PROPOSAL FOR RECONNAISSANCE SURVEY FOR TUNGSTEN AND ASSOCIATED MINERALS (G-4 STAGE) IN CHIKARA BLOCK NMEDT FUNDED PROJECT DISTRICT– JHANSI UTTAR PRADESH

CHIKARA BLOCK

COMMODITY: TUNGSTEN

By

MINERAL EXPLORATION AND COSULTANCY LIMITED
DR. BABASAHAB AMBEDKAR BHAWAN
SEMINARY HILLS NAGPUR

Summary of the Block for Reconnaissance Survey (G-4)

GENERAL INFORMATION ABOUT THE BLOCK

	Features	**Details**
	Block ID	Chikara Block (90.00 sq km)
	Exploration Agency	Mineral Exploration & Consultancy Limited (MECL)
	Commodity	Tungsten & Associated Minerals
	Mineral Belt	Quartz veins in Bundelkhand Gneissic Complex (BGC) of UP
	Completion period with entire Time schedule to complete the project	12 Months.
	Objectives	The present exploration program at G4 stage has been formulated to fulfil the following objectives: i) Preparation of Geological map on 1:12,500 Scale. ii) To assess the continuity, with thickness & quality of Tungsten mineralization in quartz vein of BGC. iii) Scout boreholes to the tune of 500m will be drilled to assess the depth of mineralized zone. iv) Based on the drilling and mapping, geological resources will be estimated as per MEMC rules. v) To carry out exploration as per Minerals (Evidence of Mineral Contents) Rules, 2015, Mineral Auction Rule – 2015 and MMDR Act – 2015 as to facilitate the Government of India for auctioning of the Tungsten Block.
	Whether the work will be carried out by the proposed agency or through outsourcing and details thereof. Components to be outsourced and name of the outsource agency	Work will be carried out by MECL. Drilling component is being outsourced, Agency name shall be given after tender finalization.
	Name/Number of Geoscientists	Two nos. Geoscientist (Field + HQ)

<table>
<tr><td></td><td>Expected Field days (Geology, surveyor)</td><td>Geologist Party days: 70 days</td></tr>
<tr><td>1.</td><td>Location</td><td>The Tungsten Block area falls partly in Survey of India Toposheet No. 44J/03 covers total area of 90.00 sq.km. The block area falls in and around the villages Chikaraa, Bharatpur, Dhawkhar, Bamhori, Rori; Tehsil- Mauranipur; Dist- Jhansi, Uttar Pradesh.</td></tr>
<tr><td></td><td>Latitude and Longitude</td><td>Corner cardinal points of Chikara G4 Block (90.00 sq. km)
<table>
<tr><th>Points</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>A</td><td>25° 19' 0.83" N</td><td>079° 12' 44.96" E</td></tr>
<tr><td>B</td><td>25° 17' 23.29" N</td><td>079° 14' 58.92" E</td></tr>
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<tr><td>G</td><td>25° 17' 49.73" N</td><td>079° 11' 30.29" E</td></tr>
</table></td></tr>
<tr><td></td><td>Villages</td><td>Chikaraa, Bharatpur, Dhawkhar, Bamhori, Rori</td></tr>
<tr><td></td><td>Tehsil/Taluk</td><td>Mauranipur</td></tr>
<tr><td></td><td>District</td><td>Jhansi</td></tr>
<tr><td></td><td>State</td><td>Uttar Pradesh</td></tr>
<tr><td>2.</td><td>Area (hectares/ sq. km)</td><td></td></tr>
<tr><td></td><td>Block Area</td><td>90.00 sq.km (9000.00 Ha)</td></tr>
<tr><td></td><td>Forest Area</td><td>Fairly dense mixed jungle (mainly bamboo) in the south-western part of the block and remaining area occupied by private and government land.</td></tr>
<tr><td></td><td>Government Land Area (Bilanam)</td><td>Data not available</td></tr>
<tr><td></td><td>Charagaha</td><td>Data not available</td></tr>
<tr><td></td><td>Private Land Area</td><td>Data not available</td></tr>
<tr><td>3.</td><td>Accessibility</td><td></td></tr>
<tr><td></td><td>Nearest Rail Head</td><td>Jhansi Railway Station (24 Kms).</td></tr>
<tr><td></td><td>Road</td><td>The national highway NH-76 passes on the eastern side of the block. Motorable/ metaled roads are available in the area.</td></tr>
<tr><td></td><td>Airport</td><td>Khajuraho around 135 km from the block</td></tr>
<tr><td>4.</td><td>Hydrography</td><td></td></tr>
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	Local Surface Drainage Pattern (Channels)	In Jhansi District, entire system of drainage is a part of Yamuna sub basin of Ganga basin. The area is mainly drained by Betwa, Pahuj, Dhasan, Sukhnai and Jamni rivers and its tributaries. These rivers are perennial in nature. The General flow direction of rivers is North to North –East and follows the slope of the area. In general drainage pattern is dendritic in nature. The Dhasan Rivers drains in the eastern part of the block in Mauranipur and Gursairai blocks. The major tributaries of Dhasan are Lakheri, Sukhai and Kureri rivers which are ephemeral in nature.
	Rivers/ Streams	Betwa on the western side of the block and Dhasan river on the eastern side.
5.	**Climate**	
	Mean Annual Rainfall	The average annual normal rainfall is 885 mm. About 91% of rainfall takes place for June to September (Monsoon Season).
	Temperatures (December) (Minimum) Temperatures (June) (Maximum)	January is the coldest month of the year when the mean daily maximum temperature is 24.10 °C and the mean daily minimum temperature is 9.2°C, May is the hottest month with mean daily maximum temperature is 42.6° C and mean daily minimum temperature is 28.8°C. The mean monthly maximum temperature is 32.6°C and mean minimum temperature is 19.2°C.
6.	**Topography**	
	Toposheet Number	Part of Toposheet No. 54O/03 & 54 O/07.
	Morphology of the Area	The study area forms part of Bundelkhand plateau. Low dissected hills and valley of structural origin, pediment and pediplain of denudational origin. The block area is characterized by long serrated ridges of quartz reefs.
7.	**Availability of baseline geoscience data**	
	Geological Map (1:50K/25K)	Regional geological map sourced from Bhukosh (1:50K) available.
	Geochemical Map	NGCM Data (Source: Bhukosh)

