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Occurences of Copper and other Metal Mineralization Near Village Phalet, East Of District Udaipur, Rajasthan, India

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Asbstract: ***In north-western India a thick pile of Precambrian stratified clastogenic and organogenic rock assemblage are present. Volcano-sedimentary and igneous rocks resting over the underlying Banded Gneiss Complex (BGC of Heron, 1953) are also known as Bhilwara Supergroup (Gupta et al., 1992) and Mewar Gneiss Complex (Roy and Kröner, 1996 and Roy and Jakhar 2002) (Table No 1). The area has undergone with a polyphase deformation and first order unconformity. Due to the regional metamorphism the rocks belong to green schist facies.***

The copper occurrences in village Phalet, east of Udaipur were investigated. The area consists of a number of old workings showing malachite stains in the quartzites inter-bedded with chlorite schist. Sulphide occurrences have also been observed along fractures in the quartzites. In the area a zone of old workings extends over a strike length of 800 m close to the Aravalli/Pre-Aravalli contact. Small slag heaps, gossan, malachite and azurite coatings are observed in the exposures near the old workings which shows smelting of the ore was onsite only. The ore body is confined to a highly sheared quartzite within migmatite and granite gneisses. Chalcopyrite and Pyrite generally occur parallel to bedding or foliation. Thick ore zones are seen in hinge zone of F2 folds.

I. INTRODUCTION

The rocks belonging to the Aravalli Supergroup comprise a wide variety of lithotypes and show regional migmatisation associated with the granitic activity. Several occurrences of copper were reported from the Aravalli in the eastern part of Udaipur district. Ancient copper workings are known to exist near Untrol, Rampura, Oden, Vilota, Lilawa, Vaparo, Kotri, Nana, Sakroda, Phalet, and Boi-ka-Pancholi villages in the Udaipur district. It is interesting to note that the copper occurrences in this area are associated with the basal Aravalli quartzites flanking the Banded-Gneissic-Complex (Heron, 1953) and in most of the cases have a similar geological setting. At Phalet, isolated old workings showing malachite stains (Plate 1E) are seen in the Banded-Gneissic-Complex and Basal Aravalli Quartzite. Considering the extent of old workings and the large amount of slag (Plate 2B) dumps present nearby, areas near Phalet has been investigated.

II. LOCATION

Phalet village (latitude 24°00' and 24°01' and longitude 73°53' and 73°54') of Udaipur district located 26 kilometers SE of Udaipur, lies in the Survey of India toposheet No. 45 H/14 area exposes metamorphites and younger intrusives belonging to the Pre-Aravalli and the Aravalli Supergroup of rocks. The Aravalli rocks of the study area strike NNW – SSE and dip at 60° to 70° easterly.

III. GEOLOGICAL SETUP OF THE AREA

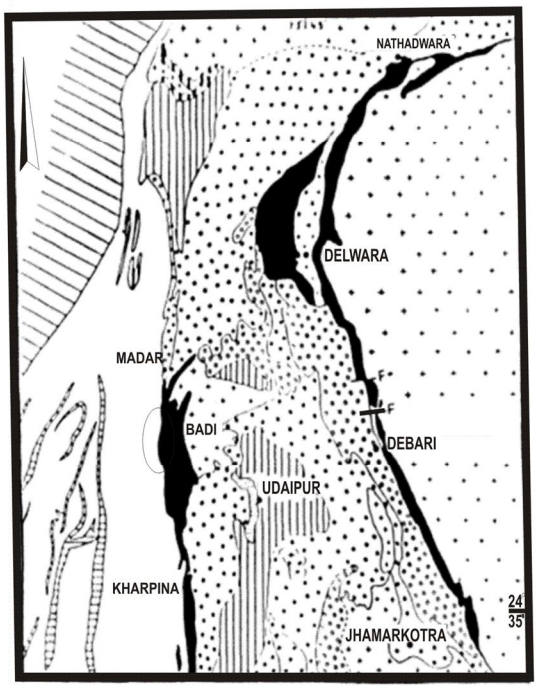
Heron (1953) considered Banded Gneissic Complex (Pre-Aravalli) as representing the remnants of an old igneous floor on which the Aravalli sediments were deposited. The Pre-Aravalli rocks are migmatitic in nature in which banded biotite gneiss and granitic - gneiss are the most dominant constituents within which mica schist, quartzite, fuchsite quartzite and amphibolite are often found. Chlorite-schist interbedded with lenticular quartzites, massive quartzites, talc chlorite schist and migmatites belonging to Aravalli system are observed. All the Pre-Aravalli members are later intruded by pegmatite and aplite.

