CHAPTER III

GEOLOGY OF THE STUDY AREA
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3.1 INTRODUCTION

The author attempts to give a general description of the geology of Salem district to understand the geological setting in and around Konganapuram. The geological formations of the Salem district can be grouped into 4 units namely,

a. The older granulite group found in major part of the district.

b. The meta-sediments, showing repeated deformation and mineralisation covering isolated structures in the central part of the district.

c. The younger granitic intrusives in the west and southwest of the district and
d. The ultramafic and basic intrusives.

The area under investigation can be grouped under the following

3.2 Geological Succession in Salem district:

<table>
<thead>
<tr>
<th>Age</th>
<th>Lithology</th>
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<tbody>
<tr>
<td>Recent</td>
<td>Soils, alluvium, granites, quartz veins, dolerite dykes.</td>
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<tr>
<td>Archaeon</td>
<td>Dunites, peridotites, anorthosites, pyroxenites etc.</td>
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<td></td>
<td>Calc-granulites, crystalline limestone, amphibolites, quartzites.</td>
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<td></td>
<td>Magnetite - quartzites.</td>
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<td></td>
<td>Charnockites, garnet-sillimanite - gneisses, pyroxene-granulites and garnetiferous amphibolites.</td>
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<td>Granite - gneisses, biotite-gneisses and hornblende-gneisses.</td>
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3.3 GRANULITES OF SOUTH INDIA

The origin of Archaean charnockites in Southern India has been subject of numerous investigations (Pichamuthu, 1953) but any recently the subject has been approached using modern geochemical and experimental methods (Condie et.al, 1982).

3.3.1 Transition Zone

A transition zone exits between a granite greenstone terrane to the north and a charnockite (granulite) terrane to the south. This transition zone, across which rocks change from amphibolite to granulite facies, is 20 to 35 km. in outcrop width has been a subject of several studies. (Janardhan et.al, 1979, Friend et.al, 1981, 1982, Hensen et.al, 1984 and Radhakrishnan et.al, 1990)

Field and geochemical data strongly suggest that charnockites in transition zone developed from tonolitic precursor similar in composition to tonolites, tandhjemites in the granite - greenstone terrane to the north. The low pressure charnockites in the transition zone are mixed with amphibolite - facies rocks and reflect pressures of about 5 to 6 kb. and temperature of 600 - 700°C (Hensen et.al, 1984).

Most charnockites in the transition zone are interspersed in tonolite gneiss from which they have developed and evidence for both prograde and retrograde metamorphic processes are present in the charnockites from the transition zone. Charnockites from the medium and high pressure terrane occur in the charnockite massifs along Moyar-Bhavani shear zone. Central Nilgiri hills has medium
pressure temperature condition (pressure 6 to 7 kb., temp. 735 - 750°C). Shevaroys is high pressure terrain and has a pressure about 9 kb. and temperature 750°C - 900°C.

3.4 AMPHIBOLITIC AND GRANULITE FACIES TERRAIN

The high grade terrain south of the transition zone which includes both granulites and amphibolite facies gneisses, migmatites, granites and supra-crustal rocks extend to the southern tip of India and into Sri Lanka (Philip Allan, 1990). The present study area falls in this group of granulite amphibolite facies gneisses, migmatites, granites and supra-crustal rocks.

Charnockite appears as dark, greasy discontinuous patches within the gneiss. They show diffuse contact between gneiss and charnockite. As degree of charnockitisation increases, the small patches grow together into continuous branches or large masses. It is inferred that the structural inhomogenities in the gneisses probably controlled charnockitisation. The tonolitic gneiss in the transition zone is commonly migmatitic in nature.

The granitic material is frequently present within the migmatitic gneiss. Amphibolite inclusions of varying size are frequently occurring as broken or stretched bands. The late granites are normally pink granites with pegmatoidal and aplitic phases.
3.5 LITHO STRATIGRAPHY OF THE STUDY AREA

The study area gains importance as it lies in the transition zone between high and low grade terrane in South India and along a deep seated shear zone. The transition zone between high and low grade is an irregular zone that stretches 600 kms. from Mangalore on the west coast to north of Madras of the east coast or South India. The reconstruction of litho-stratigraphic succession in this terrain as in any other Archaean terrains, is best with problems. As pointed out by Sulton and Windely (1974) the reconstruction of litho-stratigraphy in an Archaean terrain is believed to be only tectonically significant.

