

**PROPOSAL FOR PRELIMINARY EXPLORATION (G-3)
THAKURDIH CHARAKMARA BLOCK
SINGHBHUM COPPER BELT, DISTRICT: EAST SINGHBHUM,
STATE- JHARKHAND, UNDER NMET**

Copper and Associated Minerals

By

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

Place: Nagpur

Date: 24th December 2021

Summary for G-3 Stage Exploration of Thakurdih-Charakmara Block Singhbhum Copper Belt

Features	Details
Block ID :	Thakurdih- Charakmara Block
Current Exploration Agency	MECL
Previous Exploration Agency	GSI and MECL.
Geological Report (Previous stage Geological Report)	Geological Report for the Field Season 1970-71 & 1971-72 28 BHs of BJ series involving total Drilling of 4805.76 m in adjacent Mundadevta-Darkhuli Block . Geological Report for the Field Season 1975-76 & 1977-78, 3 BHs drilled in Mundadevta Sub-Block Extension involving meterage of 755.05 m and Drilling of 1961.95 m in 11 BHs in South Jharia Block . In Charakmara Block only 2 test BHs were drilled involved 300.45m.
Commodity	Copper(Cu) and Associated Minerals (Ni, Co, Mo and W)
Mineral Belt :	Singhbhum Copper Belt
Budget & Time Schedule to complete the project	Rs. 388.59 Lakhs ; 12 months
Objectives:	1. To take up exploratory drilling as per G3 level of exploration to intersect copper mineralization at 20mRL of vertical depth 60m and at -40mRL of vertical depth 120m from surface. 2. To carry out Integrated Geophysical Surveys Induced Polarization (I.P), Resistivity and Magnetic at 100m , 50m profile interval and 20m station interval to delineate potential zone areas. 3. To estimate copper resources at G3 Level as per UNFC norms and Minerals (Evidence of Mineral Contents) Rules 2015.
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:	The work will be carried out by the proposing agency i. e MECL.
Name/ Number of Geoscientists :	Geologist: 01 Nos. at HQ (60 days)
Expected Field days (Geology, Surveyor)	Geologist: 01 Nos. at Field (120 days) Surveyor : 60 days
1. Location:	
Location	The proposed block area covered 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.		
Block boundary coordinate	CARDINAL POINTS OF THAKURDIH CHARAKMARA BLOCK		
	BOUNDARY POINTS	WGS-86 (UTM ZONE 45)	
		EASTING	NORTHING
	1	466667	2468627
	2	469000	2468629
	3	469000	2466395
	4	467970	2466393
	5	467970	2465027
	6	469588.1535	2465025.267
	7	469606.9495	2463998.267
	8	466667	2464000
Villages :	Mahespur, Angarishol, Thakurdih, Bhandudihi, Jharapara, Baharagora, Darkhuli, Jharia, Ichrashol, Kapariya, Singpura, Charakmara, Madhupur.		
Tehsil/ Taluk :	Baharagora		
District :	East Singhbhum		
State :	Jharkhand		
2. Area (hectares/ square kilometres)			
Block Area :	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 and Birsa-Munda Airport, Ranchi is at 220 km from the area towards NW.		
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°C (Minimum) 27°C (November- December) (Maximum) 26°C (Minimum) 16°C		
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	Surface Geological Map of Baharagora Copper Prospect is on scale 1:6000 (Field season: 1975-76 & 1977-78)
Geochemical Map and Geophysical Map	Surface plan showing data of Geochemical and Geophysical Traverses on scale: 1: 6000 (Field season:1970-71,71-72)
8. Historical work	A total 28+3=31 Boreholes drilled by GSI in two phase between 1970-1978 with a cumulative Drilling of 4805.76+755.05=5560.81 m in the Mundadevta-Darkhuli Block and Mundadevta Sub Block extension respectively. A Reserve/Resource of (indicated + inferred) at cut off grade of 1.0%, 0.7% and 0.5% Cu down to 290 m vertical depth from datum line (at -100 mRL) amount to 2.12mt , 3.876 and 6.86mt respectively and a total 11 Boreholes drilledby GSI between 1975-1978 with a cumulative drilling of 1961.95m in the South JhariaBlock. A Reserve/Resource of (indicated + inferred) at cut off grade of 1.0%, and 0.5% down to 200 m and 300m vertical depth from datum line (at -100 mRL) amount to 0.65mt and 0.92mt respectively. Two boreholes have been drilled by GSI Charakmara block with a cumulative drilling of 300.45m resource not calculated. MECL presently working in 2.13 sq.km area with G2 stage of exploration through NMET fund in Mundadevta-Darkhuli-South Jharia Copper Blockfor the assessment of continuity of the lodes at down dip and to understand the persistence of the ore body at closure intervals for a greater confidence in providing resource.
9 Justification for taking up G3 stage mineral exploration.	A. Geological Survey of India had carried out Geological mapping, Geo-physical survey and Geochemical sampling in the study area.A total of 7 no. of Geo-physical Aero-EM anomalous intercept recorded and subsequently ground Geophysical IP survey conducted in 26 grid lines covering entire proposed area with 150-300m line interval and dipole length 30m to 150m. A total 15 no. of IP strong anomalies and 23 no. of IP weak anomalies have identified which need to be tested through drilling. B. Entire proposed area was covered with Geo-chemical soil sampling for Cu, Ni, Co and Mo is analyzed by hot extraction and cold extraction methods. The soil grid planned with 30m sampling interval, 150-300m line spacing, and closer spacing 10-15m adopted at anomalous zones. A total 48 no. of anomalies identified and categorized weak, moderate, strong. In general, geochemical anomaly maxima coincide with the old workings and dump debris. Most of the Geo-chemical anomalies supported surface persistence of Geophysical anomaly which needs to be

