4. Introduction

This chapter deals with a detailed petrographic and mineralogical description of the different rock types of the study area. The rock types of Devanarasipur area show interesting association with typical mineral assemblages and textural peculiarities. Different minerals have been identified based on their optical characters. Different rock types in each lithological unit have been identified based on their petrographic and mineralogical variation. From petrographic studies, the following broad divisions of different rock types are recognized,

1. Gneisses
2. Schists
3. Quartzites
4. Ultramafic rocks
5. Gabbro-anorthosite suite
6. V-Ti-magnetite deposits*

*V-Ti-magnetite ore deposits which are also grouped as a petrographic unit are described in detail in the next chapter.

4.1 Gneisses

4.1.1 Petrography

The granitic gneisses of the Devanarasipur area were shown as Shimoga granite in the geological map of Mysore, prepared by the Slater Department of Mysore Geological Department (1906) and are now found to be part of the Peninsular Gneissic Complex.
The gneisses are medium to coarse grained with well developed gneissic foliation. It shows grey to greyish white colour. In thin sections, it shows well developed gneisses texture (Fig.4.1 and Fig.4.2). Mineralogically it consists of quartz which is the chief constituent of granitic gneisses and is next to feldspar in abundance, it occurs as lenticular elongated grains and sometimes also occurs as rounded blebs potash feldspar, plagioclase and biotite with secondary chlorite and accessories like magnetite and sphene. As the gneisses of the study area resemble granite in their mineralogy, they are designated as granitic gneisses.

4.1.2 Mineralogy

**Quartz:** It is the chief constituent mineral of granitic gneiss and next to feldspars in abundance, which is colourless to greyish white in hand specimen. Quartz always appears as fresh and colourless in thin section, it occurring as unhedral to lenticular elongated grains of variable sizes and also as rounded blebs in the subhedral plates of K-feldspars. Undulose extinction of quartz is exhibited and tiny inclusions of other minerals, sutured borders of quartz grains are frequently noticed. It shows various degrees and stages of replacement relationship with K-feldspar and plagioclase. It replaces plagioclase.

**Plagioclase:** Plagioclase is generally more abundant than K-feldspar. In hand specimen, it is greyish white in colour with good cleavages and subhedral outline, it is colourless with low relief in thin section. It occurs as subhedral plates. It is both twinned and un-twinned however; twinned grains are more abundant some of the plagioclase minerals show a well developed polysynthetic twinning consisting of several individuals and shows marginal granulation (Fig.4.3 and Fig.4.4). The twin lamellae of plagioclase are bent and displaced after fracturing. Plagioclase is replaced either partially or completely by quartz. Twinning in plagioclase is after albite and albite ala laws and sometimes after pericline laws. The abundance of albite and albite ala laws is characteristic feature of metamorphic origin.
Further, these twin laws also suggest low temperature optics for the plagioclase feldspars.

**Biotite:** In granitic gneiss of Devaranarasipur area biotite is the only mafic mineral present. In hand specimen, it is black in colour. In thin sections, it is dark brown in colour. It occurs as subhedral grains with serrated edges and distinct cleavages. It is pleochroic with $X=$ greenish and $Y=$ reddish brown. The absorption is stronger when the cleavages are parallel to the vibration plane of polarizer. It shows parallel extinction.

**Magnetite:** Magnetite is the accessory mineral in the granitic gneiss. It is black in colour and isotropic. It occurs as subhedral to unhedral grains.

**Sphene:** It is also a common accessory mineral in the granitic gneiss. It is pale brown in colour and wedge shaped.

### 4.2 Schists

#### 4.2.1 Petrography

On the basis of the mineral assemblages, it is found convenient to classify the schist of Devaranarasipur area into two (1) quartz-chlorite-calcite schist and (2) quartz-chlorite schist.

