PROPOSAL OF RECONNAISSANCE SURVEY (G-4 STAGE) FOR IRON AND ASSOCIATED MINERALS IN KARMAI-CHUWAHI BLOCK (33.40 SQ. KM)

DISTRICT- SIDHI, MADHYA PRADESH

COMMODITY: IRON

BY

MINERAL EXPLORATION & CONSULTANCY LIMITED

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SEMINARY HILLS

PLACE- NAGPUR

DATE- 14.09.2023

Summary of Karmai-Chuwahi G4 Block for Reconnaissance Survey (G4 Stage)

GENERAL INFORMATION ABOUT THE BLOCK

	Features	**Details**
	Block ID	KARMAI-CHUWAHI G4 BLOCK
	Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
	Commodity	Iron
	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).
	Completion period with entire Time schedule to complete the project	Time Line for Exploration work with Drilling is 12 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 mineralization viz. BHQ and Ferruginous quartzite encourages in taking up the G4 Exploration in the area. Evaluation of previous work and field investigation done by MECL has indicated occurrence of Iron in and around the proposed block. On the basis of these evidences of mineralisation, the present exploration program has been formulated to fulfill the following objectives. i) To carry out Geological & structural mapping on 1:12,500 scale for demarcation of Iron 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 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, 10 Nos. of scout boreholes 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.
	Whether the work will be carried out by the proposed agency or through outsourcing and details thereof. Components to be outsourced and name of the outsource agency	Work will be carried out by the proposed agency (MECL).
	Number of Geoscientists	Nos. of Geoscientists: 2 (1Field + 1HQ)
	Expected Field days(Geology, Surveyor)	Geologist Party days:150 field + 60 HQ Survey Party days : Nil
1.	**Location**	
	Longitude-Latitude	**The co-ordinate of the corner points of the proposed Karmai-Chuwahi Iron block (G-4) (33.4 sq km)**

		CARDINAL POINTS	**DDMMSS (WGS84)**
			LATITUDE (N) / **LONGITUDE (E)**
		A	24°09'57.4136" / 81°34'45.4228"
		B	24°08'54.4538" / 81°34'48.4429"
		C	24°09'19.4420" / 81°36'36.5603"
		D	24°07'43.8823" / 81°36'36.4995"
		E	24°07'37.4064" / 81°30'04.5902"
		F	24°08'41.8614" / 81°30'04.1164"
		G	24°08'43.3977" / 81°30'42.9683"
		H	24°09'05.4338" / 81°30'42.9522"
		I	24°09'07.1659" / 81°32'53.5019"
		J	24°09'55.5706" / 81°32'54.2470"
	Villages	Karmai, Chuwahi, Pand, Tal	
	Tehsil/Taluk	Majhauli	
	District	Sidhi	
	State	Madhya Pradesh	
2.	**Area (hectares/ square kilometres)**		
	Block Area	33.40 sq km	
	Forest Area	The hills are highly forested while valleys areas are cultivated land.	
	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	Kanchanpur Road Railway Station (17 Km)	
	Road	Fair weathered road connects all the major villages of the area. SH-55 runs from east to west in the block.	
	Airport	Bamrauli Airport (220 Km), Prayagraj	
4.	**Hydrography**		
	Local Surface Drainage Pattern (Channels)	The drainage pattern varies from sub-parallel to dendritic and radial. It is mainly controlled by structure and	

		lithology.
	Rivers/ Streams	The area is mainly drained by Banas river.
5.	**Climate**	
	Mean Annual Rainfall	Maximum rainfall is witnessed during the period from June end to September. The average rainfall is about 1500 mm. The rainfall is received from the southwest monsoon.
	Temperatures (December) (Minimum) Temperatures (May-June) (Maximum)	Minimum temperatures 10°C Maximum temperatures up to 45°C
6.	**Topography**	
	Toposheet Number	63H/12
	Morphology of the Area	The area exhibits rugged topography with series of hills/ridges and intervening valleys. The maximum elevation is about 480m and average elevation is about 400m.
7.	**Availability of baseline geoscience data**	
	Geological Map (1:50K/25K)	Bhukosh (1:50,000)
	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 Mahakoshal Group which is well known for various mineral resources including Iron. ii) Mineralisation of Iron is occurring in and around the area associated with BHQ and Ferruginous quartzite. iii) MECL has conducted field visit in the proposed block. During geological traverses, MECL has identified BHQ and Ferruginous quartzite trending ENE and dipping 55°

		southerly. 9 samples were collected from several places inside the block and was analysed in MECL Chemical Lab. Samples are showing **Fe** values ranging from **40.62%** to **57.00%**. iv) Based on the mineralization evidences of Iron 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. v) 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. vi) The Reconnaissance Survey (G4) 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 is estimated to make up 32.07% of the Earth's mass and its elemental abundance varies between about 5% of the Earth's crust and as much as 80% of the planet's core (Morgan and Anders, 1980). It is therefore not surprising that there are a number of commonly occurring iron minerals and many iron ore deposits found at the surface of the Earth. Morris (1985) suggested that just one of the iron-enrichment deposit types alone, derived from iron formations, represents the largest and most concentrated accumulation of any single metalliferous element in the Earth's crust. Iron ore is the primary raw material from which metallic iron is extracted to make steel.

1.1.2 The steel industry is a very important one for the economy as a whole. It is the backbone of any industrial economy. Steel finds widespread applications in many sectors such as construction, power, infrastructure, aerospace, consumer products, and industrial machineries. The steel industry has strong forward and backward linkages in terms of material flows and income generation. Based on the World steel Association statistics The world's crude steel production has more than doubled since 2000 (World steel Association, 2021). It can be seen that this 129% growth in world crude steel production (850 mmt to 1951mmt) between 2000 and 2021 can be attributed mainly to China's massive increase of 706% in its crude steel production over the same period.

1.1.3 To meet the growing demand for steel products, world iron ore production has increased dramatically since 2000. World's production of usable (processed) iron ore has increased from about 970 million tons in 2000 to 2600 million tonnes in 2021. With 900 million tonnes of usable iron ore mined in 2021, Australia is the largest iron ore producing country, followed by Brazil (380 million tonnes), China (360 million tonnes) and India (240 million tonnes).

1.1.4 India's share of global crude steel production in 2021 is 6.1% (118.2 million tonnes) which has been raised from 4.8% (68.3 million tonnes) in 2011. The Indian steel sector has grown dramatically over the few years and is the second-largest producer of steel globally, contributing to about 2% of the country's GDP. Further, The National Steel Policy which was released in 2017 aims to attain a steel production capacity in India of 300 MT by 2030. It has a long-term vision to enhance domestic consumption, produce high-quality steel and make the sector globally competitive. As a result, traditional high-grade iron ore reserves are being significantly depleted and many new iron ore deposits of lower grade are being explored to meet the future demand. India's crude iron ore reserves are estimated to be around 5.5 Bt, containing 3.4 Bt of iron, the major economic deposits of iron ore in India are distributed across the following five broad zones:

- Zone A- Chiria, Noamundi, Kiriburu, Meghahatuburu, Thakurani, Bolani, Gua, Malangtoli, Gandhamardan, Daitari.
- Zone B- Bailadila, Dalli, Rajhara, Rowghat, Mahamaya, Aridongri, Surajgarh.
- Zone C- Donimalai, Ramgad, Kumaraswamy, NEB Range, Ettinahatti, Tumti, Belagal, Chitradurga and Tumkur Districts of Karnataka.
- Zone D- Goa, Ratnagiri in Maharastra and North Karnataka
- Zone E- Kudremukh, Bababudan, Kudachadri

1.1.5 The first four zones (A–D) account for hematite/goethite mineralization and Zone E accounting predominantly for the magnetite mineralization. The most common names used in India to describe iron ore types are Banded Hematite Quartzite (BHQ), Banded Hematite Jaspilite (BHJ), and Banded Magnetite Quartzite (BMQ).

