Proposal for Mardongri Jamtara Block, District Chhindwara, Madhya Pradesh for Preliminary exploration (G_3 Stage) Mineral Exploration under NMET

(Critical Mineral)

By

The MP State Mining Corporation Ltd, Madhya Pradesh

Place- Bhopal

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Summary of the Block for G_3 Stage Exploration

GENERAL INFORMATION ABOUT THE BLOCK

	Features	Details
1	Block ID	Mordongri (Jamtara) PGE Block
2	Exploration Agency	The MP State Mining Corporation Ltd
3	Commodity	PGE and associated minerals
4	Mineral Belt	Mardongri mafic ultramafic complex of Betul belt
5	Completion Period with entire Time schedule to complete the project	17 months
6	Objectives	The proposed block fall in Chhindwara district of Madhya Pradesh (Anx-1 Location Plan). The Mardongri mafic ultramafic complex of rocks of Betul group consist of bi-modal volcanic rocks, including pillowed and non-pillowed meta-basalt, rhyolites and altered rhyolites, fine to medium grained foliated meta gabbro/amphibolite, foliated and porphyritic (younger) granites and intrusive mafic ultramafic rocks. The proposed block covers the Mardongri mafic ultramafic complex and lies in the eastern part of the Betul belt, which extends in north having a trend of ENE-WSW to E-W. In the study area, surface indications of mineralization are present in the form of presence of box-work, typical sulphide alteration zones which give yellow staining, dissemination of sulphide grains in various rock types such as meta-gabbro, coarse grained amphibolite, meta-basalts, quartz veins, felsic volcanics, granite and quartz syenite. Veinlets of quartz, epidote, granite and gabbro rich in sulphides mineralization are also noticed in these rocks. GSI indicated presence of the PGE, Ni, Cr, Cu, Co, and V in the area by carrying out bed rock sampling and four number of trenches along with petrographic studies.

		The geological map (Anx-2) On the basis of these evidence of mineralization, the present exploration program has been formulated to fulfill the following objectives. i) To carry out Geological mapping on 1:4000 scale for demarcation of rocks & mineralization with the structural features to identify the surface manifestations and lateral disposition of the mineralized zones. ii) Systematic soil sampling and bed rock sampling in 200m*200m grid along with stream sediment sampling. iii) Shallow pitting / trenching will be done to expose the concealed host rock and mineralisation. This will guide for exact demarcation of the present ore bodies. The exploration will be helpful in estimation of preliminary resources of PGE and associated mineral in the block area. iii) Scout drilling to check the depth extension of mineralisation. iv) In case the results of the Preliminary exploration are positive, it will help in planning of general exploration programme, which in turn will facilitate the state govt. for auctioning of block.
7	Whether the work will be carried out by the proposed agency or through outsourcing and details thereof.	Will be carried out by MPSMCL & few components through outsourcing.
8	Name/ Number of Geoscientists	Geologist:- 02
9	Expected Field days (Geology)	Geologist:- 200 field + 70 HQ

1	**Location**	
	Latitude	Anx-4
	Longitude	Anx-4
	Villages	Anx-5
	Tehsil/ Taluk	Umreth
	District	Chhindwara
	State	Madhya Pradesh
2	**Area (hectares/ square kilometres)**	
	Block Area	6.6 sq km
	Forest Area	Exact extent of forest area is missing. Forest map prepared based on the toposheet is attached as Anx- 5
	Government Land Area	Data not available.
	Private Land Area	Data not available.
3	**Accessibility**	
	Nearest Rail Head	The nearest railway station is Parasia, located on the Betul-Amla Chhindwara narrow gauge railway track of Central Railway. The other nearby railway stations are Nawegaon and Chhindwara located on the same track.
	Road	The area lies about 40 km west of Chhindwara town and well connected by metal roads. The area can be approached from Bhopal-Betul via Ghoradongri-Sarni road or via Multai road. It can also be approached from Bhopal-Chhindwara via- Hoshangabad-Piparia-Tamia road.
	Airport	Nagpur
4	**Hydrography**	
	Local Surface Drainage Pattern (Channels)	The area mainly exhibits undulatory topography marked by linear mounds dissected by sub parallel to dendritic drainage pattern.
	Rivers/ Streams	Area is drained mainly by Kanhan River and its tributaries viz., Bel nadi, Karawoh nala, Batiyadev nala etc. in the south and middle part of the area and Pench River in the north
5	**Climate**	
	Mean Annual Rainfall	Rain fall (annual) average 1000 mm.

	Temperatures (December) (Minimum) Temperatures (June) (Maximum)	The minimum and maximum temperatures are 02^0 C and 45^0 C respectively.
6	**Topography**	
	Toposheet Number	55J/12 Anx-5
	Morphology of the Area	Both agricultural land and forest cover dominate the study area with thick soil cover and limited exposures especially in the agricultural land.
7	**Availability of baseline data**	
	Geological Map	1:12.5 K Geological Map available
	Geochemical Map	Available
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Available
8	**Justification for taking up Preliminary Exploration**	In view of MMDR Amendments & Mineral Auction Rule, 2015, we have identified this block for exploration of Graphite to take up the work under NMET funding. In the proposed study area, there are geological indications, surface indications of mineralization are present in the form of presence of box-work, typical sulphide alteration zones which give yellow staining, dissemination of sulphide grains in various rock types such as meta-gabbro, coarse grained amphibolite, meta-basalts, quartz veins, felsic volcanics, granite and quartz syenite. Veinlets of quartz, epidote, granite and gabbro rich in sulphides mineralization are also noticed in these rocks. Please refer Anx-2 for the same. Furthermore, there are several studies carried out by GSI for PGE and associated elements in nearby area.

		The block also came in auction in phase XI for composite license. GSI is confirming presence of PGE and associated mineral in the area & have recommended for further detailed study for delineating the prospective zones for mineralization. Mardongri mafic ultramafic complex of rocks of Betul group occupies the area which is to be closely checked for further PGE occurrences. Systematic soil sampling and bed rock sampling to be carried out along with stream sediment sampling. Additional trenching and pitting work has to be resorted to, for deciphering the shape of the different bands. As this sector holds the promise of high grade ore, drilling has to be initiated in this area immediately. The details of the same are discussed in "Previous Work", each case wise. These 3 points are guiding for the presence of PGE and associated minerals in the area. The exploration will be helpful in estimation of Preliminary Exploration mineral resources (333) of PGE & other associated minerals in the block area. In case the results of the Preliminary Exploration are positive, it will facilitate the state govt. for auctioning of block.

Detailed description of the block

2. Physiography:

The area mainly exhibits undulatory topography marked by linear mounds dissected by sub parallel to dendritic drainage pattern. Area is drained mainly by Kanhan River and its tributaries viz., Bel nadi, Karawoh nala, Batiyadev nala etc. in the south and middle part of the area and Pench River in the north.