#### 4.2.1.1 Quartz-chlorite-calcite schist

This variety is more abundant than quartz-chlorite schist in Devaranarasipur area. In hand specimen, it is greyish green coloured, fine to medium grained and brittle, schistosity is well developed and exhibited in thin section, it exhibits well defined schistose texture mineralogically it is composed essentially of quartz, chlorite and calcite with minor amounts of magnetite. Parallelism of flakes/scales of chlorite, lenticular grains of quartz, and calcite contributes to overall schistose texture of the rock.
4.2.1.2 Quartz-chlorite schist

It is green coloured, medium grained and brittle. It also exhibits well developed schistosity due to parallel alignment of quartz and chlorite grains. In this section, it shows schistose texture (Fig.4.5 and Fig.4.6) and is composed essentially of quartz and chlorite with accessory calcite and magnetite. Quartz occurs as lenticular elongated grains. Chlorite is green in colour. It occurs as flakes and scales aligned parallel to the plane of schistosity.

4.2.2 Mineralogy

Quartz: Quartz forms the dominant minerals in the schists. In hand specimen, it is colourless to greyish white and hard, appears fresh. It occurs as unhedral to lenticular elongated grains showing parallel alignment. It shows marked undulose extinction and very smaller inclusions of other minerals.

Chlorite: Both quartz-chlorite-calcite schist and quartz--chlorite schist of the Devaranarasipur area contains chlorite as essential mineral. In hand specimen, it is green in colour with good cleavages. In thin sections, it occurs as flakes, patches and scaly aggregates which contain inclusions of magnetite and aligned parallel to the plane of schistosity. It is pleochroic from yellowish green to green. Parallel extinction is seen and also the inclusions of quartz and magnetite. The pleochroic colours correspond to pro-chlorite.

Calcite: Calcite is an essential constituent of quartz--chlorite--calcite schist and a minor constituent of quartz-chlorite schist, identification of calcite is not easy in hand specimen, however its presence can be confirmed by checking with the reaction of rock with HC1 solution, which gives effervescence. In thin sections it is colourless, it occurs mainly as porphyroblasts and less commonly as fine grains aligned parallel to the plane of schistosity of the rock. The porphyroblasts are subhedral in outline with well developed rhombohedra
cleavages. A marked change in relief is noticed on rotation of the stage of the microscope in plane polarized light. The porphyroblasts show twinning and symmetrical extinction.

Magnetite: Magnetite is present in minor quantities in both the varieties of schist. It occurs as porphyroblasts and also as blebs in chlorite. The porphyroblasts are euhedral to subhedral in outline. They differ in their morphology when compared to the magnetite crystals of gabbro-anorthosite suite of rocks. They are black and opaque and isotropic. These crystals in schists are believed to be formed due to re-crystallization of the Fe-oxide in the meta-sediments of the study area.

4.3 Quartzites

4.3.1 Petrography

Quartzite is dirty white to greyish blue coloured, fine grained and hard in hand specimen. In thin section, it shows granulous texture (Fig.4.7 and Fig.4.8), in which sub-rounded lenticular grains of quartz are compactly arranged. Mineralogically, it is consisting essentially of quartz with minor amounts of muscovite and accessory magnetite and hematite.

4.3.2 Mineralogy

Quartz: It is the chief constituent mineral of quartzites. In hand specimen, it is colourless to greyish blue and hard. In thin section it is always fresh and colourless. It occurs as sub-rounded to lenticular grains with sutured boundaries that are compactly arranged. In some samples a single grain of quartz is broken into several small grains. The quartz grain exhibits undulose extinction under crossed polarized light.
Muscovite: It occurs in minor amounts closely associated with quartz. It is colourless. It occurs as flakes and elongated grains with distinct cleavages. It exhibits parallel extinction and high order interference colours.

Hematite and Magnetite: These are accessory opaque minerals of quartzite. It is black in colour. It occurs as unhedral grains and also as dusty grains in quartzite.

4.4 Ultramafic rocks

4.4.1 Petrography and Mineralogy

The petrographic studies and the mineral assemblages in the ultramafic rocks of Devarnarsipur area are broadly divided into four varieties as follows (1) Chromite bearing Dunite (2) Hornblendite (3) Metapyroxenite and (4) Talc-chlorite schist.

