

Regional Exploration Proposal (G-4 level) for Manganese in Ambadala-Sunakhunti Area (Block-ID ER-ODS-02) in an area of 100Sq. Km.
District: Rayagada & Kalahandi, (Odisha)

1.0.0 Introduction:

- 1.1.1 Manganese being important constituents in steel manufacture has played a vital role in the industrial growth of a nation. The increasing demand of base metals has been accorded high priority in the XIIth Plan document.
- 1.1.2 During the last three decades, no large Manganese deposit has been discovered in India. However, the possibility of working of small mineral bodies in proximity to each other, through technological advances and increased operational efficiency, cannot be ruled out. Therefore, it is necessary to locate and explore such small sized deposits in clusters.
- 1.1.3 In view of the MMDR amendments act – 2015, Mineral (Evidence of Mineral Contents) Rule 2015 and Mineral Auction Rule – 2015, Ministry of Mines, GSI identified the block for exploration & MECL decided to take up the block for G-4 level of exploration under NMET funding. MECL requested Ministry of Mines, Government of India to reserve the block to carry regional exploration
- 1.1.4 Ministry of Mines, Govt. of India allotted 30 Regional Mineral Exploration Blocks for G-4 exploration from the 100 reports handed over by GSI to MoM. The Regional Exploration for Manganese in Ambadala-Sunakhunti block (Block ID- ER-ODS-02) in 100 Sq. Km., District-Rayagada, Kalahandi (Odisha) is one of the blocks allotted to MECL. Accordingly MECL prepared proposal for regional exploration and being put up for approval of Technical Committee of NMET.

1.2.0 Location of the Block:

- 1.2.1 The block area is around 50 km from Bhawanipatana, the district headquarter of Kalahandi district Via Santapur to Ambadala. The rail route of South-eastern Railway (Raipur-Vizianagaram Section) passes through Ambadala. **The block is located in Survey of India Toposheet No. 65 M/5 and 65 M/9.** The Co-ordinates of the corner points of the block is given below and covers an area of 100 sq.km.

A) 19°45'00" N and 83°26' 50"E B) 19°51' 45" N and 83°26' 50"E
C) 19°51'45" N and 83°31' 26"E D) 19°45' 00" N and 83° 31' 26"E

1.3.0 Physiology and Drainage:

- 1.3.1 The centrally NE-SW portion of the block area is covered by high ridges and covered by Ambadala reserve forest of dense mixed jungle mainly of Sal. Rest of the area is of undulating terrain with isolated hillocks. The highest peak of 900 m from mean sea level is in the North-Eastern part of the area, whereas, the general ground level is around 275 m from mean sea level.
- 1.3.2 The streams in the area forms dendritic drainage pattern forming Nalas flowing southerly forming tributary system of Vamsadhara River.

2.0.0 Previous work:

- 2.1.1 Prospecting work was done by Dash, Chhitaranjan, Behra S.N. and Patel S.N. (2003-2005) and delineation of potential Manganese ore bands within the manganiferous horizons of the central sector of Eastern Ghats Granulite belt in Odisha covering parts of Bolangir, Kalahandi and Rayagada districts was also carried out. Their Prospecting work in the area during 2003-05 helped in delineation of 12 important blocks between Jambragurha in South up to Hardatal in north, containing significant Manganese ore bodies with over 20% Mn.
- 2.1.2 The available chemical results indicate that potential Manganese ore bodies were demarcated from a number of localities such as **Loharpadar** (300m x 10m, grade 0.41-32.45% Mn) in a quarry section, Just North of block area, **Anujurhi** (cumulative strike length 800m x 10m, grade Mn 9.45-36.92%), **Paikaranipinda** (cumulative length 500m x 10m, in two parallel ore bodies) and **Sunakhunti** (cumulative length 500m x 10m, grade 0.21% to 54.36% Mn), all these blocks are in the block area. In **Sunakhunti area** the NE-SW manganiferous zone extends for a strike length of 2 km. The ore body is exposed discontinuously (in three stretches) and is bounded by Calc-silicate granulite and quartzite.

