CHAPTER IV

GEOLOGY OF THE STUDY AREA
4.1 Introduction

Gopalakrishnan et al (1975) and others reveal that there are at least three distinct groups of rocks distinguishable among the basement rocks of Tamil Nadu. However, all the three groups are extensively migmatized as in many parts of Tamil Nadu and perhaps represent more than one period of migmatization.

The three groups or supergroups recognized in Tamil Nadu are as follows:

1. Khondalite - charnockite supergroup
2. Sathyamangalam supergroup (comparable to Sargur)
3. Bargur supergroup (comparable to Dharwar).

No distinct contact is recognized among these supergroups as the contacts are obscured usually by migmatization. However, Gopalakrishnan et al (1975) classified the three supergroups based on distinct lithological assemblage, grade of metamorphism and structural patterns seen within them.

4.2 Khondalite - Charnockite supergroup

Nearly 75% of the area of Tamil Nadu are covered by rocks of Khondalite - charnockite supergroup and its
migmatised equivalent.

**Example**: Hill massifs, southern Tamil Nadu south of Noyil-Cauvery lineament.

The coastal tracks along the eastern margin of Peninsular India is not covered by this supergroup. The hill ranges such as Nilgiri, Biligirirangan hills, Sathyamangalam-Anthiyur hill tracks, Kollaimalai - Pachaimalai hills, Shevaroys, Chitteri-Kalrayan hills and Jawvadihill are mostly composed of charnockite group of rocks and the migmatitic varieties derived from them. The khondalite group is seen chiefly in the southern districts and Coimbatore District of Tamil Nadu.

**4.2.1 Lithological assemblage of khondalite group**
(After Gopalakrishnan et al, 1975)

1. Garnetiferous - graphite sillimanite schists
2. Garnetiferous - graphite sillimanite gneiss
3. Quartz - granulite (or) quartzites
4. Crystalline limestone
5. Calc-granulite
6. Calc-gneiss

**4.2.2 Charnockite group - Lithological units**

1. Intermediate charnockite
2. Pyroxene granulite
3. Amphibolite
4. Magnetite quartzite
5. Ultramafic body such as
   i) Dunite
   ii) Peridotite
   iii) Pyroxenite
6. Gabbro
7. Dolerite dykes

Note:
(a) Magnetite - quartzite is rare within khondalite group and pure quartzites is rare in charnockite group.
(b) Ultramafic bodies are almost absent within the khondalite group.
(c) Both supergroup of rocks migmatised are more than one period. Normally migmatites are restricted to the hill flanks and plain.
(d) Both groups show poly-deformation nature.

4.3 Sathyamangalam supergroup (equal to Sargur supergroup)

This group of rocks cover a linear area in Tamil Nadu (Fig.11) and has a roughly East-west trending belt extending from near Sultan battery in the Wynad area of Kerala towards the east coast of Tamil Nadu. It has geographical and geological continuity with Wynad groups of Kerala and Sargur groups of Karnataka.
FIG-11

NANOGRAIN DISTRIBUTION OF SATYAMANGALAM SUPERGROUP OF ROCKS IN TAMIL NADU

(after Gopalakrishnan et al. 1975)
4.3.1 Sathyamangalam Belt

Sathyamangalam belt is controlled by two major E-W trending lineament of Tamil Nadu, the southern boundary of the belt is controlled by Noyil-Cauvery lineament south of which, the migmatites derived from khondalite-charnockite group are exposed. The northern boundary is controlled by Bhavani-lineament and extends eastwards (Refer Fig.11). Further eastwards the group of rocks, the valleys between the Shevaroys, Chitteri, Kalrayan hill ranges in the north and the Kollimalai and Pachaimalai hills in the south (Pascoe, 1973), referred in Gopalakrishnan et al (1975) may belong to this group. It is interesting to note that the hills are made up of charnockite groups of rocks, while, the valleys belong to Sathyamangalam group of rocks. Further eastward, this group of rocks are exposed in the low rolling terrain of Palar river as enclaves of different sizes within migmatites. The Sathyamangalam supergroup in Shevaroy valleys is represented by hornblende-schist, mica-schist and chlorite-schist.

4.3.2 Lithology of Sathyamangalam

The rock types which constitute the Sathyamangalam rocks are,
1. Fissile mica gneisses
2. Quartz-feldspathic gneiss
3. Hornblende gneiss
4. Amphibolite
5. Various types of quartzite.

