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SATELLITE LINEAMENTS AND SUBTLE STRUCTURES IN CAUVERY BASIN-TAMILNADU

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Abstract

IRS P-6 LISS III imagery in the east coast of Cauvery 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 sandstone reservoirs are commonly coincident with pervasive basement lineament trends. Mesofracture zone, a special type of lineament structure play a vital role in oil exploration can be identified in large scale satellite imagery and lineament density high zones with consisting of numerous relatively short and near parallel lineaments. The orientation of these surface and subsurface linearities has been found the new structural anomalies in the study area.

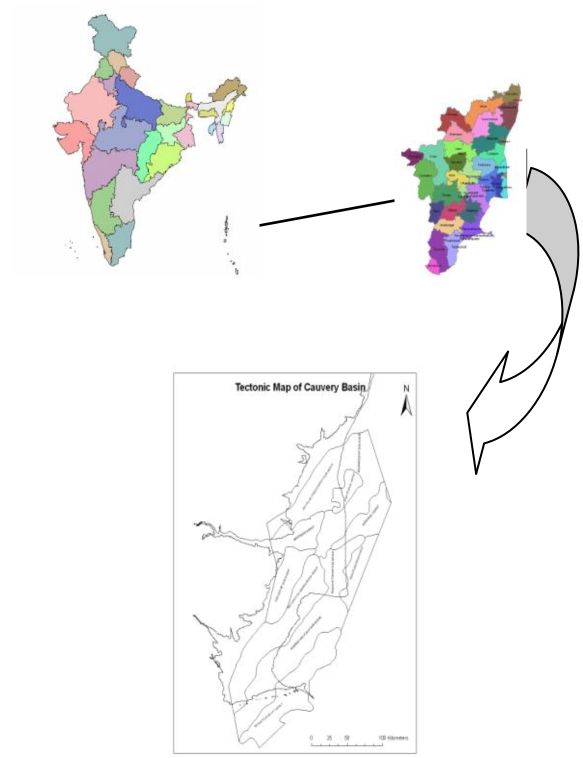
Key words: Structural anomaly, Lineaments, Phanerozoic, Tectonics.

Introduction

Cauvery Basin exhibits a number of horsts and graben structures as evidenced by geophysical studies. Cauvery basin, formed during late Jurassic period by sagging of a part of the Indian shield mainly along the dominant NE-SW Eastern Ghat trend, is located in the southern part of east coast of Indian between the northernly plunging Sri Lanka basement massif and the peninsular craton.. The surface exposures of sedimentary rocks had been studied and mapped by Blanford of Geological Survey of India in 1865. ONGC initiated systematic geological,geophysical and drilling activities for exploration of hydrocarbon in since 1958. Remote sensing and GIS have been used intensively in many earth science applications especially in mineral and hydrocarbon [9]. Geomorphological and morphotectonic studies have been carried out by many earlier workers based on air photos and landsat images [3].
The present study, reveals the basement linearities of Cauvery basin in relation to the surface lineaments demarcated from the satellite imageries over the basin.

