafic phyric in nature over which aphyric massive basalt is raised. The uppermost flow is characterized by fine grained, compact, aphyric to amygdaloidal massive basalt.(Fig.11).

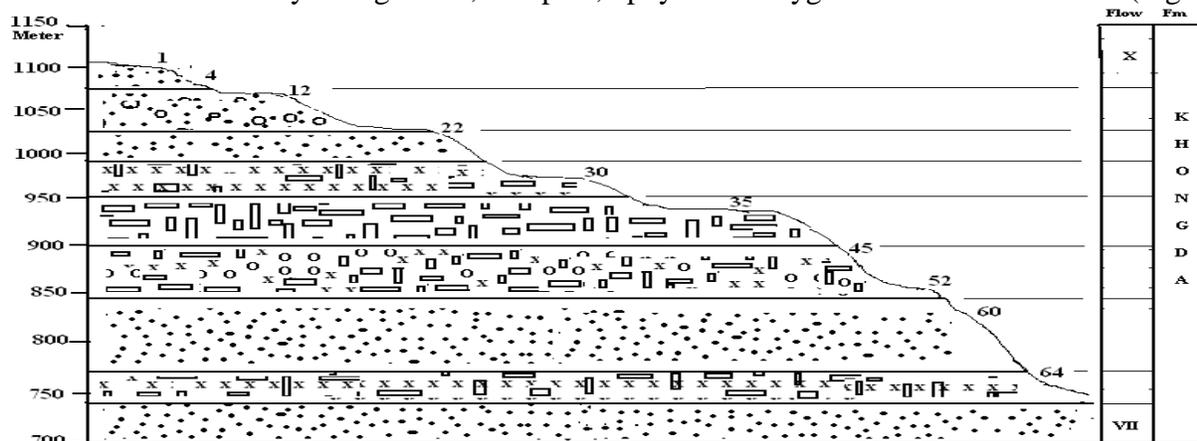


Fig.11 Khongda Traverse (Kh1-Kh64)

**Khongda-II Traverse (KhII 1-KhII 60, Height 1085 m, 55 G/3):**

This field traverse is characterized by the presence of 10 lava flows falling into two formations namely Chandpur and Khongda. In the formation first, lowermost (flow no I ) is plagioclase aphyric massive basalts and the above flow ( flow no. II) is fine grained, plagioclase mafic phyric basalts. This flow is overlain by next two flows consisting of aphyric massive to mafic phyric in nature from where next Formation Khongda exists. This flow is overlain by plagioclase mafic phyric amygdaloidal basalt. This is overlain by plagioclase mafic phyric, fine grained basalt, again overlain by compact massive and mafic phyric basalt with amygdales. The uppermost flow is characterized by aphyric massive basalt. This field section is characterized by the presence of ten different lava flows forming 385m thick pile (Fig.12).

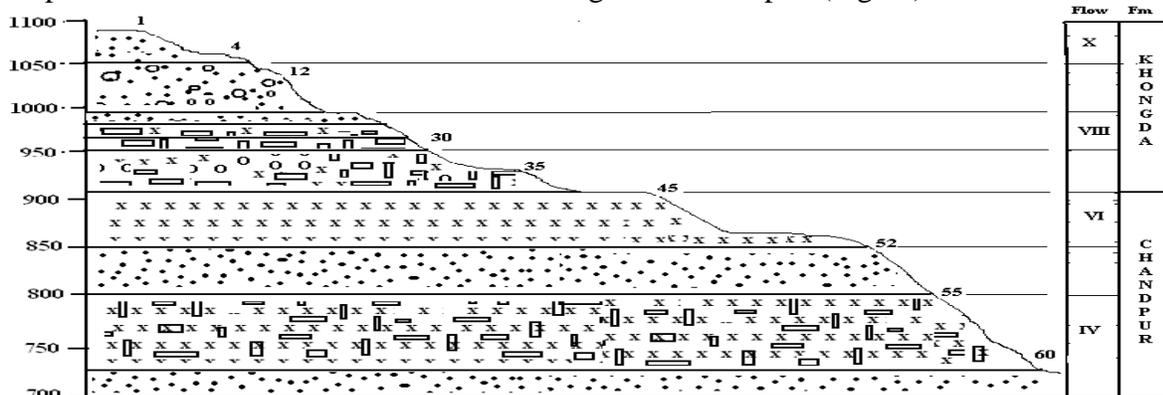


Fig.12 Khongda-II Traverse. (Kh 1-Kh-64)

**Pili Traverse (P 1-P 50, Height 658 m, 55 G/3):**

This field traverse is characterized by the presence of 10 lava flows. In the lower formation, the lowermost flow is fine grained, aphyric massive basalt. This is overlain by next flow consisting of plagioclase mafic phyric, massive basalts. The uppermost formation where aphyric amygdaloidal, plagioclase aphyric massive overlain by plagioclase, aphyric basalts are observed. Further this is overlain by aphyric massive basalt. Next flow is characterized by fine grained, highly weathered, mafic phyric amygdaloidal basalt overlain by mafic-phyric flow. Over this flow there exist another two flow having the characteristics of plagioclase phyric to plagioclase mafic phyric in nature over which a next flow of aphyric massive basalt is raised. The uppermost flow is fine grained, hard and compact, aphyric massive basalt. This field section is characterized by the presence of ten different lava flows forming 258 m thick pile (Fig.13).

