If observations agree with our theory that is nice, but if they do not, that is interesting.

(An Anonymous Wise Man)
STRUCTURE

Due to the paucity of exposures and weathering of the major country rocks, viz., phyllites, mica schists and granitoids the area is not suitable for detailed structural work. A general investigation of the structures has therefore been made for better understanding of the petrogenetic evolution in the area.

(1) PLANAR STRUCTURE

(a) Foliation – In phyllites foliation is defined by a silky sheen on the surface of splitting, resulted from the alignments of flaky incipient crystals of micas and chlorite and occasionally by thin layers of quartz mosaics. The foliation plane, which is also a schistosity plane, dips at an average amount of 60° northerly.

In mica schists foliation appears in the form of schistosity defined by parallel or subparallel disposition of basal cleavage planes of mica flakes and dimensional orientation (parallelism) of rod-shaped quartz and feldspars. Occasionally schistosity shows gentle puckering. The attitudes of dip of the schistosity planes are similar to those of phyllites.

Foliation in epidiorites and amphibole schists is pronounced in nature. The outcrops of these rocks are less weathered. A crude parallelism of amphibole crystals (moderately coarse grained actinolite and tremolite) along with chlorite
and quartz grains define the foliation planes of the amphibole schists. The higher grade amphibolites, which occur within the granitic country of the northern part of the area, the schistosity is pronounced, whereas, in the lower grade amphibolites which occur in the southern part of the area, it is poorly developed. The amount of dip of these foliation planes ranges between $70^\circ$ and $80^\circ$ northerly with local variation towards south.

In the granitoid rocks, foliation is defined by thin impersistent mafic layers composed essentially of biotite alternating with thicker layers of granular quartzo-feldspathic minerals. In the granitised mica schists, the foliation, as expected, is well developed and is defined by parallel disposition of both muscovite and biotite flakes alternating with quartzo-feldspathic thicker bands in which quartz is occasionally rod like. In augen gneiss varieties of granitoid rocks a fine grained foliated often micaceous groundmass encloses megascopically conspicuous 'eyes' of K-feldspar megacrysts. Each of these 'eyes' may usually be of a single crystal or more frequently an aggregate composed dominantly of feldspar and minor quartz grains. The foliation planes in granitoid group of rocks also dip towards north with an average amount of $70^\circ$.

Therefore, the planar structure defines a regular trend and uniform attitude over almost whole of the area and it is plotted in pole diagrams (Figs. 3, 4, 5). The general trend of foliation is WNW-ESE. However, over the whole area and
Figs. 3, 4, and 5  A-Pole Diagrams of metasedimentaries, granites, amphibolites-tremolite-actinolite schists.
sometimes even within a single exposure variation in strike is noticed. The variation within a single exposure is due to the swirling nature of foliation plane or incompetency of the rock body. Moreover, the foliation plane almost constantly maintains a northerly dip, although reversal of dip direction is locally encountered.

Except for the Kanapahar and Burabazar granite bodies, the lithologic boundaries of all major rock groups are strikingly parallel to their individual planar structural trend. This indicates that this planar structure in the meta-pelitic rocks could be parallel to original bedding or it may be an axial plane cleavage of an isoclinal fold with northerly dipping limbs.

(2) **LINEAR STRUCTURE**

(a) Mineral lineation - This is best developed in mica schist, quartz-mica schist and variants of phyllites. This is essentially a down-dip lineation as furnished by the parallel or sub-parallel alignment of elongated flakes of mica, elliptical and streaky quartz.

Mineral lineation is not well developed in the granitoid group of rocks. However, in the porphyritic granite, a crude mineral lineation is exhibited by a sub-parallel alignment of the long axes of the feldspar megacrysts.
(3) **FOLDS**

The general BSE-WNW strike of the formations is observed in this area. The rocks usually dip northerly at a moderate to high angle. Local variations in strike and dip and even reversal of dips can be related to folding on a regional scale. It is thought that fairly large folds have thrown the rock formations into broad warps. The regional geological set-up in terms of structure consists of close isoclinal folds, where the fold axes are either horizontal or plunge at low angles, towards east or west. Of course, detail structural study of the fold pattern has not been undertaken by the present author.

(4) **FAULTS**

Structurally the present area is situated in the vicinity of the hinge zone of Chotanagpur plateau, which has suffered repeated tectonic movements. The geological framework of the area has changed accordingly. The most important structural break of this area, is furnished by a long zone of faulting, which is incidentally coupled with another fault zone, occurring north of it. Ball (op. cit.) recognised a boundary of granite-gneisses to the north and schistose metasediments to the south in the southern part of the present area. This fault extends both towards west in the Ranchi district and towards east in the Bankura district. Dunn (op. cit.) doubted the existence of any fault, although movements have taken place here and there along the granite gneiss-metasedimentary boundary.
Later workers (GSI, 1977) indicated the presence of two roughly E-W, more or less parallel, shear zones in this district. These zones are again sub-parallel to the Singhbhum shear zone, occurring about 50 km. southwards of the southern shear zone of this district (Fig. 6).

The present author however, supports Ball's view regarding the existence of a fault zone and the evidences in favour of this are enlisted below:

i) A series of hillocks of brecciated quartzite located at Kedali Pahar, Baikunthapur, Bhabanipur and Fagudih, characterise this zone. The quartzites show silicification in the form of innumerable ramifying veins along fracture planes supposed to have resulted from movement. Such ramifying fractures are also seen in other types of rocks on or near this zone.

ii) Intense cataclasism and mylonitization and other deformation features of minerals (kinking of biotite, flattening of muscovite) in different types of rocks are regular features on or near this zone.

iii) Extensive mineralisation, restricted along this zone, readily suggests hydrothermal and pneumatolytic activity along some weak planes formed by disjunctive movements.

Quartz-kyanite-corundum veins occurring at Salboni Inchadih, Ragma are considered to be open space filling by hydrothermal fluid (Ray, cited in Roy, 1982). Frequent
Fig. 6 Distribution of Shear Zones (G.S.I. 1984)
Fig. 7  Field photograph of Quartz-Tourmaline Vein at Kerar.
Fig. 7
presence of quartz-tourmaline veins (Fig. 7) apatite-magnetite vein with secondary silicification and vug-filling giving rise to rich apatite deposit of economic grade, specially at Beldih, occurrence of minor quartz-galena and silver-gold vein at Beldih and sporadic ferruginisation, chloritisation, kaolinitisation, epidotisation - all these features characterise this zone.

(5) **JOINTS**

Joints are mostly developed in granitoid rocks and phyllites. Usually strike joints are common. Oblique joints come next in abundance. Structural data on joints are rather meagre to focus anything on the joint system of the area.