PROPOSAL FOR G3 STAGE MINERAL EXPLORATION OF CHROMITE AND ASSOCIATED MINERALS AROUND PATNA-CHINGURIPAL VILLAGE IN JAJPUR DISTRICT, ODISHA

(Chromite and Associated Minerals)

By

Natural Resources Division, Tata Steel Limited

Place: Jamshedpur, Jharkhand

Summary of the Block for G3 Stage Exploration
GENERAL INFORMATION ABOUT THE BLOCK

	Features	Details
	Block ID	Patna-Chinguripal
	Exploration Agency	Natural Resources Division-Tata Steel Limited
	Commodity	Chromite and associated minerals
	Mineral Belt	Sukinda Ultramafic Complex
	Completion Period with entire time schedule to complete the project	12 months
	Objectives	1. Carryout topographical survey, geological mapping, bed rock sampling, trench sampling followed by chemical analysis to identify potential zones of chromite. 2. Conduct geophysical surveys including Magnetic, Gravity and Electrical Resistivity. 3. Undertake exploratory drilling over the identified mineralized area, perform drill core sampling and analysis to understand depth of mineralization, extend of ore zone and hence quantify resource (333) and grades.
	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	Field geological activities including mapping, collection of samples, topographical survey, trenching, database preparation, review, interpretations, report writing etc., shall be conducted by inhouse team and facilities. Some of the other jobs such as chemical analysis, geophysical survey, mineragraphic study, exploratory drilling shall be conducted through outsourced agencies.
	Name/ Number of Geoscientists	6 geologists shall be deployed in the project. 1. Sangeeth Gopi, Principal Geologist 2. Viraj A Verlekar, Sr. Area Manager Geologist 3. Deviprasad Jena, Sr. Manager Geologist 4. Deepaka Kumar Acharya, Geologist 5. Shreenivas Mishra, Geologist 6. Parvinder Kaur, Assistant Geologist
	Expected Field days (Geology) Geological Party Days	Geology = 180 days Geological Party = 360 days

<table>
<tr><td>1.</td><td>Location</td><td></td></tr>
<tr><td></td><td>Coordinates of the block boundary</td><td>
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<tr><th>CORNER POINTS</th><th>LATITUDE</th><th>LONGITUDE</th></tr>
<tr><td>A</td><td>21° 02' 57.5649" N</td><td>85° 45' 00.0033" E</td></tr>
<tr><td>B</td><td>21° 03' 25.0759" N</td><td>85° 45' 00.0464" E</td></tr>
<tr><td>C</td><td>21° 03' 45.7625" N</td><td>85° 45' 18.1807" E</td></tr>
<tr><td>D</td><td>21° 03' 45.9273" N</td><td>85° 45' 33.3355" E</td></tr>
<tr><td>E</td><td>21° 03' 57.8012" N</td><td>85° 45' 32.6938" E</td></tr>
<tr><td>F</td><td>21° 03' 57.5581" N</td><td>85° 45' 00.0857" E</td></tr>
<tr><td>G</td><td>21° 04' 16.3812" N</td><td>85° 45' 00.1097" E</td></tr>
<tr><td>H</td><td>21° 04' 15.6728" N</td><td>85° 45' 22.4521" E</td></tr>
<tr><td>I</td><td>21° 04' 40.1741" N</td><td>85° 45' 23.3694" E</td></tr>
<tr><td>J</td><td>21° 03' 53.1048" N</td><td>85° 46' 33.0998" E</td></tr>
<tr><td>K</td><td>21° 03' 53.8862" N</td><td>85° 46' 16.0926" E</td></tr>
<tr><td>L</td><td>21° 03' 51.5467" N</td><td>85° 46' 16.2585" E</td></tr>
<tr><td>M</td><td>21° 03' 45.4930" N</td><td>85° 46' 16.8949" E</td></tr>
<tr><td>N</td><td>21° 03' 39.7135" N</td><td>85° 46' 17.3823" E</td></tr>
<tr><td>O</td><td>21° 03' 40.7368" N</td><td>85° 46' 25.5861" E</td></tr>
<tr><td>P</td><td>21° 03' 29.7685" N</td><td>85° 45' 55.3208" E</td></tr>
<tr><td>Q</td><td>21° 03' 11.5274" N</td><td>85° 45' 34.5923" E</td></tr>
</table>
</td></tr>
<tr><td></td><td>Villages</td><td>Chinguripal, Patna</td></tr>
<tr><td></td><td>State</td><td>Odisha</td></tr>
<tr><td>2.</td><td>Area (hectares/ square kilometres)</td><td></td></tr>
<tr><td></td><td>Block Area</td><td>3.90 sq.km</td></tr>
<tr><td></td><td>Forest Area</td><td>-</td></tr>
<tr><td></td><td>Government Land Area</td><td>-</td></tr>
<tr><td></td><td>Private Land Area</td><td>-</td></tr>
<tr><td>3.</td><td>Accessibility</td><td></td></tr>
<tr><td></td><td>Nearest Rail Head</td><td>Sukinda Railway Station serves as the nearest railway station which is around 28.5 km from the block.</td></tr>
<tr><td></td><td>Road</td><td>The block can be approached via road in multiple ways preferably take NH-16 north to Jajpur/Byasanagar then regional road towards Sukinda and then towards Patna-Chinguripal block</td></tr>
<tr><td></td><td>Airport</td><td>Nearest airport is in Bhubaneswar (135 km from the block)</td></tr>
<tr><td>4.</td><td>Hydrography</td><td></td></tr>
<tr><td></td><td>Local Surface Drainage Pattern (Channels)</td><td>Dendritic to Sub-dendritic pattern</td></tr>
<tr><td></td><td>Rivers/ Streams</td><td>Patna Nala, Damsal Nala and small streams</td></tr>
<tr><td>5.</td><td>Climate</td><td></td></tr>
<tr><td></td><td>Mean Annual Rainfall</td><td>1500 to 1600 mm</td></tr>
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	Temperatures (December) (Minimum) Temperatures (June) (Maximum)	12°- 22°C 32°- 47°C
6.	Topography	The northern, western and eastern part of blocks consists of rugged terrains forming parts of Daitiri Protected Forest and Bhaibhaunia Huri hill respectively. Whereas southern part has relatively flat ground.
	Toposheet Number	73G/16
	Morphology of the Area	The northern, western and eastern part of blocks consists of rugged terrains with hills and narrow valley, while the central and southern part of the terrain consists of flat land with agricultural land and human settlements. The highest elevation of the area is approximately 300 m above MSL near Daitari Protected Forest and the lowest elevation is approximately 125m above MSL noted near Chinguripal village.
	Availability of baseline geoscience data	Source: NDGR portal; Report published by Directorate of Geology, Steel and Mines Department, Government of Odisha
	Geological Map (1:50K/ 25K)	Available in 1:50000, 1:25000
	Geochemical Map	Soil and stream sediment data at regional scale
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Available (Geophysical – Magnetic and Gravity data at Regional Scale)
	Justification for taking up Preliminary Exploration	The Sukinda Ultramafic Complex forms part of the metamorphosed Precambrian rocks of Peninsular India. In this region, chromite is found as layered stratiform deposits within igneous complexes of dunite and peridotite, where the rocks are highly serpentinized. The chromite bands are developed within a south-west plunging synform, and six distinct bands have been established by the Geological Survey of India (GSI). Bands in the southern limb are relatively continuous, whereas those in the northern limb are deformed and discontinuous. As per the report titled *"Report on the Investigation of Chromite Deposits in Gurjang Area (Kaliapani Block), Sukinda Ultramafic Belt, Cuttack District, Orissa"* published by GSI in 1986, detailed geological investigations (G3 stage), including drilling, were carried out in the Gurjang area located just outside

		the eastern part of the block. These investigations successfully delineated and proved a chromite resource of **5.741 million tonnes within intersection depth of 50 meters**. Moreover, most of these chromite bodies occur as lenses and are friable in nature. This established resource underscores the mineral potential of Chromite Band-(III) and provides a strong basis for further exploration to assess continuity, grade variation, and additional reserves in the unexplored western sectors. The block was previously explored by Directorate of Geology, Steel and Mines Department, Government of Odisha, by surface exploration only, where they mentioned laterite exposed in the block has Cr_2O_3 percentage more than 1% and Cr_2O_3 content in the sediments collected from the stream in this block is more than 1%. Also, northern block of the valley area (i.e. valley area between northernmost foothill of Bhaibhaunia Huri and the southernmost foothill of Daitari range) exposes peridotite containing Cr_2O_3 up to 3.04%. Further, majority of opaques present in this peridotite have been established as chromite. However, no sub-surface investigation was carried out either by geophysical survey or by exploratory drilling. **This block was allocated to NRD Tata Steel at the third Joint TCC meeting held on 4th Sept 2025.** After field visit by geologists of Tata Steel Limited, different lithologies have been traced down and representative samples were collected where Cr_2O_3 reached up to 1.27%. Although chrome ore bodies are not exposed in the block, there is a reasonable possibility of subsurface extension of regional chrome band-III beyond Chinguripal Mines of M/s IMFA. Based on the findings of previous exploration in the nearby areas, considering geological suitability, a G3 stage exploration can henceforth be taken in the block targeting potential chromite mineralization.

DETAILED DESCRIPTION ABOUT THE BLOCK

1.0 Block Summary

1.1 Location and Accessibility

The block is constituted of villages like Chinguripal and Patna and falls within SOI toposheet no. 73G/16 of Jajpur District, Odisha. Hence the block is named as "**Patna-Chinguripal Block".** Geographically, it lies between latitudes 21° 02' 57.5649" N to 21° 04' 40.1741" N and longitudes 85° 45' 00.0033" E to 85° 46' 33.0998" E. The block can be approached via road in multiple ways preferably take NH-16 north to Jajpur/Byasanagar then regional road towards Sukinda and then towards Patna-Chinguripal block. Alternative access routes include connections from Tomka to Kaliapani or from Kamakhyanagar via Kathpal and Birasal, ensuring good accessibility for exploration and mining activities. Sukinda Railway Station serves as the nearest railway station which is around 28.5 km from the block. Nearest airport at Bhubaneswar is located 135 km away from the block.

