# Proposal for Reconnaissance Survey (G4 Stage) of VTM and PGE (Pt, Ir, Os, Pd, Ru, Re, Au) in Koilamati, Karbi Anglong, Assam under NMEDT

## Commodity: VTM and PGE (Pt, Ir, Os, Pd, Ru, Re, Au)

**By**

**MMPL Private Limited**

**Place: Kolkata**
**Date: January-2026**

## 1 Summary of the Block G4 Stage Exploration

| | Features | Details | | |
|---|---|---|---|---|
| | Block ID | Koilamati Block | | |
| | Current Exploration Agency | MMPL Private Limited | | |
| | Previous Exploration Agency | Geological Survey of India | | |
| | G4 stage Geological Report (Previous stage Geological Report) | ▪ Geology of parts of Diphu Sub-division, Karbi Anglong District, Assam. (Progress Report for the F.S. 1988-1989 by J.C. Dutta, M. Surendranath, and A.K. Buragohain).<br>▪ Systematic geological mapping of the central parts of Mikir Hills and detailed investigation of fracture line mineralised zones around Luhajuri and Bajajuri, Karbianglong district, Assam. (Progress Report for Field Season 1977-78 by G. K. Pancholi and Des Raj). | | |
| | Commodity | VTM and PGE (Pt, Ir, Os, Pd, Ru, Re, Au) | | |
| | Mineral Belt | Shillong Group | | |
| | Completion Period with the entire time schedule to complete the project | 12 months | | |
| | Objectives | Objectives of the Reconnaissance Survey (G4) in Koilamati over an area of 91.3 sq km are as follows:<br>1. Geological mapping on a 1:12500 scale within the area of occurrence of VTM and PGE.<br>2. Collection of bedrock, groove samples, trenching, and pitting.<br>3. Scout drilling will be planned based on the presence of individual mineralized zones.<br>4. Determination of thickness of ore body and estimation of resource and grade in 334 class of Minerals (Evidence of Mineral Contents) Rule 2015. | | |
| | Whether the work will be carried out by the proposed agency or through outsourcing, and details thereof. Components to be outsourced and the name of the outsourced agency | The work will be carried out by the proposed agency. | | |
| | Name/Number of Geoscientists | In the field: Two Geologists.<br>At Headquarters: One Geologist | | |
| | Expected Field Days (Geology) Geological Party Days | Item execution duration is 12 months, and the actual field days of the field geologist are 180 days for two geologists and 45 days for HQ. | | |
| **1.** | **Location** | **Point ID** | **Lattitude** | **Longitude** |
| | | A | 26° 21' 8.912" N | 93° 37' 59.599" E |
| | | B | 26° 24' 41.366" N | 93° 45' 22.917" E |

| | | | | |
|---|---|---|---|---|
| | | C | 26° 22' 26.530" N | 93° 47' 0.320" E |
| | | D | 26° 18' 21.999" N | 93° 39' 46.485" E |
| | Villages | Koilamati, SarishKoilamati, Teron Gaon, Hanse Gaon, and Jengpata | | |
| | Block | Nilip | | |
| | District | Karbi Anglong | | |
| | State | Assam | | |
| **2.** | **Area (hectares/square kilometres)** | | | |
| | Block Area | 76.32 Sq Km | | |
| | Forest Area | xx | | |
| | Government Land Area | xx | | |
| | Private Land Area | xx | | |
| **3.** | **Accessibility** | | | |
| | Nearest Rail Head | Diphu Railway Station (98.4 km) | | |
| | Road | NH-329 (Doboka-Diphu Rd) | | |
| | Airport | Jorhat (82km) | | |
| **4.** | **Hydrography** | | | |
| | Local Surface Drainage Pattern (Channels) | Dendritic to Sub-parallel | | |
| | Rivers/Streams | Dargurug river | | |
| **5.** | **Climate** | | | |
| | Mean Annual Rainfall | The rainfall in the area usually varies from 1900-2400 mm | | |
| | Temperatures (December)(Minimum) Temperatures (June)(Maximum) | Minimum temperature varies from 6°C to 12°C in December and January. The maximum temperature varies from 23 °C to 32.9 °C in August. | | |
| **6.** | **Topography** | | | |
| | Toposheet Number | 83F/11 and 83F/15 | | |
| | Morphology of the Area | The study area shows hilly to undulating physiography and lies within the Mikir Hills, which form a part of the Shillong Plateau. Minimum and maximum elevations are 80m and 400m, respectively. | | |
| **7** | **Availability of baseline geoscience data** | | | |
| | Geological Map (1:50,000) | Available | | |
| | Geochemical Map | Not Available? | | |
| | Geophysical Map (Aeromagnetic, ground geophysical, and regional as well as local-scale GP maps) | Ground magnetic and Gravity survey is proposed to be conducted in and around the ridge areas within the block. Further, on the availability of the NGPM data, the target ground survey area will be modified. | | |
| **8.** | **Justification for taking up Reconnaissance Survey (G4 Stage)** | Justification for taking up the investigation in the G4 stage: | | |

| | | |
|---|---|---|
| | | 1. The Koilamati Block, located in the Karbi Hills of the Shillong Plateau, represents a layered mafic-ultramafic intrusive complex with significant Fe-Ti-V and PGE mineralisation potential.<br>2. Stratified Fe-Ti-V oxide bands (magnetite-ilmenite-titanomagnetite) occur within gabbro-anorthosite intrusives, indicating a layered magmatic system.<br>3. Recent SEM-EDS and XRD studies confirm the presence of PGE-bearing sulphides, including braggite, laurite, and cooperite, in the ultramafic-mafic complex, reinforcing the area's dual potential for VTM and PGE mineralisation. (Majumdar et al. 2019).<br>4. Recent academic research and earlier GSI exploration findings in the nearby region, along with the analytical data of the samples collected from the proposed block area, support the mineral potential of the area.<br>5. A significant exploration gap persists within the block, i.e., large-scale geological mapping, subsurface investigation, systematic sampling, and mineralogical characterization.<br>6. Therefore, the proposed G4 stage exploration will include large-scale geological mapping, geochemical sampling, and ground geophysical surveys (magnetic) to delineate Fe-Ti-V-PGE mineralized zones.<br>7. The samples have been collected during a regional traverse by the Geologists of MMPL, and the analytical results are showing promising values for $Fe_2O_3$, $TiO_2$, and $V_2O_5$ associated minerals. Details are given in Table No 1.<br>8. The major oxide chemistry shows high Fe(T) and $TiO_2$, and $V_2O_5$ with low $SiO_2$, indicating Fe-Ti-V oxide-rich mafic rocks favourable for VTM mineralization. The geochemical signature and local geology are promising and justify taking up the block under the G4 stage exploration. Details are given in Table No 1.<br>9. The enrichment of Cr and Ni indicates a favourable mafic-ultramafic geological environment conducive to VTM-PGE mineralization; the values are significant exploration indicators. Details are given in Table No 2.<br>10. The detection of trace Pt, Pd, and Ru values indicates a favourable mafic-ultramafic geological environment with potential for PGE mineralization. In association with Cr-Ni enrichment, these results justify taking up the block for G4 stage exploration to assess potential. Details are given in Table No 3.<br><br>11. In the Karbi Anglong District, two major lineaments have been identified, both trending NE-SW and running sub-parallel to each other. Along the northern lineament, an ultramafic complex is reported near **Borpung-Lohazari**. And, south of this lineament, another ultramafic complex occurs at **Samchampi**.<br>Further along the same NE extension, the **Koilamati complex** comprises reported mafic-ultramafic and gabbro- |

| | | |
|---|---|---|
| | | anorthosite assemblages associated with **VTM mineralization**.<br>These blocks are situated within an ultramafic tectono-magmatic setting, which indicates the potential for mineralization along this structural corridor.<br><br>**Based on the above observation, the area shows favourable conditions for Fe-Ti-V and PGE mineralisation; therefore, a G4 stage investigation is proposed to assess the block's mineral potential.** |

