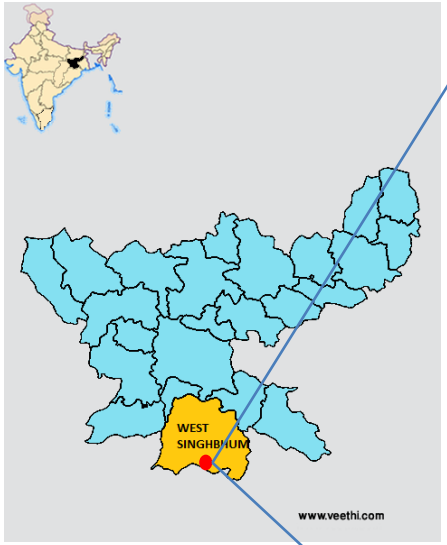
Proposal for Investigation of Manganese and Associated Minerals in Kankura Block, West Singhbhum District, Jharkhand for G3 Stage Mineral Exploration

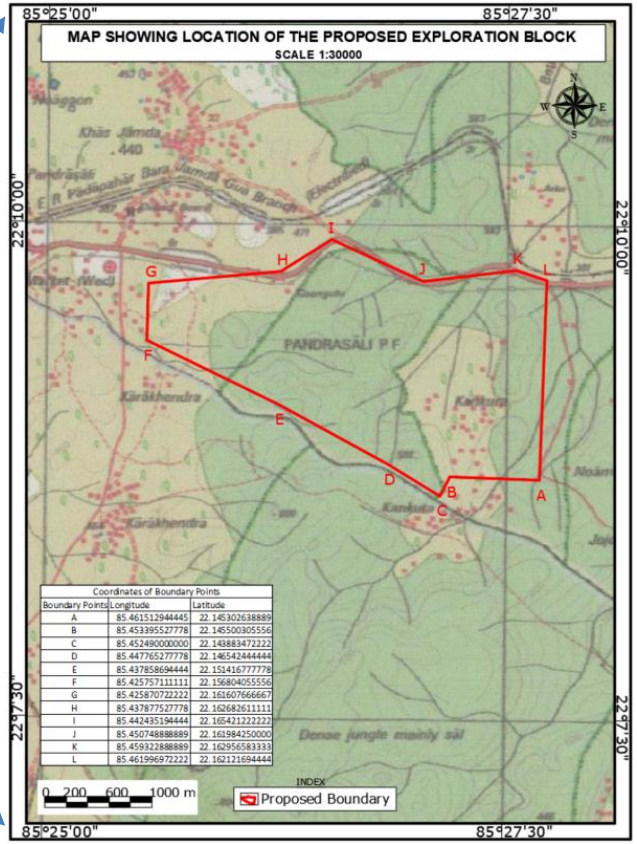
Presentation at: 05th TCC-II Meeting, NMET
Date: 27.01.2025

Location of the proposed block over toposheet

INDEX MAP



State: Jharkhand
District: West Singhbhum
Toposheet Reference: 73F/8
Proposed block area: 5.60 Sq. Km.



Accessibility

- 71 Km from Chaibasa, the district headquarters situated in the northeast direction.
- 4.0 Km from Noamundi in West.
- 1.0 Km from Barajamda in East.
- NH-320G passes along the northern boundary.
- Barajamda railway station and siding is only 2.0 Km. from the block area.

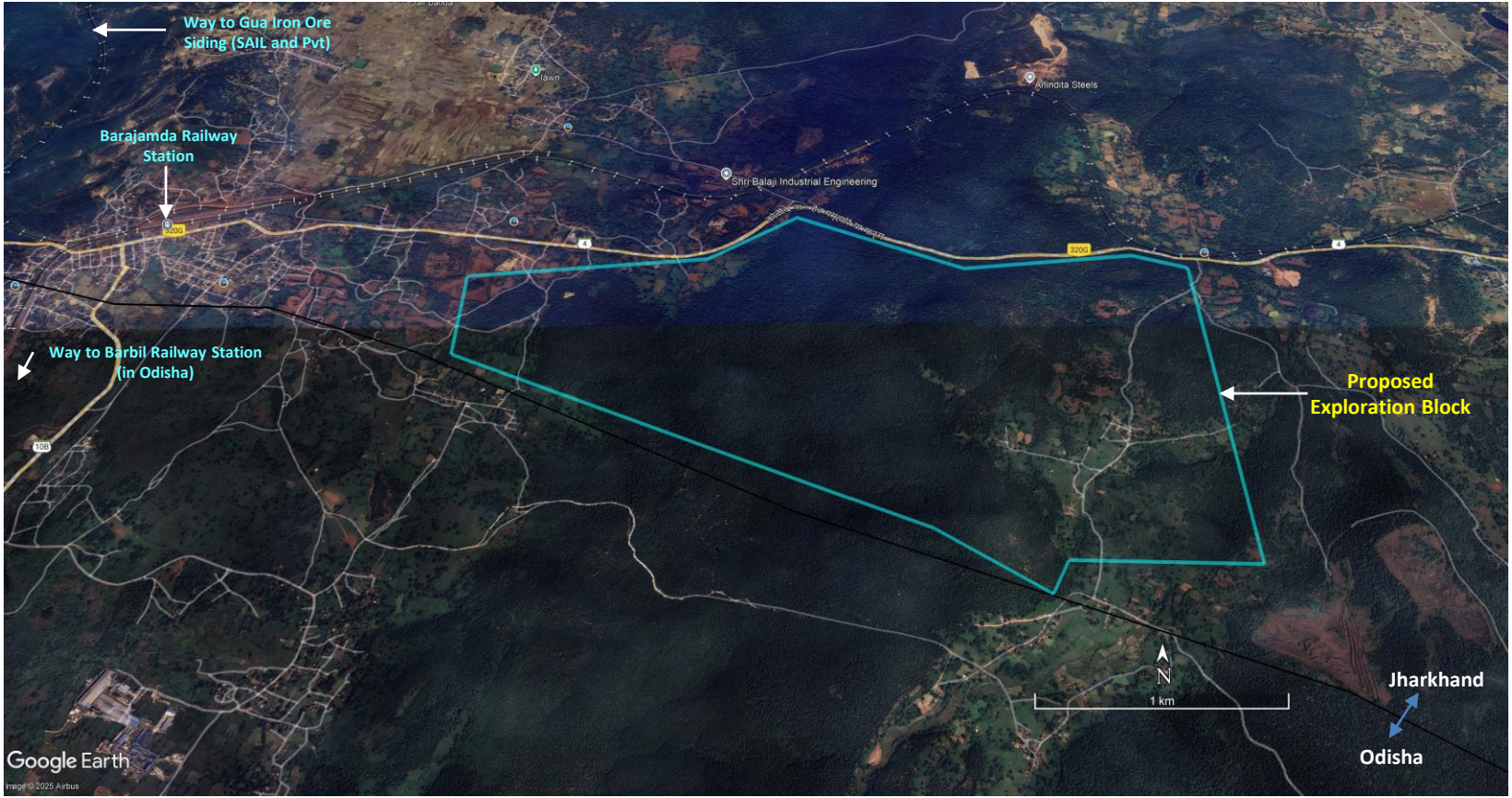
Morphology:

Undulatory hilly area with a valley in the eastern side and flat lands along the northwestern margin.

