PROPOSAL FOR PRELIMINARY EXPLORATION (G-3)
FOR MANGANESE ORE IN
NAGARDHAN BLOCK
(2.00 SQ. KM AREA)
DISTRICT- NAGPUR, MAHARASHTRA

COMMODITY: MANGANESE

BY

MINERAL EXPLORATION AND CONSULTANCY LIMITED

DR. BABASAHAB AMBEDKAR BHAWAN

SEMINARY HILLS

PLACE: NAGPUR

DATE: 14th February 2024

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

	Features	**Details**
	Block ID	**Nagardhan Manganese Block**
	Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
	Commodity	**Manganese**
	Mineral Belt	Sakoli Fold Belt
	Budget & Time schedule to complete the project	145.87 lakhs & 11 months
	Objectives	Based on the geological data of 10(A) 2(B) cases, provided by DGM, Maharashtra and field visit by MECL geologist in and around Nagardhan Block, Dist- Nagpur, Maharashtra, the present exploration programme for preliminary exploration (G-3) has been formulated. The objectives of the present Preliminary exploration (G-3) are as follows: i) To carry out Geological & Structural mapping on 1:4000 scale for identification of manganese bearing formation (host rock) with the structural features to identify the surface manifestation and lateral disposition of the mineralized zones. ii) To prepare the detailed surface map of the area by means of surface contouring at 2m interval in 1:4000 scale. iii) To establish three dimensional dispositions of the earlier reported mineralised zones of Manganese by means of trenching and drilling. iv) To assess the quality and quantity of the resources (333) as per UNFC norms & Minerals (Evidence of Mineral Contents) Rules- 2021.
	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.
	Name/Number of Geoscientists	
	Expected Field days (Geology, Geophysics, Surveyor)	Geologist Party days: Field -150 days & HQ-60 days
		Survey Party days: 45 days (for topographic survey)
		Sampling Party days: 30 days

<table>
<tr><td>1.</td><td>Location</td><td>The proposed exploration block is located in Ramtek Tehsil of Nagpur district and about 45km in northeast of district headquarter Nagpur and about 10km from tehsil headquarter Ramtek. The area falls under the parts of Survey of India Toposheet No 57O/7 and is bounded by latitude 21º 19' 09.39" N to 21º 20' 03.45" N and longitude 79° 18' 59.65" E to 79° 19' 41.49" E (Plate No I).</td></tr>
<tr><td></td><td>Latitude and Longitude</td><td><table>
<tr><th>BOUNDARY POINTS</th><th>LATITUDE</th><th>LONGITUDE</th></tr>
<tr><td>A</td><td>21º 20' 03.45" N</td><td>79º 18' 59.69" E</td></tr>
<tr><td>B</td><td>21º 20' 03.42" N</td><td>79º 19' 41.43" E</td></tr>
<tr><td>C</td><td>21º 19' 09.40" N</td><td>79º 19' 41.49" E</td></tr>
<tr><td>D</td><td>21º 19' 09.39" N</td><td>79º 18' 59.65" E</td></tr>
</table></td></tr>
<tr><td></td><td>Villages</td><td>Nagardhan, Nandapuri, Hamlapuri</td></tr>
<tr><td></td><td>Tehsil/Taluk</td><td>Ramtek</td></tr>
<tr><td></td><td>District</td><td>Nagpur</td></tr>
<tr><td></td><td>State</td><td>Maharashtra</td></tr>
<tr><td>2.</td><td>Area (hectares/ square kilometres)</td><td></td></tr>
<tr><td></td><td>Block Area</td><td>2.00 sq.km</td></tr>
<tr><td></td><td>Forest Area</td><td>Non-Forest area</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>Data not available</td></tr>
<tr><td>3.</td><td>Accessibility</td><td></td></tr>
<tr><td></td><td>Nearest Rail Head</td><td>The nearest railhead is Nagpur (about 45km) and nearest railway station is Kanhan Junction (about 18km).</td></tr>
<tr><td></td><td>Road</td><td>The block area is well connected to district headquarter Nagpur, by all weather metalled road from the NH-07/NH-44 via Kanhan or via Mansar and Ramtek.</td></tr>
<tr><td></td><td>Airport</td><td>The nearest airport is Dr. Babasaheb Ambedkar International Airport, Nagpur (about 50km).</td></tr>
<tr><td>4.</td><td>Hydrography</td><td></td></tr>
<tr><td></td><td>Local Surface Drainage Pattern (Channels)</td><td>The general slope of the country is towards south and the drainage is collected by southerly flowing Bhagi nala ultimately draining into Kanhan River. The area has got dendritic pattern of drainage.</td></tr>
<tr><td></td><td>Rivers/ Streams</td><td>Kanhan River about 18 km south of the block</td></tr>
</table>

