

**HINDUSTAN COPPER LIMITED**  
**(A Government of India Enterprise)**  
**Tamra Bhawan**  
**1, Ashutosh Chowdhury Avenue**  
**KOLKATA – 700019**

**CORRIGENDUM – I**

Dated 12.09.18

**Sub: Expression of Interest for Geophysical Survey in Copper Mining Leases of Hindustan Copper Limited at ICC, KCC and MCP**

**EOI No.: HCL/HO/ED (Commercial)/GEOPHYSICAL Dated 28.08.2018**

The Last Date of Submission of offers against above EOI is hereby extended till 27.09.18 upto 3:00PM.

All other terms and conditions shall remain the same.

(D.K.Mahajan)

Executive Director (Materials & Contracts)

INVITATION FOR SUBMISSION OF EXPRESSION OF INTEREST FOR GEOPHYSICAL SURVEY IN COPPER MINING LEASES OF HINDUSTAN COPPER LIMITED AT ICC, KCC AND MCP.

Hindustan Copper Limited (HCL) is a Government of India Enterprise under the administrative control of Ministry of Mines. It was incorporated on 9<sup>th</sup> November 1967 under Companies Act 1956.

HCL is Country's only vertically integrated producer of refined copper from indigenous sources. Major activities of HCL are mining, ore beneficiation, smelting, refining and casting of refined copper metal into downstream products. HCL has underground mines at Khetri Nagar, Rajasthan; open cast mine at Malanjkhand, Madhya Pradesh; underground mine and smelter-refinery plant at Ghatsila, Jharkhand; continuous cast copper rod plant at Taloja, Maharashtra and a copper refinery plant at Jhagadia, Gujarat.

The Company manufactures and markets copper cathodes, continuous cast copper wire rods and by-products such as gold, silver, selenium, copper sulphate and sulphuric acid.

HCL holds all the operating mining leases of copper in India; in the state of Jharkhand, Hindustan Copper Limited has three Mining Leases namely Surda Mining Lease, Kendadih Mining Lease and Rakha Mining Lease. In the state of MP, it has Malanjkhand Mining Lease. Hindustan Copper Limited has three Mining Leases in the state of Rajasthan namely Khetri Mining Lease, Kolihan Mining Lease and Chandmari Mining Lease.

Hindustan Copper is desirous to prove the strike and depth continuity of the deposit through deep ground geophysical surveys in the mining leases to assess the full potential of the deposits. Presently mining operations are in progress in most of the mining leases and present exercise shall be to prove the continuity beyond the present operation of mining and established ore body upto a depth of about 1000 -1200 meters.

The proposed work involves geophysical survey/exploration at the following Lease areas in India:

*Eastern Sector /ICC*

- a) Surda Mining Lease, Dist. Singhbhum (E), Jharkhand over an area of 388.68 hectare.
- b) Kendadih Mining Lease, Dist. Singhbhum (E), Jharkhand over an area of 1139.60 hectare.
- c) Rakha Mining Lease, Dist. Singhbhum (E), Jharkhand over an area of 785.091 hectare

*Central Sector/MCP*

- d) Malanjkhand Mining Lease, Dist. Balaghat, Madhya Pradesh over an area of 479.9 hectare

### *Western Sector/KCC*

e) Khetri Mining Lease, Dist. Jhunjhunu, Rajasthan over an area of 395.07 hectare

f) Kolihan Mining Lease, Dist. Jhunjhunu, Rajasthan over an area of 163.23 hectare.

g) Chandmari Mining Lease, Dist. Jhunjhunu, Rajasthan over an area of 148.45 hectare.

A brief of the Mining Leases is attached as Annexure -I

### **Objective**

The organisation wishes to carry out ground geophysical surveys over its mining leases to assist in targeting economic mineral resources. Proven technologies for Base metal exploration will be utilized including Gravity & Magnetic, Electromagnetics, Induced Polarisation, , etc.

HCL intends to appoint an experienced contractor for the Geophysical exploration work with objective as stated above.

### **The Project**

HCL is seeking a consultant/ organisation to provide state of the art ground and downhole geophysical services. Key components of this work will include:

- Carrying out ground geophysical surveys as per methodology & work plan finalized in consultation HCL
- Interpreting geophysical survey data and recommendation on future exploration requirements.
- Establishing a database for geophysical data and ensuring that all relevant data is stored in the database.
- Presenting findings to the HCL exploration team.

### **Deliverables**

The expected deliverables are:

- On time completion of ground and downhole geophysical surveys Database of geophysical survey data
- Project specific reports which cover data interpretation and recommendations of future exploration requirements.

