PROPOSAL FOR GENERAL EXPLORATION (G-2) IN THAKURDIH AREA-1 BLOCK (4.1 Sq.km area) FOR COPPER AND ASSOCIATED MINERALS, SINGHBHUM COPPER BELT, DISTRICT: EAST SINGHBHUM, STATE- JHARKHAND.

Copper and Associated Minerals

By

Mineral Exploration & Consultancy Limited
(A Government of India Enterprise)
A Mini Ratna Company
Seminary Hills, Nagpur – 440006, Maharashtra

Place: Nagpur
Date: 12th September, 2025

Summary for G-2 Stage General Exploration for Copper & Associated Minerals in Thakurdih Area-1 Block , Singhbhum Copper Belt, East Singbhum District, Jharkhand

Features	Details
Block ID :	Thakurdih Area-1 Block
Exploration Agency	Mineral Exploration And Consultancy Limited (MECL)
Previous Exploration Agency	GSI and MECL.
Commodity	Copper (Cu) and Associated Minerals
Mineral Belt :	Singhbhum Copper Belt
Budget &Time Schedule to complete the project	Rs. 2302.38 Lakhs; 18 months
Objectives:	In consideration with previous G3 stage exploration and borehole data, present exploration work at G2 stage has been planned in Phased manner (Phase-I & II) to prove the strike & depth persistence of copper mineralisation at close spaced interval and upgrade the copper ore resources under Indicated category (332 of UNC). The objectives of present exploration (G2) is as follows. **Phase-I** ➢ To update Detailed geological map & Topographic survey map at 1:2000 scale along with surface sampling (Bedrock/Channel). ➢ To carryout trenching work on borehole profiles (if required) ➢ To carryout infilling 1st level boreholes (60m vertical depth) at 100m spacing interval to prove the strike and depth persistence of Copper ore zones in the entire Northern band (covering 2.3 km strike length) & Southern Band (covering 1.1 k.m. strike length) **Phase-II (Based on outcome & Review with TCC of NMET)** ➢ To carryout infilling 1st level boreholes (60m vertical depth) to fill up the gaps at 50m spacing interval and followed by 2nd level boreholes (upto 120m VD) at 100m spacing interval in alternate sections to prove the strike and depth persistence of Copper ore zones in Northern band (covering 2.3 km strike length) & Southern Band (covering 1.1 km strike length). ➢ To drill 3 Nos. deeper level boreholes, two in Northern Band and one deeper level borehole in Southern Band up to 4th

<table>
<tr><td></td><td>Level (i.e. 240 m vertical depth) to confirm the deep-seated mineralisation for future prospects and planning.
➢ To estimate the Copper ore resources (332) as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules-2015 & amended up to 2021.
➢ To carry out the geotechnical studies for assessment of strength of rocks occurring in the block.
➢ To ascertain the amenability of the Copper ore through beneficiation study.</td></tr>
<tr><td>Whether the work will be carried out by the proposed agency or through outsourcing and details thereof. Components to be outsourced and name of the outsource agency:</td><td>The work will be carried out by MECL.</td></tr>
<tr><td>Name/ Number of Geoscientists :</td><td>Geologist: 01 Nos. at HQ (60 days)</td></tr>
<tr><td>Expected Field days (Geology)</td><td>Geologist: 01 Nos. at Field (300 days)</td></tr>
<tr><td>1. Location:</td><td></td></tr>
<tr><td>Location</td><td>The proposed block area covered 4.10 sq.km comprising North, Northwest and West of Baharagora town East Singhbhum district in Jharkhand. Near the junction of NH-49 (Kharagpur to Bilaspur) and NH-18 (Dhanbad-Balasore), Baharagora is a small town in East Singhbhum district and situated on the south-east corner of Jharkhand, India. It is 60 km from Kharagpur, 90 km from Jamshedpur, 50 km from Ghatshila, 50 km from Baripada and 200 km from Kolkata. Chakulia and Dhalbhumgarh are the nearest railway stations. The nearest airport is Netaji Subhas Chandra Bose International Airport, Kolkata which is 200 km. away from the study area.</td></tr>
<tr><td>Block boundary coordinate</td><td>Thakurdia Area-1 (4.10 sq.km) corner cardinal cardinal points
<table>
<tr><th rowspan="2">Corner Cardinal points</th><th colspan="2">WGS -84 (DMS)</th></tr>
<tr><th>LATITUDE</th><th>LONGITUDE</th></tr>
<tr><td>1</td><td>22° 19' 23.1904" N</td><td>86° 40' 34.8022" E</td></tr>
<tr><td>2</td><td>22° 19' 23.4125" N</td><td>86° 41' 56.3542" E</td></tr>
<tr><td>3</td><td>22° 18' 10.7567" N</td><td>86° 41' 56.5099" E</td></tr>
<tr><td>4</td><td>22° 18' 10.6238" N</td><td>86° 41' 20.5106" E</td></tr>
<tr><td>5</td><td>22° 19' 04.1304" N</td><td>86° 40' 34.6370" E</td></tr>
</table></td></tr>
<tr><td>Villages :</td><td>In and around villages of Thakurdih, Maheshpur, Bhandudihi</td></tr>
<tr><td>Tehsil/ Taluk :</td><td>Baharagora</td></tr>
</table>

District :	East Singhbhum
State :	Jharkhand
2. Area (hectares/ square kilometres)	
Block Area :	4.10 sq.km
Forest Area :	-
Government Land Area	-
Private Land Area	-
3. Accessibility	
Nearest Rail Head :	The nearest railhead is Chakulia and Dhalbhumgarh, which are at a distance of 25 km and 31 km respectively in the Howrah-Mumbai line of the South-Eastern Railway.
Road :	NH 49 (old NH 6) running from Kharagpur in West Bengal to Bilaspur in Chhattishgarh and NH-18 (Old NH 33) running from Govindpur in Jharkhand to Balasore in Odisha made a junction at Baharagora Town.
Airport :	Netaji Subhas Chandra Bose International Airport, Kolkata is at 200 km towards East
4. Hydrography	
	The major part of the Baharagora area is covered by alluvium and soil upto 20m thickness. The area is constituted of rolling plains with occasional low ridges and is about 80 to 100 m above mean sea level. The major river nearby the area is Subarnarekha River in the West of the block.
Rivers/ Streams	Part of tributaries/water shed area of River Subarnarekha
5. Climate	
Mean Annual Rainfall :	The average annual rainfall in the East Singhbhum District is reported about 1200-1300 mm, mainly during June to August.
Temperatures	(May-June) (Maximum) 40^0C (Minimum) 27^0C (November- December) (Maximum) 26^0C (Minimum) 16^0C
6. Topography	
Toposheet Number	73J/11
	The major part of the area is covered by alluvium and soil. The general altitude of the area is 80 to 100 m above mean sea level. The general slope of the ground is South-West, all the drainage system following West and South-West trend merging in Subarnarekha River.
7. Availability of baseline geoscience data	
Geological Map	Geological Map of Thakurdih Area-1 Block on 1:2000 scale is available.
Geochemical Map and Geophysical Map	Geochemical and Geophysical Traverses on scale: 1: 6000 (Field season:1970-71,71-72) is available
8. Historical work	The block area was previously explored by MECL at G3 stage in 2024-25 and the area forms the part of Baharagora copper prospect located southeastern extremity of Singbhum copper belt of Jharkhand. Previous workers carried out exploration activities in and around the block in the past. The list of available reports of the area

	as listed below. 1. Geological Report on Preliminary Exploration (G3) for Copper and Associated Minerals in Thakurdih Area-1 Block, Singbhum Copper Belt, East Singbhum District, Jharkhand (MECL, July, 2025). 2. Report on the Exploration in the Mundadevta-Darkhuli Block, Baharagora Copper Prospect, Singhbhum District, Bihar by P Majumder, Geologist (Sr), AMSE Wing, GSI, September, 1974. 3. Exploration for Copper in the South Jharia-Charakmara Blocks and Mundadevta Sub-Block Extension, Baharagora Copper Pospect, Singhbhum District, Bihar, FSP: 1975-76 & 1977-78, By P Majumder, Geologist (Sr.)., AMSE Wing, GSI, February, 1984. 4. Geological Report on General Exploration (G2) for Copper Mineralisation, Mundadevta-Darkhuli South Jharia Block, Singbhum Copper Belt, East Singbum District, Jharkhand (MECL, October, 2022) 5. Geological Report On Preliminary Exploration (G3) For Copper Ore In Thakurdih-Charakmara, Singbhum Copper Belt, East Singbhum District, Jharkhand State, December, 2023.
9 Justification for taking up G2 stage mineral exploration.	➢ Thakurdih Area-1 is part of previously explored Thakurdih-Charakmara G3 Block and forms the part of prominent Baharagora copper prospect located at the extreme southeastern end of Singbhum copper belt of Jharkhand. ➢ MECL carried out G3 stage exploration in Thakurdih Area-1 Block during 2024-25 under NMET funding. Detailed geological mapping (1:2000 scale) over 4.10 sq.km. area and exploratory drilling work at approx.. 200m interval carried out in Northern & Southern Band to prove the strike and depth continuity of mineralisation at 1st level (60m vertical depth) and in few sections at 2nd level (120m vertical depth) from the surface. ➢ In Thakurdih Area-1, copper mineralisation occurs along two zones namely Northern band & Southern band. In northern band, mineralization mainly occurs along the unexposed Porphyroblastic Garnetiferous Chlorite Mica schist. In southern band, mineralization mainly occurs along the contact of Granitic rock with the Meta-basic schistose rocks. Additionally, mineralization occurs in silicified brecciated rocks, less

	frequently in quartzite. Copper and associated mineralisation is mainly Litho-structure and shear controlled. In general, the mineralisation strikes E-W to NW-SW with 55° to 80^0 N & NE dip in Northern band while N50°W-S50°E with 60° to 80^0 NE dip in the Southern band. ➢ Out of 17 boreholes drilled in previous G3 exploration, total 7 lodes pertaining to northern band NB1, NB2, NB3, NB4, NB5, NB5A, NB6 and 6 lodes pertaining to southern band SBA, SB1A, SB3, SB4, SB5 & SB6 were delineated in 16 boreholes at 0.2% Cu cut-off. (0.2%-1.21% Cu over 2.08-27.62m true width). At 0.5% cut-off, 3 lodes of northern band (NB1, NB3 & NB6) and 4 lodes of southern band (SB1, SB1A, SB3 & SB4) delineated in 9 boreholes (0.50%-1.28% Cu over 2.10m-5.57m true width). At 1.0% Cu cut-off I lode of northern band (NB6) and 2 lodes of southern band (SB1 & SB1A) delineated in 3 boreholes (1.01%-1.41% Cu over 2.45-3.63m true width). ➢ Copper ore resources estimated at 0.2%, 0.5% & 1.0% Cu cut-off at 1st level i.e. 60m Vertical depth, few sections at 2nd level i.e. 120m & 180 Vertical depth in Northern Band & Southern Band of Thakurdih Area-1 Block. ➢ At 0.2% Cu cutoff, total Net geological in situ resource 4.43 million tonnes with an average grade of 0.38% Cu over 6.14m covering cumulative strike length of 2.6 km estimated ➢ At 0.5% Cu cut-off, 1.02 million tonnes Net resource with an average grade of 0.70% Cu over 3.45m covering a cumulative strike length of 1.8 km estimated. ➢ At 1.0% Cu cut-off, 0.13 million tonnes net resource with average grade of 1.23% Cu over 2.77m for a cumulative strike length of 600m estimated. ➢ Resources placed under Inferred category (333 of UNFC) in Thakurdih Area-1 Block. ➢ Additionally, ICPMS studies of composite samples of ore zones indicated total 4 ore zones (0.5% Cu cut-off zones) with ∑REE+Y+Sc values >1000 ppm ranging from 1105.30 to 4654.36 ppm with an average value of 2462.37 ppm.

