Chapter - 2
CHAPTER- 2

GEOLOGY OF GUNDLUPET TALUK

2.1 INTRODUCTION

A detail literature on the stratigraphy, lithology and structural features of an area plays an important role in the qualitative, quantitative evaluation and assessment of groundwater resources of any area. Preliminary conclusions with the help of regional geological map forms the backbone of any study.

Geology of Karnataka state in general and the Gundlupet taluk in particular are dealt in detail in this chapter.

2.2 GEOLOGY OF KARNATAKA

As per the geological map prepared by geological survey of India (1981) our state has an areal extent of 2,10,000 sq.km and occupies the area between 74° 00' East longitude 11° 45' – 18° 00' North latitude. The geological history of Karnataka is largely confined to two oldest eras namely Archean and Proterozoic. Lithologically the state consists of Schistose rocks (meta sediments, meta volcanics and other rock types) gneisses, granites and granuliltes (charnockite) of early Precambrian age, Kaladgi, Badami and Bhima groups of rocks of upper Proterozoic age Deccan traps of Cretaceous-Eocene age followed by laterites derived from different parent material and recent alluvium have been encountered (Map 2.1 and Map2.2).
MAP 2.1 MAJOR LINEMENTS OF SOUTH INDIA (IRS - 1A)

1. Hunsur lineament
2. Kabini lineament
3. Cauvery fault
4. Vagai river fault
5. Kunnakuzhi Todu lineament
6. Achankovil fault
7. Mattupattidam lineament
8. Crystalline Sedimentry Contact fault
9. Mettur East fault
10. Moyar Fault
11. Bhavani lineament
12. Mettur East fault
2.3 GEOLOGY OF PROTEROZOIC BASIN – SOUTHERN KARNATAKA

The Dharwar craton that forms part of the Precambrian shield records more than billion years of history of the earliest period of the earth, involving several periods of crustal growth. The Dharwar craton consists of several tectonomorphic units (Mukhopadhyay, 1986) namely supracrustal rocks, peninsular gneissic complex, younger granites, granulites.

The distinct types of Supra crustal rocks are recognized based on lithology, mode of occurrence and grade of metamorphism. The ancient supracrustal rocks are highly folded and metamorphosed remnants within the grey gneisses as enclaves and belong to Sargur group (Janardhan et al., 1978, Swaminath and Ramakrishnan, 1981) Swaminath and Ramakrishnan (1981) classified the Supracrustal rocks of Southern Karnataka into two major blocks (Map 2.3) the western part into ten belts- Chitradurga, Shimoga, Bababudan, western ghats, Holenarasipura, Sigagudda, Nuggaehalli, Krishnarajpet, Sargur and Javanahalli and Eastern region into two belts viz., Kolar and Hulilyurdurga.

2.4 GEOLOGY OF GUNDLUPET TALUK

Gundlupet taluk occupies an area of 1406.30 sq.km and lies between 76° 24' to 76° 50' longitude 11° 32' to 11° 58' latitude. Gundlupet taluk falls in the Western block of Archaen rocks of Southern Karnataka and exposes the
different lithological units which forms the part of “SARGUR SCHIST BELT” (Map 2.4, Plate-1 to 6).


**2.4.1. SARGUR BELT**

Foote (1900) grouped the Schistose rocks of erstwhile Mysore state into Dharwar system. Often there has been debates on whether some of the schist belong to older series. Swaminathan and Ramakrishnan (1981) of the Geological Survey of India confirmed the existence of an older cycle of Supracrustal and name them as Sargur groups, after Sargur village (Begur – Heggadadevana Kote road – 40 km south west of Mysore) and proved the earlier concept of Rama Rao (1940) that Sargur are different from Dharwars in the mode of occurrence and grade of metamorphism. Sargur belt does not represent a well defined belt of schists but consists of a series of intimately associated enclaves of supra crustal rocks within the peninsular gneisses.

