PROPOSAL OF RECONNAISSANCE SURVEY (G-4 STAGE) FOR TIN AND ASSOCIATED MINERLAS IN PENDRA BLOCK (110.362 SQ.KM AREA) DISTRICTS- BILASPUR, CHATTISHGARH

COMMODITY: TIN AND ASSOCIATED MINERALS

BY

MINEREAL EXPLORATION AND CONSULTANCY LIMITED

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SEMINARY HILLS

PLACE: NAGPUR

DATE: NOVEMBER, 2022

SUMMARY OF THE BLOCK FOR RECONNAISSANCE SURVEY (G-4 STAGE) FOR TIN AND ASSOCIATED MINERLAS IN PENDRA BLOCK (110.362 SQ.KM AREA) DISTRICTS- BILASPUR, CHATTISHGARH

GENERAL INFORMATION ABOUT THE BLOCK

	Features	**Details**
	Block ID	Pendra Block
	Exploration Agency	Mineral Exploration And Consultancy Limited (MECL)
	Commodity	Tin and Associated Minerals
	Mineral Belt	Chhotanagpur Gneissic Complex
	Completion Period with entire Time schedule to complete the project	14 Months
	Objectives	Objectives of proposed exploration has been set in accordance to MEMC Rule (2015), Amended in 2021. The objectives of this exploration will be i. Geological Mapping in 1:12500 scale to identify the distribution of granitoids within Chhotanagpur Granite Complex. ii. Characterization of granitoids through Major Oxide and Trace element study iii. Identification of provenance of Tin and associated minerals through follow up stream sediment analysis as well as bed rock sample analysis to formulate G-3 level of exploration.
	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.
	Name/ Number of Geoscientists	1 Geoscientists in Field 1 1 Geoscientists in HQ

	Expected Field days (Geology) Geological Party Days	180 Field Days 60 HQ days
1.	**Location**	

Table No-1
Coordinates of cardinal points of Pendra Block, District:Bilaspur, Chattishgarh

Cardinal Points	Geographic Coordinate System in Degree Decimal (WGS 1984)		UTM (WGS 1984, Zone 44N)		Area (Sq.Km)
	Latitude	Longitude	Easting (m)	Northing (m)	
A	22.7537	81.9836	600989.3987	2516591.8289	110.362
B	22.7533	81.8140	583572.0461	2516438.8838	
C	22.8540	81.8030	582384.9588	2527587.1725	
D	22.8539	81.8671	588959.8863	2527607.7239	
E	22.7868	81.8664	588935.8801	2520175.9102	
F	22.7864	81.9832	600920.2742	2520209.5937	

	Villages	Pendra, Gurrela, Saraipani, Dhanauli, Lahsuna, Dongritola, Kachharpara
	Tehsil/ Taluk	Pendra
	District	Bilaspur
	State	Chattishgarh
2.	**Area (hectares/ square kilometers)**	
	Block Area	110.362 km^2
	Forest Area	Data Not Available
	Government Land Area	Data Not Available
	Private Land Area	Data Not Available
3.	**Accessibility**	
	Nearest Rail Head	Pendra Road
	Road	The area is also well connected by NH-30 and NH-130 from Raipur via Bilaspur- Marwahi Bypass road. The major all-weather roads are those connecting Pendra Road with Anuppur via Venkatnagar to the north and Pendra Road with Marwahi to the northeast.
	Airport	Raipur
4.	**Hydrography**	

	Local Surface Drainage Pattern (Channels)	Western and south western part of the area is undulating in nature and characterized by ridges intervening with valleys whereas rest of the block is plain with small hillocks at places. Hills are scattered but in the western part the hills show arcuate pattern. The highest elevation point is 751m located at south of Pandripani village and lowest elevation is 583m located at south of Harradih village.
	Rivers/ Streams	The major parts of the area are drained by northerly streams and Nala along with their tributaries. The important nalas of the area are Kudrinala, Pundahrinala, Maradabranala etc. There are few numbers of dams are made on the major nalas to store water and drained by small canals to the nearby localities for irrigation purpose.
5.	**Climate**	
	Mean Annual Rainfall	Generally average annual rainfall varies between 300cm and 450cm with a maximum of 600cm during the monsoon.
	Temperatures (December) (Minimum) Temperatures (June) (Maximum)	The climate is tropical, with a rainfall of 1500 mm. which is mostly restricted to the monsoon period i.e. July to September. The driest month is November with scanty rainfall whereas the most precipitation falls in July. Winters are quite cold and summers are pleasant. The average temperature of the area is 24°C. Maximum temperature reaches up to 47°C during the month of May and minimum temperature goes below 10° C during the months December and January.
6.	**Topography**	
	Toposheet Number	64F/13
	Morphology of the Area	. Already mentioned above
7	**Availability of baseline geosciences data**	
	Geological Map (1:50K/ 25K)	1:50000 (Bhukosh)
	Geochemical Map	Maps regarding NGCM work in the Toposheet for different elements are available within which Anomaly map for Tin is attached in the proposal for reference.
	Geophysical Map	Not Available

8.	**Justification for taking up Reconnaissance Survey / Regional Exploration**	During FS 2018-19, NGCM work has been carried out in the study area along with geological mapping in 1:50000 scale. Among the analysed elements of stream sediments samples, Sn values range from 0.50 ppm to 29.22 ppm in the entire Toposheet . The threshold value in the area is 11.07 ppm which is 5.2 times higher than the crustal abundance (2.1 ppm). The mean, mode and median values are 3.76, 0.50 and 2.93 ppm respectively. The population has a skewness of 3.48 and a high kurtosis of 16.85. The distribution is highly asymmetric and unimodal in nature and skewed to the right of mean with a heavy tail. Its geochemical distribution map shows maximum concentration over granite and granite gneisses of Chhotanagpur Gneissic Complex to the southeast of Pendra and Gaurrela, south of Saraipani, southwest of Dhanauli which are located within the block. There are 5 stream sediment samples having Sn value 12.06 ppm, 13.72 ppm, 14.12 ppm, 17.95 ppm and 29.22 ppm found within the present block which is higher than the threshold value of the Toposheet estimated during the NGCM work. Moreover three stream sediment samples from the proposed block showing Sn value 3.88 ppm, 4.03 ppm and 4.95 ppm which is more than the mean value of the entire samples collected from the Toposheet. Moreover, high concentration of Halfnium (Hf) was demarcated over granite and granite gneisses of Chhotanagpur Gneissic complex.Anomalous concentration of Zirconium (Zr) was indicated in geochemical distribution map over granite and granite gneisses of Chhotanagpur Gneissic complex near Gaurrela area. In continuation of the above, it has been recommended in the GSI report that S-typegranitoids are characterized by concentration of metals like Tin, Tungsten, Uranium and Thorium while A-type granitoids are characterized by concentration of metals like Tin, Molybdenum, Tungsten, Lithium and REE. As the study area shows anomalous values of above mentioned minerals in the rocks, a comparative study of granitoids of the area can be taken-up to classify them and detail study may help to find the economical potentiality of strategic minerals, if any.

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DISTRICTS- BILASPUR, CHATTISHGARH

1.0.0 INTRODUCTION:

1.1.0 Preamble

1.1.1 Tin is one of the earliest metals known andused mainly in bronze implements. It is a scarceelement having an incidence of about 2 ppm in theearth's crust. Its unique combination of propertieslike non-toxic nature, high malleability, chemicalinertness and ease with which it can form anamalgam and alloy with other metals has given it aspecial status among non-ferrous metals. Pure tinis a silvery-white metal which is soft and malleable.It does not occur naturally as metal. By far, themostimportant tin mineral is cassiterite (SnO_2), which theoretically, in its purest form contains78.77% tin.But usually it includes impurities of Nb,Ta, Zr, Sc,W and Fe. The less common tin ore isstannite(Cu_2SnFeS_4). Tin is now used mostly for tin plating,soldering special alloys and in making bronze.