5.	**Climate**	
	Mean Annual Rainfall	Average annual rainfall is 100 cm
	Temperature:	Minimum temperatures: below 10°C (December-January), Maximum temperatures: up to 46°C (April-May)
6.	**Topography**	
	Toposheet Number	55O/7
	Morphology of the Area	The area is almost flat terrain and covered with agriculture land. The average height of the area is 310m above MSL.
7.	**Availability of baseline geoscience data**	
	Geological Map (1:50K/25K)	1:50,000 / 1:25,000 (Bhukosh, Geological Survey of India)
	Geochemical Map	Not available.
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Not available.
8.	**Justification for taking up Reconnaissance Survey/ Regional Exploration**	i) The Nagardhan Manganese block is lapsed lease area by State Government of Maharashtra, which was granted as per section 10(A) 2(B) of the MMDR Act-15. The block was granted to M/s. Excel Mining Incorporation during 04/02/2011 to 03/02/2013 for 2 years. ii) The Directorate of Geology and Mining (DMG), Government of Maharashtra, Nagpur requested to MECL to take up the exploration in lapsed 10(A) 2(B) mining lease areas vide letter no. Tech/1848/2023/3938, dated 22/12/2023. iii) M/s. Excel Mining Incorporation has carried out the prospecting in the area involving 7 pits and 6 vertical boreholes. Three (3) out of 7 no. of pits intersected manganese boulders and remaining 4 were barren in respect of manganese. The manganese mineralisation intersected in 4 (BH-1, Bh-2, Bh-3 & Bh-4) out of 7 vertical boreholes drilled in the block. However the analytical data for pits as well as boreholes are not available. iv) MECL studied the data provided by the DMG, Maharashtra and carried out the field visit in and around the Nagardhan area. The geologist team studied the area and found the surface indication of the manganese mineralisation in the paddy field and a shallow

		pit within the block area. v) Thus the manganese mineralisation in the area ids confirmed both by previous data and the field visit by MECL geologists. However, the analytical data is not available. vi) The manganese ore is the basic source to provide manganese as indispensable input in making of iron and all types of steels and so far there is no technology which can substitute manganese in steel making. Manganese is also categorised as notified mineral under Fourth Schedule of MMDR Amendment Act-2015, which prospecting and exploration is needed before auction. vii) Hence, considering the request of DMG, Maharashtra, available data, field visit by MECL geologists and demand of manganese ore, MECL has planned to carry out exploration in the Nagardhan Block and proposed preliminary exploration (G-3) exploration in block to fulfil the demand of manganese in the country.

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PROPOSAL FOR PRELIMINARY EXPLORATION (G-3) FOR MANGANESE ORE IN NAGARDHAN BLOCK (2.00 SQ. KM AREA) DISTRICT- NAGPUR, MAHARASHTRA

1.0.0 INTRODUCTION

1.1.0 Preamble:

1.1.1 Manganese is one of the most common elements in the Earthôs crust and is widely distributed across the planetôs surface. It is very hard, brittle, gray-white transition metal that is found in variety of minerals, but never as free element in nature; is it often found in minerals in combination with iron. Manganese ore is the basic source to provide manganese as indispensable input in making of iron and all types of steels. So far there is no technology which can substitute manganese in steel making. Manganese combines the twin benefits of relatively low price with outstanding technical usage.

1.1.2 In order to sustain the current level of production of Mn ores and to meet the future demands, the exploration of Manganese ore is the need of the hour.

1.1.3 In India the Manganese Ore deposits mainly occurs as metamorphosed bedded sedimentary deposits associated with Gondite Series (Archaeans) of Madhya Pradesh (Balaghat, Chhindwara & Jhabua districts), Maharashtra (Bhandara & Nagpur districts), Gujarat (Panchmahal district), Odisha (Sundargarh district) and Kodurite Series (Archaeans) of Odisha (Ganjam & Koraput districts) and Andhra Pradesh (Srikakulam & Vishakhapatnam districts).

1.1.4 The total reserves/resources of manganese ore in the country as on 1.04.2020 has been placed at 503.62 million tonnes as per NMI database, based on UNFC system (Mineral Year Book-2021). Out of these, 75.04 million tonnes are categorised as Reserves and the balance 428.58 million tonnes are in the Remaining Resources category. Gradewise, Ferromanganese grade accounts for 8%, Medium grade 6%, BF grade 29% and the remaining 57% are of Mixed, Low, Others, Unclassified, and Not-known grades including 0.16 million tonnes of Battery/Chemical grade (Mineral Year Book-2021).

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1.1.5 Statewise, Odisha tops the total reserves/ resources with 34% share followed by Karnataka (24%), Madhya Pradesh (12%), Maharashtra (12%) & Goa (7%) , Andhra Pradesh (6%) and Jharkhand (3%). Rajasthan, Gujarat, Telangana and West Bengal together shared the remaining 2% resources.

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

1.1.7 The Nagardhan Manganese block is lapsed lease area by State Government of Maharashtra, which was granted as per section 10(A) 2(B) of the MMDR Act-15. The block was granted to M/s. Excel Mining Incorporation during 04/02/2011 to 03/02/2013 for 2 years. The Directorate of Geology and Mining (DMG), Government of Maharashtra, Nagpur requested to MECL to take up the exploration in lapsed 10(A) 2(B) mining lease areas vide letter no. Tech/1848/2023/3938, dated 22/12/2023.

