iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** IX **Month of publication:** September 2017

DOI: http://doi.org/10.22214/ijraset.2017.9069

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue IX, September 2017- Available at www.ijraset.com

Geology and Base Metal Mineralisation around Village Munwas, Udaipur, Rajasthan

Kavita Bhardwaj [1], Narendra K. Chauhan[2]
[1, 2] *Department of Geology, Faculty of Earth Science, M.L.S. University, Udaipur-313001, Rajasthan, India*

Abstract: ***The study area is present near the contact of Aravalli Supergroup and Banded Gneissic complex (Mewar Gneiss). Number of Copper occurrence has been recorded in the form of Malachite stains on surface at the contact which is affected by ductile shearing. Copper mineralization is controlled by this ductile shear zone and primarily distributed in transitional unit of quartzite and meta-volcanic rock with some pyrites and magnetite from Kotri in South to Gopakuda in North. Old workings and slag heaps are also present near Kotri village which is situated NE of Munwas village. Copper mineralisation is confined to the ridges forming the edge of hilly terrains of Lower Aravalli Supergroup.***
Keywords: Base metal, Copper, Munwas, Kotri, APC contact

I. INTRODUCTION

Munwas village is 19 km North of Udaipur district whereas Kotri village (study area) is 3.5 km NE of Munwas village between 24˚ 46' Latitude and 73˚ 45' Longitude which falls in Survey of India toposheet no. 45H/14 and is located at the contact of Aravalli Supergroup and Banded Gneissic Complex *(*Mewar Gneiss). The area comprises a gently undulating country rock towards east and a rugged terrain towards west.

Detailed geological map of the area prepared on Scale 1:5000. In addition, geochemical sampling including rock chip samples, soil samples and stream sediment samples have been collected from this area and analysed by hand held XRF machine.

II. REGIONAL GEOLOGY

Regionally study area is part of Aravalli Supergroup and falls in Delwara formation of Lower Aravalli Supergroup (Table-1). In the type area (the Nathdwara-Udaipur-Jhabua belt), the entire meta-sedimentary rocks with minor volcanic and ultramafic intrusive comprising Heron's 'Aravalli system', 'Raialo series' and the 'outliers of the Delhi system', lying between the pre-Aravalli gneisses in the east (renamed as the Mewar Gneiss after Roy et al. 1988 and Jakhar 2002) and the Delhi fold belt in the west have been defined as the Aravalli Supergroup. The unconformity at the base of the Aravalli Supergroup has been recognised by the occurrence of patches of conglomerate, angular unconformity, metamorphic discordance and occurrence of palaeosols. The shelf sequence of the Aravalli Supergroup is divided into two groups separated by a pronounced unconformity marked by surface of weathering, overlapping relationship and conglomerates. The constant westerly younging noted in some formations has been explained as due to rotation of these units initially, by listric normal faulting and subsequently, by the east-west compression during different stages of folding. *(After Roy et al. 1988, Fig-1)*

A. *The Delwara Formation:* The Proterozoic Aravalli sequence commences with basal volcano-sedimentary Delwara Group of rocks occurring along the eastern margin of the Aravalli fold belt between Nathdwara and Salumber. This volcano-sedimentary sequence is represented by meta-volcanic rocks (chlorite schist and amphibolite) with Chert, quartzite and carbonates. This unit has its maximum development in the northern part, in the type area around Delwara as well as in the form of linear zone bordering the western margin of the Ahar River Granite. In south, the sequence pinches out thereby bringing the Debari sequence in direct contact with the basement rock (BGC). In the vicinity of Delwara, the Lower Aravalli sequence occurs in the form of two sub-parallel belts separated by the basement rocks in between. The Delwara meta-volcanics overlie the basal conglomerate and quartzite unit which marks the unconformity between the basement (BGC) and the cover Aravalli sequence. The meta-volcanics are highly vesicular and are constituted of both picritic as well as alkali basalts. These volcanics are related to the rifting of the Aravalli basin. The Delwara sequence passes upwards into a sequence of quartzite, dolomite, phyllite and calc-pelite representing a shelf facies litho assemblage.

