Chapter-IV

GEOLOGICAL SETTING

4.1 Regional geological setting

The area under investigation forms a part of the Assam-Meghalaya plateau (erstwhile Shillong Plateau) and consists of a series of NE-SW trending hill ranges of moderate heights. Mazumder (1986) observed that the Meghalaya massif is a distinct geomorphic unit stretching across the Garo, Khasi and Jaintia hills in an East-West direction overlapping Kamrup district towards north and is delineated sharply to the south against, alluvial plains of Bangladesh. Lithologically, the plateau is made up of Precambrian metamorphic rocks which can be grouped into following major units:

1. The Gneissic Complex
2. The Shillong group
3. The Khasi Green Stone and Not exposed in the area under review
4. The Porphyritic granites

4.2 Rock types of the area

The rock types encountered in the area under study can be grouped into the following lithological units.

1. Gneisses
   - Dioritic rocks
   2. Enclaves
      - Hornblende biotite gneisses
      - Quartzofeldspathic gneisses
4.2.1 Gneisses

This group includes quartzofeldspathic gneisses (country rock) which forms the basement for younger rocks. In field, they are second dominant rock type and are intruded by the granites. These rocks are best exposed in the northern parts of the area near Pahamrioh showing sharp contact relationship with the granites (Plate 4.1a). They also occur as enclaves of varying dimension within the coarse grained variety of granite in the Saiden area.

Migmatitic gneiss is seen at few localities of Saiden, which is reported to extend further south of the study area by Mazumder (1986).

4.2.2 Enclaves

The granites of Nongpoh are studded with abundant mafic enclaves of various sizes which range in composition from dioritic to Hornblende biotite gneiss. The quartzofeldspathic gneissic enclave and hornblende biotite gneissic enclaves are believed to be the remnants of pre-existing formations by earlier workers, constituting the basement gneisses into which the granites have been intruded at a later stage. On the basis of mineralogy and field occurrences, the enclaves are divided into Hornblende biotite gneiss enclaves, quartzofeldspathic gneiss enclaves and dioritic enclaves.

4.2.2.1 Hornblende biotite gneiss enclaves

Large and small bands or screens of these rocks trending NE-SW, are found to occur near Pahamrioh, Garikhana, Marangar, Saiden and Nongpoh proper. They have sharp contact with the encasing granites (Photo 4.1b). These rocks are well foliated
and range in size from less than a meter to several meters. The contact zones of these enclaves with granites are delineated by a peripheral zone of biotite selvages. These rocks are frequently seen impregnated with numerous quartz veinlets (Plate 4.3a).

4.2.2.2 Dioritic enclaves

These enclaves occur along Umden road and Nongpoh proper. They have a diffused contact relationship with the enclosing granite. They are usually dark coloured medium to coarse grained and very hard is compact. These rocks are devoid of foliation. Phenocrysts of K-feldspar analogous to those of the associated granite are seen within these enclaves along the contact zones, indicating feldspathisation (Plate 4.1c).

4.2.2.3 Quartzofeldspathic gneiss enclaves

Quartzofeldspathic gneiss enclaves are found to occur near Shangbanglo, Sainden and adjacent areas and they have a sharp contact with the enclosing porphyritic granite and coarse grained granite. At places these gneissic enclaves bear evidences of shearing within the granite (Figure 5.3 and 5.4).

3.2.2.4 Micaceous Schlierens

Micaceous schlierens are numerous and found to occur within Porphyritic granite. They are mainly composed of biotite with a lense shaped or elongate outline and range few centimeters in size. These schlierens are seen aligned parallel to the flow lines of the granites (Plate 5.1a).

4.2.3 Granites and its Derivatives

4.2.3.1 Porphyritic Granite

As mentioned earlier, porphyritic granite is the most
dominant rock type of the area and is characterised by the presence of abundant phenocrysts of well developed feldspar grains aligned preferentially. Fresh exposures of porphyritic granite are seen at Pahamrich, Garikhana, Nongpoh proper, Iewmolong, Marangar and Nongshar.