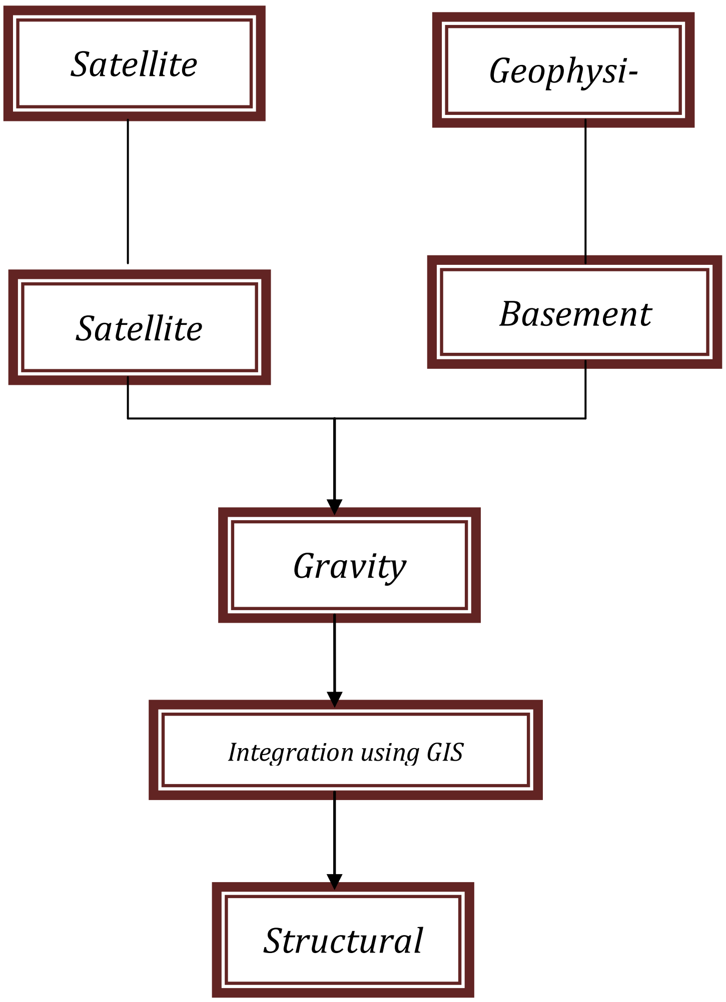
Study area

The study area lies North Latitudes 09^{o} 03' 00" -12^{o} 10' 00" and East Longitudes 78^{o} 09'30"-79^{o}54'15" covering parts of Survey of India topo maps 58 M, 58N and 58K. The study area covers extensive Cauvery Basin bounded by Bay of Bengal and Palk Strait on the East and South East and districts of Perambalur, Trichi, Karur, Dindugal, Madurai and Virudhunagar on the West, Pondichery on the North and Ramanathapuram on the South. The location map of the study area is as shown in Figure.1



Lineament extraction

IRS P-6 LISS III satellite image shows prominent trends of lineaments. Lineaments have been extracted from drainage pattern and vegetation. The satellite images due to its many capability such as the synoptic aerial coverage, multi spectral captivity of data, temporal resolution, etc., they produce better information than conventional aerial photographs [10]. A digital image enhancement technique can contribute significantly in extracting lineaments; the same have been attempted using the software Erdas 9.1. The variety of image enhancement technique the filtering operations [12] principal component analysis (PCA) and spectral rationing [1] are the most commonly ones and the same have been applied in the study. The flow chart methodology is as shown in Figure.2



Basement faults:

Published reports and papers have been used for analysis of subsurface linearities interpreted from seismic and basement structures. Avasthi et.al 1977 and Mani 2000 analyzed gravity, magnetic and basement fault systems respectively. In Cauvery basin and observed that the alignment of oil and gas field reservoirs along major basement fault trends. From the above data rectified and georeferenced using Arc GIS 9.3. the basement linearities and correlated with the surface lineaments interpreted from Landsat ETM and IRS LISS III images and they concluded that there was a strong relation between surface and subsurface linearities related to oil and gas fields.

Results and discussion

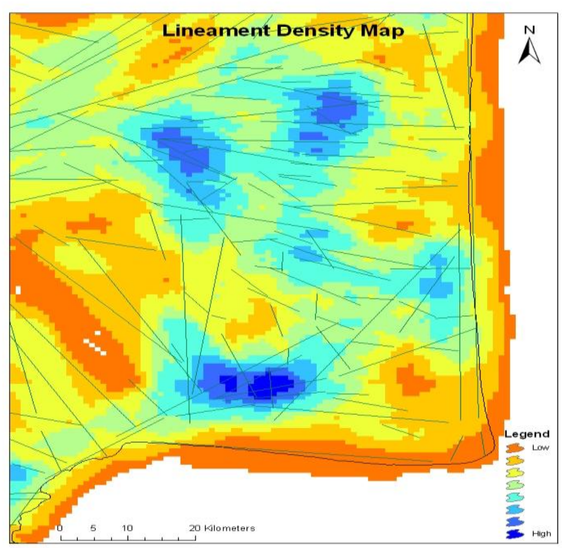
Orientation of surface lineament and subsurface linearities:

Meso fracture zones:

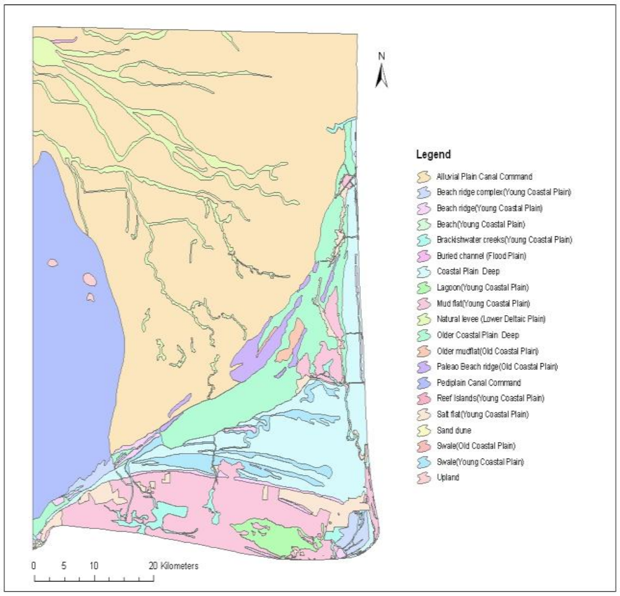
The study of mesofracture zones deserves special attention in view of the importance of locating dilatation and fissure zones in the productive horizons for solving petroleum geological problems. Mesofracture zones are identified in large scale satellite imagery and high altitude aerial photos as high density lineament zones Figure.3 with a width of up to a few kilometres and a length up to several tens of kilometres, consisting of numerous relatively short (1-4 km) and near parallel lineaments. The genetic nature of these zones is determined by their relations to plicate and disjunctive structures. Mesofracture zones have the following characteristic features: they are organized systems of individual lineaments with consistent orientations. They independently intersect different types of relief, Geomorphology, Landuse Landcover, Geology, Soil, and stratigraphic associations of rocks, without change in direction.

