# PROPOSAL OF RECONNAISSANCE SURVEY (G-4 STAGE) FOR IRON, MANGANESE AND ASSOCIATED MINERALS IN TINDNI BLOCK (21.38 SQ. KM) DISTRICT- JABALPUR, MADHYA PRADESH

**COMMODITY: IRON, MANGANESE AND ASSOCIATED MINERALS**

**BY**

**MINERAL EXPLORATION & CONSULTANCY LIMITED**
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**PLACE: NAGPUR**
**DATE: 20.04.2024**

**Summary of Tindni G4 Block for Reconnaissance Survey (G-4 Stage)**

**GENERAL INFORMATION ABOUT THE BLOCK**

| | **Features** | **Details** |
|---|---|---|
| | Block ID | Tindni G-4 Block |
| | Exploration Agency | Mineral Exploration and Consultancy Limited (MECL) |
| | Commodity | Iron, Manganese and Associated Minerals |
| | Mineral Belt | The area belongs to the Mahakoshal Group of rocks. Mineralisation of Iron is occurring around the area associated with Banded Iron Formation (BIF) while Manganese is associated with BIF and Phyllites. |
| | Budget and Completion period with entire Time schedule to complete the project | Rs. 157.81 lakhs.<br>Time Line for Exploration work with Drilling is 10 months. |
| | Objectives | The Mahakoshal belt represents a volcano-sedimentary sequence exposed proximal to the ENE-WSW to E-W trending Son-Narmada Lineament Zone (SNLZ) in the Central India and has an aerial extent of approximately 9000 sq. km. The Paleoproterozoic Mahakoshal belt is well known for hosting numerous economic mineralization like Sulphides, Gold, PGE, Manganese, Iron (BHQ/BMQ) etc. The presence of supporting lithology for Iron and Manganese mineralization viz. BIF and Phyllites encourages taking up the G-4 Exploration in the area.<br><br>Evaluation of previous work, work done by GSI and private exploration agencies has indicated occurrence of Iron and Manganese in and around the proposed block. BHQ is the proto ore for Iron ore. Within the proposed block, a prominent BHQ reef having 9 km length and 300m wide runs from W-E in the northern part of the area. The proposed exploration is to target the leaching zones along the length of the BHQ.<br><br>The block area also falls in the vicinity of a lease hold by M/s. Shree Mining area for Iron and Manganese. Based on the data available, DMG , Madhya Pradesh has selected the proposed block for exploration so that it can be made feasible |

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| | | for auctioning. It is currently in the e-auction portal for Composite License.<br><br>Evaluation of field visit done by MECL has indicated occurrence of BIF and manganiferous phyllite associated with BIF bands in the proposed block.<br><br>On the basis of these evidences of mineralisation, the present exploration program has been formulated to fulfill the following objectives.<br><br>i) To carry out Geological & structural mapping on 1:12,500 scale for demarcation of Iron and Manganese bearing host rock for these mineralisation with the structural features to identify the surface manifestations and lateral & vertical disposition of the mineralized zones.<br><br>ii) To collect bedrock samples, channel samples and trench samples & to analyze for Iron & Manganese for further course of Exploration program.<br><br>iii) Pitting / trenching will be done to expose the concealed host rock and mineralisation.<br><br>iv) If phase-I exploration data will give positive results, 8 Nos. of scout boreholes (approximately 520 m of drilling) shall be drilled which in turn will decide the future course of Exploration program at G-3 category of UNFC.<br><br>v) To estimate reconnaissance resources (334) along with accessory elements as per UNFC norms and Minerals (Evidence of Mineral Content) Rules-2015 at G-4 level. |
| | Whether the work will be carried out by the proposed agency or through outsourcing and details thereof.<br>Components to be outsourced and name of | Work will be carried out by the proposed agency (MECL). |

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| | the outsource agency | |
| | Number of Geoscientists | Nos. of Geoscientists: 2 (1Field + 1HQ) |
| | Expected Field days( Geology, Surveyor) | Geologist Party days:100 field + 30 HQ |
| | | Survey Party days : Nil |

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| **1.** | **Location** | |
| | Longitude-Latitude | Refer Location and Accessibility |
| | Villages | Tindni, Ker, Lakarhai, Chhattarpur, Padariya etc. |
| | Tehsil/Taluk | Panagar |
| | District | Jabalpur |
| | State | Madhya Pradesh |
| **2.** | **Area (hectares/ square kilometres)** | |
| | Block Area | 21.38 sq km |
| | Forest Area | No Reserve Forest falls in the Block area, Open Mixed Jungle is present in the block. |
| | Government Land Area | Data not available |
| | Charagaha | Data not available |
| | Private Land Area | Part of the area is private cultivated land |
| | Study of DSS | Area Not Inviolate |
| **3.** | **Accessibility** | |
| | Nearest Rail Head | Deori (9 km) railway station in West Central Railways. |
| | Road | The proposed block is well connected via NH-30 connecting Jabalpur to Sihora. |
| | Airport | Jabalpur in SE Direction, about 30 km from the block area |
| **4.** | **Hydrography** | |
| | Local Surface Drainage Pattern (Channels) | The drainage pattern is sub dendritic to sub-parallel in nature. |
| | Rivers/ Streams | The area lies adjacent to Tindni reservoir and a canal runs along the north western part of the block boundary. |
| **5.** | **Climate** | |
| | Mean Annual Rainfall | Average annual rainfall is about 1400 mm. The climate of the area is mainly tropical with clearly defined dry and rainy seasons. The humidity is generally low except during the monsoons. |
| | Temperatures (December) | Minimum temperatures 10 $^{\circ}$C |

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| | (Minimum)<br>Temperatures (May-June)<br>(Maximum) | Maximum temperatures up to 45°C |
| **6.** | **Topography** | |
| | ToposheetNumber | 64 A/03 |
| | Morphology of the Area | The topography in the proposed block is moderate to flat with ridges passing east-west inside the block boundary and in the south western part of the block. |
| **7.** | **Availability of baseline geoscience data** | |
| | Geological Map (1:50K/25K) | STM ( 1:25,000) |
| | Geochemical Map | Available |
| | Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps) | Available |
| **8.** | **Justification for taking up Reconnaissance Survey/ Regional Exploration** | i) The area belongs to the Agori formation of Mahakoshal Group which is well known for hosting various mineral resources including Iron and Manganese. Mineralisation of Iron and manganese are occurring in and around the area is associated with Banded Iron Formation (BIF).<br><br>ii) GSI carried out STM during FSP 1998-99 in and around this area and identified favorable lithounits for hosting iron and manganese mineralization viz. BIF bands. They also reported pockets of iron occur within the duricrust. The ore is in the form of lumps with platy, laminated or biscuity hematite ore cemented by very little laterite matrix. These lumps have analysed 50% to 70% $Fe_2O_3$ with an average grade of 55% $Fe_2O_3$. The duricrust is underlain by thick blue dust horizons interlayered with clay. The blue dust has analysed 70% to 75% $Fe_2O_3$. They also observed that the primary mineralised bodies for manganese are manganiferous argillites associated with phyllite and BHC and manganiferous cherts. Secondary mineralisation is associated with quartz veins which have intruded the BHC. They also identified gold mineralization that analyzed 0.4-4.2 ppm along |

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| | | the quartz reefs at the contact of supracrustal granite and recommended to investigate further.<br><br>iii) Evaluation of previous work, work done by GSI and private exploration agencies has indicated occurrence of Iron and Manganese in and around the proposed block. BHQ is the proto ore for Iron ore. Within the proposed block, a prominent BHQ reef having 9 km length and 300m wide runs from W-E in the northern part of the area. The proposed exploration is to target the leaching zones along the length of the BHQ.<br><br>iv) Exploration of Chhatarpur Iron, Manganese and Laterite block by M/s Shree Mining is in the north western part of the proposed block. They reported a geological resource of 2.02 mT and 0.122 mT of Iron (at 40% cut-off) and Managanese (at 10% cut-off) respectively with grade ranges from 35%-45% Fe in laterite and 10%-35% Mn at G-3 level. Chhatarpur block is currently in the e-auction portal for composite license.<br><br>v) MECL has conducted field visit in the proposed block. During geological traverses, our team has identified the host rocks viz. BIF/ Ferruginous quartzites and manganiferous argillites associated with phyllite and BHC at several places. The samples are being analyzes in MECL Chemical laboratory.<br><br>vi) Based on the mineralization evidences of Iron and Manganese in and around the block, the present Reconnaissance Survey exploration program at G-4 level has been prepared. Geological mapping, surface sampling and pitting/trenching will be helpful in assessing the lithology, disposition and grade of the mineralized zones, structural features etc.<br><br>vii) The Exploration will be helpful in estimation of reconnaissance resources of Iron and Manganese and associated minerals in the block |

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| | | area. Geochemical sampling of BRS/Channel/Chip Sample/ Pitting/trenching and the drilling of scout boreholes will be helpful in assessing the disposition and grade of mineralization.<br><br>viii) The Reconnaissance Survey (G-4) will eventually help in planning of detailed exploration program (incase upgraded to G-3 level) which in turn will facilitate the state Government for auction of block. |

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## 1.0.0 INTRODUCTION

### 1.1.0 Preamble

1.1.1 Iron and Manganese being important constituent in steel manufacture has played a vital role in the industrial growth of a nation. Both Iron and Manganese are one of the most common elements in the Earth's crust and is widely distributed across the planet's surface. Iron, the metal of common man has its use in every sphere of life, since the Iron Age 800 BC and there on, it forms the backbone for the industrial growth of a nation. The stage of growth in iron and steel industry of a nation is a measure of its economic status among the world communities. Manganese is very hard, brittle, gray-white transition metal that is found in variety of minerals, but never as free element in nature and it is often found in the form of minerals in combination with iron.