Table-1: Stratigraphic Succession of the Study Area by Roy and Jakhar (2002) is:

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue IX, September 2017- Available at www.ijraset.com

III. LOCAL GEOLOGICAL & STRUCTURAL SETUP OF THE AREA

Locally, study area near Kotri falls under Delwara formation of Debari group and belongs to Lower Aravalli Supergroup and situated at Aravalli Proterozoic contact (APC).

Lithologically Area comprises granite gneiss & migmatites (BGC), quartzite with sericite, quartzite with magnetite and biotite, arkosic conglomerate, meta-volcanics (chlorite schist/basalt/amphibolite) and Quartz veins (Table-2).

Granite gneiss of Pre-Aravalli forms a basement which is overlain by basal quartzite of Aravalli Supergroup. Pyrophyllite occurs at contact of Granite gneiss and basal quartzite as small pockets. The Pyrophyllite pocket deposits are metamorphosed 'Al' rich sediments (i.e. Palaeosol), rich of aluminous silicates and forming ancient weathering surface on the rocks of Bhilwara Supergroup (Manoj K. Pandit, Helga de wall, Narendra K. Chauhan, 2008*)* Conglomerate occurs as thin impersistent bands within basal quartzite near contact of meta-volcanics/chlorite schist (Fig-2).

Fig-2: Geological Map of the Kotri (study area) around village Munwas, District Udaipur, Rajasthan