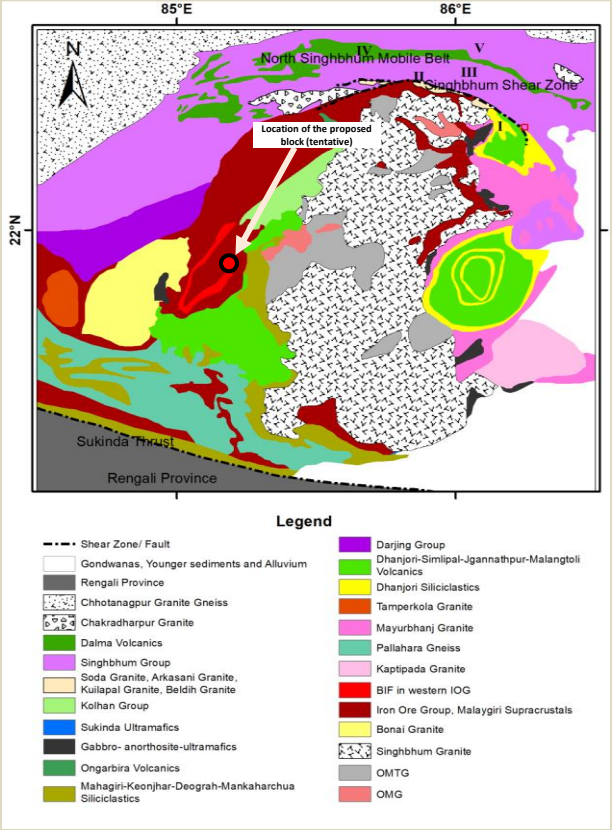
Forest Cover:

Central highlands is covered in forest.

Location of the proposed block over Google Image



Regional Geology



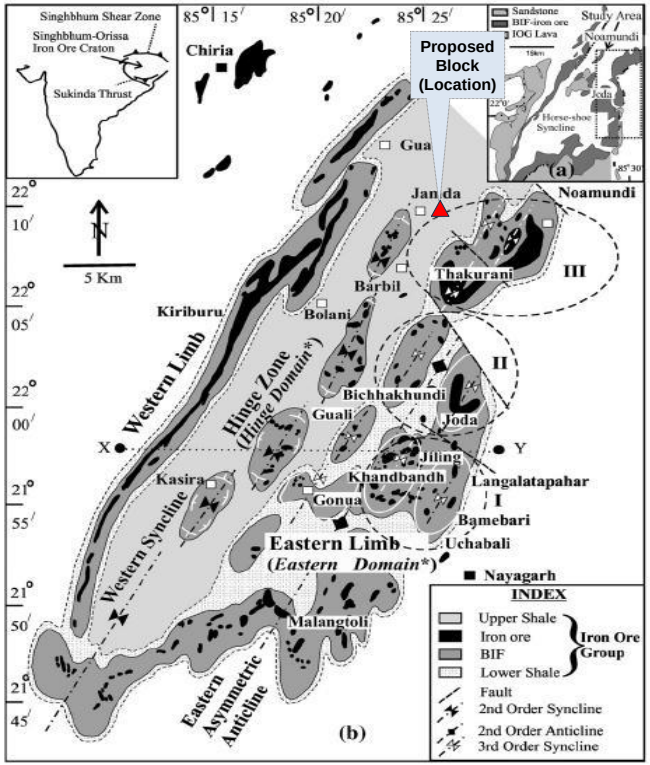
Source: after Saha, 1994 and modified from other sources

- The area is part of Iron Ore Group (IOG) of Singhbhum Super Group.
- The iron and manganese ore bearing sequence in West Singhbhum, popularly known as Noamundi-Jamda-Koira belt is a part of West Singhbhum- Kandahar basin.
- The rocks are disposed along NNE-SSW trending greenstone belts and associated sedimentary basins (Baidya, 2015).
- The manganese mineralization in the Noamundi-Jamada-Koira sector is hosted in the shales occurring within the lower phyllite and shales of the Iron Ore Group.

Regional stratigraphy

Jones (1934)	Murty & Acharya (1975)		Saha (1994) Modified after Sarkar & Saha (1977)	
Upper shales, epidiorite and ash bed	Iron Ore Group	Mixed facies formation	Koira Group	Singhbhum granite
BHQ with iron ore bodies		Upper Shale Formation		Upper Shale with volcanics
Shales with occasional sandstones		Banded Iron Formation		BHJ with iron ore, ferruginous quartzite
Purple sandstone with basal conglomerate		Lower Shale Formation		Lower shale and acid, intermediate tuffs, local dolerite
---------- Unconformity ----------		Volcanic Formation		
Older Dharwars				

Location of the block over Simplified Geological map of Noamudi-Jamda-Koira Belt



Litho-structural disposition (modified after Jones, 1934 and referred from work of Ghosh and Mukhaopadhyay, 2007)

General:

The study area belongs to Iron Ore Group in the Singhbhum Super Group of Pre-Cambrian era (>c. 3100 Ma), of Dharwarian age (Mishra 2006).

Major lithologies:

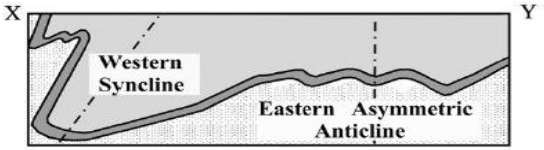
Slightly metamorphosed sedimentary formations viz., Banded Hematite Jasper (BHJ), phyllites, with intercalation of lava flows and tuffs.

Structures:

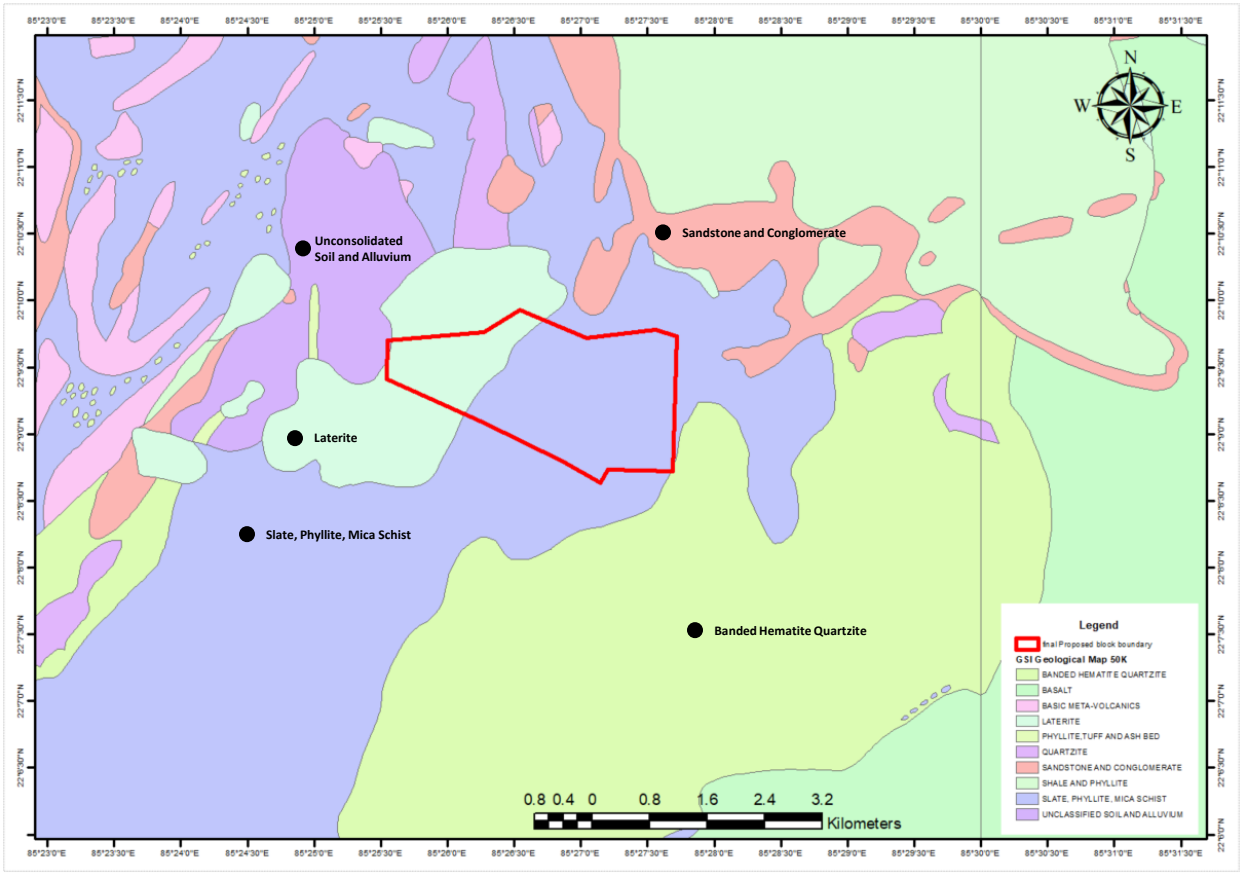
The Bonai-Kendujhar Belt (BKB) of north Odisha, structurally disposed in the form of a Horse-Shoe shaped synclinorium. The core of this synclinorium occupied dominantly by shale with intercalations of chert bands hosting several manganese ore deposits (Mohakul and Bhutia, 2015).