3.0.0 Geology and Structure:

3.1.0. Regional Geology and Structure of the Area.

- 3.1.1. Regionally the Lithounits exposed in and around the block area are of the Khondalite, Charnokite and Peninsular gneiss group of rocks of Eastern Ghat Supergroup belonging to Archaean Age. There are many instances of inliers exhibited by Khondalite group of rocks. The Regional Geological Sequence of Lithounits exposed (after GSI, District Resource Map) is given below:-

Regional Stratigraphic Sequence of Area (After GSI)			
Age	Supergroup	Group	Lithounits
Late Holocene	---	---	Soil / Alluvium
Archaean	Eastern Ghat	Peninsular Gneiss	Biotite gneiss, Granite gneiss, Migmatite
		Charnokite	Acid/ Intermediate Charnokite
		Khondalite	Quartz –garnet- Sillimanite schist / Gneiss

3.2.0. Geology and Structure of the Block

- 3.2.1. The Lithounits exposed in the block area are of Khondalite, Charnokite and Peninsular gneisses group of Rocks of Eastern Ghat Supergroup belonging to Archaean Age. The manganese ore bodies are bounded by calc silicate granulite and quartzite exhibiting NE–SW trend. The Stratigraphic sequence of the Lithounits exposed in the Block area (After GSI) is given below:-

Stratigraphic Sequence of the Lithounits in the Block Area			
Age	Supergroup	Group	Lithounits
Late Holocene	---	---	Soil / Alluvium
Archaean	Eastern Ghat	Peninsular Gneiss	Biotite gneiss, Granite gneiss, Migmatites
		Charnokite	Acid/ Intermediate Charnokite
		Khondalite	Quartz –garnet- Sillimanite schist / Gneiss

4.0.0 Objective of the proposed exploration programme:

4.1.1 The basic Geoscience data provided by GSI has been studied and evaluated. Based on the evaluation the present exploration programme has been formulated to fulfill the following objectives.

- i) To carry out geological mapping on 1:12,500 scale and demarcate the rock types of manganese bearing formations with the structural features to identify the surface manifestations and lateral disposition of the ore body.
- ii) To collect surface samples to analyze them for Mn, SiO₂, Al₂O₃, P & LOI and associated elements and decide further course of exploration programme.
- iii) In case, surface samples give positive results supported by Geophysical survey giving sub-surface positive details for the extension of the ore body then 5 no's scout boreholes shall be drilled in the Ambadala-Sunakhunti area and other mineralized patches in the 100 sq.km. area which in turn will decide the future course of exploration programme at G-3/G-2 category of UNFC.
- iv) To estimate reconnaissance Manganese resources along with accessory elements as per UNFC norms and Minerals (Evidence of Mineral Contents) Rules-2015 at G-4 level.

5.0.0 Proposed scheme of Exploration:

5.0.1 In accordance to the objective set for the block, the exploration programme is proposed. 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 objective. The details of different activities to be carried out are presented in subsequent paragraphs.

5.1.0 Geological mapping:

5.1.1 Geological Mapping will be done in the total area of 100 Sq. Km. on 1:12,500 scale. Rock types, their contact, structural features will be mapped. Surface manifestations of the ore bodies available along with their surface disposition will be marked on map. Surface samples of various litho-units for petrological studies and from ore bodies for Mn, Fe, Al₂O₃, SiO₂, P & LOI assay with accessory minerals will be taken during the course of geological mapping.

5.2.0 Geochemical Sampling

5.2.1 Surface sampling (Bed Rock Samples/Soil Samples)

During the course of Geological mapping the Bed rock and Soil samples shall be collected from the out crops and soil covered area respectively. A total of 100 no's bed rock samples shall be collected, prepared and analyzed for Manganese assay.

