PROPOSAL FOR PRELIMINARY EXPLORATION (G-3 STAGE) FOR LIMESTONE IN CHOKKANATHAPURAM BLOCK (8.5 SQ KM), ARIYALUR AND PERAMBALUR DISTRICTS, TAMIL NADU.

COMMODITY: FOSSILIFEROUS LIME STONE

(PROPOSED BLOCK AREA = 8.5 Sq km;
TOPOSHEET Part of 58M/03 and 58M/04)

By

GEO EXPLORATION AND MINING SOLUTIONS

No. 17, Advaitha Ashram Road, Fairlands,
Salem – 636004, Tamil Nadu, India.
Email: ifthiahmed@gmail.com, geothangam@gmail.com
Web: https://www.gemssalem.com

PLACE : Salem

DATE : 06-11-2024

Table of Contents

List of Tables

List of Figures

List of Plates

Summary of the Block for Preliminary Exploration (G3 Stage)

GENERAL INFORMATION ABOUT THE BLOCK

	Features	Details	
	Block ID	Chokkanathapuram, Block	
	Exploration Agency	**GEO EXPLORATION AND MINING SOLUTIONS** No.17 Advaitha Ashram Road, Fairlands, Salem – 636004, Tamilnadu, India.	
	Commodity	Fossiliferous Lime stone	
	Mineral Belt	Ariyalur Cretaceous formation	
	Completion Period with entire Time schedule to complete the project	12 months	
	Objectives	1. To demarcate the various limestone grade occurrence within the area by drilling of 20 boreholes. 2. To estimate grade wise Limestone inferred resources in the Block area as per UNFC norms at G3 (333) level of exploration. 3. To carry out exploration as per Minerals (Evidence of Mineral contents) Rules 2015, Mineral (Auction) Rules 2015 and MMDR Amendment act 2015 in turn to facilitate the State Govt. (Tamil Nadu) in auctioning of the block.	
	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	Geologist - 3 Nos (Field Geologist:2 Nos & HQ geologist:1 Nos); Surveyor -1 Nos; Samplers -2 Nos; Labors – 4 Nos.	
	Expected Field days (Geology) Geological Party Days	Geological mapping (LSM & DM) including BRS collection, pitting/ trenching – logging, & sampling	240-man days (120X2Geologist)
		Scout drilling – 600m	90-man days (45X2Geologist)
		Survey work for marking block boundary; Topographic	60-man days (60X1Surveyor)

		mapping for DM block and pit/trench marking			
		Sample processing (BRS/ PTS/ Soil sample/ stream sediment sample)		150-man days (75X2Sampler)	
		Total field days Field Geologist		330 man days (240+90)	
		Surveyor		60 man days	
		Sampler		150 man days	
		Labours (4 nos)		1560 man days (390X4)	
1.	**Location (Plate-I)**	**A**	**B**	**C**	**D**
	Latitude	11°17'3.77''N	11°16'31.31''N	11°14'44.77''N	11°15'16.87''N
	Longitude	79°7'34.84''E	79°8'45.21''E	79°7'54.89''E	79°6'45.31''E
	Villages	Namangunam, Kadur, Nakkampadi, Vellur			
	District	ARIYALUR AND PERAMBALUR DISTRICTS, TAMIL NADU			
2.	**Area (hectares / Sq. kilometers)**				
	Block Area	**8.5 Sq. km**			
	Forest Area	NIL			
	Government Land Area	No data			
	Private Land Area	No data			
3.	**Accessibility**				
	Nearest Rail Head	Sendurai railway station, about 5 Km, lies in the east direction from the proposed block on Ariyalur-Villupuram railway line of southern Railway			
	Road	The proposed block is about 5 km west from the Sendurai and can be reached via state highway running from Ariyalur to Sendurai.			
	Airport	Tiruchirappalli (72 km) in SW Direction.			
4.	**Hydrography**				
	Local Surface Drainage Pattern (Channels)	The drainage pattern of the area is sub-parallel to dendritic in nature. The regional slope is towards east. Denudational, structural and fluvial processes mainly control the geomorphic evolution of the area. Mainly the varying resistance of geological formations to those has governed the evolution of various landforms.			
	Rivers/ Streams	Mostly first and second order streams are observed in the proposed block.			
5.	**Climate**				

	Mean Annual Rainfall	Mean annual rainfall: 949 mm NE Monsoon (October to December) :- 314.7mm
	Temperatures (December) (Minimum) Temperatures (June) (Maximum)	(minimum): 21 (maximum): 39
6.	**Topography**	
	Toposheet Number	Part of 58M/03 and 58M/04
	Morphology of the area	The proposed block area is mainly pediplained and no major topographical highs or lows and shows gradual change in the slope towards east.
7.	**Availability of baseline geoscience data**	
	Geological Map (1:50K/ 25K)	1:50K map available in Bhukosh & NGDR (Plate-II)
	Geochemical Map	Available (NGCM, GSI)
	Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps)	Not available
8.	**Justification for taking up Reconnaissance Survey / Regional Exploration**	1. The Kallankurichchi Formation is traced from Kulumur in the north to Vellipirangiyam in the south for a distance of 28 km with a width ranging from 200 meters to 3 km. The main rock type of this formation is fossiliferous limestone. Among 28 km strike length, more exploration activities are done in the southern part of this Formation and existing limestone mines are also occurred in the southern part of this Formation. 2. Though in the proposed area, fossiliferous limestone occurrence of Kallankurichchi Formation is well established previously, but, exploration activities are less as compared to the southern part. Therefore, G3 stage of exploration is required for quantitative and qualitative evaluation and to convert the Geological resource to mineable reserves with higher level of confidence. 3. Limestone mines exists in the south of the proposed block in the same Kallankurichchi Formation. 4. Most limestone deposits in India exhibit significant variability in grade. The silica (SiO_2) and magnesium oxide (MgO) content in limestone are crucial factors influencing the

		chemical composition of raw materials used in cement manufacturing. In sedimentary limestones, the levels of these components, along with calcium oxide (CaO), can vary consistently both laterally and vertically, even within a small area. This variability makes it challenging to accurately estimate the quantity and quality of limestone based on data from nearby locations, especially for key factors like silica and MgO, which are critical to determining the suitability of the limestone for use in cement and other industries. Limestone with high silica and MgO content is unsuitable for cement manufacturing without blending with higher-grade limestone and may not be ideal for clinker production. Therefore, thorough exploration is essential to identify and quantify different grades of limestone according to the specific requirements of various industries. 5. The augmentation of limestone resources, which are fundamental to infrastructure development, is crucial for making this block eligible for auction in compliance with existing rules and regulations. 6. The demand for cement in the construction industry is expected to rise in the coming years, which will, in turn, drive an increased demand for limestone. As investments in infrastructural projects such as railways, water supply, transportation, electricity, and telecommunications grow, the need for limestone will also escalate.

PROPOSAL FOR PRELIMINARY EXPLORATION (G-3 STAGE) FOR LIMESTONE IN CHOKKANATHAPURAM BLOCK (8.5 SQ KM), ARIYALUR AND PERAMBALUR DISTRICTS, TAMIL NADU

1. Introduction

Limestone is one of the most important industrial minerals used in the manufacture of lime, cement, chemicals, fertilizers and metallurgical industries in Tamil Nadu. The limestone in Tamil Nadu occurs in two types as described below;

(a) Crystalline limestone: It occurs in the Southern Granulite Terrain (SGT), in parts of Salem, Tiruchirapalli, Karur, Dindigul, Madurai, Virudhunagar, Tirunelveli, Thoothukudi, Coimbatore and Kanniyakumari districts. The total reserve of crystalline limestone is about 200 MT.