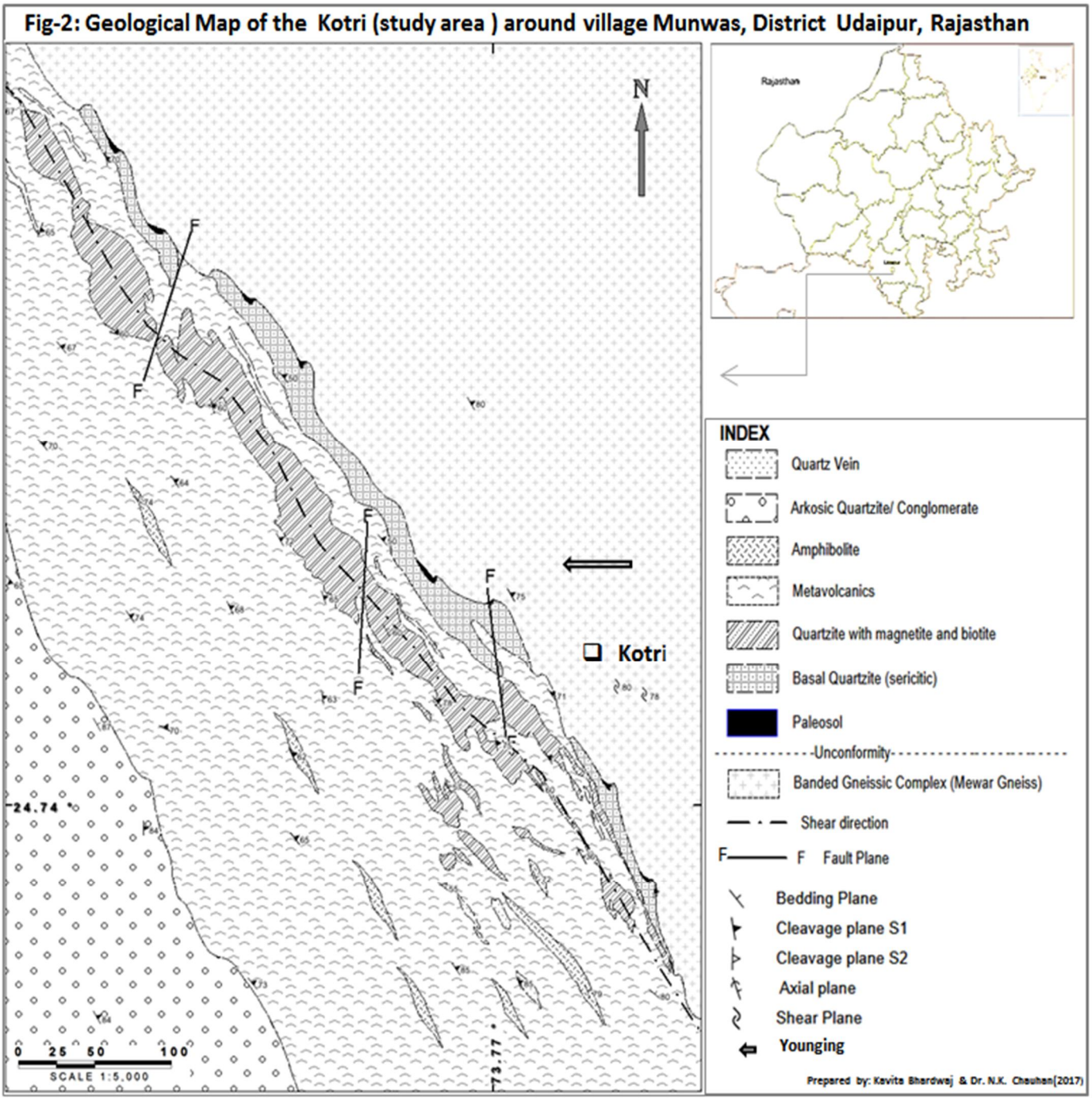


Table-2: Local Stratigraphic sequence in the study area near Kotri is as follows

Lower Aravalli	Arkosic Quartzite (with small to big and rounded to elongated pebbles) Chlorite Schist Transitional unit of Chlorite Schist and Quartzite+- Magnetite & Biotite Conglomerate Basal Quartzite + Vein quartz(milky white)+ pebbly conglomerate
	----------Palaeosols (pyrophyllite + aluminous minerals.)----------
Pre-Aravalli	Granite gneiss/ Migmatites (Mewar Gneiss)

The general strike of the rock units varies between N10˚W to N10˚E dipping 65˚ to 88˚ towards easterly. The area is affected by intense ductile shearing along NS direction. Folding and 3 sets of joints are seen in quartzite and meta-volcanics. Cleavage planes (S1 and S2) are clearly visible in chlorite schist which are axial planar to AF1 & AF2. Rock units are younging towards west and dipping towards east shows rotation may by listric normal faulting and subsequently, by the east-west compression at different stages of folding (Roy et al., 1988)

IV. LITHOLOGIES & PTROGRAPHICAL STUDY OF THE AREA

The following lithologies were noticed during field traverses:

A. Granite Gneiss & Migmatites

Folded and sheared Granite gneiss and migmatites are well exposed on the eastern part of the area. Upper surface is weathered and altered at most of the places and making it peneplain. Granite gneisses are pinkish-grey in colour, medium to coarse grained and hypidio-blastic in texture. The gneissic granite comprises feldspar, quartz, biotite and other accessory minerals.

B. Pyrophyllite

Pyrophyllite is present as small minable pockets at the contact of granite gneiss (BCG) and overlain by Basal Quartzite of Aravalli Supergroup named as a Palaeosols. It is greenish in colour, fine grained and hard in nature. Kyanite also present with pyrophyllite at few places near contact (*Manoj K. Pandit, Helga de wall, Narendra K. Chauhan, 2008).*

C. Conglomerate

Isolated thin lenses of pebbly conglomerate are well preserved in the basal quartzite at eastern margin (Plate 1 a). At western boundary massive conglomerate is at contact of meta-volcanics and yellow to pinkish grey in colour; composed of elongated and sub rounded pebbles of metavolcanics, quartz and weathered feldspar set in a siliceous matrix

D. Quartzite

The Quartzite is exposed at the contact of Aravalli and Pre-Aravalli boundary and forming the ridges ranges near contact. At contact Quartzite is sericitic in nature and not hosting Copper but Quartzite at top of the ridges hill range is little bit magnetic and biotitic and hosting copper mineralisation as malachite staining observed along strike at most of the places. In overall scenario both the quartzites are sheared, recrystallized and fine grained. Colour varies from off white to grey to reddish brown (Ferruginous) and mostly hard and compact in nature and intruded by numerous quartz veins as criss-cross and irregular pattern with different dimensions. Three sets of Joints are common (E-W or NE-SW & N-S). Several dip-slip faults have cut the quartzite. This sheared quartzite is duplicated with meta-volcanics (Plate 1 d & e).