4.4.1.1 Chromite bearing dunite

The most common ultramafic rock in the study area is chromite bearing dunite. In hand specimen, when it is fresh, it is grey to green in colour, massive and fine grained. In thin section, it exhibits relict cumulus texture (Fig.4.9 and Fig.4.10). Minerallogically, it is made up of olivine with subordinate amounts of chromite. Chromite crystals replace the olivine indicating the origin of chromite earlier than olivine. Olivine shows alteration to serpentine. Partial serpentinisation of olivine in chromite bearing dunite is noticed (Fig.4.11) serpentine minerals are identified as antigorite which exhibits mesh texture (Fig.4.12). Nearly 80% of olivine is converted into antigorite leaving behind small amount of relict olivine (Fig.4.13 and Fig.4.14).

Dunite is completely altered to serpentinite due to metamorphism process in which olivine shows its complete alteration to antigorite which occur as blades texture (Fig.4.15 and
Formation of antigorite from olivine indicates that it is high-temperature mineral formed during amphibolite-grade metamorphism around 470\(^\circ\)C.

Chromite crystals have also been subjected to deformation in chromite bearing dunite, chromite crystals occur as chains exhibiting chain texture (Fig.4.17) The chains of chromite crystals surrounding the antigorite needles formed from olivine results in the formation of occluded silicate structure (Fig.4.18).

Individual grains are fractured and fractures are filled by the serpentine material dividing the single chromite grain into equal haves resulting in the development of pull-apart texture. This texture is a secondary texture developed during deformation (Fig.4.17 and 18).

**4.4.1.2 Hornblendite**

This variety of ultramafic rock consists of entirely of amphibole represented by hornblende. This unit shows typical cumulus texture (Fig.4.19), indicating that hornblendite is also part of the ultramafic-mafic complex of the Devaranarasipur area.

Hornblende occur as prismatic crystals and exhibits pleochroism from light yellow to bluish green, it shows alteration to chlorite along the grain boundaries (Fig.4.20). It shows inclined extinction with z/c=19\(^\circ\). Typical amphibole cleavages which intersect at 54\(^\circ\) and 126\(^\circ\) are noticed in hornblende (Fig.4.21 and Fig.4.22).

**4.4.1.3 Metapyroxenite**

Metapyroxenite is represented by tremolite-actinolite schist. It is fine grained, dark greyish green coloured and hard in hand specimen and it exhibits schistose texture in thin section, (Fig.4.23 and Fig.4.24) and composed predominantly of tremolite and actinolite with minor amounts of chlorite, talc and chromite. It is highly deformed and recrystallised variety of ultramafic rock. In some samples of meta-pyroxenes tremolite even appears as elongated
needle with colourless grains along with green coloured actinolite with presence of chromites crystals (Fig.4.25).

Tremolite occurs as long prismatic crystals (Fig.4.25 and Fig.4.26) and also as columnar aggregates (Fig.4.24). It possesses a fairly high relief. It exhibits distinct cleavages in two directions typical of amphiboles. It frequently alters to talc. Its extinction angle is \( z^\wedge c \ 10^\circ \text{to}16^\circ \).

Chromite occurs as euhedral to subhedral crystals and also as chains (Fig.4.25 and Fig.4.27). Chromite also occurs as accessory mineral in some pyroxenite (Fig.4.29 and Fig.4.30).

Actinolite is next dominating mineral to tremolite, in the tremolite-actinolite schist. It occurs as prismatic crystals (Fig.4.28) with distinct cleavages. It is green in colour and pleochroic in \( X = \) yellowish green, \( Y = \) green and \( Z = \) pale green. It frequently alters to chlorite. Its extinction angle is \( z^\wedge c \ 12^\circ \text{to} 19^\circ \).

Calcite occurs in minor amounts in tremolite-actinolite schist. It is grey to colourless. It occurs as rhombohedral crystals with distinct rhombohedral cleavages. It shows marked change on cleavage traces on rotation of the stage of the microscope and symmetrical extinction.