	➢ Similarly, total 8 ore zones (0.2% Cu cut-off zones) indicated ∑REE+Y+Sc values >1000 ppm ranging from 1028.87 to 3913.3 ppm with an average value of 1691.58 ppm. Anomalous REE values reported mostly in Quartz - k-feldspar chlorite - biotite schist±Amphibole (silicified & granitized), Gt. Chlorite schist/metabasic schist, granite and contact zones of schist and granite. ➢ Also, ICPMS studies of composite samples (0.5% Cu cut-off) pertaining to ore zones indicated total 11 ore Zones with Co values range from 101.48ppm Co to 288.03 ppm Co. over 2.50m to 7.50m with One zone shown highest Co value of 1300ppm over 4m (MTB-08). One Zone had shown Mo value of 192.97 ppm Mo over 7.50m thickness (MTB-08). At 0.2% Cu cut-off, Total 18 zones indicated cobalt values range from 102.79 ppm Co to 367.13 ppm Co with one zone shown highest value of 1220.33 ppm over 3.50m thickness (MTB-08). Two zones shown Mo values of 147.60m over 8.0m (MTB-08) & 138.83 ppm Mo over 13.23m (MTB-17). ➢ G3 stage Report recommended that "G3 stage exploration established Copper ore resource at Inferred (UNFC-333) resource category in Thakurdih Area-1 Block. Copper bearing lodes are open in depth and there are significant gaps in exploration. Hence, G2 stage exploration was recommended in the area by close spaced drilling for gaining more confidence on resource and grade. Also, Time Domain EM survey would be helpful to delineate conducting bodies and deeper level mineralisation in the area". ➢ As per the G3 Stage Report recommendations, systematic exploration at G2 stage involving drilling of infilling boreholes for 1st level (50m vertical depth) intersections at 50m spacing interval and for 2nd level (100m vertical depth) intersections in alternate sections (100m interval) is required to prove the strike and depth continuity of ore zones in Northern band (2.3 km strike length) & Southern band (1.1km strike length) of the Block area for gaining more confidence on resource and grade. ➢ Thakurdih Area-1 prospect hold potential for polymetallic mineralisation. Systematic G2 stage exploration at close spaced interval (50m interval for 1st level & 100 interval for 2nd level in alternate sections) would be helpful to estimate and upgrade

	copper ore resources at 332 category of UNFC at higher confidence level as well as to figure out the potentiality for other associated minerals i.e. REE, Co and Mo mineralisation besides copper in the area. ➢ G2 stage exploratory drilling shall be taken up in 2 Phases. In Phase-I, 1st level infilling boreholes (60m Vertical depth) shall be drilled at 100m spacing interval to cover the entire potential zone of Northern Band over 2.3 km strike length and Southern Band over 1.1 km strike length. Based on the outcome and review, Phase-II infilling drilling shall be taken up for 1st level boreholes to fill up the gaps at 50m spacing interval and followed by drilling of 2nd level boreholes (120m Vertical depth) at 100m spacing interval in alternate sections including three deeper level boreholes (up to 4th level) to confirm the deep seated mineralisation for future prospects and planning. ➢ The present exploration at G2 stage would be helpful to estimate the Copper and associated minerals at indicated category (332) of UNFC. ➢ Moreover, the present Thakurdih Area-1 Block is just adjoining Block to Mundadevta-Darkhuli & South Jharia G2 Block where MECL carried out G2 stage Exploration during 2021-22 for Copper and a net geological instu resource of 1.75 million tonnes of 0.96% Cu at 0.50% Cu cut-off and 0.64 million tonnes of 1.46% Cu at 1.00 Cu cut-off was estimated up to maximum 245m vertical depth. ➢ Hence, upgrading the Thakurdih Area-1 Block to the G2 stage would enable the Government either to amalgamate it with the adjoining Mundadevta–Darkhuli South Jharia G2 Block to form a sizable block for auction, or to auction both blocks separately.

Proposal for General Exploration (G2) for Copper and Associated Minerals in Thakurdih Area-1 Block, Singhbhum Copper Belt, District: East Singhbhum, Jharkhand.

1. 0 INTRODUCTION

1.1.1 Copper with its unique physical, mechanical and electrical properties, has played a vital role in the industrial growth of a nation. In India, around 75% of demand is met through imports. The increasing demand of Copper metal in the country can be eased with the exploration of new copper deposits of economic importance. In view of the above, exploration for copper ore has been accorded high priority in the XIIth Plan document.

1.1.2 During the last three decades, no large base metal deposit has been discovered in India. However, the possibility of working of small mineral bodies in proximity to each other, through technological advances and increased operational efficiency, cannot be ruled out. Therefore, it is utmost imperative to locate and explore such small sized deposits in clusters.

1.1.3 Thakurdih Area-1 Block area is part of previously MECL explored Thakurdih-Charakmara G3 block and forms the part of Baharagora Copper prospect is located near the southeastern extremity of the Singhbhum Copper Belt of Jharkhand. The existence of old workings (shallow pits) for copper in Thakurdih-Charkamara area was reported by previous workers (Stoehr 1870 & Dunn 1937). The area was covered by airborne multi-instrument geophysical surveys in 1963. Ground evaluation of the electromagnetic and magnetic signatures coupled with the available geological knowledge indicated the presence of potential mineralized zones in the Baharagora area. Integrated geological, geochemical and ground geophysical surveys and exploratory drilling in the area by GSI (FS 1975-76 & 1977-78) indicated a number of small blocks i.e. Mundadevta-Darkhuli & South Jharia and Charakmara Thakurdih area. Mundadevta-Darkhuli & South Jharia block was explored by MECL (2021-22) at G2 stage for Copper and a net geological instu resource of 1.75 million tonnes of 0.96% Cu at 0.50% Cu cut-off and 0.64 million tonnes of 1.46% Cu at 1.00 Cu cut-off was estimated up to 245m vertical depth.

1.1.4 During 2022-23, MECL carried out G3 stage exploration work for copper in four sub-blocks (including Thakurdih Area-1) over 10.0sq.km area in Thakurdih Charakmara Block. Based on Integrated ground geophysical anomalies (Low resistivity and high chargeability) three scout boreholes drilled in the area yielded significant copper mineralised zones in Thakurdih Area-1 sub-Block. Total 128689 tonnes (0.13 million tonnes) of copper ore Reconnaissance resource (UNFC-334) with average grade of 0.39% Cu over an average thickness of 3.23m estimated and further exploration at G3 stage was recommended in Thakurdih Area-1 block.

1.1.6 It was recommended that Integrated geophysical anomalies intersected significant mineralized zones of considerable thickness and grade at depth in the test boreholes drilled in Thakurdih Area-1. Hence, in order to ascertain the potentiality of the prospect, Seamless G3/G2 stage exploration was recommended to confirm the strike and depth persistence of ore zone in Area-1 of Thakurdih-Charakmara block.

1.1.7 Recently, MECL (2024-25) carried out G3 stage exploration in Thakurdih Area-1 Block under NMET funding. The work included detailed geological mapping on 1:2000 scale, topographical survey over 4.10 sq.km. area, collection and analysis of bedrock samples (26 nos.), trench samples (48 nos.) for Cu, Pb, Zn, Ni, Co, Mo & W analysis and exploratory drilling work involving 2200m in 17 Boreholes (Phase-I &II) at 200m spacing interval approximately, along with allied activities of borehole deviation survey, borehole geophysical logging and associated laboratory studies for Copper and associated minerals, Au & Ag and ICP-MS analysis including petrographic (10 nos.), mineragraphic studies (10 nos.) and specific gravity determination etc.

1.1.8 Exploratory drilling work indicated significant several copper ore zone intersections in all drilled 17 boreholes in Thakurdih Area-1 Block. Copper ore resources have been estimated at different cut-offs up to mostly 60m to 120m & 180m vertical depth from surface. At 0.2% Cu cut-off, the total Net in-situ resource is 4.43 Mt @ 0.38% Cu over 6.14 m across 2.6 km strike; at 0.5% Cu cut-off, 1.02 Mt @ 0.70% Cu over 3.45 m across 1.8 km strike; and at 1.0% Cu cut-off, 0.13 Mt @ 1.23% Cu over 2.77 m across 600 m strike. All resources are under Inferred (UNFC-333) category.

1.1.9 ICPMS studies revealed enrichment of REE+Y+Sc (>1000 ppm) in 4 ore zones (0.5% cut-off) averaging 2462 ppm and 8 ore zones (0.2% cut-off) averaging 1692 ppm, mostly within schists, granite, and contact zones. Cobalt enrichment was observed in 11 ore zones (0.5% cut-off) with values up to 1300 ppm (MTB-08), and 18 ore zones (0.2% cut-off) with values up to 1220 ppm (MTB-08). Significant Molybdenum values were also recorded, including 192.97 ppm over 7.5 m (MTB-08) and 138.83 ppm over 13.23 m (MTB-17).

1.1.7 It was recommended that G3 stage exploration established Copper ore resource at Inferred (UNFC-333) resource category in Thakurdih Area-1 Block. Copper bearing lodes are open in depth and there are significant gaps in exploration. Hence, G2 stage exploration is recommended in the area by close spaced drilling for gaining more confidence on resource and grade. This will facilitate the Government to amalgamate with adjoining Mudadevta-Darkhuli South Jharia G2 Block for auction.

1.1.8 Keeping in view the potentiality of the prospect and recommendations of the previous workers, the present G2 stage exploration in Thakurdih Area-1 block has been formulated to establish copper ore resource and associated minerals at Indicated category (332 of UNFC). The upgradation of the block from G3 to G2 enhance the confidence on resource and grade and facilitate the Government to auction the block.

2.0 LOCATION AND ACCESSIBILITY

2.1 The study area is situated in and around Thakurdih, Bandudihi and Maheshpur Villages located about 4km Northwest of Baharagora town and tehsil headquarter in East Singhbhum District, Jharkhand.

2.2 The Thakurdih Area-1 block falls under Survey of India Toposheet No. 73J/11, covering an area of 4.10 sq and lies between 22° 18' 10.6238" N to 22° 19' 23.4125"N latitudes and 86° 40' 34.6370"E to 86° 41' 56.5099"E longitudes. The block location is shown in **Plate-I**. The locational co-ordinates (Geographic & UTM) of the cardinal points of the Thakurdih Area-1 Block, Singhbhum Copper Belt, East Singhbhum District, Jharkhand are in given in **Table 2.1**.

Table-2.1

Co-ordinates of the corner points of the block boundary of Thakurdih-Area-1 Block, Singhbhum Copper Belt, East Singhbhum District, Jharkhand

Corner Cardinal points	WGS -84 (DMS)		UTM (Zone 45N)	
	LATITUDE	LONGITUDE	Easting	Northing
1	22° 19' 23.1904" N	86° 40' 34.8022" E	466667	2468627
2	22° 19' 23.4125" N	86° 41' 56.3542" E	469000	2468629
3	22° 18' 10.7567" N	86° 41' 56.5099" E	469000	2466395
4	22° 18' 10.6238" N	86° 41' 20.5106" E	467970	2466393
5	22° 19' 04.1304" N	86° 40' 34.6370" E	466661	2468041

2.3 The block area can be approached by metal road from Baharagora. Baharagora is a small town and tehsil headquarter near the junction of NH-49 (Kharagpur to Bilaspur) and NH-18 (Dhanbad-Balasore), in East Singhbhum district and situated on the south-east corner of Jharkhand, India. It is 60 km from Kharagpur, 90 km from Jamshedpur, 50 km from Ghatshila, 50 km from Baripada and 200 km from Kolkata. The nearest railhead is Chakulia and Dhalbhumgarh, which are at a distance of 25 km and 31 km respectively in the Howrah-Mumbai line of the South-Eastern Railway. The nearest airport is Sonari Airport (Jamshedpur) at about 62 km and Netaji Subhas Chandra Bose International Airport, Kolkata which is 186 km towards East from the area.

3.0 REGIONAL GEOLOGY AND STRUCTURE

3.1.1 The Precambrian Geology of the Singhbhum Craton was first built up by Dunn (1929,1937), Dunn and Dey (1942) and they divided the craton into four major structural units, which are I) Singhbhum geo-anticline comprising highly metamorphosed rocks of Iron Ore Series, II) Dalma lava geo-syncline in the north, running parallel to the geo-anticline, III) a shear-zone, known as Singhbhum Shear Zone, and IV) a second geo-anticline to the north of the Dalma Lava Geo-syncline with an intervening thrust zone. According to them Singhbhum shear zone extends from Duarpuram, North-East of Chakradharpur, in an approximately East-West direction, turns South-East near Jamshedpur and continues through Jaduguda-Rakhamines, Surda-Mosaboni-Badia mines and eventually ends up at Granites near Baharagora. However later studies revealed that the shear zone extends upto Mayurbhanj districts of Odissa where its trace can be found through some N-S trending shears.

3.1.2 The Singhbhum Shear Zone (SSZ) is the most important single structural element and stands out as a premier metallogenic province geologically and structurally favourable corridor hosting deposits of uranium, copper, and gold and other critical and strategic metals. The SSZ, high strain ductile zone extending over 200km, from west to the southeast with widths varying from a few hundred meters to several kilometers dipping about 40° northward. SSZ is characterized by multiphase deformation, extensive hydrothermal activity and a diverse lithological framework that includes granites, schist and pegmatites highly conducive for polymetallic mineralisation and has been extensively investigated by AMD, GSI and MECL.