E. Meta Volcanics /Chlorite Schist

These are Hard, compact and greenish coloured with fine to medium grained in texture and shows massive character. Amygduler structures and vesicles are also present and vesicles filled by quartz, calcite, feldspar and epidote at places (Plate 1 b & Plate 2 a, b, c

and d). Some Magnetite's also observed in this unit near village Munwas. A few of bodies show preferred dimensional orientation of hornblende grains whereas at places discordant bands are also noted. In Kotri area, amygdules have been deformed and stretched parallel to the schistocity in rocks. Chlorite schist is light to dark green in colour, fine to medium grained, well laminated and foliated in nature. Exposed part is weathered, rusty and ferruginous at most of the places. Oxidized and fresh pyrite cubes and veins are present at some places (Plate 1 f, g & h).

F. Quartz vein

Quartz veins of different dimensions are present in the area. These are associated with all litho units exposed in the area. Generally the quartz veins are barren of any metallic or other minerals. Brecciation in of Quartz veins observed. Quartz veins are cutting across the rocks most of the place (Plate 1 c & e).

V. MINERALISATION

Surface indications for copper mineralisation in the mapped area include chalcopyrite specks, stain of malachite and small old workings in transitional unit of quartzite-chlorite schist with some pyrites. Slag heaps is also present near study area.

A. Host rock & Ore mineral

In the study area; transitional unit of quartzite & chlorite schist and magnetic quartzite are playing role as host rock for copper mineralisation. Chalcopyrite and Malachite are main ore minerals observed.

Chalcopyrite ($CuFeS_2$ Copper Sulphide) is a brass-yellow or greenish in colour, metallic lustre and high specific gravity. It is brittle and has a greenish grey streak. Copper is removed from chalcopyrite by weathering or solution, transported a short distance, then redeposit as secondary sulphide, oxide, or carbonate minerals.

Malachite ($Cu_2\ CO_3\ (OH)_2$ Copper carbonate hydroxide) is a mineral that forms at shallow depths within the Earth, in the oxidizing zone above copper deposits. It precipitates from descending solutions in fractures, caverns, cavities and inter-granular spaces of rock (Plate 1 f & h)

Prima facie by field study, it is observed that copper mineralisation is present as discontinuous patches and specks along strike direction i.e. NNW-SSE. Surface encrustation of malachite is present at most of the places along strike direction from north to south. Cu values in rock chip and stream sediment samples are varying between 250 ppm to 2000 ppm and in slag heaps 1000 ppm to 7000 ppm By hand held XRF.

B. Control of Mineralisation

In the Kotri, Copper mineralization is structurally controlled by the shear zone and F_2 folds and primarily distributed in quartzites and meta-volcanic rocks. Minor quantity of pyrite occurs as cubes. Mineralisation is as fracture filled. Replacement is rarely seen. No wall rock alteration observed. In the area along the shear zone and at the contact of Basal quartzite with meta-volcanic malachite staining at old working and stock work is well preserved.

On the regional scale presence of malachite, old working, slag heaps, ferruginous stuff and disseminations of pyrite are noted along the Archean Proterozoic contact or along the contact of volcanic rocks with dolomite. These contacts are sheared or mylonitised which are also affected by East-West faults in the area. Some of the N-S thrust planes are observed on the outcrop scale. These shear planes or E-W and N-S faults are majorly control the mineralization in the area. In and around the study area, Geological survey of India (GSI) had done geological mapping and some geochemical sampling and drilling. Chalcopyrite intersected in few bore holes with 'Cu' value is ranging from 0.2% to 1.5% but it was not that much encouraging because of limited thickness. Mineralisation nature in drill holes is mainly as thin veins and dissemination type.