4.4.1.4 Talc-chlorite schist

It is a variety of altered ultramafic rock. This variety is less in abundance than tremolite-actinolite schist. In hand specimen, it is yellowish green in colour, fine grained and soft. In thin section, it shows schistose texture. Mineralogically, it is composed of talc as essential mineral with subordinate amount of chlorite and accessory magnetite.
4.5 Gabbro-Anorthosite Suite

4.5.1 Petrography

The gabbro-anorthosite suite of rocks of the Devaranarasipur area essentially represents the re-crystallization of plagioclase caused due to the deformation and metamorphism by which it exhibit varied fabrics. Essential mineralogical composition of these rocks are of plagioclase, chloritized hornblende and uralitized pyroxene with accessories like calcite, magnetite, pyrite and chalcopyrite. Magnetite forms the main constituent of magnetite-gabbros. By taking the account on the extent of re-crystallization in the gabbro-anorthosite suite, three types are recognized: (1) tectonically least deformed varieties, (2) partly re-crystallized varieties and (3) fine grained fully re-crystallized varieties. These rocks preserve the igneous characters to a great extent. Least deformed varieties contain plagioclase megacrysts which exhibit polygonal xenomorphic fabric (Fig.4.31 and Fig.4.32). A well defined relict cumulus texture is preserved where in hornblende / chlorite fills the interstices of plagioclase crystals (Fig.4.33 and Fig.4.34). Megacrysts of plagioclase are broken down into fine grains in the partly re-crystallized varieties (Fig.4.35 and Fig.4.36). As the re-crystallization advances the Carlsbad twinning in plagioclase is progressively effaced (Fig.4.37). Thoroughly re-crystallized varieties exhibit polyhedral granular texture with finer grains of plagioclase and crude orientation (Fig.4.38). Based on the modal plagioclase content, the gabbro-anorthosite suite of rocks of the Devaranarasipur area are classified according to definitions given by Windley (1973), as Magnetite-gabbro, gabbro, anorthositic-gabbro, gabbroic-anorthosite and anorthosite.

4.5.1.1 Magnetite-gabbro

In hand specimen it is medium grained, hard and greyish black in colour. In thin section it shows excellent cumulus texture. Mineralogically, it is composed essentially of
saussuritized plagioclase (modal content varies from 30.07 to 64.20%), ilmenite rich magnetite (18 to 47%), chloritized hornblende (16 to 25%) with minor amounts of calcite, chalcopyrite and pyrite. Ilmenite rich magnetite occurs as euhedral to subhedral grains forming up to 47% of the rock. The gabbro is therefore designated as magnetite-gabbro. These magnetite grains get segregated to give rise to ore bands/layers.

4.5.1.2 Gabbro

It is mesocratic, hard and medium grained. In thin section, it exhibits a well defined relict cumulus texture wherein chloritized hornblende filling the interstices of plagioclase crystals (Fig.4.39 and Fig.4.40). The mineral assemblages of gabbro are saussuritized plagioclase (44.75 to 48% modally), chloritized hornblende (41 to 47%) with minor amounts of calcite (4.72 to 10.52%), magnetite (1.0 to 6.0%).

4.5.1.3 Anorthositic gabbro

Further depletion of chloritized hornblende in gabbro grades on to anorthositic gabbro (Fig.4.37 and Fig.4.38). It is medium grained and leucocratic. It is composed essentially of saussuritized plagioclase (60 to 70% modally), chloritized hornblende (25 to 30%) with minor amounts calcite (2 to 8%), magnetite (2 to 2.66%).

4.5.1.4 Gabbroic anorthosite

Further gradation from anorthositic gabbro to gabbroic anorthosite with a decrease in chloritized hornblende is noticed (Fig.4.35 and Fig.4.36). Gabbroic anorthosite is leucocratic and medium grained. The mineral assemblages of this variety are saussuritized plagioclase (74 to 75% modally), chloritized hornblende (14 to 16.07%) with accessories like calcite and magnetite.
4.5.1.5 Anorthosite

It is greyish to bluish white in colour and medium grained. It is essentially made up of saussuritized plagioclase (85 to 86.31%) with amount of chloritized hornblende (9.37 to 10%) and accessories like calcite, magnetite and uralite. In thin section, it exhibits polygonal xenomorphic fabric (Fig. 4.31 and Fig. 4.32). The Megacrysts of plagioclase show marginal granulation.