Besides the main sargur belt there are several isolated but closely associated schist bands in Mysore district like those of Wolagere Amble, alattur, Nanjangud and as stringes in Gundlupet region. It has now been agreed
MAP. 2.4
GUNDLUPET TALUK
GEOLOGY

LEGEND
- Felsite & Felsite Porphyrites
- Dolerite/Gabbro dykes
- Granodolite, Tonalite and Migmatite gneises
- Banded Iron Formation
- Metapelite (Staurolite-Kyanite-Sillimanite Schist)
- Amphibolite hornblende schist
- MetaUltramaflics, Meta pyroxenite, serpentinised dunite and Peridotite
PLATE - 3

10. SEGEWADI: EXPOSURE OF THE WEATHERED GRANITE, OBSERVED STORED WATER IN ROCK PITS.

11. MADAPATNA: WEATHERED AND FRACTURED AMPHIBOLITE

9. KARBAHALI: VIEW OF THE GREY COLOURED SOIL HORIZON.

12. MADAPATNA: EXPOSURE OF THE WEATHERED GRANITE.
PLATE - 6

22. RAGHAVAPURA: ERODED GRANITIC GNEISS DUE TO FLOW OF CHANNEL WATER

24. MADAPATNA: EXPOSURE OF MIGMATIZED GNEISS

21. BASAVANAPURA: VIEW OF THE LAKE

22. KABBAHALI: EXPOSURE OF THE WEAT MAFIC ROCK
upon that all schist belts of south India older than 3100 Million years should be grouped as Ancient Supracrustal of Sargur type (Radhakrishna 1983).

2.4.2 Lithology

Janardhan (1994) described high grade supracrustal rocks occurring as huge enclaves within gneisses of different ages, which includes quartzite – Pelite carbonate association along with banded iron formations, Manganiferous horizons and Amphibolites. The components of the ultra mafic and basic rocks were emplaced into the supracrustal and were invaded by large scale acid Igneous rocks.

Detail petrological work on these Supracrustal rocks which are very well exposed around Sargur, Doddakanya and Terekanambi has been carried out by Ramachandra (op. cit), Srikantappa (op.cit), Ravindra Kumar (op.cit), and Shadakshara Swamy (op.cit).

The chief rock types of Gundlupet taluk are Felsite and Felsite porphyries, Sensitized zone (Epidote Gneiss), Dolerite/Gabbro dykes, Granodiorite, tonalite and migmatite gneiss, Banded iron formation, metapelite (staurolite-kyanite-silliminite schist) amphibolites and hornblende schist, Meta ultramafics, metapyroxenite, serpentised dunite peridotite and gneisses, amphibolite, schists with intrusions of dykes with a mantle of different types of soils which is the resultant of the weathering of these rocks.
2.4.3 Gneisses

Well foliated biotite gneisses which are light coloured, coarsed in nature are the prominent rock types of the area, which are referred as peninsular gneisses. Schistose rocks occur as enclaves within these gneisses.

Rama Krishna et al., (1976) divided Gneisses into three major components namely.

1. The macro layered trimodal Gneiss with alternating bands of amphibolites and ultramafics.
2. Migmatites of various structure types.
3. Homophanous granitoids.

The entire Gundlupet taluk comprises of granitic gneisses having the strike NNE and SSW direction with a general easterly dip of 70° to 78°. They are grayish to pinkish in color. The grey gneisses are highly weathered, fractured and fissured up to an average depth of 8 to 10 mts. The pink coloured gneisses are massive and do not suffer much tectonic disturbances.

2.4.4 dykes and Veins

Dolerite dykes and quartz veins are common with variable strike directions and width. They are found in the village limits of Bandarapur, Veeranapura and Shivapura village. They have a variable width of 5 to 15 mts. and extend over a distance of 2 to 3kms. These intrusions have a bearing on the
movement of groundwater and hence whenever these intrusions are encountered a detail investigation about their extent, and attitude is considered to identify the water bearing and non water bearing horizons.

