PROPOSAL FOR RECONNAISSANCE SURVEY (G-4 STAGE) FOR GOLD AND ASSOCIATED MINERALS IN PARMA BLOCK (133.00 SQ.KM) DISTRICTS: SINGRAULI, MADHYA PRADESH

COMMODITY: Gold and Associated Minerals

BY

MINERAL EXPLORATION AND CONSULTANCY LIMITED

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SEMINARY HILLS

PLACE: NAGPUR

DATE: 14.02.2024

Summary of the Block for Preliminary Exploration (G-3 Stage)

1.	Features	Details
	Block ID	Parma
	Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
	Commodity	Gold and Associated minerals
	Mineral Belt	Karhiya Thapna Ultrmafic belt, Mahakoshal
	Budget & Time schedule to complete the project	Rs. 185.19 lakhs & 10 months
	Objectives	The Mahakoshal belt represents a volcano-sedimentary sequence exposed proximal to the ENE-WSW to E-W trending Son-Narmada Lineament Zone (SNLZ) in the Central India and has an aerial extent of approximately 9000 sq. km. The Paleoproterozoic Mahakoshal belt is well known for hosting numerous economic mineralization like Sulphides, Gold, PGE, Manganese, Iron (BHJ/BMQ) etc. The presence of supporting lithology for PGE, Gold and associated mineralization viz. BIF, phyllite, quartzite and mafic-ultramafic rocks respectively encourages in taking up the G-4 Exploration in the area. Based on the evaluation of exploration data of previous work, the present exploration program has been formulated to fulfil the following objectives: i) To carry out regional geological mapping on 1: 12500 scale for demarcation of, Gold and associated mineral bearing formations (host rock) with the structural features to identify the surface manifestations and lateral disposition of the mineralized zones. ii) To collect surface (chip/Channel) samples & analyze for Gold and Associated Minerals from ultramafics, ferruginous chert, cherty quartzite, BHQ,

		graywake and Phyllite and from the contact of BHQ/BMQ and phyllite and decide further course of Exploration program. iii) To carry out trenching to expose Ultramafic, BHQ for Gold and Associated mineral bearing formations concealed under soil. iv) If phase-I surface samples and mapping data will give encouraging results, 500m of drilling shall be done in the anomalous zones designated after the geochemical and trench sampling, to establish the lateral and depth continuity of the mineralization which in turn will decide the future course of Exploration program at G-3 category of UNFC. This will further facilitate the state government to put up the block for auctioning. v) To estimate geological resources, if any (334 category) of Gold and associated minerals 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).
	Name/Number of Geoscientists	
	Expected Field days(Geology, Geophysics, surveyor)	Geologist Party days: Field -180 days & HQ-70 days
		Sampling Party days: 70 days

<table>
<tr><td>1.</td><td>Location</td><td></td></tr>
<tr><td></td><td>Latitude and Longitude</td><td>
<table>
<tr><th rowspan="2">Cardinal Point</th><th colspan="2">DMS (WGS 84)</th><th colspan="2">44N Zone</th></tr>
<tr><th>LONGITUDE</th><th>LATITUDE</th><th>Northing</th><th>Easting</th></tr>
<tr><td>A</td><td>82° 14' 53.4838" E</td><td>24° 25' 57.1779" N</td><td>626533.43</td><td>2702687.277</td></tr>
<tr><td>B</td><td>82° 17' 29.8413" E</td><td>24° 26' 17.7505" N</td><td>630930.932</td><td>2703360.48</td></tr>
<tr><td>C</td><td>82° 17' 29.9593" E</td><td>24° 24' 59.8969" N</td><td>630956.586</td><td>2700965.675</td></tr>
<tr><td>D</td><td>82° 25' 00.4105" E</td><td>24° 24' 59.8683" N</td><td>643644.269</td><td>2701088.781</td></tr>
<tr><td>E</td><td>82° 25' 00.7158" E</td><td>24° 24' 38.9273" N</td><td>643659.454</td><td>2700444.687</td></tr>
<tr><td>F</td><td>82° 27' 28.8957" E</td><td>24° 24' 49.4414" N</td><td>647830.062</td><td>2700811.41</td></tr>
<tr><td>G</td><td>82° 27' 29.8136" E</td><td>24° 22' 28.7801" N</td><td>647901.413</td><td>2696484.649</td></tr>
<tr><td>H</td><td>82° 16' 34.6252" E</td><td>24° 21' 23.6879" N</td><td>629459.22</td><td>2694300.541</td></tr>
<tr><td>I</td><td>82° 13' 41.5539" E</td><td>24° 23' 50.5255" N</td><td>624542.251</td><td>2698773.309</td></tr>
</table>
</td></tr>
<tr><td></td><td>Villages</td><td>Parai, Bharra, Bichhiya, Parma, Karlo</td></tr>
<tr><td></td><td>Tehsil/Taluk</td><td>Chitrangi</td></tr>
<tr><td></td><td>District</td><td>Singrauli</td></tr>
<tr><td></td><td>State</td><td>Madhya Pradesh</td></tr>
<tr><td>2.</td><td>Area (hectares/ square kilometres)</td><td></td></tr>
<tr><td></td><td>Block Area</td><td>133.00 sq.km</td></tr>
<tr><td></td><td>Forest Area</td><td>Partial Forest Land (the ridges are occupied by forest)</td></tr>
<tr><td></td><td>Government Land Area</td><td>Data not available</td></tr>
<tr><td></td><td>Charagaha</td><td>Data not available</td></tr>
<tr><td></td><td>Private Land Area</td><td>Most of the area is covered under forest especially the hilly ridges. The remaining area is cultivated private land.</td></tr>
<tr><td>3.</td><td>Accessibility</td><td>Parma block, bounded by the latitudes 24° 21' 23.69" N - 24° 26' 17.75" N and longitudes 82° 13' 41.55" E and 82° 25' 00.72" E (Topo Sheet No. 63L/03 & 63 L/07) is located in the northern part of Singrauli district.</td></tr>
<tr><td></td><td>Nearest Rail Head</td><td>Singrauli (SGRL) railway station on the East Central Railway is 60 km from the block. The block is about 70 km from Sidhi town.</td></tr>
<tr><td></td><td>Road</td><td>It is located 60 km towards North from District headquarters Singrauli via Singrauli-Chitrangi Road. It is about 700 km from State capital Bhopal via</td></tr>
</table>

		NH-45 and NH-30.
	Airport	Bamrauli Airport (Prayagraj) is the nearest airport situated 220 km from the block.
4.	**Hydrography**	
	Local Surface Drainage Pattern (Channels)	The drainage pattern is mainly dendritic to sub dendritic in nature.
	Rivers/ Streams	The northern part of the area is drained by a few northerly flowing first and second order streams, which join together to form the Gopad River. Tributaries of southerly flowing Semra Nala drain the southern part of the area. A few perennial springs discharging good amount of potable water are seen along mappable faults in areas southeast of south of Parma. The drainage pattern in plains is sub-dendritic and in hilly terrain it is sub-parallel.
5.	**Climate**	
	Mean Annual Rainfall	The normal rainfall of the region is about 1100 mm.
	Temperature	Minimum temperature 4^{O}C. Maximum temperature up to 45^{O}C.
6.	**Topography**	
	Toposheet Number	63L/03 and 63L/07
	Morphology of the Area	The hilly part of the area is thickly forested with large varieties of trees and thorny xerophytic shrubs and bushes. The area in valleys, which is almost a plain, is mostly under cultivation. The undulating areas in the valleys are partly occupied by thick forest.
7.	**Availability of baseline geosciences data**	
	Geological Map (1:50K/25K)	1:50K Geological Map (Source: NGDR)
	Geochemical Map	NGCM data available.
	Geophysical Map (Aeromagnetic,	NGPM data available.