1.1.8 Considering the request of DMG, Maharashtra, available data, field visit by MECL geologists and demand of manganese ore, MECL has proposed preliminary exploration (G-3) exploration in Nagardhan Block to fulfil the demand of manganese in the country.

1.2.0 Background:

1.2.1 In view of the enactment of the MMDR Amendment Act, 2015 and Mineral Auction Rule, 2015 by the Govt. of India, the State administration of Odisha desired that some mineral prospects of the State be explored on priority basis through National Mineral Exploration Trust (NMET) fund so that those could be auctioned and thereby earn revenue for the state along with the augmentation of reserve and resource of the country. Manganese occurrence areas in Balangir district in Odisha are among them.

1.2.2 The Nagardhan Manganese block is lapsed lease area by State Government of Maharashtra, which was granted as per section 10(A) 2(B) of the MMDR Act-15. The block was granted to M/s. Excel Mining Incorporation during 04/02/2011 to 03/02/2013 for 2 years. The Directorate of Geology and Mining (DMG), Government of Maharashtra, Nagpur requested to MECL to take up the exploration in lapsed 10(A) 2(B) mining lease areas vide letter no. Tech/1848/2023/3938, dated 22/12/2023.

1.2.3 M/s. Excel Mining Incorporation has carried out the prospecting in the area involving 7 pits and 6 vertical boreholes. Three (3) out of 7 no. of pits intersected manganese boulders and remaining 4 were barren in respect of manganese. The manganese mineralisation intersected in 4 (BH-1, Bh-2, Bh-3 & Bh-4) out of 7 vertical boreholes drilled in the block. However the analytical data for pits as well as boreholes are not available. They have also reported 50,800 tonnes manganese ore resource with Mn grade varying from 26.00% to 38.00% Mn.

1.2.5 Based on the request of DMG, Maharashtra, available data, field visit by MECL geologists and demand of manganese ore, MECL has proposed preliminary exploration (G-3) exploration in Nagardhan Block.

1.3.0 Location & Accessibility of the Area

The proposed exploration block is located in Ramtek Tehsil of Nagpur district and about 45km in northeast of district headquarter Nagpur and about 10km from tehsil headquarter Ramtek. The area falls under the parts of Survey of India Toposheet No 57O/7 and is bounded by latitude 21º 19' 09.39" N to 21º 20' 03.45" N and longitude 79° 18' 59.65" E to 79° 19' 41.49" E (Plate No I).

The coordinate of cardinal points of block boundary are as follows:

BOUNDARY POINTS	LATITUDE	LONGITUDE
A	21º 20' 03.45" N	79º 18' 59.69" E
B	21º 20' 03.42" N	79º 19' 41.43" E
C	21º 19' 09.40" N	79º 19' 41.49" E
D	21º 19' 09.39" N	79º 18' 59.65" E

The block area is well connected to district headquarter Nagpur, by all weather metalled road from the NH-07/NH-44 via Kanhan or via Mansar and Ramtek. The nearest railhead is Nagpur (about 45km) and nearest railway station is Kanhan Junction (about 18km). The nearest airport is Dr. Babasaheb Ambedkar International Airport, Nagpur (about 50km).

1.4.0 Physiography, Drainage, Climate and Vegetation

1.4.1 The area comprises of wide spread plain land and almost flat terrain covered with agriculture land. The average height of the area is 310m above MSL. The general slope of the country is towards south and the drainage is collected by southerly flowing Bhagi nala ultimately draining into Kanhan River. The area has got dendritic pattern of drainage. Kanhan River about 18 km south of the block.

1.4.2 The area experiences moderately dry and wet climate. The temperature rises from March onwards, reaching maximum up to 45°C during April-May. The winter sets from November and lasts upto February. Winter is moderate, temperature dropping below 10°C with occasional colder days. The monsoon sets in July and continues up to September, most of the rainfall occurs during the months of July and August. The annual rainfall is about 100 cm.

1.4.3 Most of the block area falls under the agriculture land, where one time crop being cultivated and there is no other significant flora is present in the area. However, the nearby surrounding areas have a varied assemblage of flora and fauna owing to diversity of physical features. The prominent forest trees are Teak/Sagwan (Teconagrandis), Mahua (Madhucalongifolia), Babul (Acacia arabica), Bamboos (Bambusabambos), Tendu (Diospyrosexsculpta) trees and variety of shrubs. Natural fauna in the bklock area are field mice, rabbit, snake, fox, wolf etc. along with domestic cattles such as ox, cow, buffalo, goats etc. and no wild animal found in the area. However, in nearby areas wild boar (Suscristatus), panther (Felis Pardus), antelopes, deer (Cervusduvancelli), fox, wolf, monkeys, hare (Lepusreficaudatus) and both poisonous and non-poisonous snakes. Birds like myna, parrot, sparrow, cuckoo, and owl are seen in the area.

