3.1. INTRODUCTION:

The following rock types have been met with during the field survey and each rock type embraces many varieties depending on addition or omission of certain minerals - magnetite-quartzite, biotite gneiss, hornblende gneiss, granitic gneiss, garnet sillimanite gneiss, amphibolite, charnockite, pink granites with pegmatites and basic dykes.

During the well inventory studies, the contacts between different litho units were studied and are marked on the map (Fig. 5.1), by observing carefully their disposition on the surface and different dug wells. The contacts between the rock types in other places are inferential as the critical areas are under soil cover.

Approximately the study area could be divided into three sectors on the basis of major rock types and alluvium.

(1) Western sector is comprised of precambrian meta sediments, peninsular gneissee amphibolites and pink granites with pegmatites.
(2) A narrow central sector is mostly comprised of alluvial sediments of Thirumanimuthar river.

(3) Eastern sector is comprised of charnockites, amphibolites and foliated gneisses with few basic dykes.

3.2. AGE RELATIONSHIP:

From the field relationship the following stratigraphic sequence is established.

<table>
<thead>
<tr>
<th>Stratigraphic position</th>
<th>Rocks of the area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recent</td>
<td>: 10. Alluvium</td>
</tr>
<tr>
<td>Closepet granite period</td>
<td>: 8. Pink granites, pegmatite.</td>
</tr>
<tr>
<td>Charnockitic period</td>
<td>: 7. Acid charnockites, intermediate charnockites.</td>
</tr>
<tr>
<td></td>
<td>: 5. Garnetiferous sillimanite gneiss.</td>
</tr>
<tr>
<td>Peninsular gneissic period</td>
<td>: 4. Hornblende gneisses.</td>
</tr>
<tr>
<td></td>
<td>: 3. Granitic gneisses.</td>
</tr>
<tr>
<td></td>
<td>: 2. Biotite gneisses.</td>
</tr>
<tr>
<td>Dharwars</td>
<td>: 1. Magnetite-quartzite.</td>
</tr>
</tbody>
</table>
3.3. FIELD STUDY:

Field relationship of various lithological units are described below.

3.3.1. MAGNETITE-QUARTZITES:

This represents one of the oldest rock units of the area. Three main bands of magnetite-quartzite rock crops out more or less continuously all round the Kanjamalai hill which lies on the Northwestern boundary of the study area.

The lowest band of magnetite-quartzite band is seen as a series of curved out crops on the southern flank of the hill, forming the crest of small knolls 30 - 90 m in height, separated by valleys or depressions. Through these depressions a few streamlets flow out of the hill into the study area. The thickness of magnetite-quartzite band ranges from 9 - 30 m across. Near Elampillai this band is 10' thick and is underlain by garnetiferous-amphibolite and dips 50° - 60° into the hill.

The second band of magnetite-quartzite is exposed discontinuously at an elevation of 305 m from the ground level and the third band is found more or less a continuous one at an elevation of 365.76 m from the foot of the hill. The total quantity of iron ores in the banded magnetite-quartzite rock is about 55 million tons.
EXPLANATION OF PLATE IV

Figure

1. Granitic gneiss exposures near Mallur - White lines are parallel to the foliation of the rock.

2. Another view of granitic gneiss exposure near Mallur.

3. Charnockitic massifs near Panamarathupatti lake.
3.3.2. BIOTITE GNEISS:

The grey coloured, foliated biotite gneisses of the area containing a good amount of biotite which sometimes altered partly to chlorite. They are traversed by veins of quartz, granites and pegmatites.

3.3.3. PENINSULAR GNEISSES:

Gneissic rocks belonging to this period are the most widely spread group of rocks in the sub-basin area. They consist of a very heterogeneous mixture of different types of granite intrusives into the foliated rocks after the latter were folded, crumpled and metamorphosed.

This group includes granitic gneisses, hornblende gneisses and garnetiferous sillimanite gneiss. Many of the hill masses like Kanjamalai, Bodamalai and parts of other hills are composed of these rocks. They are probably partly of igneous and partly of sedimentary origin, but belong to the pre-cambrian sequence and are pre-charnockite in age (Krishnan, M.S. and Iyangar, N.K.N. 1953).

