DETAILED GEOLOGICAL REPORT

PROPOSAL FOR RECONNAISSANCE SURVEY (G – 4) FOR PGE, GOLD AND REE IN MANERI – SITAPALA BLOCK (80 SQ KM), BALAGHAT DISTRICT, MADHYA PRADESH

COMMODITY: PGE, GOLD AND REE

BY

GEMCOKATI EXPLORATION PRIVATE LIMITED

PLOT NO-34, POSTAL COLONY, BAPAT NAGAR, CHANDRAPUR-442401, MAHARASHTRA.

PLACE: CHANDRAPUR

DATE: 10TH JULY 2023

Plot 34, Bapat Nagar, Nagpur Road, Chandrapur 442401
Phone: +91 85959 14877; Email: keshava.prasad@gemcokati.com
www.gemcokati.com

Summary of the Block for Reconnaissance Survey (G4 Stage)
GENERAL INFORMATION ABOUT THE BLOCK

PGE, GOLD AND REE IN MANERI – SITAPALA BLOCK (80 SQ KM), DISTRICT – BALAGHAT, MADHYA PRADESH FOR RECONNAISSANCE SURVEY (G-4 STAGE) UNDER NMET (Toposheet No. 64 C/11)		
	Features	**Details**
	Block ID	**MANERI – SITAPALA BLOCK**
	Exploration Agency	**GEMCOKATI EXPLORATION PRIVATE LIMITED.**
	Commodity	**PGE, GOLD AND REE**
	Mineral Belt	Dongargarh Supergroup represents Palaeoproterozoic and Mesoproterozoic Volcano-sedimentary sequences. Clastic sediments and metavolcanics of Mesoproterozoic metamorphic sequences are known to be hosts of gold-bearing quartz veins, disseminated gold, and anomalous concentrations of PGE & REE in structurally favourable settings.
	Completion Period with entire Time schedule to complete the project	15 Months.
	Objectives	The Present Exploration Programme (G-4) is formulated based on available regional geological data on the work carried out in area; the programme has the following objectives vis-a-vis proposed field components. 1) Desktop studies using remote sensing imageries of the area structural features and wall rock alteration zones which may be indicative of potential mineralization. 2) To carry out Geological and structural mapping on 1:12,500 scale of the block (80 sq km) to delineate various litho-units and their linear / planar structural features like shear zones, fracture zones and lineaments with special attention to record potential host rocks to gold, PGE and REE mineralization / concentration. 3) Ground magnetic, SP and IP Resistivity surveys in selected zones identified by mapping. *Since the proposed*

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		block includes forest areas as well, a geophysics component is crucial, just in case of scout drilling not materializing. Hence at this stage of the proposal, geophysical survey for a notional 5 sq km is proposed. 4) To carry out systematic grab/channel/grove sampling of bed rocks from the potential mineralized zones. 5) Systematic soil sampling / overburden material and stream sediments of first and second order streams.in the areas overlying targeted host rocks on need basis. 6) XRF and ICP analysis of major and Trace elements of selected samples. 7) Petrographic studies of possible host rock. 8) Pitting-trenching of selected zones and sampling. 9) Scout Drilling of 10 nos. up to ~60m vertical depth or less than that depending on drill core observation. 10) To assess G4 category (334) Gold, PGE & REE prospects in the Block, as per UNFC norms and Minerals (Evidence of Mineral Contents) Rules.
	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 the proposed agency. Not applicable.
	Name/ Number of Geoscientists	Two (2) Geologists; Two (2) Geophysicists; One (1) Surveyor.
	Expected Field days (Geology) Geological Party Days	Geologist - 240 days; Geophysicists – 50 days; Surveyor – 30 days.

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<table>
<tr><td>1.</td><td>Location</td><td colspan="7"></td></tr>
<tr><td rowspan="12"></td><td rowspan="12">Co-ordinates of the proposed block</td><td colspan="7">MANERI - SITAPALA BLOCK</td></tr>
<tr><td></td><td colspan="3">LATITUDE</td><td colspan="3">LONGITUDE</td></tr>
<tr><td>#</td><td>D</td><td>M</td><td>S</td><td>D</td><td>M</td><td>S</td></tr>
<tr><td>A</td><td>21</td><td>26</td><td>35.89</td><td>80</td><td>30</td><td>02.82</td></tr>
<tr><td>B</td><td>21</td><td>26</td><td>39.54</td><td>80</td><td>35</td><td>01.25</td></tr>
<tr><td>C</td><td>21</td><td>24</td><td>57.61</td><td>80</td><td>34</td><td>59.71</td></tr>
<tr><td>D</td><td>21</td><td>24</td><td>57.62</td><td>80</td><td>36</td><td>08.30</td></tr>
<tr><td>E</td><td>21</td><td>24</td><td>08.34</td><td>80</td><td>36</td><td>08.61</td></tr>
<tr><td>F</td><td>21</td><td>24</td><td>06.71</td><td>80</td><td>41</td><td>59.76</td></tr>
<tr><td>G</td><td>21</td><td>22</td><td>57.97</td><td>80</td><td>41</td><td>40.58</td></tr>
<tr><td>H</td><td>21</td><td>22</td><td>59.28</td><td>80</td><td>32</td><td>20.96</td></tr>
<tr><td>I</td><td>21</td><td>23</td><td>55.73</td><td>80</td><td>31</td><td>47.19</td></tr>
<tr><td>J</td><td>21</td><td>23</td><td>56.20</td><td>80</td><td>30</td><td>01.32</td></tr>
<tr><td></td><td>Villages</td><td colspan="7">Biranpur, Chicholi, Chaukitola, Baghatola, Sitapala</td></tr>
<tr><td></td><td>Tehsil/ Taluk</td><td colspan="7">Lanji Tehsil.</td></tr>
<tr><td></td><td>District</td><td colspan="7">Balaghat.</td></tr>
<tr><td></td><td>State</td><td colspan="7">Madhya Pradesh.</td></tr>
<tr><td>2.</td><td>Area (hectares/ sq km)</td><td colspan="7"></td></tr>
<tr><td></td><td>Block Area</td><td colspan="7">80 sq km.</td></tr>
<tr><td></td><td>Forest Area</td><td colspan="7">Nearly 60% of the block area is within Protected Forest limits.</td></tr>
<tr><td></td><td>Government Land Area</td><td colspan="7">-</td></tr>
<tr><td></td><td>Private Land Area</td><td colspan="7">-</td></tr>
<tr><td>3.</td><td>Accessibility</td><td colspan="7"></td></tr>
<tr><td></td><td>Nearest Rail Head</td><td colspan="7">Darekasa and Salekasa railway stations are situated to the S & SW of the block at about 15km from the center of the block. The railway line is connected with Mumbai–Howrah rail zone in South East Central Railway zone.</td></tr>
<tr><td></td><td>Road</td><td colspan="7">The block is easily accessed from the north, from Lanji town which is tehsil HQ on the Gondiya- Lanji-Khairagarh Road.</td></tr>
<tr><td></td><td>Airport</td><td colspan="7">Wari village which is located in the north-central part of the block is about 50km from Gondiya Airport; Nagpur Airport is at about 195km and Jabalpur Airport at about 315km.</td></tr>
</table>

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4.	**Hydrography**	
	Local Surface Drainage Pattern (Channels)	A series of NE-SW trending ridges and valleys in the block has resulted in a trellis pattern of drainage in the eastern hilly areas; in the western plains dendritic drainage pattern is observed.
	Rivers/ Streams	1st, 2nd and 3rd order streams flowing from the hill ranges in the eastern part of the block and similar streams flowing southerly from the plain areas from the western part of the block, drain to Bagh River which flows southeastwards at about 1 – 5 km to the south of the block.
5.	**Climate**	
	Mean Annual Rainfall	1633mm - Balaghat district; ~ 800m - Lanji Tehsil
	Temperatures (December / January) (Minimum) Temperatures (May)(Maximum)	15°C 44°C
6.	**Topography**	
	Toposheet Number	64C/11
	Morphology of the Area	NE-SW trending parallel ridge and valley morphology are along the eastern margin of the block; plain / gently rolling topography in the western part of the block is occupied by villages and agricultural fields.
7	**Availability of baseline geoscience data**	
	Geological Map (1:50K/ 25K)	**Available.**
	Geochemical Map	-
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	-
8.	**Justification for taking up ReconnaissanceSurvey / Regional Exploration**	(1) Atlas of Geological Potential Areas of non-Fuel Minerals in India – OGP for Gold & PGE and OGP for REE & RM has been prepared by Geological Survey of India (GSI) through a comprehensive synthesis of all-available multidisciplinary earth science data to delineate new targets regions for which the mineral potentials are yet to be established and to take up exploration activities in the country. (2) The Palaeo- and Mesoproterozoic volcano-sedimentary sequences of Nandgaon Group and

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		Khairagarh Group are part of the above delineated OGP area for Gold; both the sequences are present in the proposed block; the OGP area for PGE is located within 50km radius from the project area with a similar geological setting. (3) Clastic sediments and metavolcanics of Mesoproterozoic metamorphic sequences are known to be hosts of gold-bearing quartz veins, disseminated gold, and anomalous concentrations of PGE & REE in structurally favourable settings. (4) Therefore, a G4 exploration programme for Gold, PGE and REE is being proposed in this region.

