Proposal for Investigation of Bauxite, Aluminous Laterite, Manganese and Associated Minerals around Rengalaberha-Kashira Villages in Sundergarh District, Odisha for G3 Stage Mineral Exploration under NMET

(Bauxite, Aluminous Laterite, Manganese 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	Rengalaberha-Kashira
	Exploration Agency	Natural Resources Division, Tata Steel Limited
	Commodity	Bauxite, Aluminous Laterite, Manganese and Associated Minerals
	Mineral Belt	Bonai-Keonjhar Belt
	Completion Period with entire time schedule to complete the project	12 Months
	Objectives	1. Carryout geological mapping, bed rock, channel sampling, pitting, and sampling followed by chemical analysis to identify potential zones of bauxite and aluminous laterite. 2. 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 and preparation, chemical analysis, survey, database preparation, review, interpretations, report writing etc., shall be conducted by inhouse team and facilities. Some of the job such as mineragraphic study, exploratory drilling shall be conducted thorough outsourced agencies.
	Name/ Number of Geoscientists	4 to 6 geoscientists shall be deployed in the project.
	Expected Field days (Geology) Geological Party Days	Geology = 240 man-days (approx.) Geological Party = 600 man-days (approx.)
1.	**Location**	
	Latitude	21.91˚ to 21.97˚
	Longitude	85.23˚ to 85.26˚
	Villages	Rengalaberha, Kashira
	Tehsil/ Taluk	Koira
	District	Sundargarh
	State	Odisha
2.	**Area (hectares/ square kilometers)**	
	Block Area	3.13 Sq. Km.
	Forest Area	-
	Government Land Area	-
	Private Land Area	-
3.	**Accessibility**	
	Nearest Rail Head	Barbil - 26.0 KM
	Road	NH-520
	Airport	Bhubaneswar, Ranchi
4.	**Hydrography**	-
	Local Surface Drainage Pattern (Channels)	Dendritic drainage pattern
	Rivers/ Streams	Lekerapani Nala is main water stream in the area flows outside the southern boundary from east to west and meet Karo Nadi in the downstream side.
5.	**Climate**	
	Mean Annual Rainfall	1200 mm (Approx)
	Temperatures (December) (Minimum) Temperatures (June) (Maximum)	5˚ C 45˚ C

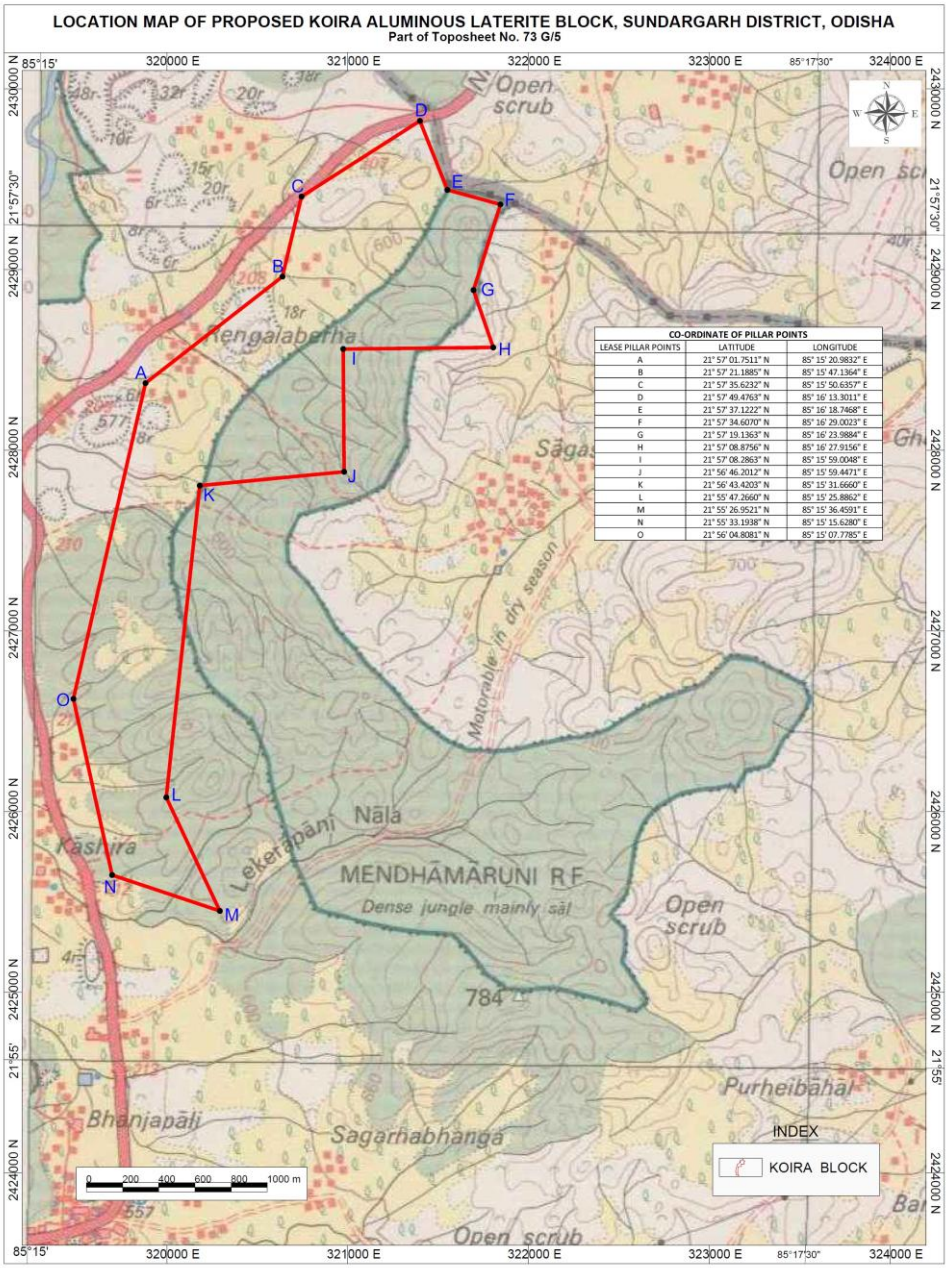
6.	Topography	The area exhibits undulatory hilly terrain, transected by numerous seasonal water courses flowing in east and western sides of the crescent shaped hill ridge.
	Toposheet Number	73F/5