1.1.2 It is well known fact that India is endowed with rich deposits of iron ore both quality and quantity wise. Indian iron ores are good demand in the international market especially in Asian markets. India could further explore markets in the Middle East and Europe as it is well placed geographically to these regions in comparison to other leading iron ore exporting countries in the world.

1.1.3 To cope with the increasing demands, mining activities have to be accelerated. Mechanisation of iron ore mines is imperative not only to increase production but also to reduce production cost. The leading iron producing countries like Brazil, South Africa and Australia have increased their iron ore production by adopting cost-effective and technologically advanced schemes of mining.

1.1.4 Beneficiation of low grade iron ore and fines that are in abundance in India could be another viable prospect. This will fetch good export value to the indigenous iron ore and create job opportunities in the sector. The Regional Research Laboratory(RRL), Bhubaneshwar, Ore Dressing Division of IBM and National Metallurgical Laboratory (NML), Jamshedpur, have developed techniques of iron ore beneficiation of iron ore on pilot scale.

1.1.5 Although India is endowed with substantial resources of iron ore, many prospective areas in the country have still not been explored. Detailed exploration may result in further augmentation of iron ore resources. With increased used of iron ore with around 50% Fe in globe steel plants there is a need to reassess the iron ore resources of the country. Banded Iron Formation, namely, Banded Haematite-Quartzite (BHQ)/Jasper and Banded Magnetite Quartzite (BMQ) are other potential sources of iron ore and need exploration for assessment of technology to beneficiate BHQ/BMQ to extract iron ore from these sources.

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## 1.2.0 Location and Accessibility

1.2.1 The block is located in the Jabalpur district of Madhya Pradesh. The proposed block is well connected via NH-30 connecting Jabalpur to Sihora. Deori Railway Station of West Central Railway Main line falls 9 km North West of the proposed block. The nearest airport Jabalpur, is 30 km away from the block in SE direction. The area falls in Survey of India Toposheet No. 64A/03. The Co-ordinates of the corner points of the block area both geodetic and UTM are given in the table below in Table-1.

**Table-1**
**Co-ordinates of the block boundary points of the proposed Tindni Iron, Manganese & associated minerals (G-4) Block, District- Jabalpur, State- Madhya Pradesh**

| Points | UTM (ZONE: 44N) | | DMS | |
|---|---|---|---|---|
| | NORTHING (m) | EASTING (m) | LATITUDE | LONGITUDE |
| A | 2574039.903 | 399675.440 | 23° 16' 21.475 N | 80° 1' 8.758 E |
| B | 2574228.640 | 399928.364 | 23° 16' 27.668 N | 80° 1' 17.615 E |
| C | 2574206.645 | 400447.949 | 23° 16' 27.066 N | 80° 1' 35.907 E |
| D | 2573951.690 | 400307.569 | 23° 16' 18.746 N | 80° 1' 31.026 E |
| E | 2573949.684 | 400214.986 | 23° 16' 18.660 N | 80° 1' 27.768 E |
| F | 2573839.146 | 400206.749 | 23° 16' 15.064 N | 80° 1' 27.505 E |
| G | 2573835.229 | 400265.400 | 23° 16' 14.950 N | 80° 1' 29.570 E |
| H | 2573742.495 | 400261.580 | 23° 16' 11.934 N | 80° 1' 29.457 E |
| I | 2573709.574 | 400459.917 | 23° 16' 10.907 N | 80° 1' 36.445 E |
| J | 2573725.761 | 400602.174 | 23° 16' 11.464 N | 80° 1' 41.448 E |
| K | 2573854.150 | 400608.629 | 23° 16' 15.640 N | 80° 1' 41.645 E |
| L | 2573935.872 | 400631.764 | 23° 16' 18.302 N | 80° 1' 42.440 E |
| M | 2574097.016 | 400751.832 | 23° 16' 23.568 N | 80° 1' 46.627 E |
| N | 2574045.646 | 401402.588 | 23° 16' 22.039 N | 80° 2' 9.542 E |
| O | 2574675.630 | 403643.622 | 23° 16' 43.001 N | 80° 3' 28.271 E |
| P | 2575376.948 | 409787.733 | 23° 17' 7.062" N | 80° 7' 4.372" E |
| Q | 2573100.430 | 409963.091 | 23° 15' 53.075" N | 80° 7' 11.030" E |
| R | 2572044.864 | 399828.148 | 23° 15' 16.641 N | 80° 1' 14.607 E |
| S | 2572893.128 | 399760.161 | 23° 15' 44.207 N | 80° 1' 12.012 E |
| T | 2573280.327 | 400988.646 | 23° 15' 57.065 N | 80° 1' 55.154 E |
| U | 2573431.765 | 400995.742 | 23° 16' 1.990 N | 80° 1' 55.368 E |
| V | 2573551.500 | 399709.768 | 23° 16' 5.603 N | 80° 1' 10.082 E |

## 1.3.0 Physiography & Drainage

1.3.1 The topography in the proposed block is moderate to flat with ridges passing east-west inside the block boundary and in the south western part of the block.

1.3.2 The drainage pattern is sub dendritic to sub-parallel in nature. The area lies adjacent to Tindni reservoir and a canal runs along the north western part of the block boundary.

## 1.4.0 Climate

1.4.1 The Average annual rainfall is 1400 mm. The climate of the area is mainly tropical with clearly defined dry and rainy seasons. The humidity is generally low except during the monsoons. The area comes within the semi arid zone with temperature ranging from 10°C (Dec-Feb) to 45°C (Apr-Jun).

## 1.5.0 Flora Fauna

1.5.1 The Block falls in the part of Amoch Reserve Forest. Main flora of the area are Mangoes, Neem (Margosa), Tendu, Mahua, Palas, Pipal, Barakar and Sagaun and main fauna are boars, Cheetal, Sambar, Rabbits, Snakes and Foxes. Large size scorpians are commonly found here which are almost jet black to brownish black in colour.

## 1.6.0 Regional Geology

1.6.1 The Proposed block falls in the Mahakoshal Group of rocks which is famous for various mineral assemblages. Mahakoshal Group of rocks are represented by the volcano-sedimentary sequence occurring as ENE-WSW trending linear belt extending from Narsinghpur district in M.P. to Palamau district in Jharkhand. The sediments include quartzite, conglomerate, phyllite, chert, stromatolitic dolomite, limestone and Banded Iron Formation inter-layered with metabasics of basaltic composition. The narrow belt of high grade gneisses which occur to the north and south of this belt in the area have been considered to be the basement for Mahakoshal Group of rocks. The Mahakoshal Supracrustals are intruded by serpentinised ultramafic bodies of dunite-peridotite and pyroxenite composition. Syn to post kinematic granitoids have intruded this sequence which are 1800 Ma and 2400 Ma old (Rb-Sr age dating, Bandyopadhyay et al, 1990). The Supracrustal rocks have been subjected to three phases of deformations, the first two phases are more pronounced (Roy & Bandyopadhyay, 1990). Green schist facies of metamorphism is seen in the entire belt, however, locally higher grade minerals also occur.

