CHAPTER XII

CHAPTER III

AERIAL PHOTOINTERPRETATION

3.1 GENERAL :

Aerial photo interpretation includes study and interpretation of low altitude aerial photographs which are acquired by s using suitable camera, film and filter on platforms as aircraft. The aerial photographs are acquired in the visible portion of the electromagnetic spectra. (0.4 μm to 0.7 μm). Panchromatic aerial film is exposed through yellow filter to reduce the atmospheric haze effects. Although commonly panchromatic black andwhite aerial photographs are used for study purpose, some times IR photographs, colour photographs or colour IR photographs may be used for specific purpose. The study of earth science and presentation of different types of related maps by using aerial photographs is known as photogeology. Photogeologic studies include two types of operations 1) interpretation of aerial photographs with respect to geologic features and 2) measurement of the geologic features such as slope, dip, strike, altitude, area etc. The second type of study is known as photogrammetry. For interpretation and photogrammetric purpose vertical aerial photographs with some degree of overlap are used. The

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overlapping is of two types 1) Fore overlap and 2) side overlap. Fore overlap is along the each flightline which is about 60% to 80%, this provides the perception of three dimensional stereomodel (Bird's eye view). The side overlap is the overlap between the photographs of adjecent flightlines and which is required to ensure the complete coverage of photograph of the area. This overlap is 20% to 30%. Because of perception of three dimensional model by using aerial photographs, the aerial photo interpretation technique is perhaps the most common and easiest remote sensing technique, which is ud used in the field of geology.

3.2 REQUIRMENTS OF AERIAL PHOTOGRAPHS :

The use of particular type and scale of photographs mainly depends on the purpose of investigations and precision of the work. The important requirements of the aerial photographs to increase readiability and interpretation are type of photographs, scale of aerial photographs and image quality. Commohly vertical aerial photographs are used for the interpretation and photogrammetric work. Sometimes

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either colour photographs or IR black and white aerial photographs may be used for specific purpose.

In order to identify significant feature of various size aerial photographs of proper scale are used. Small scale aerial photographs (1: 1000,000 to 1 : 80,000) are useful for regional mapping, but due to the availability of satellite images these are avoided. Thus medium scale (1: 60,000 to 1 : 50,000) or large scale (1: 25,000 to 1 : 15,000) aerial photographs are widely used in the photogeological studies. Sometimes very large scale aerial photographs (1 : 10,000) are advantageous to detailed examination of complex features. The most convenient aerial photographs are of panchromatic black and white either of 1 : 50,000 or 1 : 20,000 scale.

The image quality of aerial photographs should be good enough for photogeological mapping. Uniformity of photographic tone should be well maintained on the all photographs. Atleast seven to eight grey tones with varying brightness should be distinguishable; so that tonal contrast, sharpness and resolving power is very good to discriminate lithology, soil cover, vegetation etc.

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TABLE NO. 3·1 : TECHNICAL DATA OF AERIAL PHOTOGRAPHS

Task No.	Run No.	Photo No.	No. of aerial photographs
518 - A	640	1 to 5	5
	662	9 to 13	5
	664	9 to 13	5
		Total	15

Scale : 1 : 50,000 (Approximately).

Film : Panchromatic, black and white.

Period of photography : 1966 - 1967.

3.3 METHODOLOGY :

The interpretation of aerial photographs to evaluate terrain is done visually. Such visual interpretation is aided by pocket lense, or mirror stereoscope. The observation of aerial photographs with mirror stereoscope provides three dimensional stereoscopic view. The stereoscopic viewing not only helps to study relief and topography, but also visualise amount of slope and dip and association of features. Thus the three dimensional viewing is of great importance in study of geomorphology, drainage as well as in the structural analysis.

The maps of desired scale are presented either by using sketchmaster or magnifying optical instrument as optical pentograph or high magnifying enlarger HME (Sahai et al., 1980). The various types of maps commonly presented by using aerial photographs are of geomorphological, photogeological and drainage.

3.4 BASIC ELEMENTS USED FOR AERIAL PHOTO INTERPRETATION :

The interpretation of aerial photographs is an art of examining aerial photographs with the purpose of identifying

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objects on them and judging their significance (Pandey, 1987). Such interpretation involves use of several basic characteristic features on the photographs, which are known as elements of photo interpretation (Leuder, 1934, Drury 1987). These are as follows.

1) Photographic tone, 2)Photographic texture, 3)Shape of the object, 4)Size of the object, 5)Drainage texture, 6)Patterns 7)Vegetation and 8)Vertical exaggeration.