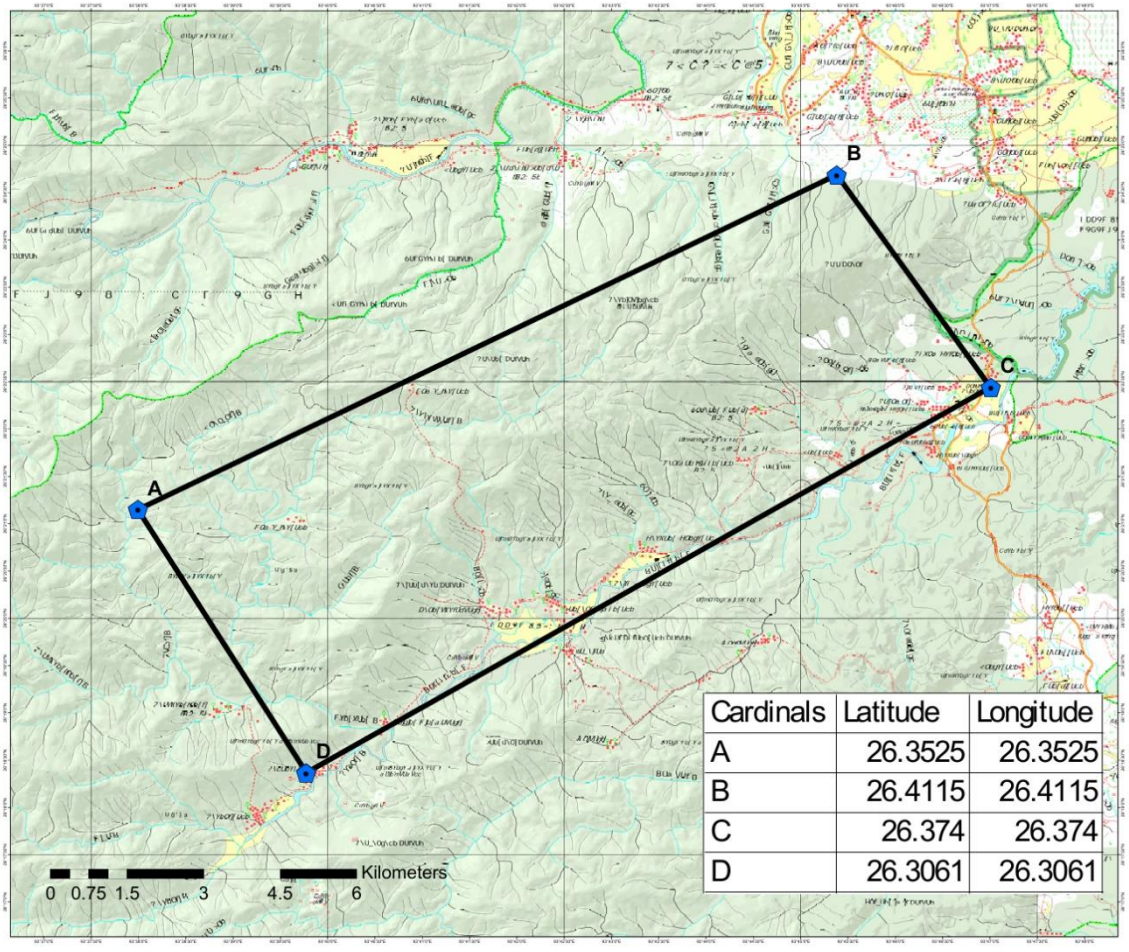
**Detailed description of the Block.**

## 1. Block Summary

**Physiography:** Koilamati area in Karbi Anglong, Assam, shows a hilly to undulating physiography as part of the dissected Karbi Anglong Plateau, with elevations ranging from about 80-100 m above mean sea level in the valley areas to around 350-400 m above mean sea level over the hilltops and ridges.

**Climate:** Koilamati area, Karbi Anglong, Assam experiences a sub-tropical monsoon climate, with maximum temperatures ranging from about 30-33 °C during April to August, minimum temperatures ranging from about 6-10 °C during December-January, and mean annual rainfall of approximately 1900-2400 mm, most of which is received during the south-west monsoon period (June to September), resulting in generally warm, humid, and wet climatic conditions.

**Location of Koilamati VTM & PGE Block, Karbi Anglong, Assam over SOI Toposheet Number-83F/11 & 83F/15**




| Cardinals | Latitude | Longitude |
|---|---|---|
| A | 26.3525 | 26.3525 |
| B | 26.4115 | 26.4115 |
| C | 26.374 | 26.374 |
| D | 26.3061 | 26.3061 |

## 2. Background Geology

**Regional Geology**: The area lies in the northeastern Karbi Hills, forming part of the Shillong Plateau in Northeast India. The Shillong Plateau consists of two cratonic blocks-the Meghalaya Plateau and the Karbi Hills- separated by the NW-SE trending Kopili Fault. (Majumdar and Gogoi, 2021).

The geology of the Shillong Plateau dates back to the Late Archean, when a sag basin was formed due to a plume-induced thermal uplift, producing the Basement Gneissic Complex (BGC) as early as 2,670 Ma. The BGC, greenstone sequences, and Shillong Group metasediments together make up the basement framework, intruded later by younger mafic and felsic magmas. The granite-greenstone belt of the Karbi Hills is likely the NE- SW continuation of a belt found in the Meghalayan part of the Shillong Plateau. The belt is a low- to medium-grade metamorphic terrain consisting of ultramafic-mafic-felsic magmatic, mafic volcanics, carbonatites, and the Shillong Group of metasediments. (Majumdar and Gogoi, 2021).

Major litho-tectonic units include:

- Shillong Group metasediments (quartzite, phyllite, schist)
- Mafic-ultramafic intrusives
- Polyphase granitoids and gneisses
- Alkaline and basic magmatic suites

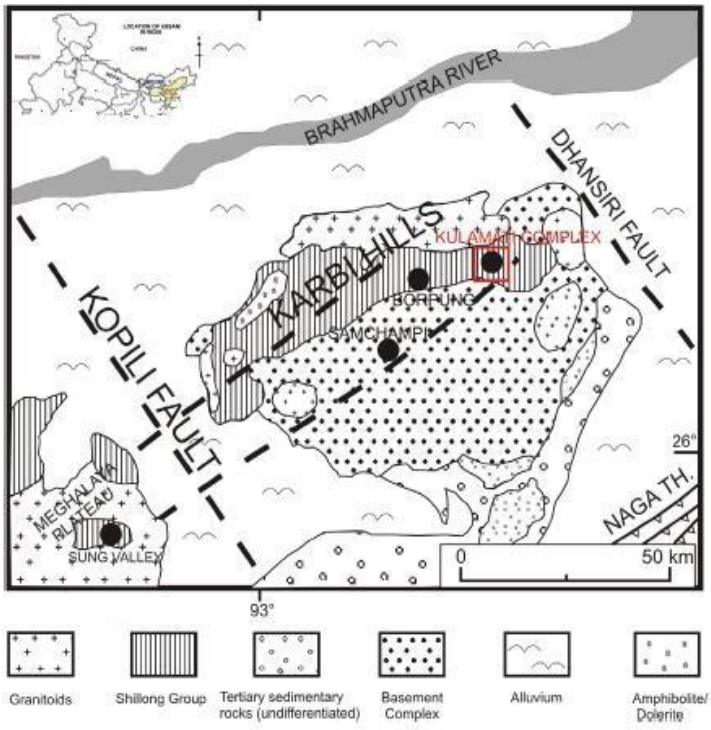



Fig: - Regional Geological Map
(Source: Majumdar and Gogoi in 2021)

Table 5: Stratigraphic Table of Karbi Hills.

| Geological age | Group | Formation | Lithology |
|---|---|---|---|
| Tertiary | | | Thin-bedded low-dipping friable sandstone |
| Unconformity | | | |
| Cretaceous (84 ± 13–90 ± 10 Ma) (105–117 Ma) | | | Carbonatite complexes, Mafic dykes, sill, and traps |
| Intrusive contact | | | |
| Cambro-Ordovician (518–470 Ma) | | Non-porphyry granitoids | Medium-fine grained, salt and pepper textured |
| Intrusive contact | | | |
| Mesoproterozoic (1,100–1,000 Ma) (1,644–1,550 Ma) | | Porphyry granitoids | Fine-grained porphyry granite, light to dark grey, fine-grained porphyritic pink granites |
| Intrusive contact | | | |
| Palaeo-Mesoproterozoic (2,018–1,600 Ma)[a] | | Mafic intrusives | Metamorphosed basalts (amphibolites), diorites, gabbro |
| Intrusive contact | | | |
| Palaeo-Mesoproterozoic (1,900–1,400 Ma) | Shillong Group | Barapani Quartzites Tyrsad Formation | Boulder bed (?), quartzites, actinolite schists, phyllites |
| Unconformity | | | |
| Late Archean to Palaeoproterozoic (2,670–2,250 Ma) | | Basement Gneissic Complex (BGC) | |

[a]Data from Dhurandhar et al. (2019).

**Regional Structure:**

The area shows an Archean deformational style comparable to Peninsular Indian shield terrains, with similar lithology, fold patterns, and metamorphic grade. Unlike southern Indian gneissic belts, distinct schist belts are absent, and earlier schistosity is largely obliterated by intense deformation.

