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LINEAMENT ANALYSIS OF PALAS BASIN SPREAD IN PARTS OF OSMANABAD AND SOLAPUR DISTRICTS, MAHARASHTRA STATE, INDIA

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ABSTRACT
The area proposed during the present investigations is the 5th order- Palas river basin, which is spread in parts of Osmanabad and Solapur districts of the State of Maharashtra. The Palas river basin covers an area of about 170 sq. km. As the area is a basin and is being drained mainly by Palas stream and its tributaries, it is evident that fluvial processes play a major role in geomorphic evolution. Due to such processes, there results mainly erosional and depositional landforms. The field observations supplemented with the analysis of aerial photographs and satellite imageries revealed the various erosional and depositional features. To determine the probable effect of structural control on drainage and other related features the lineament analysis was carried out in details.

KEY WORDS: Geomorphic evolution, Lineament, Maharashtra state, Palas basin.

INTRODUCTION

The preparation of lineament map has assumed to be of considerable significance in evaluating the geomorphological and tectonic evolution of continental area. O'Leary, et.al (1976) define lineament as mappable, simple or composite linear curvilinear relationship and which differs distinctly from the patterns of adjacent features and presumably reflects a subsurface phenomenon''. Thus the surface expressions can be delineated in form of lineaments with more or less their linear relationship observed on topographic maps in form of drainage courses and or topographic expressions. The accuracy of the analysis is directly depending upon the scale, lithological pattern, tectonic and structural characteristic, soil and vegetation coverage on the ground and the time and season of photographs and imageries obtained for the study. When lineaments are not related to structural and tectonics characteristics are usually attributed to rock fractures. Vidyanadhan et al. (1971) suggest that the term lineament or fractures can be used in the sense that it may be a linear break or cut in the rocks along joints fractures or a fault or trace of these. Long and near straight or straight stream courses, ridges, alignment of small gullies, linear sharp tonal variations can be used as the main criteria for recognition of lineaments on aerial photographs and imageries.

Regional lineament analysis of the western part of the Deccan volcanic province from Maharashtra shows the presence of northwest-southeast (NW-SE) and northeast-southwest (NE-SW) shear fractures and east-west, (E-W) north-south (N-S) trending extension fractures (Powar et. al., 1980). Development of the former lineament has been attributed to the NS compressional stresses resulted due to northward drifting of the Indian sub plate, whereas later lineaments are developed due to vertical horsting, following the impingement of the Indian subplate with Eurasian plate. This was followed by isostatic readjustment of the Indian Peninsula imparting cymatogenic uplift (Powar, 1981). According to Dhokarikar (1991), structural pattern controlling the physiographic set up is affected by the regional tilt of the peninsula and also by the lineaments which were developed after the completion of eruptive phase of basalt. The lineament fabric governing the zones of structural weakness (fracture trace) is dominantly NNW-SSE in Kokan. It follows NW-SE and NE-SW trends in rest of the area of the Maharashtra state except in north. Such a lineament fabric follows the Dharwarian strike direction and must have originated during the period of regional tilt to Peninsular India. (?).

STUDY AREA

The area proposed during the present investigations is the Palas river basin, which is spread in parts of Osmanabad and Solapur districts of the State of Maharashtra. The Palas river basin covers an area of about 170 sq. km. The Palas River of 5^{th} order originates in the Balaghat ranges in the northern part of the area and flows towards south. One major tributary originating at peripheral region in NE part in Balaghat ranges is flowing nearly west words and meets main Palas stream in the middle reaches. The area included in S.O.I. toposheet No. 56 C/1, 56 C/5 on the scale 1:50,000, and is bounded between latitude $17^{o}40'$ N to $17^{o}55'$ N and longitude 76^{0} 08'E to $76^{o}17'$ E (Figure 1). The National highway NH-9 (Bombay –Pune –Hyderabad), passes from west to east, through the area under study, nearly dividing the basin into two halves. The area is characterized by an undulating topography. The Balaghat ranges more or less continuously demarcate the northern and eastern margins of the basin. In general the area is plain, having gentle slope towards south. The area under study falls in the drought prone region, and is characterized by arid to semiarid climatic conditions. The mean annual rainfall is about 700 mm. 80% of which is received by southwest monsoon, while the remaining is generally due to retreating monsoon. In general, rain fall distribution in the region is scanty and erratic. The area under investigation constitutes part of the major continental Tholeiitic province of India commonly referred to as the Deccan Traps in Indian Stratigraphy. These are represented mainly by the basaltic lava flows which were poured out during Upper Cretaceous to Miocene period (Krishnan, op. cit), from the field characters it is observed that there are four basaltic flows exposed in the area and all are of simple and Aa type, and are structurally undistributed and free from any intrusions. (Vadagbalkar, 1998). The area under study of Palas basin, is covered by the Deccan basaltic lava flows. These volcanic flows are horizontal in their disposition and though with varying litho logical characters have structural simplicity.