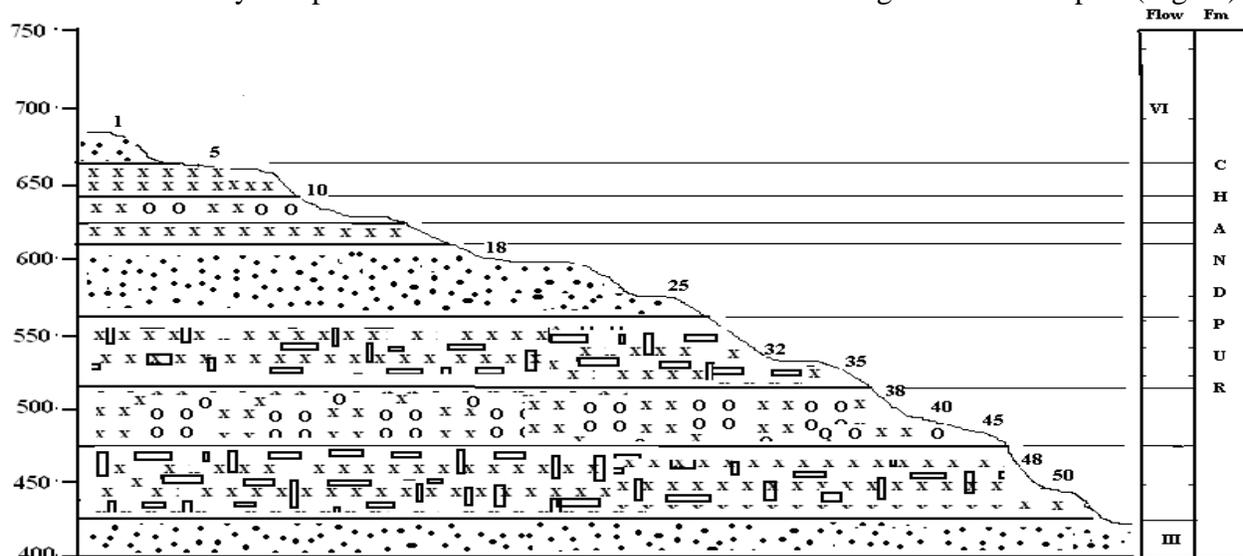


Fig.13 Pili Traverse (Pili1-Pili50)

**Comparison of lava flows of Khongda region and Western Ghats:**

In order to verify the aerial extent of various lava flows, several traverses from both the Khongda region and Western Ghats have been compared and correlated. It is noticed that with some reservation, most of the flows in the study area are traceable and comparable with the similar flow horizons exposed in the adjoining areas. However, some flows have thickened and others have thinned out due to the pinching and swelling nature of the flows. Most of the flows in study area are essentially horizontal in nature with gentle northerly slope, which can be traceable for large distance. Field correlation of Khongda region with the already established Western Ghats Stratigraphy has revealed satisfactory result. The Gulerghat formation can be comparable. With the adjoining Khongda region due to the presence of fine grained, aphyric, minutely amygdaloidal horizon, plagioclase mafic phyric basalt. The Chandpur formation can be comparable with the adjoining areas showing the distinct field characters such as pl. phyric, mafic phyric, aphyric, pl. mafic phyric nature. The Khongda formation can be comparable with the adjoining regions of pl. mafic phyric horizon, highly evolved GPB at top. The Chikhaldara formation can be comparable with adjoining region showing pl., mafic phyric basalt. (Fig.14).