Multiple phases of **pre-to syn-deformational granitic intrusions** are indicated by concordant structures in schists and granitoids, granitic veinlets within schists, and contact metamorphic effects along margins.

**a. Foliation:**

Foliation is the most prominent deformational fabric in the area and is expressed as schistosity, gneissosity and mineral alignment in schists and granitoids. The general trend of foliation varies from NE-SW to NW-SE, with local variation to E-W in the central part. The dip ranges from gentle (15°-20°) to moderately steep (40°-60°) in both directions. At places, fracture cleavage is also observed within granitoids, indicating intense deformation and recrystallization.

**b. Lineation:**

Lineation is developed in the form of mineral lineation and microfold axes, particularly within amphibolites and quartz-sillimanite schists. These linear structures show moderate plunges, generally towards S20°E to SE. The presence of lineation indicates a significant component of directed pressure and ductile deformation during metamorphism.

**c. Folds:**

Fold structures of mesoscopic scale are common in both supracrustal rocks and granitoids. Tight isoclinal folds as well as open synformal and antiformal folds are observed, and many of them appear coaxial in nature. The fold axes generally plunge towards S20°E to SE. Crenulation cleavage is locally developed in amphibolites and quartz-sillimanite-mica schists. Due to a lack of distinct marker horizons and poor exposure, regional fold geometry and the number of deformation phases could not be clearly established.

**d. Joints:**

The area exhibits multiple joint sets, predominantly trending N-S, E-W, NE-SW, and NW-SE, especially within granitoids. These joints often act as pathways for hydrothermal fluids, and prominent quartz veins are emplaced along N-S and NE-SW trending joint planes, indicating structural control on vein mineralization.

**e. Shear Zones and Faults:**
Several rivers and streams in the area follow shear zones or fault planes, suggesting strong structural control on drainage. Shear zones are identified by features such as kaolinization, sericitization, slickensides, and the presence of secondary quartz veins. Major shearing is observed along the Kaliyani and Nambar river courses. The Kaliyani shear zone is about 1 km wide and extends for nearly 30 km and is associated with quartz veining and hot springs beyond the mapped area, indicating deep-seated tectonic activity. Shearing is more intense in the northern metasedimentary block (downthrown side) compared to the southern Archean gneissic terrain.

**Rock Description in and around the Koilamati VTM and PGE Block:**

In the study block, lithological assemblage is dominated by layered ultramafic-mafic intrusives emplaced within Shillong Group metasediments.

**a. Layered Gabbro-Anorthosite**
Medium-to coarse-grained, well-layered gabbro and anorthosite form the principal host to VTM mineralisation. The rocks are composed of plagioclase (labradorite-bytownite), clinopyroxene, orthopyroxene, with subordinate olivine. Cumulate textures, rhythmic layering, and modal banding are common, indicating magmatic differentiation.

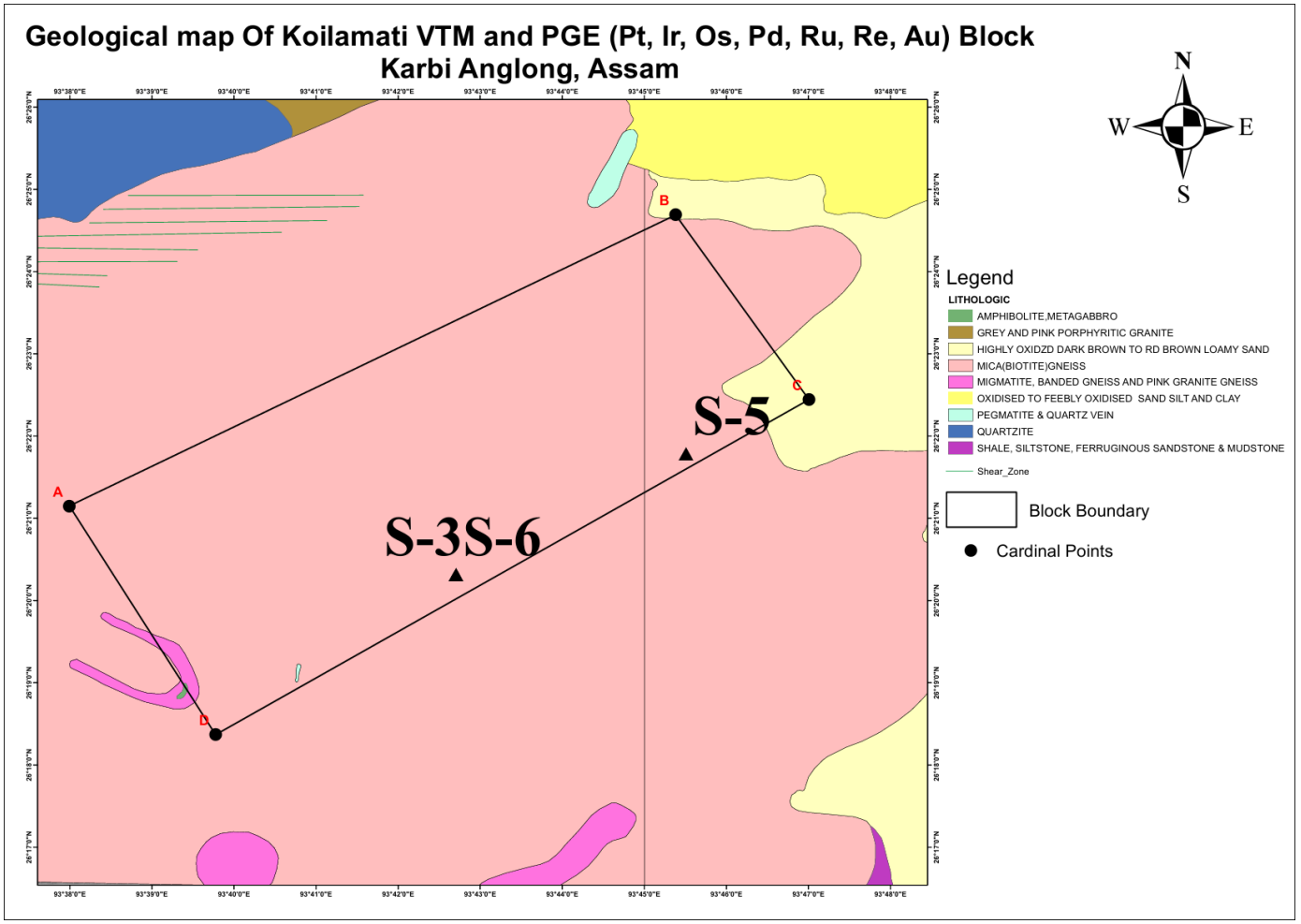
**b. Oxide-rich Magnetite-Ilmenite Bands (VTM horizons)**
Stratiform to semi-massive bands of titaniferous magnetite with ilmenite constitute the principal ore horizons. These bands are laterally persistent, concordant with magmatic layering, and locally show alternating magnetite-rich and magnetite-poor layers.

**c. Shillong Group Metasediments (Country Rock)**
Quartzite, phyllite, and schist occur as basement and wall rocks to the intrusive complex. These units locally supplied sulphur to the mafic magma, aiding sulphide saturation and PGE precipitation.

**d. Minor Granitoids/Gneiss**
Older granitoid and gneissic rocks occur in the periphery of the block and are not directly mineralised but form the regional basement framework.

**Geology of the study area:**

The proposed Koilamati Block lies within the Mikir Hills segment of the Shillong Plateau, near Koilamati village (26°21′N; 93°46′E) in eastern Karbi Hills, along the Kalapahar Ridge, close to Dhoniram Ingti village. It is underlain by Archean-Proterozoic gneissic basement rocks and Shillong Group metasediments. The area hosts gabbro-anorthosite, pyroxenite, and ultramafic intrusives, emplaced along NE-SW and E-W shear zones such as the Kaliyani River Lineament, which control magmatic mineralisation.
According to Majumdar et al. 2021, the Kulamati gabbro-anorthosite complex in the Karbi Hills, Shillong Plateau, is a newly discovered stratified Fe-Ti-V-bearing magmatic body classified as titanomagnetite ore, intruding the Shillong Group and is unmetamorphosed, suggesting a post-Shillong Group (<1,400 Ma) emplacement.
The ore body is stratified, consisting of alternating magnetite-ilmenite-rich and magnetite-poor layers within gabbro-anorthosite hosts. The magnetite-rich bands contain titanomagnetite, ilmenite, hematite, and coulsonite, whereas the silicate layers comprise plagioclase, clinopyroxene, olivine, and chlorite. The proposed block is locally affected by an NE-SW-trending faults.
The Koilamati stratified gabbro-anorthosite complex records one such magmatogenic event, acquiring Fe-Ti-V-PGE mineralization from mantle-derived melts, similar to models proposed for the eastern Indian shield.
Fe-Ti-V mineralisation occurs in titanomagnetite-ilmenite-coulsonite assemblages within gabbro-anorthosite units, recording $TiO_2$ (10.9-12.7 wt%) and $V_2O_5$ (up to 1.47 wt%) in oxide-rich zones (Majumdar et al., 2021).
PGE minerals such as braggite (Pt, Pd, Ni)S, laurite ($RuS_2$), and cooperite (PtS) have been reported for the first time from the Koilamati complex, confirming its dual potential for VTM and PGE mineralisation (Majumdar & Gogoi, 2019).