There is no geochemical data available from the present study area of investigation. The geological map of the study area is shown in Fig.6.

The Litho-stratigraphic sequence establish by the author in the study area is as follows:

- Dolomite
- Pyroxenite
- Pegmatite
- Pink granite
- Granite
- Charnockite
- Hornblende-biotite gneiss
- Granitic gneiss
- Gneiss.
**GEOLOGY MAP OF THE STUDY AREA**

**Legend**

- **Granite**
- **Pink Granite**
- **Dolomite**
- **Chamockite**
- **Pyroxenite**
- **Gneiss**
- **Hornblende Biotite Gneiss**
- **Granitic Gneiss**
3.6 DESCRIPTION OF INDIVIDUAL ROCK TYPES

3.6.1 Gneiss

Rocks exhibiting compositional layering (i.e.) alteration of layers rich in felsic and mafic minerals respectively are termed gneisses.

Gneisses of the study area can be called as ortho-gneisses since they are of igneous origin. Although gneisses are generally regarded as high grade regional metamorphic rocks this is not necessarily so. The name is given on petrographic and non-genetic criteria.

Some special petrographic names are given to gneisses. A mineral prefix may be added to indicate some abundant or significant mineral, for example the study area consists of gneisses with abundant biotite and hornblende minerals and are called as biotite gneisses and hornblende gneisses respectively.

A granitic gneiss or granite gneiss is a gneiss of granite composition with a variety of possible origins. A gneissic granite, however is fundamentally a granite with a superimposed gneissic texture.

The main genetic varieties are as follows:

1. Ortho-gneisses formed by low-grade regional or dynamic metamorphism of coarse crystalline rocks.
2. Ortho-gneisses formed by medium to high-grade regional metamorphism of coarse crystalline rocks.
3. Ortho-gneisses formed by protoclassics, example syntectonic intrusion magma with movement accompanying crystallisation.
The high grade metamorphism of a granite may be progressive (i.e., it may have been reduced first to quartz-mica schist and then the micas changed back to feldspar at high grade) or it may be metamorphosed directly. In the later case there is little driving force for mineralogical change because original igneous minerals such as quartz, orthoclase, plagioclase, biotite and hornblende are stable under the low metamorphic conditions. However, deformation cause textural changes, chiefly to quartz and micas which recrystallise to give a dimensional and lattice preferred orientation. Feldspars may undergo slight changes such as exsolution, mechanical twinning or transformation from orthoclase to microcline. There may be slight chemical rearrangement to give replacement textures such as graphic or granoblastic intergrowths in the marginal zones of feldspars or replacement perthites and antiperthites. Biotite may alter to garnet plus sillimanite as radial acicular aggregates. New hornblende or biotite sprout from iron oxide. Relict crystals of igneous plagioclase are recognised by their zoning, but the original igneous textured tend to be destroyed and it is rarely possible to distinguish on textural grounds between gneisses derived directly from granitic rocks from sediments or from various rocks by metamorphism plus metasomatism.

Plate V, Fig.1, and Plate V, Fig.2 shows the gneissic rock formation in Rikkiampatti of the study area.

3.6.2 Granite Gneiss

Granite gneiss is a finegrained white rock characterised by vitreous feldspars, colorless quartz and spangles of muscovite and occurs in the study area.
Fig 1  The Western side view of gneissic rock formation in Rakkiampatti.

Fig 2  The gneiss formation in the Rakkiampatti study area.
In this section, it is allotriomorphic. It is essentially comprised of microcline and quartz. Microcline displays crosshatching. Quartz occurs as anhedral grains and displays undulose extinction. Laths of muscovite occurs intersertial to quartz and feldspar. Magnetite and zircon occur as accessories.

