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AN ANALYSIS ON STRUCTURAL/LINEAMENTS USING REMOTE SENSING AND GIS–A CASE STUDY OF CHIGICHERLA WATERSHED, ANANTAPUR DISTRICT, ANDHRA PRADESH, INDIA

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Abstract:

Geologic lineament mapping is considered as a very important issue for the problem solving in Ground water, especially in selecting the site for construction (dams, bridges and road.), minerals exploration and hydrological research. The regional study and automated extraction of linear features such as faults, joints, folds, dikes, crustal fracturing, and lithological contacts from remotely sensed imagery has been the subject of extensive research over several decade. The structural information is represented on the map using different symbols. The symbols are shown as fixed part of the legend given at. The main structural features that control the occurrence and movement of ground water are faults, fractures, joints, dykes, etc .Availability of ground water along fractures and faults is better as compared to its immediate surroundings. The dykes work as a barrier for the flow of ground water. Thus in up slope front of a dyke ground water availability is better as compared to the down slope side. Soil covers the major part of the area under study that makes the job of identification of structural elements a difficult problem However, the drainage map prepared from the topographical map and the satellite data reflect the linears to a great extent.

Structure / lineament map forms the backbone for developmental ground water prospects map, important role in the study ground water prospects map in any part of the world .

Remote Sensing (RS), integrated with Geographic Information System (GIS), provides an effective tool for analysis of ground water prospecting mapping purpose. The geospatial technology of RS and GIS holds the potential for timely and cost – effective assessment of natural resources. Therefore, we have used RS and GIS to study Structure/ lineament around Chigicherla Watershed Anantapur District Andhra Pradesh, India. The study covering an area of about 211 sq. km. In this view the present work has been taken up to study and assess some of the natural resources and environmental potential of study area which is falling in the Survey of India topo sheets No: 57 F10, 11,13 and 57 F 14. Under this study three thematic maps such as location map, drainage map and Structure/ lineament maps were prepared. Information, when used along with information on other natural resources, like water, soil, hydro-geomorphology, etc...

Keywords: Liss - IV Satellite Imagery, SOI Topo Sheet, Remote Sensing and GIS.

Introduction:

To create Geo spatial thematic layers primarily for three themes (Infrastructure, Settlement and Drainage) for the entire watershed boundary, where as for two themes (Soil and Ground Water Prospect) will be prepared for the prioritized area. Apart from these geo-spatial resource themes, geospatial layers by using the remote sensing techniques these processes are described classification techniques, requirement of input layers, geo database schemas, field verification procedure etc. This will help in the systematic organization of contents and removal of redundancy while creating the database. The drainage on granitoid rocks is of dendritic type. The density of drainage is moderate. The presence of dendritic drainage is the reflection of an impervious and homogenous sequence, qualifying the rocks to be ***"Aquifuge"*** (example – granite, Todd, 1995), .reflecting that these neither contain nor transmit water. This is mainly due to the impervious nature of the rocks due to lack of primary porosity. But in the field it is found that many bore holes are located on the granitoid terrain. This clearly indicates that the secondary porosity that develops due to tectonism helped in the infiltration of surface water for the development of aquifers at depth. The development of lineaments and their intensity not only helps in initiating

weathering, it also quickens it. This helps the rocks that are acting as aquifuges to have aquifers at slightly deeper levels, where the rock will be fractured.

The field visits indicate the presence of bore wells and tanks on the granitoid and gneissic country support and reflect the aquifers occurring at shallow to moderate depths that in turn points to the importance of lineaments in the evaluation of ground water. In the Anantapur area, the lineament density is about 0.3 that has been taken as a measure of fracture porosity.

It was claimed that a few bore holes drilled on the lineaments in Anantapur area have yielded from 75 lpm to 1500 lpm, with the depth ranging from 22.00 m to 30.50m. (Raju, et.al, 1979). They even claimed that the maximum yield of 1500 lpm for a bore hole of a depth of 30.50 m in a hard rock terrain may be a record**.**

The procedure described to create Geo-spatial layers are applies to the on screen delineation procedure and applicable to popular image processing and GIS software packages. However, there can be some deviation in the steps to be followed but the end output will be confirming to the total report. This chapter will be detailing the creation of following geo-spatial layers using ortho rectified high resolution (5.6) satellite LISS-IV imagery: The definition of lineament advocated by Dennis (1967) has been followed in the present work. Drainage has helped in drawing lineaments as it is controlled by lineaments / structure. Hence, it reflects the linearity very clearly. Joints are also be considered as linears that play a great role in the infiltration of surface water.