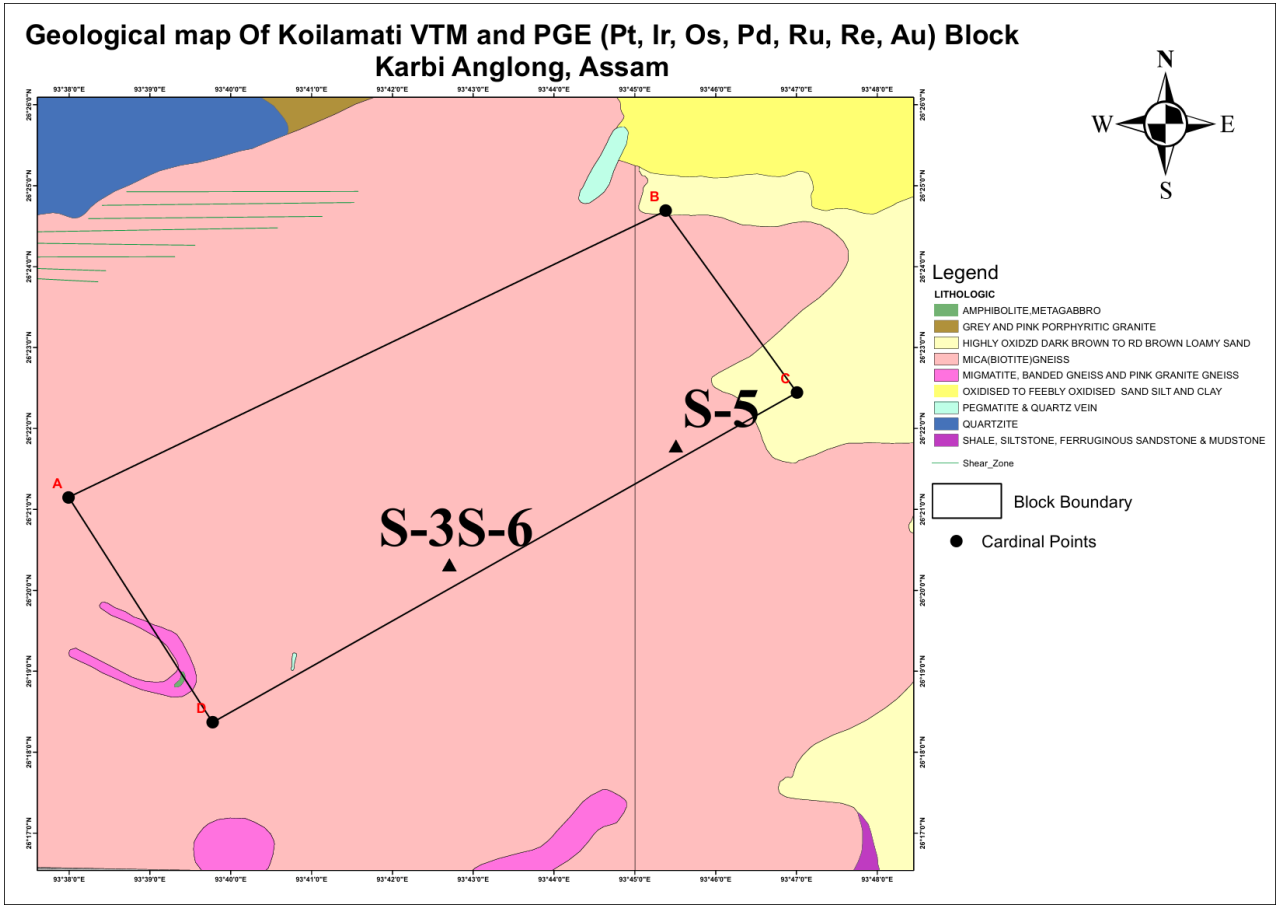



***Proposed Block Boundary on Geological Map, Scale- 1:50,000 (Source-NGDR)***

During the field conducted by the Geologist of MMPL Private Limited, a bedrock exposure of a magnetite-bearing body recorded in a stream section shows a strong magnetic response. The outcrop contains a distinct magnetite band of about 4 cm within fine-grained pyroxenite. The abundant magnetite floats in the vicinity suggests continuity of mineralization. These features indicate magmatic layering and cumulate processes typical of mafic-ultramafic intrusives, signifying potential Fe-Ti-V (VTM) and associated PGE mineralization in the Koilamati area, Karbi Anglong district, Assam.

Three samples (S3, S5, and S6) were collected during the field work. Laboratory analysis shows that the major oxides Fe(T), $TiO_2$, and $V_2O_5$ range from 17.3-52.05%, 1.02-13.84%, and 0.05-1.25%, respectively. The minor elements Cr and Ni range from 137-7185 ppm and 41-584 ppm, respectively, indicating an ultramafic rock.
Trace element concentrations include Co (99.5-161 ppm), Ga (11.1-42.1 ppm), Nb (1.7-11.9 ppm), La (7.2-95 ppm), Ce (16.4-192 ppm), Nd (9.1-51.3 ppm), Ta (0.5-2.1 ppm), Th (1-2.8 ppm), and U (0.5-10.9 ppm). The maximum values of PGE are Pt (0.02 ppm), Pd (0.031 ppm), and Ru (0.008 ppm). The details of the sample location and its analytical result are given below:

| Sample | Latitude | Longitude |
|---|---|---|
| S3 | 26°20'18.81"N | 93°42'42.33"E |
| S5 | 26°21'47.21"N | 93°45'30.40"E |
| S6 | 26°20'18.81"N | 93°42'42.33"E |




***Sample Location on Proposed Block Boundary, Scale-1:50,000 (Source: NGDR portal)***

**Table 1 (Major Oxide): Analytical results of rock samples of the proposed block in Koilamati, KARBI ANGLONG, ASSAM.**

| S.No. | Sample No. | Major oxide (%) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Al2O3 | BaO | CaO | Cr23 | Fe (T) | Fe2O3 | K2O | MgO | MnO | Na2O | P2O5 | SO3 | TiO2 | SiO2 | SrO | V2O5 | LOI |
| 1 | S-3 | 5.93 | <0.05 | <0.05 | 1.05 | 52.05 | 74.41 | 0.06 | 0.41 | 0.29 | 0.08 | <0.05 | <0.05 | 13.84 | 2.47 | <0.05 | 1.25 | <0.1 |
| 2 | S-5 | 16.19 | <0.05 | 2.75 | <0.05 | 22.54 | 32.23 | <0.05 | 0.68 | <0.05 | <0.08 | 1.68 | <0.05 | 1.79 | 29.65 | <0.05 | <0.05 | 14.81 |
| 3 | S-6 | 6.80 | <0.05 | 6.12 | 0.31 | 17.30 | 24.73 | 0.10 | 17.12 | 0.20 | 0.45 | 0.08 | 0.09 | 1.02 | 41.29 | <0.05 | <0.05 | 1.50 |

**Table 2 (Minor Element): Analytical results of rock samples of the proposed block in Koilamati, KARBI ANGLONG, ASSAM.**

| Sl. No. | Sample No. | Minor Element in ppm (mg/kg) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Cr | Ni | Cu | Pb | Sr | Zn | Zr |
| 1 | S-3 | 7185 | 584 | 114 | 17 | <5 | 479 | 13 |
| 2 | S-5 | 62 | 18 | 41 | 41 | 223 | 84 | 43 |
| 3 | S-6 | 2144 | 661 | 70 | 13 | 42 | 109 | 25 |

**Table 3 (PGE): Analytical results of rock samples of the proposed block in Koilamati, KARBI ANGLONG, ASSAM.**

| Sl. No. | Sample No. | PGE in ppm (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Pt | Pd | Ru | Rh | Ir | Os |
| 1 | S-3 | 0.020 | 0.031 | 0.008 | <0.005 | <0.005 | <0.005 |
| 2 | S-5 | 0.010 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 3 | S-6 | 0.010 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |

**Table 4.a (TREE): Analytical results of rock samples of the proposed block in Koilamati, KARBI ANGLONG, ASSAM**

| Sl. No. | Sample No. | TREE in ppm(mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Li | Be | B | Sc | Co | Ga | Se | Rb | Y | Nb | Mo | Cd | In | Sn |
| 1 | S-3 | 7.1 | <0.5 | <5 | 19.0 | 161 | 42.1 | 0.7 | 4.9 | 4.1 | 2.2 | <0.5 | 0.7 | <0.5 | <0.5 |
| 2 | S-5 | 22.1 | 1.9 | <5 | 63.8 | 12.6 | 22.5 | <0.5 | 1.5 | 13.3 | 11.9 | <0.5 | 3.9 | <0.5 | 14.7 |
| 3 | S-6 | 7.2 | <0.5 | <5 | 21.8 | 99.5 | 11.1 | <0.5 | 1.6 | 13.3 | 1.7 | <0.5 | 6.0 | <0.5 | <0.5 |

**Table 4.b (TREE): Analytical results of rock samples of the proposed block in Koilamati, KARBI ANGLONG, ASSAM**

| Sl. No. | Sample No. | TREE in ppm(mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sb | Te | Cs | **La** | **Ce** | Pr | Nd | Sm | Eu | Gd | Tb | Dy | Ho | Er |
| 1 | S-3 | <0.5 | <0.5 | <0.5 | 7.2 | 16.4 | 2.0 | 9.1 | 1.7 | <0.5 | 1.5 | <0.5 | 0.9 | <0.5 | 0.5 |
| 2 | S-5 | <0.5 | <0.5 | <0.5 | 95 | 192 | 13.9 | 51.3 | 9.0 | 1.3 | 7.3 | 0.6 | 3.1 | <0.5 | 2.0 |
| 3 | S-6 | <0.5 | <0.5 | <0.5 | 9.8 | 20.3 | 2.6 | 13.1 | 3.1 | <0.5 | 3.3 | <0.5 | 2.5 | <0.5 | 1.6 |

**Table 4. c (TREE): Analytical results of rock samples of the proposed block in Koilamati, KARBI ANGLONG, ASSAM**

| Sl. No. | Sample No. | TREE in ppm(mg/kg) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Tm | Yb | Lu | Hf | Ta | W | Tl | Bi | Th | U |
| 1 | S-3 | <0.5 | <0.5 | <0.5 | 1.0 | <0.5 | 2.7 | <0.5 | <0.5 | 2.4 | 1.2 |
| 2 | S-5 | <0.5 | 1.5 | <0.5 | 3.4 | 2.1 | 2.7 | <0.5 | <0.5 | 2.8 | 10.9 |
| 3 | S-6 | <0.5 | 1.4 | <0.5 | 0.8 | <0.5 | <0.5 | <0.5 | <0.5 | 1.0 | <0.5 |

## 3 Mineralisations-VTM and PGE

- Stratiform magmatic Fe-Ti-V (titanomagnetite-ilmenite) mineralisation in a layered mafic intrusion. The stratified Fe-Ti-V oxide body exists mostly in the magnetite-rich layer. The magnetite-rich bands are composed of titanomagnetite, haematite, ilmenite, and coulsonite.
- Layered magmatic VTM (vanadium-titanium-magnetite) mineralisation hosted within a stratified gabbro-anorthosite intrusion.
- Layered intrusion-hosted stratiform PGE mineralisation associated with Fe-Ti-V (magnetite-ilmenite) oxide horizons in a mafic-ultramafic complex.

## 4 Scope for Proposed Exploration:

- Identification of ore-bearing ultramafic bodies.
- Delineation of VTM-bearing horizons using integrated methods.
- PGE potential within the ultra-mafic rocks.

## 5 Previous Work:

### a. Geological Survey of India

- GSI (1988-1989) "Report on Geology of Parts of Diphu Sub-Division, Karbi Anglong District, Assam" (Progress Report for the F.S. 1988-1989 by J.C. Dutta, M. Surendranath, and A.K. Buragohain).
- GSI (1977-78) "Systematic Geological Mapping of Central Parts of Mikir Hills and Detailed Investigation of Fracture Line Mineralised Zones Around Luhajuri and Bajajuri, Karbianglong District, Assam". (Progress Report for Field Season 1977-78 by G. K. Pancholi and Des Raj).

### b. Recent Academic Study

- An investigation of Fe-Ti, V in the north-east Karbi Hills, Shillong Plateau, north-east India: Implication for mineralization. (By: Dilip Majumdar, Abhijit Gogoi & Arundhuti Ghatak, 2021).
- First Report on Platinum Occurrence in Ultramafic-Mafic Complex, East-Central Karbi Hills of Assam, North-East India. (Dilip Majumdar and Abhijit Gogoi,2019).
- Need to intensify base metal exploration activities in Mikir Hills, northeastern India. (By: D. Majumdar, 2010).

## 6 Block description

| Point_id | Latitude | Longitude |
|---|---|---|
| A | 26° 21' 8.912" N | 93° 37' 59.599" E |
| B | 26° 24' 41.366" N | 93° 45' 22.917" E |
| C | 26° 22' 26.530" N | 93° 47' 0.320" E |
| D | 26° 18' 21.999" N | 93° 39' 46.485" E |

### 6.1 Planned Methodology

In accordance with the objectives set for reconnaissance survey (G4 stage of exploration) in the Koilamati Block, Karbi Anglong district, geological mapping in 1:12500 scale, surface sampling, scout drilling, core sampling, chemical studies, petrological and mineralogical studies are proposed in the block. The exploration will be carried out as per the Minerals (Evidence of Mineral contents) Rules, amended in 2021. Accordingly, the details of different activities to be carried out are presented in subsequent paragraphs.

### 6.2 Geological Mapping

Large-scale geological mapping (LSM) on a 1:12500 scale in the area (91.3 sq km) will be carried out by taking geological traverses. The contacts of different lithologies, surficial lithology, structural features, etc., will be noted in detail. The geological map on a 1:12500 scale will be generated based on the details gathered during the field visit.

### 6.3 Geophysical Work

Geophysical surveys using gravity and magnetic methods will be carried out in prospective areas to find subsurface anomalies after reviewing the results of geological mapping, trenching, and pitting.

### 6.4 Borehole plan:

Scout boreholes with **a** total meterage of 800 m will be planned based on the outcome of geological mapping, trenching, geophysical activity**,** and chemical analysis of bedrock, pitting & trenching, and groove samples.

### 6.5 Core Logging

The drill cores would be logged systematically, viz., details of litho-units, color, structural feature, texture, mineralization, rock quality designation, and type of ore would be recorded.

### 6.6 Core Sampling

The drill core will be split into two halves vertically, and one part will be preserved in the core box. The other half will be powdered to 200 mesh size, and the same will be divided into four parts (250 g each) through coning and quartering. One part of a 250 g sample will be sent to the chemical laboratory for analysis, the second part to be preserved in the camp as a duplicate sample, the third part to be utilized for preparing a composite sample for the individual ore band and the fourth part would be kept as either check sample or a sample to be used for any other specific purpose.

The length of each sample will be kept between 0.50 m and 1.0 m, depending upon the width of the ore and its physical character. The primary core samples will be analyzed for ICPMS of 34 elements and trace elements, and Major oxides, including LOI by XRF methods.

### 6.7 Petrographic & Mineralographic Studies

Thin and polished sections will be prepared from outcrop samples as well as from the core samples, and those samples will be studied for detailed petrographic and mineralographic characteristics. These samples will be drawn from ore zones and associated rocks. A provision of 10 nos. specimens for petrographic and 10 nos. specimens for mineralographic studies is kept for the proposed area.

### 6.8 Bulk Density Determination

In addition, bulk density determination of 5 nos. of samples will be carried out for the proposed block.