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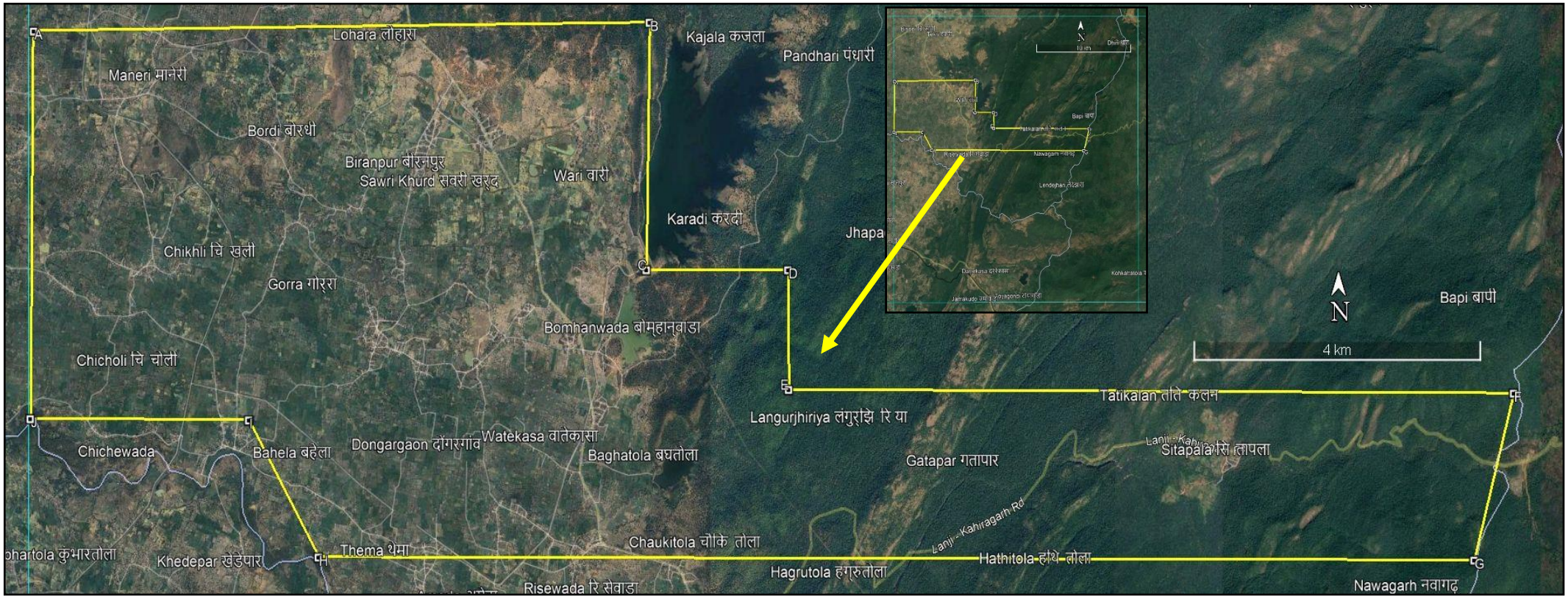
1. **Proposed Block area on Google Earth image.**



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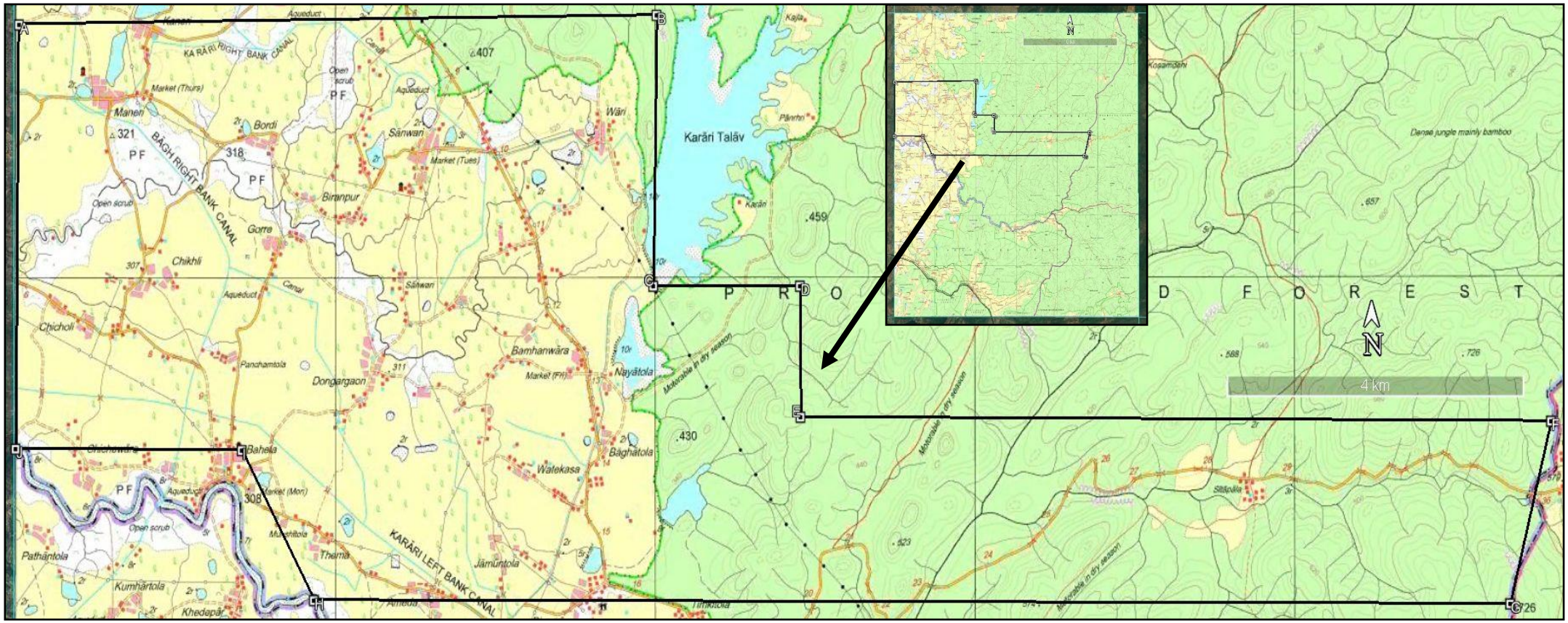
2. Location of the proposed block demarcated on Survey of India (SOI) Toposheet 64 C/11.



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1.0.0 Block Summary

1.1.0 Preamble:

1.1.1 Introduction of National Mineral Policy, 2016 and the series of amendments to the Mines and Minerals (Development & Regulation) [MMDR] Act since 2015, has received the much-needed impetus to the exploration of mineral commodities in the country. These amendments also paved way for participation of Notified Private Exploration Agencies in Mineral Exploration activities to catalyze the search for various mineral commodities, much needed for the Atmanirbhar Bharat.

1.1.2 Subsequently in 2020, the Geological Survey of India (GSI), being the premiere organization entrusted for the baseline data acquisition, processing and interpretation of non-fuel mineral commodities, has rolled out geological potential maps for a host of non-energy mineral commodities in the form of Atlas of Geological Potential Areas of Non-fuel Minerals in India.