HCL intends to appoint an experienced contractor for the Geophysical exploration work with objective as stated above.

Expressions of Interest (Eoi) are invited from interested party/organizations for undertaking the above jobs.

Interested parties should indicate the following in their Eoi:

- (i) Methodology to be adopted along with a statement on references and outcome of application of the method in similar projects, expected Time line and Execution Plan
- (ii) Detailed Scope of Work for carrying out the work indicating equipments to be used ,and expected role of HCL
- (iii) Brief description of the organization, stating nature of business, type of Company, location and details of management and ownership.
- (iv) Experience in the related field of Geophysical Survey for Base metal exploration with documentary evidence.
- (v) Financial capability.

The interested parties, will be required to make Power Point presentation of its proposed work plan and credentials the dates for which shall be informed in advance.

The selection of the interested party for the work shall be done by HCL thro' an open tendering process in due course of time.

The management reserves the right to reject all or any of the Eoi without assigning any reason thereto.

Eoi should be submitted on or before 12.09.2018 to:

Shri D K Mahajan  
Executive Director (Commercial)  
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## **Brief of Mining Leases and Geophysical Exploration Scheme in different Mining Leases of Hindustan Copper Limited**

Hindustan Copper Limited (HCL), a public sector undertaking under the administrative control of the Ministry of Mines, Govt. Of India, was incorporated on 9th November 1967. It is the only vertically integrated copper producing company with presence in mining, beneficiation, and smelting, refining and downstream saleable products.

HCL holds all the operating mining leases of copper in India and in the state of Jharkhand, Hindustan Copper Limited has three Mining Leases namely Surda Mining Lease (388.68 Hectares), Kendadih Mining Lease (1139.60 Hectares) and Rakha Mining Lease (785.091 Hectares). In the state of MP, it has Malanjhand Mining Lease over an area of 479.9 Hectares. Hindustan Copper Limited has three Mining Leases in the state of Rajasthan namely Khetri Mining Lease: (Lease Area 395.07 ha), Kolihan Mining Lease: (Lease Area 163.23 ha) and Chandmari Mining Lease: (Lease Area 148.25 ha)

Scheme of exploration in different mining leases of Hindustan Copper Limited are as enumerated below. In this scheme it is assumed that geophysical exploration methods will be employed to establish positive anomaly in the mining leases to assess the full potential of the deposits which are not yet explored properly.

A brief description of the leases are as follows:

### **1. Surda Mining Lease: (Lease Area 388.68 ha):**

The Surda Mine (latitude – between 22o 32’ 42” N and 22o 34’ 19” N and longitude – between 86o 24’ 42” E and 86o 26’ 32” E, Survey of India Toposheet- 73 J/6) is located in Ghatsila Sub-Division, Dist: East Singhbhum State: Jharkhand occurring in the famous Singhbhum Copper Belt. It is situated 10 km away from Ghatsila Railway Station, S.E. Railways and around 230 km from Kolkata and 45 km from Tatanagar.

Strike extension of Surda Mining Lease is about 4.5 Km. Presently Surda Mine is being operated at Surda Mining Lease. The mine has been developed over a strike length of 2.2 km. and to a depth of 474m. i.e. 13th level.

Chalcopyrite is the most pre-dominant sulphide mineral followed, in order of abundance, followed by pyrite and pyrrhotite. Important amongst oxide minerals are apatite, magnetite and uranium mineral. Gold and silver occurs in minor quantities. The sulphides

occur commonly as massive, veins, stringers along foliation and fracture planes, as disseminations and as minor replacement patches and veins. Recently depth exploration drilling has been completed by surface exploratory drilling of about 7500 meters corresponding to about 750 meter vertical depth. Three holes have intersected ore body corresponding to 20<sup>th</sup> level i.e. about 750 meters vertical depth at about 20500 N (RRA Co-ordinate). Surface exploration drilling activity may be undertaken upto the extent of the present mining limit Area between 19000 N to 19750 N and between 23000 N to 23500 N area may be taken up to establish the continuity/existence of the mineralized zone through geophysical/ geochemical exploration methods. Exploration drilling to be taken up in this area after establishment of positive anomaly, in order to estimate the resource upto about 1400 meters depth.

### **PAST EXPLORATION RECORDS**

In all 83 bore holes totaling 21,910 mt and 3056 underground boreholes totaling 50,953 mt has been drilled till 31.03.2012.

