PROPOSAL FOR RECONNAISSANCE SURVEY (G-4 STAGE) FOR SILLIMANITE IN CHIPPILANGSO BLOCK (37.93SQ.KM AREA) DISTRICT- KARBI ANGLONG, ASSAM

COMMODITY:SILLIMANITE

BY

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Summary of the Block for Reconnaissance Survey (G4 Stage)

GENERAL INFORMATION ABOUT THE BLOCK

	Features	Details
	Block ID	Chippilangso Block
	Exploration Agency	Mineral Exploration Corporation Limited (MECL)
	Commodity	Sillimanite
	Mineral Belt	ASSAM - MEGHALAYA GNEISSIC COMPLEX
	Completion period with entire Time schedule to complete the project	18 Months
	Objectives	Based on the evaluation of available geological data, the present exploration program has been formulated to fulfil the following objectives: i) To carry out Geological & Structural Mapping on 1:12,500 scale for demarcation of Sillimanite bearing formations (host rock) with the structural features to identify the surface manifestations and lateral disposition of sillimanite bearing rocks. ii) To collect surface (trench/pit) samples & analyse for Sillimanite and decide further course of exploration program. iii) A total of 5 No. of scout boreholes shall be drilled in case, analytical results of surface 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 Sillimanite as per UNFC norms and Minerals (Evidence of Mineral Contents) Rules-2015 at G-4 level.
	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	Three nos. Geoscientist (2 Field + 1HQ)
	Expected Field days (Geology, Sampler, surveyor)	Geologist Party days: (195+195+120)=510 days
		Sampler Party days: (120+120+120)=360 days
		Surveyor Party days: (90+90)= 180 days

1.	**Location**	Longitude	Latitude
		A)93°10'33.325"E	26°14'51.760"N
		B)93°14'57.157"E	26°13'32.721"N
		C)93°09'11.625"E	26°09'39.327"N
	Toposheet No	Falls in Toposheet No. 83F/04	
	Villages	Howraght,Dengaon,Doboka	
	Tehsil/Taluk	Diphu	
	District	KarbiAnglong	
	State	Assam	
2.	**Area (hectares/ square kilometres)**		
	Block Area	37.93 sq.km	
	Forest Area	The block co-ordinates were subjected in the Decision Support System (DSS) of Forest department, Ministry of Environment, Forest and Climate Change (MOEFCC). **It has been found that the block area is under "not inviolate". (Go)-Non Forest area.**	
	Government Land Area	Data not available	
	Private Land Area	Data not available	
3.	**Accessibility**		
	Nearest Rail Head	Hojai(49 km), Diphu (72 km)	
	Nearest Road	Howraghat (21 km) Hojai (49km)	
	Nearest Airport	Guwahati - (205 km)	
4.	**Hydrography**		
	Local Surface Drainage Pattern (Channels)	The area is mainly drained by chippilangso,Lansomipi and Bishnathnala and Chelabor river showing dendritic pattern of drainage. The area is surrounded by Thick dense forest in northern and eastern sides and agricultural lands in western sides. Majority of the land within the buffer-zone consists of hilly tract with ultimate spurs and valleys.	
	Rivers/ Streams	Chelabor River	
5.	**Climate**	Climate of the area is sub-tropical and humid. It experiences southwest monsoon between May and September. May and June are the hottest while December and January are the coldest months of the year. Summer temperature ranges from 22ºC to 34ºC, and winter temperature ranges from 6ºC to 12ºC. Annual average rainfall of the district is about 1200 mm, with monsoon rainfall comprising about 63% of the annual rainfall. The area	

		receives maximum rainfall in July and August. Humidity is generally 70 – 80%.
	Mean Annual Rainfall	Average 1200 mm
	Temperatures (December) (Minimum) Temperatures (April) (Maximum)	Minimum temperatures $6^{O}C$ (December) Maximum temperatures up to $34^{O}C$ (June-July)
6.	**Topography**	Mainly of rugged hills which merges below the alluvium in the west.
	Toposheet Number	83F/04
	Morphology of the Area	Elevation of the plain areas varies between 70m and 80m while that of hilly areas ranges from about 300m to 1300m. Some noticeable peaks of the area are Kumbong Parbat (1160m), Kala Pahar (991m), Bara Binhum Parbat (823m) Chotta Binhum Parbat (798m), Kiarang Parbat (648m) etc. There are many unnamed peaks with more than 500m height in the area. Some residual hills of lower elevation like Mahamaya Parbat and Langsek Pahar also exist in the middle of TS 83F/4. The area shows an overall slope towards south and south-west.
7.	**Availability of baseline geoscience data**	Yes
	Geological Map (1:50K/25K)	Geological Map (1:50,000 scale) from Bhukosh
	Geochemical Map	Available. GSI(Code No. : GCM/NER/ASM/2015/012) & scale 1:50000
	Geophysical Map)	Available. GSICode: M1AGS-GPM/NC/NER/2017/11312 & scale 1:50000
8.	**Justification for taking up Reconnaissance Survey/ Regional Exploration**	i) Directorate of Geology & Mining,Assam, investigated the economic potentiality of the sillimanite deposits around chippilangso village in the northern part of the area and demarcated the following three grades. **Grade I-**99% sillimanite **:** Massive sillimanite with 59% Al_2O_3 **Grade II-** 70% sillimanite**:** Regular bands of sillimanite with 38% Al_2O_3 **Grade III-** 40% sillimanite **:**Single band with 28% Al_2O_3 ii)Of the three above grades, grade I type

		occur as irregular mass and only one pocket was located with probable extension of **62m x 10m.** iii) Three regular bands of Grade II were extensively explored by DGM, Assam and in two blocks; they proved reserves of 0.31 metric tonnes. iv) The single band of Grade III is **900 m X 100 m** in dimension. Techniques to beneficiate low grade Al_2O_3 deposits for recovery of 70%sillimanite was done by Indian Bureau of Mines by applying froth floatation process. Assay result gives the following average composition of sillimanite Al_2O_3-58.90%, Fe_2O_3-0.75%, TiO_2-0.60%, P.C.E. is 1830. So far as composition is concerned, this Sillimanite of Chippilangso is suitable for making refractory bricks. v) Based on the evaluation of geological data, the present Reconnaissance survey(G-4) program has been prepared. The Geological Mapping & surface sampling will be helpful in assessing the disposition of the mineralized zones, structural features like shears and faults, if any. vi) The Exploration will be helpful in estimation of reconnaissance resources of Sillimanite in the area. vii) The Reconnaissance Survey will be helpful in planning of detailed exploration program which in turn will facilitate the state Government for auction of block.