-1)Photographic tone:

This refers to the relative brightness of parts of surfaces making up a scene. On the black and white photograph tone is expressed as different shades of levels of grey. The tonal variations is useful to detect number of objects with different shapes, patterns and textures. It is one of the important factor reacted with the reflectance properties of surfacial features.

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-2) Photographic texture :

It is the frequency of tonal change on the photographic image. It is produced by an aggregate of various features on the surface. The textural characters depend on the size and shape of the surfacial features and scale of the aerial photograph. Thus it determines the overall visual smoothness or coarseness of the image.

-3) Shape of the object :

This refers to general form or outline of surfacial geomorphic features. This element is useful in the interpretation of lithology, soil cover, structures and occurrance of groundwater.

-4) Size of the Object :

It is one of significant element of photo-recognisation which is generally used alongwith shape of the objects. The surfacial features with varying size are related to the change in the relief i.e., to-photography of the surface.

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-5)Drainage texture:

Drainage is network of surfacial streams and rivers. Drainage texture is the study of both drainage density and drainage frequency. This factor is good indicator of the terrain characteristic such as composition and texture of rocks, topography and infiltration capacity of the area.

-6)Patterns :

It is spatial arrangement of either tone and texture or drainage or landforms or landuse on the air photographs. Patterns is very significant factor in interpreting lithology and structure. The drainage pattern is related to the type of drainage network, which are generally concerned to the underlying lithological material and structures. The topographic and landform patterns are related to either destructional or constructional works of various geomorphic agencies.

-7)Vegetation :

The apperance of vegetation on the black and white

aerial photographic depends on the scale of the photographs and vegetational cover. Generally, it is imaged as various shades of grey tone. Vegetation may be dense to sparse or absent. Sometimes vegetation luxirously grow along weak planes or on some exposures.

-8)Vertical exaggeration :

The false apperance of greater elevation or slopes or dips on earths surface in the steromodel is known as vertical exaggeration. Although this is highly misleading the terrain features, but helps to identify forth order geomorphic features as river terraces, leeves and gently titled stratas. According to Melton (1955) aerial photographs are very useful in the region of low topography such as plain, peneplain, flat lands and plateau.

3.5 SPECIFICATION OF AERIAL PHOTOGRAPHS USED:

The panchromatic black and white aerial photographs which were available have been used for the geological interpretation. The image quality of aerial photographs is quite good to detect and interprete various man made and natural

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features on the surface. The details of the aerial photographs used for the area under study is given as follows :

(1) Task	:	518-A
(2) No. of flight lines	:	3(640, 662, 664)
(3) Number of photographs	:	15
(4) Photoscale	:	1:50,000
(5) Flighting height	:	7500 mts.
(6) Type of photographs	:	Vertical
(7) Size of photographs	:	22.5cms. X 22.5Cms.
(8)Area covered by each Photograph	:	128 Sq.Kms.
(9)Overlap Forward	:	65% - 75%
Lateral	:	25% - 30%

3.6 DRAINAGE ANALYSIS :

Drainage analysis is the study of drainage network and their fluvial characters with respect to drainage pattern and basin morphometry. The parameters of basin morphometry, which has been used are:

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a)Stream order number.

b)Bifurcation ratio

c)Stream length frequency.

The drainage network delineated under binocular attachment mirror stereoscope. The study constitute for rivers namely Anjan and Purna. The drainage network of these rivers is not covered fully in the studied aerial photographs, hence, Shelgaon nala, a tributary of Purna river is taken for basin morphological analysis. The stastical data regarding length of streams and area are measured by curvimeter and planimeter respectively.

3.6 -1) Drainage Pattern :

To know structure or nature of bed rocks, drainage pattern has been studied. The area display dendritic drainage pattern. The streams in the moderately and gently dissected areas on the either side of Purna and Anjan river, are sub parallel. Such sub parallel drainage pattern reflects the general topographic slopes, which is in the north-south direction in the studied area.

3.6 -2) Basin Morphometry :

The Horten(1945)methodology for numbering of stream orders has been adopted. This method has been successively

