PROPOSAL FOR RECONNAISSANCE SURVEY (G-4 STAGE EXPLORATION) FOR REE AND ASSOCIATED MINERALS IN AND AROUND LANGMIPI - LACHING THING AREA (124.68 SQ.KM), DISTRICTS: WEST KARBI ANGLONG, STATE: ASSAM

COMMODITY: REE AND ASSOCIATED MINERALS

BY

MINERAL EXPLORATION AND CONSULTANCY LIMITED

DR. BABASAHAB AMBEDKAR BHAWAN

SEMINARY HILLS

PLACE: NAGPUR

DATE: 15th SEPTEMBER, 2024

Summary of the Block for Reconnaissance Survey (G-4 Stage)
GENERAL INFORMATION ABOUT THE BLOCK

	Features	Details
	Block ID	Langmipi - Laching Thing area
	Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
	Commodity	REE & associated minerals
	Mineral Belt	Assam-Meghalaya Gneissic Complex
	Completion Period with entire Time schedule to complete the project	15 months
	Objectives	Based on the evaluation of geological data available, the present exploration program has been formulated to fulfill the following objectives: i. To carry out geological mapping on 1:12,500 scale. ii. To collect surface (Bedrock/Soil/Stream Sediment) and pit samples for analyses of REE and other associated minerals to decide further course of exploration program. iii. To drill scout boreholes in case, analytical results of surface/pit/trench samples are positive. The future course of exploration program will be decided after reconnaissance survey (G-4) outcome to G-3/G-2 level of exploration. iv. To estimate reconnaissance resources of REE bearing minerals as per UNFC norms and Minerals (Evidence of Mineral Contents) Amendment Rules, 2021 at G-4 level mineral 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	Two
	Expected Field days (Geology) Geological Party Days	Geologist Party Days: 180 (Field) + 60 Days (HQ)

1.	**Location**

CORNER POINTS	LATITUDE	LONGITUDE	NORTHING	EASTING
A	25°48'1.29"N	92°44'2.85"E	2853602.01 m N	473346.98 m E
B	25°49'57.74"N	92°48'9.82"E	2857172.08 m N	480229.55 m E
C	25°50'36.56"N	92°52'4.06"E	2858358.07 m N	486751.69 m E
D	25°48'46.13"N	92°52'4.06"E	2854961.09 m N	486748.27 m E
E	25°43'26.64"N	92°48'37.84"E	2845140.19 m N	480992.29 m E
F	25°43'26.64"N	92°44'2.85"E	2845153.41 m N	473329.94 m E

	Villages	Mokyndur, Langmipi, Laching Thing, Rongpi, Thenglong
	Tehsil/ Taluk	Sarupathar Tehsil
	District	West Karbi Anglong
	State	Assam
2.	**Area (hectares/ square kilometers)**	
	Block Area	124.68 sq. km
	Forest Area	Block area partially falls in forest land. Block is free form eco sensitive zone and wild life sanctuary area (As per PM Gatishakti Portal)
	Government Land Area	Data Not Available
	Private Land Area	Data Not Available
3.	**Accessibility**	
	Nearest Rail Head	Lanka
	Road	Kheroni-Tahpat-jirkinding road passes through the eastern part of the block.
	Airport	Lokpriya Gopinath Bordoloi International Airport which is located at a distance of 250 km West from the proposed block.
4.	**Hydrography**	

	Local Surface Drainage Pattern (Channels)	Kopili River along with its tributaries, Diyung and Amring rivers form the drainage system. Kopili river shows meandering with a number of cut-offs in its course.
	Rivers/ Streams	Kopili, Diyung and Amring
5.	**Climate**	
	Mean Annual Rainfall	The average annual precipitation is 1698 mm.
	Temperature	The average minimum temperature varies between 10°C (December to January) & the average maximum temperature varies between 31 to 40°C (July to September).
6.	**Topography**	
	Toposheet Number	Part of Toposheet Nos. 83C/09, 83C/10, 83C/13 & 83C/14
	Morphology of the Area	Geomorphologically the entire area is occupied by undulating low hills.
7	**Availability of baseline geosciences data**	
	Geological Map (1:50K/ 25K)	1:50,000 (Bhukosh)
	Geochemical Map	Geochemical Map were generated from the data mentioned in the report of NGCM program and also verified from NGDR portal.
	Geophysical Map	Not Available
8.	**Justification for taking up Reconnaissance Survey / Regional Exploration**	a. The proposed Langmipi - Laching Thing Block in the eastern fringe of the Shillong Plateau mostly comprises of Migmatites belonging Assam-Meghalaya gneissic complex which has been intruded by younger granites and pegmatites. Geologically, younger granites and pegmatites are potential to host REE minerals. b. National Geochemical Mapping program of GSI has in the area reveals anomalous value of ΣREE. A total 30 Nos of stream sediment samples are falling within the proposed block and the ΣREE+Sc+Y value varies form 242.03 ppm to 1618.07. There are 19 samples which shows ΣREE+Sc+Y value more than 500 ppm and 7samples having more than 1000 ppm value. The anomaly map (Plate No-III) shows the anomaly is located in the north eastern, western and the south eastern part of the block..

		c. The REE normalized diagram shows enriched LREE with decreasing value of HREE. Majority of the samples shows negative Eu anomaly whereas 4 Nos of samples shows positive Eu anomaly. d. It is evident from the data that fractional crystallization had played an important role. Geological setup and Geochemical data indicate the chance of occurrence of REE bearing minerals in the area with anomalous concentration. e. Hence the proposal for G-4 level exploration for REE has been formulated in the area.

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1.1.0 INTRODUCTION

1.1.1 Rare earth elements are characterized by high density, high melting point, high conductivity and high thermal conductance with distinctive electrical, metallurgical, catalytic, nuclear, magnetic and luminescent properties make them indispensable for a variety of emerging high end and critical technology applications which are relevant to India's energy security i.e., clean energy, defense, civilian application, environment and economic areas. REE demand is expected to continue its growth, especially for their use in low carbon technology. The ever-increasing demand for these REE necessitates a concerted effort to augment the resource position of our country.

1.1.2 The Rare earth elements (REE) are a collection of 17elements in the periodic table , namely scandium, yttrium and lanthanides (15 elements in the periodic table with atomic numbers 57 to 71 namely: lanthanum (La), cerium (Ce), praseodymium(Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb) and lutetium (Lu). In spite of its low atomic weight Yttrium (atomic no. 39) has properties more similar to the heavy lanthanides and is included with this group. Scandium (atomic no. 21) is found in a number of minerals although it may also occur with other rare earth elements (REE).

1.1.3 Although these elements tend to occur together, the lanthanide elements are divided into two groups. The light rare earth elements (LREE) are those with atomic numbers 57 through 62(La, Ce, Pr, Nd, Pm, Sm) and the heavy rare earth elements (HREE) are those with atomicnumbers from 63 to 71 (Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu) and Y, Sc. However, because of their geochemical properties, rare earth elements are typically dispersed and not often found concentrated as rare earth minerals in economically exploitable ore deposits.

1.1.4 Generally the light rare earth elements (LREE) are more abundant in the earth's crustand easily extracted than heavy rare earth elements (HREE). It was the very scarcity of these minerals (previously called "earths") that led to the term "rare earth". The first such mineral discovered was gadolinite, a compound of cerium, yttrium, iron, silicon and other elements. This mineral was extracted from a mine in the village of Ytterby in Sweden; several of the rare earth elements bear names derived from this location.

