CHAPTER - 2

GEOLOGIC AND GEOMORPHIC SETTINGS

2.1 GEOLOGIC SETTINGS

The drainage area of Dhansiri is by and large composed of Tertiary sediments comprising Disang, Barail and Surma Groups of rock. The north western part of the basinal area comprising the Kaliyani subbasin is, however, covered by Shillong Group of rocks of Precambrian age. A small tract toward the north eastern part of the basinal area constituting the lowermost reach of Dhansiri river, is covered by unconsolidated alluvial deposits of Recent to sub recent age, (Fig. 2.1).

The north eastern part of the basinal area comprising Disang Group of rocks which covers almost entire Nagaland state, is characterised by regional thrusts, faults and folds. Naga and Disang thrusts demarcate Schuppen and Naga folded zones. Naga folded zone passes through Kohima synclinorium. The Schuppen belt itself comprises a number of thrust slices overiding one over the other. Both Naga and the Disang thrusts are not themselves continuous features but comprise smaller discontinuous thrusts which diverge and converge so as to produce separate strips overiding each other along a NE-SW trend and all of them showing a dominant north westerly direction of movement with south easterly hade.

The earliest records of geological investigation in Nagaland are contained in memoirs of Geological Survey of India by Mallet (1876), Oldham (1883) and Hayven (1904) who made an effort for location and evaluation of Tertiary Coal deposit of Naga hills. The pioneering effort in geological mapping especially for the Schuppen belt, part of Naga hills was to follow soon after from Geologist of Assam Oil Company, whose
work is well documented by Evans (1932, 1938), Mathui and Evans (1964) and Dasgupta (1977). They identified three major structural zones, namely, (1) Eastern zone of argillites, metamorphics and ultrabasic intrusives, (2) Central zones of Barails and Disangs between Zungki and Disang thrusts and (3) Zone of Schuppen between Disang and Naga thrusts. The schuppen belt is also indicated by the presence of number of thrusts.

Brunnchariler (1964) concluded that stratigraphy of Naga hills can be given in terms of three major systems namely, Pre-Mesozoic, Metamorphic Complex, Late Cretaceous and Eocene Flysch and Mio-Pliocene Chindwin Mollasse. He also observed that Flysch lies unconformably on Pre-Mesozoic metamorphics and on probably Early Mesozoic carbonate formations.

The stratigraphic succession of the entire Dhansiri basin area is shown in Table 2.1

The Precambrian gneissic Complex is the oldest Group of rocks which covers the north western part of the basin comprising biotite-hornblende gneiss, sillimanite gneiss and schist, granite gneiss and subordinate amount of pyroxene-hornblende granulite (Krishnan, 1968). About 12 percent of the basinal area is covered by metasediments of the Shillong Group and Precambrian gneiss. The arenaceous and argillaceous metasediments and ferruginous quartzite, quartz biotite schist, phyllite and auto-clastic conglomerate.

The Disang Group succeeding the Precambrian rocks, constitutes the south eastern part of the basinal area comprising about 52 percent of the basinal area. At the head waters of Dayang and Dhansiri the outcrop of the Disang is clearly discernible by strike valley. Near Kohima the outcrop broadens out and extends in east and north east direction occupying a large part of Nagaland.

This geosynclinal facies of the Eocene is made up of monotonous sequence of dark grey shales of concretionary and occasionally carbonaceous beds with thin beds of
sandstones which is more dominant near the top of the Group. Further the exposures of ferrugeneous shales, sandy shales and alternations of fine grained sandstones and sandy shales are not uncommon. Then again to the north east near Mokokchung the Disang Group contains ample ferruginous concretions. In Nagaland the Disangs show an increasing tendency of metamorphism. Near Kohima, shales are slaty while further east they are typically hard, glossy and dark blue slates.

The Disang Group of rocks are regionally folded into Kohima synclinorium bounded in the north west by the “Belt of Schuppen” - a zone of imbricate thrusts (Mukherjee, 1980). Numerous small folds are also noticed.

The Barail Group succeeding the Disang, covered about 13 percent of the basinal area. It occupies the south western part of the basin. Towards north and north east the Barail Group has been traced from the Dhansiri valley through Nagaland and to Assam valley. The rocks show a gradual change from the underlying Disang shales to more arenaceous facies.

The Barail Group is essentially arenaceous; the outcrop is everywhere relatively high ground. The Barail Range, from which the name comes, reaches over 1,600m at Maryngksih, which is the highest point on the horizontal sandstones of the shelf facies.