	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Not applicable.
8.	**Justification for taking up Reconnaissance Survey**	1. The proposed area belongs to the Bundelkhand Gneissic Complex which is well known for hosting sulphide minerals viz Pyrite and chalcopyrite in granites and older enclaves, along with large bodies of quartz vein which is hosted by tungsten and tin mineralization. 2. F.S. 2004, GSI under S.P. Nim have carried out "Reconnoitre survey of quartz reefs in Bundelkhand granitoid complex for use as abrasive/refractory minerals in parts of southern Uttar Pradesh". During reconnaissance survey, total quartz veins were mapped in this area on 1:25000/50000 scale and collected around 201 samples which have given anomalous values for tungsten (i.e >300PPM) 3. In the proposed Chikara block, a total 15 no of BRS samples are collected by GSI (2004) whose Tungsten analytical values range between **minimum 409 ppm to maximum 827 ppm**. Shri S.P Nim recommended for detailed tungsten investigation in this area for anomalous values of tungsten. 4. Hence, to establish strike and depth continuity of tungsten mineralization in quartz vein it is proposed for taking up the block for G4 exploration as samples collected by GSI have shown anomalous tungsten values. 5. Establishing the extent and depth continuity of the Tungsten rich quartz reef along the strike would lead to upgradation of block for G3 exploration which in turn would facilitate the Govt of India for auctioning the block.

PROPOSAL FOR RECONNAISSANCE SURVEY (G4 LEVEL) FOR TUNGSTEN & ASSOCIATED MINERALS IN THE CHIKARA BLOCK DISTRICT - JHANSI, UTTAR PRADESH

1.0.0 INTRODUCTION

1.1.0 Tungsten, also known as wolfram, is a very rare dense lustrous greyish-white to steel grey metal with unique properties. It has highest melting point and has highest tensile strength at temperatures above 1650□C and lowest coefficient of expansion of any pure metal. Tungsten does not occur freely in nature as metal, the most important tungsten minerals are Scheelite ($CaWO_4$), Stozlite ($PbWO_4$) and Wolframite, which is a solid solution or a mixture or both of the isomorphous substances' ferrous tungstate ($FeWO_4$) and Manganous tungstate ($MnWO_4$). All primary tungsten deposits are associated with granitic intrusions or with medium-to high grade metamorphic rocks. Tungsten deposits are usually located in orogenic belt resulting from subduction related collision plates.

1.2.0 The total resources of tungsten ore in the country, as per NMI data, as on 1.04.2015 based on UNFC system, has been estimated at 87.39 million tonnes with WO3 content of 1,42,094 tonnes. All these resources are placed under 'Remaining Resources' category. Resources of tungsten-bearing minerals are mainly distributed in Karnataka (42%), Rajasthan (27%), Andhra Pradesh (17%) and Maharashtra (9%). The remaining 5% resources are in Haryana, Tamil Nadu, Uttarakhand and West Bengal.

1.3.0 Critical minerals are those minerals that are essential for economic development and national security. The lack of availability of these minerals or concentration of extraction or processing in a few geographical locations may lead to supply chain vulnerabilities and even disruption of supplies. Based on the resource/ reserve position in the country, production, import dependency, use for future technology/ clean energy, requirement of fertilizer minerals in an agrarian economy, the MOM has notified a set of 30 critical minerals and Tungsten is one of them.

1.4.0 On enactment of MMDR Amendment Act-2015, Minerals (Evidence of Mineral Contents) Rule-2015 and Mineral Auction Rule-2015, Govt. of India directed State Governments and Exploration Agencies to speed up exploration work for critical and strategic minerals, accordingly MECL has identified the proposed Chikara block for tungsten and associated minerals at Reconnaissance (G-4) level.

2.0.0 LOCATION AND COMMUNICATION

2.0.1 The Chikara Block falls in Survey of India Toposheet No. 44J/03 and is bounded by the

following co-ordinates located in Jhansi district of Uttar Pradesh.

Corner cardinal points of Chikara G4 Block (90.00 sq. km)

Points	Latitude	Longitude
A	25° 19' 0.83" N	079° 12' 44.96" E
B	25° 17' 23.29" N	079° 14' 58.92" E
C	25° 10' 41.21" N	079° 09' 54.38" E
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2.0.2 The Chikara block is located at a distance of 73 kms from Jhansi district HQ. The nearest railway station is Jhansi. The nearest airport is Khajuraho around 117 km from the block.