4.5.2 Mineralogy

Plagioclase: It is the essential constituent of gabbro-anorthosite suite of rocks. In hand specimen, it is greyish white in colour with distinct cleavages. In thin sections, it is colourless with low relief. It occurs as larger polyhedral roughly equidimensional grains and also as small grains. It is almost invariably well twinned. No zoning is seen. In least deformed samples, it shows polysynthetic twinning (Fig. 4.43 and Fig. 4.44). Although it is saussuritized, the original grain boundaries can still be made out.

These plagioclase grains which exhibit polysynthetic twinning are affected by marginal granulation due to re-crystallization caused by deformation and metamorphism (Fig. 4.43 and Fig. 4.44). The resulted granules of plagioclase are polyhedral in outline exhibiting undulose extinction. In these rocks the anorthite content of plagioclase varies from 40 to 70% indicating its composition corresponding to andesine-labradorite. In magnetite-gabbros and gabbros, the anorthite content of plagioclase varies from 40 to 50%. In anorthositic gabbro, it varies from 40 to 55% and in gabbroic anorthosite and anorthosite it ranges from 55 to 70%. Anorthite content in these rocks is determined based on the extinction angle measurements. Twinning in plagioclase is according to albite, calsbad and combined Carlsbad-albite laws. Generally, the presence of C-twins (calsbad, carlsbad-albite and baveno-ala laws) is considered to be characteristic of the igneous nature, while the A-twins
(aibite, pericline and acline laws) are of metamorphic origin. In the Devaranarasipur area, the abundance of carlsbad and combined Carlsbad-albite laws exhibited by plagioclase of gabbro-anorthosite suite, are considered to be characteristic of igneous nature. The twin lamellae of plagioclase are bent in conformity with the bending of the plagioclase crystals, caused by the deformation in solid state with a certain amount of interstitial liquid. Twinned plagioclase grains are fractured and the twin lamellae are displaced after fracturing (Fig.4.38). The fractures in plagioclase are filled up by secondary calcite veins and chlorite grains. Bending of the twin lamellae along with the bent outlines of plagioclase crystals indicate that twinning is developed during the bending of the crystals by the pressure of adjoining crystals.

Plagioclase is saussuritized and composed of granular fine grained alteration material which consists predominantly of zoisite and epidote and minor amount of clinozoisite (Fig. 4.41 and Fig.4.42). Calcite and chlorite are closely associated with the saussuritized plagioclase.

**Hornblende:** It is an important constituent of gabbro-anorthosite suite of rocks. It occurs as prismatic crystals and also as stumpy grains exhibit two sets of well defined cleavages intersecting at 56° and 124° which is typical of amphiboles. Its pleochroic scheme is \(Z = \text{bluish green}, Y = \text{pale green} \) and \(X = \text{light yellow} \) with \(Z \wedge C = 16° \) to \(23° \). In some samples, rarely it is possible to identify hornblende because of intensive chloritisation.

Chlorite: Chlorite is the secondary alteration product in the gabbro-anorthosite suite of rocks. Chlorite in these rocks is formed by the alteration of either hornblende or pyroxene. It occurs as scaly aggregates, patches and stringers. It is green in colour and frequently fibrous in nature. It is pleochroic in yellow and green. It exhibits distinct cleavages in one direction, anomalous blue interference colour and parallel extinction.
**Epidotes:** Epidotes occur mainly as secondary alteration products after plagioclase in the gabbro-anorthosite suite of rocks. The different epidote group of minerals noticed here are epidote, zoisite and clinozoisite.

**Epidote:** It occurs as subhedral grains with distinct cleavages. It shows yellow and green colours. Pleochroism is strong with X = colourless to pale yellow, Y = greenish yellow and Z = yellowish green. X^\perp C = 5^0 to 8^0.

**Zoisite:** It occurs usually as packed columnar aggregates often radiating, in the saussuritized plagioclase. It is colourless with one set of cleavages. It is non-pleochroic. It shows anomalous berlin blue interference colour and parallel extinction. 2V values vary from 40^0 to 50^0.

**Clinozoisite:** It is associated invariably with zoisite and epidote. It occurs as prismatic crystals with one set of distinct cleavages. It is colourless and non-pleochroic. Its extinction angle is Z^\perp C = 18^0 to 22^0 and 2V varies from 64^0 to 73^0.