1.1.3 The Atlas of Obvious Geological Potential Areas for mineralization of different non-energy mineral commodities, thus formed the starting point in recognizing potential areas for Reconnaissance Survey (G-4) for specific commodities of interest. Then identifying the gap areas wherein, the State and Central Exploration agencies have not yet carried out such exploration activities has resulted in the carving out of a block for the Reconnaissance Survey (G-4) in the present proposal.

1.1.4 Although, as per the Geological Potential Atlas, a major part of the proposed block falls in area marked as OGP-Gold, principles of Metallogenic Epochs has been applied to envisage mineralization as a result of Palaeoproterozoic Volcanism which include REE, vanadiferous titanomagnetites and possible base metals (Cu, Ni, Co). So effectively this is a total Greenfield exploration proposal backed by some field data acquired during a quick reconnaissance field visit.

`1.2.0 Physiography

The physiography in the proposed block presents a contrasting picture between western and eastern part of the block.

The western part of the block is relatively flat-lying soil covered area; the minimum and maximum elevation in this part of the block is 304m and 327m respectively. Several villages and agricultural lands occupy this part of the block.

On the other hand, the eastern part of block represents a ridge and valley topography with minimum and maximum elevation being 327m and 566m respectively. It is occupied by thick forest and outcrop-rich NNE – SSW trending

ridges and valleys. The figure below gives a clear picture of the contrasting topographies of the two parts of the block. proposed area is an undulating country with high ridges towards east with laterite capping, thickly forested with intervening valleys.

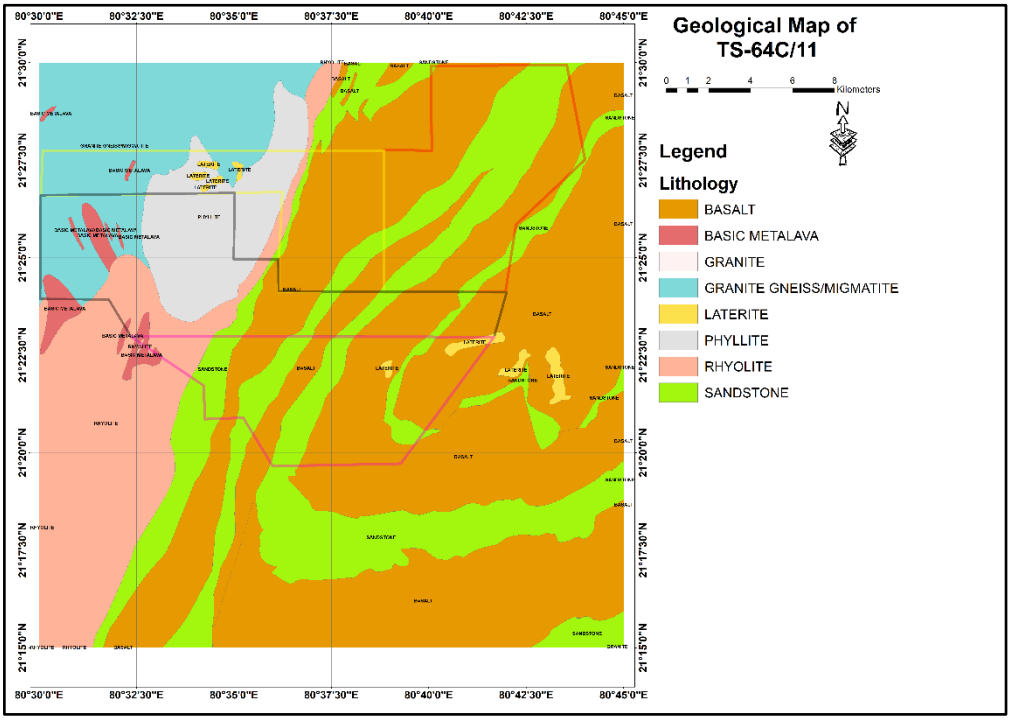
Higher order streams originating in the higher elevations of the block ultimately drain in to eastward flowing Bagh River which is located to the south of the block.

1.2.1 Background of Previous work:

A perusal of GSI portal for relevant reports for the toposheet 64C/11 yielded 4 reports. The area in the toposheet has been part of the studies:

1. Mapping by Dr. S.N. Sarkar (1949-50);
2. Search for chromite by R.K. Sharma & Harbans Kumar (1968);
3. Regional Integrated Surveys by V.D. Mahajan (1977) and
4. Search for Dimension Stones by A.K Dawande, S.D. Pimprikar, J.K. Srivastava. A.A. Dharwadkar and D.V. Ganvir (1997).
5. STM by Pradeep Mawar (2012) in adjacent toposheets

1.2.2 Regional Geology & Description of stratigraphic units:



3 - Regional Geology of Toposheet 64C/11 (Bhukosh 1:50,000 Map)

The Stratigraphic Sequence of the lithological formations exposed in the region is presented in the table below:

Regional Stratigraphy of Toposheet 64C/11			
Age	**Supergroup**	**Group**	**Formation**
Palaeoproterozoic - Mesoproterozoic	**Dongargarh Supergroup**	Khairagarh Group	Kotima Basalt
			Ghogra Sandstone
			Mangikhuta Basalt
			Karutola Sandstone
			Sitagota Basalt
			Bortalao Sandstone
Palaeoproterozoic		Nandgaon Group	Bijli Rhyolites
Archaean	**Amgoan Gneissic Complex**	Amgoan Group	Amgoan Gneiss
			Phyllites
			Metalava enclaves

1.2.3 Description of Stratigraphic Units:

The Amgoan Gneissic Complex consisting of Basement gneisses and supracrustals - phyllites and enclaves of meta-lava, Nandgaon Group represented by Bijli Rhyolites and Khairagarh Group represented by alternating sequence of Sandstones and basalts make up the lithopackage present in the block area.

Amgoan granitic gneiss / migmatite:

Amgoan granitic gneiss is usually medium to coarse-grained rock with well-developed foliation. The granitic rock after a prolonged compressive stress has converted to gneiss. The texture is granoblastic, equigranular to inequigranular; gneissic fliationb is defined by sub-parallel alignment of biotite flakes, elongated quartz and feldspar crystals; colour varies from light grey to pinkish grey (Pradeep Mawar, 2012 – STM in contiguous toposheets).

Meta-lava / metabasalt / amphibolite enclaves:

In the western parts of the block where-in rocks of Amgaon gneissic complex are present, occur a few enclaves of fine-grained massive metabasalt and medium to fine-grained amphibolite. However, extensive cultivation activities overall several decades in this part of the block, have obliterated many such enclaves shown on the Bhukosh geological map.

Bijli Rhyolite:

The rhyolites are hard, generally pink- and grey-coloured rocks. In the block area where outcrops were encountered, they are porphyritic texture with phenocrysts of quartz and elongated feldspar set in medium to fine grained matrix.

Basalt:

Basalts occupy the valley portions in the eastern part of the block. They are greenish grey in general and show a wide variety of textures – from hard compact fine-grained rocks to amygdular basaltic (and pitted texture where amygdales are dislodged) to porphyritic textures with phenocrysts of glassy material set in fine matrix.

Sandstone:

The sandstones form the high ridges in the eastern part of the block area. They are grey to off-white to pale pink coloured hard, compact rocks. They show primary bedding and cross lamination features at places.

Intrusive Gabbro:

One spinel-bearing peridotitic intrusive body is present in the basalt in the eastern part of the block.

Laterite:

Several laterite occurrences have been recorded in the toposheet are located outside the block area. However, there appears to be many more laterite patches which have not been recorded on the available geological map. These laterites have developed over the Archean supracrustals as well as Paleo- and Mesoproterozoic volcanic rocks.

Clay:

Several clay pockets have developed in the supracrustal-occupied areas but all of them are located outside this block area.

1.2.4 Mineral potentiality based on Geology

This proposal was conceived based on extensive literature survey on mineralization potential of palaeo- and meso-Proterzoic volcanic provinces. It is found that such volcanic provinces do have significant PGE concentrations in similar stratigraphic settings. Couple of important references are cited at the end of this document.

Subsequent to the desktop studies on the available literature on Meso-proterozoic volcanics, the focus of reconnaissance fieldwork was to look for gabbroic phases within the basaltic terrain.

