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# Remote Sensing and GIS Applications of Linament mapping of mahesh River Basin, Akola & Buldhana District, Maharashtra, India Using Multispectral Satellite Data

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**ABSARCT**

*IRS P-6 LISS III imagery of Mahesh River Basin reveals the presence of prominent lineament sets. Lineaments have been recognized with the advent of satellite imagery. It has been convincingly demonstrated that many of these structures are related to basement tectonics. There it has been shown that structural anomalies the definition of enhanced fracture production zones over Deccan trap are commonly coincident with pervasive basement lineament trends. For instance, the satellite imagery data interpretations supports the view that Gavilgarh faults indicates an older age and the remaining lineaments represents a younger age. The basin lies between two major lineaments i.e. Purna lineament following the course of Purna River display a WNW-ESE trend it is traceable for over 80 km from south of Akola in the east to some distance east of Jalgaon in the west, where it merges into Tapi lineament, this lineament lies in the northern part of the basin and the southern part is delineated by Kaddam lineament trending NW-SE and extends up to 240 km and that has been named after Kaddam River whose course has been controlled by this fault lineament. This lineament has northerly dipped. Faulting has been recognized in several sectors of this lineament. The basin lies between two major lineaments i.e. Purna lineament following the course of Purna River display.*

**Keywords:** Remote sensing; GPS; Lineament map; Satellite image

## 1. INTRODUCTION:

A lineament is defined as a large scale linear structural feature. Such features may represent deep seated faults, master fractures and joints sets, drainage lines and boundary lines of different rock formations. Lineaments provide the pathways for groundwater movement and are hydro-geologically very important (Sankar, 2002). Lineaments are important in rocks where secondary permeability, porosity and intergranular characteristics together influence groundwater movements. The lineament intersection areas are considered as good groundwater potential zones. The combination of fractures and topographically low ground can also serve as the best aquifer horizons Rao, (2001).Consequently, optical remote sensingtechniques over three decades have shown a greatpromise for mapping geological feature variations over awide scale (Mostafa and Bishta, 2005; Semere andGhebreab, 2006; Maged et al., 2009).

Lineaments have been identified on images through visual interpretation by comparing spatial variation in tone, color, texture, association, etc. 25 m area on either side of lineaments and intersections of lineaments are considered to be favorable for accumulation of groundwater. Lineament study of the area from remotely sensed data provides important information on sub-surface fractures that may control the movement and storage of ground water. Sub-surface permeability is a function of fracture density of rocks Numerous lineaments has identified in the area. They are having varying dimensions and areal extents as well. Lineaments are nothing but the manifestation of linear features that was identified from remote sensing data. These linear features usually represent faults, fractures or shear zones was identified on satellite images on the basis of tonal contrast, stream or river alignment, and differences in vegetation and knick-points in topography. The concentrations of lineaments are more in southern central region of the study area than the northern region. The Mahesh River basin than the upper reach as well as and generally having east-west trend. A close observation of the lineaments interpreted from IRS LISS-III satellite imagery revealed the presences of two generations of lineaments. For instance, the satellite imagery data interpretations supports the view that Gavilgarh faults indicates an older age and the remaining lineaments represents a younger age. The basin lies between two major lineaments i.e. Purna lineament following the course of Purna River display a WNW-ESE trend it is traceable for over 80 km from south of Akola in the east to some distance east of Jalgaon in the west, where it merges into Tapi lineament, this lineament lies in the northern part of the basin and the southern part is delineated by Kaddam lineament trending NW-SE and extends upto 240 km and that has been named after Kaddam River whose course has been controlled by this fault lineament. This lineament has northerly dipped. Faulting has been recognized in several sectors of this lineament. The basin lies between two major lineaments i.e. Purna lineament following the course of Purna River display.