In 1981, the term ‘Bhilwara Supergroup’ has been introduced for the Pre-Aravalli and assigned an age between 3.2 and 2.5 b.y. The overlying Aravallis are represented by conglomerate, quartzite, garnetiferous biotite schist, calc - argillite and marble (younging towards west). These rocks represent a group of low grade metamorphic rocks intruded at places by syn to post-tectonic granite. Gupta et al. (1980) have assigned Aravalli Supergroup status to the Aravalli System of Heron. The general trend of the rock

formations is NNW –SSE with moderate dips in an easterly direction. The quartzite bands display well preserved mega – folds. These have been superposed by broad upright E – W trending warps.

The early Proterozoic Aravalli Supergroup of Rajasthan includes a thick basal unit of mafic volcanics with intercalated quartzites. The volcanics have been metamorphosed from greenschist to amphibolite facies which, together with intense deformation, obliterated original mineralogy and texturs.

FIG: 1 Simplified geological map of Aravalli Supergroup in the type area (After Roy et al. 1988) showing distribution of various lithological units.



The sedimentary structures observed in the Aravalli quartzites and the amygdules in metavolcanics indicate that the Aravalli sequence is normal and not upturned as suggested by Heron(1953). Further, no evidence is available to say that the quartzites are deposited over the erroded surfaces of gneisses.

Heron (1935) recorded malachite staining and old workings 3.5 miles SE of Sakroda at the junction of the basement gneisses complex and the Aravallis. Dunn (1942), Roy (1958) and Jhingran et al., mentioned the Sakroda copper occurrence in their publications. Gossan is intermittently exposed in the quartzites occurring within migmatite (Pre-Aravalli) (Plate 1F). Besides gossan, malachite and azurite coatings are also seen in the exposures near the old workings.

Stratigraphically area has been classified under Delwara Group and Debari Group (Roy and Jakhar 2002). The rocks of the Delwara Group is forming lowermost unit of Aravalli Supergroup (Table 1). It occurs along the eastern margin of the Aravalli hills discontinuously in an enechelon pattern in between Nathdwara to Phalet, Ora to Jaisamand, Salumbar to Ghatol and further beyond Talwara. Chlorite schist is the major rock in the area exposed along the western slopes of the ridge and in the valley below; while prominent bands massive quartzite of uneven thickness occur along the crest of the ridge. Along the eastern slopes of the ridges, migmatites at lower levels occurs as a continuous band.

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The rocks of Debari Group have been considered as the basal sequence of the Aravalli Supergroup resting over the pre-Aravalll gneisses and schists with a first order erosional unconformity.

Temporally the unconformity has been placed at 2500 Ma (Anon, 1981). The unconformity at the base of the Debari Group represents the Eparchaean break.