	ground geophysical, Regional as well as local scale GP maps)	
8.	**Justification for taking up Reconnaissance Survey/ Regional Exploration**	i) The Mahakoshal Group is characterized by a greenstone-banded iron formation comprising orthoquartzite, metalavas, dolomites, tuffs, phyllites, banded hematite-magnetite quartzite/jasper and carbonatite pillow lava, dolerites, and volcanic agglomerate. The meta-volcano sedimentary assemblage of the Mahakoshal Group in parts of Sidhi, Singrauli and Sonbhadra districts, M.P. and U.P. is an important Proterozoic metallogenic province of Central India. ii) Geological Survey of India has been actively engaged in delineating the occurrences of gold and base metal mineralization in Mahakoshal Group of rocks for more than four decades. During field season 1971-72, Geological survey of India carried out Airborne Geophysical survey, which included Multi-sensor (Electromagnetic, Magnetic, and spectrometric) survey in parts of Jabalpur, Rewa, Satna, Shahdol and Sidhi area (Madhya Pradesh) (Block-5, BRGM, CGG). It has brought out large number of aero electromagnetic and aeromagnetic anomalies in this area. In subsequent field seasons, the anomalies were checked to locate possible causative sources related to base metal mineralization in the area. Malachite and limonite encrustations in highly sheared/brecciated carbonaceous phyllites about 1.5 km SE of Majhigawan (63L/7), malachite stains, limonitized coatings and gossan materials about 1.5 km SE of Thapna (63L/7) and near Karhiya (63 L/7) have been noticed during ground evaluation of AEM anomalies (Shukla et. al., FS 1992-93). Anomaly near Karhiya is located over ultramafics which have analyzed 0.2 to 0.41% Cu, 0.38 to 0.59% Ni and gold values ranging from 0.18 and 0.11 ppm. Occurrence of Cu-Ni mineralization associated with an ultramafic body measuring 35m x 5m located about 1.5 km SE of Thapna was brought out by K.S. Thakur during FS 1993-94. The ultramafic body (20 samples) yielded 160 ppm -1.1% Cu, 610 ppm-0.49% Ni, and <0.1-0.27% Au. iii) As a follow-up, investigation for PGE and gold associated with copper and nickel mineralization in ultramafic- mafic suite near Thapna was carried out by Khadse & Roy of GSI during the Field Season 1995-96 and 1997-98 has been undertaken investigation of PGE, Gold, Copper and Nickel in Ultramafic-mafic rocks near Thapna and Karhiya, Sidhi district, M.P. GSI reported Chemical analysis of bedrock samples revealed anomalous content of gold. Samples of ultramafic rocks around Thapna have analysed 0.15% Cu, 0.20% Ni and 0.56ppm Au. Ultramafic body have recorded upto 200 ppb Pt, 8

		ppb Pd and 12 ppb Ir. Ultramafic rock samples from Karhiya have analysed 58 ppb Pt, 118 ppb Pd and 1.5 ppb Ir, 0.2ppm Au, 530ppm Cu & 710ppm Ni. On the basis of findings detailed investigation in terms of gold, PGE, Nickel and associated minerals were recommended. iv) Regional Geochemical Mapping carried out by Paul et. al. (2016) in parts of toposheet nos. 63L/3, 6 & 7 brought out higher concentration of Au found in northern part of toposheet nos. 63L03 & 07 at the contact of Mahakoshal and Semri Group of rocks which according to them could be taken up for further investigation. v) The EPMA study of few samples of Thapna-Garhor-Baghara area (Bage & Kinker, 2018) in parts of toposheet 64L/07, shows presence of Mg rich ilmenite, high TiO2 rich mineral phases, spinel, and chrome magnetite, which is an indicative of presence of possible lamproite and carbonatitic suite of rocks in the area which could have potential for REE mineralization. vi) During the 2021-22 field season, the Geological Survey of India (GSI) conducted a reconnaissance survey for gold and associated sulphide mineralization in a portion of Toposheet No. 63L/11. The survey identified banded iron formations (BIFs) across the block, trending ENE-WSW, with Fe_2O_3 content ranging from a high of 59.21% to a low of 31.11%. Additionally, one quartz vein sample (near Khatai turn), intruding within the BMQ, yielded 7,700 ppb of gold, while another sample showed 470 ppb of gold. Based on these findings, further investigation was recommended. vii) GeoMysore Services (India) Pvt. Ltd. carried out exploration work during the year 2003 to 2006 in and around Sidhi covering an area of 2700 sq km. In the course of the exploration, stream sediment shows more than 30 ppb Pt+Pd and rock chip samples in meta-basalt and volcanoclastics showed more than 30 ppb of Pt+Pd from the Thapna area. viii) The NGCM data obtained from the NGDR portal has been used to create a contour map. This map highlights significant nickel enrichment in the central and eastern regions of the proposed block, with the Amanous area exhibiting nickel concentrations exceeding 200 ppm. ix) The Geology with the aeromagnetic data reveals moderately strong aeromagnetic response over the sequence of metavolcanics with partings of BIF. It is very clear on the aeromagnetic profiles. The aeromagnetic response is low over the sequence of sandstone. The ultramafic body south of Parma is located closer to the linear magnetic response. A few linear zones of high-grade electromagnetic anomalies with slow decay ratio

		probably cause due to alteration of rocks, bands of iron rich formations and carbonaceous phyllite. x) Overall, the rock formations in the area exhibit similarities to those found near Thapna and Karhiya. Previous studies by the GSI have identified these formations as ultramafic-mafic, which are considered promising for gold and nickel, along with grey phyllite and BIF, which are significant for gold exploration. Given this potential, a G-4 stage exploration has been planned to cover a wider region, including the Parma, Bharra, and Karlo areas. xi) The Reconnaissance survey will help in planning of higher stages of exploration program (in case upgraded to G-3 level) which in turn will facilitate the state Government for Auction of the block.

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1.0.0 Preamble

1.1.1 Gold in its purest form is a bright, slightly reddish yellow, dense, soft malleable and ductile metal. It is one of the least reactive chemical elements and is solid under standard conditions. Gold often occurs in free elemental (native) form, as nuggets or grains, in rocks, in vein and in alluvial deposits. Gold dissolves in alkaline solution of cyanide, which are used in mining and electroplating. It also dissolves in mercury, forming amalgam alloys, but this is not a chemical reaction. Gold is resistant to corrosion and to most acid and has unique properties distinct from other metals. Gold is a relatively scarce metal in the world and a scarce commodity in India. The domestic demand is mainly met through imports.

1.1.2 As per NMI data, based on UNFC system, as on 1.4.2020, the total reserves/resources of gold ore in the country have been estimated at 518.23 million tonnes. Out of these, 23.72 million tonnes were placed under Reserves category and the remaining 494.50 million tonnes under Remaining Resources category. The total reserves/resources of gold (primary), in terms of metal stood at 607.26 tonnes. Out of these, 92.76 tonnes were placed under Reserves category and 514.50 tonnes under Remaining Resources category. The resources include placer-type gold ore in Kerala estimated at 26.12 million tonnes containing 5.86 tonnes gold metal.

1.1.3 The world reserves of PGM are estimated at 69,000 tonnes concentrated mostly in South Africa (91%) followed by Russia (6%), Zimbabwe (2%) and USA (1%). India is not producing platinum group of elements in the country and is meeting its demand entirely by imports. The demand for PGEs is expected to touch 120 tonnes by 2025, as per the report of the Sub-Group for 12th Plan period.

1.1.4 Nickel is a lustrous, silvery-white metal and is the fifth most common element of earth's crust. Nickel is used in making of stainless steel, catalyst for chemical industries, as an electroplating material, heat resistant alloys, alloying element for non-ferrous metals, space, defence & rocket industries and nickel cadmium batteries.