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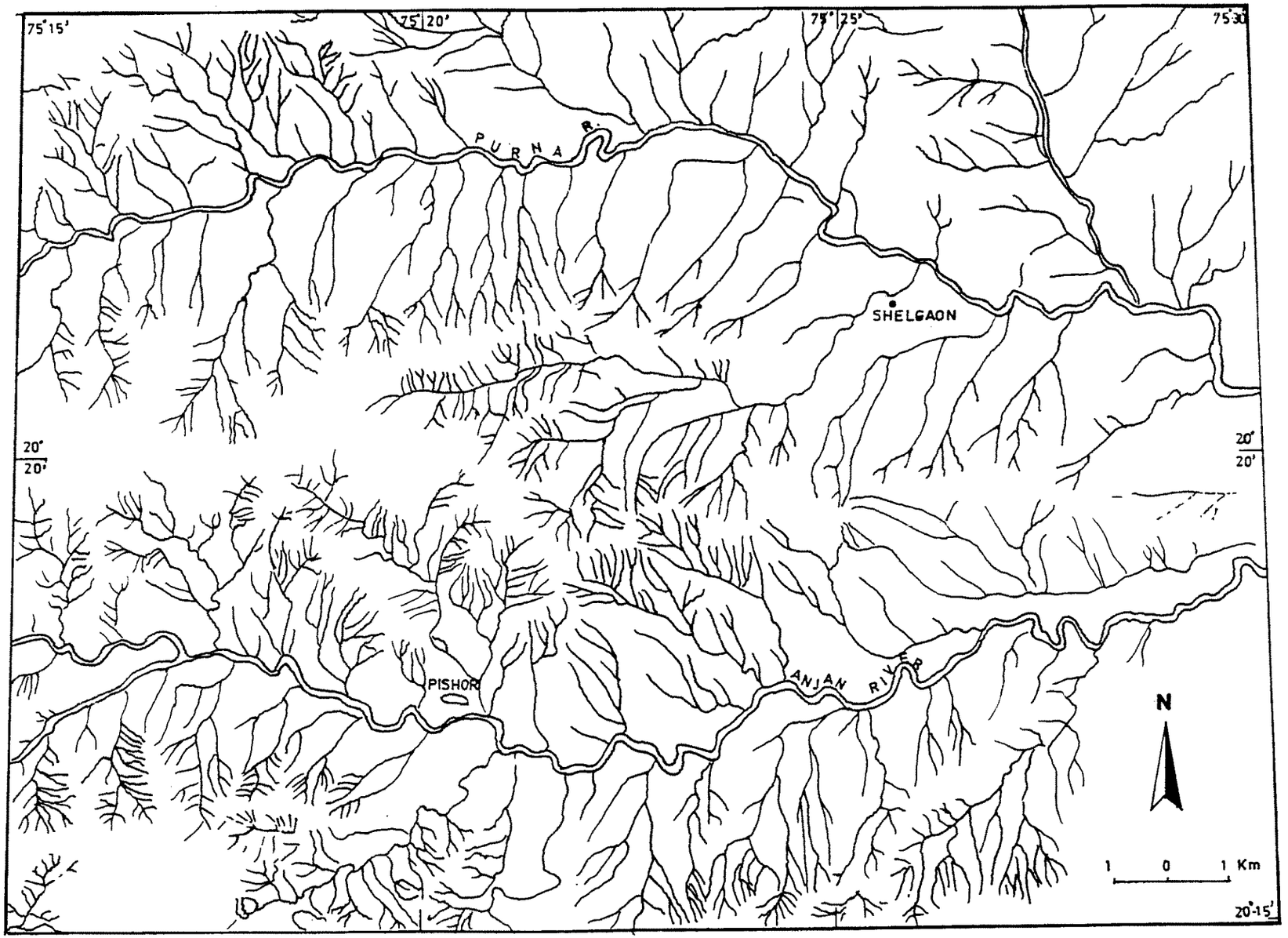

Fig. 3.1 : Drainage Map Around Pishor (Base- Aerial Photographs , Scale 1:50000)

used by Zambre(1982) and Madhkar(1990) to study drainage characters.

1)Stream order number :

The Shelgaon basin includes the streams upto 4th order Fig. 3.2. The number of streams of different order is presented as below:

Stream Order	No. of Streams
I	121
II	27
III	5
IV	1

The first order streams are considerably very high in number than those of the higher order streams.

2) Bifurcation ratio :

This term was first used by Horton (1945) to express the ratio of number of streams of any given order to the number in next lower order. The calculated bifurcation ratiom of Shelgaon basin is as follows:

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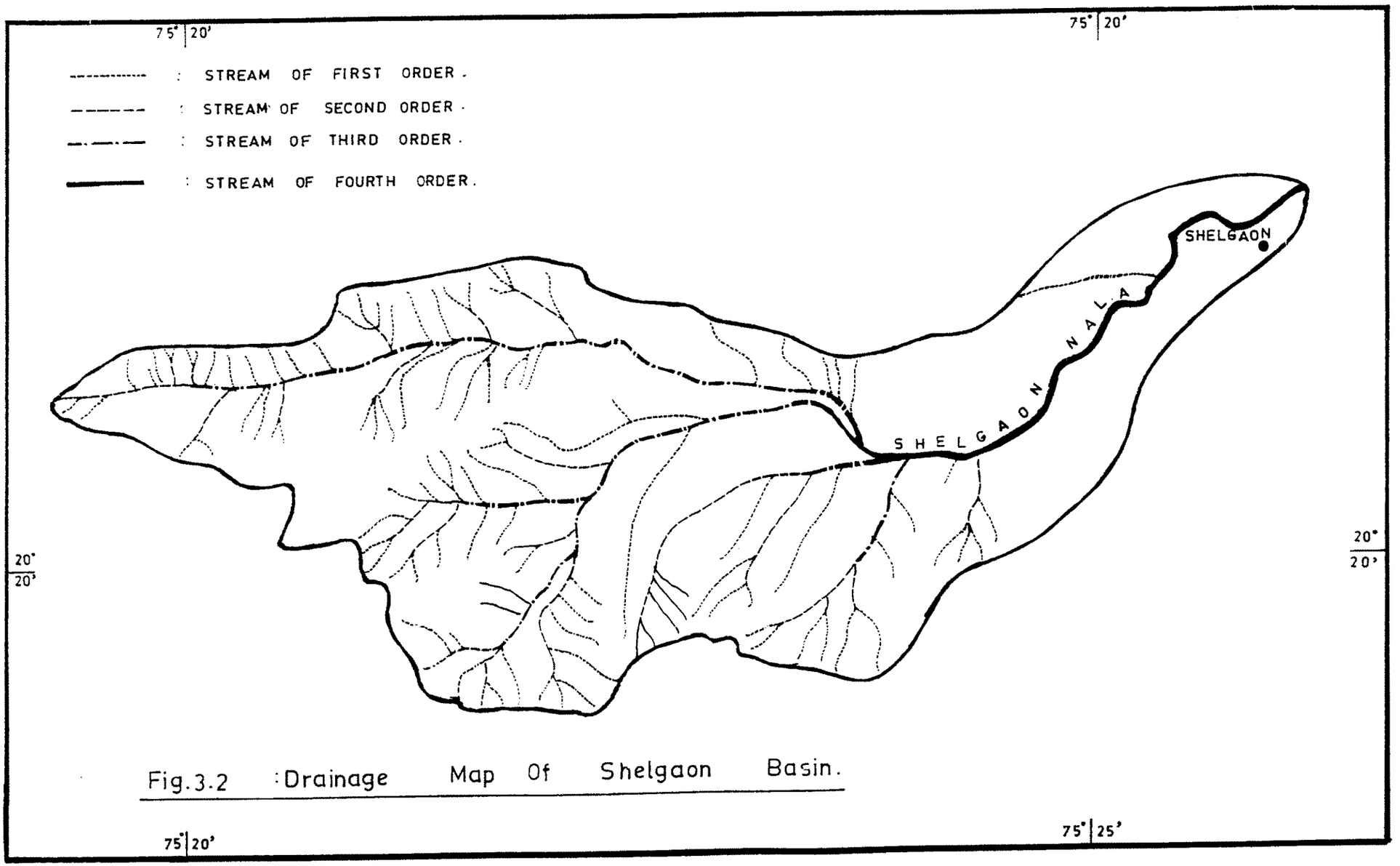

Fig.3.2 : Drainage Map Of Shelgaon Basin.

N1/N2	:	4.48
N2/N3	:	5.40
N3/N4	:	5.00
Average	:	4.96

The above data indicates that the bifurcation ratio in the basin is in between 4.48 to 5.40. The bifurcation ratio values suggests the drainage network has been not controlled by any structures(Strahler 1957).

The logs of number of streams versus their respective stream order number is plotted and shown in Fig. 3.3. The plot is a straight line which confirms Horton's law of stream orders. The law of stream order states that the number of stream segments of each order forms an inverse geometrical sequence with order number.

3) Stream length frequency

The stream length analysis data has been presented in table 3.2 . The log of total stream length of each order versus the log of stream order is plotted (Fig 3.4). The above data indicates that the average lengths of streams increases with the higher stream order. According to Horton (1945), the stream order is related to channel length by geometric relationship of a straight line (Fig. 3.4). The

Table 3.2 : STREAM LENGTHS AND LENGTH RATIOS FOR STREAMS OF THE SHELGAON NALA

Stream Order	Number of streams	Stream length in Kms.	Average stream length in kms.	Length ratio
First	121	64.45	0.5326	0.6930
Second	27	20.75	0.7685	0.3341
Third	05	11.5	2.3	0.2705
Fourth	01	8.5	8.5	-
Total	154	105.2		