Pure white quartz micaceous and fuchsite quartzite, garnetiferous quartzites, ferruginous quartzites, magnetite quartzite, kyanite quartzite, quartz-sillimanite schist, calc-granulite in the form of diopside granulite including ultramafic rocks represented by talc-chlorite schist, talc-actinolite schist and also by dolerite dykes.

The innumerable small bodies, bands and lenses of layered ultramafic-ultrabasic rocks ranging from dunite-peridotite-eclogite-garnetiferous gabbro to anorthosite seen within the Sathyamangalam group of rocks are possibly either younger intrusives into them and emplaced along reactivated lineaments, shear and fracture zones or represents tectonic slices floating within Sathyamangalam group of rocks (Gopalakrishnan et al, 1975).

4.3.3 Grade of metamorphism

The Sathyamangalam group of rocks and the intrusives in them are highly migmatised and deformed. Different formations are seen only as enclaves of small and
detached lenses and bands within the migmatitic gneisses. Still, much younger intrusives are the Tiruchengode type granite and pegmatoidal granite which remigmatised the earlier migmatised and associated resistors.

4.3.4 Structural Pattern

Sathyamangalam group of rocks swerves from WNW-ESE through EW to ENE-WSW within very short distances indicating a series of rows along NS to NNW-SSE axis. The dip of foliation are generally steep to vertical. Eastwest trending isoclinal folds dipping steeply southwards are noticed at a number of places. Minor fold axis with axial plane trending NNW-SSE and NW-SE are seen at many places. A number of younger dolerite dykes follow these directions.

4.4 Bargur group (equal to Dharwar group)

Kolar schist belt of Karnataka occurs around Bargur and Maharajakadai towards E and N of Krishnagiri respectively in Dharmapuri District, Tamil Nadu (Refer Fig.11).

4.4.1 Lithology of Bargur group

Essentially it is made up of hornblende schist, amphibolite, ferruginous-quartzite, quartz—sericite schist.
4.4.2 Metamorphism

The schists are enclosed within an extended area of migmatites. A number of smaller enclaves of such schists are noticed within the surrounding migmatites.

4.4.3 Structural Pattern

The strike of foliation of these schists is nearly north-south with steep dips on both sides.

The above data indicate a complex structural and tectonic history for the Tamil Nadu rock types. It extends from the pre-granulitic rocks (more than 2900 m.y.) to alkali syenites (750 m.y.) - carbonatite complex.

To sum up, more than 2000 m.y. episodes are recorded with the high grades rocks of Tamil Nadu. The author working in the Mallur area of Salem District, observed khondalite-charnockite supergroup and Sathyamangalam supergroup of rocks.

4.5 Petrology and Mineralogy of the rocks of the study area

The Geological map of the study area is shown in the Fig.12 It comprises of the following rock types.
FIGURE 12
GEOLOGICAL MAP OF THE STUDY AREA

LEGEND

Pink granite
Dolerite dykes
Hornblende biotite gneiss
Quartz feldspathic gneiss
Quartz-magnetite rock
Pyroxene granulite
Pyroxene granulite + sulphides
Pyroxene granulite + garnet
Pyroxene granulite
Pyroxenite
Charnockite

Scale
Road
Strike & dip of foliation

Legend:

Legend:

Legend:
1. Basement Gneisses
2. Charnockite + Garnet
3. Pyroxenite
4. Pyroxene Granulite + Garnet
5. Banded Magnetite-Quartzite
6. Quartzo-feldspathic gneiss
7. Retrogressed gneisses
8. Dolerite dykes
9. Granitic Intrusives (Pink Granite)

4.5.1 Basement Gneisses

The term 'Basement gneisses' is commonly applied to describe a variety of gneisses namely Peninsular gneisses, and quartzo-feldspathic gneiss. These basement gneisses are well foliated and are trending NE-SW. The contact between basement gneisses and the adjoining group of charnockites are gradational.

4.5.2 Charnockite + Garnet

Charnockite forms the most predominant lithotype in the whole of the study area and around it, occupying the high raising hills and major part of plains. Charnockite generally contains older supracrustal enclaves. Charnockite is a medium to coarse grained rock showing apparently poor foliated nature (Plate 2, Fig.1).
Fig. 1. Coarse grained charnockite quarry, west of Merikkuvalasu.