3. Background Geology

Regional Geology

Present area of exploration for PGE mineralization lies in the eastern part of the Betul belt which consist mostly of bi-modal volcanic rocks, including pillowed and non-pillowed meta-basalt, rhyolites and altered rhyolites, fine –medium grained foliated meta gabbro/amphibolites, foliated and porphyritic (younger) granites and intrusive mafic ultramafic suits of rocks known as Mordongri mafic-ultramafic complex/intrusive. The disposition of the litho-units in the eastern end of the Betul belt indicate the presence of as fine to medium grained equigranular to sometimes porphyritic mylonitic granite is emplaced at sheared contact of the rhyolite and metabasalt. This mylonitic/sheared granite occurs at the triple point junction of rhyolite and metabasalt and also occurs as enclaves within porphyritic granite. The disposition of bimodal volcanics in this part of the Betul belt show the presence of two felsic volcanic sequence from south to north with a metabasalt sequence bi-furcating them. The northern felsic volcanic sequence is mainly a tuff dominated sequence with intercalations of intermittent dismembered massive rhyolite bands. The layered rhyolite sequence towards south is mainly composed of tuffaceous rhyolites, massive rhyolite and altered rhyolite. At places rhyolite show alteration zones in this sequence and are non-mapable on this scale. The interrelationship of the northern felsic sequence and the metabasalt sequence has gradational contact which is sheared at places. Mafic body is present intermittently within this sequence. The northern part of this sequence has sheared contact with mafic dominated part of the bimodal sequence and towards eastern part, the sequence is covered by Deccan Trap. The younger pink and grey porphyritic and sometimes equigranular granite truncates the eastern contact.

The metabasalt sequence is mainly composed of fine grained metabasalt, which shows deformed pillows covering considerable area in the eastern part. The rocks of the Betul belt have undergone three phases of progressive deformation. In the mapped area only one set of dominant foliation, represented by regional schistoity/foliation developed in all rock types throughout the area is observed. The general trend of schistosity/foliation is ENE-WSW to E-W with varying dip of 50° to 80° either southerly or northerly.

Regional Stratigraphy of the study area

Deccan Traps	Basaltic lava flows and dolerite dykes	
Intrusive contact / Disconformity		
GONDWANA SUPERGROUP	Conglomerate, sandstones, and shales	
Unconformable / Tectonic Contact		
BETUL GROUP	INTRUSIVES	Basic dykes, pegmatites, quartz veins Homophonous amphibole-mica granite, Porphyritic granite
	Intrusive / Tectonic contact	
	PADHAR MAFIC – ULTRA MAFIC SUITE	Diorite, epidiorite, gabbro, norite, pyroxenite, hornblendite, websterite, harzburgite, Anorthosite, Diorite, talc – serpentinite rock, quartz – epidote rock
	Intrusive / Tectonic contact	
	SONAGHATI FORMATION	Intercalated sequence of quartzite and quartz-mica schist
	Conformable / Tectonic contact	
	BARGAON FORMATION	Meta-sediments (mica schists) meta rhyolite and felsic Meta tuff meta basalt and amphibole – chlorite schist.
	Conformable / Tectonic contact	
	RANIPUR FORMATION	Phyllite, banded hematite / magnetite quartzite, BIF granulite, meta-basalt, amphibolite carbonaceous phyllites calcareous quartzite, calc silicates, marble
Un-conformable / Tectonic contact		
AMLA GNEISS	BASEMENT ROCK	Banded migmatite gneiss, quartzofeldspathic mica schist /gneiss

Betul group:

The ENE–WSW trending Betul supracrustal belt forms a conspicuous litho-tectonic unit of the granitoid–gneiss terrain lying between Mahakoshal belt in the north and Sausar supracrustal belt in the south. This belt extends for about 135 km with an average width of 15km from Chhindwara town in the east to Chicholi village in Betul district in the west and is composed of volcano-sedimentary rocks intruded by mafic–ultramafic and granitic suite of rocks in that order (Srivastava and Chellani, 1995) This belt is characterized by bimodal volcanic rocks and is distinguished from the unimodal volcanics (mafic volcanics) of Mahakoshal belt and volcanic-free Sausar belt.

Geochemical data show that the meta-basalt of bimodal sequence of Bargaon Formation is tholeiitic in composition and comparable to low K-tholeiites generated near an arc environment (Ramachandra and Pal, 1992; Raut and Mahakud, 2002). On the other hand, the rhyolites exhibit transitional calc-alkaline to alkaline characters, which indicate that they are not cogeneitc with the associated mafic volcanic rocks. Due to intense shearing and copious granitic magmatism, the supracrustal rocks occur as dismembered sequences within the granitic host. One of the syn-tectonic granitic phases yielded an Rb–Sr age of ca. 1.5 Ga (quoted in Raut and Mahakud, 2002), which constrains the upper age of the supracrustal sequence. Around the Betul supracrustal belt, the granitic rocks yield an age of ca. 1.5 and 0.9 Ga, where ca. 1.2–0.9 Ga ages are common in

the granites (s.l.) adjacent to the Sausar and Bilaspur–Raigarh belts. Thus, the available data show that Proterozoic granitic magmatism which spanned over a period of, 900 Ma (ca. 1.8–0.9 Ga), occupy large part of CITZ. Similar ages from the granitic rocks were obtained from the CGGC (Pandey et al., 1998; Ray Barman et al., 1994).

The Betul belt is surrounded by younger Gondwana sediments and Deccan Trap from three directions and through a narrow NW-SE trending corridor along Kanhan River, the gneissic complex of Betul belt shows tectonic contact with the gneisses of Sausar belt of Chhindwara district. Lithologically the Betul Archaean-Proterozoic belt is represented by the Betul gneissic complex comprising of granitic gneisses, banded gneisses, amphibolites and schists with enclaves of supracrustals comprising tremolite actinolite schist, graphite schist, garnetiferous biotite schist and calc silicate. These rocks are traversed by younger acidic and basic intrusive phases as well as thin and thick pegmatite veins. The basement for these rocks is not exposed. The meta-sedimentary sequence termed as “Golighat group” which has three 26 distinct lithological packages, i.e., Quartz mica schist, garnetiferous mica schist and interbands of actinolite tremolite-chlorite dominated basic schist (amphibolites) bearing Kosmi Formation. Impure marble and calc silicates bearing Temni Formation, which occur as small lensoid bodies and the Sonaghati Formation, representing linear ENE-WSW trending arenaceous rocks, which passes through Sonaghati (Chellani et. al., 2002). The supracrustal rocks exhibit metamorphic grade varying from lower- to middle amphibolite facies. The common mineral assemblages include garnet-biotite- staurolite-andalusite in metapelites, calcite/ dolomite-antigorite-talc-tremolite in calcareous rocks, epidote- diopside in calcsilicates, quartz-grunerite-magnetite in BIF, actinolite-hornblende- plagioclase in basalts and quartz-K-feldspar-plagioclase-muscovite in rhyolites. A large suite of mafic–ultrmafic rocks, showing ENE–WSW map pattern and covering over 100 sqkm, is encountered in the northern part of the Betul belt (Fig no. 5.1). It contains discrete sheets and plutons of peridotite, pyroxenite, hornblende pyroxenite, gabbro, norite and diorite. Cumulus texture is common in these rocks. At places, the co-existing Opx-Cpx-plag, in addition to magmatic textures, exhibit equigranular granoblastic texture, which indicate recrystallization under ambient P–T condition subsequent to their emplacement in the deeper levels of the crust. Presence of granulite facies BIF enclaves in the mafic–ultramafic rocks also corroborates this contention. Almost all the phases of the mafic–ultramafic complex contain primary phlogopite. These ultramafic rocks are generally undeformed, except in some shear zones, producing schistosity.

4. Geology of the Block:

The proposed area comprises the rock formations of Mardongri mafic ultramafic suite of Betul Group. It consist mostly of bi-modal volcanic rocks, including pillowed and non-pillowed meta-basalt, rhyolites and altered rhyolites, fine –medium grained foliated meta gabbro/amphibolites, foliated and porphyritic (younger) granites and intrusive mafic ultramafic suits of rocks known as Mordongri mafic-ultramafic complex/intrusiveThe mapped area in and around Mordongri lies in the eastern part of the Betul belt, which is located in between two major lineaments named as Satpura fault and the Tapti lineament which trend roughly ENE-WSW in this area. The regional foliation of the rocks and shear zones in the area are controlled by these lineaments and follow these lineaments.

