CHAPTER – I

CHAPTER I

I N T R O D U C T I O N

1.1 GENERAL:

The Deccan trap of Peninsular India represents possibly the largest volume of continental basalts on the earth's surface. The structural fabric of the Deccan Volcanic Province is largely the result of vertical movements of the cymatogenic type (King 1959), in which the uplift may amount to hundreds of metres and is accompanied by arching at many places. The investigations carried out during the last two decades (Badgley 1962) have demonstrated that amongst the various conventional methods the remote sensing techniques can provide valuable information regarding the Geomorphic features and structural fabric of continental basaltic areas (Powar 1981).

1.2 GEOMORPHOLOGY :

Although geomorphology is concerned with the study of land forms, materials and their related processes, now a days it is related to the aspect of resources and environmental management. Mapping of landforms has become

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another valuable tool in assessing the potential of land for development and its planning. Indirectly, geomorphological studies are helpful to assess economical aspects of the region.

Basically four aspects of geomorphology are distinguished (Sharma 1981, Spark 1990) which are as follows:

1. Static/Descriptive geomorphology(Study of landforms).
2. Dynamic geomorphology (process and short term changes so caused in landform).
3. Genetic geomorphology (long term development of relief).
4. Environmental geomorphology(ecological links between geomorphology and other related disciplines).

The fourth aspect of geomorphology is the application of geomorphological techniques to the solution of planning, environmental management; tectonic movements and geological evolution, engineering, hydrology, padology etc.

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Normally, routine methods adopted in evoluting geomorphology and presentation of geomorphical map is done with the help of topographic map and conventional field studies. Now a days remote sensing technique is becoming a special and important technique. This technique is widely applied in the mapping of geology, geomorphology, soil vegetation etc.

1.3 REMOTE SENSING AND GEOMORPHOLOGY :

Remote sensing is the science and art of obtaining information about an object, area, or phenomena through the analysis of data acquired by device or instrumentation that is not in contact with the object, area or phenomena under investigation. In this technique data is collected with the help of various types of sensors, which is analysed to obtain information regarding the objects, areas or phenomena being investigated. Now a days sensors are operated from space born (satellites) or air born (air crafts) platforms to acquire the data with multiple altitudes.

Remote sensing techniques have opened new era for landform analysis and planned development of environmental aspects (Rao 1978, Rao and Bedi 1981, Bedi 1982). According

to them the geomorphologic studies can easily be carried out by using remote sensing data, thus it is possible to study and analyse large or small areas directly on images. The easiest form of remote sensing is black and white aerial photographs. Since 1965 the evolution of scanning system such as multispectral scanners, thermal scanners, thematic mappers have been used either on aircraft or satellite to collect surfacial data.

The main operational advantages of remote sensing techniques in the field of geomorphology have been described by Luder (1959), Rao and Bedi (1981), Pandey (1987), Drury (1987), Lillesand and Kiefer(1987). They are described as

1) The images provide synaptic view over a large area, which depend upon the scale and type of image. Satellite images covers thousands of Sq.Kms.area, which helps in studying the regional scale features.

2) The land forms are most conspicuous features appearing on the images.

3) The various types of scale and images provide better quality of images and various geomorphological information.

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4) Delineation of landforms on images is directly possible as the degree of readiability of various types of images differ.

5) The remote sensing data also provides a repeatative cover facilities, which is helpful in monitoring dynamic geomorphic phenomena such as changes in river channels, process of erosion and sedimentation deforestation, coastal dyanamics, landslides etc.

6) The morphometric details like relative heights, the slope, steepness, drainage, basin etc. can easily be measured and studied on same type of images, such studies are of most significant in analytical and applied geomorphical analysis.

Remote sensing techniques have changed the conventional pattern of geomorphic analysis where studies were carried out locally first and then on regional scales. Whereas the technique provides information on regional scale in the laboratory itself.

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1.4 SCOPE OF STUDY :

The large amount of research work is available regarding the use of remote sensing techniques in the mapping of geology, soil and geomorphology. In general, either black and white photographs or satellite images have been used in the interpretation and delineation of various surfacial characters of sedimentary and metamorphic terrain. Some work is also reported about study of lava flows of Deccan traps by using aerial photographs and landsat imagery. Considering the above work an attempt has been made to study the geomorphology of part of Deccan trap and its environmental aspects by using remote sensing techniques. The multiple view approach of remote sensing has been adopted to evaluate terrain characters for which space born and air born data is used. To distinguish and demarcate lava flows, work of digital analysis is done. The geomorphological data alongwith lineaments, drainage and litheunits are presented on regional scale maps. The drainage analysis has also been carried out by using aerial photographs and topographic map. The special attention is given to evaluate occurrance of groundwater.