(b) Non–crystalline limestone or fossiliferous limestones: It is found mainly in the Cauvery Basin and in parts of Tiruchirapalli, Ariyalur and Thoothukudi districts. The total estimated reserve of non-crystalline limestone is about 670 MT.

The demand for cement in the construction industry is expected to rise in the coming years, which will, in turn, drive an increased demand for limestone. As investments in infrastructural projects such as railways, water supply, transportation, electricity, and telecommunications grow, the need for limestone will also escalate.

Limestone plays a crucial role in the Infrastructure Development of the country. Hence exploration of these commodities is the need of the hour.

Following the enactment of the MMDR Amendment Act 2015, along with the Minerals (Evidence of Mineral Contents) Rules 2015 and Mineral Auction Rules 2015, the Government of India instructed state governments to accelerate exploration efforts for various mineral commodities and make them available for auction. Recently, amendments to the MMDR Act have been introduced, enabling state governments to auction blocks with lower confidence levels of exploration, thereby increasing the number of blocks available for auction.

2. Location and Accessibility

The block is located in Ariyalur and Sendurai taluks of Ariyalur District and Kunnam Taluk of Perambalur District, Tamil Nadu. The proposed block lies about 5 km west from the Sendurai railway station on Ariyalur-Villupuram railway line of southern Railway. It can be reached via road and is about 5 km west from the Sendurai and Sendurai can be reached via state highway running from Ariyalur. Tiruchirappalli (72 km in SW direction) is the nearest airport from the block. The area falls in the Survey of India Toposheet No. 58M/03 and 04.

3. Physiography & Drainage

The proposed block area is mainly pediplained and no major topographical highs or lows and shows gradual change in the slope towards east. The drainage pattern of the area is sub-parallel to dendritic in nature. The regional slope is towards east. Denudational, structural and fluvial processes mainly control the geomorphic evolution of the area. Mainly the varying resistance of geological formations to those has governed the evolution of various landforms. Mostly first and second order seasonal streams are observed in the proposed block.

4. Climate

The area experiences hot and dry climate during February-June and September-October and it is hot and humid during remaining months. The average annual rainfall is 949 mm. The climate of the area is mainly sub-tropical.

5. Flora and Fauna

The area is a barren land, Seasonal agriculture practice based on the monsoon conditions. The area is devoid of wild life, except for reptiles.

6. Regional Geology

The Cauvery sedimentary basin occupies a vast area of coastal tract of Tamil Nadu and Puducherry and the adjoining land extending from Puducherry in the north to Tuticorin in the south and stretches in to Bay of Bengal. Cretaceous sediments in the Cauvery basin occurs in three sub-basins namely, Puducherry sub-basin in the north, Vridhachalam sub-basin in the central part and Tiruchirappalli sub-basin in the southern part. Tiruchirappalli and Puducherry sub-basins are proved to be a potential storehouse of cement grade, chemical grade and marginal grade limestones (Figure-1). The age of the rocks exposed in these sub-basins ranges from Cretaceous to Palaeocene and Tiruchirappalli sub-basin is classified under three groups, viz, Uttatur being oldest followed by Tiruchirappalli and Ariyalur Group of rocks.

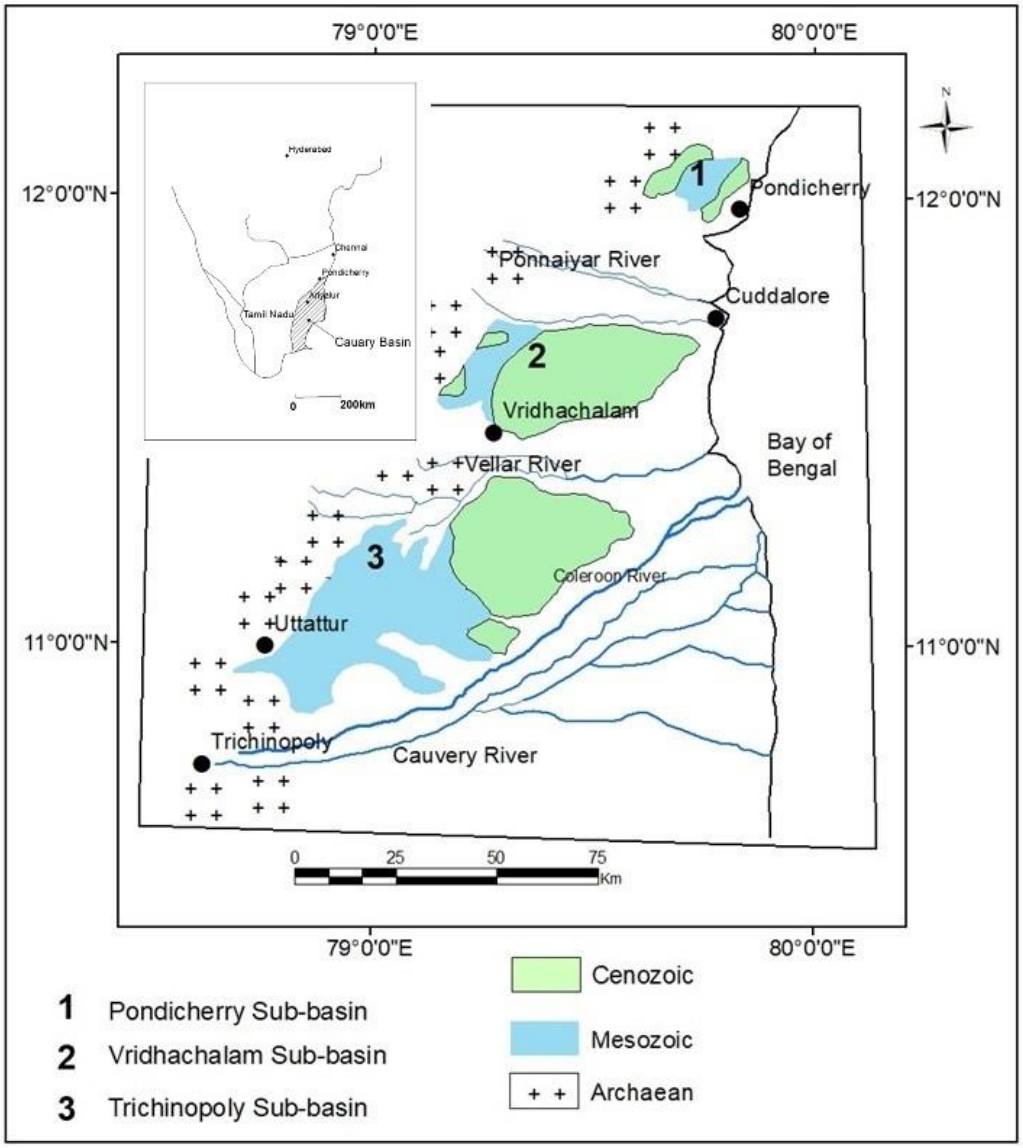


Figure 1: Location map of the Cauvery Basin

Blanford (1862) divided the Cretaceous Formations of Tiruchirappalli district into three distinct groups, viz. Uttattur, Trichinopoly and Ariyalur groups. He divided the Ariyalur Group into three subdivisions. (i) lower fossiliferous beds, (ii) middle fossiliferous beds and (iii) upper fossiliferous beds. Leveilee (1889), while reviewing the geology of the area, proposed to include the upper fossiliferous Ariyalur beds of Blanford into Niniyur stage, corresponding to Danian on the occurrence of Hercoglossadanica, a characteristic Danian form. The upper fossiliferous beds (of Ariyalur Group of Blanford) have been recognised as 'Niniyur Group' on the basis of lithological and palaeontological (find of rich algal flora) considerations by Rama Rao (1956). Sastry et al., (1972) brought out litho-biostratigraphic classification of Ariyalur Group for the first time. They divided the group into four Formations: Sillakkudi, Kallankuruchchi, Ottakkovil and Kallamedu Formations in the ascending order.