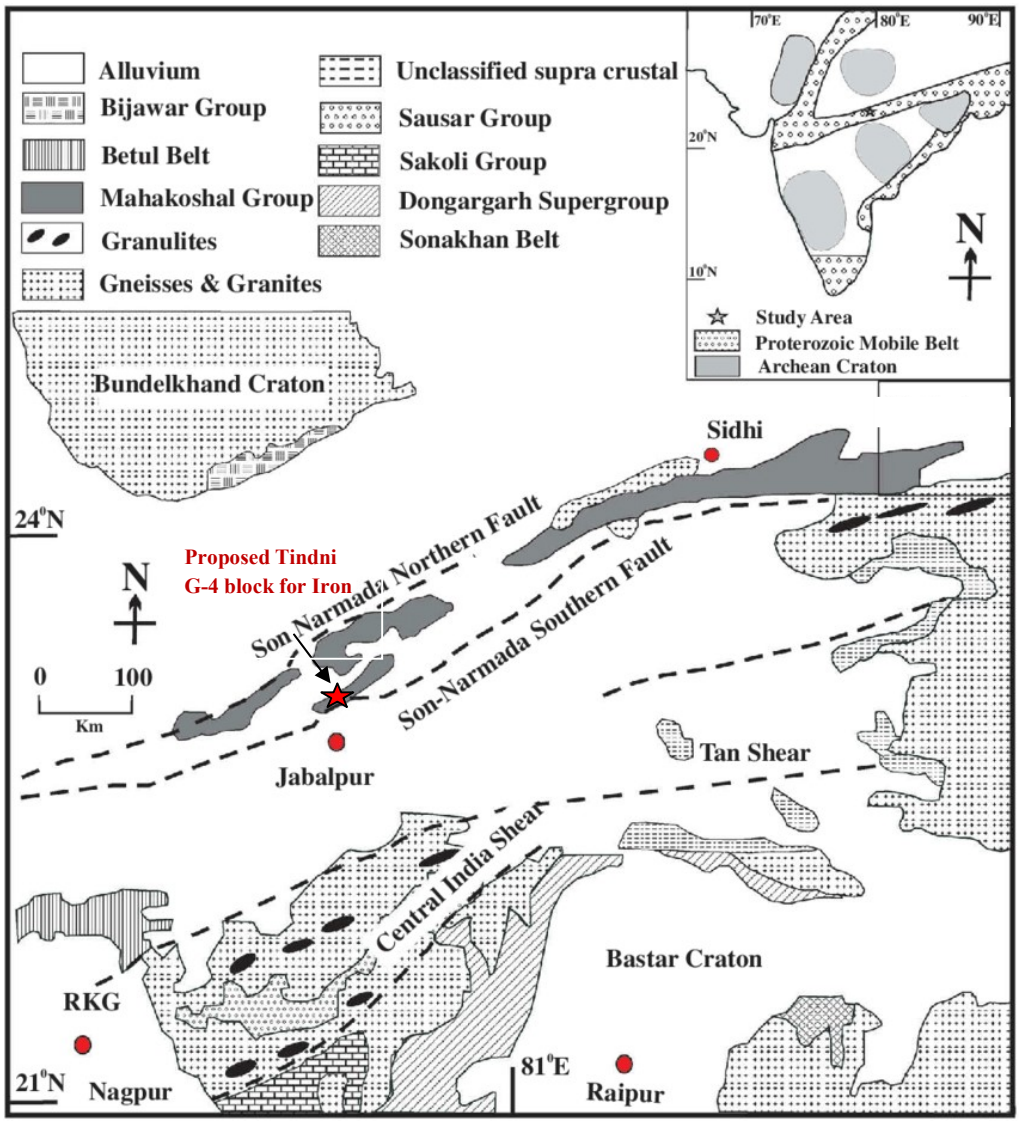



Fig- Map showing Proterozoic Mobile belt, Mahakoshal Group and the proposed G4 block (Modified After Bora, S and Kumar, S., 2015)

1.6.2 Nair et al. (1995) have advocated a threefold classification of Mahakoshal Group. The lower part comprises ultramafic flows and plugs constituting Chitrangi Formation, while the middle part named as Agori Formation, comprises chemogenic sediments viz. meta carbonates, chert and BIF with thin mafic flows. The upper part named as Parsoi Formation comprises thick sequence of argillites and greywacke.

## 1.7.0 Regional Structure

### 1.7.1 Diastropic Structures

The overall structural framework of the Mahakoshal belt is represented by a series of upright to slightly overturned folds on southerly dipping axial planes and the folds developed during the initial stage of deformation were refolded into nearly vertical to reclined folds during the course of the progressive deformation, especially in the vicinity of the shear zones. According to Roy and Bandyopadhyay (1990), the

Supracrustal rocks of the Mahakoshal belt have been involved in folding of at least three generations (D1, D2 & D3) and the present day ENE-WSW disposition of the belt is due to the development of D1 and D2 structures. The shear zone rocks include as part of the Mahakoshal Supracrustal and the granitoids occurring further on the southern margin. The mylonitic foliation within the shear zone is parallel to the schistosity of the dominant folds (D1) and sheath like folds are found in the mylonites. The North to NNW subhorizontal shortening across a large terrain of the deformed rocks and a shearing movement superimposed over the regional strain along the steep southerly dipping slip/shear planes represented by slip faults (Abhinaba Roy and M. K. Devarajan).

1.7.2 The regional strike of the Mahakoshal Group of rocks is ENE-WSW to East-West with dips ranging from 55° to 80°. Presence of isoclinal folds, asymmetrical folds and cross folds, reflect the deformational events. The earliest recognized folding which has generated tight, isoclinal, reclined folds with sub vertical axial planes is represented by a closure at Pan Umariya village located at south west of the Imaliya village. The pervasive foliation in the volcano sedimentary sequence, which strikes in ENE-WSW direction and was generated during this deformation, is seen in this part of the Mahakoshal belt. The plunge of the folds is towards SSE. The second event of the deformation has developed folds with sub vertical axial planes with axis plunging very gently either ENE or WSW. Both of these events have developed folds which are co-axial but one has a gentle plunge whereas the other has steep plunge of axis. Topography in this part is also representing ENE-WSW trending alternate hills and valleys. The third event, which has NNW-SSE axial trend with open warps where cross faults are present, has caused discontinuity or gap in these ridges. This particular activity is most important in the Mahakoshal belt for localization of mineralisation. The above mentioned diastrophic structures like foliation, mesoscopic and minor folds, are reflecting the deformational history of the supracrustals in the present area. In the central part of Mahakoshal belt fold closures of the major folds as such are not well preserved, however, some of the F2 fold closures seen in the central part are at Pan Umariya, Sihora and Tindni which also represent the large scale folds of the Mahakoshal belt. The map scale folds and minor folds have varying plunges which are either plane cylindrical or non-planar and non-cylindrical, tight to isoclinal, upright to reclined folds. These may overall represent sheath geometry. These are seen in the Sarda area (23°28’31”:80°08’41”, 64A/3) in the central part of the Mahakoshal belt (Singhai and Keshava Prasad, 1997-98). Plunge in the minor fold of Tindni closure, which is plane, cylindrical, upright to reclined fold, varies from 15° to 80° both towards ENE and WSW as observed in this part of the Mahakoshal belt. Such variations have been attributed to inhomogeneous nature of the strata in the area (Roy and Bandyopadhyay, 1990).

1.7.3 **Non Diastrophic Structures**

The non-diastrophic structures and planar features like bedding is represented by compositional layering within the BIF, colour banding in the chert and jasper bands and alternate silica rich and mica rich layers within the metapelites of the Mahakoshal

belt. The colour banding in the dolomite and chert, which is a dominant unit in this part, is exhibited by light to dark greyish tone and pink to pinkish & purple impurities in chert bands. Intercalations of phyllite within the dolomite and calcareous intercalations in argillaceous rocks are reflecting the depositional characters. Thin sedimentary units, which are of arenaceous nature, are also found in the calcareous and argillaceous rocks. The variation in grain size, fineness and coarseness are characteristic of these units. Presence of intra-formational conglomerate and its gradation towards coarseness or fineness is indicative of its depositional nature. In this part, the regional stratification is ENE-WSW to WNW-ESE with sub vertical dips varying from 70° to 80° due south. Meta basaltic flows, which occur in Shahdar and Madhana area upto east of Pan Umaria show flow structures like vesicles filled with secondary materials or minerals. Flows may contain Pahaehoe like features and these may have development of pillow structure as has been suspected form the north eastern part of Dungaria in Sleemanabad area.

### 1.8.0 Geology of the Block

The area mostly exposes lithounits belonging to Early Proterozoic to Archaean aged Mahakoshal Group of Rocks comprising Quartz veins, Quartz porphyre veins, Mafic and Ultramafic intrusive, Phyllite with bands of quartzite, Conglomerate Dolomite, Limestone with bands of BIF, Manganiferous chert, quartzite and metabasalts, pyroclasts. Brief description of various rock types are as follows:

i) **Chert:** Chert bands are massive and brecciated. Bulk of the chert exposures are seen in the ridges. In the bedded type, alternate white and jasper red bands are a few centimeters thick. In most of the places, chert is highly brecciated, at places looking like true sedimentary breccia with angular fragments set in siliceous matrix.

ii) **Dolomite:** Grey colored massive dolomite occurs as lenses within chert, usually 1-2m thick and several tens of metres long. They show typical elephant skin weathering and have thin (4-10 cm) chert layers.

iii) **Phyllite:** They are usually green, greyish green and greenish yellow in colour. Primary banding is rarely seen in these rocks and only ENE-WSW trending pervasive foliation is observed at places garnets are noticed in these phyllites. Phyllites are also associated with the BHC are grey in colour with lot of clay component in it.

iv) **Manganiferous Phyllite:** This is a minor component of the vast occurrence of phyllites in the area. Important occurrences of these phyllites are near villages Kurro-Piparia, to the west of Gosalpur and to the ESE of Tindni. This phyllite, also referred as manganiferous argillite, is light to dark grey in colour with varying amount of clay component. The manganese mineral is psilomelane. The band between Tindni and Sakri is slaty in appearance and soils the fingers.

v) **Metapelite:** Near the contact of supracrustals with the Madan Mahal granite, a few lensoidal bodies of biotite-quartz bearing metapelites are exposed. The rock is dark grey and, on weathered surface, compositional banding is conspicuous with silica rich layers standing out as ribs. The exposures have an appearance of a calcareous rock but the fresh surface look is quartzitic.

vi) **Banded Hematite Chert/Jasper (BHC/BHJ):** BIF occupies the rigde of Mohari-Chhatarpur - Tindni-Bichhiya-Sakri. Hematite is hard and massive. Several thin BHC bands occur as detached bodies within phyllites. At several places, thin magnetite rich

layers are also seen within this BHC. At several places, thin magnetite rich layers are also seen within this BHC.

vii) **Intrusives:** Madan Mahal granite, dolerite and amphibolite dykes and quartz reefs/veins have intruded the supracrustal rocks of Mahakoshal Group.

viii) **Granite:** Both grey and pink phases of granites are observed in the area. The rock is a course to medium grained biotite granite. Exposures are huge and boulder.

ix) **Mafic dykes:** Numerous ENE-WSW trending mafic dykes are observed intruding the supracrustal. Most of them are amphibolite dykes.

x) **Quartz reefs/veins:** Thin quartz veins are occasionally seen emplaced along the regional foliation. They are off-white to blue-grey in colour. Apart from these, there are two quartz reefs near the contact of supracrustals and the granite.