Study area:

Chigicherla watershed area Anantapur District, Andhra Pradesh state bteweenlies longitude 77° 35 ' 00" to 77° 46 ' 00" latitude14 °30' 00" to 14 °35' 00" watershed area around 211 sq km. Five Mandals are covered namely Anantapur, Rapatadu, Kanaganipalle, Battalapalle and Dharmavaram. The Study area is mostly plain land and western part is covered with residual hills, denudational hills and some pediments are there. Anantapur district area experiences semi-arid climate, the summer is very hot and the Mercury rises to + 42^0 Celsius. Winter is pleasant; night temperature is about 13^0 Celsius to 15^0 Celsius. Average rainfall per annum 550 mm.

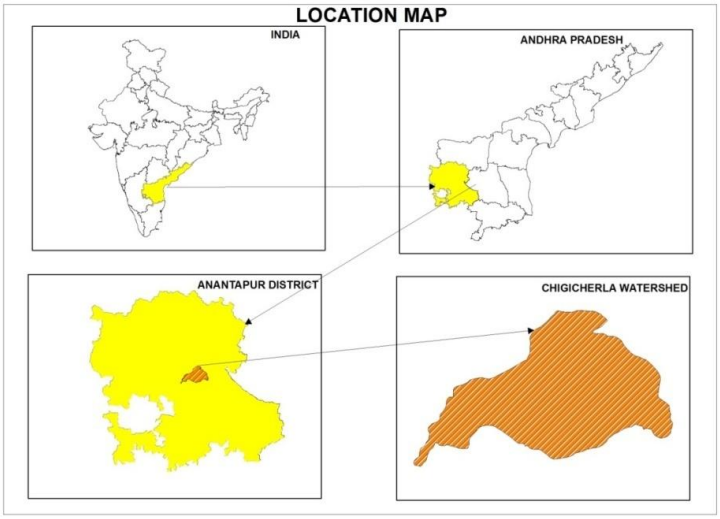

Figure 1. Location map of Chigicherla Water shed, Anantapur district, A.P

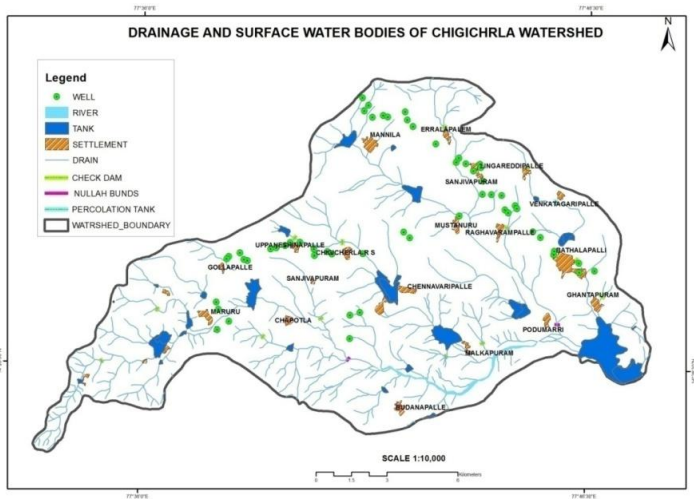

Figure 2. Base map of Chigicherla Water shed, Anantapur district, A.P

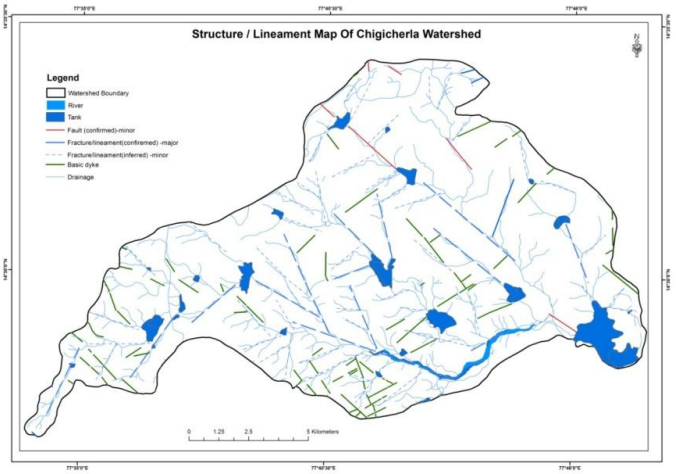

Figure 3. Lineament / Structural map of Chigicherla Water shed, Anantapur district, A.P