1.1.5 The world reserves of nickel are estimated at 89 million tonnes of metal content. Indonesia (24%), Australia (22%), Brazil (12%), Russia (8%), Cuba (6%) and Philippines (5%) are the major countries having reserves of Nickel. Nickel is not produced from primary

sources in the country and the entire demand is met through imports. However, HCL is planning to recover nickel as a by-product in the form of nickel sulphate during refining of copper at Ghatsila copper smelter of Hindustan Copper Ltd (HCL) in Jharkhand. Zone A-Chiria, Noamundi, Kiriburu, Meghahatuburu, Thakurani, Bolani, Gua, Malangtoli, Gandhamardan, Daitari.

1.1.6 China and India are moving forward with large scale plans to reduce the amount of carbon emission in their respective countries. Currently, more than half of platinum and palladium mineral goes into making catalytic converters in automobiles. Automobiles that run on diesel predominantly use platinum for catalytic conversion. The chemical inertness and refractory properties of these metals are conducive for their applications in electrical, electronics, dental, medical fields and glass industry. These metals are also used as catalyst in various chemical processes, viz, in organic synthesis in hydrogenation, de-hydrogenation and isomerisation, production of nitric acid, the raw material for the manufacture of fertilizers, explosives & polymers and fabrication of laboratory equipment. In addition, platinum, palladium and a variety of complex gold-silver-copper alloys are used as dental restorative materials. The non-corrosive and nonallergic properties of platinum find varied applications in the medical field. Platinum's excellent compatibility with living tissue unaffected by the oxidising reaction of blood, enables its utility in pacemakers.

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

1.1.8 Subsequently, after receipt of consent from DMG (vide letter no. 8772 dated 11/07/2024), Madhya Pradesh to take up exploration work, MECL has prepared an exploration proposal for reconnaissance survey (G-4) for Gold and associated in Parma Block in Singrauli district of Madhya Pradesh and submitted to NMET for taking up for discussion in forthcoming TCC.

2.0.0 Background

2.1.1 The Exploration for strategic, critical, rare metals, rare earths elements and precious metals is given top priority by Govt. of India after amendment of MMDR act. Moreover, emphasis has been given to explore the more numbers of blocks. Keeping this in view, the present proposal Reconnaissance Survey (G-4 stage exploration) for Gold and associated

minerals in Parma Block, District: Singrauli, Madhya Pradesh is being put up for evaluation under NMET funding and execution.

3.0.0 Location and Accessibility

3.1.1 Parma, Bharra, Karlo and Karthua villages are located in Chitrangi Tehsil of Singrauli district in Madhya Pradesh, India. It is located 60 km towards North from District headquarters Singrauli via Singrauli-Chitrangi Road. It is about 700 km from State capital Bhopal via NH-45 and NH-30.

3.1.2 Parma block, bounded by the latitudes 24° 21' 23.69" N - 24° 26' 17.75" N and longitudes 82° 13' 41.55" E and 82° 25' 00.72" E (Topo Sheet No. 63L/03 & 63 L/07) is located in the northern part of Singrauli district. Singrauli (SGRL) railway station on the East Central Railway is 60 km from the block. The block is about 70 km from Sidhi town.

3.1.3 The Co-ordinates of the corner points of the block are given in both DMS in **Table No.-I**.

Table No. I: Co-Ordinates of the Corner Points of the Parma Block (WGS-84)

Cardinal Point	DMS (WGS 84)		44N Zone	
	LONGITUDE	LATITUDE	Northing	Easting
A	82° 14' 53.4838" E	24° 25' 57.1779" N	626533.43	2702687.277
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4.0.0 Physiography and Drainage

4.1.1 Topography of the area is hilly and rugged with a series of ENE-WSW trending parallel, linear ridges having steep slopes. The highest elevation (574 m) is seen on top of the ridges at 1.30 km NW of Parma village. The general elevation of other ridges is varying from 340 to 440 m and elevation of plains is about 300 m. The plains around Dhavai, Bichhiya, Bahera and Parai are under cultivation.

4.1.2 The northern part of the area is drained by a few northerly flowing first and second order streams, which join together to form the Gopad River. Tributaries of southerly flowing Semra nalla drain the southern part of the area. A few perennial springs discharging good amount of potable water are seen along mappable faults in areas south of Parma. The drainage pattern in plains is sub-dendritic and in hilly terrain it is sub-parallel.

5.0.0 Climate

5.1.1 The climate of the area is characterized by hot summer, cold winter & well distributed rainfall during south west monsoon. The year can be divided into four seasons. The winter comes at far end of November and lasts till first week of March. The period for March to middle of June conditions hot weather. May is the hottest month of the year. The south west monsoon starts form middle of June and continues till end of September. The daily mean maximum temperature in May is 45° C and daily mean minimum is 25° C. The day temperature on individual days during the period April to first week June gets up to 44° C to 45° C. January is generally coldest month of the year. The maximum daily mean temperature in January is 24° C and minimum daily temperature about 4° C. Monsoon is active between July and September and annual rainfall is around 1100 to 1600 mm.

6.0.0 Flora and Fauna

6.1.1 The area under investigation is largely covered by dense, thick forest, with some sections consisting of revenue land primarily used for agriculture. Many temperate forests with a thick canopy and tall grasses, reaching up to six feet, are prevalent. Wild shrubs, particularly jungle tulsi, dominate the remaining forested areas, creating a habitat for a wide variety of fauna. The principal tree species include Sal (*Shorea robusta*), Saja, Tendu (*Diospyros melanoxylon*), Dhaora (*Woodfordia fruticosa*), Salai (Boswellia serrata), Shisam, Mahua (Madhuca indica), Palas, and Bhira. In the dry mixed deciduous forest, species like Axe-wood (*Anogeissus latifolia*) and Bijasar (*Pterocarpus marsupium*) are common, while shrub forests feature Katha (*Acacia catechu*), Ber (*Ziziphus jujuba*), and Karanda (*Carissa spinarum*).

6.1.2 The area is also rich in wildlife, including monkeys, foxes, snakes, hares, scorpions, hyenas, and sambars.

7.0.0 Regional Geology

7.1.1 The volcano-sedimentary sequence of the Mahakoshal Belt (MB) extends from Barmanghat in Narsinghpur to Palamau in Bihar, with a maximum width of approximately 20 km and a length of about 600 km, covering an area of around 9,000 sq km. To the west of this belt lies the Harda inlier (Ramakrishnan & Vaidyanadhan, 2010). The MB is bounded by two major faults. In the north, it is separated from the Proterozoic Vindhyan Basin by the Son Narmada North Fault (SNNF) and Son Narmada South Fault (SNSF), with local slivers of Sidhi gneiss, which are considered equivalents of Bundelkhand granite. In the south, the MB

is largely divided from the Proterozoic gneiss and granites of the Central Indian Tectonic Zone (CITZ) by the SNSF. Much of the MB is covered by Deccan Trap, Gondwana sediments, and Quaternary alluvium. The general trend of the MB is east-west to ENE-WSW, and the area of investigation is situated in its eastern part.

7.1.2 MB is composed of quartzite, carbonate, chert, BIF, graywacke-argillite and mafic volcanic due to which some of the authors called it as greenstone belt rather the term is not appropriate since the belt has predominant sediments rather than basic volcanics or greenstones.

7.1.3 Nair et.al. (1995) has carried out work in MB and proposed three-fold stratigraphic classification to the belt. The three formations in the order of younging are Chitrangi formation, Agori Formation and Parsoi Formation. The Chitrangi Formation is mainly dominated by the mafic and ultramafics with sedimentary sequences of BIF interbanded with Metabasalt. Main lithology exposed in the lower part of MB is metabasalt in deformed form, grading in to schist rock and pillow basalt that at places is weathered and deformed also. Younger to Chitrangi formation is Agori Formation that is exposed in the eastern as well as western part of MB.