M/s Robertson Research Australia (RRA), Australia has done an in depth study of the Singhbhum Copper Belt. During course of resource estimation they were of the opinion that drill hole spacing is, at many places, too sparse to provide an acceptable basis of geostatistical estimation. In fact only three drill hole penetrate the lode system within reserve block below 8<sup>th</sup> level. Another 124 drill hole used for reserve estimation which intersect lode at 6<sup>th</sup> level and above, and cannot be given much weight in predicting reserve below 8<sup>th</sup> level.. M/s Robertson Research Australia (RRA), Australia has recommended 14,750 mts of surface drilling in 27 bore holes in three phases (I, II and III) in Surda area. Phase III drilling is contingent upon the results of phase I and II drilling. As per recommendation of M/s RRA, a total of 17 bore holes were drilled in Surda Block with a meterage of 14600 mts by M/s MECL in the year 1994-96. The bore holes were planned to intersect copper ore body at 8<sup>th</sup>, 11<sup>th</sup> and 14<sup>th</sup> levels of Surda mine. In the year 2009-10 M/s Monarch Gold Mining Company Limited (MGMCL) has drilled about 7950 mtrs of surface drilling in 12 surface bore holes between 1300 S to 300 N in Surda mine area and some positive intersections of copper mineralization were found in these surface boreholes at 13<sup>th</sup> level.

## **2. Kendadih Mining Lease: (Lease Area 1139.60 ha)**

Kendadih Mining Lease (Survey of India Toposheet- 73 J/6) is located in the southern sector of the best defined part of the Singhbhum Copper Belt Thrust. The SCB Thrust, from the Surda Mine in the south to Jaduguda north of Rakha, forms a very well defined arcuate ridge. The major lode system is hosted by informally named “Mine Series” schists sandwiched between older Dhanjori Formation metabasalts and younger Chaibasa Formations. It is in east Singhbhum district of Jharkhand state in the Singhbhum copper belt. It is at distance of about 20 km from Ghatsila Railway Station. and around 240 km from Kolkata and 50 km from Tatanagar. Strike length of the lease is about 4.5 Km.

The area exhibits hilly topography with maximum height of about 320 mRL. The hill ranges trend NW-SE and raise about 40 meter above ground level. The major nala cuts across the hill ranges and drains into the Subarnarekha river.

Kendadih underground copper mine (latitude-22°34' 16"N to 22°37'22"N and longitude 86°23'33"E to 86°27' 07"E of Survey of India Toposheet- 73 J/6), is located at Ghatsila subdivision of East Singhbhum district of Jharkhand state in the Singhbhum copper belt. It is at distance of about 20 km from Ghatsila Rly. Stn. And around 240 km from Kolkata and 50 km from Tatanagar.

### **PAST EXPLORATION RECORDS**

Ore-body at the Kendadih and Sideswar blocks has been systematically explored by GSI, IBM and also by HCL authority since 1960. This was preceded by surface geological mapping geophysical & geochemical surveys. Depth of oxidation was deciphered by drilling.

In Kendadih Mine area and north of the mine area, there are several lodes. These are essentially narrow lodes and developed through surface and underground boreholes. In all 51 surface boreholes totaling 11477.65 m have been drilled. Also 582 underground boreholes totaling 10619.36 m have been drilled upto 31.03.2000.

There are major line of old workings in Rakha Mine and Roam Sidheswar Mine block. M/s John Taylor & Sons explored the area through two shafts. Later Mineral Exploration Corporation Limited also executed the exploration in Sidheswar block. HCL also drilled few boreholes in the area and lode intersections were established. But these holes were essentially of shallow depth and established mineralization up to depth corresponding to 3<sup>rd</sup> level of proposed mine.

Exploratory drilling at the Kendadih and Sidheswar blocks of the lease need to be taken up in view of the start of operation of Kendadih Mine as well as development of Chapri-Sidheswar Mine. Surface exploratory drilling has been completed to prove depth extension of ore body upto 8<sup>th</sup> level of the mine i.e. upto about 250 meters vertical depth. In this scheme it is proposed to take the area east of 13000 E between northern boundary of the lease for length of about 1500 meters through geophysical exploration methods, to establish presence of mineralization. Further exploration to establish depth and strike extension may be taken up after establishment of positive anomaly trough geophysical/geochemical exploration, by drilling at 300/200 meters grid pattern.