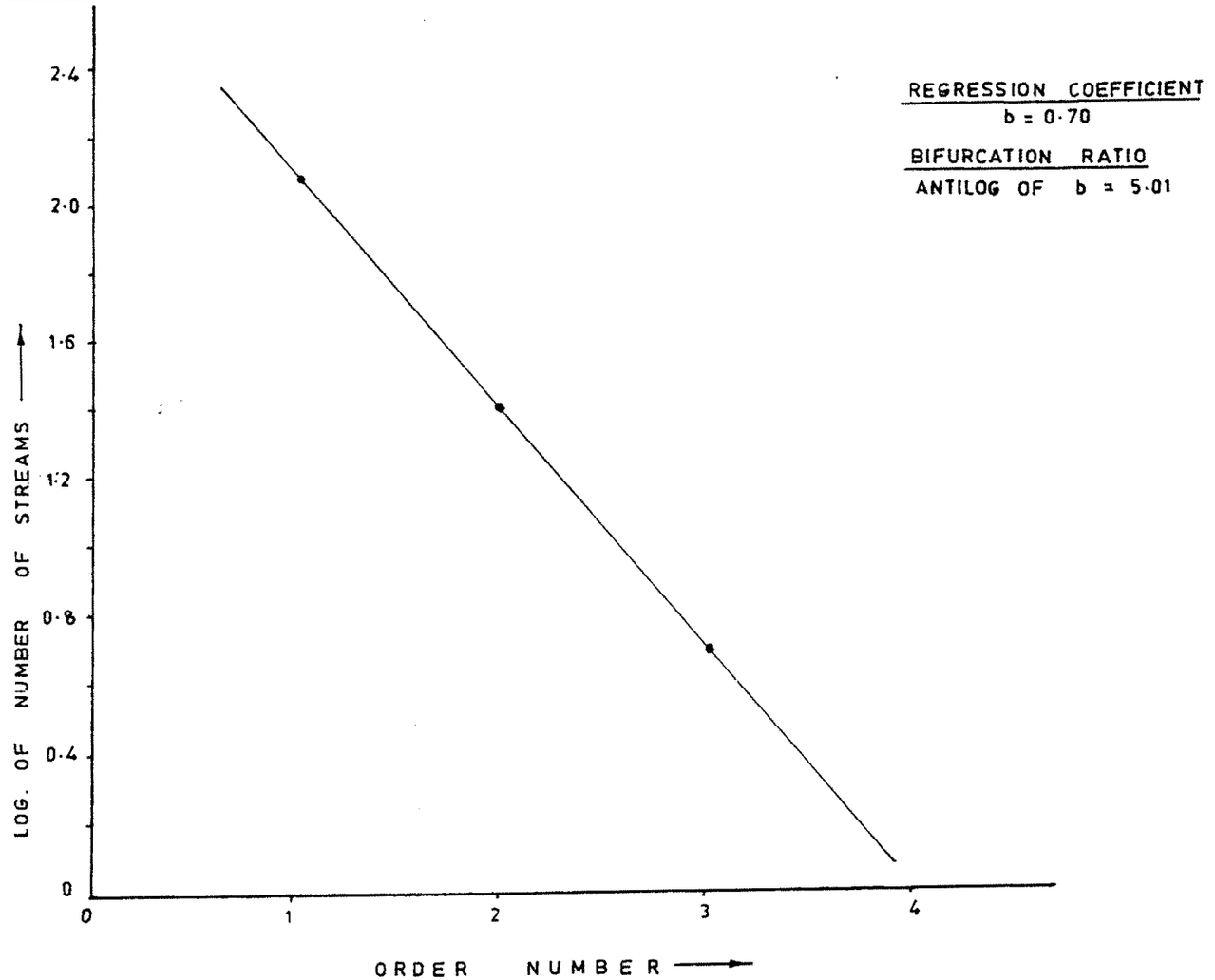

Fig. 3.3 : Regression Of Stream Segments On Stream Order.