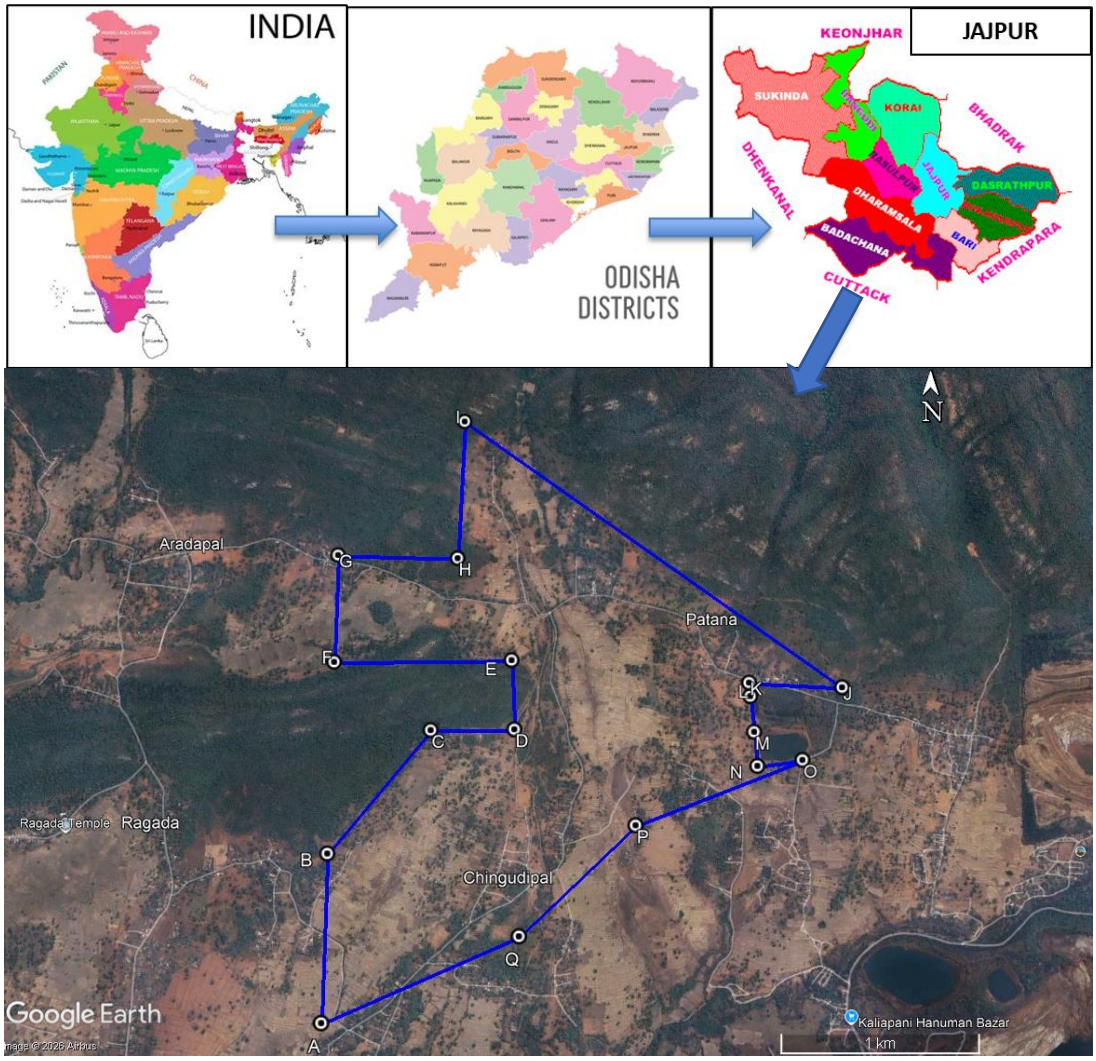
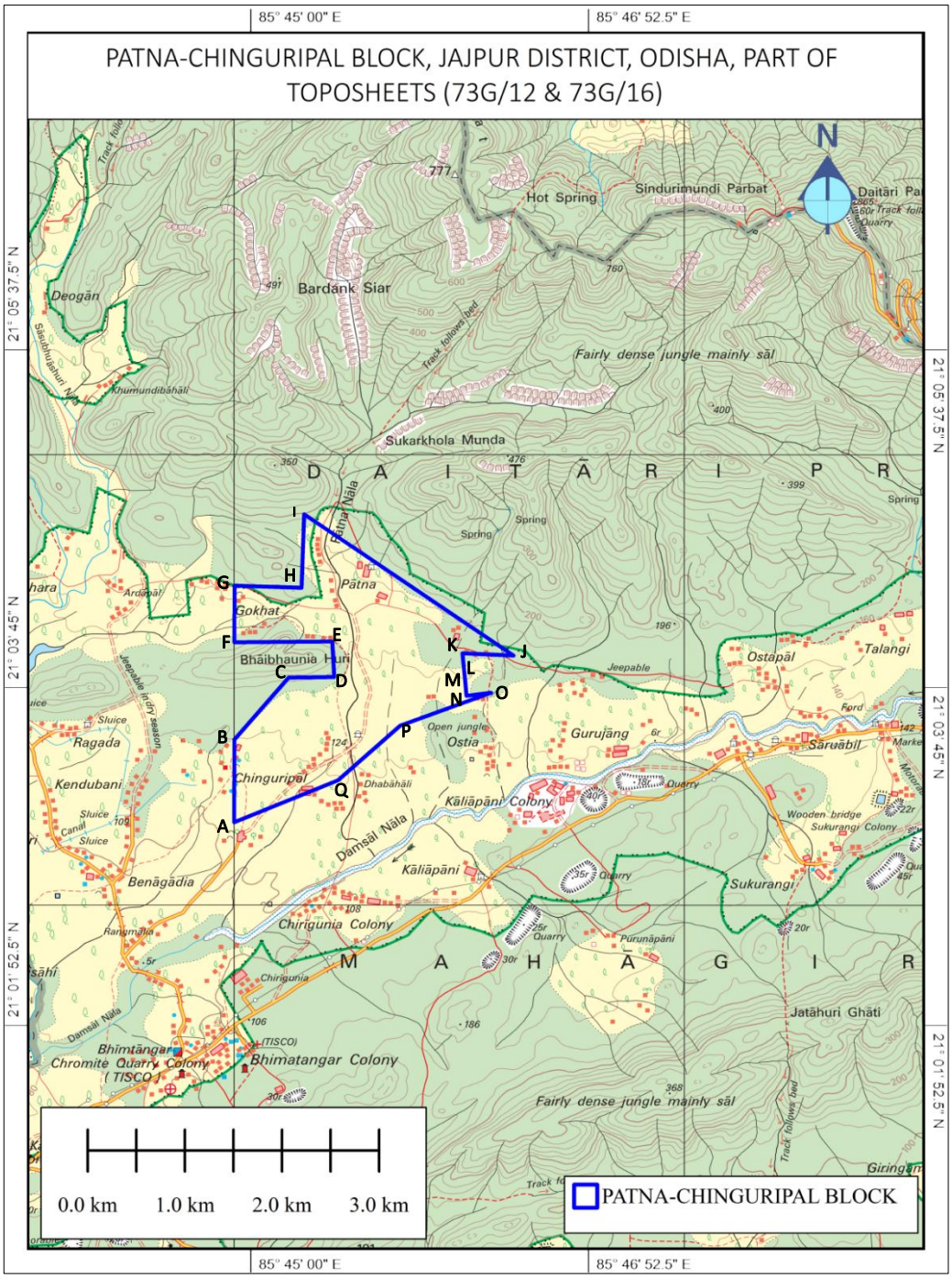


Figure 1: Index map showing location of Patna-Chinguripal block over google image.

1.2 Physiography:

The northern, western, and eastern parts of the block forms rugged terrain with hills and narrow valley, forming part of the Daitari Protected Forest and Bhaibhaunia Huri hill, while the southern region consists of relatively flat land. The central and southern areas are primarily occupied by agricultural fields and human settlements. The elevation in the region varies significantly, with the highest point reaching 375 meters above mean sea level near Sukinda Forest and the lowest point at 125 meters near Chinguripal village. The area falls on South-West part of toposheet no. 73G/16. The drainage pattern in this area predominantly shows dendritic to sub-dendritic pattern. Patna Nala, Damsal Nala and some minor streams are flowing in this area. The area experiences a temperature ranging from 32°- 47°C during summer months and 12°- 22°C during winter months. Average annual rainfall in the area ranges from 1500 to 1600 mm.



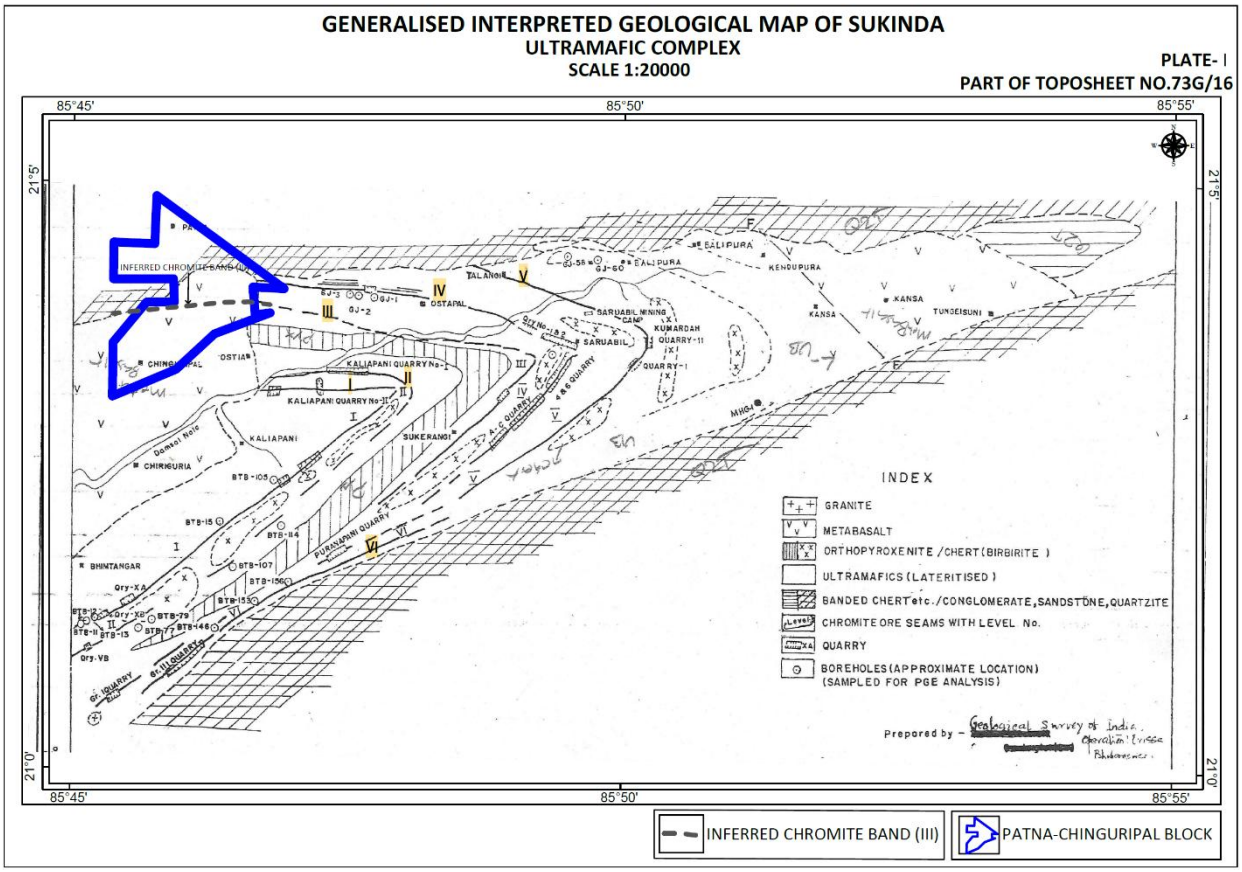
Map 1: Location Map of block (part of toposheet 73G/12 &73G/16)

1.3 Regional Geology

The Sukinda Ultramafic Complex forms part of the metamorphosed Precambrian rocks of Peninsular India. The ultramafic bodies in the Sukinda Valley belong to the Iron Ore Group (IOG) of Archean age and occur as intrusive bodies within the IOG. They are structurally emplaced between two major fault zones: to the north, the Banded Iron Formation of the Tomka–Daitari ranges, and to the south, the quartzite of the Mahagiri ranges.

The chromite deposits of the Sukinda Valley occur as bands, lenses, and pockets within a host rock of serpentinized dunite–peridotite. In this region, chromite is found as layered stratiform deposits within igneous complexes of dunite and peridotite, where the rocks are highly serpentinized, forming minerals such as antigorite, chrysotile, and lizardite. The chromite bands are developed within a southwest-plunging synform, and six distinct bands have been established by the Geological Survey of India (GSI). Bands in the southern limb are relatively continuous, whereas those in the northern limb are disrupted by faulting. The central part of the valley exhibits intense lateralization, resulting in the formation of saprolite, limonite, and laterite. It is observed that the laterites and limonite contain a considerable amount of nickel mineralization.

Out of the six chromite bands, Band I to Band V consist of soft, friable brown ore, whereas Band VI is characterized by hard, lumpy ore occurring within a talc–serpentine matrix. The major rock type in this area is predominantly altered serpentine–talc–chlorite–magnesite–sulphide. It can be inferred that northern limb of band (III) (Trending: NW-SE, dipping towards south-west) continues into the Patna-Chinguripal block.