Plate VI, Fig.1 and Plate VI, Fig.2 are the granitic gneiss rocks found in Thangaiyur.

3.6.3 HORNBLENDE - BIOTITE GNEISS

As could be seen in the geological map, most of the occurrences are concentrated in the northern part covering in the study area. It is comprised of plagioclase feldspar, quartz, hornblende and biotite. Development of hornblende-biotite gneiss across the foliation commonly follows NE-SW set of fractures. Hornblende biotite gneiss occurring in the study area are relatively fresh and less altered when compared to large lenticular bodies, often exposed in cultivated plain and well cuttings. Also they are medium grained hard and compact and exhibit well developed gneissic banding. Plate VII, Fig.1, Plate VII, Fig.2 and Plate VIII, Fig.1 shows the various structural patterns found in the hornblende-biotite rocks formed in Vellakaipatti.

3.6.4 Charnockite

Charnockite is divided into acidic, basic, intermediate and ultrabasic charnockite series for convenience of description, which are not sharply marked off from one another. The unaltered variety of charnockite series present such a remarkable in microscopic character.
The formation of granitic gneiss is Thangaiyur.

The granitic gneiss rock formation found in Thangaiyur.
The hornblende-biotite gneiss formation in Vellakalpatti.

The different structures found in hornblende biotite gneiss in Vellakalpatti.
The various structural pattern formed in hornblende biotite gneiss found in Vellakalpatti.
The rocks are characterised by the dark color and vitreous and greasy lustre which are particularly well marked in the charnockite and its totally fresh appearance. The rock show a megascopic similarity in the bluish-grey color but have a wide textural and mineralogical variation. In texture they vary from very fine grained brownish or bluish grey types.

3.6.4.1 Petrogenesis of Charnockite

Charnockite show a combination of characters of igneous and metamorphic origin. Banding is fairly common in the charnockite of the study area but the bands are neither so conspicuous as in gneisses nor persistent for they can be followed only for a few metres. The banding of crude foliation which is generally parallel to the regional structure seems to have been imported during emplacement and they are no marked evidence of post consolidation folding or comprehension.

On the basis of the field studies charnockite are found as Archaean shield area and stated further that a granitic magmas generated at lower crustal level which assimilated at depths the mafic granulites forming the present basement and attained a composition which on differentiation which gave rise to the charnockite suite of acid rocks.

Charnockite of Salem concluded that the pyroxene granulites represent the earliest igneous intrusives and that the intermediate, charnockite are migmatic products formed from the injection of a leptite magma into the basic rocks.
Pyroxene found in the charnockite are of secondary origin derived from olivine and diopside hornblende. The charnockites may be the same rocks as the Dharwars differing only in their mode of metamorphism.

Exposures of charnockite rocks are formed found only in regions which have suffered intense metamorphism of the highest grade where in almost all the rock formation shows considerable evidence of recrystallisation and development of granulitic structures.

3.6.5 Granite

The term granite can be used for the rocks that are acidic in composition and texturally of coarse-grained nature. Granites are essentially composed of quartz (10% by volume) and one or more feldspar usually with some ferromagnesian mineral in addition. Granites are normally leucocratic with an average colour index of about 10.

3.6.5.1 Mineralogy

Feldspars makes up the greater part of a granitic rock. Two types of per alkaline and alkali granite may be distinguished according to the nature of the alkali feldspar present. Hyper solves types have a single alkali feldspar, normally a micro perthite, while sub solves types have two alkali feldspars, micro perthite (or orthoclase or microcline) and independent albite. In the remaining granitic rocks, the alkali feldspar present is a potash soda or potash variety, micro perthite or orthoclase or microcline, microcline-micro perthite. The alkali feldspar is usually more or less anhedral.
The lime-bearing plagioclase present in granites, grano diorites and tonalites is on the hand, commonly subhedral and frequently zoned. Its composition falls within the oligoclase to andesine range.