Granitic gneisses are frequently well foliated, consist of white bands of quartz-feldspar alternating with dark bands.
EXPLANATION OF PLATE V

Figure

1. Hornblende gneissic-exposures near Kuttanattam, hamlet of Karumapuram.

2. Another view of Hornblende gneiss, strikes N40°E and dips 40°NW.

3. Doleritic dyke exposures - 1½ km from Vennandur, on the Vennandur - Mallur road.
   Background: Suriyamalai hill.
containing hornblende, biotite and minor accessories. Hornblende gneisses are well exposed near the village Karumapuram, which is 15 km away from Tiruchengodu on the Tiruchengodu - Salem highways. The granitic gneisses are sometimes with much garnets and sillimanites forming garnetiferous sillimanite gneisses as at the foot of the Kanjamalai hills near Ariyanur. These rocks have been subjected to severe compression and folding and hills are the denuded remanants of folded strata.

The general strike of these rock is NE - SW. The development of garnet, dislocation of basic bands, thinning and dragging of basic materials along the sheared planes, development of white or grey coarse grained feldspars and quartz are inseparable associations in the field. Pink granite is seen always intruded parallel to the foliation of the country rocks - biotite - hornblende gneiss. The contact between the granitic gneisses and the adjoining charnockitic rock is always gradational and precise demarcation is impossible.

3.3.4. AMPHIBOLITES:

Amphibolites are dark coloured, metamorphic rocks of medium to relatively coarse grained one, whose principal mineral components are hornblende and plagioclase. The important accessories are epidote, chlorite, biotite and garnet.
EXPLANATION OF PLATE VI

Figure


2. Garnetiferous sillimanite gneiss - pink coloured garnets are studded in the gneissic bands.

3. Doleritic dyke exposures near Vennandur.
They may be probably younger than gneisses and may represent early intrusives (Krishnan, M.S. 1953).

Amphibolites underlain the magnetite-quartzite band near Elampillai. Isolated outcrops of this rock are also seen in the central sector of the study area. A thick band runs southward from Kalparapatti traversing through charnockites, to Minnakkal which lies on the western side of Suriyamalai hill.

Foliation is highly variable. Where hornblende crystals are prismatic in habit, or when biotite and chlorites are present, the rock may be decidedly schistose, otherwise foliation is completely lacking and the rocks breaks with an irregular fracture.

3.3.5. CHARNOCKITES:

Jarugumalai, Bodamalai and Suriyamalai hills in the study area, consist mainly of charnockites. These are generally acid to intermediate in composition and also show garnetiferous varieties and some hybrid types.

Charnockites show a combination of characters of igneous and metamorphic rocks. They send out apophyses and veins into the surrounding rocks. Tongues of charnockites cutting
across the foliation of the country rocks are found in the study area. Foliations can be observed on the weathered surfaces and it is due to the parallel arrangement of planar minerals. Granitic mineral composition is widely prevalent but the mixture of granitic and basic materials in the proximity of the basic granulite is a notable feature and thus intermediate charnockites develops.

The general strike of the rock ranges between NEE - SWW to NE - SW. Local variations other than this directions are also observed when the rock is faulted or when develops minor folds.

3.3.6. GRANITES AND PEGMATITES:

Granites associated with pegmatites are very prominent in the western parts of the study area. These rocks are found as intrusive bosses amidst the older gneissic and charnockitic rocks. Graphic granites are noticed at the western end of the Kanjamalai hill.

The pegmatites of the study area are of two types, viz. (a) those developing at the shear planes and essentially composed of grey microcline and quartz of very coarse nature and showing no intergrowth structure, and
(b) those of pink pegmatite character with pink orthoclase having graphic intergrowth with quartz.

The former is observed in the shear planes of granitic gneisses and charnockites and the latter is noticed near the pink granite bodies. The development of pegmatites in the area under investigation has been the last regional activity.