1.1.6 Almost all the current iron ore production in India comes from hematite/goethite reserves (BHQ/BHJ). While there are also substantial magnetite resources in India, they are not exploited because they are located in the environmentally and ecologically sensitive areas of the Western Ghats, a UNESCO World Heritage Site in India and one of the eight "hottest hotspots" of biological diversity in the world. India produced about 255 Mt of usable iron ore in financial year 2022-23, primarily spread across four Indian states, that is, Odisha, Chhattisgarh, Karnataka, and Jharkhand. Unlike Australia and Brazil, the iron ore

mines in India are numerous and relatively small in size. Ownership of the mining companies spans both the public and private sectors, with the state-owned National Mineral Development Corporation Limited (NMDC) being the largest iron ore producer in India. Other major iron ore producers include the state-owned Steel Authority of India Limited (SAIL), Orissa Mining Corporation (OMC) and Tata Steel, JSW, JSPL, ESL steel, Rungta and Vedanta from the private sector.

1.1.7 India is close to self-sufficient with respect to iron ore, but the current reserves have a limited life of 15–20 years at the present rate of steel production. Hence, despite revision of the threshold value for iron ore reserves to 35–45% Fe depending on the ore type, with their high-grade reserves under threat of depletion it is now obligatory for the mining industry to look at exploitation of the huge resources/reserves of low/lean-grade iron ores in India, which in the past have been left undeveloped.

1.1.8 The Govt. of India enacted the MMDR Amendment Act, 2015 duly introducing the system of auction for allocation of Mineral Concessions.

1.1.9 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, Sidhi etc district of Madhya pradesh.

1.1.10 Subsequently, after receipt of consent from DMG (vide letter no. 8772 dated 11/07/2023), Madhya Pradesh to take up exploration work, MECL has prepared an exploration proposal for reconnaissance survey (G-4) for iron in Karmai-Chuwahi Block in Sidhi district of Madhya Pradesh and submitted to NMET for taking up for discussion in the upcoming TCC.

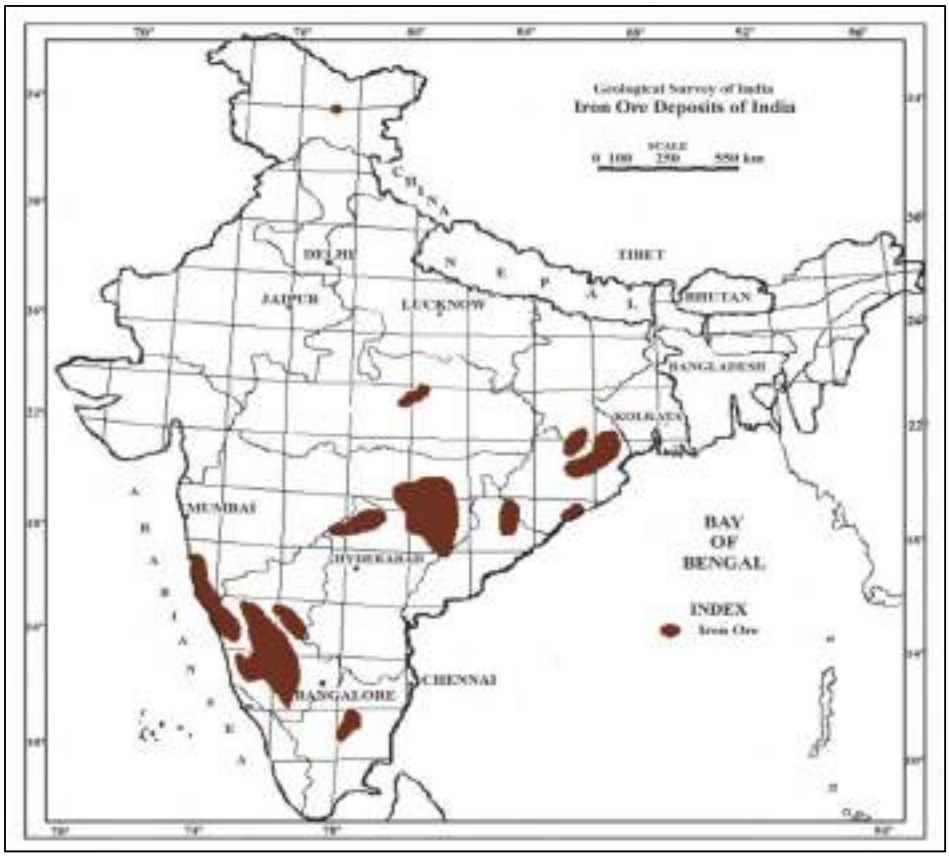


Fig- Major economic deposits of iron ore in India

1.2.0 Location and Accessibility

1.2.1 The block is located in the Sidhi district of Madhya Pradesh and falls in Majhauli tehsil. The area is about 50km south west to the district headquarter Sidhi, 5 km from Tehsil town Majhauli and 260km from Jabalpur via Umaria. The proposed block is well connected via SH-55 connecting Sidhi to Beohari. The entire block area is accessible through fair weather metalled roads connecting all the major villages like Karmai, Chuwahi, Tal, Pand, Semariya etc. Kanchanpur Road Railway Station, in Singrauli-Katni line of East Central Railway (ECR), lies 17 km south east from the block. The nearest airport is Bamrauli Airport about 220 km north of the block in Prayagraj. The area falls in Survey of India Toposheet No. 63H/12.

1.3.0 Physiography & Drainage

1.3.1 The topography of the area varies according to the litho-units. The Mahakoshal BHQ/BMQ, ferruginous quartzites are forming the ridges while the granite and

intrusives forms the low mounds. The valleys are mostly occupied by Phyllites. The area exhibits rugged topography with series of hills/ridges and intervening valleys. The maximum elevation is about 480m and average elevation is about 400m.

1.3.2 The drainage pattern is mainly controlled by structure and lithology. It varies from sub-parallel to dendritic and radial. The area is drained by Banas river which flows from north to south.

1.4.0 Climate

1.4.1 The area is known for severe cold during December and January and hot summer during May and June. The climate, in general, is of an extreme type. The maximum temperature rises to more than 44˚C and the lowest temperature drops down to about 5˚ C. Frost is experienced during winter. Maximum rainfall is witnessed during the period from June end to September. The average rainfall is about 1500 mm. The rainfall is received from the southwest monsoon.

1.5.0 Flora and Fauna

1.5.1 The main floral species are Sal (Shorea robuste), Mahue (Maduka Latifolia), Tendu (Diraphyros metanoxylon), Babal (Accacie archia) and Halda (Adinaorfolia). On the neighbourhood villages common species are mango (Manginifera indica), Ber (Zizyphera-gujuha), Jamun (Enginea lambelane), Imli (Tamarindicus indica), Neem (Azadirachte indica) and Bel (Aegle marmalos).

The thick forest harbors a variety of wild life each as tigers, leopards, beers, wild boars, sambhars, chital and deer.