Fig. 2. Charnockite showing well foliated nature, near Sandhiyur.
Weathering of the rocks show well banded mafic and felsic layers, which at places become very pronounced due to shearing parallel to foliation as seen near Sandiyur, Virasamipudur (Plate 2, Fig.2).

Whole rock analysis by x-ray fluorescent method of charnockite and biotite gneiss from Attur valley, Salem, Tamil Nadu is given by Salim Ahmed Khan et al, (1989) (Table II). He regards that the transformation of charnockite into gneiss involved addition of potash and loss of iron, magnesium, calcium and perhaps sodium retrogression of charnockite to gneiss along shear zones. In Table III, microprobe analysis of charnockite and biotite gneiss occurring in the shear zone is given. He attributes the presence of two kinds of plagioclase and biotite in the gneisses to retrogression. The influx of carbonates along the shear zones regarded by Khan et al is perhaps from magnesite veins in the nearby Salem ultramafic complex.

Most of Tamil Nadu and Kerala of South India are made up of granulite facies charnockites and their retrogressive products (Ramachandran and Lily Rani Bosu (1981). These rocks equilibrated at different pressure temperature conditions.
TABLE - II
Whole - Rock Analyses (XRF) of charnockite and Biotite gneiss from Salem District, Tamil Nadu.

<table>
<thead>
<tr>
<th>Wt%</th>
<th>Charnockite</th>
<th>Biotite gneiss</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiO$_2$</td>
<td>70.06</td>
<td>72.99</td>
</tr>
<tr>
<td>TiO$_2$</td>
<td>0.35</td>
<td>0.18</td>
</tr>
<tr>
<td>Al$_2$O$_3$</td>
<td>15.80</td>
<td>14.15</td>
</tr>
<tr>
<td>Feo *</td>
<td>2.67</td>
<td>1.56</td>
</tr>
<tr>
<td>Mno</td>
<td>0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>Mgo</td>
<td>0.97</td>
<td>0.40</td>
</tr>
<tr>
<td>CaO</td>
<td>3.48</td>
<td>2.09</td>
</tr>
<tr>
<td>Na$_2$O</td>
<td>4.82</td>
<td>3.28</td>
</tr>
<tr>
<td>Kzo</td>
<td>1.19</td>
<td>3.36</td>
</tr>
<tr>
<td>P$_2$O$_5$</td>
<td>0.10</td>
<td>0.07</td>
</tr>
<tr>
<td>LOI</td>
<td>*0.038</td>
<td>*1.37</td>
</tr>
</tbody>
</table>

**TOTAL** 99.85 99.46

(In ppm)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rb</td>
<td>56</td>
<td>10/</td>
</tr>
<tr>
<td>Sr</td>
<td>336</td>
<td>375</td>
</tr>
<tr>
<td>Y</td>
<td>/10</td>
<td>/10</td>
</tr>
</tbody>
</table>

Feo - as total Iron.

(after SALEEM AHMEDKHAN & A.S.JANARDHAN, (1989))
Microprobe analyses of charnockite and biotite gneiss from Attur Valley, Salem District, Tamil Nadu.

<table>
<thead>
<tr>
<th></th>
<th>CHARNOCKITE</th>
<th>BIOTITE GNEISS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiO₂</td>
<td>61.45</td>
<td>52.18</td>
</tr>
<tr>
<td>TiO₂</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>24.48</td>
<td>1.60</td>
</tr>
<tr>
<td>FeO</td>
<td>-</td>
<td>29.57</td>
</tr>
<tr>
<td>MgO</td>
<td>-</td>
<td>17.15</td>
</tr>
<tr>
<td>K₂O</td>
<td>0.41</td>
<td>-</td>
</tr>
<tr>
<td>Na₂O</td>
<td>7.83</td>
<td>0.15</td>
</tr>
<tr>
<td>CaO</td>
<td>5.24</td>
<td>0.30</td>
</tr>
<tr>
<td>MnO</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>99.61</td>
<td>100.95</td>
</tr>
<tr>
<td>No. of Analyses</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>No. of Cation Based on</td>
<td>8(0)</td>
<td>6(0)</td>
</tr>
</tbody>
</table>