1.5.0 Previous Work

1.5.1 The earliest mention of manganese ore is by Jenkin (1833) and Voysey (1833) dealing with the geology and mineralogy of the Nagpur area, Central provinces.

1.5.2 Dutta (Fremor 1909) discovered several manganese ore deposit in Bhandara district. Fremor (1909) was the first to describe in detail the deposits in the entire manganese belt in his memoir, ñThe manganese ore deposits of India".

1.5.3 The area witnessed mining activity from the beginning of the 18 th century. The activity was at the peak during world war-II period. Further, the mining has been at its lowest ebb or came to an almost standstill during peace time and the prospects were abandoned possibly due to impoverishment in grade, sharp decline in prices and shallow depth persistence.

1.5.4 Fermor (1909) Dunn (1936) Basu 1964) Deshpande (1960) Roy (1961) 66, 68)D. J. Dasgupta et al (1984) Pal and Bhowmik (1995) and others have discussed themineralogical and para genetic aspect of Manganese ore and Gondite (Gondite is a rock aggregate of manganese bearing minerals along with quartz and garnets).

1.5.5 Among the Private entrepreneurs who have worked in the manganese belt includes M/s Shanti Narang, M/s. Khemka Brothers and Shri C.K. Ram Choudhary who quarried the ore in RamtekMahuli-Junewani area which is nearby to the block.

1.5.6 Meshram et al. (2001) have studied and assessed manganese ore in Gugaldoh block in Ramtek tehsil.

1.5.7 MOIL has done exploration in this manganese belt in its lease area. MOIL has many underground and open cast mines of manganese are present in the nearby area.

1.5.8 During M/s. Excel Mining Incorporation has carried out the prospecting in the area involving 7 pits and 6 vertical boreholes. Three (3) out of 7 no. of pits intersected manganese boulders and remaining 4 were barren in respect of manganese. The manganese mineralisation intersected in 4 (BH-1, Bh-2, Bh-3 & Bh-4) out of 7 vertical boreholes drilled in the block. However the analytical data for pits as well as boreholes are not available. They have also reported 50,800 tonnes manganese ore resource with Mn grade varying from 26.00% to 38.00% Mn.

1.6.0 Regional Geology

1.6.1 The area belongs to Mansar Formation of Sausar Group, which is a part of Sausar Supracrustal Belt. The Sausar Fold Belt (SFB), an important mesoproterozoic fold belt with southern convexity on the southern margin of the Central Indian Tectonic Zone (CITZ) trends E-W to ENE-WSW with about 20 to 40 km wide and 300 to 350km long. The Sausar Fold Belt (SFB) comprises of two major lithotectonic assemblages, viz. Tirodi Biotite Gneiss (TBG) and metasedimentary Sausar Group (Figure-1).