Map 2: Generalised Interpreted Map of Sukinda Ultramafic Complex (Source- Unpublished map of GSI)

1.4 Regional Stratigraphy

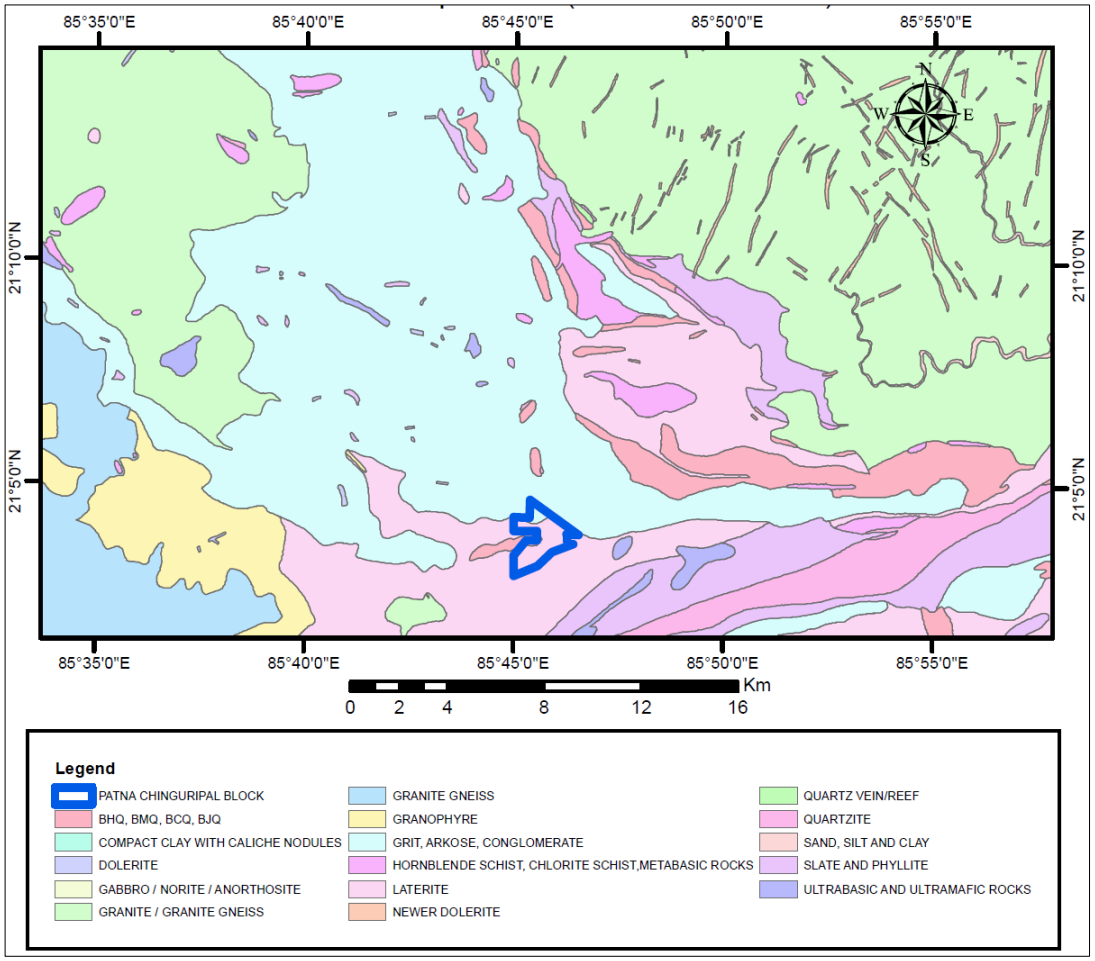
The regional stratigraphy of Sukinda-Nausahi Belt (Mondal, 2009) is given below:

Table 1: The regional stratigraphy of Sukinda-Nausahi belt (Mondal, 2009)

		Generalised Sequence	Zircon age	other ages
	Kolhan Group	KG (Time Equivalent to SMB)		2100-2200 Ma[3]
----------	Unconformity----------	----------	----------	----------
Singhbhum Mobile Belt (SMB)	Dolerite Dyke Swarms	NDS		950-2500 Ma[3, 6]
	Dhanjori-Simlipal-Dalma-Jagannathpur-Malangtoli and Singhbhum Group: Igneous and Sedimentary Sequences	Late Archaean to Proterozoic Mobile Belts (SMB)		2072 Ma[5] (~3.09-2.25 Ga)[7]
----------	Unconformity----------	----------	----------	----------
Archaean GraniteGreenstone Terrain (AGGT) (Older Metamorphic Group, Iron Ore Group, Older Metamorphic Tonalite Gneiss, Singhbhum Granite, Bonai Granite, Nilgiri Granite, Mayurbhanj Granite	**Mayurbhanj Granite**	SBG-B	3.1 Ga[1]	
	Singhbhum Granite Type B	SBG-B		3.1 Ga[3]
	Iron Ore Group Igneous and Sedimentary Sequences: IOG Igneous Suites (**Ultramafic-maficplutonic suite** e.g., Nausahi Sukinda-Jojohatu (NSJ) ultramafic suite; Nuasahi-Nilgiri-Gorumahishani-Badampahar (NNGB) gabbro-anorthosite-dioritemafic suite; Ultramafic-mafic suite e.g., komatiites and high-Mg basalts in Gorumahishani-Badampahar, Tomka-Daitari and Jamda-Koira belts; Felsic volcanics); IOG Sedimentary Sequences	Iron Ore Group (IOG)	3506.8 ± 2.3 Ma[9] age of zircon from dacitic lava within the Iron OreGroup; Tomka-Daitari Basin 3121 ± 3 Ma[4] ageof zircon from gabbroic suite, Nuasahi breccia zone 3285 ± 7 Ma[8] age of zirconfrom the pegmatitic biotite granodiorite overlain by IOG conglomerate 3328 ± 7 Ma[1]	3205 ± 280 Ma[4] Sm-Nd isochron age of gabbroic suite from the Nuasahi massif
	Singhbhum Granite Type A	SBG-A		3.3 Ga[3]
	Older Metamorphic Tonalite Gneiss	OMTG	Age clustering at 3.4 and 3.2 Ga[1]	3288 + 35 Ma[2] Sm-Nd isochron age with OMG
	Older Metamorphic Group	OMG	Age clustering at 3.55, 3.4 and 3.2 Ga[1]	3305 + 60 Ma[2] Sm-Nd isochron age

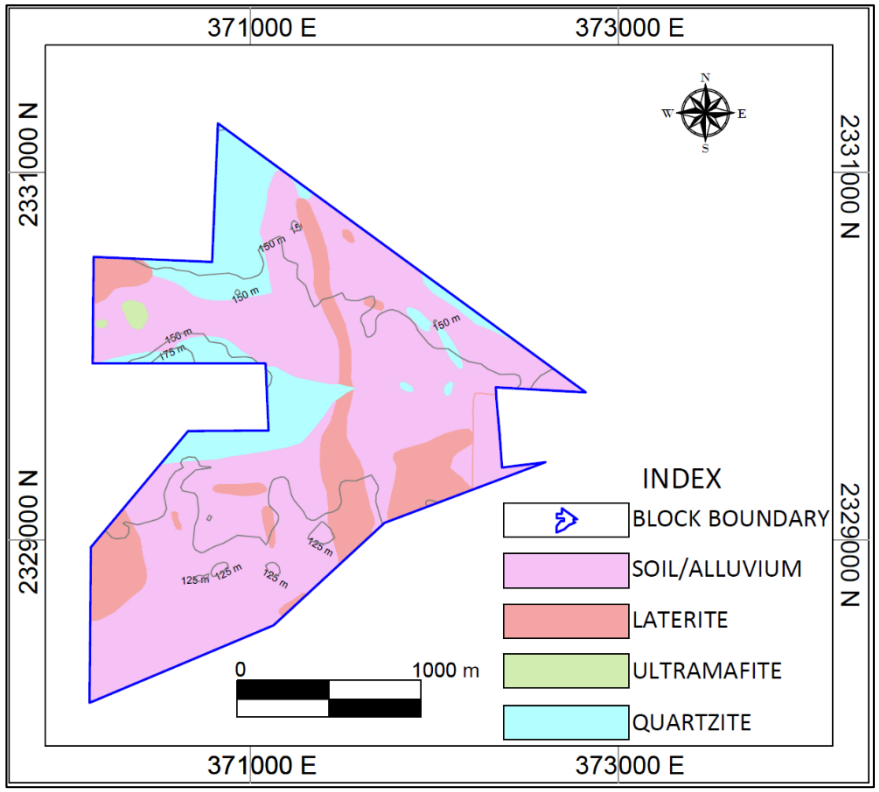
[1]Mishra et al. (1999); [7]Mishra and Johnson (2005); [2]Sharma et al. (1994); [3]Saha et al. (1988); [4]Auge et al. (2003); [5]Roy et al. (2002); [6]Roy et al. (2005); [8]Nelson et al. (2008); [9]Mukhopadhyay et al. (2008)

MAP 3: Regional Geological Map around Patna-Chinguripal Block (1:50000) Part of Toposheet (73G/12 &73G/16)



Map 4:Regional Geological Map around Patna-Chinguripal Chromite Blocks (1:50000) Part of Toposheet (73G/12&G/16) (Source: NGDR)

MAP 4: Large Scale Geological map of Patna-Chinguripal block, Jajpur District, Odisha (1:25000), Part of Toposheet (73G/16)



Map 4: Large Scale Map of Geological map of Chingudipal block, Jajpur District, Odisha (1:25000), Part of Toposheet (73G/16) (Source: NGDR)

1.5 Geology of the Block

The area was previously mapped by Directorate of Geology, Steel and Mines Department, Government of Odisha in 1:25000. The block is located at the western part of Chinguripal chromite mine of M/s IMFA. The rock types in this block belongs to Iron Ore Super Group of Precambrian age (Geological Report published by Directorate of Geology, Steel and Mines Department, Government of Odisha).