Based on the reported occurrences of Pyroxinitic / gabbroic / peridotitic intrusive phases in the Khairagarh Volcano-sediments, a search for chromite was launched in 1968; however, no such occurrences were found.

Stream sediment sampling carried out in the western part of Toposheet no. 64C/11(V.D. Mahajan, 1977), where metagabbro dykes, Bijali rhyolites and tuffs, Pitepani metabasalt belonging to Dongargarh supergroup are exposed, did not bring out significant basemetal anomalies. However, one sample from stream draining over rhyolite intruded by aplite vein showed anomalous value for copper and **two samples** from streams originating from a small raised area **where metagabbro is exposed** showed low anomaly for nickel.

These were considered as spot anomalies of no economic significance. Therefore, no further follow-up work was recommended in this area.

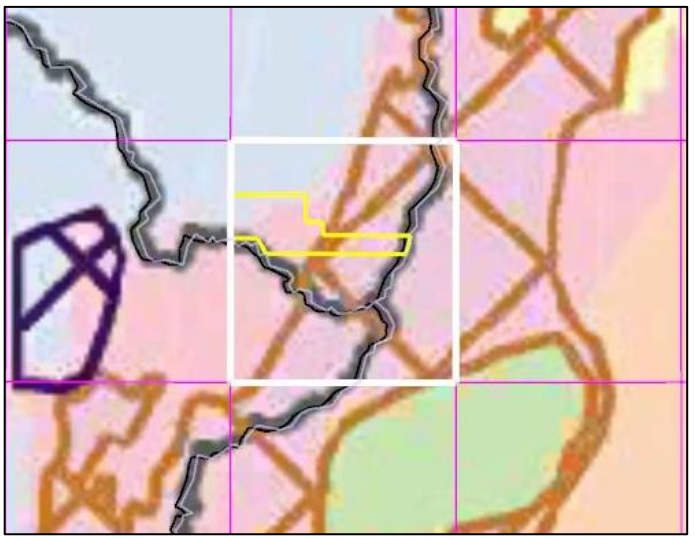
But it is well established fact that the gabbroic intrusive phases associated with Meso-Proterozoinc Volcanics do have affinity towards chalcophile elements (Ni, Co, Cu, Cr) and magnetite-bearing gabbro can have significant PGE anomaly upto 1%.

Three (3) such magnetite gabbro were sampled and were analyzed; the Ni values range from 112ppm to 209ppm (against normal background values of 80 ppm); the Co values range from 73ppm to 148ppm (against normal background values of 25 ppm); V values range from 199pm to 310ppm (against normal background values of 120 ppm); The totalPGE values ranged from 0.23 to 0.25ppm.

Encouraged by the above results, one more sampling programme was mounted – this time the focus was to sample exclusively from the magnetitite-bearing gabbro/basalt zone. During this sampling programme, a total of 11 samples were collected from the ~350m long zone and were analyzed for PGE by NiS Fire Assay. This time the totalPGE values ranged from 0.12ppm to 0.49ppm.

Therefore it is submitted that the Meso-Proterzoic volcanic suite of basalts which occupy nearly 20sq km of the total area of the block, are to be taken up to delineate the intrusive gabbroic phases within them.

Further, the Atlas of Geological Potential Areas indicates that the entire Khairagarh volcano-sedimentary sequence as OGP for gold; PGE area is situated in the toposheet west of the present block in the boundary between Amgaon neiss and Bijli Rhyolite. (Fig. below).



4 – The proposed Block with reference to the OGP map for Gold (yellowish brown polygons) and PGE (dark blue polygons)

Going through the literature on the limited amount of field investigations carried out in parts of the area, considering the overall geology and structure, coupled with metallogenic epoch criteria, and abundant literature available on mineralization in similar Meso-Proterozoic geological settings, it is submitted that the region can have high potential for deep seated mineralization for gold, PGE, nickel, basemetals and associated minerals.

2.0.0 Block description:

The proposed block area is approached through Nagpur to Amgoan -Lanji road; from Amogaon, the block is easily accessed from the north, from Lanji town which is tehsil HQ on the Gondiya- Lanji-Khairagarh Road.

The block is about 25km from Amgoan and 10km from Lanji town. Darekasa and Salekasa railway stations are situated to the S & SW of the block at about 15km from the center of the block. The railway line is connected with Mumbai–Howrah rail zone in South East Central Railway zone.

Wari village which is located in the north-central part of the block is about 50km from Gondiya Airport; Nagpur Airport is at about 195km and Jabalpur Airport at about 315km.

Table: - 1 Block Description

MANERI - SITAPALA BLOCK					
LATITUDE			LONGITUDE		
D	M	S	D	M	S
21	26	35.89	80	30	02.82
21	26	39.54	80	35	01.25
21	24	57.61	80	34	59.71
21	24	57.62	80	36	08.30
21	24	08.34	80	36	08.61
21	24	06.71	80	41	59.76
21	22	57.97	80	41	40.58
21	22	59.28	80	32	20.96
21	23	55.73	80	31	47.19
21	23	56.20	80	30	01.32

2.1.0 Field visit by GEMCOKATI and Results

Subsequent to identifying the gap area for Reconnaissance Exploration Project proposal and on receipt of in-principle approval for 4 contiguous blocks, Gemcokati mounted a 10-days field visit to collect representative bedrock samples from the proposed blocks. Despite the lack of interior roads to cover the block areas uniformly, efforts were made to visit all the blocks and collect samples from each of the 4 blocks. At least one sample of every rock type occurring in each block were collected.

During the field visit, no visible mineralization indication were seen, except a magnetite rich gabbroic dyke intruded into the basalt.

Out of a total of 44 bedrock samples, 21 samples were collected from the present Maneri – Sitapala Block. And of the 21 samples, 12 samples were analyzed at Shiva labs, Bengaluru. The sample locations and the details are presented in the figure & table below.

The limited fieldwork could delineate one zone of magnetite / Fe-Al Spinel bearing rocks with in 10m of the contact from sandstone, within the basalt. The zone is 270m long (measured on Google Earth) and about 30m in width on a sloping ground. Rich disseminations of octahedral crystals of spinel, initially suspected as magnetite (but not highly magnetic), were found in fine-grained dark greyish green matrix and in other outcrops had a ferruginous tint all over. Three samples, two from northern and southern extremes and one sample from the central part of the magnetite-rich zone were collected.

Based on the literature survey which pointed out that magnetite bearing enclaves in meso-Proterozoic basalts may potential for anomalous concentration of PGE, the three samples were analyzed for PGE with NiS-Fire assay with ICP finish method.

The details of the samples collected during the field visit and the different analytical method used for analyzing the samples are shown in the table below.