The quartz is found filling up the spaces between the other constituents as small plates or aggregates of grains. It is frequently rich in minute fluid inclusions and sometimes in tiny hair-like crystals of rutile. Few granitic rocks have more than 40 per cent of quartz, and the average content for granites is some 30 per cent.

The mica of granitic rocks include both biotite and muscovite in characteristic plates and flakes. Biotite, but not muscovite, may also be found in association with amphibole and pyroxene. In general, the biotite of the granitic rocks is moderately rich in iron, brown and strongly pleochroic in thin section. But in certain granites, it is very strongly pleochroic, very iron-rich variety. A feature of the biotite is the occurrence of dark pleochroic haloes ·radioactive properties of the latter.

Amphibole, when present, in the per alkaline granites, commonly reibekite or arfuedsonite; and in certain granites and grano diorites. In the majority of granites, the amphiboles is a somewhat aluminous hornblende, green or brownish green in this section.

Pyroxene is uncommon in granitic rocks, except in per alkaline granites, where aegirine or aegirine-augite may be present.
Among the accessory constituents, apatite as little prisms and needless, small crystals of zircon, and grains of opaque ore are almost ubiquitous. The main ore is magnetite but ilmenite is present in some rocks, and ilmenite-haematite exsolution intergrowths are not uncommon. Pyrite is found sometimes, also pyrhotite and chalcopyrite, the latter only in very small amount. Crystals of light brown pleochroic sphere are often seen. Plate IX, Fig.1 shows the white granite (Thippu white) occur in Annamalaipalayam, Idappadi.

3.6.5.2 Textures and structure

The texture of these rocks is normally subhedral-granular, sometimes there is some micro-graphic intergrowth of quartz and feldspar. A number of granites and grano diorites are porphyritic, commonly with phenocrysts of potash feldspar.

With regard to the larger-scaled structures, some granites have a banded or layered structure in the field, a few granitic rocks may develop a drusy structure.

3.6.6 Pink Granite

A striking feature of the Geology of the granite-greenstone terrain is the occurrence of a long linear belt of younger potassic granites extending in an arcuate manner for a length of nearly 500 km. and having the same physiographic trend as the major greenstone belts. This granite belt is not a single mass of granite as represented, but consists of multiple intrusions emplaced within the peninsular gneiss complex. The most characteristic rock type belonging to this younger granitic episode is a coarse-grained porphyritic potassic granite with large-sized porphyroblasts of grey or pink coloured microcline.
From the modern viewpoint of plate tectonics, it is possible to conceive of the development of potassic granite plutons along collision belts of adjacent plates. Eventually, palacomagnetic pole analysis should be able to list this possibility. The view of Swaminath et al (1976) that this younger granite belt represents a major geo-suture demarcating the granite-greenstone terrain into two distinct blocks of differing crustal thickness. Seismic evidence also suggests a discontinuity (Kaila et al, 1979).

Friend (1981) who has recently examined the southern continuation of the granite has confirmed development of megacrysts of potash feldspar in response to activity of late stage k-rich fluids in a still active stress zone. He has also agreed with the conclusion that the closepet granite is the result of process of anatexis and partial melting of Peninsular gneisses. He connects the development of charnockite patches with the development of closepet granites, both events being contemporaneous. Charnockite formation as a result of an influx of mantle derived volatile phase rich in CO$_2$, according to him, would drive out H$_2$O released from the hydrous minerals like biotite and amphibole, which in turn, would result in crustal fusion and generation of granite magma.

3.6.6.1 GEOLOGY OF THE CLOSEPET GRANITE

The Archaean ($\approx 2500$ Ma) closepet granite is a polyphase body intruding the peninsular gneiss complex and associated supracrustal rocks. In the amphibolite-granulite facies transition zone the granite displays complex internal structure, where it is intimately mixed with migmatites and charnockites. Field
observations suggest that anatexis of peninsular gneisses led to the formation of granite melt, and there is a space-time relationship between migmatite formation, charnockite development and production and emplacement of granite magma. A distinct melting zone is recognised along the margins of granite outcrop, where one can observe all stages of granite formation (i.e.) from migmatite formation to production and accumulation of granite melt into individual phases. Additionally the granite body is bounded by discontinuous outcrops of high grade supracrustal rocks, which bear significance to the granite emplacement, as immediately outside these supracrustal units, the amount of melting diminishes, thus, they may have acted like walls in checking the granite activity.