5. Nature of Mineralisation

In the mafic-ultramafic intrusive rocks sulphides rich zones have been observed at many places and at some places sulphide mineralization has been observed upto 4-5% by visual estimation. Sulphide mineralization was noticed in mostly in meta-gabbro, while in coarse grained amphibolite sulphide dissemination was very less in comparison to metagabbro. Petrographic and SEM-EDX studies revealed that coarse grained amphibolite consist of fair amount of oxide phases in the form of Ilmenite, Ti-ilmenite, chromite and magnetite etc. Presence of Pd and Au mineralization in the stream sediment may indicate association of mineralization with the oxide phase.

Details of Mineralised zone

Dissemination of pyrite and chalcopyrite grains is observed in meta-gabbro near jamtara, Rayyatwari and Piparia villages; in coarse grained amphibolite near Jamtara, Belkheda, Piparia villages; fine network of quartz and granitic veins intruded in meta-gabbro also posses dissemination of sulphides near Jamtara and Piparia villages. The sheared contact of meta-basalt with foliated rhyolite also shows sulphide dissemination in the form of disseminated grains. It can be well observed along the contact in Gujarghat, Kanhan River section, Karaboh and Mordongri villages. Felsic volcanics – altered rhyolite comprising impersistent alteration zones are also present in the area. It is well established that these alteration zones host base metal mineralization at a number of places in the Betul belt. In the area consideration also provide surface indication of mineralization in these rock types are seen. Granitic intrusion along the shear zone posses very good amount of sulphide disseminations in the form of pyrite and chalcopyrite. It may be postulated that these may indicate secondary enrichment of the elements and may host multi element concentrations. Presence of REE minerals such as xenotine, monazite etc have been noticed under SEM-EDS studies. Geochemical data of these granite also posses total REE content upto 1134 ppm. The presence of gossans like impression which shows box work structures and yellowish brown, crimson red colour developed over quartz syenite rocks also indicate presence of sulphide mineralization and may be REE in this rock. Presence of disseminated and segregate sulphides is the primary criteria and indication of the mineralization in the area. During the field work good amount of pyrite, chalcopyrites have been observed in the hand specimen. Good amount of the pyrite and chalcopyrite have also been observed in gabbro near Jamtara village and fine network of the quartz veins also posses very good amount of sulphide mineralization, two gold grains have been identified during the SEMEDX studies from this area. So sulphide mineralization may be potential zone for the mineralization in this area. Apart from the Mordongri mafic ultrmafic complex, good amount of the sulphide mineralization is seen in pillowed meta-basalt and in granite especially at the sheared contact in and around Mordongri, Karaboh and Gujarghat area.

6. Mineral Potentiality

The large scale geological mapping on 1:12,500 scale reveals that the main rock types present in the area are mylonitic granite, felsic volcanics comprising variety of rhyolites and felsic tuff, pillowed/non-pillowed meta basalt, foliated meta gabbro, coarse grained amphibolite, meta-gabbro, porphyritic/equigranular granite, alkali gabbro, quartz syenite, siliceous limestone and dykes of Deccan trap basalt. The main mafic ultramafic body in Mordongri area intruded into foliated rhyolite and exposed at surface continuously for about 8 km in length and 750m to 1 km in width in EW trend which is parallel to the regional trend of the Betul belt. Major part of the mafic body lie beneath the rhyolite and meta-basalt of the bi-modal sequence of the Betul belt.
Mordongri mafic ultramafic suits of rocks consist of layers of coarse grained amphibolite and coarse grained meta-gabbro. Both the lithologies show presence of sulphide and oxide phases that may be potential zones of Au-PGE mineralization.

GSI is confirming presence of PGE in the area & have recommended for further systematic geochemical sampling on grid pattern, stream sediment sampling, geophysical survey (magnetic, electromagnetic and gravity survey) is recommended in the area for searching PGE, Au, Cu, Ni and Cr mineralization.

These 2 points are guiding for the presence of PGE and associated minerals in the area.

The exploration will be helpful in estimation of Preliminary Exploration mineral resources (333) of PGE and associated minerals in the block area.

7. Scope for Proposed Exploration

The proposed block fall in Chhindwara district of Madhya Pradesh (Anx-1 Location Plan).

i. Geological mapping in the said block in 1:4000 scale.
ii. To identify and estimate PGE and associated mineral content by Fire assay analysis at shallow depth, trenching/pitting will be done.
iii. Geophysical survey to check PGE anomalous zone.
iv. To check the continuity of ore body in strike direction and depth extension.
v. Sampling & their analysis.
vi. To estimate the Preliminary Mineral Resources and grade for orebody in the block as per UNFC and MEMC-2015.

8. Observation and recommendations of previous work

The large scale geological mapping on 1:12,500 scale reveals that the main rock types present in the area are mylonitic granite, felsic volcanics comprising variety of rhyolites and felsic tuff, pillowed/non-pillowed meta basalt, foliated meta gabbro, coarse grained amphibolite, meta-gabbro, porphyritic/equigranular granite, alkali gabbro, quartz syenite, siliceous limestone and dykes of Deccan trap basalt. The main mafic ultramafic body in Mordongri area intruded into foliated rhyolite and exposed at surface continuously for about 8 km in length and 750m to 1 km in width in EW trend which is parallel to the regional trend of the Betul belt. Major part of the mafic body lie beneath the rhyolite and meta-basalt of the bi-modal sequence of the Betul belt. Besides the main body there are numerous meta-gabbroic sills/dykes intruding the bimodal sequence which are related to Mordongri mafic ultrmafic intrusive. Mordongri mafic ultramafic suits of rocks consist of layers of coarse grained amphibolite and coarse grained meta-gabbro. Both the lithologies show presence of sulphide and oxide phases that may be potential zones of Au-PGE mineralization. However, the bed rock samples and trench samples don't show encouraging results for Au-PGE mineralization. The Au values are below detection limit of 25 ppb in all samples. The maximum value for Pt is 19ppb and for Pd is 33 ppb. The highest value for Ir is 11 ppb, for Ru 09 ppb and for Rh is 04 ppb. No particular zone or rock type could be decipher for PGE mineralization from the available analytical data of bed rock samples. Sporadic high values of Ni, Cr and Cu are recorded in various rock types present in the study area. The highest value for Ni is 570 ppm, for Cr 820 ppm and for Co is 107 ppm. These values are recorded in the saples of meta gabbro. High values of 1050 ppm, 1450 ppm and 1700 ppm of Cu are recorded in metabasalt enclave, coarse grained amphibolite and meta gabbro respectively. The ore petrography and SEMEDX

studies indicate the presence of good amount of oxides and sulphides of Fe, Cu and Ni in these rocks. Few grains of gold have also been identified during the SEMEDX study. Good numbers of Pd-Au grains associated with oxide phase have been identified in SEM-EDX study of a sample from stream sediment. Besides Mordongri mafic ultramafic suits of rocks, surface indication and under the microscope, the mineralization in the form of dissemination of sulphides is observed in metabasalt, quartz veins and granites near shear zones and quartz syenite in the study area. Granite shows total REE content upto 1134 ppm in geochemical analysis and few REE minerals like xenotine, euxenite and monazite etc have been identified during SEM EDS studies of mylonitic granite emplaced at the sheared contact near south of Karaboh village.