TABLE III
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Si</td>
<td>2.73</td>
<td>1.98</td>
<td>1.98</td>
<td>6.01</td>
<td>2.92</td>
<td>6.04</td>
<td>6.49</td>
<td>6.81</td>
<td>0.33</td>
</tr>
<tr>
<td>Ti</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.62</td>
<td>-</td>
<td>0.30</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Al</td>
<td>1.28</td>
<td>0.07</td>
<td>0.05</td>
<td>2.97</td>
<td>1.15</td>
<td>3.52</td>
<td>3.74</td>
<td>5.76</td>
<td>0.20</td>
</tr>
<tr>
<td>Fe</td>
<td>-</td>
<td>0.95</td>
<td>0.95</td>
<td>2.53</td>
<td>-</td>
<td>3.30</td>
<td>3.19</td>
<td>0.42</td>
<td>3.58</td>
</tr>
<tr>
<td>Mg</td>
<td>-</td>
<td>0.97</td>
<td>0.97</td>
<td>2.74</td>
<td>0.03</td>
<td>1.78</td>
<td>2.01</td>
<td>0.33</td>
<td>6.94</td>
</tr>
<tr>
<td>K</td>
<td>0.02</td>
<td>-</td>
<td>-</td>
<td>2.05</td>
<td>0.01</td>
<td>1.96</td>
<td>2.06</td>
<td>1.97</td>
<td>-</td>
</tr>
<tr>
<td>Na</td>
<td>0.68</td>
<td>0.05</td>
<td>0.01</td>
<td>-</td>
<td>0.86</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>11.62</td>
</tr>
<tr>
<td>Ca</td>
<td>0.24</td>
<td>0.01</td>
<td>-</td>
<td>-</td>
<td>0.14</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mn</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.14</td>
</tr>
</tbody>
</table>


(after SALEM AHEMED KHAN AND A.S. JANARDHAN, (1989))
1) North of Noyil - Cauvery shear zones, the pressure data documents a continuous regional gradient from 7.5 to 8kb in the Bhavani shear zone to 8.7 to 9.2 kb in the northern margin of the Nilgiri (Reith et al, 1988).

2) Other high pressure areas are shevaroy hills 7.4 + 1 kb and Kollaimalai hills 8.8 + 1 kb (Reith et al, 1982).

3) South of Noyil - Cauvery shear zone, the available pressure data is palni hills 6.5 kb, Kerala khondalite belt 4.5 to 6.5 kb.

4) For area between Achankoil and Noyil - Cauvery region. 5 to 5.8 kb (Ravindrakumar, Chako, 1988 and Santhosh, 1988).

5) Ramachandran et al observes that the mean density high grade metamorphic rocks of South Indian granulite terrain in 2-77 gms / cc.

A fresh specimen of charnockite is either dark greenish blue or bluish grey (Plate 3, Fig.1). The dark colour of the charnockite has been attributed to the presence of abundant thin greenish chlorite veinlets (Plate 3, Fig.1) lacing plagioclase and quartz (Janardhan et al, 1979).

The garnetiferous variety is generally coarse grained and the texture of charnockite ranges from granulitic to granoblastic type. Garnet in charnockites appears as discrete crystals or as aggregates. It is usually a pale pinkish almanidine rich variety. Commonly garnets show alteration along their fractures and margins to pale brownish biotite, particularly in sheared charnockites.

Detailed petrographic study of charnockite samples from Mallur, and around it has revealed a more or less uniform, textural and mineralogical assemblages, except from the zones of retrogression.

Mineralogically, charnockites are essentially composed of quartz, plagioclase, orthopyroxene and biotite, with hornblende chlorite, microcline, antiperthite, myremekite and garnet (Plate 3, Fig.2). Common accessory minerals include opaques ores (magnetite and/or ilmenite), apatite, zircon, sphene and rarely rutile.
PLATE III

Fig.1. Charnockite with mafic enclaves near Sandhiyur.

Fig.2. Charnockite show the mineralogical variations (X Nicols, 30x).
The dominant constituent, quartz, normally shows undulose extinction. Sheared charnockites show granulation of quartz starting from peripheries towards the core. Plagioclase occurs as polygonal aggregate with triple point junctions, sometimes with a tendency to stretch along foliation. Marginal sericitisation of plagioclase is common in sheared charnockites. Orthopyroxene occurs as anhedral to sub-hedral grains with distinct greenish to pale pinkish pleochroism. Often hypersthene shows fine exsolution lamellae. Alteration of hypersthene to deep brownish biotite and greenish chlorite is common, accompanied by dusty mass of opaques.