3.3.7. BASIC DYKES:

Basic dykes, mainly doleritic in texture and composition, are found in the southeastern part of the study area, 1½ km from Venandur on the Venandur - Mallur road. The general strike direction is NE - SW.

3.3.8. ALLUVIUM:

Central sector of the study area mostly comprised of alluvial sediments of Thirumanimuthar river.

3.4. PETROGRAPHY:

A short account of the petrological features of each rock type is discussed below.
3.4.1. MAGNETITE-QUARTZITE:

This hard and compact rock is composed of alternate thin laminae of quartz and magnetite. The magnetite is steel grey in colour. In many rock specimens the thickness of the magnetite laminae is greater than the quartz. Under the microscope, opaque magnetite and aggregate of quartz form alternative bands. Model percentage of magnetite varies between 10% to 35%.

3.4.2. BIOTITE GNEISS:

It is a tough rock composed of black colour biotite, quartz, feldspar with minor accessories. Under microscope, biotite is pleochroic with distinct basal cleavages. Feldpars are orthoclase and oligoclase in composition. Quartz is clear and free from any alteration with wavy extinction.

3.4.3. GRANITIC GNEISS:

The mineral component of this rock are quartz, feldspar, hornblende and biotite and ores. The percentage of mafic varies from section to section. Quartz grains are elongated and occur as aggregate and extinct simultaneously, therby showing their optical parallelism. Potash feldspars are orthoclase and are cloudy in appearance with low relief and R.I.
The plagioclases are oligoclase in composition and are of equal amount to potash feldspar. Simple twins are prevalent in the plagioclase. Biotite is pleochroic in yellow and brown. Hornblende is green in colour with $Z\alpha C = 16^\circ$ shows typical amphibole cleavage. Hornblende shows linear parallelism under the microscope. Modal percentage of minerals of this rock is Quartz - 27% ; K-feldspar - 32% ; Plagioclase - 27% ; Hornblende - 7% ; Biotite - 5% ; Accessories - 2%.

3.4.4. HORNBLende GNEISS :

This coarse grained rock composed of quartz, feldspar with hornblendes. These granular minerals greatly predominate as phyllosilicates the latter almost exclusively of biotite. Under microscope, hornblende is green in colour, with typical amphibole cleavage, shows symmetrical extinction. Quartz grains are clear and free from any alteration shows wavy extinction. Feldsparts are orthoclase and oligoclase.

3.4.5. GARNETIFEROUS SILLIMANITE GNEISS :

It is a tough rock, composed of needles of sillimanite, scales of biotite, quartz, feldspar, pink coloured garnet occasionally magnetite. Silky lustre and prismatic habit are the typical characters of sillimanite.
Under the microscope the sillimanites form needles with transverse cracks and occasionally cleavages. It is colourless and often occurring along with quartz. The needles are not properly distributed and their orientation is irregular. Biotite is pleochroic in brown and yellow and occurs as scales. Feldspars are orthoclase and oligoclase in composition.

3.4.6. AMPHIBOLITE:

Amphibolites are foliated metamorphic rocks composed essentially of hornblende and plagioclase. Hornblende and plagioclase (oligoclase) are equally abundant. Almandine garnet and biotite are also present in minor quantity.

Under microscope hornblende of amphibolites is deep-green in colour. Prismatic crystals of hornblende found with quartz and iron oxides. Oligoclase occurs as xenoblastic grains, few are twinned. Brown colour biotite with distinct cleavage are also seen. Sphene is a minor accessory.

3.4.7. CHARNOKITES:

The important minerals of this group is hypersthene. Generally these rocks are dark coloured and hence it is difficult to distinguish the acid variety from the intermediate variety in hand specimen. Under the microscope, the acid variety is
composed of quartz, potash feldspar, sodic oligoclase, hypersthene and iron ores. The intermediate variety is made up of andesine plagioclase, orthopyroxenes, augite and ore and with or without quartz. Hornblende may accompany in both varieties. Sub-parallel arrangement of mafics is seen in both varieties. Optical properties of hypersthene are $2V = 60^\circ$, $Z \wedge C = 2^\circ$ to $5^\circ$. Pleochroism - $X =$ pink; $Z =$ light green; Almandine variety of garnets are also seen.