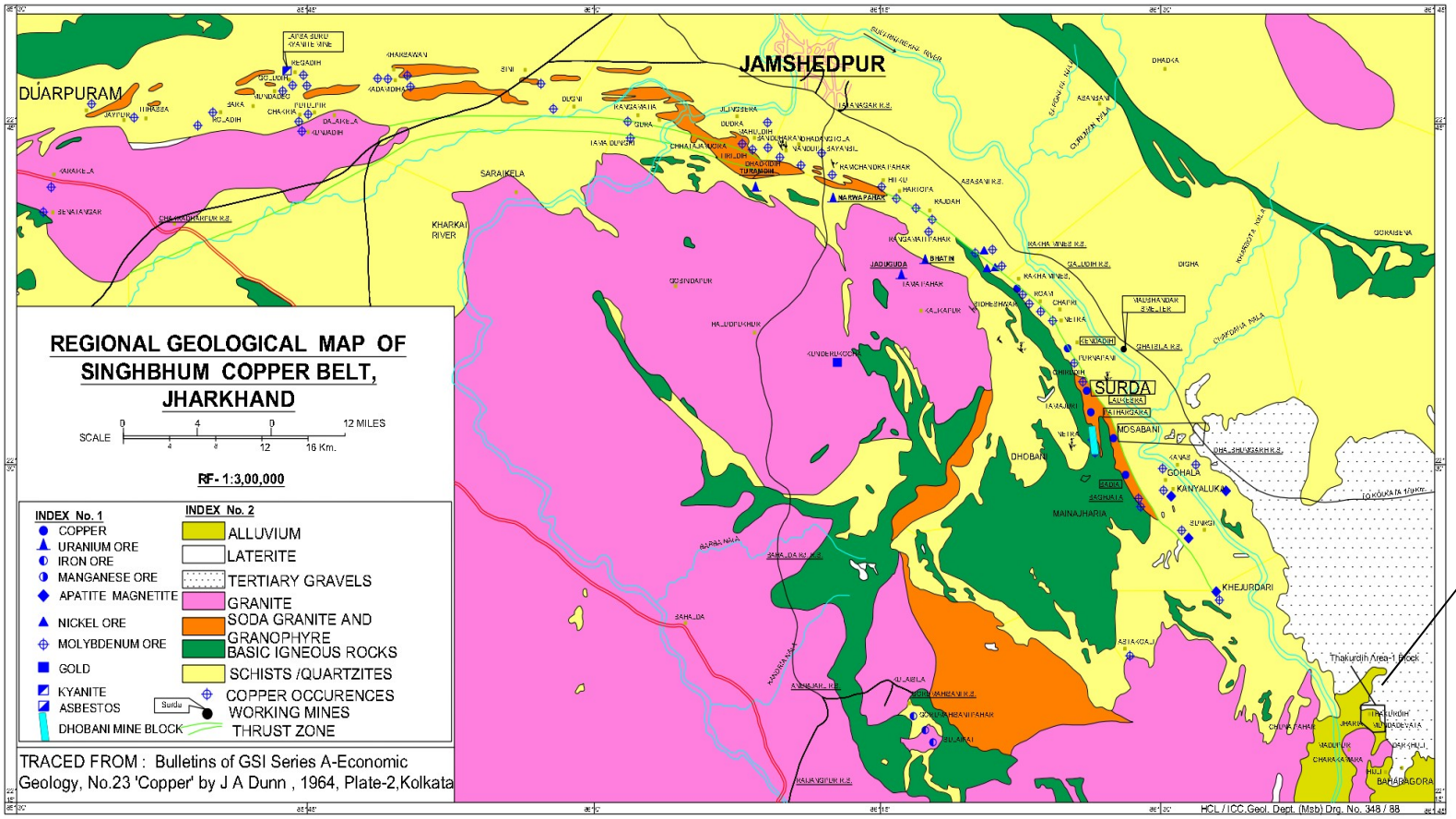
3.1.3 The Stratigraphic succession of the Singhbhum-Odissa Craton after Saha et.al, 1988 is given in the following Table 3.1 and the regional geological map is given as **Plate-II** and **Text Figure-1**.

Table 3.1:
Stratigraphic Succession of Singbhum-Orissa Craton After Saha et.al, 1988

Newer Dolerite dykes	c.950-1600Ma
Mayurbhanj Granite	c.2100Ma
Gabbro-anorthosite-ultramafics	
Kolhan Group	c.2100Ma (?)
---------- Unconformity ----------	
Dhanjori Group	
Dhanjori-Simlipal lavas	c.2300Ma
Quartzite-conglomerate	
Singhbhum Group	c.2300-2400 Ma
Pelitic and arenaceous metasediments, mafic sills	
---------- Unconformity ----------	
Singhbhum Granite (Phase III)	c.3100 Ma
Iron Ore Group	
Mafic lava, acid volcanics, tuffaceous shale~ banded hematite jasper, banded hematite quartzite, chert, and quartzite	
---------- Unconformity ----------	
Singhbhum Granite) (Phase I and II)	c. 3300Ma
---------- Unconformity ----------	
Older Metamorphic Tonalite Gneiss (OMTG)	c.3700-3800 Ma
Older Metamorphic Group (OMG)	c.4000 Ma
Pelitic schist, quartzite, amphibolites	

3.1.4 Thakurdih Area-1 block lies in the southeastern extremity of the Singhbhum Shear Zone and forms part of the Baharagora Copper prospect, which includes sub-blocks like Mudadevta–Darkhuli, South Jharia, and Thakurdih–Charakmara. The area is underlain by Archean granite/granite gneiss, Archean–Proterozoic dolerites, Palaeoproterozoic quartzites and schists of the Chaibasa Formation, Tertiary gravels, and Quaternary alluvium and laterite.

3.1.5 Earlier studies (GSI, 1974; Saha et al., 1977; Misra, 1999; Mishra et al., 2002) suggest that granites around Baharagora differ from the Singhbhum granite in tectonic setting, deformation, and mineralogy, and are identified as Mayurbhanj Granite of Neo-Archean age. However, this granite is considered composite, with older and younger phases, and its exact age relationship with Singhbhum granite remains debated.



Thakurdih Area-1 Block

Text Figure-1

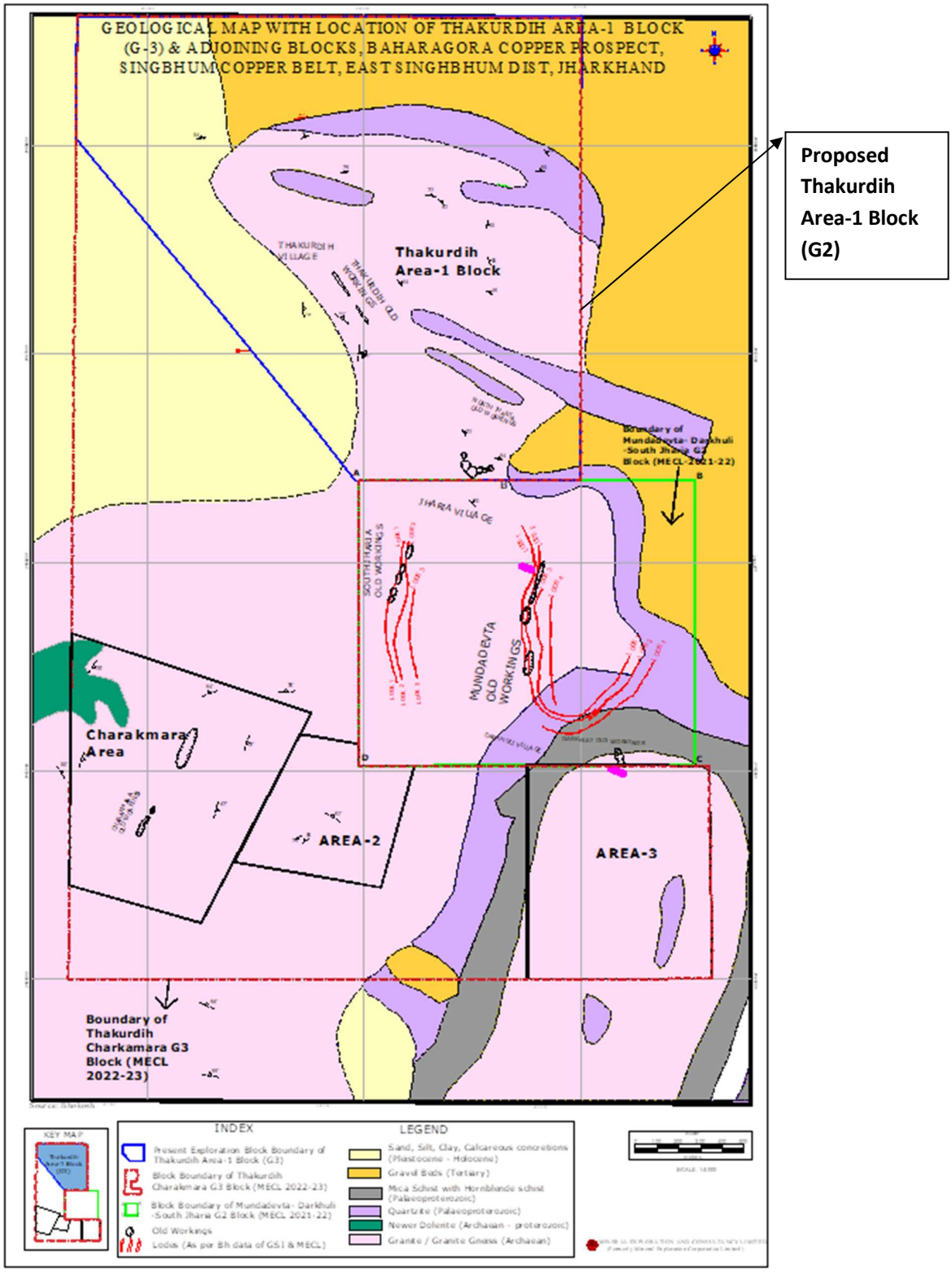
4.0 REGIONAL STRUCTURE & MINERALISATION

4.1 The Singhbhum Shear Zone (Singbhum Copper Belt) extends from North Singhbhum to Baharagora and Mayurbhanj, with shearing and brecciation preserved in schists and quartzites. Thakurdih Area-1 lies at the southeastern end of the shear zone, which here is narrow and obscure within granite. Schist foliation reflects shear-planes formed by transposition, with tectonic transport broadly up-dip. Rock formations show structures based on competence: mica schists form S-tectonites with folds and cleavages, while harder rocks show joints, brecciation, mullions, and rodding. Planar structures include stratification (S0), foliations (S1, S2), crenulation cleavage, slickensides, and joints. These reflect fold-related schistosity, with three joint sets well developed in quartzite and schists. Linear structures comprise puckers, mineral lineations, bedding-cleavage intersections, streaking, and grooving. No major faults occur, except minor drag faults in quartzites and quartz schists. Quartzite & Quartz schist in the Baharagora area are thrown into S-shaped, plunging synforms and antiforms, with plunge varying from 35°to 50° towards northeast. In the Mundadevta-Darkhuli block, the synformal flexure is asymmetric with eastern limb dipping more steeply (80-85°) than the western limb (60-65°). The plunge of the fold axis is about 40° towards N40°E. In general, litho units strike varies from NW-SE, E-W and dip 55°-85° due NE and north.

4.2 The rocks show middle amphibolite facies metamorphism (biotite, garnet, staurolite, kyanite) from regional metamorphism, later retrograded to middle greenschist facies (biotite, muscovite, chlorite) due to shearing. The area hosts numerous metamorphosed basic sills and dykes within Chaibasa mica schists, along with Newer Dolerite intrusives in granite and altered ultramafics represented by quartz–actinolite–anthophyllite rocks.

4.3 Mineralisation in the Singhbhum Shear Zone is structurally controlled and occurs as apatite–magnetite, sulphide, and uranium types, with sulphides hosted in diverse lithologies such as sodagranite (Mosabani), epidiorite (Dhobani), quartz–chlorite–biotite schists (Surda–Tamapahar), and chlorite schists (Ramchandrapahar). Sulphides, mainly chalcopyrite, pyrite, and pyrrhotite, occur as disseminations, stringers, and veins along shear/tension planes, with copper as the principal metal and traces of Mo, Ni, Co, and Au also reported. Numerous workable deposits across the Singhbhum Copper Belt share common features in ore assemblage and occurrence. The stratabound nature of the ore bodies, their spatial link with metavolcanics, lack of strong wall-rock alteration, metamorphic imprint, co-folding with host rocks, and parallelism to down-dip lineations indicate early emplacement from ore solutions derived by leaching of volcanic rocks through convective surface waters (Majumdar, 1984).

4.4 Geological map with location of Thakurdih Area-1 Block with adjoining blocks previously explored by MECL in Baharagora Copper prospect is given as **Text Figure-2.**