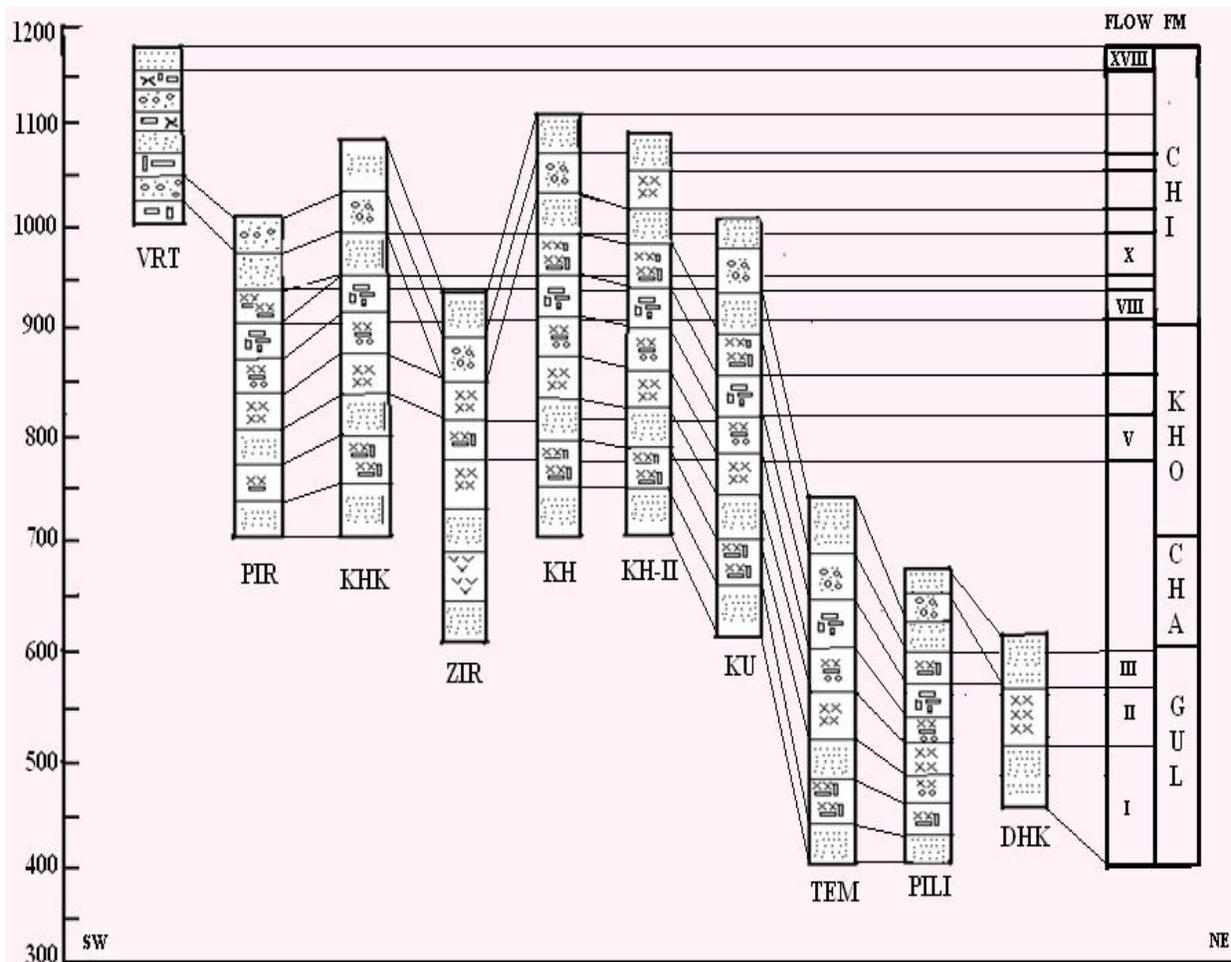


Fig. 14: Field correlation diagram showing various formations exposed in the Khongda Region. (1. Vairat. 2. Pirkheda 3. Khatkali 4. Zira 5. Khongda.6. Khongda-II 7. Kund 8. Tembrusonda 9. Pili . 10. Dhakna )

### Summary and conclusion

The study area when compared with the Western Ghats show similarity in field characters. In the study area and Western Ghats, each formation is separating by highly evolved giant plagioclase basalt horizon (GPB). Igatpuri formation of Western Ghats is characterized by pl. mafic phyric basalt horizon with, GPB as marker horizon. The Thakurvadi formation is identified due to the presence of pl. phyric to mafic phyric horizons with highly evolved GPB at the top. The Gulerghat formation shows similarity with least the evolved pl. mafic phyric flows where as the Chandpur formation can be comparable with the Khandala formation showing simple flows consisting of highly evolved GPB horizon. The thickness of these formations in the both the area shows variation due to the greater degree of erosion exhibited by these basalts. The decrease in number of flows can accounted due to the progressive and successive overstepping of lava flows. The horizontal with the structural control nature of these flows owe their present position to the pre Deccan topography which control the distribution of these lava flows.

Even though, most of the flows appear horizontal in the field, by using topographic levels of a particular flow horizon small dips of 0.50 to 10 have been computed. The amount of dip is

negligible and also the variation in the amount and direction of dip between individual lava flows and the presence or absence and thinning of individual members. Some of the flow shows the orientation of Phenocryst or microphenocrysts in some specific direction indicating the direction of movement of the surrounding liquids but because of irregularity of movement within the flow, they are not trust worthy indicators of the direction of a flow as a whole. However, the presence of stretched vesicles may indicate local direction of movement of the flow (Khadri, 1989).

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