1.6.0 Regional Geology

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. It stretches from Palamau district, Jharkhand in the east to Barman ghat near Jabalpur, M.P in the west (Nair *et al.*, 1995, Soni and Jha, 2001). The Mahakoshal Group of rocks inferred to have been deposited in a narrow fault-controlled pull-apart basin in an intra-continental rift environment during Late Archaean to Early Proterozoic period (Nair, *et al.*,1995). The rocks of Mahakoshal Group are separated to the north from Meso-Neoproterozoic platformal Vindhyans and a

linear belt of gneisses-granite around Sidhi district, M.P. by the Son Narmada North Fault (SNNF) whereas the intrusive granitoid and the Gondwana sediments to the south are separated from it by the Son Narmada South Fault (SNSF). Along the central part of the basin, there is an E-W trending well defined Obra-Amsi-Jiawan Fault within the Agori Formation (Singh and Khan, 1984). Goyal and Jain (1976) described this fault between Agori and Parsoi formations. The contact between Agori and Parsoi formations is gradational in the eastern part whereas in the western part it is unconformable as observed by Nair *et al*., (1995). The relative age and mutual relationship of Mahakoshal Group with the intrusive granitoids are well established whereas its relationship with the basement rock *i.e.* Dudhi Granite Gneiss Complex/ Chhota Nagpur Gneiss Complex still remains debatable.

The Mahakoshal Group has been intruded by the syn-tectonic granites (Barambaba, 2.045 Ga) and syn to post tectonic syenites (Bari, 1.8-1.36 Ga, Roy and Devarajan, 2000). The southern margin of Mahakoshal Group does not show a sharp contact and has been obliterated by 1709 ±102 Ma old late intrusive granite phases (Sarkar *et al*., 1998).

The regional stratigraphic succession shows a considerable variation in the lithology of Mahakoshal Group from west to east. The western part of the belt is rich in carbonate, BIF and volcanics. The eastern part of belt shows predominance of clastic sediments with subordinate amount of BIF and carbonate. On the basis of lithological character, the Mahakoshal Group of rocks was broadly divided into Agori and Parsoi formations (Mathur and Narain,1981).

The volcano-sedimentary litho-assemblage present in the northern part of Mahakoshal belt between Jungel and Karthua is named as Jungel Group. It comprises basalt, gabbro, serpentinite, peridotite, agglomerate and tuffs and the sedimentary assemblage includes polymictic conglomerate (with pebbles of vein quartz, quartzite, BIF) sandstone, shale and porcellanite. The stratigraphic position of basic/ ultrabasics and sedimentary rocks has not been clearly understood. The stratigraphic succession of Mahakoshal belt, GSI (2011) is given in Table- I-A.

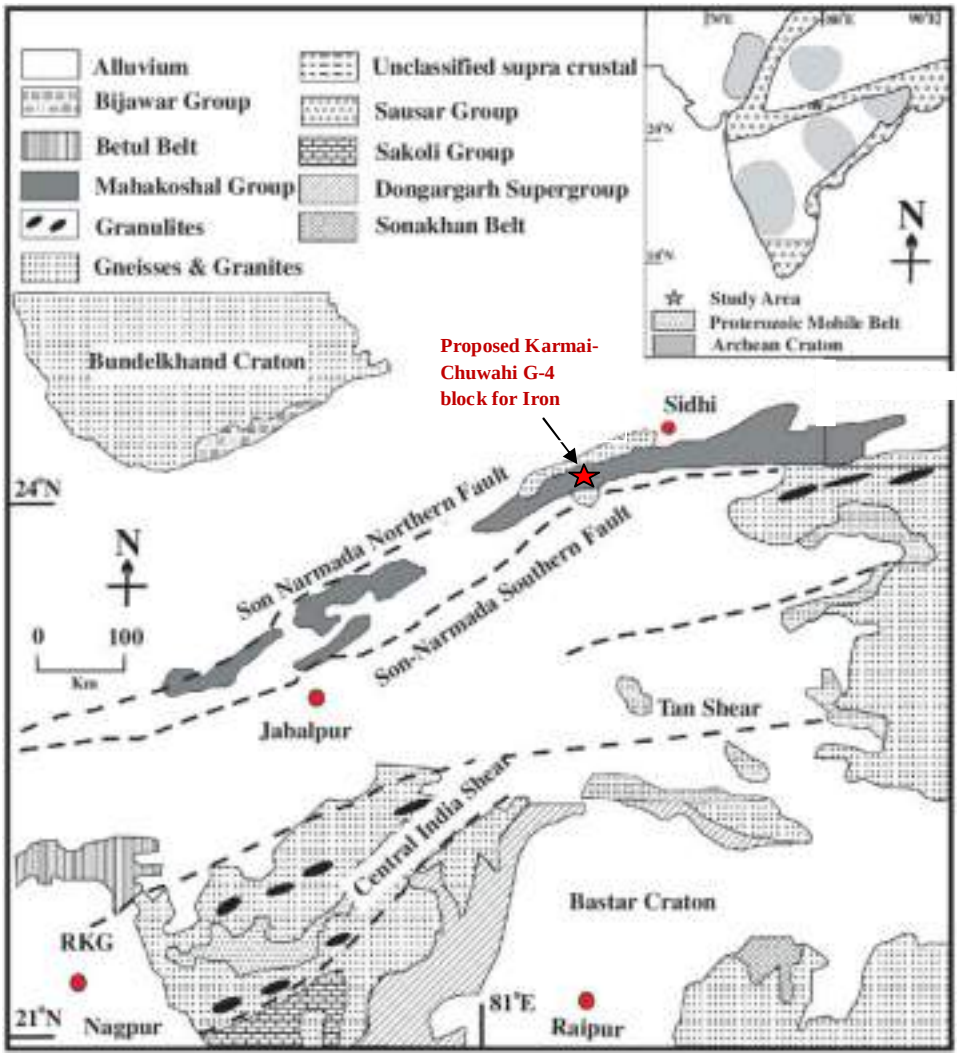


Fig- Map showing Proterozoic Mobile belt, Mahakoshal Group and the proposed G4 block (Modified After Bora, S and Kumar, S., 2015).

Table-I-A: Stratigraphy succession of Mahakoshal Belt, GSI, 2011

Age	Super group	Group	Formation	Lithology
Mesoproterozoic	Vindhyan Supergroup			
Undifferentiated-Proterozoic		Jhirganadi, Baghisoti-Dumar,		Two mica granite, diorite, porphyritic granite, mesocratic granite and pink leucogranite

Age	Super group	Group	Formation	Lithology
		Asnadohar and Sirpalia Granite		
Palaeoproterozoic		Dudhi Granitoid		Quarzt reef
				Basic rocks (Dolerite)
				Biotite grainite
				Tourmaline granite
				Porpyritic grainite and unakite
				Leucocratic granite
				Porphyritic grainte
				Pink grainite gneiss
				Grey grainite gneiss
		Mahakoshal	DUDH-MANIA	Phyllite/shale/slate/mica schist with intrusives
				Interbedded phyllite and slate
				Quartzite
				BIF and mica schist
			PARSOI	Marble /phyllite schist
				Quart-mica schist
				Quartzite-/arenaceos phullite
				Andulasite phyllite, Silliminite schist
				Phyllite, greywacke,quartzite,

Age	Super group	Group	Formation	Lithology
				metabasics
				quartzite
			AGORI	Phyllite, shale and tuff
				carbonate rocks
				BHQ,BHJ, and brecciated quartzite
				BIF, Phyllite, greywacke, quartzite and metabasic
				Basic rocks
				Tuff and ash beds
Palaeoproterozoic to Archaean		Dudhi Gneissic Complex		Feldspathic gneiss
				Porphyroblastic gneiss
				Banded gneiss, migmatite and biotite gneiss

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 Paleoproterozoic to Archaean aged Mahakoshal Group of Rocks comprising Quartz veins, Mafic and Ultramafic intrusive, Phyllite with bands of quartzite, Conglomerate Dolomite, Limestone with bands of BIF, quartzite and metabasalts, pyroclasts. The tentative srtratigraphic sequence of litho units exposed in the Block area (After GSI) is given in Table I.B.