1.1.2 In India, tin ore is found associated with granite,pegmatites and quartz veins and also inplacerdeposits. Resources are spread over in Bastar and Dantewada districts of Chhattisgarh, Tosham deposit in Bhiwani district of Haryana and Malkangiri district of Odisha.

1.1.3 The total reserves/resources of tin ore in thecountry as per NMI data, based on UNFCsystem,as on 1.4.2015 is placed at 83.73 million tonnescontaining about 1,02,413 tonnesmetal. About 4,419tonnes ore containing 154 tonnes metal are placedunder 'Reserves' category and the bulk, i.e., about83.72 million tonnes containing about 1,02,259tonnes metal are placed under 'Remaining Resources'category. As per DMG Chhattisgarh, the total recoverable reserves of cassiterite concentrate is19,544.58 tonnes in Tongpal area,Katekalyan area and Padapur-Bacheli area. Out of 19,544.58 tonnes,18,837.16 tonnes are placer deposit. The entireresources of tin are located in Chhattisgarh andHaryana. About64% of the total ore/metal resourcesare located in Haryana and 36% in Chhattisgarh, whilenominal resources are located in Odisha.

1.1.4 Cassiterite which was reported in Dantewada district (Bastar district in formerly Madhya Pradesh) by the Directorate of Geology and Mining and was found being associated with the lepidolite-bearing pegmatites. However in Govindpal-Tongpal area of Dantewada district, Chhattisgarh, tin in the form of cassiterite is being mined from the sediments deposited in thestreams. The stream sediments are dugmanually withconventional implements. Subsequent panning ofthese sediments helps in separating the lightergangue minerals, while the heavier part is recovered as cassiterite. Chhattisgarh is the only tin producingState in India.

1.1.5 During the recent past no large-scale deposit for Tin and associated minerals has been discovered in India. Moreover, the possibility of working of small mineral bodies in proximity to each other, though technological advances and increased operational efficiency cannot be ruled out. Therefore, it is necessary and imperative to locate and explore further potential areas for Tin mineralisation.

1.2.0 Background

1.2.1 Exploration for strategic, critical, precious, rare earths and PGE are given top priority by Govt. of India, after amendment of MMDR act 2015. Keeping in view that Tin being a strategic mineral, the present proposal is being put up for Reconnaissance Survey. Keeping in view Reconnaissance survey (G-4) level proposal is been prepared for NMET funding and execution.

1.3.0 Location and Accessibility

1.3.1 The study area of 110.362 sq. km is bounded by latitudes 22.8540°N to 22.7537 N and longitudes 81.8030°E to 81.9836°E, falls under the jurisdiction of Pendra tehsil of Bilaspur district. The Block is located in the southern part of Survey of India Toposheet No 64F/13. The coordinates of the cardinal points of the block boundary is given below in Table No. – 1.

Table No-1
Coordinates of cardinal points of Pendra Block,
District:Bilaspur, Chattishgarh

Cardinal Points	Geographic Coordinate System in Degree Decimal (WGS 1984)		UTM (WGS 1984, Zone 44N)		Area (Sq.Km)
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1.3.2 Pendra Road Railway station is located in the south central part of the block. Pendra Road railway staion is falling in Bilaspur- Katni section of South-East Railway which is running across the study area from south to north, which directly connects Raipur to Pendra via Bilaspur. Pendra Road Railway Station is 212 km from Raipur Railway Station.

1.3.3 The area is also well connected by NH-30 and NH-130 from Raipur via Bilaspur- Marwahi Bypass road. The major all-weather roads are those connecting Pendra Road with Anuppur via Venkatnagar to the north and Pendra Road with Marwahi to the northeast.. A few forest roads and cart tracks branch out from the above roads. Despite of railway, bus communication

is also good to Pendra from Raipur through many routes via Bilaspur. The interior villages of the area are connected by tar, semi-metalled roads. On the whole, the area is easily accessible by vehicle except some part of the area which occupied by high hills and dense forest.

1.4.0 Physiography and Drainage

1.4.1 Western and south western part of the area is undulating in nature and characterized by ridges intervening with valleys whereas rest of the block is plain with small hillocks at places. Hills are scattered but in the western part the hills show arcuate pattern. The highest elevation point is 751m located at south of Pandripani village and lowest elevation is 583m located at south of Harradih village

The major parts of the area are drained by northerly streams and Nala along with their tributaries. The important nalas of the area are Kudrinala, Pundahrinala, Maradabranala etc. There are few numbers of dams are made on the major nalas to store water and drained by small canals to the nearby localities for irrigation purpose.

1.5.0 Climate

1.5.1 The climate is tropical, with a rainfall of 1500 mm. which is mostly restricted to the monsoon period i.e. July to September. The driest month is November with scanty rainfall whereas the most precipitation falls in July. Winters are quite cold and summers are pleasant. The average temperature of the area is 24°C. Maximum temperature reaches up to 47°C during the month of May and minimum temperature goes below 10° C during the months December and January.

2.0.0 Geology

2.1.0 Regional geology

2.1.1 The Indian shield comprises of cratons, mobile belts and platform sediments. One such component of Indian shield is purana basin. Purana basin date to Proterozoic Eon and it varies from pericratonic basin to intracratonic basin. The study area is embraced between such a Proterozoic intra-cratonic Chhattisgarh basin in the south and Proterozoic, Intra-cratonic Vindhyan basin in the north, to its western extremity lies the Proterozoic Satpura Mobile Belt and to its far-east extremity lies Gondwana sediments of Mahanadi graben. The area between Chattisgarh basin and Vindhyan basin is termed as central Indian Tectonic Zone (CITZ). This almost E-W trending tectonic zone extends from Satpura Mobile Belt in west to CGGC in east, upto Shillong Pleateau in far east and Albany-Fraser mobile belt of Australia (Harris and Beeson, 1993). It is a thick veneer of highly tectonizedzone containing supracrustal rocks of Sausar group, Mahakoshal group, Chhotanagpur Gneissic Complex (CGGC) with granitoid intrusions. The tectonization of supracrustal rocks is a result of supercontinental cycle of Columbia (2.1 to 1.8 Ga), (Rogers and Santosh 2002) and Rodenia (Li et. al., 2008). The participation of the rocks in two successive supercontinent cycle has deformed and

metamorphosed these supracrustal rocks to so extent that barely parenteal signature of them is yet preserved. The northern boundary of CITZ is marked by Son-Narmada lineament (SONA) and southern boundary by Central Indian shear zone (CIS). Between these two demarcated boundary lies various other series of parallel shear zones, one such as regionally marked shear zone is Gavilgarh-Tan shear zone(GTSZ) (Acharya and Roy, 2000). All the above shear zone and lineaments occur almost parallel to each other in central India and trend to E-W or ENE to WSW. The Gavilgarh-Tan Shear Zone (GTSZ) is a prominent crustal-scale shear/fault zone that runs ENE-WSW for nearly 300 km, from Dhanora in the west to Seoni in the east. The GTSZ comprise of Precambrian basement gneisses that separate the Betul and the Sausar supracrustal belts (Golani et al., 2001). The zone is well marked in Kanhan valley but its eastern extremity continuation in the basement rock has been obscured by overlying cretaceous Deccan traps. In the Amarkantak region the GTSZ is termed as Tan shear zone, which can be traced from the North of Amarkantak to Nagai in the east (Jain et. al., 1991).