Methodology:

Any structural element that has a linear trend is a lineament. Further, Lineament is a linear feature that has the control on the structure (Dennis, 1967). Exploration of ground water is not complete without the study and analysis of lineaments. Remote sensing, the modern technology is extensively used in the exploration, especially in identifying the linears. This technique has been used by, Howe (1956), Ray (1960), Chikeshec (1965), Setzer (1966), Mollard (1968), Pluhowski (1972), Bowden (1975), Avery (1977) and others.

The area under report has extensive spread of granitoids and gneisses. In the hard rock terrain like the study area, fracture porosity plays a major role in understanding the occurrence and movement of ground water. Different types of classifications of

Lineaments are in vogue. Geological Survey of India classified the lineaments as "A" "B" and "C" classes that have lengths of 300 km, 250 km and 150 km respectively. It is difficult to adopt this type of classification in a smaller area. Hence, in the area under study, lineaments that are responsible for the development of drainage system are considered as the "A" class, the lineaments that occur on the pediment and pediplain as "B" classes and the lineaments that occur on the denudational hills as "C" class. This classification is followed to analyse the potential of ground water only, hence are not shown on the structural map. In addition to the length, it is the density that plays yet important role in the occurrence of ground water in a granitoid terrain

The drainage on granitoid rocks is of dendritic type. The density of drainage is moderate. The presence of dendritic drainage is the reflection of an impervious and homogenous sequence, qualifying the rocks to be ***"Aquifuge"*** (example – granite, Todd, 1995), .reflecting that these neither contain nor transmit water. This is mainly due to the impervious nature of the rocks due to lack of primary porosity. But in the field it is found that many bore holes are located on the granitoid terrain. This clearly indicates that the secondary porosity that develops due to tectonism helped in the infiltration of surface water for the development of aquifers at depth. The development of lineaments and their intensity not only helps in initiating weathering, it also quickens it. This helps the rocks that are acting as aquifuges to have aquifers at slightly deeper levels, where the rock will be fractured.

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Thus, in a hard rock terrain, where the weathered material is of limited thickness that may not have higher degree of percolation, it is only the secondary porosity in the form of lineaments that helps in developing an aquifer condition in an otherwise an aquifuge type of rock. Hence, it is necessary to consider the influence of lineaments in ground water exploration, especially in a hard rock terrain.

THE LINEAMENTS IN THE GRANITOID TERRAIN:

The lineaments in the granitoid terrain are more in percentage than in the other units. The characters of these lineaments are:

1. These are comparatively shorter in length.
2. They are multi directional.
3. The drainage pattern is controlled by the trend of the lineaments.

FAULTS:

1. The dyke trends though are linear in disposition are not considered for the lineament analysis. The direction, their intersection etc are detailed in the chapter on 'Geology'.
2. The linears along the drainage lines or patterns. These are conspicuous in the granitic errain.
3. The linears have been classified both in respect of direction and length.

In the area under report, lineaments are classified with a background of the geological formation, i.e.,

1. The lineaments occurring in the granitoid terrain.
2. The lineaments observed in the sedimentary terrain.
3. The lineaments noticed in the Quaternary sequence.

CONCLUSIONS:

In any hard rock lineaments play a major role in tapping the ground water. But, in the alluvial tracts, as in the present case, there is paucity of surface lineaments. The above observation has shown that there do exist lineaments below the river alluvium. The inference is supported by the density of wells. No doubt, the river alluvium should have multi layered aquifers, but the intensity and density of wells need an explanation. In the present situation, the alluvium does not have number of multi layered aquifers, as the thickness of the alluvium is less. The well inventory in this tract has reflected that there are shallow and the deeper wells. The relatively deeper wells are indicating higher yields. The moot question that arises is to why do the relatively deeper wells yield more water?. The plausible answer and explanation is that, in addition to the limited multi layered aquifers, due to less thickness in the alluvium, the fractured bed rock also acts as an aquifer.

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