PROPOSAL FOR RECONNAISSANCE SURVEY (G-4 STAGE)FOR SILLIMANITE IN CHIPPILANGSO BLOCK (37.93SQ.KM AREA) DISTRICT- KARBI ANGLONG, ASSAM

1.0.0. Preamble

1.0.1 Sillimanite is mainly used in refractories and ceramic products because of their ability to form mullite phase at high temperature. Mullite is an essential component of high-alumina refractories forming the inner lining of furnaces and high temperature vessels widely used in the production of metals, ceramics, glass and cement. These are used to manufacture refractory products like dense bricks, insulating bricks, monolithic & castables. Sillimanite refractory bricks are extensively used in steel and glass industries and also in ceramics, cement kilns, heat treatment furnaces and petrochemical industries.

1.0.2 The consumption of sillimanite was 56,100 tonnes in 2018-19. Refractory Industry alone accounted for about 78% of consumption, Ceramic Industry (4%), Foundry Industry (10%) and rest by Other Industries.

1.0.3 The increasing demand refractory material i.e. of sillimanite in the country could be eased with the exploration of new sillimanite deposits of economic importance.

1.1.0 Global scenario:

1.1.1 World reserve of Sillimanite and related minerals is large in the USA. Andalusite is limited to only a few countries. The main producer and exporter of Andalusite are South Africa and France while USA and India are the main producers of kyanite. India is the leading producer of sillimanite.

1.2.0 Global demand:

1.2.1 The availability of inexpensive refractory grade bauxite from China served to increase demand for refractories from alternative raw material such as Andalusite. Demand for refractories in iron and steel production is expected to increase in countries with higher growth rates in steel production. Increased demand also is anticipated for refractories used to produce other metals and in the industrial mineral market because of increasing production of cement, ceramics, glass and other mineral products.

1.3.0 India's demand:

1.3.1 Imports of sillimanite were at 99 tonnes which increased manifolds during 2018-19 as compared to the previous year. Ukraine (53%), HongKong (28%), Japan (7%), China (6%) and USA (5%) were the main suppliers of sillimanite.

1.3.2 The production of sillimanite at 69,033 tonnes in 2018-19 decreased by 15% as compared to that in the previous year. There were 6 reporting mines in 2018-19. Besides, four mines reported production of sillimanite as an associated mineral with garnet and kyanite during the year.

Ninety-nine per cent of total production during the year was contributed by three producers. About 35% of total production of sillimanite was reported by the Public Sector mines, while the remaining 65% of production was reported by the Private Sector mines.

AndhraPradesh, the main producing State, contributed 45% of the total output in 2018-19 followed by Odisha (25%), Maharashtra (19%), Kerala (11%) and remaining share was contributed by Meghalaya

1.4.0 Employment generation

1.4.1 Employment generation is the natural process of social development. Equal employment opportunity is a government policy. Population growth is one of the reasons for unemployment. Creating jobs is a keystone of any economic recovery program. The proposed reconnaissance survey (G-4 stage) for Sillimanite in Chippilangso block is likely to generate opportunity of temporary employment on contract basis for short period for local peoples of these remote and rural areas of Karbi Anglong district, Assam.

1.5.0 Background

1.5.1 A meeting was held on 14-07-2021, at the Directorate of Geology and Mining,Assam regarding different mineral exploration activities carried out during last few years and proposed programmes to be taken up in the next field seasons within the state of Assam by Geological Survey of India, State Unit, Assam (GSI, SU) and Mineral Exploration Corporation Limited (MECL).

1.5.2 A power-point presentation was displayed and elaborated by Shri Manas Jyoti Das, Asstt . Manager (Geology) on behalf of MECL regarding mineral exploration activities carried out during last few years.

1.5.3 Sri P. Ravindran, HOD (Exploration), MECL also expressed his desire for some non-coal exploration works like Sillimanite deposits of Samelangso and Chippilangso areas of Karbi Anglong, Iron ore and REE deposits of Barpung, Karbi- Anglong district, Malai Hills and Chakrasila Hills of Western Assam.

1.5.4 After detailed discussions on all the related matters, the investigation of Sillimanite deposits in Chippilangso, Karbi Anglong was decided to be taken up for investigation by MECL in the next field season.

1.5.5 Exploration for refractory minerals is given top priority by Govt. of India, after amendment of MMDR act 2015. Keeping in view, the present proposal is being put up for Reconnaissance Surveyof sillimanite. Consequent upon positive outcome, the exploration programme shall follow G3/G2, which may facilitate state government for auctioning of the block at the earliest.

2.0.0 Location and Accessibility

2.0.1 The Chippilangso block is located about 21 km NW of Howraghat. Howraghat is about 70 Km NW of Diphu. The nearby railway stations are Hojai (49 km) & Diphu (72 km). The area falls in Toposheet No. 83F/04. Diphu is the district headquarters of Karbi Anglong District and about 249km from state capital, Guwahati.

2.1.0 Block description

2.1.1 Area of the Chippilangso block falls in Survey of India Toposheet No. 83F/04 and covers an area of 37.93 sq.km in and around villages Howraghat, Dengaon, Doboka of Karbi Anglong District, Assam state. The block location in Toposheet 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.-III.A**.

Table-III.A

Co-ordinates of the Corner points of the Chippilangso Block

Block Corner points	WGS 84 (DD)		UTM Zone-46 (m)	
	Latitude	Longitude	Easting (m)	Northing (m)
1	26°14'51.760"N	93°10'33.325"E	517568.945	2903128.666
2	26°13'32.721"N	93°14'57.157"E	524892.561	2900709.179
3	26°09'39.327"N	93°09'11.625"E	515313.864	2893514.406

2.2.0 Physiography

2.2.1. The area comprises mainly of rugged hills which merges below the alluvium in the west.Elevation of the plain areas varies between 70m and 80m while that of hilly areas ranges from about 300m to 1300m. Some noticeable peaks of the area are Kumbong Parbat (1160m),

Kala Pahar (991m), Bara Binhum Parbat (823m) Chotta Binhum Parbat (798m), Kiarang Parbat (648m) etc. There are many unnamed peaks with more than 500m height in the area. Some residual hills of lower elevation like Mahamaya Parbat and Langsek Pahar also exist in the middle of TS 83F/4. The area shows an overall slope towards south and south-west.

2.2.2 The area experiences sub-tropical climate with hot and humid summer and cold winter.Climate of the area is sub-tropical and humid. It experiences southwest monsoon between May and September. May and June are the hottest while December and January are the coldest months of the year. Summer temperature ranges from 22ºC to 34ºC, and winter temperature ranges from 6ºC to 12ºC. Annual average rainfall of the district is about 1200 mm, with monsoon rainfall comprising about 63% of the annual rainfall. The area receives maximum rainfall in July and August. Humidity is generally 70 – 80%.Though the average rainfall in Karbi Anglong district is 1200 mm, it is not uniformly distributed. Therefore, there is a wide range of disparity in distribution of rainfall from place to place.

3.0.0 Regional Geology

3.0.1 The area constitutes mainly of the Gneissic Complex of the Archaean with predominance of migmatitic biotite gneiss, quartzo-feldspathic gneiss, biotite/amphibole gneiss, quartz-sillimanite Schist, grey and pink gneiss with porphyritic granitoids. Metamorphism of alumina-rich sediments has given rise to small bodies of quartz-biotite-sillimanite schist and quartz-garnet-biotite schists/gneiss.