### **Rakha Mining Lease: (Lease Area 785.091 ha)**

The Rakha Lease (latitude – between 22° 36' 46"N and 22° 39' 50" N and longitude – between 86° 21' 19" E and 86° 24' 13" E, Survey of India Toposheet- 73 J/6) is located in Ghatsila Sub-Division, Dist: East Singhbhum State: Jharkhand occurring in the famous

Singhbhum Copper Belt. It is situated 16 km away from Ghatsila Railway Station, S.E. Railways and around 230 km from Kolkata and 40 km from Tatanagar. The SCB Thrust, from the Surda Mine in the south to Jaduguda north of Rakha, forms a very well defined arcuate ridge. The major lode system is hosted by informally named "Mine Series" schists sandwiched between older Dhanjori Formation metabasalts and younger Chaibasa Formations. It is in east Singhbhum district of Jharkhand state in the Singhbhum copper belt. Strike extension of the lease is about 7 Km.

Recently for proving the depth and strike extension of the resources preliminary exploration (G3 Level) with drilling at 300 meters apart in strike and depth has been proposed 4800 meters of drilling in the first phase has been completed and another 4500 meters of drilling will be undertaken in the second phase. Depth exploration drilling has been done in Rakha Mining Lease in Rakha block where mining has been done upto 6<sup>th</sup> level and ore body has been proved at upper levels. The Tamaphar block i.e. between 32000 N to 35000N may be taken up for exploration through geophysical exploration methods. Further exploration drilling to establish depth and strike extension may be taken up after establishment of positive anomaly trough geophysical/ geochemical exploration, by drilling at 300/200 meters grid pattern.

## **PAST EXPLORATION RECORDS**

### **a) Prospecting :**

Geological survey of India has started large scale geological mapping from Sideshwar side in 1968-69 linking up this area with the adjoining Roam-Sideshwar block. The work in this area brought out indications of strong mineralisation and it was recommended that exploratory drilling should be taken up immediately.

### **b) Geophysical Surveys:**

The available airborne geophysical data over Singhbhum Copper Belt was flown as part of 'Operation hard rock' in 1968, Parsons (1971) and A.M.S.E.

(1975). The surveys were flown by two different systems both of which combined electromagnetic, magnetic and radiometric method. The magnetic data along the Surda-Rakha section of the Singhbhum Copper Belt (SCB) shows a linear magnetic anomaly striking North West. A similar increase in the magnetic susceptibility was noted in an adit through the mineralisation of Roam Sideshwar. In the oxidized layer at surface the magnetic susceptibilities are typically half to a quarter the values recorded in fresh rock. I.P. Resistivity survey was carried out to test the depth of oxidation cover in this deposit.

### **(c) Diamond Drilling**



Series	Depth of inter section below the datum	Interval along strike	Remarks
First	55 m	60m or 120m	To test lode at the 1st level of old cape copper company developments.
Second	95m	60m or 120 m	To test lode at the 3rd level of old cape copper company developments
Third	185m	120m	To test lode at the 7th level of old cape copper company developments
Fourth	275m	180	-
Fifth	450m	360m	-
Sixth	600m	360m	-

Hindustan Copper Limited carried out limited exploratory diamond drilling in SW part during 1974-75. G.S.I. carried out systematic exploration interconnecting the major lodes at certain mine horizons. The upper level series of boreholes were drilled at a 60-120m strike interval. The lower series of boreholes were planned at 170-180m strike interval. The deepest series of boreholes were drilled at 360m interval to establish the continuity of ore bodies.

Density of drilling:

The drilling reveals that the mineralization continues in depth up to 400m RL. The deepest borehole (RMS-51) drilled in the area is of 679.75m depth.

### 3. **Khetri Mining Lease: (Lease Area 395.07 ha)**

The lease hold area is lying in Khetri Taluka, covering Gothra-Banwas villages, in Jhunjhunu of Rajasthan. The area is part of Toposheet no. 44 P/16 (scale 1:50,000) location with Latitude N 28003'46"- N 28005'50" and Longitude E 75048'44"- E 75049'53". (total area 395.07 Hect.)

GLOBAL CO-ORDINATE OF KHETRI MINES LEASE AREA

S. No.	PILLAR	NORTHING	EASTING	ELEVATION
1	MB11	28° 04' 48.3''	75° 49' 20.4''	351 m
2	MB12	28° 04' 11.7''	75° 48' 43.1''	403 m
3	MB14	28° 04' 53.6''	75° 48' 24.1''	363 m
4	MB15	28° 04' 55.1''	75° 48' 21.0''	382 m
5	MB16	28° 04' 33.6''	75° 48' 04.3''	391 m
6	MB17	28° 04' 32.8''	75° 48' 06.0''	382 m
7	MB18	28° 04' 52.9''	75° 47' 40.9''	369 m
8	MB19	28° 04' 45.2''	75° 47' 55.9''	390 m
9	MB7	28° 04' 17.0''	75° 48' 31.6''	418 m
10	PB1	28° 04' 40.3''	75° 49' 30.5''	344 m
11	PB2a	28° 05' 47.5''	75° 49' 52.3''	344 m
12	PB3a	28° 05' 29.7''	75° 50' 02.0''	340 m
13	PB4	28° 05' 03.1''	75° 49' 06.2''	352 m
14	PB5(a)	28° 05' 15.3''	75° 48' 54.4''	349 m
15	PB5(c)	28° 05' 35.6''	75° 49' 17.7''	344 m
16	PB5B	28° 05' 27.3''	75° 49' 25.9''	339 m