	tested by drilling. C. GSI bore holes have intersected considerable copper mineralisation in various bore holes in proposed G3 and existing G2 area. GSI has calculated resources in different cut-offs , details provided in section 5.4 . D. Significant mineralized zones intersected in BHs of currently running Mundadevta Darkhuli south Jharia G2 block by MECL. E. In the proposed G3 area, in Charakmara Block GSI has drilled two test boreholes BC-1 and BC-2 have significant results and it was described that this zone is likely to persist along strike and dip and it was recommended that to ascertain the ore potential of the Charakmara Block further drilling is necessary. There is a reasonable chance of finding some tonnage from this block. So far no exploratory drilling was carried out to test the North Jharia and Thakurdih old workings. A few boreholes may be drilled to test these areas. F. MECL team has carried out field visit and collected Surface samples around Charakmara , Thakurdih, South Jharia old workings and samples were analysed by handheld XRF which provided values ranging from 0.0013%Cu to 0.5635% Cu.
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**Proposal for Preliminary Exploration (G3) in Thakurdih-Charakmara Block,
Singhbhum Copper Belt, District: East Singhbhum, Jharkhand.**

1.0 INTRODUCTION

- 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 the demand is met through imports. The increasing demand of copper metal in the country could be eased with the exploration of new copper deposits of economic importance.
- 1.2 Singhbhum Shear Zone in the Singhbhum craton is the most important structural element known for its metallogenic importance. A number of workable deposits are located in the South-eastern sector of this shear zone. The Baharagora Copper Prospect is situated near the South-eastern tip of this shear zone.
- 1.3 The Airborne Mineral Surveys and Exploration Wing of the GSI carried out Airborne magnetic, electromagnetic and radiometric surveys over parts of Bihar, Jharkhand, Bengal, Rajasthan and Andhra Pradesh in 1967-68 with the assistance of U.S.A.I.D. under the project "Operation Hardrock". The more promising E.M. anomalies were examined in detail by the integrated geological, Geochemical, and geophysical techniques. Airborne geophysical data supplemented by the detailed ground follow up work (1968-70) like :-
- A. Geological traverse mapping on 1:6000 scale, detailed studies of old workings and geological structures by P. Mazumder
 - B. Geochemical Prospecting by P. Mazumder and Jethra jointly
 - C. IP-Resistivity Surveys were carried out by Duttagupta, Prasad and Saxena.
- Which indicated a **probable zone of sulphide mineralisation in the Baharagora area.**
- 1.4 The area was covered by IP- Resistivity traverses in 26 grid lines 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 IP Strong anomalies, 23 no of IP weak anomalies.
- 1.5 Subsequently Geo-Chemical soil samples have collected in the same grid where Geophysical survey was carried out. Cold extraction analysis was carried out by Jone's Kit on soil samples collected at intervals of 30m from 'b' horizon along the geological traverses. Soil samples at closer intervals (10-15m) were collected from the anomalous zones thus delineated by reconnaissance geochemistry and analyzed in the laboratory by the hot extraction technique for copper, nickel, cobalt and molybdenum which resulted with 46 anomalies with strong, moderate, and weak categories. In general, geochemical anomaly maxima coincide with the old workings and dump debris.
- 1.6 A total 28+3=31 Boreholes drilled by GSI in two phase between 1970-1978 with a cumulative Drilling of 4805.76+755.05=5560.81 m in the Mundadevta-Darkhuli Block and Mundadevta Sub Block extension respectively. A Reserve/Resource of (indicated + inferred) at cut off grade of 1.0%, 0.7% and 0.5% Cu down to 290 m vertical depth from datum line (at -100 mRL) amount to 2.12mt, 3.876 and 6.86mt respectively and a total 11 Boreholes drilled by GSI between 1975-1978 with a cumulative drilling of 1961.95m in the South Jharia Block. A Reserve/Resource of (indicated + inferred) at cut off grade of 1.0%, and 0.5% down to 200 m and 300m vertical depth from datum line (at -100 mRL) amount to 0.65mt and 0.92mt respectively. Two boreholes have been drilled by GSI Charakmara block with a cumulative drilling of 300.45m resource not calculated.

1.7 Following the request from the MECL, consent to carry out G-3 level of exploration in the Baharagora Area has been received from DMG, Jharkhand viz. letter no. 507 dated 24.06.2020.