Table I.B

Stratigraphic sequence of the Karmai-Chuwahi G4 Block

(After GSI)

Supergroup	Group	Formation	Rock Type	Age
Deccan Trap Supergroup	Amarkantak Group	-	Basalt	Upper Cretaceous to Palaeocene
Gondwana Supergroup	Lower Gondwana	Pali Formation	Sandstone	Late Permian – Early Triassic
Vindhyan supergroup	Semri Group	Deoland Formation	Sandstone	Mesoproterozoic
------Unconformity---------				
Mahakoshal Group		Parsoi Formation	Phyllite	Palaeoproterozoic
		Agori Formation	Metabasalt	
			Phyllite	
			Dolomite	
			Quartzite/ Ferruginous quartzite/ BHQ/BMQ	
------Unconformity---------				
Chotanagpur Gneissic Complex		-	Granite Gneiss	Archaean to Palaeoproterozoic
Sidhi Gneiss Group		-	Granite Gneiss	Archaean to Palaeoproterozoic

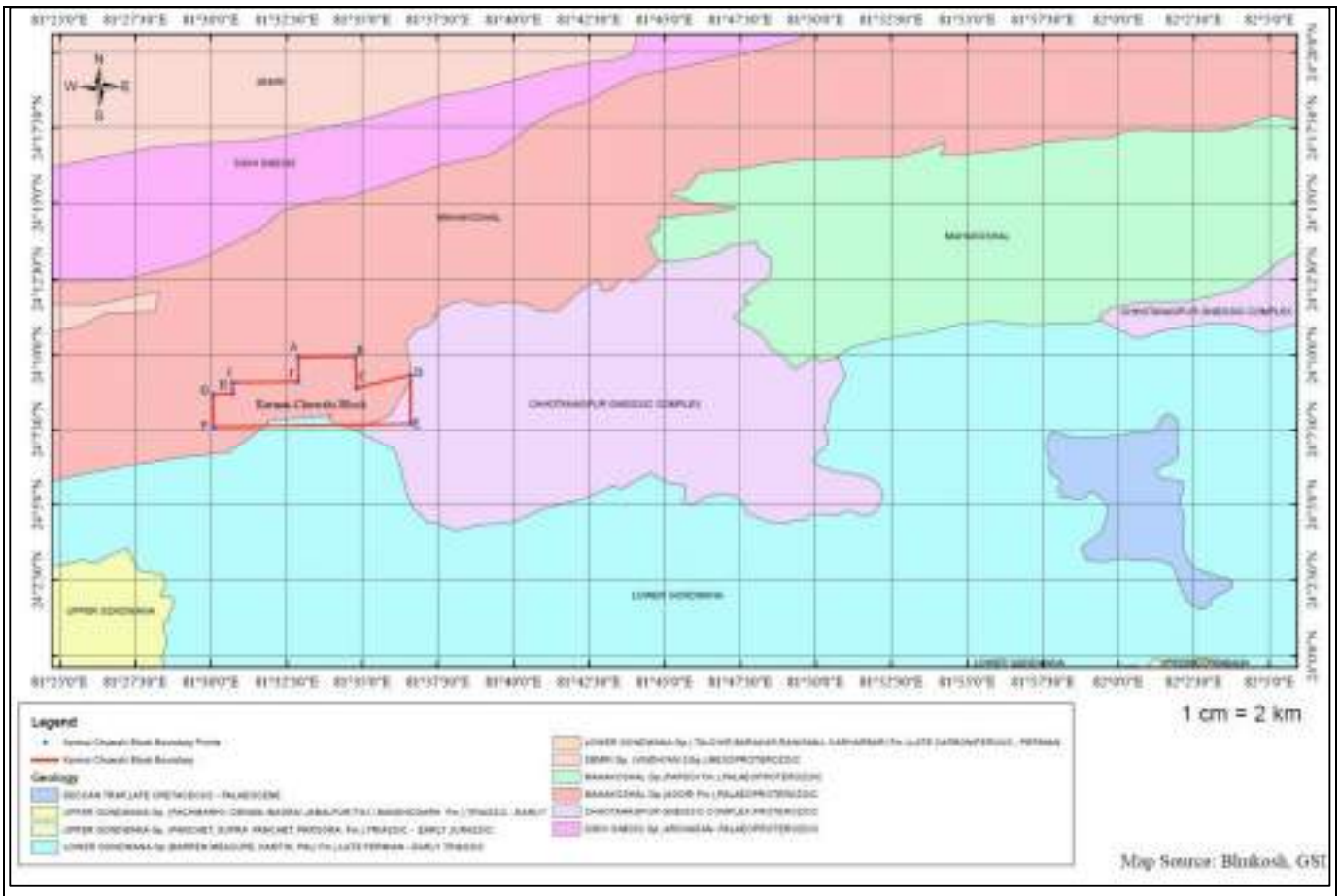


Fig- Map showing Stratigraphic disposition in and around the proposed G4 block (Bhukosh,GSI)

1.9.0 Mineral Potentiality based on geology and ground geochemistry

1.9.1 Iron mineralization associated with the Paleoproterozoic aged Mahakoshal Group of rocks has been present in the area marked by the presence of BIF and Ferruginous quartzites. Phyllites are exposed in the moderate to low lying areas and across road cuts. In general, it represents low-grade metamorphic activities. At places, they are whitish or greyish in colour. The low lying areas are mostly soil covered.

2.0.0 Previous Work

2.1.0 The southern limit of Mahakoshal Group has been a matter of debate as most of the mappers had shown granite, granite gneiss, schist and metamorphics occurring to the south as basement for Mahakoshal Group. In the "Field Workshop" on Mahakoshal Group (10 &11 April 2004), it was well established

that most of the granites are of intrusive nature and the enclaves of schist/phyllite within them are part of Mahakoshal Group.

2.2.0 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.

2.3.0 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 continue has vast continuation in the area.

2.4.0 The first detailed geological account of this area was given by Kedar Narain who carried out systematic geological mapping on parts of Degree sheet Nos. 63H and 63L during 1952-1953, 1954-1955. He described the metasedimentary rocks of this area as Bijawars and later redesignated as "Sidhi Series". According to him the granite and granite gneisses occurring north of meta-sediments are intrusive into later and both are intruded by basic and ultrabasic rocks.

2.5.0 The area has been extensively studied by number of workers Abhinaba Roy and B. K. Bandyopadhyay(1986) studied geology and Ground evaluation of Majhauli Group for Aero- Magnetic structures in parts of Toposheet no 63H12 Sidhi District M.P. M.K.

2.6.0 Mukhopadhyay studied Aero-electromagnetic Anomalies in different Parts of **Degree Sheet 63H**, District Sidhi, Madhya Pradesh (Toposheet Nos. 63 H/11, 12, 15 & 16). M.K. Mukhopadhyay, Abhinaba Roy and B.K. Bandopadhyay (1981-83), carried out the ground Reconnaissance of Aero-Electromagnetic Anomalies in parts of toposheet Nos. 63H/11, 12, 13 and 63L/3, 7 in BRGM / CGG Block-5, District Sidhi, Madhya Pradesh. Ground Geophysical Survey in Parts of Toposheet on 63H/8, 63H/12 & 63H/15 Shahdol-Sidhi Districts MP was carried out By R. N. Prasad &A. K. Agrawal (Geophysicist).

2.7.0 Geological mapping was carried out in the Majhauli Block of the area by M.P. Jaiswar, and P.N. Chakraverty, Geologist. R. K. Shrivastava, B.K. Bhandaru,

B.R. Bejarniya, and P.C. Patra(Geologist)(1985-86) carried out Geological Mapping of Pre-Vindhyan Rocks(Mahakoshal group of Rocks) in the Tikhwa-Naurhiya-Gijwar area, Sidhi and Shahdol district M.P. Akhilesh Narain and P.I. Thambi (1977-78), carried out study on Geology and structure of Khaddi-Gajrehi area Gopad-Banas Tehsil Sidhi District Madhya Pradesh.