Remote Sensing Data Processing and Analysis:

False Colour Composition:

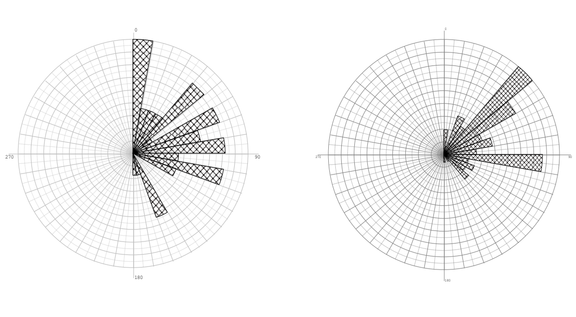


The band combination found to be most useful was a standard false colour composite with Band1 (blue) Band 2 (green) displayed on the blue gun, Band 3 (red) displayed on the green gun, and Band 4 (near-IR) displayed on the red gun. This band combination made it easier to identify linear patterns of vegetation, which represent paleochannels and deeper soils associated with geological structures of the earth. Which is very useful to identify the lineament pattern and geomorphic features.Figure.4 false color composite methods is very useful to identify geomorphological features in the study area.



Rose diagram

Lineaments patterns have been summarized using rose diagram, when lineament processing is completed, the final "Geological" lineament file is also converted back to a vector format. Than the vector mean calculated for surface lineaments as well as subsurface faults. The vector means direction of major surface lineament is 47°. The vector means direction of minor lineament is 275° as there is bi-model distribution at an angle of 90°. The vector means direction of subsurface faults is 57°Figure.5



SURFACE LINEAMENTS BASEMENT LINEARITIES

GIS Functionality in Analysis of Geological Structure

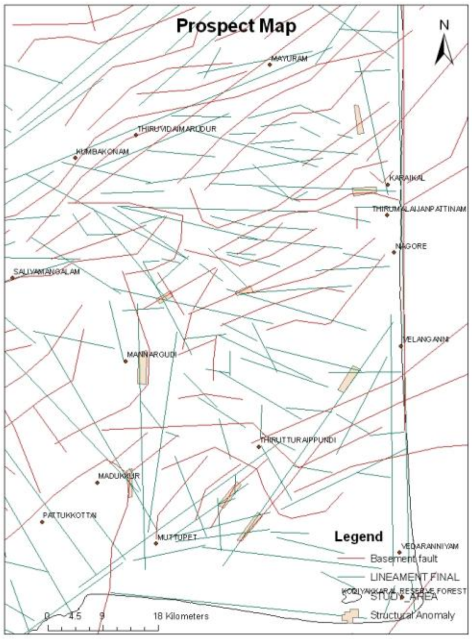
Geographical Information Systems (GIS) have become increasingly powerful due to improvements in both hardware and software. With this increase in the power of GIS, many fields in both geography and geology have found new uses for GIS. One of the geological fields that have recently benefited from GIS 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 softwares. From the above technique all the thematic maps integrated using GIS software and positive zones have been identified.

Integrated analysis of Geological, Geophysical and Remote sensing Data in Identification of Fracture Zones:

Large divisions of the earth's crust are indicated by diverse tectonic contacts represented as individual disjunctive structures with apparent displacements. Usually, they determine the outer boundaries of large oil- and gas- bearing regions, in which petroleum distincts and zones of accumulation are located. Intra basin mega fractures mainly determine the stratigraphic altitude of oil-bearing layers and the formation of various types of oil and gas traps. Interpretation of this type of fracture, particularly if it is still active today, is quiet feasible. In such cases satellite imagery of different scales can be used for detailed studies of oil and gas bearing regions. The results of lineament analysis of satellite imagery can be fragmentarily verified by conventional geological and geophysical methods. Interpretation of satellite imagery and aerial photos can be valuable in selecting targets for present work. Most of the surface lineaments are correlated with the subsurface faults which is obscured from the geophysical data.

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 its strongly relation with subsurface linearities and surface lineaments wherever observed those were identified by positive structural anomaly Figure.6.



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