Regionally the basin has undergone two phases of deformation (D1 & D2). The general trend of the basin is NNE-SSW and basically represents a large regional synclinorium overturned to SE with fold axis plunging towards NE. The F1 and F2 folds are coaxial and coplanar too but the F3 folds are of cross fold type having WNW-ESE axial trend (Chakraborty and Majumdar, 1986).

The work in the eastern limb of the syncline revels that the eastern domain consists of two to three third-order NNE-SSW trending F1 synclines (Ghosh and Mukhopadhyay, 2007) in different sectors.

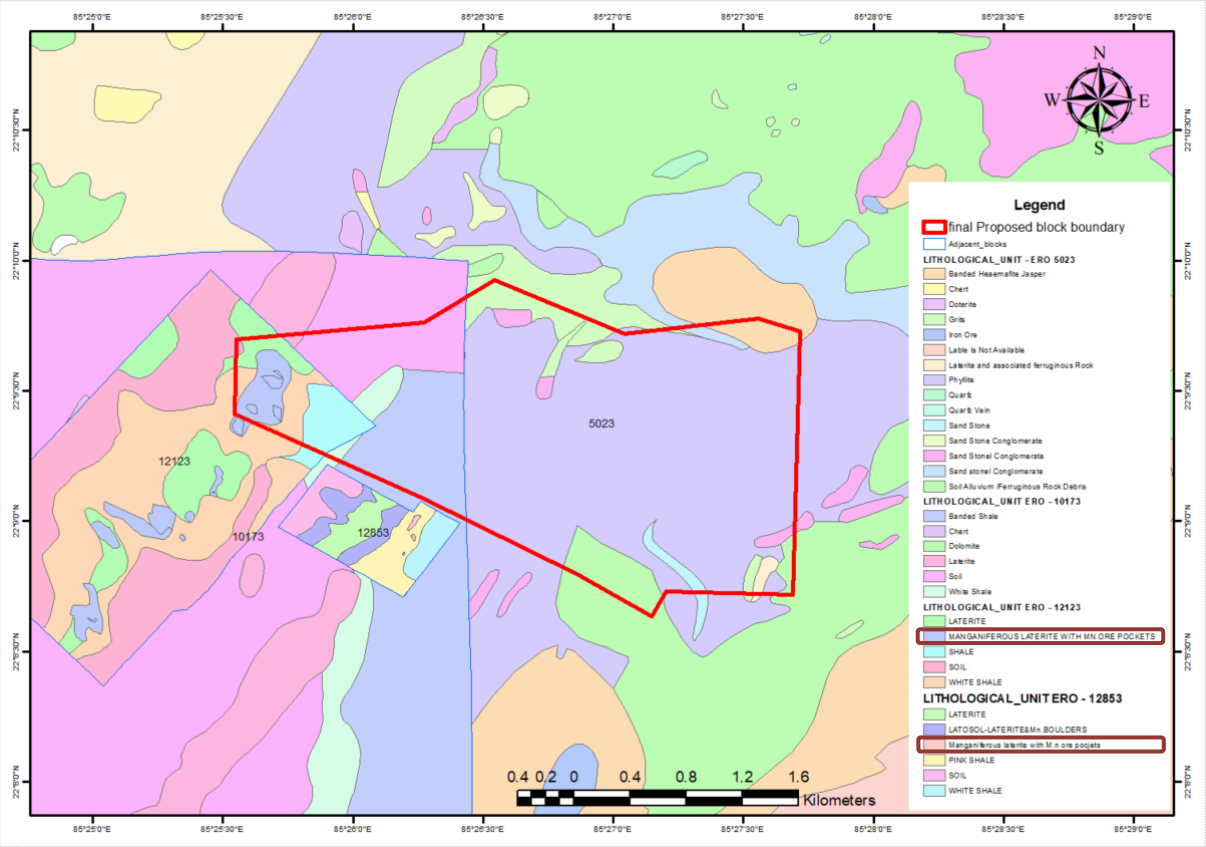


Location of the block over 1:50000 Scale Map (Sourced from NGDR)



As per 1:50000 scale major lithologies in the area are slate, phyllite, mica schist and laterite.

Mosaic of geological maps of LSM and DM within and around the proposed exploration block