During field traverses taken by geologists from Tata Steel Limited in the area, it is observed that the area consists of mainly jointed, fractured and massive quartzites, Fuchsite Quartzite, Quartzite with typical boxwork texture, ultramafites that are slightly weathered and magnetic, and laterite that are at some places conglomeratic. The general trend of the litho-units varies from WNW–ESE to ENE–WSW to E–W with a southerly dip of 40°–80°. The valley portion of the area is predominantly covered by soil and alluvium, with laterite as a significant component. Additionally, two small ultramafic patches and four isolated quartzite patches are present within the valley. It is inferred that northern limb of Chromite band-(III) within the Sukinda Ultramafic complex is extending into this block from the Chunguripal Mine of M/s IMFA. The local stratigraphy of Patna-Chinguripal block is given below:

Table 2: The local stratigraphy of Patna-Chinguripal block; Source: Geological Report on Patna-Chinguripal PL Area, Directorate of Geology, Govt. of Odisha (2005)

Recent	Soil/Alluvium
	Laterite
Precambrian	Peridotite
	Quartzite
	Base not seen

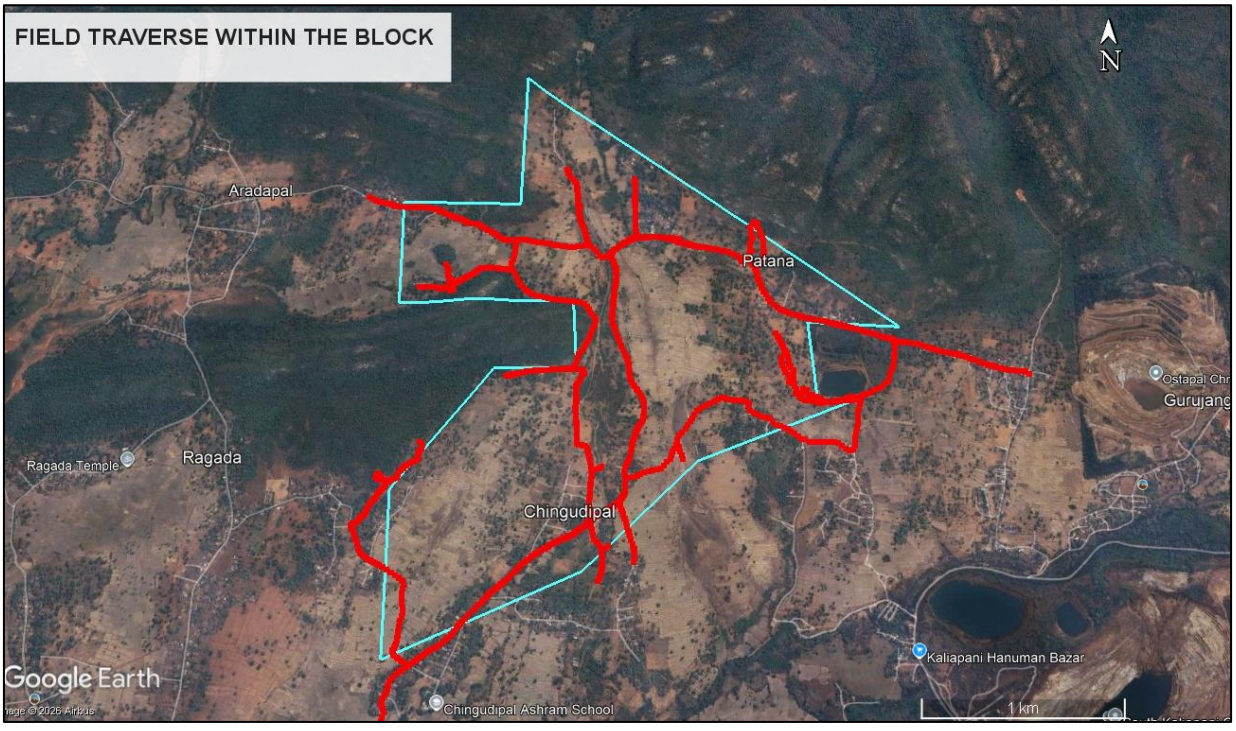
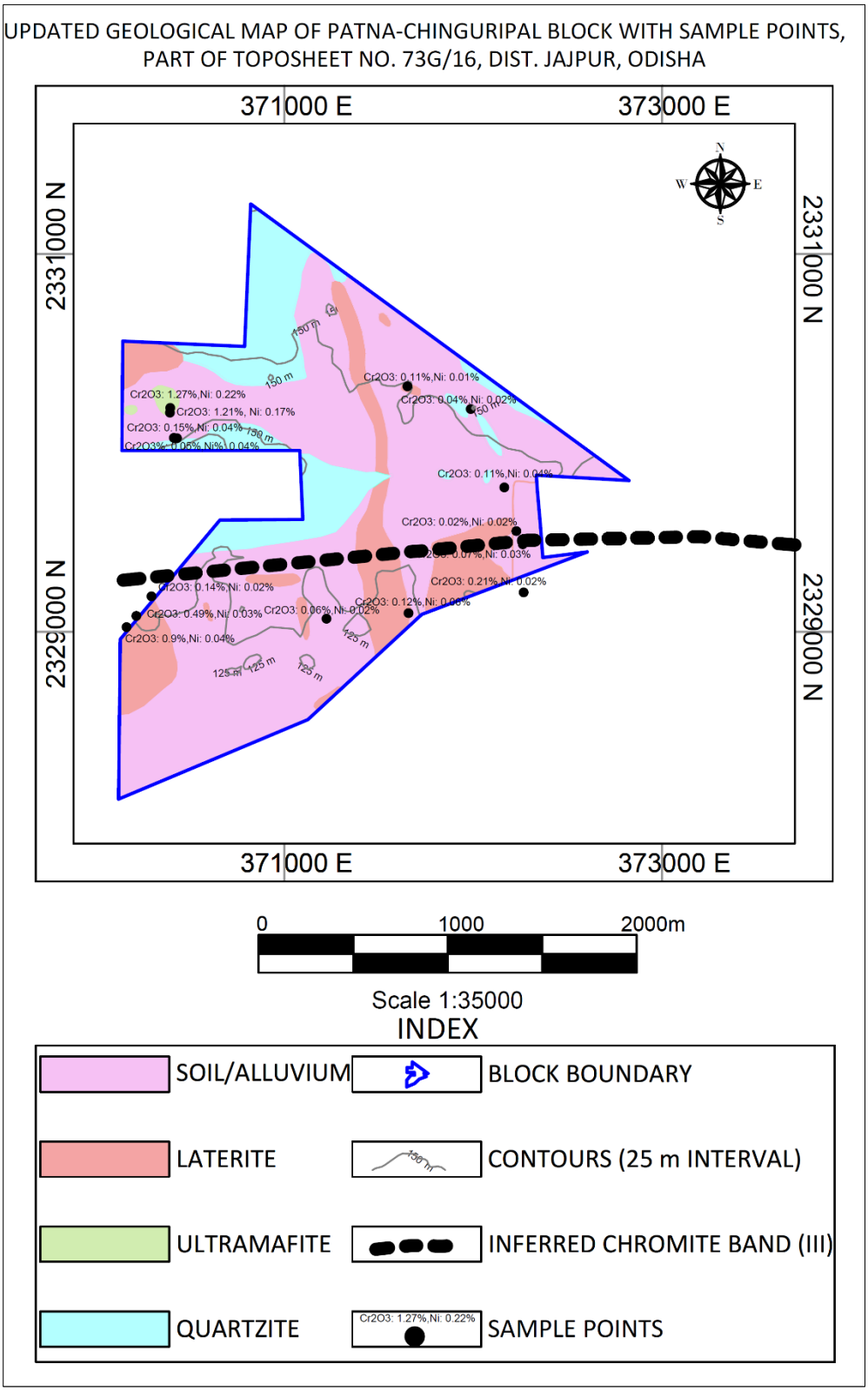


Figure 2: Traverse Map of Patna-Chinguripal Block



Map 5: Updated Geological Map of Chinguripal Block after field visit by geologists of Natural Resource Division, Tata Steel.

Reconnaitory field traverses were carried out on this block by Tata Steel's Geologists and representative samples were collected from various lithologies, and the proportions of different oxides and elements were analysed. The results are presented in the table below:

Table 3: Chemical analysis of collected samples from the block by Geologists of Natural Resources Division-Tata Steel Limited

Sample ID	Cr_2O_3 %	Ni%	SiO2%	Al2O3%	Fe%	CaO%	MgO%	TiO2%	P%	S%	V2O5%
CP-01	**0.9**	0.04	26.41	12.79	33.2	0.16	0.12	0.59	0.003	0.031	0.137
CP-02	**0.49**	0.03	23.62	18.23	31.14	0.09	0.28	0.68	0.003	0.029	0.16
CP-03	**0.14**	0.02	80.48	4.23	3.53	0.14	0.18	0.36	0.002	0.028	0.011
CP-04	**1.21**	0.17	37.17	2.25	7.17	0.31	35.00	0.09	0.003	0.032	0.008
CP-05	**1.27**	0.22	36.37	2.86	8.33	0.13	33.8	0.12	0.002	0.028	0.013
CP-06	**0.15**	0.04	82.79	11.19	0.56	0.07	0.03	0.46	0.002	0.027	0.02
CP-07	**0.05**	0.04	93.15	0.88	0.32	0.04	0.32	0.04	0.003	0.025	0.004
CP-08	**0.11**	0.01	41.23	12.83	19.77	0.09	0.15	0.56	0.003	0.027	0.085
CP-09	**0.04**	0.02	91.69	0.75	0.53	0.12	0.32	0.04	0.002	0.034	0.004
CP-10	**0.06**	0.02	22.14	20.17	30.22	0.11	0.32	0.71	0.003	0.03	0.168
CP-11	**0.12**	0.06	45.29	8.86	25.22	0.09	0.26	0.39	0.002	0.028	0.14
CP-12	**0.21**	0.02	32.37	10	29.65	0.13	0.22	0.43	0.002	0.031	0.135
CP-13	**0.07**	0.03	76.53	8.3	3.66	0.09	0.05	0.6	0.003	0.031	0.037
CP-14	**0.02**	0.02	79.24	8.11	2.73	0.12	0.01	0.66	0.002	0.026	0.014
CP-15	**0.11**	0.04	72.13	9.96	4.41	0.07	0.04	0.63	0.002	0.035	0.043
CP-16	**56.13**	0.14	3.27	10.8	9.47	0.13	15.67	0.18	0.004	0.031	0.097

Note: Sample CP-16 was collected from the old stack of the adjoining M/s IMFA-Chinguripal mines, which explains its high Cr_2O_3 content of 56.13%s

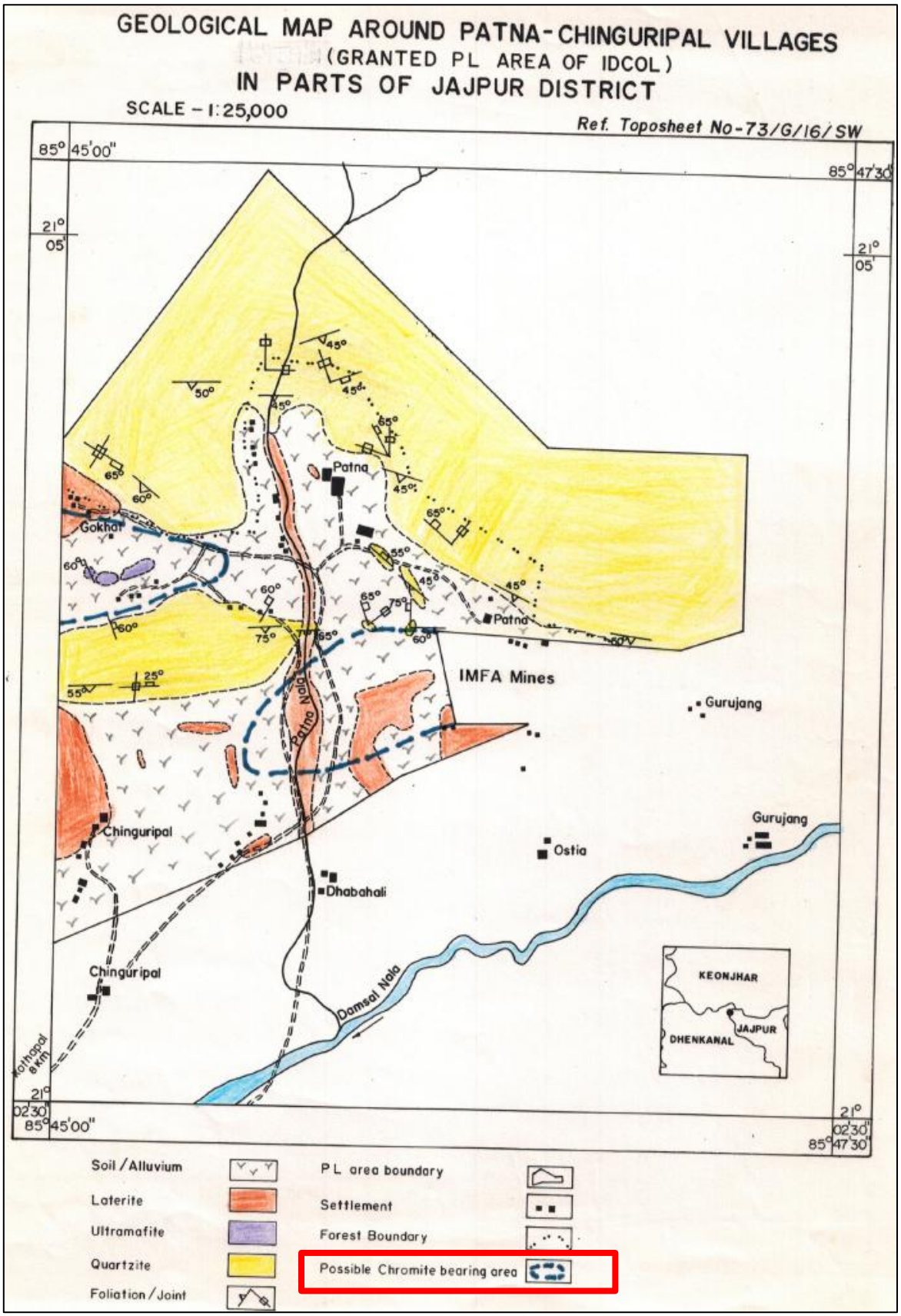
The block lies in the western end of M/s IMFA-Chinguripal mining lease. Position of Patna-Chinguripal block with respect to different mining lease is show in the figure below:

Map 6: Different mining lease around Patna-Chinguripal Block.