Table 1 Stratigraphy of Udaipur area given by various authors

Heron (1953)	Gupta et. al. (1997)				Roy and Jakhar (2002)		
Delhi system (2000-700m.y.)	Delhi Supergroup				Delhi Supergroup		
"Raialo series" Aravalli system (Archaean)	ARAVALLI SUPERGROUP	Jharol Group	Dovda Group	Nathdwara Group	ARAVALLI SUPERGROUP		Lakhwali Formation / Jharol Formation
						Upper	Kabita dolomite
							Debari Formation
		Barilake Group	Kankroli Group				
							Tidi Formation
		Udaipur Group				Middle	Bowa Formation = Machla mangra Formation
							Mochia Formation = Zawar formation
		Debari Group (Babarmal Formation)					Udaipur Formation
							Jhamarkotra Formation
						Lower	Delwara Formation
Banded Gneiss Complex (>2500 m. y.)	Bhilwara Supergroup				Mewar Gneiss		

IV. STRUCTURE OF THE AREA

The strike of the rock formations is N20°W – S20E on the SE side and N35°W – S35E towards NW of the area dipping at 65° to 70° easterly in almost all the cases. Graded bedding in quartzites indicates normal sequence, younging towards east. Joints trending N60°E - S60°W with 55° to 60° dip towards SE are prominently displayed by all the rocks. In addition to this, the lenticular quartzites show two sets of closely spaced fractures, one set trending N30°W -S30°E with 66° to 70° dip towards NE and the other following the same trend with vertical dips. The brecciated nature of the lenticular quartzites and the fracture pattern suggest that the contact of these quartzites with chlorite schist is sheared, the direction of shearing being parallel to the strike direction (Plate 2A). Fractures have become more prominent due to weathering

V. LITHOLOGICAL DESCRIPTION OF THE AREA:

Prominent rocks of the pre – Aravalli are chlorite schist, granite gneiss and migmatites with bands of quartzite and dolomite. The rocks the Aravalli Supergroup in the area is represented by the basal conglomerates and metabasics interbedded with quartzite. At the contact of gneiss, and metabasics interbedded with the quartzite emplacement of syn-granite is seen. Quartz veins are also common in the area.

A. Migmatites

Migmatites exhibits varying textures, structures and composition. The quartz and feldspathic material constitute about 20 – 90 % of the volume. Banded structure is rather common with the alternate layer of leucogranitic and meleanocratic material. Leucocratic bands are massive and coarse grained, contain quartzo feldspathic mineral with muscovite and magnetite viens at some places. Quartzite bands occur as boudins and rootless / intra folial folds in migmatites. This grade from ortho quartzite to micaceous quartzite and contain magnetite and pyrite dominantly. Amphibolites are very common in migmatites. It shows banded nature near the granite and gneisses.

B. Conglomerates

The conglomerates are observed nearby village Phalet are traced for about 1 km in strike length at the base of highest peak 631 in the area with outcrop thickness of 5 – 15m. Clasts are rounded to elliptical with quartzite, magnetite and amphibolites composition. Matrix is siliceous, argillaceous and feldspathic.

C. Quartzites

The quartzite exposed in the area can be differentiated two varieties foliated or sheared and massive. The quartzite exposed in the eastern side near the contact with granite is sheared and grey to reddish in colour (Plate 2A.). It comprised mainly transparent quartz grains, cherry red and yellow coloured weathered ferruginous matter and mica. The second quartzite band exposed in the western side is massive showing very little or no brecciation, pale to grey in colour, well bedded and medium to coarse grained and sometimes fine-grained to almost gritty in nature. It overlies the chlorite schist and crops out prominently along the crest of the main ridge, and has a maximum thickness of nearly 50 meters. Current bedding is seen indistinctly at a few places while graded-bedding is strongly displayed. Lenticular bands of quartzites occur in the west of the conglomerate beds. Ferrugineous quartzite (Gossan) is present in the eastern side is sheared exhibiting dark brown and red coloration (Plate 1F) has been obsereved and some of the old workings are also seen. In the hill 662, malachite stains are seen in the quartzites. Magnetite, fresh pyrite and chalcopyrite are also present in the quartzite.

D. Meta Volcanics

On the west of quartzite thick band of meta volcanic are exposed (Plate 2D). The rock is well foliated and contain irregular to elliptical vesicles filled with quartz, carbonate and malachite. It is dark green in colour and contains amphibole and chlorite. At some place, malachite stains are found in meta volcanics.

