

PROPOSAL FOR RECONNAISSANCE (G4) SURVEY FOR LIMESTONE IN WEST
KARBI ANGLONG DISTRICT – VOTERANLANGSO AREA, ASSAM
(THROUGH NMET FUND)



খনিজ সম্পদৰ
অন্বেষণত

GOVERNMENT OF ASSAM

DIRECTORATE OF GEOLOGY & MINING
GUWAHATI

**RECONNAISSANCE SURVEY FOR LIMESTONE IN VOTERANLANGSO AREA OF
WEST KARBI ANGLONG DISTRICT- (ASSAM) EXPLORATION G-4**

Details enclosed with map

i.	Name of Mineral	Limestone
ii.	Name of Block	VOTERANLANGSHO
iii.	Location	Latitude : 25°37'00"N to 25°34'00"N Longitude : 92°44'3"E to 92°44'50"E
iv.	Toposheet No.	83 C/10 and 83 C/14
v.	Name of villages	Voteranlangsho, Chirimthipi
vi.	Sub-division	Hamren
Vii.	District	West Karbi Anglong District
Viii.	Area	25 km ² (approximately)
ix.	Type of Land	Forest and agriculture land belongs to private and Govt. near Krungming Reserve forest
x.	Status of Exploration	Partly explored by DGM
xi.	Detailed mapping	25 sq. km. in 1:12500 Scale
xii.	Present Category of UNFC	334
xiii.	Total Meterage to be drilled	500mtrs (approx.)
xiv.	Number of borehole to be drilled	10 nos. (approx.) 5 in Polygon pattern and 5 In prospective zones
xv.	Spacing of boreholes	More than 800 Mtr. (borehole to borehole)
xvi.	Depth of borehole	50 Mtr. (approx.)
xvii.	Category of exploration as per UNFC	334
xviii.	Logging	All the borehole cores (Approx. 300 Mtr.)
xix.	Sampling	300 Nos. (Approx.)
xx.	Analysis	DGM Lab.
xxi.	Report Writing	Will be done by Exploration agency

**Reconnaissance survey (G-4 level) for Limestone Exploration Voteranglangso
Area in 25 sq. km. area District West Karbi Anglong (Assam)**

1. Introduction:

Assam is the state where the cements are very much in short supply from the local production. Limestone is perhaps, the most exploited minerals since limestone constitute the basic raw materials for these industries. But today bulk of the cement comes to Assam outside of the state because of the local plant hardly meet the growing demand. In view of the above, the central and state government have been evincing keen interest in promoting cement plants, mini or major, within the state of Assam. In this background, the state Directorate of Geology and Mining was entrusted with the task of undertaking raw materials investigation for cement and lime manufacture within the State.