## 2. STUDY AREA:

The Mahesh River basin is situated in Akola and BuldhanaDistricts of Maharashtra which is located between 76°46’11’’E and longitude 20°40′ 36” N latitude covered bysurvey of India toposheets no. 55 D/9, 55 D/7,55D/11,55D/13,55D/14 and 55 D/15on 1:50,000 scale. It canbe approached from Amravati by road transport which isabout 120 Km. The Mahesh River basin which is a majortributary of Mun River lies towards the western and southernpart of Akola and Buldhana districts. The total area covered byMahesh River Basin is 328.25 Sq. Kms (Fig.1). The study area isoccupied by alluvium and Deccan basalts which arehorizontally disposed and is traversed by well-developed setsof joints. The Ajanta hill ranges are bordering the district inthe Southern with their slope towards Western. The startingpart of Akola district is plain whereas the Western part isagain elevated with its general slope towards Sothern. TheMahesh River Basin flows in the Southern to Westerndirection having western slope and meets the Mun River nearBalapur village in Akola district. Purna is the major river ofthe Akola and Buldhana districts. The important tributaries ofPurna River are Katepurna, Morna, Man, Vidrupa, Shahanur,Van and Nirguna. Most of the watershed area was covered byunconsolidated sediments, black cotton soil, Red soils andbasaltic rocks of Deccan Traps. The study area was drainedby Mahesh River flowing south to western with almostdendritic to sub-dendritic drainage pattern.

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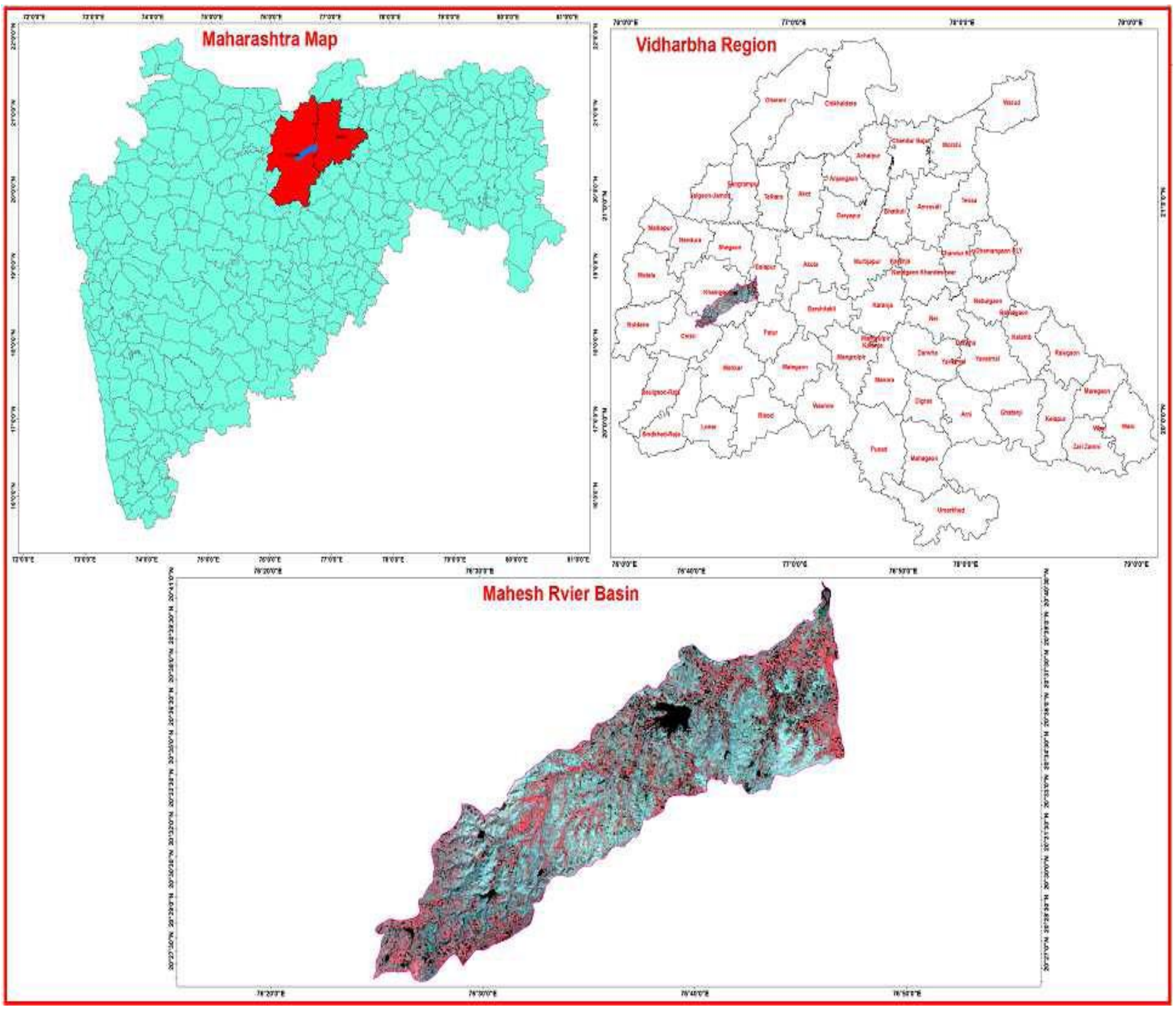