E. Calc – Argillites and Marble

In the area west of hill 662, calc – argillites and marble overlies meta volcanics. These units are exposed over width of 0.5 to 1.5 km. To the west of these rocks granites and gneisses are exposed. Locally, steatite/ pyrophyllite bearing marble are also seen traversing these rocks.

F. Granites, Pegmetites and Quartz Viens

Granites occur within migmatites show gradational contact. At places, leucogranite patches are also seen. Granite is rich in magnetite near the contact of ferrugineous quartzite. Several pegmatites and quartz viens are seen in the area. Sometimes, pegmetites are rich in pyrites. These pegmetites are parallel to the foliation.

G. Calcite and Siderite Viens

Thin calcite and siderite viens ranging in width from a few mm to few cm are seen traversing the metavolcanics and quartzites.

VI. EVIDENCE OF COPPER MINERALIZATION

It is interesting to note that ancient copper workings are known to exist near Phalet-Karget-Sakroda in the Udaipur district associated with the basal Aravalli quartzites flanking the Banded-Gneissic-Complex. Many isolated old workings showing malachite stains are also seen in the Banded-Gneissic-Complex. Considering the extent of old workings and the large amount of slag dumps (Plate 2B), the area must have been mined out in old time for copper.

A. Gossan

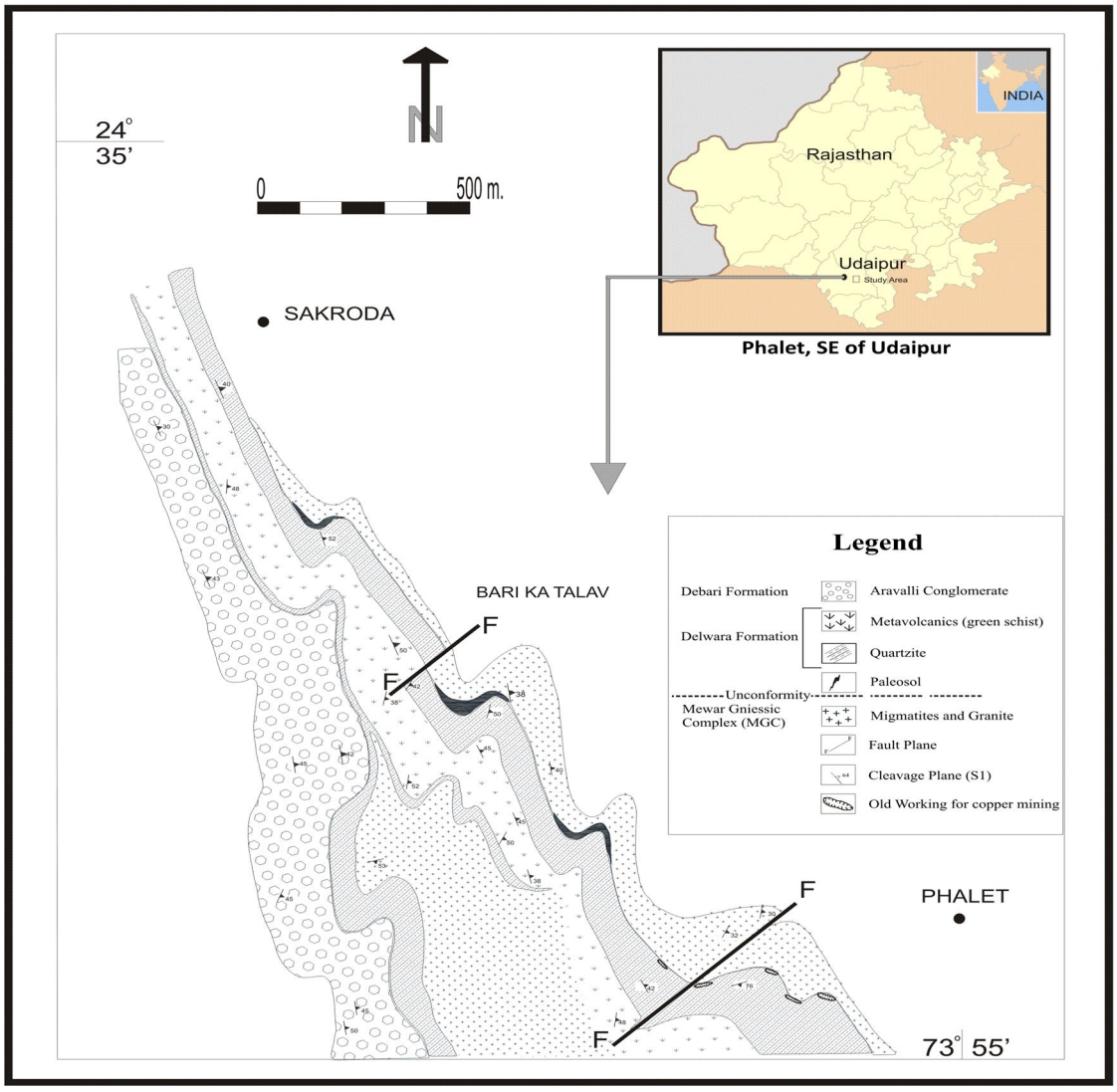
Gossan is exposed intermittently in the quartzites occurring within migmatite (Pre-Aravalli) over a strike length of 600 m, but close to the western part of the old workings. Gossan (Plate 1F) occurs in the highly sheared quartzite (Plate 2A), quartz - mica schist and granitic gneiss. It is vuggy, semi-porous, brick red, coffee-brown or ochreous yellow in color with varying amount of limonite (Plate 2C). Box works, when seen are either coarse cellular or fine cellular with hard walls. The angle between rifts is obtuse. The minerals identified include hematite, goethite (Plate 2C), jasper, muscovite, sericite and kaolinite. Near the old workings, profuse malachite staining is observed (Plate 1E). Malachite stains are also seen occasionally in metavolcanic, garnetiferous biotite schist and calc-argillite.