The tentative srtratigraphic sequence of litho units exposed in the Block area (After GSI) is given in Table-2.

**Table-2**
**Lithostratigraphy of Mahakoshal Group of rocks around Sihora, Chhatarpur and Majhgawan areas, Jabalpur district, Madhya Pradesh**
(After GSI)

| Age | Supergroup | Formation/Beds | Lithology |
|---|---|---|---|
| Quarternary | | Alluvium, silt and laterites | |
| Late Cretaceous-Palaeocene | Deccan Trap | Amarkantak | Basaltic flows |
| Late Jurrasic-Early Cretaceous | Gondwana | Sandstone & Conglomerate | |
| | | Intrusives | Quartz veins, Quartz porphyre veins<br>Mafic and Ultramafic intrusives |
| Paleoproterozoic | | Madan Mahal Granite | Granite |
| Early Proterozoic to Late Archaean | Mahakoshal | Agori Formation | Dolomite, Limestone with bandsof BIF, Manganiferous chert, quartzite and metabasalts, pyroclasts, Phyllite |
| ---------Basement not seen-------- | | | |

## 1.9.0 Mineral Potentiality based of the block

1.9.1 Iron and Manganese mineralization associated with the Early Proterozoic aged Mahakoshal Group of rocks has been present in the area marked by the presence of BIF and Mn bearing Phyllites etc. Previous agencies have also observed the presence

of Iron and Manganese. Banded Hematite Jasper (BHJ) in the area occurs mainly as a simultaneous layering of hematite and jasper. Hematite is in dark reddish-black colored and Jasper is in dark pinkish colored. Banded Hematite Quartzite (BHQ) are also present in the area with an alternate layering of hematite and quartz bands. Hematite layer is having a dark reddish black colour and quartz is white in colour.

1.9.2 Several small occurrences of manganese are reported throughout the Mahakoshal especially in and around Sihora. Primary mineralised bodies are manganiferous argillites associated with phyllite and BHC and manganiferous cherts. Secondary mineralisation is associated with quartz veins which have intruded the BHC. Main manganese minerals are psilomelane and pyrolusite.

1.9.3 The supracrustal of Mahakoshal Group in the southern part of the mapped area come into contact with the intrusive Madan Mahal granite. Near the contact quartz reefs are emplaced at places. Visible sulphide mineralization are also seen occupying these reefs at places. GSI reported presence of Au in these reefs.

## 2.0.0 Previous Work and Recommendations

**2.1.0** The F.R. Mallet & Huges in 1833 surveyed the parts of Jabalpur District. and identified iron ore deposits associated with BIF and laterites in the area. He mentioned the presence of iron ore bands of varying thickness in the area. Earlier workers (Fermor, 1990; Krishnan, 1939) have described these gneisses and metasedimentary rocks equivalent to Dharwar Group of rocks.

**2.2.0** Then, G.R. Rao of the DGM, MP in 1959, examined this area and referred the iron ore reserve to be low to medium grade. S.S. Mishra of the DGM, MP in 1961 established that the iron ore bands has vast continuation in the area.

**2.3.0** Tiwari, Singh and Paul (2020) carried out Geophysical Mapping in Toposheet no. 55M/15, 55N/1,5 & 64A/3,4 during FSP 2019-20. Through gravity and magnetic data maps of the studied area they identified several faults and structural discontinuities. They recommended that the geological structures (i.e. faults), and gravity-magnetic highs and lows demarcated on the basis of gravity and magnetic data may be integrated with other available geo-scientific data sets to formulate future detailed exploration program.

**2.4.0** Sharma R.K. (1962 - 63) and Tiwari R.K (1964- 65) mapped in and around the area and has shown banded quartzite, dolomite, phyllite and epidiorite as unclassified unit. In the basin clastic sediments were deposited first, followed by chemogenic sediments; the chert and dolomites and then the intermittently basic lavas.

**2.5.0** Subsequent compilation of Quadrangle Geological Map (QGM) by GSI has shown these rocks as unclassified Mahakoshal and older granite gneisses. Previously exploration was conducted by Geological Survey of India, Jabalpur at G4 stage having titled “Investigation for Iron Ore in Sihora and Gosalpur area in Jabalpur

district" during FSP 2015-2017 where the occurances of iron ores in the BHC was recommended to classify as Protore.

**2.6.0** Systematic Thematic Mapping of Mahakoshal group of rocks around Sihora, Majhgawan and Chhatarpur areas of Jabalpur district, Madhya Pradesh was done by R.K. Singhai and A.V.K. Prasad during FSP 1997-1998. In the course of the investigation it was reported that the banded hematite ridges of Sihora Mangeli, Gosalpur and Chhatarpur-Tindni have one thing in common that the hematite is micaceous in nature. Surface studies of these BHC ridges revealed that the ratio of thickness of hematite to chert meso-bands ranges from 1:5 to 1:3. They also reported pockets of iron occur within the duricrust. The ore is in the form of lumps with platy, laminated or biscuity hematite ore cemented by very little laterite matrix. These lumps have analysed 50% to 70% $Fe_2O_3$ with an average grade of 55% $Fe_2O_3$. The duricrust is underlain by thick blue dust horizons interlayered with clay. The blue dust has analysed 70% to 75% $Fe_2O_3$. They also observed that the primary mineralised bodies for manganese are manganiferous argillites associated with phyllite and BHC and manganiferous cherts. Secondary mineralisation is associated with quartz veins which have intruded the BHC. They also identified gold mineralization along the quartz reefs at the contact of supracrustal granite and recommended to investigate further. It was concluded that the iron ores in the BHC is micaceous and is suitable for small scale mining.

**2.7.0** Besides GSI several small leases are present throughout the area for Iron and Manganese. One such lease was of Chhatarpur Iron, Manganese and Laterite block by M/s Shree Mining. They reported a geological resource of 2.02 mT and 0.122 mT of Iron (at 40% cut-off) and Managanese (at 10% cut-off) respectively with grade ranges from 35%-45% Fe in laterite and 10%-35% Mn at G-3 level. Chhatarpur block is currently in the e-auction portal for composite license.

## 3.0.0 Background of the exploration

3.1.0 The volcano-sedimentary sequence of the Mahakoshal Group has evinced keen interest among the geological fraternity in the last few decades. Particularly in the western part of this ENE-WSW trending belt, prospecting/exploration for Iron, Manganese, gold and basemetals has been carried out by GSI, Central Region, in areas around Sihora and Sleemanabad with promising results. Apart from these known occurrences, there existed a few more BIF bands, major ones being those near Gosalpur and Chhatarpur and the laterite capped areas around Gosalpur-Burhagar, which had not been assessed by the geologists of DGM, Madhya Pradesh.

3.2.0 Increasing demand of manganese in the country in recent years can be eased with the exploration of new manganese deposits of economic importance.

3.3.0 The Govt. of India enacted the MMDR Amendment Act, 2015 duly introducing the system of auction for allocation of Mineral Concessions. Manganese has been categorized in the Fourth Schedule which needs prospecting and exploration by the State Govt. before auctioning of the blocks.

3.4.0 MECL in association with DMG, Madhya Pradesh has looked up for the freehold area for investigation of Iron and Manganese and associated minerals around the explored Iron and Manganese blocks in Jabalpur, Katni etc DISTRICT of Madhya pradesh.

3.5.0 Subsequently, after receipt of consent from DMG, Madhya Pradesh to take up exploration work, MECL has prepared an exploration proposal for reconnaissance survey (G-4) for iron and manganese and associated minerals in Tindni Block in Jabalpur district of Madhya Pradesh and submitted to NMET for taking up for discussion in the upcoming TCC.

**4.0.0 Field visit by MECL**

MECL has conducted field visit in the proposed block. During geological traverses, our team has identified the host rocks viz. BIF/ Ferruginous quartzites and manganiferous argillites associated with phyllite and BHC at several places. The samples are being analyzes in MECL Chemical laboratory.