2. Location of the Block:

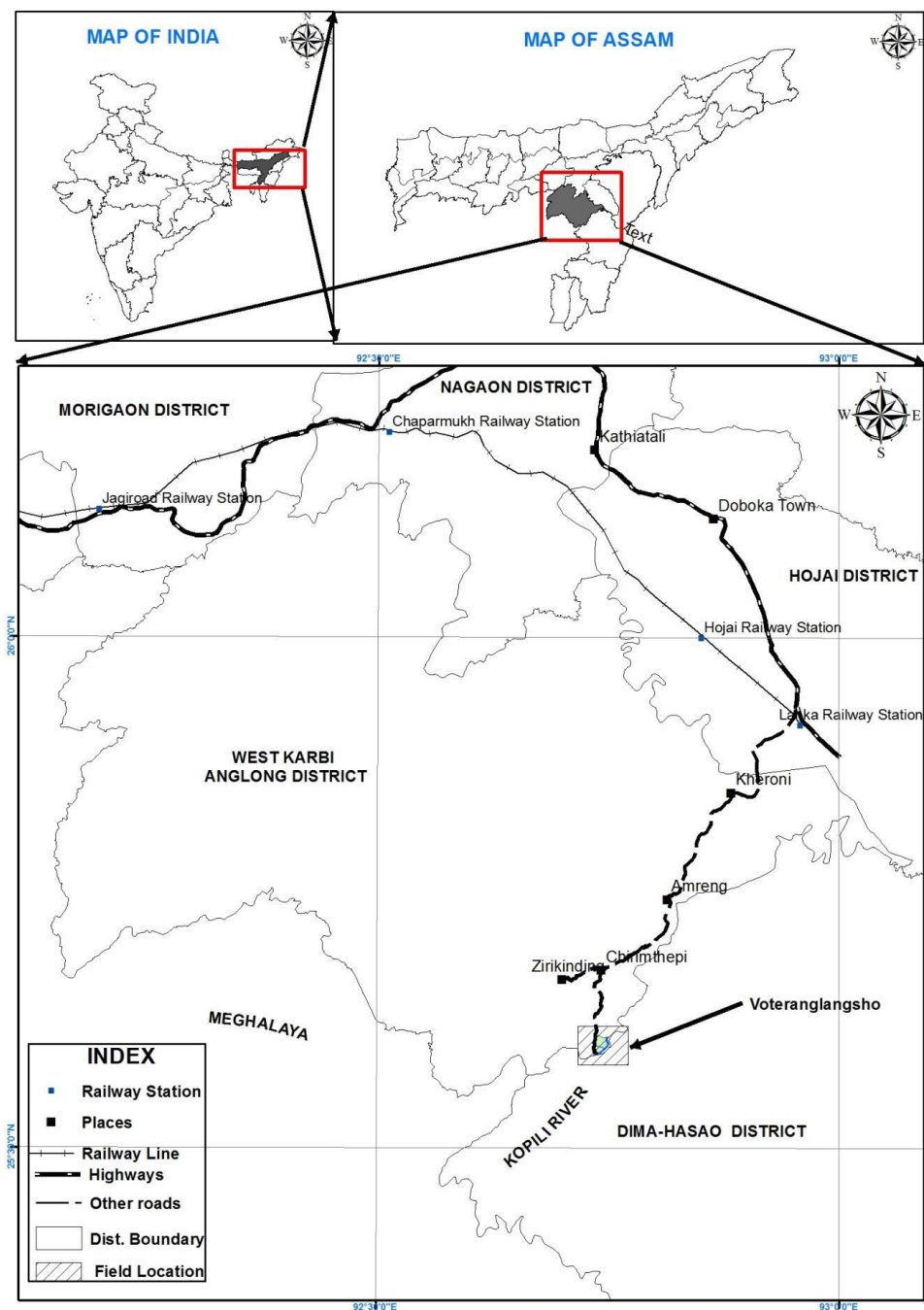
The area under investigation lies along the northern part of The Kopili river. The deposit was found to be situated on Voteranglangso area under Zirikingding Police Station of West Karbi Anglong, Assam.

The Limestone Deposits of Voterlangsho, West Karbi-Anglong district, Assam located on the north bank of Kopili River on opposite river bank of NEEPCO Power Plant, which is on the south bank of Kopili River. It is 50 Km. south-west from Lanka, 36 Km. SW from Kheroni and 18 Km. south-west from Koka Picnic Spot and about 9 km south from Chirimthepi and which is around 19 km north-east from the Zirikingding township. The nearest train station is Lanka Railway Station which fall the main line of North East Frontier railway which lies at a 151 km from Guwahati.

The deposit occurs on Voterlangsho hill with a very undulating topography and bounded Kopili River on South and South-Eastern part by ranging in Latitude 25.37'00"N to 25.34'00"N and Longitude 92.44'3"E to 92.44'50"E.

Lack of proper development of transport and communication in West Karbi Anglong district has always been considered as one of the main hurdles in implementing development schemes. The area is also connected with the roads which allow moving the heavy motors also, but conditions of the roads are very poor. Although road repairing is on progress, but major portions are in poor condition.

The area under investigation is shown as location as in the figure Map.1



Map 1 : LOCATION MAP OF THE STUDY AREA

Physiology and Drainage:

The area of the investigation lies along the western periphery of Karbi Anglong district, Assam and adjacent to the Jaintia Hills district of Meghalaya. The area lies along the southern flank of the Shillong Plateau. The drainage system of the area is controlled by its major river Kopili which flows roughly along East- West direction. The area lies along the northern bank

of the Kopili River. The river Amrengh, one of the major tributaries of Kopili also influenced the drainage system of the area. The area comprises flat topped hillocks raising from 328 meters to 284 meters above MSL. The Sukura Nala which is one of the important streams flowing to the SE direction towards Kopili River through the deposit. The overall drainage pattern is insequent type. Some nalas were dried during the investigation period.

3. Previous Work:

Preliminary investigation for the cement grade Limestone in Votera Langso in West Karbi Anglong district was carried out by the Directorate of Geology and Mining, Assam in 2019 with a view to prove and estimate sufficient reserve of cement grade limestone to sustain the raw materials demand for the cement plant.

The investigation is carried out in the form of detailed geological mapping, sampling, chemical analysis of the samples and petrography of the samples collected from the respective locations.

This investigation has resulted that the limestone deposit has the CaO % along with a lower percentage of MgO % which is favorable for the cement plant.

Under the direction of the Director of Geology and Mining, Assam, the planning, programming, and co-ordination of the work of this investigation was done by chief Geologist of the department. The actual execution of the work at the site was carried out by a team consisting of Baranlee Nath, Sr. Geologist (project in-charge); C.D Nath, Sr. Geologist (camp in-charge); Dibakar Das, Asstt. Geologist; Mousam Bora, Asstt. Geologist. The survey unit was led by Amrit kr. Gogoi (surveyor) and the field analytical laboratory unit was led by Naren Deka (Deputy Chief Chemist).

The geological work also in this area near Zirikinging was carried out by H.C. Baruah and Md. R Quddus in the year 1967-68 which was an investigation of Kaolin and Glass Sand deposit at Jirikyndeng while another work of investigation for minerals around Lanku Charchim and Zirikinging was done by B.K Barooah and D. Bharali in the season of 1983-1984, Directorate of Geology and Mining, Assam. Geological Survey of India (GSI) also carried out systematic surveying in nearby areas like Panimur, Hamren, Jaintia Hill, Umramso etc. During Field session 1985-86 GSI carried out systematic geological mapping in parts of Karbi Anglong district (Hamren sub-division), Assam by P Kapali, Geologist (Sr) D P Das Geologist (Jr) and H S Srivastava, Geologist. Again in 1986-87 systematic geological mapping in Dima-Hasao district, Assam and Jaintia hills district, Meghalaya carried out by S. Sarkar Geologist (Jr.) U. P. Singh Geologist (Jr.) S. D. Pimprikar Assistant Geologist of Geological Survey of India.

4. Geology and Structure:

4.1. Regional Geology:

Geologically, Assam and NE India compile most astonishing stratigraphy. Starting from oldest Archean gneissic rocks to recent quaternary alluvium found in this part of India. Among all other parts of Assam Karbi-Anglong host most complex geological stratigraphy. These complex stratigraphy, structure, and deformations results in Karbi-Anglong as the most mineralized part of Assam. The Archean basement gneissic complex forms the basement as other parts of NE India. It is followed by quartzites and phyllites metasediments belong to Shillong Group of rocks. But these metasediments are mostly absent in West Karbi-Anglong area. These gneisses and Precambrian metasediments of central part are intruded by younger acidic granitoid intrusive bodies. These granitoid bodies are scattered as Inselberg. These Precambrian rocks are

overlain by the younger Tertiary shelf sediments, which are again overlain at places by the Quaternary and Recent deposits.

Gneissic Complex represents the oldest group of rocks. The gneiss, when highly weathered, looks like sandstone. However, on careful examination, the dark toned mafic bands can be identified). The most prominent foliation (Gneissosity/ Schistosity/ Cleavage) strike along NE-SW direction and dip by 60°-70° towards southeast (GSI NER Report 1986-87). Exposure of equigranular, hard, compact homogeneous dark colored granite occurs at many places. The granites are generally grey-white in color with a pink tinge on fresh surface. On weathering it becomes dark grey to black in color with sub rounded spheroidally weathered surface. These Precambrian rocks are overlain by tertiary sedimentary sequences of sandstone, limestone and shale and thin coal beds. These strata are mainly horizontal to sub-horizontal striking NNE-SSW dipping towards SE by an amount of about 40 -100.

The general stratigraphic sequence of the area can be summarized as below:

Age	Group	Formation	Lithounits
Quaternary to recent			Soil and alluvium
Late Eocene to Late Paleocene	Jaintia Group -----	Kopili Formation	Alteration of splintery shale andfine to medium grained brownish sandstone
		Shella Formation	Sylhet Limestone
			Member(Fossiliferous Limestone)
			Sylhet sandstone Member withSandstone, clay and thin coal seam
	Disconformity		
Precambrians	Shillong Group		Quartzo feldspathic and quartz veins Intrusives- biotite- granitoid
	Angular Unconformity		
	Basement Gneissic Complex(BGC)		Granitoid Gneisses

Table 1: Generalized regional stratigraphic succession of the area (GSI 1985-86)

4.2. General Geology:

The limestone deposits of Voteranglangso are part of the Carbonate belt extending from the Kopili – Kharkar confluence in the south-west up to Panimur in the North-east. Our area of study comprises Precambrian crystalline rocks overlain by tertiary shelf sedimentary rock sequences of Assam-Arakan basin. The area consists of a variety of rock types which can be broadly divided into three groups: -

- i) The Pre- Cambrian granites and gneisses, quartz veins.

- ii) Tertiary hard and gritty sandstones
- iii) The tertiary fossiliferous limestones (Band II and III)

The stratigraphy of the area can be generalized as shown in the table below: -

Age	Group	Formation	Lithounits	Description
Quaternary to recent			Soil and alluvium	Red color soil
Late Paleocene to late Eocene -----	Jaintia Group	Sheila Formation	Sylhet Limestone	Band II: Highly fossilliferous hard limestone Band III: Less fossilliferous hard crystalline limestone
			Basal Sandstone	Medium to fine grained gritty sandstone grey to brown color quartzitic in character
Disconformity				
Precambrian	Basement Crystalline	Granite and various gneissic rocks		

The limestone deposit of the Voteranglangso of West Karbi Anglong district, belong to the Sylhet limestone formation of the Jaintia group (Eocene). This limestone deposit is exposed within northern bank of Kopili river upto Sukura Nala. The general strike direction the deposit is NNE-SSW and dipping is toward SE direction with an attitude ranging between 4°-8°. The width of the deposit varies from 400 to 700 meters.

This area of investigation lies at the south-eastern flank of the Pre-Cambrian rocks of the Shillong Plateau which falls in the toposheet number 83 C/10 and 14. Here Pre-Cambrians are overlain by the sedimentary rocks and soil covers. There are occasional inliers of granites and gneiss together with veins of quartz and pegmatites towards east and west of the location.

4.3. Description of the Rock Unit

5.3.1 Pre- Cambrian Complex:

The Pre- Cambrian rocks are represented by pinkish to greyish colored coarse grained porphyritic granites and granitoid gneiss. These granitoid bodies are well exposed along the Zirikinging to Mokoilum as well as Mokoilum to Jowai Road. On the other hand, some of the rounded small intrusive granitoid bodies also found near Charchim village on Kheroni Zirikinging road. Although gneissic rocks are not so much exposed on surface, but some patches are exposed as Inselberg at Langmepi on Kheroni-Zirikinging road.

Gneissic Complex represents the oldest group of rocks. The gneiss, when highly weathered, looks like sandstone. However, on careful examination, the dark toned mafic bands can be identified). Exposure of equigranularity, hard, compact homogeneous dark colored granite occurs at many places. On weathering it becomes dark grey to black in color with sub rounded spheroidally weathered surface. The porphyrite granite is generally light grey to pink in color depending upon the color of the constituent feldspar. The porphyrys are generally of K-feldspar and vary in sizes from a few mm in size to upto 5 cm as found near Makailum. At places about more than 70% of the rock mass is of the feldspar porphyrys only (GSI NER Report 1985-86).



Photo: Rounded porphyritic granite exposed near Mokoilum area where white color patches are feldspar grains which shows maximum length of upto 5cm.

5.3.2 Jaintia Group:

The rocks of the Jaintia groups rest unconformably over the Pre- Cambrian granitic and gneissic rocks. All the members of this group represent a conformable sequence having a general trends NNE-SSW and dip towards the SE at low angle 2°- 6°.

5.3.3 Basal Sandstone:

The basal sandstone consists of a thick pile of pale brown to dirty brown and whitish sandstone. The basal sandstone is hard, Compact and massive and Quartzitic in appearance. The well-developed basal sandstone can be seen near Sukura Nala as well as Koka-Panimur area. This basal sandstone highly jointed by almost 3 sets of joints which results in rectangular blocks of basal sandstone.



Photo: Rectangular blocks of Basal Sandstones on Sukura Nala resulting from rectangular joints.

5.3.4 Sylhet limestone:

The Sylhet limestone member conformably overlies the basal sandstone. Unlike in the type area around Shella Ishamati in Meghalaya, in the Voteranglangso area Sylhet formation it is probably represented by two bands of limestone (Band II and Band III). Both of the Bands are separated by a thin sandstone band. Since most of the area is covered with thick forest and soil cover, exact stratigraphy can be established after the completion of drilling process only. Both of the bands are made up of hard, compact and massive and fossiliferous limestone. Band II is more fossiliferous than Band III. The thickness of the limestone varies from 36 meters to 20 meters. It is very rich in fossils like *nummulite sp*, *alveolina sp* bounded by mostly calcareous cementing material. In thin section, large size numulites, alveolina fossils can be identified easily. These fossils are bounded by calcareous cementing material. Again, a few quartz grains and opaque material are also found in thin section. From the petrography, it can be concluded that the limestone is of "oolitic" type of limestone.

The Kopili formation is the supermost formation of the Jaintia group lying conformably over the Sylhet limestone, which is not present in the type of area of investigation.





Photo: Various surface exposure of Sylhet limestone along Sukura Nala as well as nearby Kopiliconnecting road. Surfaces are weathered due continuous water and biological activity

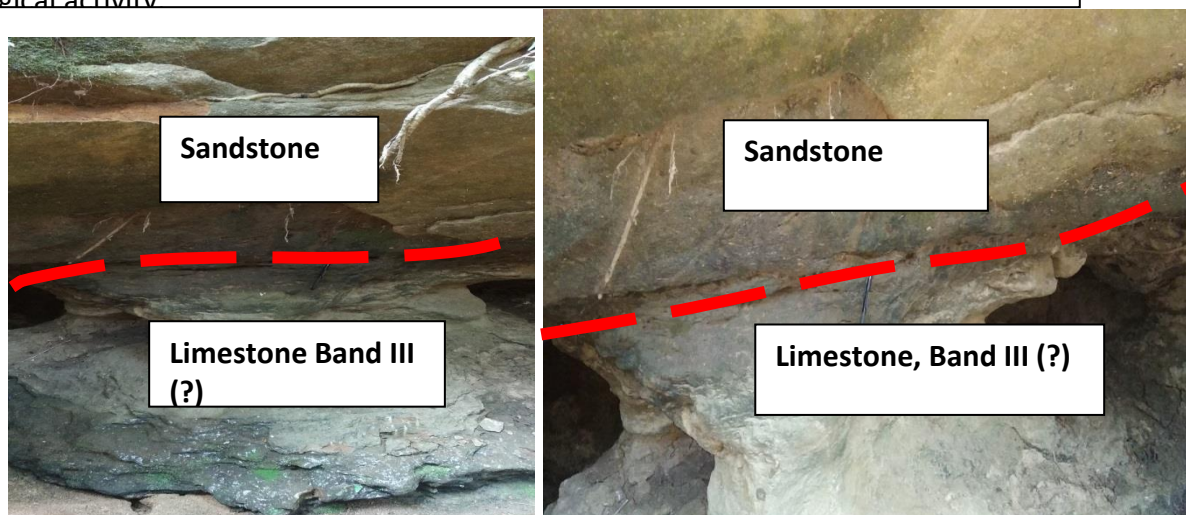


Photo: Contact between Sylhet limestone (Band III) and intermediate sandstone member.

5.4 Structures

The major structure of the area is fault which immensely affected the area of investigation. It is the Kopili Strike-slip fault along which Kopili River flow separating Shillong Plateau from Mikir hills. The right flank of the deposits there is Kopili River which flows trending in NW-SE. As we mentioned above Sylhet formation mostly horizontal dipping an about 40 – 80. Therefore, these rock sequences are devoid of any major deformational structures. Limestone strata are so massive and weathered that bedding planes cannot be mapped easily. Similarly in case of sandstone also bedding planes are not so clearly identifiable. The other small-scale structures that are observed in the field are the current beddings in sandstone, joints in sandstone, calcite recrystallization in limestone and sink hole in limestone etc.



Photo: Current bedding in sandstone
along Sukura Nala

Photo: Joints in sandstone along Sukura
Nala

5. **Objective of the proposed exploration program:**

The following are the objectives of proposed exploration:

- i) To demarcate the Limestone occurrence in the study area by Geological Mapping on 1: 12500 Scale for G-4 level of exploration.
- ii) To collect surface out crop samples and get analysed for six radical to find out the quality & grade of Limestone.
- iii) In case the results of the proposed exploration are encouraging then future exploration can be planned.
- v) To carry out the exploration as per Mineral (Evidence of Mineral Contents) Rule- 2015, Mineral Auction Rule-2015 and MMDR ACT, 1957 Amended,2015 in turn to facilitate the State Govt. (Assam) in Auctioning of Blocks.

6. **Methodology of Exploration:**

6.1. **Topographic Survey & Geological Mapping:**

Triangulation network will be laid down in the proposed study area of 25 Sq.Km. Detailed Geological Mapping will be done in the proposed block on 1:12500 scale. Borehole will be fixed on the ground. RL's and co-ordinates of survey and exploration points will be determined. All the geological features will be recorded. This map will be used as base map for future work.

6.2. Surface Sampling:

Surface / outcrop samples will be collected during Geological Mapping from outcrops / exposures of Limestone formations on a systematic 400m x 400m grid interval in an area of 25 sq.km (Approx). In case outcrops are not available on systematic grid then random samples will be collected from the available outcrops / exposures. On systematic 400m x 400m grid interval approximately 300 number samples will be generated/ collected. Ten no of samples will be tested for 6 radicals/ major oxides i.e. CaO, MgO, Al₂O₃, SiO₂, Fe₂O₃ and LOI.

6.3. Core Drilling:

- After the analysis of surface samples, number of continuous or detached mineralized zones may come up on map.
- Drill Core Logging: The drill core will be logged for rock types, structural features, textures, intersection of ore zones and type of mineralization an occurrence of various core minerals.
- Drill Core Sampling: During the geological logging of drill core, mineralized zones will be marked based on concentration and Lithological variation. All core samples (primary) will be analyzed.
- Petrological & Mineralogical Studies will be done as per requirement.

6.4. Laboratory Studies:

7.4.1 Chemical Analysis: All the surface / outcrop samples approximately 10 Nos will be analysed for 6 radicals/ all major oxides CaO, MgO, Al₂O₃, SiO₂, Fe₂O₃ and LOI.

7.4.2 Petrological Studies: Petrological studies will be done on around 10 Nos. of drill core specimen.

7.4.3 Specific Gravity Determination: Specific Gravity will be determined on 10 Nos drill core specimen.

7. Quantum of Work Time Schedule Propose:

Time schedule for Reconnaissance survey (G4) for limestone in Voteranlagso area of West Karbi, District: Anglong, Assam.														
S. N o.	Activities	Months												
		1	2	3	4	5	6	Review	7	8	9	10	11	12
1	Camp mobilisation													
2	Mapping (1:12500)													
3	Geologist days in field													
4	Surface drilling (1 rig)													
5	Survey days													
6	Sampling days													

7	Laboratory Studies													
8	Camp winding													
9	Geologist days in HQ													
10	Geological Report Writing													
Note: 1. Commencement of project may be reckoned from the day the exploration acreage is available along with all statutory clearances.														
2. Time loss on account of monsoon/agricultural activity/forest clearance/local law & order problem may be additional to above time line.														

Table No.2: - Quantum of Work Proposed

<u>Sl. No.</u>	<u>Item of Work</u>	<u>Unit</u>	<u>Quantum</u>
1	Topographic Survey on 1:12500 scale.	Sq. Km.	25
2	Geological Mapping on 1:12500 scale.	Sq. Km.	25
3	Surface / Out crop sampling	Nos.	300 numbers in an area of 25 Sq. Km
4	Core drilling (B.H)	Nos	10
5	Laboratory Studies: Surface / Out crop Samples for 6 radicals i.e.CaO, MgO, Al ₂ O ₃ , SiO ₂ , Fe ₂ O ₃ and LOI	Nos	10
6	Petrological Studies (Petrographic Studies)	Nos	10
7	Specific Gravity Determinations	Nos	10
8	Report Preparation (Digital format)	Nos.	1

8. Exploration Report:

Data generated from proposed exploration along with integration of earlier data of GSI will be utilized in Report preparation.

9. Justification

- In view of MMDR Amendment Act and Mineral Auction Rule 2015 DMG Govt. of Assam has requested DGM to take up the exploration in this block.
- The exploration work has to be carried out systematically i.e. Geological Mapping, Survey at 400m X 400m grid (G-4 level) initially.
- The exploration will help in planning of future exploration programme.

Reconnaissance survey (G4) for limestone in Voteranlagso area of West Karbi, District: Anglong, Assam. Block area- 25.00 sq km; Nos. of Borehole- 10; Borehole depth range- 50-60m; Completion Time- 12 Months							
S. No.	Item of Work	Unit	Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal		Remarks
			SoC-Item -SI No.	Rates as per SoC	Qty.	Total Amount (Rs)	
A	Geological mapping/Survey (1:12500 scale)						
a	Charges for Geologist (Field)	day	1.3	11,000	120	13,20,000	
b	Labour Charges for geological mapping/survey; Base rate - Rs.437	day	5.7	437	240	1,04,880	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
c	Charges for surveyor	one surveyor per day	1.6.1a	8,300	30	2,49,000	
d	Charges for Sampler	one sampler per day	1.5.2	5,100	60	3,06,000	
e	Labour Charges for Sample work; Base rate - Rs.437	day	5.7	437	240	1,04,880	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
f	Bore Hole Fixation and determination of co-ordinates & Reduced Level of the boreholes by DGPS	Per Point of observation	1.6.2	19,200	10	1,92,000	
	Sub Total- A					22,76,760	
B	Pitting & Trenching/Drilling						
	Pitting & Trenching	per cu m	2.1.1	3,330	200	6,66,000	
a	Drilling- Soft rock	m	2.2.1.1b	5,242	500	26,21,000	
b	Land / Crop Compansation (in case the BH falls in agreecultural Land)	per BH	5.6	20,000	10	2,00,000	Amount will be reimburse as per actuals or max. Rs. 20000 per BH with certification from local authorities
c	Construction of concrete Pillar (12"x 12"x 30")	per borehole	2.2.7a	2,000	10	20,000	
d	Transportation of Drill Rig & Truck associated per drill	Km	2.2.8	36	500	18,000	Certification in this regard is required to be provided
e	Monthly Accomodation Charges for drilling Camp (up to 2 Rigs)	month	2.2.9	50,000	3	1,50,000	
f	Drilling Camp Setting Cost	Nos	2.2.9a	2,50,000	1	2,50,000	
g	Drilling Camp Winding up Cost	Nos	2.2.9b	2,50,000	1	2,50,000	
h	Road Making (Flat Terrain)	Km	2.2.10a	32,200	15	4,83,000	Road Making will be considered as per the requirement and Road Making Charges will be reimbursed for max. 15 km.
i	Drill Core Preservation	per m	5.3	1,590	500	7,95,000	Amount will be reimbursed after successful delivery of the core to concerned library/authorities

	Sub Total- B					54,53,000	
	Sub Total A to B					77,29,760	
C	Sub Total A & B after incorporating Additional Rate for exploration work in remote and inaccessible terrain in North Eastern States and Hilly Terrain of Himalaya		para 5 of SoC	3.35 times higher than the normal SoC		2,58,94,696.00	Certification that area falls in remote and inaccessible terrain in North Eastern State and/or Hilly Terrain of Himalya region
D	Laboratory studies						
a	Primary samples						
	For 6 radicals i.e. CaO, MgO, Al2O3, SiO2, Fe2O3 and LOI (AAS method)	Nos	4.1.7a & b	2,841	450	12,78,450	
b	Check samples Internal (5%) and External (10%)						
	For 6 radicals i.e. CaO, MgO, Al2O3, SiO2, Fe2O3 and LOI (AAS method)	Nos	4.1.7a & b	2,841	68	1,93,188	
c	Petrological samples						
	Preparation of thin section	Nos	4.3.1	2,353	10	23,530	
	Study of Thin Section	Nos	4.3.4	4,232	10	42,320	
d	Bulk density						
	Determination of insitu bulk density	No.	4.1	3,540	5	17,700	
	Sub Total- D					15,55,188	
E	Charges for one Geologist per day at HQ	day	1.3	9,000	30	2,70,000	
F	Total - C+D+E					2,77,19,884	
G	Geological Report Preparation		5.2 (iii)	For the projects exceeding Rs. 150 Lakhs but less than 300 Lakhs: A Minimum of Rs. 7.5 lakhs or 3% of the work whichever is more		8,31,596	EA has to submit the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.
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		3,80,000	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.
I	Peer review Charges		As per EC decision			10,000	
	Total Estimated Cost without GST					2,89,41,480	
	Provision for GST (18%)					52,09,466	GST will be reimbursed as per actual and as per notified prescribed rate
	Total Estimated Cost with GST					3,41,50,946	or Say 341.50 Lakh
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 execution of the project by NEA on its own, a Certificate regarding non outsourcing of any component/project is required.							