2.Recommendations from Previous Exploration

2.1 Geological Report on Patna-Chinguripal Granted PL area of IDCOL in parts of Jajpur district.

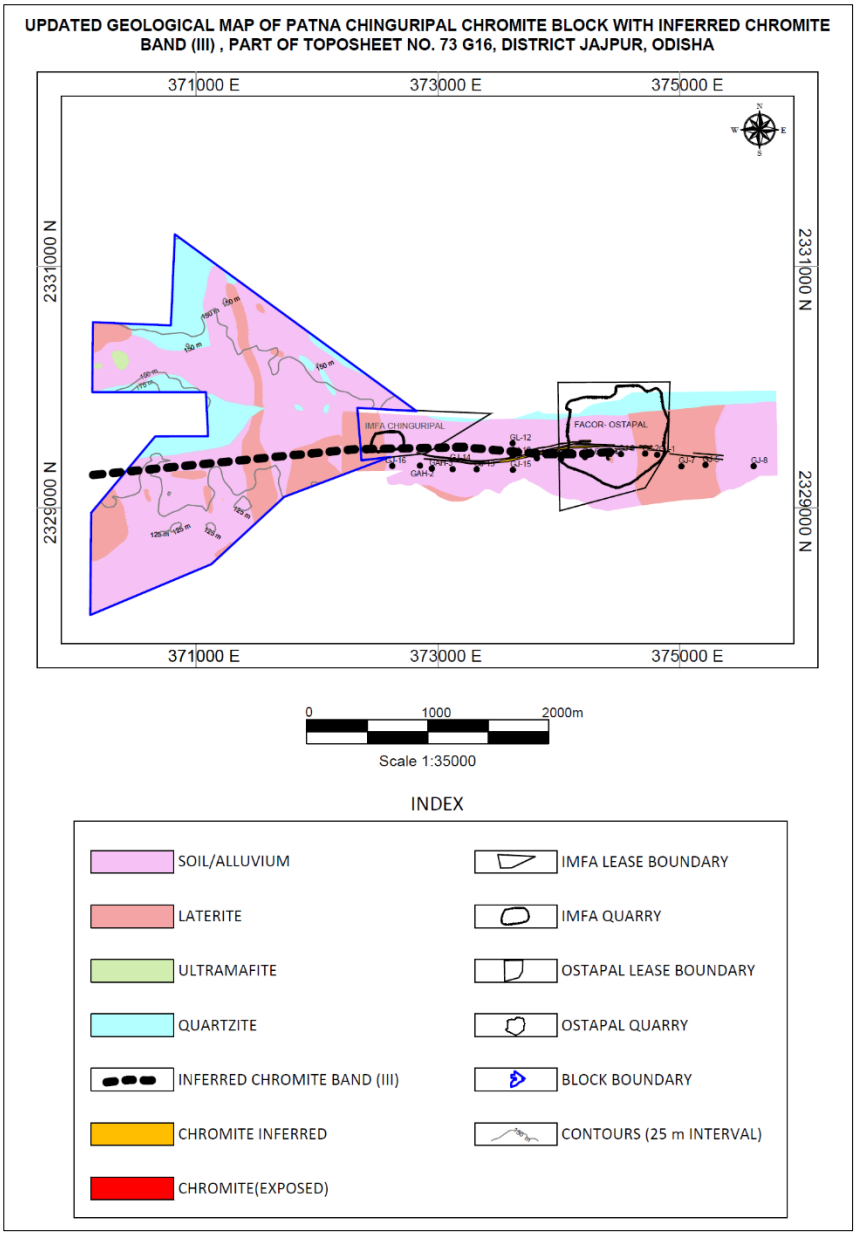
The block under consideration was previously explored by Directorate of Geology, Steel and Mines Department, Government of Odisha (Ref Report: *Geological Report on Patna-Chinguripal Granted PL area of IDCOL in parts of Jajpur district)*. The investigation indicates that the IDCOL PL-granted area around Patna-Chinguripal shows significant potential for chromite mineralization. The area lies on the northern limb of the westerly plunging syncline of the Sukinda Ultramafic Complex. The southern block, which includes the valley between the foothills of Bhaibahunia Huri and the leasehold boundary, represents the western extension of IMFA mines. Laterite exposed in this block contains more than 1% Cr_2O_3, and heavy minerals from stream sediments also show Cr_2O_3 content exceeding 1%. The northern block, located between the foothills of Bhaibahunia Huri and the Daitari range, exposes peridotite with Cr_2O_3 up to 3.04%, and chromite has been identified as the dominant opaque mineral. Based on these findings, it was recommended to intensify exploration through extensive geochemical soil sampling across the valley, excavation of deep pits and trenches near IMFA mines to study chromium variation, and detailed analysis of laterite types for chromite-bearing potential. Gravity and magnetic geophysical surveys should be carried out to delineate chromite zones, and scout boreholes should be drilled based on geological and geophysical results to confirm subsurface chromite occurrence.



Map 7: Geological Map Around Patna-Chinguripal Village (Granted Pl Area of IDCOL) In Parts of Jajpur District (Source: Geological report published by Directorate of Geology, Steel and Mines Department, Government of Odisha)

2.2 Report on the Investigation of Chromite Deposits in Gurjang Area (Kaliapani Block), Sukinda Ultramafic Belt, Cuttack District, Orissa

As per the report titled "*Report on the Investigation of Chromite Deposits in Gurjang Area (Kaliapani Block), Sukinda Ultramafic Belt, Cuttack District, Orissa*" published by GSI in 1986, Preliminary geological investigations (G3 stage), including drilling, were carried out in the Gurjang area located at the eastern periphery of the block. These investigations successfully delineated and established a chromite ore resource of 5.741 million tonnes within intersection depth of 50 meters. Moreover, most of these chromite bodies occur as lenses (06-ore lenses) and are friable in nature. This established resource underscores the mineral potential of Chromite Band and provides a strong basis for further exploration to assess continuity, grade variation, and additional reserves in the unexplored western sectors.



Map 8: Updated Geological Map of Patna Chinguripal Chromite Block with Inferred Chromite Band (III), Part of Toposheet No. 73 G/16, District Jajpur, Odisha (Source of established chrome bands- GSI report 1986)

3. Block Description

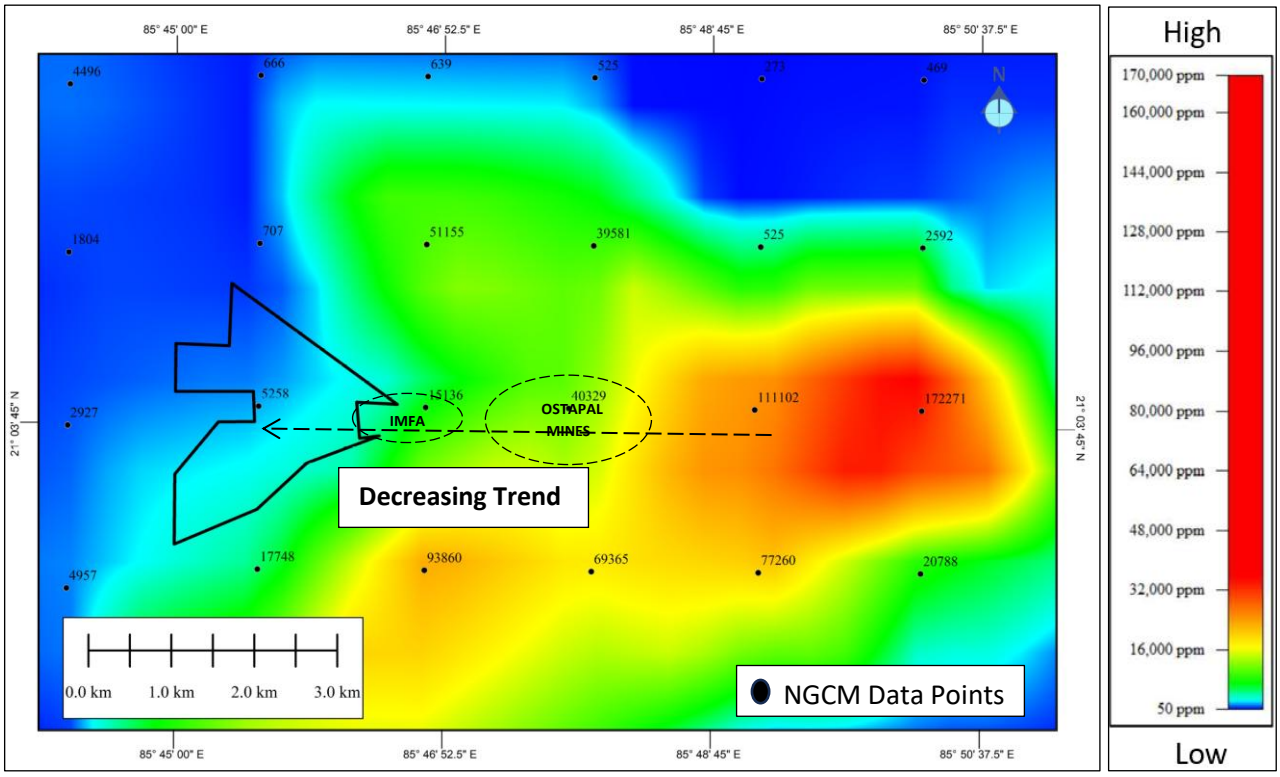
The Patna-Chinguripal block covers an area of 3.9 Sq. Km. area with 12 corner points. Coordinates of these points in degree decimal, easting and northing is given in the table below.

Table 4: Block boundary coordinate of the block.