**5.0.0 Objective of the exploration**

The Mahakoshal belt represents a volcano-sedimentary sequence exposed proximal to the ENE-WSW to E-W trending Son-Narmada Lineament Zone (SNLZ) in the Central India and has an aerial extent of approximately 9000 sq. km. The Paleoproterozoic Mahakoshal belt is well known for hosting numerous economic mineralization like Sulphides, Gold, PGE, Manganese, Iron (BHQ/BMQ) etc. The presence of supporting lithology for Iron and Manganese mineralization viz. BIF and Phyllites encourages taking up the G-4 Exploration in the area.

Evaluation of previous work, work done by GSI and private exploration agencies has indicated occurrence of Iron and Manganese in and around the proposed block.

The block area also falls in the vicinity of a lease hold by M/s. Shree Mining area for Iron and Manganese. It is currently in the e-auction portal for Composite License.

The block area also falls in the vicinity of a lease hold by M/s. Shree Mining area for Iron and Manganese. Based on the data available, DMG , Madhya Pradesh has selected the proposed block for exploration so that it can be made feasible for auctioning. It is currently in the e-auction portal for Composite License.

i) To carry out Geological & structural mapping on 1:12,500 scale for demarcation of Iron and Manganese bearing host rock for these mineralisation with the structural features to identify the surface manifestations and lateral & vertical disposition of the mineralized zones.

ii) To collect bedrock samples, channel samples and trench samples & to analyze for Iron & Manganese for further course of Exploration program.

iii) Pitting / trenching will be done to expose the concealed host rock and mineralisation.

iv) If phase-I exploration data will give positive results, 8 Nos. of scout boreholes (approximately 520 m of drilling) shall be drilled which in turn will decide the future course of Exploration program at G-3 category of UNFC.

v) To estimate reconnaissance resources (334) along with accessory elements as per UNFC norms and Minerals (Evidence of Mineral Content) Rules-2015 at G-4 level.

**6.0.0 Scope of Proposed Exploration**

The proposed Reconnaissance survey (G-4) program comprises:

i) Geological mapping (1:12,500 scale)
ii) Surface sampling (Bedrock/rock chip, soil, stream sediment)
iii) Exploratory Trenching to observe the sub-surface continuation of mineralization
iv) Drilling of 8 no of scout boreholes involving about 520m drilling with associated survey, chemical analysis, physical analysis to observe the lateral and depth wise continuity.
v) Geological report preparation.

**7.0.0 Planned Methodology**

In accordance to the objective set for reconnaissance survey (G-4) of the block, the exploration programme is proposed. The Exploration shall be carried out as per Minerals (Evidence of Mineral Contents) Rule-2015. Accordingly, the following scheme of exploration is formulated in order to achieve the objectives. The details of different activities to be carried out are presented in subsequent paragraphs.

**7.1.0 Geological Mapping**

Geological mapping will be done in the entire 21.38 sq km area on 1:12,500 scale. Different lithologies encountered during Geological mapping will be mapped with their contact and structural features. Surface manifestations of the ore bodies available along with their surface disposition will be marked on map.

7.2.0 **Surveying:**

During exploratory drilling of scout boreholes, fixation and determination of reduced level and co-ordinates of the boreholes will be undertaken by DGPS/ Total station.

7.3.0 **Surface Geochemical sampling (Bed Rock/Channel/Chip Sample):** During the course of Geochemical Sampling the bed rock /channel/chip samples shall be collected from the outcrops at a certain interval to cover the whole length of the BHQ.

7.4.0 **Exploratory Mining (Trenching/Pitting)** Trenching/pitting (Excavation) shall be carried out in the potential zones identified based on the results of geological mapping and geochemical sampling. A provision of trenching/pitting of 100 cubic meter has been planned. Trenching work will be carried out by cutting trenches of 1m width and up to 2m depth in the area to expose the BIF and Manganese bearing units. Locations of pits/trenches on ground will be decided by field geologist based on field observations. Trench will be geologically mapped thoroughly.

**7.5.0 Bed Rock/Channel Sample and Trench Samples:**

7.5.1 A total of 120 no of primary, 12 no of external check of Bedrock/Channel/Chip samples will be collected. Samples taken will be analysed for Total Fe, Total Mn, $Al_2O_3$, $P_2O_5$, Cao, $SiO_2$ and Acid insolubles. A few selected may be collected from BIF and analysed fo Au by fire Assay method (from BHQ and contact between supracrustal Granite and Phyllite).

7.5.2 A total of 100 no of primary, 10 no of external check trench samples will be collected. Sample taken will be analysed for Total Fe, Total Mn, $Al_2O_3$, $P_2O_5$, Cao, $SiO_2$ and Acid insolubles. A few selected may be collected from BIF and analysed fo Au by fire Assay method (from BHQ and contact between supracrustal Granite and Phyllite).

**7.6.0 Core Drilling:**

**7.6.1** Based on Geological mapping, Geochemical studies and trenching/pitting (Excavation), the extension of the mineralized zones (ore bodies) will be marked. To find out the potentiality of mineralized zones in strike & dip direction, 10 Nos of scout boreholes involving 600m of drilling will be carried out for first level of intersection of mineralized zones.

7.6.2 **Drill Core Logging:** The borehole cores would be logged systematically. Details of the litho units, colour, structural feature, texture, mineralization, % recovery of core, rock quality designation (RQD) etc. would be recorded.

**7.7.0 Drill Core Sampling:**

**7.7.1** The mineralized (Iron and Manganese) part of drill core will be sampled as Primary sample. The length of each sample will be kept 1.00 m within the ore zone depending upon the thickness of particular type of manganese ore and its physical character. The primary core samples will be analysed for Total Fe, Total Mn, $Al_2O_3$, $P_2O_5$, Cao, $SiO_2$ and Acid insolubles. The cores of rocks 3m immediate on footwall and 3m immediate on hanging wall of mineralized zones would be sampled at 1.0 m interval, as far as possible, depending upon the intensity of mineralization, change in lithology and core recovery etc.

**7.7.2** A total of 300 no Primary, 30 no of External Check samples shall be generated from the mineralized zones to be intersected in the boreholes. Samples will be analysed for Total Fe, Total Mn, $Al_2O_3$, $P_2O_5$, Cao, $SiO_2$ and Acid insolubles. 10% of Primary

samples will be sent as External Check Samples to NABL External Labs. A few selected may be collected from BIF and analysed fo Au by fire Assay method (from BHQ and contact between supracrustal Granite and Phyllite).

**7.8.0 Petrological & Mineralogical Studies:**

**7.8.1** During the course of Geological mapping and core logging, 10 samples from various litho units from surface, Pit/Trench/Channels and lithounits intersected in boreholes will be studied for petrography and 10 samples from mineralized zones will be studied for the ore mineral assemblages and their distribution, alteration, enrichment etc in polished sections.

**8.0.0 Justification :**

i) The area belongs to the Agori formation of Mahakoshal Group which is well known for hosting various mineral resources including Iron and Manganese. Mineralisation of Iron and manganese are occurring in and around the area is associated with Banded Iron Formation (BIF).

ii) GSI carried out STM during FSP 1998-99 in and around this area and identified favorable lithounits for hosting iron and manganese mineralization viz. BIF bands. They also reported pockets of iron occur within the duricrust. The ore is in the form of lumps with platy, laminated or biscuity hematite ore cemented by very little laterite matrix. These lumps have analysed 50% to 70% $Fe_2O_3$ with an average grade of 55% $Fe_2O_3$. The duricrust is underlain by thick blue dust horizons interlayered with clay. The blue dust has analysed 70% to 75% $Fe_2O_3$. They also observed that the primary mineralised bodies for manganese are manganiferous argillites associated with phyllite and BHC and manganiferous cherts. Secondary mineralisation is associated with quartz veins which have intruded the BHC. They also identified gold mineralization that analyzed 0.4-4.2 ppm along the quartz reefs at the contact of supracrustal granite and recommended to investigate further.

iii) Evaluation of previous work, work done by GSI and private exploration agencies has indicated occurrence of Iron and Manganese in and around the proposed block. BHQ is the proto ore for Iron ore. Within the proposed block, a prominent BHQ reef having 9 km length and 300m wide runs from W-E in the northern part of the area. The proposed exploration is to target the leaching zones along the length of the BHQ.

iv) Exploration of Chhatarpur Iron, Manganese and Laterite block by M/s Shree Mining is in the north western part of the proposed block. They reported a geological resource of 2.02 mT and 0.122 mT of Iron (at 40% cut-off) and Managanese (at 10% cut-off) respectively with grade ranges from 35%-45% Fe in laterite and 10%-35% Mn at G-3 level. Chhatarpur block is currently in the e-auction portal for composite license.

v) MECL has conducted field visit in the proposed block. During geological traverses, our team has identified the host rocks viz. BIF/ Ferruginous quartzites and manganiferous argillites associated with phyllite and BHC at several places. The samples are being analyzes in MECL Chemical laboratory.

vi) Based on the mineralization evidences of Iron and Manganese in and around the block, the present Reconnaissance Survey exploration program at G-4 level has been prepared. Geological mapping, surface sampling and pitting/trenching will be helpful in assessing the lithology, disposition and grade of the mineralized zones, structural features etc.

vii) The Exploration will be helpful in estimation of reconnaissance resources of Iron and Manganese and associated minerals in the block area. Geochemical sampling of BRS/Channel/Chip Sample/ Pitting/trenching and the drilling of scout boreholes will be helpful in assessing the disposition and grade of mineralization.

viii) The Reconnaissance Survey (G-4) will eventually help in planning of detailed exploration program (incase upgraded to G-3 level) which in turn will facilitate the state Government for auction of block.