Text Figure - 2

5.0 GEOLOGY OF THE BLOCK

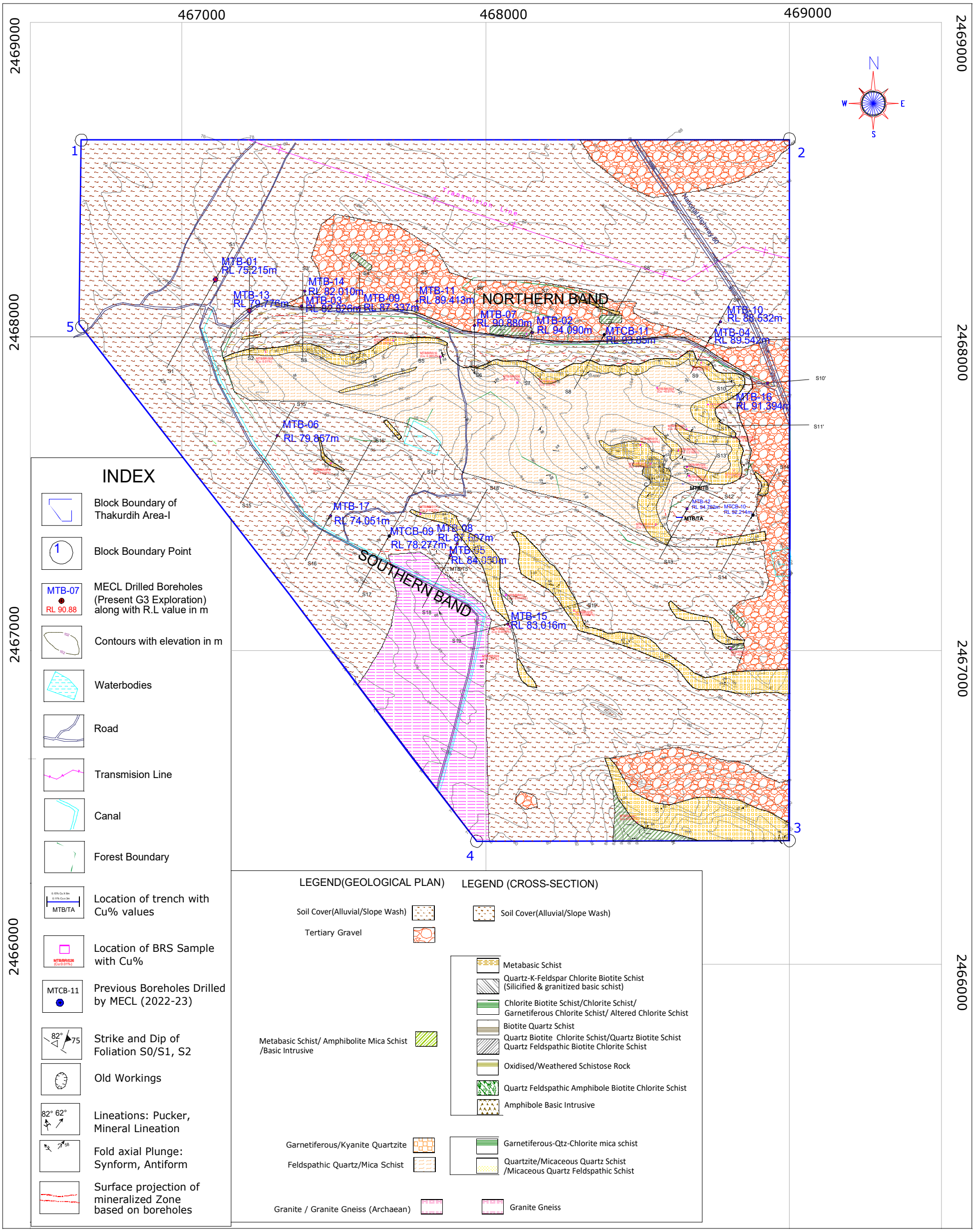
5.1 The major lithounits exposed in the area are Granite / Granite gneiss of Archean age, Quartzites (Garnetiferous/Kyanite Quarztite), Schistose rocks (Quartz/Garnetiferous mica Schist, Metabasic schist, Amphibolite schist) belonging to Chaibasa formation of Palaeoproterozoic age, Gravel Beds of tertiary age and Soil/Alluvium, slope wash of recent. Quartzite forms low rising ridges above schistose rocks in the central part of the block area. Granite outcrops seen in southwestern part of the block area. Tertiary Gravel beds occupy on the north and northeastern part of the block. In general, most of the block area is covered by soil cover/alluvium with limited rock exposures. The most of the area is under cultivation. The generalized local stratigraphic succession of the block area is given in **Table No. 5.1.**

Table No. 5.1: The Local Stratigraphic Succession of the Block area

Age	**Litho-units**
Pleistocene - Holocene	Soil/Alluvium, slope wash
Tertiary	Gravel beds
Paleoproterozoic (Chaibasa formation)	Schistose rocks: Quartz/Gt., Mica Schist, Metabasic schist, Amphibolite schist
	Quartzites, Garnetiferous/Kyanite Quarztite
Archaean	Granite / Granite gneiss

5.2 The main lithounits intersected in the boreholes drilled by MECL are granite/granite gneisses, quartzite/garnetifours/kyanite and staurolite bearing quartizites, schistose rocks of quartz schist, quartz mica schist, quartz-feldspathic schist, metabasic schist (and altered version of the same), amphibolite schist and basic dolerite dykes/basic intrusive.

5.3 Geological map of Thakurdih Area-1 Block is shown as **Text Figure No. 3.**



Text Figure-3

6.0 STRUCTURE & METAMORPHISM

6.1 Thakurdih Area-I block is located almost at the south-eastern end of the copper belt thrust/ Singhbhum shear Zone and forms the part of Baharagora Copper prospect. In Baharagora area shear zone is ill defined, narrow and gradually disguised into the granite. The dominant linear structures are parallel to the direction of tectonic transport. The planar structures present in the area are stratification plane (S1), axial plane foliation (S2) crenulation cleavage (S3), slickensides and joints. The main linear structures found are puckers, mineral lineation, Bedding-Cleavage intersection, streaking and grooving. No major faults except small drag faults due to stretching in quartzite/ quartz schist are noticed at places. In general, litho units strikes $N60^0W$-$S60^0E$, E-W dipping 60^0 to 80^0 NE and N in Thakurdih Area-1 block area.

6.3 Copper mineralization in the area is structurally controlled and mainly conforms to S1 foliation, which is refolded during D2 deformation, enhancing ore localization around D2 hinge zones similar to patterns seen in other Baharagora blocks. Stereonet analysis confirms multiphase deformation, with the D2 fold axis plunging 64° ENE and an axial plane of 058/84S. The northern ore band is hosted in porphyroblastic garnetiferous schist, while the axial zone shows no surface indications of mineralization or consistent geophysical anomalies.

6.4 The Metamorphic grade of the rocks in the area under consideration is marked by such minerals as Biotite, Garnet, Staurolite and Kyanite and indicated middle amphibolite facies of Fyfe and Turner (1966). It is very much correspondents to the regional metamorphic trend of Singhbhum group of rocks.

7.0 MINERALISATION

7.1 In Thakurdih Area-1, old NW–SW trending workings exist, but surface exposures are poor; mineralization details mainly come from drilling, with geochemical and IP–Resistivity surveys showing anomalies.

7.2 Copper mineralization occurs in two zones: the Northern band (along porphyroblastic garnetiferous chlorite–mica schist near quartzite ridge) and the Southern band (along granite–metabasic contact), with mineralized trends striking E–W to NW–SW.

7.3 Mineralization typically occurs as fissure and sheeted veins along shear-related openings; sulphides with quartz, chlorite, and magnetite fill fractures, breccias, and foliations without distinct wall-rock alteration.

7.4 In the Northern band, lodes show alternating rich/lean zones with veinlets and stringers, while the Southern band hosts denser, massive sulphide veins in fractures and breccias, controlling ore width and grade.

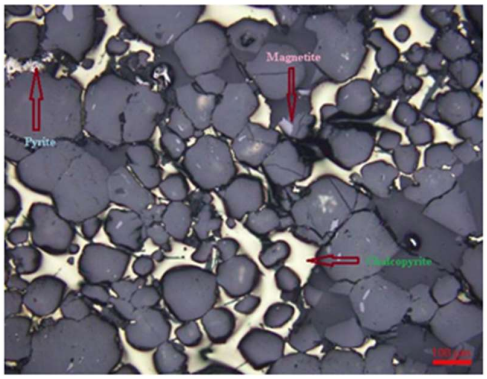
7.5 Ore occurs as (i) disseminations, (ii) stringers/veins along foliations, (iii) massive sulphide veins in breccias, and (iv) minor replacements; chalcopyrite is dominant, with pyrite, pyrrhotite, and magnetite as associates. Disseminations are rare and low grade, mainly in metabasics and quartzite; stringers and veinlets occur in schists, and massive veins in breccias, with mineralization largely through open-space fillings. Mineralization is not stratigraphically restricted but occurs preferentially in porphyroblastic garnetiferous quartz–chlorite–mica schist, silicified breccia, metabasics, granite, and occasionally quartzite. Copper mineralization is litho-structural and shear-controlled, hosted in shear/fold-related openings, forming stringers, veins, veinlets, and breccia fillings, aligned with foliation planes and co-folded with host rocks. Drilling revealed seven lodes in the Northern band (NB1–NB6) and six in the Southern band (SB1–SB5). Mineralization is erratic, with pinch-and-swell features; ore width and grade depend on cut-off, thickness, and parting strength.

7.5.3 **Borehole Core Photographs :**

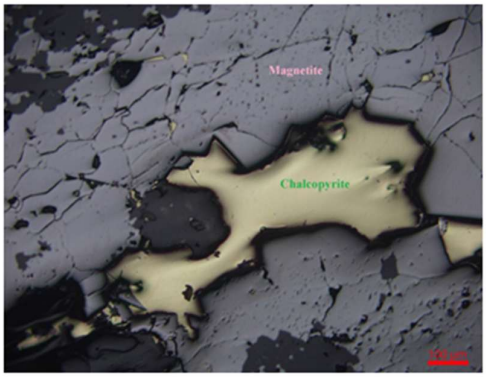
Photo 17: Stringers, veinlets and sheeted interconnected veins of Chalcopyrite and Pyrite, mainly occurring along porphyroblastic garnetiferous mica shist (MTB-4)

Photo 18: Stringers, veinlets and sheeted interconnected veins of Chalcopyrite and Pyrite mainly occurring along porphyroblastic garnetiferous mica shist (MTB-4)

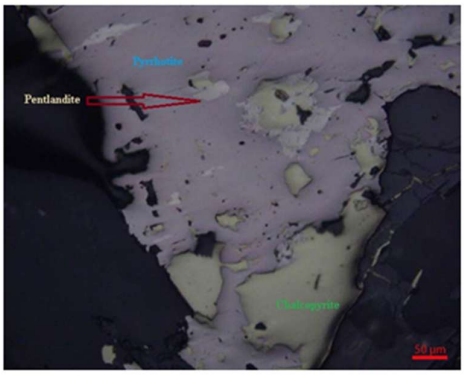
Photo 19: Massive thick fracture filling vein of Cpy, at contact of Granitic rock with Meta-basics. (MTB-5)



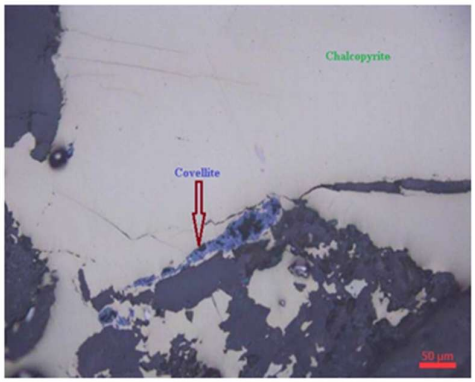
Pmg – 8: Photomicrograph chalcopyrite dendritic fillings along inter-granular spaces and associated pyrite and magnetite grains as seen under reflected light.
Specimen No.: MTB-12/M1 **Magnification :** 100X



Pmg – 9: Photomicrograph showing magnetite and chalcopyrite patches and very fine inclusions of chalcopyrite within magnetite as seen under reflected light.
Specimen No.: MTB-17/M1 **Magnification :** 100X



Pmg – 6: Photomicrograph showing pyrrhotite-chalcopyrite intermixed patches and pentlandite exsolutions within pyrrhotite as seen under reflected light.
Specimen No.: MTB-04/M1 **Magnification :** 200X



Pmg – 7: Photomicrograph showing patchy fillings of covellite replacing chalcopyrite as seen under reflected light.
Specimen No.: MTB-06/M1 **Magnification :** 200X

8.0 PREVIOUS WORK

8.1.1 The Baharagora Copper Prospect is located near the southeastern extremity of the Singhbhum Shear Zone. The existence of old workings (shallow pits) for copper in the Baharagora area area was reported as early as 1870 by Stoehr. A description of these workings was given by Dunn (1937). The area was covered by airborne multi-instrument geophysical surveys in 1963. Baharagora copper prospect comprises of number of sub blocks namely Mundadevta Darkhuli, South Jharia, Thakurdih and Charakmara Blocks.

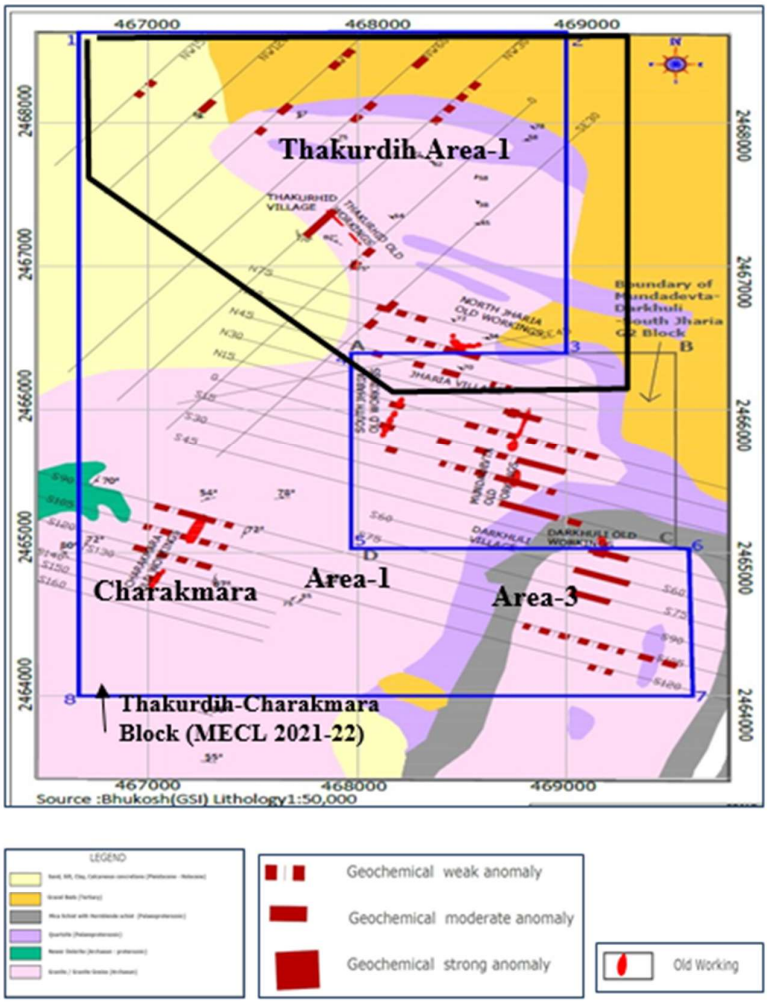
8.1.2 The Airborne Mineral Surveys and Exploration wing of GSI carried airborne Geophysical survey under “Operation Hardrock” in 1967-68. Airborne Geophysical data supplemented with Ground Geophysical Reconnaissance indicated a probable zone of Mineralisation in the Baharagora Area. GSI reported that Ground evaluation of the electromagnetic and magnetic signatures coupled with the available geological knowledge indicated the presence of potential mineralised zones. This led to the intensification of efforts in the form of integrated geological, geochemical and ground

geophysical surveys and exploratory diamond drilling to locate ore bodies and to assess the potentiality of the deposit. Results of all these efforts have indicated that the Baharagora copper deposit consists of a number of small blocks/mineralised grounds Mundadevta Darkhuli, South Jharia and Charakmara Blocks are apparently more promising.