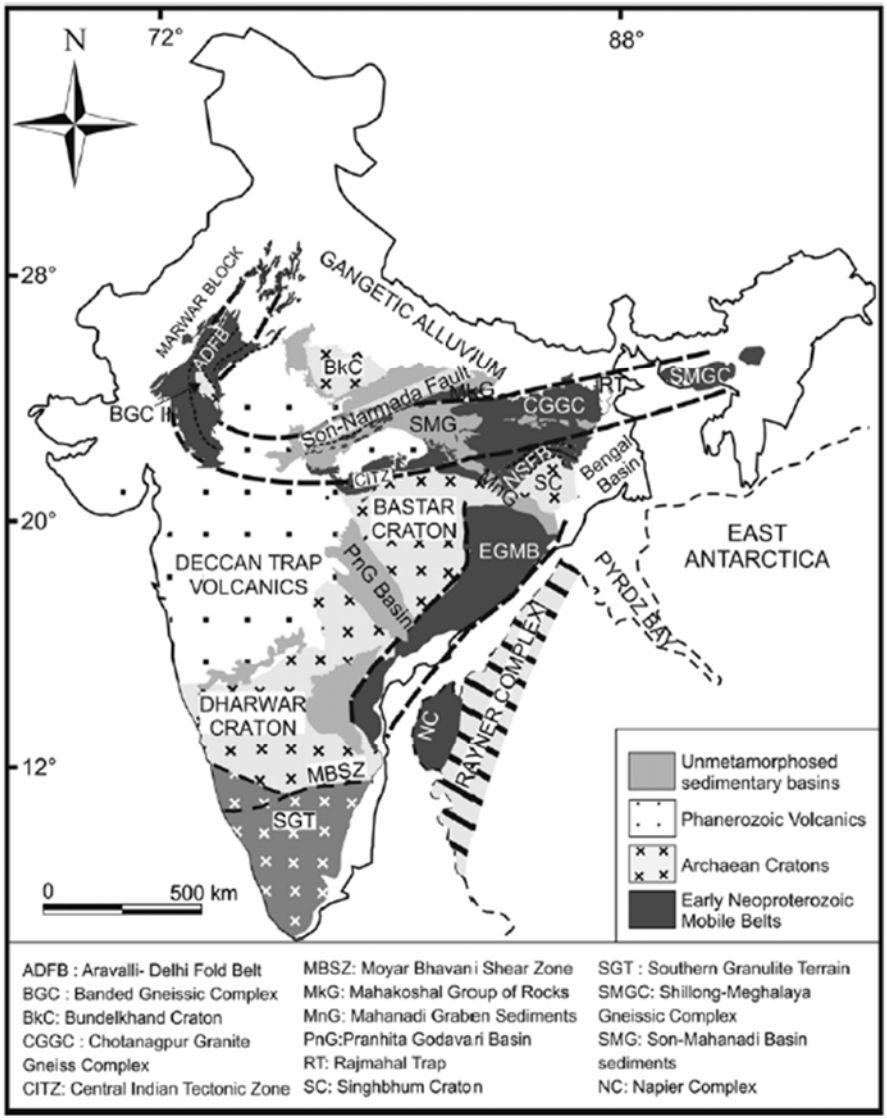


Fig 1: Geological map showing Indian crystalline basements and sedimentary cover. The thick dashed line represents the Early Neoproterozoic suture (modified after Acharyya 2003). The position of Antarctica is also shown in the figure during the Rodinia assembly (modified after Dasgupta& Sengupta 2003).

2.2.0 Block Geology

2.2.1 Geologically the study area lies to the north of Tan Shear Zone. The study area predominantly comprises of unclassified granites and gneisses of Chhotanagpur Gneissic Complex (CGC).

Chhotanagpur Gneissic Complex (CGC) is unconformably overlain by platform sediments of Gondwana Supergroup, Lameta Group, Deccan Traps and laterite deposits. The stratigraphy and various lithounits of the area are discussed below.

Table No 2

Stratigraphic Succession within the block

Era	Group	Formation	Lithology
Cenozoic			Laterite capping, Alluvium
----------Unconformity----------			
Early Permian to Late Carboniferous	Lower Gondwana	Talchir	Fine grained sandstone, siltstone and shale
----------Unconformity----------			
Paleoproterozoic to Archean	Chhotanagpur Gneissic Complex (CGC)		Unclassified granites and gneisses

2.2.2 **Chhotanagpur Gneissic complex (CGC):** The CGC occurs as a basement rock in the area. About 90% of the mapped area is covered by CGC. The supracrustal rocks of CGC might have processed the gneisses and variety of granitoids. . Outcrops of foliated pink granite, grey granite gneiss, foliated grey granite, porphyric pink and grey granite, tourmaline bearing pink granite are exposed at different locations.

a) Gneiss: A highly metamorphosed rock, distinguished by the presence of thin bands of leucosome and melanosome. The gneiss contains igneous protolith with minerals of plagioclase, quartz and biotite. Such gneiss present in the area is termed as orthogneiss. A ductile gneiss shows curvi-linear laminations and to minor scale transposition of these continuous lamination inferring a ductile-brittle deformation. The degree of deformation increases further southward towards Tan shear zone with better development of S-C shear fabric. Gneissocity trending NW-SE to WNW-ESE and S-C fabric and feldspar augens with dextral shear sense are well developed in granite gneisses and foliated granites. Both grey granite gneiss and pink porphyroblastic granite gneiss are exposed in the study area. However development of foliation is common but gneissocity is poorly developed.

The grey granite gneiss is mainly exposed nearKachharparavillage as observed by the previous geoscientists. Although isolated patches of it is present at Dongritola. The rock is usually leucocratic to grey in colour, medium grained and mostly massive and high in quartz. It is found to contain minor disseminations of garnet crystals. The reference photograph for the grey granite gneiss is given as Photographs-1.

Photograph 1: Granite gneiss exposed at Dongritola village (Source: GSI Report)

The pink porphyroblastic granite gneiss is exposed at some localities within the study area according to the previous reports with poorly developed gneissocity. In general, the rock is well foliated and comprises of porphyroblasts of pink feldspar. At some places the porphyroblasts are large enough to obliterate the foliation or gneissocity. The rock is massive consisting of mainly pink feldspar and quartz with biotite and muscovite as accessory minerals. At places the feldspar exhibits augen structure. Muscovite rich foliated pink granite noticed to the SW of Dongritola (Photograph-2). At Dhanauli, the foliated pink granite was seen by previous workers having NW-SE trend with dip towards SW.

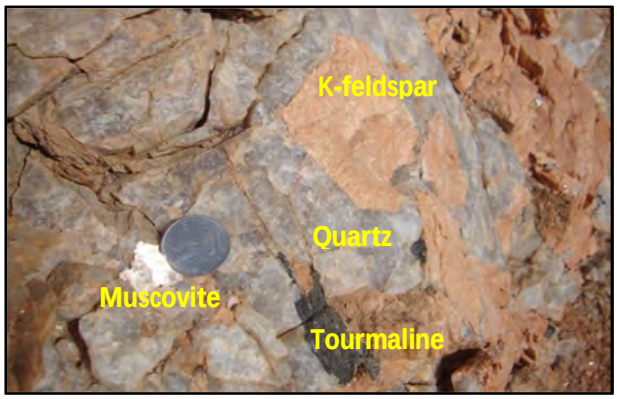
Photograph 2: Muscovite rich foliated pink granite exposed to the SW ofDongritola village (Source: GSI Report)

b) Porphyritic granite: The pink coloured, coarse grained, porphyritic granite with large euhedral to subhedral phenocrysts of K-feldspar is found as a major lithounit present in most part of the study area. This granite occurs as small mounds or hillocks, occupying comparatively high relief and shows intrusive relationship with the county rock. The granite contains mainly phenocrysts of K-feldspar, quartz with biotite and tourmaline as accessory mineral and the outcrops are generally found near Anjani,Manaura, Lahsuna villages.

c) Pink granite: They are medium grained granite, containing mostly pink feldspar with quartz, tourmaline and muscovite and minor amount of plagioclase feldspar.This pink granite sometimes bears small needle shaped disoriented tourmaline crystals which was reported to the north of Saraipani (Photographs-3).

Photograph 3: Tourmaline rich pink granite exposed to the north of Saraipani Village (Source: GSI Report)

The already discussed granites and gneisses are intruded by tourmaline bearing pegmatitic veins. Milky white quartz rich intrusion, quartzo-feldspathic veins and aplites are common within the granites and gneisses. The pegmatites in the study area vary in size from few centimeters to metres and comprises mainly of pink feldspar, with subordinate amount of quartz, tourmaline and muscovite. An Intrusion of pegmatite body (Photographs-4 & 5) within the foliated pink granite to the SW of Dongritola and quartz lense of approximately 30cm long and 4cm wide, as an elongated patch within the grey granite gneiss at Dongritola village (photograph 6) were reported.