4.5.3 Pyroxenite

Pyroxenite in Mallur area is represented by minor elongated lenses, on the northern side of Kombakkadu (Plate 4, Fig.1). Pyroxenite band is aligned parallel to NE - SW direction dipping 60° SE.

Pyroxenite are medium grained to coarse grained, dark greenish rock comprising of pyroxene, hornblende, plagioclase with accessories of quartz and magnetite. Pyroxene is often highly pleochroic, hypersthene. Hornblende is bright green in colour. Thin section study of pyroxenite shows granulitic texture indicating effects of granulation. They show uniform mineralogy, represented
Plate IV

Fig. 1. Pyroxenite boulders near Kombakkadu.

Fig. 2. Thin section of pyroxenite crystals and mafics (X Nicols, 30x).
PLATE-IV

FIG-1

FIG-2
by orthopyroxenes, hornblende, plagioclase and accessory quartz and magnetite (Plate 4, Fig.2).

4.5.4 Pyroxene Granulite + Garnet

Pyroxene granulite is a dark coloured, hard and compact rock often exhibiting exfoliation (Plate 5, Fig.1) in the field. Only a few minor bands are recorded from the north western part of the study area, important villages are Ervadi, Karupilankadu, Milakanayakanur, Minakkal. Pyroxene granulite also occurs as ponds and lensoidal enclaves within charnockite.

At places pyroxene granulite is garnet bearing mostly almandine-pyrope variety (Plate 5, Fig.2). Under the microscope the detailed studies on a small number of pyroxene granulite bodies that they are appropriately called as "two-pyroxene granulites" as they are commonly made up of varying amounts of ortho- and clinopyroxenes, plagioclase, amphibole and other accessories. Despite their reconstitution under granulite facies metamorphism, they sometime retain a relict sub-ophytic texture, pointing to their meta-igneous nature. However, most of the pyroxene granulites show a typical granulitic texture (Plate 6, Fig.1).

Commonly orthopyroxene occurs as granular aggregates in association with other minerals. Rarely it occurs as
Fig. 1. Pyroxene granulite exhibiting exfoliation, Ervadi-Siddanayakanur Road.

Fig. 2. Garnet bearing pyroxene granulite north-eastern side of Uduppattamudur.
Fig. 1. Thin section of garnetiferous-pyroxene granulite shows, pyroxene, chlorite, quartz and garnet. (X Nicols, 30x).

Fig. 2. Recrystallisation of pyroxene granulite (sulphidic) near Thottivalasu.
large platy crystals such as associated with garnet at Thottiavalasu possibly indicate recrystallisation (Plate 6, Fig.2).

4.5.5 Banded Magnetite-Quartzite

Banded magnetite quartzite is a hard and compact rock and 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 quartz (Plate 7, Fig.1).

Banded magnetite quartzite have a minor distribution of the study area and mostly occur in the south western part of the study area. Two minor bands are found near Merkkuvalasu, and Ayiepalaiyam. Garnet is found to be a common constituent of these magnetite quartzites.

Thin section of a typical magnetite quartzite rock shows banded granulitic texture consisting of fine grained embayed quartz ribbons alternating with streaky granular magnetite with some fibrous amphiboles. Under the microscope, opaque magnetite and aggregate of quartz from alternative bands.

4.5.6 Quartzo-feldspathic gneiss

Quartzo-feldspathic gneiss is generally a well foliated, medium to coarse grained leucocratic rock
(Plate 7, Fig.2) It comprises of colourless milky white quartz and whitish feldspars with little biotite and or muscovite and sometimes with garnet. Garnet wherever present is pale brownish to pale pinkish in colour and peppery in nature often showing stretching along foliation.

The quartzo-feldspathic gneiss has a considerably good representation, occurring as irregular enclaves and linear remanants within charnockite and other gneisses. Coarse grained garnetiferous quartzo-feldspathic gneiss is found in the northern slope of Soriyamalai (Refer Plate 1, Fig.1).

Under the microscope, the quartzo-feldspathic gneiss exhibits gneissic texture comprising quartz, partially sericitized feldsparts (K-feldsparts and plagioclase) in addition to accessory biotite and opaques. (Plate 7,Fig.2)

4.5.7 Retrogressed gneisses

The distribution of retrogressed gneisses is limited in the area of investigation. They are among the most thoroughly studied lithotypes, mainly because the process of retrogression is very well defined in the field area. There are two kinds of retrogressed gneisses from charnockite namely.