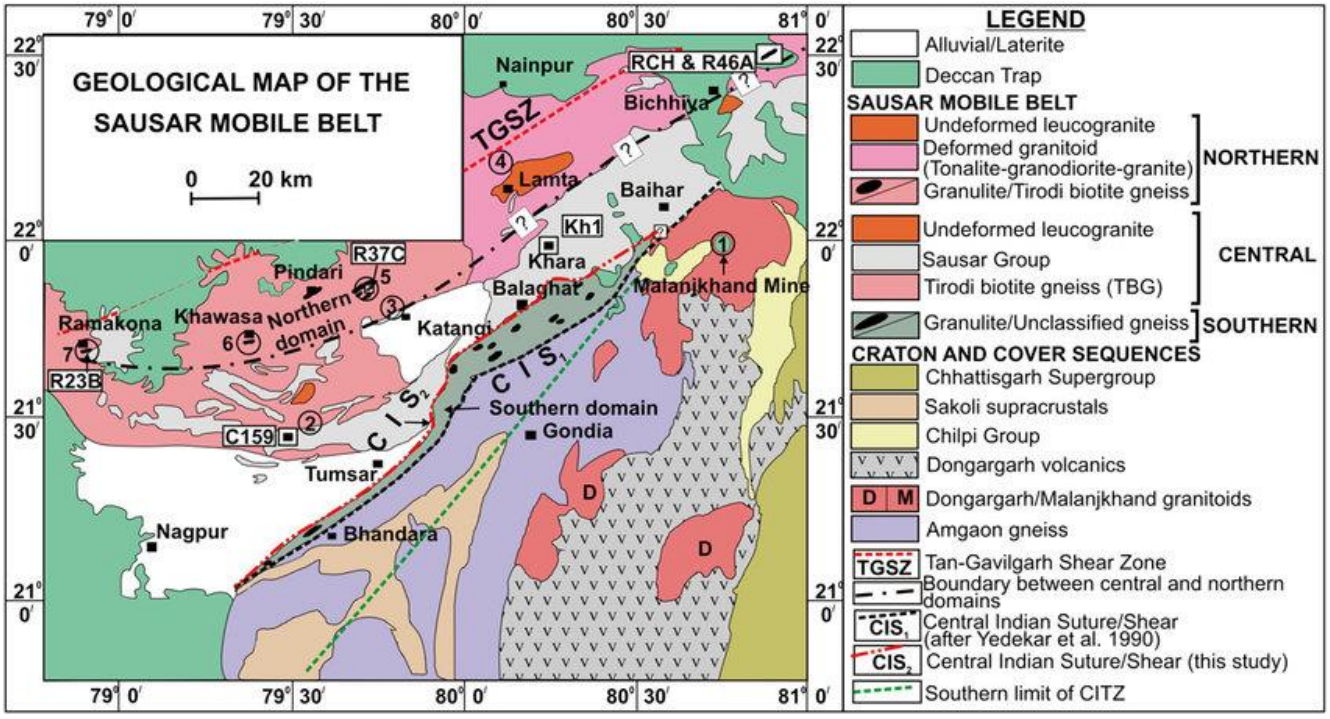

Figure-1: Geological Map of the Sausar Mobile Belt (After Bhowmik & Pa2000)

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1.6.2 The Sausar Group of rocks constitute as important constituent of CITZ lying in the Central Indian Peninsular Shield at the southern fringe of Satpura Province comprises a lithotectonic assemblage of strongly folded and metamorphosed non volcanic psamo-pelitic and chemogenic manganese rich matasedimentary package lying over Tirodi Biotite Gneiss with a tectonised contact. A Large-scale southerly vergent recumbent fold causes possible reversal of stratigraphic sequence due to which Sausar stratigraphy has remained problematic on various counts (Khan et al. 2002).

1.6.3 The Sausar Group is divided into four Formations in ascending order i.e, the LohangiFormation, Mansar Formation, Chorbahuli Formation and BichuaFormations (Khan et al., 2002). The litho units such as quartzite, quartz-mica schist, calc-silicate, calcitic and dolomitic marble and manganese/ gondite ore are present in Sausar Group. TheTirodiBiotite Gneiss (TBG) forms the basement for Sausar Group. The entire Sausar Fold Belt (SFB) is intensely deformed and has undergone upper amphibolite to granulite facies of metamorphism. The granite, pegmatite and quartz veins also occur as intrusives within Sausar Group of rocks.

1.6.4 The Sausar Group of rocks is known for hosting syn-sedimentary strata bound and stratiform manganese deposits. The manganese ore in this area is associated with the psammo-peliticschists of Mansar Formation. Some pocket manganese occurrences are also associated with calc silicate and dolomites of Lohangi Formation.

1.6.5 The stratigraphic succession proposed for the Sausar Mobile Belt is uncertain to some extent due to absence of any basement-cover relationship and structural and metamorphic complexities. Narayanswami et.al, considered Tirodi gneiss as the basement of the Sausar Group. The contact between Tirodi gneiss and the Sausar Group is mostly tectonised at most places. Recently polymictic conglomerate has been reported at the contact of Tirodi gneiss and the Sausar Group from the locality of Mansar (Mohanty 1993) conforming that Tirodi gneiss is the basement of the Sausar Group. Recent workers (Pal and Bhowmik, 1998; Khan et al., 2000 and Chatopadhyay et al., 2001) on the basis of structural evidences have argued that the TBG is a complex medley of different type of gneisses i.e. biotite gneiss, granite gneiss, migmatite gneiss and patches of older supracrustals forming the crystalline basement.

1.6.5 However, the latest stratigraphy of the area as proposed by Khan et al. (2002) is given in below.

Regional Litho-Stratigraphic Succession (after Khan et al, 2002)

Age	Stratigraphy	Formation	Lithology
	Recent		Alluvium and soil
	Quaternary		Laterite
Meso-proterozoic	Sausar Group	Intrusives	Massive potassic granite, pegmatite, aplite and quartz veins Foliated potassic granite, occasionally rich in biotite and/or fibrolite
		Bichhua Formation	Pure and impure dolomitic marble with subordinate red, yellow and grey chert
		Chorbahuli Formation	Coarse grained, garnetiferous quartz mica schist with local development of magnetite and staurolite: Micaceous and/or cherty ferruginous quartzite and meta-arkose with local development of magnetite and/or garnet
		Mansar Formation	Biotite (± fibrolite) - muscovite-quartz schist with thin bands of quartzite and dolomitic marble and thick horizons of Mn- ore and gondite.
		Lohangi Formation	Calc silicate rocks, calc-gneiss with subordinate pink calcitic marble and minor Mn ore horizons.
		Sitasaongi Formation	Coglomerate, quartzite, quartz mica schist
----------Tectonised Contact----------			
Archaean	Pre- Sausar Basement	Tirodi biotite gneiss (TBG)	Multicomponent gneiss e.g. biotite gneiss, migmatite gneiss, quartzo-feldspathic gneiss, felsic gneiss, tonalite-gneiss, cordierite-gneiss etc with small metabasic and mafic granulite enclaves; often highly deformed and converted to biotite-fibrolite-schist

1.6.5 Geology of the block area

The rock type of the block area mainly belongs to Mansar formation of Mesoproterooic Sausar Group of rocks. The manganese ore body occurs in feldspathic biotite-muscovite schist, which grade laterally along strike and down dip into muscoviteï biotite gneiss. The general geology sequence and lithology of the pearl granted area as observed has been given below.

