DETAILED PROPOSAL REPORT (DPR)

RECONNAISSANCE SURVEY (G4) FOR ALUMINOUS LATERITES WITH ASSOCIATED CRITICAL MINERALS, MALIK MIRZAPUR AREA, BIDAR DISTRICT, KARNATAKA

(100 SQ.KM)

COMMODITY: VANADIUM AND ASSOCIATED CRITICAL MINERALS

By

GMMCO TECHNOLOGY SERVICES LTD (GTS)

HYDERABAD, TELANGANA

CKA Birla Group | GTS

FOR SUBMITTING PROPOSAL FOR UNDERTAKING PRELIMNARY EXPLORATION

From:	To:
Dr. Akkala Surendra Babu	The Director & HoD
Chief of Technical Services	National Mineral Exploration Trust, Secretariat, Ministry of Mines,
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Rangareddy District, Hyderabad – 500089	New Delhi – 110011.

1) Name and address of the Applicant		
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(b)	Postal address	GTS Ltd, 9th Floor (9A/2), Vaishnavi Cymbol, Puppalaguda, Gandipet Mandal, Rangareddy District, Hyderabad, Telangana, India – 500089
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(g)	E-mail address	pundarikarao.d@gts-india.com

2) **2) Details of Accreditation as Private Exploration Agencies and Notification under the Provision to Section 4(1) of the MMDR Act.**		
(a)	Date of accreditation granted by QCI-NABET	20th May - 2024
(b)	Date of expiry of accreditation	15th May - 2027
(c)	Date of Notification under the provision to Section4 (1) of the MMDR Act.	13th Sept - 2024
(d)	Date of expiry of notification	12th Sept - 2027
(e)	Category of the Exploration agency (Category A or B) under Notification	Category - A

3) Location details of the area proposed				
(a)	State	Karnataka		
(b)	District(s)	Bidar District		
(c)	Nearby village(s)	Malik Mirzapur, Kasimpur, and Secundrapur		
(d)	Survey of India (SOI) Toposheet No(s)	56G/05		
(e)	Area in Sq.Km	100		
(f)	Boundary co-ordinates of the Proposed Block (in Decimal Degree)	**Corner points**	**Latitude**	**Longitude**
		A	17°48'21.91"N	77°24'4.39"E
		B	17°54'58.55"N	77°21'33.86"E
		C	17°56'7.56"N	77°25'34.78"E
		D	17°49'31.84"N	77°28'26.41"E

4) Mineral Potential of the area		
(a)	Name of Mineral(s) identified/expected in the area/block	Vanadium and Associated Critical Minerals
(b)	Title of the Project	Reconnaissance Survey (G4) for Aluminous Laterites with associated Critical Minerals, Malik Mirzapur Area, Bidar District, Karnataka.
(c)	Stage of Exploration	G-4
(d)	Basis on which mineral potential of the area has been identified	Please refer enclosed "Summary proposal"

5) Documents enclosed with the application	
(i)	Location of the proposed block demarcated on Survey of India (SOI) Toposheet No.56G/05
(ii)	Documents mentioned in item 4(d) above.

Signature of the applicant

Dr. Akkala Surendra Babu
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GMMCO Technology Services Ltd
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Place: Hyderabad
Date: 08.05.2026

Summary of the Block

Detailed Project Report (DPR) for Reconnaissance Survey (G4) for Aluminous Laterites with associated Critical Minerals, Malik Mirzapur Area, Bidar District, Karnataka (G4-Stage & 100 Sq. Km)

<table>
<tr><th>S.No</th><th>Features</th><th>Details</th></tr>
<tr><td></td><td>Block ID</td><td>Malik Mirzapur Block</td></tr>
<tr><td></td><td>Exploration Agency</td><td>M/s GMMCO Technology Services Limited Hyderabad, India.</td></tr>
<tr><td></td><td>Commodity</td><td>Vanadium and associated Critical Minerals</td></tr>
<tr><td></td><td>Mineral Belt</td><td>Deccan trap volcanism</td></tr>
<tr><td></td><td>Completion Period with entire Time schedule to complete the project</td><td>Eight (8) months</td></tr>
<tr><td></td><td>Objectives</td><td>1) To target the laterite for Vanadium, Scandium, Titanium, REE and Gallium mineralisation in laterite over Deccan Trap.
2) To carry out detailed geological mapping of the 100 sq km block on 1:12,500 scale for delineation potential zones for V, Sc, Ti, REE and Ga mineralisation.
3)To undertake systematic grab, channel, and groove sampling of bedrock from identified favourable and mineralized zones.
4) To assess and establish G-4 category (UNFC code 334) reconnaissance level prospects for Vanadium, Titanium, and Gallium within the block, in accordance with UNFC norms and the Minerals (Evidence of Mineral Contents) Rules.</td></tr>
<tr><td></td><td>Whether the work will be carried out by the proposed agency</td><td>M/s GMMCO Technology Services Limited Hyderabad, India</td></tr>
<tr><td></td><td>Name/Number of Geoscientists</td><td>Two Senior Geologists</td></tr>
<tr><td></td><td>Expected Field days (Geology) Geological Party Days</td><td>Two Senior Geologists: 60 days</td></tr>
<tr><td>1.</td><td>Location</td><td></td></tr>
<tr><td></td><td>Latitude and Longitude</td><td>
<table>
<tr><th>Corner points</th><th>Latitude</th><th>Longitude</th></tr>
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<tr><td></td><td>Villages</td><td>Madaknalli, Andur, Kasimpur, and Secundrapur</td></tr>
<tr><td></td><td>Tehsil /Taluk</td><td>Bidar</td></tr>
<tr><td></td><td>District</td><td>Bidar</td></tr>
<tr><td></td><td>State</td><td>Karnataka</td></tr>
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2.	**Area (hectares/square kilometers)**	
	Block Area (Sq. Km)	100
	Forest Area	Data not available
	Government Land Area	Data not available
	Private Land Area	Data not available
3.	**Accessibility**	
	Nearest Rail Head	Bidar Railway station
	Road	Bidar is the Nearest Town to Malik Mirzapur. Bidar is 14 km from Malik Mirzapur. Road connectivity is there from Bidar to Malik Mirzapur.
	Airport	The nearest airport is Rajiv Gandhi International Airport (RGIA), Hyderabad
4.	**Hydrography**	
	Local Surface Drainage Pattern (Channels)	The proposed area represents a plateau geomorphic setting characterized by an undulating terrain, with a moderately to highly dissected upper plateau developed in the north-western part of Toposheet No. 56G/05. The regional physiography and drainage pattern, governed by prevailing tropical climatic conditions, have played a significant role in the development of laterite cover and the residual enrichment of alumina, primarily through prolonged processes of chemical weathering, oxidation, and leaching.
	Rivers/Streams	2nd order Nalas present in proposed area
5.	**Climate**	
	Mean Annual Rainfall	The mean annual rainfall in Bidar, Karnataka, generally ranges between 847 mm and 1183 mm
	Temperatures (December) Minimum Temperatures (June) (Maximum)	Tropical climate with hot summers, mild winters, and southwest monsoon rainfall.
6.	**Topography**	
	Toposheet Number	56G/05
	Morphology of the Area	The proposed area is gentle undulations and low-lying areas
7	**Availability of baseline geosciences data**	
	Geological Map (1:50K/25K)	Regional Geological Map - GSI (1:50000 scale)
	Geochemical Map	NGCM data available
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well also Local scale GP maps)	NGDR

8.	**Justification for taking up Reconnaissance Survey / Regional Exploration**	Laterites are well-known secondary hosts of critical minerals such as Vanadium (V), Cobalt (Co) and Scandium (Sc), formed through residual enrichment during intense chemical weathering under low-erosion conditions. The proposed block lies in the Deccan Plateau and is characterized by Deccan Trap basaltic flows with extensive laterite cover. Weathered vesicular, zeolitic and red bole horizons developed at flow contacts provide favourable geological settings for the concentration of critical minerals. Geochemical mapping carried out by GSI in the same toposheet by Pawar and Nirmalkumar (2023) reported anomalous values of V (239-1183 ppm), Co (1-128 ppm) and Sc (25-56 ppm) from laterite zones. Further, Deepu T.R. et al. (2025), GSI, reported significant enrichment of V (89-4280 ppm; average ~898 ppm) and Sc (4-104 ppm; average ~43 ppm) from limited surface and borehole samples. However, subsurface data are restricted to two boreholes and the sampling density is inadequate to establish lateral continuity and grade consistency. Hence, the area merits G4 (Reconnaissance) level exploration to systematically assess the critical mineral potential.

Detailed Block Summary of the Malik Mirzapur Block

Contents

Block Summary

1. Introduction

Critical minerals such as Vanadium (V), Cobalt (Co) and Scandium (Sc) are of strategic importance due to their applications in advanced alloys, energy storage systems and high-technology industries. Identification and assessment of indigenous resources of these minerals have been prioritized, including their occurrence in secondary and unconventional geological environments. Laterites, developed through prolonged chemical weathering under low erosion conditions, are recognized as significant secondary repositories of critical minerals due to residual enrichment processes (Schulz, 2017; Jones and Vasyukova, 2018; Wang et al., 2021).

The proposed area is situated in the Deccan Plateau and is underlain by Deccan Trap basaltic flows with widespread laterite cover. The basaltic flows exhibit weathered vesicular and zeolitic zones at flow contacts, commonly associated with red bole and intertrappean horizons. These horizons provide favourable geological conditions for the concentration and retention of critical minerals during lateritization.

Geochemical mapping carried out by GSI in the adjoining area within the same toposheet by Pawar and Nirmalkumar (2023) reported anomalous concentrations of V (239-1183 ppm), Co (1-128 ppm) and Sc (25-56 ppm) from laterite zones. Further, a Critical Mineral Assessment Programme conducted by Deepu T.R. et al. (2025) over a limited area reported enrichment of V (89 - 4280 ppm; average ~898 ppm) and Sc (4-104 ppm; average ~43 ppm) from surface and borehole samples. Subsurface information is, however, limited to two boreholes, and the sampling density is inadequate to establish lateral continuity, thickness variation and grade consistency of mineralized laterite horizons (Plate-3, 4 & 5).

In view of the favourable geological setting and encouraging but limited geochemical data, the proposed block is considered suitable for G4 (Reconnaissance) level exploration during the ensuing Field Season to systematically assess the distribution and potential of critical mineralization.

Location and details of the area

The proposed block falls in the survey of India toposheet No. 56G/05 in the administrative jurisdiction of Bidar District District, Karnataka (Plate-1). The area forms part of Gulbarga division, where laterite is exposed. Bidar is the Nearest Town to Malik Mirzapur. Bidar is 14 km from Malik Mirzapur. Road connectivity is there from Bidar to Malik Mirzapur.

Physiography

Toposheet No. 56G/05 is characterised by a plateau-dominated physiography with gently to moderately undulating terrain, developed as part of the Deccan plateau region. The area comprises laterite-capped uplands, intervening shallow valleys, and

locally dissected plateau remnants, reflecting prolonged subaerial exposure and tropical weathering.

Elevation varies moderately across the toposheet, with higher ground forming subdued plateaus and lower elevations marked by seasonal nalas and minor drainage channels. The drainage pattern is predominantly dendritic to sub dendritic, controlled by regional slope and structural weaknesses, and exhibits a moderate to high degree of dissection in places. The combined influence of physiography, drainage, and tropical climatic conditions has favoured intense lateritisation and residual concentration of alumina and associated elements, making the area conducive for aluminous laterite bauxite and allied critical mineral occurrences.

Regional Geological setup

The proposed block, situated in the southeastern part of the Deccan Plateau within toposheet 56G/05 is predominantly characterized by basaltic flows of the Deccan Trapsand lateritic outcrops. These flows are of Upper Cretaceous to Paleogene age and regionally correlated to flows 9 to 13. Individual flows are differentiated by the presence of inter-trappeanchert and/or red bole horizon. These flows are under the Ambaneli Formation of the Sahyadri Group. The oldest flows, no.9 and 10, are dark to grey, fine-grained and very sparsely porphyritic with plagioclase of 5 mm size. The base of the flow is not in the area. A thin bed of red bole separates this flow from the overlying flow.

The second flow (No. 11 and 12) is exposed between 580+/-2 m and 630+/-2 m above msl. The flow is dark grey, very fine-grained at places and porphyritic in texture. This shows light and dark coloured horizontal bands, which may be either due to compositional change or stretching of the vesicles. In the weathered portions, some horizontal grooves are seen, which might have been developed due to differential weathering.

It contains vesicles of 1 mm to 5 mm in size, which are partly to filled with zeolite, calcite, secondary silica and glass. The intertrappean horizon overlying the second flow and is greenish, cream, white to brown, unfossiliferous siliceous chert. The third flow (No.13) is exposed above 630+/- 2 m and is the youngest flow in this area. It is greenish-grey, fine to coarse-grained and sparsely to moderately glomeroporphyritic in texture (T.P. Gururaja and A.S. Khan FS 1978-79. A.S. Khan FS 1979-80, B Chakrabarti FS 1980-81).

Laterite covers about half of the area on the eastern side and a few scattered mounds in the remaining area, which form plateaus of various sizes having irregular outlines, linear ridges, and conical and flat-topped blocks of small size. Laterite is yellowish to reddish brown, limonitic and highly porous with vermicular openings. The contact between the underlying flow and laterite is gradational.

Table 1: Generalized stratigraphy of the toposheet (Source: Compiled 50 K Geological Map, GSI)

Age	Supergroup	Group	Formation	Lithology
Cenozoic				Laterite
Upper Cretaceous to Palaeocene	Deccan Trap	Sahyadri	Ambaneli	Basalt flow 13
				Basalt flow 11, 12
				Intertrappean
				Basalt flow 10
				Basalt flow 9

In the local geological context, the lateritic profiles exhibit a systematic upward increase in degree of weathering, marked by development of saprolite, core-stone horizons, mottled zones, and ferruginous/aluminous duricrust caps, with fresh basalt encountered at depths exceeding 30- 40 m. Such well-developed lateritisation has facilitated residual concentration of alumina, iron, titanium, vanadium and allied elements, making the Deccan Traphosted laterites of the area favourable targets for aluminous laterite bauxite and critical mineral exploration. The geological setting thus provides a strong rationale for undertaking G-4 stage reconnaissance investigations in the proposed block under UNFC and MEMC Rules.

Geology of the Block

The proposed block is underlain by Cenozoic laterite formations developed over Late Cretaceous-Palaeocene basaltic flows of the Deccan Traps (Sahyadri Group), along with associated intertrappean beds comprising chert and chert with marl. The laterites represent the products of intense chemical weathering of basalt under tropical climatic conditions, leading to residual enrichment of iron, alumina, and associated elements. Consequently, the lithological assemblage within Toposheet No. 56G/05 is dominated by Deccan Trap basalts, intertrappean sediments, and lateritic caps (Plat-3).

Four younger basalt flows, designated Flows 9,10,11,12 & 13 (Table 1), are recognised in the area. These flows are sub-horizontal to horizontal, laterally extensive, and exhibit typical ‘Aa’ type basaltic characteristics, including thick massive cores, locally developed columnar jointing, rough and rubbly upper surfaces, and highly vesicular flow tops. Vesicles, ranging in size from 1 mm to 10 mm, are commonly infilled with secondary minerals such as calcite, zeolite, drusy quartz, and chalcedony. Individual flows are distinguished on the basis of their fragmental and vesicular flow tops, weathering characteristics, joint patterns, and intervening intertrappean horizons. Laterite occurs both as isolated cappings and as extensive blanket deposits over the trap flows, with profile thickness varying from 1 m to 30 m. Parts of Flows II and III have undergone advanced lateritisation, producing vermicular, hard, massive, and concretionary laterite. The laterite exhibits colour variations from brick red and reddish-brown to dark greyish-red, reflecting differences in degree of weathering and iron enrichment.

Scope for proposed exploration

The proposed exploration programme aims to undertake G-4 stage reconnaissance investigation to assess the aluminous laterite bauxite potential and associated critical minerals (V, Ti, and Ga) within the block. The scope includes systematic geological and structural mapping to delineate laterite cover, basalt flows, intertrappean horizons, and favourable geomorphic domains controlling lateritisation and mineral enrichment.

Detailed surface sampling (grab, channel, and groove) will be carried out from laterite profiles, bauxite horizons, and mineralised zones to evaluate the spatial and vertical variation of Al_2O_3, Fe_2O_3, TiO_2, V, Sc, REE and Ga. Limited shallow subsurface investigations, wherever feasible, will be undertaken to understand laterite thickness, profile development, and grade continuity.The exploration will generate baseline geological, geochemical, mineralogical, and analytical data to identify promising zones, establish G-4 category (UNFC code 334) prospects, and provide a scientific basis for subsequent G-3 stage detailed exploration.

Mineral Potentiality based on Geology

Mineralisation within the proposed block is closely associated with intense lateritisation of Deccan Trap basalts, which has resulted in the residual concentration of aluminium and iron, along with enrichment of vanadium, Scandium, titanium, and gallium. During prolonged tropical weathering, silica and alkalis were leached, while relatively immobile elements such as Al, Fe, Ti, Sc, REE and V became progressively concentrated within the lateritic profile. Vanadium is preferentially enriched through adsorption and substitution within iron oxides and hydroxides, whereas titanium occurs largely as resistant Ti-bearing phases and as lattice-bound components within the weathered basalt. Gallium, owing to its geochemical affinity with aluminium, is commonly incorporated within aluminous laterite and bauxite horizons. The development of thick, mature lateritic profiles, particularly over Flows II and III, thus provides favourable conditions for the formation of Al-V-Sc-Ti-Ga bearing laterite and bauxite, warranting systematic G-4 stage reconnaissance evaluation.

2. Previous Work

Systematic geological investigations in and around the proposed block have been carried out by the Geological Survey of India (GSI) from time to time. Early regional geological mapping established the presence of Deccan Trap basaltic flows, intertrappean sediments and lateritic caps, and delineated the broad stratigraphic framework of the area. These studies documented extensive lateritisation of basaltic flows, particularly over plateau surfaces, indicating favourable conditions for the development of laterite and associated secondary mineral enrichment.

Sinha et al. (1980) carried out geological mapping on 1:50,000 scale in toposheets 56F/4, 56G/5 and 56G/6. The area was reported to be largely covered by tholeiitic Deccan Trap basalts of Cretaceous to Eocene age, resting disconformably over Bhima Group limestones of Precambrian age. The Deccan Trap basalts are capped

by laterite at places, with a gradational contact between basalt and laterite. The Bhimalimestones are described as grey to buff coloured, banded, thin-bedded and laminated, generally horizontal with local warping. The contact between Bhimalimestones and Deccan Traps is marked by the presence of clayey red bole horizons of 10–30 cm thickness.

Geochemical mapping carried out by Pawar and Nirmalkumar (2023) in toposheets 56G/01 and 56G/05 reported anomalous concentrations of Vanadium (239 -1183 ppm), Cobalt (1-128 ppm) and Scandium (25 - 56 ppm) from seven GCM samples collected from laterite zones, particularly in and around SindolTanda village (toposheet 56G/05).

Subsequently, Deepu T.R. et al. (2025) carried out a Critical Mineral Assessment Programme over an area of 25 sq. km on 1: 25,000 scale. The study reported Fe_2O_3values ranging from 14.16 to 59.88% (average 38.38%), Al_2O_3 from 10.22 to 26.90% (average 18.51%) and TiO_2 from 0.97 to 5.78% (average 2.03%), along with notable enrichment of Vanadium (89-4280 ppm; average 897.81 ppm) and Scandium (4-104 ppm; average 42.90 ppm) from bedrock samples. Two boreholes (KBST-1: 21.5 m and KBST-3: 35.1 m) intersected well-developed lateritic profiles comprising duricrust, ferruginous laterite and saprolite over basalt. KBST-1 recorded maximum V (1035 ppm) and Sc (77 ppm) within the upper 6 m, while KBST-3 showed higher concentrations of V (2209 ppm over 1.25 m), Sc (average 157.5 ppm) and ΣREE (1138 ppm over 4.2 m) within the ferruginous saprolite zone.

3. Block description

The following coordinates are proposed for systematic execution of the G-4 stage exploration programme in the Malik Mirzapur block:

Table-2. Boundary coordinates of the proposed block

Corner points	Latitude	Longitude
A	17°48'21.91"N	77°24'4.39"E
B	17°54'58.55"N	77°21'33.86"E
C	17°56'7.56"N	77°25'34.78"E
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Field Evidence and In-situ Geochemical Analysis (Mallik Mirzapur Block)

The in-situ geochemical data and field observations (Fig.1 & 2) from the Mallik–Mirzapur block indicate the development of a mature lateritic profile formed under intense tropical weathering conditions. The relatively low silica content (5-18% SiO_2), coupled with high concentrations of Fe_2O_3 (21-63%) and moderate Al_2O_3 (16-33%), reflects advanced lateritization characterized by strong desilication and residual enrichment of iron and aluminium. Titanium dioxide (TiO_2) values ranging from 1% to 5% show relatively limited variation, indicating its immobile nature during weathering and its residual concentration within the lateritic profile. Distinct lithological variations such as laterite, Al-laterite, Fe-laterite, and ferruginous soils demonstrate clear

vertical and lateral geochemical zonation within the profile. The enrichment of Fe is accompanied by elevated vanadium concentrations, suggesting its association with iron oxides, while aluminium-rich zones show a positive correlation with gallium. Notably, nickel values reaching up to 545 ppm in lateritic and soil horizons indicate secondary enrichment processes and suggest incipient nickel lateritization. Chromium shows localized high concentrations, possibly controlled by resistant primary minerals or residual accumulation. These geochemical characteristics collectively point to multi-stage weathering involving leaching, mobilization, and reprecipitation of elements.

Given the significant enrichment of Fe, Al, and associated trace metals, along with the stable presence of TiO_2, the area demonstrates promising mineralization potential. Therefore, detailed exploration at the G4 level is strongly justified to establish the thickness, continuity, and grade variation of the lateritic horizons. Systematic drilling, grid-based sampling, and laboratory validation are essential to delineate ore zones, understand subsurface controls, and evaluate economic feasibility.

Table-3. Handheld XRF results of the Laterite samples

S.No	Latitude	Longitude	Lithology	Si_2O_3	Al_2O_3	Fe_2O_3	TiO2	V	Cr	Ni	Ga
				%				PPM			
1	17°51'36.55"	77°27'17.60"	Laterite	17	30	31	3	1823	280	29	32
2	17°50'49.27"	77°27'12.83"	Laterite	11	23	49	2	3135	279	37	24
3	17°50'04.10"	77°27'18.07"	Laterite	18	33	21	2	913	NA	186	NA
4	17°50'05.37"	77°26'37.14"	Laterite	12	23	48	3	2134	280	32	35
5	17°48'45.61"	77°25'25.35"	Laterite	11	23	50	3	985	336	81	41
6	17°49'12.19"	77°24'21.61"	AL-Laterite	15	23	41	2	1249	1806	168	44
7	17°49'52.24"	77°24'07.56"	Laterite	18	32	25	3	922	601	136	77
8	17°51'26.09"	77°25'03.60"	AL-Laterite	5	22	63	2	1139	933	NA	NA
9	17°52'01.77"	77°24'28.98"	Laterite	13	28	37	2	1161	367	502	45
10	17°53'03.88"	77°22'43.91"	Reddish Soil	16	16	38	3	736	492	545	84
11	17°54'12.14"	77°22'32.58"	AL-Laterite	15	27	35	2	860	398	190	41
12	17°54'10.50"	77°24'44.49"	Fe-rich soil	10	16	54	3	1007	413	454	15
13	17°53'44.32"	77°24'48.21"	Fe-Laterite	16	23	38	1	695	502	266	44
14	17°53'35.11"	77°23'59.03"	Laterite	14	26	35	5	1113	244	310	88
15	17°52'56.55"	77°25'36.51"	Laterite	10	23	53	1	1788	326	35	20

Figure 1. Field Photographs of Laterite in the Mallik Mirzapur Block

Figure 2. Field Photographs of Aluminium laterite developed in SW of Madaknalli area.

4. Planned Methodology

The proposed G4 (Reconnaissance) level exploration will be carried out with the objective of assessing the spatial distribution and preliminary potential of critical mineral mineralization within laterite profiles of the proposed area. The methodology will involve systematic geological, geochemical and limited subsurface investigations, as outlined below.

Geological Mapping

Systematic geological mapping on 1:12,500 scale will be undertaken to delineate lithological units, laterite extent, geomorphic controls and structural features. Particular emphasis will be given to identifying flow contacts, vesicular and zeolitic zones, red bole and intertrappean horizons, and variations in laterite profiles including duricrust, ferruginous laterite and saprolite.

Geochemical Sampling

Reconnaissance-level geochemical sampling will be carried out from laterite, ferruginous zones and saprolite horizons on a systematic grid pattern. Samples will be collected and analyzed for critical elements such as V, Co, Sc, REE and associated major oxides (Fe_2O_3, Al_2O_3, TiO_2). Quality control measures including field duplicates and standards will be followed.

Subsurface Investigation

Limited subsurface exploration in the form of shallow pitting/trenching and selected scout boreholes will be undertaken to understand vertical variation, thickness of laterite horizons and bedrock characteristics. Lithological logging and systematic sampling of subsurface materials will be carried out.

Data Integration and Interpretation

All geological and geochemical data will be integrated using GIS platforms to identify anomalous zones and assess their spatial continuity. The results will be utilized to prioritize target areas for subsequent G3-level detailed exploration. All geological, geochemical, and mineralogical data will be integrated to delineate favourable zones and assess the G-4 category (UNFC code 334) potential of aluminous laterite-bauxite and associated V-Ti-Ga mineralisation, providing a scientific basis for recommending G-3 stage detailed exploration.

5. Nature Quantum and Target

The following work components are proposed for the reconnaissance (G- 4) stage exploration programme in the Malik Mirzapur block:

Table-4. Quantum of proposed exploration activities

S. No	Activities	Unit	Proposed Target
1	Geological mapping and Survey work (1: 12,500 Scale)	Sq. Km	100
2	Pitting	Cu m	100
3	**Drilling** (5 bore holes, 40 m depth each)	m	200
	a) Core logging	m	200
4	**Sampling**		
	a) Bed Rock Samples	Nos.	100
	b) PTS	Nos.	50
	c) Drill core samples (Core samples will be collected at 1m interval)	Nos.	200
5	**Chemical analysis**		505
6	**Laboratory studies**		
	a) Thin section studies	Nos.	10
	b) Polished section studies	Nos.	10
	c) SEM	Nos.	02
7	**Report Preparation**	Nos.	01
8	**Preparation of exploration proposal**	Nos.	01

6. Manpower deployment

The following manpower is proposed for systematic execution of the G-4 stage exploration programme in the Malik Mirzapur block:

Table-5. Details of manpower deployment

S. No	Category	Number	Role / Responsibility
1	Senior Geologists	2	Overall supervision, planning and execution of geological mapping, structural studies, and data integration
	Field Labour	4	Collection, labelling, preparation, and dispatch of bedrock, trench and pit
3	Sampler	1	Collection, labelling, preparation, and dispatch of bedrock, trench, pit, and core samples.
4	Supporting Labour for core Sampling	2	Assist sampler in sample collection, handling, and processing.
5	Surveyor	1	DGPS Survey for BH fixation & RL determination

7. Time Schedule for Reconnaissance Survey (G-4 stage)

The proposed G-4 stage exploration programme in the Malik Mirzapur block is planned to be completed within a period of eight (8) months. The work schedule has been designed to ensure systematic progression from surface investigations to limited sub-surface evaluation and data integration.

Table-6. Exploration time schedule

Scheduled time for Reconnaissance Survey (G4) for Aluminous Laterites with associated Critical Minerals, Malik Mirzapur Area, Bidar District, Karnataka													
S. No	**Activity**	**Unit**	**Months**										
			1	2	3	**Review-1**	4	5	6	**Review-2**	7	8	
1	Camp Establishment	Days											
2	Geological mapping and Survey	Days											
3	Geologist Party field Days	Days											
4	Sampling (Pitting & Trenching)	Days											
5	Drilling	Days											
6	Core logging	Days											
7	Camp winding	Days											
8	Laboratory studies	Days											
9	Report preparation and submission	Days											

8. Break-up of expenditure

Table-7. Cost estimation for Exploration activities

Reconnaissance Survey (G4) for Aluminous Laterites with associated Critical Minerals, Malik Mirzapur Area, Bidar District, Karnataka. Area: 100 Sq. Km. Scout Bore Holes: Total drilling Meterage: 200 m; No. of BH: 05 (40m depth each); Schedule timeline: 8 months. Review after: 3 and 6 months		
S. No	**Item of Work ***	**Estimated Cost Total Amount (Rs)**
A	Geological Mapping Other Geological Work	37,16,382
B	Survey work	1,20,000
C	Trenching/Pitting	4,12,500
D	Drilling (after review)	16,73,500
E	Chemical Analysis	25,05,000
F	Laboratory Studies	53,600
G	Geological Report Preparation	2,50,000
H	Preparation of Exploration Proposal	1,69,620
I	Peer review charges	30,000
J	**Total Estimated Cost without GST**	**89,30,602**
K	Provision for GST (18% of J)	16,07,508
L	**Total Estimated Cost with GST**	**1,05,38,110**
	Say Rs. In Lakhs	**105.38**

9. Detail Break-up of expenditure

Table-8. Detailed break-up of expenditure

Reconnaissance Survey (G4) for Aluminous Laterites with associated Critical Minerals, Malik Mirzapur Area, Bidar District, Karnataka. Area: 100 Sq.Km. Scout Bore Holes: Total drilling Meterage: 200 m; No. of BH: 05 (40m depth each); Schedule timeline: 8 months. Review after: 3 and 6 months							
S. No.	Item of Work *	Unit *	Rates as per NMET SoC 2025		Estimated Cost of the Proposal		
			SoC-Item No.	Rates as per SoC (a)	Qty. (b)	Total Amount (Rs) (a*b)	Remarks
A	**Geological Mapping Other Geological Work & Surveying**						
	a. Geological mapping (1:12,500 scale)	Sq.km	1.1	18,300	100	18,30,000	
	b. Charges for Geologist per day (Field) for geological mapping & trenching work, drilling work	day	1.2.1a	14,500	60	8,70,000	For core logging, Pitting, Trenching and sampling
	c. Labours for field party (4 Nos)	day	5.8	556	120	66,720	
	d. Charges for Geologist per day (HQ)	day	1.2.1a	10,500	30	3,15,000	
	e. Charges for one Sampler per day (1 Party)	one sampler per day	1.2.1b	7,850	63	4,94,550	
	f. Labours Charges; Bedrock, Core sampling and preparation of sample	day	5.8	556	252	1,40,112	
	Sub Total- A					**37,16,382**	
B	Survey work						
	a. Charges of Surveyor (1 party) for Geophysical survey layout work & Block boundary demarcation	one surveyor per day	1.3.1	10,500	0	0	
	b. DGPS Survey for BH fixation & RL determination	Per Point of observation	1.3.2	24000	5	1,20,000	
	c. Labours Charges for survey work	day	5.8	605	0	0	
	Sub-Total B					**1,20,000**	
C	Trenching/Pitting						
	a) Excavation of Pit with back filling	per cu.m	2.1.1	4,125	100	4,12,500	50 pits
	Sub-Total C					**4,12,500**	
D	DRILLING (In-house)						
	a. Core drilling: 5 borehole points (each 40 m deep) 5*40= 200m	m	2.2.1.1c	5,500	200	11,00,000	
	b. Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7	2,000	5	10,000	
	c. Borehole Plugging by cement	per borehole	2.2.8	10,000	5	50,000	

	d. Miscellaneous Charges (Transportation, Accommodation, Camp setting, Camp Winding and drill core preservation	Lumpsum	2.2.9	25% of the Drilling cost		2,75,000	
	Drill core preservation	m	5.3	1590	150	2,38,500	
	Sub Total D					**16,73,500**	
E	LABORATORY STUDIES						
1	Chemical Analysis						
A	Major oxides (WD XRF)- (oxides+ traces -24 elements)						
	a. Bedrock	Per Sample	4.1.17a	4,200	100	4,20,000	
	b. Drill Core samples	Per Sample	4.1.17a	4,200	200	8,40,000	
	c. Pit samples	Per Sample	4.1.17a	4,200	50	2,10,000	
	10% External Check Samples	Per Sample	4.1.17a	4,200	35	1,47,000	
	Analysis of one rock/ soil sample for quantitative analysis of 14 REE elements + 9 trace element (U, Ta, Ge, Be, Hf, Sn, As, Rb, Th) by ICP-MS (sequential technique) including Ga and Sc	Per Sample	4.1.15	7,400	60	4,44,000	20 BRS + 30 Core Samples + 10 Pit samples
	10% External Check Samples	Per Sample	4.1.15	7,400	60	4,44,000	
						25,05,000	
2	Physical & Petrological Studies						
	a. Preparation of polished thin section	Per sample	4.3.2	800	10	8,000	
	b. Study of thin polished section	Per sample	4.3.4	2,800	10	28,000	
	c. SEM Studies	Per day	4.4.1a	8,800	2	17,600	
						53,600	
	Sub Total E					**25,58,600**	
F	**Total A to E**					**84,80,982**	
G	Geological Report Preparation	5 Hard copies with a soft copy	5.2	5.2		2,50,000	
H	Peer review Charges	As per EC decision				30000	
I	Preparation of Exploration Proposal (5 Hard copies with a soft copy)	5 Hard copies with a soft copy	5.1	2% of the Cost or Rs. 5.0 Lakhs whichever is less		1,69,620	
J	**Total Estimated Cost without GST**					**89,30,602**	
K	Provision for GST (18% of J)					16,07,508	
L	**Total Estimated Cost with GST**					**1,05,38,110**	
	Say Rs. In Lakhs (INR)					**105.38**	

Note:	
1	**Strict adherence to the Ministry of Finance's and GFR guidelines is mandatory. Every transaction must adhere to GFR rule 21.**
2	**In case of delay/non- performance, the appropriate action will be taken by competent authority against delinquent agency as per prevailing govt. of India rules/guidelines on procurement.**
3	**If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMEDT SoC and Item no. 6 of NMEDT SoC. In**
4	**Necessary efforts should be made to minimize any adverse impact on the environment during exploration activities.**
5	**Any item of work not mentioned above shall be added as per SoC.**
6	**All the Geological Reports and data are to be uploaded on NGDR as per MERT template by the agency.**

References

Deepu, T.R et.al (2025). Critical Mineral Assessment Programme in laterite–basalt terrain of Deccan Plateau, Karnataka, Geological Survey of India, Unpublished Progress Report, GSIJones, M.T. and Vasyukova, O.V. (2018). Critical metals in lateritic profiles: Controls on distribution and enrichment. Ore Geology Reviews, 95, pp. 849–865.

Pawar, S.S. and Nirmalkumar, (2023). Geochemical mapping in parts of toposheets 56G/01 and 56G/05, Karnataka, Geological Survey of India, Unpublished Report, GSI, Hyderabad.

Sinha, R.K et.al (1980). Geological mapping in parts of Gulbarga District, Karnataka (Toposheets 56F/4, 56G/5 and 56G/6), Geological Survey of India, Unpublished Report.

Plates

Plate -1: Location map of the proposed block (Karnataka state)

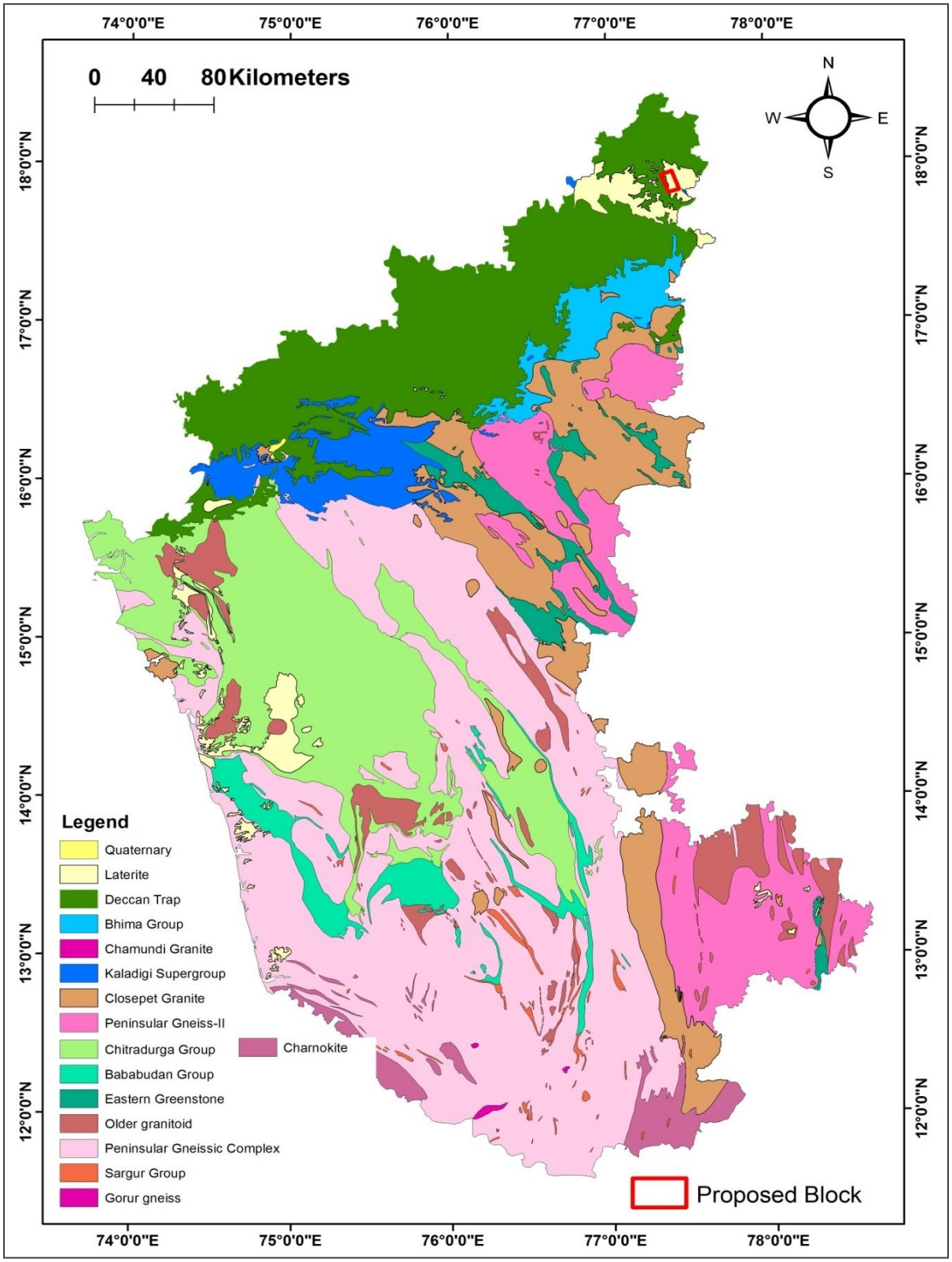

Plate-2: Geological map of toposheet no.56G/05 (1:50,000 scale) (Source. GSI, NGDR)

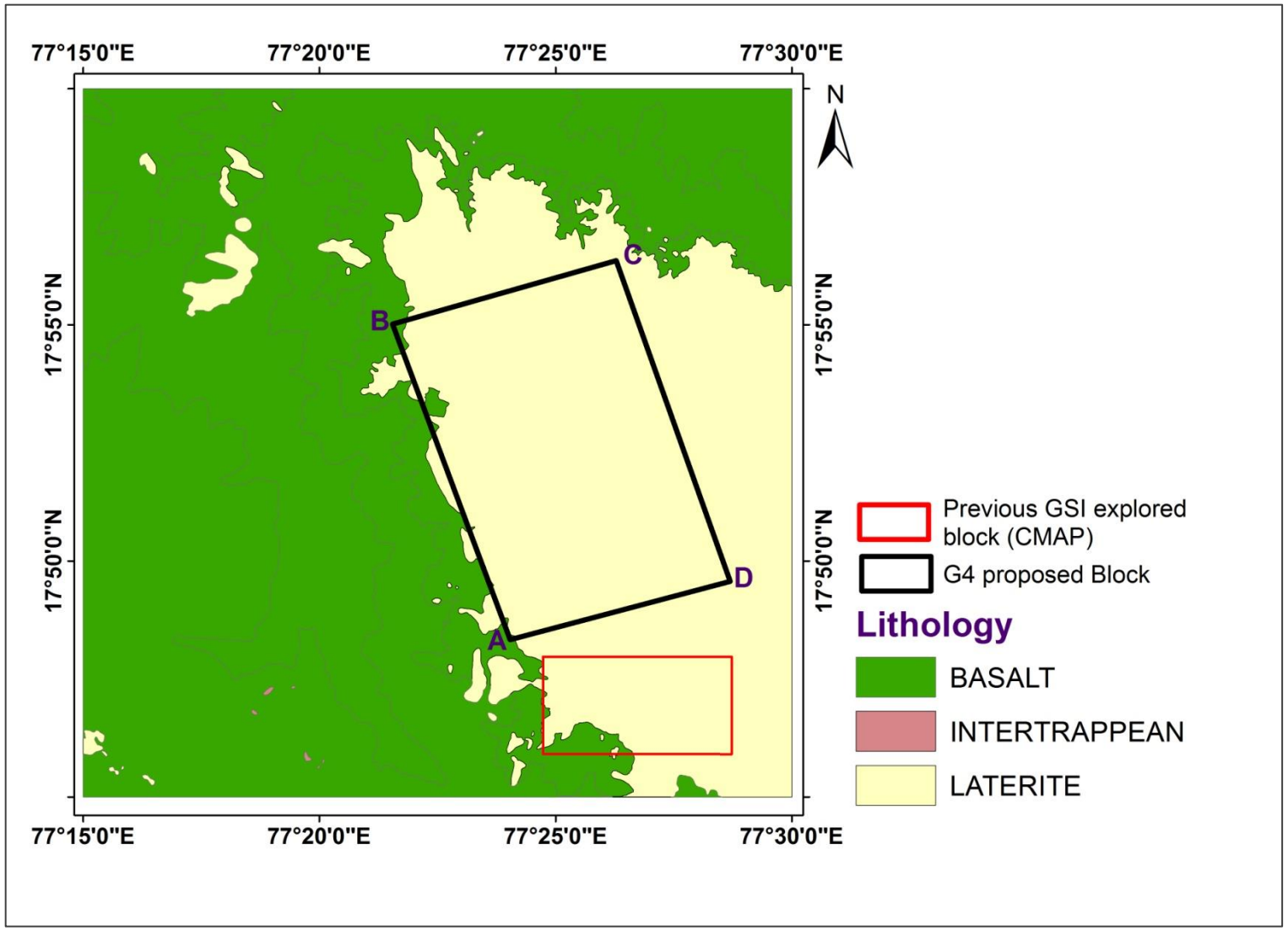

Plate-3: Survey of India toposheet no.56G/05 with proposed block and vanadium values of NGCM (Source. GSI, NGDR)

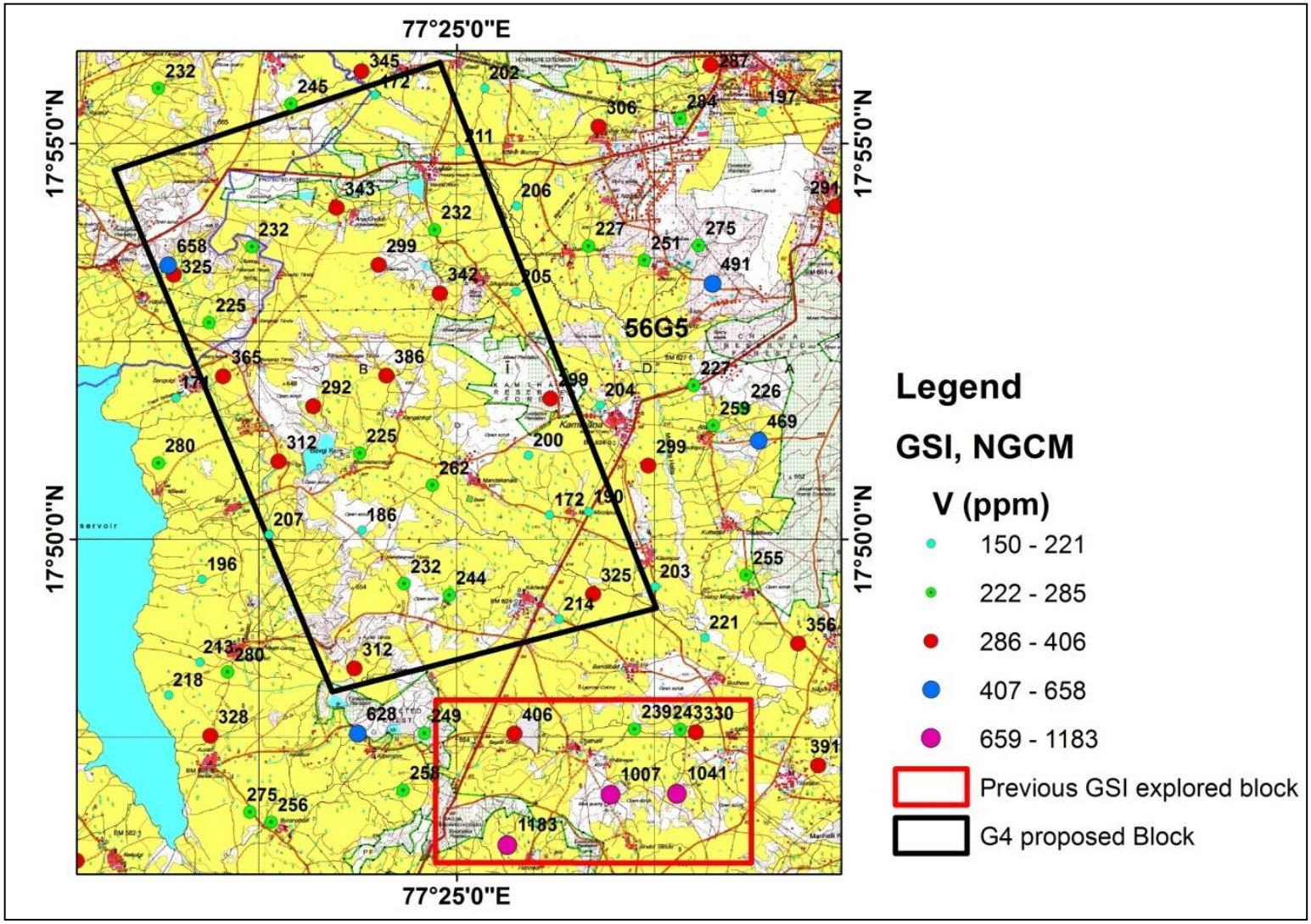

Plate-4: Scandium distribution map of Scandium (Source. GSI, NGDR)

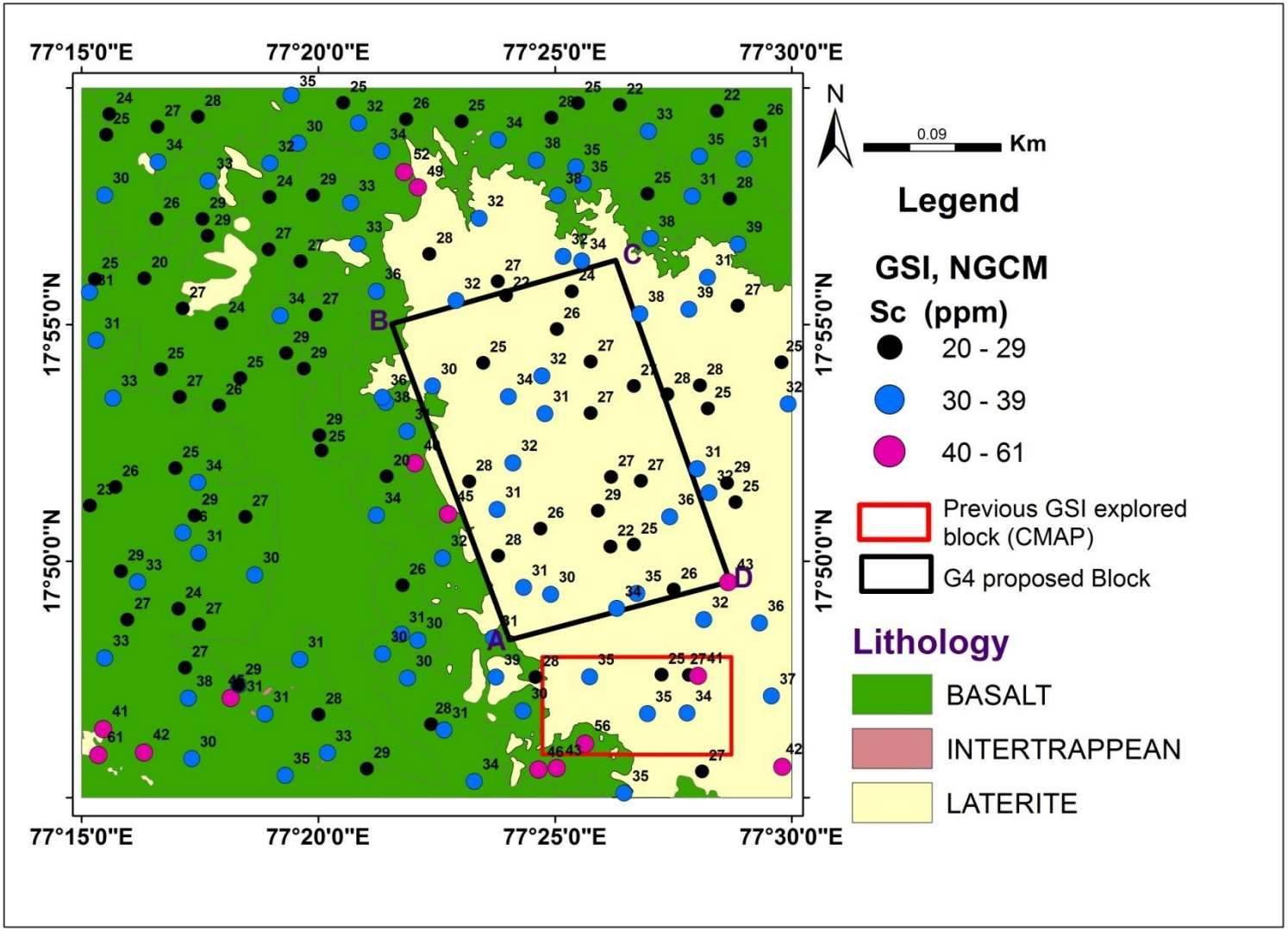

Plate-5: Cobalt distribution map of Cobalt (Source. GSI, NGDR)

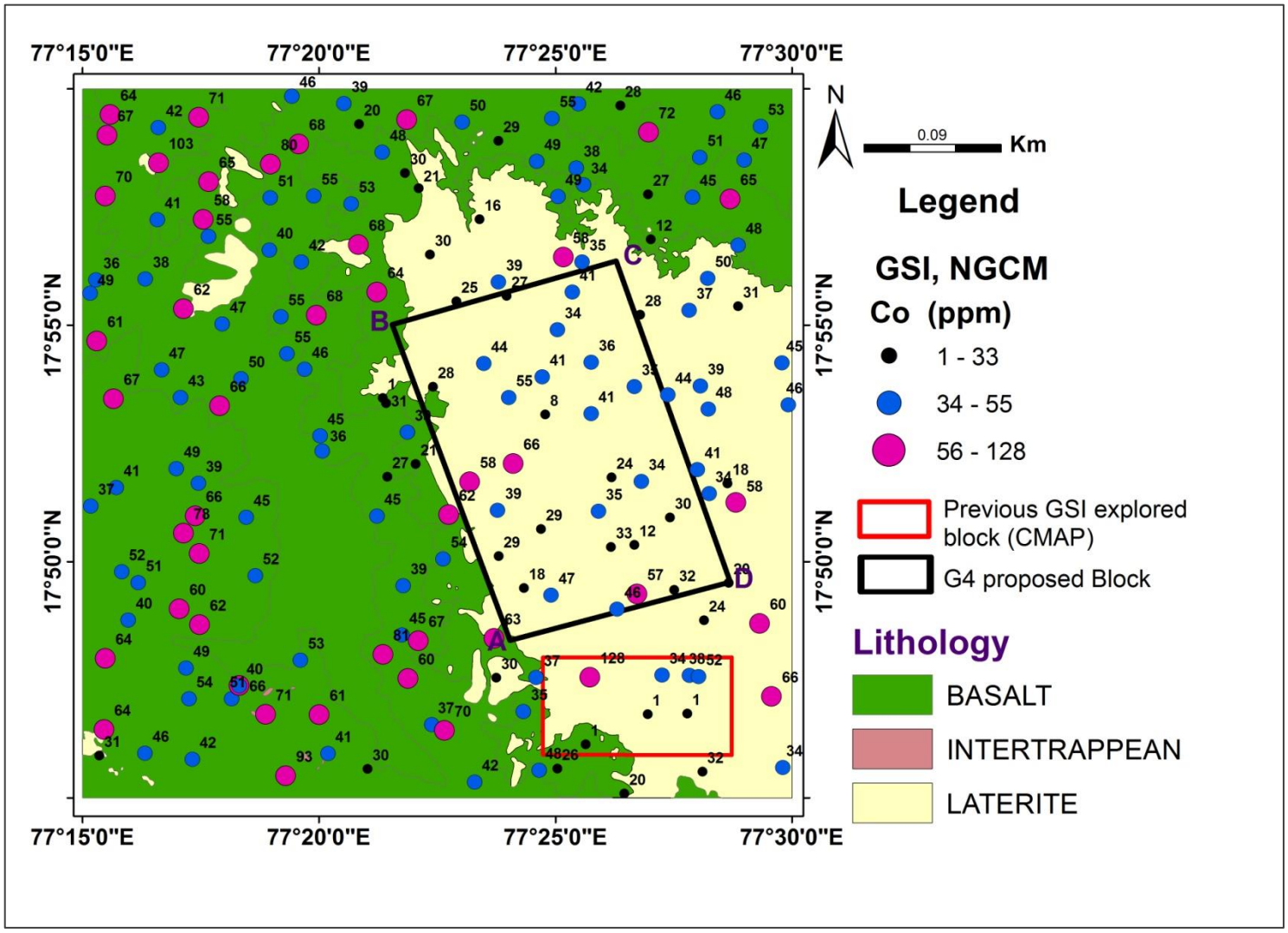

Plate-6: Proposed block (Red colour) and GSI CMAP (Yellow Colour) blocks on Google earth image

Plate-7: Tentative proposed borehole location map of proposed block

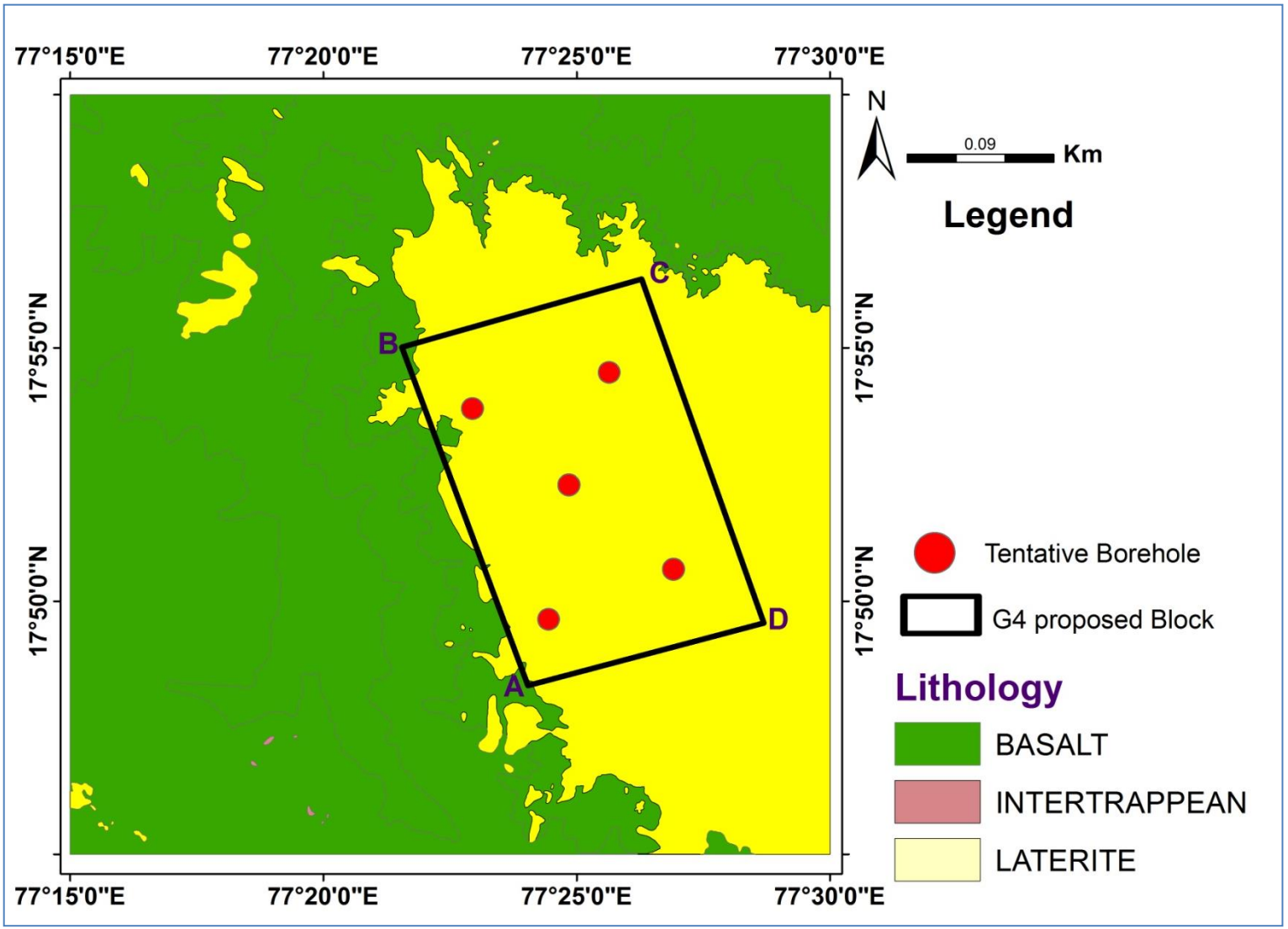

Plate-8: Laterite sample Locations