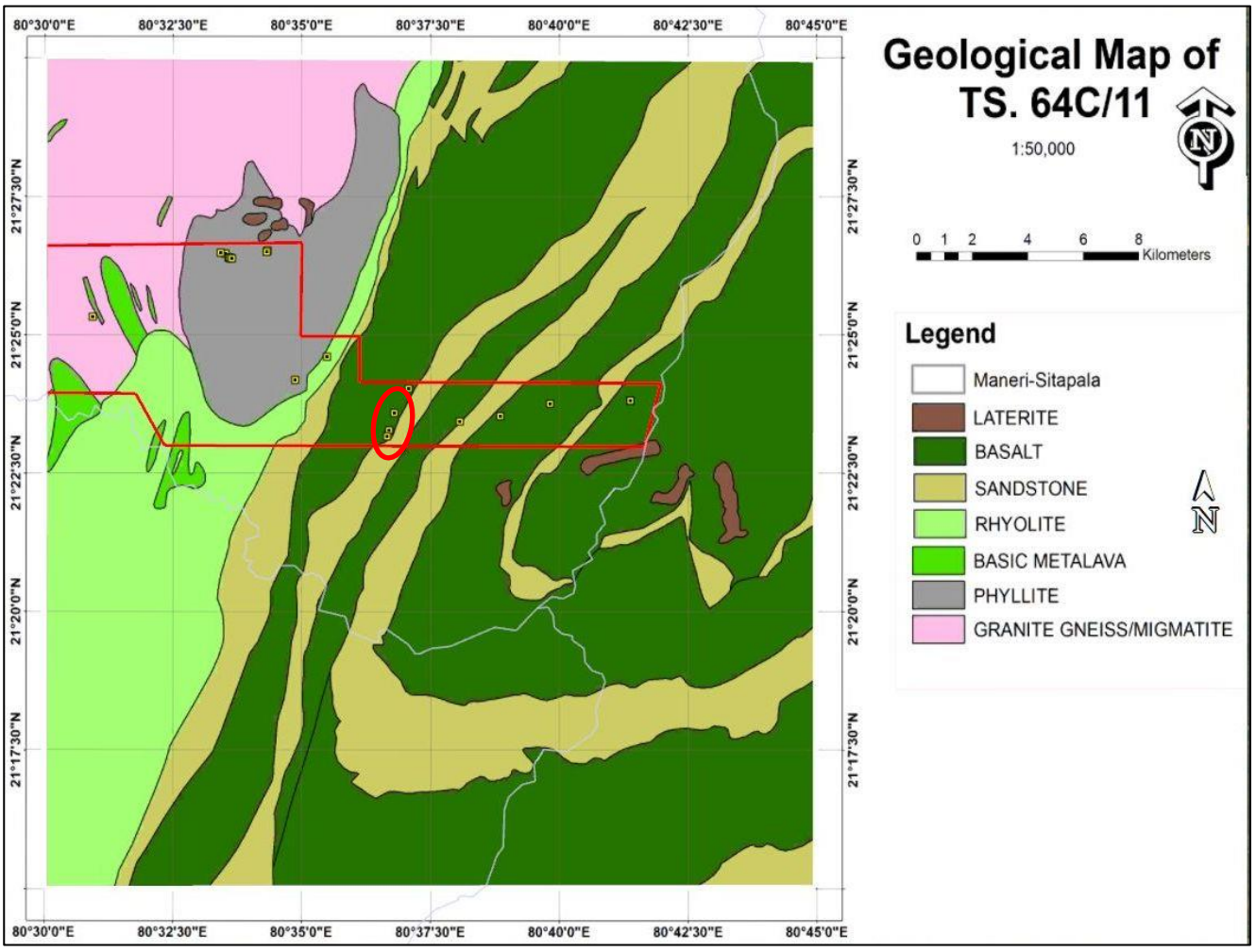
Table 2 – Details of Samples collected in the first phase of sampling and analytical method adopted

#	Lat.	Long.	Label	Lithology	Analysis Method
1	21.4411	80.5590	280423-04	Clay	XRF for Major Elements; REE by ICP MS
2	21.4398	80.5606	280423-07	Clay	XRF for Major Elements; REE by ICP MS
3	21.4417	80.5724	280423-10	Clay	XRF for Major Elements; REE by ICP MS
4	21.4421	80.5726	280423-11	Laterite over Phyllite	XRF for Iron Ore; Au by Fire Assay
5	21.3968	80.6902	290423-11	Laterite over Basalt	XRF for Iron Ore; Au by Fire Assay
6	21.3868	80.6119	290423-02	Magnetite Gabbro	Major & Minor Metals by 4 acid digestion & ICP OES finish; PGE by NiS Fire Assay
7	21.3861	80.6114	290423-03	Magnetite Gabbro	Major & Minor Metals by 4 acid digestion & ICP OES finish; PGE by NiS Fire Assay
8	21.3879	80.6120	290423-04	Magnetite Gabbro	Major & Minor Metals by 4 acid digestion & ICP OES finish; PGE by NiS Fire Assay
9	21.3750	80.6213	290423-05	Basalt	Major & Minor Metals by 4 acid digestion & ICP OES finish
10	21.4031	80.5816	030523-01	Rhyolite	Major & Minor Metals by 4 acid digestion & ICP OES finish
11	21.4294	80.6010	030523-02	Rhyolite with qz veins	Major & Minor Metals by 4 acid digestion & ICP OES finish
12	21.4101	80.5919	030523-04	Rhyolite	Major & Minor Metals by 4 acid digestion & ICP OES finish

Three of the grab samples which contained magnetite disseminations, collected from basaltic area of the map, as shown within the red circle in the figure below, returned the following values of PGE.

Table 3 – PGE values in 3 samples from magnetite-bearing zone within the basalt

Balaghat Samples (ppb)			
Sample Number	290423-02	290423-03	290423-04
Pt	90	70	100
Pd	1	1	10
Ru	110	220	40
Rh	10	20	20
Ir	20	20	80
PGE (T)	231	331	250



5. Sampling locations during the first phase fieldwork in the Maneri Sitapala block

Encouraged by the above results, another sampling programme was mounted, this time focusing on the area within the red circle where the magnetite-bearing rocks were present. During the second phase of sampling, a 15m wide and 330m long zone of rocks, suspected to be thin gabbroic intrusions in to the basalt was delineated and 11 samples were collected and submitted for PGE analysis by NiS Fire Assay method. The details of samples and results are presented in the table below.

6. The basalt exposures in the magnetite-bearing gabbro zone in Maneri Sitapala Block

7. Magnetite-rich zone with in the basalt

8. Magnetite-rich zone with in the basalt

Table 4 – The analytical results of 2nd set of magnetite-bearing gabbroic phase samples within basalt

UNITS	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)
DL	0.002	0.002	0.002	0.002	0.002	
Sample No.	Pt	Pd	Ru	Rh	Ir	Total PGE
200623-01	0.13	0.01	0.13	0.02	0.02	0.32
200623-02	<0.005	0.11	0.20	<0.005	<0.005	0.31
200623-03	0.11	<0.005	<0.005	<0.005	0.01	0.12
200623-03a	0.10	<0.005	0.04	<0.005	0.01	0.15
200623-04	0.08	<0.005	0.09	0.01	0.01	0.19
200623-05	0.05	<0.005	<0.005	<0.005	<0.005	0.05
200623-06	0.11	<0.005	0.11	0.01	0.03	0.26
200623-07	0.13	<0.005	0.11	0.01	0.02	0.27
200623-08	0.19	<0.005	0.23	0.04	0.02	0.49
200623-09	0.11	<0.005	0.04	<0.005	0.01	0.17
200623-10	0.11	<0.005	0.13	0.01	0.01	0.27

Other analytical results are presented below.

Table 5 – The analytical results of Clay and laterite samples by XRF

#	Sample No.	Lithology	Au (ppm)	Al2O3	BaO	CaO	Cr2O3	Fe2O3	K2O	MgO	MnO
		Crustal Abundance		8.23							
1	280423-04	Clay	-	16.11	<0.05	0.05	<0.05	1.24	0.06	0.08	<0.05
2	280423-07	Clay	-	18.09	<0.05	<0.05	0.25	4.54	<0.05	0.07	<0.05
3	280423-10	Clay	-	22.27	0.08	0.19	<0.05	1.48	3.71	0.62	<0.05
4	280423-11	Laterite on Phyllite	<0.01	18.85	<0.05	0.12	0.08	45.68	1.07	0.14	<0.05
5	290423-11	Laterite on Basalt	<0.01	15.76	<0.05	0.10	0.09	54.44	<0.05	<0.05	<0.05

#	Sample No.	Lithology	Na2O	P2O5	SiO2	SO3	TiO2	SrO	V2O5	ZrO2	LOI
		Crustal Abundance		0.10			0.56		0.02		
1	280423-04	Clay	<0.08	<0.05	75.17	<0.05	0.68	<0.05	<0.05	<0.05	6.34
2	280423-07	Clay	<0.08	<0.05	68.53	<0.05	0.59	<0.05	<0.05	<0.05	7.65
3	280423-10	Clay	0.11	<0.05	64.31	<0.05	0.96	<0.05	<0.05	<0.05	6.11
4	280423-11	Laterite on Phyllite	<0.08	0.24	22.37	<0.05	0.94	<0.05	0.17	<0.05	10.15
5	290423-11	Laterite on Basalt	<0.08	0.26	15.29	<0.05	3.04	<0.05	0.36	<0.05	10.41