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Soil/ Alluvium

Micaceous Schist with Pegmatite

Gondite with Manganese ore

Calcareous Schist with Quartzite

Soil: it is formed due to decomposition of schists and is brown in colour. Average thickness of overburden is around 2 to 3 m.

Micaceous Schist: These are country of rocks and found to occur all over the area below soil. This formation is crisscrossed with pegmatite veins of different thickness.

Gondite with Manganese ore: The lithounit is dark grey to black, fine to medium grainedrocks containing porphyroblasts of garnet. It is syngenetic and stratabound, essentially composed of manganese bearing minerals like rhodonite, rhodocrosite, along with quartz, garnet and manganese bearing amphibole like cummingtonite, pyrolusite, hollandite etc.

Calcareous Schist with Quartzite: This formation is found to be decomposed and mainly occurs as grayish white in colour and schistose structure.

1.6.6 Regional Structure

The rocks of the Sausar Group show poly-phase deformation and metamorphism. The folds are generally overturned towards north with axial planes dipping steeply (60° - 80°) to the south along the southern part of the belt. The regional structure of the Sausar Group is divisible into four belts (Narayanswamy et. al 1963).

a) Southern belt of overturned isoclinal folding.

b) Northern belt of recumbent folds, thrust blocks and nappes.

c) Central belt of gneissic formations with narrow folded schists.

d) Regions of cross folding and refolding.

1.6.7 Metamorphism

The entire Sausar Fold Belt (SFB) is intensely deformed and has undergone upper amphibolite to granulite facies of metamorphism. The granite, pegmatite and quartz veins also occur as intrusives within Sausar Group of rocks.

1.6.8 Mineralization (Surface manifestation)

Sausar Group is well known for the manganese ore deposits, mainly within the Mansar Formation, hosting the syngenetic strata boundmineralisation. Around the area a number of working underground and open cast mines of Manganese Ore India Limited (MOIL) are present i.e. Kandri-Khadan, Mansar-khadan etc. The manganese ore horizon is composed of interbanded manganese ore minerals or layer of gondite. Gondite occurs as massive as well as banded and composed of mainly quartz, spessartite and rhodonite with some manganese amphibole (cummingtonite).

1.7.0 Scope of Proposed Exploration

1.7.1 The proposed Preliminary Exploration (G-3 stage) program comprises topographical survey (1:4000 scale), geological mapping (1:4000 scale), trenching and drilling of about 500m with associated survey, chemical analysis & physical analysis and geological report preparation.

1.8.0 Observation and Recommendations of previous work

1.8.1 M/s. Excel Mining Incorporation has carried out the prospecting in the area involving 7 pits and 6 vertical boreholes. Three (3) out of 7 no. of pits intersected manganese boulders and remaining 4 were barren in respect of manganese. The manganese mineralisation intersected in 4 (BH-1, Bh-2, Bh-3 & Bh-4) out of 7 vertical boreholes drilled in the block. However the analytical data for pits as well as boreholes are not available. They have also reported 50,800 tonnes manganese ore resource with Mn grade varying from 26.00% to 38.00% Mn.

2.0.0 Previous Work / Background information

2.0.1 The background information and previous works have been described in para 1.2.0 and 1.5.0 respectively.

3.0.0 Block description

The proposed block details are given in para 1.3.0.

4.0.0 Objective of the proposed Reconnaissance Survey (G4):

4.1.0 Based on the geological data of 10(A) 2(B) cases, provided by DGM, Maharashtra and field visit by MECL geologist in and around Nagardhan Block, Dist- Nagpur, Maharashtra, the present exploration programme for preliminary exploration (G-3) has been formulated.

4.2.0 The objectives of the present Preliminary exploration (G-3) are as follows:

i) To carry out Geological & Structural mapping on 1:4000 scale for identification of manganese bearing formation (host rock) with the structural features to identify the surface manifestation and lateral disposition of the mineralized zones.

ii) To prepare the detailed surface map of the area by means of surface contouring at 2m interval in 1:4000 scale.

iii) To establish three dimensional dispositions of the earlier reported mineralised zones of Manganese by means of trenching and drilling.

5.0.0 Planned Methodology

5.1.0 In accordance to the objective set for preliminary exploration (G-3) of the block, the exploration programme is proposed. The Exploration shall be carried out as per Minerals (Evidence of Mineral Contents) Rule-2015. Accordingly, the following scheme of exploration is formulated in order to achieve the objectives. The details of different activities to be carried out are presented in subsequent paragraphs.

5.2.0 Surveying:

5.2.1 The block area would be tied up with the triangulation network and contouring/ topographical survey will be updated in the block area. The surface features in the block area will be picked up and marked on the map on 1:4000 scale. The reduced levels and co-ordinates of boreholes, trenches and boundary coordinates would be determined. The contouring will be carried out at 2m interval.