Block Boundary	LATITUDE	LONGITUDE	EASTING	NORTHING
A	85° 45' 00.0033" E	21° 02' 57.5649" N	370124.109	2328115.333
B	85° 45' 00.0464" E	21° 03' 25.0759" N	370131.982	2328961.236
C	85° 45' 18.1807" E	21° 03' 45.7625" N	370660.367	2329593.213
D	85° 45' 33.3355" E	21° 03' 45.9273" N	371097.804	2329594.869
E	85° 45' 32.6938" E	21° 03' 57.8012" N	371082.127	2329960.113
F	85° 45' 00.0857" E	21° 03' 57.5581" N	370140.949	2329959.992
G	85° 45' 00.1097" E	21° 04' 16.3812" N	370146.182	2330538.763
H	85° 45' 22.4521" E	21° 04' 15.6728" N	370790.826	2330511.934
I	85° 45' 23.3694" E	21° 04' 40.1741" N	370823.179	2331265.097
J	85° 46' 33.0998" E	21° 03' 53.1048" N	372824.418	2329802.227
K	85° 46' 16.0926" E	21° 03' 53.8862" N	372333.748	2329830.03
L	85° 46' 16.2585" E	21° 03' 51.5467" N	372337.981	2329758.058
M	85° 46' 16.8949" E	21° 03' 45.4930" N	372354.913	2329571.776
N	85° 46' 17.3823" E	21° 03' 39.7135" N	372367.612	2329393.961
O	85° 46' 25.5861" E	21° 03' 40.7368" N	372604.635	2329423.602
P	85° 45' 55.3208" E	21° 03' 29.7685" N	371728.499	2329093.092
Q	85° 45' 34.5923" E	21° 03' 11.5274" N	371125.848	2328536.858

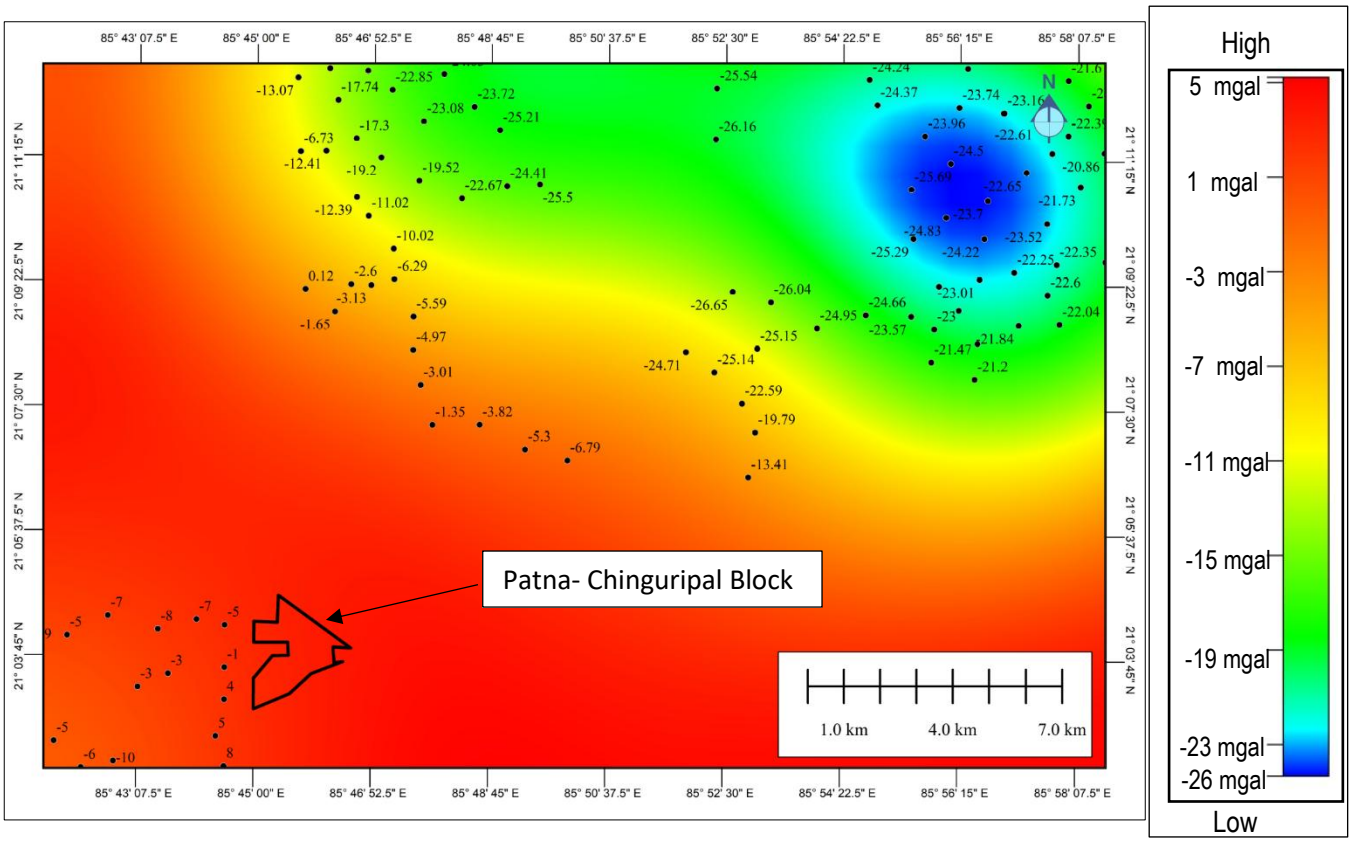
4. Review of NGCM and NGPM data in and around the block:

NGCM and NGPM data sourced from NGDR for toposheet nos. 73G/16, was plotted and analysed. Based on the data a detail investigation of the Chromite mineralization of the block was carried out. As per NGCM data soil and stream sediment sampling was carried out in nearly regular grid of 2 km by 2 km spacing in toposheet 73G/16. In the block samples near to the Chinguripal-IMFA mine showed the most anomalous value of chrome (≈15000ppm) and then it decreases away towards western end of the block. The data displays decreasing trend towards west through IMFA and Ostapal Mines possibly due to subsurface nature of ore body.



Map 9: NGCM Data (soil and stream) in and around the Patna- Chinguripal Block. (Source: NGDR)

Although no gravity data points were measured within the block, gravity values were interpolated using available NGPM data sourced from the NGDR portal. The block lies within a relatively high gravity zone (≈2 mGal) compared to surrounding areas.



Map 10: NGPM Data (Gravity) in and around the Patna- Chinguripal Block. (Source: NGDR)

5. Scope for proposed exploration

On review of existing baseline and past exploration reports, data from areas within and around this block and field data collected recently by geologists of Tata Steel Limited, it is proposed that initially geological mapping (1:4000 scale) shall be carried out along with topographical survey (Drone/ DGPS survey) with bed rock & trench sampling, chemical analysis to delineate outcrops, surface geology and potential zones of chromite mineralization. Drone based high resolution magnetic surveys is planned in the entire block area followed by Gravity surveys and Electrical Resistivity surveys on the potential targets to locate potential subsurface chromite ore bodies. After synthesizing all acquired data till this stage, exploratory core drilling is proposed to be carried out in two levels (at 400m spacing) to intersect the ore body at vertical depths of 30m and 90m to understand the lateral extent and for proving depth of mineralization for chromite. Threshold value for Cr_2O_3 is 10% (source: IBM). All borehole collars and boundary pillar of the block shall be surveyed by DGPS. Finally, all acquired data shall be collated to estimate resources in G3 category guided by MEMC Rules. Petrological studies along with thin section to be prepared. Complete mineral study report to be submitted after the completion of work.

The scope of the proposed exploration has been formulated and is outlined below:

1. **Topographical Survey using Drone/ DGPS:** 837Ha
2. **Detailed Geological Mapping (1:4000 scale):** 837 Ha
3. **Geophysical Survey:** Drone Magnetic Survey-837 Ha; Gravity Survey- 560 stations with grid spacing of (100 x 30 metres) over areas of Inferred Chrome band (III) & Ultramafic outcrops and grid spacing of (100 x 15 metres) over anomalous zone; Electrical Resistivity- 20-Line Km
4. **Trenching:** 10 Nos; Trench Dimension: 10m(L) x 1m(W) x 2m (D)
5. **Core Drilling:** Total 10 BHs (955m); i.e. 1st level of exploration (intersecting ore body at a vertical depth of ~30m) having 05 boreholes (drilling meterage -300m) at 400m spacing interval and 2nd level of exploration (intersecting ore body at a vertical depth of ~90m) having 05 boreholes (drilling meterage -655m) at 400m spacing.
6. **Sampling & analysis:** BRS and trench samples-130 Nos. and Core samples-250 Nos.
7. **QAQC-** 38 Nos**.** (10% of Core Samples – 25 Nos; 10% of BRS and trench samples- 13 Nos.)
8. **Quantitative analysis for REE and Trace Elements:** 10 Samples (ICP-MS)
9. **Mineragraphic study:** 10 samples.
10. **GR Writing & Resource Estimation:** To estimate Chromite Resources (333) in the block as per UNFC norms & Minerals (Evidence of Mineral. Contents) Rules-2021.

5.1. Planned Methodology

It is planned to carryout following activities to explore the area adequately at G3 stage.

1. Topographical Survey (1:4000 scale)
2. Geological mapping (1:4000 scale)
3. Bed rock sampling, trench sampling and analysis
4. Geophysical survey: Drone Magnetic Survey, Gravity Survey & Electrical Resistivity- 20-Line Km.
5. Exploratory drilling: Core drilling, sampling, analysis to establish and prove the extent & depth of mineralised zone
6. Borehole collar survey and fixing of boundary pillars
7. Petrological and Mineragraphic Studies.
8. Chemical analysis of selected samples for REE and trace elements
9. Mineragraphic study
10. Data synthesis and preparation of Geological report (grade & resource estimates)

6. Nature, Quantum, and Target

6.1 Topographical Survey, Geological Mapping, Trenching & Geochemical Sampling:

Topographical survey shall be carried out using Drone/ DGPS to generate contour map of the area at 4m contour interval.

Detailed geological mapping on 1:4000 scale will be carried out over entire area simultaneously bedrock sampling will be undertaken from the outcrops. All collected samples shall be subjected to chemical analysis.

During bed rock sampling, rock chips shall be collected from three or more locations of about equal proportion over the same lithology to avoid biasness. Trenches shall be made across the potential inferred ore zone to understand width of mineralization, lithological variations and quality of ore.

6.2 Geophysical Survey:

To delineate subsurface geological structures and assess the extent of mineralization within the prospect area, an integrated geophysical survey programme is proposed, comprising Aeromagnetic (drone-based magnetic), Gravity survey and Electrical Resistivity survey.

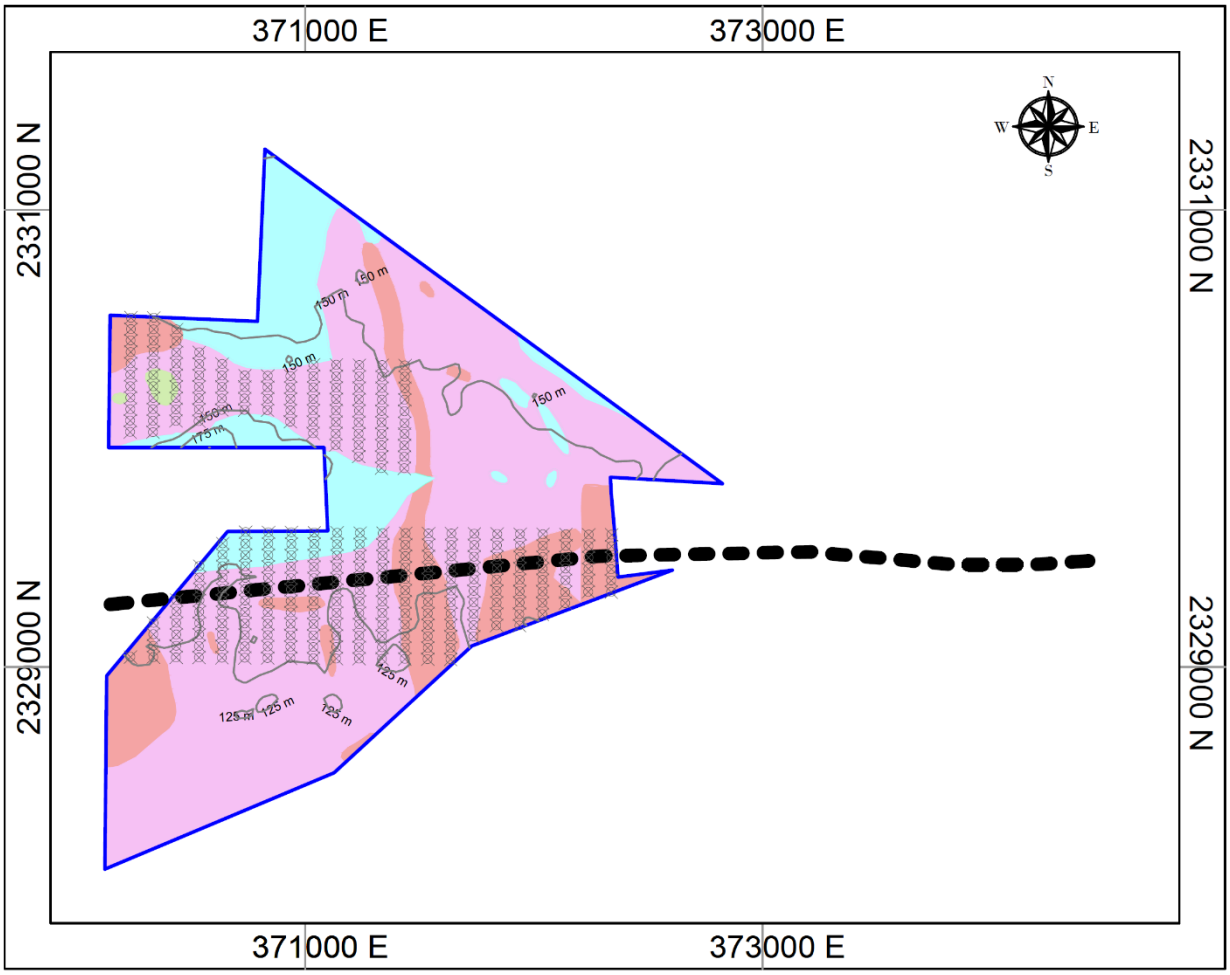
A high-resolution drone-based aeromagnetic survey will be carried out over the entire 3.9 sq km area. The survey is intended to map magnetic anomalies associated with lithological variations, structural features, and possible mineralized zones beneath soil cover. The data obtained will aid in identifying prospective targets and structural trends for follow-up ground investigations.