## 7 Nature and Quantum of Work

| **Nature and Quantum of Work** | | | |
|---|---|---|---|
| **Quantum of work for Reconnaissance Exploration (G4 Stage) of Koilamati Block, Karbi Anglong, Assam** | | | |
| **Sl No.** | **Item of work** | **Unit** | **Quantity** |
| **A** | **Large-scale Geological Mapping** | | |
| 1 | on 1:12500 Scale | sq. km | 76.32 |
| **B** | **Survey Work by surveyor days** | | |
| 1 | Demarcation of proposed boundary, trench location, groove line location, and Fixation of the borehole, by DGPS | Per point of observation | 12 |
| **C** | **Geophysical survey** | | |
| 1 | Ground Magnetic (10-30 L.Km)* | Per station | 3250 |
| **D** | **Surface sampling** | | |
| 1 | Bed Rock sampling, Pitting/Trenching | Nos | BRS-100<br>Pitting & Trenching-200 |
| **E** | **Trenching/pitting** | | |
| 1 | Trenching | Cu.m | 200 |

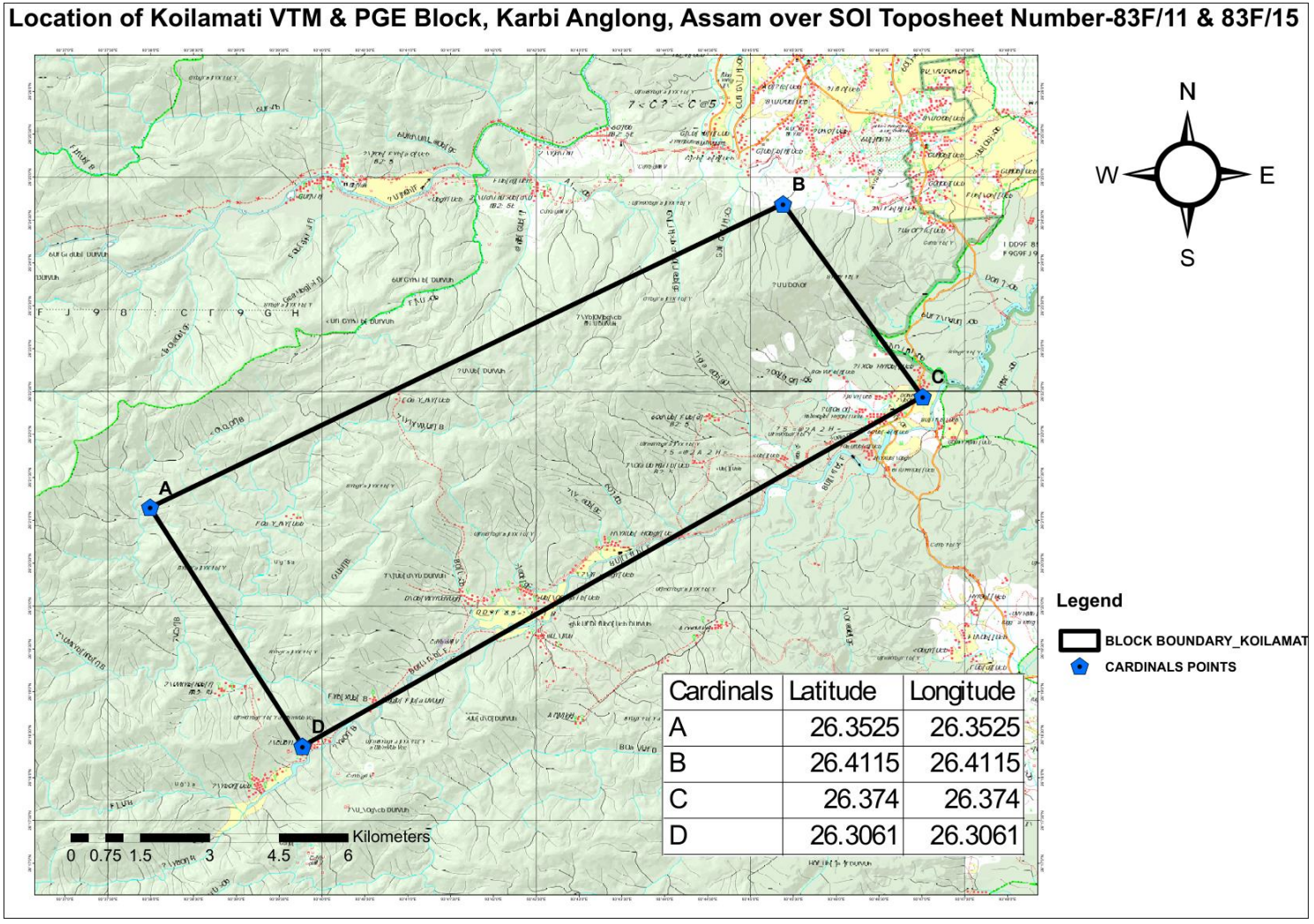
| | | | |
|---|---|---|---|
| **D** | **Drilling** | | |
| 1 | Core drilling | m | 800 |
| 2 | Borehole Pillaring (12"x12"x30")** | nos | 8 |
| **E** | **Chemical Analysis** | | |
| i) | Major oxides (WD XRF)- (oxides+ trace-24 elements) for groove samples, Trench sample, core sample | nos | BRS-100<br>Pitting & Trenching-200<br>Borehole-400 |
| **ii)** | For PGE (ICP-MS Ni-S Fire assay technique) | | **BRS-40**<br>**Pitting & Trenching-80**<br>**Borehole-160** |
| **F**<br>1 | Preparation of polished thin section | **nos** | 10 |
| 2 | Complete petrographic/ ore microscopic study report of rock samples (alongwith 5 no of digital photo micrographs) | nos | 10 |
| 3 | EPMA Studies | Nos | 10 |
| | PCS analysis (WD XRF)- (oxides+ trace-24 elements) | | 10 |
| **G** | Sp. Gravity | **nos** | 5 |
| **H** | Report Preparation (as per MEMC Amendment Rule 2021/UNFC) | **nos** | **1** |

## References


- GSI (1988-1989) "Report on Geology of Parts of Diphu Sub-Division, Karbi Anglong District, Assam" (Progress Report for the F.S. 1988-1989 by J.C. Dutta, M. Surendranath, and A.K. Buragohain).
- GSI (1977-78) "Systematic Geological Mapping of Central Parts of Mikir Hills and Detailed Investigation of Fracture Line Mineralised Zones Around Luhajuri and Bajajuri, Karbianglong Districtassam". (Progress Report for Field Season 1977-78 by G. K. Pancholi and Des Raj).
- An investigation of Fe-Ti, V in the north-east Karbi Hills, Shillong Plateau, north-east India: Implication for mineralization. (By: Dilip Majumdar, Abhijit Gogoi & Arundhuti Ghatak, 2021).
- First Report on Platinum Occurrence in Ultramafic-Mafic Complex, East-Central Karbi Hills of Assam, North-East India. (Dilip Majumdar and Abhijit Gogoi,2019).
- Need to intensify base metal exploration activities in Mikir Hills, northeastern India. (By: D. Majumdar, 2010).


## List of Plates

- Plate 1 Proposed block boundary over Survey of India topographic map 83F/11 and 83F/15 on a 1:50,000 scale.
- Plate 2: Regional Geological Map (Source: Majumdar and Gogoi, 2021).
- Plate 3 Proposed Block Boundary on Geological Map with sample location (source-NGDR)




| Cardinals | Latitude | Longitude |
|---|---|---|
| A | 26.3525 | 26.3525 |
| B | 26.4115 | 26.4115 |
| C | 26.374 | 26.374 |
| D | 26.3061 | 26.3061 |