Table 6 – The analytical results of basalts by ICP-OES

#	Sample No.	LITHOLOGY	Ag	Al	Ba	Ca	Cd	Co	Cr	Cu	Fe	Ga
		Crustal Abundance						25		60		
1	290423-02	Magnetite-bearing Gabbro	<1	59868	59	5071	22	73	25	157	244301	30
2	290423-03	Magnetite-bearing Gabbro	<1	139262	295	7386	11	148	58	193	202603	38
3	290423-04	Magnetite-bearing Gabbro	<1	57872	98	1092	20	106	36	133	252923	28
4	290423-05	Basalt	<1	79821	218	62693	<10	50	239	69	70194	13
5	030523-01	Rhyolite	<1	68713	1010	828	<10	11	<10	8	27833	21
6	030523-02	Rhyolite with qz veins	<1	45192	656	1149	<10	7	60	88	54445	16
7	030523-04	Rhyolite	<1	52926	670	316	<10	9	<10	11	45074	13

	Sample No.	LITHOLOGY	K	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb
		Crustal Abundance						80				
1	290423-02	Magnetite-bearing Gabbro	693	9513	2759	<10	<100	112	3418	<5	<100	<10
2	290423-03	Magnetite-bearing Gabbro	13847	13244	2082	<10	1923	209	1925	<5	104	<10
3	290423-04	Magnetite-bearing Gabbro	912	5725	2154	12	<100	152	1873	<5	<100	<10
4	290423-05	Basalt	7729	48635	1053	<10	8255	139	432	<5	<100	<10
5	030523-01	Rhyolite	40861	2949	149	<10	837	11	223	<5	418	<10
6	030523-02	Rhyolite with qz veins	18746	2487	905	<10	490	41	656	<5	<100	<10
7	030523-04	Rhyolite	26832	3595	759	<10	370	<5	181	<5	<100	<10

#	SAMPLE NO.	LITHOLOGY	Sn	Sr	Te	Tl	Ti	V	W	Zn	Zr
		Crustal Abundance						120			
1	290423-02	Magnetite-bearing Gabbro	<10	139	24	<10	2412	283	<10	<5	64
2	290423-03	Magnetite-bearing Gabbro	<10	60	<10	<10	1551	541	<10	139	146
3	290423-04	Magnetite-bearing Gabbro	<10	74	49	<10	2392	249	<10	170	73
4	290423-05	Basalt	<10	121	<10	<10	3711	199	<10	<5	69
5	030523-01	Rhyolite	<10	40	<10	<10	2172	<10	<10	<5	369
6	030523-02	Rhyolite with qz veins	<10	10	<10	<10	968	<10	<10	48	270
7	030523-04	Rhyolite	<10	12	<10	<10	2264	<10	<10	60	326

Based on the analytical results of samples collected during the field visit, a G-4 stage Reconnaissance Survey with following objectives is proposed for the block.

1. A systematic reconnaissance survey of the Khairagarh Volcano-sedimentary sequence using hyper-spectral and multi-spectral satellite data.

2. Airborne magnetic survey using Drone-mounted Magnetic sensors for fast and higher resolution data acquisition, interpretation for delineating magnetite-bearing zones which may be potential zones of PGE accumulation.

3. Detailed Mapping, Trenching and sampling of the magnetite gabbro (?) zone in the basalt which has returned very promising PGE values with total PGE (mainly Pt-Ru) ranging from 0.12 ppm to 0.49ppm.

4. Scout drilling of 5 inclined BHs to check the continuity of the zone up to a vertical depth of 50m / 60m.

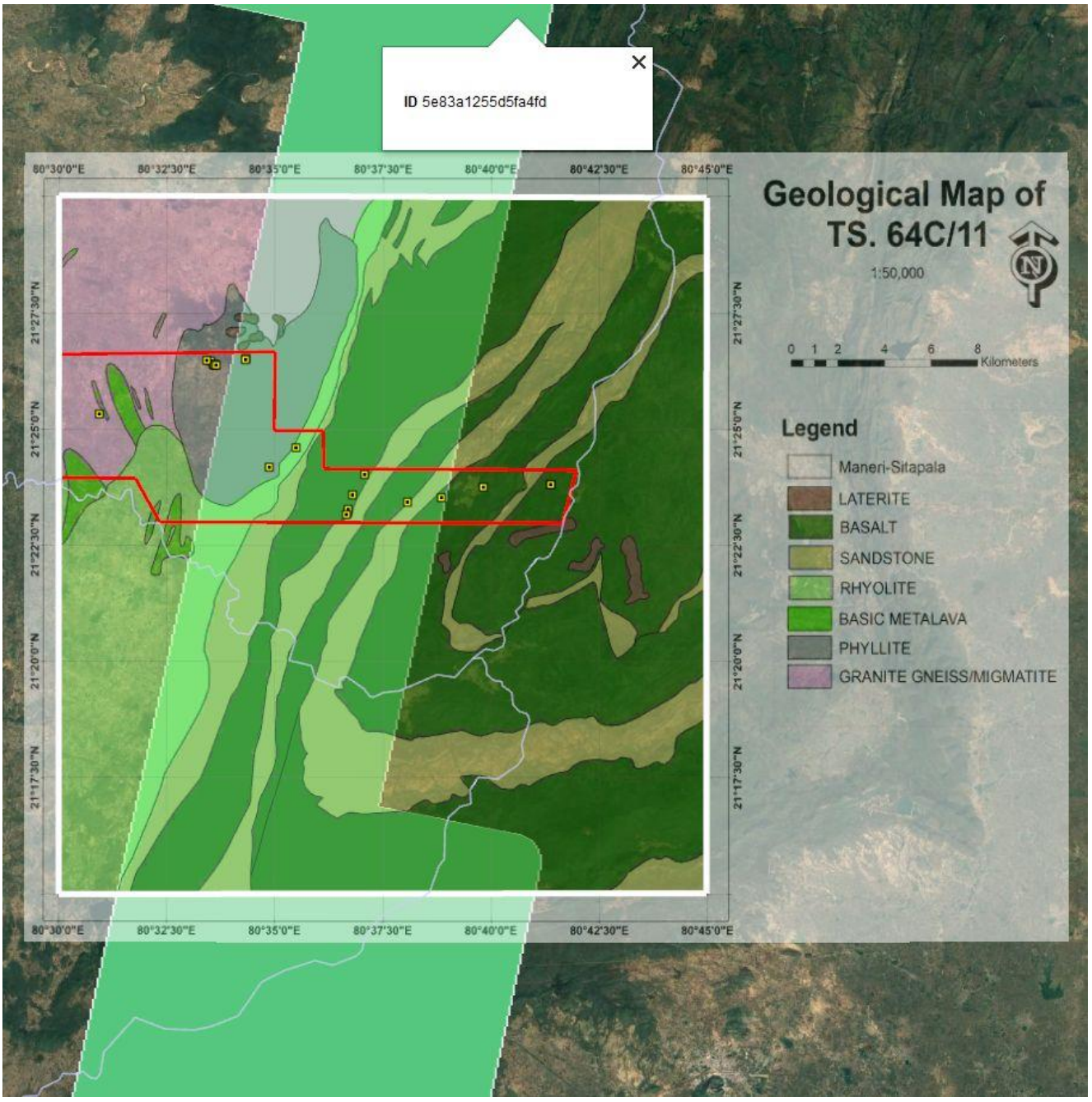
5. Pitting and sampling of the laterite-covered hills whose samples have returned anomalous values of V2O5.

3.0.0 Planned Methodology

The exploration program is proposed in accordance to the objective set for reconnaissance survey (G-4) as per Minerals (Evidence of Mineral Contents) Rule-2015.

3.1.0 Remote Sensing Studies

Hyperspectral Hyperion image for a part of this toposheet / block is available as shown below. the Hyperion imagery (the Scene ID Is shown in fig. below) which is available with NASA. Covers about 300 sq km of the toposheet and about 32sq. km out of total 80sq km area of the present block.



9. The available Hyperspectral Imagery coverage for the proposed area of the project

Gemcokati plans to acquire the said hyperspectral Hyperion imagery from NASA public domain; it is also planned to acquire multispectral imagery / data available with NRSA and use both in conjunction to interpret and produce element and mineral potential maps. An option of acquiring Hyperspectral Hyperion data for the entire toposheet is also being explored – through a Nagpur-based company - Aerizone Creative Labs. Pvt. Ltd., at a cost of Rs 10 lakhs if approved by NMET.