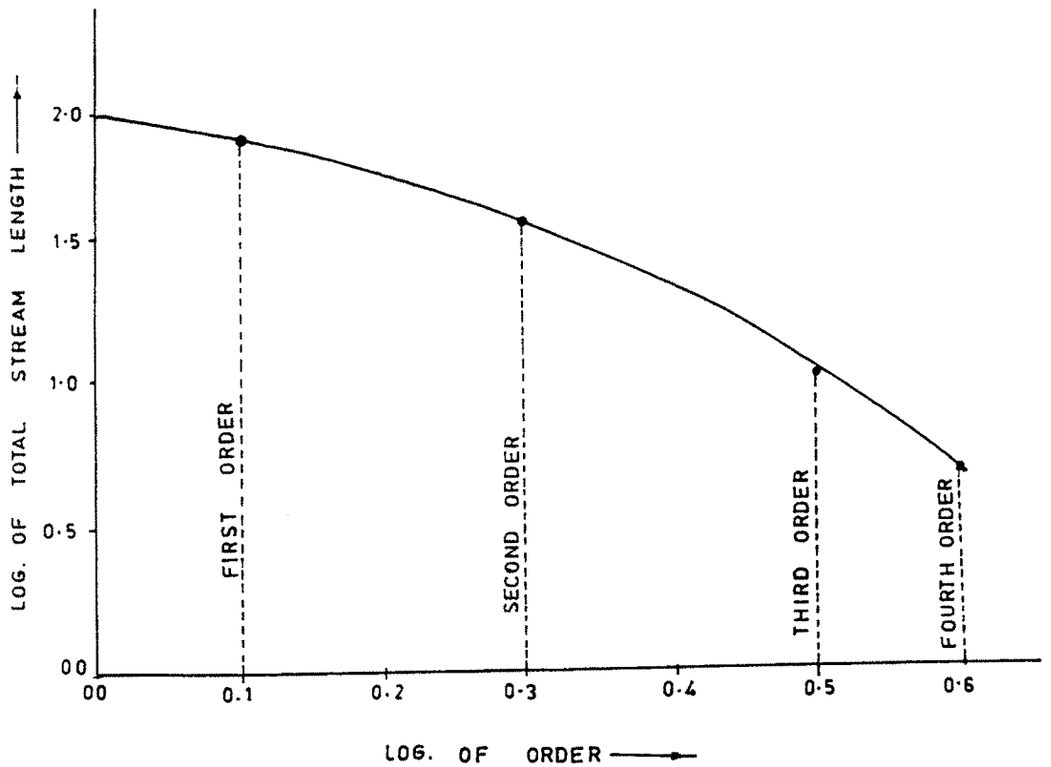

Fig. 3.4 : Regression Of Total Stream Length On Stream Order.

Fig 3.4 shows that the relation of total stream length on stream order gives a curved line concave downward; indicating headward erosion.

3.7 GEOMORPHOLOGICAL ANALYSIS :

The geomorphological analysis constitute studies of physiography, slope, drainage, landforms and their mapping. The geomorphological map presented gives the information, not exclusively morphological characters but also the information regarding the processes operated on the materials (Gondie 1981).

As medium scale aerial photographs (1:50,000) have been used fof study purpose, the detailed photogeomorphological map has been presented in Fig. 3.5 . The mapping parameters used are (1)Physiography and Landforms (2)Slope and (3)River.

(1) Physiography and Landforms:

By observing steromodels the area has been divided physiographically into three sub units:-(a)Highly dissected area (b)Moderately dissected area and (c)Gently dissected area.