Photograph 4 & 5: Pegmatite body (N20E) intruding foliated granite (N50W) to the SW of Dongritola Village (Source: GSI Report)

Photograph 6: Quartz lense within the granite gneissatDongritola Village. (Source: GSI Report)

2.2.3 **Gondwana sediments**: These sediments are of Permian to Mid-Cretaceous age (Mahadevan 2002). The Lower Gondwana sediments rest unconformably over CGC marked by a distinct unconformity represented by boulder bed and conglomarate. This boulder bed is overlain by siltstone, sandstone and khaki green shale. However in the study area the exposures are scanty. The boulder bed is absent here in the study area and the light yellow coloured, fine grained sandstone of Talchir Formation has been highly weathered so that it occupies nearly flat topography.

2.2.4 Alluvium: Alluvium is formed due to the deposition of the sediments by paleo river system. It is yellowish, greyish, brownish coloured with kankar at some places and clayey sediments.

2.3.0 Structure within the Block

2.3.1 As the major part of the study area is covered with gneiss, primary structure is unexpected to observe. However Foliation in terms of schistocity and gneissocity trending NW-SE to WNW-ESE and S-C fabric with dextral shear sense are well developed in granite gneisses and foliated granites at number of locations within the study area.

3.0.0 Previous Work

3.1.0 General

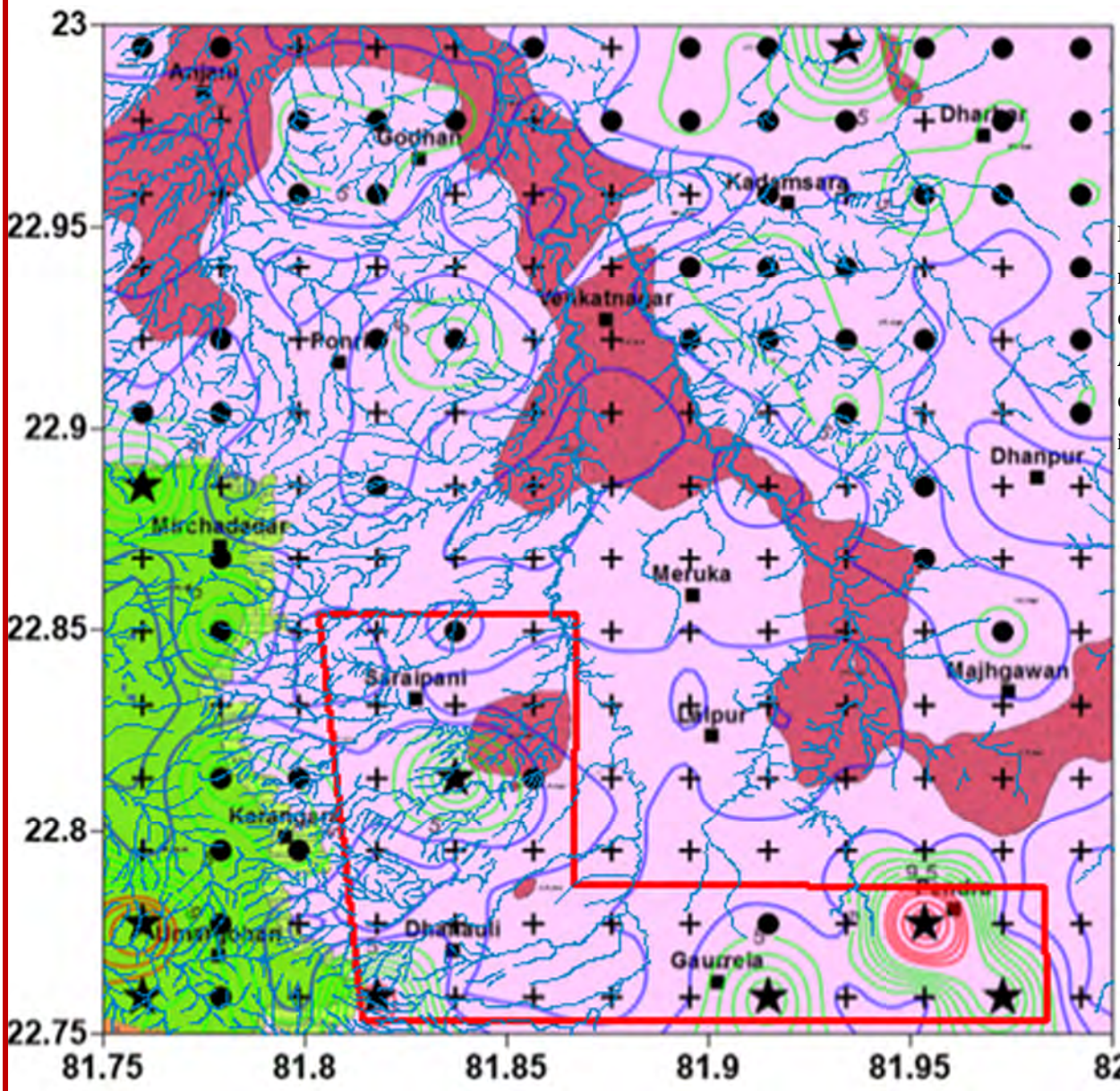
3.1.1 W. King (1886) and Hughs and Hiralal (1885), mapped the granite and granitic gneiss rocks of Bilaspur district on 1:2,53,440 scale as "Archean rocks". These archean rocks (older metamorphics) were comparable to sausar group rocks but exact relation between these two is hard to establish since they are overlain by thick sediments of Gondwana and Deccan trap. The toposheet 64 F/13 exposes same type of lithology. After prolonged time of 1885, no geological work has been carried out in the toposheet 64F/13.

3.2.2 Geochemical mapping was carried out in FS: 2018-19 on 1:50,000 scale in Toposheet No 64F/13 (an area of 728 sq km) covering parts of Bilaspur district of Chhattisgarh and Shahdol (presently Anuppur) district of Madhya Pradesh with an objective to generate a geochemical baseline data of the country by multi-elemental analysis (68 elements) and preparing geochemical anomalies indicating distribution pattern of various elements. The field work was initiated on 18.09.2018 and completed on 11.03.2019.As part of the work, a total of 728 sq. km area in toposheet no. 64F/13 was geochemically mapped with collection of 728 nos. of stream sediment/slope wash samples. The stream sediments/slope wash samples were made to pass through a 120 mesh size sieve so as to prepare 500 grams of unit cell sample. A total 182 nos. of composite samples were prepared by coning and quartering of four adjacent unit cell samples. Apart from this, 09 nos. each of soil regolith and C-horizon, duplicate, stream water and PS samples were collected.

3.2.0 Mineral Potentiality of the block based on previous work and Justification

3.2.1 During FS 2018-19, NGCM work has been carried out in the study area along with geological mapping in 1:50000 scale.

3.2.1 Among the analysed elements of stream sediments samples, Sn values range from 0.50 ppm to 29.22 ppm in the entire Toposheet . The threshold value in the area is 11.07 ppm which is 5.2 times higher than the crustal abundance (2.1 ppm). The mean, mode and median values are 3.76, 0.50 and 2.93 ppm respectively. The population has a skewness of 3.48 and a high kurtosis of 16.85. The distribution is highly asymmetric and unimodal in nature and skewed to the right of mean with a heavy tail. Its geochemical distribution map shows maximum concentration over granite and granite gneisses of Chhotanagpur Gneissic Complex to the southeast of Pendra and Gaurrela, south of Saraipani, southwest of Dhanauli which are located within the block.