2.1.0 PHYSIOGRAPHY & DRAINAGE

2.1.1 The study area forms part of Bundelkhand plateau. The topography is undulatory plain with isolated hills rising abruptly and form steep and nearly inaccessible scarps. The block area is characterized by long serrated ridges of quartz reefs ranging in NE-SW direction.

2.1.2 The elevation of the block varies from 190m to 290m above mean sea level. The proposed block is part of Yamuna River sub basin, in general drainage pattern is dendritic in nature. The Dhasan Rivers drains in the eastern part of the block in Mauranipur and Gursairai blocks. The major tributaries of Dhasan are Lakheri, Sukhai and Kureri rivers which are ephemeral in nature.

2.2.0 CLIMATE & RAINFALL

2.2.1 CLIMATE

January is the coldest month of the year when the mean daily maximum temperature is 24.10 °C and the mean daily minimum temperature is 9.2°C, May is the hottest month with mean daily maximum temperature is 42.6° C and mean daily minimum temperature is 28.8°C. The mean monthly maximum temperature is 32.6°C and mean minimum temperature is 19.2°C.

2.2.2 RAINFALL

The average annual normal rainfall is 885 mm. About 91% of rainfall takes place for June to September (Monsoon Season).

3.0.0 PREVIOUS WORK

3.0.1 The Bundelkhand area is referred by Medlicott (1859) who mapped in various parts of the present Madhya Pradesh between 1860 and 1869. Oldham (1859), Hacket (1870) and Mallet (1868) mapped the granite and gneissic rocks of Bundelkhand province as Bundelkhand Granite. The word "Bundelkhand Gneiss" was coined by Dr. A. M. Heron (1935), who considered it as the oldest rock of Archaean age and correlated it with Banded Gneissic Complex and Berach Granite of Rajasthan.

3.0.2 Gurusiddappa et al. (FS 1984-85), carried out "systematic geological mapping of 1600 sq km area on 1:50,000 scale was undertaken with the objective of mapping the different components of the Bundelkhand Granite-Gneiss Complex to evaluate its structural, petrological events, to scout for the search of mineralised belts in the area covered by granite-gneiss, greenstone, metasedimentary and metavolcanic rocks around Ajnor-Tikamgarh-Bhagwan-Khargapur area of Tikamgarh and Chhatarpur districts of Madhya Pradesh". In this report it was mentioned about specks, stringers and thin veinlets of pyrite, chalcopyrite, covellite along the joints and minor fracture planes within the grey-gneisses. Indications of specks and stringers of pyrite and chalcopyrite with stains have been reported within the medium-grained pink rock. It was also reported about diaspore and pyrophyllites occurring in the form of pocket deposits along quartz reefs trending northeast with fracture plane within metasedimentary rocks along these reefs cutting across. Few pockets of kaolin occur within the area due to alteration of feldspars.

3.0.3 Large scale mapping and base metal exploration for an area of 600 sq.km of Bundelkhand granitic terrain in Gwalior district were carried out by Chellani and Chakraborty (2001). The chemical analysis of chip samples collected across shear zones/ lineaments at regular intervals indicate a relatively good mineralisation near Lakhnauti but poor mineralisation near Barera, Bilua, Antri and Aniti. Large scale geological mapping and analysis of channel samples collected from 800m long, 4-6m wide NNE-SSW trending shear zone revealed average copper assay value of 2100 ppm average assay width of 2.49m. The maximum value of copper mineralisation was 5625 ppm. Vikash Kumar Suman and Asrar Ahmad (2015-16) reported the presence of specks of sulphide near Sokra village during STM. Large scale mapping on 1:12,500 scale was carried out in parts of Gatholi Kalan, Dongra Khurd, Pyasa, Kusmar, Baron, Gona, Uldana Kalan and Saidpur areas. The pyrophyllite was observed within the groundmass of quartz-sericite-pyrophyllite schist affected by hydrothermal activity due

to the intrusion of quartz veins.

3.0.4 During the F.S. 2016-2018, GSI carried out Application of Hyperspectral / Multispectral Remote Sensing techniques to prepare Alteration / Mineralized Zone in Tikamgarh and Jhansi Districts of Madhya Pradesh and Uttar Pradesh respectively. Sulphide and carbonate minerals, such as pyrite, chalcopyrite, azurite and malachite respectively, have been identified during the field work near Laron, Murara, Parara, Kumarpura, Sakera and Baron.

3.0.5 S.P. Nim of Geological Survey of India, during Annual Programme 2000-2001, worked in the region and in his report (February 2004) titled "Report on Reconnoitory Survey of Quartz Reefs in Bundelkhand Granitoid Complex for use as Abrasive/Refractory Minerals in parts of Southern Uttar Pradesh (Item No. MIP/NR/UP/2000/003)". During reconnaissance survey, total quartz veins were mapped this area on 1:25000/50000 scale and collected around 201 geochemical samples which have given anomalous values for tungsten (i.e. >300PPM with a maximum of 1000PPM) had found Tungsten (W) in quartz samples and recommended that Quartz reefs of BGC, have quite promising concentration of tungsten and can be searched for tungsten deposits.