1. Biotite gneiss
2. Epidote-chlorite gneiss.
PLATE VII

Fig.1. Banded magnetite quartzite near Kombakkadu.

Fig.2. Quartz feldspathic gneiss near west of Parapatti.
PLATE - VII

FIG. 1

FIG. 2
The farmer is more common and later is localized and is of unmappable in dimensions. The divisioning is based on dominant mafic minerals present in the gneiss.

Hornblende biotite gneiss could be seen from the geological map (Refer Fig.12). Most of these occurrences are concentrated in the northwestern part of the study area, in addition to a smaller lens of retrogressed gneiss near Kilakkuvalasu (Plate 8, Fig.1). The outcrops exhibits development of retrogressed gneiss from charnockite. The transformation of charnockite to bleached hornblende-biotite gneiss has progressed both along and across the steep foliation trends. Development of retrogressed gneiss across the foliation commonly follows NE-SW set of fractures (Plate 8, Fig.2).

Well developed linear retrogressed zones in charnockites are exposed in low rock mounds. Retrogressed gneiss from the retrogressed zones is relatively fresh and less altered when compared to the larger lenticular bodies, often exposed in cultivated plains and well cuttings. Retrograded gneiss from the northwestern part of study area is medium grained, hard and compact and exhibit well developed gneissic banding with alternating mafic and felsic layers (Plate 9, Fig.1).
PLATE VIII

Fig. 1. Thin section of quartzo-feldspathic gneiss essentially comprised of quartz, feldspars and opaques (X Nicols, 30x).

Fig. 2. Retrogressed gneiss near Kilakkuvulasu.
Fig. 1. Retrogressed gneiss shows well developed banding with mafic and felsic layers near Akkaraipalayam.

Fig. 2. Thin section of retrogressed gneiss shows hornblende-biotite and other accessories (X Nicols, 30x).
Under the microscope, retrogressed gneiss show typical gneissic texture, with quartz, partially saussurritized plagioclase and a fine grained mixture of brown and green biotite (Plate 9, Fig.2). Subordinate amounts of secondary untwinned feldspar and accessory muscovite, chlorite, ilmenite and released magnetite are present.

4.5.8 Dolerite dykes

Dolerite dyke rocks show a wide range of grain size from very fine grained, basaltic, to very coarse grained, gabbroic in nature. But the most common are medium grained. They are generally dark greenish to black (melanocratic) hard and compact, massive and less jointed, (Plate 10, Fig.1).

Though the dolerite dykes have varying lengths, ranging from 2 to 50 mts and some thin branches have even upto a few centimeters in thickness. Most of the dykes, either stand out prominently as low ridges or exposed as exfoliated boulders in plains (Plate 10, Fig.2).

In thin section, dolerite is comprised of augite and plagioclase (Labradorite) feldspars. Olivine, biotite, iron and ilmenite are other accessory minerals.
Fig.1. Doleritic dyke exposures Annamalaipatti to Kombakkadu Road.

Fig.2. Doleritic dyke exposures from Mallur to Vennandur road, near Annamalaipatti background of Soriyamalai hill.
Under the microscope, laths of labroderite are found embedded in plates of augite indicating sub-ophitic to ophitic texture. Augite plates are pale green in colour with irregular margins and shows high relief and refractive indices (Plate 11, Fig.1).

4.5.9 Granitic Intrusives (PINK GRANITE)

Granitic intrusives are of only localized in nature, occurring at Thottivalasu. North western part of Thottivalasu has good amount of pink granitic intrusives represented by swarms of intrusion (Plate 11, Fig.2). In hand specimen it is pink colour and under the microscope it is seen that the porphyroblast are of mesoperthitic and are embedded in a matrix of quartz, plagioclase and microcline. Biotite occurs as scales within matrix.

4.6 Tectano-stratigraphy

The reconstruction of litho-stratigraphic succession of the study area, as in any other Archaean terrain is beset with problems and as pointed out by Sutton and Windley (1974) the construction of litho-stratigraphy in an Archaean terrain is believed to be only tectonically significant.
PLATE XI

Fig. 1. Thin section of dolerite dyke shows ophitic texture (X Nicols, 30x).