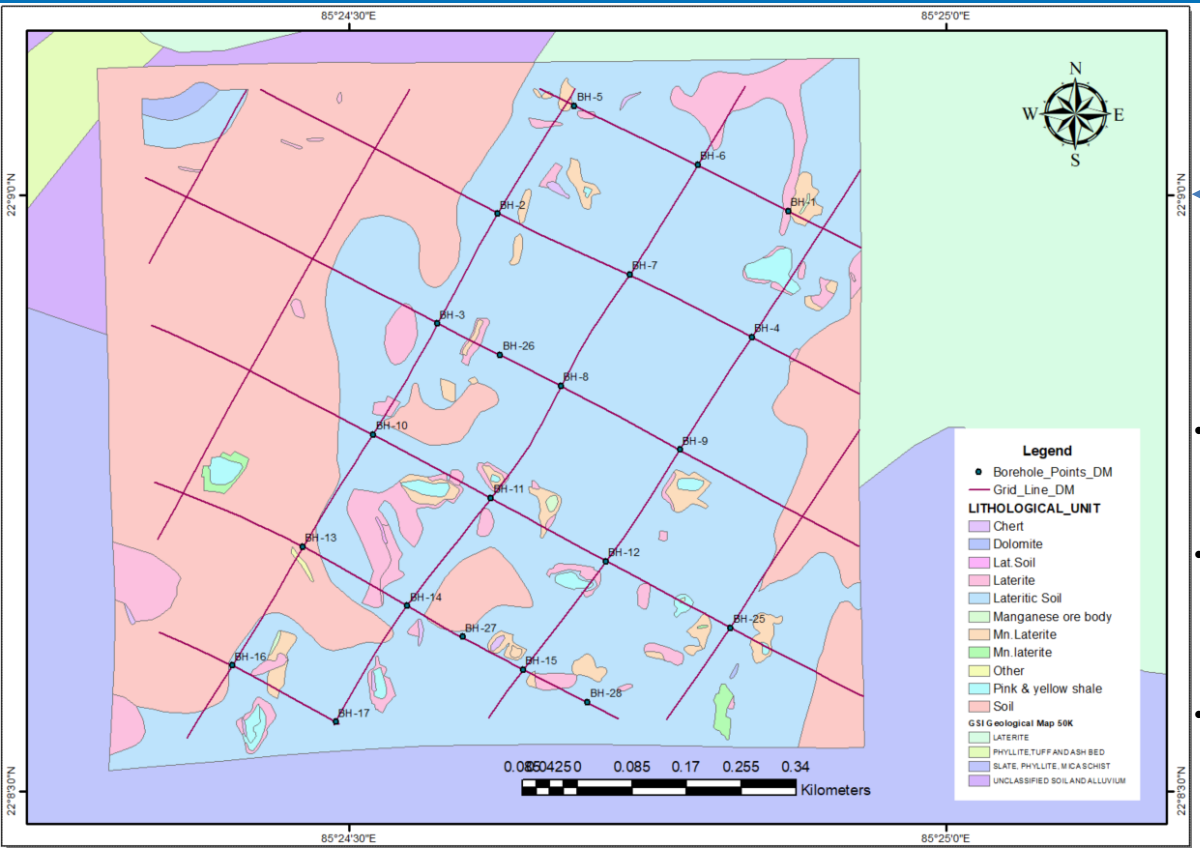


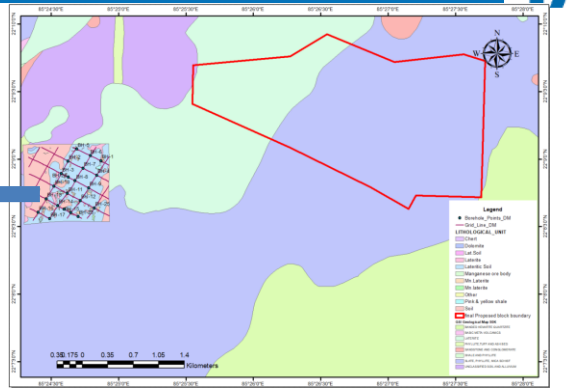
The geology of the area covering the entire proposed exploration block is detailed in the "**Large scale geological mapping and preliminary appraisal for iron and manganese around Noamundi-Jamda-Kotgarh area, Singhbhum Dist., Bihar (ERO-05023 -1971)**. The study was conducted over an area of about 160 Sq. Km with LSM.

In the report it is mentioned that within the mapped area, iron Ore (Hematite) occurs as small pockets within the BHJ and all the occurrences having economic significance. **Manganese deposits in the area are small and occurs within the shale and laterite.**

Very detail investigation for manganese exploration was carried out over Thakurani A bock located just south of the proposed exploration block. The observations and findings are mentioned in the "FINAL REPORT ON THE INVESTIGATION OF MANGANESE OREIN THAKURANT 'A' AND THAKURANT 'B' (DULKI) BLOCKS KEONJHAR DISTRICT, ORISSA" and the exploration work carried out over 2.0 Sq. Km. area **by mapping in 1:2000 scale and 29 boreholes of 1864.95m drilling at ~ 200m square grid**.

Detail Geological map with drilled borehole locations of in the Thakurani 'A' Block





- Exploratory drilling operation in Thakurani "A" block commenced on 24th December 1991, and the operation was completed on 18th April 1997.
- The summarized lithologs of boreholes indicate that the **ore zone is stratigraphically and structurally controlled and is restricted to the clayey and ferruginous/yellow brown clay/shale besides the laterite and brecciated chert zones**.
- **The base of the mineralization is marked mostly by the appearance of white clay shale/banded shale (pink-purple), brecciated chert (barren) and dolomitic limestone.**

Exploration result of Thakurani 'A' Block (by GSI)

Reserves have been computed by polygonal and triangular methods.

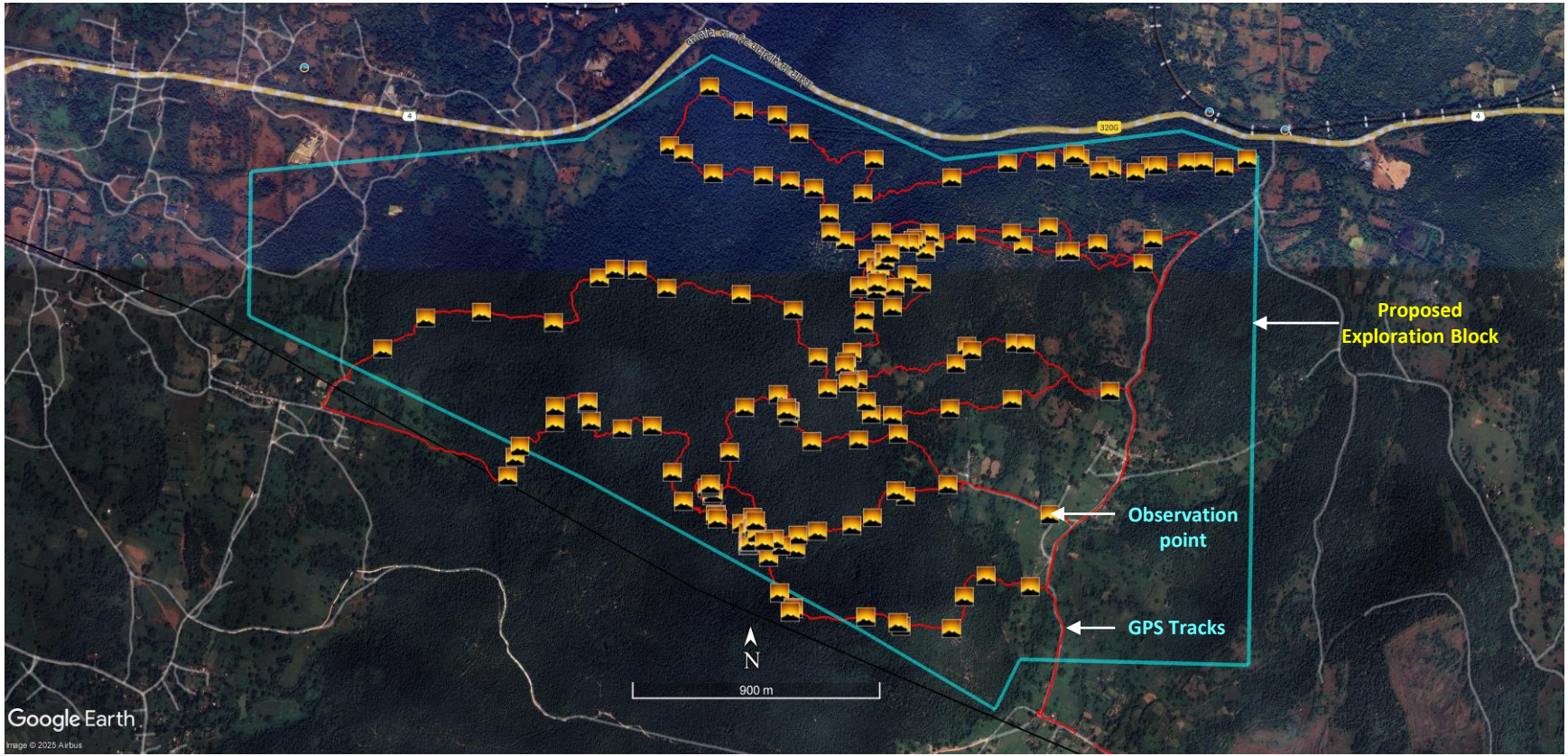
A total of recoverable reserve of 3.20 million tonnes of manganese ore are available in Thakurani "A"

Particulars	Thakurani "A" Block (%)	Resource (Mt)
High Grade (More than 45% Mn)	8.24	0.26
Medium Grade (35 to 44.99% Mn)	16.09	0.51
Low Grade (25 to 34.99% Mn)	33.44	1.07
Marginal Grade (20 to 24.99% Mn)	27.77	0.89
Black Iron (7 to 19.99% Mn)	14.46	0.46
TOTAL	**100**	**3.2**