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1.5 LOCATION AND STUDY AREA:

The study area belongs to the part of Deccan trap basalts located about 90 Kms. north of Aurangabad (Fig.1.1) in Central Maharashtra (Marathwada). The Pishor is one of the village of Kannad tahsil of Aurangabad district. The area is accessible by road connecting Kannad and Sillod towns of Aurangabad District, and is located on Survey of India toposheet No. 46 P/7 and 46 P/8 on the scale 1:50,000. The study area lies within the latitudes 20° 10'N to 20° 25'N and longitude 75° 15' E to 75° 30'E. The total area is 725Sq.kms.

1.6 DEVELOPMENT OF THE AREA:

The field visits in the study area gave the information that an Earthern dam is under construction across the Anjan river west of Pishor at about 1 Km.

1.7 PHYSIOGRAPHY AND CLIMATE:

The area under study is part of Anjan river basin which is tributory of Purna river in Central Maharashtra. The Anjan river basin is flanked by hills and plateau comprising basaltic lava flows. The slope of hills and plateaus are

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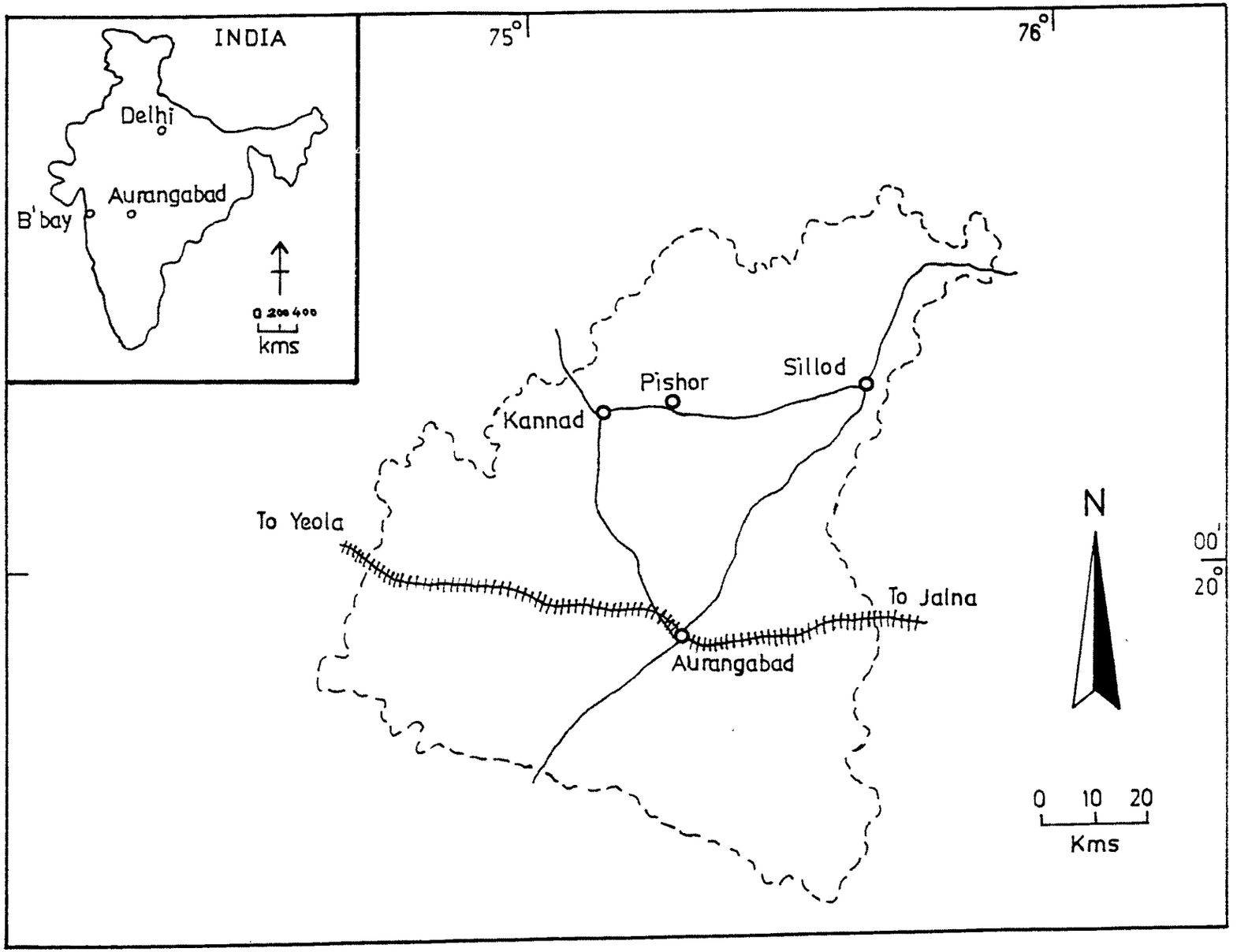

