CHAPTER IX

STRUCTURAL ASPECTS OF THE ROCK TYPES

INTRODUCTION:

The rock types around Chetput display major structural features which are relatively simple. The structural elements of rock types are depicted in Fig. 36. The structural elements encountered in the rock types are foliation, lineation, and minor folds that are related to major structures. Rock types display well developed joints and, in places, they are sheared.

FOLIATION:

The pelitic and semipelitic gneisses display foliation owing to the presence of oriented streaks of biotite. The ferruginous psammites show foliation owing to the presence of oriented prisms of eulite and drawn-out streaks of magnetite. The basic members of the Charnockite series possess foliation owing to the presence of streaks of granular pyroxenes, hornblende and flakes of biotite. The acid members of the Charnockite series are characterized by drawn-out
SKETCH MAP SHOWING THE STRUCTURAL ELEMENTS OF THE ROCK TYPES OF THE THESIS AREA

EXPLANATION

- **Dolerites**
- **Pink granite, Pegmatite & Aplit**
- **Dark grey granodiorite gneisses**
- **Dark grey granodiorite gneisses with Porphyroblasts of plagioclase Amphibolites**
- **Enderbite**
- **Basic member of Charnockite series**
- **Biotite gneiss**
- **Cordierite gneiss**
- **Magnetite-Quartz rock**

**Legend**:
- Dip & Strike of foliation
- Vertical dip & Strike of foliation
- Inclined joints
- Vertical joints
- Synform with plunge
- Antiform with plunge
- Minor fold Antiform
- Minor fold Synform
- Shear
- River
leaves of quartz and oriented flakes of biotite that impart to them a foliated appearance. The amphibolites display foliation due to the presence of oriented prisms of hornblende and flakes of biotite. The dark grey granodiorite gneisses are foliated (Plate XIII, Fig. 1) owing to the presence of drawn-out leaves of quartz and streaks of biotite. Gneissose pink granites show foliation due to the occurrence of oriented flakes of biotite.

The foliation of the above mentioned rock types are thrown into major folds. As a consequence, the trend of foliation varies from NNE to ENE and the rock types are folded as plunging antiforms and synforms.

In the southern zone of the eastern division an antiform is encountered about 4 kilometers north of Kadambur. It is comprised of folded members of Charnockite series, amphibolites and dark grey granodiorite gneisses. The axis of the antiform trends NE - SW and its plunge is 30° towards SW. The axial plane is vertical and the limbs of the fold dip at an angle of 80° to 60° towards north-west and south-east.
In the southern zone of the central division, a synform is met with about 3 kilometers west of Gingee. It is comprised of foliated layers of Charnockite series, dark grey granodiorite gneisses and pink granites. The trend of foliation is mostly NE - SW. The plunge of the synform is 35° towards SW and the axial plane is vertical.

Besides this synform, an antiform occurs to its west which extends from Valatti in the central zone of the central division to Kalattampattu in the southern zone of the western division. It is comprised of folded layers of Charnockite series, amphibolites, dark grey granodiorite gneisses and pink granites. It has a plunge of 40° towards south-west.

In the northern zone of the central division a synform is encountered 2 kilometers west of Arasam-pattu. Its axis trends NE - SW and is comprised of folded members of Charnockite series, dark grey granodiorite gneisses and pink granites. The plunge of the synform is 40° towards SW. The axial plane is vertical.
In the northern and central zones of the western division an antiform occurs and its core is comprised of metasediments which are enclosed within the Charnockite series. Its plunge is $35^\circ$ towards SW.

To the north of this antiform, a synform is present in the northern zone of the western division and is comprised of acid members of the Charnockite series. Its plunge is $35^\circ$ towards SW.

These are the major folds encountered in the thesis area.

LINEATION:

The rock types display, in places, one set of lineation that are related to major folds. The lineation shown by the rock types is mainly due to mineral orientation. The lineation is seen along the plane of foliation of Charnockite series due to the presence of streaks of pyroxenes and hornblende. In enderbites, drawn-out leaves of quartz display lineation in the plane of foliation and along the noses of major
folds the quartz leaves display bending of their lineation. Sometimes, gneissose pink granites display lineation due to the presence of streaks of biotite in the plane of their foliation.