1.1.5 In the other hand, critical minerals are those minerals that are essential for economic development and national security. The lack of availability of these minerals or concentration of extraction or processing in a few geographical locations may lead to supply chain vulnerabilities and even disruption of supplies. The future global economy will be underpinned by technologies that depend on minerals such as lithium, graphite, cobalt, titanium, and rare earth elements. These are essential for the advancement of many sectors, including high-tech electronics, telecommunications, transport, and defence. They are also vital to power the global transition to a low carbon emissions economy, and the renewable energy technologies that will be required to meet the 'Net Zero' commitments of an increasing number of countries around the world. Hence, it has become imperative to identify and develop value chains for the minerals which are critical to our country.

1.1.6 Considering important parameters such as resource/ reserve position in the country, production, import dependency, use for future technology/ clean energy, requirement of fertilizer minerals in an agrarian economy, the Committee has identified a set of 30 critical minerals. These are Antimony, Beryllium, Bismuth, Cobalt, Copper, Gallium, Germanium, Graphite, Hafnium, Indium, Lithium, Molybdenum, Niobium, Nickel, PGE, Phosphorous, Potash, REE, Rhenium, Silicon, Strontium, Tantalum, Tellurium, Tin, Titanium, Tungsten, Vanadium, Zirconium, Selenium and Cadmium. (Critical Minerals for India, Report of the Committee on Identification of Critical Minerals, Ministry of Mines, June 2023)

1.1.7 A study, conducted by the Council on Energy Environment and Water, identified 12 minerals out of 49 that were evaluated as 'most critical' for India's manufacturing sector by Vision 2030 which makes more thrust for exploration in Strategic Mineral, Precious Metals, Platinum Group of Elements by Government of India.

1.2.0 BACKGROUND

1.2.1 The Exploration for strategic, critical, rare metals, rare earths elements, PGE and precious metals is given top priority by Govt. of India after amendment of MMDR act. Moreover, emphasis has been given to explore the more numbers of blocks in North eastern states. Keeping this in view, the present proposal Reconnaissance Survey (G-4 stage exploration) for REE and associated minerals in and around Langmipi - Laching Thing area, Districts: West Karbi Anglong, Assam is being put up for evaluation under NMET funding and execution.

1.3.0 BLOCK LOCATION AND ACCESSIBILITY

1.3.1 Langmipi - Laching Thing area falls in the parts of Survey of India Toposheet No. 83C/09, 83C/10, 83C/13 and 83C/10 covering a total area of 124.68 sq. km in around villages of Mokyndur, Langmipi, Laching Thing, Rongpi, Thenglong, West Karbi Anglong District, State-Assam. The location map of the block area is given in **Plate-I.** The Co-ordinates of the corner points of the block area both geodetic and UTM are given in **Table No. -1**

Table- 1

Co-ordinates of the Corner points of the Langmipi - Laching Thing Area, West Karbi Anglong, Assam

CORNER POINTS	LATITUDE	LONGITUDE	NORTHING	EASTING
A	25°48'1.29"N	92°44'2.85"E	2853602.01 m N	473346.98 m E
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1.3.2 The block is connected through Kheroni-Tahpat-jirkinding road passes through the eastern part of the block. Lanka is the nearest railhead which is located 20 km north eastern side of the block. The nearest airport is Lokpriya Gopinath Bordoloi International Airport which is located at a distance of 250 km West from the proposed block.

1.4.0 PHYSIOGRAPHY, DRAINAGE AND CLIMATE:

1.4.1 Geomorphologically the entire area is occupied by undulating low hills. Kopili River along with its tributaries, Diyung and Amring rivers form the drainage system. Kopili river shows meandering with a number of cut-offs in its course.

1.4.2 The climate is in general Monsoon type. But there are some differences from the other districts of Assam. Rainfall increases towards the east and the west of Assam from this district. The climate is of an extreme type compared to other districts of Assam. The pattern of rainfall is such that the south is usually dry and the north is relatively rainier. The area around Lanka is a semi desert. Floods create havoc usually from June to October. The

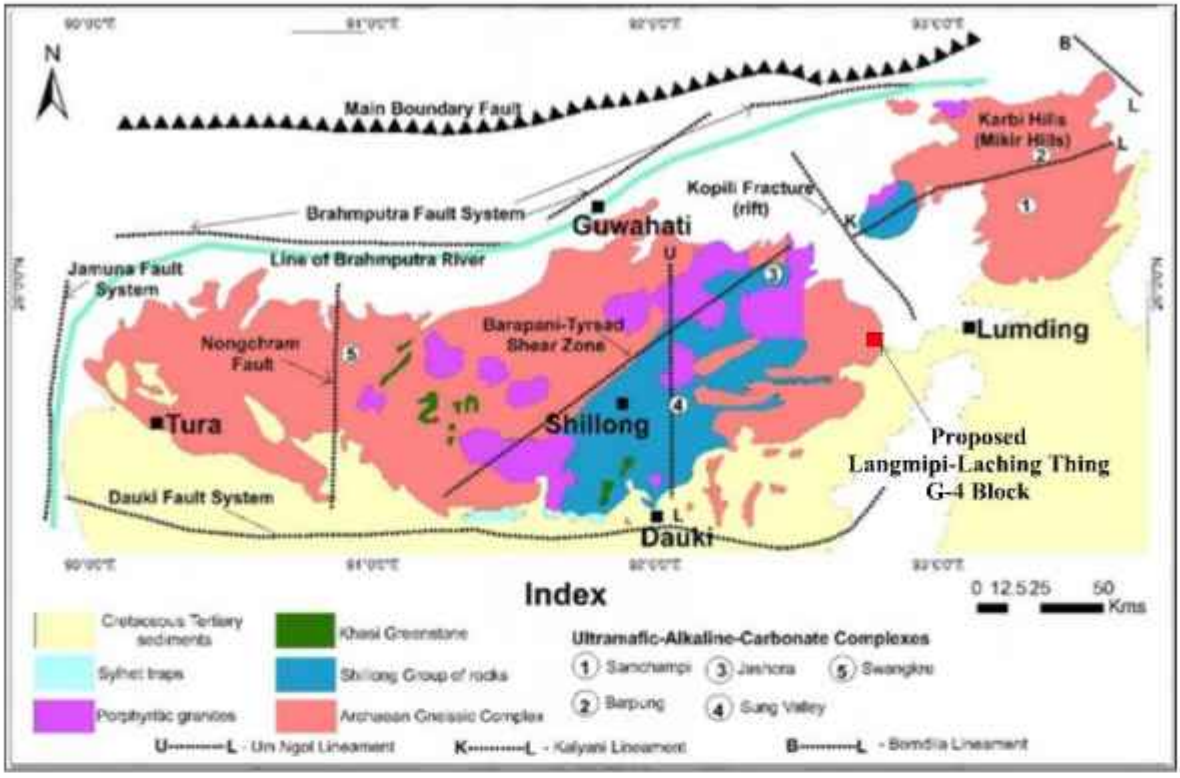
monsoon lasts from April to May. Deforestation, El-Nino effect, speedy urbanization and global warming in general are changing the rainfall pattern of the district. At present, the district has a vegetation cover of only 12%. The climate of the area is characterized by coldness, generally high humidity and abundant rainfall. Thunderstorms generally occur between March and May. The southwest Monsoon period is from June to about first week of October. From November the day and night temperatures start to fall, the drop being more rapid in nights. January is the coldest month, with the mean daily maximum being 20°C and the mean minimum being 10°C.