The model percentage of acid charnockite are Quartz - 35%; K-feldspar - 40%; Plagioclase - 19%; Hypersthene - 4%; Accessories - 2%.

Intermediate charnockite: Quartz - 10%; K-feldspar - 5%; Plagioclase - 35%; Pyroxene (clino and ortho) - 35%; Hornblende - 10%; Accessories - 5%.

3.4.8. PINK GRANITE:

In hand specimen it is pink colour and under microscope it is seen that the porphyroblasts of mesoperthite texture are embedded in a matrix of quartz, plagioclase and microcline. Biotite occurs as scales with matrix. Modal percentage of minerals of this rock is:

Quartz - 32%; Perthite - 25%; Microcline - 28%;
Plagioclase - 10%; Biotite - 4%; and Accessories - 1%. 
3.4.9. DOLEIRITIC DYKE:

This dark coloured fine grained rock composed mainly of
angite and plagioclase (Labradorite) feldspars. Olivine,
biotite, iron and ilmenites are accessory minerals.

Under microscope, laths of Labradorite found embedded in
plates of angite. Angite plates are pale green in colour,
shows high relief, high R.I with irregular margin. Olivine
with transverse fractures shows high order interference colour,
surrounded by pyroxenes and magnetitic rim.

Model percentage of doleritic dyke are Plagioclase -
40 to 45 %; Pyroxene - 35 to 45 %; Olivine - 3 %;
iron and titanium oxides - 8 %; Micro pegmatite - 5 %.

(cont..36.)

.....
3.5. STRUCTURAL INTERPRETATION OF AIRPHOTOS:

In areas where geological conditions are closely reflected in morphological or topographical expression of rock type and structure, it may be possible to recognize geological features quite uniquely using the direct evidence presented by airphotos.

Airphoto studies of the area reveal the linear features as lineaments which have the tonal control over the drainages existing in the study area. Faults, fractures, major relief forms, change in topography are also having distinct linear appearance in the photographs. Where the lineaments are the result of faulting and fracturing, they represent areas and zones of increased porosity and permeability in the study area.

Fig. 3.1 represents the lineament pattern of the Attayampatti sub-basin. On the basis of limited field check, an attempt is made to interpret the lineaments of the study area.

3.5.1. LINEAMENT ANALYSIS AND RESULTS:

The lineament map of the study area displays a wide ranging azimuthal frequency of lineaments of varying length.

The area in the south is delimited by a major ENE - WSW trending lineament, about 25 km in length, and all other lineaments
LINEATION MAP OF ATTAYAMPATTI SUB-BASIN.

- G.W.D Bore-wells.
- Lineament
- SH: Structural Hills.

Scale:

- 0
- 5
- 10
are less than 25 Km. in length. Their azimuthal frequency plots show that these fall under three groups and their mean orientations are:

1) N 50° E and S 50° W.
2) N 50° W and S 50° E, and
3) N 10° E and S 10° W.

The NE - SW system of lineaments are less in number and widely spaced, whereas the NW - SE lineaments are closely spaced with more frequency. The former set represent the wind gaps between Kanjamalai and Jarugumalai structural hills and promoting erosion along them. The NW - SE set may represent a shear zone. The N 10° E and S 10° W set of lineaments are thin vegetation linears.

In the study area, 10 test-bore holes, for investigation purposes, were drilled by Groundwater Department (PWD, Govt. of Tamil Nadu). It is inferred that the bore-holes located in areas where lineaments intersects are successful with good potentials. The yield of the bore-well at Gajalnickenpatti is 11.4 m³/hr, at Ammapalayam it is 6.24 m³/hr and at Mahudanchavadi the yield of the bore-well is 11.5 m³/hr. Unsuccessful bore wells of poor yield are found in the non lineament zones, ex.Vaikundam and Mallasamudram.

....