Though, the geochemical analytical results of bed rock samples from Mordongri area couldn't help in delineating any zone for PGE mineralization, surface evidence of sulphide mineralization are present in the form of dissemination of sulphide in various rock types of this area. Sporadic high values for Ni, Cr and Cu are also recorded from these rocks. The SEM-EDX study also reveals of presence of Pd and Au in stream sediment and sulphide and oxide phases in different rock types of Mordongri area. Therefore, systematic geochemical sampling on grid pattern, stream sediment sampling, geophysical survey (magnetic, electromagnetic and gravity survey) is recommended in the area for searching PGE, Au, Cu, Ni and Cr mineralization. Very good amount of sulphide mineralization was observed in granite, especially at the sheared contact in and around Mordongri village, these shear zones and quartz veins can be targeted for base metal mineralization. Apart from the Mordongri mafic/ultramafic intrusive, indications of mineralization in the form of sulphide disseminations have been noticed in meta-basalt, granite, quartz syenite and quartz veins near Karaboh, Gujarghat, Mordongri and Bhooli villages. This area should be searched for base metal mineralization through systematic soil and bed rock sampling. Good concentration of REEs have been noticed in geochemical results as well as REE minerals xenotine, euxenite and monazite etc have been identified during the SEMEDX studies, So systematic grid sampling and soil sampling is recommended in the granites especially in Gujarghat, Mordongri and Rayyatwari and Karaboh areas.

9. Planned Methodology

Work will start with geological mapping of the block on 1:4000 scale and systematic geochemical sampling along with geophysical surveys to identify potential zones for exploration drilling.
Core drilling will be carried out at G3 level of exploration as per "The Minerals (Evidence of Mineral Contents) Rule 2015.

Pitting & trenching will be carried out at G3 level of exploration as per "The Minerals (Evidence of Mineral Contents) Rule 2015.

PGE and associated mineral analysis of all the samples will be done from NABL accredited laboratories.

Samples will check in several ways. They are listed below: -

Sr No	Sample Check Type		Percentage
2	External Check	:-	10%
4	Moisture absorption & Bulk Density	:-	2%
5	Mineralogical analysis	:-	5%

These activities will be followed by data interpretation and report writing work.

10. Nature Quantum and Target

Components	G3 Stage	Proposed Quantum
Aerial reconnaissance	Remote sensing, airborne geophysical survey etc.	Not needed
Geological Survey	i 4K/ 4K ii Assessment of lithology, structure, surface mineralisation and analysis of old history of mining, if any.	Detailed mapping on 4K scale – 6.6 Sq Km
Geochemical Survey	i Regional Grab / chip / Stream Sediment / Soil Sampling ii Recording of broad geomorphology, drainage, etc.	170
Geophysical Survey	Magnetic, electromagnetic and gravity survey	200m line spacing
Pitting/ Trenching	It will be done in 200m*200m grid pattern covering the mineralized area in three lines.	50 (100m3)
Surface sample	Surface sample collected during geological mapping	50
Systematic drilling /	Few boreholes if required along the positive profiles delineated by surface sampling/pitting trenching (Mts)	5 (500 meterage)
Groove Sampling /Grab and Chip Sampling	A few samples from bed rock (few representative samples from all the exposed rocks in the area for first-hand information and more samples from rocks which host the mineralization).	
Core sample	Sample from mineralised zones as well as hanging wall/footwall Side to be collected. Sample length to be specified (Mts)	200
Petrographic and mineragraphic studies	Principal rock types, mineral assemblage, identification of minerals of interest (Numbers)	25
Synthesis of all	i) Integration of regional geophysical, geological and geochemical data.	As required
available data	ii) Synthesis of all available data and Report writing	

11. Manpower Deployment

For Geologist	
Area (Sq Km)	6.6
Field Work Days	200
HQ Work Days	70
Labour	400
Core Drilling	
No of Boreholes	5
Drilling Depth	100
Meterage	500
Let 40% be analyzed (Numbers)	200
Pitting & Trenching	
Numbers of pits / Trenching	50
Length (Mts)	1
Breath (Mts)	1
Depth (Mts)	2
Total Volume (M3)	100
Number of Samples & Analysis	
From BH	200
Trench sample	100
Surface sample	220
Total Samples	520
External Check @ 10%	52
Total Samples	572
For Preparation	
No of sampler	2
No of samples	572
No of sample per day	5
Activity days	114
Sample Man days	236
Labour	944
Logging	
Logging per day (Mts/Day)	50
Meterage	500
BH Logging	15
Pit / Trench Logging per day (Pits/Day)	2
Number of Pits / Trenches	50
Man days for pit logging	25
Total Logging Man days	30
For HQ Man days	60
Petrological Study	
Mineralogical Study @ 5%	25

12.Break up of Expenditure

Cost Estimate for Preliminary Exploration (G3) for Mardongri Jamtara PGE Block, 6.6 sq. km, No.of BH: 5, Borehole depth range 100 m; Schedule timeline 17 months Review: After 8 Months]						
S. No.	**Item of Work ***	**Unit ***	**Rates as per NMET SoC 2020-21**		**Estimated Cost of the Proposal**	
			SoC-Item No. *	**Rates as per SoC * (a)**	**Qty. (b)**	**Total Amount (Rs) (a*b)**
A	**Geological Mapping Other Geological Work & Surveying**					
	Geological mapping, (1:4,000 scale) & Trenching , drilling work					
i	a. Charges for Geologist per day (Field) for geological mapping & trenching work, drilling work	day	1.2a	11,000	200	2,200,000
ii	b. Labours Charges; Base rate	day	5.7	504	400	201,600
	c. Charges for Geologist per day (HQ)	day	1.2b	9,000	70	630,000
	d. Charges for one Sampler per	one sampler per day	1.5.2	5,100	236	1,203,600

	day (1 Party)					
	e. Labours (4 Nos)	day	5.7	504	944	475,776
	Sub Total- A					**4,710,976**
B	**Ground Geophysical Survey**					
1	Gravity Method detailed **(outsourced)**	Per station	3.1a	3,800	160	608,000
2	Magnetic survey **(outsourced)**	Per station	3.2a	1,800	160	288,000
3	Electromagnetic survey (sounding) **(outsourced)**	Line km	3.7a	21,197	80	1,695,760
4	c. Labours Charges	day	5.7	504	-	-
5	Geophysicist party days (HQ) (Outsourced)	per day		9,000	-	-
	Sub Total- B					**2,591,760**
C	**Survey work**					
a	DGPS Survey for BH fixation & RL determination **(outsourced)**	Per Point of observation	1.6.2	19,200	13	249600

b	Charges of Surveyor (1 party) for Geophysical survey layout work & Block boundary demarcation **(outsourced)**	one survey or per day	1.6.1a	8,300	-	0
c	Survey man days for forest clearance works **(Outsourced)**	days	1.6.1b	8,300	-	0
d	Labours Charges for survey work;	day	5.7	504	-	0
	Sub-Total C					**249,600**
D	**Trenching/ Pitting**					
	a) Excavation of Trenches	per cu.m	2.1.1	3,330	150	**499500**
E	**DRILLING (after review)**					
1	Drilling up to 300m (Hard Rock) **(Outsourced)**	m	2.2.1.4a	11,500	500	5,750,000
2	Borehole deviation Survey by Multishot Camera	m				
3	Land / Crop Compansation (in case the BH falls in	per BH				