B. Old Workings

Old workings are seen confined to three zones. The prominent NE - SW trending zone having a strike length of 1200 m (located 1.5 km west of Phalet village) is being studied. This zone of old working with 31 pits, inclines or shafts are largely confined to quartzite (Plate 1A & B), bands occurring within migmatites. The inclines are along the pitch of the fold i.e. 30° - 35° towards SE, incidentally parallel to the fold axis.

The second zone of old working is sub parallel to the main zone and has 5 shallow pits concentrated over length of 150m. Mine dumps are seen scattered all along the ridges. In the northern part nearly 1.5km from the first zone, a third zone of old working is present (Plate 1C & D). These are confined to the contact of ortho-quartzite with meta volcanic and extended over 0.50 km. The old working trend in N-S direction. The old workings are in the form of small pits presently filled with mine dumps. There is only one open pit which is circular in shape, measures 50m in diameter. A limited quantity of slag heap is noticed near the main zone of old working and nala closed to Phalet village.

FIG: 2 Geological map of study area around village Phalet, showing distribution of various lithological units and structure data.



C. Slag damps

Slag dumps of copper are seen in the west of village Phalet and near the copper occurrence (Plate 2B). The sizes of dumps indicate the extensive mining of copper ore in the past though large quantity of slags had been used in construction and road making material by villagers.

VII. COPPER MINERALIZATION

Quartzite, quartz sericite and muscovite schist are the principal host rock of copper mineralization, although it is also seen in granite gneisses and quartz vien. The dominant minerals in the schist are quartz, muscovite, K- feldspar, epidote and dolomite. K- feldspar occur as large sub- idioblastic grains and are pro tectonic evidence by dislocation of twin planes. The sulphide ore minerals (Plate 2E & F) are oriented parallel to the foliation, quartzite often contains magnetite besides sulphide ore. The mineralized quartzite contains alternate bands rich in pyrite. The foliation is parallel to the bedding and Chalcopyrite occurs as fine to coarse dissimination, stringers, vienlets etc.