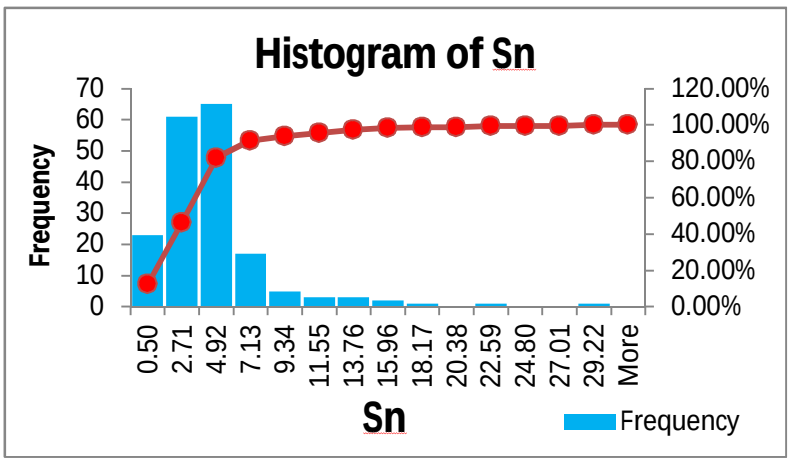
Representative map of distribution of Sn Anomaly over different lithology in the area

LEGEND

Laterite	Cenozoic	
Basalt, Amarkantak Gp	U. Cretaceous-Paleocene	
Limestone, Lameta Gp.	U. Cretaceous	
Sandstone, Talchir Fm.	L. Carboniferous-E. Permian	
Granite gneiss, CGC	Archean-Paleoproterozoic	

- 25 to 106.82
- 106.82 to 247.3
- 247.3 to 448.01

- Below mean value
- Mean to Threshold value
- Above Threshold value



Descriptive Statistics of Sn (ppm)	
Mean	3.76
Standard Error	0.27
Median	2.93
Mode	0.50
Standard Deviation	3.66
Sample Variance	13.36
Kurtosis	16.85
Skewness	3.48
Range	28.72
Minimum	0.50
Maximum	29.22
Sum	684.66
Count	182
Threshold value	11.07
Upper continental crustal value	2.1

3.2.2 There are 5 stream sediment samples having Sn value 12.06 ppm, 13.72 ppm, 14.12 ppm, 17.95 ppm and 29.22 ppm found within the present block which is higher than the threshold value of the Toposheet estimated during the NGCM work. Moreover three stream sediment samples from the proposed block showing Sn value 3.88 ppm, 4.03 ppm and 4.95 ppm which is more than the mean value of the entire samples collected from the Toposheet.

3.2.3 Moreover, high concentration of Halfnium (Hf) was demarcated over granite and granite gneisses of Chhotanagpur Gneissic complex.Anomalous concentration of Zirconium (Zr) was indicated in geochemical distribution map over granite and granite gneisses of Chhotanagpur Gneissic complex near Gaurrela area.

3.2.3 In continuation of the above, it has been recommended in the GSI report that S-typegranitoids are characterized by concentration of metals like Tin, Tungsten, Uranium and Thorium while A-type granitoids are characterized by concentration of metals like Tin, Molybdenum, Tungsten, Lithium and REE. As the study area shows anomalous values of above mentioned minerals in the rocks, a comparative study of granitoids of the area can be taken-up to classify them and detail study may help to find the economical potentiality of strategic minerals, if any.

4.0.0 Scheme of Proposed Exploration

4.1.0 General

4.1.1 Based on the outcome of NGCM work carried out in GS 2018-2019 and the recommendation of GSI, the proposed scheme of exploration has been planned for G-4 level of exploration for Tin and associated minerals.

4.2.0 Objective of Proposed Exploration

4.2.1 Objectives of proposed exploration has been set in accordance to MEMC Rule (2015), Amended in 2021. The objectives of this exploration will be

i. Geological Mapping in 1:12500 scale to identify the distribution of granitoids within Chhotanagpur Granite Complex.

ii. Characterization of granitoids through Major Oxide and Trace element study

iii. Identification of provenance of Tin and associated minerals through follow up stream sediment analysis as well as bed rock sample analysis to formulate G-3 level of exploration.

4.3.0 Planned Methodology

4.3.1 G-4 level of exploration for Tin and associated minerals in Pendra block is formulated to full fill the above mentioned objective in accordance with MEMC rule 2015(amended till 2021). The components of exploration are described below.

4.3.2 **Geological Mapping**

Geological mapping will be done in the entire 110.362sq km area on 1:12,500 scale. Rock types, their contact, structural features will be mapped. The disposition of different types of granitoids shall be marked in the map during mapping.

4.3.3 **Geochemical Sampling**

Initially 50 Nos of follow up stream sediments samples shall be collected from 1st order and if necessary from 2nd order stream around the samples with high anomalous value reported by GSI to identify the provenance of the mineralisation. Further 50 Nos of Bed Rock/ Soil sample shall be collected from suitable litho units to identify the primary source of mineralisation and to identify its distribution pattern.

A total 100 primary samples will be collected for assay for 34 elements by ICPMS including Sn, W, Mo, Hf, Zretc. Total 15 Nos Check samples (5% internal + 10% External) will be analyzed

15 Nos of bed rock samples shall be subjected for whole rock analysis (Major Oxides and Trace Elements) for characterization of granitoids and its origin.

4.3.4 **Trenching/Pitting**

Shallow trenching/pitting (Excavation) shall be carried out in the potential zones identified based on the results of Geological Mapping and Geochemical Sampling. A provision of shallow trenching/pitting of 200 cubic meter is proposed. Trenching shall be done for correlation of mineralized zones on surface up to a depth of 2-2.5 m after removal of soil/weathered column in the area. Locations of pits/trenches on ground will be decided by field geologist based on field observations. A provision of 100 Nos of primary channel samples&15 Nos check (5% internal+10% External) samples is kept for analysis of assay for Sn, W, Mo, Hf, Zr element analysis by AAS. The trench /pit walls will be mapped on 1:200 scale.

4.3.5 **Core Drilling:**

Based on Geological mapping, Geochemical studies, pitting and trenching, the extension of the mineralized zones (ore bodies) will be marked. To find out the potentiality of mineralized zones in strike & dip, a 5 no of scout boreholes involving 500m of drilling will be carried out for shallow level intersection of mineralized zones. The boreholes shall be fixed on ground by DGPS instrument.

4.3.6 **Drill Core Sampling:**

During geological logging of drill core, mineralized zone will be marked on basis of concentration and lithology. Total 100 Nos of primary and check 15 Nos (5% Internal Check+10% External Check) samples and 15 Nos of composite samples will be analyzed for Sn, W, Mo, Hf, Zr.

4.3.7 **Petrological & Mineralogical Studies**:

During the course of Geological mapping and core logging 20 Nos of samples from various litho units from surface and intersected in boreholes will be studied under microscope for mineral assemblage and microscopic alteration. 10 Nos of sample shall be subjected to mineragraphic study.

4.3.8 Details of the particular, Quantum and the targets are tabulated in Table No.-3

Table No-3
Envisaged Quantum of proposed work in Pendra Block

Sl. No.	Item of Work	Unit	Target
1	**Geological Mapping** (on 1:12,500 Scale)	Sq km	110.362
2	**Geochemical Sampling** (Taken up in Anomalous areas) a) Stream Sediment b)Bed rock c) Soil	Nos.	100
3	**Exploratory Mining***		
	Excavation (Trenching/Pitting)	Cu. m.	250 Cu m
	Channel Samples in Trench	m	100 m
4	**Drilling (coring)***		
	Borehole Fixations by DGPS	**Nos**	**5 Nos**
	Drilling	**m**	**500 m**
	Drilli core Primary samples	**Nos**	**100 Nos**
	Composite Samples on Drill Core	Nos	15 Nos
5	**Laboratory Studies**		
	Geochemical Samples (Primary + Check) for 34 Elements by ICPMS	**Nos**	**100 + 15=115 Nos**
	Channel Samples (Primary + Check) for Sn, W, Mo, Hf, Zr by AAS	Nos	**100 + 15=115 Nos**
	Borehole Core Samples (Primary + Check) for Sn, W, Mo, Hf, Zr by AAS	Nos	**100 + 15=115 Nos**
	Composite samples on Borehole Core Samples	Nos	15
	Whole Rock Analysis (Major oxides and Trace elements)	Nos	15
6	**Petrological Samples (Surface & BH Core Samples)**		
	a) Petrographic Study b) Mineragraphic Study	Nos Nos	20 Nos 10 Nos
7	**Report Preparation (Digital format)**	Nos.	01 Nos
*** The 2nd Level of work to be decided after review of Geological Mapping &Geochemical Sampling and Trenching.**			

5.0.0 Time Schedule

5.1.0 General

5.1.1 The proposed exploration programme envisages geological mapping, surface sampling, geophysical survey, trenching, scout drilling, sample preparation and laboratory studies, which will be completed within 11 months, geological report preparation will take 4 months including peer review with one month overlapping with lab works. Therefore, a total of 14 months is planned for completion of the entire proposed programme. Tentative Time schedule/action plan for proposed Reconnaissance Survey (G-4) is given in Table No.VII.B.