	agricultural Land)					
4	Construction of concrete Pillar (12"x12"x30")	per borehole				
5	Transportation of Drill Rig & Truck associated per drill (2 rigs)	Km				
6	Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)	month				
7	Drilling Camp Setting Cost	Nos				
8	Drilling Camp Winding up Cost	Nos				
9	Road Making (Flat Terrain)	Km				
10	Drill Core Preservation **(Outsourced)**	per m	5.3	1,590	200	318,000
	Sub Total E					**6,068,000**
F	**Borehole Geophysical Logging (Outsourced)**		3.12	622.00	500	**311,000**
G	**LABORATORY STUDIES**					
1	**Chemical Analysis**					

i)	**Geochemical Sampling-Surface samples (Bedrock/Channel /Soil/Stream sediment)**					
	a. Au by Fire Assay	Nos				
	b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method	Nos	4.1.7a	3,846		-
	c. For PGE by Fire Assay	Nos	4.1.5d	11,800	220	2,596,000
	Proximate analysis of Graphite	Nos	4.1.16	3,000		-
ii)	**Surface Check samples (10% External)**					
	a. Au by Fire Assay	Nos				
	b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method	Nos	4.1.7a	3,846	-	-
	c. For PGE by Fire Assay	Nos	4.1.5d	11,800	22	259,600
	Proximate analysis of Graphite	Nos	4.1.16	3,000	-	-
iii)	**Trench & Check Samples from Trench**					

	Trench samples					
	a. Au by Fire Assay	Nos				
	b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method	Nos	4.1.7a	3,846		-
	c. For PGE by Fire Assay	Nos	4.1.5d	11,800	100	1,180,000
	Proximate analysis of Graphite	Nos	4.1.16	3,000		-
iv)	**Trench Check samples (10% External)**					
	a. Au by Fire Assay	Nos				
	b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method	Nos	4.1.7a	3,846	-	-
	c. For PGE by Fire Assay	Nos	4.1.5d	11,800	10	118,000
	Proximate analysis of Graphite	Nos	4.1.16	3,000	-	-
v)	**BH Core samples**					
	a. Au by Fire Assay	Nos				
	b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by ICPMS-34 elements	Nos	4.1.14	7,731	-	-

	c. For PGE by Fire Assay	Nos	4.1.5d	11,800	200	2,360,000
	Proximate analysis of Graphite	Nos	4.1.16	3,000	-	-
vi)	**BH Core samples (10%External)**					
	a. Au by Fire Assay	Nos				
	b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by ICPMS-34 elements	Nos	4.1.14	7,731	-	-
	c. For PGE by Fire Assay	Nos	4.1.5d	11,800	20	236,000
	Proximate analysis of Graphite	Nos	4.1.16	3,000	-	-
2	**Physical & Petrological Studies**					
i	Preparation of thin section	Nos	4.3.1	2,353	25	58,825
ii	Study of thin section	Nos	4.3.4	4,232	25	105,800
iii	Preparation of polish section	Nos	4.3.2	1,549	25	38,725
iv	study of polished section	Nos	4.3.4	4,232	25	105,800
v	Digital Photographs	Nos	4.3.7	280	50	14,000
vi	Separation of heavy mineral	Nos	4.3.6b	13,820	15	207,300
vii	Sp. Gravity	Nos	4.8.1	1,605	10	16,050
	SEM Studies	per hour				

vii i	EPMA studies	per hour				
	Sub Total G					**7,296,100**
H	**3D ore body modeling**		**As per the actuals/implementing agency to put the cost based on the market survey**			**2,200,000**
I	**Total A to H**					**23,926,936**
J	**Geological Report Preparation**	**5 Hard copies with a soft copy**	**5.2**	**5.2 (i/ii/iii/iv)**		**750,000**
K	**Peer review Charges**		**As per EC decision**			**30,000**
L	**Preparation of Exploration Proposal (5 Hard copies with a soft copy)**	**5 Hard copies with a soft copy**	**5.1**	2% of the Cost or Rs. 5.0 Lakhs whichever is less		**478,539**
M	**Operational Charges**		**6 (iii)**			**816,527**
M	**Tendering cost**					**478,539**
N	**Total Estimated Cost without GST**					**26,480,540**
0	**Provision for GST (18% of J)**					**4,766,497**
P	**Total Estimated Cost with GST**					**31,247,038**
					or Say Rs. In Lakhs	**312.47**

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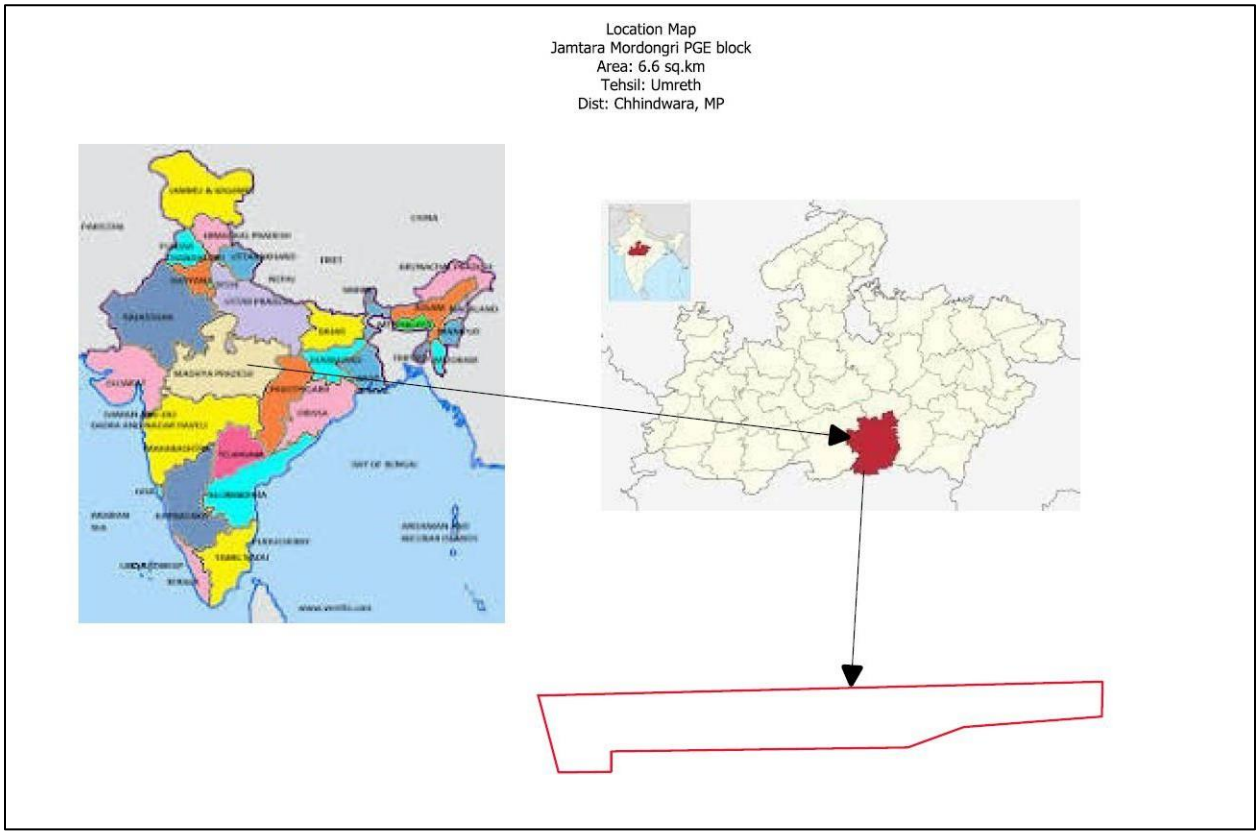
MOHAMMAD ATIF RAZA FS 2015-16, FINAL REPORT ON SEARCH FOR PGE MINERALIZATION IN MORDONGRI MAFIC/ ULTRAMAFIC COMPLEX, CHHINDWARA DIST., M.P. (G-4 stage).