7.1.4 The Agori Formation is characterized by chemogenic sediments such as carbonates, cherts, and banded iron formations (BIF), interlayered with phyllite and schist. The phyllite has undergone metamorphism, transitioning from greenschist facies to lower amphibolite facies. The Parsoi Formation of the Mahakoshal Belt (MB) is dominated by clastic sediments, with thick sequences of argillites and greywacke interspersed with quartzite bands. It also contains BIF, phyllites, and garnet-bearing Banded Magnetite Grunerite Quartzite (BMGQ), forming the upper part of the MB. Over time, significant revisions to the MB stratigraphy have been made by various researchers. Recently, Roy and Devrajan (2000) and Devrajan (2006) introduced changes to the stratigraphic nomenclature. They identified the younger formations in the Chitrangi-Deosar and Gurhar Pahar areas as the Dudhmaniya Formation, part of the Parsoi Formation, consisting of BIF-argillite sequences. They also renamed the Agori Formation as the Sleemnabad Formation. The eastern part of the MB, where all these formations are well exposed, has been extensively studied and established by many researchers.

7.1.5 Lastly at the closing of the basin the MB have been intruded by ultramafic –mafic, alkaline rocks and granitoids during the time gap of 2.045 Ga to 1.75 Ga (Sarkar, et al., 1995; Roy and Deverajan, 2000). These granotids play an important role in the crustal evolution

and formation of Mahakoshal belt. The most recent work related to the geology of MB has been carried out by Devrajan in 2006.

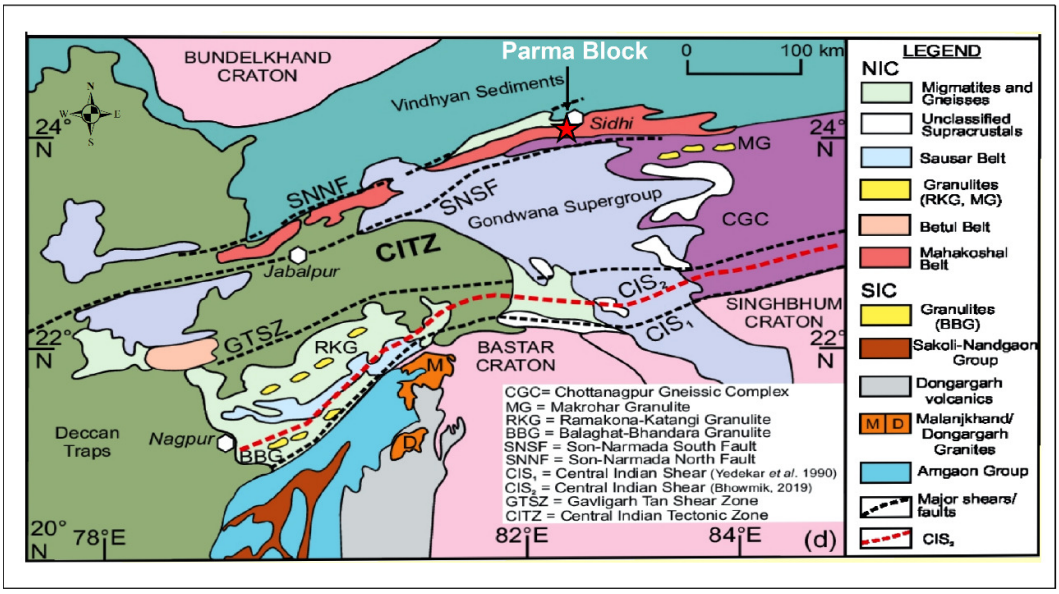

Fig-1 Map showing Mahakoshal Group and the proposed G4 block (Modified after Bora, S and Kumar, S., 2015)

7.1.6 The stratigraphic Succession of the Mahakoshal Group is as followed:

Akhilesh Narayan and Thambi (1979)	P.I. Thambi and L.Gurusiddappa (1980)	Mishra and Tripathi (1990)
Alluvium Gondwana **Lower Vindhyan—**Semri Sandstone -----Angular unconformity---- **Jungel Group-** Orthoquartzite, purple shale, limestone, pocket of porcellanite, Gopad conglomerate and feldspathic quartzite. -------- Disconformity-------- **Intrusive- P**egmatite, quartz vein, Barambaba granite, basic, ultrabasic rocks **-------- Intrusive contact-------** **Mahakoshal Group Supracrustal** BMQ, BHQ, Ferruginous rock with BHJ, Carbonaceous phyllite/tuffs, basic schist, Dolomite, orthoquartzite ---- unconformity faulted------ Greenstone granite belt- Granite gneiss, migmatite and granite, Amphibolite/talc chlorite schist, Older sediments- Garnetiferous grunerite mag.qtz. Biotite-garnet schist. Staurolite-garnet schist. Basement not exposed	Recent to Quarternary –Alluvium/Laterite conglomerate,grit and shale (semi consolidated but well jointed) ----Unconformity------ **Jungel Homotexial to Semri Group** Porcellanite and shale, Glauconitic sandstone and shale, Conglomerate -----Disconformity----- Orthoquartzite, lower purple shale, Orthoquartzite with conglomerate at base, Upper purple shale ---------- Angular unconformity— Younger intrusive – Feldspathic rocks, Lamprophyre,and carbonatite,pyroxenite,lherzolite and Gabbro/dolerite -------- intrusive contact---------- Mahkoshal Group of rocks- **Agori Formation:** Metavolcanic agglomerate/ breccia, lapilli tuff mafic and ultramafic lavas, carbonatite and basaltic pillow lavas Banded haematite/ magnetite quartzite, ferruginous, phyllite, grunerite/ actinolite garnet magnetite quartzite **Parsoi Formation**; Phyllites, Sericite schists, garnet mica schist (tuffaceous chloritic, carbonaceous) with intercalations of intraformational conglomerate, greywacke, feldspathic quartzite, orthoquartzite and lenses of Limestone.	Recent to Sub-recent –Alluvium ---------unconformable contact--------- **Vindhyan Supergroup:** Conglomerate, Orthoquartzite, shale, sandstone, Porcellanite ----Unconformable and faulted contact with Mahakoshal Group of rocks----- **Intrusive:** Pyroxenite, lherzolite, kimberlite, Gabbro, carbonatite, quartz epidote calcite veins **Jungel Group:** white and purple sst, purple shale,porcellanite and conglomerate, ----- Unconformable and faulted contact----- **Mahakoshal Group of rocks** Intrusive: Qtz veins, qtz epidote veins, quartz epidote calcite veins, and dolerite dykes, barambaba granite. Mafic to ultramafic metalavas,agglomerate, volcanic breccia, tuff, carbonatite and basaltic lava flows. Agori Formation: Banded haematite/ magnetite quartzite, ferruginous, phyllite, chert breccia, ferrugenous chloritic, argillaceous and tuffaceous phyllite, feldspathic quartzite, basic schist, limestone and dolomite. ------Faulted contact---------- Parsoi Formation: Chloritic, ferrugenous, tuffaceous and arenaceous phyllite, greywacke, garnet, amphibole rocks, metabasic, intraformational conglomerate --------Faulted contact------ Archean- Granite gneiss

Table V: Regional Stratigraphy of Mahakoshal Group of rock after Narain and Thambi et.al (1979), Thambi and Gurusiddappa (1980) and Mishra and Tripathi (1990)

8.0.0 Regional Structure

8.1.1 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).

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).

8.1.2 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.

