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GENETIC MODEL FOR MINERALISATION WITH SPECIAL REFRENCE TO MALIKHERA-MOKANPURA AREA OF DARIBA-RAJPURA-BETHUNMI POLYMETALLIC SULPHIDE BELT RAJASTHAN

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ABSTRACT

The present paper deals with genetic model for mineralization with special refrence to malikhera-mokanpura area of dariba-rajpura –bethunmi polymetallic sulphide belt Rajasthan. The assessment has been discussed in the light of genetic model already available for belt and certain studies performed by GSI earlier including geochemical and geophysical studies. Significance of present detailed study of deformations and polymetamorphism has also been discussed.

Keywords: dariba-rajpura-bethunmi belt, mineralisation, genetic model, polymetamorphism, deformation

I. INTRODUCTION

The Dariba-Rajpura is one of the most important polymetallic sulphide deposit of the world The Malikhera-Mokanpura area is adjacent area to the Rajpura mineralized block of Dariba-Rajpura-Bethunmi polymetallic sulphide mineralized belt. The belt is almost 17 kms. long with Dariba as its southern end and Bethunmi as its northern end. The proposed area of study is northern extention of well known Rajpura-Dariba polymetallic sulphide deposit. The Malikhera-Mokanpura area (Latitude 74°07 to 74°11' and Longitude 24°57' to 25°00') is part of Survey of India Toposheet No. 45 K/4 and 45 L/1. The area is part of newly created Rajsamand district. Earlier, it was part of Udaipur district In fact it is a junction of three political districts, Rajsamad, Chittorgarh and Udaipur within the radius of 15 kms.

II. IMPLICATION OF GENETIC MODEL

As the study area is part of a mineralized heft, namely Dariba-Rajpura-Bethunmi polymetallic sulphide belt, the possibility of mineralisation can be expressed in the light of Genetic model of the deposit, available. Shrivastava (1992), on the basis of evidences has proposed that Dariba-Rajpura deposit belong to the sedimentary exhalative category, as far as their genetic modelling is concerned Such models been reviewed earlier by Morganti (1981);

Garson and Mitchell 31); Gustafson and Williams (1981); Large (1981, 1983); Turnit J84) and Hutchison (1983) The physico chemical control on formation 1F deposits have been discussed by Finlow-Rates (1980), Russell et. al (1981), Russell (1983), Lydon (1983), Lydon et al (1986), Goodfellow and Jonasson (1986a, 1986b) and Macintyre (1992) In general, the consensus among these workers is that the deposits formed by precipitation of sulphide minerals from metalliferous brines that were exhaled along active submarine faults. Metals and fluids were most likely derived from the sedimentary pile either by normal dewatering during basinal subsidence or by hydro-thermal leaching during periods of elevated heat flow and convective circulation of seawater through the sedimentary pile.

In the Rajpura-Dariba deposit, there is direct association of acid volcanic layers in the host rocks. The doubtful microfossils of bacterial dimension including framboids (Shrivastava, 1981) proiide some evidence of life, if not their active involvement in the oregenesis Profuse occurrence of Graphitic-mica schist (organic/carbonaceous matter) in the Dariba-Raipura deposits is probably the most impoilant evidence of life. The most likely source of organic matter seems algae.

It is further proposed by Shrivastava (op cit) that the water column in the basin can be divided into three parts, the deepest reducing conditions with rich H_2O, the intermediate or CO2 zone, and the shallow oxygen zone The bacterial decomposition occur at the deepest zone The intermediate or transition zone is conducive to partial oxidation of organic matter so as to produce abundant CO_2 while maintaining strongly reducing milieu. In the shallow zone, there is virtually complete oxidation of all organic matter. Before deposition of parent to the graphitic-mica-schist (Carbonaceous shales) at DaribaRajpura there were evaporitic conditions as evidenced by presence of: scapolite. Silica is also deposited being rich in the sea water, in the form of chert or somewhat replacing carbonates. The high carbon content indicate slow sedimentation in anoxic sedimentary exhalative deposition in subsiding basin may also be controlled by movement of rifted blocks.

The Genetic model (Shrivastava, 1992) keep on saying that at the sediment water interface in such an anaerobic basin, several centres of nucleation of crystallization of the precursor minerals of pyrite were initially formed and later produced their microcrysts. The microcrysts were attracted by each other, probably magnetically, and appear to have aggregatised to form microspherules. The pyrite framboids were formed through a process in which precursor spherules have undergone sulphur oxidation resulting into pyrite microcrysts. The spherical form of the framboid can be interpreted as the response to the requirement of achieving minimum surface area. Good number of textural variations observed helped to clearly demarcate atleast three major onological stages of diagenesis. Leaving a side this first stage, in the second stage, framboids showing segregation textures producing opthalmic pattern, poly framboidal texture, motion and disruption features. In the third stage, all the framboidal pyrites gradually got converted into massive types by coalescence followed by recrystallization then producing tripple point junctions and later pentagonal tendency before their complete digestion into massive variety. Shrivastava's model (op.cit) can be summarized in the form of following steps:-

(i) Heated metal rich dense brines are exhaled periodically from fault controlled vent bounding graben where slow sedimentation is in progress into deep anoxic parts.