Towards the south western part of the area, an outlier of Tertiary sediments rests unconformably over the gneisses.

The generalized succession of these formations was first suggested by GSI is given in the **Table I.A**

Table- I A

Regional Stratigraphic sequence of Litho units

Table 3.1: A generalised stratigraphic set up of Assam			
(G.S.I, Miscellaneous Publication No. 30. 2009).			
Age	**Group Name**	**Formation (Thickness)**	**Lithology**
Holocene	Unclassified	Newer alluvium	Sand, silt and clay
Middle to Upper Pleistocene	Unclassified	Older alluvium	Sand, clay, pebble, gravel and boulder deposit
----------Unconformity/ Tectonic ----------			
Pliocene-Pleistocene	Siwalik Group	Kimin Formation	Sandstone with clay stone
		Subansiri Formation	Micaceous sandstone
Pliocene	Dihing Group	Dihing Formation (900m)	Pebble beds, soft sandy clay, clay, conglomerates, grit and sandstone
---------- Unconformity----------			
		Dupitila Formation	Sandstone, mottled clay, grit and conglomerate; locally with beds of coal, conglomerate and poorly consolidated sandstone with layers and pockets of pebbles
Mio-Pliocene	Dupitila Group	(Surma valley: 3300)	
		Namsang Formation	Coarse, gritty, poorly consolidated sandstone and conglomerate of coal pebbles
		(Upper Assam: 800m)	
----------Unconformity----------			
		Girujan Clay Formation(1800m)	Mottled clays, sandy shale and subordinate mottled, coarse to gritty sandstone
Mio-Pliocene	Tipam Group	Tipam sandstone Formation(2300m)	Bluish grey to greenish, coarse to gritty, false bedded, ferruginous sandstone, clays, shale and conglomerates
----------Unconformity----------			
	Surma Group	Bokabil Formation	Shale, sandy shale, siltstone, mudstone and lenticular, coarse ferruginous sandstone
Miocene		(900 to 1800m)	
		Bhuban Formation	Alternations of sandstone and sandy shale and thin conglomerate, argillaceous in middle part.
		(1400 to 2400)	
----------Unconformity----------			

		Renji Formation	Massive bedded sandstone; its equivalent- the Tikak Parbat Formation in the Upper Assam is marked by thick coal seam in basal part.
		(600 TO 1000)	
Eocene-Oligocene	Barail Group	Jenam Formation	Shale, sandy shale and carbonaceous shales with interbedded hard sandstone; its equivalent the Bargolai Formation in Upper Assam is marked by thin coal seams.
		(1000 to 3300m)	
		Laisong Formation (2000 To 2500)	Well bedded compact flaggy sandstone and subordinate shale; its equivalent- the Nagaon Formation in Upper Assam is marked by thin bedded, hard sandstone and interbedded shale.
	Disang Group		Splintery dark grey shale and thin sandstone
		Kopili Formation	Shale, sandstone and marl
Palaeocene-Eocene	Jaintia Group		Sylhet Limestone (Fossiliferous Limestone)
		Shella Formation	Sylhet sandstone, clay and thin coal seam
		Langpar Formation (exposed in Meghalaya)	Calcareous shale, sandstone-limestone
----------Unconformity----------			
Cretaceous	Alkali Complex of Samchampi		Pyroxenite- serpentinite with abundant development of melilite pyroxene rock, ijolite, syenite and carbonatite
----------Unconformity----------			
Cretaceous		Sylhet Trap	Basalt, alkali basalt, rhyolite, acid tuff
		(exposed in Meghalaya)(600m)	
----------Unconformity----------			
Perm-Carboniferous	Lower Gondwana	Karhabari Formation	Very coarse to coarse grained sandstone with conglomerate lenses, shale, carbonaceous shale and coal
		Talchir Formation	Basal tillite, conglomerate with sandstone bands, siltstone and shale
----------Unconformity----------			
Neo-Proterozoic-early Palaeozoic	Granite Plutons		Porphyritic coarse granite, pegmatite, aplite, quartz vein traversed by epidiorite, dolerite

----------Intrusive contact----------			
Palaeo- Meso Proterozoic	Shillong Group		Quartzite, phyllite, quartz-sericite schist, conglomerate
----------Unconformity----------			
Archaean (?) Proterozoic	Gneissic Complex		Complex metamorphic group comprising ortho and para gneisses and schists, migmatites, granulites etc. Later intruded by acidic and basic intrusive.

3.1.0 Geology of the Block

Migmatitic biotite gneiss and quartzo-feldspathic gneiss are the dominant rock types of the area. Subordinate amount of quartz sillimanite schist, massive sillimanite boulders and quartz sillimanite gneiss are also present.Quartz sillimanite schist and gneissic rocks occur as alternate bands in the area. Massive sillimanite occur as minor pockets within the gneissic rock. Some metabasic rock boulders are also occurring in the area. The plain area is mainly covered by recent alluviums.

3.2.0 Mineral Potentiality based on previous work

Directorate of Geology & Mining,Assam, investigated the economic potentiality of the sillimanite deposits around Chippilangso village.Their findings are discussed below.

1978-79

On the basis of sillimanite content in the rock, the area can be classified into four categories, Viz. Grade-1 composed of 99% sillimanite

Grade-2 Composed of 70% sillimanite and rest quartz

Grade-3 Composed of 40% sillimanite and rest quartz

Grade-4 Composed of 25% sillimanite and rest quartz and Mica

The average Al_2o_3 content in the various grades are 59%,38%, 28.7 % and 13%respectively.

Grade-I: Occurs as irregular masses spreading along the NE-SW strike for considerable distances. Only three such pockets are located with the migmatitic gneisses.

The probable extents of these pockets are given below:-

Sl. No.	**Dimension**			
1.	Length	100m	75m	50m
2.	Breadth	15m	20m	15m

All the occurrences are located in the Chippilangso area. These sillimanite masses occur like potatoes and biscuit of brown to dove brown in colour.

Grade 2: Occurs as regular bands of considerable areal extent along strike. Two types of Grade 2 deposits occur i.e. pink and white.

Sl. No.	**Dimension**			
1.	Length	450m	1350m	425m
2.	Breadth	75m	258m	35m

All the bands occur in association with biotite sillimanite gneiss or quartzofelspathic gneiss.

Grade 3: Occurs as irregular patches with quartz and pyrite in comparison to the earlier two types.

Sl. No.	**Dimension**		
1	Length	900m	1110m
2	Breadth	100m	141m

Grade 4: Occurs only as a small patch. Composed of biotite with minute crystals of sillimanite. The rock is mainly biotite sillimanite gneiss.

Sl. No.	**Dimension**	
1	Length	80m
2	Breadth	15m

1979-80

i) Directorate of Geology & Mining, Assam, investigated the economic potentiality of the sillimanite deposits around Chippilangso village in the northern part of the area and demarcated the following three grades.