1.5.0 FLORA & FAUNA:

1.5.1 The topography of the area consists of the dense jungle with grass land, where the grass often reaches a height of 5 m in the south eastern part of the toposheet. Within the dense jungle vast area of grass lands with about 1 to 2 m high grass. These are abound in deers, monkeys, jungle fowl, pheasants and small birds of several kinds, whereas elephants are fairly common near the hills where the jungle is considerably thick .Tiger (Dhekiapatia), Leopard (Nahor Phutuki),Wolf (Kukurnesia), Swamp Deer(Bheleng), Spotted Deer(Phutokiasor),Barking Deer(Kiasor),Hog Deer, Hares and Wild Bison are reported to be very common. Monitor Lizard (Gui) and Python (Ajagar) also available. Poisonous serpents and Vipers of various types are reported. The forest can be broadly placed under northern Tropical Moist Deciduous and Northern Tropical Evergreen types. Sal preserved in small pockets some of which is regenerated. A number of species are mixed along with Sal. Undergrowth is mainly grasses. The evergreeen to semi-evergreen forest is chiefly confined to slopes and ridges and is characterized by the penness of the country and canopy. Commercially valuable cane is also available in these areas.

1.6.0 REGIONAL GEOLOGYAND STRUCTURE

The proposed study area in toposheet No. 83C/09, 83C/10, 83C/13 and 83C/14 lies in the eastern fringe of the Shillong Plateau. The study area is regionally sandwiched between NNW-SSE trending Kopili Fault in the east NE-SW trending Barapani-Tyrsad shear zone in the north west.



Regional Geological and tectonic framework of the Shillong Plateau (compiled by GSI from Evans, 1964); Desikachar, 1974; Mazumdar, 1976; Nandy, 1980; Acharyya et al., 1986; Gupta and Sen 1988; Golani, 1991; Das Gupta and Biswas, 2000)

1.6.2 The Assam Meghalaya Gneissic Complex is considered as the tectonically detached and uplifted part of the Indian Peninsular Shield separated by the "Garo-Rajmahal Gap" (Evans 1964) from the Chhotanagpur Gneissic Complex. The main structural trend in the Assam Meghalaya Plateau is NE-SW, which is persistent all over the area and variation of this trend is apparent at places near the contact of granite pluton intrusions. The NE extension of the Assam Meghalaya Plateau is known as Mikir Hills. The Mikir Hills are separated from the Meghalaya plateau by the alluvium tract of the Kopili River and the NE-SW Kopili Fault (Nandy, et al., 1986).

1.6.3 The lithounits in and around the region belong to the Archean-Proterozoic Assam-Meghalaya Gneissic Complex (AMGC) which is unconformably overlain by metasedimentary rocks by Paleo-Meso Proterozoic Shillong Group, all intruded by Neo-Proterozoic-early Palaeozoic granite plutons. The AMGC comprises of ortho and para gneisses, schists, migmatites and granulites and the Shillong Group comprises meta-sedimentary rocks of Quartzite, phyllite, quartz sericite schist, conglomerate.

1.7.0 GEOLOGY AND STRUCTUREOF THE BLOCK AREA

1.7.1 The rock types of the area include Assam-Meghalaya Gneissic Complex of Archaean to Proterozoic age, metasediments of Shillong Group of lower to middle Proterozoic age, Neo Proterozoic to early Palaeozoic acid intrusive which includes medium to coarse grained granite and Tertiary sedimentary rocks of Jaintia Group, Barail Group and unclassified Quaternary sediments. The litho-stratigraphy succession in and around the area is as follows

Table No: 2

The Litho-stratigraphy succession in the toposheet No 83C/13 and 83C/14 (After GSI)

Supergroup	Group	Formation	Lithology	Age
	Newer Alluvium Group	Barpeta Formation II	Clay, micaceous sand and silt	Holocene
		Barpeta Formation I	Sand, silt and clay	
		Hauli Formation	Micaceous sand, silt, clay	
	Older Alluvium Group	Sorbhog Formation	Silty clay with minor sand	Pleistocene
Unconformity				
	Barail Group		Sandstone and shale	Eocene to Oligocene
Diastem				
	Jaintia Group	Shella Formation	Sandstone	Palaeocene to Eocene
		Kopili Formation	Sandstone with thin bands of shale, limestone and intraformational conglomerate	
Unconformity				
	Mylliem Granitoid		Medium grained granite	Neoproterozoic to Early Palaeozoic
Intrusive Contact				
	Shillong Group		Quartzite	Palaeoproterozoic to Mesoproterozoic
Unconformity				
Assam Meghalaya Gneissic Complex			Augen Gneiss, Biotite Gneiss, Migmatites	Archean (?) to Proterozoic

1.7.2 The Assam Meghalaya Gneissic Complex comprises Biotite Gneiss, Augen Gneiss and Migmatite. Biotite gneiss is one of the most important lithological unit and is composed essentially of quartz and feldspar with biotite, along with minor amphibole defining the gneissosity. As observed by the previous workers, the grain size varies from outcrop to outcrops. The gneissosity also differs from place to place and at some places the gneissosity is not well developed. Some of the quartz shows recrystallisation.

1.7.3 In the other hand, Augen gneiss is also a quartzo-feldspathic rock with biotite and amphibole making up the mafics and with the augens of pink feldspar. It appears to occupy an intermediate position between the biotite gneiss and the true migmatite. Thus in some places the occurrence of augen gneiss is inferred from the presence of boulders in the nalla sections. The quartz and some feldspar appear to have been crushed into lenticular eye like forms producing the characteristic augens. The chief material of the augens are the feldspar. The mafic bands are around the augens. The augen gneiss is similar to that of the biotite gneiss shows effects of migmatisation, and in these portions the size of the augens are small.

1.7.4 Migmatite is a faintly and unevenly foliated composite gneiss. It is composed of alternating melanocratic palaeosome of ferromagnesian minerals and leucocratic neosome of quartzo feldspathic materials in varying proportions.

1.7.5 Quartzite of Shilong group of metasediments is present in northern part of the proposed study area. As observed by the previous geoscientist, this quartzite is having about 90 % quartz with subordinate amounts of feldspar and mica. Some recrystallisation of quartz is also observed at some places. Though some lateral and vertical variation is observable. The cementing materials is siliceous to slightly ferrugeneous. At some places quartzite has the appearance of a granite, granite gneiss, there the intrusions of quartzo-feldspathic material could be seen. The quartz grains are generally of uniform size and are well rounded.

1.7.6 The fossiliferous limestone of paleocene to Eocene age belonging to Jaintia group is also present in the study area and a small south eastern part of the block is covered with sandstone of Barail Group of Eocene to oligocene age.

1.7.7 Eastern part of the proposed study area is covered with silty clay and sand of older alluvium group of Pleistocene age.

1.7.8 The regional geological setup also indicates the possibility of presence of youger intrusite granite and pegmatite body which could not be mapped in 1:50000 scale due to its dimension.