TABLE- VII-B TIME SCHEDULE / ACTION PLAN FOR EXPLORATION																	
			1	2	3	4	5	6		7	8	9	10	11	12	13	14
1	Camp Setting	Month															
2	Geological Mapping	Month															
3	Pitting /Trenching	Cu.m															
4	Surface Drilling (1 rig)	m															
5	Geologist Party days (1Party)	Party days															
6	Sampling Party days (1 party)	Party days							REVIEW								
7	Camp Winding	Month															
8	Laboratory Studies	Month															
9	Geologist Party days, HQ (1Party)	Party days															
10	Report Writing with Peer Review	Month															
	* Commencement of project will be reckoned from the day the exploration acreage is available along with all statutory clearances.																
	*Time loss on account of monsoon/agricultural activity/forest clearance/local law and order problems will be addition to above time line.																

7.0.0 Cost Estimate

7.1.0 Breakup of Expenditure:

7.1.1 Tentative Cost has been estimated based on Schedule of Charges (SoC) of projects funded by National Mineral Exploration Trust (NMET) w.e.f. 01/04/2020 The total estimated cost is Rs. 163.46 Lakhs. The summary of cost estimates for Reconnaissance Survey (G-4 Level) is given in Table No.-VII.A

Table No-4

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

Sl. No.	Item	Total Estimated Cost (Rs.)
1	Geological Work	29,85,480.00
2	Pitting & Trenching	8,25,000.00
3	Drilling	72,41,200.00
	Sub total	**110,51,680.00**
4	Laboratory Studies	18,73,365.00
	Sub total	**18,73,365.00**
5	Report	6,46,252.25
6	Peer Review	10,000.00
7	Proposal Preparation	2,71,425.95
	Total	**138,52,723.20**
8	GST (18%)	24,93,490.18
Total cost including 18% GST		**163,46,213.37**
SAY, in Lakhs		**163.46**

Table No-VIILA

COST ESTIMATE FOR RECONNAISSANCE SURVEY (G-4 STAGE) FOR TIN AND ASSOCIATED MINERLAS IN PENDRA BLOCK (110.362 SQ.KM AREA)

DISTRICTS- BILASPUR, CHATTISHGARH

Total Area - 110.362 sq. km; Completion Time - 14 Months

S.N	Item of Work	Unit	Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal		Remarks
			SoC-Item -Sl No.	Rates as per SoC	Qty.	Total Amount (Rs)	
A	**GEOLOGICAL WORK**						
a	Charges for one Geologist per day at HQ for monitoring, data processing etc. (1 no.)	day	1.3	9,000	60	5,40,000	
b	Charges for one Geologist per day at field for mapping, channel sampling and logging (1 no./1 party)	day	1.3	11,000	180	19,80,000	
c	Labour (2 Nos) Base rate - Rs.437/-	day	5.7	437	360	1,57,320	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
e	Charges for one Sampler (1 Party) for geochemical, channel and core samples	one sampler per day	1.5.2	5,100	45	2,29,500	
f	Labours (4 Nos) Base rate - Rs. 431/-	day	5.7	437	180	78,660	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
	Sub-Total A					**29,85,480**	
B	**PITTING AND TRENCHING** $						
a	Trenching	Cu m	2.1.1	3,300	250	8,25,000	
	Sub-Total B					**8,25,000**	
C	**DRILLING**						
1	Drilling up to 300m (Hard Rock)	m	2.2.1.4a	11,500	500	57,50,000	Will be done after review of mapping, geochemical sampling & analytical work and Geophysical Survey
2	Borehole deviation Survey by Multishot Camera	m	2.2.6	330	500	1,65,000	
3	Land / Crop Compansation (in case the BH falls in agricultural Land)	per BH	5.6	20,000	5	1,00,000	Amount will be reimburse as per actuals or max. Rs. 20000 per BH with certification from local authorities
4	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000	5	10,000	
5	Transportation of Drill Rig & Truck associated per drill (1 rigs)	Km	2.2.8	36	1,000	36,000	1650km to & fro from Nagpur/ Rig
6	Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)	month	2.2.9	50,000	3	1,50,000	
7	Drilling Camp Setting Cost	Nos	2.2.9a	2,50,000	1	2,50,000	
8	Drilling Camp Winding up Cost	Nos	2.2.9b	2,50,000	1	2,50,000	
9	Approach Road Making (Hilly Terrain)	Km	2.2.10b	32,200	4	1,28,800	Road Making will be considered as per the requirement and Road Making Charges will be reimbursed accordingly.
10	DGPS Survey for BH coordinate & Reduce level including Base station	per point	1.6.2	19,200	6	1,15,200	As per MEMC Amendment Rule, 2021 and Mineral Auction Rule, 2021
13	Drill Core Preservation	per m	5.3	1,590	180	2,86,200	Amount will be reimbursed after successful delivery of the core to concerned library/authorities
	Sub Total C					**72,41,200**	
D	**LABORATORY STUDIES**						
1	**Chemical Analysis**						
I	**Primary & Check Samples from Surface outcrop and steam sediments**						
i)	**Primary samples**						
	a. 34 Elements of ICPMS	Nos	4.1.14	7,731	100	7,73,100	
ii)	**Internal Check Samples**						
	a. 34 Elements of ICPMS	Nos	4.1.14	7,731	5	38,655	
iii)	**External Check Samples**						
	a. 34 Elements of ICPMS	Nos	4.1.14	7,731	10	77,310	
II	**Primary & Check Samples from Trench**						
i)	**Primary samples + 15% Check**						
	a. For Sn, W, Mo, Hf, Zr by AAS	Nos	4.1.7a	2,506	100	2,50,600	
ii)	**Internal Check Samples**						
	a. 34 Elements of ICPMS	Nos	4.1.14	2,506	5	12,530	
iii)	**External Check Samples**						
	a. 34 Elements of ICPMS	Nos	4.1.14	2,506	10	25,060	
III	**Primary & Check Samples from Drill Core**						
i)	**Primary samples + 15% Check**						
	a. For Sn, W, Mo, Hf, Zr by AAS	Nos	4.1.7a	2,506	100	2,50,600	
ii)	**Internal Check Samples**						
	a. 34 Elements of ICPMS	Nos	4.1.14	2,506	5	12,530	
iii)	**External Check Samples**						
	a. 34 Elements of ICPMS	Nos	4.1.14	2,506	10	25,060	
IV	**Composite Samples**						
	a. For Sn, W, Mo, Hf, Zr by AAS	Nos	4.1.7a	2,506	15	37,590	
2	**Physical & Petrological Stusies**						
i)	Preparation of thin section	Nos	4.3.1	2,353	20	47,060	
ii)	Complete petrographic study report	Nos	4.3.4	4,232	20	84,640	
iii)	Preparation of Polished Section	Nos	4.3.2	1,549	10	15,490	
iv)	Complete Mineragraphic study report	Nos	4.3.4	4,232	10	42,320	
iii)	Digital Photographs	Nos	4.3.7	280	15	4,200	
iv)	Whole Rock Analysis(Major Oxides + Trace elements, i.e. Ba, Ga, Nb, Ta, Yb, Rb, Sr, Y,Zr, Ni, Cr)	Nos	4.1.15a + 4.1.15b	8,831	20	1,76,620	
	Sub-Total -D					**18,73,365**	
E	**Total A to D**					**129,25,045**	
F	**Geological Report Preparation**	**5 Hard copies with a soft copy**	**5.2**	For the projects having cost more than Rs. 50 lakhs Upto 150 Lakhs - A minimum of Rs. 2.5 lakhs or 5% of the value of work whichever is more and Rs 3000/- per eaach additional Copy		**6,46,252**	
G	**Peer review Charges**		**As per EC decision**			**10,000**	
H	**Preparation of Exploration Proposal (5 Hard copies with a soft copy)**	**5 Hard copies with a soft copy**	**5.1**	**2% of the Cost or Rs. 3.8 Lakhs whichever is lower**		**2,71,426**	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.
I	**Total Estimated Cost without GST**					**138,52,723**	
J	**Provision for GST (18% of K)**	**%**				**24,93,490**	GST will be reimburse as per actual and as per notified prescribed rate
K	**Total Estimated Cost with GST**					**163,46,213**	
					or Say Rs. , In Lakhs:	***163.46***	

Note:

$ 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 and geochemical sampling

Note - If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMET SoC and Item no. 6 of NMET SoC. In case of execusion of the project by NEA on its own, a Certifiate regarding non outsourcing of any component/project is required.