2.5 STRATIGRAPHY

The stratigraphy of Sargur could not be worked out by the earlier workers with certainly, due to its splitting into separate enclaves, lack of way up criteria for basement cover relations and the invariably intrusive or tectonic contact surrounding gneisses.

Vishwanath and Ramakrishna (1976) and Swaminath et, al (1976) have reconstructed a lithographic column on the classical ensialic geosynclinal model. The following table represents the major litho types of Sargur belt.

| S | Younger basic dykes |
| A | Peninsular Gneisses |
| R | Meta ultra mafic |
| G | |
| U | BIF (Hypersthene, Hedenbergite, amphibole magnetite quartz-rock) |
| O | Sillimanite - garnet-kyanite-graphite |
| U | Corundum – biotite-K. Feldspar-Plagioclase |
| P | Quartz schist and para-gneisses. |
|   | Quartzite, Sillimanite, Kyanite and fuchsite bearing |

Basement indistinguishable from Peninsular Gneisses
2.6 LINEAMENTS

Study of lineament has become an important part in analyzing the structure and tectonic aspects of any areas. Most of the structures represent the zones of weakness in the earth crust. Though there is no displacement, the rock may be highly fractured and susceptible to stream erosion. Studies on the lineament tectonics help in understanding the groundwater conditions of hard rock terrain, where secondary porosity, in the form of fractures are the controlling factors of groundwater flow and occurrence.

"The lineament was originally used by Hobbs (1904), to describe linear feature that are significant lines of landscapes" although linear features has been discussed since the 1800s (Hodgson, 1974). During the Indo-US workshop on “Regional geophysical lineaments, their tectonic and economic significant”.

Use of space imagery in structural mapping has bee proved beyond doubt. Major faults and fractures are expressed as linear features in satellite imagery. These large scale linear features, which expresses itself in terms of topography and underlying structural features are termed as “LINEAMENTS”. These features at times control the direction of flow of surface water and act as potential zones of groundwater concentration. Hence a critical study of lineaments in conjunction with drainage and topography can result in very high successful wells.
Many lineaments have prominent geomorphic expressions, which may be continuous or discontinuous. In discontinuous lineaments separate features are aligned in a particular direction and are relatively closely spaced. Lineament may be simple or composite. Simple lineaments are formed by a single type of features, such as a linear stream valley or linear boundary between different types of terrain. The composite type of lineaments is defined by more than one type of features such as alignment of stream segments and ridges (Sabins, 1978).

2.7 LINEAMENTS DRAINAGE CHARACTERISTICS

The lineaments of varying length are seen in the area (Map.2.5). They are recognized as major and minor lineaments. There are 13 major and 52 minor lineaments in Gundlupet taluk. Their orientation is shown in the following table.

<table>
<thead>
<tr>
<th>FORMATION</th>
<th>DIRECTION</th>
<th>LINEAMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N-S</td>
<td>MAJOR: 01</td>
</tr>
<tr>
<td></td>
<td>NNE-SSW</td>
<td>MAJOR: 03</td>
</tr>
<tr>
<td>GNESSIC</td>
<td>NNW-SSE</td>
<td>MAJOR: 04</td>
</tr>
<tr>
<td>TERRAIN</td>
<td>NW-SE</td>
<td>MAJOR: 01</td>
</tr>
<tr>
<td></td>
<td>NE-SW</td>
<td>MAJOR: 03</td>
</tr>
<tr>
<td></td>
<td>E-W</td>
<td>MAJOR: 01</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>MAJOR: 13</td>
</tr>
</tbody>
</table>
From the above data it is seen that majority of the lineaments are NNE-SSW to NE-SW trending along which direction both the major and minor lineaments have been identified.

The drainage of the Gundlupet taluk controlled by the lineament. The Peninsular gneisses are marked by whitish to grayish white tone and poor relief. The drainage is very prominent in the gneisses as compared to other lithological units. The drainage is of dendritic type.