Uttatur Group of rocks occur over the Gondwana Group of rocks is consisting of two Formations namely Maruvattur and Karai Formations. The Maruvattur Formation consists of coralline limestone, bedded limestone, marl, clay, sandstone and grey shale, while the Karai Formation consists of shale and concretionary shale. The Uttatur Group of rocks is deposited during marine transgression in oscillating basin.

The Uttatur Group is followed by the Trichinopoly Group of sediments. It unconformably overlies Karai shale in Kulakalnattam, Kunnam, Mungilpadi, Karambiyam - Gardudamangalam, Anaipadi and Kottur-Pilimisai and is enriched in ammonites, gastropods, brachiopods and fossil wood fragments. The lower Kulakkanattam Formation consists of calcareous sandstone and thin bands of shell limestone. The Upper Anaipadi Formation comprises lower shale dominant and upper sandstone dominant members.

Ariyalur Group unconformably rests over Trichonopoly Group and is divisible into four Formations, viz. Sillakkudi, Kallankuruchchi, Kallamedu and Niniyur Formations in ascending order. Sillakkudi Formation is chiefly composed of argillaceous sandstone with bands and lenses of hard calcareous sandstone. The Formation is unconformably overlain by Kallankuruchchi Formation.

Kallankurichchi Formation is traced from Kulumur in the north to Vellipirangiyam in the south for a distance of 28 km with a width ranging from 200 metres to 3 km. To the north, it is covered by the alluvium of the Vellar river and in the South by the alluvium of the Marudaiyur. It is reported to occur as outcrops at Esanai and also south of the Coleroon river in Tanjavur District. The country occupied by Kallankurichchi Formation is a relatively elevated undulating plain for fossils of gryphea, Pyenodonite Inoceramus, bryozoon debris etc. scattered on the surface. This Formation starts with 1- to 3-metre-thick conglomerate at the base, Rounded cobbles and pebbles of gneiss, ferruginous quartzite, quartzite, grey and pink felspar, yellowish and argillaceous limestone are encased in a calcareous and gritty matrix. Conglomerate grades upward into conglomeratic limestone and fossiliferous limestone. The conglomerate is well exposed in a nala section about 3 km east of Ariyalur town on Ariyalur-Kallankurichchi road and also in the Kallar river section one km east of Konerirayapuram. The main rock types of this formation are fossiliferous limestone, calcarenite and calcareous sandstone. Limestone, in general, is massive, made up fully of fossils including grypheainocramus, electryonia, stygmatophygus, corals broyozooms, etc., with aragonite veins and minute grains of quartz and tiny mica flakes. Biotite believes in common in some intervals cross lamination and crude planar lamination are locally represented in some bech show normal grading Limestone is of 1) biohermal type-without any bedding formed by biomechanical accumulation with marly and ferruginous cement: 2) biostromal type showing faint developed of bedding and 3) cream coloured hard fine grained fossiliferous limestone. Ferruginous contents in the limestone are variable. Towards the northern end, this limestone

grades into calcarenite and calcareous sandstone/gritstone. The calcareous grit carries coarse angular grains of quartz and feldspar. It becomes extremely difficult to demarcate sharply this Formation from the overlying Kallamedu Formation. But towards south (i.e. south of Kulumur) the contact between the two formations is sharp. This formation is characterised by extensive development of 1-to-3-meter thick Kankar, 'terra rosa' and laterite pisolites. This feature is conspicuously observed in Nallampettu-Nerinjikorai section along its strike direction. Limestone of this Formation is cement grade. It is being quarried just west of Periyanagalur by M/S Sastry, Dalmia cement (Bharat Ltd.), The Tamil Nadu Cement Corporation is setting up a cement plant based on this limestone 2 km east of Ariyalur town.

Kallankuruchchi Formation is conformably overlain by a sequence of arenaceous sediments known as Kallamedu Formation. Main rock types of the Kallamedu Formation are fine to coarse grained white, light green or light yellowish to yellowish brown micaceous and argillaceous sandstone with thin bands and lenses of hard calcareous sandstone and occasional clay intercalations. The hard thin bands of calcareous sandstone are more prominent in the lower beds and almost absent in the upper ones. The Formation is significant as it contains dinosaurian bone remains.

Kallamedu Formation is overlain by a sequence of fossiliferous marine sediments (upper fossiliferous beds of Ariyalur Group of Blanford). The contact zone between Kallamedu Formation and Niniyur Formation is concealed throughout except at a very few localities. Niniyur Formation is composed of thin bands of limestone, light greenish, whitish and light yellowish shale, soft marl, soft argillaceous sandstone and occasional thin bands and lenses of chert. The bulk composition of the formations marl and shale though the thin bands of limestone are more prominent as they stand out as white ribbons on erosion. Individual bands vary in thickness from 15 cm to 30 cm.

Niniyur Formation is overlapped by Cuddalore Formation of Mio-Pliocene age consisting conglomerate, ferruginous sandstone, pinkish clay and laterite.

The detailed regional stratigraphic succession of these groups (Sundaram and Rao, 1979 and S. Nallappa Reddy and R. Nagendra, 2017) is given in Table-1.

Table 1: Regional stratigraphy of the area

(Modified after Sundaram and Rao, 1979 and S. Nallappa Reddy and R. Nagendra, 2017)

FORMATION	LITHOLOGY
Alluvium	Sand, Silt and Clay
Cuddalore	Mottled Sandstone and Clay

	Ariyalur Area (Tiruchirapalli sub-basin)		Vridhachalam area (Vridhachalam sub-basin)		Puducherry area (Puducherry sub-basin)	
GROUP	FORMATION	LITHOLOGY	FORMATION	LITHOLOGY	FORMATION	LITHOLOGY
ARIYALUR	Niniyur	Limestone, marl / calc shale	Aladi	Limestone	Manaveli	Fossiliferous clay / sandy clay and siltstone
		Sandstone		Clay / shale with limestone	Karasur	Fossiliferous limestone / sandy limestone with marl / calc shale
	Kallamedu	Sandstone with shale / clay		Fossiliferous sandy limestone	Nesal	Fossiliferous shale / clay argillaceous sandstone with shell limestone / calcareous sandstone
				Calcareous sandstone		
				sandstone		
	Kallan-kurichchi	Fossiliferous limestone with conglomerate at base	Mattur	Argillaceous sandstone		
				Fossiliferous calcareous sandstone / sandy limestone		
	Sillakkudi	Sandstone with shale, gritstone and conglomerate	Patti	Clay / shale with limestone	Vanur	Argillaceous sandstone with sandy limestone
				Fossiliferous limestone with calcareous shale		Argillaceous and micaceous sandstone
		Limestone and calcareous sandstone	Parur	Conglomerate / pebbly and cobbly sandstone with shale		
TRICHINOPOLY	Anaipadi	Sandstone / gritstone with limestone	Not exposed		Not exposed	
		Shale / siltstone with limestone				
	Kulakkal-nattam	Shell limestone (Coquinite), pebbly hard calc. Sandstone band				
		Gypseous clay / shale				
		Pebbly and cobbly sandstone / conglomerate				