Grade I - 99% sillimanite massive sillimanite with 59% Al_2O_3

Grade II -70% sillimanite regular bands of sillimanite with 38% Al_2O_3

Grade III - 40% sillimanite single band with 28% Al_2O_3

ii)Of the above three grades, grade I type occur as irregular mass and only one pocket was located with probable extension of **62 meter x 10meter**. However drifted boulders of this grade were noticed at several places.

iii) Three regular bands of Grade II were extensively explored by DGM, Assam and in two blocks; they proved reserves of 0.31 metric tonnes.

iv) The single band of Grade III is 900 m X 100 m in dimension.

3.2.1 Work Done by GSI in and around the areas

D. K. Chandra, Assistant Geologist, Geological Survey of India who carried out investigations for the limestone-occurrences in the Mikir Hills, Assam and examine the suitability of these limestone for use in the manufacture of Portland cement. The field-work was undertaken during the period 21st Dec, 1947 to the end of April, 1948.

The limestone occur along the southern and south-eastern foot of the Mikir Hills. The area examined is roughly bounded by lat.25°45': 26°5' and long. 93°10': 93°40', and falls within the Survey of India 1" = 1 mile sheets 83 F/4,8,12 and 83 G/l,5,9. The occurrences are partly in the Sibsagar dist. and partly In the Nagaon dist. and are almost confined to the boundary-zone between the two districts.

M. M. Munshi, Geologist, and B.K. Duara, Assistant Geologist, Geological Survey of India carried out geological mapping in parts of the united Mikir and North Cachar hills and nowgong district, assam in 1962-1963.

Systematic geological mapping of an area of 1125 sq km was carried out in parts of the Mikir hills and adjacent plains of the Nagaon district on toposheets 83 F/4 & 8, 83 G/l & 5, and 83 C/NE on 1:126,720 scale. The area consists of the alluvial plains between Phuluni and Lanka along the Jamuna valley and the south eastern flanks of the Mikir hills. The main rock types are granitoid mica gneisses and granites and a few exposures of limestones, shales, sandstones, mudstones and clays. The only minerals of any economic value are some very impure limestones and pink granites useful for building purposes.

Dr. M. S. Singh, Sr. Geologist, R. T. Kumar, Sr. Geologist and R. K. Ahirwar, Geologist, Geological Survey of India carried out geochemical mapping in toposheet no. 83F/8 and in parts of 83F/4 in Field Season: 2015-16.

In the course of Geochemical Mapping, a total of 1264 sq km area has been covered under the Geochemical mapping on 1:50000 scale in T.S. 83F/8 and in part of T.S. 83F/4 in Karbi Anglong district, Assam. Twenty-four (24) nos. of stream sediment sample on 4*4 km grid, 220 nos. of Stream Sediment Samples on 2*2 km grid, 15 nos. of regolith samples, 15 nos. of C-Horizon samples, 15 nos. of stream water samples, 2 nos. of petrological samples, 2 nos. XRD samples and 15 nos. samples for heavy mineral studies were collected during the course of field work.

1. Incidence of higher anomalies of REE (∑REE= 1126ppm) and Hf (148.61ppm) were seen around Dambaksa. Though the higher values of REE might be due to presence of gneiss, granitoids or pegmatite veins in the area, as La (243 ppm), Ce (404 ppm), Pr(59.39ppm), Sm(43.20ppm), Gd(37.60ppm), Tb(6.35ppm), Dy(34.67ppm), Er(21.40ppm), Tm (3.41ppm), Yb(21.39ppm), Lu(3.22ppm) and Hf (148.61ppm) are higher than both their corresponding

maximum value in SGSC (Standard Global Soil Composition Range) and background significant anomalous values. Further study can be taken up for REE and Hf concentration in and around Dambaksa (T.S.83F/8) if necessary.

2. As La (232.50 ppm), Pr (57.68 ppm), Nd (219.93), Sm (36.98ppm), Gd (31.97 ppm), Tb (5.81 ppm), Dy (32.00ppm), Er (17.06 ppm), Yb (17.86ppm) and ∑REE (1045ppm) are higher than both their corresponding maximum value in SGSC and background significant anomalous values in the sample collected from Haphjan and Chelabor in T.S.83F/4, these areas can be further studied for in details if necessary.

3. Though granitic and gneissic rock have high level of U content, the U anomaly noticed in stream sediment samples from Rulpi Parbat (21.26ppm) and Mahamaya Parbat (17ppm) where porphyritic granite is exposed (T.S.83F/4) are higher than both the maximum limit in SGSC and background significant anomalous value, so further study may be taken up for U concentration in and around Rulpi Parbat and Mahamaya Parbat areas.

Dr.Nabendu Majumdar, Senior Geophysicist, Pankaj Kumar Das, Geophysicist and Piu Dhibar, Geophysicist, Geological Survey of India carried out geophysical mapping by gravity and magnetic surveys on1:50000 scale in parts of Karbi Anglong and Nagaon districts of assam covering toposheet nos. 83F/4 and 83F/8 in Field Season: 2017-18.

Gravity and elevation data were acquired from 711 stations while magnetic data from 709 stations (excluding 2 noisy localities) of which 422 Gravity and 420 magnetic stations are in toposheet 83 F/04 . Rock samples were collected simultaneously from 56 stations.Gravity-magnetic data were collected along available roads and foot tracks, with station density of one station in 2.5 sq km area as per the guidelines of Standard OperatingProcedure (SOP).

Overall, the range of values of gravity and magnetic anomalies are lower than those normally associated with ore zones, and hence, not encouraging for major mineral hunt. However, occurrences of few weakly mineralised pockets particularly in Samchampi alkali carbonatite complex, as apparent from discrete gravity and magnetic high closures of limited extents, cannot be ignored.

Detailed geological and geophysical investigations were recommended for Samchampi alkali-carbonatite-ultramafic complex and areas in and around Dambaska in TS 83F/8 for ascertaining their mineralisation potentials. Area on the south of Mahamaya Parbat near Dokmoka township in TS 83F/4 may be studied in detail as high gravity nosing and high REE contents have been found here.

4.0.0 Observation and Recommendations of previous work

4.0.1. Geologically, the location of the block area falls under Assam Meghalaya Gneissic Complex where migmatitic biotite gneiss and quartzo feldspathic gneiss are the dominant rock types. Subordinate amount of quartz sillimanite schist, massive sillimanite boulders and quartz sillimanite gneisses are also present. So, it is worthwhile to test this area to delineate possible sillimanite ore body during further exploration work. Since the current exploration work is reconnaissance (G-4) level exploration, the possibility of other mineralisation will also be tested.

4.1.0 Objectives of Proposed Exploration

4.1.1 Based on the evaluation of available geological data, the present exploration program has been formulated to fulfil the following objectives:

i) To carry out Geological & Structural mapping on 1:12,500 scale for demarcation of Sillimanite bearing formations (host rock) with the structural features to identify the surface manifestations and lateral disposition of the mineralized zones.

ii) To collect surface (Trench/pit) samples &analyse for Sillimanite.

iii) A total of 5 No. of scout boreholes shall be drilled in case, analytical results of surface 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 (334) of Sillimanite as per UNFC norms and Minerals (Evidence of Mineral Contents) Rules-2015.