**Fig. 1: Location map of Mahesh River Basin**

## 3. Methodology:

Different types of primary and secondary geological structures (attitude of beds, schisticity /foliation, folds, lineaments, circular features, etc.) can be visually interpreted by studying theLandforms, slope asymmetry, outcrop pattern, drainage pattern, and stream/ river courses. Lineaments (faults, fractures, shear zones, and thrusts.) appear as linear and curvilinear lines on the satellite imagery, and are often indicated by the presence of moisture, alignment of vegetation, straight drainage courses, alignment of tanks / ponds, etc. Lineaments are furtherSub-divided based on image characteristics and geological evidence. The attitude of beds (strike and dip) was estimated by studying the slope asymmetry, landform, drainage characteristics, etc. For instance horizontal to sub-horizontal beds show mesa / butte type of landform, dendritic drainage pattern and tonal / color banding parallel to the contour lines; inclined beds show triangular dip facets, cuestas, homoclines and hogbacks. The Schistosity / foliation of the rocks are shown as numerous thin, wavy and discontinuous trend lines. Non-plunging and plunging folds were mapped from the marker horizons. Non plunging folds produce outcropping in parallel belts, and plunging folds produce V or U shaped outcrop pattern.

Doubly plunging folds was indicated by oval shaped outcrops. Further classification into anticline or syncline can be made on the basis of dip direction of beds. Circular features, representing structural

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domes/ basins, sub-surface igneous intrusions, salt domes, etc. show circular to quasi-circular outcrops and trend lines with radial/ annular drainage pattern.