5.3.0 Surveying:

5.3.1 The block boundary will be surveyed by DGPS and total station in WGS-84 datum for demarcation of block boundary points. Survey party will be associated with stream sediment sample and Bed rock sample collection by taking up the points and plotting its location on map for proper interpretation of the sample data. Survey party will also be associated with Geological Mapping. Rock types, their contact, structural features etc. will be observed during Geological mapping and the Litho-contacts will be plotted for finalization of Geological map on 1:12,500 scale. During drilling scout borehole, fixation and determination of reduced level and Co-ordinates of the boreholes only will be undertaken. If mineralized zones are identified, contouring of the surrounding areas of ore bodies would be done on 2 m contour intervals along with survey of surface features.

5.5.0 Geophysical Survey:

5.5.1 The area of the block is nearly 100 sq.km. The litho-units hosting mineralization are Calc-silicate and granulite will be occupying top portion or the slope of hills covered mostly by rubble & soil. Hence, to assess the strike of the sub-surface ore body continuation need of Geophysical survey is felt. 20 line km in split profile lines Magnetic, Resistivity and Induced Potential will be carried out in the Geophysical survey. The Magnetic Survey will be taken at 25 m station interval.

5.6.0 Exploratory Mining

5.6.1 Trenching/Pitting:

Trenching and pitting shall be carried out in the potential zones identified based on the results of geological mapping & Geochemical sampling. A provision of shallow trenching of 100 cu. m. is kept. Pitting shall be done for correlation of mineralized zones on the surface up to a depth of 1 m after removal of soil/weathered column in the area. Locations of the pits & trenches on ground will be decided by field geologist based on field observations. A provision of 110 no primary & check trench/pitsamples is kept for analysis for Mn, Fe, Al_2O_3 , SiO_2 , P & LOI assay. The pit & trench walls will be mapped on 1:200 scale. Thus 100 Cu. M. of shallow trenching & pitting work along with associated geological and laboratory studies have to be carried out.

5.7.0 Core Drilling:

5.7.1 Geophysical survey will be helpful in adding new area in the block in the strike continuity. Hence 5 scout boreholes involving 600 m of drilling will be undertaken for upper level of intersection.

5.8.0 Drill Core Logging:

5.8.1 The drill core will be logged for rock types, structural features, textures, intersection of ore zones, type of mineralization and occurrence of various ore minerals. The logging for determining the Rock quality determination will also be undertaken.

5.9.0 Drill Core Sampling

5.9.1 During the geological logging of drill core samples in mineralized zones will be marked on concentration wise and lithology wise. 200no's of samples (primary) will be analyzed for Mn, Fe, Al_2O_3 , SiO_2 , P & Lol assay, 10%primary samples will be given for check. 10 no's composite samples will be analyzed for Mn, Fe, Al_2O_3 , SiO_2 , P & Lol assay.

5.10.0 Whole Rock Analysis:

5.10.1 10 No of samples shall be subjected to whole rock analysis to check the rock types, their variation in chemical composition, will be done 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 Analysis.

5.11.0 Petrological Studies:

5.11.1 During the course of Geological mapping and drill core logging 30 samples from various litho-units from surface and intersected in boreholes will be studied for petrography and 30 samples from mineralized zones will be studied for the ore mineral assemblages and their distribution, alteration, enrichment etc in polished sections.

5.12.0 Specific gravity Determination:

5.12.1 For the specific gravity determination 10 samples from the mineralized zones intersected in the boreholes will be sent to lab.

5.13.0 XRD studies:

5.13.1 Ten (10) Nos of samples from the composite samples,shall be subjected for XRD studies.

5.14.0 Spectroscopic Studies

5.14.1 10Nos of samples shall be subjected for Spectroscopic Studies (La-MC-ICP MS Method Full Spectrum of 48 radicals) or(12 elements Cd, Sn, W, Sb, Mo, Ce, Nb, Ba, La, Bi, Co & Ni)for trace elements.