4.1.2 The proposed Reconnaissance Survey (G-4 stage) program comprises, Geological Mapping (1:12,500 scale), Trench/Pit sampling, Drilling of 5 Nos of scout boreholes involving about 500m drilling with associated survey, chemical analysis, physical analysis and Geological Report preparation.

5.0.0 Planned Methodology

5.0.1. In accordance to the objective set for the reconnaissance survey (G-4) of the block, the exploration programme is proposed. The exploration shall be carried out as per Minerals (Evidence of Mineral Content) Rule-2015. 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.

5.1.0 Geological Mapping

5.1.1. Geological mapping will be done in the entire 37.934 sq.km area on 1:12,500 scale. Rock types, their contact, structural features etc. will be mapped. Surface manifestations of the sillimanite bodies available along with their surface disposition will be marked on the map.

5.2.0 Surveying:

5.2.1. As exploration work is at G-4 level, no detailed survey work is planned.The block boundary will be surveyed by total station in WGS-84 datum for demarcation of block boundary points. Borehole fixation and determination of reduced level and co-ordinates of the scout boreholes only will be undertaken.

5.2.2. The block is of around 37.93 sq km area, hence after identifying the disposition of mineralized zones, the area surrounding mineralized zones (ore bodies)/potential area will be contoured on 1:1,000 scale at 1.00m contour interval. Surveying of surface features within such sub blocks will be undertaken.

5.3.0 Exploratory Mining (Trenching/Pitting)

5.3.1. Shallow trenching (Excavation) shall be carried out in the potential zones identified based on the results of geological mapping. A provision of shallow trenching of 500 cubic meters is kept. Locations of trenches on ground will be decided by field geologist based on field observations.

5.3.2. Pitting shall be done for correlation of mineralized zones (if any) on surface up to a depth of 2m after removal of soil/weathered column in the area. A provision of shallow pitting of 50 cubic meters is kept. Locations of pits on ground will be decided by field geologist based on field observations.

5.3.3 A provision of 345 Nos of primary & check (5% internal+10% External) trench/pit samples is kept for analysis of Al_2O_3, SiO_2, Fe_2O_3, TiO_2, MgO, Na_2O, K_2O & LOI.

5.4.4. The trench /pit walls will be mapped on 1:200 scale.

5.4.5. Thus, a total of 550 cu m of shallow trenching/pitting work along with associated geological & laboratory studies will be carried out.

5.5.0 Core Drilling:

5.5.1. Based on Geological mapping, the extension of the mineralized zones (ore bodies) will be marked. To find out the potentiality of mineralized zones in strike & dip, 5 Nos scout boreholes involving 500 m of drilling will be carried out for first level (shallow - 50m) of intersection of mineralized zones.

5.6.0 Drill Core Logging:

5.6.1 The drill core will be logged for rock types, structural features, textures, intersection of sillimanite zones, types of mineralization and occurrence of various ore minerals. The logging for determination of Rock Quality Determination/Designation (RQD) will also be undertaken.

5.7.0 Drill Core Sampling:

5.7.1 During geological logging of drill core, sillimanite zones will be marked on basis of concentration and lithology. Total 230 Nos of primary and check (5% Internal Check+ 10% External Check) samples will be analysed for Al_2O_3, SiO_2, Fe_2O_3, TiO_2, MgO, Na_2O, K_2O & LOI.

5.8.0 Sampling and analysis

5.8.1 Total 300 primary channel samples from trench/pit, 15 internal check and 30 external check samples are proposed to be analysed for Al_2O_3, SiO_2, Fe_2O_3, TiO_2, MgO, Na_2O, K_2O & LOI.

5.8.2 From drill core, total 200 primary samples, 10 internal check and 20 external check samples are proposed to be analysed for Al_2O_3, SiO_2, Fe_2O_3, TiO_2, MgO, Na_2O, K_2O & LOI.

5.9.0 Petrological Studies:

5.9.1 During the course of geological mapping and core logging 30 samples from Surface, Trench/Pit and borehole core will be studied for petrography.

5.10.0 Specific Gravity Determination:

5.10.1 The specific gravity determination of 20 samples from the mineralized zones intersected in the boreholes will be carried out.

5.11.0 Bulk Density Determination:

5.11.1 The Bulk Density determination 25 samples from the mineralized zones intersected in the pits will be carried out.

5.12.0 Nature Quantum and Target

5.12.1. Details of the particular, quantum and the targets are tabulated in **Table No.-V.A.**

Table No-V. A
Envisaged Quantum of proposed work in Chippilangso Block

Sl. No.	Item of Work	Unit	Target
1	**Geological Mapping** (on 1:12,500 Scale)	Sq km	37.934
2	**Topographical Survey** (Surface features/Trench/Pit/Borehole* locations etc)	Sq km	In mineralized area (If required)
3	**Exploratory Mining (Trench/pit)**		
	a)Excavation (Pitting) (1m*1m*2m)	Cu. m	50
	b)Excavation (Trenching) (2m*1m)	Cu. m	500
4	**Trench/pit Sampling**		
	a) Channel Sampling	Nos	300
	b) Check Samples (5% Internal + 10% External) of Bed Rock	Nos	45
5	**Drilling (coring)***		
	a) Drilling, total 5 (Scout Boreholes)	m	500
6	**Drill Core Sampling***	Nos	
	a) Drill Core (Primary) Samples	Nos	200
	b) Drill Core (check) Samples		30
7	**Laboratory Studies**		
	i) Surface Samples		
	a) Channel Sampling	Nos	100
	b) Check Samples (5% Internal + 10% External) of Bed Rock	Nos	15

	ii) Samples from Trench/pit		
	a) Channel Sampling	Nos	200
	b) Check Samples (5% Internal + 10% External) of Bed Rock	Nos	30
	iii) Drill Core Samples*	Nos	
	a) Drill Core (Primary) Samples	Nos	200
	b) Drill Core (check) Samples		30
	iv) Petrological Samples (Surface & BH Core Samples)		
	a) Preparation of Thin Section	Nos	30
	b) Study of Thin Section	Nos	30
8	**Specific gravity Determination***	Nos.	20
9	**Bulk density Determination**	Nos	25
10	**Report Preparation (5 Hard copies with a soft copy)**	Nos.	1
11	**Preparation of Exploration Proposal (5 Hard copies with a soft copy)**	Nos.	1
*** The 2nd level of work to be decided after review of Geological Mapping & sampling.**			

6.0.0 Manpower Deployment

6.0.1 Manpower deployment List will be provided later.

7.0.0 Break-up of Expenditure

7.0.1. Cost has been estimated based on NMET schedule of charges mandated in the circular OM No. 61/1/2018/NMET dated 31st March 2020 for exploration projects funded by NMET. The total estimated cost is **Rs. 836.61 Lakhs.** The summary of cost estimates for reconnaissance (G-4 Level) is given in **Table No.-VII.A** and details of cost estimates are given in **Table No. – VII.B.**