1.7.9 The studied area underwent polyphase deformation and metamorphism. Magmatic structure like migmatite banding are noticed in the gneisses. The sub dendritic to sub trellised drainage pattern indicates that the area is undulating.Number of small folds like ptygmatic fold, box fold, kink band fold etc are present in the area. The presence of granite gneiss, biotite gneiss, augen gneiss and migmatites indicates that the area has undergone high degree of metamorphism mainly in the southern most part.

1.8.0 PREVIOUS WORK - OBSERVATION AND RECOMMENDATIONS

1.8.1 La Touche was perhaps the first geologist who visited the area during 1883 while taking traverses through Jaintia, Khasi and Dima Hasao. The area was subsequently mapped by Sondhi (1949) and Mukherjee (1944 and 1953). Later, Rao and Chakraborti (1963-64), Dayal and Raj (1964-65), Gangopadhayay (1965-66) etc. studied parts of the area in connection with selection of dam sites for hydel projects over Kopili River. Gopalakrishnan (1962) carried out detailed studies in this area in connection with investigation for cement grade limestones and clay.

1.8.2 The earliest work in the area has been carried out by P. Kapali, Geologist (Sr),D.P. Das, Geologist (Jr),H.S. Srivastava Geologist (Jr) on "Systematic geological mapping in the Hamren Sub-Division of the Karbi Anglong District,Assam" was carried out during the field season 1984-85 and an area of 575 sq.kms was covered in parts of toposheets 83 C/9 and 83C/13.The rock formations encountered belong to the Archaean Gneissic Complex (Biotite gneiss, Augen gneiss, Migmatite and Amphibolite);The Precambrian metasediments of Shillong Group (massive and micaceous phyllitic quartzite);Porphyritic/Porphyroblastic and other granites and granitic rocks (granitoids) and the Tertiary quartzitic sandstone of the Therria Stage.

1.8.3 Quaternary geological and geomorphological mapping was taken-up in two separate areas of Dhubri, Nagaon and and Karbi Anglong districts, Assam by C.G. Hemantha Kumar, Geologist (Sr) R.T. Bhuyan, Asstt. Geologist, B.N. Gohain, Asstt. Geologist, B. Boruah, Asstt. Geologist. A total of 1,750 sq. Km. area was mapped on 1:50,000 scale covering parts of Toposheet nos. 78 O/13 & 78O/15. 83 B/16 J33CA13 and 8J3F/4. The two separated areas are described in Nagaon and Karbi Anglong disrticts, covering an area of 1,150 sq Km in parts of Toposheet nos. 83B/16, 83C/13 and 83F/4.

1.8.4 An area of 905 sq. km. has been covered by systematic geological mapping covering parts of KarbiAnglong, North Cachar Hills and Nagaon districts of Assam in two separate blocks, one covering parts of toposheet No. 83F/4 and the other covering parts of toposheet Nos. 83G/1, 83G/2 and 83C/13 by J. C. Dutta, S. Chowdhury, D. P. Das, S. N.

Sharma, A. Bora, G. C. Sarmah; Geological Survey of India for field season 1991-92. In the area covering parts of toposheet Nos. 83G/1, 83G/2 and 83C/13, thick pile of arenaceous and argillaceous sediments belonging to the Barail, Surma and Tipam Groups is exposed.

1.8.5 Later during FS 2017-18, NGCM work has been carried out in the toposheet no 83C/13 and 83C/14. In T.S. No. 83C/14, an area of 698 sq. km was geochemically mapped with collection of 182 Nos. of stream sediment/slope wash sampling on 2 km X 2 km grid. Anomalous occurrences of Rare Earth Elements (ΣREE) in stream sediments were been concentrated in granitic gneiss near Charchim, Gilangso and Phanglangso villages in North West parts of toposheet number 83C/14. The stream sediment samples contain Total Rare Earth Elements (REE+Sc, Y) in the range of 57.79995 to 1468.484ppm. ΣLREE values ranges between 43.93 and 1263.52 ppm with an average value of 204.65 ppm and ΣHREE ranges between 13.87ppm and 240.15ppm.

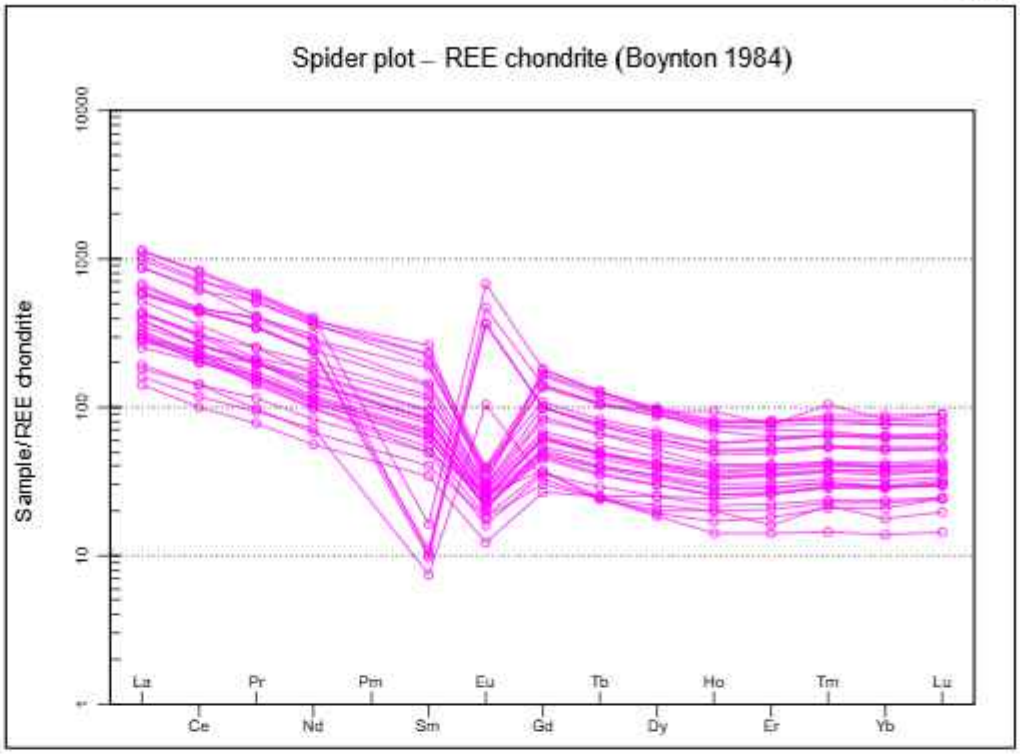
1.8.6 During F.S. 2017-18, in T.S. No. 83C/13, 698 sq. km area has been geochemically mapped and collecting 182 Nos. of stream sediment/slope wash sampling on 2 km X 2 km grid. It has been observed that TREE ranges between 140.77ppm and 1818.89ppm of 182 stream sediment samples. The anomalous value17 stream sediment samples which are collected from Rikangmiham, DeoryTinali, Langparpam and Thenglong villages in South Western parts of toposheet TREE ranges between 618.38ppm and 1920.88ppm with an average value of 1024.50ppm, LREE between 401.16 and 1608.78ppm with an average value of 753.50ppm and HREE between 207.82 and 380.21ppm. It was recommended that the area can be taken up for G4 item for REE investigation.

1.9.0 Mineral Potentiality of the Block and Justification for Taking up the Exploration

1.9.1 The proposed Langmipi - Laching Thing Block in the eastern fringe of the Shillong Plateau mostly comprises of Migmatites belonging Assam-Meghalaya gneissic complex which has been intruded by younger granites and pegmatites. Geologically, younger granites and pegmatites are potential to host REE minerals.