**Magnetite:** Magnetite with ex-solved ilmenite is the essential constituent in magnetite-gabbros. It occurs in small amounts in gabbros but it forms accessory in anorthositic rocks. It occurs as idiomorphic to hypidiomorphic grains with polygonal outlines. It contains inclusions of chlorite at places. It is isotropic. It is closely associated with disseminations of pyrite and chalcopyrite in magnetite-gabbros and magnetite bearing anorthosites.

**Calcite:** Calcite occurs in minor amounts in gabbro-anorthosite suite of rocks. It is colourless. It occurs as rhombohedral crystals with well developed rhombohedral cleavages. It exhibits marked change in relief on rotation of the stage of the microscope in plane polarized light. It exhibits symmetrical extinction. In all the cases, calcite is secondary alteration product of plagioclase.
Uralite: Rarely it is possible to identify original pyroxene because of intensive uralitization noticed in the gabbro-anorthosite suite of rocks. Uralite is the secondary alteration product after pyroxene. It is pale green in colour. It occurs as aggregates of small prismatic crystals and also as fibrous grains. It shows inclined extinction. It occurs in minor quantities in the gabbro-anorthosite suite.
Fig: 4.1, Photomicrograph of Granitic Gneiss exhibiting gneissic texture under plain polarized light (4x)

Fig: 4.2, Photomicrograph of Granitic Gneiss exhibiting gneissic texture under crossed polarized light (4x)
Fig: 4.3, Photomicrograph of Granitic Gneiss under pain polarized light (4x)
Note the marginal granulation of mega plagioclase crystal

Fig: 4.4, Photomicrograph of Granitic Gneiss under crossed polarized light
Note the Polysynthetic twinning in the mega-cyst of plagioclase mineral
Fig: 4.5, Photomicrograph of Quartz chlorite schist under plain polarized light

Fig: 4.6, Photomicrograph of Quartz chlorite schist under cross polarized light showing schistose texture
Fig: 4.7, Photomicrograph of Quartzite exhibiting granulose texture under plain polarized light. Note the sub-rounded compactly arranged quartz grains with sutured borders and presence of opaque hematite

Fig: 4.8, Photomicrograph of Quartzite exhibiting granulose texture under crossed polarized light. Note the Undulose extinction exhibited by the quartz grains with crossed polarized light
Fig: 4.9, Photomicrograph of Dunite exhibiting relict cumulus texture under plain polarized light. Note the relict boundaries of Olivine and released Iron oxide.

Fig: 4.10, Photomicrograph of Dunite exhibiting relict cumulus texture under crossed polarized light. Note the relict boundaries of Olivine and released Iron oxide.
Fig: 4.11, Photomicrograph of chromite bearing Dunite showing partial serpentinisation under plain polarized light. Note the bladed antigorite around relict Olivine

Fig: 4.12, Photomicrograph of chromite bearing Dunite showing partial serpentinisation and mesh texture under crossed polarized light. Note the bladed antigorite around relict Olivine
Fig: 4.13, Photomicrograph of dunite exhibiting alteration of olivine to antigorite under plain polarized light. Note the relict boundaries of Olivine.

Fig: 4.14, Photomicrograph of dunite exhibiting alteration of olivine to antigorite under plain polarized light. Note the relict boundaries of Olivine.
Fig: 4.15, Photomicrograph of chromite bearing serpentinised dunite consisting of antigorite under plain polarized light

Fig: 4.16, Photomicrograph of chromite bearing serpentinised dunite consisting of antigorite under crossed polarized light
Fig: 4.17, Photomicrograph of chromite bearing dunite showing chain texture and pull-apart texture, under plain polarized light.

Fig: 4.18, Photomicrograph of chromite bearing dunite showing chain texture exhibited by chromite grains, under crossed polarized light
Fig: 4.19, Photomicrograph of hornblendite showing cumulus texture. Hornblende exhibits pleochroism from light yellow to bluish green colour under plain polarized light.

