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DEFORMATION IN MALIKHERA-MOKANPURA AREA OF DARIBA-RAJPURA-BETHUNMI POLYMETALLIC SULPHIDE BELT RAJASTHAN

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ABSTRACT

The Dariba-Rajpura-Sindesar-Bethunmi polymetallic sulphide mineralized belt is in fact, Dariba-Bethunmi doubly plunging synform of upright isoclinal folds. The closures of synform have been observed at Dariba in the south and Bethunmi in the north (Samaddar, 1987). Earlier (Basu, 1964; Dutta, 1970; Gupta et. al., 1980), the rocks of the entire belt were believed to constitute the western limb of a northeasternly plunging macrosyncline. It was also considered by earlier workers (op.cit) that a closure of which said to be exposed near Binder and eastern limb of which constitute Pur-Banera belt, some 80 kms apart from western limb. Present work of the author totally refute such openions on the basis of data and its analysis concentrated to the study area which is only a part of the belt.

I.INTRODUCTION

To facilitate the description, the deformations, the structural elements and manifestations of individual pulsations have been assigned separate deformational episodes within the different tectonic systems. The structural elements which are related kinematically such as folds and planer and linear tectonic anisotropy, have been accommodated within the same deformational episode.

The structural elements recorded in these rocks on the basis of their position in stratigraphy, mutual relationship and orientation have been designated as DI, D2, D3 episodes. The folds, lineations and planar tectonic anisotropy corresponding to these three episodes have been designated as Fl, B1, S1; F2, B2, S2 and F3, B3 and S3 respectively. The inter relationship of structural data obtained by the author are not conclusive for the belt in toto, as the studies are limited only to the part of the belt. In the present description, the major fold have been named after the villages, where their geometry is the best developed. A detailed structural map prepared for Malikhera- Mokanpura area of Dariba- Rajpura-Bethunmi polymetallic sulphid mineralized belt has been presented. Stereographic projections have also been prepared sector wise for the structural analysis of the area.

1.1.FIRST DEFORMATION(D1)

Dl episode has been evident by earliest fold developed in the rocks. Fl folds occur as mesoscopic structures. These folds are open to tight with high amplitude/wavelength ratio. In the study area Fl folds are tight by appressed, overturned, gently to moderately plunging, moderately inclined and locally acquire a reclined gemetry. Earliest fold, that is first generation fold (Fl) are not better preserved in the area. None the less, overall

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shape of the ferruginous breccia has been controlled by Fl folds. In one of the hand specimen (Plate 9, Fig. B) and photomicrograph of thin section of Graphitic mica schist (Plate 10 Fig. A and B), there is preservation of Fl fold inside schistosity running parallel to Fl fold axis. In Dariba area, however, Fl is seen in mesoscepic scale (Sarnaddar, 1987). Fl are infact, co-eval with F2 fold system. Fl are very tight folds with high amplitude/wave length ratio (1:4) and have produced prominent slaty cleavage. The early folds (Fl) are also preserved in the eastern limb of Dariba-Bethunmi synform on macroscopic scale. They are reclined folds having steep plunge towards ESE and axial plane trending N-S with steep dip towards east. 131 lineation associated with Fl folding present as mesofold axis and as intersection lineation of bedding and Si schistosity. The orientation of the lineation suggests doubly plunging nature of the Fl fold. The prefered orientation of sheet minerals like chlorite, muscovite and biotite in metasediments has defined the first schistosity (SI), developed in the Malikhera-Mokanpura area. The schistosity shows angular relationship with bedding. In hinge zone of Fl folds, the strike of bedding and schistosity show variable angular relationship. In limbs, the strike of the bedding and schistosity tends to be parallel to sub-parallel. The SI schistosity is better developed in the eastern parts of the area. The N-S orientation of the steeply inclined schistosity (60° to 75° toward east), roughly changes to N10°E-SIO°W in the northern parts of the studyarea.

1.2. SECOND DEFORMATION (D2)

The folds schistosity and lineations kinematically related D2 episode have been designated as F2, S2 and f32 respectively. Temporal relationship of the D2 has been established on the basis of refolding of Fl by F2 in the rocks.

The Dariba-Bethunmi synform makes a tight and appressed isoclinal synform fold (F2) with axial plane trending gradually from N-S to N50°E-S50°W respectively with a steep dip towards east. The synformal closure at Dariba in the south exhibits steep plunge (55° to 60°) towards ENE, whereas, the synform closure at Bethunmi in the north, shows moderate plunge (20°-45°) towards WSW. The nature of the plunge also indicate that the belt has gone twisting along E-W axis.

S2 schistosity is well developed as axial plane cleavage of the F2 folds. The Si schistosity forms the enveloping surface for the F2 folds. The S2 schistoity, in general, is the regional foliation. In the hinge zone, it shows angular relationship with bedding, whereas on the limbs, it tends to be parallel to sub-parallel with the bedding. S2 schistosity wherever imprinted on the older rocks it shows an angular discordance with bedding and SI schistosity. The deformation of Si about F2 fold axis has resulted locally, in the parallelism between Si and S2 in the limbs of isoclinally folded F2 folds.