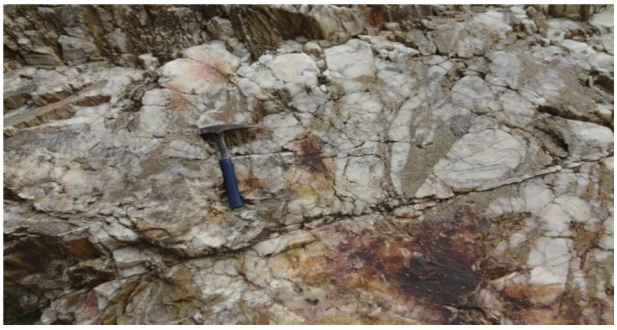
VI. CONCLUSION

Several numbers of copper occurrences are recorded in the form of boudinage pattern along the Archean Proterozoic boundary. Mineralization has been stretched along the shear zone which is striking in N- S direction. Concentration of the copper mineralization well accumulated along the shear plane in the quartzite and chlorite schist of the cover sequence. But length and width of boudins has not convinced for economic type of mineralization and not favourable host package is also present near the study area where fluid can be accumulated due to the remobilization.

Plate: 1

a. Thin Pebbly horizon is well preserved in the Basal Quartzite

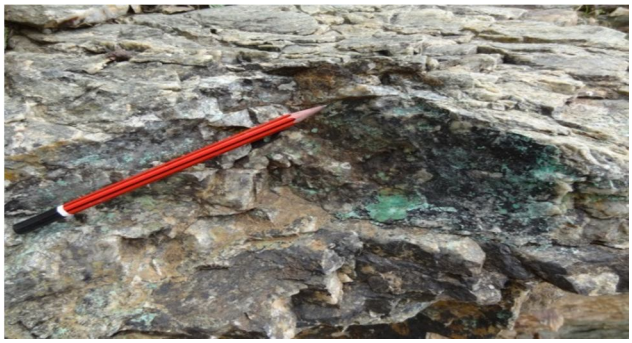
b. Amygdule's and vesicles are stretched along the foliation plane in Meta-volcanic rock



c. Sheared and folded quartz veins within basal quartzite

d. Highly sheared basal quartzite near Archean Proterozoic contact (APC).

e. Vein quartz intersecting basal quartzite

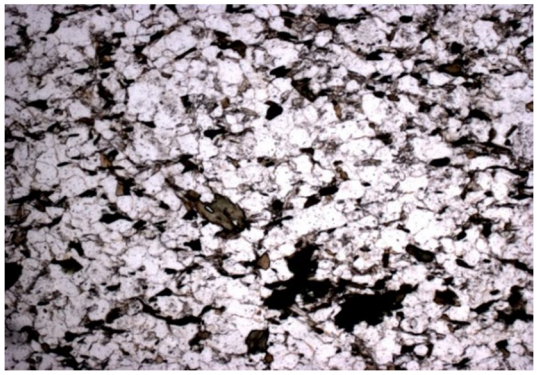


f. Malachite staining appears along the sheared unit

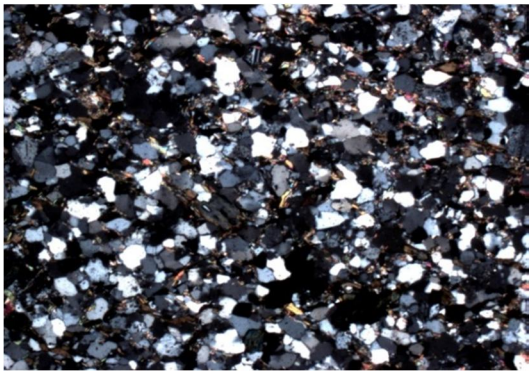
g. Crenulated AF2 folds in Chlorite Schist