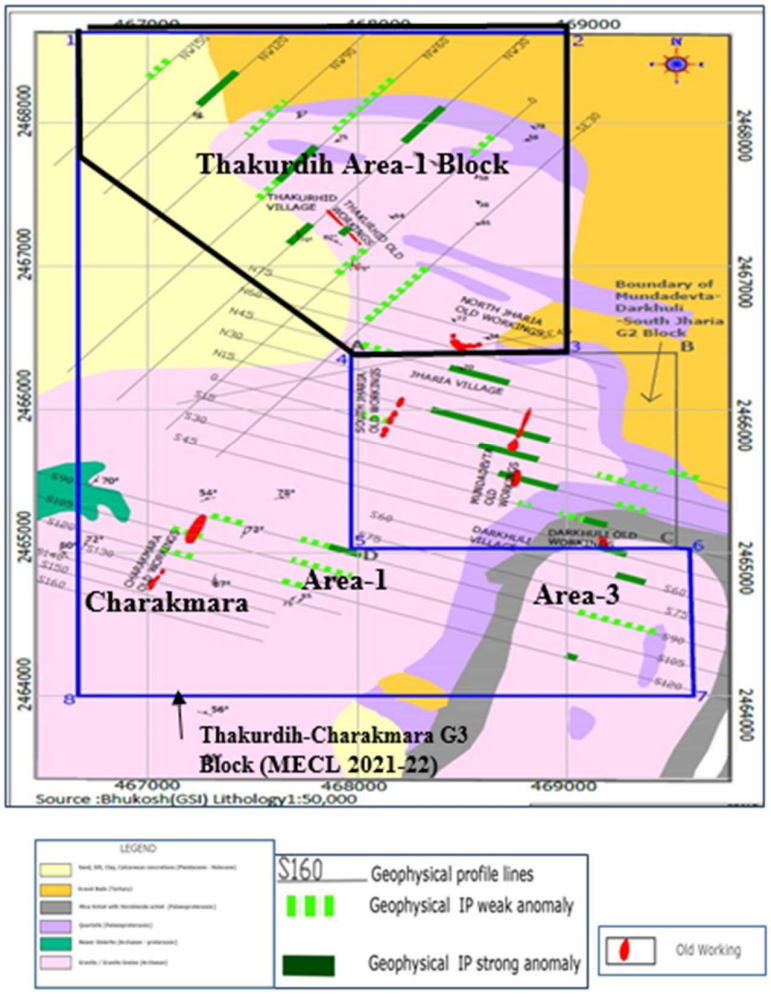
8.1.3 During previous exploration of GSI, (Majumder 1971) carried out exploration in Mundadevta-Darkhuli Block and a geological resource of 1.22m tonnes of 1 .23% Cu and 0.70m tonnes of 0.87% Cu and 0.21% Ni was estimated. Based on the outcome of previous work of GSI, MECL explored Mudadevta-Darkhuli & South Jharia Block for Copper and associated minerals over an area of 2.13 sq.km. at G2 stage in 2021-22. Total 5112m in 23 nos Boreholes were drilled in the area and resources estimated at 0.50% Cu and 1.0% Cu cut-off separately with 2.0m minimum stoping width (M.S.W.) as true width and 3.0m maximum parting. Total 1.74 milllion tonnes of net geological in-situ resources with an average grade of 0.96% Cu over 3.58m thickness at 0.50% Cu cut-off and 0.64 milllion tonnes of net geological in-situ resource with an average grade of 1.46% Cu over 3.53m thickness at 1.00% Cu cut-off up to a vertical depth of 245m from ground surface. The Thakurdih-Area-1 Block is just adjoining and northern extension to the Mundadevta-Darkhuli & South Jharaia G2 Block. (Plate-IV-D).

8.1.4 During the F.S. 1975-76 & 1977-78, GSI carried out geochemical survey followed by geophysical survey carried in the Block area. Soil samples at closer intervals (10-15m) were collected from the anomalous zones and analyzed for copper, nickel, cobalt and molybdenum which resulted with 46 anomalies with weak, moderate, and strong categories. In general, geochemical anomalies coincide with the old workings, values are upto 10000ppm for Cu. Subsequently, the area was covered by IP-Resistivity traverses at interval of 150/300 m with dipole length of 150m. In some sections, detailing with shorter dipole separation (30m) had been done which resulted with 15 no of high chargeable IP and Magnetic anomaly zones with values 200nT to maximum value 1200 nT. Geophysical anomalies indicated weak IP anomalies in Charakmara area and strong IP anomalies in Thakurdih Area-1, Area-2 and Area-3 of the block area. Geophysical anomalies (IP) corroborated well with geochemical anomalies and old workings in the area. (**Text Figure 6A & 6B**)

8.1.5 In Charakmara there is a line of discontinuous pits for a distance of about 500m in a NE-SW direction in metabasites, basic schists and biotite quartz schist within the granitic country rocks. Similarly, NW-SE trending old workings located in Thakurdih (Area-1) area. GSI drilled 2 test boreholes namely BC-1 and BC-2 in Charakmara area involved 300.45m drilling spaced 100m apart. A zone of mineralisation in BC-1 intersected over a width of 1.35m with 0.59% Cu & 0.11% Ni and in BC-02 over a width of 2.05m with 2.74% Cu. Further drilling was recommended by the previous workers and further it was opined that there is a reasonable chance of finding some tonnage from this block.



TEXT FIGURE: 6.A. Geochemical anomaly map (after GSI



TEXT FIGURE: 6-B. Geophysical anomaly map (after GSI

8.1.6 G3 Stage Exploration in Thakurdih-Charkmara Block (10 sq.km) by MECL: During the year 2022-23, MECL carried out G3 stage exploration in Thakurdih-Charakmara block including Thakurdih Area-1 sub block over 10.0 sq.km. area. Work included ground geophysical survey (I.P. Resistivity, Magnetic at 100/50 m profile at 20m interval), exploratory drilling (1497.50m in 12 Boreholes) and associated activites. Integrated geophysical survey (I.P. Resistivity and Magnetic) carried out in the area (60 Lkm) has brought out some prominent anomalies in Thakurdih Area-1 & 3 (Text Figure 7.). High chargeability and low resistivity zones were delineated and anomalies corroborated well with old workings, previous geophysical and geochemical anomalies of GSI.

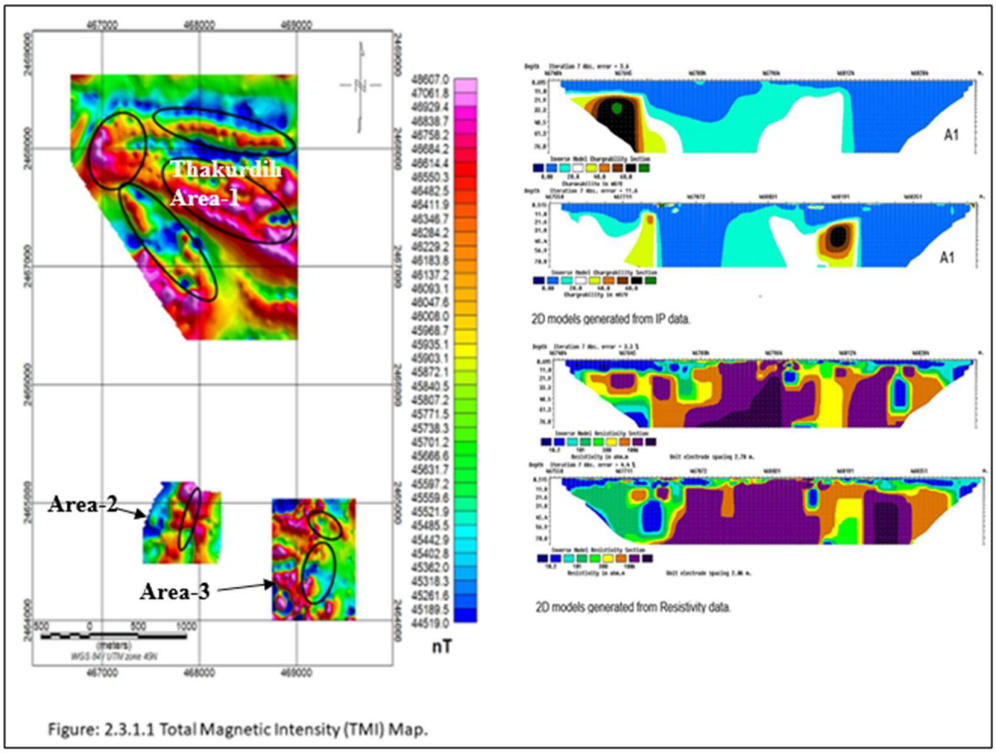


Figure: 2.3.1.1 Total Magnetic Intensity (TMI) Map.

TEXT FIGURE- 7: Geophysical anomalies in sub blocks of Thakurdih-Charakamara Block (MECL 2022-23)

8.10 In Thakurdih Area-1 sub block, based on integrated ground geophysical anomalies all three drilled scout/test boreholes (MTCB-09, 10 & 11) intersected mineralized zones at 0.20% cut-off value. MTCB-09 intersected (Lode-IB) zone of 0.26% Cu over 3.22m thickness and Borehole MTCB-10 (Lode-1AA) intersected zone of 0.46% Cu over 5.20m thickness. Total 128689 tonnes (0.13 million tonnes) with average grade of 0.39% Cu estimated in the area.

8.11 It was recommended that "Integrated geophysical anomalies intersected significant mineralized zones of considerable thickness and grade at depth in the test boreholes

drilled in Thakurdih Area-1. Hence, in order to ascertain the potentiality of the prospect, seamless G3/G2 stage exploration is recommended to confirm the strike and depth persistence of ore zone in Thakurdih Area-1 of Thakurdih-Charakmara block."

8.12 **G3 Stage Exploration in Thakurdih Area-1 Block by MECL (2024-25)**

8.12.1 Based on the recommendations of the previous report, MECL carried out G3 stage exploration in Thakurdih Area-1 Block (2024-25) for copper and work included Detailed geological mapping (1:2000 scale), topographic survey, surface sampling, trenching work, followed by exploratory drilling at approx.. 200m spacing interval and associated activities and laboratory studies.

8.12.2 In Thakurdih Area-1, copper mineralisation occurs along two zones namely Northern band & Southern band. In northern band, mineralization mainly occurs along the unexposed Porphyroblastic Garnetiferous Chlorite Mica schist. In southern band, mineralization mainly occurs along the contact of Granitic rock with the Meta-basic schistose rocks. Additionally, mineralization occurs in silicified brecciated rocks, less frequently in quartzite. Copper and associated mineralisation is mainly Litho-structure and shear controlled. In general, the mineralisation strikes E-W to NW-SW with 55° to 800 N & NE dip in Northern band while N50°W-S50°E with 60° to 80^0 NE dip in the Southern band.

8.12.3 Out of 17 boreholes drilled, total 7 lodes pertaining to northern band NB1, NB2, NB3, NB4, NB5, NB5A, NB6 and 6 lodes pertaining to southern band SBA, SB1A, SB3, SB4, SB5 were delineated in 16 boreholes at 0.2% Cu cut-off. (0.2%-1.21% Cu over 2.08-27.62m true width). At 0.5% cut-off, 3 lodes of northern band (NB1, NB3 & NB6) and 4 lodes of southern band (SB1, SB1A, SB3 & SB4) delineated in 9 boreholes (0.50%-1.28% Cu over 2.10m-5.57m true width). At 1.0% Cu cut-off I lode of northern band (NB6) and 2 lodes of southern band (SB1 & SB1A) delineated in 3 boreholes (1.01%-1.41%Cu over 2.45-3.63m true width).

8.12.4 Copper ore resources (inferred category) estimated at 0.2%, 0.5% & 1.0% Cu cut-off and placed under 333 category of UNFC. At 0.2% Cu cutoff, total Net geological in situ resource 4.43 million tonnes with an average grade of 0.38% Cu over 6.14m covering cumulative strike length of 2.6 km at 1^{st} level (60m VD), few sections at 2^{nd} level (120m & 180 VD).

8.12.5 At 0.5% Cu cut-off, 1.02 million tonnes with average grade of 0.70% Cu over 3.45m covering a cumulative strike length of 1.8 km at 1^{st} level (60m VD), few sections at 2^{nd} level (120m & 180 VD) .

8.12.6 At 1.0% Cu cut-off, 0.13 million tonnes net resource with average grade of 1.23% Cu over 2.77m for a cumulative strike length of 600m at 1^{st} level (60m VD), few sections at 2^{nd} level (120m & 180 VD).

8.12.7 Summary of estimated Inferred Resources (333 of UNFC) is given below **Table. 5.**

Table No. 5. Summary of Estimated Resources (333) by cross section method in Northern Band & Southern Band, Thakurdih Area-1 Block.