8.0.0 Reference

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Rogers, John J. W. and M. Santosh "Configuration of Columbia, a Mesoproterozoic supercontinent" Gondwana Research 5.1 (2002): 5-22

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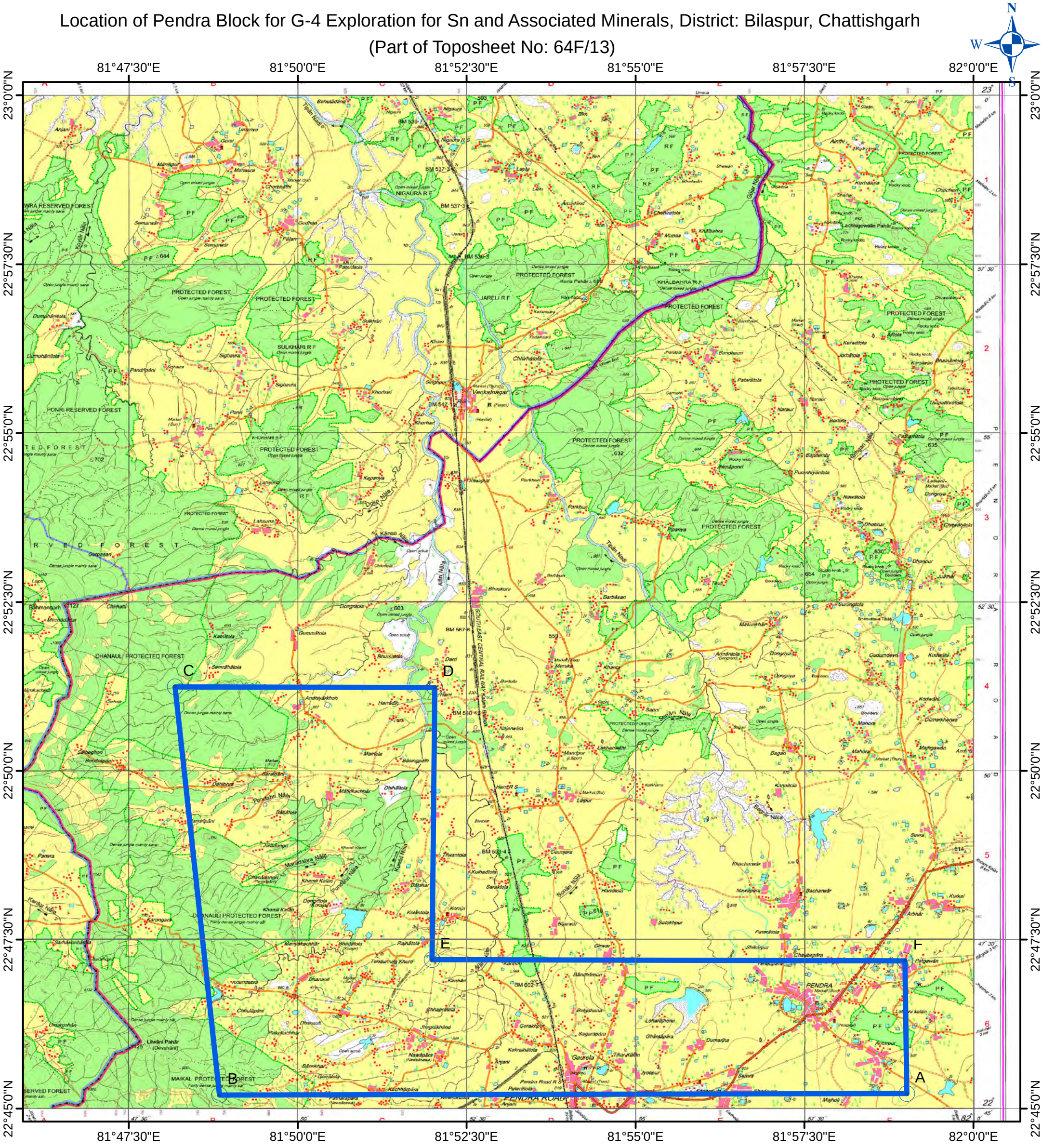
9.0.0 Enclosures

Plate –I: Location Map of Pendra Block, Dist: Bilaspur, Chattishgarh

Plate- II: Geological Map of Pendra Block, Bilaspur, Chattishgarh

Location of Pendra Block for G-4 Exploration for Sn and Associated Minerals, District: Bilaspur, Chattishgarh

(Part of Toposheet No: 64F/13)