In the richer zone chalcopyrite occur as stock works within quartzite with shears and fractures (Plate 2A). Chalcopyrite occurs as coarse to medium xenoclastic grains parallel to schistosity often as inclusion in feldspar and quartz. Idioblasts of pyrite are seen on schistosity. Magnetite and pyrite together occur as compositional bands. These bands make an acute angle with schistosity.

VIII. CONCLUSION

The main rock type hosting the copper mineralization and staining is quartzite (Plate 1A &E) having a general trend of N20W dipping at 65 easterly, although some granite gneiss and quartz vien also show the same. The mineralization is confined to the eastern side only due to the shearing effect and is absent on the western side of quartzite band. The contact is sheared in the eastern side of quartzite band which pronounced the most favorable conditions for the mineralization which was accumulated and further remobilized to the F2 fold hinges where as in the western side the quartzite rock is hard and massive and could not generate the conditions for the mineralization.

Thick encrustation of malachite staining with the specks of chalcopyrite and pyrite has been traced for the strike length of 60 m, 2.5 km NW of village Phalet. The contact of granite and basal quartzite is marked by intensive shearing, faulting and re crystallization where malachite stains are observed and is also the zone of copper mineralization with sericitisation along with the highly ferruginous siliceous rock at its contact.

The occurrences of copper trending E-W has been worked by three isolated old workings. The northern one is quite big in size and appears to be vertical shaft like opening (10 m wide & 16 m deep) filled with rock debris. The old workings observed in the southern part are in the form of elongated shallow trenches 10 - 20 m. long and 5 m. wide.

The mineralization some trending NE – SW does not extend for more than 50 m- and marked by isolated dark brown outcrops which are highly sheared and are filled with siliceous & recrystallised calcareous material. Disseminated specks of chalcopyrite and pyrite along with lump of ferruginous matter are also seen associated with the sheared rock. The copper was mined out in earlier days as we are getting the slag heaps spreaded out in surroundings of Village Phalet. Some quantitity of slag has been used for road making raw material in the village. gossans and old workings can be correlated with slag heaps and metal extraction process in ancient time (Plate 1F).

REFERENCES

[1] Bakliwal, P.C., Ramasamy, SM. and Ray, A.K. (1983). Lineament tectonics of Proterozoic basins of western India. Abs. Proc. Seminar on Proterozoic 1983, Lusaka, Zambia (April 1983)
[2] Chauhan, N.K., Sharma, B.L., Mohemmad Sabah, A., 1996. Structural geometry and strain history of the Early Proterozoic Aravalli Rocks of Gorimari, Udaipur District, Rajasthan. Journal Geological Society India 47, 59–74.
[3] Chauhan, N.K., Sharma, A., Sharma, V., 2004. Geology and structure of rocks exposed north-east of Gogunda, District Udaipur, Rajasthan. Rajasthan Mineral Bulletin DMG 25, 10–15.
[4] Dunn, J.A. 1964 Bulletin of G.S.I. on Copper. 1981
[5] Goel O P 1988 Petrogenesis of basal Aravalli metabasites, east of Udaipur, Rajasthan; In: Precambrian of the Aravalli Mountain, Rajasthan, India (ed.) Roy A B; Geol. Soc. India Memoir. 7 317–326
[6] Gupta, S.N., Arora, Y.K., Mathur, R.K., Iqbaluddin, Prasad, B., Sahai, T.N. and Sharma, S.B., 1980. Lithostatigraphic map of Aravalli region. Geological Survey of India, Hyderabad.
[7] Gupta SN, Mathur RK, and Arora YK 1992. Lithostra-tigraphy of Proterozoic rocks of Rajasthan and Gujarat - A review. Rec Geol Surv Ind, 115; 7-8; 63-85,
[8] Gupta, S.N., Arora, Y.K., Mathur, R.K., Iqbaluddin, Prasad, B., Sahai, T.N. and Sharma, S.B. 1997. Mem. Geol. Surv. India, 123, 1–262.
[9] Heron, A.M., 1953. Mem. Geol. Surv. India, 79, 1–389.
[10] Heron A.M. 1935 The geology of central Rajputana, Mem. G.S.I, Vol, 79Heron, A.M. (193 The Geology of South Eastern Mewar. Mem. Geol. Surv. Ind. 68(1): 1-120
[11] Helga de Wall, Manoj K. Pandit, Narendra K. Chauhan 2012. Paleosol occurrences along the Archean–Proterozoic contact in the Aravalli craton, NW India, Precambrian Research 216– 219 (2012) 120– 131
[12] Hills, E.S. (1963). Elements of Structural Geology, John Wiley, New York, 483 pp Jayaram, B. N., and Mathur, R. K., 1975, Syngenetic sulphide metallogenesis in the Precambrian of south eastern Rajasthan: Geol. Survey India. Misc. Publ. no. 34, p. 179–186.