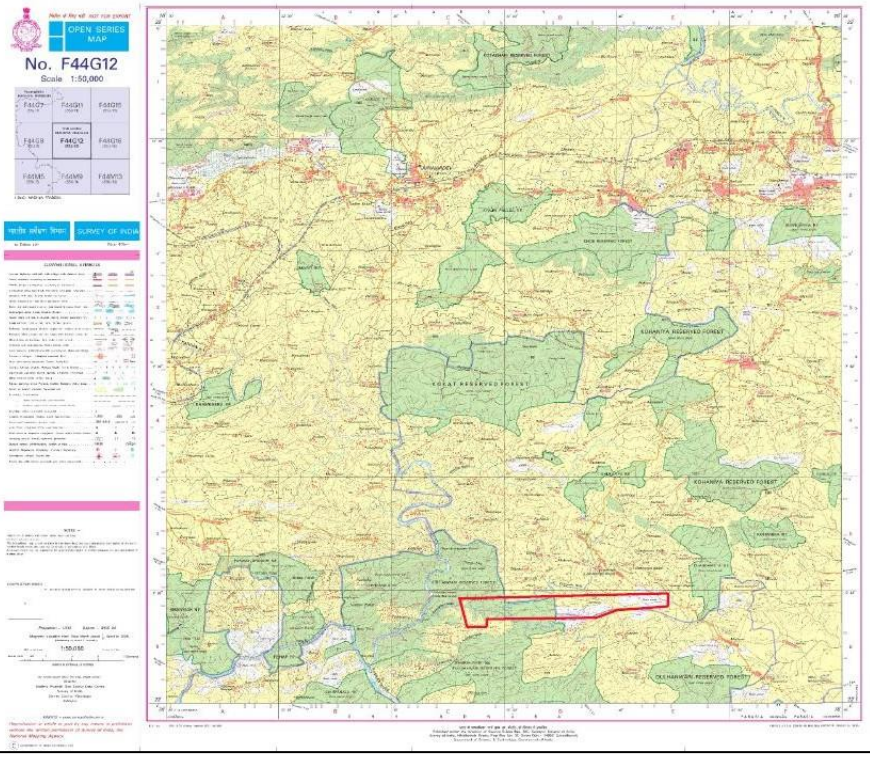
Annexure

Anx-1


Location Map
Jamtara Mordongri PGE block
Area: 6.6 sq.km
Tehsil: Umreth
Dist: Chhindwara, MP

Anx-2

Toposheet 55J/12 and Forest Map
Jamtara Mordongri PGE block
Area: 6.6 Sq. Km
Tehsil- Umreth
Dist: Chhindwara, MP



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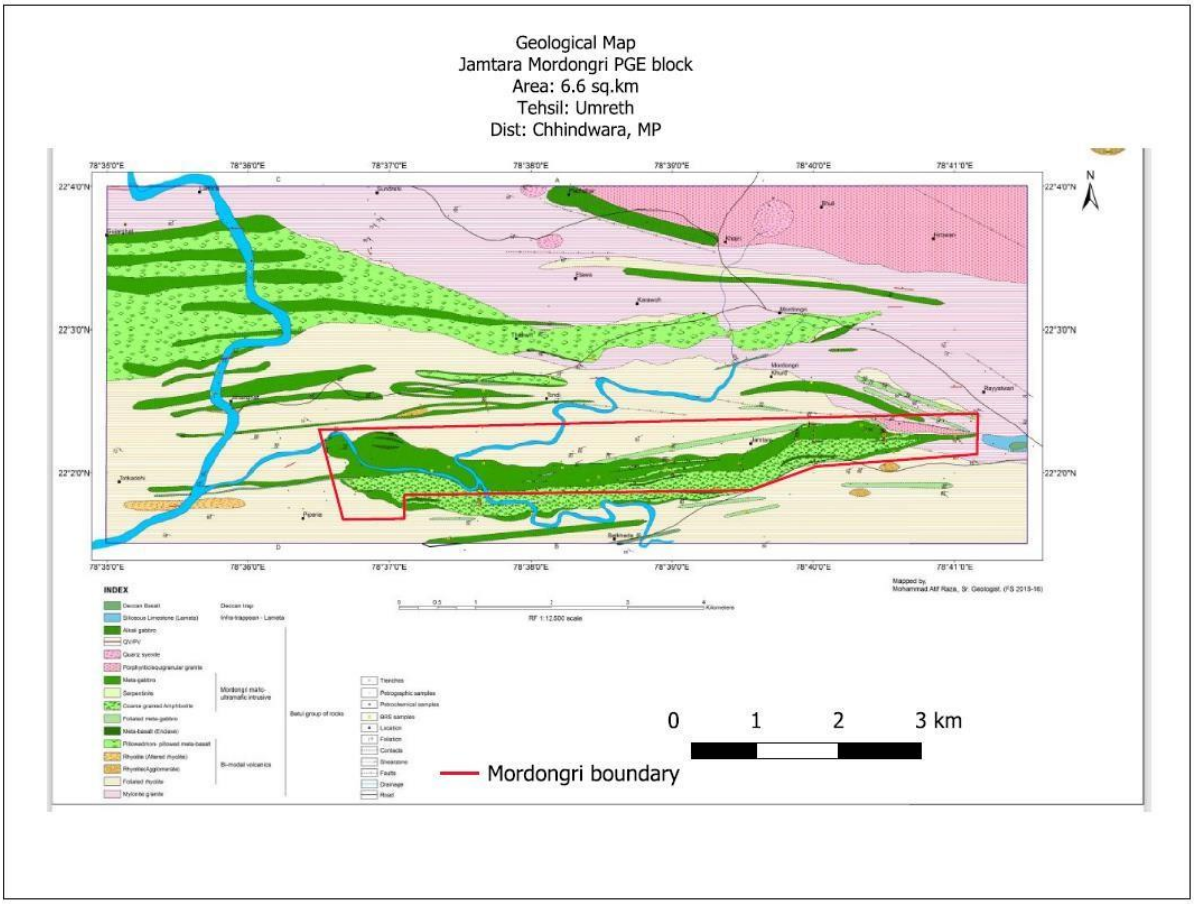
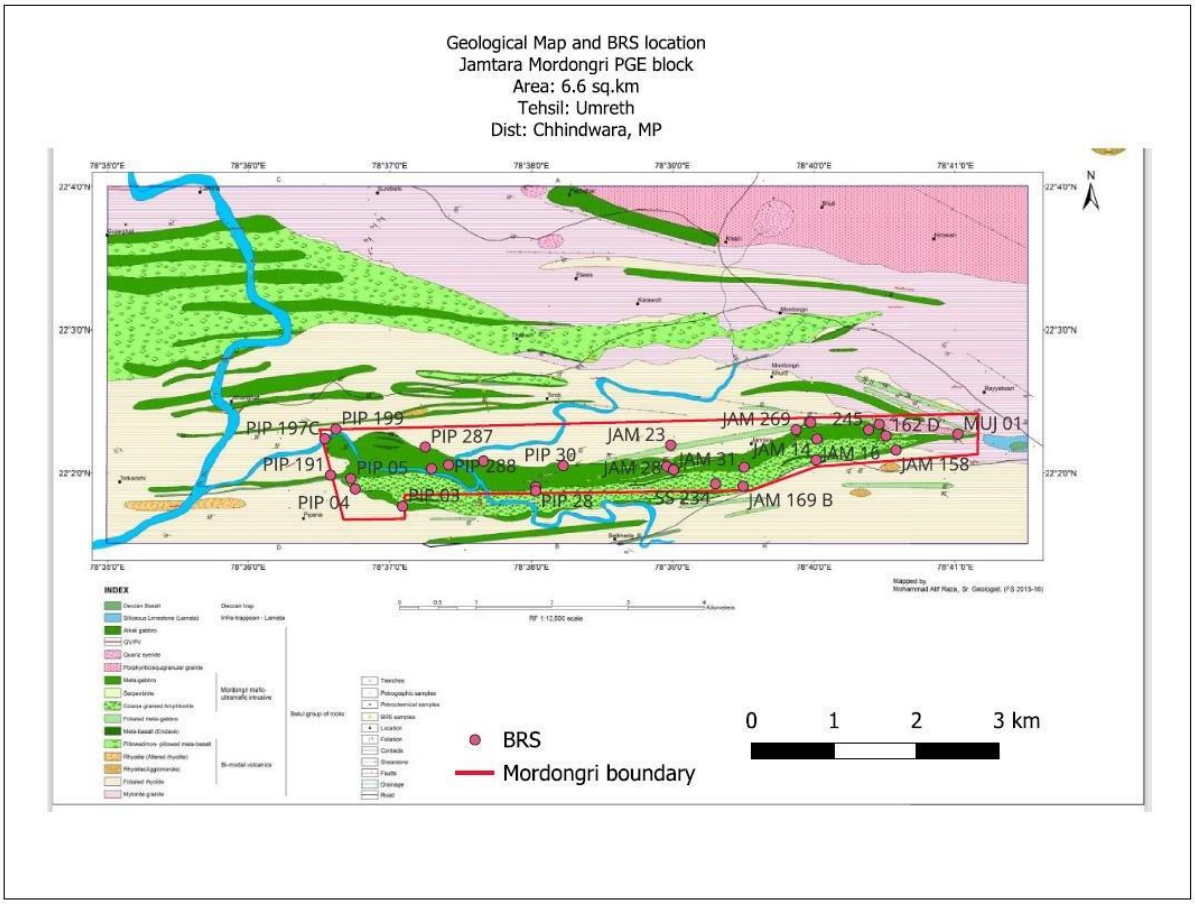