***Plate 1 Proposed block boundary over Survey of India topographic map 83F/11,15 on 1:50,000***

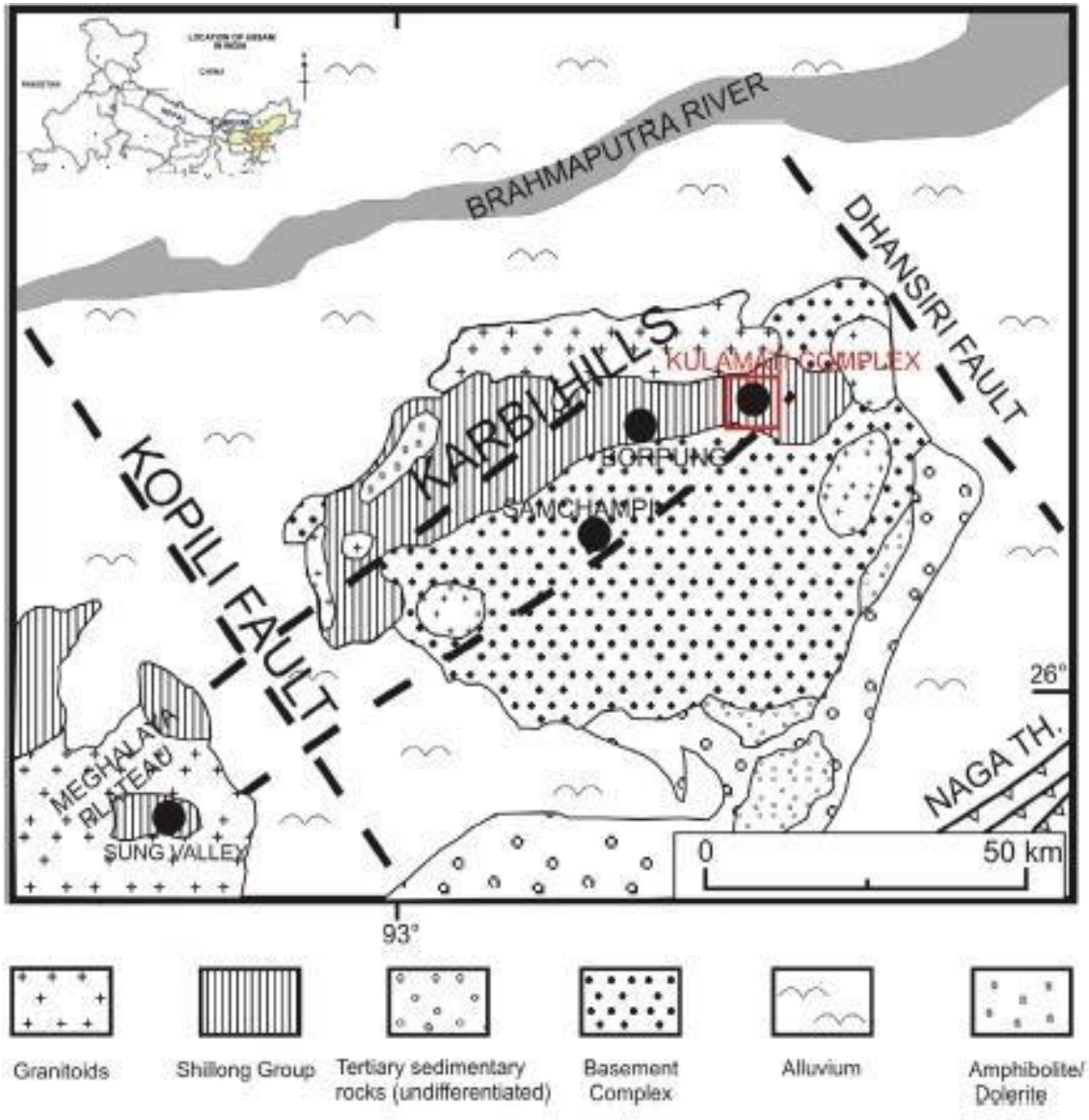



***Plate 2 Regional Geological Map (***Source: Majumdar and Gogoi in 2021).

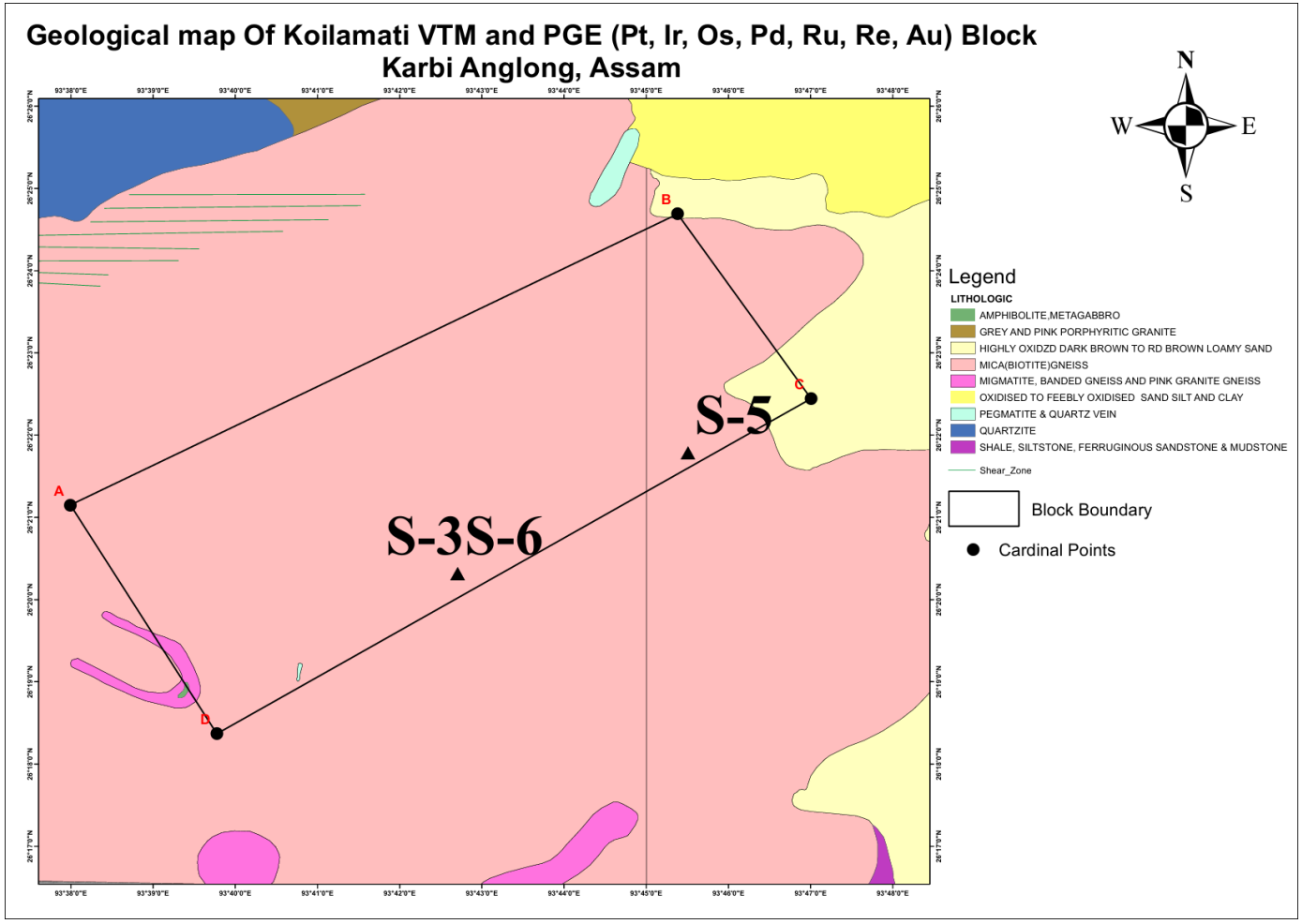



***Plate 3 Proposed Block Boundary on Geological Map, Scale- 1:50,000 (Source-NGDR)***

***Timeline***

| *Reconnaissance Exploration (G4 Stage) of VTM and PGE and associated minerals in Koilamati, Karbi Anglong District, Assam* | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Area 70 sq km \| No. of BH: 8 \| Borehole depth range: 500 m \| Timeline: 12 months \| Review after 6 months* | | | | | | | | | | | | | |
| ***S. No.*** | ***Item of work*** | ***1*** | ***2*** | ***3*** | ***4*** | ***5*** | ***6*** | | ***7*** | ***8*** | ***9*** | ***10*** | ***11*** | ***12*** |
| *1* | *Camp Setup* | | | | | | | | | | | | | |
| *2* | *Large Scale Mapping (1:12500)* | | | | | | | | | | | | | |
| *3* | *Trenching / Pitting* | | | | | | | | | | | | | |
| *4* | *Bed Rock Sampling* | | | | | | | | | | | | | |
| *5* | *Geophysical Survey* | | | | | | | *REVIEW* | | | | | | |
| *6* | *Scout Drilling* | | | | | | | | | | | | | |
| *7* | *Core Sampling & Preparation* | | | | | | | | | | | | | |
| *8* | *Chemical Analysis of Core Samples* | | | | | | | | | | | | | |
| *9* | *Processing of Analytical Data* | | | | | | | | | | | | | |
| *10* | *3D Ore Body Modeling* | | | | | | | | | | | | | |
| *11* | *Preparation of Geological Report* | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