3.2.0 Geological Mapping

Geological mapping of 80 sq. Km area of the block would be carried out on 1:12,500 scale. Various litho-units, their contact relationship, textural characters and structural features will be mapped. Surface manifestations of any mineralization available along with their surface disposition will be marked on map. Focus will be on the potential target zones arising out the hyperspectral data interpretation and identifying the intrusive magnetite-bearing gabbroic phases within the basalt.

The already identified Magnetite-bearing zone within the basalt will be mapped on 1:4000 scale before the trenching and sampling activity.

3.3.0 Geochemical Sampling

3.3.1 Bed Rock Sampling:

During the course of geological mapping the bed rock samples shall be collected from the basalt / gabbro outcrops exhibiting indications of mineralization for any metal-oxide / sulphide minerals, shearing, brecciation, oxidation, silicification, ferruginization and alteration.

A total **100 nos. bed rock samples** from targeted location would be collected by either chip, groove or channel sampling method for analysis for gold, PGE, Nickel, Co and other basemetals with appropriate analytical methods. Total **16 nos. check** samples (5% internal + 10% External) will be analyzed as well.

3.3.2 Trench Sampling:

A total of 420 cu.m of trenching from 7 trenches (30m x 1m x 2m) at strike spacing of 50m is envisaged over the 350m long magnetite-bearing gabbro-basaltic zone. A total of 140 samples may get generated and will be analyzed for PGE by NiS Fire Assay method. About 20 samples will be analyzed as check samples. So in all, there may be a maximum of 160 nos. of samples for PGE by NiS Fire Assay.

3.3.3 Pit Sampling:

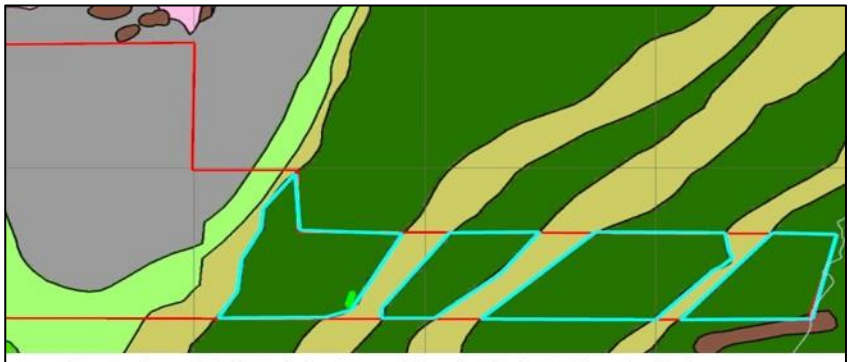
A Total of 20 cu.m of pitting from 10 pits (2m x 1m x 1m) are planned from 5 laterite hill areas where samples have returned anomalous values of V2O5. Total 92 samples (80 samples from pits plus another 12 check samples) will be analyzed by XRF for Total Fe and V2O5 apart from other elements in the package.

3.3.34 Drill Core Sampling:

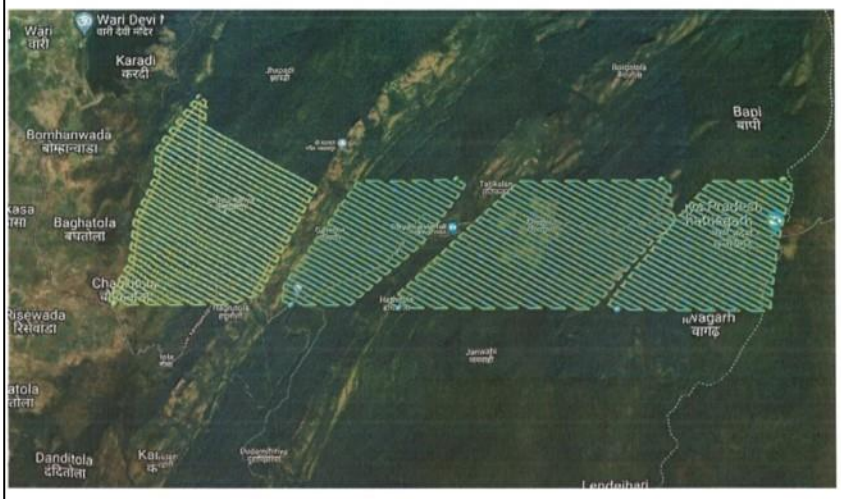
4 inclined boreholes of 75m inclined depth are planned across a strike length of the 350m long magnetite-bearing gabbro-basaltic zone. A total of 60 samples (plus 10 check samples) may get generated from these boreholes for PGE analysis by NiS Fire Assay.

4.0.0 Geophysical Survey

In Maneri – Sitapala Block, the total extent of Khairagarh basalts is about 19.75sq.km. These basalts are to surveyed with drone-mounted magnetic sensors to acquire magnetic data at 100m line-spacing for interpretation up to a depth of about 150m.



➢ **Illustration of Flight Path for Maneri Sitapala Block, Madhya Pradesh.**



Area	Line Kilometre
Area 1	86.5 Lkm
Area 2	44 Lkm
Area 3	82 Lkm
Area 4	51.7 Lkm
Total Lkm	**264.2 Lkms**

10. Planned flight path configuration for drone-mounted magnetic survey on the basaltic areas

It is expected that such a high-resolution magnetic data can delineate magnetite-bearing zones within the basaltic areas. Such areas are to be targeted for detailed geological mapping and further investigations.

5.0.0 Whole Rock and other Geochemical Analysis

Apart from commodity specific chemical analysis as indicated in Section 3.3.0, 25 nos. out of 100 bedrock samples, 70 no. of Trench Samples and 40nos. of drill core samples are to be analyzed for a package of 34-elements by ICP To understand the geochemical characteristics and signature of the terrain.

5.1.0 Petrological & Mineragraphic Studies

During the course of Geological mapping 25 nos. of samples from various litho units from outcrop will be studied for petrography and 20 number will be studied in polished sections (Mineragraphic studies) for the metal oxide / sulphide mineral assemblages in metalliferous gabbro for their distribution, alteration, enrichment etc.

5.2.0 EPMA Studies

Ten (10) samples will be studied by EPMA for identification, textural characterisation and paragenesis of metal oxide / sulphide minerals.

7.0.0 Quantum of Work

The following Table shows the Nature & Quantum of Work to be carried out during Reconnaissance survey

Table: - 7 Quantum of proposed work in Maneri Sitapala Block

Sl.	Item of Work	Unit	Target
1	**REMOTE SENSING**	Nos	2
	a) Imagery procurement	Nos	1
	b) Cost of interpretation in terms of Geologist man days	Days	90
2	**Geological Mapping** (on 1:12,500 Scale)	Sq km	80
	a) Charges for one Geologist per day at HQ	Days	30
	b) Charges for one Geologist per day in Field	Days	300
3	a) Geophysicist (in field)	Days	30
	b) Geophysicist (in Hqs)	Days	15
4	**Geochemical Sampling**	Nos.	
	a) Bed Rock Sampling		100
	b) Trench Sampling		140
	c) Pit Sampling		80
	d) Drill Core sampling		60
6	**Laboratory Studies**		
	a) Bed rock samples (XRF)	Nos	100
	b) Trench Sampling (For PGE by NiS Fire Assay)		140
	c) Pit Sampling (XRF)		80
	d) Drill Core sampling		60
	e) Check Samples (5% Internal + 10% External) of the above		~60
	f) Other geochemical Samples (Multi-element by ICP)		135
7	**Physical Studies**		
	a) EPMA studies	Nos.	10
8	**Petrological Samples (Surface Samples)**		
	Preparation and Study of Thin Sections	Nos	25
9	**Mineragraphic Studies (Surface Samples)**		
	Preparation and study of Polished Section	Nos	20
10	Report Preparation (5 Hard copies with a soft copy)	Nos.	1
11	Preparation of Exploration Proposal (5 Hard copies with asoft copy)	Nos.	1

Table: - 8 Summary of Cost Estimates for Reconnaissance Survey (G-4 Level) Exploration