2.8.0 Specialized Thematic Mapping was carried out in parts of Mahakoshal Belt and adjoining granitoids in the Tikhwa-Karda area, Sidhi, and Shahdol districts(Parts of Toposheet 63H/4,8,12,16) by Utkarsh Tripathi, Yuvaraj M and Ravishankar D, Geologists (2013-15). Search for low-grade Iron Ore in Mahakoshal Belt Jabalpur, Katni, Rewa, Sidhi, Shahdol, Singrauli Districts(In Parts of Degree sheet 63Hand 64A was carried out by Shalini Gupta and Vivek Kumar Maurya, Geologist (2015-17).

2.9.0 Geochemical mapping of Toposheet no. 63H/12 in parts of Sidhi and Shahdol districts of M.P was carried out by Anuj Kumar and Rajnish Kumar (2018-19).

3.0.0 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 at several places. A total of 9 no. of BRS/Chip samples were collected and analysed in MECL Chemical Lab. Samples are showing Fe values ranging from 40.62 to 57.00 %. The analytical results of Samples analysed in MECL Chemical Lab are mentioned below:

Table III – Analysis Results of Samples in MECL Chemical Lab

Sample No.	Latitude (N)	Longitude (E)	Fe%	Mn%	SiO_2%	Al_2O_3%	P_2O_5%
P-01	24°08'9.78"	81°35'43.77"	51.73	0.25	6.60	5.55	0.07
P-02	24°08'9.36"	81°35'43.98"	57.00	0.05	5.06	4.08	0.10
P-03	24°08'47.53"	81°35'27.79"	19.57	0.01	39.97	20.86	0.02
P-04	24°08'47.53"	81°35'27.79"	10.33	0.02	49.29	24.21	0.02
P-05	24°08'53.72"	81°35'25.55"	45.51	0.85	9.74	9.53	0.53
P-10	24°08'30.23"	81°32'33.84"	13.34	0.03	75.36	1.91	0.19
P-11	24°08'57.48"	81°32'16.88"	2.19	0.01	77.02	13.78	0.08
P-12	24°08'51.30"	81°30'58.90"	42.22	0.04	24.18	3.52	1.57
P-15	24°08'39.47"	81°31'17.52"	40.62	0.30	25.36	4.79	0.16

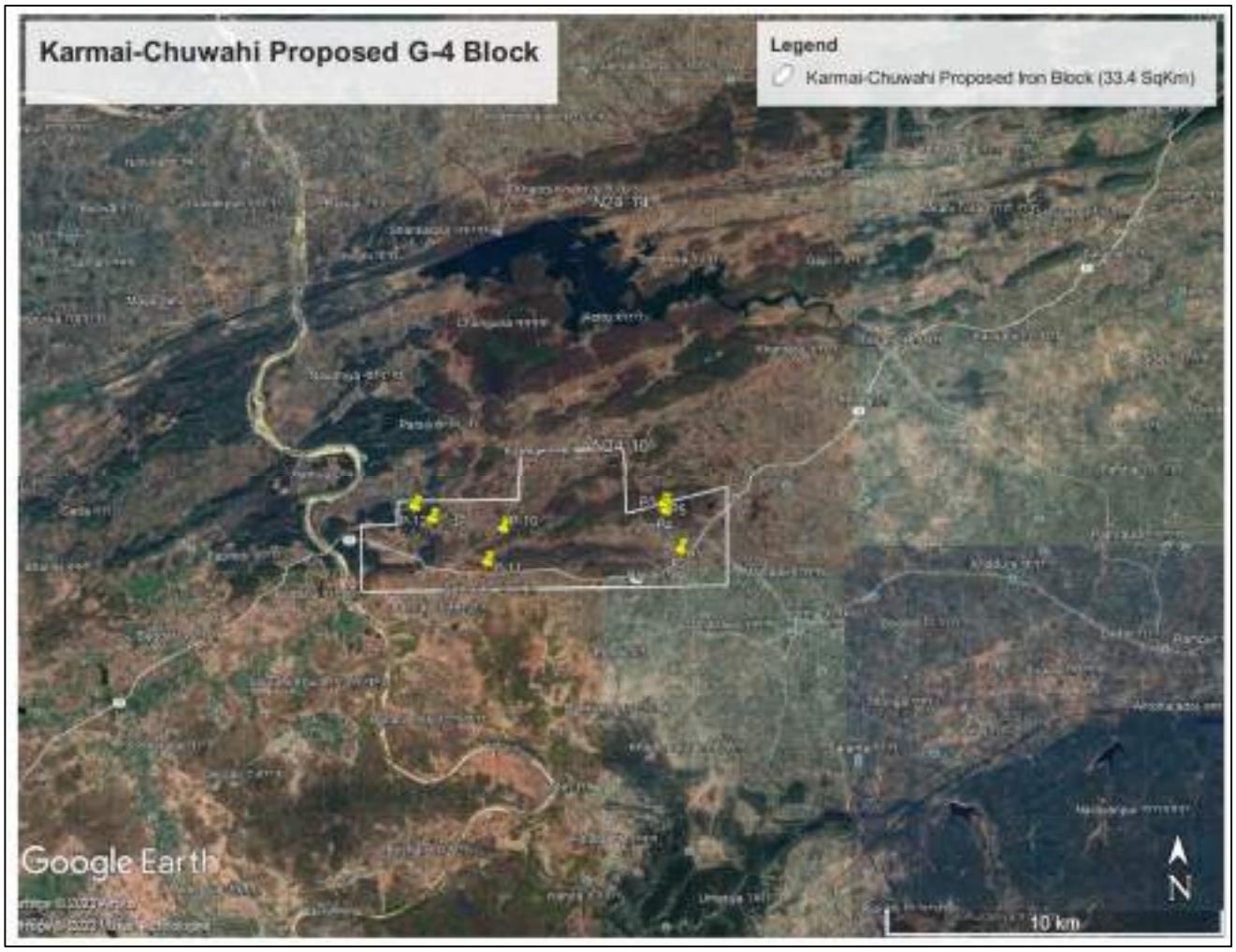


Fig- Google Earth Location of the samples collected by MECL from the area in the Proposed G4-Block for Iron

Fig-Quartzite exposure near sample collection point P-11 (Southern part of the block)

Fig- Phyllite exposure along road cuts

Fig- Ferruginous quartzite exposure near sample collection point P-01 & 02 (NW of Chuwahi)

Block description

3.1.0 The proposed G-4 block for Iron falls in Survey of India Toposheet No. 63H/12 and covers an area of 33.40 sq km in and around villages Karmai, Tal, Chuwahi, Pand, Semarahi etc. of Sidhi District, Madhya Pradesh. The block location is given in **PLATE-I.** The Co-ordinates of the corner points of the block area both geodetic and UTM are given in **Table No.-IV.**

Table No. IV- The co-ordinate of the corner points of the proposed Karmai-Chuwahi Iron block (G-4) (33.4 sq km)

CARDINAL POINTS	UTM (ZONE- 44n)		DDMMSS (WGS84)	
	EASTING (m)	NORTHING (m)	LATITUDE (N)	LONGITUDE (E)
A	558844.480	2672721.297	24°09'57.4136"	81°34'45.4228"
B	558937.725	2670785.286	24°08'54.4538"	81°34'48.4429"
C	561985.619	2671566.780	24°09'19.4420"	81°36'36.5603"
D	561996.706	2668627.778	24°07'43.8823"	81°36'36.4995"
E	550935.477	2668384.749	24°07'37.4064"	81°30'04.5902"
F	550915.015	2670367.028	24°08'41.8614"	81°30'04.1164"

CARDINAL POINTS	UTM (ZONE- 44n)		DDMMSS (WGS84)	
	EASTING (m)	NORTHING (m)	LATITUDE (N)	LONGITUDE (E)
G	552011.322	2670418.243	24°08'43.3977"	81°30'42.9683"
H	552008.390	2671095.967	24°09'05.4338"	81°30'42.9522"
I	555692.387	2671163.185	24°09'07.1659"	81°32'53.5019"
J	555707.582	2672651.975	24°09'55.5706"	81°32'54.2470"

4.0.0 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.

