CHAPTER TWO

PETROGRAPHY
Bayana Volcanics

The field characteristics of Bayana volcanics and Khetri amphibolites are discussed in the previous chapter. Bayana volcanics have been affected by lowest grade of regional metamorphism (Sharma 1988). They are mostly fine to medium grained and dark grey to greenish grey in colour. The rocks contain well preserved vesicles and amygdules and appear to be hard and massive in hand specimen.

Texturally these rocks are generally porphyritic and posses ophitic to sub-ophitic and sometimes hyalo-ophitic textures. The most abundant minerals occurring in these rocks are pyroxene and plagioclase followed by opaques and glass in varying amounts. Among the secondary minerals amphiboles are found in many samples. In some samples recrystallized quartz and secondary calcite also occur in accessory phase. The vesicles are generally filled with quartz, calcite and aggregates of zeolites. The size of amygdules vary from place to place and range from a fraction of mm upto 3cm in diameter. Sometimes the amygdules are deformed and vary in shape from rounded to oval and sometimes elongated and flattened. In some thin sections particularly from Ker area crystals of olivine and or serpentine appear to be found in minor amount. The samples of Jahaj area appear to show the presence of K-feldspar.
i.e. orthoclase and microcline which are medium to fine-grained in size. The important mineral constituents of these rocks are as follows:

**Pyroxene**

Augite is the dominant constituent mineral among the pyroxene family. However, the crystals of other minerals like titanaugite, aegirine-augite and aegirine are also present but in subordinate amounts. Augite occurs both in the form of phenocrysts as well as an important constituent of groundmass. Augite crystals show euhedral to subhedral shape with two distinct sets of cleavage at nearly 90° angle. The crystals of augite show extinction at about 45° angle. In some thin sections pseudomorphs of augite are seen which are now represented by hornblende and chlorite. The mineral titanaugite shows yellow to brownish yellow colour in plane polarised light whereas under cross nicols it shows green colour. The pyroxene crystals bear ophitic to sub-ophitic relationship with plagioclase laths.

**Plagioclase**

Plagioclase occurs as phenocrysts and is an important constituent of groundmass and bears ophitic to sub-ophitic relationship with the crystals of pyroxene. The plagioclase laths commonly show excellent penetration as well as polysynthetic twinning. The twin lamellae of plagioclase crystals extinct at about 37° angle, which
suggest their composition as bytownite. In some samples the laths of plagioclase show saussuritization and albitionization effects which is indicated by replacement of plagioclase to epidote, clinozoisite and sericite, and in some cases plagioclase crystals are also seen with calcic core surrounded by more albitic rims. The plagioclase core is mostly dusty due to its alteration to sericite.

Amphibole

Hornblende, tremolite, actinolite, Fe-actinolite etc. are common constituents of amphibole family found in the rocks of Bayana volcanics. The crystals of hornblende are euhedral to subhedral in shape, green in colour and show pronounced pleochroism scheme (X=pale yellow and brown, Y=light green, Z=dark green, Z A C=27°) and distinct two sets of cleavage. In some samples prismatic crystals of hornblende are seen to penetrate into each other. The crystals of tremolite-actinolite minerals are xenoblastic to porphyroblastic in their forms. The lamellar crystals of actinolite-tremolite series are also not uncommon. The Fe-actinolite is the dominant constituent among the tremolite-actinolite series.

Glass

It is another primary constituent member of these rocks. In certain rock samples the glass has been transformed into palagonite, a yellow coloured cryptocrystalline mineral under cross nicols.
Opaques

They occur as irregular masses and fine dust disseminated throughout the rocks. Hematite dominates in opaques, however, magnetite is also observed.

Khetri Amphibolites

These rocks show uniform textural relationship and mineral assemblages. Major mineral constituents of these rocks are amphiboles followed by plagioclase, quartz, chlorite, epidote, apatite and calcite which occur in accessory amounts. Some relatively less altered samples contain relics of pyroxene. In such samples relics of porphyritic and sub-ophitic textures are preserved which attest their magmatic origin. Various minerals show the following characteristics.

Amphibole

The principal mineral constituents forming more than 50 percent mineralogical composition of these amphibolites belong to the amphibole family. They are represented by actinolite-tremolite series and hornblende. Fe-actinolite is also found in few samples. However, actinolite is the dominant constituent among the actinolite-tremolite series. Most evenly distributed actinolite constituents show pleochroism from greenish yellow to greenish blue with the extinction angle of 15° to 16°. Actinolite-tremolite in most of the samples occur in
the form of xenoblastic to porphyritic crystals elongated in shape. On the other hand, euhedral to subhedral greenish coloured crystals of hornblende are also found which show characteristic pleochroism scheme, (X- pale yellow and brown, Y-light green, Z-dark green, $Z \wedge C = 27^\circ$). In some samples long crystals of hornblende are seen to penetrate each other.

**Plagioclase**

Though plagioclase is not found in all the samples, the laths of plagioclase as phenocrysts are found in varying amount in many thin sections. The laths of plagioclase are twinned on carlsbad law and extinct at about 30 to 34$^\circ$ angle indicating their composition as bytownite to labradorite.

**Pyroxene**

Among the relict pyroxene, augite, aegirine-augite are the dominant varieties found in studied samples. Few samples of these amphibolites also contain crystals of hypersthene. Crystals of pyroxene occur as phenocrysts and are euhedral to subhedral in shape and green to light green in colour. Brown coloured variety of augite is also found but in subordinate amount and bears only one set of cleavage. Crystals of augite and aegirine-augite posses two sets of cleavage. The pseudomorphs of clinopyroxenes are not uncommon, which are essentially occupied by amphiboles.