Table No VII.A

Summary of Tentative Cost Estimates for Reconnaissance Survey

(G-4 Level)

Summary of Cost estimate		
Sr no	**Item**	**Total**
1	Geology	1,00,02,000
2	Pitting and Trenching	18,15,000
3	Drilling	70,18,800
4	Subtotal (1-3)	1,88,35,800
5	In Remote and inaccessable terrain existing in north eastern states {subtotal (1-3) x 3.35}	6,30,99,930
6	Laboratory studies	53,75,850
7	Drill Core Preservation	4,13,400
8	Report Preparation	20,00,000
9	Peer Review	10,000
	Total (5-9)	**7,08,99,180**
10	GST-18%	1,27,61,852
	Grand Total	**8,36,61,032**

8.0.0 Time schedule

8.0.1 The proposed exploration programme envisages Geological mapping, surface and Trench/Pit sampling, scout drilling, sample preparation and laboratory studies, which will be completed within 15 months, geological report preparation will take 4 months with one month overlapping with field and lab works. Therefore, a total of 18 months is planned for completion of the entire proposed programme. Tentative Time schedule/action plan for proposed Reconnaissance (G-4) for Sillimaniteis given in **Table No. VIII-A.**

TABLE- VIII-A TIME SCHEDULE / ACTION PLAN FOR EXPLORATION PROPOSAL FOR SILLIMANITE IN CHIPPILANGSO (G-4) BLOCK, DISTRICT - KARBI ANGLONG, ASSAM

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	Camp Setting	Month																			1 month
2	Geological Mapping	Month																			6 Months
3	Survey Party days (1 Party)	Party days																			180 Days
4	Pitting /Trenching	Cu.m																			550 Cu m
5	Surface Drilling (1 rig)	m.																			500m in 5 Bhs
6	Geologist Party days (1Party)	Party days																			390 Days
7	Sampling Party days (1 party)	Party days																			360 days
8	Camp Winding	Months																			1 month
9	Laboratory Studies	Months																			11 Months
10	Geologist Party days, HQ (1Party)	Party days																			120 days
11	Report Writing with Peer Review	Months																			4 months

Time loss on account of monsoon/agricultural activity/forest clearance/local law and order problems will be addition to above time line.

9.0.0 References:

1) Geological Survey of India, (2009): Geology and Mineral resources of Assam. Miscellaneous Publication no 30 Pt-IV, vol. 2(i), pp.7-9
2) Director, D.G.M., Assam,1982, Geology and Mineral Resources and Groundwater
3) D. K. Chandra,1947, A Preliminary Report On The Availability Of Materials For Cement Manufacture In The Mikir Hills, Assam.
4) Munshi, M. M., 1962. Re por t on the Geological mapping and investigation for coal along JaintiaValley , United Mikir and North Cachar Hills , Assam. rep. F .S. 1961-62.
5) Dr. M. S. Singh, R. T. Kumar and R. K. Ahirwar 2015-2016, Geochemical mapping in toposheet no. 83F/8 and in parts of 83F/4.
6) Dr.Nabendu Majumdar, Pankaj Kumar Das and PiuDhibar, 2017-18, Geophysical mapping by gravity and magnetic surveys on 1:50000 scale in parts of karbianglong and nagaon districts of assam covering toposheet nos. 83F/4 and 83F/8.

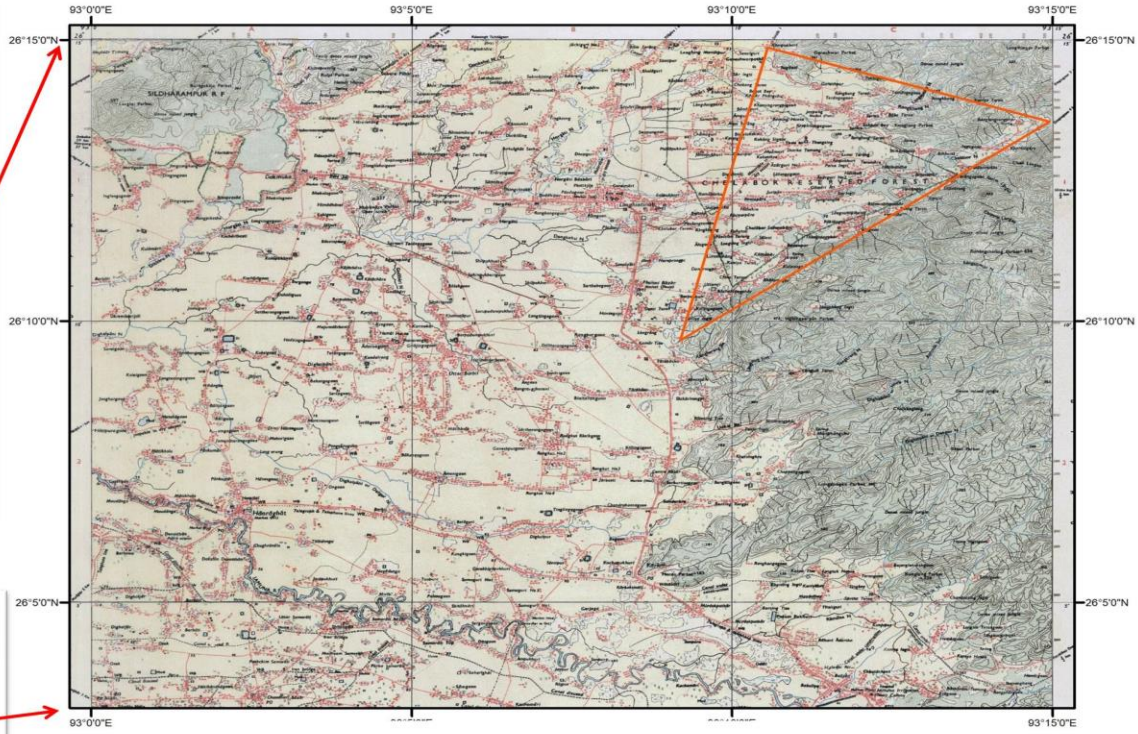
List of Plates:

1. **Plate-I: Block Location Map of Chippilangso Block in toposheet no. 83 F/04, Karbi Anglong District, State Assam**
2. **Plate-II: Regional Geological map with proposed Chippilangso Block, Karbi Anglong District, State Assam**
3. **Sample location cum drainage Map of Geochemical mapping in parts of Karbi Anglong and Nagaon districts of Assam covering Toposheet Nos. 83 F/4 by GSI.**
4. **Layout of Gravity and Magnetic stations in parts of Karbi Anglong and Nagaon districts of Assam covering Toposheet Nos. 83 F/4 and 83 F/8 by GSI.**