9.0.0 Geology of the Block

9.1.1 Geologically, the area exposes rocks from the Mahakoshal Supracrustal Belt, dating back to the Archean to Lower Proterozoic era. The region contains rocks from the Parsoi, Agori and Chitrangi Formations (Nair et al.). Ridges in the area are composed of Banded Iron Formations (BIFs) and metabasalt, while the low-lying regions are dominated by phyllites. This area is part of the ENE-WSW trending Son-Narmada composite megalineament zone, where the Mahakoshal Group of rocks is exposed as a linear supracrustal belt trending in the same direction. Nair et al. (1985) and Jain et al. (1995) subdivided the Mahakoshal Belt into

the Chitrangi, Agori, and Parsoi Formations. The Chitrangi Formation consists of highly altered peridotitic lava, metabasalt with pillow structures, epidiorite, agglomerate, and calc-chlorite schist in the lower sections, with minor andesitic lavas in the upper layers. The Agori Formation, which lies above the Chitrangi Formation, includes tuffs with metabasic lenses, BIFs, and quartzite. The Parsoi Formation is characterized by phyllites with intercalated quartzite bands. The main rock types exposed are:

i) **Banded Magnetite Quartzite/Jasper:** Banded Iron Formation in the area is exposed in the form of Banded Magnetite Quartzite (BMQ) and at places magnetite is interbanded with Jasper (BMJ) in place of quartzite. The bands follow regional strike i.e. ENE-WSW direction dipping steeply towards south.

ii) **Metabasalt:** Metabasalts occupy mostly the ridges of the area. Vesicular metabasalt, carbonated metabasalts, amygdaloidal metabasalts, olivine metabasalts and ferruginous metabasalts are the different types observed in the area. Among all the types carbonated metabasalt was the most extensive lithology exposed.

iii) **Phyllite:** Chlorite phyllite occupies the southern part of area, particularly around Bairdah. Discontinuous exposures of chloritic-greenish phyllite are seen in the nallas at about 2 km, WNW of Thapna on northern side of the BIF ridge. Exposures of altered greenish chlorite phyllite are seen in largely alluvium-covered area at 1.75 km east of Thapna. In the southwestern part of the area covered it is well exposed around Gajrol. Thin cover of Vindhyan sediments rests over the chlorite phyllite in southern part, particularly the ridges and mounds are occupied by conglomerate/breccia and coarse grained sandstones. Sericite phyllite is well exposed in road and nalla cuttings around Kovandal and Harphari. It is separated from chlorite phyllite by a thin persistent band of iron formation. A small mound at 800 m ESE of Dhavai exposes weathered phyllite. The fine grained, highly altered, folded, thinly foliated rock type is intruded by numerous, thin quartz veins which occur parallel to the foliation planes. In the area at about 500 m south of Kovandal and sericitic phyllite shows development of fairly large crystals of pyrite. A very well exposed sequence of sericite phyllite at 1.25 km north of Bairdah shows numerous, thin quartz veins of limited length along its foliation. Large numbers of joints are seen in the phyllite.

iv) **Ultramafic:** Few bodies of metapyroxenite in area 2 km ENE of Thapna. The metapyroxenites show variation in grain size. The details of ultramafic body exposed at SE of Karhiya given the detailed mapping. Two parallel basic dykes having almost N-S trend and exposed in area at 1 km SE of Thapna. One basic dykes having E-W trend exposed near Parma.

v) **Greywacke:** A thick sequence of greywacke is exposed around Thapna, Gorhar and Karhiya. The fine to medium grained, dark coloured, banded rock is highly jointed. At some places it shows large content of magnetite. Thin sections of this rock type exhibit bands of quartz with cubic crystals of opaques. A large number of thin bands of coarse grained, gritty arenite occur within the greywacke/phyllite sequence. At some places the arenite contains pebbles of phyllite. Graded bedding in the arenite indicates that the whole sequence is right side-up. A large number of compact, dark coloured, fine-grained magnetite (opaque)-quartz-chlorite rocks occur within the grey phyllite. These rocks being more resistant to weathering form more prominent outcrops, parallel to foliation of grey phyllite. Beautiful asymmetrical open folds are exhibited by phyllite exposed on a mound at 1 km ENE of Thapna. A small out crop of impure dolomitic rock is seen at 300 m north of Gorhar, a western side of a road to Dhani. Thin bands of ferruginous cherty rock occur within the sequence of grey phyllite. At some places the ferruginous chert contains rich pockets of iron ore. A few pits and slag dump closer to the banded ferruginous rocks indicate iron smelting activity in this area.

vi) **Quartzite:** The coarse-grained quartzite show graded and current beddings. Quartz veins occur mostly parallel to foliation planes. They are more common in sericite phyllite. The quartz veins have generally 30 to 40 cm width and a few metres length. A few quartz veins are seen in the metabasic rocks also. Large numbers of white quartz veins are seen in the arenites. Some of the quartz veins exhibit shearing and have vugs filled with reddish coloured oxidised material.

vii) **Carbonates:** The dolomitic limestones show nearly uniform characteristics and vary in colour from pinkish grey to light grey, probably suggestive of calcitic and dolomitic variants respectively. Some of the best exposures of carbonates are in the vicinity of the massive chert bands.

viii) **Sandstone:** Pinkish medium grained, hard and compact sandstone lithounit are exposed centre of the block. It is primarily made up of quartz, feldspar and iron oxides. Clasts of jasper, vein quartz, BIF and quartzite are also found to be embedded in the sandy matrix of it.

Lithostratigraphic succession of the Block

Age	Group	Formation	Lithology
Upper Proterozoic	Lr. Vindhyan		hale, porcellanite, Sandstone
Middle-Upper Proterozoic	Jungel Group		Conglomerate
Intrusive			Mafic/Ultramafic rock, quartz veins
Lower Proterozoic	Mahakoshal Group	Parsoi Formation	Chloritic, ferruginous, and arenaceous phyllites, metabasics, Intraformational conglomerate and orthoquartzite.
		Agori Formation	Pillow lava/Pillow basalt BIF, Marble/Dolomitic Marble (?) Agglomerate, Chert Breccia Metabasics, Quartzite Phyllite (variegated)
……. Basement is not exposed……			

10.0.0 Previous Work and its Recommendations

10.1.1 The volcano sedimentary sequences of Mahakoshal Group (MG) are the prime important part of investigation through decades by many researchers and scientist. Breakthrough work was carried out by Narain and Thambi (1978), who propounded the name of Mahakoshal over the historic name of the geographic name of Bijawars of Son valley. Among all the three parts, western, central and eastern, the later one has been extensively studied by the earlier workers. Predominance of clastic sediments over non-clastic in eastern part and non-clastic over clastic sediments in western part is the general character of MG. Mallet (1869) followed by Oldham et.al. (1901) has contributed to the scientific information about MG by conducting geological traverses in the area. Nair et.al. 1995 detailed the stratigraphy, structure and geochemistry of Mahakoshal Greenstone belt.

10.1.2 Gold exploration in the area was carried out by Khan et al., 1994 in Gurhar Pahar (part of toposheet no. 63L/11), Son valley gold belt, Singrauli district, Madhya Pradesh and

explained that gold mineralisation is mainly associated with bluish to grey quartz veins, quartzcarbonate sulphide veins and tuffaceous variegated and carbonaceous phyllite. Gold occurs in fine particles (30-50 micron in size) in native form. In Gurhar Pahar area gold mineralisation reported to have extended over a strike length of 3.4 km with a width varying 10-110 m with barren partings. Pockmarked with ancient workings were also reported.

10.1.3 Jha and Agasty (2008), Jha et al, 2001, 2002, Bage et.al. 2016, 2017 and Gupta and Maurya, 2019 had carried out investigation for gold prospect in different parts of eastern Mahakoshal belt among which chakariya gold prospect was carried out up to G-2 stage of investigation. Exploration for gold in Randhor area, Sidhi district, Madhya Pradesh (E-1stage) brought to light a 2.5 km long and 05 m to 10 m wide gold bearing zones with barren partings. The mineralised zone occurs within the Mahakoshal Group of rocks.

10.1.4 During the FS 2018-20 Singh et.al. from GSI NR has carried out Regional Mineral Targeting project in parts of toposheet no. 63L/07,10,11,12,14 and 15 and 63P/03,04 and 07 and prepared various prospective maps for localisation of gold mineralisation and other sulphides. They have collected 30 nos. BRS samples from the area and reported Au values ranging from 0.05 ppm to 0.12 ppm and one BRS shows value of 1.37 ppm.