(ii) The pulses of exhalation of metals show a defined sequence - Fe, Zn, Pb and Cu. The combinations of the two nearer metals in the transition is more likely, although there may be more than two metals.

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(iii) Organic matter might have contributed 's' as part of organic sulphur become available as H_2S during bacterial attack before consolidation of sediments, while the residue is gradually released during thermocatalytic breakdown of the burned organic matter. Alternatively, brines carrying metal chloride complex causing the release of hydrogen suiphide by thermal degradation of sulphur ntaining organic compounds Sulphur in part might have derived ogenically from sulphate

(iv) As, the exhalation occur in the form of neutrally buoyant plumes that spread laterally across the sea floor below a density interface, it satisfy the formation of thin laminae of sulphides over relatively a wide areas The deposition of metals from hot brine is more effective around the margins of the basin where they met and mingled with cooler waters The sulphides are precipitated from these plumes in response to the physico-chemical conditions of the depositional basin.

III. BEARING OF STUDY ON DEFORMATION

The Dariba-Rajpura part of the belt show very narrow basin iongated for a strike length of 3 kms. In this part the mineralized loads are concentrated along two faults. These two faults are parallel to each other and the regional strike of the area, thus almost N-S. Among two faults, eastern fault has accumulated metals to form a load called East load. In the western fault there are two loads named North load and South load. It is very clear that mineralization is fault controlled.

Coming to the further north of Rajpura village to the present study area, these faults have been totally vanished from the surface of area leaving no traces. Sammaddar, (1987) have clearly mentioned that there are no evidences his team of Geological Survey of India could detect for these mineralized faults.

Author's study, on deformation is significant in the sense that these faults have been traced. Availability of the ferruginous breccia itself is the most prominent evidence which is also rich in gossans and showing high geochemical values even of Hg. Further north, the fault have been traced as large yellow soil (of gossan) have been recovered in at least two dugwells, one at Malikhera another further north to Malikhera.

This is authors presumption presumption that the mineralized faults have been greatly shifted west ward following fanning of F3 folds.

IV. BEARING OF STUDY ON POLYMETAMORPHISM

As model says, the mineralization occur in a sedimentary basin where metals and possibly sulphur have been exhaled periodically before get deposited to form one layer, after another.

The syn-sedimentation, has although made the metals available to the belt but could not concentrated the same to make a deposit of economic potential. In fact, later processes are responsible for the same. At a later date the metals remobilized and get concentrated in the form of load as ore shoots, veins, stringers cross cutting the host syn-sedimentary rocks (now, metamorphites).

While making a total scanning of all the geological events the area has suffered, it is author's proposal that possibly the effective mobilization could have occur at the time of M2 phase of metamorphism. the second phase of metamorphism M2 was most intense and effective because there has been maximum spread of heat and pressure both. Preservation of graphite shows a role of gaseous phase. There is a possibility that maximum

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temperature and pressure must have reached some 650°C with 4 to 6 KB pressure. It is concluded on the basis of kyanite, staurolite and pyrrholite geo-thermometry and geobarometry.

Deb et. al. (1989) has expressed that Pb isotopic data shows date of mineralization around 1800 Ma. If author will treat the as reliable one, this must be time of M2 metamorphism itense ,mobilisation of metals and hydrothermal activity.

V. CONCLUSION

Shrivastava's genetic model (1992) has explained the ore genesis to enough degree of satisfaction. As the model says, the mineralization occur in a sedimentary basin where metals and possibly sulphur have been exhaled periodically before get deposited to the form one layer, after another. The synsedimentation has although made the metals available to the belt but could not concontrated the same to make a deposit of economic potential. In fact, later processes are responsible for the same. At a later date, the metals must have been remobilized and get concentrated in the form of loads making ore shoots, veins, stringers, cross cutting the host syn-sedimentary rocks (now, metamorphites) and to each other.

While making a total scanning of all the geological events and their order the area has suffered, it is authors conclusion that possibly the effective mobilization could have occur at the time of M2 phase of metamorphism. The second phase of metamorphism (M2) was most intense and effective because there has been maximum spread of heat and pressure both. Preservation of graphite shows a role of gaseous phase. There is a possibility that maximum temperature and pressure must have reached some 650°C with 4 to 6 KB pressure. It is concluded on the basis of Kyanite, Staurolite and Pyrrhotite geothermometry and geobarometry.Deb. et. al. (1989) has expressed that Pb isotopic data shows the date of mineralization around 1800 Ma. If author will treat the data as reliable one, this must be time of M2 metamorphism intense remobilization of metals and hydrothermal activity.

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