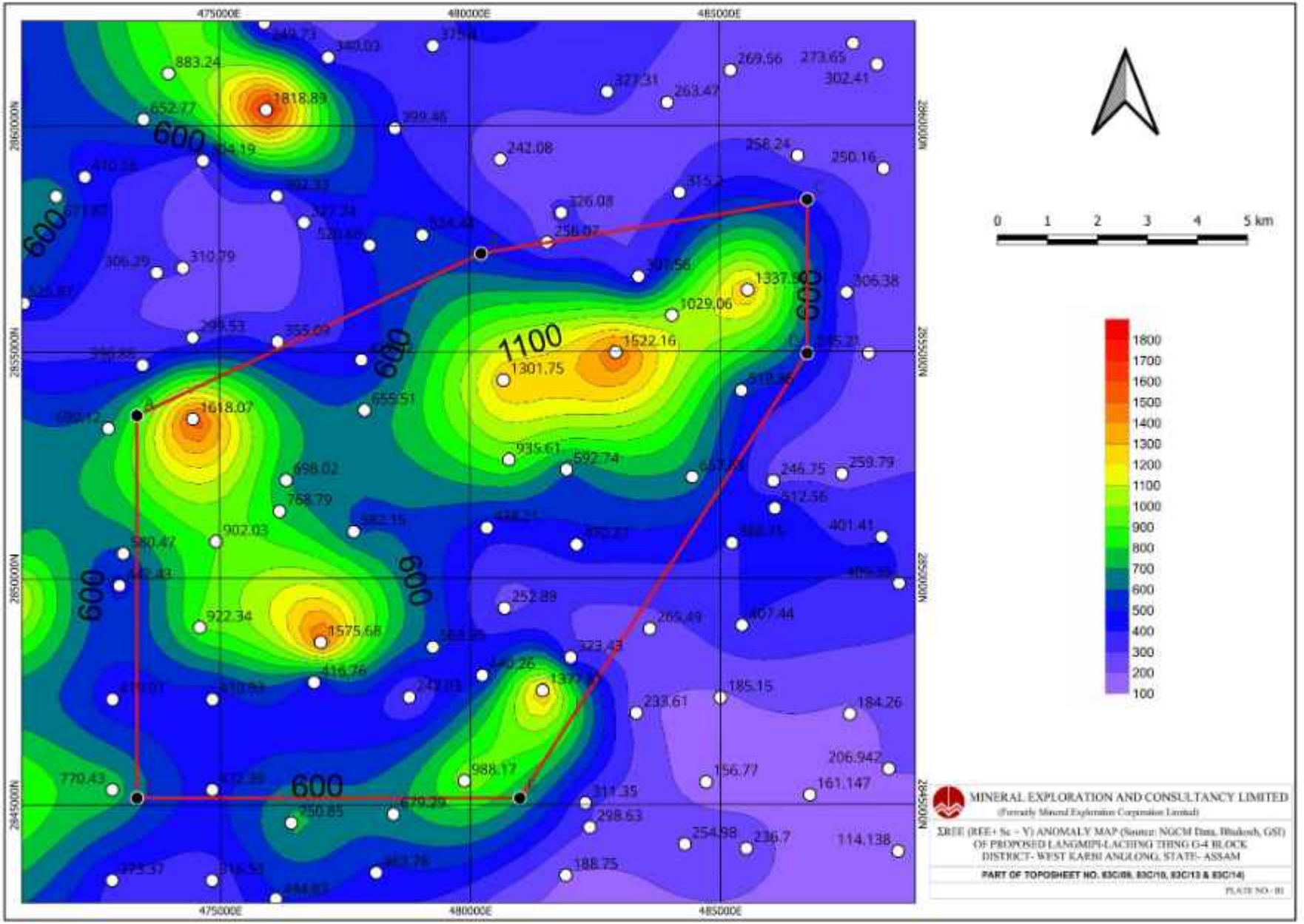
1.9.2 National Geochemical Mapping program of GSI has in the area reveals anomalous value of ΣREE. A total 30 Nos of stream sediment samples are falling within the proposed block and the ΣREE+Sc+Y value varies form 242.03 ppm to 1618.07. There are 19 samples which shows ΣREE+Sc+Y value more than 500 ppm and 7samples having more than 1000 ppm value. The anomaly map (Plate No-III) shows the anomaly is located in the north eastern, western and the south eastern part of the block..

1.9.3 The REE normalized diagram shows enriched LREE with decreasing value of HREE. Majority of the samples shows negative Eu anomaly whereas 4 Nos of samples shows positive Eu anomaly.



1.9.4 It is evident from the data that fractional crystallization had played an important role. Geological setup and Geochemical data indicate the chance of occurrence of REE bearing minerals in the area with anomalous concentration.

1.9.5 Hence the proposal for G-4 level exploration for REE has been formulated in the area.


475000E
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2855000N
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200
100
MINERAL EXPLORATION AND CONSULTANCY LIMITED
(Formerly Mineral Exploration Corporation Limited)
ΣREE (REE+ Sc + Y) ANOMALY MAP (Source: NGCM Data, Bhukosh, GSI)
OF PROPOSED LANGMIPI-LACHING THING G-4 BLOCK
DISTRICT- WEST KARBI ANGLONG, STATE- ASSAM
PART OF TOPOSHEET NO. 83C/09, 83C/10, 83C/13 & 83C/14)
PLATE NO - III

1.10.0 SCOPE FOR PROPOSED EXPLORATION.

1.10.1 The proposed Reconnaissance survey at G-4 stage exploration program for REE mineralization will comprise of Large Scale Geological mapping (1:12,500 scale), Surface Sampling (Bedrock & Stream Sediments), Soil profile sampling through Pitting, Heavy mineral separation, Drilling, chemical analysis, physical analysis and geological report preparation. The Exploration shall be carried out as per Minerals (Evidence of Mineral Contents) Amendment Rules, 2021. Accordingly, the following scheme of exploration is formulated in order to achieve the objectives. The details of different activities to be carried out are presented in subsequent paragraphs

1.10.2 **GEOLOGICAL MAPPING**

Geological mapping will be done in the entire 124.68 sq. km area on 1:12,500 scale. Rock types, their contact, structural features will be mapped. Surface manifestations of the mineralisation available along with their surface disposition will be marked on map.

1.10.3 **GEOCHEMICAL SAMPLING**

Initially around 50 Nos of follow up stream sediments samples shall be collected from 1st order and 2nd order stream around the samples with high anomalous value reported by GSI during the NGCM work to identify the provenance of the mineralisation.

Further around 50 Nos Bed Rock samples by means of chip sampling and around 25 nos surface channel sampling shall be collected from suitable litho units from the potential provinance to identify the primary source of mineralisation and to identify its distribution pattern.

Soil samples shall be collected from 2 Km X 2 Km grid by means of pitting. Hence around 50 Nos of pit may be dug with cumulative 75 cu.m of excavation. Around 50 Nos of Samples shall be collected soil horizon wise to observe the dispersion pattern in the different soil horizons.

Moreover, 20 Nos of BRS samples to be collected from the limestone body spreaded over approx. 11 sq km area within the block to identify its potentiality for industrial use.