Cut-off	Lode No.	Gross Total Resource (Tonnes)	Net Resource (Tonnes)	Average Grade (Cu %)	Average Thickness (m)	Total Net Metal content (Tonnes)
0.2%	NB1, NB2, NB3, NB4, NB5, NB5A, NB6, SB1, SB1A, SB2, SB3, SB4 & SB5	4924418 (4.92 MT)	4431977 (4.43 MT)	0.38	6.14	16841
0.5%	NB1, NB3, NB6, SB1, SB1A, SB3, SB4	1130244 (1.13 MT.)	1017220 (1.02 MT.)	0.70	3.45	7120
1.0%	NB6, SB1A, SB1	139996 (0.14 MT)	125997 (0.13 MT.)	1.23	2.77	1550

8.12.8 Additionally, ICPMS studies of composite samples indicated total 4 ore zones (0.5% Cu cut-off zones) with ∑REE+Y+Sc values >1000 ppm ranging from 1105.30 to 4654.36 ppm with an average value of 2462.37 ppm.

8.12.9 Similarly, total 8 ore zones (0.2% Cu cut-off zones) indicated ∑REE+Y+Sc values >1000 ppm ranging from 1028.87 to 3913.3 ppm with an average value of 1691.58 ppm. Anomalous REE values reported mostly in Quartz - k-feldspar chlorite - biotite schist±Amphibole (silicified & granitized), Gt. Chlorite schist/metabasic schist, granite and contact zones of schist and granite.

8.12.10 Also, ICPMS studies of composite samples (0.5% Cu cut-off) indicated total 11 ore Zones with Co values range from 101.48ppm Co to 288.03 ppm Co. over 2.50m to 7.50m with One zone shown highest Co value of 1300ppm over 4m (MTB-08). One Zone had shown Mo value of 192.97 ppm Mo over 7.50m thickness (MTB-08). At 0.2% Cu cut-off, Total 18 zones indicated cobalt values range from 102.79 ppm Co to 367.13 ppm Co with one zone shown highest value of 1220.33 ppm over 3.50m thickness (MTB-08). Two zones shown Mo values of 147.60m over 8.0m (MTB-08) & 138.83 ppm Mo over 13.23m (MTB-17).

9.1 OBSERVATIONS & RECOMMENDATIONS OF PREVIOUS WORK

9.1.1 **Recommendation of G3 Report** – "G3 stage exploration established Copper ore resource at Inferred (UNFC-333) resource category in Thakurdih Area-1 Block. Copper bearing lodes are open in depth and there are significant gaps in exploration. Hence, G2 stage exploration was recommended in the area by close spaced drilling for gaining more confidence on resource and grade. Also, Time Domain EM survey would be helpful to delineate conducting bodies and deeper level mineralisation in the area".

9.1.2 As per the recommendations, G2 stage exploration involving systematic exploratory infilling 1st level boreholes (60m VD) at 50m spacing interval and followed by 2nd level (120m vertical depth) boreholes at 100m spacing interval in alternate sections is required to prove the strike and depth continuity of ore zones in potential Northern band (2.3 km strike length) & Southern band (1.1 km strike length) over a cumulative strike length of 3.4km and upgrade the resource to indicated category for gaining higher confidence on resource and grade. Moreover, the potentiality of other associated minerals i.e. REE, Co & Mo exploration at G2 stage to be assessed along with copper.

10.0 MINERAL POTENTIALITY

10.1 The G3 stage exploration for copper and associated minerals carried out in Thakurdih Area-1 Block established copper mineralization in northern band and southern band over a cumulative strike length of 2.8 km. During previous G3 Stage exploration, boreholes intersected several significant copper ore zones at 0.2% cu, 0.5% Cu & 1.0% Cu cutoff. Considering the cut-off grade criteria parameters for resource estimation, copper ore resources were estimated at various cut-off grades i.e. at 0.2%, 0.5% and 1.0% Cu cut-off and resourced estimated upto 1st level (60m VD), few sections at 2nd level (120m & 180 VD) and the same is described under **para 8.12.**

8.12.11 Additionally, Borehole data at G3 state indicated encouraging values for REE, Co and Mo along with Copper as described under **para 8.12**. Hence, Thakurdih Area-1 prospect hold potential for polymetallic mineralisation. Systematic G2 stage exploration at close spaced interval (50m interval for 1st level & 100m interval for 2nd level in alternate sections) would be helpful to estimate and upgrade copper ore resources at 332 category of UNFC as well as to figure out the potentiality for other associated minerals i.e. REE, Co and Mo mineralisation besides copper in the area.

11.0 PRESENT WORK

- In consideration with previous G3 stage exploration and borehole data, present exploration work at G2 stage has been planned in Phased manner (Phase-I & II) to prove the strike & depth persistence of copper mineralisation at close spaced interval and upgrade the copper ore resources under Indicated category (332 of UNC). The objectives of present exploration (G2) is as follows.

Phase-I

- To update Detailed geological map & Topographic survey map at 1:2000 scale along with surface sampling (Bedrock/Channel).
- To carryout trenching work on borehole profiles (if required)
- To carryout infilling 1st level boreholes (60m vertical depth) at 100m spacing interval to prove the strike and depth persistence of Copper ore zones in the entire Northern band (covering 2.3 km strike length) & Southern Band (covering 1.1 k.m. strike length)

Phase-II (Based on outcome & Review with TCC of NMET)

- To carryout infilling 1st level boreholes (60m vertical depth) to fill up the gaps at 50m spacing interval and followed by 2nd level boreholes (upto 120m VD) at 100m spacing interval in alternate sections to prove the strike and depth persistence of Copper ore zones in Northern band (covering 2.3 km strike length) & Southern Band (covering 1.1 km strike length).
- To drill 3 Nos. deeper level boreholes, two in Northern Band and one deeper level borehole in Southern Band up to 4th Level (i.e. 240 m vertical depth) to confirm the deep-seated mineralisation for future prospects and planning.
- To estimate the Copper ore resources (332) as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2015 & amended up to 2021.
- To carry out the geotechnical studies for assessment of strength of rocks occurring in the block.
- To ascertain the amenability of the Copper ore through beneficiation study.

12.0 PLANNED METHODOLOGY

12.1 The proposed General Exploration at G-2 stage in the block comprises of updating of Geological map on (1:2,000 scale), exploratory drilling in phased manner along with associated survey, chemical analysis, physical analysis and Report preparation. The Exploration shall be carried out as per Minerals (Evidence of Mineral Content)

Rule-2015 and amended up to 2021. Accordingly, the following scheme of exploration has been formulated in order to achieve the objectives. The details of different activities to be carried out are presented in subsequent paragraphs:

12.2 Survey

The Thakurdih Area-1 Block boundary was surveyed for demarcation of block boundary/corner points by DGPS in WGS-84 datum during previous G3 stage investigation by MECL (2024-25) including Topographical Surveying in the entire block area (4.10 sq.km.) at 2 m contour interval and existing physical and manmade features in the area were surveyed. During present G2 stage investigation, Topographical map of the area shall be updated at 1:2000 scale and Boreholes will be fixed on the ground whose RL's and co-ordinates will be determined by DGPS survey.

12.2 Geological Mapping:

Detailed Geological Map of the Block area is available at 1:2000 scale. During present G2 stage investigation the available Geological map shall be updated at 1:2000 scale. All the geological features will be recorded and litho-contacts along with structural features will be plotted for finalization of Geological map. This map will be used as base map for planning of boreholes and future work. During the course of geological mapping total 20 Nos. Bedrock samples shall be collected for analysis of for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn by AAS method. Total 2 nos. External check samples (10% of primary samples) shall be analysed for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn at external NABL accredited laboratory to check for analytical bias if any.

12.3 Trenching:

Trenches shall be excavated along the suitable borehole profile lines to decipher the ore zone if required. A provision of total 200 cu.m. trenching work is kept. The location of trenches shall be decided by the site geologist based on the outcome of geological mapping and location of borehole. During the course of trenching work total 150 nos. trench samples shall be collected for analysis of Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn by AAS method. Total 15 nos. External check samples (10% of primary samples) shall be analysed for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn at external NABL accredited laboratory to check for analytical bias if any.

12.4.1 Drilling:

During the previous exploration at G3 stage, boreholes were drilled approximately 200m interval in Northern & Sourthern Band in Thakurdih Area-1 Block.

The present G2 stage Exploratory drilling has been planned in two phases (Phase-I & II). During Phase-I, 1st level infilling boreholes (60m Vertical depth) shall be drilled at 100m spacing interval to cover the entire potential zone of Northern Band over 2.3 km strike length and Southern Band over 1.1 km strike length. Based on the outcome and review, Phase-II infilling drilling shall be taken up for 1st level boreholes to fill up the gaps at 50m spacing interval and followed by drilling of 2nd level boreholes (120m Vertical depth) at 100m spacing interval in alternate sections Additionally, two deeper level boreholes in Northern band and one deeper level borehole in southern band shall be drilled at 4th level (up to 240m vertical depth from surface) to confirm the deep-seated mineralisation for future prospects and planning.

The summary of Phase-I and Phase-II drilling is given below **Table 12.1.**

Phase	Zone	Total Drilling meters	No. of Bhs.	Remarks
Phase-1	Northern Band	1730	14	Total 23 Bhs for 1st Level at 100m interval
	Southern Band	1090	9	
	Sub Total	**2820**	**23**	
Phase-II	Northern band	7060	45	Total 36 Bhs for 1st Level at 50m interval & 25 Bhs for 2nd Level at 100m interval in alternate sections & 3 deeper level (4th level) boreholes
	Southern Band	2915	19	
	Sub Total	**9975**	**64**	
	Total	**12795**	**87**	

Total 23 Boreholes (2820m) planned in Phase-I for 1st level intersections at 100m spacing interval. In Phase-II, total 64 Boreholes (9915m) planned of which total 36 Boreholes for 1st level intersections at 50m spacing interval and followed by total 25 Boreholes for 2nd level intersections at 100m interval in alternate sections. Total 3 No.s deeper level boreholes (2 in Northern band & 1 in Southern Band) up to 4th level (240m vertical depth) planned. Altogether (Phase-I &II) 12,795m in 87 incline Boreholes planned in the area to target Northern band over 2.3 km strike length and southern band over 1.1km strike length in Thakurdih Area-1 are given in below **Table**

12.1. Location of proposed boreholes and sections are given as Plate No. III and IV respectively. Schematic LV section with proposed borehole intersections also given as Plate No. V.

Table No.12.1:

Details of proposed Phase-I boreholes in Thakurdih Area-1 Block (G2 Stage)

PHASE-I- THAKURDIH AREA-1 BLOCK							
NORTHERN BAND							
S.No.	**Phase**	**SECTION NO**	**BH NO**	**Azimuth**	**Angle**	**PROPOSED DEPTH (m)**	**LEVEL**
1	Phase-I	S1A	PBH-01	S	50	110	1ST
2		S2B	PBH-04	S	50	110	1ST
3		S3B	PBH-07	S	50	180	1ST
4		S4B	PBH-10	S	50	120	1ST
5		S5B	PBH-13	S18W	50	120	1ST
6		S6B	PBH-16	S	50	120	1ST
7		S7B	PBH-19	S	50	120	1ST
8		S8B	PBH-22	S	50	130	1ST
9		S8E	PBH-25	S	50	110	1ST
10		S9B	PBH-28	S30W	50	120	1ST
11		S10B	PBH-31	W	50	130	1ST
12		S12	PBH-33	N66W	50	120	1ST
13		S13B	PBH-36	S	50	120	1ST
14		S14B	PBH-39	S5E	50	120	1ST
			Sub Total			**1730**	
SOUTHERN BAND							
S.No.	**Phase**	**SECTION NO**	**BH NO**	**Azimuth**	**Angle**	**PROPOSED DEPTH (m)**	**LEVEL**
1	Phase-I	S15A	PBH-40	S30W	50	130	1ST
2		S16B	PBH-43	S30W	50	150	1ST
3		S16D	PBH-45	S30W	50	110	1ST
4		S17B	PBH-47	S20W	50	120	1ST
5		S18B	PBH-50	S20W	50	120	1ST
6		S19B	PBH-53	S33W	50	110	1ST
7		S20A	PBH-57	S75W	50	100	1ST
8		S21	PBH-86	S44W	50	150	1st
9		S22	PBH-84	S44W	50	100	1ST
			Sub Total			**1090**	
			GRAND TOTAL			**2820**	

Table No.12.1:

Details of proposed Phase-II boreholes in Thakurdih Area-1 Block (G2 Stage)