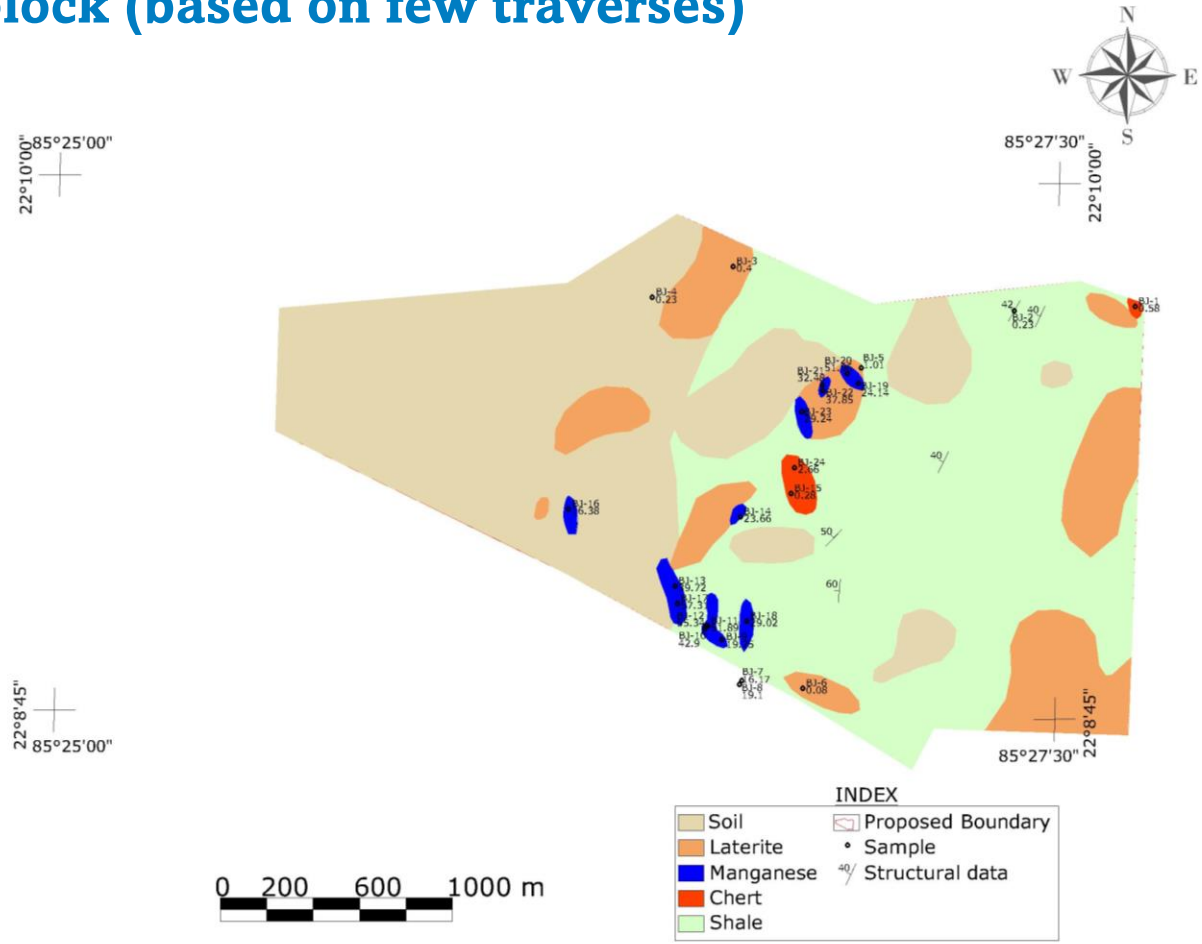
The total quantities of wad as calculated at 5% and 10% Mn cut off value in Thakurani "A" are as follows:

Particulars	Resource (Mt)
5% Mn cut-off value	5.19
10% Mn cut-off value	2.41

Field traverse path and observation locations within the proposed exploration block



Updated Lithological Map of the proposed exploration block (based on few traverses)



- The eastern part of the block is mainly covered with shale and laterite while the western part is dominated with soil cover.
- Overall, the lithologies in the area trend in NNE-SSW direction and dip moderately due west.
- Total 8 nos. of manganese ore bearing zones are identified embedded within the shale formation.
- A total of 24 samples are collected from the area covering various observed lithologies and noticed manganese ore bodies. It is observed that manganese content (Mn%) in the 16 ore samples collected from the manganese ore bodies ranges from 16.17% Mn to 57.31% Mn. Two iron rich lateritized shale samples (BJ-1 and BJ-3) have reported high iron values too. Few samples collected from shale and chert also reported higher manganese content (more than 1.0% Mn) than the background values, indicate that there could be other manganese ore bodies which are concealed and not exposed at current surface.

Chemical Analysis of the field collected samples

Sl No	Sample ID	Mn (%)	Fe (%)	SiO_2 (%)	Al_2O_3 (%)	P (%)	S (%)	CaO (%)	MgO (%)	TiO_2 (%)	K_2O (%)	Lithocode
1	BJ-1	0.58	54.19	6.09	4.84	0.489	0.012	0.009	0.168	0.343	1.006	Lateritized ferruginous shale (enriched)
2	BJ-2	0.23	8.59	53.12	18.54	0.029	0.006	0.069	3.102	1.374	3.814	Shale
3	BJ-3	0.40	56.44	6.80	6.43	0.045	0.013	0.027	0.031	0.381	0.169	Lateritized ferruginous shale (enriched)
4	BJ-4	0.23	43.33	14.49	13.31	0.107	0.012	0.066	0.046	0.929	0.190	Lateritized shale
5	BJ-5	1.01	42.96	13.23	11.68	0.259	0.007	0.110	0.156	0.697	0.777	Lateritized shale
6	BJ-6	0.08	41.05	17.02	14.46	0.074	0.007	0.109	0.040	0.905	0.164	Lateritized shale
7	**BJ-7**	**16.17**	42.66	2.82	1.82	0.207	0.015	0.090	0.109	0.151	0.912	Iron rich manganese ore
8	**BJ-8**	**19.10**	40.66	2.15	1.00	0.209	0.012	0.072	0.042	0.065	0.514	Iron rich manganese ore
9	**BJ-9**	**19.25**	23.04	11.89	10.72	0.302	0.010	0.267	0.099	0.820	0.948	Manganiferous shale
10	**BJ-10**	**42.90**	15.36	1.82	2.16	0.100	0.015	0.151	0.038	0.109	1.223	Manganese ore
11	**BJ-11**	**51.89**	7.27	1.35	1.70	0.089	0.012	0.084	0.027	0.107	1.203	Manganese ore
12	**BJ-12**	**55.34**	4.00	0.69	1.37	0.068	0.010	0.069	0.007	0.035	1.357	Manganese ore
13	**BJ-13**	**39.72**	11.44	10.62	3.91	0.114	0.013	0.146	0.112	0.288	1.005	Manganese ore
14	**BJ-14**	**23.66**	17.48	12.06	9.91	0.130	0.011	0.062	0.328	0.703	2.499	Manganese ore
15	BJ-15	0.28	39.71	34.58	3.67	0.255	0.005	0.053	0.059	0.216	0.279	Iron rich chert
16	**BJ-16**	**16.38**	42.04	3.81	4.51	0.034	0.010	0.036	0.031	0.132	0.752	Iron rich manganese ore
17	**BJ-17**	**57.31**	1.10	0.73	2.53	0.097	0.017	0.069	0.014	0.037	0.395	Manganese ore
18	**BJ-18**	**29.02**	9.68	27.13	6.13	0.056	0.015	0.094	0.218	0.400	2.229	Manganese ore
19	**BJ-19**	**24.14**	9.99	15.29	13.75	0.078	0.014	0.710	0.224	1.197	0.423	Manganese ore
20	**BJ-20**	**51.96**	2.89	2.33	5.02	0.091	0.016	0.771	0.227	0.121	0.421	Manganese ore
21	**BJ-21**	**32.48**	17.38	6.87	6.95	0.051	0.019	0.748	0.238	0.409	1.967	Manganese ore
22	**BJ-22**	**37.85**	10.95	5.89	6.87	0.045	0.015	0.921	0.231	0.461	1.860	Manganese ore
23	**BJ-23**	**29.24**	14.88	15.77	6.23	0.055	0.013	0.707	0.277	0.374	1.859	Manganese ore
24	BJ-24	2.66	37.73	28.62	6.01	0.266	0.004	0.631	0.445	0.507	0.955	Iron rich chert

Photographs of the manganese bearing BRS samples

Iron rich manganese ore (Mn% = 16.17)

Iron rich manganese ore (Mn% = 19.10)

Manganiferous shale (Mn% = 19.25)

Photographs of the manganese bearing BRS samples

Manganese ore (Mn% = 42.90)

Manganese Ore (Mn% = 51.89)