4.1.0 Geological Mapping

Geological mapping will be done in the entire 33.40 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. BIF and phyllites, the target lithologies for Fe and Mn in the area, shall be mapped in relation with gneiss and migmatites of Mahakoshal Group of rocks.

4.2.0 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.

4.3.0 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.

4.4.0 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 meters 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 BIFs. Locations of pits/trenches on ground will be decided by field geologist based on field observations. Trench will be geologically mapped thoroughly.

4.5.0 Bed Rock/Channel Sample and Trench Samples:

4.5.1. A total of 120 no of primary and 12 no of external check Bedrock/Channel/Chip 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 total of 6 Nos. (5 Primary + 1 Check) of selective samples may be collected from BIF and analysed fo Au and Ag by fire Assay method.

4.5.2. A total of 80 no of primary and 8 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 total of 6 Nos. (5 Primary + 1 Check) of selective samples may be collected from BIF and analysed fo Au and Ag by fire Assay method.

Note: Sample analysis for Gold will be done from the powdered samples of -100mesh. Other sample analysis will be done from the powdered samples of -200mesh.

4.6.0 Core Drilling:

4.6.1. 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 500m of drilling will be carried out for first level of intersection of mineralized zones.

4.6.2. **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.

4.7.0 Drill Core Sampling:

4.8.0 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 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.

4.9.0 A total of 400 no Primary and 40 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 total of 6 Nos. (5 Primary + 1 Check) of selective samples may be collected from BIF and analysed fo Au and Ag by fire Assay method.

Note: Sample analysis for Gold will be done from the powdered samples of -100mesh. Other sample analysis will be done from the powdered samples of -200mesh.

4.10.0 Total 10 Nos of composite samples will be analysed for Total Fe, Total Mn, Al_2O_3, P_2O_5, Cao, SiO_2 and Acid insolubles

4.11.0 Whole Rock Analysis:

4.11.1. Whole Rock analysis for SiO_2, Al_2O_3, Fe_2O_3, TiO_2, MnO, CaO, Na_2O, K_2O+H_2O, MgO, P_2O_5, CO_2, S and LOI will be carried out on 10 Nos samples to check the rock types, their variation in chemical composition.

4.12.0 Petrological & Mineralogical Studies:

4.12.1. 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.

4.13.0 Trace element Studies: Trace element Studies will be done on 10 nos. for 34 elements.

4.14.0 Justification :

i) The area belongs to the Mahakoshal Group which is well known for various mineral resources including Iron.

ii) Mineralisation of Iron is occurring in and around the area associated with BHQ and Ferruginous quartzite.

iii) MECL has conducted field visit in the proposed block. During geological traverses, MECL has identified BHQ and Ferruginous quartzite trending ENE and dipping 55° southerly. 9 samples were collected from several places inside the block and was analysed in MECL Chemical Lab. Samples are showing **Fe** values ranging from **40.62** to **57.00** %.

iv) Based on the mineralization evidences of Iron 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.

v) 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.

vi) The Reconnaissance Survey (G4) 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.

4.15.0 Nature Quantum and Target

4.15.1. Details of the particular, Quantum and the targets are tabulated in **Table No.-V.**

Table No-V

Envisaged Quantum of proposed work in Karmai-Chuwahi G4 Block

Sl. No.	Item of Work	Unit	Proposed Quantum of work
1	Geological Mapping (on 1:12,500 Scale)	sq km	33.4
2	Survey Work		
	i) Bore Hole Fixation, RL & Coordinate Determination by DGPS	Nos	10
3	Trenching	cu m	100
4	Core Drilling (10 Scout Boreholes x 50.0 m)	m	500
5	Sample Preparation & Chemical Analysis		

Sl. No.	Item of Work	Unit	Proposed Quantum of work
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+80+400=600 (Surface+Trench+BH)
B.	Primary samples for Gold etc (Bedrock/Channel /Trench/Core Samples)		
	i) Primary samples for Au and Ag by fire Assay	Nos.	5+5+5=15 (Surface+Trench+BH)
C.	Composite Samples for Iron-Manganese for Total Fe, Total Mn, Al_2O_3, P_2O_5, Cao, SiO_2 and Acid insolubles	Nos.	10
D.	External Check samples (Bedrock/Channel /Trench/Core Samples)	Nos.	62
6	Trace Elements Studies (34 Elements)	Nos.	10
7	Whole Rock Analysis For SiO2, Al2O3, Fe2O3, TiO2, MnO, CaO, Na2O, K2O+H2O, MgO, P2O5, CO2, S and LOI.	Nos.	10
8	Petrographic Studies	Nos	10
9	Mineragraphic Studies	Nos	10
10	Report Preparation (Digital format)	Nos.	1

5.0.0 Manpower Deployment

5.1.0 Manpower deployment List will be provided later.

6.0.0 Break-up of Expenditure

6.1.0 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. **184.21 Lakh**. The summary of tentative cost estimates for Reconnaissance Survey (G-4 Level) is given in **Table No.-VI.A** and details of tentative cost estimates are given in **Table No.–VI.B**. Tentative Time schedule/action plan for proposed Reconnaissance Survey (G-4) Block is given in **Table No. VI-C.**

Table No-VI.A
Summary of Tentative Cost Estimates for Reconnaissance Survey (G-4 Level) Exploration in Karmai-Chuwahi Block, Sidhi, Madhya Pradesh

Sl. No.	Item	Total
1	Geological Work	2,904,280
2	Pitting & Trenching	333,000
3	Laboratory Studies	3,100,230
4	Drilling	8,224,200
	Sub total	**14,561,710**
4	Report	728,086
5	Peer Review	30,000
6	Proposal Prepration	291,234.20
	Total	**15,611,030**
7	GST (18%)	2,809,985.35
Total cost including 18% GST		**18,421,015**
SAY, in Lakhs		**184.21**

Table No-VI.B

Details of Tentative Cost Estimates for Reconnaissance Survey (G-4 Level) Exploration in Karmai-Chuwahi Block, Sidhi, Madhya Pradesh

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	150	1,650,000	
ii	Charges for one Geologist per-HQ	day	1.2	9,000	60	540,000	
iii	2 labours/ party (Rs 477/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	494	300	148,200	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 Labour charge not included	day	1.5.2	5,100	80	408,000	
v	4 labours/ party (Rs 477/day/labour) (As per rates of Central Labour Commissioner)	day	5.7	494	320	158,080	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
				Sub Total- A		**2,904,280**	
B	**PITTING AND TRENCHING**						
i	Trenching	Cu m	2.1.1	3330	100	333,000	
				Sub Total- B		**333,000**	
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	600	2,520,000	Surface Samples-120, Trench Samples-80, BH Samples-400)
	b.External (10%) Check samples for 4 Radicals Fe, Al2O3, P2O5 & SiO2	Nos	4.1.15a	4,200	60	252,000	
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	4,760	
iii	**Composite Samples** for Total Fe, Total Mn, Al2O3, P2O5, Cao, SiO2 and Acid insolubles	Nos	4.1.15a	4,200	10	42,000	
iv	**Trace element study (34 Elements)**	Nos	4.1.14	7,731	10	77,310	
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	
vi	Whole Rock Analysis (Major oxides)	Nos	4.1.15a	4,200	10	42,000	