10.1.5 Khadse and Roy (1997) carried out Investigation of PGE & Gold associated with Copper and Nickel mineralization in Ultra-Mafic suite near Thapna, Sidhi district, Madhya Pradesh. Chemical analysis of bedrock samples revealed anomalous content of gold. Samples of ultramafic rocks around Thapna have analysed 0.15% Cu, 0.20% Ni and 0.30 to 0.70 ppm Au. Ultramafic body have recorded upto 200 ppb Pt, 8 ppb Pd and 12 ppb Ir. Ultramafic rock samples from Karhiya have analysed 58 ppb Pt, 118 ppb Pd and 1.5 ppb Ir. Further investigation in terms of gold, PGE, Nickel and associated minerals were recommended.

10.1.5 Bage and Kewat (2016) undertook Geochemical Mapping of the Toposheet Nos 63L/11 and 64I/5(Part) in Sidhi District, Madhya Pradesh and Mirzapur District of Uttar Pradesh and had reported good values of Iron and gold in the area in soil samples.

10.1.6 Paul and Sikdar (2016) undertook Geochemical Mapping of the Toposheet nos 63L/3, 6 & 7 covering parts of Mirzapur district of Uttar Pradesh and Rewa & Sidhi districts of Madhya Pradesh. The concentration of Cr, Ni, Zr and Hg is considerably higher than the average crustal abundance of these elements. The values of Co, Cu, V, Zn, La, Ce, Nd shows slightly higher values as compared to the average crustal abundance of these elements but does not show any anomaly as none of these elements cross the threshold value. Higher concentration of Au was found in northern part of toposheet nos. 63L03 & 07 at the contact of Mahakoshal and Semri Group of rocks and recommended to be taken up for further

investigation. Presence of ultramafic and feldspathoid rocks in northern part of toposheeet no. 63L07 was recommended for further attention. Therefore, the area was recommended for further systematic geological prospecting of minerals of interest.

10.1.7 Maurya, Kewat and Gupta (2022) carried out Reconnaissance survey for Gold and basemetals in Mishirgawan area where they observed sulphide and iron mineralization. Sulphides in the area are observed mainly in the form of veins or in the disseminated forms. Iron mineralisation was observed in the form of Banded Magnetite Quartzite (BMQ) running all along the mapped area and striking the regional strike of Mahakoshal Belt. Sulphides of copper and iron in the form chalcopyrite, malachite and pyrite in vein of quartz carbonate and in disseminated form were observed within the carbonated metabasalt. They have reported the occurrence of gold mineralization in the area in different form within different lithounits which indicates the association of mineralization with the carbonates and/or quartz carbonate veins and quartz veins within the area. BIFs in the form of BMQ has yielded Fe_2O_3 varying from 24% to 59% can be explored for iron since the band is running along the strike throughout the mapped area and has considerable width varying from 10-20 m. It was mentioned that one sample of quartz vein (near Khatai turn) intruded within BMQ has yielded 7700 ppb of gold and other sample has yielded 470ppb of Au and thus recommended to be investigated further.

10.1.8 Apart from GSI, the GeoMysore (2006) Karnataka was engaged in exploration study for gold, PGE, Gold and Nickel in Sidhi district, Madhya Pradesh under Reconnaissance Permit. During the course of investigation Geomysore reported Stream samples with analytical values of more than 30 ppb of Pt+pd and rock chip samples with analytical value of more than 30 ppb of Pt.+Pb.

11.0.0 Objective of the exploration

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

11.1.2 Based on the evaluation of exploration data of previous work, the present exploration program has been formulated to fulfil the following objectives:

i) To carry out regional geological mapping on 1: 12500 scale for demarcation of Gold and associated mineral bearing formations (host rock) with the structural features to identify the surface manifestations and lateral disposition of the mineralized zones.

ii) To collect surface (Bedrock/Channel) samples & analyze for Gold and associated minerals zones and decide further course of Exploration program.

iii) To carry out trenching to expose Ultramafic, BHQ for Gold and Associated mineral bearing formations concealed under soil.

iv) If the surface sample data yields positive results, 500 meters of scout drilling will be conducted in the anomalous zones identified through geochemical analysis and trench sampling. The drilling aims to establish the lateral and depth continuity of the mineralization, which will determine the future course of the exploration program at the G-4 category under the UNFC. This will also assist the state government in preparing the block for auctioning.

v) To estimate geological resources (334 category) of gold if any as per UNFC norms and Minerals (Evidence of Mineral Content) Rules-2015 at G-4 level.

12.0.0 Scope of Proposed Exploration

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

i) Remote sensing studies

ii) Large scale Geological mapping (1:12500 scale)

iii) Surface sampling (Bedrock/Channel)

iv) Trench sampling

v) Drilling of 5 no of boreholes involving about 500m drilling with associated chemical analysis, physical analysis to observe the lateral and depth wise continuity.

vi) Geological report preparation.

13.0.0 Planned Methodology

The exploration program is proposed in accordance with the objective set for the Reconnaissance Survey (G-4) the block. The Exploration shall be carried out as per Minerals (Evidence of Mineral Contents) Rules-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.

14.1.1 Remote Sensing Studies

Remote sensing study shall be carried out in the entire 133.00 sq. km area to identify the lineaments, lithological contacts, other structural features and the mineral potential zones through mineral targeting process.

14.1.2 Geological mapping:

Detailed geological mapping on 1:12500 scale will be carried out in the entire 133.00 sq km of the block area by taking geological traverses. The contacts of different formations, identification of different lithological units, structural features, etc., will be carried out in detail. The geological map on 1:12500 scale will be generated based on the detail geological mapping of the block and interpretation of exploration data.

14.1.3 Geochemical Sampling

Surface sampling (Bed Rock/ Channel):

A total of 120 primary bedrock samples (from ultramafics, BIF, quartz veins, phyllite, etc.) will be collected and analyzed for gold. Additionally, 50 bedrock samples from ultramafic formations will be collected and analyzed for nickel, chromium, cobalt, molybdenum, copper, lead, zinc, bismuth, germanium, vanadium, and gallium. Total 12 no of check samples (10% external) will also be analyzed for Au and 5 nos. check samples analyses for Ni, Cr, Co, Mo, Cu, Pb, Zn, Bi, Ge, V and Ga. 20 nos. of bedrock samples from ultramafics kept for PGE analysis.

14.1.4 Trenching

A total of 150 cu.m trenching have been proposed in the area to ascertain the continuity of gold and associated mineralization identified during the mapping. Hence, a total of 130 nos of primary samples would be collected & 10% of Primary samples i.e. 13 samples will be sent to NABL External Labs for Gold and associated minerals as mentioned in the attached cost sheet.

14.1.5 Petrological & Mineralogical Studies:

During the course of geochemical sampling and core logging 20 nos. of samples from various litho units from surface will be studied for petrography in thin section and 15 samples from mineralized zones will be studied for the mineragraphy in polished sections.

14.1.6 Drilling:

A provision of 500m drilling in 5 boreholes (scout) has been kept subject to surface samples analytical results to delineate the vertical and lateral continuity of mineralization.

A total of 100 nos. of primary samples from borehole cores will be collected and analyzed for Gold and 50 nos. of samples collected for Ni, Cr, Co, Mo, Cu, Pb, Zn, Bi, Ge, V and Ga. Total 10 no of check samples (10% external) will also be analyzed for Gold and 5 nos. check samples for Ni, Cr, Ni, Co, Mo, Cu, Pb, Zn, Bi, Ge, V and Ga.

14.1.7 **Whole Rock analysis**

Whole Rock analysis for SiO_2, Al_2O_3, Fe_2O_3, TiO_2, MnO, CaO, MgO, Na_2O, K_2O, $+H_2O$, P_2O_5, CO_2, Ba, Rb, Sr, Y, Zr, Nb & S radicals will be carried out on 20 nos. of rock samples to check the rock types, their variation in chemical composition.