PHASE-II- THAKURDIH AREA-1 BLOCK							
SOUTHERN BAND							
S.No.	**Phase**	**SECTION NO**	**BH NO**	**Azimuth**	**Angle**	**PROPOSED DEPTH (m)**	**LEVEL**
1	Phase-II	S1B	PBH-02	S	50	110	1ST
2		S2	PBH-58	S	50	175	2nd
3		S2A	PBH-03	S	50	110	1ST
4		S2B	PBH-59	S	50	170	2nd
5		S2C	PBH-05	S	50	120	1ST
6		S3	PBH-87	S	55	350	4th
7		S3A	PBH-06	S	50	120	1ST
8		S3B	PBH-60	S	50	220	2nd
9		S3C	PBH-08	S	50	130	1ST
10		S4	PBH-61	S	50	195	2nd
11		S4A	PBH-09	S	50	120	1ST
12		S4B	PBH-62	S	50	195	2nd
13		S4C	PBH-11	S	50	120	1ST
14		S5A	PBH-12	S	50	120	1ST
15		S5B	PBH-63	S18W	50	185	2nd
16		S5C	PBH-14	S18W	50	120	1ST
17		S6	PBH-64	S	50	195	2nd
18		S6A	PBH-15	S	50	120	1ST
19		S6B	PBH-65	S	50	195	2nd
20		S6C	PBH-17	S	50	120	1ST
21		S7	PBH-66	S10W	55	180	2nd
22		S7A	PBH-18	S	50	120	1ST
23		S7B	PBH-67	S	50	185	2nd
24		S7C	PBH-20	S	50	120	1ST
25		S8A	PBH-21	S	50	120	1ST
26		S8A	PBH-68	S	50	190	2nd
27		S8C	PBH-23	S	50	120	1ST
28		S8C	PBH-69	S	50	195	2nd
29		S8D	PBH-24	S	50	120	1ST
30		S8E	PBH-70	S	50	180	2nd
31		S8F	PBH-26	S	50	120	1ST
32		S9A	PBH-27	S30W	50	110	1ST
33		S9B	PBH-71	S30W	50	195	2nd
34		S9C	PBH-29	S52W	50	120	1ST
35		S10A	PBH-30	W	50	120	1ST
36		S10B	PBH-72	W	50	195	2nd
37		S11	PBH-32	W	50	120	1ST
38		S12A	PBH-34	N66W	50	120	1ST

PHASE-II- THAKURDIH AREA-1 BLOCK							
SOUTHERN BAND							
S.No.	**Phase**	**SECTION NO**	**BH NO**	**Azimuth**	**Angle**	**PROPOSED DEPTH (m)**	**LEVEL**
39		S13A	PBH-35	S	50	120	1ST
40		S12	PBH-73	N66W	50	175	2nd
41		S13B	PBH-74	S	50	175	2nd
42		S13C	PBH-37	S5E	50	120	1ST
43		S13D	PBH-75	S5E	50	175	2nd
44		S14A	PBH-38	S5E	50	120	1ST
45		S9	PBH-76	S30W	55	355	4TH
			Sub Total			**7060**	
SOUTHERN BAND							
S.No.	**Phase**	**SECTION NO**	**BH NO**	**Azimuth**	**Angle**	**PROPOSED DEPTH (m)**	**LEVEL**
1	Phase-II	S15B	PBH-41	S30W	50	130	1ST
2		S16A	PBH-42	S30W	50	140	1ST
3		S16C	PBH-44	S30W	50	130	1ST
4		S17A	PBH-46	S20W	50	110	1ST
5		S17C	PBH-48	S20W	50	110	1ST
6		S18A	PBH-49	S20W	50	100	1ST
7		S18C	PBH-51	S25W	50	110	1ST
8		S19A	PBH-52	S30W	50	110	1ST
9		S19C	PBH-54	S38W	50	100	1ST
10		S19D	PBH-55	S37W	50	100	1ST
11		S20	PBH-56	S37W	50	100	1ST
12		S15	PBH-77	S30W	50	230	2nd
13		S16B	PBH-78	S30W	50	200	2nd
14		S17B	PBH-79	S20W	50	175	2nd
15		S17C	PBH-80	S30W	50	180	2nd
16		S18B	PBH-81	S20W	50	180	2nd
17		S19B	PBH-82	S38W	50	180	2nd
18		S19	PBH-83	S75W	50	190	2nd
19		S18	PBH-85	S30W	55	340	4th
			Sub Total			**2915**	
			Grand Total			**9975**	

Note: The location of proposed boreholes (Phase-I & II) and their depths are tentative and may subject to vary as per actual field and geological conditions. The actual positions of boreholes shall be decided by the site geologist based on the outcome of geological mapping, drilling results and site conditions.

12.4 **Borehole Core Logging**

Detailed drill core logging will be done with consideration of lithological details, structural features, e.g. joints, veins foliations, mineralization pattern, visual estimation of copper content and other associated minerals in percentage etc. for entire length of all the holes and determination of Rock Quality Designations (RQD) for entire length of core in each borehole.

12.5 **Borehole sampling (Primary analysis)**

The borehole cores shall be spitted into two equal halves by using proper core splitter. One half will be powdered to -200 mesh size and the other half will be kept for future studies. The powdered material will be mixed thoroughly and about 100 gram of samples will be taken for chemical analysis by successive coning and quartering as primary samples and rest of the material (-200 mesh size) will be kept as duplicate for future reference. Total 4350 nos. borehole core primary samples shall be analysed for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn by AAS method.

12.5 **Borehole sampling (Check Analysis)**

Total 435 nos. External check samples (10% of primary samples) shall be analysed for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn at external NABL accredited laboratory to check for analytical bias if any.

12.6 **Petrography and Mineragraphy Studies**

Total 10 nos. of samples for Petrographic study by thin section 10 no of samples for Mineragraphic studies through polished section are proposed to be carried out at MECL Lab. Petrological and Mineragraphic study report includes 10 Nos. of digital photomicrographs of thin and polished sections.

12.6 **Specific gravity determination**

Total 10 nos. of selected samples shall be subjected to specific gravity determination studies.

12.7 **Beneficiation studies**

Laboratory scale beneficiation studies shall be carried out for mineralised zones to ascertain the amenability of the copper ore.

12.8 **Beneficiation studies**

Laboratory scale geotechnical studies shall be carried out to determine the different Physico-Mechanical properties viz. as bulk density (ρ), unconfined compressive strength (UCS), Young's modulus of elasticity (E), indirect tensile strength (ITS), cohesion(c,) angle of internal friction (ϕ) and Porosity (n) with analysis of data and test report.

13.0 Quantum of Proposed Work

Table- 13.1 Nature and Quantum of proposed G2 exploratory programme

Sl.No	Description and Nature of Work	Unit	Target
A	**GEOLOGICAL & SURVEY WORK**		
1	Detailed Geological Mapping (1:2000 scale)	Sq. km	Update (4.10 sq.km.)
2	Topographical survey (1:2000 scale) 2m contour interval	Sq.km.	
a	Bore Hole Fixation and determination of co-ordinates & Reduced Level of the boreholes and block boundary by DGPS	Per Point of observation	87
B	**TRENCHING**		
1	Excavation of trenches along Borehole profiles (if required)	Cu.m.	200
C	**DRILLING**		
1	Drilling up to 300m (Hard Rock)	m	12795
2	Borehole deviation Survey by Multishot Camera	m	12795
3	Borehole geophysical logging (3 Nos. Deeper Boreholes)	m	1045
C	**LABORATORY STUDIES**		
1	**Chemical Analysis**		
i)	**Surface Samples (Bedrock/Channel) Primary samples**		
	a. for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn	Nos	20
ii)	**Surface Check samples External (10%)**		
	a. for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn	Nos	2
iii)	**Trench Samples**		
	a. for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn	Nos	150
iv)	**Check Trench Samples**		
	a. for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn	Nos	15
v)	**Borehole Primary samples**		
	a. for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn	Nos	4350
vi)	**Check samples External (10%)**		
	a. for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn	Nos	435
v)	**Composite Samples**		
	1. 34 Element by ICP-MS	Nos.	50
	2. For Au & Ag by fire assay	Nos.	50
D	**Petrological samples (BH Core Samples)**		
i	Preparation of thin section	Nos	10
ii	Study of Thin Section	Nos	10
E	**Mineragraphic Studies (BH Core Samples)**		
a	Preparation of polished section	Nos	10
b	Study of Polished Section	Nos	10
c	Digital Photographs	Nos	10
d	Specific gravity determination	Nos	10
E	Geo-Technical Studies (on One BH cores)	Nos.	15
F	Beneficiation Studies (for Cu)	Nos.	1
G	Geological Report Preparation	Nos	1

14.0 MANPOWER DEPLOYMENT

Manpower deployment List will be provided later.

15.0 BREAK-UP OF EXPENDITURE

Tentative Cost has been estimated based on Schedule of Charges (SoC) of projects funded by National Mineral Exploration Trust (NMET) w.e.f. 01/04/2020. The total estimated cost is Rs. **2302.38 Lakh**. The summary of tentative cost estimates for General Exploration (G-2 stage) is given in **Table No.-15.1** and details of tentative cost estimates is given in **Table No.–15.2**. Tentative Time schedule/action plan for proposed General Exploration (G2 stage) is given in **Table No. 15.3.**

Table- 15.1 Summary of Cost Estimates- Thakurdih Area-1 Block (G2)

Sl. No.	Item	Total
A	Geological work	9,127,480
B	Trenching/Pitting	666,000
C	Drilling	163,867,061
D	Survey work	1,670,400
E	Laboratory Studies	16,598,232
F	Benefication studies	300,000
G	Geotechnical studies	358,180
	Sub total	**192,587,353**
H	Geological Report	2,000,000
I	Peer Review	30,000
J	Exploration Proposal Preparation	500,000
	Total Cost (without GST)	**195,117,353**
L	GST (18%)	35,121,124
Total cost including 18% GST		**230,238,477**
SAY, in Lakhs		**2,302.38**

11.0 TIME SCHEDULE

11.1 The proposed exploration programme at G2 stage in Thakurdih Area-1 Block envisages updating topographic surveying, geological mapping, surface sampling, trenching work and exploratory drilling (Phase-I &II), deviation survey, borehole geophysical logging, sample preparation and laboratory studies and geological report preparation which will be completed within 18 months by deploying 4 drill rigs therefore, a total of 18 months is planned for completion of the entire program.

Table No. 15.3: TIME SCHEDULE /ACTION PLAN FOR GENERAL EXPLORATION (G-2) FOR COPPER & ASSOCIATED MINERALS IN THAKURDIH AREA-1 , SINGHBHUM COPPER BELT, EAST SINGHBHUM DISTRICT, JHARKHAND STATE.
(Time schedule 18 months: Review after 1st Phase Drilling & 2nd Phase Drilling)

S. No.	Actvities	Qty.	1	2	3	4	5	6	Review	7	8	9	10	11	12	13	Review	14	15	16	17	18
1	Camp Setting	months																				
2	Updation of Geological Map & Topographic survey (1:2000 scale) & Collection of surface samples	4.10 sq.km																				
3	Trenching & Sampling work	months																				
4	Phase-I Drilling & associated works (4 rig)																					
5	Phase-II Drilling & associated works (4 rig)																					
6	Geologist party days (Field)	months																				
7	Sampling party days,	months																				
8	Camp winding	months																				
9	Laboratory Studies	months																				
10	Beneficiation Studies	1 No.																				
11	Geotechnical Studies	1 No.																				
12	Geologist party days at HQ	months																				
13	Report Writing with Peer Review	months																				

1	**Commencement of project may be reckoned from the day the exploration acreage is available along with all stautory clearances.**
2	**Time loss on account of monsoon/agricultural activity/forest clearence/local law & order problem/ lockdown etc will be additional to above time line.**

Table 15.2 Estimated cost for Preliminary Exploration (G-2 stage), for Copper and associated minerals in Thakurdih-Area-1, District:East Singbhum, State: Jharkhand. [Block area- 4.10 sq. km; Schedule timeline- 18 months, Review - After Phase-I, Total Boreholes-87 (Phase-I: Total 23 Bhs for 1st level at 100m interval , Phase-II -Total 64 Bhs including 36 Bhs for 1st level at 50m interval, 25 Bhs for 2nd level at 100m interval in alternate sections & 3 Deeper level Boreholes (4th level 240m VD)