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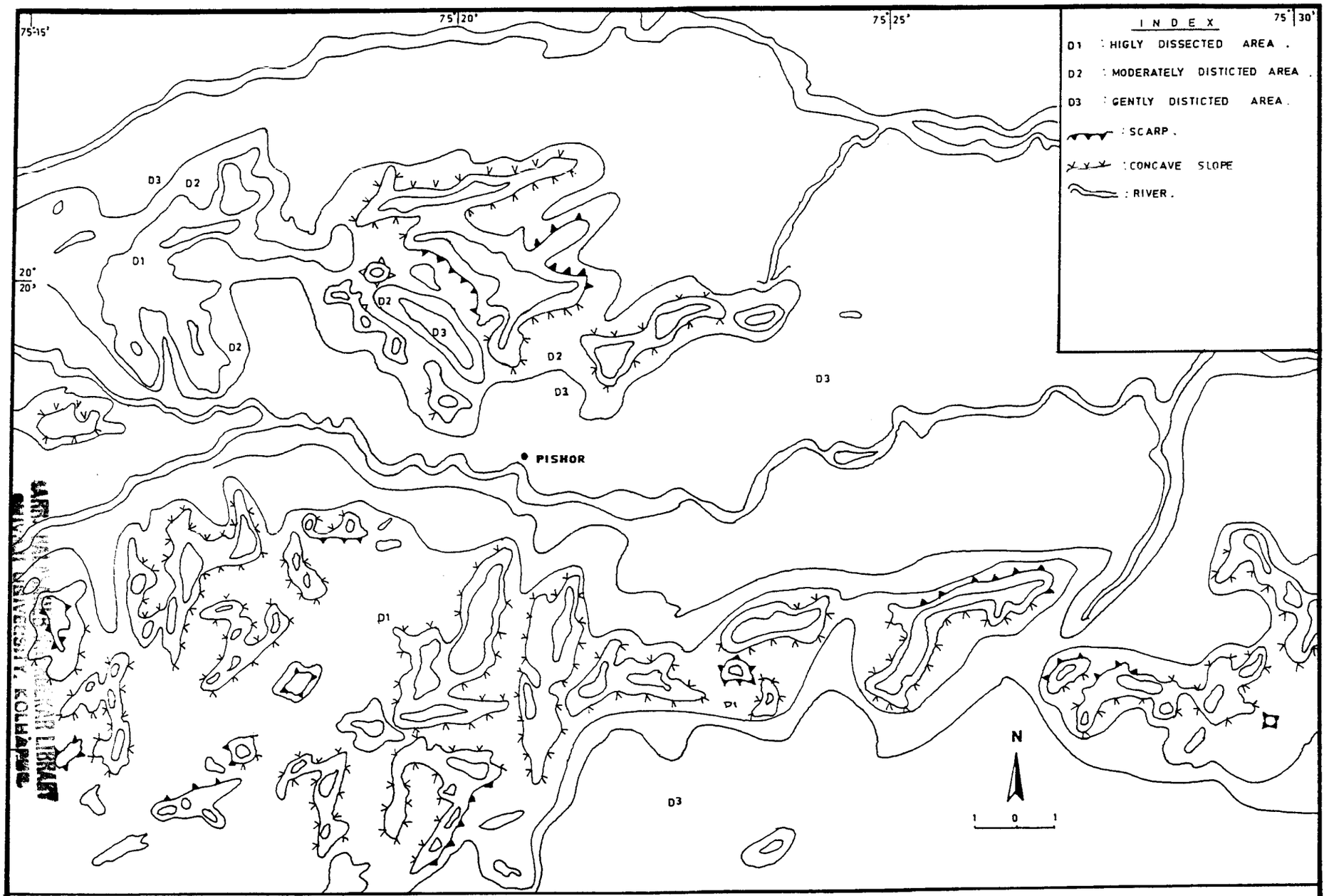

Fig. 3.5 : Geomorphological Map (Base - Aerial Photographs , Scale 1 : 50000).

(a)Highly dissected area :

Highly dissected areas constitute greater elevated features of hills and ridges. Hills are flat topped or smoothly rounded, which are nothing but mesa and butte landforms. In this area the drainage density is more than other subunits. The slopes of highly dissected area show thin alternate bands of light grey and dark grey tones which closely resembles parallel-

-tophographic contours.

(b)Moderately dissected areas :

These areas are in between the highly dissected and plane area of Anjan river valley. In general, the high grounds of this subunit are of rolling undulating topography. The tonal characters of this subunit is lighter grey tone of weathered basalts, pink zeolitic basalts and also at some places of red beds.

(c)Gently dissected areas :

This is mainly plain area which occur on either side of Anjan and Purna rivers. This area on the aerial photographs show agricultural field patterns.

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(2) Slope Characters :

Aerial photographs distinctly show change in the slope especially in the highly dissected areas. The changes in slope is of two types :

(a) angular concave break in slope and

(b) angular ■ convex break in slope.

Angular concave break in slope is located where there is change in the lava flow layer, in such case the top lava flow is massive with scarps which is lying on the soft material of lower lava flows. Angular convex break in slope is especially seen at the top of each lava flow which is massive in character.

(3) River :

The Anjan river and Purna river flow through the gently dissected areas. These rivers show meandering course. In the study area these rivers are nearly parallel to each other and flow towards east. Under the binocular lenses of mirror storoscope, the flood plains and forth order landforms such as river terraces are visible. Along the course of these rivers the linear brighter tone indicate the presence of alluvials fill.

3.8 LAVA FLOW INTERPRETATION :

The geological mapping is the function of distribution of lithological units and structures in the area. Such photogeological maps with the help of aerial photographs has been presented by various workers (Das and Roy (1973), Abrams(1980) and Patil 1977 and 1992.). The various criteria which are used in the lithologic interpretation on the black and white aerial photographs are differences in tophography, surface slopes, drainage, geometry of rock units, surface features and tone etc.