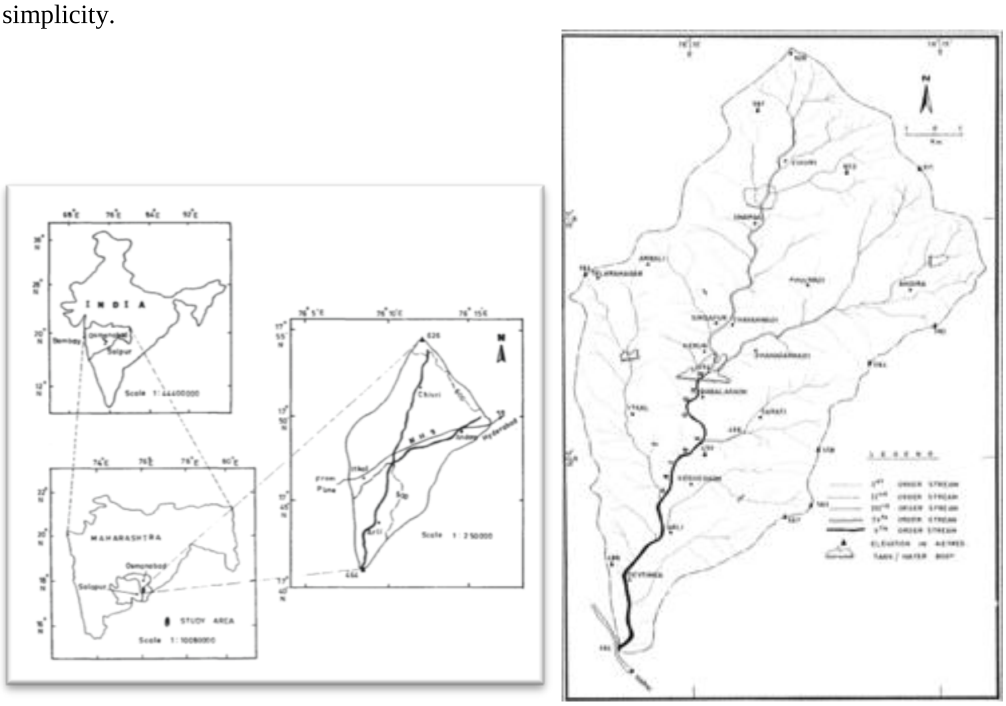

Figure 1: Location and Drainage Map of Palas Basin

At the same the area falls under typical climatic conditions. Development of geomorphic features therefore appears to be mainly controlled due to litho logical variations rather than the climate, as it can be considered as uniform control over the area. As the area is a basin and is being drained mainly by Palas stream and its tributaries, it is evident that fluvial processes play a major role in geomorphic evolution. Due to such processes, there results mainly erosional and depositional landforms (Vadagbalkar, 2013). The field observations supplemented with the analysis of aerial photographs and satellite imageries revealed the various erosion features like Mesa and butte, Pediment, Erosion or Planation surface, Stream gullies and valleys and depositional feature as Alluvium deposition. To determine the probable effect of structural control on drainage and other related features the lineament analysis was carried out in details.

METHODOLOGY and ANALYSIS

In the present analysis along with topographical sheets, aerial photographs, satellite imageries and false colour composite on various scales are taken help of in identifying the linear fabric of the region. Lineament analysis with the help of topographic sheets has been carried out for Palas basin by identifying linear or nearly straight course of streams. Length and orientation of each lineament has been measured. The lineaments then have been grouped according to the orientation by selecting 10 class intervals and the frequency in each class has been determined. Such a frequency has then been converted into percentages. On similar lines, length frequency has then been converted into percentages. On similar lines, length frequency and percent length frequency have been computed. The number and length frequencies of lineaments so computed are presented in Table 1 (a). These frequencies have been presented by way of Rosette diagram, along with the lineaments in Figure 2 (a). The lineament analysis with the help of aerial photographs and the satellite imageries has similarly been carried out. However in such analysis apart from the linear stream segments, the lineaments in the topography have also been identified and analyzed by tonal difference. The number and length frequencies of lineaments with the help of aerial photographs have been presented in Table 1 (b) and those from the satellite imagery have been presented in Table 1 (c). Their graphical presentation has also been made by way of Rosette diagram along with the lineaments in Figure 2 (b) and (c) respectively.