15.0.0 Nature, Quantum and Target

15.1.1 The particulars and quantum/ target of the exploratory work envisaged are tabulated in **Table No.-II.**

Table No-II: Envisaged quantum of proposed exploratory work in Parma Block

Sl. No.	Item of Work	Unit	Proposed Quantum of work
1	Geological Mapping (on 1:12500 Scale)	sq km	133.00
2	Survey Work		
	ii) Bore Hole Fixation, RL & Block Coordinate Determination by DGPS	Nos	5
3	Trenching	cu m	150
4	Core Drilling (5 bhs)	m	500
5	Sample Preparation & Chemical Analysis		
6	Primary samples for PGE, Gold & Associated minerals (Channel /Core Samples)		
A.	Primary samples for Au by fire assay	Nos.	300 (Surface+Trench+BH)
B.	External (10%) Check samples for gold by fire assay	Nos.	30
C	Primary samples for Cr, Ni, Co, Ag, Mo, Cu, Pb, Zn, Bi, Ge and Ga by AAS.	Nos.	150 (Surface+Trench+BH)
D	External check samples for Cr, Ni, Co, Ag, Mo, Cu, Pb, Zn, Bi, Ge and Ga by AAS.	Nos.	15
7	Trace Elements Studies (34 Elements)	Nos.	20
8	Primary samples for PGE	Nos.	20
9	Whole Rock Analysis (Ultramafic and Mafic rocks) SiO_2, Al_2O_3, Fe_2O_3, TiO_2, MnO, CaO, MgO, Na_2O, K_2O, $+H_2O$, P_2O_5, CO_2, Ba, Rb, Sr, Y, Zr, Nb & S	Nos.	20
9	Petrographic Studies	Nos.	20
10	Mineragraphic Studies	Nos.	15

Sl. No.	Item of Work	Unit	Proposed Quantum of work
11	Specific Gravity	Nos.	5
12	Report Preparation (Digital format)	Nos.	1

16. 0.0 The **Manpower deployment**

Manpower deployment List may be provided later.

17.0.0 Break-up of Expenditure

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 and the total estimated cost is **Rs. 189.98 Lakhs.** The summary of tentative cost estimates for Reconnaissance Survey is given in **Table No.-IV** and a detail of tentative cost estimates is given as annexure**.** Tentative Time schedule/action plan for proposed Reconnaissance Survey (G-4 Level) for Iron and associated minerals is given in **Table No.-V.**

Table No-IV: Summary of Tentative Cost Estimates for Reconnaissance Survey (G-4 Level)

Sl. No.	Item	Total Estimated Cost (Rs.)
1	Geological Work	3,393,640.00
2	Trenching	499,500.00
3	Drilling	7,055,280.00
4	Geophysical survey	1,718,693.00
	Sub total	**12,667,113.00**
5	Laboratory Studies	2,351,415.00
	Sub total	**15,018,528.00**
6	Report	750,926.40
7	Peer Review	30,000.00
8	Proposal Preparation	300,370.56
9	**Total**	**16,099,824.96**
10	GST (18%)	2,897,968.49
Total cost including 18% GST		**18,997,793.45**
SAY, in Lakhs		**189.98**

Table No-V: Timeline for Reconnaissance Survey (G-4 Level) for Gold and associated minerals in Parma Block, Districts: Singrauli, State: Madhya Pradesh

		1	2	3	4	5		6		7	8	9	10
1	Camp Setting												
2	Geological Party Days												
3	Trenching & Sampling												
4	Sample Preparation												
5	Laboratory Studies												
6	Geophysical survey												
7	DGPS survey /BH Fixation						Review		Review				
8	Core Dilling												
9	Camp Winding												
10	Geologist Party days, HQ												
11	Geological Report Writing												
12	Peer Review												
* Commencement of project will be reckoned from the day the exploration acreage is available along with all statutory													
* Time loss on account of monsoon/agricultural activity/forest clearance/local law and order problems will be addition to													

18.0.0 Justification:

18.1.0 The Mahakoshal Group is characterized by a greenstone-banded iron formation comprising orthoquartzite, metalavas, dolomites, tuffs, phyllites, banded hematite-magnetite quartzite/jasper and carbonatite pillow lava, bombs, and volcanic agglomerate. The meta-volcano sedimentary assemblage of the Mahakoshal Group in parts of Sidhi, Singrauli and Sonbhadra districts, M.P. and U.P. is an important Proterozoic metallogenic province of Central India.

18.2.0 Geological Survey of India has been actively engaged in delineating the occurrences of gold and base metal mineralization in Mahakoshal Group of rocks for more than four decades. During field season 1971-72, Geological survey of India carried out Airborne Geophysical survey, which included Multi-sensor (Electromagnetic, Magnetic, and spectrometric) survey in parts of Jabalpur, Rewa, Satna, Shahdol and Sidhi area (Madhya Pradesh) (Block-5, BRGM, CGG). It has brought out large number of aero electromagnetic and aeromagnetic anomalies in this area. In subsequent field seasons, the anomalies were checked to locate possible causative

sources related to base metal mineralization in the area. Malachite and limonite encrustations in highly sheared/brecciated carbonaceous phyllites about 1.5 km SE of Majhigawan (63L/7), malachite stains, limonitized coatings and gossan materials about 1.5 km SE of Thapna (63L/7) and near Karhiya (63 L/7) have been noticed during ground evaluation of AEM anomalies (Shukla et. al., FS 1992-93). Anomaly near Karhiya is located over ultramafics which have analyzed 0.2 to 0.41% Cu, 0.38 to 0.59% Ni and gold values ranging from 0.18 and 0.11 ppm. Occurrence of Cu-Ni mineralization associated with an ultramafic body measuring 35m x 5m located about 1.5 km SE of Thapna was brought out by K.S. Thakur during FS 1993-94. The ultramafic body (20 samples) yielded 160 ppm -1.1% Cu, 610 ppm-0.49% Ni, and <0.1-0.27% Au.

18.3.0 As a follow-up, investigation for PGE and gold associated with copper and nickel mineralization in ultramafic- mafic suite near Thapna was carried out by Khadse & Roy of GSI during the Field Season 1995-96 and 1997-98 has been undertaken investigation of PGE, Gold, Copper and Nickel in Ultramafic-mafic rocks near Thapna and Karhiya, Sidhi district, M.P. GSI reported Chemical analysis of bedrock samples revealed anomalous content of gold. Samples of ultramafic rocks around Thapna have analysed 0.15% Cu, 0.20% Ni and 0.56ppm Au. Ultramafic body have recorded upto 200 ppb Pt, 8 ppb Pd and 12 ppb Ir. Ultramafic rock samples from Karhiya have analysed 58 ppb Pt, 118 ppb Pd and 1.5 ppb Ir, 0.2ppm Au, 530ppm Cu & 710ppm Ni. On the basis of findings detailed investigation in terms of gold, PGE, Nickel and associated minerals were recommended.

18.4.0 Regional Geochemical Mapping carried out by Paul et. al. (2016) in parts of toposheet nos. 63L/3, 6 & 7 brought out higher concentration of Au found in northern part of toposheet nos. 63L03 & 07 at the contact of Mahakoshal and Semri Group of rocks which according to them could be taken up for further investigation.

18.5.0 The EPMA study of few samples of Thapna-Garhor-Baghara area (Bage & Kinker, 2018) in parts of toposheet 64L/07, shows presence of Mg rich ilmenite, high TiO_2 rich mineral phases, spinel, and chrome magnetite, which is an indicative of presence of possible lamproite and carbonatitic suite of rocks in the area which could have potential for REE mineralization.

18.6.0 During the 2021-22 field season, the Geological Survey of India (GSI) conducted a reconnaissance survey for gold and associated sulphide mineralization in a portion of Toposheet No. 63L/11. The survey identified banded iron formations (BIFs) across

the block, trending ENE-WSW, with Fe_2O_3 content ranging from a high of 59.21% to a low of 31.11%. Additionally, one quartz vein sample (near Khatai turn), intruding within the BMQ, yielded 7,700 ppb of gold, while another sample showed 470 ppb of gold. Based on these findings, further investigation was recommended.