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)	
	Sub Total- C					**3,100,230**	
D	**DRILLING**						
i	Drilling upto 300m (Very Hard Rock) (1 rigs)	m	2.2.1.4a	12,650	500	6,325,000	
ii	Land / Crop Compansation	per BH	5.6	20,000	10	200,000	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	10	20,000	
iv	Transportation of Drill Rig & Truck associated per drill	Km	2.2.8	36	1,050	37,800	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	4	200,000	
vi	Drilling Camp Setting Cost	Nos	2.2.9a	250,000	1	250,000	
vii	Drilling Camp Winding up Cost	Nos	2.2.9b	250,000	1	250,000	
viii	Approach Road Making (Flat Terrain)	Km	2.2.10a	22,020	5	110,100	Road Making will be considered as per the requirement and Road Making Charges will be reimbursed
ix	Bore Hole Fixation and determination of co-ordinates & Reduced Level of the boreholes and by DGPS	Nos	1.6.2	19,200	11	211,200	*10 Boreholes and 1 base station
x	One complete borehole plus mineralised cores of all the remaining Bhs	m	5.3	1,590	390	620,100	This amount will be reimbursed after successful delivery of the cores to concerned libraries/authorities
	Sub Total- D					**8,224,200**	
E	**Total A to D**					**14,561,710**	
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		**728,086**	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 Lakhs whichever is lower		**291,234**	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**					**15,611,030**	
J	**Provision for GST (18% of I)**					**2,809,985.35**	GST will be reimburse as per actual and as per notified prescribed rate
K	**Total Estimated Cost with GST**					**18,421,015.05**	
				or Say Rs. In Lakhs		**184.21**	
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.						

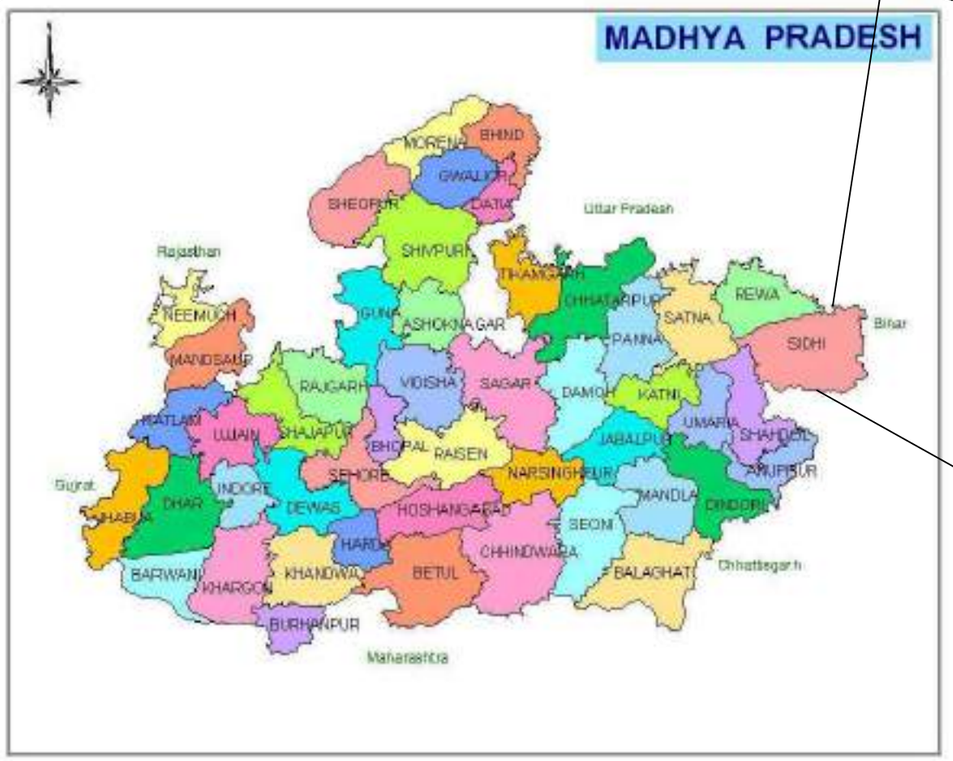
Table No-VI.C

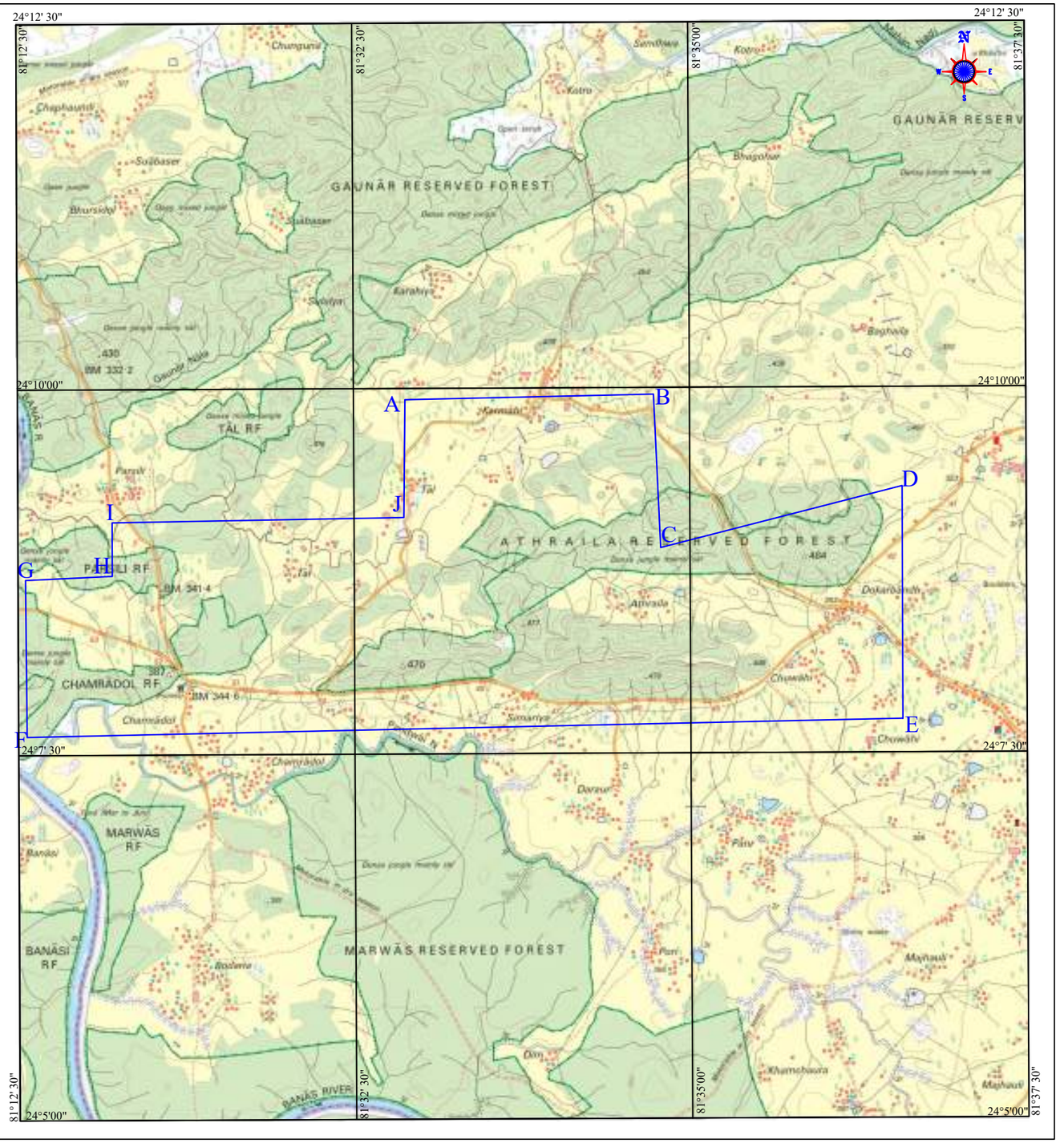
Tentative Time Schedule/action plan for proposed Reconnaissance Survey (G-4) Block