3.0.6 In the proposed Chikara block a total 15 no of geochemical samples are collected by GSI (2004) whose Tungsten analytical values range between minimum 409 ppm to maximum 827 ppm, which is anomalous for tungsten mineralization. Shri S.P Nim recommended for detailed tungsten investigation in this area.

3.0.7 Mineral Exploration and Consultancy Limited (MECL) has carried out G4 level exploration, which included geological mapping with collection of BRS/SSS/ Soil sampling in Hanspur block, District: Jhansi, State: Uttar Pradesh. This block lies at about 20 km from the proposed block.

3.0.8 MECL based on the exploration work carried out in G-4 level, potential Tungsten bearing areas were marked, where tungsten (W) mineralization is associated with quartz reefs of the block along the complete strike length of the exposed quartz reefs. The quartz reef situated near Devendrapura village has sample collected and analysed for W which has analysed to a value up to 444.62 ppm and also scheelite has been confirmed under short-wave UV ray survey near the high value sample's location. In Hanspur block, a total of 216 nos. of bed rock were collected in which 64 samples W concentration (>200 ppm) ranges from 211ppm to 633ppm.

3.0.9 Based on the positive anomaly and potential area demarcated for Tungsten (W) mineralization, MECL upgraded the G4 block into Murara(A) and Devendrapura(B)

blocks for G3 exploration. The exploration work is currently in progress. Also, in Hanspur Block, the G4 exploration is underway for Tungsten (W) mineralization. The BRS sample collected shown W values ranging from 126ppm to 633ppm. The results of some BRS samples with tungsten values more than 120ppm is given below in the table below.

Sl.No.	Sample No.	Northing (m)	Easting (m)	W (>120 ppm)
1	HNS-28	2798336	297390	157.2649
2	HNS-29	2798313	297284	303.8042
3	HNS-30	2798120	296890	382.0121
4	HNS-31	2798220	296944	236.599
5	HNS-58	2799386	298200	221.2461
6	HNS-61	2800124	298794	369.3338
7	HNS-62	2800222	298877	275.611
8	HNS-67	2800701	299250	348.7096
9	HNS-68	2800614	299196	308.7282
11	HNS-70	2799903	299503	272.8473
12	HNS-71	2799840	299389	307.6788
13	HNS-72	2799797	299327	259.9178
14	HNS-85	2801885	299600	391.0053
15	HNS-86	2801916	299760	375.3525
16	HNS-87	2802037	299847	246.7692
17	HNS-88	2802127	299928	304.0055
18	HNS-89	2802275	300029	240.8123
19	HNS-90	2802377	300102	442.889
20	HNS-91	2802501	300244	299.269
21	HNS-92	2802560	300282	336.9288
22	HNS-93	2802633	300341	358.7575
23	HNS-94	2802705	300414	492.2524
24	HNS-95	2802755	300450	367.6231
25	HNS-96	2802888	300557	384.2562
26	HNS-97	2803012	300630	364.6153
27	HNS-98	2803111	300690	271.3539
28	HNS-99	2802013	300346	343.5354
29	HNS-118	2802457	300676	221.462
30	HNS-133	2804616	301695	633.0083
31	HNS-134	2804531	301671	495.7896
32	HNS-147	2802222	300980	239.2319
33	HNS-148	2802309	300968	276.691
34	HNS-149	2802443	301084	448.865
35	HNS-150	2802532	301197	527.0478
36	HNS-151	2802709	301320	429.0256
37	HNS-152	2802797	301431	557.8559
38	HNS-153	2802930	301565	271.437
39	HNS-154	2803082	301669	415.9388
40	HNS-155	2803165	301791	276.6113
41	HNS-156	2803314	301951	411.7831

Sl.No.	Sample No.	Northing (m)	Easting (m)	W (>120 ppm)
42	HNS-157	2803526	302139	385.1634
43	HNS-158	2803674	302264	542.4685
44	HNS-159	2803790	302396	517.9247
45	HNS-160	2803921	302522	335.7905
47	HNS-162	2804100	302697	352.1534
48	HNS-175	2805235	302106	230.9154
49	HNS-176	2805566	302317	239.9251
50	HNS-177	2805719	302416	385.2823
51	HNS-178	2805959	302602	177.3942
52	HNS-179	2806227	302813	211.1697
53	HNS-180	2806407	302949	190.9868
54	HNS-187	2807967	304162	244.0658
56	HNS-189	2808320	304452	400.0907
57	HNS-190	2808559	304629	190.2132
58	HNS-191	2808895	304904	301.9506
59	HNS-192	2809109	305066	318.7563
60	HNS-193	2809280	305191	323.1925
61	HNS-194	2809454	305268	286.9000
62	HNS-201	2810823	306214	290.8835
63	HNS-202	2796612	297466	272.0623
64	HNS-203	2794997	294200	287.3416
65	HNS-204	2804396	301817	350.4029
66	HNS-205	2804126	301755	435.7365
67	HNS-206	2803893	301715	344.8321
68	HNS-210	2804338	302524	151.3146
69	HNS-211	2804556	302647	126.5263
70	HNS-212	2803322	304226	144.049
71	HNS-213	2803030	303965	257.4116
72	HNS-214	2802969	303963	146.8435
73	HNS-215	2801596	300430	406.2084

4.0.0 GEOLOGY OF THE AREA

4.0.1 The study area at central part of the Archaean Bundelkhand granite-gneissic complex (~ 3.59 Ga; Saha et al., 2015) comprises granitoid varieties in different shades of colour such as porphyritic and non-porphyritic coarse grained pink granite, medium to fine grained granite with small to large enclaves of older metamorphic/ supracrustal. Other important lithounits of study area are linear bodies of quartz reef which from prominent geomorphic features with positive relief in the study area. Supracrustal enclaves are part of green stone belt represented by volcano-sedimentary sequence.