RESULTS AND DISCUSSION

The lineament analysis carried out with the help of topographic sheets reveals the maxima in N 50o-60o direction while sub maxima in N 10o-20o direction. It is seen that the maxima and sub maxima of the percent length frequencies also coincide with these directions. The lineaments analysis carried out with the help of aerial photographs also reveals the maxima in N 50o-60o direction while sub maxima in N 0o-20o, and N 60o-70o direction. It is also seen that the maxima and sub maxima of the percent length frequencies coincide with N 50-60 and N 10o-20o directions. The lineament analysis carried out with the help of satellite imageries reveals the maxima in N50- 60 direction as above, while sub maxima in N 10o-20o and N320o-330o direction. It is also seen that the maxima and sub maxima of the percent length frequencies coincide with N 10o-60o (N 10o-20o) directions. The combined study of the lineaments reveals that the N 50o - 60o directions is the maxima, which can be correlated with the NE-SW regional direction, which in turn can be considered as shear fracture while the sub maxima direction N 10- 20 more or less coincides with the regional direction of extension fractures. These two directions are also representing the flow directions for major Palas stream (N 10o - 20o) and for a major tributary stream (N 50o - 60o) originating from eastern boundary and meeting the main Palas stream in the central part of the basin, indicating the probable structural control for these two streams (Figure 1).

Table: 1 (a) – Lineament Analysis of Palas Basin [Based on Topographical Maps]

Azimuth (In degree)	N	N%	L	L%
270 – 280	6.00	6.52	15.30	6.47
280 – 290	3.00	3.26	8.20	3.47
290 – 300	4.00	4.35	9.10	3.85
300 – 310	4.00	4.35	10.00	4.23
310 – 320	6.00	6.52	15.40	6.51
320 – 330	6.00	6.52	16.70	7.06
330 – 340	5.00	5.43	12.80	5.41
340 – 350	4.00	4.35	10.10	4.27
350 – 360	4.00	4.35	11.60	4.90
0 – 10	5.00	5.43	12.60	5.33
10 – 20	8.00	8.69	20.70	8.76
20 – 30	6.00	6.52	15.40	6.51
30 – 40	6.00	6.52	13.70	5.79
40 – 50	3.00	3.26	6.60	2.79
50 – 60	9.00	9.78	23.80	10.07
60 – 70	5.00	5.43	11.10	4.69
70 – 80	6.00	6.52	19.10	8.08
80 – 90	2.00	2.17	4.10	1.73

Table: 1 (b) – Lineament Analysis of Palas Basin [Based on Aerial Photographs]

Azimuth (In degree)	N	N%	L	L%
270 – 280	2.00	2.17	4.20	1.82
280 – 290	3.00	3.26	5.00	2.17
290 – 300	2.00	2.17	5.90	2.56
300 – 310	3.00	3.26	6.60	2.86
310 – 320	6.00	6.52	14.40	6.24
320 – 330	4.00	4.34	13.30	5.76
330 – 340	4.00	4.34	10.80	4.69
340 – 350	3.00	3.26	6.10	2.64
350 – 360	3.00	3.26	12.20	5.29
0 – 10	9.00	9.80	18.10	7.84
10 – 20	9.00	9.80	23.10	10.00
20 – 30	8.00	8.70	17.20	7.45
30 – 40	5.00	5.43	12.50	5.42
40 – 50	5.00	5.43	11.30	4.90
50 – 60	10.00	10.86	29.50	12.78
60 – 70	9.00	9.80	18.20	7.88
70 – 80	7.00	7.61	18.20	7.88
80 – 90	2.00	2.17	4.20	1.82

Table: 1 (c) – Lineament Analysis of Palas Basin [Based on IRS Satellite Imagery]

Azimuth (in degree)	N	N%	L	L%
270 – 280	2.00	2.08	9.50	3.24
280 – 290	6.00	6.25	19.60	6.68
290 – 300	4.00	4.17	13.60	4.63
300 – 310	4.00	4.17	8.80	3.00
310 – 320	3.00	3.13	10.00	3.41
320 – 330	8.00	8.30	17.50	5.96
330 – 340	7.00	7.29	18.40	6.27
340 – 350	3.00	3.13	5.30	1.81
350 – 360	6.00	6.25	16.10	5.49
0 – 10	5.00	5.21	13.20	4.50
10 – 20	8.00	8.30	29.50	10.05
20 – 30	7.00	7.29	27.70	9.44
30 – 40	2.00	2.08	4.60	1.57
40 – 50	5.00	5.21	12.60	4.29
50 – 60	10.00	10.42	36.10	12.30
60 – 70	6.00	6.25	18.40	6.27
70 – 80	4.00	4.17	19.80	6.75
80 – 90	6.00	6.25	12.80	4.36