The Khetri Copper Mine is well connected by metalled road to Tehsil : Khetri (09 kms from mine shaft), District Head Quarter : Jhunjhunu (60 Kms from mine shaft), State Capital : Jaipur (170 Kms from mine shaft), Country Capital: New Delhi (190 Kms from mine shaft). Nearest railway Station is Nizampur on Rewari-Jaipur section (North Western Railway) & another is Chirawa (30 Kms) on Loharu-Jaipur section (North Western Railway).

Geophysical exploration in Khetri Mining Lease is to be undertaken on a priority basis as the upper levels from where present production activities are going on are almost exhausted and lower levels upto (-300 mRL) need to be proved immediately for sustaining production. For this reason proposal has been submitted for drilling of 53020 meters in 82 number of bore holes. It is planned to undertake about 12190 meters of

drilling in the first phase to prove depth extension of ore body between 3900 to 5000 meters latitude upto (-180 mRL) and about 13760 meters of drilling to prove upto between “0” mRL to (-180 mRL) between 1960 to 2900 latitude. Remaining about 27070 meters of drilling will be undertaken in the next phase to prove depth extension of ore body between (-180 mRL) and (- 300 mRL). Depth exploration through geophysical/ geochemical exploration methods is suggested to prove ore body corresponding to below “0” mRL to (- 420 mRL) between 1960 latitude to 6800 latitude.

### Past Exploration Record

Surface and Underground diamond drilling carried out by various agencies (till 31.03.2018):

#### i) Surface Diamond Drilling

Agency	Number of Bore holes	Meterage	Spacing (m) (strike wise)
GSI	87	24,765	30/60/120
Bird & Co	26	5,606	30/60/120
Punia	2	349	30/60/120
NMDC & HCL	67	24,745	30/60/120
W.Bengal Coal Field 22		8,043	30/60/120
MECL	146	56,199	30/60/120
IBM	48	14,263	30/60/120
<b>Total</b>	<b>398</b>	<b>1,33,970</b>	

#### ii) Underground Diamond Drilling:

Agency	Number of Bore holes	Meterage	Spacing (m) (strike wise)
IBM	14	822	30/60/90
GSI	93	6308	30/60/90
HCL	2730	240340	30
<b>TOTAL</b>	<b>2837</b>	<b>247470</b>	

#### 4. **Kolihan Mining Lease: (Lease Area 163.23 ha)**

The Kolihan Mining Lease is on the survey of India Topo sheet No 44P/16 in Kolihan Village of Khetri Taluka in Jhunjhunu District of Rajasthan. The Lease extends over a

strike length of about 2 Km. It is proposed that Ore body below 64 mRL is to be established through Geophysical methods.

Past Exploration:

The systematic exploration has been undertaken by different exploring agencies like G.S.I., D.A.E., M.E.C. Ltd and HCL as well. Exploration through diamond drilling carried out by different agencies till 31.03.2011 in Kolihan Copper Mine is tabulated below:

Agencies	Number of B.H.			Meterage Drilled		
	Surface	Underground	Total	Surface	Underground	Total
G.S.I.	19	47	66	8348	3970	12318
D.A.E.	5	9	14	674	620	1294
M.E.C. Ltd.	3	--	3	1450	--	1450
HCL	18	951	969	7232	96234	103466
Total	45	1007	1052	17704	100824	118528

Topography:

The topographical analysis reveal that the mineralized hill ridge of the mine block which is about 2.5 KM N 150 W of Bhopalgarh Fort and about 2 KM NW of Khetri town, stretches about 640 meters in N 180 E direction which is almost co – incident with the axis of the hill N 160 E. The knife – edge exposure of hard and tough massive peak – quartzite attains a height of 670 M above MSL.

The strike directions, corresponding to the western slopes and eastern are North and N 340 E where as the inclinations are 360 and 320 respectively i.e. in general western slope is steeper, more rugged and difficult to traverse than the eastern slope.