5.15.0 Proposed Quantum of Work:

5.15.1 The details of proposed work is given in the table below:

Proposed Quantum of Work for Reconnaissance Survey for Manganese in Ambadala-Suna-khunti area, (Block-ID ER-ODS-02), in area of 100 Sq Km Area, District: Rayagada, Kalahandi, (Odisha)			
Sl. No.	Item of work	Unit (m)	Proposed Quantum of Work
1	Geological Mapping (on 1:12,500 Scale)	Sq. Km.	100 sq. km.
2	Topographical Survey * (on 1:12,500 Scale in potential Zone Areas)	Sq. Km.	As per requirement
	Bore Hole Fixation (Scout Boreholes) *	Nos.	5 Nos.
	RL & Coordinate Determination	Nos.	5 Nos.
3	Geochemical Sampling		
	a) Bed Rock Sampling	Nos.	100 Nos.
4	Ground Geophysical Survey (Work to be carried out after completion of Geological Mapping)		
	a) Magnetic Survey at 50m Interval	No of Sts.	1020 Nos.
	b) Resistivity	Line Km	20 Line Km
	c) Induced Polarization Survey at an station interval of 25m and line interval of 100m	Line Km	20 Line Km
5	Excavation (Trenching /Pitting) *	Cu. m.	100 Cu m
6	Drilling (coring)*	m	600m (5 Bhs)
7	Geological work *		
	a) Geological Core Logging, Sample Preparation etc.	m	600m (5 Bhs.)
8	Laboratory Studies		
	i) Surface Sampling (Primary samples)		
	ii) Bed Rock samples		
	a) For Mn, Fe, SiO ₂ , Al ₂ O ₃ , P & LOI	Nos.	100 Nos.
	iv) Check Samples (Bed Rock)		
	a) For Mn, Fe, SiO ₂ , Al ₂ O ₃ , P & LOI	Nos.	10 Nos.
	v) Pit & Trench Primary & Check Samples *		
	a) For Mn, Fe, SiO ₂ , Al ₂ O ₃ , P & LOI	Nos.	110 Nos.
	vi) Drill Core (Primary + Check) Samples *		
	a) For Mn, Fe, SiO ₂ , Al ₂ O ₃ , P & LOI	Nos.	220 Nos.
9	Physical Studies		
	a) XRD – Studies on Composite samples *	Nos.	10 Nos.
	b) Spectroscopic Studies (La-MC-ICP MS Method Full Spectrum of 48 radicals) *	Nos.	10 Nos
10	Petrological Samples (Surface & Bh Core Samples)#		
	a) Preparation of Thin Section	Nos	30 Nos
	b) Study of Thin Section	Nos	30 Nos
11	Mineragraphic Studies (Surface & Bh Core Samples) #		
	a) Preparation of Polished Section	Nos	30 Nos
	b) Study of Polished Section	Nos	30 Nos
12	Whole Rock Analysis*		
	For SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , MnO, CaO, Na ₂ O, K ₂ O+H ₂ O, MgO, P ₂ O ₅ , CO ₂ , & S.	Nos	10 Nos
14	Specific gravity Determination*	Nos.	10 Nos
15	Report Preparation [As per Mineral (Evidence of Mineral Contents) Rule-2015]	Nos	1
*The 2 nd Level of work to be decided after Review of Geological Mapping & Geochemical Sampling			
# part samples shall be analyzed in second level of work after review			

6.0.0 Time schedule and cost Estimate:

6.1.0 Time schedule

6.1.1 The proposed block area is nearly of 100 sq. km. there is possibility of getting sub-surface extension of the ore body already recognized two no's of areas and some new prospective areas. The details are indicated in bar chart given below.