In Karbi-Anglong the Barail beds of the shelf facies are mainly fairly coarse ferruginous sandstones, associated in places with carbonaceous shales. The Naogaon stage is consisted of hard, mostly well bedded sandstones with bands of shale. The Baragolai stage is made up of different proportions of sandstones and shales with thin coals seams throughout. The overlying Tikak Parbat is similar, but is marked by thin coal seams at its base.

Overlain unconformably on the Barails are the Surma beds of Miocene age. It covers about 5 percent of the basinal area. The Surma Group covers western part of the
basinal area. The Surma Group consists essentially of alternation of shales and sandstones with occasional thin conglomerates. The Surma Group, the lowest division, the Bhutan stage is divided into three substages, two groups of alternating beds being separated by an argillaceous group. The distinction fades out in western part of Surma valley where the whole stage becomes monotonous succession of shales, sandy shales and siltstones with only minor sandstones. The Upper Bokabil stage is consists of shales and sandy shales with thick lenticular beds of fairly coarse ferruginous sandstones. The Surma sediments were deposited in the upper Assam valley in a mainly fluvial environment (Rangarao, 1983). Numerous fluvial structures are seen along these sediment. Surma is overlain by alluvium, which covers about 18 percent of the basinal area. It covers most part of Upper Assam and also occupies the lower reach of the basinal area, containing sands, silts and clays. The north eastern extremity of the basin, which falls in the Golaghat district of Assam is covered by blanket of alluvial deposits comprising mainly unconsolidated sediments. These unconsolidated sediments are also found to occur when the Dhansiri river emerges with the vast flood plain of Brahmaputra river. The alluvial plain in the northern part of the basinal area is characterised by almost flat terrain gently sloping toward north. It contains occasional pebbles which are derived from the quartzites, schist and shales. Another isolated alluvial tract is found towards the south western margin of the basin surrounded by gneissic complex. Numerous fluvial structures are seen along these alluvium.

The Disang Group which covers the south eastern part of the basinal area is composed of series of faults. The landsat imagery analysis and photogeological studies by Ganju and Khar (1985) highlight the structural complexity of the area, which consist of numbers of faults and thrusts. The entire Naga hills belt is constituted of five mega structural elements from west to east namely (i) Schuppen zone (ii) Naga folded zone (iii) Flysch zone (iv) Naga metasedimentary and basic complex and (v) Chindwin Molasse. Each mega structural zone is demarcated by NE-SW trending Naga, Disang, Tapu, Zunki and Namaya thrusts.
GEOLOGICAL MAP OF DHANSIRI BASIN
(AFTER G.S.I. 1973)
with a general north westerly direction of movement. (Fig 2.2)

The ‘Belt of Schuppen’ between Naga and Disang thrusts is constituted of a number of thrusts which diverge and unite with the Naga thrust. Three of these namely Cholimsen, Lakhuni and Chanch thrusts nearly run along the entire length of northern and central parts of the ‘Schuppen belt’ and form separate strips or wedges ranging from 60 to over 100 km in length.

Disang thrust represents a zone of thrusts which diverge and unite so as to produce separate strips or wedges along a general NE-SW trend. The structural style and facies distribution of sediments east and west of Disang thrust appear to be at significant variance with each other. The ‘Schuppen belt’ is characterised by a dominant arenaceous content, while sediments to the east are represented by monotonous sandstone and shale alternations and shales with subordinate sandstone and siltstone.

South east of the “Belt of schuppen” lies the great overthrust mass of Naga Hills. The Naga zone between Disang and Tapu thrusts is characterised by a number of reversals denoted by NE-SW trending anticlines and synclines. Further south, but slightly offset to the west of the Disang is the Kohima synclinorium which is rather better known at its eastern side. There is a slight southerly pitch, although the rim of the structure is everywhere in the Disang the synclines bring in higher groups as the Surma valley is approached. In the western part of the basinal area the Shillong plateau, Karbi-Anglong and in the upper Assam valley are an autochthon consisting of crystalline rocks partly covered by Tertiary and later sediments, this mass the (Foreland Spur) has been overthrust from the north west by the Eastern Himalaya and from the south east by the Naga hills.

The “Foreland Spur” is made of Precambrian rocks covered in places by nearly horizontal or gently dipping sediments. In Shillong Plateau and Mikir hills there is a criss cross of ancient fault line, which have been reactivated in late Tertiary or Post Tertiary
The Shillong Plateau falls steeply southwards to the Surma valley, the slope coincides with a south dipping monoclines. The Surma valley is a region of NE-SW folding. The synclines are broad and symmetrical, the anticlines mostly narrow, sharply folded and asymmetrical. The steeper flanks of the anticlines are almost all faulted. The Surma valley merges eastward into the southern part of Kohima synclinorium, (Mathur and Evans, 1964).