[13] L S Shekhawat, M K Pandit, and D W Joshi. Geology and geochemistry of palaeoproterozoic low-grade metabasic volcanic rocks from Salumber area, Aravalli Supergroup, NW India.
[14] Paliwal, B.S. (1981): Tectonics of Precambrian rocks southwest of Udaipur. Unpublished Ph. D. Thesis, University of Rajasthan, Jaipur. 1-121
[15] Rai, D.K, 1985. Exploration for copper in Phalet area, Udaipur district, Rajasthan (F.S. 1983-84) Roy A B and Jakhar S R 2002 Geology of Rajasthan (Northwest India) - Precambrian to recent; Scientific Publishers (India), Jodhpur, pp 42
[16] Singh, P.N. 1978 Investigation for base metal mineralisation in Nana, Sakroda, Kotri area, Udaipur district, Rajasthan, Progress report for F.S. 1977 – 7
[17] Yadav. P.K. 1981 Progress report for F.S, 1980-81 on base metal investigation in Phalet are Yadav, P.K , 1983. Interim report on exploration for copper in Phalet area, Udaipur district, Rajasthan (F.S. 1980-82)

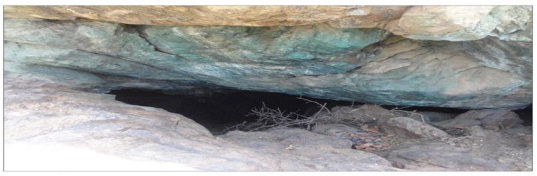
Plate: 1

A. Series of old working pits in sheared quartzite and granite contact trending roughly E-W direction along F2 (1st zone)

B. Close view of a shaft in an old working pit for copper mining.

C. Old workings for copper mining in the eastern slope (3rd zone).

D. An old working on eastern slope of the hill filled by debris of quartzite.



E. Malachite staining at old working sites along sheared quartzite.

F. Gossan zone in sheared quartzite near old working of copper mining.

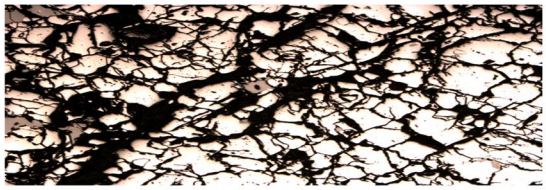
Plate: 2

A. Quartzite band showing intense shearing effect. Note: hammer in direction of shearing

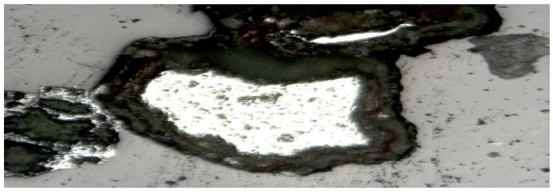
B. Presence of slag scattered around village phalet indicating ancient metal extraction practice