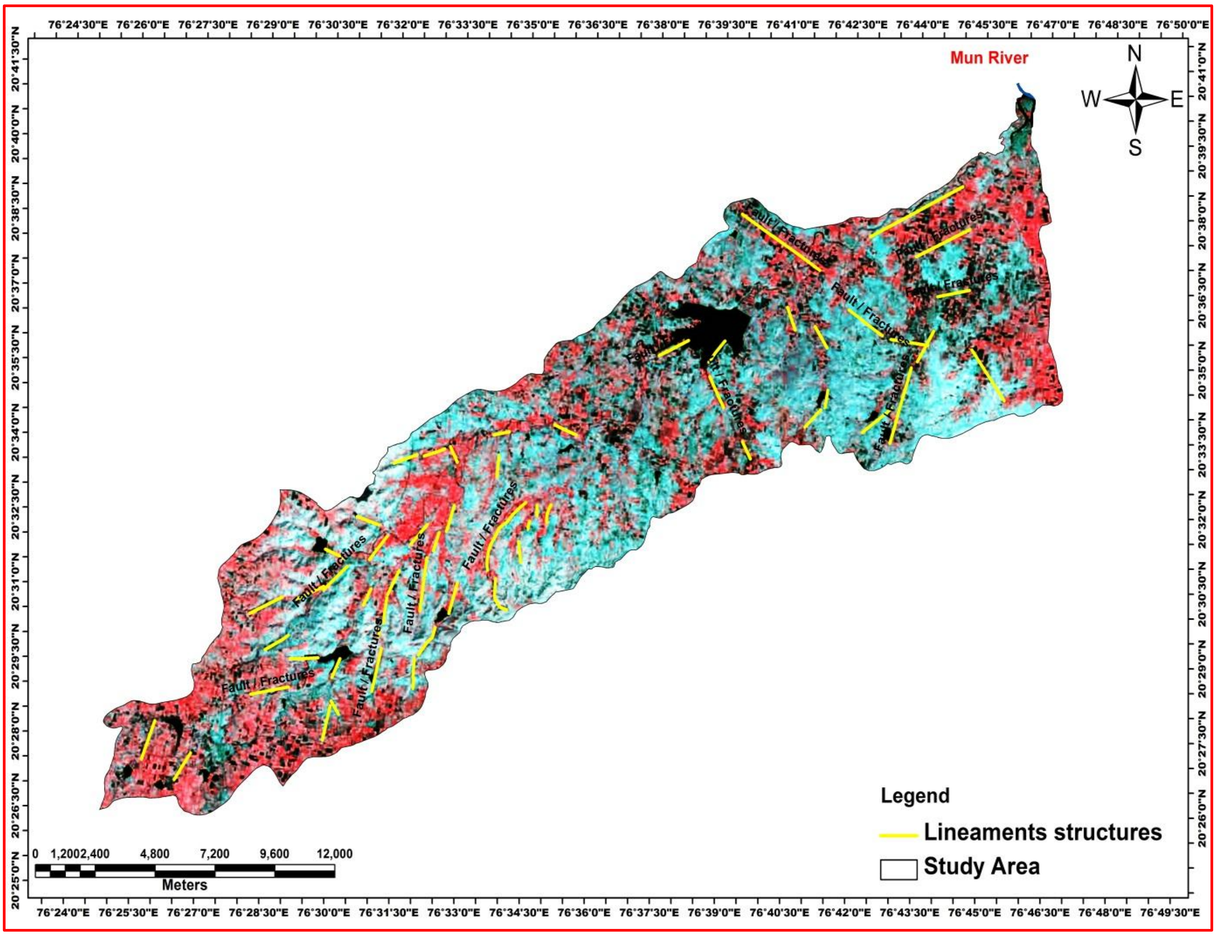


**Fig. 2: Lineaments Map from LISS-III satellite image**

## 4. Lineament extraction:

The IRS (LISS III) satellite image shows prominent trends of lineaments. Lineaments have been extracted from drainage pattern and vegetation. The satellite images due to its much capability such as the synoptic aerial coverage, multi spectral captivity of data, temporal resolution, etc., they produce better information than conventional aerial photographs. A digital image enhancement technique can contribute significantly in extracting lineaments; the same have been attempted using the software ERDAS Software 9.1 The variety of image enhancement technique the filtering operations principal component analysis (PCA) and spectral rationing are the most commonly ones and the same have been applied in the study. The flow chart methodology is as shown in Fig.3.

