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**Submission of proposal for Reconnaissance
Survey for Graphite, Vanadium, Barium and
associated Minerals in Chamdewal-Madlak
Area, Champawat District Uttarakhand
(UNFC Stage- G4) under NMEDT**

Commodity:

Graphite, Vanadium, Barium and associated Minerals

By:

Ocean Drilling and Exploration Private Limited

Place: Jaipur

Date: 8-July-2026

SUMMARY OF THE PROPOSED AREA FOR G4 STAGE EXPLORATION

Sl. No	Features	Details
I	Block ID	Chamdewal-Madlak
II	Exploration Agency	Ocean Drilling & Exploration Pvt Ltd.
III	Previous Exploration Agency	GSI
IV	Previous stage (Geological Report)	G-4
V	Commodity	Graphite, Vanadium, Barium and other associated minerals
VI	Mineral Belt	
VII	Completion Period with entire schedule to complete the project	10 months
VIII	Objectives	➤ Phase-I a) Large Scale mapping of the proposed area (1:12500 scale): proposed area of the area is 51.00 sq.km. b) Systematic collection of BRS/soil/trench/Channel samples. ➤ Phase-II a) Scout drilling to delineate the continuity of the mineralized zone vertically and horizontally. b) Analysis of the collected sample and accordingly delineating the potential Zone/area for further stage of exploration. c) Estimation of resource if any, as per the guidelines of NMEDT. d) Final Report preparation and submission to NMEDT.
IX	Whether the work will be carried out by the proposed agency or through outsourcing and Details thereof.	Most of the work will be carried out by the proposed agency; some specialised work like DGPS/Total station suvey,chemical analysis etc will be outsourced.
X	Components to be outsourced and name of the outsource agency	
	Name / Number of Geoscientists	2 nos. of Geoscientist
	Expected Field days (Geology, Geophysics, Surveyor)	Geologist party days on field: 90Days Geologist party days in HQ: 30 Days
1.	Location	

	Latitude & Longitude	Reconnaissance survey for Graphite, Vanadium, Barium And associated mineral in Chamdewal-Madlak Area, Champawat District of Uttarakhand (G4) Proposed area falls in the toposheet No. 62C/3 and 62C/7.	
		A	29°27'23.67"N, 80°13'19.20"E
		B	29°26'5.92"N, 80°14'23.33"E
		C	29°24'28.89"N, 80°14'11.56"E
		D	29°23'28.23"N, 80°15'46.65"E
		E	29°22'2.36"N, 80°15'45.05"E
		F	29°22'0.12"N, 80°13'33.31"E
		G	29°25'52.77"N, 80° 9'36.82"E
	Villages	Chamdewal, Madlak, Shiling villages	
	Tehsil/ Taluk		
2.	District	Champawat District	
	State	Uttarakhand	
	Area (hectares/ square kilometres)		
	Block Area	51.00 Sq. Km.	
	Forest Area	Data not available	
	Government Land Area	Data not available	
	Private Land Area		
3.	Accessibility		
	Nearest Rail Head	Tanakpur is the nearest railway station, about 100 km from Lohaghat	
	Road	The field area is situated in Champawat district of Uttarakhand state with Champawat and Lohaghat being the important localities near the field area. NH-9 is passing from western side of the area, connecting Champawat and Lohaghat. The area is approachable by metalled roads from Lohaghat. Most of the area is approachable by metalled roads and the forest covered and interior parts can be approached by foot tracks.	
	Nearest Airport	Naini Saini Airport, pithoragadh is the nearest airport from the study area which nearly 70km away.	
4.	Hydrography		
	Local Surface Drainage Pattern (Channels)	The area lies in the Lesser Himalaya and exhibits rugged topography. Lohawati and Kunda Khala drain through the southern part of the area. The Kali River forms the international boundary between the Nepal and India. The maximum and the minimum elevation above the msl are 1500 m in the north-eastern corner and 450 m near the	

		confluence of Sarju river with Kali river, respectively. The general slope of the area is south western with an angle varying from 0° to 70°.
	Rivers/ Streams	Kali river
5.	Climate	The area undergoes through extreme types of climate. The altitude controls the climate. The high altitudes experience snow between December and January, while valleys become very hot during summers. Rains are common throughout the year, but real rainy season starts from the end of June and continues upto October.
	Avg. Annual Rainfall	The average rainfall is about 1700-1800 mm per annum.
	Temperatures (December) (Minimum)	The climate of the area is humid subtropical to temperate, influenced by altitude and the Himalayan monsoon. Summers are mild to warm, with maximum temperatures generally ranging between 25° – 31°C, while winters are cold, the minimum temperature often dropping to around 2° to -4°C. The region receives an average annual rainfall of about 1,700 – 1,800 mm, mostly concentrated during the June to September monsoon. Snowfall may occur during the peak winter months, especially in January.
	Temperatures (June) (Maximum)	-4°C. 31 °C.
6.	Topography	
	Toposheet number	62C/3 and 62C/7
	Morphology of the Area	The study area forms part of Lesser Himalaya and exhibits rugged topography. The elevation in the area ranges from 450 to 1500 m above msl as calculated from DEM data.
7.	Availability of baseline geoscience data	
	Geological Map (1:50K/ 25K)	Available 1:50000 scale map
	Geochemical Map	Available 1:50000 scale map (NGCM)
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Not Available
	Justification for taking Preliminary Exploration under G4	A. Background Information 1. In pursuance of field season program item code: M1AGCS-GCM/NC/NR/SU- UP/2020/29776, FS: 2020-21 of the Geological Survey of India, the

geochemical mapping was carried out on 1: 50,000 scale in toposheet 62C/3 & 62C/7 covering Champawat district and parts of Pithoragarh districts of Uttarakhand as a part of NGCM programme by **Surinder Lal, Senior Geologist & Vidya Somarajan, Senior Geologist**. The objective of the item was to understand the geochemical nature of terrain and to generate systematic baseline geochemical database of Toposheet No. 62C/03 & 62C/07 using multi elemental analysis and to understanding the mineral potential, soil fertility, human and animal health of the study area. Culmination of study will lead to creation of a seamless geochemical map for 62 elements.

The work included the sampling of stream sediment, slope wash, regolith (—Rl-top layer of soil), —Cl horizon of soil, water samples for chemical analysis and rock samples for petrographic studies. Total 193 composite stream sediments / slope wash samples have been collected from 2 km x 2km grid interval, 12 nos. of Regolith and C-horizon soil samples from 5'x5' grid interval and 12 nos. of Water samples from 5'x5' grid interval. 10 duplicate samples, which is 3-5% of the composite samples, have been collected from the study area.

Geologically, the area comprises of diverse rock types. The geological set up is very complex due to the repeated tectonic disturbances caused by different orogenic cycle. The rock succession exposed in the district mainly falls in two groups namely, Ramgarh and Almora Group of rocks apart from the Siwalik Group of Tertiary rocks at the southern side of the district, which is Late Tertiary to Quaternary, exposed all along the foothill belt of the Sub-Himalaya.

The rock types of Ramgarh Group are purple to pale

green quartzite with interbeds of greenish grey phyllite, Metavolcanic rocks, streaky gneiss, chlorite schist with sericitic quartzite and metabasites, schistose quartzite and limestone with calc-phyllites. The Almora Group consists of Salla, Gorakhnath, Gumalikheth Formations along with the Champawat granodiorite.

The rocks of Gumalikheth Formation are phyllitic in nature and based on physical properties, can be further divided into buff phyllite and grey phyllite with carbonaceous bands. The buff coloured phyllite is exposed in the eastern and central parts of the field area. It is fine grained with silky sheen present on the foliation surfaces and devoid of carbonaceous matter. The grey phyllite is the dominant lithology present in the area which is grey coloured, fine grained to occasionally gritty and does not soil hands.

Carbonaceous phyllite in the study area is thinly foliated, soils hand, greasy to feel and exhibit dull lustre on a freshly broken surface. It occurs as bands within grey phyllite indicating changing depositional environment.

The analytical results of composite stream sediment/slope wash samples are summarized below:

- a) The analytical data shows that **V content varies from 43 ppm to 569 ppm**. The elemental distribution of V shows concentration values (272 ppm – 308 ppm) higher than the anomaly value (266 ppm) in grid nos. 96, 98, 109 and 120 of toposheet 62C/03 over the rocks of **Gumalikheth Formation**.
- b) The analytical data shows that **Ba content varies from 272 ppm to 6901 ppm**. The elemental distribution of Ba shows concentration values (2591 ppm – 6901 ppm) higher than the anomaly value (2292 ppm) in grid nos. 28, 30, 96, 98, 107, 109, 110, 111, 120 130 and 150 of toposheet 62C/03), the

anomalous values are seen over the rocks of **Gumalikheth Formation.**

2. A G-4 stage reconnaissance survey was conducted in the **western part of toposheet number 62C/3** by Saurabh Kumar and Saikat Manna over an area of 50 sq. km. Main objective of the project was to assess the potential for vanadium and allied metals mineralization. The study was undertaken in accordance with the Field Season Programme (FSP) 2022–2023 and covered areas represented in Survey of India toposheet numbers 62C/3 and 53O/15.
 - a) Total 50 nos. of bedrock samples, 50 nos. channel samples, 15 nos. pitting and trenching samples, 11 nos. petrochemical samples, 15 nos. petrographic samples, 05 nos. XRD samples and 30 nos. fixed carbon and sulphur samples were collected
 - b) The BRS and channel samples (total 100 nos.) show **Vanadium values range of 33 to 5212 ppm. Barium values range from 164 to 40518 ppm. The Yttrium values range from 23 to 444 ppm. The Molybdenum values range from 0.85 to 288 ppm.**
 - c) The BRS and channel samples (total 30 nos.) Shows **Fixed Carbon** values ranges from **1.21% to 7.06%.**

The encouraging values of V, Graphite, Ba, Y and Mo in the area indicate a promising potential for **Vanadium, Graphite and allied metals**. The area needs to be further explored both in terms of further reconnaissance work in the strike continuity of the existing carbonaceous phyllite bands as well as G-4 stage investigation for resource estimation.

B: Justification:

1. A G-4 stage reconnaissance survey was conducted in the **western part of toposheet number 62C/3** by

Saurabh Kumar and Saikat Manna over an area of 50 sq. km.

The BRS and channel samples (total 100 nos.) show **Vanadium values range of 33 to 5212 ppm (0.52% V). Barium values range from 164 to 40518 ppm. The Yttrium values range from 23 to 444 ppm. The Molybdenum values range from 0.85 to 288 ppm.**

2. During the year 2020-21, **NGCM survey** has been carried out by the GSI in the proposed area. The survey involved the systematic collection and analysis of various sample types, including stream sediment, slope wash, regolith (—Rll-top layer of soil), —Cll horizon of soil, water samples. Chemical analysis of these samples revealed anomalously high values of V & Ba.

Some of the samples with anomalous value are as follows:

62C03/096/S/20: V-272 ppm, Ba-3432 ppm

62C03/107/S/20: V-197 ppm, Ba-2591 ppm

62C03/108/S/20: V-170 ppm, Ba-1906 ppm

62C03/120/S/20: V-308 ppm, Ba-6901 ppm

62C03/130/S/20: V-195 ppm, Ba-2882 ppm

62C03/131/S/20: V-159 ppm

Based on the reporting and recommendations of the NGCM report of Geological Survey of India (GSI) and the encouraging results for Vanadium (V) and Barium (Ba) in the study area, a **G-4 stage** exploration is proposed for Vanadium, Graphite, and Barium in the **Chamdewal-Madlak Area**, Champawat district, Uttarakhand. The objective of the proposed G-4 stage exploration is to investigate the continuity of mineralization and delineate potential zones of the reported elements.

**DETAIL PROJECT REPORT FOR THE RECONNAISSANCE SURVEY FOR
GRAPHITE, VANADIUM, BARIUM AND ASSOCIATED MINERAL IN
CHAMDEWAL - MADLAK AREA, CHAMPAWAT DISTRICT OF UTTARAKHAND
(G-4 STAGE).**

1. AREA SUMMARY

1.1 Physiography

The proposed **Chamdewal - Madlak** is part of the Survey of India toposheet No. 62C/03 & 62C/07, Champawat district, Uttarakhand. Total area of the proposed area is 51.0 sq. km. The study area forms part of Lesser Himalaya and exhibits rugged topography. The elevation in the area ranges from 450 to 1500 m above msl as calculated from DEM. The area lies in the Lesser Himalaya and exhibits rugged topography. Lohawati and Kunda Khala drain through the southern part of the area. The Kali River forms the international boundary between the Nepal and India. The maximum and the minimum elevation above the msl are 1500 m in the north-eastern corner and 450 m near the confluence of Sarju River with Kali River, respectively. The general slope of the area is south western with an angle varying from 0° to 70°. The climate in the area is subtropical to temperate. Altitude factor plays a significant role in the variation in climatic condition. The area experiences mild summer and quite severe winter with mild foggy conditions prevailing in valley portions, especially near the river. Summer in the area begins from March and is extended till Mid-June. Over the course of the year, the temperature typically ranges between 25° – 31°C, while winters are cold, the minimum temperature often drops to around 2° – 4°C. The average rainfall of about 1,700 – 1,800 mm per annum indicates a moderate amount of precipitation.

1.2 Background Geology (Regional Geology, Geology of the Area)

1.2.1 Regional Geology: The Himalayan rock sequence is subdivided into four major morpho-tectonic units, from south to north, the Sub-Himalaya, the Lesser Himalaya (Inner and Outer), the Greater Himalaya and the Tethyan Himalaya. The field area lies in the Outer Lesser Himalayan region located within the Almora Klippe. Geologically, on a regional scale, the area exposes rocks of Ramgarh, Almora and Garhwal Groups and Quaternary sediments. The rocks of Almora Group of undifferentiated Proterozoic age are delineated from rocks of Ramgarh Group along South Almora Thrust (SAT) in the south and from rocks of Garhwal Group along North Almora Thrust (NAT) in the north. It is classified into Gorakhnath, Gumalikheth and Chaura formations.

Regional stratigraphy of the area is depicted below:

Age	Group		Lithology
Holocene	Newer Alluvium		Fine sand, silt, gravel, cobble, and occasional boulders embedded in unoxidised arenaceous matrix
Undifferentiated Pleistocene	Older Alluvium	Kapkot Alluvium	Cobble, pebble, gravel and occasional boulder embedded in yellow brown oxidised sandy matrix
Meso-Proterozoic	Garhwal	Pithoragarh	Violet to pink dolomite at places highly siliceous, dolomitic limestone, limestone and phyllite
		Rautgara	Fine to medium grained thinly bedded purple quartzite inter-bedded with slate, phyllite, chlorite schist and metabasite
Undifferentiated Proterozoic		Champawat Granite	Fine to medium leucocratic granite and granodiorite
	Almora	Chaura	Granulite, garnet-mica schist, feldspathic schist
		Gumalikhhet	Carbonaceous phyllite, quartzite and schist
		Gorakhnath	Augen gneiss, Muscovite gneiss inter-bedded with quartzite, Quartzite, garnetiferous mica schist with bands of quartzite
		----- Almora Thrust -----	
	Ramgarh	Swala	Biotite schist, para and ortho gneiss, minor quartzite band and intrusive granite
		Maula	Thickly bedded quartzite, biotite schist and para gneiss
		Bhandoli	Chlorite schist with sericite quartzite band

1.2.2 Geology of the Area: The study area is located within the Gumalikhhet Formation of the Almora Group of rocks. The litho-units exposed in the area are phyllitic rocks belonging to Gumalikhhet Formation of the Almora Group and leucocratic granite representing the Champawat Granite. General strike of the rocks is NW-SE and dipping towards North. Based on physical and mineralogical parameters observed in field, the phyllitic rocks of Gumalikhhet Formation have been categorized into buff phyllite, grey phyllite and carbonaceous phyllite. The colour of the units is genetic in nature and can be seen on freshly broken surfaces. The

basement for Gumalikhet Formation is Ramgarh Group of rocks. The proposed stratigraphy in the field area is depicted below.

Age	Group		Lithology
	Garhwal	Rautgara Formation	
		----- NAT -----	
ca. 500 Ma	Almora	Champawat Granite	Medium grained leucocratic granite
800-580 Ma		Gumalikhet Formation	Carbonaceous phyllite Grey phyllite Buff phyllite
		----- SAT -----	
	Ramgarh	Nathuakhan Formation	

Description of rock types:

1. **Gorakhnath Formation:** The Gorakhnath Formation is again classified into three members i.e.
 - a) Garnetiferous mica schist, chlorite schist, fine grained quartzite with chlorite schist and phyllite
 - b) Muscovite gneiss interbedded with quartzite bands and
 - c) Augen gneiss.
2. **Gumalikhet Formation:** The Gumalikhet Formation has been described by many workers as garnetiferous mica schist and micaceous flaggy quartzite with patches of graphite in the form of layers, nodules. Lenses etc. The mapped area primarily consists of phyllitic rocks. Based on physical parameters observed in the field, the phyllitic rocks of Gumalikhet Formation have been categorized into buff phyllite, grey phyllite and carbonaceous phyllite.
 - a) **Buff Phyllite:** The buff phyllite is encountered in the eastern and central parts of the field area. It is fine grained, cream to buff coloured, predominantly composed of quartz and micaceous minerals. The cleavage developed in phyllite in response to non-uniform stresses, suffered during the deformation event, forms perpendicular to the direction of maximum shortening. The phyllite at places contains high arenaceous material and is locally schistose. The alignment of micaceous minerals in planar fabric in response to the metamorphic conditions induces a glossy or silky sheen present on the foliation surfaces. The unit is devoid of carbonaceous matter and the contact with

grey phyllites is gradational in nature. The rocks in the unit are dominantly NE dipping with dip amounts in range of 23° to 67°. The unit has suffered brittle-ductile deformation during the regional deformation events, evident from the boudinaged quartz veins observed within it.

b) **Grey Phyllite:** The grey phyllite is the dominant lithology present in the area. It is grey coloured, fine grained to silty or sandy and does not soil hands. Patches of metagreywacke with high arenaceous content are observed at many places. The carbonaceous phyllite bands occur within grey phyllite indicating changing depositional environment. At places, it is sulphidized at places with yellow-brown staining, pyrite encrustations, pungent sulphurous smell with sulphur and iron leaching. The pyrite crystals developed on the bedding/foliation planes indicating their syn-depositional nature, which later leached out showing orange-yellow coatings.

The carbonaceous phyllite is black coloured and easily soils hands. Pyrite crystals and sulphur leaching are observed within the carbonaceous bands. The rocks in the unit are dominantly NE dipping with dip amounts in range of 19° to 86°. The carbonaceous bands pinch out laterally as well as vertically.

3. **Champawat Granite:** The Champawat Granite is exposed in the south part of the Area. The Champawat Granite is emplaced within the synclinal core of Almora Group is a fine to medium grained homogeneous well-jointed leucocratic granite and granodiorite body.

1.2.3 Structure and Framework of the Area

Structurally, the rocks have suffered diastrophic episodes. The bedding is generally parallel to sub parallel to the foliation. Rocks of Almora Group are folded into a synform with axis trending NW-SE. Puckers are common in the phyllite. An East - West trending northerly dipping South Almora Thrust (SAT) separate rocks of Almora Group from the Ramgarh Group and southerly dipping high angle North Almora Thrust (NAT) delineates rocks of Almora Group from the Garhwal Group. An intra-formational East -West trending fault within the Member - 'a' of Gorakhnath Formation separate quartzite, chlorite schist and phyllite unit from the overlying garnetiferous mica schist and chlorite schist unit. Besides, a number of folds and faults are also present in the area. Champawat Granite an intrusive body within the Almora Group has developed chloritoid porphyroblast in a very narrow zone within the phyllite.

a) **Primary structures:** The structures formed during the course of sediment deposition are referred to as Primary sedimentary structures. These are generated by four fundamental kinds of processes:

- (1) Mainly deposition (depositional structures),
- (2) Processes that involve an episode of erosion followed by deposition (erosional structures),
- (3) Deposition followed by physical soft-sediment deformation (deformation structures), and
- (4) Biogenically mediated deposition or non-biogenic deposition followed by biogenic modification (biogenic structures).

Bedding planes, flaser bedding and slump structures are encountered within the meta-sedimentary rocks in field area. Multiple phases of deformation suffered during the Himalayan orogeny have either obliterated or overprinted the primary structures.

b) **Secondary structures:** Secondary or diastrophic structures are the most dominant feature in the study area. The multiple phases of deformation suffered by the rocks during the Himalayan orogeny are responsible for the development of various planar structures observed in the area.

- i. **First Generation (F1) Fold:** The F1 folding event has been conventionally accepted as pre-dating the Himalayan collision, and is defined as tight, isoclinal (and nearly recumbent) folds, manifested by the parallel orientation of the bedding (S0) and foliation (S1) planes. These folds are intrafolial in nature and clearly visible in quartz veins that act as markers. The axial plane of the fold is parallel to the regional composite.
- ii. **Second Generation (F2) Fold:** The F2 folding event is the major, most widespread episode of deformation, correlatable with the folding of the Lesser Himalayan domain. The F2 fold modifies the F1 folds into a series of synform and antiform folds. Both S1 and S0 have been deformed to develop reclined F2 folds, which are characterized by a penetrative axial plane (S2) foliation dipping 10-20° due NE and NW. The F2 folding is superimposed over the first generation F1 folds, which has coaxially folded the F1. The S2 axial plane foliations are parallel to S1 and S0 foliations except in the hinge area of fold and form composite regional foliation.
- iii. **Third Generation (F3) Fold:** The third and possibly latest phase of deformation (F3) is represented mostly by locally developed broad, open warp like folds. These folds are asymmetric in nature. The superposition of F2 and F3

folds is reported to develop Type-I (dome-and-basin geometry) and Type-2 (mushroom/crescent geometry), resulting in the development of doubly plunging pattern. The F3 folds recorded in the area are shallow to moderately plunging.

1.3 Mineral Potentiality Based on Geology and Geochemistry

1. A G-4 stage reconnaissance survey was conducted in the western part of toposheet number 62C/3 by Saurabh Kumar and Saikat Manna over an area of 50 sq. km. The BRS and channel samples (total 100 nos.) show Vanadium values range of 33 to 5212 ppm (0.52% V). Barium values range from 164 to 40518 ppm. The Yttrium values range from 23 to 444 ppm. The Molybdenum values range from 0.85 to 288 ppm. Fixed Carbon analysis of samples shows up to 7.06% FC.

2. During the year 2020-21, NGCM survey has been carried out by the GSI in the proposed area. The survey involved the systematic collection and analysis of various sample types, including stream sediment, slope wash, regolith (—Rll-top layer of soil), —Cl horizon of soil, water samples. Chemical analysis of these samples revealed anomalously high values of V & Ba.

Some of the samples with anomalous value are as follows:

62C03/096/S/20: V-272 ppm, Ba-3432 ppm

62C03/107/S/20: V-197 ppm, Ba-2591 ppm

62C03/108/S/20: V-170 ppm, Ba-1906 ppm

62C03/120/S/20: V-308 ppm, Ba-6901 ppm

62C03/130/S/20: V-195 ppm, Ba-2882 ppm

62C03/131/S/20: V-159 ppm

➤ Chemical results of the samples collected while filed visit

- To validate the geochemical potential of the proposed area, agency visited the proposed area and 7 representative BRS samples were collected and analyzed.
- The analytical results reveal significant enrichment of Vanadium (V) and Barium (Ba) in the proposed area, with Vanadium values ranging upto **1848 ppm** and Barium values up to **33,690 ppm**.

S.No	Samples No	Vanadium(V)	V ₂ O ₅ (Vx1.785)	Barium (Ba)
1	BRS-1/UK-1	1848.05 ppm	3298.77 ppm	33690.19 ppm(3.37%)
2	BRS-2/UK-2	1201.94 ppm	2145.46 ppm	25387.20 ppm (2.54%)
3	BRS-3/UK-3	989.93 ppm	1767.03 ppm	3782.62 ppm

4	BRS-4/UK-4	1815.31 ppm	3240.33 ppm	5491.42 ppm
5	BRS-5/UK-5	1234.04 ppm	2202.76 ppm	5856.71 ppm
6	BRS-6/UK-6	1668.11 ppm	2977.58 ppm	5715.09 ppm
7	BRS-7/UK-7	1653.98 ppm	2952.35 ppm	5156.05 ppm

1.4. Scope for Proposed Exploration

The project proposes to undertake a **Reconnaissance Survey (G-4 stage)** over an area of **51.00 sq. km**, which will include **large-scale geological mapping** on a **1:12,500 scale**. As part of the exploration programme, a total of **approximately 300 metres of core drilling** is planned, comprising **three scout boreholes** with an average depth of **100 metres** each.

All boreholes will be **inclined**, with dip angles ranging between **45° and 50°**, depending on the **local terrain conditions** and **geological constraints**, in order to delineate the **continuity of the mineralized zone**.

1.5 Recommendations of previous exploration work

- A G-4 stage reconnaissance survey was conducted in the western part of toposheet number 62C/3 by Saurabh Kumar and Saikat Manna over an area of 50 sq. km. The BRS and channel samples (total 100 nos.) show Vanadium values range of 33 to 5212 ppm (0.52% V). Barium values range from 164 to 40518 ppm. The Yttrium values range from 23 to 444 ppm. The Molybdenum values range from 0.85 to 288 ppm. Fixed Carbon analysis of samples shows up to 7.06%.
- During the year 2020-21, NGCM survey has been carried out by the GSI in the proposed area. The survey involved the systematic collection and analysis of various sample types, including stream sediment, slope wash, regolith (—Rl-top layer of soil), —Cl horizon of soil, water samples. Chemical analysis of these samples revealed anomalously high values of V & Ba. Vanadium values range upto 308 ppm. Barium values range upto 6901 ppm.

The anomalous V and Ba concentrations in NGCM geochemical mapping, particularly over the Gumalikhet Formation of proposed area justify taking up a G4 reconnaissance project in this area.

The justification becomes stronger when supported by results from the nearby G4 stage study (Chaura–Sirmoli–Lohaghat areas), which not only reaffirmed similar anomaly trends in Vanadium, Graphite and Barium but also revealed associated enrichment in multiple strategic and precious elements.

1.6 Objectives of Exploration

➤ Phase-I

a) Large Scale mapping of the proposed area (1:12500 scale): proposed area of the Area **51.00 sq.km.**

b) Systematic collection of BRS/soil/trench/Channel samples.

➤ Phase-II

- a) Total three nos. of scout borehole with total 300m of drilling to delineate the continuity of the mineralized zone.
- b) Analysis of the collected sample and accordingly delineating the potential Zone/area for further stage of exploration.
- c) Estimation of resource as per the guidelines of UNFC and NMEDT.
- d) Final Report preparation and submission to NMEDT.

2.0 PREVIOUS WORK

Previous Exploration details in the proposed area:

- i. A G-4 stage reconnaissance survey was conducted by Saurabh Kumar and Saikat Manna over an area of 50 sq. km. to assess the potential for vanadium and allied metals mineralization. The study was undertaken in accordance with the Field Season Programme (FSP) 2022–2023 and covered areas represented in Survey of India toposheet numbers 62C/3 and 53O/15. Vanadium values range of 33 to 5212 ppm (0.52% V). Barium values range from 164 to 40518 ppm. The Yttrium values range from 23 to 444 ppm. The Molybdenum values range from 0.85 to 288 ppm. Fixed Carbon analysis of samples shows BRS-8 with 7.06% FC and CH-35 with 2.32% FC.
- ii. During the year 2020-21, NGCM survey has been carried out by the GSI in the proposed area. The survey involved the systematic collection and analysis of various sample types, including stream sediment, slope wash, regolith (—Rl-top layer of soil), —Cl horizon of soil, water samples. Chemical analysis of these samples revealed anomalously high values of V & Ba. Vanadium values range upto 308 ppm. Barium values range upto 6901 ppm.

2.0 PREVIOUS WORK

Previous Exploration details in the proposed Area:

- iii. A G-4 stage reconnaissance survey was conducted by Saurabh Kumar and Saikat Manna over an area of 50 sq. km. to assess the potential for vanadium and allied metals mineralization. The study was undertaken in accordance with the Field Season Programme (FSP) 2022–2023 and covered areas represented in Survey of India toposheet numbers 62C/3 and 53O/15. Vanadium values range of 33 to 5212 ppm (0.52% V). Barium values range from 164 to 40518 ppm. The Yttrium values range from 23 to 444 ppm. The Molybdenum values range from 0.85 to 288 ppm. Fixed Carbon analysis of samples shows BRS-8 with 7.06% FC and CH-35 with 2.32% FC.
- iv. During the year 2020-21, NGCM survey has been carried out by the GSI in the proposed area. The survey involved the systematic collection and analysis of various sample types, including stream sediment, slope wash, regolith (—Rl-top layer of soil), —Cl horizon of soil, water samples. Chemical analysis of these samples revealed anomalously high values of V & Ba. Vanadium values range upto 308 ppm. Barium values range upto 6901 ppm.

3.0 AREA DESCRIPTION

The proposed **Chamdewal - Madlak** is part of the Survey of India toposheet No. 62C/03 & 62C/07, Champawat district, Uttarakhand. Total area of the proposed area is 51.0 sq. km.

Localities present in the vicinity include Chamdewal, Madlak, Shiling, etc villages. The coordinates of the proposed Chamdewal Madlak Area corner points are given in table below:

CHAMDEWAL - MADLAK AREA (51.00 SQ.KM)		
CORNER POINTS	TOPOSHEET NO.: 62C/03 & 62C/07	
	LATITUDE	LONGITUDE
A	29°27'23.67"N,	80°13'19.20"E
B	29°26'5.92"N,	80°14'23.33"E
C	29°24'28.89"N,	80°14'11.56"E
D	29°23'28.23"N,	80°15'46.65"E
E	29°22'2.36"N,	80°15'45.05"E
F	29°22'0.12"N,	80°13'33.31"E
G	29°25'52.77"N,	80° 9'36.82"E

4.0 PLANNED METHODOLOGY

4.1 Methodology of exploration: An area of 51.00 sq. km has been proposed as the Chamdewal - Madlak Area in Champawat District, Uttarakhand, for undertaking G-4 stage exploration targeting Vanadium, Graphite, Barium, and allied metal mineralisation. The exploration programme has been designed in line with the objectives of reconnaissance survey (G-4) and will be carried out in compliance with the provisions of the Minerals (Evidence of Mineral Contents) Rules, 2015 and the Minerals (Evidence of Mineral Contents) Amendment Rules, 2021.

The primary objective of the proposal is to delineating the potential Zone/area for further stage of exploration. Accordingly, a systematic scheme of exploration has been formulated to achieve these objectives. The detailed description of the proposed exploration activities is presented in the following sections.

- a) **Geological mapping (1:12500 scale):** Geological mapping will be done on the entire 51.00 sq. km. area on 1: 12,500 scales. Outcrop boundaries marking the lithological variations along with their contact and structural features, if any, will be covered during the mapping.

Total 50 number of BRS/Channel samples will be collected from various litho-units based on the surface evidence of mineralization. A total of 50 cubic metres of trenching will be undertaken to examine the strike continuity in the unexposed part mineralisation identified during the G-4 stage of exploration. From these trenches, about 50 samples, each of 1 metre length, will be systematically collected for chemical analysis to assess the grade and continuity of mineralisation.

- b) **Surveying:** Boreholes location will be fixed by DGPS/Total station. during the drilling programme, the survey party will carry out borehole fixation and determination of the reduced levels and coordinates of the proposed **03 nos.** of scout boreholes.
- c) **Core Drilling:** To determine the nature of mineralization and depth of mineralised zones, a total 03 nos. of scout boreholes with total 300 m of drilling, are proposed after the delineation of potential zones. Average borehole depth is ~100 m.

Drilling of all the boreholes will **be carried out in NQ size** to reach the planned final depth of each borehole.

Furthermore, the number of boreholes may be increased, if required, to validate and establish the lateral continuity in case the mineralisation persists beyond the initially delineated zones.

d) Drill Core Sampling: During the geological logging of drill cores, mineralised zones will be marked on the basis of the visual estimation of mineralization, concentration of ore minerals and lithology. Length of the samples may vary accordingly.

e) Laboratory studies:

i. BRS/Channel samples:

- A total of 50 nos. BRS and 5 nos. check (10%) samples will be analysed for V, Ba, Ga, Mo, U, Cu, Pb, Zn, Y (Total 09 elements) by ICP-MS.
- A total of 65 nos. samples (25 BRS+25 Trench samples+15 Channel Samples) and 7 nos. check (10%) samples will be analysed for fixed carbon by Graphite Proximate Analysis.
- A total of 50 nos. samples and 5 nos. check samples will be analysed for major oxides+ 9 Trace elements by WD_XRF method.

ii. Trench Samples:

- A total of 50 nos. primary samples and 5 nos. check (10%) samples will be analysed for V, Ba, Ga, Mo, U, Cu, Pb, Zn, Y (Total 09 elements) by ICP-MS.

iii. Core Samples:

- A total of 50 nos. primary core samples and 5 nos. check (10%) samples will be analysed for V, Ba, Ga, Mo, U, Cu, Pb, Zn, Y (Total 09 elements) by ICP-MS.

iv. XRD studies: A total of 20 nos. samples shall be subjected to XRD studies for the determination of mineral phase.

v. EPMA studies: A total of 10 hrs. shall be subjected to EPMA studies for determine of the quantitative and qualitative chemical composition of mineral.

vi. Raman Spectrometry: A total of 10 hrs. shall be subjected to raman spectrometry for determination of graphite crystallinity.

f) Petrological Studies: A total of 10 nos. of samples shall be subjected to Petrological Studies.

4.3 Estimation of resources

Estimation of resources will be done according to UNFC norms and the Minerals Evidence & Mineral Contents (MEMC) Rule—2015 at the G-3 level and to meet the NMEDT objectives.

4.4 Report preparation

Submission of reports will be done as per the recommendations of NMEDT in compliance with G4 level as per MEMC 2015 and suggestions for follow-up work to upgrade the project, if deemed necessary.

5. NATURE, QUANTUM AND TARGET

The nature and quantum of work proposed are given in Table:

Reconnaissance survey for Graphite, Vanadium, Barium and associated mineral in Chamdewal - Madlak area, Champawat district of Uttarakhand. (G-4 Stage) Area-51.00.km, Scale- 1:12,500			
Sl. No.	Item of work	Unit	Qty.
1.	Geological mapping(1:12,500)	Sq.km	51.00
2.	a.DGPS Survey of 03 nos. boreholes	Days	5 days
3.	a. Trenching b. Drilling 03 nos. of scout boreholes	Cubic meters meter	50 300
4.	Laboratory studies		
	i. Analysis of one rock/soil sample for quantitative analysis of 14 REE elements+9 Trace element (V, Ba, Ga, Mo, U, Cu, Pb, Zn, Y) by ICPMS	Nos.	150 (50 BRS+50 Trench+50 Core samples)
	ii. Check samples (10%)	Nos.	15
	iii. Graphite Proximate Analysis (BRS+trench+channel samples)	Nos.	65 (25+25+15)
	iv. Check samples (10%)	Nos.	07
	v. Major oxides (WD XRF) -(oxides + traces- 24 elements)	Nos.	50
	vi. Check samples (10%)	Nos.	5
5.	Laboratory studies		
	1. X-ray diffraction studies	Nos.	20
	2. Preperation of polished thin section of Rock	Nos.	10
	3. Complete Petrographic/ore microscopic study/mineragraphic report of rock sample (along with 5 nos. digital photo micrographs)	Nos.	10
6.	EPMA	hrs	10
7.	Raman Spectrometry (graphite Crystallinity)	hrs.	05

6. EXPLORATORY DRILLING

A total four (03) nos. of scout boreholes are proposed to be drilled. Total 300m of drilling with individual borehole of 100m- 120m depth is proposed.

7. MANPOWER DEPLOYMENT

- a) 2 nos. of Geologist: 90 Field days+ 30 HQ days
- b) 1 nos. of Sampler Party: 41 Days and 4 Labours: (41x4)=164 Days

8. TIME SCHEDULE:

Annexure 3B

Time Schedule/Action Plan Reconnaissance survey for Graphite, Vanadium, Barium and associated mineral in Chamdewal - Madlak Area, Champawat district of Uttarakhand.

S N o	Activity	Months /Days	1	2	3		4	5	6		7	8	9	10
1	Camp Setting	Months												
2	Geological Mapping & Sampling	days												
3	Surface Drilling (1 rigs)	m												
4	Core logging and sampling													
5	Survey Party days	days												
6	Geologist Man days (Field)	days												
7	Geologist Man days (HQ)	days												
8	Sampler Man days	days												
9	Laboratory Studies	Nos.												
10	Report Writing with Peer Review	months												
11	Camp Winding	months												

[Handwritten signatures and dates]
 12/06/2024

9. BREAK-UP OF EXPENDITURE:

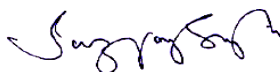
Annexure-3A								
Reconnaissance survey for Graphite, Vanadium, Barium and associated mineral in Chamdewal - Madlak Area, Champawat district of Uttarakhand.								
Area: 51 sq.km, Drilling: 300 m, Scale:12,500 (Schedule timeline: 10 months Review: After 3 & 6 Months)								
[Implementing Agency: M/s Ocean Drilling and Exploration Private Limited]								
S. No.	Item of Work *	Unit *	Rates as per NMET SoC 2025-26		Estimated Cost of the Proposal			Remarks
			SoC-Item No. *	Rates as per SoC * (a)	Qty . (b)	Total Amount (Rs) (a*b)	Hilly terrain of Himalaya region (Total amount X 2)	
A	Geological Mapping & Other Geological Work							
1	Large Scale Mapping (LSM)	per sq. km.	1.1.c	28600	51	1458600	1458600	Himalayan Region Rate
2	a. Charges for Geologist per day (Field)	day	1.2.1a, (b)	14,500	90	13,05,000	26,10,000	
	b. Labours Charges; Base rate	day	5.8	556	180	1,00,080	2,00,160	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher.
	c. Charges for Geologist per day (HQ)	day	1.2.1a	10,500	30	3,15,000	3,15,000	
3	a. Charges for one Sampler per day (1 Party)	one sampler per day	1.2.1b	7,850	41	3,21,850	6,43,700	Hilly area and tough terrain condition
	b. Labours (4 Nos)	day	5.8	556	164	91,184	1,82,368	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective

								State Govt. whichever is higher.
	Sub Total- A					35,91,714	54,09,828	
B	SURVEY WORK (MoU)							
1	DGPS Survey for BH fixation & RL determination	Per Point of observation	1.3.2	24,000	4	96000	192000	3 boreholes
	Sub-Total B					96,000	192000	
C	DRILLING							
1	Excavation of trenches up to 2.0m depth	per cu. m	2.1.1	4125	50	206250	412500	
2	Core Drilling (Hard rock in NQ size) (2nd Phase)	m	2.2.1.1d	10,000	300	3000000	6000000	Tree (03) nos. of scout drilling of average 100m depth
3	Land / Crop Compensation (in case the BH falls in agricultural Land)	per BH	5.6	30,000	3	90,000	1,80,000	As per Actual as certified by local authorities subject to a maximum of Rs. 30000 per borehole
4	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7	2000	3	6,000	12,000	
5	Borehole plugging by cement	Lumpsum per borehole	2.2.8	10000	3	30,000	60,000	
6	Miscellaneous charges (Transportation of Drilling Rig, Accommodation for drill Camp, Camp setting and winding, construction of	Lumpsum	2.2.9(2)	For drilling cost more than Rs. 50 lakhs and less than 1 crore 20% of cost with maximum ceiling of Rs 15 Lakhs		12,00,000	12,00,000	
7								
8								
9								
10								

	Approach road and drill core preservation).							
11	Drill Core Preservation	per m	5.3	1,590	150	2,38,500	2,38,500	
	Sub Total C					47,70,750	81,03,000	
E	LABORATORY STUDIES							
	Chemical Analysis							
1								
a)	Major oxides (WD XRF) -(oxides + traces- 24 elements)	Nos	4.1.17a	4,200	50	2,10,000	2,10,000	
b)	Check samples Internal (10%)	Nos	4.1.17a	4,200	5	21,000	21,000	
2.a)	Analysis of one rock/soil sample for quantitative analysis of 14 REE elements+9 Trace element (V, Ba, Ga, Mo, U, Cu, Pb, Zn, Y) by ICPMS	Nos	4.1.15	7400	150	11,10,000	11,10,000	50 trench samples+ 50 BRS+ 50 core samples
b)	Check samples Internal (10%)	Nos	4.1.15	7400	15	1,11,000	1,11,000	
3.a)	Proximate Analysis of Graphite	Nos	4.1.18	3,614	65	2,34,910	2,34,910	a. 25 nos. from BRS samples b. 15 nos. from channel samples c. 25 nos. from trench samples (composite from each trench)
b)	Check samples Internal (10%)	Nos	4.1.18	3,614	7	25,298	25,298	

c	XRD analysis for identification of minerals (Random)	Nos	4.5.2	4,000	20	80,000	80,000	
5	Physical & Petrological Studies							
a)	Preparation of polished thin section of Rock	Nos	4.3.2	800	10	8,000	8,000	
b)	Complete Petrographic/ore microscopic study/mineragraphic report of rock sample (along with 5 nos. digital photo micrographs)	Nos	4.3.4	2,800	10	28,000	28,000	
e)	Raman Spectrometry (graphite crystallinity)	hrs	4.5.1	2,700	5	13,500	13,500	
g)	EPMA	hrs	4.4.1	10,500	10	1,05,000	1,05,000	
	Sub Total E					19,46,708	19,46,708	
F	Total A to E					1,04,05,172	1,56,51,536	
G	Geological Report Preparation	Nos	5.2	Total cost of the project exceeding Rs. 150 lakh Rs 7.5 Lakh			7,50,000	
H	Peer review Charges	lumpsum	As per EC decision				30,000	
I	Preparation of Exploration Proposal	5 Hard copies	5.1	2% of the Cost or Rs. 5.0 Lakhs whichever is less			3,13,031	EA will be reimbursed after submission of the Hard Copies and the soft copy of

	(5 Hard copies with a soft copy)	with a soft copy						the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal.
J	Total Estimated Cost without GST						1,67,44,567	
K	Provision for GST (18% of J)						30,14,022.01	GST will be reimbursed as per actual and as per notified prescribed rate
L	Total Estimated Cost with GST						1,97,58,589	
M				or Say Rs. In Lakhs			197.59	
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							





5. REFERENCE

1. Kumar Saurabh, Manna Saikat. (2022-23): Reconnaissance survey for Vanadium and allied metals mineralization in Almora Group of Rocks, Chaura, Sirmoli and Lohaghat areas, Champawat District, Uttarakhand (G-4 Stage). Rep., Geological Survey India, FS 2022-23.
2. Surinder Lal and Vidya Somarajan, (2020-21): Geochemical mapping in toposheet no. 62C/3 & 62C/7 covering parts of pithoragarh & almora districts of Uttarakhand. Rep., Geological Survey of India, FS 2020-21.

Plate-I: Geological map of proposed area for Reconnaissance survey for Graphite, Vanadium, Barium and associated mineral in Chamdewal - Madlak area, Champawat district of Uttarakhand

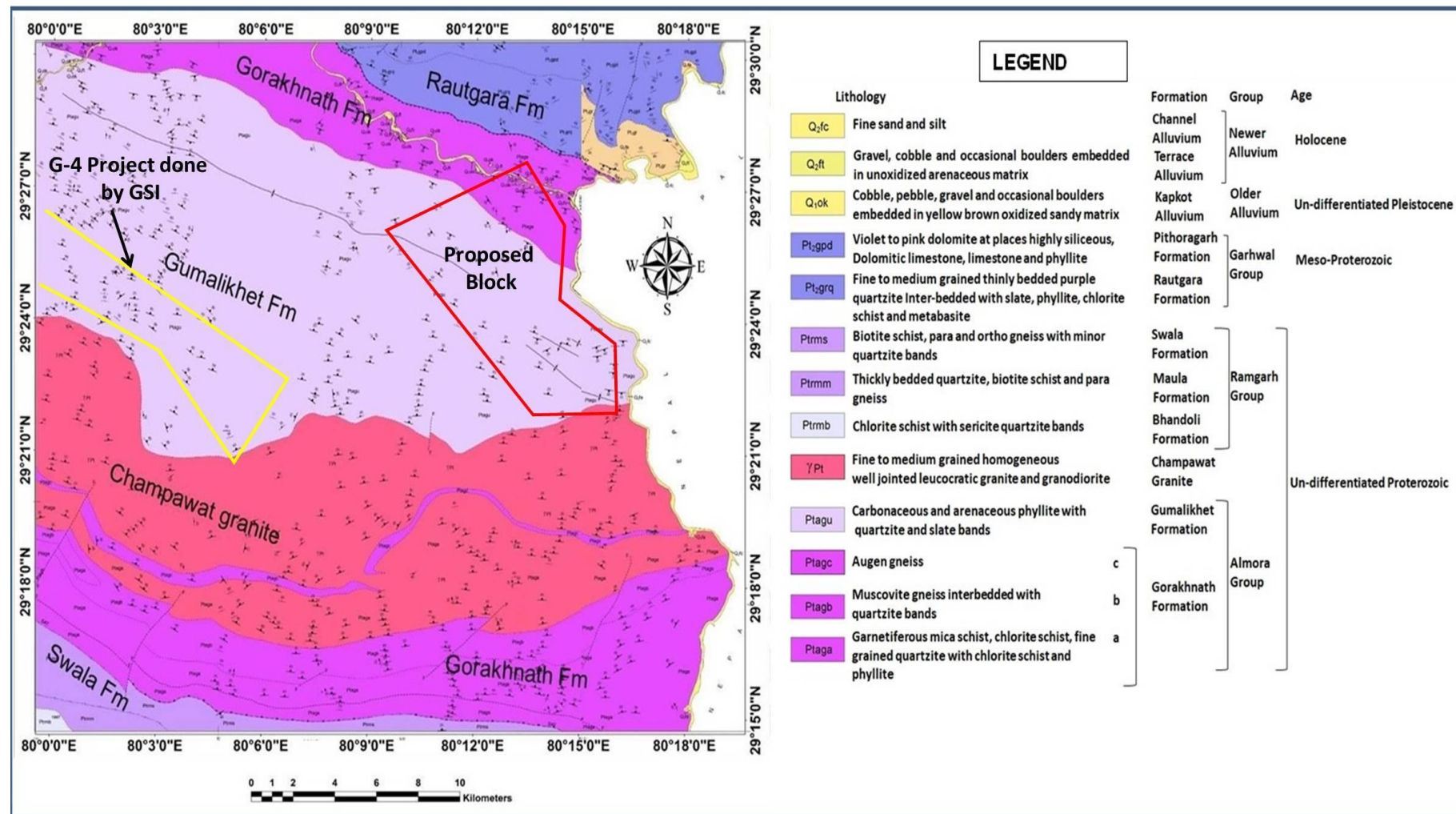


Plate-II:a Google earth location of proposed area for Reconnaissance survey for Graphite, Vanadium, Barium and associated mineral in Chamdewal - Madlak area, Champawat district of Uttarakhand (G4).

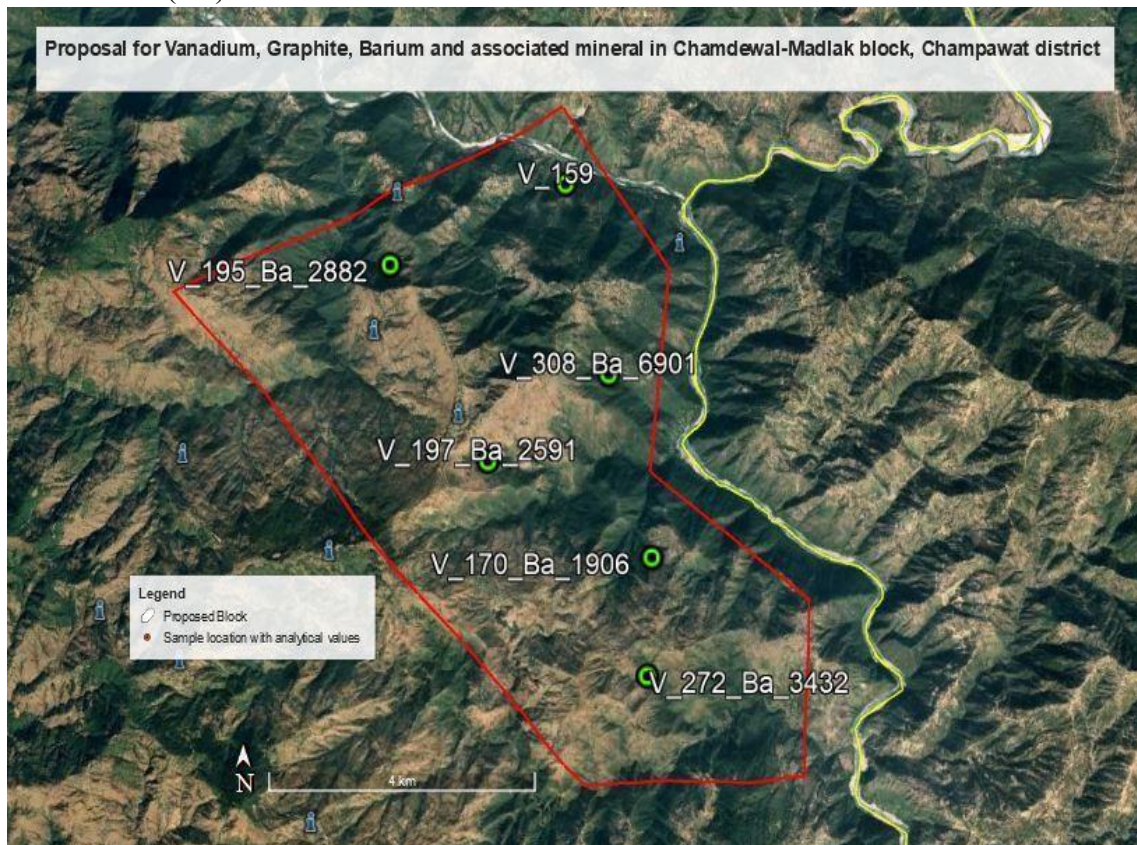


Plate-II:b. Google earth image of proposed area showing Location of samples collected during field visit. .

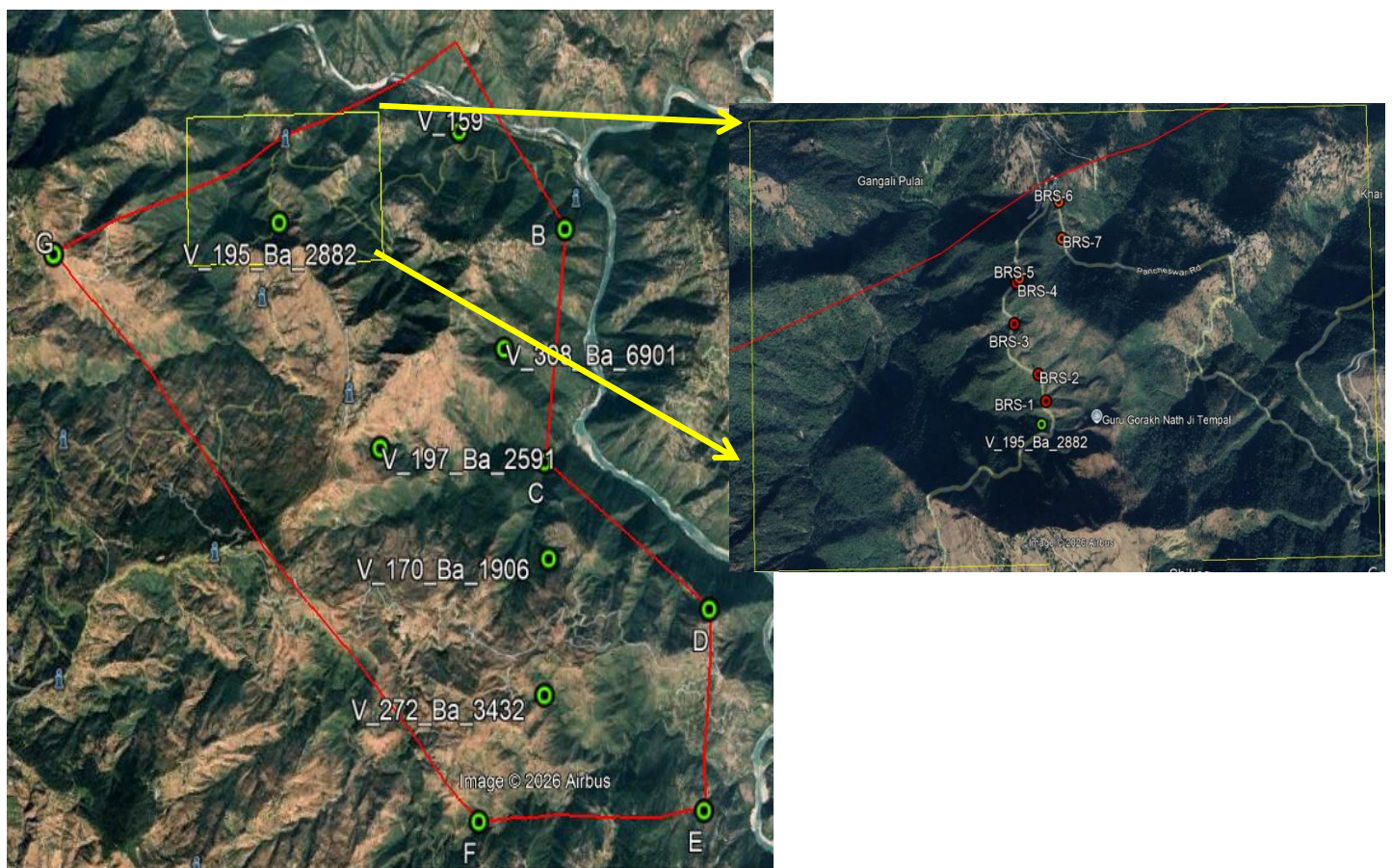


Plate-III: Elemental dispersion and histogram of Vanadium (V) in toposheet no. 62C/03 & 62C/07

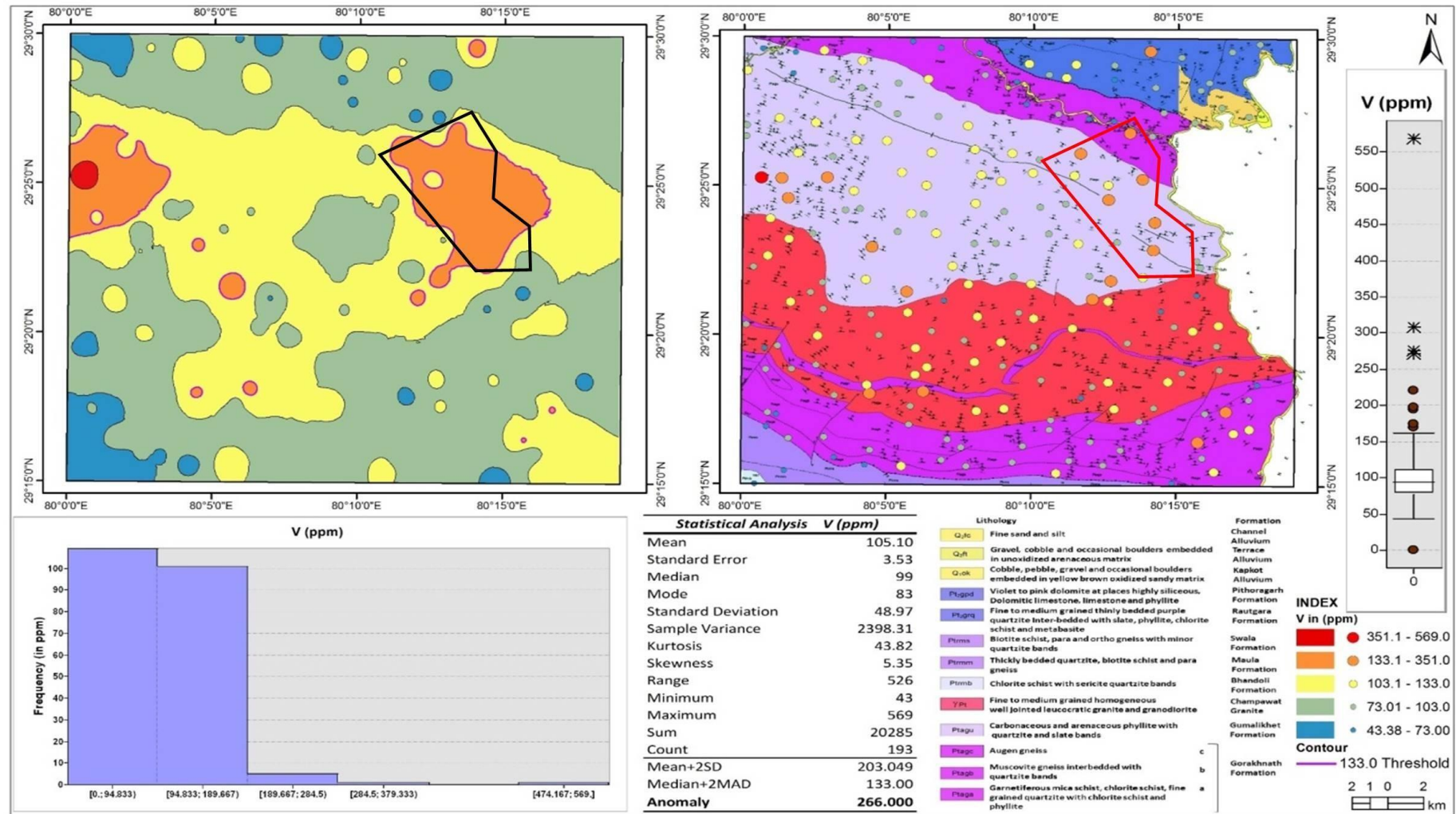


Plate-IV: Elemental dispersion and histogram of Barium (Ba) in toposheet no. 62C/03 & 62C/07