LOCATION MAP OF CHIPPILANGSO BLOCK, KARBI ANGLONG, ASSAM

INDIA

ASSAM



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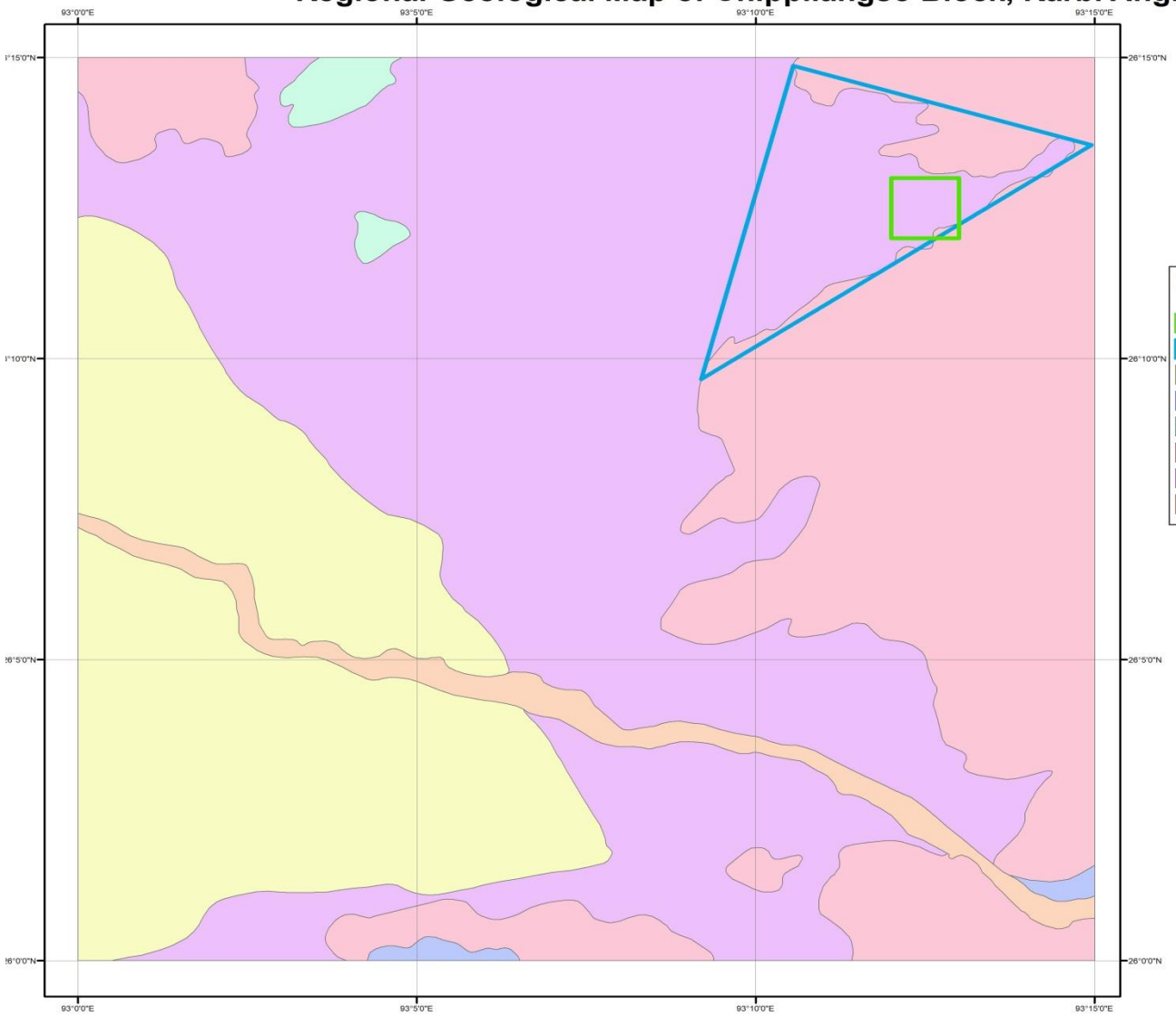
Regional Geological Map of Chippilangso Block, Karbi Anglong, Assam



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Legend

- DGM ASSAM BLOCK
- PROPOSED BLOCK
- FEEBLY OXIDIZED SAND, SILT AND CLAY
- FERRUGINOUS SANDSTONE, CLAY & BASAL CONGLOMERATE
- GREY AND PINK PORPHYRITIC GRANITE
- MICA(BIOTITE)GNEISS
- OXIDISED TO FEEBLY OXIDISED SAND SILT AND CLAY
- UNSTABILISED & UNOXIDISED SAND, SILT AND CLAY

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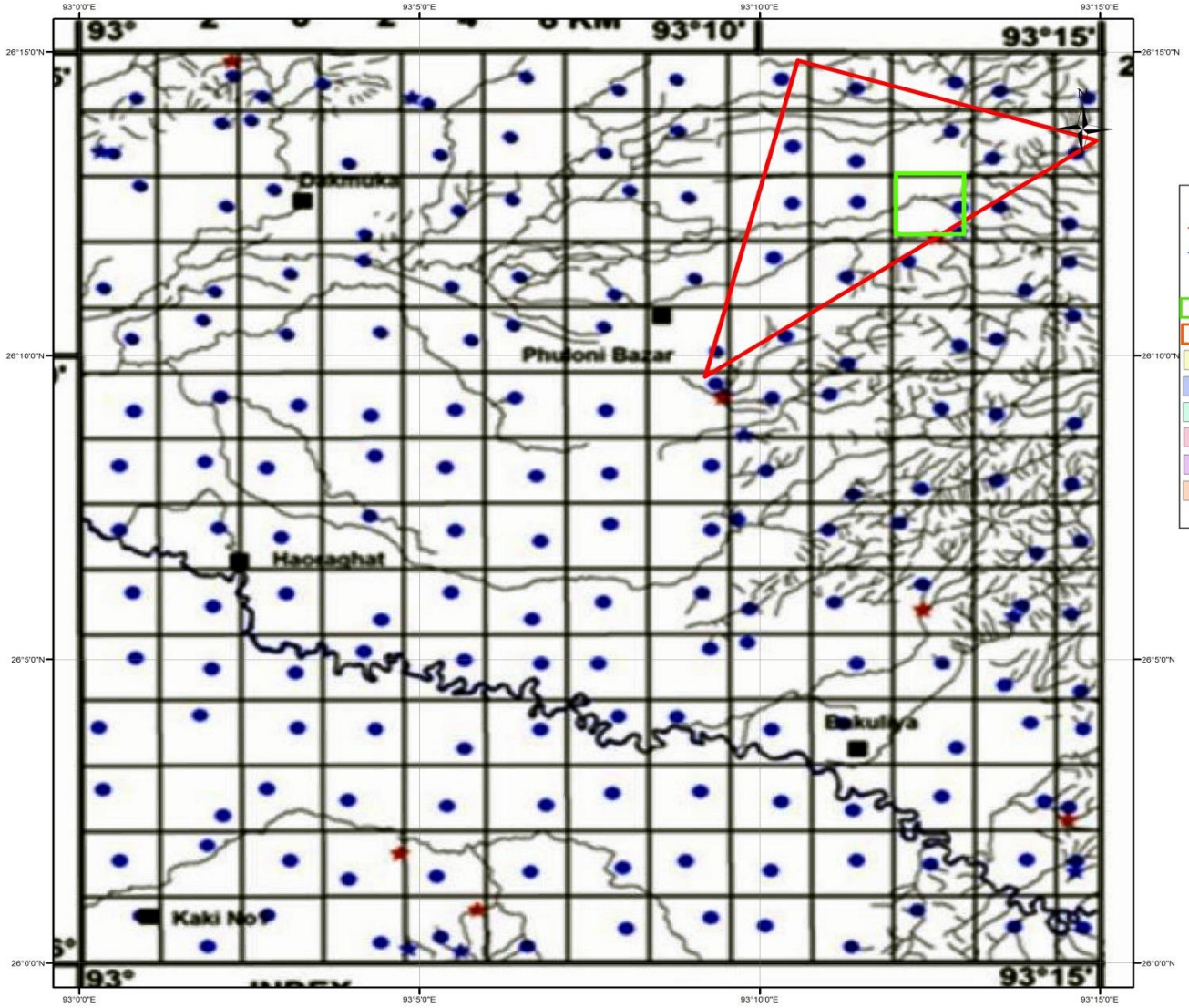
Sample location cum drainage Map of NGCM in Toposheet no 83 F/4