18.7.0 GeoMysore Services (India) Pvt. Ltd. carried out exploration work during the year 2003 to 2006 in and around Sidhi covering an area of 2700 sq km. In the course of the exploration, stream sediment shows more than 30 ppb Pt+Pd and rock chip samples in meta-basalt and volcanoclastics showed more than 30 ppb of Pt+Pd from the proposed area.

18.8.0 The NGCM data obtained from the NGDR portal has been used to create a contour map. This map highlights significant nickel enrichment in the central and eastern regions of the proposed block, with the Amanous area exhibiting nickel concentrations exceeding 200 ppm. Similarly, the chromium anomaly map indicates that chromium enrichment closely aligns with nickel enrichment. The anomalies of both nickel and chromium show a strong correlation with the presence of metabasalt and ultramafic formations within the block.

18.9.0 The Geology with the aeromagnetic data reveals moderately strong aeromagnetic response over the sequence of metavolcanics with partings of BIF. It is very clear on the aeromagnetic profiles. The aeromagnetic response is low over the sequence of sandstone. The ultramafic body south of Parma is located closer to the linear magnetic response. A few linear zones of high grade electromagnetic anomalies with slow decay ratio probably cause due to alteration of rocks, bands of iron rich formations and carbonaceous phyllite.

18.10.0 The gravity and magnetic data collected during the NGPM program exhibit a distinct gravity low and magnetic high response, which correlate well with the lithology exposed in the block.

18.11.0 Overall, the rock formations in the area exhibit similarities to those found near Thapna and Karhiya. Previous studies by the GSI have identified these formations as ultramafic-mafic, which are considered promising for gold and nickel, along with grey phyllite and BIF, which are significant for gold exploration. Given this potential, a G-4 stage exploration has been planned to cover a wider region, including the Parma, Bharra, and Karlo areas.

18.12.0 The Reconnaissance survey will help in planning of higher stages of exploration program (in case upgraded to G-3 level) which in turn will facilitate the state Government for Auction of the block.

19.0.0 References

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iii) Khadse, V.K. (2000): Report on Investigation for PGE, Gold, Copper and Nickel in Ultramafic-Mafic rocks near Thapna and Karhiya, Sidhi district, Madhya Pradesh.

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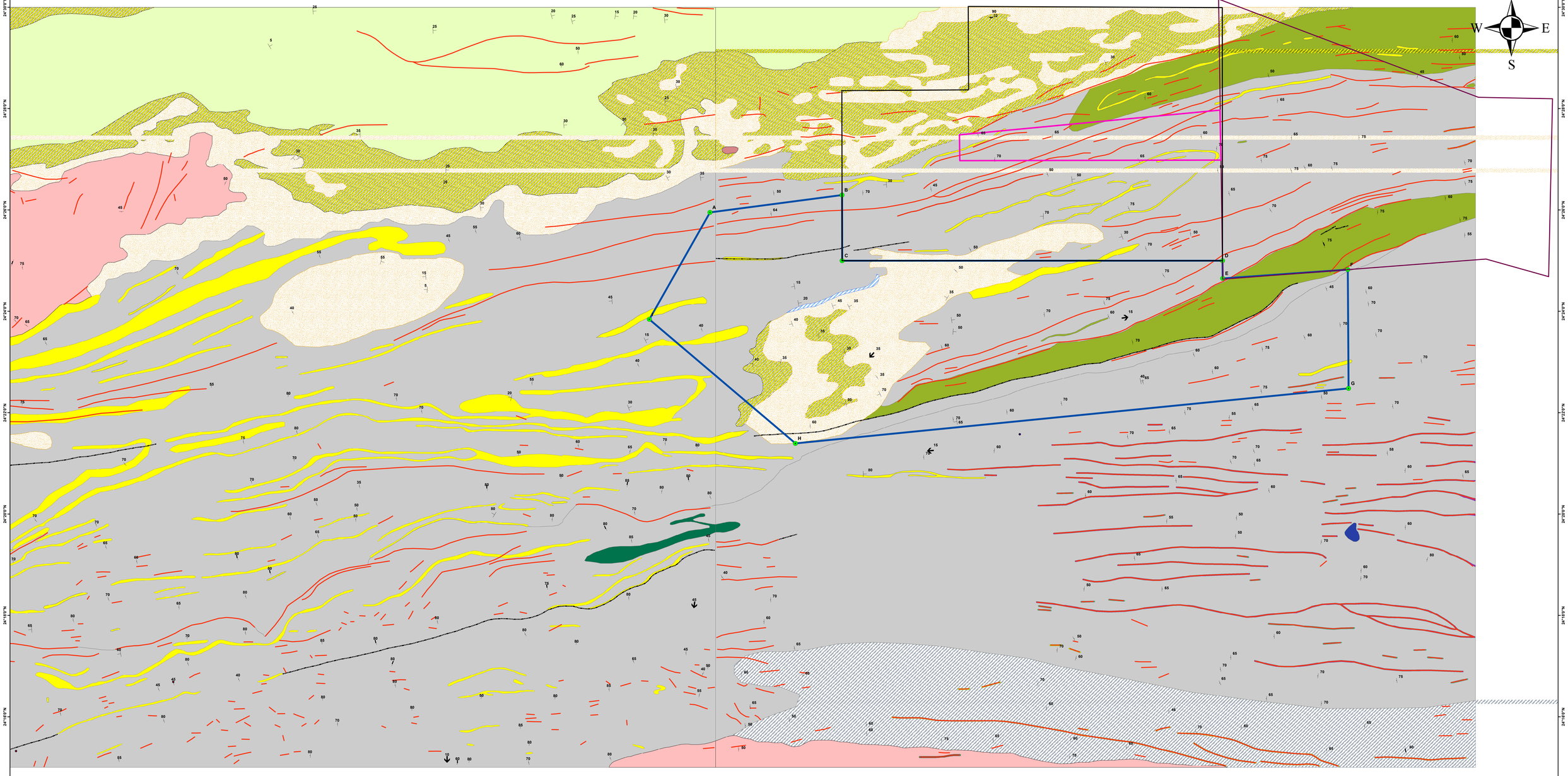
Geological Map showing Parma Block, Singrauli and Sidhi Districts, Madhya Pradesh



Legend

- Turra_GM block_Ni_GSI
- Thapna-Garhor-Baghara_GSI
- Boda-Piparawan-Kurainiya Block_GSI
- BB_Parma Block
- Parma Block
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- oriented_structure_line_gcs_ngdr_63L07

oriented_structure_plane_gcs_ngdr_63L03

point_type

- AXIAL PLANE
- BEDDING
- CLEAVAGE/FOLIATION/SCHISTOSITY (S1)
- JOINT

oriented_structure_plane_gcs_ngdr_63L07

point_type

- AXIAL PLANE (ANTICLINE)
- BEDDING
- CLEAVAGE/FOLIATION/SCHISTOSITY (S1)
- JOINT
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- dyke_gcs_ngdr_63L07
- shear_zone_gcs_ngdr_63L03
- shear_zone_gcs_ngdr_63L07

lithology_gcs_ngdr_63L03

lithologic

- DOLERITE
- GRANITE GNEISS
- PHYLLITE
- PORCELLANITE
- QUARTZITE
- SANDSTONE
- SHALE

lithology_gcs_ngdr_63L07

lithologic

- BIF
- BIOTITE SCHIST
- DOLERITE
- GRANITE
- GRANITE GNEISS
- LAMPROPHYRE
- LATERITE
- LIMESTONE
- META BASALT
- META GABBRO
- PHYLLITE
- PORCELLANITE
- QUARTZITE
- SANDSTONE
- SHALE

Location Map of Parma Block, Singrauli District, Madhya Pradesh