4.0.2 The late phase of igneous activity is manifested by the intrusion of very large bodies of quartz reef. The quartz reefs are prominent in the area and form long ridges. Their outcrop pattern varies from lenticular to elongated ridges with multiple branching at the

places. The quartz reefs in the mapped area show NNE-SSW to NE-SW general trend. In this quartz reef we also found the patches of highly crushed and brecciate silicified masses of dark chocolate coloured. In these crushed masses the network of milky quartz veins is absent instead we found clast and fragment of milky quartz which indicate later phase brecciation by which network of milky quartz veins gets crushed and fragmented. In this quartz reef we observed very good cross- cut relationship between at least two generation of quartz veins in the older veins. Conspicuous solution structure such as comb structure is also well developed. At many places, iron encrustations have also been found.

The litho-stratigraphic sequence of the proposed block from is depicted in the table below.

Stratigraphic Sequence of the Chikara block(G-4)

Formation	Soil/Alluvium
Intrusive	Quartz vein, Dolerite dyke, Quartz reefs, Carbonatite veinlets.
Bundelkhand Granite	Fine grained pink granite, Medium grained granite, Coarse grained pink granite, Coarse grained pink porphyritic granite, Coarse grained grey granite.
Newer Metamorphic Group	Banded Iron Formation (BIF)
Older Metamorphic	Amphibolites, Granodiorite/ Micro-granodiorite

4.1.0 COMMON ROCK TYPES

Various lithounits exposed in the block area and described in the following paragraphs:

4.1.1 Bundelkhand Granite

4.1.1.1 The Bundelkhand massif is majorly occupied by a large plutonic complex of a batholithic dimension known as Bundelkhand granite. The emplacement of younger Bundelkhand granitoids is suggested to be resultant of collision related tectonics during the Neoarchean period (Mondal et al., 2002). Based on mutual field relations and petrography, three types of granites were recognized by Basu (1986); (i) coarse grained porphyritic granite, (ii) medium grained porphyritic granite, and (ii) leucogranite, each with numerous sub-types. Four categories of granite have been broadly classified by Roy and Purohit (2018) based on accessory minerals viz; biotite granite, hornblende granite, hornblende-biotite granite and leucogranite. The granitoids range in composition between quartz diorite and K-feldspar bearing granite. As per the compiled

geological map of the study area by Geological Survey of India.

4.1.1.2 In the area mainly coarse-grained porphyritic granite, medium grained granite and fine-grained granite are prominently exposed. The medium-grained porphyritic granite has the maximum aerial extent. In the block majority of the granite are pinkish in colour and a few places small outcrops of grey granites are exposed.

4.1.2 Quartz Reefs

4.1.2.1 One of the most outstanding features of the Bundelkhand Craton is the occurrence of NE–SW trending giant quartz reefs, which occur as large linear hills/ridges rising sharply above the ground over the basement gneisses and granitoids and form prominent physiographic features. Formation of these reefs is considered to be the outcome of tectonically controlled hydrothermal activity along vertical to sub vertical shear zones that formed in response to extensional tectonics at 2.1–2.0 Ga (Pati et al., 2007; Bhattacharya and Singh,OP cit).

4.1.2.2 In the area major quartz reefs are also trending in NE–SW direction almost in all portions of the block. The quartz reefs are of various colours viz. milky to dull white, buff, greenish, greyish and jasper varieties of quartz are also seen. Dull white, milky white and pinkish white or reddish white or buff colour quartz are common. No pattern is discernible in the disposition of different colours of quartz. These quartz reefs have sharp contact with the granitic rocks of BGC and contact is generally covered by scree/debris/soil. Secondary quartz veins in the quartz reefs are frequently seen. At places, quartz reefs exhibit deep red ferruginous coating on the quartz crystals, which suggests that ferruginous solution activity has taken place in the quartz reef.

4.1.2.3 Quartz reefs generally show pinching and swelling nature along the strike and also die out probably due to soil cover in between the exposures of reefs. Brecciation and shattering are commonly noted in the reefs and these have undergone polyphase deformation represented by lineaments, faults, different set of secondary quartz veins, different sets of quartz reef. Secondary quartz veins, composed of white quartz, are frequently observed in the quartz reefs.

4.1.2.4 Above mentioned quartz reefs are the source of Tungsten mineralization in the proposed block along the strike length.

4.1.3 **Banded** Iron Formation (BIF)

4.1.3.1 Banded Iron Formation (BIF) is exposed as linear discontinuous ridges occurring within medium to coarse-grained pink granite and migmatites. BIF is the most conspicuous in the enclave suite of Bundelkhand Massif and is widespread. Compositionally they are

banded quartz-magnetite rock, banded magnetite-grunerite rock and banded quartz-grunerite-garnet-actinolite rock. These form low mounds in a peneplained granitic country.