		Gypceous clay sandy clay, sandstone, limestone		
U T T A T U R	Karai	Conglomerate	Not exposed	Not exposed
		Gypeseous clay / shale		
		Conglomerate		
		Gypseous clay / shale mud with marlstone		
	Maruvattur	Clay / shale with limestone		
		Limestone with marl / clay		
Upper Gondwana	Terani	Gritty ferruginous sandstone Claystone with sandstone intercalation	Not exposed	Not exposed
Kovandankurichchi Formation		Boulder conglomerate		
Archaean Crystallines		Gneisses/charnockite and granulites		

7. Block Geology

As per the previous work carried out by different agencies, various lithologies including limestone has been reported in the block. The limestone is yellowish in colour, at places, dirty white to brown in nature and is characterized by the presence of copious fossils of pelecypods, gastropods and comparatively a smaller number of corals. It is hard and compact with dissolution cavities and often associated with thin bands of marl. The matrix of the limestone is calcareous. Rich assemblage of Gryphea, Alectrionia, Inoceramous and broken shell fragments constitute the limestone ideal for cement industry. It is often associated with calcareous clay called marl. Marl intercalation is common feature in the limestone. Marl bands vary in thickness from mm to few centimeters. The marly limestone is poorly consolidated due to which it is soft in nature. The tentative stratigraphic sequence of litho units exposed in the Block area (After GSI) is given in Table-2.

Table 2: Tentative stratigraphic succession of the proposed block

Group		Formation	Lithology
			Alluvium
Ariyalur Group	Maestrichtian	Kallamedu Formation	Sandstone
		Kallankurichi Formation	Kankar Limestone (fossiliferous) with marl intercalation Sandy limestone and calcareous sandstone Conglomerate
	Campanian	Sillakudi Formation	Sandstone /calcareous sandstone

8. Previous works

The detailed investigation for limestone in the east of Ariyalur town (erstwhile Trichy district) was taken up by the Department of Geology and Mining in 1975 on behalf of the Tamil Nadu Cements Corporation with a view to locating suitable grade of limestone in the area for the setting up of a cement plant of 1,500 tonnes per day capacity. The Department of Geology and Mining carried out the prospecting operations in different places at different phases (Phase I to Phase V) and assessed the limestone reserves quantitatively and qualitatively in the Kallankurichi Formation of the Ariyalur Group.

During the first phase of investigation (1975-76), an area of about 411 hectare was covered and estimated 24 million tonnes of cement grade limestone on the basis of 23 drill holes and 54 wagon drill holes.

The phase II investigation (1976-77) was carried out in an area bounded by Kallar River in the north and Periyanagularodai near its junction with the Kil Palavur-Jayamkondam road, near Nerinjikorai. The length of the limestone belt is about 7.0 km and its width ranges from 300 to 500 meters on an average, while at places it may be as wide as 1km (Near the Periyanagalur mines of Dalmia). The investigation involved drilling 22 bore holes at an approximate interval of 600m and 62 wagon drill holes at an inter grid distance of 200m. The drill holes ranged in depth from 13.95 to 50.65m while for the wagon drill the depth ranged from 5 to 13.50m. A total reserve of 78 million tonnes of cement grade and high-grade limestone was estimated over an area of 365 hectares (up to a depth of 40m). The Phase III investigation was carried out in the area falling in south of the area investigated under Phase II.

The Department of Geology and Mining, Tamil Nadu carried out Phase IV investigation and reassessed the high iron limestone deposits in the areas reserved for TANCEM in Valajanagaram area and demarcated the high and low iron limestone horizons for planning the mining operations.

The Phase-V (1988) investigation was carried out by the Department of Geology by drilling in the free hold area in Puduppalayam and Reddipalayam villages (Bhaskaran, 1994). The area prospected covered part of both Department of Geology of Mining and TANCEM. A total of 21 vertical boreholes were drilled for a total depth of 701.40m. Limestone reserves of 23.75 million tonnes were estimated in the area covered under prospecting Phase V.

The Tamil Nadu State Department of Geology, MECL, KIOCL, and GSI conducted extensive geological exploration in the vicinity of our proposed block to assess mineral resources and evaluate geological potential.

BLOCK	Exploration Agency
Phase I to Phase V inKallankurichchi Formation of the Ariyalur Group.	State DGM on behalf of Tamil Nadu Cement Corporation
Adanakurichi Limestone Block	MECL – G2 Stage - 15.1NE
Alathiyur Limestone Block	MECL – G2 Stage -16.1NE
Anandawadi Limestone Block	MECL – G2 Stage - 7.5SE
Unjini-Anandwadi Limestone Block	MECL – G2 Stage - 7SE
Periyathirukonam Limestone Block	GSI – G2 Stage -19.7S
A-03 Reddipalayam Limestone Block	KIOCL - G2 -16.7S
A-06 Reddipalayam (Sub Blocks A, B) Limestone Block	KIOCL - G2 - 16.8S
Uchimedu Limestone Block	GSI – G3 Stage - 22.5NE
Sendurai – Maravathur Limestone Block	MECL – G3 Stage - 7E
Unjini-Anandwadi Limestone Block	MECL – G2 Stage - 7.4SE

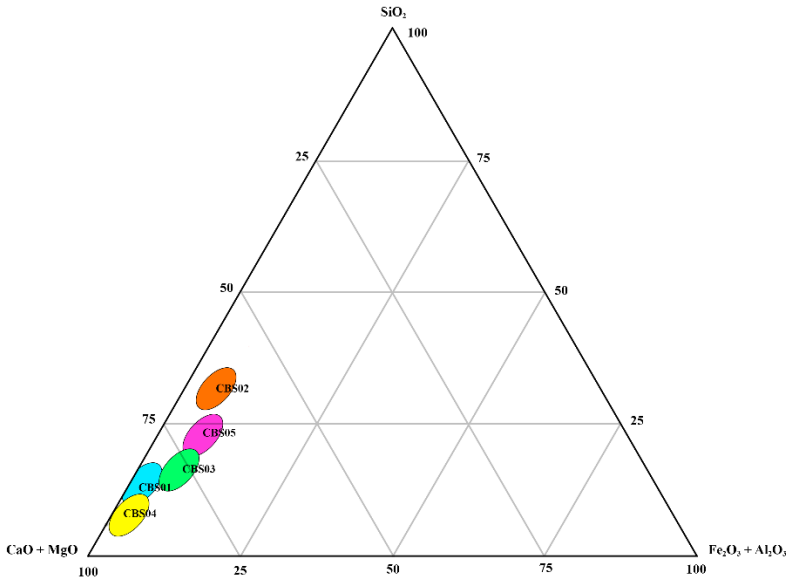
9. Site Visit

As per the TCC's directive, Geo Exploration and Mining Solutions conducted a field visit, collecting bedrock and auger samples. These samples were analyzed in a NABL-accredited laboratory, yielding an average grade of 44.94% CaO. This result highlights the limestone's high calcium oxide content.