1.10.4 **Heavy Mineral Separation**

25% of total Stream sediment and Soil profile samples, i.e., total 25 nos of stream sediment and pit samples shall be subjected to heavy mineral separation by means of heavy media, gravity and magnetic separation.

1.10.5 Drilling

Based on Geological mapping and pitting, the extension of the enriched zones will be marked. To find out the potentiality of mineralized zones in strike & dip, few scout boreholes involving 500m of drilling will be carried out for shallow level intersection of mineralized zones to target the REE bearing horizons based on anomalous values of geochemical samples.

Moreover, the subsurface variation of grade of the limestone body shall be tested by one borehole.

1.10.6 Chemical Analysis

A total around 300 Nos of samples shall be generated (Surface samples-100 (50 Stream Sediment, 50 BRS) and 25 Nos surface Channel Samples, Pit sample- 50 (For Soil Profile Sampling), Heavy Minerals: 25 Samples, Core Sample: 100) for REE and shall be analysed for 34 elements, i.e., REE and associated trace elements (Sn, Hf, Nb, Ta, U, Th, Be, Ba, Ge, As, Rb, Sr, W, Mo, Ti, Zr, Cs, Y, Sc, Pb, Zn) through ICPMS.

10% of the primary samples, i.e., 30 Nos samples shall be subjected as external check samples and analysed for the same elements by ICPMS.

10 Nos of samples shall be sujected to determination of major oxides by XRF.

20 Nos of BRS and 30 Nos of BH core samples of limestone, i.e., total 50 Nos of samples shall be subjected to analysis of CaO, MgO, SiO_2, Fe_2O_3, Al_2O_3, P_2O_5, SO_3 by XRF.

1.10.7 PETROLOGICAL STUDIES:

During the course of Geological mapping and core logging, 10 samples from various litho units from surface and intersected in boreholes will be subjected to petrographic study.

1.10.8 XRD & EPMA Study

10 nos. of samples from mineralized zones shall be subjected for XRD studies. Moreover, few samples shall also be subjected to EPMA study.

Table No 3
Summarized Details of the proposed quantum of work

Sl. No.	Item of Work	Unit	Target
1	**Geological Mapping** (on 1:12,500 Scale)	sq.km	124.68
2	**Geochemical Sampling**		
	Surface Samples (50 Stream Sediment, 50 BRS) and 25 Nos surface Channel Samples For REE	Nos	125
	Surface BRS sample for limestone	Nos	20
3	**Pitting**		
	a) Excavation (50 Nos)	Cu.m	75
	b) Collection of different horizon soil sample	Nos	120
4	**Drilling* (Phase II After Review)**		
	a) Drilling (core) Scout drilling	m	500 m
	b) Geological Logging	m	500
	c) Borehole core samples (primary) (100 for REE and 30 for Limestone)	Nos	130
5	**Laboratory Studies**		
	a)REE associated Trace Elements (34 Element)by ICPMS Surface samples-125 (50 Stream Sediment, 50 BRS) and 25 Nos surface Channel Samples Pit sample- 50 (For Soil Profile Sampling) Heavy Minerals: 25 Samples Core Sample: 100	Nos	300
	b) External Check Samples	Nos	30
	c) Analysis of CaO, MgO, SiO2, Fe2O3, Al2O3, P2O5, SO3 and K2O for Limestione by XRF and LOI) (20 BRS+ 30 BH Core sample)	Nos	50
	d) Major Oxide study	Nos	10
6	**Physical Study**		
	a)Heavy Mineral separation	Nos	25
	b) Petrological Study	Nos	10
	c) XRD Study	Nos	10
	d) EPMA Study	Hours	10
	e) XRD Study	Nos	10
7	**Report Preparation (5 Hard copies with a soft copy)**	Nos.	1

1.11.0 BREAK-UP OF EXPENDITURE

1.11.1 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. 459.63 Lakhs.** The summary of tentative cost estimates for Reconnaissance Survey (G-4 Level) is given in Table below. Detailed cost sheet for

proposed Reconnaissance Survey (G-4) for REE & associated minerals is given as Annexure No. **I**

Table No: 4

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

Sl. No.	Item	Total Estimated Cost (Rs.)
1	Geological Work	8,886,123.00
2	Pitting	954,750.00
3	Drilling	24,265,390.00
4	**Sub total**	**34,106,263.00**
5	Laboratory Studies	3,196,380.00
6	**Sub total**	**37,302,643.00**
7	Report	1,119,079.29
8	Peer Review	30,000.00
9	Proposal Preparation	500,000.00
10	**Total**	**38,951,722.29**
11	GST (18%)	7,011,310.01
Total cost including 18% GST		**45,963,032.30**
SAY, in Lakhs		**459.63**

1.12.0 TIME SCHEDULE

1.12.1 The proposed exploration programme envisages geological mapping, geochemical sampling, exploratory mining, drilling, sample preparation and laboratory studies, which will be completed within 13 months, geological report preparation will consume 3 months with one month overlapping. Therefore, a total of 15 months is planned for completion of the entire program.

Enclosed Plates:

i. Location map of Proposed Langmipi – Laching Thing Area, District: West Karbi Anglong, Assam

ii. Geological Map of Proposed Langmipi – Laching Thing Area, District: West Karbi Anglong, Assam

iii. ΣREE Anomaly Map of Proposed Langmipi – Laching Thing Area, District: West Karbi Anglong, Assam

Time Schedule for Reconnaissance Survey (G-4 Stage Exploration) For REE & associated minerals in and around Langmipi - Laching Thing Area, Districts: West Karbi Anglong, State: Assam																
		1	2	3	4	5	6	7	8		9	10	11	12	13	14	15
1	Camp Setting																
2	Geological Party Days																
3	Pitting & Sampling																
4	Heavy Mineral Separation/ Sample Preparation																
5	Laboratory Studies									Review							
6	DGPS survey /BH Fixation																
8	Core Dilling																
9	Camp Winding																
10	Geologist Party days, HQ																
11	Geological Report Writing																
12	Peer Review																
* 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																	

Cost Estimate of Reconnaissance Survey (G-4 Stage Exploration) For REE & associated minerals in and around Langmipi - Laching Thing Area, Districts: West Karbi Anglong, State: Assam

Total Area - 124.68 sq km; Scout Boreholes: 5 Nos, Average Depth: 100 m Completion Time -15 Months (After Recipt of NoC), Review after 8th Month

ANNEXURE-I

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	Rates as per SoC North Eastern States and Hilly Terrain of Himalaya (3.35 times than the normal SoC rate)	Qty.	Total Amount (Rs)	
A	**GEOLOGICAL WORK**							
a	Charges for Geologist at HQ for data processing	day	1.3	9,000	-	60	540,000	
b	Charges for Geologist at field for LSM mapping at 1:12500 scale, Surface sampling, Pitting and Scout Drilling	day	1.2	11,000	36,850	180	6,633,000	Hilly Tearrain with Forest area
c	Labour Charges for Geologist at Field	day	5.7	522	1,749	360	629,532	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
d	Charges for Sampler for geochemical, channel, Pit and BH Core Samples	one sampler per day	1.5.2	5,100	17,085	45	768,825	
e	Labour Charges for Sampling Work; Base rate - Rs. 522/ per day	day	5.7	522	1,749	180	314,766	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
	Sub-Total A						**8,886,123**	
B	**PITTING**							
a	PITTING	Cu m	2.1.2	3,800	12,730	75	954,750	A total 50 Nos of Pit with average Depth of 1.50m = 50 X 1.5 m = 75 m
	Sub-Total B						**954,750**	
C	**DRILLING**							
1	Core Drilling up to depth of 300m - Hard Rock	m	2.2.1.4a	11,500	38,525	500	19,262,500	
2	Fixation of borehole and determination of co-ordinates & Reduced Level (RL) of the boreholes by DGPS (including charges for labours deployed for the work)	Per point of observation	1.6.2	19,200	64,320	5	321,600	5 Nos of Scout BHs
3	Land / Crop Compensation (in case the BH falls in agricultural Land)	per BH	5.6	20,000	67,000	5	335,000	
4	Construction of concrete Pillar (12"x12"x30")	per borehole	2.2.7a	2,000	6,700	5	33,500	
5	Transportation of Drill Rig & Truck associated per drill	Km	2.2.8	36	121	4,400	530,640	Approx 4400 km to & fro from Nagpur/ Rig
6	Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)	month	2.2.9	50,000	167,500	3	502,500	
7	Drilling Camp Setting Cost	Nos	2.2.9a	250,000	837,500	1	837,500	
8	Drilling Camp Winding up Cost	Nos	2.2.9b	250,000	837,500	1	837,500	
9	Road Making (Hilly Terrain)	Km	2.2.10b	32,200	107,870	5	539,350	
10	Drill Core Preservation	Per m	5.3	1,590	5,327	200	1,065,300	
	Sub-Total C						**24,265,390**	
D	**Sub Total A to C**						**34,106,263**	
E	**LABORATORY STUDIES**							
1	**Chemical Analysis**							
	Primary Samples Surface + Pit + Heavy Minerals+BH Core Samples)							
i)	**Primary samples**							
	REE associated Trace Elements (34 Element)by ICPMS	Nos	4.1.14	7,731		300	2,319,300	Surface samples-125 (50 Stream Sediment, 50 BRS) and 25 Nos surface Channel Samples Pit sample- 50 (For Soil Profile Sampling) Heavy Minerals: 25 Samples (25% of Total Stream sediment and Soil profile samples) Core Sample: 100
iii)	**External check samples (10%)**							
	REE associated Trace Elements (34 Element)by ICPMS	Nos	4.1.14	7,731		30	231,930	
iv)	Analysis CaO, MgO, SiO2, Fe2O3, Al2O3, P2O5, SO3, K2O for Limestone by XRF technique and LOI	Nos	4.1.15a	4,200		50	210,000	20 Nos of BRS Sample + 30 Nos of BH Core sample for Limestone
v)	Whole Rock Analysis for Major Oxides by XRF technique	Nos	4.1.15a	4,200		10	42,000	
2	**Physical & Petrological Stusies**							
i)	Preparation of thin section	Nos	4.3.1	2,353		10	23,530	
ii)	Complete petrographic study report	Nos	4.3.4	4,232		10	42,320	
v)	Digital Photographs	Nos	4.3.7	280		15	4,200	
vi)	XRD Study	Nos	4.5.1	4,000		10	40,000	
vii)	Seperation of Heavy Media through Gravity and magnetic separation	Nos	4.3.6b	13,820		10	138,200	25 Nos of Stream Sediment Pit samples will be Subjected to Heavy mineral Seperation (25% of Total Stream sediment and Soil profile samples)
viii)	Seperation of Heavy Media by liquid	Nos	4.3.6a	2,380		25	59,500	
ix)	EPMA Study	Hour	4.4.1	8,540		10	85,400	
	Sub-Total -E						**3,196,380**	
F	**Total D+E**						**37,302,643**	
I	**Geological Report Preparation**	**5 Hard copies with a soft copy**	**5.2**	For the projects having cost exceding Rs 300 Lakh, A minimum of Rs 9 Lakh or 3% of the work whichever more and Rs 10000/- per each additional copy			**1,119,079**	EA has to submit the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.
J	**Peer review Charges**		**As per EC decision**				**30,000**	
K	**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. 5.00 Lakhs whichever is lower**			**500,000**	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.
L	**Total Estimated Cost without GST**						**38,951,722**	
M	**Provision for GST (18% of L)**	**%**					**7,011,310**	GST will be reimburse as per actual and as per notified prescribed rate
N	**Total Estimated Cost with GST**						**45,963,032**	
						or Say Rs. , In Lakhs:	*459.63*	

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, geochemical sampling and analysis

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.

475000E 480000E 485000E

2860000N 2855000N 2850000N 2845000N

0 1 2 3 4 5 km

1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100

MINERAL EXPLORATION AND CONSULTANCY LIMITED
(Formerly Mineral Exploration Corporation Limited)

ΣREE (REE+ Sc + Y) ANOMALY MAP (Source: NGCM Data, Bhukosh, GSI)
OF PROPOSED LANGMIPI-LACHING THING G-4 BLOCK
DISTRICT- WEST KARBI ANGLONG, STATE- ASSAM

PART OF TOPOSHEET NO. 83C/09, 83C/10, 83C/13 & 83C/14)

PLATE NO.- III

472000E 474000E 476000E 478000E 480000E 482000E 484000E 486000E 488000E

2860000N 2858000N 2856000N 2854000N 2852000N 2850000N 2848000N 2846000N 2844000N

45 80 45 40 70 50 45

A B C D E F

0 1 2 3 4 5 km

INDEX

Lithotypes

- ARKOSE/GRITTY SANDSTONE, COAL, FIRECLAY & SHALE
- AUGEN GNEISS
- FOSSILIFEROUS LIMESTONE/CALCAREOUS SHALE-SANDSTONE
- MEDIUM GRAINED GRANITE
- MIGMATITE
- OXIDISED TO FEEBLY OXIDISED SAND SILT AND CLAY
- QUARTZITE WITH THIN PHYLLITE INTERBANDS
- SST, SHALE,SILTSTONE,LIMESTONE & CONGLOMERATE
- UNSTABILISED & UNOXIDISED SAND, SILT AND CLAY
- WHITE TO GREYISH SAND,SILT , PEBBLE AND CLAY.

BEDDING

CLEAVAGE/FOLIATION/SCHISTOSITY (S1)