Coarseness and size of the feldspar phenocryst vary greatly from outcrop to outcrop. Contact with the country rock quartzofeldspathic gneiss is sharp and near the contact, size of the phenocryst diminishes, i.e., there is a progressive increase in grain size away from the contact zones (Plate 4.1d). The phenocryst size range upto 6cms in length and often show well defined crystal outlines with simple and carlsbad twins. At places greenish patches of epidotes are also observed in the porphyritic granites. It is also noticed that sometimes the biotite flakes are seen to segregate into clots and lenses of small size, depending on the concentration of biotite clots, some porphyritic granites are mafic rich and give a dioritic look. The colour of the feldspar phenocrysts vary from pink to white (Plate 4.2a and 4.2b).

4.2.3.2 Coarse Grained Granite

They are exposed at the southern part of the pluton. The grains are fairly coarse and equigranular quartz, feldspar and biotite are easily identifiable. At places they contain pyrite grains. Enclaves of quartzofeldspathic gneiss are common in this rock.

4.2.3.3 Medium granied Granite

This variety is exposed near Nongpoh proper, Garikhana and along Umden Road. The rock is grey is colour, fairly hard
and compact and has a gradational contact relationship with porphyritic granite and this variety can be regarded as a slightly finer variety of porphyritic granite.

It is observed that the contact relationship between porphyritic, coarse grained and medium grained granite is gradational.

4.2.3.4 Fine Grained Granite (Aplitic type)

These rocks occur mostly as dykes cutting porphyritic granite trending roughly NE-SW in the Iewmolong area. They have a sharp contact with the encasing porphyritic granite. They are usually pink in colour and very hard and compact (Plate 4.2d and 4.3b).

4.2.3.5 Pegmatite

Pegmatites are common in the area occurring as dykes and veins cutting the porphyritic granites. They measure up to 5m x 1m in size as seen in Garikhana, Umden and Pahamrioh. Small flakes of biotite are abundant in these pegmatites (Plate 4.2c).

4.2.3.6 Quartz veins

Quartz veins and quartzofeldspathic veins of different shapes and sizes are found to impregnate all rock types of the study area.

4.3 Stratigraphic relations

Based on the field relations of different rock units, the stratigraphic positions of the rock types can be given as follows:
<table>
<thead>
<tr>
<th>ENCLAVES</th>
<th>GRANITES AND ITS DERIVATIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dioritic rocks</td>
<td>Quartz veins,</td>
</tr>
<tr>
<td>Horblende biotite gneisses</td>
<td>quartzofeldspathic veins</td>
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<td>and quartzofeldspathic</td>
<td>and Pegmatites</td>
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<tr>
<td>gneisses</td>
<td>Fine grained granites</td>
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<td></td>
<td>(aplitic type)</td>
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<tr>
<td></td>
<td>Coarse grained granites</td>
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<tr>
<td></td>
<td>and Porphyritic granites</td>
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</table>
Plate 4.1

a) A sharp contact relationship between quartzofeldspathic gneiss and coarse grained granite. Locality-Saiden.

b) A sharp contact relationship of hornblende biotite gneiss and medium grained granite. Locality-Nongpoh proper.

c) Dioritic enclave showing appearance of large K-feldspar phenocrysts analogous to that of adjacent granite. Locality-Nongpoh proper.

d) Photograph showing progressive increase in size of K-feldspar phenocrysts away from the contact zone. Locality-Marangar.
Plate 4.2

a) Orientation of K-feldspar phenocrysts in pink porphyritic granite. Locality-Pahamrioh.

b) K-feldspar phenocrysts in grey porphyritic granite. Locality-Umden road.

c) Well developed biotite flakes in pegmatite. Locality-Garikhana.

d) A vein of fine grained granite within the porphyritic granite. Locality-Pahamrioh.
Plate 4.3

a) An enclave of hornblende biotite gneiss impregnated by quartz veinlets.
   Locality: Pahamrioh.

b) Occurrence of fine grained aplitic vein in the porphyritic granite.
   Locality: Shangbanglo.