GPS Map Camera
Ariyalur, Tamil Nadu, India
200 Main road Sokkanathapuram, Tamil Nadu 621716, India
Lat 11.266567°
Long 79.128172°
05/10/24 11:29 AM GMT +05:30
Google

Table 3: Sample Analysis data

SAMPLE NUMBER	Sample Description	Sample Description	Sample Code	LATTITUDE	LONGITUDE	LOI	SiO2	CaO	MgO	Al2O3	Fe2O3	Total	CaCO3	MgCO3
1	CBS01	Limestone -1	5001	11°15'18.72"N	79° 7'10.59"E	41.1	7.3	49	0.85	0.32	0.53	99.01	88.02	1.77
2	CBS02	Limestone -2	5002	11°15'57.69"N	79° 7'20.01"E	32	21.7	38.8	2.22	1.47	2.11	98.36	69.85	4.63
3	CBS03	Limestone -4	5004	11°15'51.05"N	79° 8'21.37"E	38	9.41	45.9	1.49	1.41	1.92	98.07	82.48	3.12
4	CBS04	Limestone -5	5005	11°15'17.40"N	79° 7'56.39"E	41.8	4.81	50.7	1.01	0.26	0.52	99.12	91.18	2.11
5	CBS05	Limestone -6	5006	11°16'17.91"N	79° 8'22.11"E	37.1	14.33	40.4	2.62	1.92	2.01	98.33	72.61	5.48
					Minimum	32	4.81	38.8	0.85	0.26	0.52	98.07	69.85	1.77
					Maximum	41.8	21.7	50.7	2.62	1.92	2.11	99.12	91.18	5.48
					Average	37.99	11.51	44.94	1.64	1.08	1.42	98.58	80.83	3.42



The analytical data was subsequently plotted on a trilinear diagram, which serves as a valuable tool for classifying and interpreting geochemical compositions. Upon careful examination of the plotted diagram, it becomes evident that all the collected samples distinctly fall within the cement-grade limestone category.

10. Block description

The proposed G-3 block for Limestone falls in Survey of India Toposheet No. 58M/03 and 58M/04 and covers an area of 8.5 sq km in and around villages, Namangunam, Kadur, Chokkanathapuram and Vellur, Ariyalur and Perambalur districts, State Tamil Nadu. The block location is given in PLATE-I and II. The Co-ordinates of the corner points of the block area are given in Table-3.

Table 4: Block co-ordinates of the proposed block

Corner Point	Latitude (DMS)	Longitude (DMS)
A	11°17’3.77”N	79°7’34.84”E
B	11°16’31.31”N	79°8’45.21”E
C	11°14’44.77”N	79°7’54.89”E
D	11°15’16.87”N	79°6’45.31”E

11. Planned Methodology

The current exploration plan for the proposed Chokkanathapuram block includes geological mapping, topographical surveys, and exploratory drilling (at G-3 level) at an overall grid interval of 800 meters. The planned activities are outlined below.

DGPS of Boundary Corner Pillars Survey, Topographical Surveying & Geological Mapping

The Blocks boundary and borehole locations shall be surveyed by DGPS in WGS-84 datum for demarcation of block boundary/corner points for 8.5 sq km. 13 Boreholes will be fixed on the ground whose RL’s and co-ordinates of survey and exploration points will be determined. Topographical Surveying will be carried out in a scale of 1:4000, at 1 m contour interval by Total Station. Detailed Geological Mapping will be done in the proposed block on 1:4000 scale to demarcate the limestone and associated lithologies for planning of G3 level work. All the geological features will be recorded and litho-contacts will be plotted for finalization of Geological map. This map will be used as base map for future work.

Geo-physical survey (Resistivity survey) – In order to establish the extent and thickness of the soil over the bed rock 10 Line Km resistivity survey is proposed. The resistivity profiling will be carried out within the DM block

Subsurface Drilling

The present exploration scheme is prepared by proposing total core drilling of 1780.00m in 13 boreholes of NQ size. The borehole location map is enclosed as PLATE -IV and the details of proposed boreholes at G-3 level are listed below in Table-4.

Table 5: Details of Proposed Boreholes in proposed G-3 Block

S. No.	Section No.	Borehole No.	Inclination (°)	Total depth (m)
1	T1-T1’	BH-1	90 (Vertical)	~120
2	T1-T1’	BH-2	90 (Vertical)	~200
3	T2-T2’	BH-3	90 (Vertical)	~60
4	T2-T2’	BH-4	90 (Vertical)	~120
5	T2-T2’	BH-5	90 (Vertical)	~200
6	T3-T3’	BH-6	90 (Vertical)	~60
7	T3-T3’	BH-7	90 (Vertical)	~120

8	T3-T3’	BH-8	90 (Vertical)	~200
9	T4-T4’	BH-9	90 (Vertical)	~60
10	T4-T4’	BH-10	90 (Vertical)	~120
11	T4-T4’	BH-11	90 (Vertical)	~200
12	T5-T5’	BH-12	90 (Vertical)	~120
13	T5-T5’	BH-13	90 (Vertical)	~200
Total proposed drilling				1780
Note: BH depth is tentative and this estimation is calculated on the basis of regional strike and dip of the body. BH will be closed after intersection of lower contact of fossiliferous limestone.				

Drill Core Logging and Sampling

Detailed drill core logging will be conducted, taking into account factors such as weathering, grain size, fossil content, color of various formations, intercalation or parting of marl, and structural features. Based on these parameters, the limestone grade can be broadly assessed, which will also aid in sampling. Primary samples will be collected at 1meter intervals, with adjustments made according to changes in lithology and core recovery. For sample preparation, the borehole core will be longitudinally split into two equal halves using a core splitter. One half will be powdered to a -120 mesh size, while the other half will be preserved for future studies. The powdered material will be thoroughly mixed, and about 100 to 250 grams of sample will be taken for chemical analysis through successive coning and quartering as primary samples. The remaining material (at -120 mesh size) will be retained as a duplicate for future reference.

Total number of primary samples likely to be generated would be 1380 nos. for Limestone. Internal check samples (5% of primary samples) would be 70 samples and External check samples (10% of primary samples) would be 138 samples. External check samples 10% of primary samples i.e. 65 Nos. will be sent to NABL accredited Labs for analysis of CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5 and LOI.

Laboratory studies

Chemical analysis for limestone

Primary BH samples for Limestone (1380 Nos.) will be analyzed for 8 radicals, CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5 and LOI by XRF method. 5% of primary samples (70 nos.) will be analyzed as internal check for 8 radicals CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5 and LOI. 10% of primary samples (138 Nos.) will be sent to NABL external labs as external check samples for analysis of 8 radicals CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5 and LOI.

Petrological studies

Petrographic studies of limestone are essential for several reasons:

Identification of Mineral Composition: Limestone primarily consists of calcium carbonate minerals like calcite and aragonite, but it may also contain other minerals like dolomite, quartz,

clay minerals, and organic material. Petrographic analysis helps in identifying these components, which is crucial for understanding the rock's properties and behavior.

Classification and Typing: Limestones can vary significantly based on their origin, whether they are biochemical, chemical, or detrital. Petrographic studies help in classifying the limestone, which can be important for its industrial use (e.g., in cement production) or in geological research.

Quality Control for Industrial Use: In industries like cement manufacturing, steel production, and construction, the quality of limestone is critical. Petrographic studies help in assessing the purity, homogeneity, and potential impurities in the limestone, ensuring that it meets the required standards.