Manganese Ore (Mn% = 55.34)

Photographs of the manganese bearing BRS samples

Manganese Ore (Mn% = 39.72)

Manganese Ore (Mn% = 23.66)

Iron rich manganese ore (Mn% = 16.38)

Photographs of the manganese bearing BRS samples

Manganese Ore (Mn% = 57.31)

Manganese Ore (Mn% = 29.02)

Manganese Ore (Mn% = 24.14)

Photographs of the manganese bearing BRS samples

Manganese Ore (Mn% = 57.31)

Manganese Ore (Mn% = 29.02)

Manganese Ore (Mn% = 24.14)

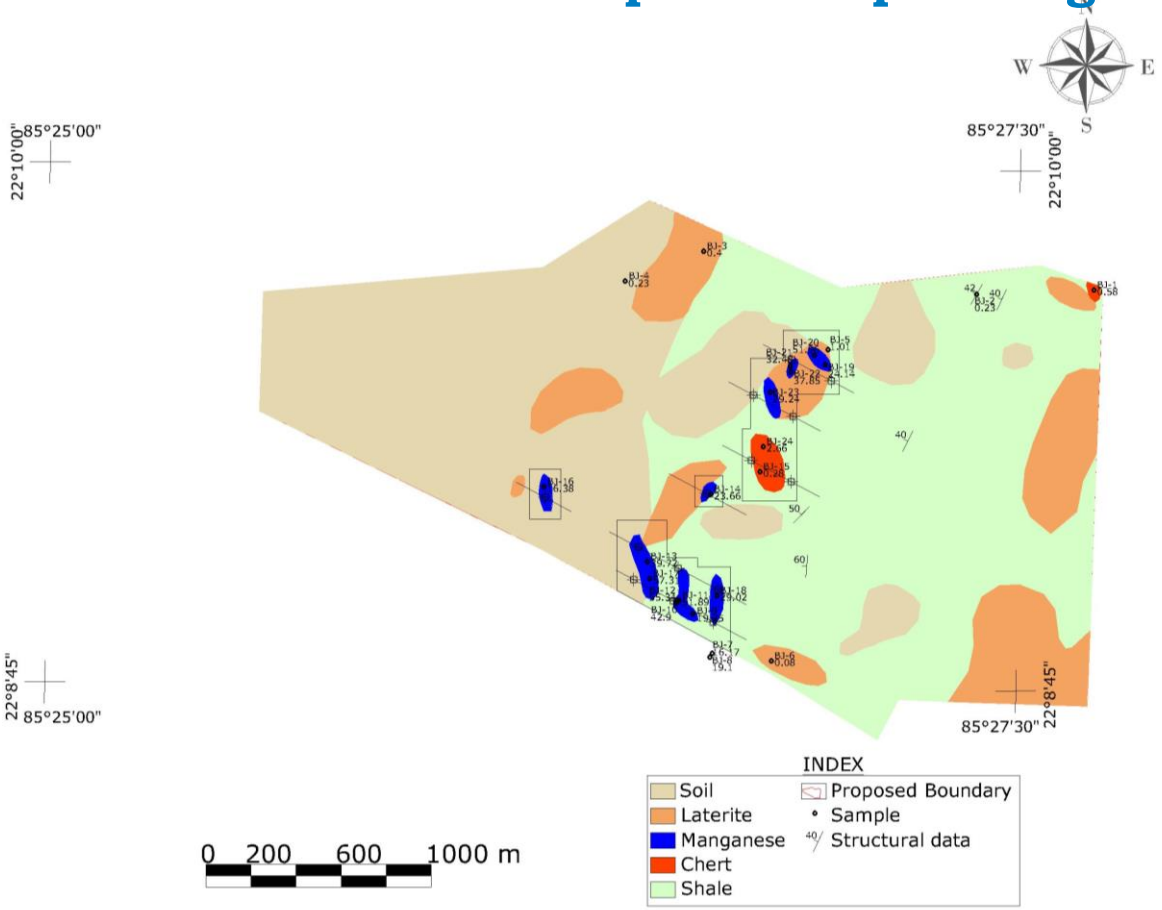
Photographs of the manganese bearing BRS samples

Manganese Ore (Mn% = 51.96)

Manganese Ore (Mn% = 32.48)

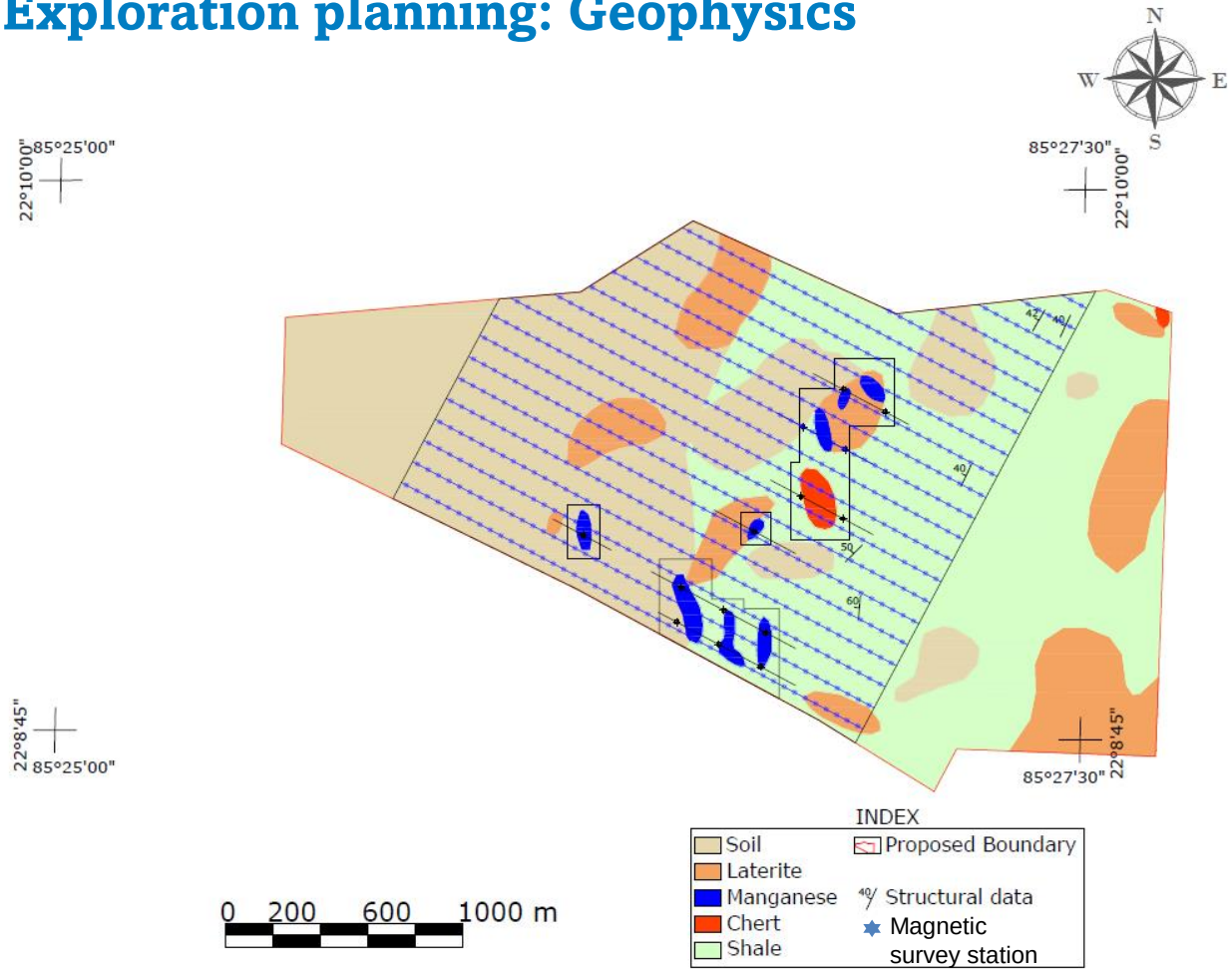
Manganese rich Chert (Mn% = 2.66)

Potential ore zone and exploration planning



- The 8 manganese ore zones as observed on the surface may be clubbed in 4 mineralized zones (2-large and 2-small). In the other parts of the area also, there are indications of manganese in laterites and shale.
- Additional areas are also considered both west and east side of the observed mineralized zones which shall be covered during exploration to surface-out concealed ore zones if any.
- It is proposed to conduct geological mapping in proposed area in 1:5000 scale with soil, bed rock, channel, groove sampling.
- Guided by the geochemical signature then conduct geophysical survey and locate potential canceled ore zones if any.
- Finally undertake exploration core drilling in the potential area in 200m grid/section spacing to prove and establish resource in G3 category.