Estimated Time Schedule of the Reconnaissance survey (G4) for Iron in Karmai-Chuwahi Block, Districts: Sidhi State: Madhya Pradesh. [Block area- 33.40 sq. km; Schedule timeline- 12months]																
S. No.	**Particulars**	**Months**	**1**	**2**	**3**	**4**	**5**		**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total**
1	Camp Setting	**Months**	**1**													1
2	Geological Mapping	**days**		**20**	**20**	**20**	**20**									80
3	Survey days	**days**							**10**	**10**	**10**					30
4	Trenching	**cu.m**				**50**	**50**									100
5	Drilling (1 rig)	**m**							**100**	**150**	**150**	**100**				500
6	Geologist days	**days**		**20**	**20**	**20**	**20**			**20**	**20**	**30**				150
7	Sampling days, Core Sampling	**days**					**30**	**Review**	**15**	**15**	**15**	**15**				90
8	Camp winding	**Months**										**1**				1
9	Laboratory Studies	**days**			**30**	**30**	**30**			**30**	**30**	**30**	**30**			210
10	Geologist days, HQ	**days**												**30**	**30**	60
11	Report Writing with Peer Review	**days**												**30**	**30**	60

List of Plates:

1. Plate-I: Location Map of the Proposed Karmai-Chuwahi block, Distt Sidhi, State Madhya Pradesh
2. Plate-II: Regional Geological Map of the Proposed Karmai-Chuwahi block, Distt Sidhi, State Madhya Pradesh





INDEX

BLOCK BOUNDARY

CO-ORDINATES OF CARDINAL POINTS OF THE PROPOSED KARMAI-CHUWAHI IRON BLOCK

CARDINAL POINTS	LATITUDE	LONGITUDE
A	24°10'00"	81°32'30"
B	24°10'00"	81°35'00"
C	24°8'30"	81°35'00"
D	24°9'30"	81°36'00"
E	24°7'30"	81°36'00"
F	24°7'30"	81°32'30"
G	24°8'30"	81°32'30"
H	24°8'30"	81°33'00"
I	24°9'30"	81°33'00"
J	24°9'30"	81°32'30"

MINERAL EXPLORATION AND CONSULTANCY LIMITED

LOCATION MAP

PROPOSED KARMAI-CHUWAHI (33.4 sq km) BLOCK FOR IRON EXPLORATION (G-4)

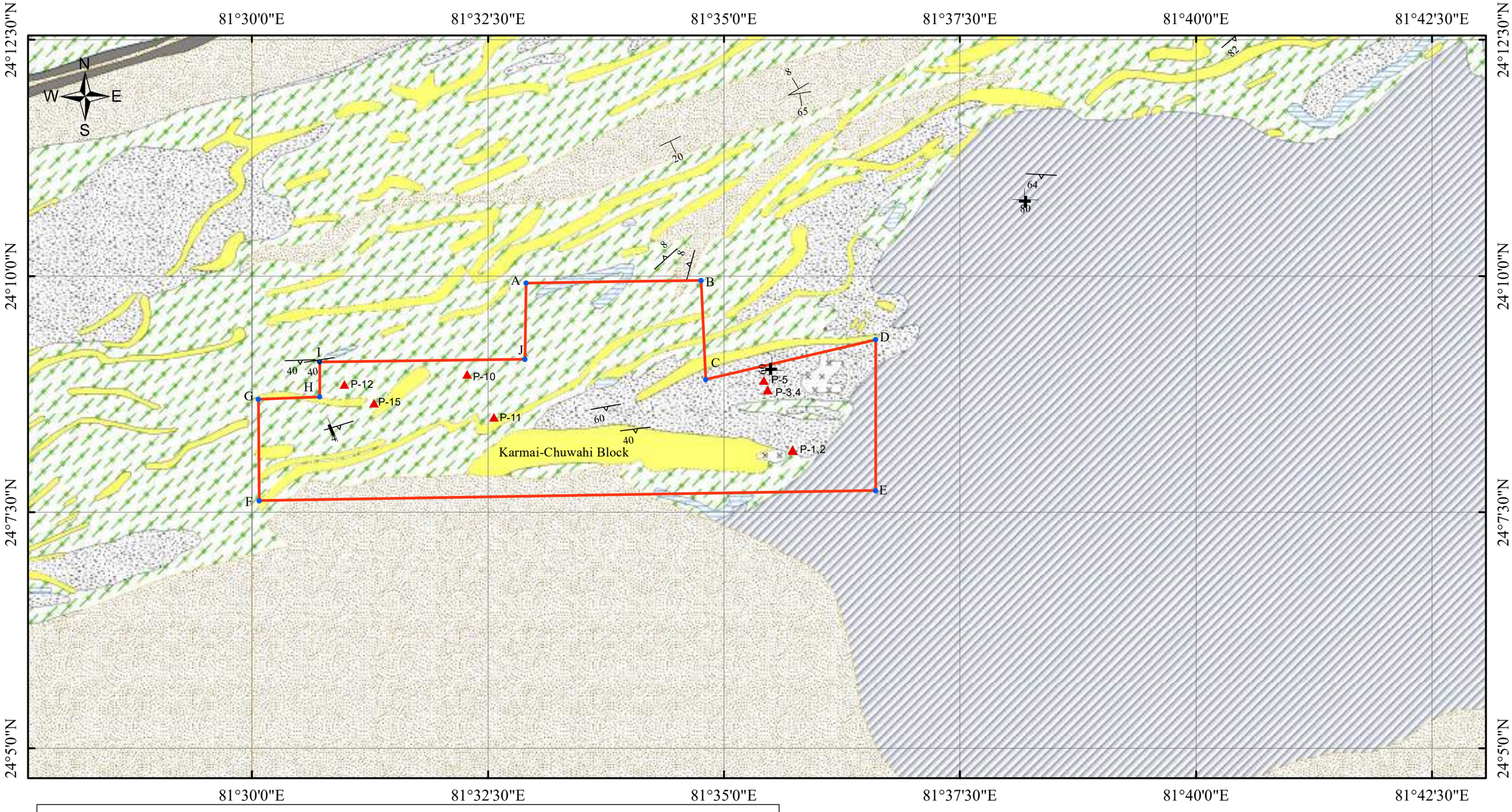
(PART OF TOPOSHEET NO. 63H/12)

NOT TO SCALE

DISTRICT : SIDHI TEHSIL : MAJHAULI STATE : MADHYA PRADESH

MECL / EXPLORATION / SEP-2023

REGIONAL GEOLOGICAL MAP OF PROPOSED KARMAI-CHUWAHI BLOCK (G-4) FOR IRON
DISTRICT- SIDHI, STATE- MADHYA PRADESH



Legend

- BEDDING
- CLEAVAGE/FOLIATION/SCHISTOSITY (S1)
- JOINT
- Sampling Points by MECL
- Karmai Chuwahi Block Boundary Points
- Karmai Chuwahi Block Boundary

Lithology

- BASALT
- DOLOMITE
- GRANITE GNEISS
- META BASALT
- PHYLLITE
- QUARTZITE
- SANDSTONE
- SHALE

Kilometers

0 1 2 4 6 8

1 cm = 1 km

PROPOSED BLOCK AREA: 33.40 SQ. KM

Map Source: Bhukosh, GSI