- a. Accordingly a proposal for Preliminary Exploration (G-3) Baharagora Copper block have been prepared by the MECL based on the data of previous explorations carried out by the GSI to assess the ore body geometry in more details and estimation of resources under G3 category.
- b. In 34th TCC meeting of NMET held on 28th of October, 2021 it was advised :-
 - (1) To exclude area of G2 stage of exploration i.e. Mundadevta –Darkhuli – South Jharia Block from the proposed block to avoid any discrepancy during auctioning of the block in future.
 - (2) In the proposed area , anomalous U values have been reported in February, 2020, therefore MECL needs to take clearance from Atomic Mineral Directorate (AMD) for taking up exploration in the area.
 - (3) All the geochemical, geophysical etc. data available with GSI may be taken into account before finalisation of strategy of further exploration.
 - (4) Initially surface evidence is to be collected and analysed, especially collection of samples from old working and outcrops, thereafter the results and findings will be reviewed by the TCC to demarcate the borehole location and further exploration.
 - (5) Instead of using only the name Baharagora, name of a few villages may be mentioned in future while curving out areas for exploration.
- c. Accordingly, MECL has modified the proposal and sending to 36th TCC meeting of NMET.

2.0 LOCATION AND ACCESSIBILITY

- 2.1 The study area Thakurdih-Charakmara Block is situated under Thakurdih, Charkamara , Darkhuli and Jharia Village at approx. West and Northwest of Baharagora town, East Singhbhum District, Jharkhand of Survey of India Toposheet No.73J/11.
- 2.2 Baharagora is a small town 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. Chakulia and Dhalbhumgarh are the nearest railway stations. The nearest airport is Netaji Subhas Chandra Bose International Airport, Kolkata which is 200 km towards East from the area.

3.0 REGIONAL GEOLOGY AND STRUCTURE

3.1 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.

- 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.
- iv) A second Geo-anticline to the north of the Dalma Lava Geo-syncline with an intervening thrust zone.

3.2 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 Odisha where its trace can be found through some N-S trending shears. However, recent studies by Sarkar and Saha (1959, 1962, 1966) and subsequently Sarkar, Saha and Miller (1969) revised the stratigraphic sequence in Singhbhum and adjoining areas (Table-I). According to these authors, the Singhbhum cratonic area had undergone three orogenic cycles. The Older Metamorphic Orogeny (3035m.y.), The Iron Ore Orogeny (2000 m.y.), The Singhbhum Orogeny(905-934 m.y).

3.3 The Singhbhum Shear Zone is the most important single structural element and has been traced for 200 km in length with a width of few hundred meters to several kilometres. Mainly three types of mineralisation has been localised along this shear zone: Apatite-Magnetite, Sulphide and Uranium mineralisation irrespective of any good relationship of time and space in between. The main sulphide minerals are Chalcopyrite, Pyrite and Pyrrhotite. Other minerals occur in minor to very minor proportions. Sulphide mineralisation is not restricted to any particular lithology. Copper is the metal mainly found with the traces of other metals such as Mo, Ni, Co, Au also reported. A number of workable deposits are there situated in the South-Eastern section of this structural unit, numerous other sulphide occurrences also found in the rest of the belt.

Table-1: Geological Succession of the Precambrian rocks of Singhbhum and adjoining areas. After Sarkar, Saha& Miller (1969).					
South of copper Belt-Thrust Zone in Singhbhum, N. Mayurbhanj and N. Keonjhar			North of Copper Belt Thrust Zone in Sungbhum		Sundargarh District
-----End of Singhbhumorogenic cycle (C. 850 m.y.)-----					
NEWER DOLERITES	Biotite Granite-gneiss of SE Singhbhum and N Mayurbhanj		Soda-granite, granophyre? Chakradharpur granite-gneiss		
	Granophyres Gabbro-anorthosite (1470m.y.), Ultramafic intrusions (within and outside Singhbhum granite)		Kuilapal granite		
	Kolhan Group (C. 1500-1600 m.y.)		Dalma Lavas		
	Jagannathpu r Lavas (1600-1700 m.y.)	Dhanjori formations	Dhalbhum formation, Chaibasa formation	Singhbhumgroup ? (2000-1700 m.y.)	Dhalbhum formation (I.O.S. of Krishnan Gr. Gangpur)
-----Unconformity-----					
-----End of Iron Ore Orogenic cycle (c. 2700 m.y.)---					
	Singhbhum Granite				
	Upper shales with sandstone and volcanics Banded hematite Jasper				
Iron Ore Group	Lower shales Basic lavas Sandstone and conglomerate				
-----Unconformity-----					
End of Older Metamorphic Orogenic Cycle (C 3200 m.y.)--					
	Granitic activity				
	Basic intrusives				
	Older Metamorphic Group, Calc-Gneiss, Calc-Schist, Hornblende Schist, Quartzite and Quartz Schist.				

4.0 GEOLOGY OF THE AREA

- 4.1 **Lithology:** The proposed area exposes mainly Granite/ Granite Gneiss of Archaean (Singhbhum Granite Complex), Newer Dolerite of Archaean-Proterozoic, Quartzite of Palaeoproterozoic, Mica Schist with Hornblende Schist of Palaeoproterozoic, Gravels of Tertiary and Sand Silt Clay Calcareous concretions of Pleistocene -Holocene .Exposure of rocks e.g. Granite, intruded by newer dolerite dykes outcrops near Charakmara village. Quartzite/ Quartz schist are varying in grade from sericite quartzite to kyanite -sericite quartz schist. Mica schists are associated with hornblende schist and garnet-biotite-hornblende schist. Muscovites in greater proportion in the mica schist are produced from earlier biotite through retrograde metamorphism with associated separation of magnetite. Quartzite/Quartz schist varying to quartz granulite forms low ridges above mica schists.

- 4.2 **Structure:** According to the previous workers, Baharagora is located almost at the south-eastern end of the copper belt thrust/ Singhbhum shear Zone but in this area shear zone is still defined, narrow and gradually disguised into the granite. The dominant linear structures are parallel to the direction of tectonic transport. As per the previous workers the following structural elements have been observed and are briefly discussed below:
- 4.3 **Planar Structure:** The planar structure present in this area are Stratification plane (S1), axial plan foliation (S2), crenulation cleavage (S3). Slickenside and Joints. S1 preserved in very few places and are marked by compositional variations. S2 appears as fine foliation in mica schist and shows brilliant preferred orientation of mica and chlorite in metabasic rocks. These planar structures are interpreted as axial planar schistosity is parallel to the axial planes of the folds on S1. Slickensides are prevalent in quartz schist and quartzite. Joints are very profound in competent rock like quartzite and quartz schist. 3 sets of joints namely i) Strike Joints, ii) Dip joints, iii) Diagonal joints are well developed.
- 4.4 **Linear Structure:** The main linear structures found are puckers, mineral lineation, Bedding-Cleavage intersection, streaking and grooving. Puckers are limited to mica schist and are developed on S2. Pucker axis are sub-parallel to mineral lineation. Mineral Lineation are defined by preferred orientation of mica and chlorite in pelitic schists; garnets in psammitic schists; chlorite, biotite and amphibole in metabasites. Bedding-cleavage intersection seen near to the hinge area of the Mundadevta-Darkhuli Sub-block and has the same plunge as the axis of the synformal flexure.
- 4.5 **Faults:** No major faults except small drag faults due to stretching in quartzite/ quartz schist are noticed.
- 4.6 **Folds:** 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. Small scale folds including chevrons and mullions are quite common in the area. Axes of these folds are parallel to the down-dip lineation in number of places.
- 4.7 **Metamorphism:** Metamorphism in this area indicated by minerals as Biotite, Garnet, Staurolite and kyanite points towards middle amphibolite facies of Fyfe and Turner (1966). Occurrence of these index minerals during regional metamorphism constitutes a progressive series which is followed by retrogressive metamorphism during later shearing movements resulting developments of Biotite, muscovite and chlorite indicating Middle Greenschist facies.
- 4.8 **Copper mineralisation:**
- 4.8.1 **Mode of occurrences:** In Mundadevta-Darkhuli block, the mineralization occurs along both the limbs as well as in the hinge part of the asymmetric synformal flexure. Four main zones of mineralisation numbered 1,2,3,4 starting from footwall side and a number of minor veins have so far been intersected in the boreholes drilled by GSI and in South Jharia Block three main zones of mineralisation numbered 1,2,3 starting from footwall side and a number of minor veins have been intersected in the boreholes drilled by GSI. The individual lodes consist of alternatively richer and leaner bands. Even in some cases lodes are in the

form of sheeted zones separated by poorly mineralised partings. Thus the widths and grades of the lodes depends on the cut-off grade, thickness and strength of the partings. Mineralisation is in the form of fissure veins type associated with closely spaced shear zones, often show branching, sometimes cymoidal and mostly parallel to sub-parallel to the foliation. Four main modes of occurrence of copper-nickel ore in the proposed area.

- i) Dissemination confined to Biotite Quartz rock
- ii) Stringers and veinlets along foliation and fractures of schists
- iii) Massive sulphide veins in brecciated veined Quartz
- iv) Minor streaks and replacement patches.

4.8.2 **Hostrocks:** Mineralisation in this area is not confined to any particular stratigraphic horizon nor to any particular litho-unit. However some litho-units are preferred relative to other. Zones are restricted to Quartz-chlorite-biotite Schist, Biotite-quartz rock, Quartz-biotite schist, silicified brecciated rock and Metabasites.

4.8.3 **Structural control:** Mineralisation in this area is broadly controlled by litho-structure i.e. various openings as a result of multi stage deformation. Ore bodies are located along the shear tension surfaces and are more or less parallel to the foliations of the host rock. Different openings thus gave rise to in-filling types of mineralisation such as stringers, veins and veinlets, Breccia filling etc.

5.0 PREVIOUS WORK

5.1 Old workings for Copper was first reported by Stoehr in the year of 1870 in the Baharagora area. During mapping of the area Dunn and Dey (1942) also gave a brief description about these old workings. Sinha and party carried out SP-Resistivity and Magnetic survey in the area during field session of 1950-51. Sharma and Shai carried out detailed Geological Mapping and Geochemical prospecting for copper in the area during the field session of 1969-70.

5.2 During the field session 1968-69 P Majumder carried out reconnaissance of the aero-EM intercept BBI-20-601.1 near Baharagora and recommended detailed Geological, geochemical and ground geophysical investigations. In the following year detailed integrated geological, geochemical and IP-resistivity investigation was taken up. Based on the results of these integrated surveys Drilling was commenced by GSI in the block.

5.3 A total 4805.76 m of diamond core drilling in 28 BHs was completed in **Mundadevta-Darkhuli Block**. Later in the second phase 3 more BHs (BH-39, BJ-40 and BJ-41) was drilled with a meterage of 755.05 m in **Mundadevta Sub-Block Extension** (northern extension of **Mundadevta Darkhuli Block**. Subsequently total 11 Borehole (BJ-14, BJ-16, BJ-20, BJ-32 to BJ-38 and BJ-43A) drilled by GSI with a cumulative Drilling of 1961.95m in the **South Jharla Block**.

5.4 GSI bore holes have intersected considerable copper mineralisation in various bore holes in proposed G3 and existing G2 area. GSI has calculated resources in different cut-offs details provided below.

Table-2: Details of ore reserves in GSI Blocks.

SI No.	Name of Block	Total No. of BHs drilled	Total Meterage (m)	Reserve/Resource (m.t.)		Vertical Depth(m)
				Cut –Off Grade 1% Cu	Cut –Off Grade 0.5% Cu	
1	Mundadevta-Darkhuli Block	28	4805.76	1.924	5.925	Indicated(190) Inferred (290)
2	South Jharia Block	11	1961.95	0.65	0.92	300
3	Charakmara Block	2	300.45	Not Calculated		
4	Mundadevta Sub Block extension	3	755.05	0.2	0.94	290
		Total	7823.21m			

5.5 In the proposed area, Near Charakmara village GSI has drilled two BC-1 and BC-2 drillholes have significant results like below.

- BC-1 : 1.35m X 0.59% Cu & 0.11% Ni
- BC-1 : 0.85m X 0.92% Cu & 0.17% Ni
- BC-2 : 2.05m X 2.74% Cu
- BC-2: 1.55m X 3.62% Cu & 0.06% Ni

5.6 MECL proposed further drilling of 23 Bhs with 4935m in Mundadevata-Darkhuli South Jharia block (G2),out of these 23 Bhs 3 conditional Bhs have not been completed till date due to agricultural land. All the bore holes have intersected significant mineralized zones. Presently samples are under process for analysis; some of the available results are shown below

Table-3: Details of mineralised zones intersected in currently running Mundadevata-Darkhuli South Jharia block (G2) of MECL.

BH NO.	FROM (m)	TO (m)	THICK. (m)	Grade of Cu at 0.5% Cut Off	Ni %
MBMJ-02	105.00	114.00	9.00	0.50	0.03
MBMJ-02	143.35	145.35	2.00	0.49	0.02
MBMJ-02	157.85	162.90	5.05	0.50	0.05
MBMJ-02	173.50	177.50	4.00	0.51	0.02
MBMJ-03	149.77	150.27	0.50	0.62	0.02
MBMJ-03	163.00	164.00	1.00	0.60	0.03
MBMJ-04	99.40	104.84	5.44	0.90	0.15
MBMJ-05	73.00	74.00	1.00	0.39	0.18
MBMJ-05	111.00	113.00	2.00	0.24	0.29
MBMJ-06	74.50	75.00	0.50	0.81	0.04
MBMJ-06	84.00	85.00	1.00	0.45	0.07
MBMJ-06	86.00	87.00	1.00	0.68	0.09
MBMJ-07	101.00	114.00	13.00	0.55	0.03
MBMJ-07	182.00	186.00	4.00	0.49	0.04
MBMJ-07	188.00	189.00	1.00	0.68	0.03

5.7 Results of Surface Sample Collected from Field :-

SL No.	Sample No.	Ni %	Cu%
1	CHL-1A	0.0091	0.182
2	CHL-1B	0.0043	0.1289
3	CHL-1C	0.0023	0.0505
4	CHL-1D	0.0022	0.0093
5	CHL-1E	0.001	0.0273
6	CHL-1F	0.0054	0.0551
7	CHL-1G	0.0037	0.0794
8	CHL-1H	0.01	0.5635
9	CHL-1I	0.0117	0.3372
10	CHL-1J	0.0815	0.0013

6.0 PRESENT WORK

6.1 Objectives of the present level (G3) exploration are as follows:

1. To take up exploratory drilling as per G3 level of exploration to intersect copper mineralization at 20mRL of vertical depth 60m and at -40mRL of vertical depth 120m from surface.
2. To carry out Integrated Geophysical Surveys Induced Polarization (I.P), Resistivity and Magnetic at 100m , 50m profile interval and 20m station interval to delineate potential zone areas.
3. To estimate copper resources at G3 Level as per UNFC norms and Minerals (Evidence of Mineral Contents) Rules 2015.

7.0 PLANNED METHODOLOGY

7.1 **Ground Geophysical Survey:** Based on the physical properties of the Copper in typical geological settings the variation in Resistivity, Conductivity and Self potential are very high. So Integrated Geophysical surveys Induced Polarization (I.P), Resistivity, and Magnetic were planned to carry out in proposed area.

7.2 The survey was planned to cover all the three areas in which the profiles were laid at an interval of 100m with station interval of 20m in area-1 and profiles at an interval of 50m with station interval of 20m in area-2 and area-3 . The profiles will be laid perpendicular to the strike direction; each block has different profile line directions. A total of 60 Line km of I.P, Resistivity & Magnetic surveys were planned. The Approximate time period to conduct the survey will be around 5 months (4 months for acquiring data and 1 month for processing and interpretation)

Table-4: The details of geophysical quantity block wise and line kilometers required.

S.No	Block	Area (sq.km.)	Bin Size	Line Km	Profile direction
1	Area-1	4.10	100 x 20m	40.56 km (appx.)	N30°E
2	Area-2	0.38	50 x 20m	7.34 km(appx.)	N94°E
3	Area-3	0.86	50 x 20m	16.7 km(appx.)	N120°E
			Sum Total	60 km (approved)	

8.0 Drilling:

- 8.1 At present total of 10 bore holes (5 conditional) with 1500m of drilling have been planned at 100 m strike interval. out of these 10 boreholes 5 boreholes are planned targeting to intersect at 20mRL of vertical depth 60m and 5 boreholes are planned targeting to intersect at -40mRL of vertical depth 120m so that the area can be included in UNFC G3 resource.

Table-5: Details of proposed boreholes.

Section no.	Borehole No.	Inclination	Bearing	Proposed Level of Intersection [Vertical Depth (m)]	TOTAL DEPTH (m)
1	PBH-1	50°	290°N	60	120
4	PBH-4	50°	290°N	60	120
5	PBH-5	50°	290°N	60	120
6	PBH-6	50°	290°N	60	120
7	PBH-7	50°	290°N	60	120
				Total	600
Conditional BHs					
2	PBH-2	50°	290°N	120	180
3	PBH-3	50°	290°N	120	180
1	PBH-8	50°	290°N	120	180
5	PBH-9	50°	290°N	120	180
7	PBH-10	50°	290°N	120	180
				Total	900
				Sumtotal	1500

8.2 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.

8.3 Primary Sample

- 8.3.1 The borehole cores will be spitted into two equal halves by using 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. This will generate about 100 nos. of samples, which will be sent to MECL Lab. for analysis for Cu, Ni, Mo, Co and W.

8.3.2 Check samples will be prepared and around 10(10%) samples analysis will be done at External lab and 5 nos. (5%) sample analysis will be done at Internal laboratories for Cu, Ni, Mo, Co and W.

8.3.3 A total nos. of 23 sample (20 Primary sample (20%) + 3 [1 (5% of 20 internal)+2 (10% of 20 external) Check sample] will be analysed for Au by Fire Assay.

8.4 **Composite Sample**

8.4.1 Composite samples will be prepared zone wise based on primary sample data. This will generate about 20 nos. of composite samples which will be analysed for radicals such as Cu, Ni, Co, W and Mo. All the composite samples will be analysed for Au by Fire Assay method.

8.5 **Petrography and Mineragraphy Studies**

8.5.1 Total 10 nos. of samples for Petrographic study by thin section 20 no of samples for Mineragraphic studies through polished section are proposed to be carried out at MECL Lab.

9.0 Quantum of Proposed Work

Table- VI Nature and Quantum of proposed exploratory programme

Sl.No	Description and Nature of Work	Unit	Target
A	GEOLOGICAL WORK		
1	Geological Mapping	Sq. km	-
2	Topographical Survey	Sq. km	-
a	Bore Hole Fixation and determination of co-ordinates & Reduced Level of the boreholes by DGPS	Per Point of observation	10
B	Ground Geophysical Survey		
1	Induced Polarization (I.P), Resistivity and Magnetic	Per Line KM	60
C	DRILLING		
1	Drilling up to 300m (Hard Rock)	m	1500
2	Borehole deviation Survey by Multishot Camera	m	1500
3	Drill Core Preservation	Per m	300
D	LABORATORY STUDIES		
1	<u>Chemical Analysis</u>		
i)	Primary samples		
	a. for Cu, Ni, Co, Mo and W	Nos	100
	b. for Au by Fire Assay (20% of Primary Samples)	Nos	20
ii)	Check samples Internal		
	a. for Cu, Ni, Co ,Mo& W [5% of (i) a]	Nos	5
	b) For Au (Gold) by Fire Assay [5% of (i) b]	Nos	1
iii)	Check samples External (10%)		
	a. for Cu, Ni, Co , Mo& W [10% of (i) a]	Nos	10
	b) For Au (Gold) by Fire Assay [10% of (i) b]	Nos	2
iii)	Composite Samples		
	a) For 5 Radicals (Cu, Ni, Co ,Mo and W)	Nos	10
	b) For Au (Gold) by Fire Assay	Nos	10
E	Petrological samples (Surface & BH Core Samples)		
i	Preparation of thin section	Nos	10
ii	Study of Thin Section	Nos	10
F	Mineragraphic Studies (Surface & BH Core Samples)		
a	Preparation of polished section	Nos	10
b	Study of Polished Section	Nos	10
c	Digital Photographs	Nos	10
G	Specific Gravity Determination		
	Specific Gravity Determination	Nos	0
H	Geological Report preparation (Digital and Hard Copy Format)	Nos	5

10.0 COST ESTIMATE

- 10.1 The cost has been estimated based on actual schedule of rates mandated in the circular OM No. 61/1/2018/NMET dated 31st March 2020 for NMET funded projects which is Rs.**388.59 Lakhs**.

10.2 Summary of Cost Estimates

Sl. No.	Item	Total
1	Exploratory Drilling	19,524,100.00
2	Geology & Survey	2,859,240.00
3	Ground Geophysical Survey	8,692,158.00
4	Laboratory Studies	518,250.00
	Sub total	31,593,748.00
5	Report	947,812.44
6	Peer Review	10,000.00
7	Proposal Preparation	380,000.00
	Total	32,931,560.44
8	GST (18%)	5,927,680.88
	Total cost including 18% GST	38,859,241.32
	SAY, in Lakhs	388.59

11.0 TIME SCHEDULE

- 11.1 The proposed exploration programme envisages surveying, ground geophysical survey, exploratory drilling, deviation survey, sample preparation and laboratory studies and geological report preparation which will be completed within 12 months by deploying 1 drill rigs. Therefore, a total of 12 months is planned for completion of the entire programme.

12.0 JUSTIFICATION

- G.** Geological Survey of India had carried out Geological mapping, Geo-physical survey and Geochemical sampling in the study area. A total of 7 no. of Geo-physical Aero-EM anomalous intercept recorded and subsequently ground Geophysical IP survey conducted in 26 grid lines covering entire proposed area with 150-300m line interval and dipole length 30m to 150m. **A total 15 no. of IP strong anomalies and 23 no. of IP weak anomalies have identified which need to be tested through drilling.**
- H.** Entire proposed area was covered with Geo-chemical soil sampling for Cu, Ni, Co and Mo is analyzed by hot extraction and cold extraction methods. The soil grid planned with 30m sampling interval, 150-300m line spacing, and closer spacing 10-15m adopted at anomalous zones. A total 48 no. of anomalies identified and categorized weak, moderate, strong. In general, geochemical anomaly maxima coincide with the old workings and dump debris. **Most of the Geo-chemical anomalies supported surface persistence of Geophysical anomaly which needs to be tested by drilling.**
- I.** GSI bore holes have intersected considerable copper mineralisation in various bore holes in proposed G3 and existing G2 area. GSI has calculated resources in different cut-offs, details provided in section 5.4.

- J. Significant mineralized zones intersected in BHs of currently running Mundadevta Darkhuli south Jharia G2 block by MECL.
- K. In the proposed G3 area, in Charakmara Block GSI has drilled two test boreholes BC-1 and BC-2 have significant results and it was described that this zone is likely to persist along strike and dip and it was recommended that to ascertain the ore potential of the Charakmara Block further drilling is necessary. There is a reasonable chance of finding some tonnage from this block. So far no exploratory drilling was carried out to test the North Jharia and Thakurdih old workings. A few boreholes may be drilled to test these areas.
- L. MECL team has carried out field visit and collected Surface samples around Charakmara , Thakurdih, South Jharia old workings and samples were analysed by handheld XRF which provided values ranging from 0.0013%Cu to 0.5635% Cu.

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PLATES:

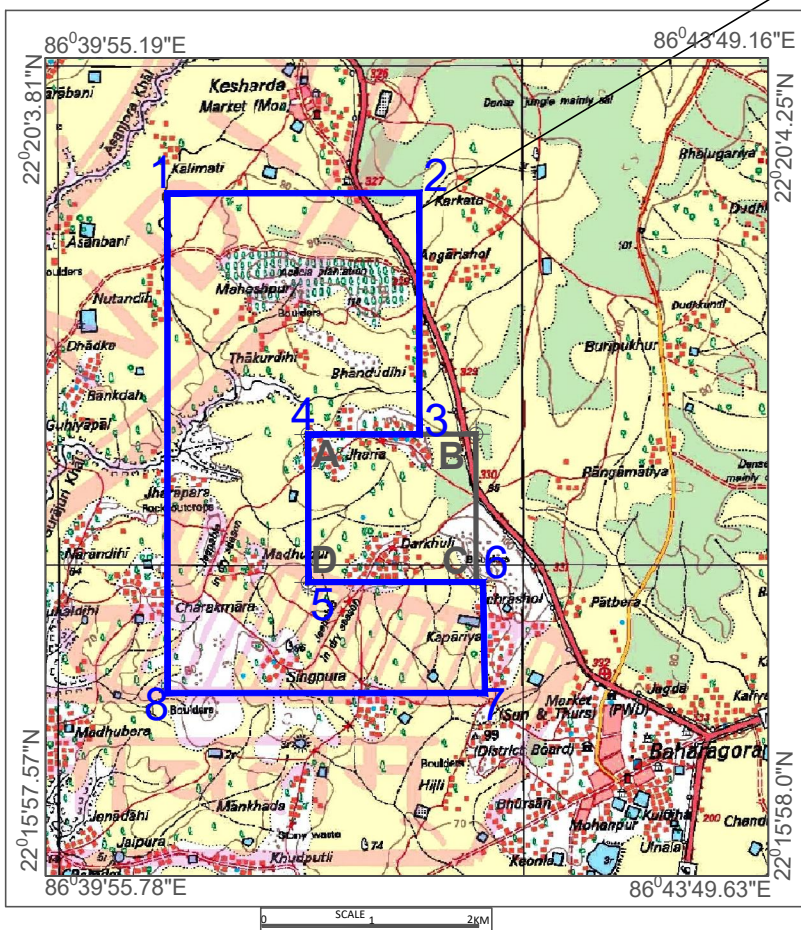
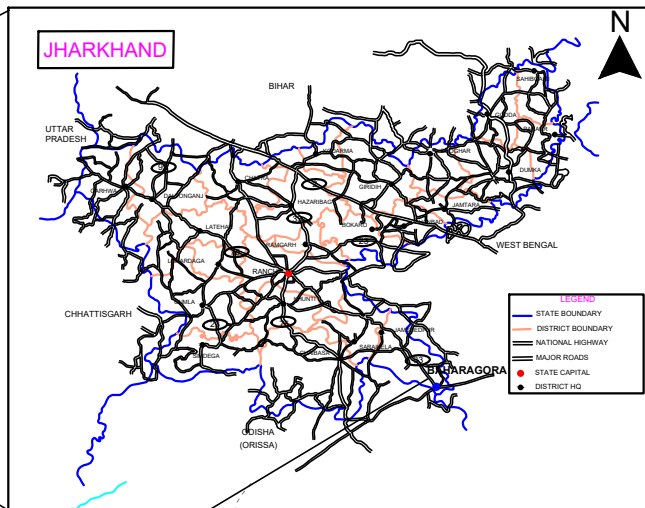
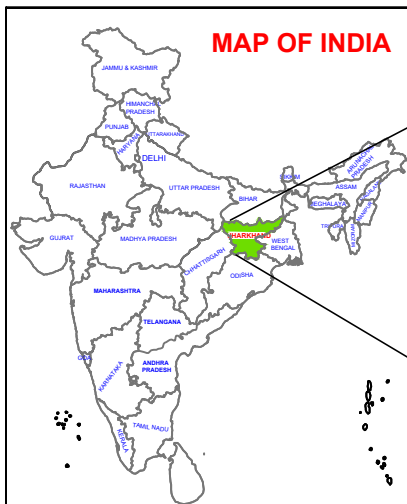
S.No	Description	Plate No.
1	Location map of Thakurdih-Charakmara Block.	I
2	Regional Geological Map of Singhbhum Copper Belt, Jharkhand	II
3	Geological Map of Thakurdih- Charakmara Block.	III
4	Geological Cross Section along section line 1-1' to 7-7' Thakurdih-Charakmara Block.	IV
5	Longitudinal Vertical Section along section line A-A' Thakurdih-Charakmara Block.	V

Annexure: 1) Consent for Preliminary Exploration for Thakurdih-Charakmara Block (G-3) Singhbhum Schist Belt, Jharkhand - reg., No. AMD-4(4)/2021-PMSG, Date:26.11.2021.

2) Minutes of 34th TCC meeting held on 28th and 29th October, 2021, New Delhi

References:

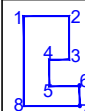
1. Report on the Exploration in the Mundadevta-Darkhuli Block, Baharagora Copper Prospect, Singhbhum District, Bihar by P Majumder, Geologist (Sr), AMSE Wing, GSI, September, 1974.
2. Exploration for Copper in the South Jharia-Charakmara Blocks and Mundadevta Sub-Block Extension, Baharagora Copper Prospect, Singhbhum District, Bihar, FSP: 1975-76 & 1977-78, By P Majumder, Geologist (Sr.), AMSE Wing, GSI, February, 1984.



CARDINAL POINTS OF THAKURDIH CHARAKMARA BLOCK

BOUNDARY	UTM ZONE 45	
	EASTING	NORTHING
1	466667	2468627
2	469000	2468629
3	469000	2466395
4	467970	2466393
5	467970	2465027
6	469588.1535	2465025.267
7	469606.9495	2463998.267
8	466667	2464000

LEGEND



Proposed boundary of Thakurdih - Charakmara Block (Area 10 sq.km)



Boundary of Mundadevta-Darkhuli-South Jharia G2 Block (Area 2.13 sq.km)



MINERAL EXPLORATION CORPORATION LIMITED

LOCATION MAP

THAKURDIH CHARAKMARA BLOCK

(PART OF TOPOSHEET NO. 73J/11)

DISTRICT : EAST SINGBHM STATE : JHARKHAND

SCALE 1:70,000

Prepared by : Exploration Division, MECL, Nagpur.

MECL / EXPLORATION / November-2021

PLATE NO - I

1