	Morphology of the Area	The eastern side of the block is having a N-W trending hill slope which slopes down towards west. A number of small seasonal streams have shaped the area with spur and valley morphology with isolated hillocks. The areas along the eastern boundary is having forest which grades to bushes and grass lands towards east. The eastern side of the block along the boundary has the highest elevation of 715 mRL whereas the lowest point is located at the western side along the block boundary having elevation of 570 mRL.
	Availability of baseline geoscience data	Yes (in NGDR and Bhukosh)
	Geological Map (1:50K/ 25K) Geochemical Map	Available (1:50000 Scale)
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Available (Regional Scale)
	Justification for taking up Preliminary Exploration	The block is falling in the north-central part of the famous horseshoe shaped Bonai-Keonjar Synclinorium which host large deposits of iron and manganese ore. The surrounding area of the block is known for rich history of mining of iron and manganese ore. As per the records available in Bhukosh and NGDR Portal, in the Kadalia block, located towards the southeast direction and placed outside the proposed block was previously explored in detail by GSI and estimated high grade resources of bauxite. About 2.0 km from this proposed exploration block, there is an operating mine of M/s Rungta Sons Pvt. Ltd which has been granted for mining of iron and bauxite. In recent past, the work carried out by GSI in the surrounding areas (especially in the eastern side), occurrences of aluminous laterite are reported. Geologists of Natural Resources Division – Tata Steel Limited in April'25 and July'25 had conducted field geological investigation within the proposed block and could identify several bauxite and aluminous laterite bearing zones along the traverse paths. Surface samples collected from the area has also revealed bauxite and laterite in the area with encouraging assay. Occurrences of few small pits could be seen close to west-central boundary which were worked out in past by locals to extract manganese ore, confirmed by locals' villagers. Occurrences of manganiferous shale is evident in the pits. Considering the above facts, the area justifies for carrying out step by step exploration to understand potentiality and then quantify resources.

DETAILED DESCRIPTION ABOUT THE BLOCK

1. Block Summary

1.1 Physiography:

The southern side of the block is situated at about 1.0 Km north of Koira township. It is located the approx. 2.0 Km. eastward from the Karo Nadi which the main surface water source of the area. The area is having a linear arcuate hill which closes in the south. Several hillocks have formed by denudation of topography due to weathering of lithologies and subsequently shaped by seasonal streams those flow from the hill tops towards the valley parts. The southern part of the block has the highest elevation of 784 mRL whereas the lowest point is located at the northwestern side along the block boundary having elevation of 570 mRL. The area is covered with thick forest in the central parts within the Mendhamaruni RF (Map-1).



Map-1: Location of the proposed exploration block over toposheet

1.2 Background Geology (Regional Geology, Geology of the Block):

A group of low-grade metamorphosed, volcano-sedimentary Pre-Cambrian rocks belonging to 'Iron Ore Series' (Jones, 1934) comprises lava, tuffs, quartzite /sandstone banded iron formation and shales. These are preserved in a horseshoe shaped basin, which show low angle northerly plunging synclinorium with the overturning of western limb towards east.

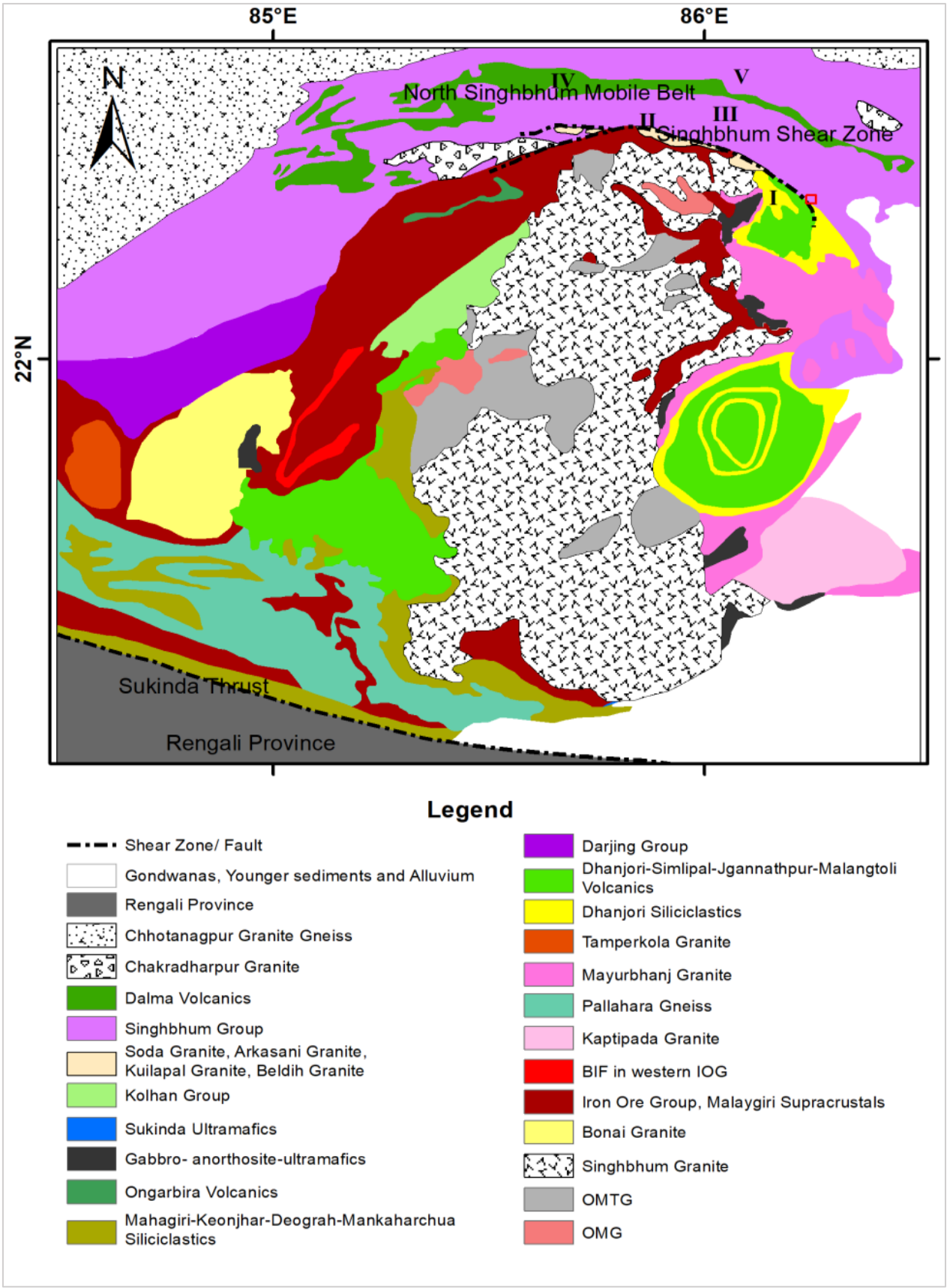
Later the litho assemblage being designated as "Iron Ore Super Group of rocks" (Prasad Rao et al, 1964) constitute the major supracrustal lithounits in the southern part of Singhbhum – Orissa craton and are conscipicuous in three different segments i.e. (i) Gorumahisani – Badampahar, (iii) Daitari – Malaygiri, (ii) Jamda- Koira. However, the stratigraphic relationship between the sequence developed in these basins is ridden with controversies. Although Saha and his co-workers (1994) believe them as time equivalents, Prasad Rao et al (1964) based on field mapping grouped the rocks into the six sequences in which the BIF bearing Gorumahisani sequence considered the oldest and the Koira sequence as the youngest. Murty and Acharya (1975) prefers two-fold classification of iron ore sequences of the region in which the Daitari-Tomka and Malyagiri sequence are clubbed with the the older Gorumahisani sequence. The most important sequence extending from Khandahar in south to Chakradharpur in north is considered to be the youngest and contains litho-sequence comprising the coarse clastics, basic volcanics, volcano clastics, Banded Iron Formation (BIF) and pelites in its type area at Koira-Jamda-Noamundi valley. The nomenclature of the sequence includes Iron Ore Group (Dunn, 1940; Jones, 1934), Noamundi Group (Banerjee, 1974). Koira Group (Murty & Acharya, 1975) and Khandahar Group (Sarangi & Acharya, 1975).

V.N. Murty, by means of detailed structural studies has described the area as the low angle northerly plunging assymetrical synclinorium whose western limb is slightly overturned towards east, whereas the rocks on the eastern limb are found to be right side up (Sarkar and Saha 1962) and preserved the correct order of stratigraphic super-position. The litho units of this area shows a general NNE-SSW trend in north Orissa and south Jharkhand and are known for its rich iron and manganese ore deposits. In addition to this, the recent work by Geological Survey of India has reported the occurrences of plateau type bauxite in the sourthern part of the belt along Kadalia, Malangtoli and Dunkujhori (T.S. 73 G/5) and Jaldih (T.S 73G/1).

1.3 Regional stratigraphy

The lithostratigraphic succession of the area work out by earlier workers based regional field study is shown below:

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



Map-2: Regional geological map of the Singhbhum craton (Source: after Saha, 1994 and modified from other sources)

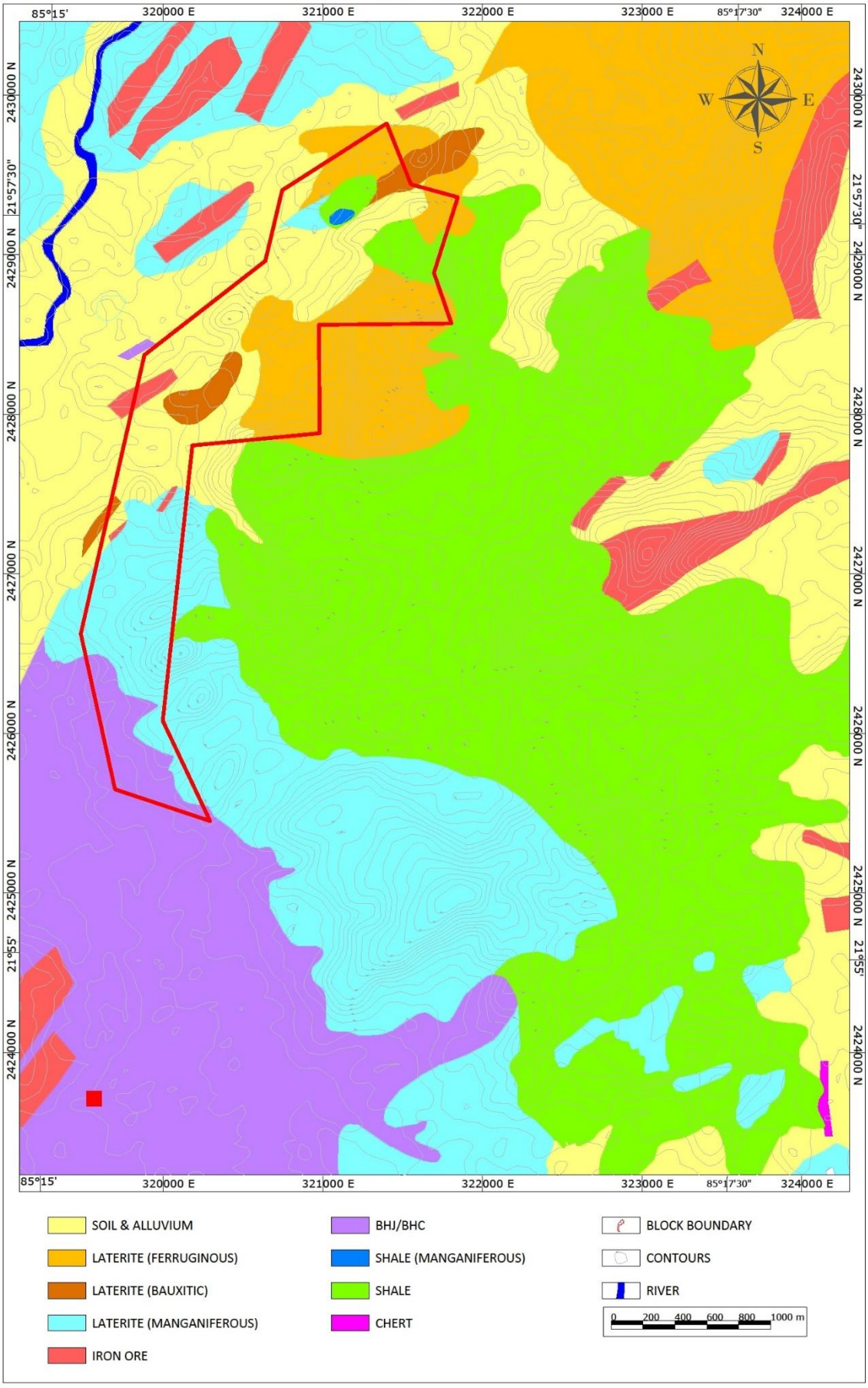
The structure of IOG is complex due to superimposition of cross folds on the limb of major fold, particularly northwards from Noamundi towards Jojohatu at north of Goilkera-Noamundi fault. The boundary between Singhbhum Granite and IOG is also complex in nature. In Chaibasa-Saraikela area, inter banded sequence of quartzite, conglomerate, sandstone and laminated phyllite represents part of IOG. In Kharkari river section, IOG uncomfortably overlies OMG and later Singhbhum Granite intruded IOG after first phase of folding and low-grade metamorphism.

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. The BIF and associated iron ore occur as isolated bodies forming low lying linear ridge. The Mesoarchean Iron Ore Group of rocks uncomfortably overlies the Bonai Granite while the Bonai Granite is equivalent of Singhbhum Granite Phase-A (Mohakul and Bhutia, 2015).

Most prominent structure in Bonai-Kedujhar Belt is north northeast-south southwest (NNE-SSW) trending asymmetrical syncline that closes southward where the western limb of the syncline is overturned (Jones, 1934; Dunn, 1940; Dunn and Dey, 1942). The NNE-SSW trending asymmetrical syncline is considered to be F_2 that is coaxial with earlier tight to isoclinals F_1 folds. A later stage of folding (F_3) with E-W axis has affected this syncline (Sarkar and Saha, 1962). The western limb of the regional syncline shows moderate to high dip defined by thick BIF exposed in Kiriburu-Meghahtuburu-Bolani area. The eastern limb is shallow dipping towards west, showing dissected highlands occupied by BIF, exposed around Thakurani Pahar and Joda Township. The intervening area between these two limbs is exposed around Jamada-Koira valley (Mohakul & Bhutia, 2015). According to Ghosh and Mukhopadhyay (2007), the area comprises an overturned syncline in the west and a low plunging syncline-anticline pair in the East. According to Mohakul& Bhutia (2015), the phyllites, exposed in Jamada-Koira valley are older than BIFs. In the study area, the Banded Iron Formation (BIF) occupies the synclinal ridges part (Mohakul and Bhutia, 2015). The Bonai-Kendujhar belt (BKB) rocks have undergone very low-grade metamorphism forming mostly phyllite and volcanics of green schist metamorphic grade.

1.4 Section of the block for exploration

The past work of GSI in and around the area are referred and consulted in detail while selecting the potential target area for further exploration. Based on review of such studies traverses are undertaken by the Geologists of Natural Resources Division-Tata Steel Limited in April and in July 2025 which confirmed occurrence of potential zones of bauxite and aluminous laterites. Samples collected from the area confirmed excellent alumina (Al_2O_3) values in the ore samples. At places shale is found to be manganiferous. There are few small old pits located near the west-central part of the block. In those pits, manganiferous shale is evident. As per locals, these pits were made by locals in past to extract manganese ore. While defining the block, the boundaries of the existing mining leases or already explored blocks by different agencies are considered to ensure no overlap. The northern part of the block is restricted up to the district boundary (Sundergarh and Keonjhar) while the northwestern part of limited up to the National Highway NH-520. With all these considerations, an area of 3.13 Sq. Km. is selected and proposed for carrying our Preliminary Exploration (G3 Stage) for bauxite, aluminous laterite, manganese, and associated minerals.



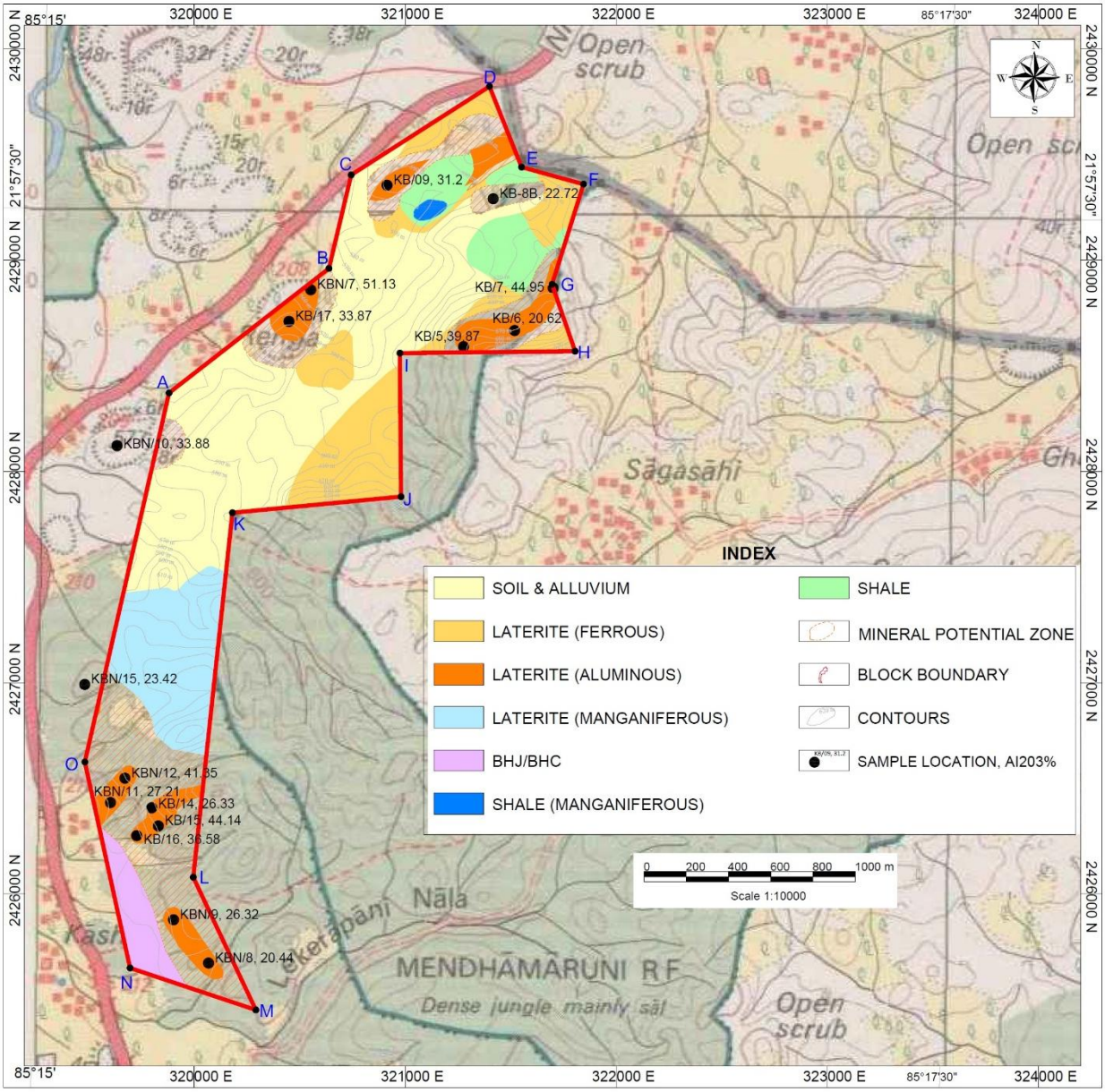
Map-3: Location of the proposed exploration block Over GSI Map (1: 50000)
Source: NGDR

1.5 Geology of the Block

Large scale mapping in the area revealed occurrences of shale, manganiferous laterite, banded hematite chert (BHC), ferruginous laterite, bauxitic laterite, soil, and alluvium. The southcentral part of the area is dominated by manganiferous laterite and banded hematite chert (BHC) while the northern part is mostly denominated with ferruginous laterite, soil, shale and bauxitic laterite. Overall, the lithologies in the area trend along northwest-southeast direction and dipping moderately due west.

Recently the Geologists of Natural Resources Division-Tata Steel Limited had carried out few geological traverses within the proposed block where they had observed occurrences of shale/phyllite and laterites as predominant lithologies of the area along with soil. Laterites in the area were observed to have developed over shale, resembling pisolititic texture at places and fleshy in colour which indicates possible high in alumina concentration. Considerable surface samples are collected from the area and later analyzed. The team could locate seven zones of bauxite and aluminous laterite in the area (Map-5) during the few reconnaitory traverses and suggested that with systematic mapping and allied activities more such zone may be expected in this target area.

The occurrence of manganiferous shale in the west-central part of the block (as per GSI map) with past evidence of local mining can be a target area for investigation and o locate zones of economic manganese mineralization (if there).



Map 5: Location of the observed Bauxitic and Aluminous Lateritic Zones in the area by Geologists of Natural Resources Division-Tata Steel Limited

1.5.1 Chemical analysis of collected samples from the area by Geologists of Natural Resources Division-Tata Steel Limited

Sl. No.	Sample ID	%Al2O3	%SiO2	%Fe	%TiO2	%Mn	%P	%S	%CaO	%MgO	%K2O	Lithology
1	KB/05	39.87	6.36	21.38	1.02	0.07	0.07	0.010	0.050	0.040	0.010	Bauxite
2	KB/06	20.62	15.52	36.44	0.77	0.05	0.10	0.010	0.060	0.040	0.010	Aluminous laterite
3	KB/07	44.95	2.14	25.86	1.46	0.05	0.08	0.010	0.110	0.060	0.010	Bauxite
4	KB/08A	25.74	34.65	15.11	0.92	0.34	0.09	0.010	0.240	0.370	0.460	Aluminous soil (silica rich)
5	KB/08B	22.72	45.16	11.40	0.95	0.50	0.06	0.010	0.280	0.550	1.110	Aluminous soil (silica rich)
6	KB/09	31.20	1.56	36.09	1.05	0.05	0.06	0.050	0.050	0.030	0.010	Aluminous laterite (ferruginous)
7	KB/13	23.25	1.83	44.51	0.22	0.05	0.04	0.010	0.060	0.020	0.040	Aluminous laterite (iron rich)
8	KB/14	26.33	4.22	38.66	0.65	0.05	0.09	0.010	0.090	0.040	0.040	Aluminous laterite (iron rich)
9	KB/15	44.14	6.31	18.48	0.81	0.03	0.06	0.010	0.070	0.030	0.080	Bauxite
10	KB/16	36.58	4.19	27.86	0.83	0.03	0.07	0.010	0.030	0.030	0.060	Bauxite
11	KB/17	33.87	3.37	30.99	0.75	0.05	0.06	0.010	0.040	0.020	0.040	Bauxite

A total of 11 samples collected from the laterites in the area have resulted good values of Al_2O_3 while other radicals are well within the permissible limit to consider for economic use as bauxite and aluminous laterite.

1.6 Mineral potentiality based on Geology, Geophysics and Geochemistry

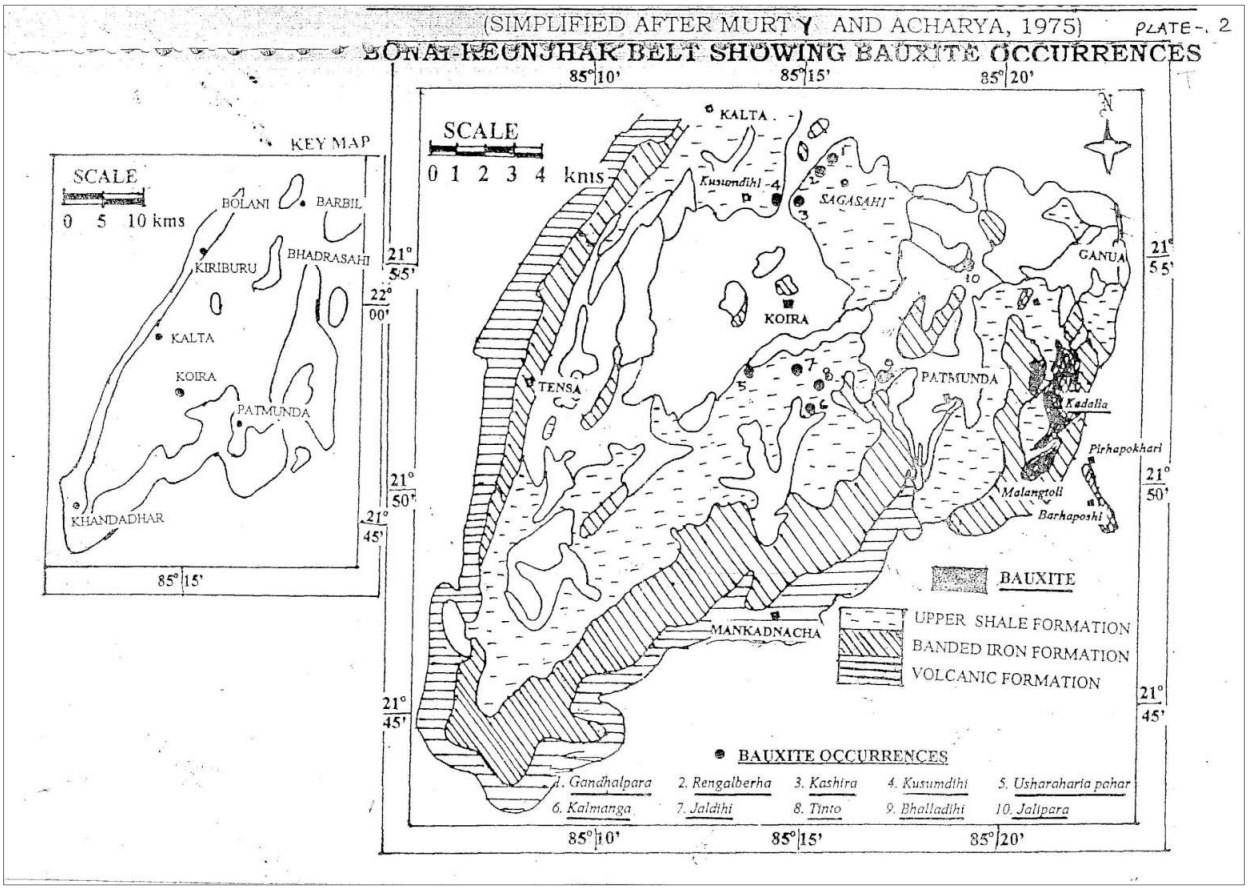
The past work by GSI had reported the occurrence of bauxite in the southern part of the synclinorium around Jaldihi. Subsequent work in the area by Shri S.K. Jena, 1999 helped to locate the bauxite plateau at Kadalia (6.0 km x 1.0 km), Malangtoli (2.0 km x 1.0 km), Dunkujhori (1.0 km x 0.5 km) at an elevation of 800 m R.L. and above which falls in parts of Toposheet No.75G/5. Later during F.S.: 2004-06 the Geological Survey of India (GSI) carried out detailed exploration around these blocks with 1:2000 scale mapping and drilling of 97 boreholes at 200m x 200m grid. The analytical data of the analyzed samples showed that Al_2O_3 content above 40% cut-off varied from 40.54% to 60.74%, SiO_2 0.96 to 8.94%, Fe_2O_3 from 5.20% to 25.80%, TiO_2 0.70% to 2.50% and LOI from 20.35% to 29.32%.

1.7 Scope for proposed exploration

On review of existing baseline and past exploration reports and data therein from areas within and around this proposed block, it is planned that initially topographical survey (using drone and DGPS survey) shall be carried out followed by geological mapping (1:5000 scale) with bed rock, channel sampling, chemical analysis to delineate outcrops, surface geology and potential zones of bauxite, aluminous laterite and manganese (if any). Pitting shall also be carried out to understand nature and quality of ore at around 1.0m depth from surface. After synthesizing all acquired data till this stage, exploratory core drilling is proposed to be carried out at suitable grid (400 x 400/ 400x 200) to understand lateral extend, depth of mineralization for bauxite and aluminous laterite. In the manganese potential areas, geophysical survey (magnetic, resistivity and IP survey shall be carried out to locate potential subsurface manganese ore bodies/ zones and then those targets shall be drilled proved at a suitable grid (200 x 200/ 200 x 100/ 200 x 50). 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 Rule.

1.8 Recommendations of Mineral Exploration Report

The Geological map (Map-6) of the southwestern part of Bonai-Kendujhar belt (simplified after Murty and Acharya, 1975) which is referred in the final report on "*Preliminary Appraisal of the Bauxite resources of the Pre-Cambrian Bonai-Kendujhar belt in parts of Kendujhar and Sundargarh districts, Orissa (E-I); Field season 2004-2005 & 2005-2006*" has shown occurrence of bauxite around Gandhalpada, Rengalberha, Kashira and Kusumdihi (Map-7). These deposits are included in the proposed G3 stage exploration proposal.



Map 6: Location of the known bauxite deposits in Bonai-Keonjhar Belt over simplified Geological Map, after Murty and Acharya, 1975

1.9 Objectives

It is planned to explore the deposit with topographical survey, geological mapping (1:5000 scale), BRS and channel sampling, pitting and related sampling, geophysical survey, exploratory drilling, sampling, and analysis of borehole core samples, then assess potential of the area and estimate G3 resources above threshold (+20% Al_2O_3 and +10% Mn).

2. Previous Work

2.1 Previous Exploration within adjoining area by GSI

2.1.1 FINAL REPORT ON PRELIMINARY APPRAISAL OF THE BAUXITE RESOURCES OF THE PRE-CAMBRIAN BONAI-KENDUJHAR BELT IN PARTS OF KENDUJHAR AND SUNDARGARH DISTRICTS, ORISSA (E-I); Field Season 2004-2005 & 2005-2006

An area of 5.0 sq km was covered by detailed mapping at 1:2000 scale in Kadalia, Malangtoli and Dunkujhori block during the F.S. 2004-06. The laterite in the mapped area occurs as ferruginous laterite and Aluminous laterite. The ferruginous laterite and aluminous laterite occur towards eastern side of the mapped area around Kriykudar and Mithirda villages. It also occurs in the central and southeastern part in Dunkujhori block and borders along the eastern and southeastern part in the Malangtoli block. They are reddish brown to reddish orange colour, cavernous in nature and the cavities are filled with limonite, goethite and haematite. The thickness of the laterite varies from 1.0m to 9.0m as encountered in the boreholes.

Bauxite in the area occurs both in the form of pisolites and in massive nature. Pisolite bauxite are well developed around south of Kadalia. Massive bauxite is reported as small and irregular patches occurring to the south and southwest of Kriykudar village. The bauxite is observed in the western slope of the Malangtoli area near Mithirda village. Bauxite is also seen to the north of Malangtoli village.

90 nos. of composite samples were collected from 34 pit walls were processed and sent for chemical analysis in the chemical laboratory of GSI, Odisha. The analytical result reveals that the Al_2O_3 content varies from 29.38% to 44.17%, SiO_2 from 7.06 to 31.97%, Fe_2O_3 from 15.20 to38.30%, TiO_2 from 1.50 to 4.00% and LOI from 7.55% to 28.53% in the Kadalia block .In the Malangtoli block the analytical result reveals that the Al_2O_3 content varies from 20.65% to 59.78%, SiO_2 from 1.90% to 28.85%, Fe_2O_3 from 41.01% to 44.81%, TiO_2 from 0.93% to 2.54% and LOI from 14.91 to22.03%.

A total of 173 nos. of scarp/ channel samples have been collected from 13 locations in the Kadalia south block and from 21 location in the Malangtoli block. The analytical data of the scarp/channel samples from Kadalia block shows the Al_2O_3 content to vary from 18.98 to 59.10%, SiO_2 from 1.16 to 31.75%, Fe_2O_3 from 4.84 to 48.40%, TiO_2 from 0.60 to 6.0% and LOI from 11.28 to30.27%. In the Malangtoli block the analytical data indicate that the Al_2O_3 content to vary from 2.09 to 58.08%, SiO_2 from 0.94 to 27 64%, Fe_2O_3 from 7.20 to 51.80%, TiO_2 from 0.20 to 5.30% and LOI from 13.42 to 28.90%.

A total of 2119.25m was drilled in 97 completed boreholes to cover the entire Kadalia block and Malangtoli block. Vertical boreholes were drilled up to 16.0m to 25.0m from the surface until it intersected the white shale below the ore zone. Dry drilling method was adopted except for the portion where the borehole has intersected hard formations like banded chert and iron ore. Most of the boreholes intersected the bauxite ore zone which varies in thickness from 1.5m to 23.5m in the Kadalia block and from 2.0m to 9.0m in Malangtoli block. The other litho-units intersected in the boreholes are ferruginous and aluminous laterite, pink, purple, yellow, brown to white shale with intercalations of ferruginous shale and powdery iron ore.

In course of detailed mapping in Kadalia, Malangtoli and Dunkujhori blocks and drilling in Kadalia (South) and Malangtoli block the presence of bauxite has been established in the area. The thickness of the bauxite ore zone varies from 9.00m in borehole to 23.50m in boreholes.

The Al_2O_3 content in the area varies from 43.41% to 48.15%, SiO_2 from 13.34 to 24.86%, Fe_2O_3 from 8.25 to 16.35%, TiO_2 from 3.03 to 3.25% and LOI from 20.02 to 23.81%.

3. Block description

The proposed exploration block covers an area of 3.13 Sq. Km. area with 15 corner points. Coordinates of these points in degree decimal is given in the below table.

Boundary coordinates of the block

Corner Points	Longitude	Latitude
CO-ORDINATE OF PILLAR POINTS		
LEASE PILLAR POINTS	LATITUDE	LONGITUDE
A	21° 57' 01.7511" N	85° 15' 20.9832" E
B	21° 57' 21.1885" N	85° 15' 47.1364" E
C	21° 57' 35.6232" N	85° 15' 50.6357" E
D	21° 57' 49.4763" N	85° 16' 13.3011" E
E	21° 57' 37.1222" N	85° 16' 18.7468" E
F	21° 57' 34.6070" N	85° 16' 29.0023" E
G	21° 57' 19.1363" N	85° 16' 23.9884" E
H	21° 57' 08.8756" N	85° 16' 27.9156" E
I	21° 57' 08.2863" N	85° 15' 59.0048" E
J	21° 56' 46.2012" N	85° 15' 59.4471" E
K	21° 56' 43.4203" N	85° 15' 31.6660" E
L	21° 55' 47.2660" N	85° 15' 25.8862" E
M	21° 55' 26.9521" N	85° 15' 36.4591" E
N	21° 55' 33.1938" N	85° 15' 15.6280" E
O	21° 56' 04.8081" N	85° 15' 07.7785" E

4. Planned Methodology

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

1. Topographical Survey
2. Geological mapping, bed rock, channel sampling and analysis.
3. Pitting, pit sampling and analysis.
4. Mineragraphic and studies.
5. Core drilling, sampling, analysis to prove, extent, depth of mineralised zone, grades and estimate resources.

5. Nature, Quantum, and Target

5.1 Survey, Geological Mapping, Pitting & Geochemical Sampling:

Topographical survey shall be carried out using drone and DGPS to generate orthomosaic map of the area. The DEM thus generated shall be used to extract contours at 10m or smaller interval.

Geological mapping in 1:4000 scale shall be conducted over the entire area while simultaneously bed rock, channel sampling and analysis shall be carried out.

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. Channel samples shall be collected across the ore zone for >1.0m section (as applicable).

Pits of 1.0m x 1.0m x 1.0m shall be made in the ore zone to understand near surface lithological variations and quality of ore.

5.2 Exploratory Drilling:

The guideline of MoEF & CC dated 29th Dec, 2023, issued in Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 and Van (Sanrakshan Evam Samvardhan) Rules, 2023 which guide us that “Surveys in the forest lands for mining purposes which involve breaking of forest land by way of drilling the bore holes and digging the trenches,

such as for mining, shall not be treated a non-forest purpose as long as such surveys involve felling of up to hundred trees in the entire areas proposed for survey and drilling of twenty five boreholes of four inch diameter in a block". Complying to this guideline, 25 boreholes are planned to be drilled in the area.

Core drilling (NQ size) shall be conducted over the identified most promising target zones to understand subsurface geology and extend of mineralization. All the boreholes shall be drilled vertically. It is evident from past exploration in this region that depth of mineralization goes up to 23.0 m for 40% cut-off Al_2O_3. Henceforth, boreholes shall be drilled to an average depth of around 25.0 m or till the end of mineralization whichever is less in the bauxite bearing zone. However, in the manganese bearing area, average 60m depth of each hole is considered. For calculation at this point it is assumed that 20 boreholes shall be drilled in bauxite/ aluminous laterite bearing area while 5 boreholes shall be drilled in manganese potential zones. Therefore, total meterage of drilling shall be 800m (500m for bauxite/ aluminous laterite and 300m for manganese). Samples shall be collected and analysed for sample length of 1.0 m in the ore zone and one sample in both top and bottom of the ore zone are planned to be analysed.

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 of 20% Al_2O_3 shall be considered for bauxite/ aluminous laterite while for manganese resources shall be estimated at 10% Mn cut-off.

5.3 Broad Quantum of Work (NQT)

Components	Quantum
Phase-I	
Topographical Survey	1. 3.13 Sq. Km. area of drone and DGPS based topographical Survey.
Lithological Mapping, sampling and analysis	2. 3.13 Sq. Km area (1:4000 scale) 3. Bed rock, channel sampling = 75 nos. 4. QAQC samples (10%) = 8 nos.
Pitting, sampling, and analysis	1. 40 Nos. 2. Sampling and analysis = 40 samples
Petrographic and mineragraphic studies	1. Thin polished sections = 10 Nos. 2. Complete petrographic/ ore microscopic/ mineragraphic study= 10 Nos. 3. XRD analysis = 10 Nos. 4. Combined determination of Trihydrate Alumina = 10 Nos. 5. Trace element study by ICP-MS = 10 samples.
Phase-II	
Geophysical Survey	1. Magnetic, Resistivity and IP Survey = 10 Line Km
Exploratory Drilling	2. No. of holes = 25; Meterage = 800m 3. Borehole collar survey = 25 nos. (final with DGPS) 4. Sample analysis = 600 nos. 5. QAQC samples (10%) = 60 nos. 6. Determination of insitu bulk density = 6 samples.
Synthesis of all available data	1. Peer Review. 2. Geological Report writing and submission with recommendations.

Activity Timeline for the Project

Sl. No.	Activity Plan	M1	M2	M3	M4		M5	M6	M7	M8	M9	M10		M11	M12
1	Topographical Survey														
1	Lithological Mapping (1:5000 scale) and Sampling														
2	Pitting														
3	Sample preparation for chemical analysis														
1st Review by TCC on progress and Outcome															
4	Geophysical Survey														
2nd Review by TCC on Progress and Outcome						Review-1							Review-2		
5	Exploratory drilling, borehole collar survey etc														
6	Logging, sampling, sample preparation, bulk density determination														
7	Sample analysis														
8	Mineragraphic, XRD, trace element study														
Final Review by TCC on progress and Outcome															
9	Data synthesis and draft report preparation														
10	Peer Review														
11	Final Report preparation and submission														

References

1. Preliminary Appraisal of the Bauxite resources of the Pre-Cambrian Bonai-Kendujhar belt in parts of Kendujhar and Sundargarh districts, Orissa (E-I); Field season 2004-2005 & 2005-2006.

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