Exploration and Resource Evaluation: In the context of mining or quarrying, petrographic studies are used to evaluate the quality and extent of limestone deposits, guiding exploration efforts and helping in the assessment of the economic viability of the resource.

Petrological studies will be done on 20 nos. of core sample and surface specimen.

Specific Gravity /Bulk density Determination

Specific gravity tests are essential in exploration for several reasons:

Mineral Identification and Characterization: Different minerals have characteristic specific gravities. By measuring the specific gravity of rock samples, geologists can infer the mineral composition, which helps in identifying economically valuable minerals and understanding the overall rock makeup.

Ore Grade Estimation: Specific gravity is crucial for determining the density of ore, which is necessary for estimating the ore grade and the volume of the deposit. This information is vital for assessing the economic viability of a mineral deposit.

Resource Estimation: Accurate resource estimation requires knowledge of the specific gravity of the material being explored. The specific gravity helps convert volume measurements obtained from drilling or sampling into weight, allowing for accurate calculation of the total amount of material available.

Specific Gravity will be determined on 20 nos. drill core specimen.

The Quantum of Work Proposed

Table 6: The Quantum of work proposed

S. No.	Description and Nature of Work	Unit	Target
A. Geological Work and Surveying			
1	Geological Mapping (1:4000 scale)	sq km	8.5
2. Survey work			
i	Topographical Survey (1:4000 scale)	sq km	8.5
ii	Borehole fixation	Nos.	13

iii	RL and co-ordinate determination by DGPS	Nos.	17
3 Geophysical survey (resistivity survey)		L. Km	10
B. Exploratory drilling			
1	Drilling	m	1780
2	Drill core preservation	m	1780
C. Laboratory studies			
1	Primary BH Samples (CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5 and LOI) by XRF	Nos.	1380
2	BH Check Samples Internal 5% (CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5 and LOI) by XRF	Nos.	70
3	BH Check Samples External 10% (CaO, MgO, Al_2O_3, SiO_2, Fe_2O_3, SO_3, P_2O_5 and LOI) by XRF	Nos.	138
4. Petrological samples (Surface & BH Core Samples)			
I	Preparation of thin section	Nos.	20
ii	Study of Thin Section	Nos.	20
5. Specific Gravity Determination			
i	Specific Gravity Determination	Nos.	20
D	**Report Preparation (5 Hard copies with a soft copy)**	Nos.	5

PROPOSAL FOR LIMESTONE IN CHOKKANATHAPURAM BLOCK (8.5 SQ KM), ARIYALUR AND PERAMBALUR DISTRICTS, TAMIL NADU FOR PRELIMINARY EXPLORATION (G3 STAGE) UNDER NMET COMMODITY: FOSSILIFEROUS LIMESTONE

S. No	Nature of work	Unit	Rate as per NMET SoC March 2020		Estimated Cost of the Proposal		Remarks
			SoC- Item- S. No.	Rates as per SoC	Qty	Total Amount (Rs)	
1.1	Headquarters geologist (PGRS, Map generation, statistical & geological interpretation and report work)	1 no	1.2	9000/-	75 Man days	675000	
1.2	Field Geologist (Geological Mapping, sampling, pit & trench logging, core logging, sampling, sample processing)	2 nos	1.2	11,000/-	370 Man days (270+100)	4070000	
1.3	Surveyor	1no.	1.6.1b	8,300/-	75 days	622500	
1.4	Casual labour (field work including geological mapping , surveying, pitting & trenching)	4nos	5.7	534/-	1560 man days	833040	As per rates prescribed by Central Labour Commission rates or respective State Govt. whichever is higher.
1.5	Sampler (marking of cores, core splitting, crushing, powdering, cone & quartering, sample packing, labeling)	2nos	1.5.2	5100/- (Per day per sampler)	280 days	1428000	Processing of 1000 CS, 30 BRS, 75 PTS and 15 PCS @ 3 samples per day per sampler (approx.)
Total (1)						**7628540**	
2.1	Core Drilling (sedimentary rock)	m	2.2.1.4a	5242/-	1780m	93,30,760	
2.2	Land or crop compensation	Per borehole	5.6	20000/-	13nos	2,60,000	
2.3	Construction of concrete Pillar (12"x12"x30")	Per borehole	2.2.7a	2,000/-	13nos	26000	

2.4	Rig mobilization charges (Transportation of Drill Rig & Truck associated per Drill)	Km	2.2.8	36/-	1400 km	50400	
2.5	Monthly Accommodation Charges for drilling Camp	Rig/month	2.2.9	50,000/-	5	2,50,000	Period required for drilling 1780 m @ 13 boreholes
2.6	Drilling Camp Setting Cost	nos	2.2.9a	2,50,000/-	1	2,50,000	
2.7	Drilling Camp Winding up Cost	nos	2.2.9b	2,50,000/-	1	2,50,000	
2.8	Approach Road Making	Km	2.2.10.a	22,020/-	8	1,76,160	
2.9	Bore Hole Fixation and determination of coordinates& Reduced Level of the boreholes and by DGPS	Nos	1.6.2	19,200/-	13nos	2,49,600	13 boreholes + 1 base station
2.1	Drill Core Preservation (complete borehole plus mineralized cores of all the remaining Bhs)	m	5.3	1,590/-	1780	28,30,200	Entire drill core including soil will be analyzed.
2.11	Pitting & Trenching	Cu.m	2.1.2	3,800/-	150Cu.m	5,70,000	
Total (2)						**1,42,43,120**	
3	Laboratory studies						
3.1	Primary BH Samples (CaO, MgO, Al2O3, SiO2, Fe2O3, SO3, P2O5 and LOI) by XRF	Nos	4.1.15a	4,200/-	1380	57,96,000	Major oxide
3.2	BH Check Samples Internal 5% (CaO, MgO, Al2O3, SiO2, Fe2O3, SO3, P2O5 and LOI) by XRF	Nos	4.1.15a	4200/-	70	2,94,000	Major oxide 5% internal sample
3.3	BH Check Samples Internal 10% (CaO, MgO, Al2O3, SiO2, Fe2O3, SO3, P2O5 and LOI) by XRF	nos	4.1.15a	4200/-	138	5,79,600	Major oxide 10% internal sample
Total (3)						**66,69,600**	
4	Petrological studies						
4.1	Preparation of thin section	Nos.	4.3.1	2,353/-	20	47,060	
4.2	Petrological Study of thin section for optical properties	Nos.	4.3.4	4,232/-	20	84,640	
4.3	Specific gravity	Nos.	4.8.1	1605/-	20	32,100	

Total (4)						**1,63,800**	
5	**Geophysical survey (resistivity survey)**	Per station	3.5a	70,650/-	10 station	**7,06,500**	10X1km = 10km
Total (1+2+3+4+5)						**29411560**	
6 Miscellaneous							
6.1	Preparation of Exploration Proposal	Nos	5.1	2% of project cost	1	5,88,231.20	5 hard copies with 1 soft copy
6.2	Geological report preparation	Nos	5.2	A Minimum of Rs. 7.5 lakhs or 3% of the work whichever is more	1	8,82,346.80	5 hard copies with 1 soft copy Additional copy @Rs.3000/- per copy
6.3	Report Peer Review Charges			lumpsum		30,000	
Total (1+2+3+4+5+6)						**30912138**	
7	GST (18%)					**55,64,184.84**	
GRAND TOTAL (1+2+3+4+5+6+7)						**3,64,76,322.84**	