5.3.0 Geological Mapping:

5.3.1 Geological mapping on 1:4,000 scale will be carried out in the entire block area. The rock types, their contact, structural features, mineralisations etc. will be mapped by taking traverses and will be marked on the map. Surface manifestations of the mineralisation available along with their surface disposition will also be marked on the map.

5.3.0 Exploratory Mining (Trenching / Pitting):

5.3.1 During the exploration, shallow trenching/ pitting (excavation) work will be carried out by cutting trenches of 1m width and 2 m depth and by pitting 1m width and 2 m depth directly on the fresh outcrop/rock exposures across the manganese bearing formations involving 100 cubic meter excavation. A provision of 50 no of trench/pit samples for manganese has been kept. The trench walls will be mapped on 1:200 scale.

5.3.2 Around 5% samples (3 numbers) will be analyzed in Chemical Laboratory of MECL as Internal check samples and 10% of Primary samples (5 numbers) will be sent to NABL External Labs for analysis of manganese mineralization (Mn, SiO2, P2O5 Fe2O3, MnO2 and Acid Insolubles) as external check samples.

5.4.0 Exploratory Drilling:

5.4.1 Based on Geological Mapping and Trenching/ Pitting, the extension of the mineralized zones will be marked. To confirm the potentiality of mineralized zones in strike & dip direction, approximately 500.00 m of drilling will be carried out for upper (first) level of intersection of mineralized zones. The azimuth and angle of inclination of the proposed boreholes will be decided by the field geologist once the attitude (strike & dip) of mineralized zones (host rock) is deciphered after geological mapping and trenching/pitting.

5.5.0 Drill Core Logging

5.5.1 The borehole cores would be logged systematically. Viz. details of the litho units, colour, structural feature, texture, mineralization, besides the recovery, rock quality designation (RQD) and graphite and manganese ore type would be recorded.

5.6.0 Drill Core Sampling

5.6.1 The mineralized (graphite & manganese) part of drill core will be sampled as Primary sample. The length of each sample will be kept 1.00 m within the ore zone depending upon the thickness of particular type of manganese ore and its physical characters. The primary core samples will be analysed for 6 radicals i.e. Mn, SiO_2, P_2O_5 Fe_2O_3, MnO_2 and Acid insolubles. The cores of rocks 3 m immediate on footwall and 3 m immediate on hanging wall of mineralized zones would be sampled as far as possible, depending upon the intensity of mineralization, change in lithology and core recovery etc.

a) A total of 120 no of primary core samples will be analysed for 6 radicals i.e., Mn, SiO_2, P_2O_5 Fe_2O_3, MnO_2 and Acid Insolubles.

b) Around 5% (6 numbers) samples will be analysed for 6 radicals i.e., Mn, SiO_2, P_2O_5 Fe_2O_3, MnO_2 and Acid Insolubles in Chemical Laboratory of MECL as Internal check samples and 10% of Primary samples (12 numbers) will be sent to NABL External Labs for analysis of 6 radicals i.e., Mn, SiO_2, P_2O_5 Fe_2O_3, MnO_2 and Acid Insolubles as external check samples.

5.7.0 Whole Rock Analysis:

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

5.8.0 Petrological and Mineragraphic Studies

5.8.1 Thin and polished section studies on drill cores samples would be done for ascertaining the petrographic and mineragraphic characteristics. These samples would be drawn from ore zones and host rocks. A provision of 10 specimens for petrographic and 10 specimens for mineragraphic studies has been kept in the block.

5.9.0 Specific gravity study

5.9.1 A provision of 10 samples for specific gravity determination has been kept.

5.10.0 Quantum of work:

5.10.1 The quantum of work proposed by MECL in Nagardhan Manganese (G-3) Block is given in Table-5.1.

Table-5.1: Proposed Quantum of Exploratory Work in Nagardhan Manganese Block, District-Nagpur, Maharashtra.

Sl. No.	Item of Work	Unit	Proposed Quantum of work
1	Topographical Survey (1:4000)	sq. km	2.00
2	Geological Mapping (1:4000)	sq. km	2.00
3	Exploratory Mining (Trenching/Pitting) (1m x 2m x25m) x 7 trenches	Cu. m	100
4	Core Drilling	m.	500
5	Sample Preparation & Chemical Analysis		
A.	**Trench / Pit Samples**		
	i) Primary samples for 6 radicals i.e. Mn, SiO_2, P_2O_5, Fe_2O_3, MnO_2 and Insolubles	Nos.	50
	ii) Internal Check samples (5% of Primary samples) for 6 radicals	Nos.	3
	iii) External Check sample (10% of Primary samples) for 6 radicals	Nos.	2

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Sl. No.	Item of Work	Unit	Proposed Quantum of work
B.	**Borehole Core Samples**		
	i) Proximate Analysis of Primary samples for Graphite for 4 parameters i.e. Fixed Carbon (FC), Ash (A), Moisture (M) and Volatile Matter (VM)	Nos.	120
	ii) Internal Check samples (5% of Primary samples) for Graphite for 4 parameters	Nos.	6
	iii) External Check sample (10 % of Primary samples) for Graphite for 4 parameters	Nos.	12
	iv) Composite samples	Nos.	15
6	Whole rock analysis	Nos.	10
7	Petrographic Studies	Nos	10
8	Mineragraphic Studies	Nos	10
9	Specific gravity studies	Nos	10
10	Report Preparation (Digital format)	Nos.	1