Fig. 2. Pink granite intrusion near north-western part of Thottivalasu.
Since the present area of investigation, has experienced more than two phases of migmatization and metamorphism and polyphase deformation, the primary sedimentary and igneous structure are not expected to be retained without getting thoroughly modified and largely obliterated. Thus the order of superposition cannot be determined in the absence of primary features.

In the absence of primary, sedimentary and igneous structures, geochronology remains the only total reliable parameter in the reconstruction of lithostratigraphy. There is no geochronological data available from the present area of investigation. A few data are available for the rocks from the adjacent area as shown in Table.

4.6.1 Tectano-stratigraphy of Study Area

Table IV shows the tentative-stratigraphy of geology, structure, metamorphism, tectonism, metallogeny and geochronology of a few parts of North Arcot and Dharmapuri District in Tamil Nadu (Sugavanam, 1988).
TABLE: TENTATIVE SUCCESSION OF STRATIGRAPHY, STRUCTURE, IGNEOUS, METAMORPHIC AND METALLOGENY (after Sugavanam et al., 1988)

<table>
<thead>
<tr>
<th>Event</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>D5 Dyke</td>
<td>Lamprophyre, Tinguite, Phonolite, Lamprophyre, Trachyte &amp; Basaltic Dykes</td>
</tr>
<tr>
<td>Alkali Syenite</td>
<td>Quartz barytes, Carbonatite Veins, syenite, Pyroxenite, Diabase</td>
</tr>
<tr>
<td>F5 Folds NNE-SSW</td>
<td>SHEAR FOLDS (Dextral)</td>
</tr>
<tr>
<td>D4 Dykes (1700 m.y)</td>
<td>Swarms of E-W &amp; N-S trending plexus of dolerite, gabbro, norite dykes</td>
</tr>
<tr>
<td>F4 Folds WNW-ESE</td>
<td>ISOCLINAL FOLDS</td>
</tr>
<tr>
<td>F3 Folds N-S</td>
<td>SHEAR FOLDS (Dextral)</td>
</tr>
<tr>
<td>D3 Dykes (2100 m.y)</td>
<td>WNW-ES trending dolerite, gabbro and norite dykes</td>
</tr>
<tr>
<td>F2 Folds</td>
<td>ENE-WSW Open symmetrical folds (enétral)</td>
</tr>
<tr>
<td>Ginge Complex (2450 m.y)</td>
<td>Gingee Granite, Porphyrite Granite, M3 Migmatite - hornblende - biotite gneiss</td>
</tr>
<tr>
<td>D2 Dykes</td>
<td>Folded and saurised dykes of dolerite, gabbro, norite, hornblende</td>
</tr>
<tr>
<td>F1 Folds</td>
<td>NNE-SSW Asymmetrical Isoclinal</td>
</tr>
<tr>
<td>F0 Folds</td>
<td>(7) RECUMBENT FOLDS</td>
</tr>
</tbody>
</table>

SHEAR FOLDS (Dextral)

SHEAR FOLDS (Enétral)

Formation of regional lineaments, shear zones with mylonite, phylloite, cataclasite, faser rocks.

Regional warps, formation of structural basins and domes.

Formation of regional shear zones and lineament zones of mylonite, phylloite, cataclasite and faser rocks.

AMPHIBOLITE FACIES

Formation of regional shear zones with mylonite, phyllonite, cataclasite and faser rocks.

Pre-Granulitic Tonalite Trondjhemite, Granite Granodiorite

Pre-Granulitic Tonalite Trondjhemite, Granite Granodiorite

Mg Migmatite, Charnockite
The tentative tectonostratigraphy of the study area is as follows (Table-V).

<table>
<thead>
<tr>
<th>TABLE - V</th>
</tr>
</thead>
</table>

Pink granite intrusions

Retrogressed charnockite - Hornblende biotite gneiss

Saussuritisised Dolerite dykes

Charnockite - khondalite Supergroup

SUPRACRUSTALS

<table>
<thead>
<tr>
<th>Metasediments</th>
<th>Quartzo feldspathic gneiss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volcanics</td>
<td>Magnetitite quartzite</td>
</tr>
<tr>
<td>Layered Ultramafic Complex</td>
<td>Pyroxene granulite</td>
</tr>
<tr>
<td>Pyroxenite</td>
<td></td>
</tr>
<tr>
<td>Basement gneiss?</td>
<td>(Not Recognized)</td>
</tr>
</tbody>
</table>