C. Occurrence of goethite and limonite in sheared quartzite SW of village Sakroda

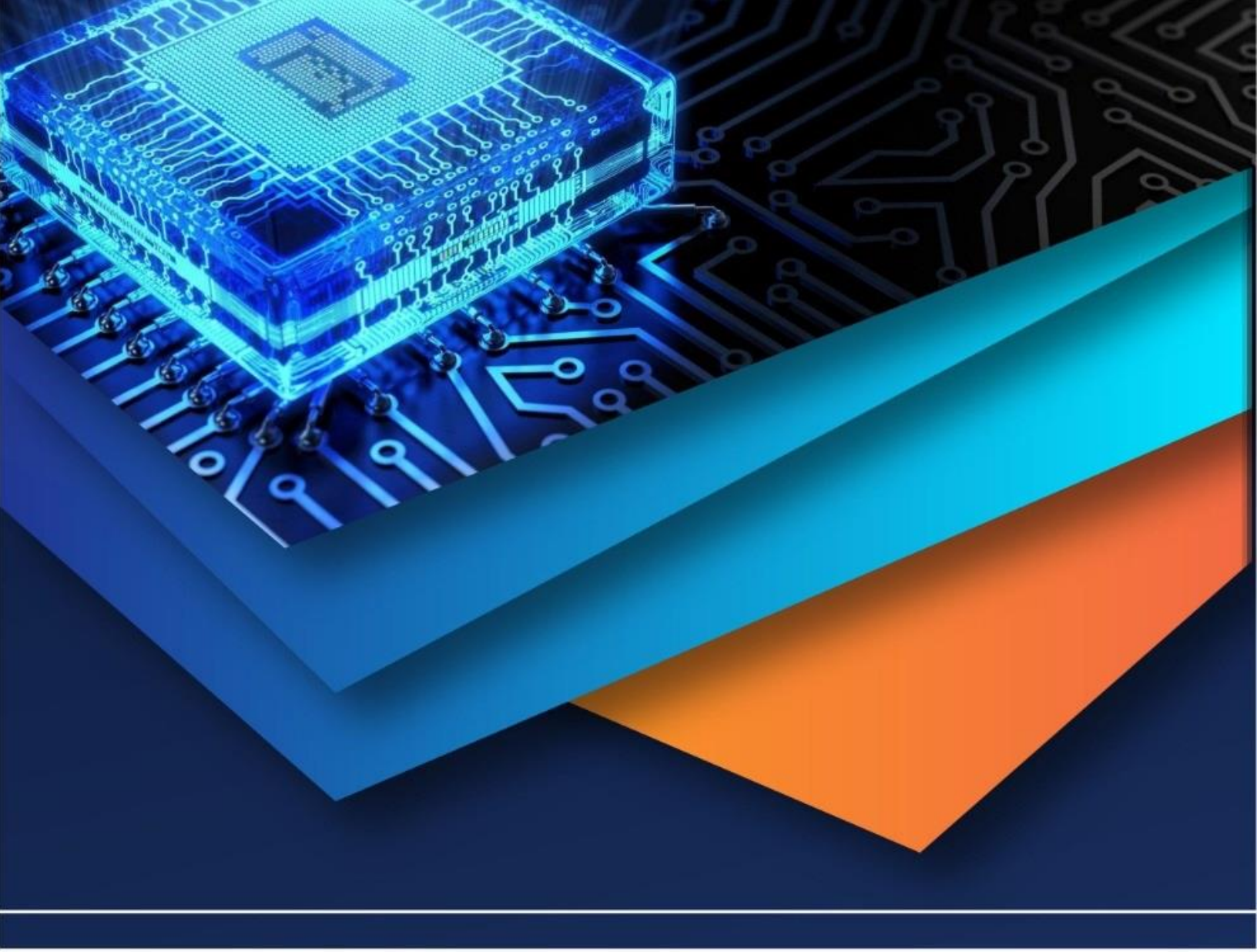
D. Folded Quartz vein in metavolcanics indicating F2 fold.



E. Chalocopyrite and other sulfides in polish Section



F. Polish section of Sheared Banded Iron Quartzite showing specs of sulphide mineral phase



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