Since the expected width of the chromite band in the block is of 6-8m (as inferred from adjoining areas and previous exploration of nearby areas by GSI) A detailed gravity survey is proposed to collect around 560 stations with grid spacing of (100 x 30 metres) over areas of Inferred Chrome band (III) & Ultramafic outcrops and grid spacing of (100 x 15 metres) over anomalous zone. The survey is specifically designed to detect high-density chromite-bearing ultramafic bodies, as chromite typically exhibits a significantly higher density compared to the surrounding rocks. Gravity anomalies identified through this survey will help delineate concealed chromite lenses and banded chromite horizons, as well as structural controls influencing their distribution.

Electrical Resistivity survey will be carried out over the gravity anomaly to confirm the low resistivity zones. The surveys will be conducted along potential gravity anomalous zones (approximately 20-line km of survey) to identify zones of low resistivity and variations in subsurface resistivity, which may correspond to chromite-rich bodies.

All geophysical data will be processed and interpreted to delineate target areas for further detailed exploration, including exploratory drilling.

UPDATED GEOLOGICAL MAP OF PATNA-CHINGURIPAL BLOCK WITH PROPOSED GRAVITY STATION POINTS, PART OF TOPOSHEET NO. 73G/16, DIST. JAJPUR, ODISHA



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INDEX

SOIL/ALLUVIUM

LATERITE

ULTRAMAFITE

QUARTZITE

INFERRED CHROMITE BAND (III)

BLOCK BOUNDARY

CONTOURS (25 m INTERVAL)

Gravity Survey Points (100*30 m)

Map 11: Updated Geological map of Patna-Chinguripal Block with Proposed Gravity Stations

6.3 Exploratory Drilling:

The proposed exploration program for this chromite block involves 10 boreholes in 2 phases using HQ-size core drilling (~63.5 mm diameter) along five geological sections at 400m grid interval to qualify as G3 exploration as per MEMC rules. First Phase is proposed to intersect the chrome band at vertical depths of approximately 30m (five boreholes with cumulative meterage of 300m) and the second phase to intersect the bands at a vertical depth of 90m (five boreholes with cumulative meterage of 655m), hence a total drilling meterage of 955m in both phases.

Core drilling is specifically targeted at the most promising zones to obtain detailed insights into subsurface geology and the extent of mineralization. All boreholes will be drilled at an inclination of 45° to the horizontal. Geological mapping, previous reports, and inferred continuity of Chrome Band-III from nearby mines forms the basis for this plan.

Five conceptual cross sections have been drawn across the inferred ore band at a spacing of 400 meters. The first section was positioned approximately 100 meters from the eastern boundary of the block, adjacent to the IMFA mines. These sections form the basis for borehole alignment and depth calculations.

The execution will be phased, beginning with the first phase where five boreholes will be drilled to confirm chromite incidence. Based on the findings, the second phase will involve drilling the remaining boreholes to a vertical depth of 90 meters over the inferred Chrome Band-III.

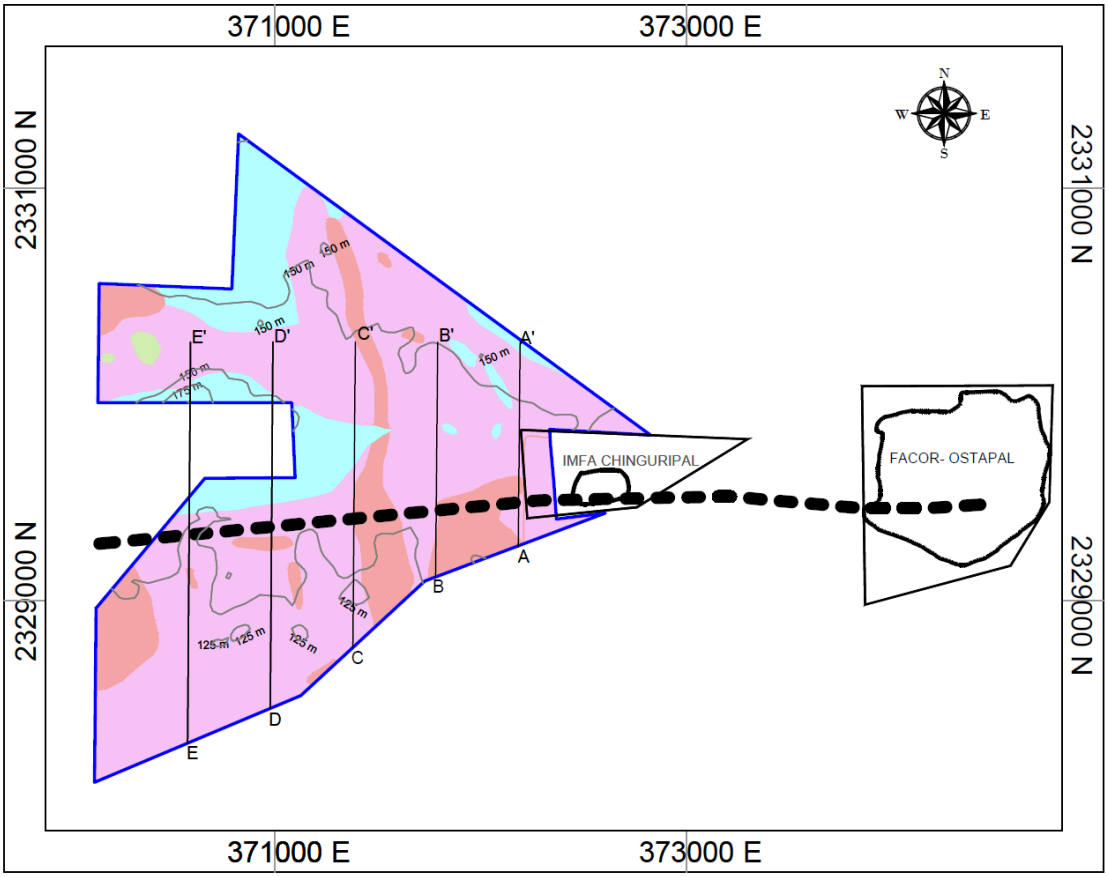
This approach aims to evaluate vertical and lateral extent, thickness, geometry, and grade continuity of the ore body.

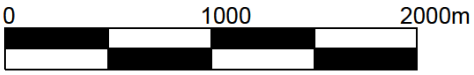
Details of the projected Boreholes are given in Table No - 5 and conceptual sections with projected boreholes (section 6.4). The anticipated chromite bands are shown on the MAP-12. The depth of the projected boreholes (PBH-1 to PBH-10) has been calculated based on surface topography and the intersection points of inferred chromite bands. Therefore, the total planned drilling meterage is 955 m.

Samples will be collected and analyzed at 1.0 m intervals within the ore zone. Additionally, two samples from both the top and bottom of the ore zone are planned for analysis. Apart from these, five samples at 1.0 m intervals will be analysed in the limonitized zone.

With all generated data, G3 (UNFC-333) category resources shall be established complying latest guidelines of MEMC Rule and any other guidelines made thereafter. During estimation of resource threshold value Cr_2O_3-10% (source: IBM) of shall be considered for chromite.

GEOLOGICAL MAP OF PATNA-CHINGURIPAL BLOCK WITH SECTIONS ACROSS INFERRED CHROMITE BAND (III), PART OF TOPOSHEET 73G/16, DIST. JAJPUR, ODISHA





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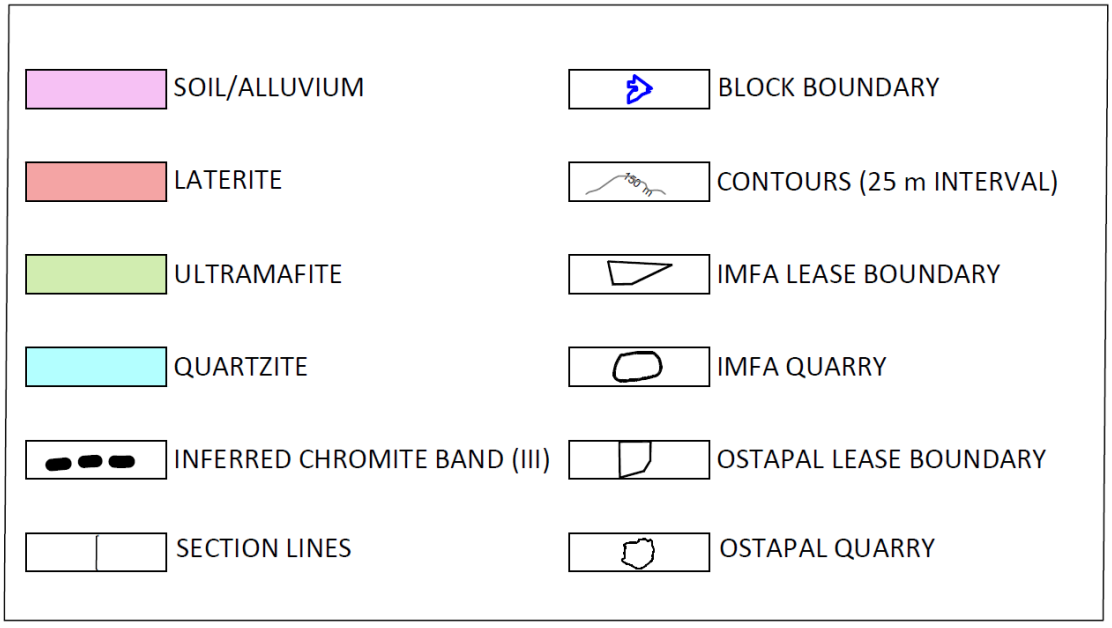
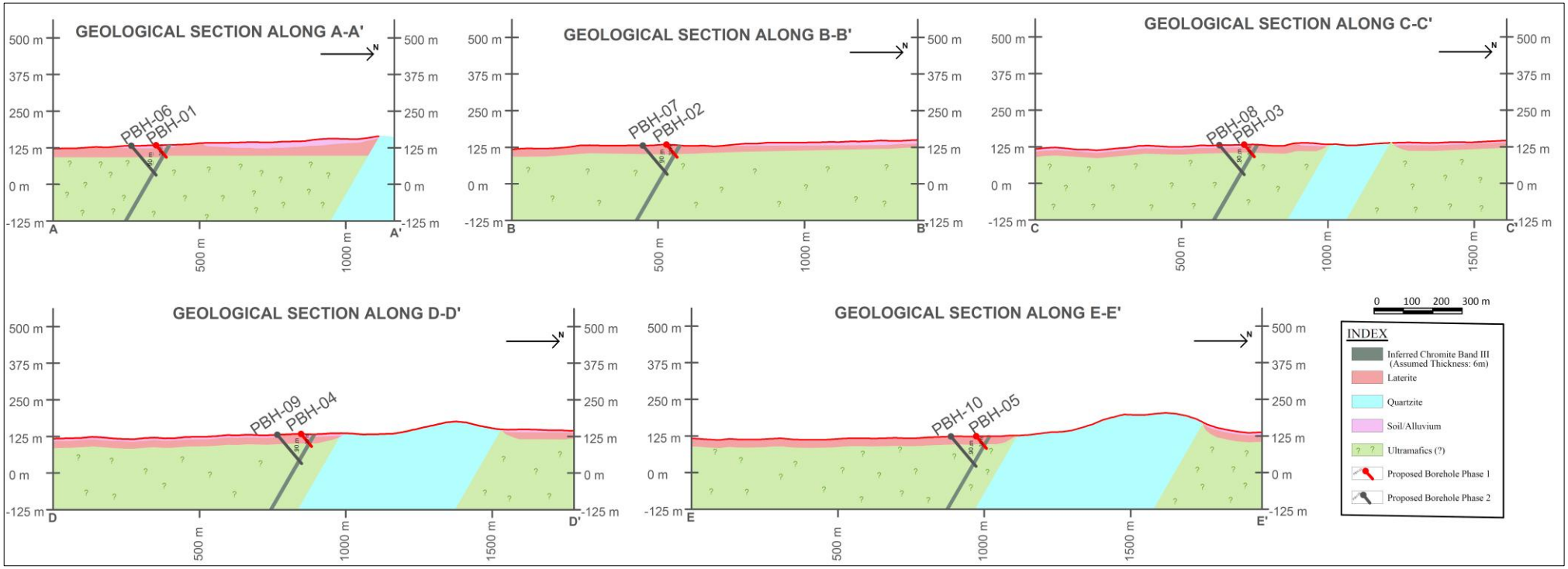