Geological Map
Jamtara Mordongri PGE block
Area: 6.6 sq.km
Tehsil: Umreth
Dist: Chhindwara, MP
INDEX
0 1 2 3 km
Mordongri boundary

Anx-4

Points	X	Y
A	78.6	22.03
B	78.68	22.03
C	78.68	22.03
D	78.66	22.03
E	78.65	22.03
F	78.61	22.03
G	78.61	22.02
H	78.61	22.02

Anx-5


Geological Map and BRS location
Jamtara Mordongri PGE block
Area: 6.6 sq.km
Tehsil: Umreth
Dist: Chhindwara, MP
PIP 197C
PIP 199
PIP 287
PIP 191
PIP 05
PIP 288
PIP 30
PIP 04
PIP 03
PIP 28
JAM 23
JAM 28
JAM 31
SS 234
JAM 269
245
162 D
MUJ 01
JAM 14
JAM 16
JAM 158
JAM 169 B
INDEX
BRS
Mordongri boundary
0 1 2 3 km

Anx-6
Analysis result of BRS samples

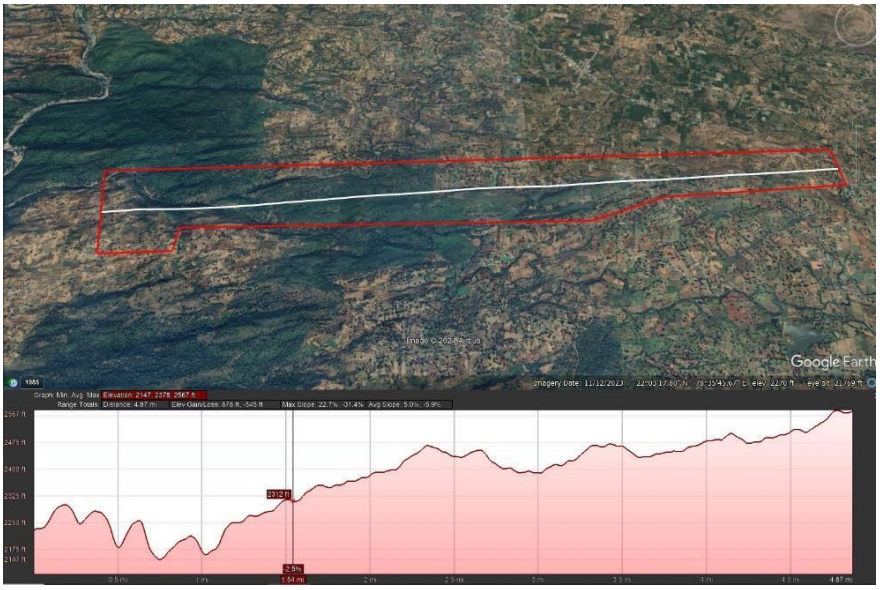
Sample Id	Latitude	Longitude	Pt in ppb	Pd in ppb	Ir in ppb	Ru in ppb	Rh in ppb	Cr in ppm	Co in ppm	Ni in ppm	Cu in ppm	V in ppm	Au in ppm
PIP 199	22.03822 4	78.61043 5	<5	18	<3	<3	<3	55	20	35	55	271	<25
PIP 197C	22.03708 5	78.60913 1	<5	6	<3	<3	<3	20	25	<10	10	67	<25
PIP 191	22.03282 4	78.60981	<5	<5	<3	<3	<3	25	15	15	15	182	<25
PIP 04	22.03121 7	78.61270 1	<5	7	<3	<3	<3	55	10	70	30	152	<25
PIP 05	22.03241 9	78.61218 3	<5	6	<3	<3	<3	129	56	226	100	204	<25
PIP 03	22.02917 3	78.61826 3	15	25	3	9	3	140	40	300	120	125	<25
PIP 254	22.03358 7	78.62166 1	<5	6	<3	<3	<3	410	21	230	15	156	<25
PIP 287	22.03612 5	78.62092	10	11	<3	<3	<3	160	50	62	119	355	<25
PIP 289	22.03447 1	78.62775 1	10	<5	<3	<3	<3	201	35	151	38	143	<25
PIP 288	22.03402 6	78.62364 6	<5	<5	<3	<3	<3	25	36	26	10	338	<25
PIP 253	22.02994 3	78.62727 4	<5	5	<3	<3	<3	368	88	530	95	107	<25
PIP 255 SS	22.02938 5	78.62732 7	<5	9	<3	<3	<3	400	41	182	21	152	<25
PIP 252	22.02968 8	78.62742 6	<5	<5	<3	<3	<3	371	68	356	25	112	<25