2.8 CLASSIFICATION OF LINEAMENTS

Numerous efforts have been made to classify the lineaments on the basis of their origin, mode of expression or magnitude, in spite of which no clear grouping has emerged. One type of classification of lineaments is on the basis of their magnitude (length), which in a way reflects their nature, significance and origin.

In hard rock terrain, fractures and porosity play a dominant role in the occurrence and movement of groundwater. The low lying areas along the lineaments indicates the zones of abundant natural recharge and underground storage. Hence it indicates the zones of abundant natural recharge and underground storage; hence it is felt necessary to classify the lineaments, fault, fracture system with regard to groundwater potential. For the taluk such a classification (Raju et al., 1979) has been attempted. The lineaments that extent
along stream coarse and in the proximity of alluvial and colluvial zones have been grouped as class ‘A’ or high yielding lineaments. These lineaments are direct importance with regard to the occurrence of groundwater and are prospective zones for the development of groundwater. The pediplan and the dissected pediments and which often cut across the low lying areas have been classified as class ‘B’ or moderately yielding lineaments.

2.9 LINEAMENTS DENSITY

Considering the total length of lineaments over the area of a taluk in the same manner as drainage density has evolved a concept of lineament. The lineament density is the ratio of the total length of the lineament and basin area. A high value of these parameters is an indication of large-scale availability of groundwater in the region.

2.10 SOILS

Soil is a major component of land system, which provides a medium for water movement and plant growth. The potential and limitations of a soil for sustained use in the irrigation and other management practices are controlled by its inherent morphologic, morphometric physical and chemical characteristics. These characteristics are expressed in taxonomic classes as depicted on soil maps with locational references. The soil map, thus help to know the characteristics of the soils of the area to understand their problems, potentials and management needs (Map 2.6).
The recharge capacity and groundwater quality is decided by the soil types and their texture. Four types of soils exist in the study area such as Red Sandy Soil, Red Loamy Soil, Deep black Soil and Red gravely soil.

2.10.1 Red sandy soil

Forms the major types of soils and occupies the largest area in the NW and southern part of the Gundlupet taluk in contrast to the red loam these soils do contain a larger admixture of sand particles. The thickness varies from 1.0-5.0m, these also could be classified in a similar manner as those of red loam based on color and texture.

2.10.2 Red loamy soil

Develops under monsoonic, medium dry climate over acid to intermediate parent rocks, red, reddish brown and deep yellowish brown soils in the area occupies the eastern and Western part of the study area. The thickness varies from 1.0-7.0m and also could be classified into deep, medium and shallow types based on color and texture.

2.10.3 Deep black soil

Mostly occupies the central part of the area, mostly these soils are clayey highly porous with rich plasticity and the base in saturated with Ca and Mg. These have a variable thickness between 1.0-3.0m infiltration capacity of
these soils is very high in the begging and drastically gets reduced with increasing time. Permeability index calculated from the ionic chemistry of the ground water is detailed in the hydrogeochemistry chapter of this work.

2.10.4 Red gravy soil

Forms the northern part of the area. In contrast to the red loam gravelly subsoil it contains a larger admixture of sand particles. The soil thickness of 100 cms and the infiltration rate 1.0 to 1.2 cm/hrs these also could be classified in a similar manner as these of red loam band on size and texture.

2.11 HYDROGEOLOGICAL SIGNIFICANCE

Hydrologeology (both surface and subsurface) is influenced by secondary fractures and fissures developed during the tectonic activities. The drainage pattern, narrow groundwater potential zones, vegetation cover shows the impact of lineaments over the hydrogeology of Karnataka craton.

The structural activities have given rise to several major and minor lineaments, fractures and shear zones. The fault lineaments are responsible for the abrupt change in lithology of one block to the other. The groundwater characteristics of such an area is governed by lithology and structure aspects.