12. Time schedule

Components	Months											
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
Camp set up, Detailed geological Mapping on 1:4000 scale &geophysical survey												
Subsurface drilling												
Core sample (CS)												
Chemical assay studies												
Synthesis of all available data												

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For **GEO EXPLORATION AND MINING SOLUTIONS**

Dr. M. IFTHIKHAR AHMED

Managing Partner & Project Coordinator

PLATE - I

Plate – I: Location and Accessibility of Ariyalur District Map

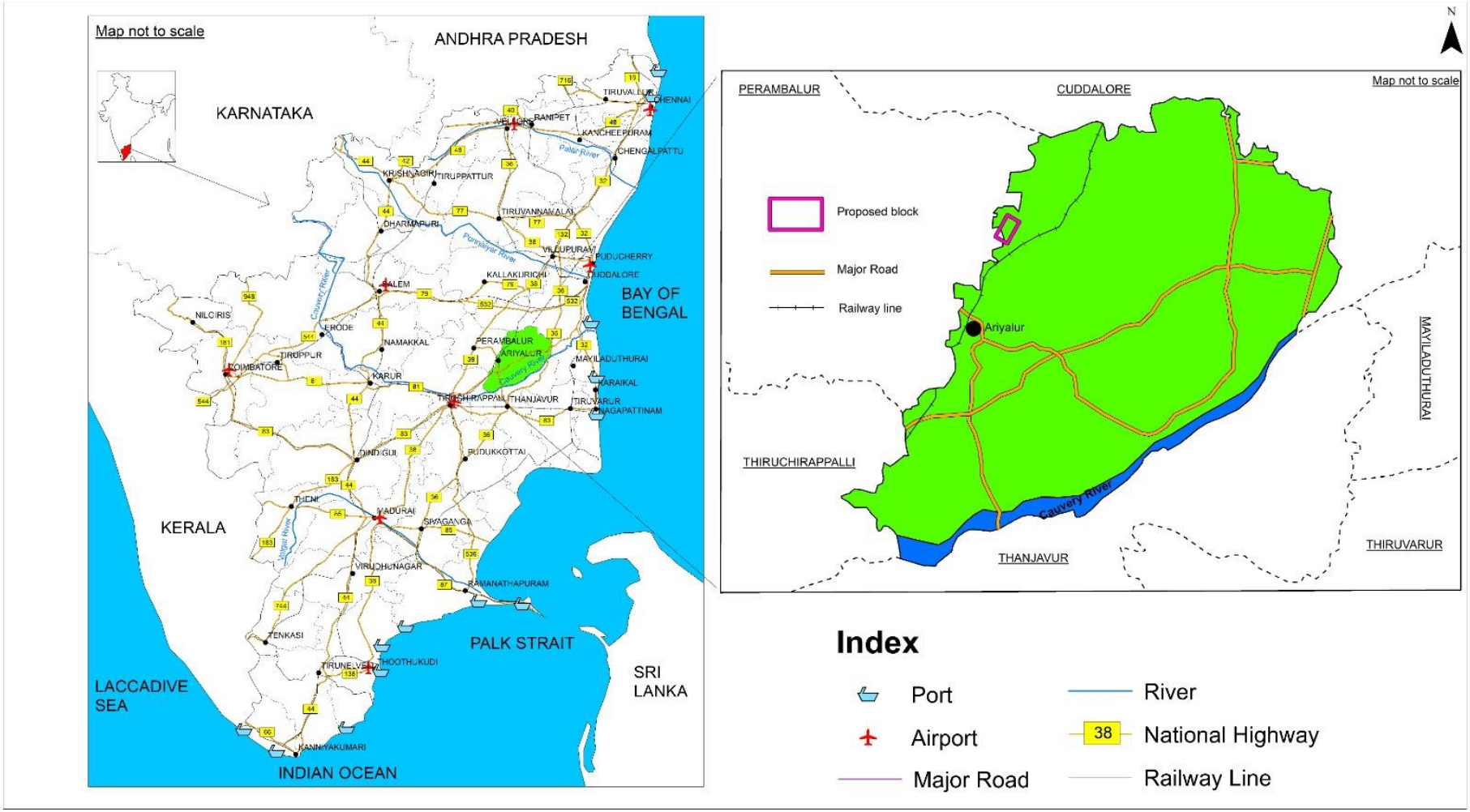


PLATE-II

Location of the proposed CHOKKANATHAPURAM block (G-4) in T. S. No, 58J/05

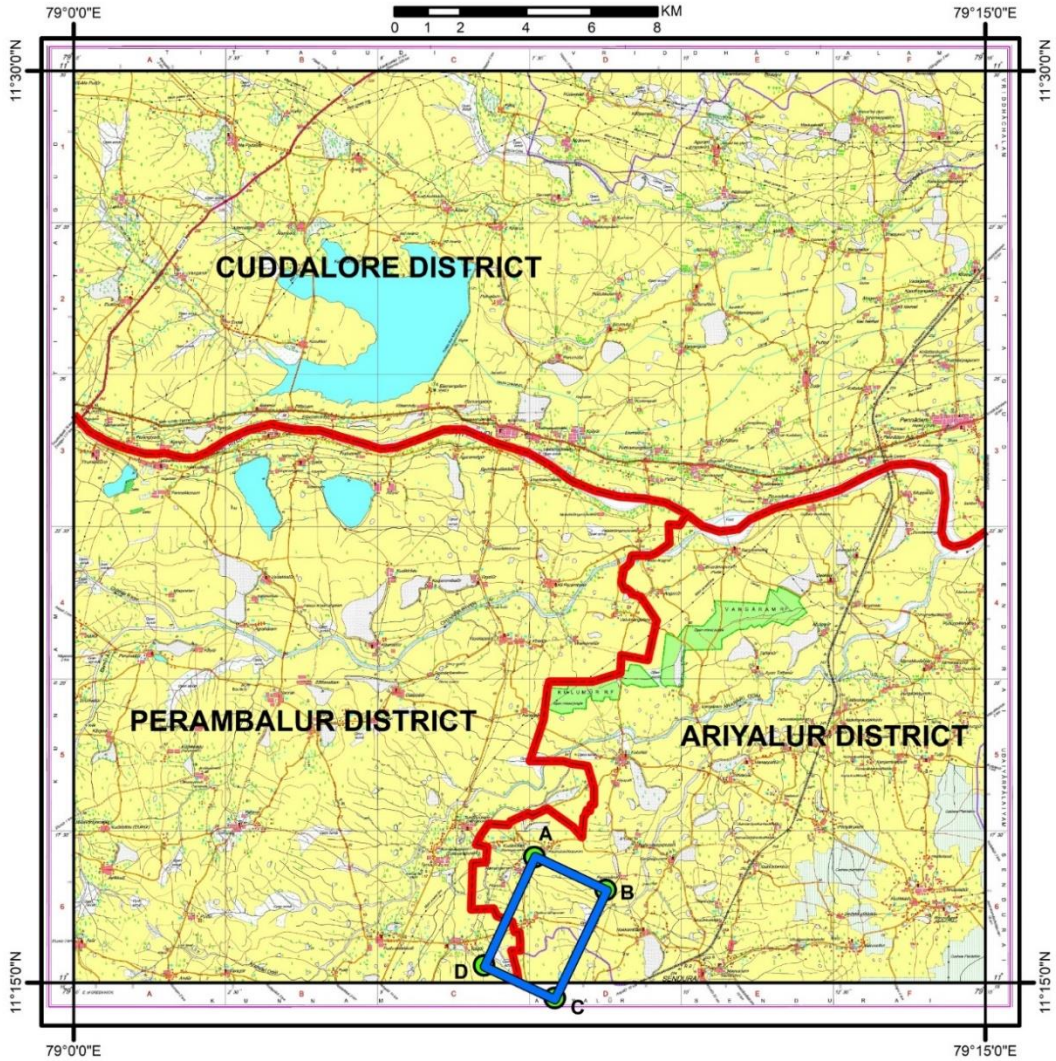


PLATE-III

Geological Map T. S. No. 58M/03, 04, 07 Ariyalur, Cuddalore, Perambalur and Tiruchirappalli Districts Tamil Nadu