The S2 is developed morphologically, as flow cleavage in the graphitic mica schist of both sides of the cherty quartzite ridge of the study area. The flow cleavage is defined by the preferred orientation of biotite, muscovite etc. with their pinacoidal faces parallel to the plane of fissility. The quartz grains show preferred orientation and flattening along S2 direction. In the localities of intense deformation, S2 has obliterated the earlier SI schistosity. S2 schistosity tends NNW-SSE and is vertical to subvertical in attitude.

F2 folds are present in the rocks on micro-,meso-, and macroscales and show wide spread distribution. F2 folds are moderate to steeply inclined open folds with low amplitude to wave length ratio. At village mokanpura the

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exposure of the nose of F2 fold have been observed. At this location F2 is showing its fold axis NNW-SSE and plunging 45° toward NNW in the dolomitic marble.

The lineations kinematically, related to F2 folds have been referred as J32 These have been represented by mesofolds axes, intersection of bedding and S2 In the area 2 is present as interaction of SI and 52, pucker lineation and mineral lineation defined by preferred orientation The orthogonal thickness of these folds remains nearly constant Associated with F2 folds, parasitic folds as asymmetrical drags on the limbs have been observed at places. The major axial trace of F2 folds have been recorded on the scale of the structural map (Fig. 1).

1.3.THIRD DEFORMATION (D3)

In the third deformation (D3), the latest generation of fold (F3) have developed. In fact, F3 constitute a set of upright folds with almost E-W axial traces. These has caused a plunge instability of F2 fold, leading to large scale axial culminations and depressions of F2 fold axis. This relationship have been explained in Fig. 4.6.

In the study impact of F3 fold axis has been observed in ,.the form of presence of faults. There are three faults showing shift of cherty quartaite bands. Two of the faults are present at east of Rajpura village and third one at northern end of the central ridge. It is authors presumption that cause of these faulting is rupture and movement parallel to F3 fold axis of the study area.

It is known that the Bhilwara Supergroup have been deformed "ong wNW-ESE to NW-SE trending axial traces (GSI, 1977) The deformation is known to be manifested by folding of S2 schistosity and F2 axial trace along the superimposed WNW-ESE axial traces. The fold kinematically related to D3 have been designated as F3 and the lineations have been described as j33 It exhibits low axial direction stability Although, Geological Survey of India (lqbaluddin et al, 1997) have recorded D3 in Bhilwara Supergroup of rock, specially in the Sawar group, but no such well developed impact of D3 have been observed in the Malikhera-Mokanpura area, possibly because the study area is only a part of the belt of considerable size.

Structural analysis using stereographic projections is well in accordance with the deformation and their imprints. Lineations J31 and j32 detected in all the sectors are almost overlapping confirming consistency in the results, obtained in the present study.

II. TIME RELATION BETWEEN METAMORPHISM AND DEFORMATION PHASES

The metamorphites of the area have suffered progressive regional metamorphism ranging from greenschist to amphibolite facies ie from hiorite to Staurolite on the basis of metamorphic textures An attempt as been made to decipher the metamorphic history and time - relationship between different phases of metamorphism and deformation Three main metamorphic episodes, named Ml, M2 and M3 have been recognised and described as below :

(i) First Phase of Metamorphism (M1)

First phase of metamorphism (M1) took place in rocks which were subjected to increase in temperature and confining pressure due to load and overburden of rocks. During this phase the main schistosity was formed. Alignment of chlorite, muscovite, biotite, quartz along the SI schistosity plane and absence of growth of garnet,

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staurolite and kyanite related to SI (Dl deformation) suggest that the schistosity was formed under greenschist facies. This schistosity forming metamorphism is syn-kinematic to Dl and is designated as Ml metamorphism.

(ii) Second Phase of Metamorphism (M2)

The metamorphism reached its peaks during second phase of metamorphism M2, with the crystallization of pelitic index minerals like garnet, staurolite and kyanite. Two stages are recognised under this metamorphism. The first stage of M2 metamorphism took place during post D1 under static condition. Porphyroblasts of biotite, garnet, kyanite and staurolite grew across the S1 schistosity. The second stage of M2 metamorphism coinsided with the initiation of D2 deformation. Syntectonic garnet porphyroblast syn-kinematic to D2 folds are observed. The crenulation cleavage related to D2 deformation show crenulation cleavage with the preferable aligned biotite, muscovite. This textural relationship suggests that during D2 metamorphism, only micas and garnet have grown. This phase was prograde regional metamorphism of Barrovian type.