The lineations are usually parallel to the trend of major fold axes. In the plane of foliation their plunge ranges from $30^\circ$ to $40^\circ$ towards south-west. Apart from these concordant lineations, there are lineations that deviate from the normal trend and they are encountered along shear zones.

**MINOR FOLDS:**

In some outcrops minor folds and contortions are seen. The minor folds generally occur as asymmetric drag folds and usually they are open type of minor folds (Plate XIII, Figs. 2 and 3).

In the hills west of Gingee, in the southern zones of the central and western divisions of the thesis area, the members of the Charnockite series, dark grey granodiorite gneisses, amphibolite and
gneissic granite display minor folds. Similar types of minor folds are seen in the above said members in the hills encountered in the central and northern zones of the central and western divisions of the thesis area. Their axes are usually parallel to the axes of major folds.

**Crenulations:**

In places, biotite-enriched grey granodiorite gneisses and pink granite gneisses display crenulations. Generally, they are smaller in scale than that of asymmetric drag folds and their axes have the same trend as major folds.

**Joints:**

Usually, the rock types display two sets of vertical joints. One set is parallel to their trend and the other set is about $70^\circ$ to $90^\circ$ to the first set (Plate XIII, Fig. 4). They are either vertical or dip at steep angles and their surfaces are usually smooth. West of Kaplambādi, east of Eyyal and northwest of Gingee, the pink granite display sheet joints and they follow the topography.
PLATE-XIII

Fig. 1. Field photograph of foliation in dark grey granodiorite gneiss.

Fig. 2. Field photograph of minor folds in the form of drag folds.

Fig. 3. Field photograph of open type of minor folds.

Fig. 4. Field photograph showing vertical joints.
SLICKENSIDES:

Along the shear zones east of Gingee and west of Vedal the rock types display slickensided surfaces due to shearing.

FAULTS:

In the northern and central zones of the western, central and eastern divisions, slip faults appear to be present but they are mostly concealed beneath the soil. Along shear zones the rocks are highly crushed and profusely traversed by quartz and epidote veins.

STRUCTURAL PATTERN:

The rock types around Chetput are characterized by structural elements that indicate NE - SW trend of the major folds with a plunge of 35° to 40° towards SW.

In order to know the relation between the trend of foliation and the major folds, the poles of foliation were projected on the southern hemisphere and they are shown in Fig. 37. The poles of lineations
FIG. 37. STEREOMICROGRAPHIC PROJECTION ON SOUTHERN HEMISPHERE OF 160 FOLIATION PLANES (●), MINOR FOLDS (x) AND THE AXIAL PLUNGE OF MAJOR FOLDS (▲) OF THE THESIS AREA.
and the axes of minor and major folds are also depicted in the projection. The geometry of foliation seen in the figure is in accordance with the observed trend of the axes of major and minor folds and their plunges. This suggests that the rock types have retained only the structural impress pertaining to the deformation that attended the emplacement of pink granite. The bent lineations encountered along noses of major folds suggest that the rock types were subjected to repeated deformations.

The transverse and longitudinal joints display the characteristics of Q- and S-Joints of Cloos (1936). The Q-joints are regarded to be tensional in origin by Cloos. He ascribes S-joints to directed lateral pressure acting in a perpendicular direction to the trend of the rock types. After the consolidation of pink granites, the rock types were subjected to severe stresses and owing to this they were severed in places.
STRUCTURAL CONTROL OF INTRUSION OF DYKES:

The trend of the dykes in the thesis area usually coincide with the trend of transverse joints present in the earlier rocks. This suggests that the intrusion of dykes was controlled by early formed master joint system which was tensional in origin. The dykes around Chetput are usually vertical and this indicates that they may have intruded vertically upwards along the pre-existing joint planes.