Cardinal Points of the proposed block

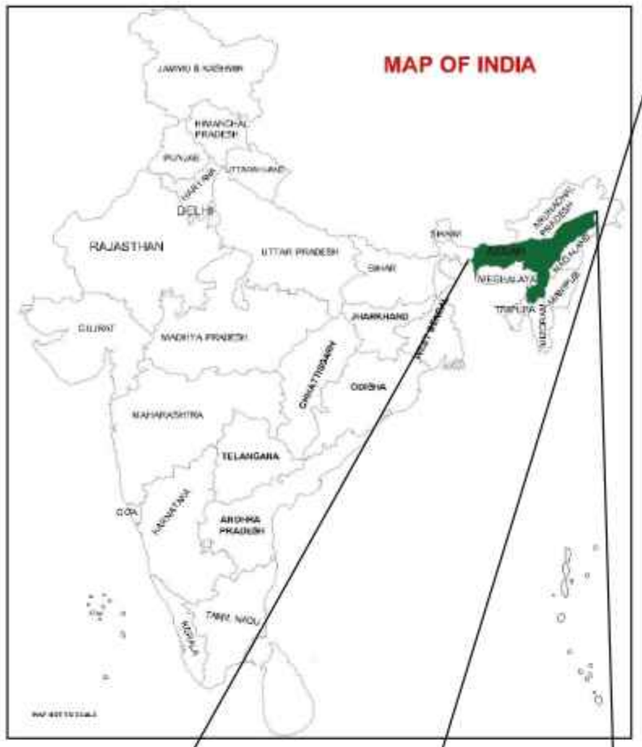
Proposed Block Boundary

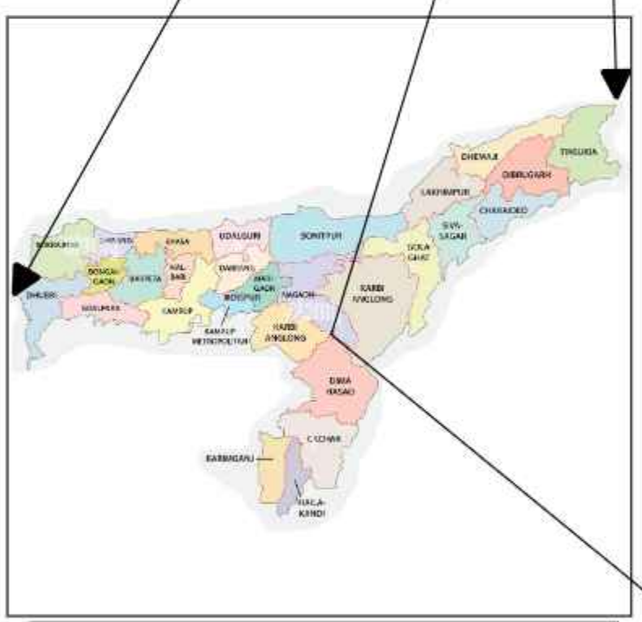
MINERAL EXPLORATION AND CONSULTANCY LIMITED
(Formerly Mineral Exploration Corporation Limited)

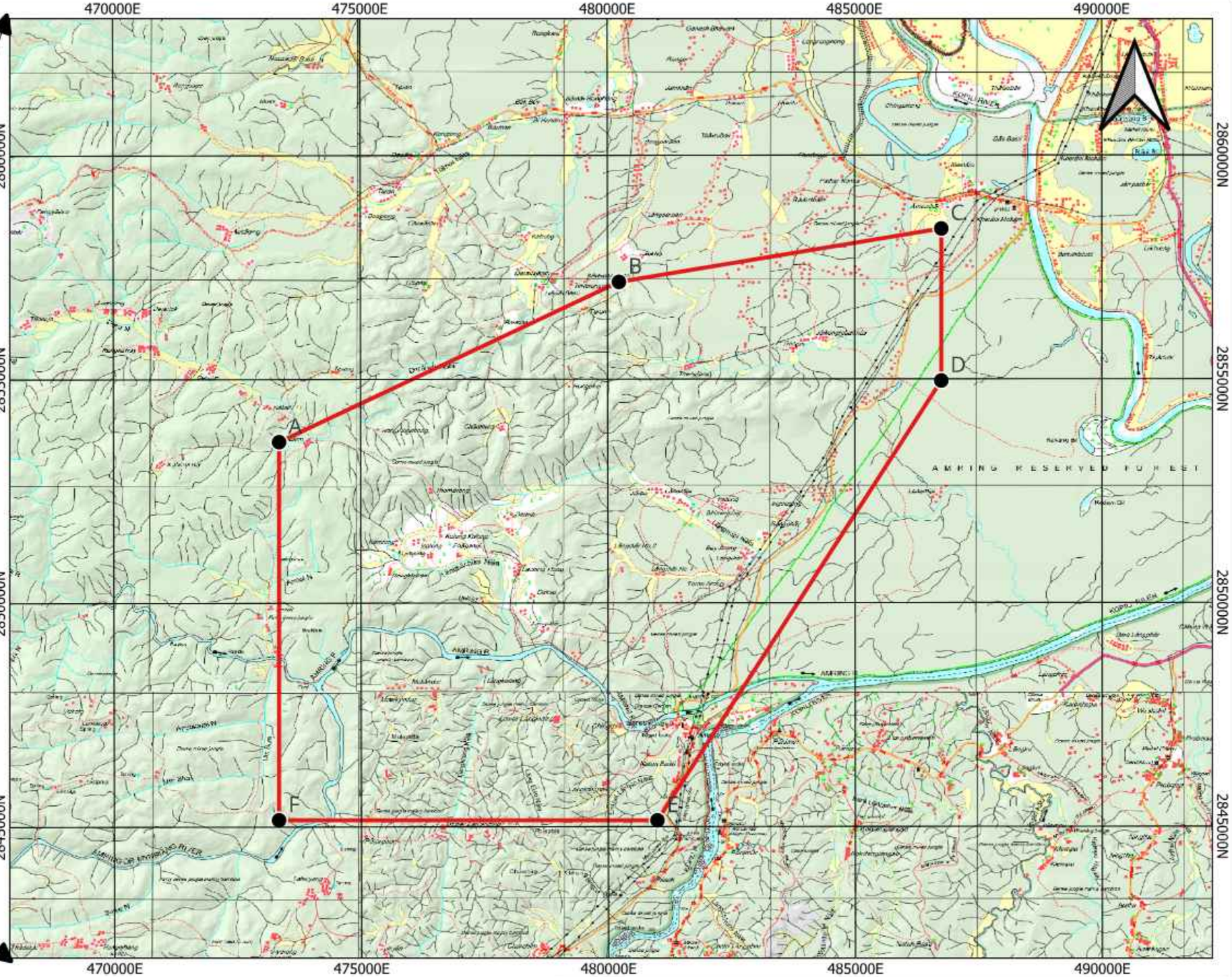
GEOLOGICAL MAP OF PROPOSED LANGMIPI-LACHING THING G-4 BLOCK
DISTRICT- WEST KARBI ANGLONG, STATE- ASSAM

PART OF TOPOSHEET NO. 83C/09, 83C/10, 83C/13 & 83C/14)

PLATE NO.- II







Co-ordinates of the cardinal points of the proposed G-4 Block for REE & RM exploration

Toposheet No. 83C/09, 83C/10, 83C/13 & 83C/14

CORNER POINTS	LATITUDE	LONGITUDE	NORTHING	EASTING
A	25°48'1.29"N	92°44'2.85"E	2853602.01 m N	473346.98 m E
B	25°49'57.74"N	92°48'9.82"E	2857172.08 m N	480229.55 m E
C	25°50'36.56"N	92°52'1.06"E	2858358.07 m N	486751.69 m E
D	25°48'16.13"N	92°52'1.06"E	2851961.09 m N	486748.27 m E
E	25°43'26.64"N	92°48'37.84"E	2845140.19 m N	480992.29 m E
F	25°43'26.64"N	92°44'2.85"E	2845153.41 m N	473329.94 m E

INDEX

- Cardinal Points of the proposed block
- Proposed Block Boundary

MINERAL EXPLORATION AND CONSULTANCY LIMITED

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LOCATION MAP OF PROPOSED LANGMIPI-LACHING THING G-4 BLOCK

DISTRICT- WEST KARBI ANGLONG, STATE- ASSAM

NOT TO SCALE (PART OF TOPOSHEET NO. 83C/09, 83C/10, 83C/13 & 83C/14)

PLATE NO.- I