Based on the mode of occurrence, texture and cross cutting relationships four major granite phases are recognised. The chronological sequence of emplacement of major granite phases is as follows:

1. Pyroxene bearing dark grey granite.

2. Porphyritic granite.

3. Equigranular grey granite.

4. Equigranular pink granite.

Equigranular pink granite occurs as sheets and anostomosing network of cross cutting reins. In some instances the pink granite is garnetiferous and contain garnet amphibole xenoliths.

A number of pegmatite and rare aplite veins recognised out across all the major granite phases. In the study area pink granites are the predominant variety
Fig 1  The white granite found in Annamalaipalayam, Idappaddi.

Fig 2  The Panoramic view of pink granite formation in Manjakkalpatti.
of rock types and they are found in the large area Manjakkalpatti, Parayakkatunur. Plate IX, Fig.2 and Plate X, Fig.1 shows the pink granite formation.

3.6.6.2 Pink granite and Charnockite relations

RamaRao (1945) very early recognised that there is a close relation between charnockites and closepet granites - the group of young potassic granites fringing the Archaean granite - greenstone nucleus. Field evidences indicate that formation of charnockites and closepet granite was very nearly contemporaneous (Janardhan et al. 1982). Friend (1983) has demonstrated that the generation of granite melts by partial anatexis of peninsular gneiss components and their emplacement is co-eval with the formation of charnockite. A genetic link between the closepet granites and charnockites event has been suggested (Friend, 1983). Geochemical aspects of origin of closepet granite is examined by Allen et al. (1986), who also have come to similar conclusions.

The fact that closepet granite occurs in a N-S linear belt away from charnockite is not explained fully by the above concepts. The tectonic significance of the segregation of granite diapers all along the border of the older Karnataka nucleus has to be elucidated. A suggestion has been put forward (Radhakrishnan and Nagvi, 1986) that this is due to basement activation on an extensive scale as a result of collision leading to crustal thickening, melting and high level emplacement of potassic granite, in the same way as proposed by Dewey and Burke (1973). Continental collision is viewed as an important probable factor in
widespread basement reactivation leading to the production of charnockite as well as potash granitic plutons.

In the study area near Ayyankattuvalavu, a well developed pink granite and charnockite relationship are clearly visible (Plate X, Fig.2)

3.6.6.3 Petrogenesis of Pink Granite

It is perhaps ironic that the genesis of granitic rocks, the commonest igneous rocks of continental crust, is still shrouded in uncertainty and debate, although trace element, especially REE, studies are providing some constraints (Hanson, 1978). There would seem to be no less than four different ways in which granitic rocks could originate, thus affording an avenue of resolving rigid attitudes associated with the “granite controversy” of a generation ago.

3.6.6.4 Fractionation

Advanced fractionation of parental mafic magmas could result in the production of necessarily small quantities of residual felsic liquids. Igneous rocks formed by the crystallization of such liquids would be expected to have low colour indices and high Fe/Mg ratios (reflecting the fractionation of mafic phase) and possibly a peralkaline chemistry (the “plagioclase effect” reflecting plagioclase fractionation). In addition, the over all compositions should approach those of the two ternary minima, i.e. either a quartz-rich ideal granite composition or an undersaturated phonolite composition. Such rocks would typically by anticipated in a “volcanic association” as they originated from liquid magmas. Probable examples include the acid intrusions associated with the upper parts of the
Fig 1  The pink granite in Manjakkalpatti.

Fig 2  The relationship between the pink granite and charnockite is well developed near Ayyankatuvalavu.
skaergaard and Bushveld intrusions (tholiitic parental magma), and nepheline syenite ring dykes of mount Kenya alkali basalt parental magma).