(iii) Third Phase of Metamorphism (M3)

Garnet and biotite showing alteration to chlorite is widely distributed, suggesting a retrograde phase of metamorphism. This retrograde phase of metamorphism was resulted due to fall in temperature and pressure as a result of uplift. Retrogression is post D2 and hence this phase of metamorphism is designated as M3. It shows growing down grade with decreasing temperature involving hydration and carbonation reactions.

IV.CONCLUSION

The deformational study, shows that there are three deformations named as Dl, D2 and D3. The structural elements which are related kinematically such as folds and planer and linear tectonic anisotropy have been accommodated with in the same deformational episode. It is concluded that the first deformation (Dl) has been recorded by earliest fold (Fl) occur as mesoscopic structures, tight by appressed, overturned and gently to moderately plunging and locally acquire a reclined geometry with axial plane trending N-S. The temporal relationship of D2 has been established on the basis of refolding of Fl by F2. F2 folds are present on micro, meso and macro-scales F2 folds are moderate to steeply inclined open folds with low amplitude to wave length ratio S2 schistosity is well developed as axial plane cleavage of F2 folds. S2 is the regional foliation. In the hinge zone it shows angular relationship with bedding, whereas on the limbs, it tends to be parallel to sub-parallel with bedding. The third deformation (D3) have developed F3, constituting a set of upright folds with almost east-west axial traces. These folds has caused a plunge instability of F2 folds leading to large scale axial culminations and depressions of F2 fold axis. Faults developed north to Rajpura etc. are resultant to rupture along F3 fold axis. Author's study refute the older view that these rocks are western limb of northeasternly plunging macrosyncline a closure of which recorded at Bhinder.

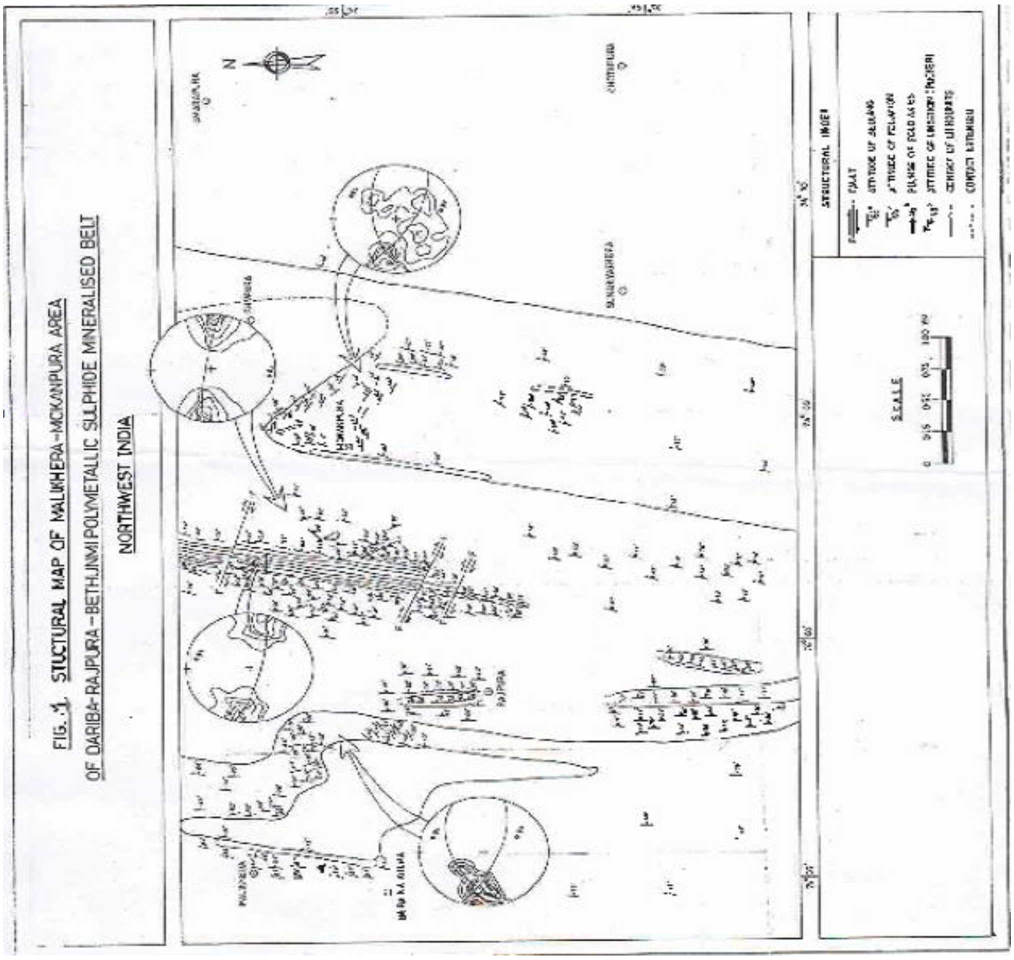

Figure: Stuctural Map Of Malikhera-Malikhera

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