The region is covered by thorny bushes mainly kickers, other jungle trees are also not uncommon. The eastern valley having the lowest level of 422 M above MSL rises gradually till the base of the hill while beyond this the rise is fairly steep. The western foot hill, the lowest level at the base is 460 M above MSL, is joined with the number of hillocks covered with the sand-dunes. The entire stretch of 2 KM in the west, from foot hill to Kharkhara seasonal river is covered with the sand-dunes.

The general inflow of water is both on east and west slopes of the main hill range, but due to vast coverage with sand –dunes and sandy soil on the west, the water gets absorbed whereas on the eastern side this in-flow of water during short rainy days in the

season causes flood. The general trend of the stream at the eastern valley level is towards southeast.

General Geology of the Area:

The general succession of the area grouped as below in the order of the succession.

General Succession

Recent : Alluvium and Blown Sand.

- Pink Feldspar Rock

Igneous - Vein quartz, calcite, ankerite, amphibole and feldspar.

Intrusives - Younger basic dykes and sills of dolerite and amphibolite  
- Older basic rocks ( Amphibolite )

Metasediments

Ajabgarh - Peak quartzite

suit of - Phyllites

rocks: - Biotite- schist + garnet !

! Copper ore

- Quartz chlorite schist + garnet ! is occurring in these

Alwar - Banded amphibole quartzite ! formations.

suit of - Feldspathic quartzite !

rocks - Crystalline lime stone / marble with amphibole and magnetite

- Feldspathic quartzite and arkosic quartzite.

Except the peak quartzite which makes the crest of the western most ridge in the area under consideration, all the rock units in the Ajabgarh suit of rocks, are mostly argillaceous sediments metamorphosed to various degree of metamorphism, though locally they show quartzite nature.

The rock units of Alwar suit of rocks are mostly arenaceous though tongues and lenses of calcareous sediments have dominated the area locally giving rise to impure crystalline limestone / marble, locally talc- magnetite rich bodies have also been observed in them. The impure limestone / marble also shows magnetic rich patches surrounded by green or dark green amphiboles. The impure limestone / marble is conspicuously bordered for a fairly long stretch along the strike by dark green / black amphibolites on either sides. The amphibolite has also been observed in patches. Biotite – vermiculite tourmaline rock has also been observed along the contacts of marble at places.

Exploration activity to be undertaken is in Kolihan Mining Lease. Total reserve/ resource of Kolihan Mining Lease is only 15 Million Tonne and measures to enhance the reserve / resource base is to be taken up immediately. In the first phase surface exploration drilling to be employed to prove the depth extension of ore body upto below "0" mRL. Geophysical methods to prove ore body at (-180 mRL) may be initiated. In the next phase after getting positive anomaly, exploration drilling will be undertaken to complete preliminary exploratory corresponding to G-3 category by drilling at 300 meters grid pattern.

5. **Chandmari Mining Lease: (Lease Area 148.25 ha)**

Toposheet No.: 44P/16

Latitude & Longitude of all corner boundary point/pillar

N 27° 59' 40"      E 75° 46' 04"

N 28° 00' 46"      E 75° 46' 50"

Strike length of the lease is 1.6 Km. Presently Chandmari Mining Lease is not in operation. Chandmari copper mine was an opencast mine situated one km northwest of Khetri town. The first bench was opened at 480 m RL, pit was designed for an ultimate depth of 348mRL. The overall stripping ratio was 1:4.51. It was considered that the continuity of payable mineralization persists at deeper levels, there was a possibility of going further down to win that ore taking one or more benches beyond 348 mRL.

That possibility was worked out and it was found to be highly un-economic because of a large overburden that was to be removed to exploit a small tonnage of ore.

A detailed study was therefore carried out and it was decided to win the ore by underground mining methods. Underground mining was commenced from 01.08.95 and a total development of 813 m was done for two levels. That was also stopped in year 2002. In March 1995, MECL completed its Exploration Report which was procured by HCL during November 2010. The report mentioned that the block contains 12.10 million tones of copper ore reserves worth 1.02% average copper grade at 0.50% 'Cu' cut off with 62% & 50% confidence limit under probable and possible category for main lodes III & IV respectively.

Based on the above facts and encouraging details mentioned in the Report, HCL moved a Proposal (Letter of Intent) to MECL through letter no HCL/KCC/Geo./2012/50 dated 29.08.2012. The proposal included 9912 m surface drilling in 22 nos boreholes, associated with Geological activities including survey, sampling and Geological report.

Accordingly, drilling work was commenced by MECL in December 2012 & completed in February 2014 and the exploration Report got finalized in August 2014 and it was finally received at HCL KCC in December 2014.