h. Malachite staining at Old working along sheared Quartzite and Chlorite schist

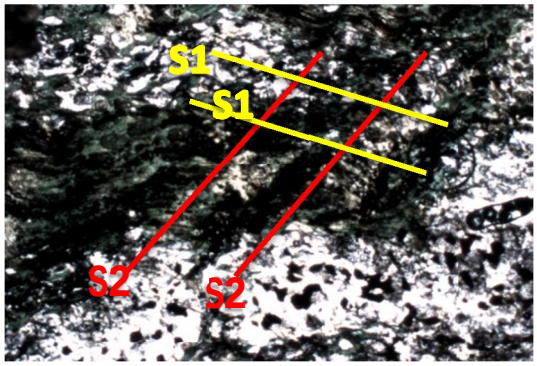
Plate-2



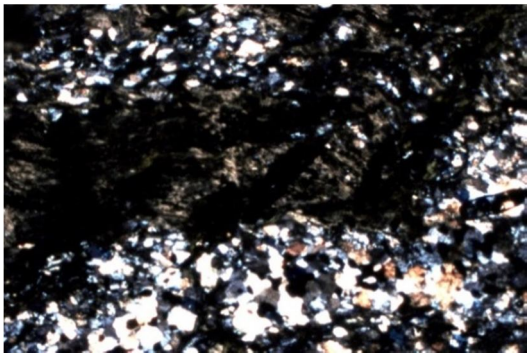
a. Photomicrograph of meta-volcanic rock showing fine grained quartz with muscovite, plagioclase feldspar, chlorite (penninite) and biotite under plane polarised light (PPL)



b. Photomicrograph of meta-volcanic rock showing fine grained quartz with muscovite, plagioclase feldspar, chlorite (penninite) and biotite under cross nicol (XN)



c. Photomicrograph of chlorite schist showing quartz and chlorite and S1 & S2 planes under plane polarised light (PPL).



d. Photomicrograph of chlorite schist showing quartz and chlorite and S1 & S2 planes under cross nicol (XN).

REFERENCES

[1] Goel O P, 1988. Petro-genesis 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.
[2] Goel, O P & Chaudhary, 1976. Geological investigation of Granites and Associated Meta-sediments north of Udaipur city, Rajasthan.
[3] Heron A.M. 1953. The geology of central Rajputana, Mem. G.S.I, Volume 79.
[4] Malhotra, G. and Joshi, D.W., G.S.I., F.s., 1991-92. Report on the study of Conglomerates of the Aravalli Supergroup, Districts Rajsamand and Udaipur, Rajasthan.
[5] Naha K and Mohanty S 1988. Response of basement and cover rocks to multiple deformations: a study from the Precambrian of Rajasthan, western India; Precambrian. Res.42 77–96.
[6] Manoj K. Pandit, Helga de wall, Narendra K. Chauhan, 2008; Palaeosol at the Archean—Proterozoic contact in NW India revisited: Evidence for oxidizing conditions during paleo-weathering?
[7] Roy et al. (1985). Tectonic and stratigraphic framework of the early Precambrian rocks of rocks of Rajasthan and northern Gujrat. Bull. Geol. min. met. Soc. India 53; 100-114.
[8] Roy et al. (1988). Stratigraphy and tectonic framework of Aravalli mountain range
[9] Roy A B and Jakhar S R, 2002. Geology of Rajasthan (Northwest India) - Precambrian to recent; Scientific Publishers (India), Jodhpur, pp 421.
[10] Singh, P.N. 1978. Investigation for base metal mineralisation in Nana-Sakroda, Kotri area, Udaipur district, Rajasthan, Progress report for F.S. 1977 – 78.
[11] Sinha-Roy, S Malhotra, G., Guha, D.B.. A transect across Rajasthan Precambrian terrain in relation to geology, tectonics and crustal evolution of south-central Rajasthan. In: Sinha-Roy, S., Gupta, K.R. (Eds.), Continental Crust of NW and Central India. Geological Society, India. 1995. 31: 63–89.Sivasubramaniam, R., 2010. Regional geology of Rajasthan (Chapter-2-Regional Geology).