### 9.0.0 Nature Quantum and Target

**9.0.1** Details of the particular, Quantum and the targets are tabulated in **Table-3.**

**Table-3**

**Envisaged Quantum of proposed work in Tindni G-4 Block**

| Sl. No. | Item of Work | Unit | Proposed Quantum of work |
|---|---|---|---|
| 1 | Geological Mapping (on 1:12,500 Scale) | sq km | 21.38 |
| 2 | Survey Work | | |
| | i) Bore Hole Fixation, RL & Coordinate Determination by DGPS | Nos | 8 |
| 3 | Trenching | cu m | 100 |
| 4 | Core Drilling (8 Scout Boreholes x 65.0 m) | m | 520 |
| 5 | Sample Preparation & Chemical Analysis | | |
| A. | Primary samples for Iron-Manganese (Bedrock/Channel /Trench/Core Samples) | | |
| | i) Primary samples for Total Fe, Total Mn, $Al_2O_3$, $P_2O_5$, Cao, $SiO_2$ and Acid insolubles | Nos. | 120+100+300=520 (Surface+Trench+BH) |
| B. | i) Primary Samples for Au by Fire Assay | Nos. | 15 |

| Sl. No. | Item of Work | Unit | Proposed Quantum of work |
|---|---|---|---|
| C. | External (10%) Check samples for 4 Radicals Fe, Al2O3, P2O5 & SiO2 | Nos. | 50 |
| D. | External (10%) Check samples for Au by Fire Assay | Nos. | 2 |
| 6 | Petrographic Studies | Nos | 10 |
| 7 | Mineragraphic Studies | Nos | 10 |
| 8 | Report Preparation (Digital format) | Nos. | 1 |

**10.0.0 Manpower Deployment**

**10.1.0** Manpower deployment List will be provided later.

**11.0.0 Break-up of Expenditure**

**11.1.0** 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. **157.81 Lakh**. The summary of tentative cost estimates for Reconnaissance Survey (G-4 Level) is given in **Table-4** and details of tentative cost estimates are given as annexure. Tentative Time schedule/action plan for proposed Reconnaissance Survey (G-4) Block is given in **Table-5.**

**Table-4**

**Summary of Tentative Cost Estimates for Reconnaissance Survey (G-4 Level) Exploration in Tindni Block, Jabalpur, Madhya Pradesh**

| Sl. No. | Item | Total |
|---|---|---|
| 1 | Geological Work | 20,92,568 |
| 2 | Pitting & Trenching | 3,33,000 |
| 3 | Laboratory Studies | 25,76,460 |
| 4 | Drilling | 74,68,550 |
| | **Sub total** | 1,24,70,578 |
| 4 | Report | 6,23,529 |
| 5 | Peer Review | 30,000 |
| 6 | Proposal Prepration | 2,49,411.56 |
| | **Total** | 1,33,73,518 |
| 7 | GST (18%) | 24,07,233.32 |
| **Total cost including 18% GST** | | **1,57,80,752** |
| **SAY, in Lakhs** | | **157.81** |

**Table-5:**
**Tentative Time schedule/action plan for proposed Reconnaissance Survey (G-4) Block**

| S. No. | Particulars | Months/Days | 1 | 2 | 3 | 4 | 5 | | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | Camp Setting | **months** | | | | | | | | | | | |
| **2** | Geological Mapping | **months** | | | | | | | | | | | |
| **3** | Survey days | **days** | | | | | | | | | | | |
| **4** | Trenching | **cu.m** | | | | | | | | | | | |
| **5** | Drilling (1 rig) | **m** | | | | | | | | | | | |
| **6** | Geologist days | **days** | | | | | | **Review** | | | | | |
| **7** | Sampling days, Core Sampling | **days** | | | | | | | | | | | |
| **8** | Camp winding | **months** | | | | | | | | | | | |
| **9** | Laboratory Studies | **months** | | | | | | | | | | | |
| **10** | Geologist days, HQ | **days** | | | | | | | | | | | |
| **11** | Report Writing with Peer Review | **months** | | | | | | | | | | | |

### 12.0.0 References


1. Tiwari, A., Singh, A. and Paul, S. (2020) Report on Geophysical Mapping in Toposheet Nos. 55M/15, 55N/1, 5 & 64A/3, 4, parts of Jabalpur, Mandla, Damoh & Narshinghpur Districts, Madhya Pradesh FSP 2019-20.

2. Singhai, R.K. and Prasad, A.V.K. (2002) Report on Special Thematic Mapping of Mahakoshal Group of Rocks around Sihora, Majhgawan And Chhattarpur areas Jabalpur District, Madhaya Pradesh FSP (1997-98).

3. Mineral Block summary of Chhatarpur Iron, Manganese ore and Laterite block, village-Chhatarpur, District-Jabalpur, Madhya Pradesh.


**List of Plates:**

Plate-I: Location Map of the Proposed Tindni block, Distt Jabalpur, State Madhya Pradesh

Plate-II: Regional Geological Map with Proposed Tindni block, Distt Jabalpur, State Madhya Pradesh

**List of Annexure:**

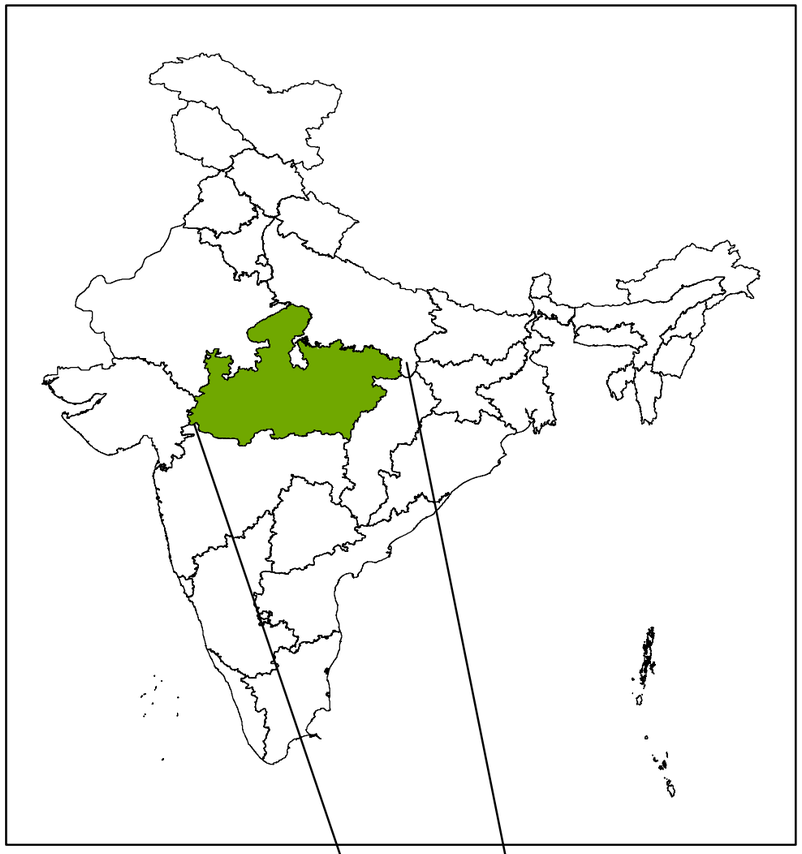
1. Detailed cost estimate sheet.