Mainly four lodes are identified i.e lode I,II,III & IV and others are local lodes existing in the block. Out of which lode III & IV combined accounts for 94 % of the total ore reserves estimated in the promotional exploration programme. The other lodes I, II and other accounts for only 6.0 % of the total ore reserves. Resources of about 68.44 % of the total ore reserves estimation have been grouped under Proved reserves and the remaining 31.56 % are kept under Probable category due to limited intersection and wide spaced boreholes.

The reserves have been estimated by both the methods i.e the cross section method longitudinal vertical section method.

The total reserves estimated by cross section method is 13.26 million tonnes of 0.99% cu at 0.50% cu cut-off.

The lodes intersected have been taken as 30m up dip and down dip for proved zone and the next 30m up dip and down dip for probable zone of development. In between the two intersections of the same correlatable lode in dip direction first 30m from each intersection have been taken as proved zone of development and the next 30m for probable zone of development under the same grade as the intersection up to the half influence of the distance between the intersections, the grade & thickness of each intersection is taken.

However to estimate the resources upto a depth of 1500 meters vertical depth it is planned to undertake geophysical/ geochemical exploration methods, exploration drilling will be employed after obtaining positive anomaly during geophysical exploration

6. **Malanjkhand Mining Lease: (Lease Area 479.9 ha).** It is in Baihar Tehsil of Balaghat District of Madhya Pradesh

Topo sheet no. 64 B/12, 64 B/16, 64 C/9 & 64 C/13

Latitude from 22<sup>0</sup> N to 22<sup>0</sup> 05' N

Longitude from 80<sup>0</sup> 40' E to 80<sup>0</sup> 45' E

The deposit extends over a strike length of about 2.2 Km and reserve resource estimated is 310.09 Mill. Ton at 0.92 % Cu.

## **TOPOGRAPHY**

The area (Fig. 1.1) is a hilly terrain consisting of narrow basins and hills. Cultivated lands for rice cover the basins and dense forests mostly cover the mountains. Malanjkhanda rises in isolated majesty above the undulating terrain and form a part of the Baihar Plateau. Originally, it was made up of six peaks with intervening saddles, forming an arcuate chain, about 2.6 km long having an eastward convexity. The highest peak of this hill is 652 m above MSL while the ground level of the surrounding areas is around 575 m. This is the general elevation of the Baihar Plateau, which rises about 270 m above the Balaghat Plains.

## **GENERAL GEOLOGY**

The ENE-WSW trending Son Narmada Lineament along the Narmada River divides the Indian Precambrian shield into two blocks. The Malanjkhanda Copper Deposit is located in the southern block of Central Indian Precambrian Shield, which is bordered by Pranhita–Godavari valley, and Son–Mahanadi valley (Fig.1.2). Geology of Malanjkhanda area consists of basement complex and weakly metamorphosed sedimentary rocks of the ChilpiGhat Series. These rocks have been classified as belonging to Lower Proterozoic age.

The basement complex is mainly composed of gneisses, schists, granitoids and basic dyke rocks. The granitoids of the area, which are commonly seen as detached outcrops, are covered mostly by lateritic soil and sediments have been described by different names such as Baihar granite or Malanjkhanda Grano-Diorite. The granitoids include a wide range of rocks, such as granite, adamellite, granodiorite and tonalite. They show a medium to coarse-grained hypidiomorphic texture. Foliation and gneissic banding are observed at places.

A huge mineralized quartz reef (2600 meters long, approximately 65 to 70 meters wide and over 600 meters depth) dipping at 60° to 70° towards east, occur in the granitoids. The reef occupies an arcuate zone representing earlier tectonic activity. The quartz reef is fractured and displaced by late traversed faulting. The mineralisation is confined to the reef and surrounding altered granitoids.