4.2.0 JUSTIFICATION FOR TAKING UP THE PROJECT

4.2.1 The proposed area belongs to the Bundelkhand Gneissic Complex which is well known for hosting sulphide minerals viz Pyrite and chalcopyrite in granites and older enclaves, along with large bodies of quartz vein which is hosted by tungsten and tin mineralization.

4.2.2 F.S. 2004, GSI under S.P.Nim have carried out "Reconnoitre survey of quartz reefs in Bundelkhand granitoid complex for use as abrasive/refractory minerals in parts of southern Uttar Pradesh"

4.2.3 During reconnaissance survey, total quartz veins were mapped in this area on 1:25000/50000 scale and collected around 201 geochemical samples which have given anomalous values for tungsten (i.e >300PPM)

4.2.4 In the proposed Chikara block, a total 15 no of BRS samples are collected by GSI (2004) whose Tungsten analytical values range between minimum 409 ppm to maximum 827 ppm as given below in the Table 4.1. Shri S.P Nim recommended for detailed tungsten investigation in this area for anomalous values of tungsten.

Sl.No.	Sample No.	Latitude (DD.DD)	Longitude (DD.DD)	Tungsten (W) ppm
1	83	25.29	79.19	770
2	84	25.29	79.19	629
3	85	25.29	79.19	765
4	86	25.33	79.28	466
5	87	25.33	79.28	409
6	88	25.32	79.27	781
7	89	25.32	79.27	827
8	90	25.31	79.26	736
9	91	25.31	79.26	770
10	92	25.30	79.25	718
11	93	25.29	79.21	686
12	94	25.29	79.24	784
13	168	25.27	79.23	586
14	169	25.27	79.23	585
15	170	25.28	79.23	546

4.2.5 Hence, to establish strike and depth continuity of tungsten mineralization in quartz vein it is proposed for taking up the block for G4 exploration as samples collected by GSI have shown anomalous tungsten values.

4.2.6 Establishing the extent and depth continuity of the Tungsten rich quartz reef along the

strike would lead to upgradation of block for G3 exploration which in turn would facilitate the Govt of India for auctioning the block.

5.0.0 PROPOSED EXPLORATION PROGRAMME

5.1.0 OBJECTIVES:

The present exploration programme has been formulated to fulfil the following objectives:

1. Preparation of Geological map on 1:12,500 Scale.
2. To assess the continuity, with thickness & quality of Tungsten mineralization in quartz vein of BGC.
3. Scout boreholes to the tune of 500m will be drilled to assess the depth of mineralized zone.
4. Based on the drilling and mapping, geological resources will be estimated as per MEMC rules.
5. To carry out exploration as per Minerals (Evidence of Mineral Contents) Rules, 2015, Mineral Auction Rule – 2015 and MMDR Act – 2015 as to facilitate the Government of India for auctioning of the Tungsten Block.

5.2.0 SCHEME OF EXPLORATION

To fulfil the objective as given in para 6.0.0, exploration will be carried out in two phases, as given below:

5.2.1 Phase-I

a) To carry out geological mapping with collection of surface geochemical samples on 1:12,500 scale.

b) To carry out Trenching work (600 Cu.m) to expose and confirm the strike continuity of the ore body

5.2.2 Phase II

a) Upon positive interpretation of Geological mapping with collection of samples, trenching and trench sampling, scout drilling involving about 500m will be to carried out to confirm the strike and depth continuity of mineralized zones.

b) To estimate Reconnoitre ore resources at G4 level as per UNFC norms and Minerals (Evidence of Mineral Contents) Rules 2015.

5.2.3 EXPLORATION SCHEME

5.2.4 Detailed Geological Mapping:

5.2.4.1 The total study area of 90.00 sq. km will be mapped on 1:12,500 scale with the

exposures of tungsten and associated mineralisation etc. as available along with the structural details marked on a plan before going for activities like sampling, pitting/trenching etc. A geological plan with pits/trenches, surface features etc. on 1:12,500 scales is to be prepared and finalized before finally leaving the worksite after completion of all exploratory activities. Along with this, luminescent survey will be carried out to locate the potential tungsten bearing areas.

5.2.4.2 The Block boundary will be surveyed by regular GPS in WGS-84 datum for demarcation of block boundary/corner points. During exploratory drilling all ten Boreholes will be fixed on the ground whose RL's and co-ordinates will be determined by DGPS.

5.2.5 GEOCHEMICAL SAMPLING

5.2.6 Surface sampling (Bed Rock/Soil Sampling):

During the course of Geochemical Sampling the bed rock and soil samples shall be collected from the exposures for tungsten and associated mineralisation. A total of 100 no of primary samples from bed rock samples will be collected for chemical analysis for assay of 23 elements by ICP-MS (viz. 14 REE and 09 Trace elements namely, U, Ta, Ge, Be, Hf, Sn, As, Rb, Th) to delineate the ore zones. Also, analysis of additional 8 Trace elements W, Mo, Co, Cu, Pb, Zn, Nb and K, for 100 numbers of primary bedrock samples. In connection with this night traverses will be taken on the Quartz Reef ridges with UV lamp to detect the fluorescence of any tungsten bearing minerals for around 300 numbers of samples. Total 10 nos. of external check samples (10%) will also be analyzed for assay of 23 elements by ICP-MS (viz. 14 REE and 09 Trace elements namely, U, Ta, Ge, Be, Hf, Sn, As, Rb, Th) to delineate the ore zones. Also, analysis of additional 8 Trace elements W, Mo, Co, Cu, Pb, Zn, Nb and K, for 10 numbers of primary bedrock samples