1. **Manpower deployment**
2. **Break-up of expenditure**

| **Cost Estimate - Title Reconnaissance Exploration (G4 Stage) of VTM and PGE in Koilamati, Karbi Anglong District, Assam, Area 76.32 sq. km, No.of BH:8, Borehole depth range- 500 m; Schedule timeline- 12 months Review: After 4 Months and 8 months]** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **S.No.** | **Item of Work *** | **Unit *** | **Rates as per NMEDT SoC 2025** | | **Estimated Cost of the Proposal** | | | **Remarks** |
| | | | **SoC-Item No. *** | **Rates as per SoC * (a)** | **Qty. (b)** | **Total Amount (Rs) (a*b)** | **Total amount Multiplying factor-1.5** | |
| **A** | **Geological Mapping, Other Geological Work & Surveying** | | | | | | | |
| **i** | Large-scale geological Mapping (1:12500 scale & trenching, drilling work. | Per Sq Km | **1.1** | ₹ 18,300.00 | **76.32** | ₹ 13,96,656.00 | ₹ 20,94,984.00 | |
| ii | a. Charges for Geologist per day (Field) for geological mapping & trenching work, drilling work (without Labour) | day | 1.2 b | ₹ 14,500.00 | 240 | ₹ 34,80,000.00 | ₹ 52,20,000.00 | |
| iii | b. Labour Charges; Base rate | day | 5.8 | ₹ 541.00 | 360 | ₹ 1,94,760.00 | ₹ 2,92,140.00 | Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or the respective State Govt, whichever is higher. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| iv | c. Charges for Geologist per day (HQ) | day | 1.2 a | ₹ 10,500.00 | 90 | ₹ 9,45,000.00 | ₹ 9,45,000.00 | |
| v | d. Charges for one Sampler per day (1 Party) | one sampler per day | 1.2.1b | ₹ 7,850.00 | 75 | ₹ 5,88,750.00 | ₹ 8,83,125.00 | |
| vi | e. Labours (4 Nos) | day | 5.8 | ₹ 541.00 | 300 | ₹ 1,62,300.00 | ₹ 2,43,450.00 | |
| | **Sub Total- A** | | | | | **₹ 67,67,466.00** | **₹ 96,78,699.00** | |
| **B** | **Ground Geophysical Survey** | | | | | | | |
| 1 | Magnetic survey | per station | 3.2a | ₹ 1,800.00 | 3250 | ₹ 58,50,000.00 | ₹ 87,75,000.00 | 200m profile spacing<br>100m station Interval |
| 2 | Geophysicist party days (HQ) | per day | 3.18a | ₹ 10,500.00 | 30 | ₹ 3,15,000.00 | ₹ 4,72,500.00 | |
| 3 | Labour Charges; Base rate | day | 5.8 | ₹ 541.00 | 480 | ₹ 2,59,680.00 | ₹ 3,89,520.00 | 4 LABAOUR<br>4 MONTHS |
| | **Sub Total- B** | | | | | **₹ 64,24,680.00** | **₹ 96,37,020.00** | |
| **C** | **Survey work** | | | | | | | |
| a | DGPS Survey for BH fixation & RL determination and lease boundary demarcation | Per Point of observation | 1.3.2 | ₹ 24,000.00 | 12 | ₹ 2,88,000.00 | ₹ 4,32,000.00 | 4 cardinal points + 8 BH points |
| c | Labours Charges for survey work; | day | 5.8 | ₹ 541.00 | 60 | ₹ 32,460.00 | ₹ 48,690.00 | 2-Labourers for 30 days |
| | **Sub-Total C** | | | | | **₹ 3,20,460.00** | **₹ 4,80,690.00** | |
| **D** | **Trenching/Pitting** | | | | | | | |
| | a) Excavation of Trenches | per cu.m | 2.1.1 | ₹ 4,125.00 | 200 | ₹ 8,25,000.00 | ₹ 12,37,500.00 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Sub-Total D** | | | | | **₹ 8,25,000.00** | **₹ 12,37,500.00** | |
| **E** | **DRILLING (after review)** | | | | | | | |
| 1 | Scout Drilling up to 400m (Very Hard Rock) | m | 2.2.1.1 e | ₹ 12,650.00 | 800 | ₹ 1,01,20,000.00 | ₹ 1,51,80,000.00 | Scout boreholes will be plane-based on the outcome of geological mapping, trenching, geophysics, and chemical analysis, with a total meterage of 800m. |
| 2 | Borehole Deviation Survey by Multishot Camera | m | 2.2.5 | ₹ 330.00 | 83 | ₹ 27,390.00 | ₹ 41,085.00 | |
| 3 | Land / Crop Compensation (in case the BH falls in agricultural Land) | per BH | 5.6 | ₹ 30,000.00 | 8 | ₹ 2,40,000.00 | ₹ 3,60,000.00 | |
| 4 | Construction of a concrete Pillar (12"x12"x30") | per borehole | 2.2.7 | ₹ 2,000.00 | 8 | ₹ 16,000.00 | ₹ 24,000.00 | |
| 5 | Miscellaneous Charges (Drill camp setting / transporation etc.) | Lumpsum | 2.2.9 | | | ₹ 20,00,000.00 | ₹ 30,00,000.00 | For drilling cost more than 1 cr and less than 2 cr: 15% of the drilling cost with a maximum ceiling of 20 lakhs |
| 6 | Drill Core Preservation | per m | X | ₹ 1,590.00 | 200 | ₹ 3,18,000.00 | ₹ 4,77,000.00 | |
| | **Sub-Total E** | | | | | **₹ 1,27,21,390.00** | **₹ 1,90,82,085.00** | |
| **F** | **LABORATORY STUDIES** | | | | | | | |
| **1** | **Chemical Analysis** | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| i | Major oxides (WD XRF)- (oxides+ trace-24 elements) for groove samples, Trench sample, core sample | Nos | 4.1.17a | ₹ 4,200.00 | 700 | ₹ 29,40,000.00 | ₹ 29,40,000.00 | BRS:100+PT:200+BH:400 =700 |
| ii | For PGE (ICP-MS Ni-S Fire assay technique) | Nos | 4.1.5a | ₹ 13,500.00 | 280 | ₹ 37,80,000.00 | ₹ 37,80,000.00 | BRS-40<br>Pitting & Trenching-80<br>Borehole-160 |
| iii | Analysis of rock sample for quantative analysis of 14 REE elements +9 trace elements by ICP-MS. | Nos | 4.1.15 | ₹ 7,400.00 | 50 | ₹ 3,70,000.00 | ₹ 3,70,000.00 | |
| | **Surface Check samples (10% External).** | Nos | 4.1.17a | ₹ 4,200.00 | 70 | ₹ 2,94,000.00 | ₹ 2,94,000.00 | |
| | a) Major oxides (WD XRF)- (oxides+ trace-24 elements) for groove samples, Trench sample, core sample | | | | | | | |
| | **Surface Check samples (10% External).** | Nos | 4.16 | ₹ 3,500.00 | 28 | ₹ 98,000.00 | ₹ 98,000.00 | |
| | b. PGE by Fire Assay | | | | | | | |
| | **Surface Check samples (10% External).** | Nos | 4.1.15 | ₹ 7,400.00 | 5 | ₹ 37,000.00 | ₹ 37,000.00 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | c)analysis of rock sample for quantative analysis of 14 REE elements +9 trace elements by ICP-MS | | | | | | | |
| **2** | **Physical & Petrological Studies** | | | | | - | | |
| i | Preparation of polished thin section | Nos | 4.3.2 | ₹ 800.00 | 10 | ₹ 8,000.00 | ₹ 8,000.00 | |
| ii | Complete petrographic/ ore microscopic study report of rock samples (alongwith 5 no of digital photo micrographs) | Nos | 4.3.4 | ₹ 2,800.00 | 10 | ₹ 28,000.00 | ₹ 28,000.00 | |
| iii | EPMA Studies | | 4.4.1 | ₹ 10,500.00 | 20 | ₹ 2,10,000.00 | ₹ 2,10,000.00 | 10 samples |
| iv | PCS analysis (WD XRF)-(oxides+ trace-24 elements) | Nos | 4.1.17a | ₹ 4,200.00 | 10 | ₹ 42,000.00 | ₹ 42,000.00 | |
| v | Sp. Gravity | Nos | 4.8.1 | ₹ 2,500.00 | 5 | ₹ 12,500.00 | ₹ 12,500.00 | |
| | **Sub-Total F** | | | | | **₹ 78,19,500.00** | **₹ 78,19,500.00** | |
| | **Total A to F** | | | | | **₹ 3,48,78,496.00** | **₹ 4,79,35,494.00** | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| G | Geological Report Preparation | 5 Hard copies with a soft copy | 5.2 | 5.2(i/ii/iii/iv) | | ₹ 7,50,000.00 | ₹ 7,50,000.00 | Reimbursement will be made after submission of the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET. |
| H | Peer review Charges | | As per EC decision | | | ₹ 30,000.00 | ₹ 30,000.00 | |
| I | 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 Lakhs whichever is less | | ₹ 5,00,000.00 | ₹ 5,00,000.00 | EA will be reimbursed after submission of 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. |
| | Total Estimated Cost without GST | | | | | ₹ 3,61,58,496.00 | ₹ 4,92,15,494.00 | |
| | Provision for GST (18%) | | | | | ₹ 65,08,529.28 | ₹ 88,58,788.92 | GST will be reimburse as per actual and as per notified prescribed rate |
| | Total Estimated Cost with GST | | | | | ₹ 4,26,67,025.28 | ₹ 5,86,04,282.92 | |
| | | | | or Say Rs. In Lakhs | | ₹ 426.67 | ₹ 586.04 | |