6.0.0 Manpower Deployment

6.0.1 Manpower deployment List may be provided later.

7.0.0 Break-up of Expenditure

7.1.0 The proposed exploration programme is planned for preliminary exploration (G-3). The work activities like camp setting, geological work, survey work, drilling & laboratory work, report writing will be completed within 11 monthsô time. The bar chart showing activities wise time schedule is placed at **Table-7.1.**

7.2.0 Tentative cost has been estimated based on Schedule of Charges (SoC) of projects funded by National Mineral Exploration Trust (NMET) w.e.f. 01/04/2020 and the total estimated cost is **Rs. 145.87 Lakh.** The summary of tentative cost estimates for Reconnaissance Survey is given in **Table No.-7.2** and details of tentative cost estimates are given as Annexure-I**.**

	Estimated time schedule for Preliminary Exploration (G-3) for Manganese in Nagardhan Block, Districts: Nagpur, Maharashtra [Block area-2.00 sq. km; Schedule timeline- 11 months]														
S. No.	**Particulars**	**Months**	**1**	**2**	**3**	**4**		**5**	**6**	**7**	**8**	**9**	**10**	**11**	
1	Camp Setting	Months													1 month
2	Survey Party days (1 Party)	days													105 Days
3	Trenching / Pitting	cu.m													100 cu. m.
4	Drilling (1 rig)	m													500m
5	Geologist Party days (1 Party)	days													150 Days
6	Sampling days for Trench & Core Sampling (1 Party)	days													30 Days
7	Camp winding	Months													1 month
8	Laboratory Studies	days													5 months (211 samples)
9	Geologist days, HQ	days													60 days
10	Report Writing with Peer Review	days													4 months

Review

Table No-7.2: Summary of Tentative Cost Estimates for Preliminary Exploration (G-3)

Sl. No.	Item	Total
1	Geological Work	32,72,820
2	Pitting & Trenching	3,33,000
3	Laboratory Studies	8,16,221
4	Drilling	71,02,760
	Sub total	**1,15,24,801**
5	Report	5,76,240
6	Peer Review	30,000
7	Proposal Prepration	2,30,496.01
	Total	**1,23,61,537**
8	GST (18%)	22,25,076.58
Total cost including 18% GST		**1,45,86,613**
SAY, in Lakhs		**145.87**

8. 0.0 Justification:

i) The Nagardhan Manganese block is lapsed lease area by State Government of Maharashtra, which was granted as per section 10(A) 2(B) of the MMDR Act-15. The block was granted to M/s. Excel Mining Incorporation during 04/02/2011 to 03/02/2013 for 2 years.

ii) The Directorate of Geology and Mining (DMG), Government of Maharashtra, Nagpur requested to MECL to take up the exploration in lapsed 10(A) 2(B) mining lease areas vide letter no. Tech/1848/2023/3938, dated 22/12/2023.

iii) M/s. Excel Mining Incorporation has carried out the prospecting in the area involving 7 pits and 6 vertical boreholes. Three (3) out of 7 no. of pits intersected manganese boulders and remaining 4 were barren in respect of manganese. The manganese mineralisation intersected in 4 (BH-1, Bh-2, Bh-3 & Bh-4) out of 7 vertical boreholes drilled in the block. However the analytical data for pits as well as boreholes are not available.

iv) MECL studied the data provided by the DMG, Maharashtra and carried out the field visit in and around the Nagardhan area. The geologist team studied the area and found the surface indication of the manganese mineralisation in the paddy field and a shallow pit within the block area.

v) Thus the manganese mineralisation in the area ids confirmed both by previous data and the field visit by MECL geologists. However, the analytical data is not available.

vi) The manganese ore is the basic source to provide manganese as indispensable input in making of iron and all types of steels and so far there is no technology which can substitute

manganese in steel making. Manganese is also categorised as notified mineral under Fourth Schedule of MMDR Amendment Act-2015, which prospecting and exploration is needed before auction.

vii) Hence, considering the request of DMG, Maharashtra, available data, field visit by MECL geologists and demand of manganese ore, MECL has planned to carry out exploration in the Nagardhan Block and proposed preliminary exploration (G-3) exploration in block to fulfil the demand of manganese in the country.

9. 0.0 References:

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List of Plates:

1. Plate-I: Block Location Map of Nagardhan Block in Toposheet no. 57O/07, District-Nagpur, Maharashtra.
2. Plate-II: Regional Geological Map of the area (Scale 1: 50,000).
3. Plate-III: Geological Map of the area (Scale 1: 25,000).

List of Annexures:

1. **Annexure-I:** Details of the total cost estimated for the Preliminary Exploration (G-3) in Nagardhan Block, District-Nagpur, Maharashtra.