5.2.7 Pitting and Trenching

Shallow trenching (Excavation) shall be carried out in the tungsten anomaly zones identified based on the results of geochemical sampling. A provision of shallow trenching on mineralized zones (if any) with 200 cubic meters is kept. Locations of trenches on ground will be decided by field geologist based on tungsten anomaly zones identified and field observations. A provision of 200 nos. of primary samples for assay of 23 elements by ICP-MS (viz. 14 REE and 09 Trace elements namely, U, Ta, Ge, Be, Hf, Sn, As, Rb, Th) to delineate the ore zones. Also, analysis of additional 8 Trace elements W,Mo, Co, Cu, Pb, Zn, Nb and K, for 200 numbers of primary samples. Total

20 nos. of external check samples (10%) will also be analyzed for assay of 23 elements by ICP-MS (viz. 14 REE and 09 Trace elements namely, U, Ta, Ge, Be, Hf, Sn, As, Rb, Th) to delineate the ore zones. Also, analysis of additional 8 Trace elements W, Mo, Co, Cu, Pb, Zn, Nb and K, for 20 numbers of primary samples.

5.2.8 Mineragraphic and Petrographic Studies:

During the course of Geochemical sampling 10 samples from various lithounits from surface will be studied for petrography in thin section and 10 samples from mineralized zones will be studied for the mineragraphy (ore mineral assemblages and their distribution, alteration, enrichment etc.) in polished sections.

5.2.9 Scanning Electron Microprobe Studies

Scanning Electron Microprobe (SEM) has been used for elemental identification and semi-quantitative compositional information of samples with high resolution image of the mineral phases. 10 nos. of tungsten bearing quartz reefs samples to be studied in the SEM-EDX to know the mineralogical and geochemical characteristics of the recorded minerals in the intrusive vein and host rock. Samples which are positive with tungsten anomalies will be studied.

5.2.10 Electron Probe Micro-Analysis Studies

Electron Probe Micro-Analyzer (EPMA) is an analytical tool used to non-destructively determine the chemical composition of small volume of solid materials. Ten numbers of polished thin sections of quartz reef will be collected. Samples which are positive with tungsten mineralization (wolframite / Scheelite) anomalies will be studied.

5.2.11 X-Ray Diffraction Studies:

A total of 10 nos tungsten bearing samples representing the deposit will be subjected to X-Ray Diffraction studies to know about the general distribution pattern of the constituent minerals of the ore.

5.2.12 Core Drilling:

5.2.12.1 As mentioned above after the completion and review of Phase I exploration work, Phase II involving 800m of core drilling will be carried out. Ten boreholes with 80m depth of each borehole will be planned based on the geological mapping, bed rock, pitting/trenching, etc. sampling carried out in the Phase I G4 level exploration programme.

5.2.12.2 **Core Logging:**

Geological core logging will be carried out systematically by recording carefully the minute details and physical/lithological characters of the rock formations including

colour, core recovery, grain size, weathered zone, texture, banding, mineralogical composition, micro-structural/structural details, lithological variations along with visual estimate and under short wave UV light in respect of tungsten ore in boreholes.

5.2.12.3 **Core Sampling:**

For preparation of samples, the borehole core will be split into two equal halves by using core splitter. One half will be powdered to (-) 200 mesh size and the other half will be kept for future studies. The powdered material will be mixed thoroughly and about 100 grams of samples will be taken for chemical analysis by successive coning and quartering as composite samples and rest of the material (-200 mesh size) will be kept as duplicate half for future reference. It will generate about 100 Nos. core samples and10 nos. check samples (10% External check of composite samples).

5.2.13 CHEMICAL ANALYSIS:

All the primary core samples i.e. 200 nos. for assay of 23 elements by ICP-MS (viz. 14 REE and 09 Trace elements namely, U, Ta, Ge, Be, Hf, Sn, As, Rb, Th) to delineate the ore zones. Also, analysis of additional 8 Trace elements W,Mo, Co, Cu, Pb, Zn, Nb and K, for 200 numbers of primary samples. Total 20 nos. of external check samples (10%) will also be analyzed for assay of 23 elements by ICP-MS (viz. 14 REE and 09 Trace elements namely, U, Ta, Ge, Be, Hf, Sn, As, Rb, Th) to delineate the ore zones. Also, analysis of additional 8 Trace elements W, Mo, Co, Cu, Pb, Zn, Nb and K, for 20 numbers of primary samples.

5.2.14 Specific Gravity:

02 nos. samples from drill core of mineralised quartz reef from the boreholes will be subjected to specific gravity determination at MECL petrology laboratory by Walker steel yard balance method. This will be used for resource estimation.