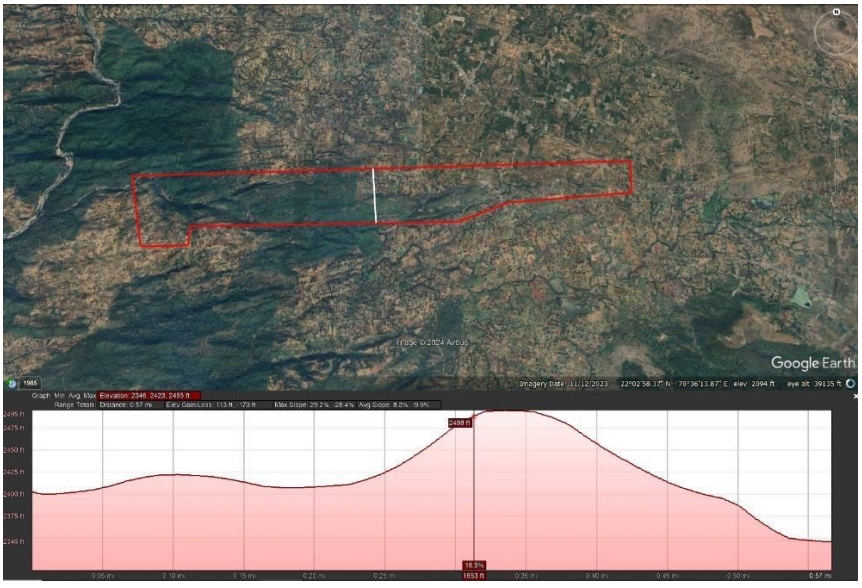
PIP 30	22.03393	78.637123	<5	14	<3	<3	<3	45	10	<10	20	182	<25
BEL 07	22.02562	78.623579	6	17	<3	3	<3	45	30	<10	60	209	<25
PIP 28	22.03145	78.633888	19	20	<3	6	<3	60	<10	<10	<10	199	<25
PIP 27 D	22.03097	78.633881	8	7	<3	<3	<3	194	54	291	53	94	<25
PIP 24	22.02852	78.633453	<5	6	<3	4	<3	35	15	<10	40	278	<25
BEL 282	22.03030	78.639787	<5	5	<3	<3	<3	293	85	400	20	122	<25
PIP 291	22.02980	78.641385	<5	<5	<3	<3	<3	162	48	50	71	403	<25
JAM 28	22.03383	78.649269	<5	7	<3	<3	<3	45	50	60	330	198	<25
JAM 23	22.03633	78.649727	<5	15	<3	<3	<3	35	40	380	105	227	<25
JAM 31	22.03345	78.650063	<5	7	<3	<3	<3	135	30	180	45	128	<25
JAM 32	22.03345	78.650063	<5	9	<3	<3	<3	90	25	60	1050	215	<25
SS 234	22.03181	78.654991	<5	5	<3	<3	<3	60	36	62	15	336	<25
PIP 173 C	22.03375	78.658356	<5	<5	<3	<3	<3	150	20	15	160	191	<25
JAM 169 B	22.03152	78.658226	<5	<5	<3	<3	<3	95	25	60	75	171	<25
JAM 20 D	22.03904	78.666	<5	5	<3	<3	<3	48	14	76	67	246	<25

JAM 269	22.03814 1	78.66445 2	<5	6	<3	<3	<3	167	82	190	11	213	<25
JAM 208	22.03900 5	78.66615 3	<5	8	<3	<3	<3	40	30	30	1700	265	<25
JAM 16	22.03706	78.66688 5	<5	10	<3	<3	<3	55	35	180	180	170	<25
JAM 14	22.03460 9	78.66680 1	<5	15	11	7	4	20	20	70	135	144	<25
JAM 165 A	22.03878	78.67420 2	<5	<5	<3	<3	<3	35	35	<10	250	219	<25
245	22.03813 2	78.67295 1	<5	<5	<3	<3	<3	132	14	22	105	202	<25
162 D	22.03743 7	78.67498 8	7	6	<3	<3	<3	96	22	56	435	205	<25
JAM 158	22.03576 3	78.67617	<5	<5	<3	<3	<3	40	25	<10	<10	164	<25
MUJ 01	22.03764 5	78.68343 4	<5	<5	<3	<3	<3	710	24	165	45	274	<25

Anx-7

Elevation profile of the block area



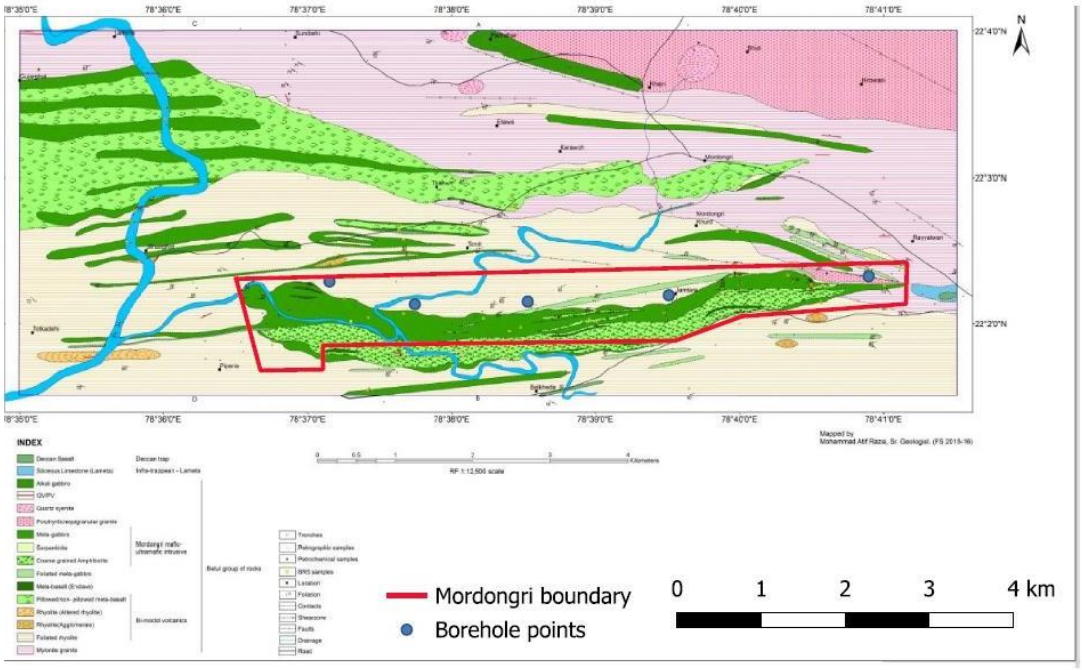


Anx-8

Sampling Plan
Jamtara Mordongri PGE block
Area: 6.6 sq.km
Tehsil: Umreth
Dist: Chhindwara, MP

Anx-9

Borehole Plan
Jamtara Mordongri PGE block
Area: 6.6 sq.km
Tehsil: Umreth
Dist: Chhindwara, MP



Anx-10

S. No.			1	2	3	4	5	6	7	8		9	10	11	12	13	14	15	16	17
1	Camp Setting	Months																		
2	Geological Mapping & Sampling	Months																		
3	Geophysical survey	Months																		
5	Pitting/Trenching	Months																		
6	Surface Drilling (1 rigs)	Months																		
7	Survey Party days	Months																		
8	Geologst Man days	Months																		
9	Geophysict man days	Months																		
9	Sampler Man days	Months																		
10	Camp Winding	Months																		
11	Laboratory Studies	Months																		
12	Report Writing with Peer Review	Months																		

R e v i e w

Note: -

Commencement of Project may be reworked from the day of exploration area is available with all Statutory Clearance.

Time loss due to monsoon / agricultural activity / forest clearance / local law & order problem(s) may be additional to the above timeline.