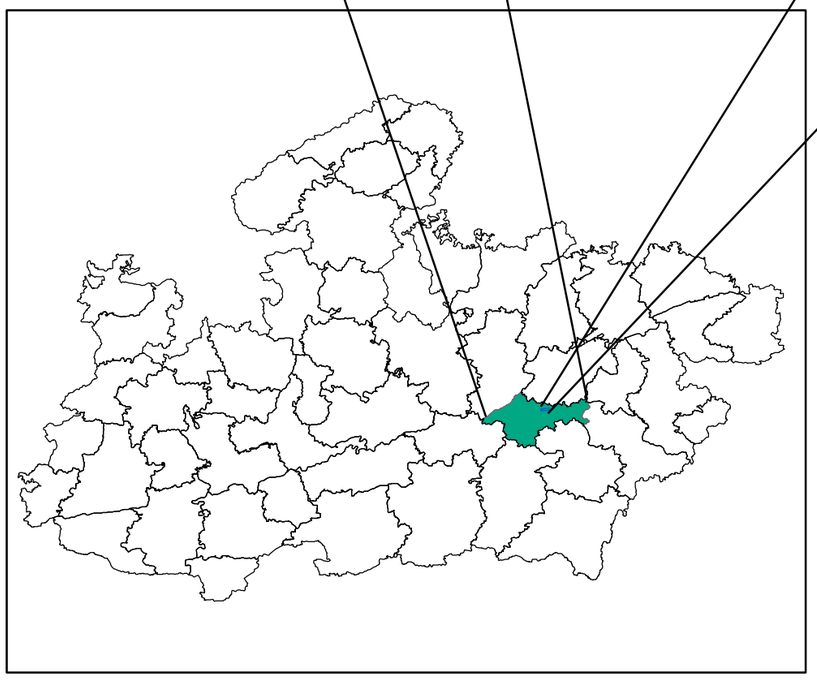
**Estimated cost for Reconnaissance survey (G4) for Iron, Manganese and associated minerals in Tindni Block, Districts: Jabalpur, State: Madhya Pradesh.**
**[Block area- 21.38 sq. km; Schedule timeline- 10 months]**

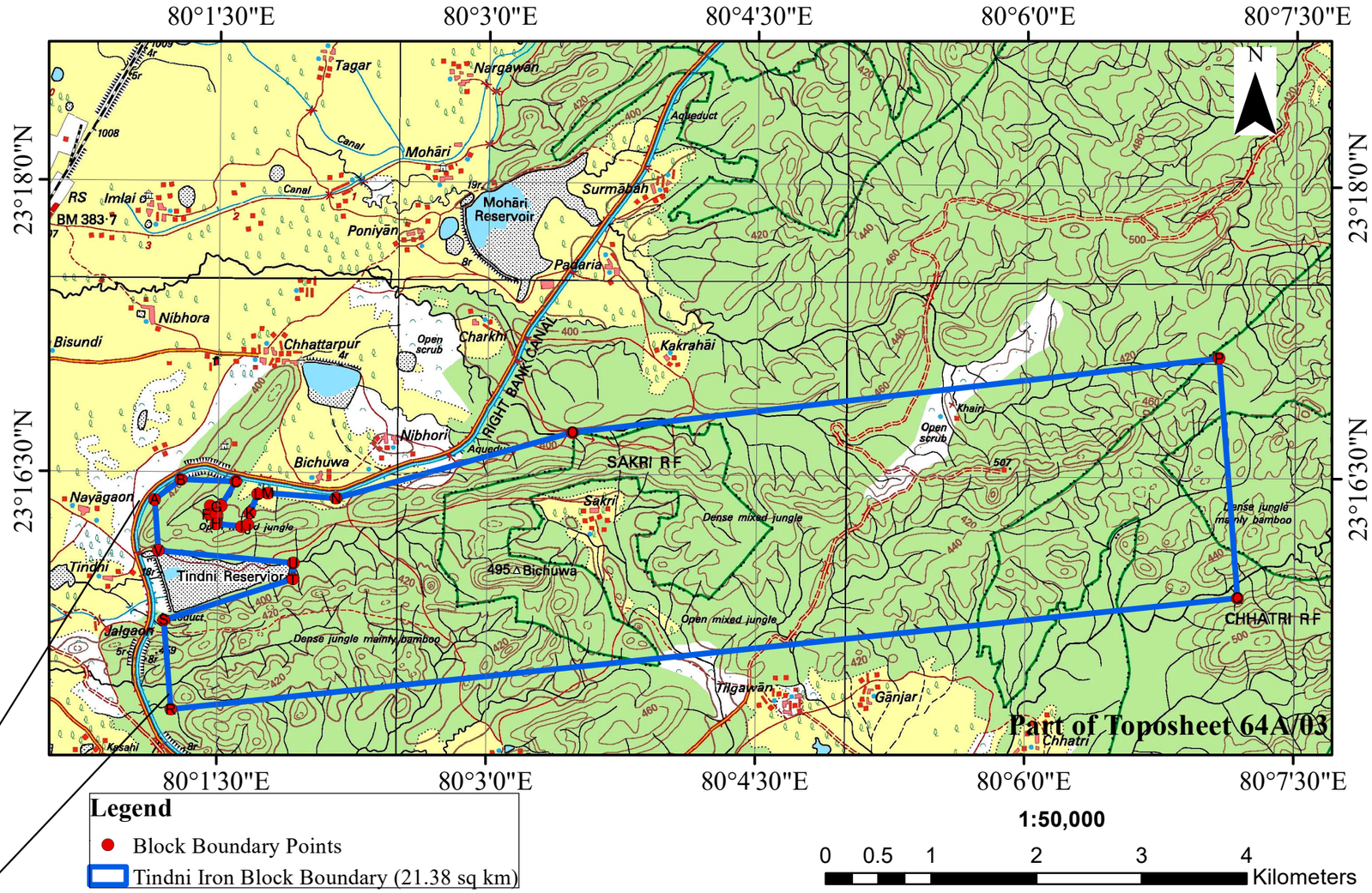
| S. No. | Item of Work | Unit | Rates as per NMET SoC 2020-21 | | Estimated Cost of the Proposal | | Remarks |
|---|---|---|---|---|---|---|---|
| | | | SoC-Item -Sl No. | Rates as per SoC | Qty. | Amount (Rs) | |
| **A** | **GEOLOGICAL WORK (1:12,500 scale)** | | | | | | |
| i | Charges for one Geologist- Field | day | 1.2 | 11,000 | 100 | 11,00,000 | |
| ii | Charges for one Geologist per- HQ | day | 1.2 | 9,000 | 30 | 2,70,000 | |
| iii | 2 labours/ party (Rs 504/day/labour) (As per rates of Central Labour Commissioner) | day | 5.7 | 522 | 200 | 1,04,400 | Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher |
| iv | Core Sampling -1 Samplers<br>Labour charge not included | day | 1.5.2 | 5,100 | 86 | 4,38,600 | |
| v | 4 labours/ party (Rs 504/day/labour) (As per rates of Central Labour Commissioner) | day | 5.7 | 522 | 344 | 1,79,568 | Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher |
| | | | | **Sub Total- A** | | **20,92,568** | |
| **B** | **PITTING AND TRENCHING** | | | | | | |
| i | Trenching | Cu m | 2.1.1 | 3330 | 100 | 3,33,000 | |
| | | | | **Sub Total- B** | | **3,33,000** | |
| | | | | | | | |
| **C** | **LABORATORY STUDIES** | | | | | | |
| **1** | **Chemical Analysis** | | | | | | |
| **i** | **Primary & Check samples for Iron-Manganese BRS/Chip/Channel/Trench/BH samples)** | | | | | | |
| | a. Primary Samples for Total Fe, Total Mn, Al2O3, P2O5, CaO, SiO2 and Acid insolubles | Nos | 4.1.15a | 4,200 | 520 | 21,84,000 | Surface Samples-120, Trench Samples-100, BH Samples-300 |
| | b.External (10%) Check samples for Total Fe, Total Mn, Al2O3, P2O5, CaO, SiO2 and Acid insolubles | Nos | 4.1.15a | 4,200 | 52 | 2,18,400 | |
| **ii** | **Primary & Check samples for gold (BRS/Channel/Core)** | | | | | | |
| | a. Primary Samples for Au by Fire Assay | Nos | 4.1.5a | 2,380 | 15 | 35,700 | Selective samples from BIF (Surface Samples-5, Trench Samples-5, BH Samples-5 |
| | b.External (10%) Check samples for Au by Fire Assay | Nos | 4.1.5a | 2,380 | 2 | 11,900 | |
| **2** | **Physical,Petrological, Mineralogical Studies** | | | | | | |
| 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 | |
| | | | | **Sub Total- C** | | **25,76,460** | |
| **D** | **DRILLING** | | | | | | |
| i | Drilling upto 300m (Hard Rock) (1 rigs ) | m | 2.2.1.4a | 11,500 | 520 | 59,80,000 | |
| ii | Land / Crop Compansation | per BH | 5.6 | 20,000 | 5 | 1,00,000 | Amount will be reimbursed as per actuals or max. Rs. 20000 per BH with certification from local authorities |
| iii | Construction of concrete Pillar (12"x12"x30") | per borehole | 2.2.7a | 2,000 | 8 | 16,000 | |
| iv | Transportation of Drill Rig & Truck associated per drill | Km | 2.2.8 | 36 | 600 | 21,600 | Certification in this regard is required to be provided |
| v | Monthly Accomodation Charges for drilling Camp (up to 2 Rigs) | month | 2.2.9 | 50,000 | 3 | 1,50,000 | |
| vi | Drilling Camp Setting Cost | Nos | 2.2.9a | 2,50,000 | 1 | 2,50,000 | |
| vii | Drilling Camp Winding up Cost | Nos | 2.2.9b | 2,50,000 | 1 | 2,50,000 | |
| viii | Approach Road Making (Flat Terrain) | Km | 2.2.10a | 22,020 | 5 | 1,10,100 | Road Making will be considered as per the requirement and Road Making Charges will be reimbursed for max. 4 km. |
| ix | Bore Hole Fixation and determination of co-ordinates & Reduced Level of the boreholes by DGPS | Nos | 1.6.2 | 19,200 | 8 | 1,53,600 | 5 Boreholes |
| x | One complete borehole plus mineralised cores of all the remaining Bhs | m | 5.3 | 1,590 | 275 | 4,37,250 | This amount will be reimbursed after successful delivery of the cores to concerned libraries/authorities |
| | | | | **Sub Total- D** | | **74,68,550** | |
| **E** | | | | **Total A to D** | | **1,24,70,578** | |
| **F** | **Geological Report Preparation** | | **5.2** | For the projects having cost exceeding Rs. 50 lakhs but less than 150 lakhs - A minimum of Rs. 2.5 lakhs or 5% of the value of work whichever is more | | **6,23,529** | Reimbursement will be made after submission of the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET. |
| **G** | **Peer review Charges** | | **As per EC decision** | | | **30,000** | |
| **H** | **Preparation of Exploration Proposal** | **5 Hard copies with a soft copy** | **5.1** | 2% of the Cost or Rs. 5.0 Lakhs whichever is lower | | **2,49,412** | EA has to submit the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal. |
| **I** | **Total Estimated Cost without GST** | | | | | **1,33,73,518** | |
| **J** | **Provision for GST (18% of I)** | | | | | **24,07,233.32** | GST will be reimburse as per actual and as per notified prescribed rate |
| **K** | **Total Estimated Cost with GST** | | | | | **1,57,80,751.78** | |
| | | | | **or Say Rs. In Lakhs** | | **157.81** | |