Time schedule (in months) for Regional Exploration for Manganese in Ambadala-Sunakhunti area, (Block-ID ER-ODS-02), in an area of 100 Sq Km, District: Rayagada, Kalahandi, (Odisha)												
Item of Work	1	2	3	4	5	6	7	8	9	10	11	12
Geological Mapping (2 Party Days)	←			→								
Bed Rock Sampling		←		→								
Surveying (1Party Days) for Sampling etc	←			→								
Sample Preparation Soil / Bed Rock / Stream (2 Party Days)			←		→							
Analytical Work				←		→						
Geophysical Survey					←		→					
Geophysical Report							←	→				
Surveying in Geophysical Survey (2 Party's)					←		→					
Exploratory mining (1Party) for Trenching / Pitting						←		→				
Drilling (600 m)							←		→			
Surveying (2 Party) for drilling, contouring and surface features						←		→				
Sample Preparation (Drill Core) Party Days (1 Party)								←		→		
Geologist Party days for Drilling and Sampling work & report work (1 Party)							←		→			
Analytical Work Drill Core Samples									←		→	
Camp winding									←		→	
Geological Report											←	→

6.2.0 Cost Estimate:

The Project cost with provisional escalation is estimated at say **Rs. 232.392 Lakhs**. The details of item wise cost estimate with inbuilt actual escalation as on 31.3.2016 is given below.

Sl No.	Item	Total Estimated Cost (Rs.)
2	Geological, Survey & Sampling Work	73,11,210/-
3	Geophysical Survey & Report	53,95,940/-
4	Exploratory Mining	1,85,300/-
5	Drilling	86,01,626/-
6	Laboratory Studies	15,67,720/-
	Subtotal	2,30,61,796/-
7	Report	2,30,618/-
	Total	2,32,92,414/-

Or Say Rs. 232.92 Lakhs (Rs.2.33 Crore)

7.0.0 Justification:

- i) In view of MMDR Amendment & Mineral Auction Rule, 2015, GSI has identified this block for exploration MECL decided to take up the work under NMET funding.
- ii) In the proposed study area, Threeno's known prospect are to be explored for & their sub-surface continuation in strike & dip directions. Apart from these there is possibility of getting few more prospects in the strike or in any concealed shears. The Geophysical surveys and Remote sensing studies will add to the Geological mapping for targeting the mineralized zone
- iii) The exploration will be helpful in estimation of reconnaissance resources of Manganese and accessory minerals in block area.
- iv) The Regional Exploration will help in planning of detailed exploration programme which in turn will facilitate the State govt. for auctioning of block.