The study area is part of Deccan Trap, which does not display different lithological units but it constitute number of lava flow. Thus the photogeologic map presented by aerial photo - interpretation is map of lava flows (Fig. 3.6). The difference in topography and change in the slope from steep to moderate indicate the presence of different lava flows. The landforms as mesa and buttes, dendritic drainage pattern and radial drainage pattern at some places support the presence of

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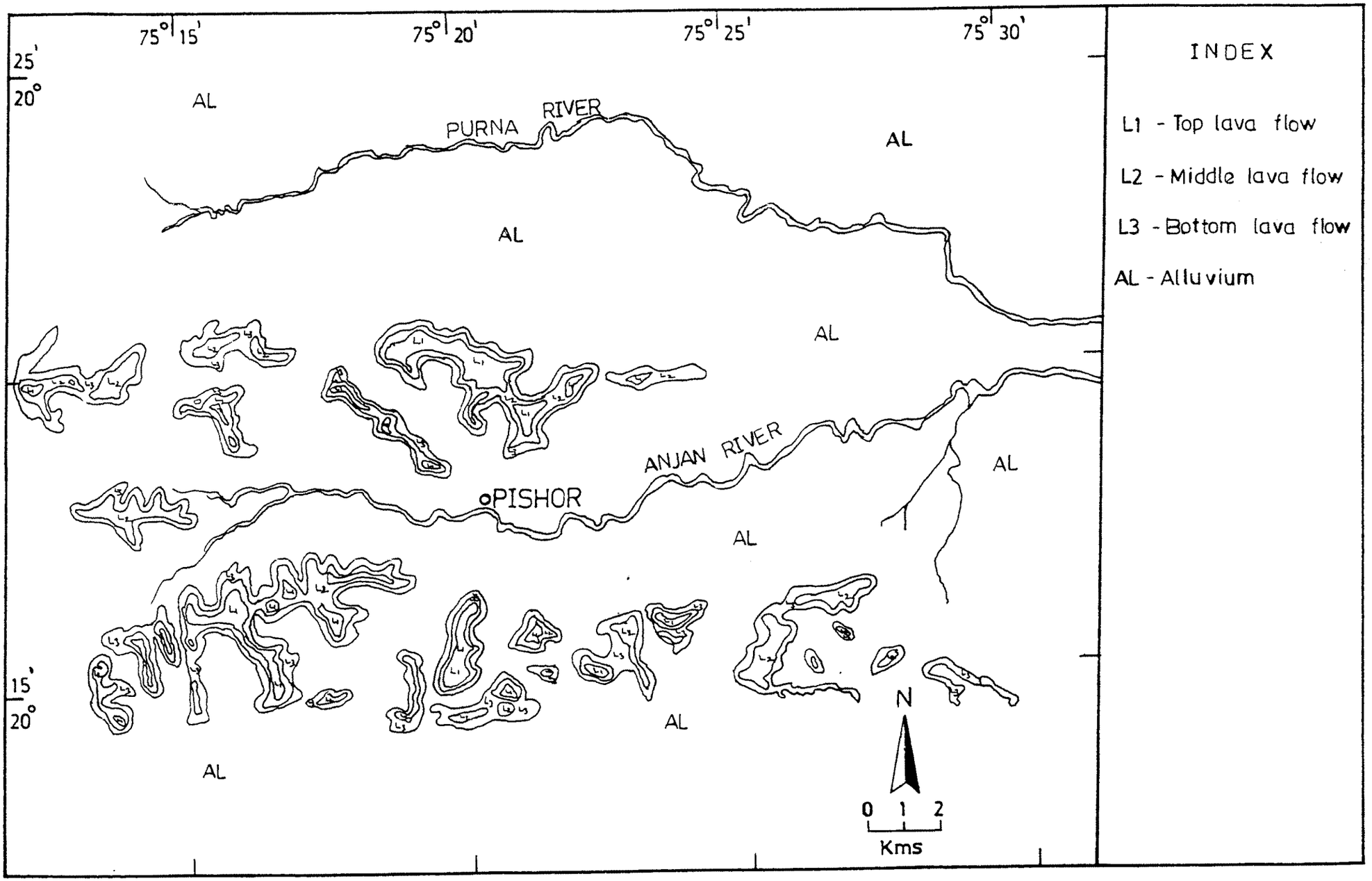

FIG. NO. 3.6 : MAP SHOWING LITHOLOGY FROM AERIAL PHOTOGRAPHS.

horizontal lava flows. The alternate bands of light grey and dark grey tones on the slopes of the scarps, hills and ridges indicate the presence of different types of basalt rock material. Light grey tone is related to the massive basalt lava flows. While dark grey tone is related to the massive basalt lava flows. While dark grey tone is related to the soft material either red bed or pink zeolitic basalt. The aerial photo-interpretation by using mirrer steroscope indicated that the area under study constitute three lava flows (Fig. 3.6).