FIG. NO. 1.1 : LOCATION MAP OF AREA AROUND PISHOR VILLAGE DISTRICT AURANGABAD.

dissected by number of gullies and small streams which joins to form seasonal streams. The highest peak is found at 860 mts. NW of Pishor whereas lowest area is noticed at east of Pishor along the Anjan river course. The general slope of the area is towards east.

The area experiences semi-arid, dry tropical climate, which receive varying amount of rainfall from June to September of every year. The average annual rainfall in the area is about 870 mms. The range in temperature is observed between 7°C in winter and maximum 42°C in summer.

1.8 GEOLOGY OF THE AREA :

1.8.1 Regional Geology:

The area under study is in part of Deccan trap basalt of Western Peninsular India. The Deccan trap of Peninsular India represent the largest volume of continental basalts on the earth's surface and is of age upper cretaceous to eocene. The basaltic flows are termed as plateau basalts and are familiar in geological literature as flood basalt(Washington 1922 and Sukeshwala 1981). The Deccan trap province is mainly constituted of basalts that are associated with acid and intermediate lavas in the coastal belt of Maharashtra and intruded by dolerite dykes in the Alibag-Panvel and

Aurangabad area. The general petrography and geochemistry of Deccan volcanics are given by Sethna and Sethna (1985, 1987), Cox and Hawkes-worth (1985). It is agreed from their investigations that the basalts are tholeitic in composition and principally consist of two varieties known as 'aa' and 'pahoehoe' flows. The 'aa' flows are recognised by basal clinker zone, a middle massive zone and top fragmentary part. The boundaries of these zones are gradational. Generally the basal clinkery zones and the top of fragmentary part contain vescicals and amygdaloidal structure. Columnar joints develop at number of places in the massive middle part. The 'pahoehoe' flows are generally compound flows composing of number of flow units which are vescicular. These flows are characterised by closely spaced sub-horizontal joints. The lava flows at places are seperated from one another by the occurance of red beds or inter-trappean beds (Adyalkar 1984). Each flow comprises of three distinct units viz., the lower massive basalt unit; followed by vescicular basalt unit and overlain at top by red beds.

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1. .2 Geology of Study Area:

The area under study is central part of Deccan trap basalts in the Aurangabad District. In the study area the lava flows consisting of number of flow units which are dissected by stream to form various geomorphic features such as plateau, mesa, butte etc. The lava flows are distinguished by presence of red beds. The red beds are interstratified layers ~~xx~~ between two lava flows which is composed of clay material. The colour of red beds varies from brick red to dark red. At some places the red beds are associated with calcarious materials in the form of veins. Basalts are dark coloured, fine grained which is classified as massive, vesicular or pink zeolitic.

1.9 PREVIOUS WORK :

Geological studies of the Deccan trap had been undertaken by number of workers: Fermor (1934), Auden(1949), West(1958), Sukheshwala and Poldervaart(1958); Sukheshwala et al. (1972, 1974), Gwalani (1981) Madhekar (1990), SukhathanMar (1989), Dhokarikar (1991).