2.2 GEOMORPHIC SETTINGS

The geomorphological classification of landforms in the entire northeastern region from Landsat imagery is done by Chakrabarti et al. (1987) on the basis of three major categories, viz., (i) Denudational landform, including dissected hills, dissected plateau and inselberg; (ii) Structural landforms comprising ridge and valley provinces, structural plateau plain and dissected structural plateau and (iii) fluvial landforms comprising present flood plain and older flood plain, piedmont zone, intermentane valley plain and alluvial fan.

The main geomorphological units coalescing to form the geomorphological set up of the Dhansiri basin are (i) denudational hills comprising dissected hills, dissected plateau and inselberg (ii) ridge and valley province and structural plateau, plains and (iii) present flood plain comprising fluvial geomorphic features in the lower alluvial plain (Fig. 2.3).

2.2.1 DENUDATIONAL HILLS

Denudational hills comprising moderately dissected hills of crystalline and metamorphic rocks are developed in major part of Karbi-Anglong. The denudational hills of gneissic complex consisting of very compact to moderately compact biotite gneiss, hornblende granulite and amphibolite are characterised by coarse to medium textured and partly lineament controlled drainage pattern (Chakrabarti et al., 1987). This region is bounded
by alluvial plain in the west and east and structural plateau in the south. In the central part of Karbi-Anglong a distinct circular depressions break the monotony of the landscape. The circular depression has a high rim around it. The dominant control of lineament has given rise to moderately dissected hills and valley.

In some parts of Karbi-Anglong crystalline and metasedimentary formations are peneplained to gently sloping surfaces. These areas are grouped under dissected plateau. The moderate dissection noticed in this region still preserves the old plateau characters. Patches of subdendritic drainage characterise the area. Escarpments are common along fault zones. Along the northern boundary scarp faces are conspicuous. The metasedimentary rocks are peneplained to smooth elevated surface (Chakrabarti et al., 1987). Isolated hillocks, relict of dissected hills of Precambrian rocks project out as inselberg in the alluvial plain. These inselbergs mainly consist of hard to compact granite and granite gneiss with rounded top.

2.2.2 Ridge And Valley Province

The hills of Nagaland and southern part of Assam are the characteristic of narrow ridge and valley province. Here the valleys are very narrow and are characterised by presence of very close linear ridges and intervening narrow valleys. It also shows high degree of dissection which give rise to very rugged terrain. Development of escarpments is also seen in Nagaland on limited scale. South of Kohima, on the main Barail range, development of crustal landform is observed on the synformal closure (Chakrabarty, et al., 1987). The longer slope of the cuesta is in south westerly to westerly direction. Steep escarpment has been developed along the eastern margin of the synformal closure. The structural plateau plain on the south and eastern part of Karbi-Anglong district is distinct. The sequence is a continuous extension of Shillong plateau of Cretaceous-Tertiary age comprising subhorizontal and low dipping sediment.
2.2.3 **Fluvial Landform**

Fluvial landforms, which comprise flood plains of old and new, are characterised by deposition of unconsolidated fluvial deposits such as natural levees, back swamps, abandoned channels, oxbow lakes, paleo channels etc. In the upper Assam region near Jorhat, Golaghat and Numaligarh, distinct alluvial plain is developed which is characterised by almost flat terrain, gently sloping towards Brahmaputra where it merges with vast flood plains of Brahmaputra. The alluvial deposits are mainly characterised by clay, sandy clay, silt and sands.
TABLE 2.1  **Stratigraphic succession of the Dhansiri basin area**  
*(after Mathur and Evans, 1964).*

<table>
<thead>
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<th>Age</th>
<th>Group</th>
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<td>Alluvium and high</td>
</tr>
<tr>
<td>and Pleistocene</td>
<td>and high level</td>
<td>high level</td>
<td>high level terraces</td>
</tr>
<tr>
<td></td>
<td>terraces</td>
<td>terraces</td>
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*unconformity*

<table>
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<th>Bokabil</th>
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<tr>
<td></td>
<td></td>
<td>Bhubon</td>
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<th>Tikak Parbat</th>
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<td></td>
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</tr>
<tr>
<td></td>
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<table>
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<th>Disang</th>
<th>Observed by faults</th>
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STRUCTURAL MAP OF DIANSIRI BASINAL AREA
(AFTER GANJU AND KHIR 1982)

Fig. 2.2
GEOMORPHOLOGICAL MAP OF DHANSIRI BASIN
(AFTER G.S.I. 1973)

INDEX
- Alluvium
- Structural Plateau Plain
- Dissected Structural plateau
- Ridge and valley province
- Denudational hill

FIG. 2.3