S. No.	Item of Work	Unit	Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal		Remarks
			SoC-Item -Sl No.	Rates as per SoC	Qty.	Amount (Rs)	
A	**GEOLOGICAL WORK**						
i	Surface sampling, Geological map updation (1:2000 scale), Borehole logging, sampling & Report writing				4.10 sq.km	Update	
ii	Charges for Geologist per day- HQ	day	1.3a	9,000	60	540,000	
i	Charges for Geologist per day - Field	day	1.3b	11,000	300	3,300,000	
iii	Labour(2 Nos.) for Geologist	day	5.7	541	600	324,600	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
iv	Charges for One Sampler per Day	day	1.5.2	5,100	640	3,264,000	
v	Labours for sampling work (4 Nos.)	day	5.7	541	2,560	1,384,960	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
vi	Survey Party Days for Borehole points fixation & RL determination	day	1.6. 1a	8,300	30	249,000	
vii	4 labours for surveyor	day	5.7	541	120	64,920	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
					Sub Total- A	**9,127,480**	
B	**TRENCHING/PITTING**						
i	Excavation of Trenches (If Required)	per.cu.m.	2.2.1	3,330	200	666,000	
					Sub Total- B	**666,000**	
C	**DRILLING**						
i	Drilling upto 300m (Hard Rock)	m	2.2.1.4a	11,500	12,650	145,475,000	
ii.	Drilling between Depth of 301-600m	m	2.1.1.4b	12,420	145	1,800,900	
iii.	Borehole deviation Survey	m	2.2.6	330	12,795	4,222,350	
iv.	Borehole Geophysical logging	5 Bhs of 350m each	3.12	622.25	1,045	650,251	For deeper level 3 boreholes Base reate Rs. 10, 88, 941/1750=622.25m)
v.	Land / Crop Compansation	per BH	5.6	20,000	87	1,740,000	
vi.	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000	87	174,000	
vii.	Transportation of Drill Rig & Truck associated per drill (4 rigs)-Two way	Km	2.2.8	36	8,000	288,000	To & Fro for 4 Rigs from Nagpur
viii.	Monthly Accomodation Charges for drilling Camp (Up to 4 Rigs)	monthly	2.2.9	100,000	9	900,000	50,000 per month up to 2 rigs, 50% additional charges will be paid for each additonal drill rig.
ix.	Drilling Camp Setting Cost	Nos	2.2.9a	250,000	4	1,000,000	
x	Drilling Camp Winding up Cost	Nos	2.2.9b	250,000	4	1,000,000	
xi	Approach Road Making (Flat Terrain)	Km	2.2.10a	22,020	8	176,160	
xii	Bore Hole Fixation and determination of co-ordinates & Reduced Level of the boreholes and block boundary by DGPS	Nos	1.6.2	19,200	87	1,670,400	
xiii	Borehole core preservation-One complete borehole plus mineralised cores of all the remaining BHs	m	5.3	1,590	3,000	4,770,000	
					Sub Total- C	**163,867,061**	
D	**Survey Work**						
a	DGPS survey for Borehole fixation & RL determination	Per point of observation	1.6.2	19200	87	1,670,400	
					Sub Total- D	**1,670,400**	
E	**LABORATORY STUDIES**						
1	**Chemical analysis**						
a	**Surface samples (Primary) (Bedrock/channel)**						
	a) Primary samples for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn by AAS method		4.1.7a & b	5,181	20	103,620	AAS method
b	**Surface Check samples (10% External check)**						
	c) For Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn by AAS method		4.1.7a & b	3,176	2	6,352	AAS method
c	**Trenching Samples**						
	a) Primary samples for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn by AAS method		4.1.7a & b	3,176	150	476,400	AAS method
d	**Trench Check samples (10% External check)**						
	c) For Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn by AAS method		4.1.7a & b	3,176	15	47,640	AAS method
e	**BH core samples**						
	a) Primary samples for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn by AAS method	Nos	4.1.7a & b	3,176	4,350	13,815,600	AAS method
f	**BH Core Check samples (10% External check)**						
	a) External Check sample (10% of Primary samples) for Cu, Pb, Zn, Ni, Co, Mo, Bi, Ge, Te & Sn by AAS method	Nos	4.1.7a & b	3,176	435	1,381,560	AAS method
g	**Composite Samples**						
	a) 34 elements by ICPMS Method	Nos	4.1.14	7,731	50	386,550	
	b) For Au & Ag by fire assay	Nos	4.1.5a	4,760	50	238,000	
2	**Petrological & Mineragraphic studies (BH core samples)**						
i	Preparation of thin section	Nos	4.3.1	2,353	10	23,530	
ii.	Complete petrographic study report	Nos	4.3.4	4,232	10	42,320	
iii.	Preparation of polished section	Nos	4.3.2	1,549	10	15,490	
iv.	Complete mineragraphic study report	Nos	4.3.4	4,232	10	42,320	
v.	Digital Photographs	Nos	4.3.7	280	10	2,800	
vi.	Specific Gravity Determination	Nos	4.8.1	1,605	10	16,050	
					Sub Total- E	**16,598,232**	
F	**Benefication studies**						
i.	Laboratory scale Ore Benefication study	Lumpsum	SoC of IBM	300000	1	300,000	
					Sub Total-F	**300,000**	
G	**Geotechnical studies**						
i.	Geotechnical study of one borehole including...Porosity, Uniaxial compressive strength, tensile strength Youngs modulus elasticity, triaxial compressive strength (cohesion & angle of internal friction) and bulk density etc.	No.	4.8.2, 4.8.4c, 4.8.5, 4.8.7, 4.8.9 & 4.10	23212	15	348,180	To be decided by TCC
ii.	Transportation of drill core by postal service		Lumpsum	10000	1	10,000	To be decided by TCC
					Sub Total-G	**358,180**	
					Sub Total-(A to G)	**192,587,353**	
H	**Geological Report Preparation**		5.2	For Projects having cost exceeding Rs. 300 lakhs-A minimum of Rs.9 lakhs or 3% of the value of work whichever is more subject to a maximum amount of Rs. 20 lakh		**2,000,000**	Reimbursement will be made after submission of the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.
I	**Peer review Charges**		As per EC decision			**30,000**	
J	**Preparation of Exploration Proposal (5 Hard copies with a soft copy)**	5 Hard copies with a soft copy	5.1/28th EC	2% of the Cost or Rs. 5.0 Lakhs whichever is lower		**500,000**	EA has to submit the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal.
K	**Total Estimated Cost without GST**					**195,117,353**	
L	**Provision for GST (18%)**					**35,121,124**	GST will be reimburse as per actual and as per notified prescribed rate
M	**Total Estimated Cost with GST**					**230,238,476.84**	
					or Say Rs. In Lakhs	**2,302.38**	
Note:							
1	If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMET SoC and Item no. 6 of NMET SoC. In case of execusion of the project by NEA on its own, a Certifiate regarding non outsourcing of any component/project is required.						

12.0 JUSTIFICATION

12.1 Thakurdih Area-1 is part of previously explored Thakurdih-Charakmara G3 Block and forms the part of prominent Baharagora copper prospect located at the extreme southeastern end of Singbhum copper belt of Jharkhand.

12.2 MECL carried out G3 stage exploration in Thakurdih Area-1 Block during 2024-25 under NMET funding. Detailed geological mapping (1:2000 scale) over 4.10 sq.km. area and exploratory drilling work at approx.. 200m interval carried out in Northern & Southern Band to prove the strike and depth continuity of mineralisation at 1st level (60m vertical depth) and in few sections at 2nd level (120m vertical depth) from the surface.

12.3 In Thakurdih Area-1, copper mineralisation occurs along two zones namely Northern band & Southern band. In northern band, mineralization mainly occurs along the unexposed Porphyroblastic Garnetiferous Chlorite Mica schist. In southern band, mineralization mainly occurs along the contact of Granitic rock with the Meta-basic schistose rocks. Additionally, mineralization occurs in silicified brecciated rocks, less frequently in quartzite. Copper and associated mineralisation is mainly Litho-structure and shear controlled. In general, the mineralisation strikes E-W to NW-SW with 55° to 80^0 N & NE dip in Northern band while N50°W-S50°E with 60° to 80^0 NE dip in the Southern band.

12.4 Out of 17 boreholes drilled in previous G3 exploration, total 7 lodes pertaining to northern band NB1, NB2, NB3, NB4, NB5, NB5A, NB6 and 6 lodes pertaining to southern band SBA, SB1A, SB3, SB4, SB5 & SB6 were delineated in 16 boreholes at 0.2% Cu cut-off. (0.2%-1.21% Cu over 2.08-27.62m true width). At 0.5% cut-off, 3 lodes of northern band (NB1, NB3 & NB6) and 4 lodes of southern band (SB1, SB1A, SB3 & SB4) delineated in 9 boreholes (0.50%-1.28% Cu over 2.10m-5.57m true width). At 1.0% Cu cut-off I lode of northern band (NB6) and 2 lodes of southern band (SB1 & SB1A) delineated in 3 boreholes (1.01%-1.41% Cu over 2.45-3.63m true width).

12.5 Copper ore resources estimated at 0.2%, 0.5% & 1.0% Cu cut-off at 1st level i.e. 60m Vertical depth, few sections at 2nd level i.e. 120m & 180 Vertical depth in Northern Band & Southern Band of Thakurdih Area-1 Block.

12.6 At 0.2% Cu cutoff, total Net geological in situ resource 4.43 million tonnes with an average grade of 0.38% Cu over 6.14m covering cumulative strike length of 2.6 km estimated

12.7 At 0.5% Cu cut-off, 1.02 million tonnes Net resource with an average grade of 0.70% Cu over 3.45m covering a cumulative strike length of 1.8 km estimated.

12.8 At 1.0% Cu cut-off, 0.13 million tonnes net resource with average grade of 1.23% Cu over 2.77m for a cumulative strike length of 600m estimated.

12.9 Resources placed under Inferred category (333 of UNFC) in Thakurdih Area-1 Block.

12.10 Additionally, ICPMS studies of composite samples of ore zones indicated total 4 ore zones (0.5% Cu cut-off zones) with ∑REE+Y+Sc values >1000 ppm ranging from 1105.30 to 4654.36 ppm with an average value of 2462.37 ppm.

12.11 Similarly, total 8 ore zones (0.2% Cu cut-off zones) indicated ∑REE+Y+Sc values >1000 ppm ranging from 1028.87 to 3913.3 ppm with an average value of 1691.58 ppm. Anomalous REE values reported mostly in Quartz - k-feldspar chlorite - biotite schist±Amphibole (silicified & granitized), Gt. Chlorite schist/metabasic schist, granite and contact zones of schist and granite.

12.12 Also, ICPMS studies of composite samples (0.5% Cu cut-off) pertaining to ore zones indicated total 11 ore Zones with Co values range from 101.48ppm Co to 288.03 ppm Co. over 2.50m to 7.50m with One zone shown highest Co value of 1300ppm over 4m (MTB-08). One Zone had shown Mo value of 192.97 ppm Mo over 7.50m thickness (MTB-08). At 0.2% Cu cut-off, Total 18 zones indicated cobalt values range from 102.79 ppm Co to 367.13 ppm Co with one zone shown highest value of 1220.33 ppm over 3.50m thickness (MTB-08). Two zones shown Mo values of 147.60m over 8.0m (MTB-08) & 138.83 ppm Mo over 13.23m (MTB-17).

12.13 G3 stage Report recommended that "G3 stage exploration established Copper ore resource at Inferred (UNFC-333) resource category in Thakurdih Area-1 Block. Copper bearing lodes are open in depth and there are significant gaps in exploration. Hence, G2 stage exploration was recommended in the area by close spaced drilling for gaining more confidence on resource and grade. Also, Time Domain EM survey would be helpful to delineate conducting bodies and deeper level mineralisation in the area".

12.14 As per the G3 Stage Report recommendations, systematic exploration at G2 stage involving drilling of infilling boreholes for 1st level (50m vertical depth) intersections at 50m spacing interval and for 2nd level (100m vertical depth) intersections in alternate sections (100m interval) is required to prove the strike and depth continuity of ore

zones in Northern band (2.3 km strike length) & Southern band (1.1km strike length) in the block area for gaining more confidence on resource and grade.

13 Thakurdih Area-1 prospect hold potential for polymetallic mineralisation. Systematic G2 stage exploration at close spaced interval (50m interval for 1st level & 100 interval for 2nd level in alternate sections) would be helpful to estimate and upgrade copper ore resources at 332 category of UNFC at higher confidence level as well as to figure out the potentiality for other associated minerals i.e. REE, Co and Mo mineralisation besides copper in the area.

13.1 G2 stage exploratory drilling shall be taken up in 2 Phases. In Phase-I, 1st level infilling boreholes (60m Vertical depth) shall be drilled at 100m spacing interval to cover the entire potential zone of Northern Band over 2.3 km strike length and Southern Band over 1.1 km strike length. Based on the outcome and review, Phase-II infilling drilling shall be taken up for 1st level boreholes to fill up the gaps at 50m spacing interval and followed by drilling of 2nd level boreholes (120m Vertical depth) at 100m spacing interval in alternate sections

13.2 The present exploration at G2 stage would be helpful to estimate the Copper and associated minerals at indicated category (332) of UNFC.

13.3 Moreover, the present Thakurdih Area-1 Block is just adjoining Block to Mundadevta-Darkhuli & South Jharia G2 Block where MECL carried out G2 stage Exploration during 2021-22 for Copper and a net geological instu resource of 1.75 million tonnes of 0.96% Cu at 0.50% Cu cut-off and 0.64 million tonnes of 1.46% Cu at 1.00 Cu cut-off was estimated up to maximum 245m vertical depth.

13.4 Hence, upgrading the Thakurdih Area-1 Block to the G2 stage would enable the Government either to amalgamate it with the adjoining Mundadevta–Darkhuli South Jharia G2 Block to form a sizable block for auction, or to auction both blocks separately

PLATES:

S.No	Description	Plate No.
1	Location map of Thajurdih Area-1 Block.	I
2	Regional Geological Map of Singhbhum Copper Belt, Jharkhand	II
3	Geological Map of Thakurdih Area-1 Block with borehole locations	III
4	Geological Cross Section	IV
5	Schematic LV Section for Northern Band & Southern Band with Proposed Borehole intersections	V

References:

1 Report on the Exploration in the Mundadevta-Darkhuli Block, Baharagora Copper Prospect, Singhbhum District, Bihar by P Majumder, Geologist (Sr), AMSE Wing, GSI, September, 1974.

2 Exploration for Copper in the South Jharia-Charakmara Blocks and Mundadevta Sub-Block Extension, Baharagora Copper Pospect, Singhbhum District, Bihar, FSP: 1975-76 & 1977-78, By P Majumder, Geologist (Sr.)., AMSE Wing, GSI, February, 1984.

3 Geological Report on General Exploration (G2) for Copper Mineralisation, Mundadevta-Darkhuli South Jharia Block, Singbhum Copper Belt, East Singbum District, Jharkhand (MECL, October, 2022)

4 Geological Report On Preliminary Exploration (G3) For Copper Ore In Thakurdih-Charakmara, Singbhum Copper Belt, East Singbhum District, Jharkhand State, Mineral Exploration Corporation Limited, December, 2023.

5 Geological Report on Preliminary Exploration (G-3) for Copper & Associated Minerals in Thakurdih Area-1 Block (4.10 sq.km.), Singbhum Copper Belt, East Singhbhum District, Jharakhand , Mineral Exploration & Consultancy Limited, July, 2025.