Chapter - 2

PETROGRAPHY
Petrography has been defined by many workers in different ways with different objectives. The simplest being petrography is the systematic description of rocks in hand specimen and thin sections (Whitten and Brooks 1972). A generalized knowledge of the lithological aspects of the rocks is essential for understanding the geology of an area, it is, therefore, necessary to work out the petrographic details of the mafic and ultramafic rocks of Jharol belt.

After a careful examination of all the samples in hand specimen, about 200 thin sections of selected samples have been prepared and studied from mineralogical and textural point of view.

The field characteristics of Jharol mafic-ultramafic rocks have been discussed in the preceding chapter. Three different types of rocks are found within the Jharol belt associated with the deep water facies. These are: (1) the Bagdunda volcanics predominantly of mafic composition, (2) the Gopir mafic volcanics and dykes and (3) the ultramafic rocks.

Since these rocks have suffered multi-phase deformation and regional metamorphism up to the grade of green schist facies, the primary mineralogy and textures have generally been partly obliterated. However, their extrusive nature is sometimes recognized in the field on the basis of certain characteristics, such as, the intercalation of the ultramafics with fine grained quartzite bands (Plate-3), the presence of relicts of pillows in the ultramafic rocks (Plate-5) and deformed-stretched vesicles found in Bagdunda volcanics (Plate-2).

In the following paragraphs, the petrographic and mineralogical features of the mafic and ultramafic rocks of Jharol belt are discussed as they are observed under the microscope.
Bulk of the rock samples from Jharol mafic-ultramafic rocks are composed of secondary minerals, such as serpentine, hornblende, chlorite, actinolite-tremolite, calcite and quartz. Plagioclases and few clinopyroxene relicts appear to be primary. There are three varieties of ultramafic rocks occurring in Jharol belt. The first one is fine to medium grained, massive rock without any preferential orientation of dimensional minerals. This variety consists mainly of serpentine which may be present as an alteration products of olivine and pyroxene. These rocks do not preserve any spinifex texture or other related textures. Criss-crossing veins of fibrous serpentine are common. There is no other major mineral constituent, except for opaque minerals which could be magnetite, chromite or chrom-spinel occurring as accessory phases. The other variety of ultramafic rocks is made up essentially of chlorite showing random orientation, and probably was formed in response to metamorphic and alteration process, commonly found in ancient mafic-ultramafic rock associations (Condie 1981). The third variety consists mainly of actinolite-tremolite with variable proportions of talc, asbestos and carbonates.

The mafic unit of Gopir volcanics and dykes consists more than 50 per cent hornblende of fine to medium grained verities. Generally the dykes are dark and massive, whereas the flows are fine grained and show development of schistosity. Plagioclase and quartz are present in very small amount with magnetite or chromite as accessory minerals. Some samples are made up predominantly of epidotes.

Bagdunda volcanics display uniform mineral assemblages and textural relations. It consists of amphiboles with variable quantities of plagioclase and quartz. Relict of clinopyroxene and plagioclase crystals are sometimes found in relatively less altered mafic rocks of Gopir and Bagdunda (Abu-Hamatteh et al. 1994).

MINERALOGY

A brief account of the mineral assemblage is as follows:

Serpentine is the major constituent mineral of Jharol ultramafics. Antigorite is the most common variety of serpentine in these rocks. It occurs in the form of fine
sheafs and plates often in a criss-cross meshwork, frequently cut across by chrysolite veins. The antigorite crystals are colourless in plain polarized light, with low relief. They possess straight extinction and one set of cleavage.

Actinolite and hornblende are the main varieties of amphibole. These minerals occur in the form of phenocysts as well as the ground mass. Actinolite crystals are light green in plain polarized light, with prismatic shape and show faint pleochroism. They show high second order polarization colours with extinction angles from 0°-8°. The crystals of hornblende are prismatic in shape, green coloured with marked pleochroism in the shades of green, bluish green, deep green to brownish green. The extinction angle is about 24°-27°. The crystals show second order interference colours and bear two sets of cleavages. The hornblende crystals generally have inclusion of iron oxides and quartz.

In some of the dyke samples (e.g., samples GRD3 and GRD4), zoisite (epidote) is the major constituent mineral. The prismatic crystals of zoisite/clinozoisite possess straight extinction, with one set of perfect cleavage. They are colourless in plain polarized light, showing high relief and deep sea blue interference colour.

Chlorite is another important constituent mineral of Jharol volcanics. The flakes of chlorite show random orientation. They have low interference colour and show straight extinction. In more altered rocks, chlorite flakes are often present. They occur as fibrous crystals and possess very low relief, showing second order interference colour.

Crystals of calcite have perfect three sets of cleavages. Some crystals show deformation effects, as the outline of the crystals appear to be curved. They show first order interference colour. The calcite crystals are generally found in association with antigorite crystals in most of the thin sections.

In the fresh looking samples of Bagdunda volcanics, laths of plagioclase show lamellar twinning, with subhedral to anhedral crystal outlines. They are of oligoclase composition. Although they are in very small amounts, they are quite distinct in the thin sections. Plagioclase crystals seem to be the relicts which have escaped alteration and metamorphism.
The crystals of palagonite which are probably formed due to the alteration of fragmental basaltic glass are massive, green in colour and appear completely isotropic under cross-nicols. They show no pleochroism, with low birefringence.

Quartz is found in minor amounts in the Gopir volcanics.

Opaques occur in the form of anhedral crystals, irregular masses or fine dust, disseminated throughout the rock samples. They are mainly magnetite and ilmenite.