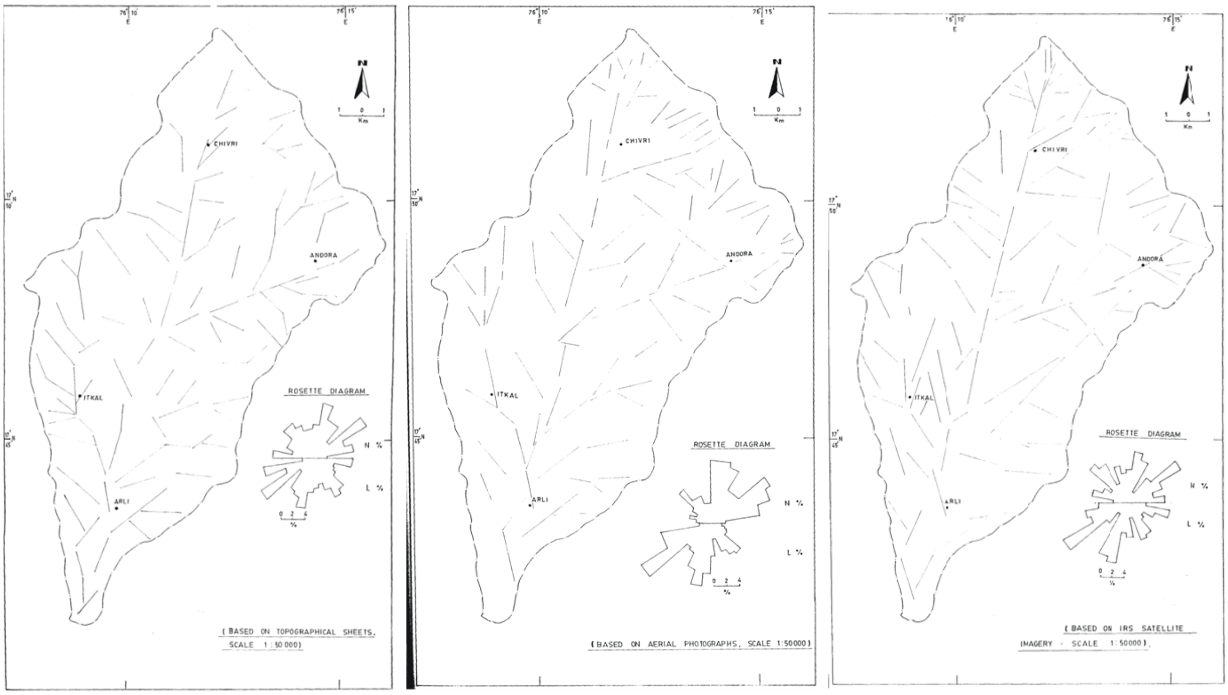

Figure 2: Lineament Maps of Palas Basin based on - a) Toposheet b) Aerial Photographs c) Satellite Imagery with Rosette diagram

CONCLUSION

Lineament analysis reveals that the N 50^{o} - 60^{o} is the maxima direction which can be correlated more or less with the regional direction of NE – SW – Shear fracture. However the sub maximal direction N 10^{o} - 20^{o}, nearly coincides with the regional direction of extension fractures. The lineament analysis reveals that the drainage pattern especially the main Palas stream seems to be controlled by fracture lineaments.

REFERENCES

Deshmukh S.S. and Nair K.K.K. (1996). Deccan Basalts. *Gondawana Geol. Mag. Spl*. **2**: 543.

Dhokarikar B.G. (1992). Groundwater Resource Development in Basaltic Rock Terrain of Maharashtra. *Water Industry publication*, Pune. **51**: 275.

Krishnan, M.S. (1968). Geology of India and Burmah. *Higinbotham*, Madras

O'Leary D.W., Friedman J. D. and Pohn H.A. (1976). Lineament, Linear lineation- some proposed new standards for old terms. *Geol. Soc. Am. Bull***. 87**:1463-1469.

Powar K.B. and Patil, D.M. (1980). Structural evolution of the Deccan Volcanic Province, A study based on Landsat imageries. *Proc. 3rd Ind. Geol. Cong.* Poona. 235-253

Powar K.B. (1981). Lineament fabric and Dyke pattern in the Western part of the Deccan Volcanic province, Deccan Volcanism and related Basalt provinces in after parts of the world, *Geol. Soc. India, Memoir.* **3:** 45 - 57

Vadagbalkar S.K. (1998). Hydrogeological Studies of Palas basin from parts of Osmanabad and Solapur District of Maharashtra, PhD thesis, Shivaji University, Kolhapur.

Vadagbalkar S.K. (2013). Hydrogeological Studies - A case study of Deccan Traps. Manas publishers and distributors, Jaipur.

Vidyanadhan Ramana Rao., K.L.V. and Parthasarthi K. P. (1971). Lineaments and their importance in landform studies*. J. Geol. Soc. India.* **12**(3): 299-302.