Legend

- STREAM WATER SAMPLE
- SOIL (R & C SAMPLE)
- STREAM SEDIMENT SAMPLE
- DGM ASSAM BLOCK
- PROPOSED BLOCK
- FEEBLY OXIDIZED SAND, SILT AND CLAY
- FERRUGINOUS SANDSTONE, CLAY & BASAL CONGLOMERATE
- GREY AND PINK PORPHYRITIC GRANITE
- MICA(BIOTITE)GNEISS
- OXIDISED TO FEEBLY OXIDISED SAND SILT AND CLAY
- UNSTABILISED & UNOXIDISED SAND, SILT AND CLAY

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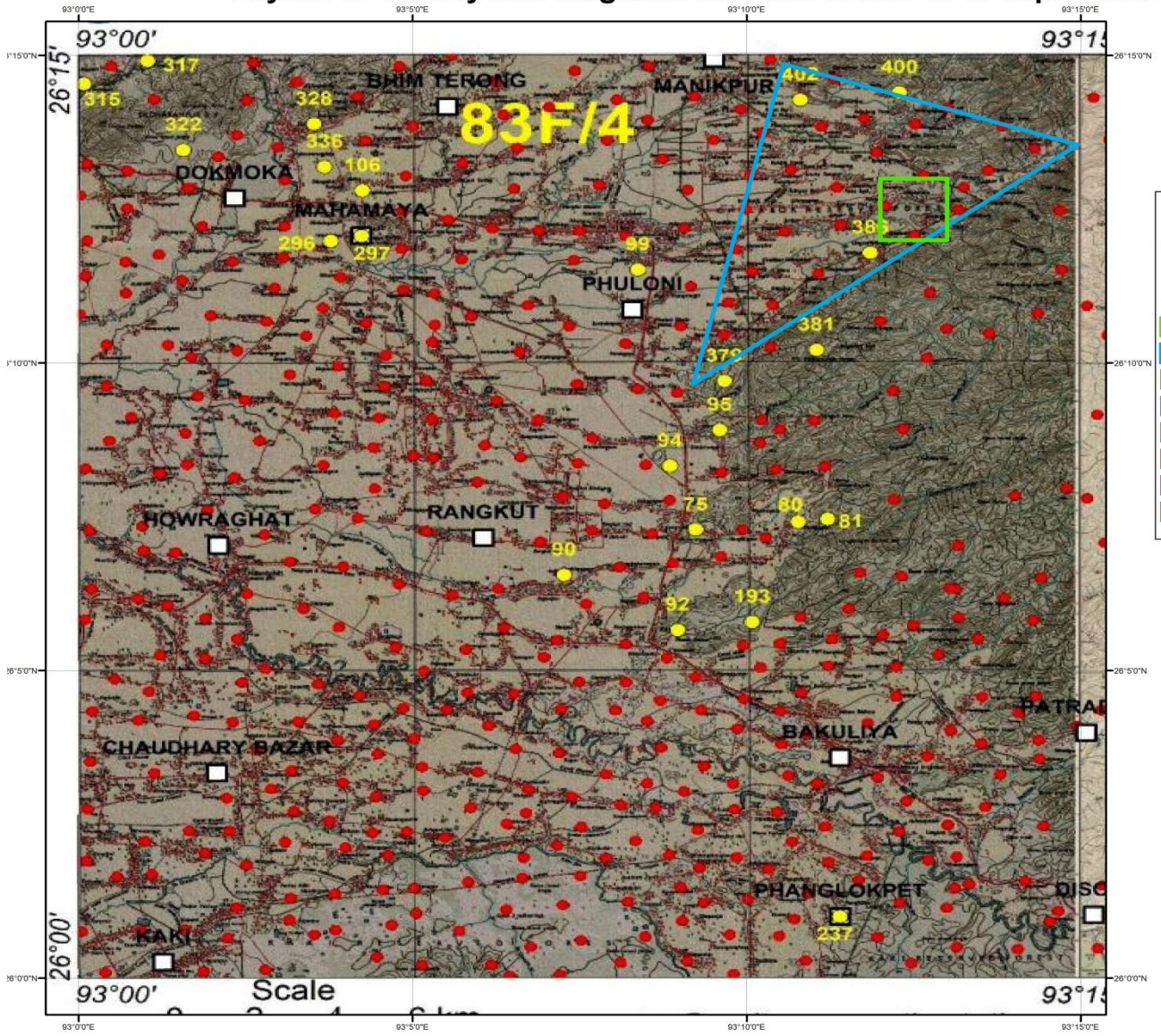
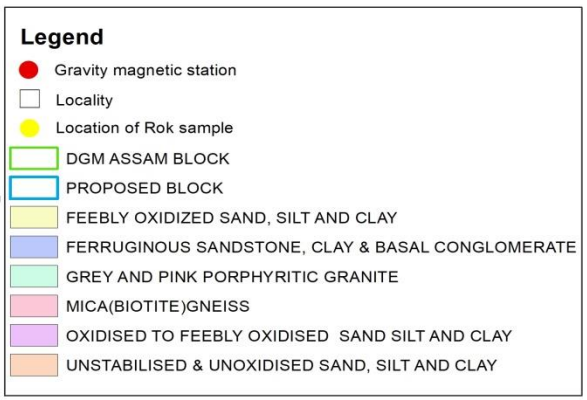
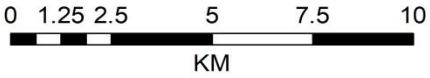
Layout of Gravity and Magnetic stations in NGPM of Toposheet no 83 F/4 by GSI







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