| **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. |

# Location Map of Proposed Tindni Block for Iron, Manganese and associated minerals Block (21.38 sq. km)
# District- Jabalpur, State- Madhya Pradesh





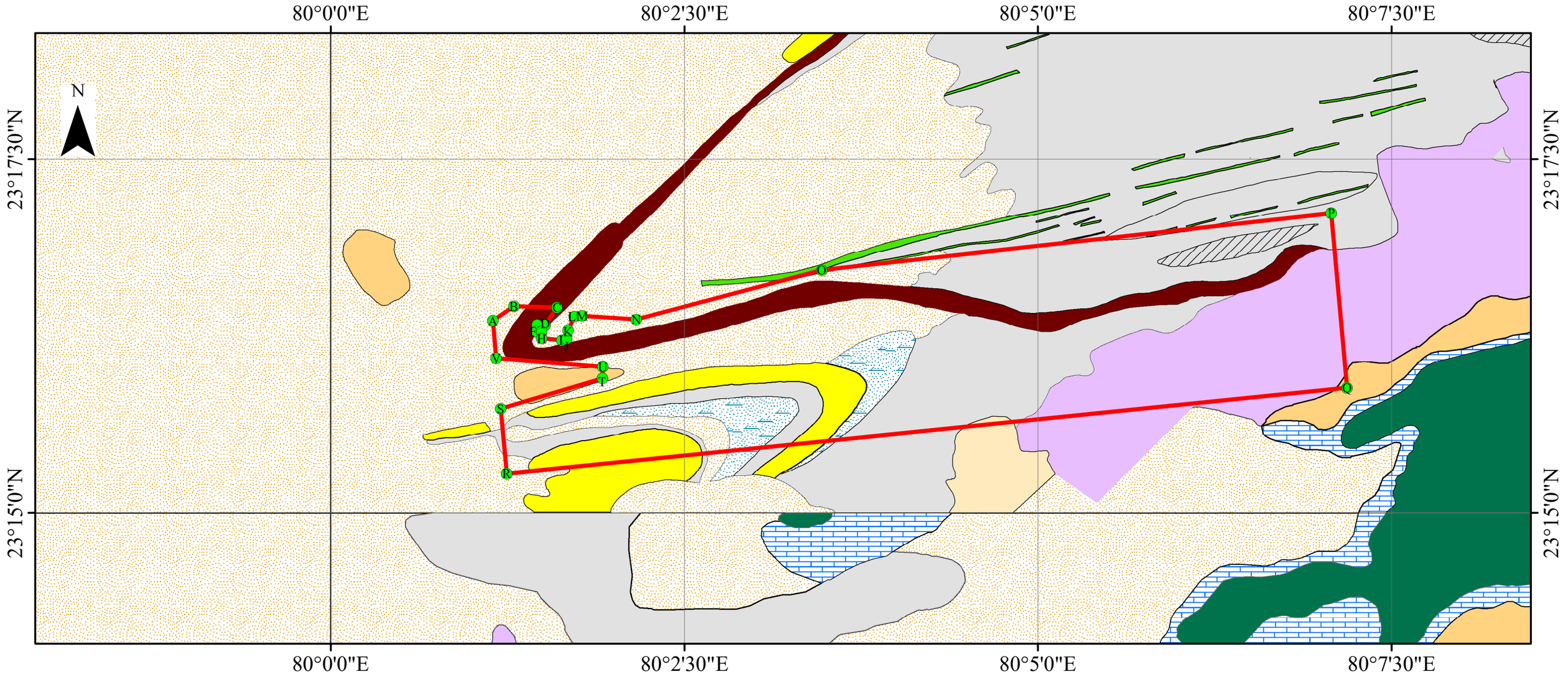



**Co-ordinates of the block boundary points of the proposed Tindni Iron & Manganese (G-4) Block, District- Jabalpur, State- Madhya Pradesh**

| Points | UTM (ZONE: 44N) | | DMS | | Points | UTM (ZONE: 44N) | | DMS | |
|---|---|---|---|---|---|---|---|---|---|
| | NORTHING | EASTING | LATITUDE | LONGITUDE | | NORTHING | EASTING | LATITUDE | LONGITUDE |
| A | 2574039.903 | 399675.440 | 23° 16' 21.475 N | 80° 1' 8.758 E | L | 2573935.872 | 400631.764 | 23° 16' 18.302 N | 80° 1' 42.440 E |
| B | 2574228.640 | 399928.364 | 23° 16' 27.668 N | 80° 1' 17.615 E | M | 2574097.016 | 400751.832 | 23° 16' 23.568 N | 80° 1' 46.627 E |
| C | 2574206.645 | 400447.949 | 23° 16' 27.066 N | 80° 1' 35.907 E | N | 2574045.646 | 401402.588 | 23° 16' 22.039 N | 80° 2' 9.542 E |
| D | 2573951.690 | 400307.569 | 23° 16' 18.746 N | 80° 1' 31.026 E | O | 2574675.630 | 403643.622 | 23° 16' 43.001 N | 80° 3' 28.271 E |
| E | 2573949.684 | 400214.986 | 23° 16' 18.660 N | 80° 1' 27.768 E | P | 2575376.948 | 409787.733 | 23° 17' 7.062" N | 80° 7' 4.372" E |
| F | 2573839.146 | 400206.749 | 23° 16' 15.064 N | 80° 1' 27.505 E | Q | 2573100.430 | 409963.091 | 23° 15' 53.075" N | 80° 7' 11.030" E |
| G | 2573835.229 | 400265.400 | 23° 16' 14.950 N | 80° 1' 29.570 E | R | 2572044.864 | 399828.148 | 23° 15' 16.641 N | 80° 1' 14.607 E |
| H | 2573742.495 | 400261.580 | 23° 16' 11.934 N | 80° 1' 29.457 E | S | 2572893.128 | 399760.161 | 23° 15' 44.207 N | 80° 1' 12.012 E |
| I | 2573709.574 | 400459.917 | 23° 16' 10.907 N | 80° 1' 36.445 E | T | 2573280.327 | 400988.646 | 23° 15' 57.065 N | 80° 1' 55.154 E |
| J | 2573725.761 | 400602.174 | 23° 16' 11.464 N | 80° 1' 41.448 E | U | 2573431.765 | 400995.742 | 23° 16' 1.990 N | 80° 1' 55.368 E |
| K | 2573854.150 | 400608.629 | 23° 16' 15.640 N | 80° 1' 41.645 E | V | 2573551.500 | 399709.768 | 23° 16' 5.603 N | 80° 1' 10.082 E |

MECL

# Regional Geological Map




## Legend

- Block Boundary Points
- Tindni Block Boundary (21.38 sq. km)

**Litho Units**

- ALLUVIUM
- BIF
- CHERT
- DOLOMITE
- MAFIC DYKE
- META PELITE
- PHYLLITE
- QUARTZ REEF / QUARTZ VEINS
- SANDSTONE
- SANDSTONE & CONGLOMERATE
- GRANITE
- BASALT
- GRANITE
- LIMESTONE
- SILT
- SANDSTONE
- PHYLLITE

1:50,000

0 0.5 1 2 3 4 Kilometers

Map source: SPECIAL THEMATIC MAPPING OF MAHAKOSHAL GROUP OF ROCKS AROUND SIHORA, MAJHGAWAN AND CHHATTARPUR AREAS JABALPUR DISTRICT, MADHAYA PRADESH (Field Season 1997-1998), GSI