6.0.0 Quantum of Work:

6.0.1 The proposed quantum of exploratory work (G4) in the Chikara block is furnished in below table

Proposed Quantum of Work, G4 stage Exploration in Chikara Block

S. No	Item details	Unit	Quantum
1	Geological Mapping (LSM) (1:12,500 scale	Sq. Km.	90.00
2	Bore Hole Fixation and determination of co-ordinates & Reduced Level (RL) of the boreholes and one reference point by DGPS	Nos.	10
3	Trenching	Cu.m	200
4	Core Drilling (Outsourced) -Very Hard Rock	M	800
5	Laboratory Studies		

S. No	Item details	Unit	Quantum
I	Primary & Check Samples from Surface outcrop and channel sample (BRS/Soil /Channel Samples)		
i)	UV-visible spectrophotometer for determination of W and associated elements		
ii)	Primary samples		
	Analysis of one rock/ soil sample for quantitative analysis of 14 REE elements + 9 trace elements (U,Ta,Ge,Be,Hf,Sn,As,Rb,Th) by ICP-MS (sequential technique)	Nos.	500
	Analysis of additional 8 Trace elements W, Mo, Co, Cu, Pb, Zn, Nb and K	Nos.	500
iii)	Check samples (10% external)		
	Analysis of one rock/ soil sample for quantitative analysis of 14 REE elements + 9 trace elements (U,Ta,Ge,Be,Hf,Sn,As,Rb,Th) by ICP-MS (sequential technique)	Nos.	50
	Analysis of additional 8 Trace elements W, Mo, Co, Cu, Pb, Zn, Nb and K	Nos.	50
II	Physical & Petrological Studies		
i)	XRD Studies	Nos.	10
ii)	Complete Petrographic Studies	Nos.	10
iii)	Complete Mineragraphic Studies	Nos.	10
iv)	Study of Thin section	Nos.	10
v)	SEM-EDX Studies	Per hour	10
vi)	EPMA Studies	Per hour	10
6	Specific Gravity	Nos.	2
7	Geological Report Preparation {As per Mineral (Evidence of mineral contents) Rule-2015}	Nos.	1

6.1.0 Time Schedule and Cost Estimates

6.2.0 Time Schedule:

The field work will take 06 months for completion Phase I exploration work. The sampling work will take 02 months overlapping with other exploration activities. Laboratory studies will take 02 months overlapping with other exploration activities. Thus, Phase I exploration work will be completed in 06 months. Review will be taken up after 03 months and after completion of Phase- I. Phase II will begin after the outcome of Phase I and recommendation of TCC. Phase II core drilling will take another 05 months for completion. Core sampling will take 04 months overlapping with drilling for 04 months. Laboratory studies will take 06 months overlapping with sampling for 04 months. Preparation of Geological Report will take another 02 months to complete overlapping with lab. studies for 02 month. Thus, the total duration of the project will be of 12 months.

TIME SCHEDULE/ACTION PLAN FOR RECONNAISSANCE SURVEY (G-4) FOR TUNGSTEN & ASSOCIATED MINERALS IN CHIKARA BLOCK, DISTRICT - JHANSI, UTTAR PRADESH. Total Area - 90.00 sq km (approx.) ; Drilling: 800 m (Scout BH), 10 BH (approx. 80 m depth); Completion Time - 12 Months, Review after: 3, 6 and 9 months

Sl. No.	Activities	Unit	MONTHS													
			1	2	3		4	5	6		7	8	9		10	11	12
1	Camp Setting	day				REVIEW				REVIEW				REVIEW			
2	Geologist Party days in Field (1 Party)	day															
3	Core Drilling (2 Rig)	m.															
4	Sampling Party days, Core Sampling	day															
5	Camp Winding	day															
6	Laboratory Studies	Nos.															
7	Geologist Party days in HQ (1 Party)	day															
8	Report Writing & Peer review	day															
	Note:																
1	**Commencement of project may be reckoned from the day the exploration acreage is available along with all statutory clearances.**																
2	**Time loss on account of monsoon/agricultural activity/forest clearance/local law & order problem/ lockdown etc. will be additional to above time line.**																

6.3.0 Cost Estimates:

6.3.1 Tentative cost has been estimated based on Schedule of Charges (SoC) of projects funded by National Exploration Development Trust (NMEDT). The total cost estimate of **Rs. 307.61 Lakhs** is being proposed for completion of exploratory work up to G4 level. Activity wise break-ups of the same are furnished below:

Sl. No.	Item	Total
1	Geological Work	47,27,172.00
2	Mineral Investigation (Pitting/Trenching, Core Drilling,etc.)	1,20,01,000.00
3	Laboratory Studies	68,46,400.00
4	**Sub total**	2,35,74,572.00
5	Total Outsourced Component	1,01,20,000.00
6	Tendering Cost	2,02,400.00
7	Reimbursement of cost in case of outsourced components of project work	10,12,000.00
8	Report	7,50,000.00
9	Peer Review Charges	30,000.00
10	Proposal Preparation	5,00,000.00
11	**Total**	2,60,68,972.00
12	GST (18%)	46,92,414.96
Total cost including 18% GST		**3,07,61,386.96**
SAY, in Lakhs		**307.61**

REFERENCES

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2. MECL (2022): Geological Report on Reconnaissance Survey (G-4) For Copper, Lead, Zinc and Gold in Laron Block, District: Jhansi, State: Uttar Pradesh
3. S.P. Nim (2004): Report on Reconnoitory Survey of Quartz Reefs in Bundelkhand Granitoid Complex for use as Abrasive/Refractory Minerals in parts of Southern Uttar Pradesh.

Annexures:

1. Location Plan
2. Regional Geological Plan
3. Block Geological plan with NGCM Bedrock Samples