Cost Estimate for G-4 Level of Exploration for Manganese in Ambadala-Sunakhunti area, (Block-ID ER-ODS-02) District: Rayagada, Kalahandi, (Odisha)						
Sl. No.	Item of Work	Unit	Base Rate 01-04-1990	Rates (2016-17)	Qty.	Amount
A	GEOLOGICAL WORK					
1	Survey Party days					
	a) Survey Party days (1party) For Sampling etc	days	1180	6,146	120	737520
	b) Survey Party days (2 party) For Geophysical Survey etc	days	1180	6,146	120	737520
	c) Survey Party days (2 party) For Drilling	days	1180	6,146	180	1106280
2	Geologist Party days					
	a) Geological Party days (2 Party) For Geological Mapping etc in an area of 100 Sq. Km	days	1541	8,021	240	1925040
	b) Geological Party days (1 Party) For Pitting/ Trenching	days	1541	8,021	90	721890
	b) Geological Party days (1 Party) For Drilling, Core Sampling	days	1541	8,021	90	721890
3	Sampling Party days	day				
	a) Sample Preparation for Bed Rock Samples (1 Partys)	days	525	2,945	120	353400
	b) Sample Preparation Drill Cores (1 Party)	days	994	2,945	60	176700
	c) Sample Preparation Pits/Trenches (1 Party)	days	525	5,733	90	515970
4	Transportation (Light Vehicles, 2 nos)	day	Lumpsum	1,500	210	315000
	Sub-Total A					7311210
B	GEOPHYSICAL SURVEY & REPORT					
	Magnetic Survey at 50m Interval	Nos.	107	482	1020	491640
	Resistivity	L. km	4168	18,710	20	374200
	Induced Potential	L. km	7860	2,17,505	20	4350100
4	Transportation (Light Vehicles, 2 nos)	Km	Lumpsum	1,500	120	180000
	Sub-Total B					5395940
C	EXPLORATORY MINING					
1	Excavation (Trenching/Pitting)	Cu. m	395	1,853	100	185300
	Sub-Total C					185300
D	CORE DRILLING (5 BH)					
1	Surface Drilling (2 rigs)	m	2035	9,494	600	5696400
2	Transportations (2 Rigs)	Km	8.8	34	4000	136000
3	Accommodation (One time/ Drill)	Nos	185925	7,28,250	2	1456500
4	Camp Setting / Winding	Nos	68606	2,68,723	2	537446
5	Road Making (Hilly Terrain)	Km	7800	30,552	15	458280
6	GI Core Boxes	Nos	Lumpsum	2,000	150	300000
7	Transportation Charges of Core Boxes	Km	8.8	34	500	17000
	Sub Total D					8601626
E	LABORATORY STUDIES					
1	Chemical Analysis					
	i) Surface sampling (Bed Rock Samples)					
	a) Mn, Fe, SiO ₂ , Al ₂ O ₃ , P, LOI	Nos.	110+(76*5)	2,709	100	270900
	ii) Check Samples (Bed rock)					
	a) Mn, Fe, SiO ₂ , Al ₂ O ₃ , P, LOI	No	110	599	10	5990
	iii) Pit & Trench, Primary & Check Samples					
	a) Mn, Fe, SiO ₂ , Al ₂ O ₃ , P, LOI	Nos.	110+(76*5)	2,709	110	297990
	iv) BH Core Sampling, Primary & Check samples					
	a) Mn, Fe, SiO ₂ , Al ₂ O ₃ , P, LOI	Nos.	110+(76*5)	2,709	220	595980
	v) Composite Samples for 6 radicals					
	a) Mn, Fe, SiO ₂ , Al ₂ O ₃ , P, LOI	Nos	110+(76*5)	2,709	10	27090

2	Physical Analysis					
	i) Petrographic Studies (BH core + Surface Samples)					
	a) Preparation of thin section	Nos	100	545	30	16350
	b) Study of thin section	Nos	228	1,495	30	44850
	ii) Mineragraphic Studies (BH core + Surface Samples)					
	a) Preparation of polished section	Nos	100	583	30	17490
	b) Study of polished section	Nos	364	2,118	30	63540
	iii) Whole rock analysis For SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , MnO, CaO, Na ₂ O, K ₂ O+H ₂ O, MgO, P ₂ O ₅ , CO ₂ , & S.	Nos	1316	6,386	10	63860
	iv) Specific Gravity Determination (BH)	Nos	32	198	10	1980
	v) XRD & Spectroscopic Studies					
	a) X-RD Studies on composite	Nos	1137	5,900	10	59000
	b) Trace Element Studies by ICPMS Studies for the full spectrum of 48 Elements *	Nos	7900	10,270	10	102700
	Sub-Total E					1567720
	Total (A+B+C+D+E)					23061796
F	EXPLORATION REPORT - 1% of (A+B+C+D+E)					230618
	GRAND TOTAL (A+B+C+D+E+F)					23292414
					Say Rs. 232.92 Lakhs	
Note	1- Revised rate of promotional work by MECL on behalf of Govt. of India vide letter no. 37(I)/2006-MI dated 02.07.2014 and based on actual escalation as per RBI indices as on 31.3.16 and provisional escalation of @15% points for drilling and 25% points for Geological & Laboratory Studies for subsequent year.					
	2- * Rate taken from GSI Schedule of rates as the same are not available in Goel Committee					
	3- Drilling rate for Gold has been considered as there is no rates for Manganese in Goel Committee report of MoM Schedule of Rates.					