3.6.6.5 Anatexis

Anatexis of continental crustal material might occur where large volumes of mafic magma had been emplaced in the crust with in a short period of time, or in other areas of exceptionally high terrane gradients in the crust. Resultant melt should have minimum compositions, approaching ideal granite compositions the more felsic the crustal material being re-melted. Rocks crystallised from such melts would not have trace-element contents indicative of prolonged fractionation from a mafic progenitor. Probable examples include some of Tertiary granites of Hebrides, Scotland, (Moor bath and J.D.Bel, 1905) associated with large central volcanoes, the intrusive and extensive acid rocks of the Taupo zone, New Zealand, and younger acid rocks (mainly extruded as ignimbrites) of the basin and range province.

3.6.6.6 Migmatization

Under conditions of tectonic crustal thickening and regional metamorphism, migmatite complexes (typically developed from the gneissic basement below a thick regionally metamorphosed clastic wedge) may intrude diapirically to mesozonal (and epizonal) levels, while undergoing the complex, long time-span processes of “granitization”. These comprise the mineralogical, chemical, physical and kinetic changes and result in the eventual emplacement of increasingly homogeneous granitic rocks of highly felsic compositions at
increasingly high crustal level. Some recognizable composite complexes might span a compositional range from diorite through quartz-diorite and granodiorite to adamellite. Only exceptionally, would there be significant amounts of more felsic rocks, which would more typically occur only as small pockets of pegmatite and other differentiates. A per aluminous condition would be common. In sum, these are the S-type granites of Chappell and A.J.R. White (1974). Examples include the coast range batholith (Hutchison, 1970) and more problematically the foliated Leucogranites of Nepal (Hanet and Allegre, 1976), the latter reflecting perhaps an unusually high component of anatexis.

3.6.6.7 Assimilation

Assimilation of crustal material by mantic-derived magmas on a massive scale could yield progressively more felsic products. This process has apparently operated in Andean-type non-tensional SBZ environments accompanied by “ponding” of rising magmas at the mantle-crust interface (Fyse, 1978). A typical range of resultant products would comprise cumulitic gabbros, hornblende gabbro, diorites, quartz-diorites, grano diorites and adamellites, with the more felsic numbers predominating at relatively shallow erosion depths, and intermediate members predominating overall. These are the I-type granites of Chappell and white, examples include the coastal batholith of Peru and the Southern California and Sierra Nevada batholiths.
3.6.7 Pegmatite

Many granitic intrusions and their immediately surrounding country rocks are traversed by dykes and veins of more silicic character. These may be fine grained (aplite), or they may have a very coarse grained (pegmatite). Though usually occurring separately they are sometimes to be found occupying the same vein. Commonly these rocks have the mineralogical composition of a granite and may be referred to as granite aplites and granites-pagmatites.

The coarse granite - pegmatites may have a portion of their potash feldspar and quartz in graphic intergrowth, and may grade into massive quartz veins. They sometimes contain a large variety of rare minerals nor found in the parent granitic rock. Local concentration of these and the large or even immense, size of the crystals of common minerals such as feldspar and mica, give many of these pegmatites considerable economic importance. Pegmatites in which no appreciable amount of hydrothermal replacement has taken place are said to be simple, those that owe their present character partly or wholly to such replacement are referred to as complex.

Simple granite-pegmatites are commonly made up essentially of quartz and potash feldspar (normally microcline-perthite) with or without minor oligoclase, muscovite, biotite, spersartite - almandite garnet, and tourmaline that is black in hand specimen.

Complex granite - pegmatites started as simple pegmatites but were subjected to hydrothermal replacement processes of ten in stages. All show
replacement of potash feldspar by albite and one of the commonest types of complex pegmatite shows also an introduction of lithium, flourine, manganese and often phosphorus as well, leading to the formation of new minerals such as lepidolite mica, red and green lithium tourmalines, spodumene and various iron and manganese, phosphates. Pegmatite veins occurring in the study area are very thin and un mapable, such veins are located, in my study area. A number of pegmatite veins that are very coarse grained and almost bi mineralic consisting of colourless quartz and whitish K.Feldspar are found.