Sl. No.	Item	Total Estimated Cost (Rs.)
1	Mapping (LSM), Other Geological/Geophysical Work	**1,43,08,200**
2	Laboratory Studies	**57,45,143**
3	Geologist at HQ	**270,000**
4	Sub Total (1 to 3)	**203,23,343**
5	Exploration Report Preparation	**750,000**
6	Proposal Preparation	**380,000**
7	Peer review charges	**10,000**
8	Sub Total (1 to 7)	**2,14,63,343**
9	GST 18%	**38,63,3402**
10	**Total:**	**2,53,26,745**
	Say Rs. In Lakh	**253**

Table 9– Cost Estimation of the project

Estimated cost for Reconnaissance Survey (G-4) for Gold, PGE, REE, Basemetals and associated mineralization in Maneri Sitapala Block, Balaghat District, Madhya Pradesh Total block area- 80 sq km; Completion Time- 15 Months							
			Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal		
Sl. No.	**Item of Work**	**Unit**	**SoC- Item No.**	**Rates as per SoC**	**Qty.**	**Total Amount**	**Remarks**
1.0	**Large scale (LSM) Geological mapping/ Trenching/ Drilling**						
1.1	Satellite Imagery / Aerial Photo Interpretation studies						
1.1a	Charges for Procurement of Hyperspectral Hyperion Imagery	No.	1.1a	10,00,000	1	10,00,000	
1.1b	Hyperspectral Hyperion Imagery / Multi-spectral Imagery interpretation	days	1.1b	9,000	90	8,10,000	

Sl. No.	Item of Work	Unit	SoC- Item No.	Rates as per SoC	Qty.	Total Amount	Remarks
1.2	Large scale (LSM) Geological mapping/ Trenching/ Drilling					-	
	a) Geologist man days (1 No) for Large scale (LSM) Geological mapping/ Trenching/ Drilling	days	1.2	11,000	300	33,00,000	
	b) Labour (field) for (Total 2 Nos i.e. 2 workers per one geologist)	per worker	5.7	477	600	2,86,200	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner (Rs. 427/- per day) or respective State Govt. whichever is higher
	Sub-total 1.0					**43,96,200**	
2.0	**Mineral Investigation**						
2.1	Pitting & Trenching						
2.1.1	Excavation of Trenches up to 2.0m depth on magnetite gabbro dyke	per cu m	2.1.1	3,300	420 30m x 1m x 2m; 7 Trenches	13,86,000	
2.1.2	Excavation of Pits up to 2.0m depth on laterite bodies	per cu m	2.1.2	3,800	20 2m x1m x1m 10 Pits	76,000	

Sl. No.	Item of Work	Unit	SoC- Item No.	Rates as per SoC	Qty.	Total Amount	Remarks
2.2	Drilling (Scout)						
2.2.1.4	Drilling in Hard Rock	per m	2.1.1.4a	11,500	300	34,50,000	
	Sub-total 2.0					**49,12,000**	
3.0	**Geophysical Survey**						
3.2a	Geophysical mapping by drone-mounted magnetic sensors method - continuous data acquisition over 264.2 Line km); Interpretation and Report	per station	3.9b / 3.9c	Actuals	~270L.km	50,000,00	
	Sub-total 3.0					**50,00,000**	
4.0	**Laboratory Studies**						
4.1	Chemical Analysis						
4.1.14	Analysis of rock samples for determination of a package by 34 elements by ICP MS / ICP OES (sequential technique)						
	a) Bedrock samples	per sample	4.1.14	7,731	100	7,73,000	
	b) Trench samples	per sample	4.1.14	7,731	70	5,41,170	
	c) Drill Core samples	per sample	4.1.14	7,731	40	3,09,240	
4.1.15	Estimation of Major oxides and minor elements by XRF						

Sl. No.	Item of Work	Unit	SoC- Item No.	Rates as per SoC	Qty.	Total Amount	Remarks
	a) Bedrock samples	per sample	4.1.15	4,200	25	1,05,000	
	b) Pit samples	per sample	4.1.15	4,200	80	3,36,000	
4.1.5	Analysis for precious metals by fire assay technique						
4.1.5a	For Gold	per sample	4.1.5a	2,380	10	23,800	
4.1.5d	Trench Samples for PGE (ICP MS Ni-S Fire Assay technique)	per sample	4.1.5b	11,800	160	18,88,000	
	Drill Core Samples for PGE (ICP MS Ni-S Fire Assay technique)	per sample	4.1.5b	11,800	80	9,44,000	
	Check Samples of 4.1.14 - 5% Internal & 10% External	per sample	4.1.14	7,731	48	3,71,088	
	Check Samples of 4.1.14 - 5% Internal & 10% External	per sample	4.1.15	4,200	15	63,000	
4.7	**EPMA studies**	Per hour	4.4.1	8,540	10	85,400	
4.8	**Petrological / Mineralographic studies**						
	a) Preparation of thin section	per sample	4.3.1	2,353	25	58,825	
	b) Study of thin section for petrography	per sample	4.3.4	4,232	25	1,05,800	

Sl. No.	Item of Work	Unit	SoC- Item No.	Rates as per SoC	Qty.	Total Amount	Remarks
	c) Preparation of polished section	per sample	4.3.2	1,549	20	30,980	
	d) Study of polished section for mineragraphy	per sample	4.3.4	4,232	20	84,640	
	e) Digital photomicrograph of thin polished section	per sample	4.3.7	280	90	25,200	
	Sub-total 4.0					**57,45,143**	
5.0	**Geologist man days (1 No.) for Geological map & Report (HQ)**	**days**	1.2	**9,000**	**30**	**2,70,000**	
6.0	**Total (1.0 to 5.0)**					**2,03,23,343**	
7	**Geological Report Preparation**	Nos	5.2	A Minimum of Rs. 7.5 lakhs or 3% of the work whichever is more	1	**7,50,000**	For the projects having cost up to exceeding Rs. 150 Lakhs but less than 300 Lakhs: A Minimum of Rs. 7.5 lakhs or 3% of the work whichever is more and Rs. 3000/- per each additional copy.
7 **8**	**Geological Report Preparation** **Preparation of Exploration Proposal**	Nos **Nos**	5.2 **5.1**	A Minimum of Rs. 7.5 lakhs or 3% of the work whichever is more **380000**	1 **1**	**7,50,000** **3,80,000**	For the projects having cost up to exceeding Rs. 150 Lakhs but less than 300 Lakhs: A Minimum of Rs. 7.5 lakhs or 3% of the work and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC- NMET in its meeting while clearing the proposal.

Sl. No.	Item of Work	Unit	SoC- Item No.	Rates as per SoC	Qty.	Total Amount	Remarks
8 9	**Preparation of Exploration Proposal Report Peer Review Charges**	**Nos lumpsum**	**5.1 As per EC decision**	**380000 10000**	**1 1**	**3,80,000 10,000**	EA has to submit the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC- NMET in its meeting while clearing the proposal.
9 10	**Report Peer Review Charges Total Estimated Cost without GST (7+8+9+10)**	**lumpsum**	**As per EC decision**	**10000**	**1**	**10,000 2,14,63,343**	
11	**Provision for GST (18%)**					**38,63,402**	GST will be reimbursed as per actual and as per notified prescribed rate
11 12	**Provision for GST (18%) Total Estimated Cost with GST**					**38,63,402 2,53,26,745**	GST will be reimbursed as per actual and as per notified prescribed rate
					Say, in Lakhs	**253**	
	Note:						
*	Marked items not indicated in SoC and required to be taken up during the course of exploration shall be charged separately (as per actuals)						
$	Trenching/Pitting dimensions are tentative may vary depending upon the geology and field conditions						
#	2nd level of work shall be carried out after review of 1st level work i.e. Geological mapping, geochemical sampling and analysis						

Table: - 10 Tentative Time schedule/action plan for proposed Reconnaissance Survey (G-4) for PGE, Gold and REE investigation in Maneri-Sitapala block.

		2023				2024										
		Sept	Oct	Nov	Dec	Jan	Feb	March	Apr	May	June	July	Aug	Sept	Oct	Nov
Sl. No.	**Activities**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1	Remote sensing study															
2	Camp setting															
3	Geophysical Survey and interpretation															
4	Geological mapping and sampling															
5	Pitting, Trenching															
6	Drilling															
7	Sample preparation															
8	Analytical work															
9	Camp winding															
10	Report Preparation															
11	Peer Review & Final Report Submission															

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