Legend

- State Boundary
- Cardinal_Points_Pendra_Block
- Proposed_Pendra_Block

0 1 2 4 6 8 Kilometers

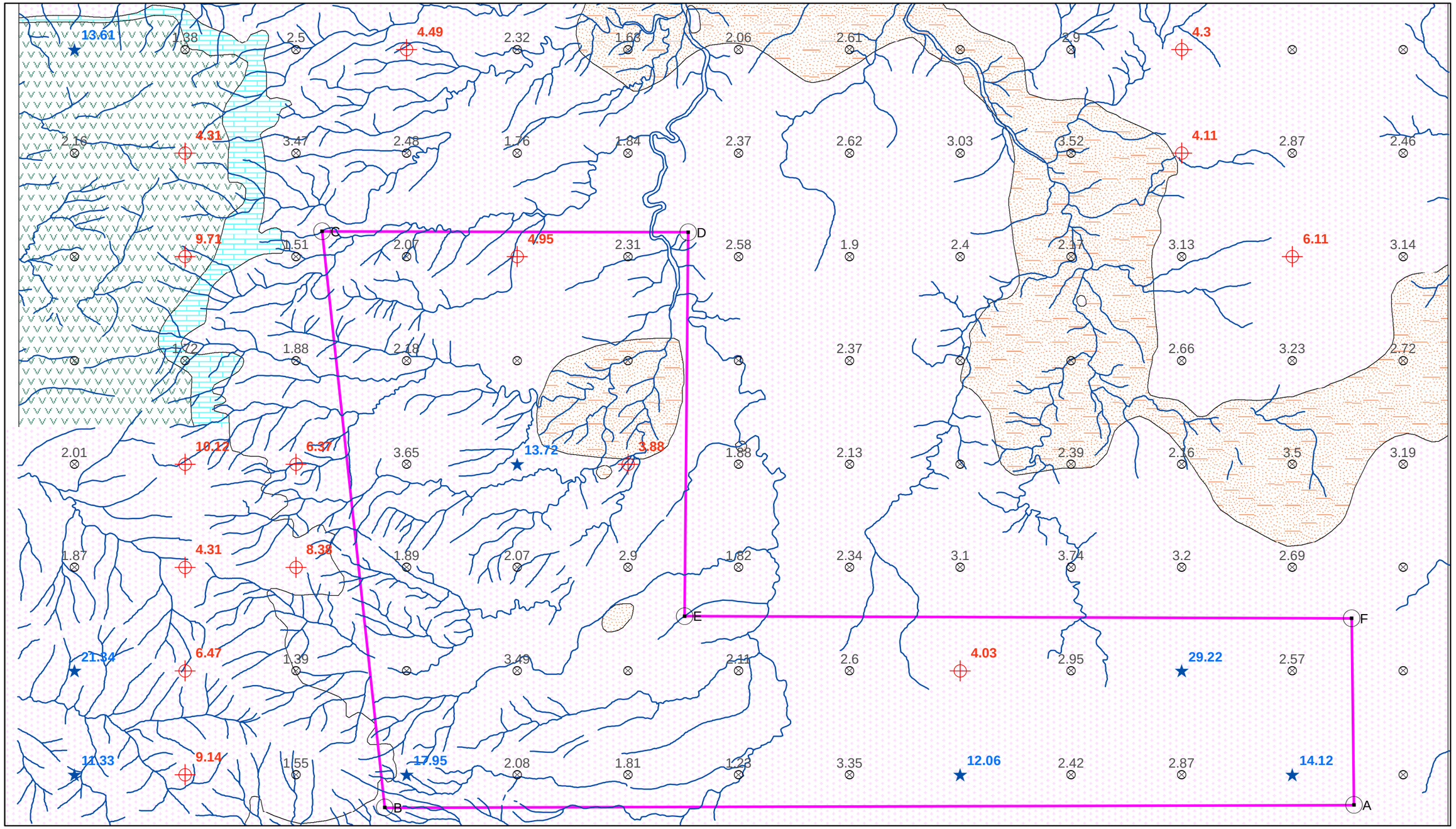
1 centimeter=1,000 meters

Coordinates of cardinal points of Pendra Block,
District:Bilaspur, Chattishgarh

Cardinal Points	Geographic		UTM		Area (Sq.Km)
	Latitude	Longitude	Easting (m)	Northing (m)	
A	22.7537	81.9836	600989.3987	2516591.8289	110.362
B	22.7533	81.8140	583572.0461	2516438.8838	
C	22.8540	81.8030	582384.9588	2527587.1725	
D	22.8539	81.8671	588959.8863	2527607.7239	
E	22.7868	81.8664	588935.8801	2520175.9102	
F	22.7864	81.9832	600920.2742	2520209.5937	

PLATE-I

GEOLOGICAL MAP OF PENDRA BLOCK (SOURCE: BHUKOSH)



Cardinal_Points_Pendra_Block

Below Mean Value of Sn

Mean To Threshold Value of Sn

Above Threholed Value of Sn

Proposed_Pendra_Block

Lithological Index

BASALT

FINE GRAINED SANDSTONE

GRANITE GNEISS

LATERITE

LIMESTONE

0 1 2 4 6 8 Kilometers

1 centimeter = 750 meters

PLATE-II

ESTIMATE FOR RECONNAISSANCE SURVEY (G-4 STAGE) FOR TIN AND ASSOCIATED MINERLAS IN PENDRA BLOCK
(110.362 SQ.KM AREA) DISTRICTS- BILASPUR, CHATTISHGARH
Total Area - 110.362 sq. km; Completion Time - 14 Months

S.N	Item of Work	Unit	Rates as per NMET SoC 2020-21		Estimated Cost of the		Remarks
			SoC-Item -Sl No.	Rates as per SoC	Qty.	Total Amount (Rs)	
A	**GEOLOGICAL WORK**						
a	Charges for one Geologist per day at HQ for monitoring, data processing etc. (1 no.)	day	1.3	9,000	60	5,40,000	
b	Charges for one Geologist per day at field for mapping, channel sampling and logging (1 no./1 party)	day	1.3	11,000	180	19,80,000	
c	Labour (2 Nos) Base rate - Rs.437/-	day	5.7	437	360	1,57,320	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
e	Charges for one Sampler (1 Party) for geochemical, channel and core samples	one sampler per day	1.5.2	5,100	45	2,29,500	
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	Sub-Total A					**29,85,480**	
B	**PITTING AND TRENCHING** $						
a	Trenching	Cu m	2.1.1	3,300	250	8,25,000	
	Sub-Total B					**8,25,000**	
C	**DRILLING**						
1	Drilling up to 300m (Hard Rock)	m	2.2.1.4a	11,500	500	57,50,000	Will be done after review of mapping, geochemical sampling & analytical work and Geophysical Survey
2	Borehole deviation Survey by Multishot Camera	m	2.2.6	330	500	1,65,000	
3	Land / Crop Compansation (in case the BH falls in agricultural Land)	per BH	5.6	20,000	5	1,00,000	Amount will be reimburse as per actuals or max. Rs. 20000 per BH with certification from local authorities
4	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000	5	10,000	
5	Transportation of Drill Rig & Truck associated per drill (1 rigs)	Km	2.2.8	36	1,000	36,000	1650km to & fro from Nagpur/ Rig
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7	Drilling Camp Setting Cost	Nos	2.2.9a	2,50,000	1	2,50,000	
8	Drilling Camp Winding up Cost	Nos	2.2.9b	2,50,000	1	2,50,000	
9	Approach Road Making (Hilly Terrain)	Km	2.2.10b	32,200	4	1,28,800	Road Making will be considered as per the requirement and Road Making Charges will be reimbursed accordingly.
10	DGPS Survey for BH coordinate & Reduce level including Base station	per point	1.6.2	19,200	6	1,15,200	As per MEMC Amendment Rule, 2021 and Mineral Auction Rule, 2021
13	Drill Core Preservation	per m	5.3	1,590	180	2,86,200	Amount will be reimbursed after successful delivery of the core to concerned library/authorities
	Sub Total C					**72,41,200**	
D	**LABORATORY STUDIES**						
1	**Chemical Analysis**						
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i)	**Primary samples + 15% Check**						
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iv)	Whole Rock Analysis(Major Oxides + Trace elements, i.e. Ba, Ga, Nb, Ta, Yb, Rb, Sr, Y,Zr, Ni, Cr)	Nos	4.1.15a + 4.1.15b	8,831	20	1,76,620	
	Sub-Total -D					**18,73,365**	
E	**Total A to D**					**1,29,25,045**	
F	**Geological Report Preparation**	**5 Hard copies with a soft copy**	**5.2**	For the projects having cost more than Rs. 50 lakhs Upto 150 Lakhs - A minimum of Rs. 2.5 lakhs or 5% of the value of work whichever is more and Rs 3000/- per eaach additional Copy		**6,46,252**	
G	**Peer review Charges**		**As per EC decision**			**10,000**	
H	**Preparation of Exploration Proposal (5 Hard copies with a soft copy)**	**5 Hard copies with a soft copy**	**5.1**	**2% of the Cost or Rs. 3.8 Lakhs whichever is lower**		**2,71,426**	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.
I	**Total Estimated Cost without GST**					**1,38,52,723**	
J	**Provision for GST (18% of K)**	**%**				**24,93,490**	GST will be reimburse as per actual and as per notified prescribed rate
K	**Total Estimated Cost with GST**					**1,63,46,213**	
				or Say Rs. , In Lakhs:		***163.46***	

Note:

$ 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 and geochemical sampling

Note - If any part of the project is outsourced, the amount will be reimbursed as per the Paragraph 3 of NMET SoC and Item no. 6 of NMET SoC. In case of execusion of the project by NEA on its own, a Certifiate regarding non outsourcing of any component/project is required.

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			1	2	3	4	5	6	REVIEW	7	8	9	10	11	12	13	14
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2	Geological Mapping	Month															
3	Pitting /Trenching	Cu.m															
4	Surface Drilling (1 rig)	m															
5	Geologist Party days	days															
6	Sampling Party days	days															
7	Camp Winding	Month															
8	Laboratory Studies	Month															
9	Geologist Party days, HQ	days															
10	Report Writing with Peer Review	Month															
	* Commencement of project will be reckoned from the day the exploration acreage is available along with all statutory clearances.																
	*Time loss on account of monsoon/agricultural activity/forest clearance/local law and order problems will be addition to above time line.																