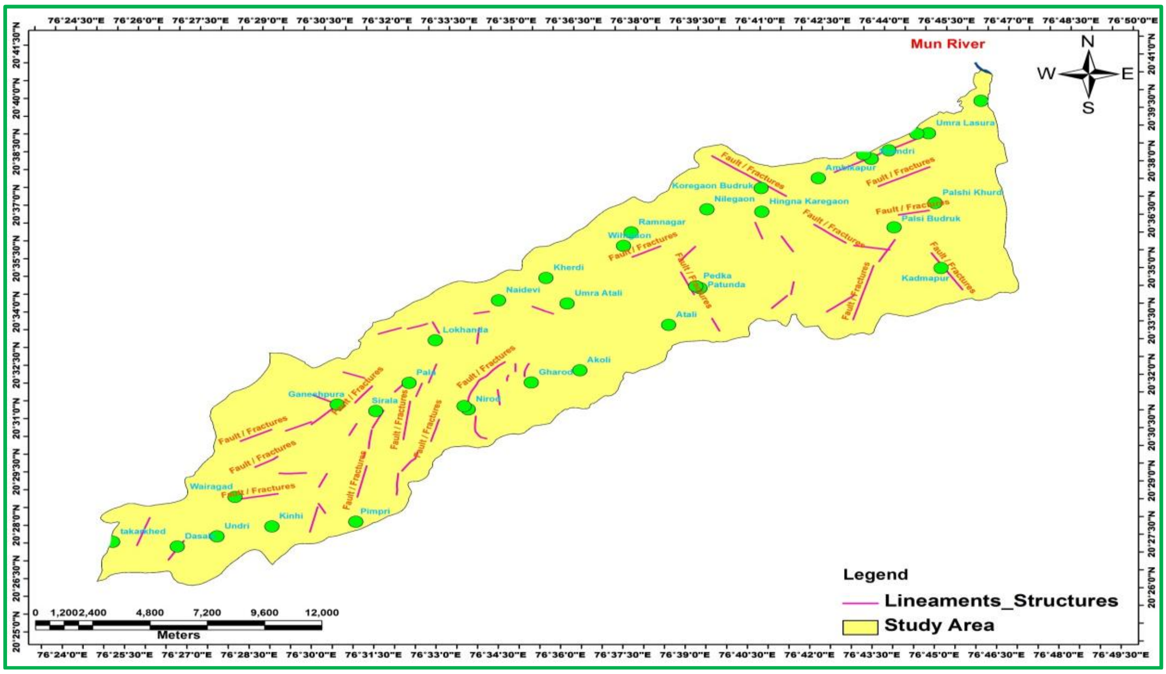


Fig. 3:Lineamentmap using Visual interpretation techniques

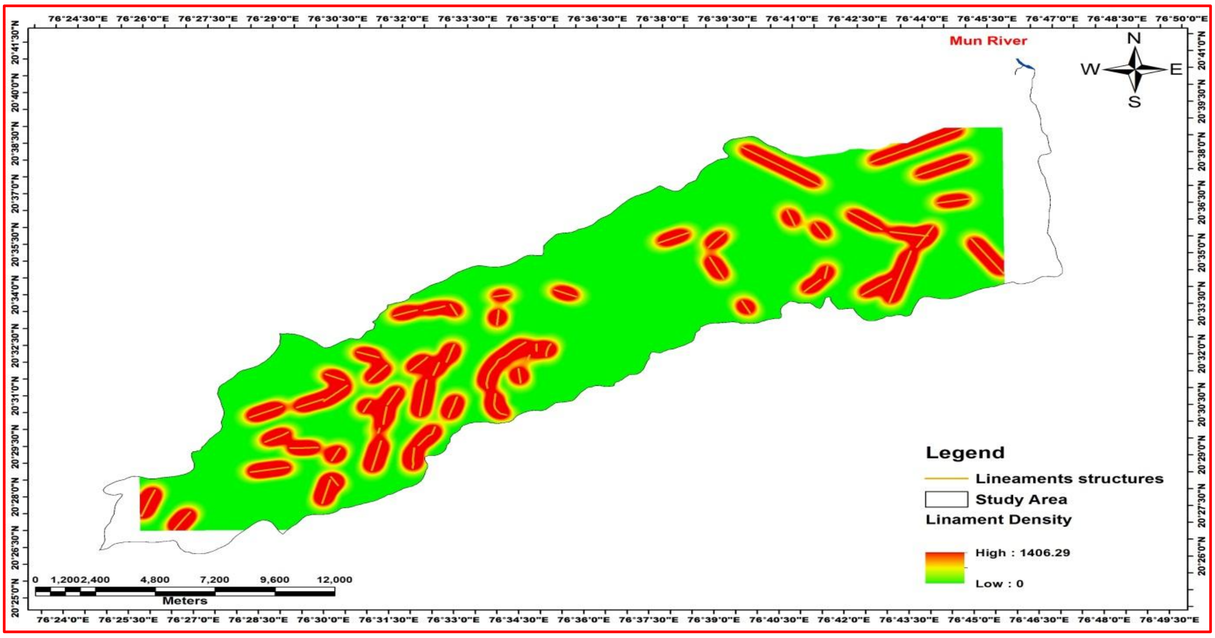


Fig.4: Lineament Density map

## 5. GIS Functionality in Analysis of Geological Structure:

Geographical Information Systems (GIS) have become increasingly powerful due to improvements in both hardware and soft-ware. With this increase in the power of GIS, many fields in both geography and geology have found new uses for GIS. One of the geological fields that have recently benefited from GIS input is structural geology. Many of the recent technological advances in structural geology involving GIS on the construction of large databases containing structural information about features such as faults, folds and fractures. This information can then be used in the construction of geological structure maps. Once data about these structural features is entered into a GIS package, data manipulation for detailed analysis can take place. Different thematic maps specified above are integrated using GIS software's. From the above technique all the thematic maps integrated using GIS software and positive zones have been identified.

**6.CONCLUSION:**

The ethics of this study is to demonstrate the information interpreted from remotely sensed imagery combined with conventional field and other data can improve the exploration process in terms of cost, accuracy and time. From the above inference in the study area and it's strongly relation with subsurface linearity and surface lineaments wherever observed those were identified by positive structural anomaly.

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