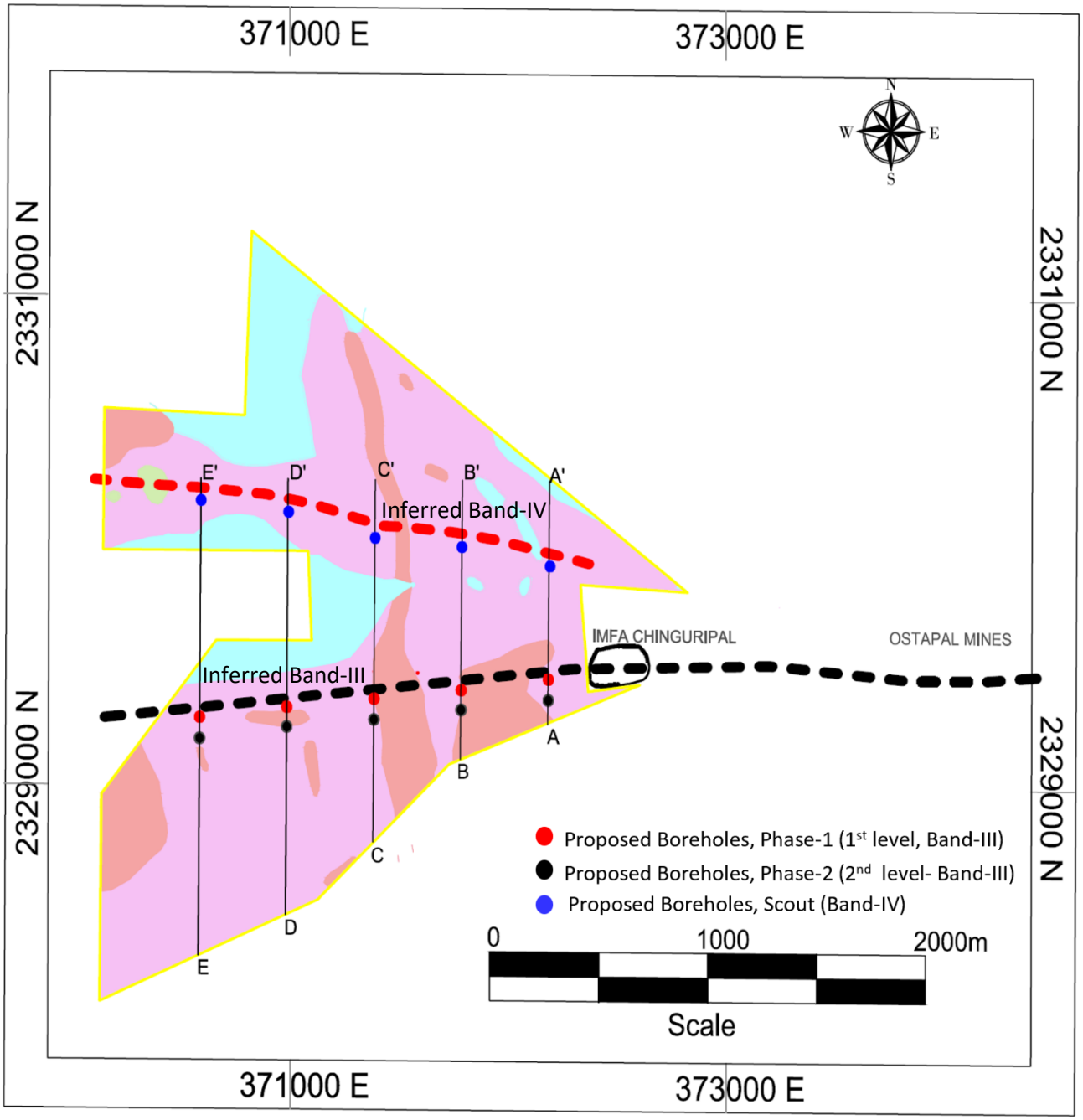
Map 12: Geological Map of Patna-Chinguripal Block with Sections across the Inferred Chromite Band (III)

6.4 Conceptual Sections of Patna-Chinguripal Block



The Chrome band is expected to be 6 m thick.

GEOLOGICAL MAP OF PATNA-CHINGURIPAL BLOCK WITH SECTIONS ACROSS INFERRED CHROMITE BAND (III), PART OF TOPOSHEET 73G/16, DIST. JAJPUR, ODISHA



Map 13:Geological Map of Patna-Chinguripal Block with Sections and proposed boreholes across the Inferred Chromite Band (III)

Table 5: Tentative depth of Proposed Boreholes

Phase	BH ID	Meterage	Total Meterage	Remarks
Phase-1	PBH-01	80	400	Band-III
	PBH-02	80		
	PBH-03	80		
	PBH-04	80		
	PBH-05	80		
Phase-2	PBH-06	130	650	
	PBH-07	130		
	PBH-08	130		
	PBH-09	130		
	PBH-10	130		
Scout	PBH-11	100	500	Band-IV
	PBH-12	100		
	PBH-13	100		
	PBH-14	100		
	PBH-15	100		
Total Meterage			1550	

6.5 Target Resource

Based on the two phases of drilling campaign, the targeted resources are expected in the order of 2 million tons assuming thickness of chrome band as 6 meters. Detailed calculation given in table below:

Section	Thickness of Ore Body (m)	Depth of Ore Body (m)	Area of Influence (m)	Density of Ore Body	Target Resource (MT)
A-A'	6.00	120.00	300.00	3.00	0.65
B-B'	6.00	120.00	400.00	3.00	0.86
C-C'	6.00	120.00	400.00	3.00	0.86
D-D'	6.00	120.00	400.00	3.00	0.86

E-E'	6.00	120.00	400.00	3.00	0.86
Total Expected Resource of Chromite					**4.10**
Tentative Net Resource after 50% reduction					**2.05**

Assumption:

- *Thickness of the ore band: 6 m*
- *The Chromite band is continuous in nature.*

6.5 Broad Quantum of Work (NQT)

Phase	Component	Details / Quantum
Phase-I	Topographical Survey	- 3.9 Sq. Km area using Drone/ DGPS-based topographical survey
	Lithological Mapping, Sampling & Analysis (Soil, bed rock sampling)	- 3.9 Sq. Km area (1:4000 scale) Bedrock samples: 30 Nos. - QAQC samples (10%): 3 Nos.
	Trenching, Sampling & Analysis	- 10 trenches (10m L × 1m W × 2m D) - Sampling & analysis: 100 Nos. samples (1m interval) - QAQC samples: 10 Nos.
	Petrographic & Mineragraphic Studies	- Thin polished sections: 10 Nos. - Complete petrographic/ore microscopic/mineragraphic study: 10 Nos. - ICP-MS (REE and trace elements): 10 Nos.
Phase-II	Geophysical Survey	- Magnetic Survey: 400 Stations - Gravity Survey: 560 stations - Electrical Resistivity (10-line km)
	Exploratory Drilling	- No. of holes: 15 Nos.; Total meterage: 1550 m - Borehole collar survey: 15 Nos. (DGPS) - Sample analysis: 450 Nos. - QAQC samples (10%): 45 Nos. - Drill core preservation (30%): ~450 m
	Synthesis of Data	- Peer Review - Geological report writing & submission with recommendations

7. Timeline for the Project

Estimated working timeline for Patna- Chinguripal Chromite Block, Jajpur District, Odisha for G3 Stage Mineral Exploration Name of the Exploration Agency - Natural Resources Division, Tata Steel Limited Total Area – 3.9 Sq. Km; Completion Time - 12 Months; Reviews: 3 months, 7months, 10 months																	
Sl. No.	**Activity Plan**	**M1**	**M2**	**M3**		**M4**	**M5**	**M6**	**M7**		**M8**	**M9**	**M10**		**M11**	**M12**
1	Lithological Mapping (1:4000 scale), Topographical Survey by DGPS															
2	Trenching															
3	Sample preparation for chemical analysis															
4	Sample analysis															
1st Review by TCC on progress and Outcome																
5	Geophysical survey (Magnetic, Gravity and Electrical Resistivity) over potential areas															
6	Processing and interpretation of Geophysical survey data															
7	Synthesis of all data, interpretation and review				**Review-1**					**Review-2**				**Review-3**		
2nd Review by TCC on progress and Outcome																
8	Exploratory drilling, borehole collar survey etc															
9	Logging, sampling, sample preparation, interpretation resource assessment															
10	Petrographic, trace element study															
Final Review by TCC on progress and Outcome																
11	Peer Review															
12	Final Report preparation and submission															

8. Field Observations and Photographs

Field observation 1: Canga bed with boulders of quartzite in a nalla bed. extending 50m on both sides with width 10m. trending NS direction.

Field observation 2: Fractured Quartzite, Sample point CP-09

Field observation 3: laterite bed along nallah. trend N-S. same conglomeritic at top. in a profile section it is lateritic. 40m on both sides NS with appx 20m wide. Sample Pont CP-10a.

Field observation 4: Lateritic outcrops; Sample point CP-02

Field observation 5: Quartzite hill fractured and jointed. Joints trending in EW and NS

Field observation 6: Lateritic Boulders exposed near western part of the block.

Field observation 7: schistose structure. CP6. CP6A-SCHIST with may be Kyanite, towards foothill. contact with quartzite. further down is red soil.

Field observation 8: Ultramafic hill. rocks are slightly weathered and magnetic. Cp5

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