Exploration planning: Geophysics



Particulars	UoM	Qty.
Magnetic Surveys	No. of Stations	841
Self-potential	Line Km	30
Induced Polarization (Dipole-Dipole)	Line Km	20

Magnetic Survey:

- Line spacing: 100m
- Station interval = 50m

Resistivity & IP Survey:

- Line spacing: 100m

3.50 Sq. Km. potential area is proposed to be surveyed out the total block area 5.60 Sq. Km.

Item wise proposed exploration quantities

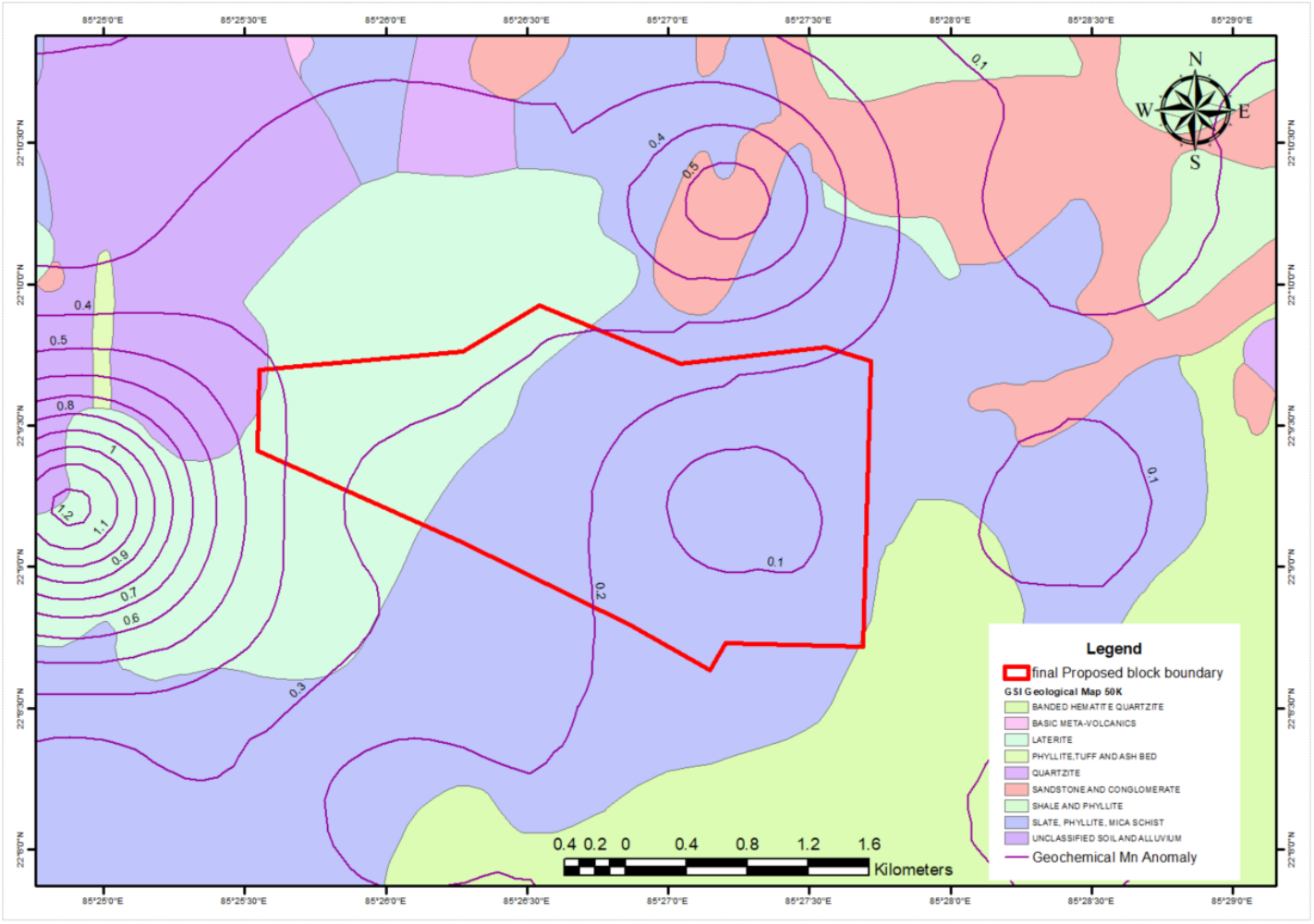
Sl. No	Item of Work	Unit	Quantity
1	**Phase-I: Geological Mapping, sampling, analysis, and laboratory studies**		
1.1	Geological Mapping at 1:5000 scale	Sq. Km.	5.60
1.2	Soil, bed rock, channel, groove sampling	No. of Samples	200
1.3	Internal Check (5%) & QAQC Sample (10%)	No. of Samples	10 + 20 = 30
1.6	Complete petrographic/ ore microscopic/ mineragraphic study (with surface and borehole samples)	No. of Samples	5
1.7	XRD analysis (with surface and borehole samples)	No. of Samples	10
1.6	Trace element study by ICP-MS (with surface and borehole samples)	No. of Samples	10
2	**Phase-II: Geophysical Survey**		
2.1	Magnetic Surveys	No. of Stations	841
2.2	Self-potential	Line Km	30
2.3	Induced Polarization (Dipole-Dipole)	Line Km	20
3	**Phase-III: Diamond core drilling (NQ size) and related activities**		
3.1	Drilling up to depth of 300m (normal rate)	m	1400
3.2	Fixation of BHs (initial & final) and boundary pillars by DGPS	Nos.	14+14+12 = 40
3.3	Topographical Survey (Using Drone/ Total Station/ DGPS)	Sq. Km.	5.60
3.4	Sample analysis	No. of Samples	700
3.5	Internal Check (5%) & QAQC Sample (10%)	No. of Samples	35 + 70 = 105
3.6	Bulk density determination (three each grade of ore) with core samples	Nos.	12
3.7	Drill core preservation	Meter	700
4	Geological Report Preparation	Nos.	1

Activity Timeline for the Project

Estimated Cost Investigation of Manganese and Associated Minerals in Kankura Block, West Singhbhum District, Jharkhand for G3 Stage Mineral Exploration
Name of the Exploration Agency - Natural Resources Division, Tata Steel Limited
Total Area - 5.60 Sq. Km; Completion Time - 15 Months; Reviews: 5 months, 9 months, 14 months