ARAVALLI SUPER GROUP (Proterozoic)

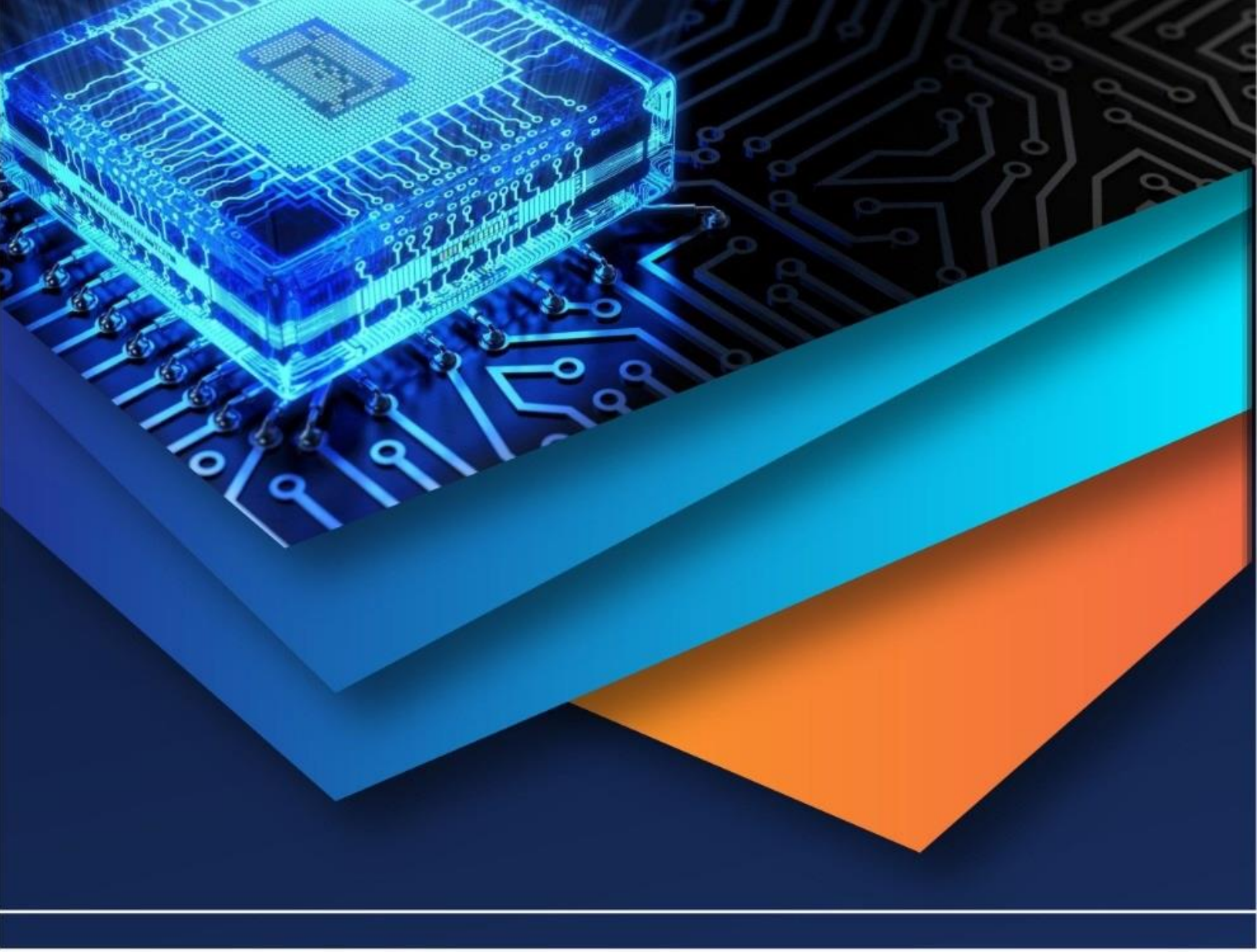
UPPER — Jharol Formation

MIDDLE

LOWER

----------Unconformity----------

MEWAR GNEISSIC COMPLEX (Archean)



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY