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**SUBMISSION OF DETAILED PROPOSAL**

**ON**

**PRELIMINARY EXPLORATION FOR VANADIUM, GRAPHITE,  
BARIUM AND OTHER ASSOCIATED MINERALS IN CHAURA-  
MAUNKANDA BLOCK, CHAMPAWAT DISTRICT OF  
UTTARAKHAND (G-3 Stage).**

**PROPOSED BY:**  
**OCEAN DRILING & EXPLORATION PVT LTD.**  
**NOTIFIED PRIVATE EXPLORATION AGENCY**  
**UNDER CATEGORY-A**  
**( NABET/AEA/25/003)**

## SUMMARY OF THE PROPOSED BLOCK FOR G3 STAGE EXPLORATION

Sl No	Features	Details
I	Block ID	
II	Exploration Agency	Ocean Drilling & Exploration Pvt Ltd.
III	Previous Exploration Agency	GSI
IV	Previous stage (Geological Report)	G-3
V	Commodity	Vanadium, Graphite, Barium and other associated minerals
VI	Mineral Belt	
VII	Completion Period with entire schedule to complete the project	15 months
VIII	Objectives	<ul style="list-style-type: none"> <li>➤ <b>Phase-I</b> <ul style="list-style-type: none"> <li>a) Detailed mapping of the proposed area on scale of 1:4000. Total area of proposed block is <b>3.59 sq. km.</b></li> <li>b) Collection of BRS/soil/Pit/Channel/Trench samples based on the earlier work and systematic geological mapping.</li> <li>c) Ground geophysical survey (self-potential) to identify the down dip extension of potential zone which may help in the planning of boreholes.</li> <li>d) Analysis of the collected surface samples</li> </ul> </li> <li>➤ <b>Phase-II</b> <ul style="list-style-type: none"> <li>a) Systematic drilling to delineate the strike and dip continuity of the mineralized zone.</li> <li>b) Analysis of the collected sample and accordingly delineating the potential Zone/area for further stage of exploration.</li> <li>c) Estimation of resource as per the guidelines of UNFC and NMEDT.</li> <li>d) Final Report preparation and submission to NMEDT.</li> </ul> </li> </ul>
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 and few specialised work may 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,	Geologist party days on field: 80 Days (first phase) Geologist party days in HQ: 30 Days (first phase)

	Surveyor)													
<b>1.</b>	<b>Location</b>													
	Latitude & Longitude	Preliminary exploration for Vanadium, Graphite, Barium and other associated minerals in Chaura- Maunkanda block, Champawat district of Uttarakhand. (G-3 Stage) Proposed block falls in the toposheet No. 53O/15 & 62C/03.												
		<table border="1"> <tr> <td>A</td> <td>29° 27' 5.666" N</td> <td>79° 58' 31.152" E</td> </tr> <tr> <td>B</td> <td>29° 25' 58.222" N</td> <td>80° 0' 13.099" E</td> </tr> <tr> <td>C</td> <td>29° 25' 32.158" N</td> <td>79° 59' 53.585" E</td> </tr> <tr> <td>D</td> <td>29° 26' 24.388" N</td> <td>79° 58' 17.414" E</td> </tr> </table>	A	29° 27' 5.666" N	79° 58' 31.152" E	B	29° 25' 58.222" N	80° 0' 13.099" E	C	29° 25' 32.158" N	79° 59' 53.585" E	D	29° 26' 24.388" N	79° 58' 17.414" E
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C	29° 25' 32.158" N	79° 59' 53.585" E												
D	29° 26' 24.388" N	79° 58' 17.414" E												
	Villages	Chaurakot, Maunkanda villages												
	Tehsil/ Taluk													
	District	Champawat District												
	State	Uttarakhand												
<b>2.</b>	<b>Area (hectares/ square kilometres)</b>													
	Block Area	3.59 Sq. Km.												
	Forest Area	Data not available												
	Government Land Area	Data not available												
	Private Land Area													
<b>3.</b>	<b>Accessibility</b>													
	Nearest Rail Head	Tanakpur is the nearest railway station, about 85 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 eastern 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 75 km away.												
<b>4.</b>	<b>Hydrography</b>	.												
	Local Surface Drainage Pattern (Channels)	The overall drainage system of the area is dendritic type in nature. The dendritic drainage pattern is indicative of uniformly resistant, homogeneous strata whereas the trellis pattern (around Banasur area) could indicate the presence of regional scale plunging fold. Runi Gad, Saina Gad, Saula Gad, Nanbori Gad and Bhala Gad are the major streams present near the area.												
	Rivers/ Streams													
<b>5.</b>	<b>Climate</b>	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, specially near the river. Summer in the area begins from March and is extended till Mid-June.
	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. -4°C.
	Temperatures (June) (Maximum)	31 °C.
<b>6.</b>	<b>Topography</b>	
	Toposheet number	62C/3 and 53O/15
	Morphology of the Area	The study area forms part of Lesser Himalaya and exhibits rugged topography. The elevation in the area ranges from 740 to 2023 m above msl as calculated from DEM data.
<b>7.</b>	<b>Availability of baseline geoscience data</b>	
	Geological Map (1:50K/ 25K)	Available 1:12500 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	<p><b>A. Background Information</b></p> <p>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.</p> <p>The primary objective of the survey was to delineate potential lithological units and carry out systematic sampling to evaluate the mineral potential of the region. Large-scale geological mapping at a scale of 1:12,500 was</p>

carried out in and around Chaura, Sirmoli, and Lohaghat areas of Champawat district, Uttarakhand.

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.

Regionally, the area comprises rocks of Proterozoic age belonging to the Gumalikhhet Formation of Almora Group and very little exposure of Champawat Granite. The rocks of Gumalikhhet 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 luster on a freshly broken surface. It occurs as bands within grey phyllite indicating changing depositional environment.

The vanadium and barium mineralization is associated with the carbonaceous phyllite in the area and could be syngenetic to diagenetic.

The BRS and channel samples (total 100 nos.) show Vanadium values range of 33 to 5212 ppm with median 578 while the Barium values range from 164 to 40518 ppm with a median 4798. The Yttrium values range from 23 to 444 ppm with median 103 while the Molybdenum values range from 0.85 to 288 ppm with median value 63. The encouraging values of V, Ba, Y and Mo in the area indicate a promising potential for V and associated mineralization. The area requires further exploration, both through reconnaissance to trace the strike continuity of the carbonaceous phyllite bands and through G-3 stage investigation for resource estimation.

**B: Justification:**

During the Field Season 2022–23, reconnaissance survey has been carried out. The survey involved the systematic collection and analysis of various sample types, including 100 bedrock samples (BRS) and 50 channel samples, 15 pitting and trenching samples. Chemical analysis of these samples revealed anomalously high values of Ba, V, and fixed carbon.

**Some of the samples are as follows:**

BRS-8: V-1228 ppm, Ba-6945 ppm

BRS-9: V-1359 ppm, Ba-7225 ppm

BRS-10: V-1213 ppm, Ba-8112 ppm

BRS-11: V-2092 ppm, Ba-8864 ppm

BRS-29: V-148 ppm, Ba-7701 ppm

BRS-30: V-294 ppm, Ba-10309 ppm

BRS-39: V-1561 ppm, Ba-3873 ppm

BRS-40: V-3627 ppm, Ba-30093 ppm

BRS-50: V-727 ppm, Ba-3839 ppm

CH-17: V-2364 ppm, Ba-4784 ppm

CH-18: V-168 ppm, Ba-5370 ppm

CH-19: V-194 ppm, Ba-4132 ppm

CH-20: V-114 ppm, Ba-5885 ppm

CH-35: V-2807 ppm, Ba-7630 ppm

CH-36: V-1722 ppm, Ba-9535 ppm

**BRS-8: 6.26% (Fixed carbon)**

**CH-35: 2.32% (Fixed carbon)**

Based on the reporting and recommendations of the Geological Survey of India (GSI) and the encouraging results for Barium (Ba) and Vanadium (V) in the study area, a **G-3 stage** exploration is proposed for Vanadium, Graphite, and Barium in the **Chaura–Maunkanda block**, Champawat district, Uttarakhand. The objective of the proposed G-3 stage exploration is to establish the strike and dip continuity of mineralization and delineate potential mineralized zones of the reported elements.

**DETAIL PROJECT REPORT FOR THE PRELIMINARY EXPLORATION FOR  
VANADIUM, GRAPHITE, BARIUM AND OTHER ASSOCIATED MINERALS IN  
CHAURA- MAUNKANDA BLOCK, CHAMPAWAT DISTRICT OF UTTARAKHAND  
(G-3 STAGE).**

## **1. BLOCK SUMMARY**

### **1.1 Physiography**

The proposed **Chaura- Maunkanda block** is part of the Survey of India toposheet No. 53O/15 & 62C/03, Champawat district, Uttarakhand. Total area of the proposed block is 3.59 sq. km. The study area forms part of Lesser Himalaya and exhibits rugged topography. The elevation in the area ranges from 740 to 2023 m above msl as calculated from DEM. The overall drainage system of the area shows dendritic nature. The dendritic drainage pattern is indicative of uniformly resistant, homogeneous strata whereas the trellis pattern (around Banasur area) could indicate the presence of regional scale plunging fold. Runi Gad, Saina Gad, Saula Gad, Nanbori Gad and Bhala Gad are the major streams which drain the block area. 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 Block)**

**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	Almora	Champawat Granite	Fine to medium leucocratic granite and granodiorite
		Chaura	Granulite, garnet-mica schist, feldspathic schist
		Gumalikhhet	Carbonaceous phyllite, quartzite and schist
		Gorakhnath	Augen gneiss, Muscovite gneiss inter-bedded with quartzite, Quartzite, gametiferous 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 Block:** 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 (Fig.5.2). 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. **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 (Fig.5.5). 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. Such bands are found around Sirmoli, Jakh, Khuteli and Chura areas.

c) The carbonaceous phyllite is black coloured and easily soils hands. The width of the carbonaceous bands varies from few cm to nearly 80 m. The carbonaceous matter typically ranges between 05-20 vol% but can be as high as 80-90% in locally defined pockets. Thick carbonaceous phyllite bands are present in the western and central portions of the field area around Chaura, Maunkanda, Jakh, Khuteli, Sirmoli and Banasur areas. Pyrite crystals and sulphur leaching within the carbonaceous bands can be conspicuously seen at places along Haldu Ki Gad. Interbands of grey phyllite and carbonaceous phyllite are exposed in area south of Khuteli. 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.

**2. Champawat Granite:** The Champawat Granite is exposed in the south-central portion of the field area, south of Thuwamara village. It is leucocratic, medium grained, foliated and weathered in nature. It is composed mainly of quartz, plagioclase feldspar, biotite, and muscovite. The plagioclase feldspar composition is Albite (An0-10), as determined by Michel-Levy method. The unit is northerly dipping. The contact between granite and phyllite is marked by a no-exposure zone. The establishment of contact relationship could not be achieved from this single exposure. However, in area south-west of Sundungra village (outside the study area), sharp contact between granite and phyllite is observed.

### 1.2.3 Structure and Framework of the Block

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 (S<sub>0</sub>) and foliation (S<sub>1</sub>) 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 S<sub>1</sub> and S<sub>0</sub> have been deformed to develop reclined F<sub>2</sub> folds, which are characterized by a penetrative axial plane (S<sub>2</sub>) 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 S<sub>2</sub> axial plane foliations are parallel to S<sub>1</sub> and S<sub>0</sub> 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**

Total 100 nos. of bedrock and channel samples have been collected from carbonaceous phyllite and grey phyllite units to ascertain the vanadium and allied metal mineralization in the area. The analytical values of Vanadium (V), Barium (Ba), Yttrium (Y) and Molybdenum (Mo) obtained are very encouraging. The highest value of Vanadium obtained is 3627 ppm. The highest value of Ba obtained is 30,093 ppm. The highest value obtained for Y is 265 ppm. For Mo, the highest value obtained is 246.44 ppm. Fixed Carbon analysis of 3 samples shows BRS-8 with 6.26% FC and CH-35 with 2.32% FC.

Details of mineralized zone are as follow:

S. No	Vanadium (V)	Barium (Ba)	Graphite (Fixed Carbon)	Molybdenum (Mo)	Gold (Au)	Yttrium (Y)
1.	BRS-8: 1228 ppm	BRS-8: 6945 ppm	BRS-8: 6.26%	BRS-9: 102.34 ppm	<b>BRS-39: 0.12 ppm</b>	BRS-11: 217 ppm
2.	BRS-9: 1359 ppm	BRS-9: 7225 ppm	CH-35: 2.32%	BRS-40: 110.86	<b>CH-35: 0.118 ppm</b>	BRS-30: 259 ppm
3.	BRS-10: 1213 ppm	BRS-10: 8112 ppm	<p style="text-align: center;"><b>Only 3 samples were analyzed from proposed Block. Out of 3 samples, two samples is positive for graphite</b></p>	BRS-50: <b>127.54</b>		BRS-40: 243 ppm
4.	BRS-11: 2092 ppm	BRS-11: 8864 ppm		CH-17: <b>170.25</b>		CH-20: 265 ppm
5.	BRS-39: 1561 ppm	BRS-29: 7701 ppm		CH-19: <b>165.71</b>		
6.	BRS-40: 3627 ppm	BRS-30: 10309 ppm <b>(1.03%)</b>		CH-35: <b>246.44</b>		
7.	BRS-50: 727 ppm	BRS-39: 3873 ppm		CH-36: <b>140.06</b>		
8.	CH-17: 2364 ppm	BRS-40: 30093 ppm <b>(3.009%)</b>				
9.	CH-35: 2807 ppm	BRS-50: 3839 ppm				
10.	CH-36: 1722 ppm	CH-17: 4784 ppm				
11.		CH-18: 5370 ppm				
12.		CH-19: 4132 ppm				
13.		CH-20: 5885 ppm				
14.		CH-35: 7630 ppm				
15.		CH-36: 9535				

The dataset suggests a **multi-commodity black shale exploration target** with potential for:

- **Primary commodities:** Vanadium, Graphite.
- **Co-/by-products:** Mo, Ba, Y.
- **Value addition:** Gold anomalies.

Such systems are globally highly valuable because they can be developed as **integrated mining projects**

#### 1.4. Scope for Proposed Exploration

This project proposes a preliminary exploration programme at the G-3 stage, which will include detailed geological mapping on a scale of 1:4,000 covering an area of 3.59 sq. km (in Phase-I) along with a total of about 3,100 metres of drilling (in Phase-II). The drilling programme will consist of 20 first-level inclined boreholes planned at a 200 m × 200 m grid spacing to intersect the mineralisation at around 30 m vertical depth, with an average borehole depth of about 110 m owing to the undulating topography. In addition, six second-level inclined boreholes are proposed on most promising profiles to test the mineralised zone at around 60 m vertical depth, with an average borehole depth of approximately 150 m. All boreholes will be inclined, with borehole angle varying between 45° and 50°, depending on local terrain condition and geological constraints.

#### 1.5 Recommendations of previous exploration work

- A G-4 stage reconnaissance survey was conducted over an area of 50 sq. km. to assess the potential for vanadium and allied metals mineralization in FS 2022-23 by GSI.
- Total 100 nos. of bedrock and channel samples have been collected from carbonaceous phyllite and grey phyllite units to ascertain the vanadium and allied metal mineralization in the area.
- The analytical values of Vanadium (V), Barium (Ba), Yttrium (Y) and Molybdenum (Mo) obtained are very encouraging. The highest value of Vanadium obtained is 3627 ppm. The highest value of Ba obtained is 30,093 ppm. The highest value obtained for Y is 265 ppm. For Mo, the highest value obtained is 246.44 ppm. Fixed Carbon analysis of 3 samples shows BRS-8 with 6.26% FC and CH-35 with 2.32% FC.

As the area is highly promising for the Vanadium, Graphite, Barium and allied minerals, the area is recommended for further stage of exploration (G3). In order to delineate prospective zones and as per the recommendation the **Chaura- Maunkanda block** is being proposed for further exploration under G3 stage.

#### 1.6 Objectives of Exploration

- **Phase-I**
  - a) Detailed mapping of the proposed area on scale of 1:4000. Total area of proposed block is **3.59 sq. km.**
  - b) Collection of BRS/soil/Pit/Channel/Trench samples based on the earlier work and systematic geological mapping.
  - c) Ground geophysical survey like (SP survey) to identify the down dip extension of potential zone which may help in the planning of boreholes.

## ➤ Phase-II

- a) Systematic drilling to delineate the strike and dip 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 block 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.
- ii. 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.
- iii. The BRS and channel samples (total 100 nos.) show Vanadium values range of 33 to 5212 ppm while the Barium values range from 164 to 40518 ppm. The Yttrium values range from 23 to 444 ppm while the Molybdenum values range from 0.85 to 288 ppm.

## 3.0 BLOCK DESCRIPTION

The area falls under Survey of India Toposheet no. 62C/3 and 53O/15 and covers about 3.59 sq. km. Localities present in the vicinity include Chaura, Maun kanda villages. The coordinates of the proposed Chaura- Maunkanda block corner points are given in table below:

<b>The Chaura- Maunkanda block ( 3.59 sq.km)</b>		
<b>CORNER POINTS</b>	<b>LATITUDE</b>	<b>LONGITUDE</b>
A	29° 27' 5.666" N	79° 58' 31.152" E
B	29° 25' 58.222" N	80° 0' 13.099" E
C	29° 25' 32.158" N	79° 59' 53.585" E
D	29° 26' 24.388" N	79° 58' 17.414" E

## 4.0 PLANNED METHODOLOGY

**4.1 Methodology of exploration:** An area of 3.59 sq. km has been proposed as the Chaura–Maunkanda Block in Champawat District, Uttarakhand, for undertaking G-3 stage exploration targeting Vanadium, Graphite, Barium, and allied metal mineralisation. The exploration

programme has been designed in line with the objectives of preliminary exploration (G-3) 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 establish both the strike and dip continuity of the mineralised zones delineated during the earlier exploration carried out by the Geological Survey of India (GSI) in Field Season 2022–23 at the G-4 stage. 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 (1:4000 scale):** Geological mapping will be done on the entire 3.59 sq. km. area on 1: 4,000 scales. Outcrop boundaries marking the lithological variations along with their contact and structural features, if any, will be covered during the mapping.

Total 30 number of BRS/Channel samples will be collected from various litho-units based on the surface evidence of mineralization. A total of 200 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 nos. of samples, each of 1 metre length, will be systematically collected for chemical analysis to assess the grade and continuity of mineralisation.

- b) Surveying:** The block boundary will be surveyed by DGPS/Total station. WGS-84 datum will be used for the demarcation of proposed area boundary points. The total block area will be contoured to create a topographical map with 5m of contour interval. The rock boundaries and contact of lithological units will be mapped using total station. Further, during the drilling programme, the survey party will carry out borehole fixation and determination of the reduced levels and coordinates of the proposed 26 nos. of inclined boreholes.
- c) Core Drilling (in Phase-II):** The drilling activities will be taken up after completion of Phase-I work and review of the analytical results
- d) Geophysical survey:** As per the previous exploration practices and in order to delineate the depth continuity of mineralised zones, a ground geophysical survey in the form of self-potential survey is proposed. A total of 12 line kilometres (Lkm) of survey has been planned with the objective of identifying graphite and vanadium bearing horizons. The interpretation of the geophysical data will aid in delineating potential

zones of mineralisation and will also provide valuable inputs for refining borehole locations and subsequent sampling strategies.

- e) **Drill Core Logging:** The borehole core will be systematically logged for rock types, structural features, textures, intersection of ore zones, types of mineralisation, and the occurrence of various ore minerals. Logging for the determination of Rock Quality Designation/determination (RQD) will also be carried out.
- f) **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.
- g) **Laboratory studies:**
  - i. **BRS/Channel samples:**
    - A total of 30 nos. BRS/channel and 3 nos. check (10%) samples will be analysed for V, Ba, Ga, Mo, Sb, Co, Cu, Pb, Zn, Y by XRF method.
    - A total of 20 nos. BRS/channel and 2 nos. check (10%) samples will be analysed for fixed carbon by Graphite Proximate Analysis.
  - ii. **Trench Samples:**
    - A total of 50 nos. trench samples and 5 nos. check (10%) samples will be analysed for V, Ba, Ga, Mo, Sb, Co, Cu, Pb, Zn, Y by XRF method.
    - A total of 60 nos. trench samples and 6 nos. check (10%) samples will be analysed for fixed carbon by Graphite Proximate Analysis.
  - iii. A total of **20 nos. of petrochemical samples** will be analysed for **REE and trace elements** for the characterisation of the mineral deposit.
  - iv. **XRD studies:** A total of 10 nos. samples shall be subjected to XRD studies for the determination of mineral phase.
  - v. **EPMA studies:** A total of 05 nos. samples shall be subjected to EPMA studies for determine of the quantitative and qualitative chemical composition of mineral.
- h) **Petrological Studies:** A total of 20 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 NMET objectives.

#### 4.4 Report preparation

Submission of reports will be done as per the recommendations of NMET in compliance with G3 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:

Preliminary exploration for Vanadium, Graphite, Barium and other associated minerals in Chaura-Maunkanda block, Champawat district of Uttarakhand. (G-3 Stage) Area-3.59sq.km, Scale- 1:4000			
Sl. No.	Item of work	Unit	Qty.
1.	Geological mapping(1:4,000)	Sq.km	3.59
2.	a. DGPS Survey of 04 boundary points (Phase-I)	Days	4days
	b. Surveyor (1 party) for topographic mapping in 1:4000 scale and contouring at 5m interval	Days	60 days
3.	<b>a. Trench 20 nos. (10 x 1 x 1)</b>	Cubic meters	200
4.	<b>Ground geophysical survey (SP survey)</b>	Lkm	12 Lkm
5.	<b>Laboratory studies</b>		
	i. BRS/Channel	Nos.	30
	ii. Trench samples	Nos.	50
	iii. Graphite Proximate Analysis (Phase-I)	Nos.	80
	iv. PCS samples for whole rock analysis (REE & trace elements)	Nos.	20
6.	<b>Laboratory studies</b>		
	1. X-ray diffraction studies	Nos.	10
	2. Petrological samples : thin section	Nos.	10
	3. polished section	Nos.	10
8.	<b>EPMA</b>	hrs	10
9.	Raman Spectrometry (graphite Crystallinity)	Nos.	5

#### 6. EXPLORATORY DRILLING

The drilling activities will be taken up after completion of Phase-I work and review of the analytical results

#### 7. MANPOWER DEPLOYMENT

- a) 2 nos. of Geologist: 80Field days+ 30 HQ days
- b) 1 nos. of Sampler Party: 27 Days and 4 Labours: (27x4)=108 Days

8. APPROVED TIME SCHEDULE: for Phase-I

<i>Annexure 3B</i>										
<b>Time Schedule Action Plan for Preliminary exploration (G3) for Vanadium, Graphite, Barium and other associated minerals in Chaura-Maunkanda block, Champawat district, Uttarakhand</b>										
<b>Schedule Timeline: Phase-I (Total 6 months)</b>										
S.No.			1	2	3	4	5	6	Review	
1	Camp Setting	Months/Days								
2	Geological Mapping & Sampling	days								
3	Ground Geophysical survey	Line Km								
4	Geophysicist party days (HQ) for data interpretation & Report	Days								
5	Survey Party days	days								
6	Geologist Man days (Field)	days								
7	Geologist Man days (HQ)	days								
10	Sampler Man days	days								
11	Laboratory Studies	Nos.								

\* Note: Date of commencement of the work schedule will be taken up on necessary clearance and approval from concerned government agencies like forest, etc

9. BREAK-UP OF EXPENDITURE:

<i>Annexures 3A</i>							
<b>Estimated Cost for Preliminary exploration (G3) for Vanadium, Graphite, Barium and other associated minerals in Chaura- Maunkanda block, Champawat district, Uttarakhand.</b> <b>Area: 3.59 sq.km, Scale-1:4000 (Schedule timeline: 15 months Review: After 06 &amp; 12 Months) Implementing Agency: M/s Ocean Drilling &amp; Exploration Private Limited</b>							
<b>PHASE-I: DETAILED MAPPING &amp; GROUND GEOPHYSICAL SURVEY</b>							
S. No.	Item of Work *	Unit *	Rates as per NMEDT SoC 2021		Estimated Cost of the Proposal		Remarks
			SoC-Item No. *	Rates as per SoC * (a)	Qty. (b)	Total Amount (Rs) (a*b)	
	Geological Mapping Other Geological Work & Surveying						
A	Geological Mapping (Detailed Mapping, other geological work and surveying)	per sq. km.					
1	a. Charges for Geologist per day (Field) for geological mapping, drilling work, core logging & sample marking	day	1.2.1a	14,500	80	11,60,000	3.59 sq.km in Hilly area
2	b. Labours Charges; Base rate	day	5.8	541	160	86,560	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	10500	30	315000	
	a. Charges for one Sampler per day (1 Party)	one sampler per day	1.2.1b	7850	27	211950	
3	b. Labours (4 Nos)	day	5.8	541	108	58428	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher.
	<b>Sub Total- A</b>					<b>18,31,938</b>	

Survey work							
<b>B</b>	DGPS Survey for boundary points fixation & RL determination	Per Point of observation	1.3.2	24000	4	96000	4 Boundary points
1	Charges of Surveyor (1 party) for topographic mapping in 1:4000 scale and contouring at 5m interval	one surveyor per day	1.3.1	10,500	60	630000	3.59 sq.km in Hilly area
2	Labours Charges for survey work (4 labourers)	day	5.8	541	240	129840	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher.
3	<b>Sub-Total B</b>					<b>855840</b>	
	Trenching						
<b>C</b>	Excavation of trenches upto 2.0m depth	per cu.m	2.1.1	4125	200	825000	1. Trenching: 20 trenches of 10mx1mx1m (Approx.)
1	<b>Sub-Total C</b>					<b>825000</b>	
	<b>Ground Geophysical Survey</b>						
<b>D</b>	self potential (8-20 line km)	L km	3.3a	1,55,350	12	18,64,200	Hilly Terrain
7	<b>Sub Total D</b>					<b>18,64,200</b>	
<b>E</b>	<b>Chemical Analysis</b>						
1	Primary samples						
i)	Trench samples: Primary (1m sample length) for major oxides and LOI by WD-XRF	Nos	4.1.17a	4,200	80	336000	a. 10 nos. BRS samples and 20 nos. of channel samples, . 50 nos Trench sample b. elements V, Ba, Ga, Mo, U, Co, Cu, Pb, Zn, Y
	+ 10 % Check Sample	nos	4.1.17a	4,200	8	33600	
	Trench Samples: Graphite Proximate Analysis:	Nos	4.1.18	3,614	80	289120	20 nos. from BRS samples and 60 nos. from trench samples

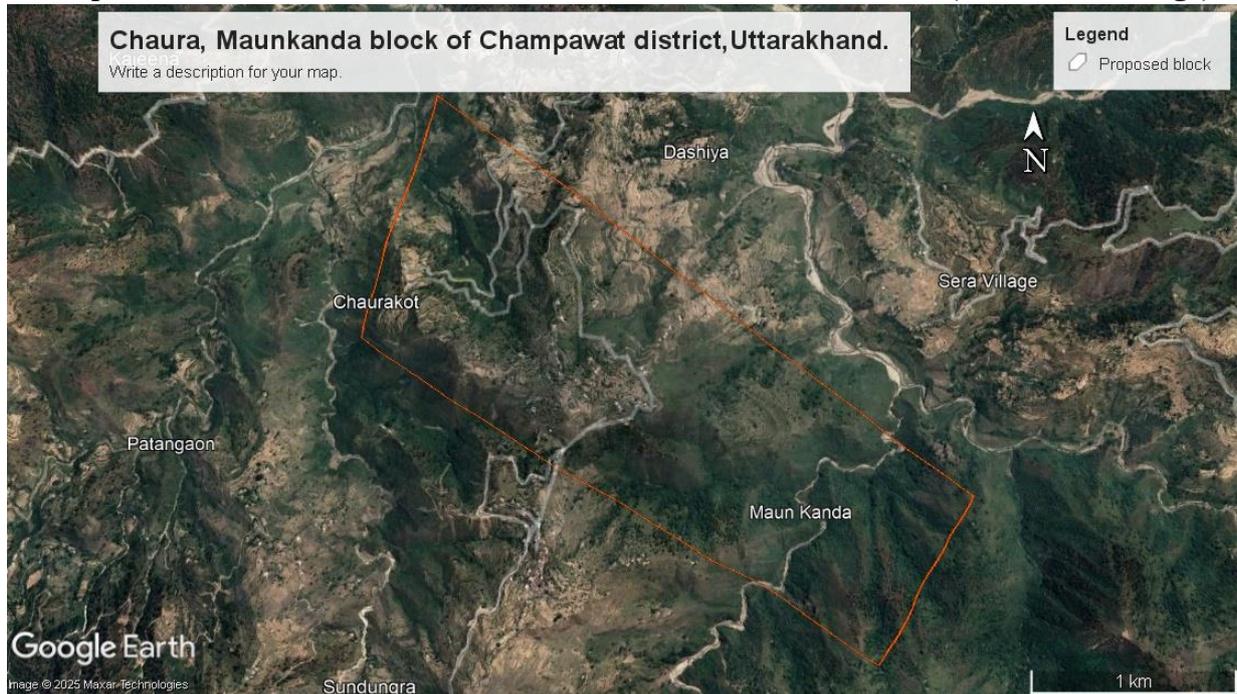
	+ 10 % Check Sample	nos	4.1.18	3,614	8	28912	
	ICPMS (Quantitative analysis of 14 REE elements +9 trace elements (U, Ta, Ge, Be, Hf, Sn, As, Rb, Th) by ICP-MS)	Nos	4.1.15	7400	20	148000	23 elements by ICPMS Method including U, Th, V, Ba, Ga, Mo, Co, Cu, Pb, Zn, Y & REE
	<b>Sub Total E</b>					<b>8,35,632</b>	
	<b>LABORATORY STUDIES</b>						
<b>F</b>	XRD analysis for identification of minerals (Random)	Nos	4.5.2	4,000	10	40000	
3	Physical & Petrological Studies						
4	Preparation of thin section	Nos	4.3.1	500	10	5000	
i	Preparation of polished section	Nos	4.3.2	800	10	8000	
ii	Complete petrographic /ore microscopic study/mineragraphic report of rock sample ( along with 5 nos. digital photo micrographs)	Nos	4.3.4	2800	10	28000	
iv	Raman Spectrometry (graphite crystallinity)	Nos	4.5.1	2,700	5	13500	As per actual rate
V	EPMA	hrs	4.4.1	10,500	10	1,05,000	
6	<b>Sub Total F</b>					<b>1,99,500</b>	
	<b>Total A to F</b>					<b>64,12,110</b>	
G	Total Estimated Cost without GST					64,12,110	
L	Provision for GST (18% of J)					11,54,180	GST will be reimbursed as per actual and as per notified prescribed rate
M	Total Estimated Cost with GST					-	75,66,290
N				or Say Rs. In Lakhs	-	75.66	
Note:							
1	Strict adherence to the Ministry of Finance's and GFR guidelines is mandatory. Every transaction must adhere to GFR rule 21.						

## **10. 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.



**PLATE-II: Satellite image of proposed “Preliminary exploration for Vanadium, Graphite, Barium and other associated minerals in Chaura- Maunkanda block, Champawat district of Uttarakhand (G-3 Stage)”.**



**PLATE-III: Geological Map of proposed “Preliminary exploration for Vanadium, Graphite, Barium and other associated minerals in Chaura- Maunkanda block, Champawat district of Uttarakhand (G-3 Stage)”.**