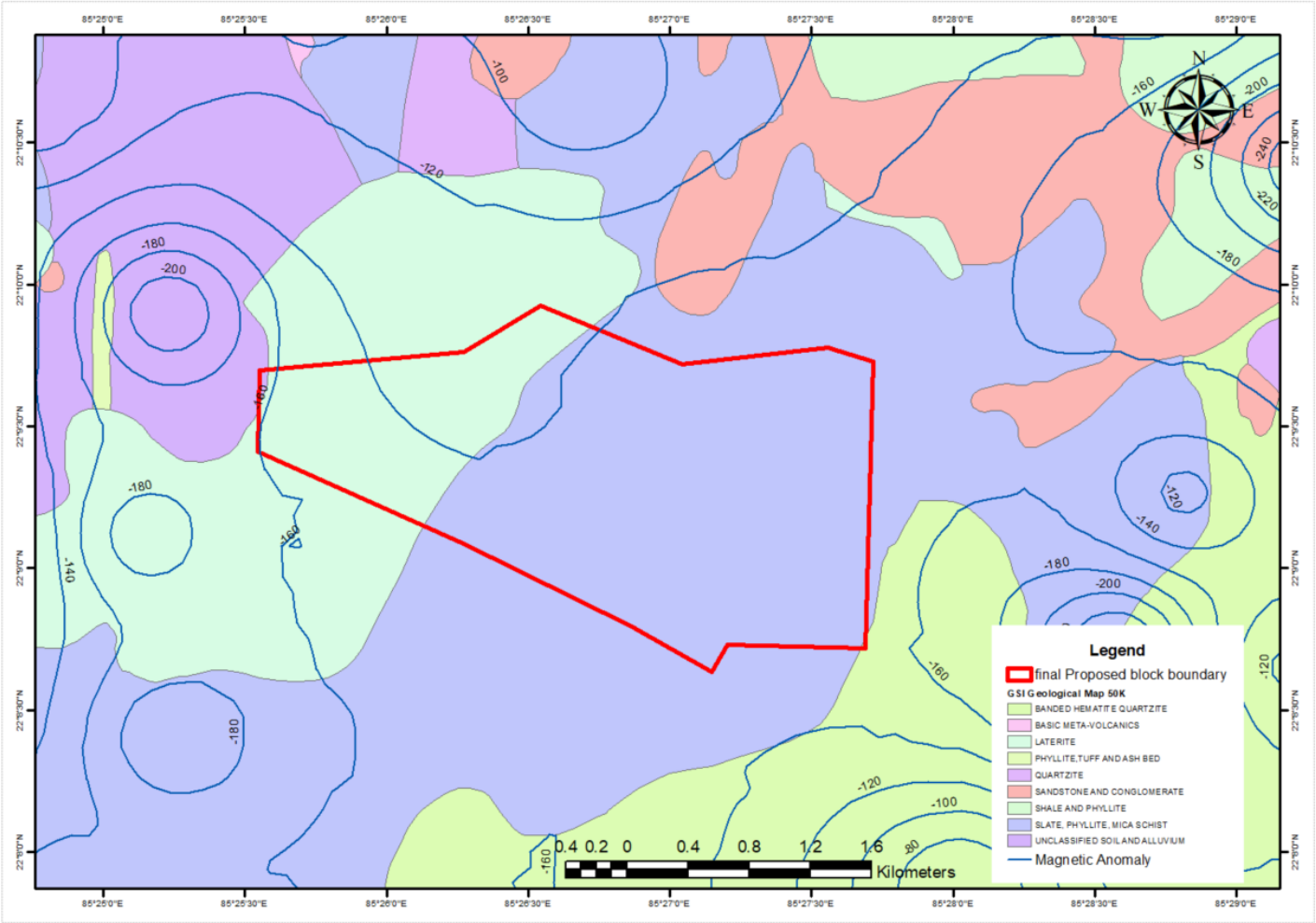
Sl. No.	Activity Plan	M1	M2	M3	M4	M5		M6	M7	M8	M9		M10	M11	M12	M13		M14	M15
1	Lithological Mapping (1:5000 scale) and Sampling																		
2	Sample preparation for chemical analysis																		
3	Sample analysis																		
4	Mineragraphic, XRD, trace element study																		
1st Review by TCC on progress and Outcome							Review-1					Review-2					Review-3		
5	Geophysical survey (Magnetic, SP and IP) over potential areas																		
6	Processing and interpretation of Geophysical survey data																		
7	Synthesis of all data, interpretation and review																		
2nd Review by TCC on progress and Outcome																			
8	Exploratory drilling, borehole collar survey etc																		
9	Logging, sampling, sample preparation, interpretation resource assessment																		
Final Review by TCC on progress and Outcome																			
10	Peer Review																		
11	Final Report preparation and submission																		

Thank You

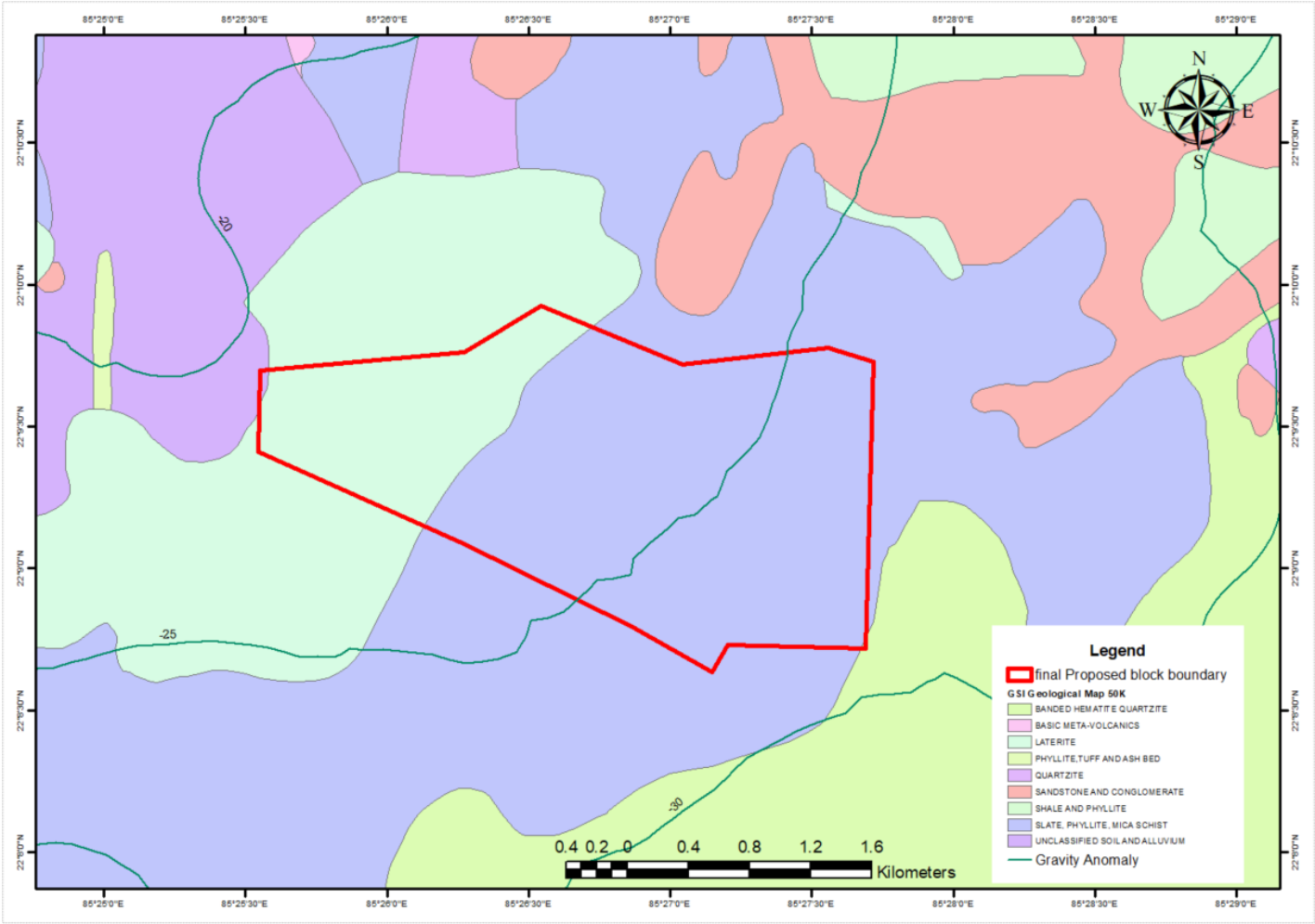


Mn% Contours generated from NGCM data (downloaded from NGDR Portal)

Data point is stream sediment sample



Magnetic Anomaly Map



Gravity Anomaly Map