Fig: 4.20, Photomicrograph of hornblendite showing cumulus texture. Hornblende exhibits inclined extinction and alteration to chlorite along the grain boundaries under crossed polarized light.
Fig: 4.21, Photomicrograph of hornblendite consisting of hornblende exhibiting typical amphibolite cleavages ($56^\circ$ and $126^\circ$) under plain polarized light

Fig: 4.22, Photomicrograph of hornblendite exhibiting the alteration of hornblende to chlorite along the grain boundary under crossed polarized light
Fig: 4.23, Photomicrograph of Tremolite-actinolite schist (Meta pyroxenite) showing schistose texture under plain polarized light

Fig: 4.24, Photomicrograph of Tremolite-actinolite schist (Meta pyroxenite) showing schistose texture under cross polarized light
Fig: 4.25, Photomicrograph of chromite bearing pyroxenite consisting of Tremolite and actinolite showing schistose texture under plain polarized light

Fig: 4.26, Photomicrograph of chromite bearing pyroxenite consisting of Tremolite and actinolite showing schistose texture under cross polarized light
Fig: 4.27, Photomicrograph of chromite bearing pyroxenite consisting of Tremolite and actinolite showing occluded silicate texture under plain polarized light. Note the presence of the chain of chromite grains (dark colour)

Fig: 4.28, Photomicrograph of chromite bearing pyroxenite consisting of Tremolite and actinolite showing occluded silicate texture under crossed polarized light. Note the presence of the chain of chromite grains (dark colour)
Fig: 4.29, Photomicrograph of meta-pyroxenite actinolite (green colour) associated with elongated needle of tremolite (colour less) under plain polarized light

Fig: 4.30, Photomicrograph of meta-pyroxenite actinolite (green colour) associated with elongated needle of tremolite (colour less) under crossed polarized light
Fig: 4.31, Photomicrograph of mega crystal of plagioclase showing polygonal xenomorphic texture with wave grain boundary in anorthosite under plain polarized light

Fig: 4.32, Photomicrograph of mega crystal of plagioclase polygonal xenomorphic texture with wave grain boundary in anorthosite under crossed polarized light
Fig: 4.33, Photomicrograph of Gabbro rock consisting of hornblende and saussuritized
plagioclase showing relict cumulus texture under plain polarized light. Note the pale yellow to
dark brown pleochroism colours of hornblende.

Fig: 4.34, Photomicrograph of Gabbro rock consisting of hornblende and saussuritized
plagioclase showing relict cumulus texture under crossed polarized light. Note the pale
yellow to dark brown pleochroism colours of hornblende.
Fig: 4.35, Photomicrograph of Mega-crystal of plagioclase re-crystallizing into fine grains advanced stage of effected twinning in gabbroic anorthosite under plain polarized light

Fig: 4.36, Photomicrograph of Mega-crystal of plagioclase re-crystallizing into fine grains advanced stage of effected twinning in gabbroic anorthosite under crossed polarized light
Fig. 4.37, Photomicrograph of fractured Mega crystal of plagioclase in anorthositic gabbro under plain polarized light 4x.

Fig. 4.38, Photomicrograph of fractured Mega crystal of plagioclase in anorthositic gabbro under crossed polarized light. Note the least deformed plagioclase shows polysynthetic twinning.
Fig: 4.39 Photomicrograph showing the saussuritized plagioclase in gabbroic rock under plain polarized light. Note the presence of irregular poikilitic hornblende plates showing light to dark brown pleochroic colour.

Fig: 4.40 Photomicrograph showing the saussuritized plagioclase in gabbroic rock under crossed polarized light. Note the pale yellow to dark brown pleochroism colours of hornblende.
Fig: 4.41, Photomicrograph showing saussuritized of mega plagioclase crystal, note alteration of plagioclase epidote in chlorite and calcite under plain polarized light

Fig: 4.42, Photomicrograph saussuritized of mega plagioclase crystal, note alteration of plagioclase to epidote in chlorite and calcite under crossed polarized light
Fig: 4.43, Photomicrograph of Mega-crystal of plagioclase re-crystallizing into fine grains, under plain polarized light 10X.

Fig: 4.44, Photomicrograph of Mega-crystal of plagioclase re-crystallizing into fine grains showing polysynthetic twinning under crossed polarized light.