3.6.8 Pyroxenite

Pyroxenite is an ultrabasic igneous rocks. Pyroxenite is predominantly pyroxene with not more than 30 per cent olivine and less than 10 per cent leucocratic minerals.

3.6.8.1 Occurrence

Pyroxenite rock occurs in a variety of ways. They form layers in the lower part of differentiated silk and complexes, they found as inclusions in basaltic flows. Plate XI, Fig.1 shows the pyroxenite rock formation in Gundarasam palayam.

3.6.8.2 Texture

The textures of the ultrabasic rocks are quite variable. An unusual texture in pyroxenites rich in magnetite and ilmenite is known as sideronitic texture. The pyroxene and other silicates are in blunt, subhedral to cuhedral crystals.
3.6.8.3 Petrogenesis

Many occurrences of pyroxenites are not, however, parts of banded complexes but are independent bodies, dikes, sheets, stocks etc. Bowen has suggested that these have been intruded not as magma but as solid crystalline masses that have moved in by dynamic processes.

Hess, on the other hand, has argued that peridotite magma has been intruded, the liquid condition being a result of high water content. This seems theoretically unlikely.

Another possibility is that the olivine was brought in suspended in basic magma and that subsequently the magma was largely squeezed or otherwise separated from the olivine or olivine and pyroxene.

The experimental work of Tuttle and Bowen suggests that the development of talc rather than serpentine is a function of temperature in the presence of a high water pressure. Thus, talc is stable above $500^\circ$C, whereas serpentine is the alteration product to be expected below this temperature. If carbon dioxide is abundant in the altering solutions, magnesium carbonate also becomes an important secondary mineral. The experimental investigation mentioned also suggest the possibility that olivine may replace pyroxene in the presence of abundant water vapour.
3.6.9 Dolomite

Dolomite is a limestone in which the mineral dolomite is more abundant than calcite. Rocks composed of both carbonates and argillaceous or arenaceous material are called hybrid rocks by some authors.

Limestones and dolomites are perhaps the most difficult group among the sediments to treat. Calcite may be distinguished by etching with hot silver nitrate solution, washing thoroughly, and staining with potassium chromate or it may be stained using Lemberg’s solution. Dolomite is stained with a solution of potassium ferricyanide.

Dolomite has probably formed as a precipitate in seawater of highly saline character, but most appears to have formed by replacement of original calcite.

In dolomites, the texture of the rock is almost or entirely destroyed. Only the coarser or larger fossils are presented, and often these remain only as casts and moulds, the calcitic shells having been leached away. Plate XI, Fig.2 shows the dolomite rock formation found near Manjakkalpatti.

3.6.9.1 Origin

Dolomite beds associated with saline deposits are generally regarded as primary. Most other dolomites are regarded as resulting from the replacement of an originally lime sediment.

The following is a summary of the main processes by which dolomite may form and criteria by which the process may be recognised.
Fig 1  The pyroxenite rock formation in Gundarasampalaiyam.

Fig 2  The dolomite rock formation found near Manjakkalpatti.
Solution of calcite, with the concentration of an originally low magnesium content in the limestone. Concentrations of dolomite in this way might be expected to be associated with stylolites and similar solution features and with unconformities within the carbonate succession.

Replacement of the limestone by dolomite shortly after deposition. Alternating beds of limestones and dolomite in which the mutual boundary is a bedding surface are often proposed as evidence of primary deposition of dolomite but could well be due to penecontemporaneous dolomitization of aragonite deposits while succeeding calcitic material is unaffected.

Subsequent dolomitization due to percolating solutions may be recognized as such

a. where it is independent of bedding or non-uniformly distributed along a bed

b. encloses cherts which themselves retain pseudomorphs of original limestone structures

c. associated with mineralization

d. is related spatially to faults, joint systems, or other structural features.

Solutions capable of causing dolomitization include hydrothermal solutions, connate waters circulating through the sediments.

Dolomitization envelops enclose ore deposits can be regarded as hydrothermal only if the ore deposits themselves can be proved to be hydrothermal.