Marathe et al(1981) have recognised two major

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groups of lava flows namely hard compact massive flow and other consist of amygdaloidal flows which are less compact. The compact flows occurs as exetensive flows, some of them have been traced out for a distance of 20 Kms. Subramanyan (1981) suggested four physiographic divisions of Deccan trap region as central high land, peninsular plateau, Maharashtra plateau and west coast. Adyalkar (1984) observed that the lava flow have been demarcated by occurance of red beds and clayey formations. Deshmukh (1993) observed number of basic dykes traversed through basaltic flews in Gangapur district Aurangabad.

Excpet the work of Zambre et al (1993) the use of remote sensing technique for the area under study is not available. They had traced out three distinct lava flows around Pishor by using remote sensing techniques.

The literature regarding the use of remote sensing techniques in the various fields of Deccan traps is available since 1970. Kulkarni (1976) recognised dark arc shaped zone on Nimbus-III (HRIR) night time infrared imagery of scale 1:15,000,000. This dark arc shaped zone is confined to a portion of the

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west coast geothermal fields of India which coinsides with Panvel-flexure lineament analysis by using landsat imagery and aerial photographs around Pune in Western Maharashtra. (Powar 1981) Muley (1980) recognised tonal and topographic lineaments on the Landsat imagery while dyke lineaments are interpreted on the aerial photographs. Powar(1981) interpreted and delineated fracture lineaments and dyke lineaments by using Landsat images of scale 1 : 1,000,000 and aerial photographs of scale 1: 80,000 of western part of Deccan volcanic province. According to him fracture lineaments are predominantly zones of structural weakness. Mulay and Peshwa(1982) carried out geomorphological and drainage studies around Khandala,Poona district of Maharashtra State, which is part of Deccan trap by using topographic map and aerial photographs. According to them the most of the streams in the area is controlled by fractures. Zambre (1982) carried out hydrological investigations by using topographic maps, aerial photographs and electrical resistivitiy method of Shivanganga basin, Pune district of Maharashtra, according to him the aerial photographs are useful to demarcate the shallow groundwater bearing acquifers

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such as thick alluvial or residual soil zones and highly weathered basaltic zones. Narayanpethkar(1991) has studied geohydrological characters of Adila basin of Solapur district by using Landsat imagery and supported the Zambre's view. Jagdale (1986) used remote sensing techniques to study geomorphological and environmental analysis of Dhudhaganga-Vedheganga riven basin. He estimated the potential resources of the above river basin and the map of the land used alongwith the possible environmental impacts on human activities especially that of deforestation, installation of sugar industry, irrigation etc. Peshwa et al (1987) used Landsat multiband imagery on scales of 1 : 10,00,000 and 1: 250,000 alongwith black and white aerial photographs on scale 1:60,000 and 1:20,000 were interpreted to demarcate fracture zones in western and central Deccan trap areas; Patel and Patole (1992) visually studied and interpreted Landsat FCC image of scale 1 : 250,000 to prepare geological map of part of Kutch (Gujarat)Based on tonal and textural characters they have descriminated Deccan basalts of cretaceous age in addition to sedimentary rocks of Jurassic and tertiary. Khadse and Shrivastav (1993) mapped 128 lineaments on Landsat imagery of parts of Betul district (M.P.) and Amaravati district (Maharashtra) which are correlated with the occurance of ground water.

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1.10 METHODOLOGY :

Considering the objectives, the studies are done on lineaments, lithology and gemorphology with the help of remote sensing techniques. The overall work has been carried out in three phases as : remote sensing investigations,field studies and laboratory analysis.

1.10.1 Remote Sensing :

The multiple approach of remote sensing technique is used to prepare thematic maps on regional scale and on local scale. The studies are grouped into two types based on the type of multi-stage data used, as Satellite data and of aerial photographs. The IRS-1A satellite data has been used for the p-resent work. The IRS data is available in two forms namely p-hotographic product (imagery) and digital data, which are analysed visually and with computer techniques respectively. The black and white aerial photographs of scale 1: 50,000 are used and interpreted using mirror stereoscope.

1.10.2 Field Studies :

It includes observing and recording geomorphic features, lithounits, fractures and lava flows. The representative

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sampling and field photography of significant geological feature along the planned traverses is done. The study of lava flows, geomorphic features, contact of lava flows and alluvium have been done with the help of Brunton compass.

1.10.3 Laboratory Studies:

In addition with field and remote sensing studies, detailed investigations are carried out regarding drainage analysis and lineament analysis.