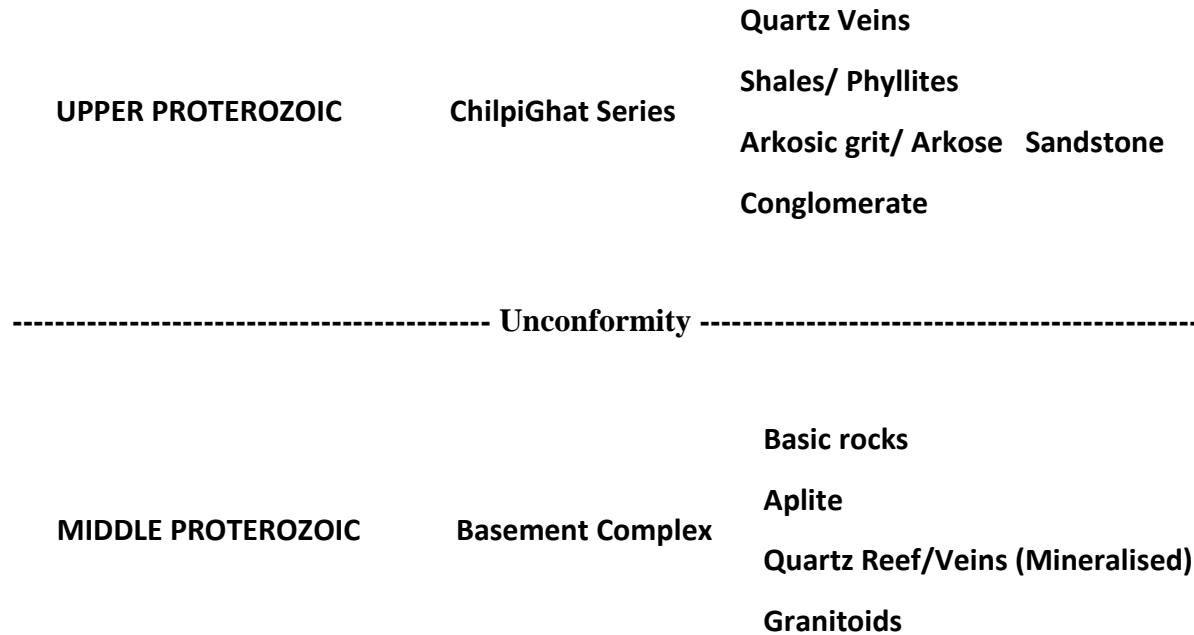
Subsequent to the mineralization, an aplitic mass intruded in the central part of the quartz reef and a series of basic rock/ dyke intruded along NNE-SSW, NW-SE and N-S trending fissures forming complicated dyke system. The Chilpi Ghat series, which comprises of conglomerate, arkosic grit and quartz with pelitic intercalations, overlies unconformably over the Basement Complex.

## **GEOLOGY OF MALANJKHAND COPPER DEPOSIT**



The Rocks of Malanjhand area are of Proterozoic age and can be broadly grouped into two divisions, each with distinct characters, separated by an unconformity. The older group consists of basement Granitoids and the younger less metamorphosed sedimentary rocks of ChilpiGhat series.

The geological succession of the area is as follows: -



Most of the mineralisation confined to sheared quartz reef /veins and to some extent in the adjacent granitoids. The reef is exposed on the hill ridges and is disposition in an arcuate shape over a length of 2.6 km in North-South direction. It dips 60-70° to the East and has an average width of 65 to 70 m. It has been emplaced along the fracture & fissure planes in the granitoids. Subsequently, the reef is sheared and fractured and permitted sulphide rich hydrothermal fluids to precipitate. The younger sedimentary formation is lying unconformable over older rocks. These rocks are exposed on the Southern and western part of the deposit.

**Past Exploration: Exploratory Diamond Drilling:**

Total of 96158 m of diamond drilling in 225 holes was undertaken till date. Over strike length of 2.6 km and already established the potential of the deposit in this area up to “-60” MRL. The diamond drilling has been undertaken along 40 section lines located at approximately 100 m interval along the strike of the deposit.

The detail of exploratory drilling undertaken from time to time by various agencies is given below:

Agencies	Phase	Period	No. of holes	Total (m)
GSI/ MECL	I	PRE-DPR 1969-78	96	22759.22
HCL/ MECL	II	1980-84	25	8896.95
MECL	II	Promotional 1983-90	88	53626.40
HCL/ BEC	II	Feasibility Studies(1990-91)	16	10875.95
<b>TOTAL</b>			<b>225</b>	<b>96158.52</b>

### **DRILLING PATTERN:**

The diamond drilling has been undertaken along 40 section lines located at approximately 110m interval along the strike of the deposit.

The bore hole spacing along the dip direction is:-

LEVEL	AVERAGE	Min. (m)	Max.(m)
Upto 400 mRL	73	50	105
400 to“-60”mRL	127	95	155

The drilling reveals that the mineralization continues in depth up to (-) 300 mRL.

In Malanjkhand Mining Lease resource is estimated under G-1 category upto 640 meter vertical depth. The evaluating resource between 640 meter depth to 1350 meter vertical depth exploration corresponding to G-3 level is proposed, For this purpose about 29000 meters of drilling is estimated. However geophysical exploration methods are proposed to be adopted initially to assess the full potential of the deposit because some of the areas at hanging wall side are covered with waste dump where drilling rigs are difficult to be employed.