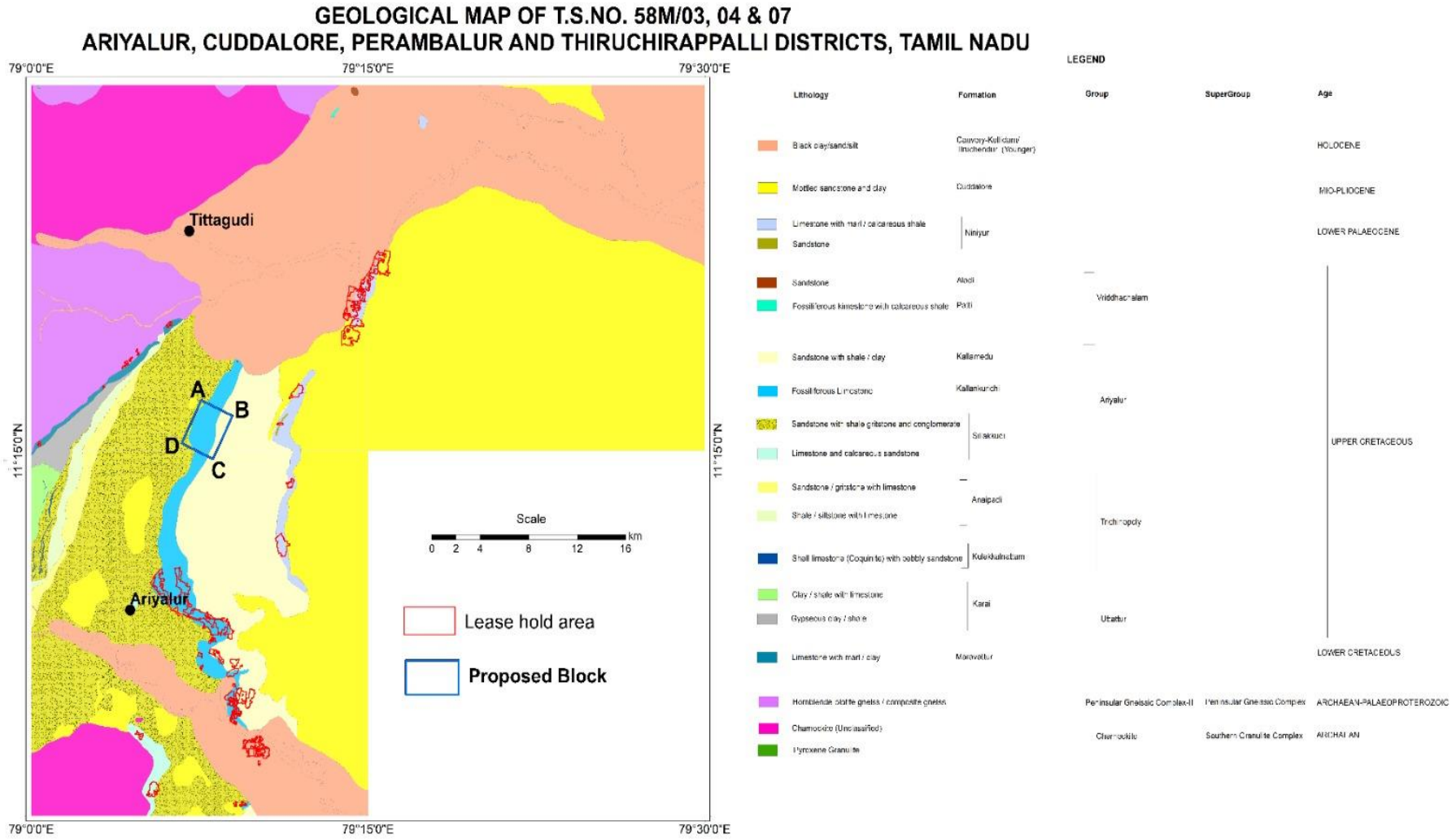
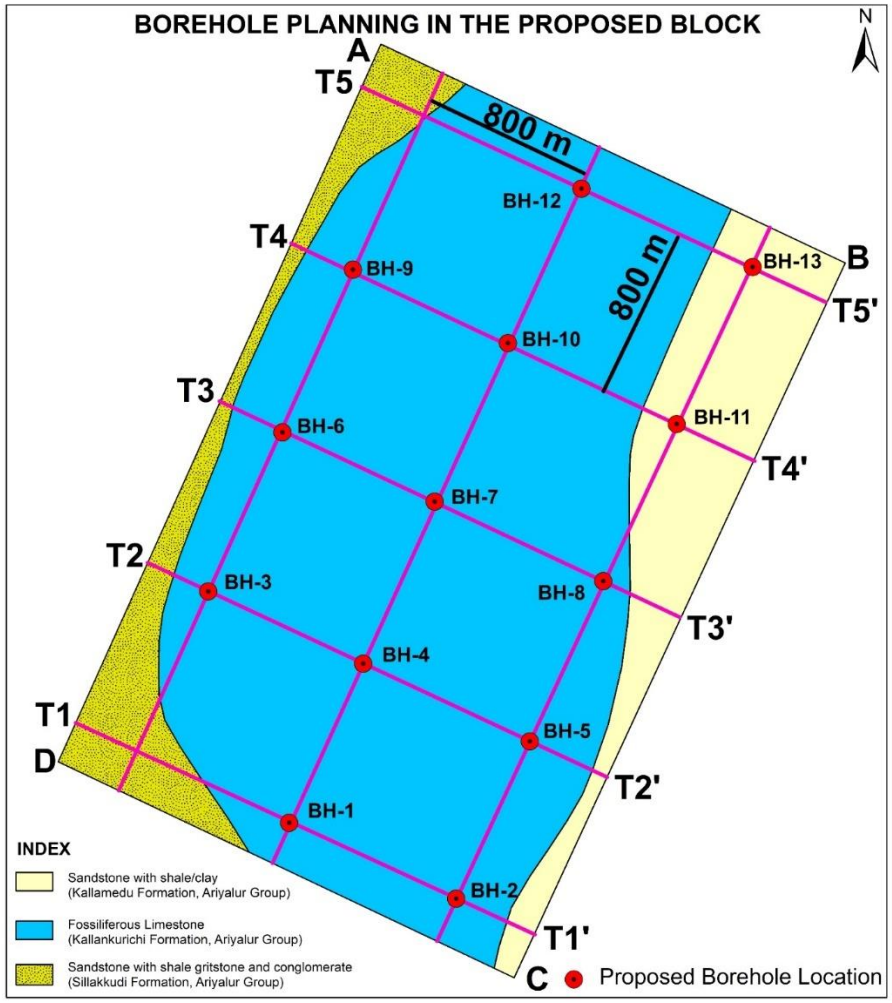
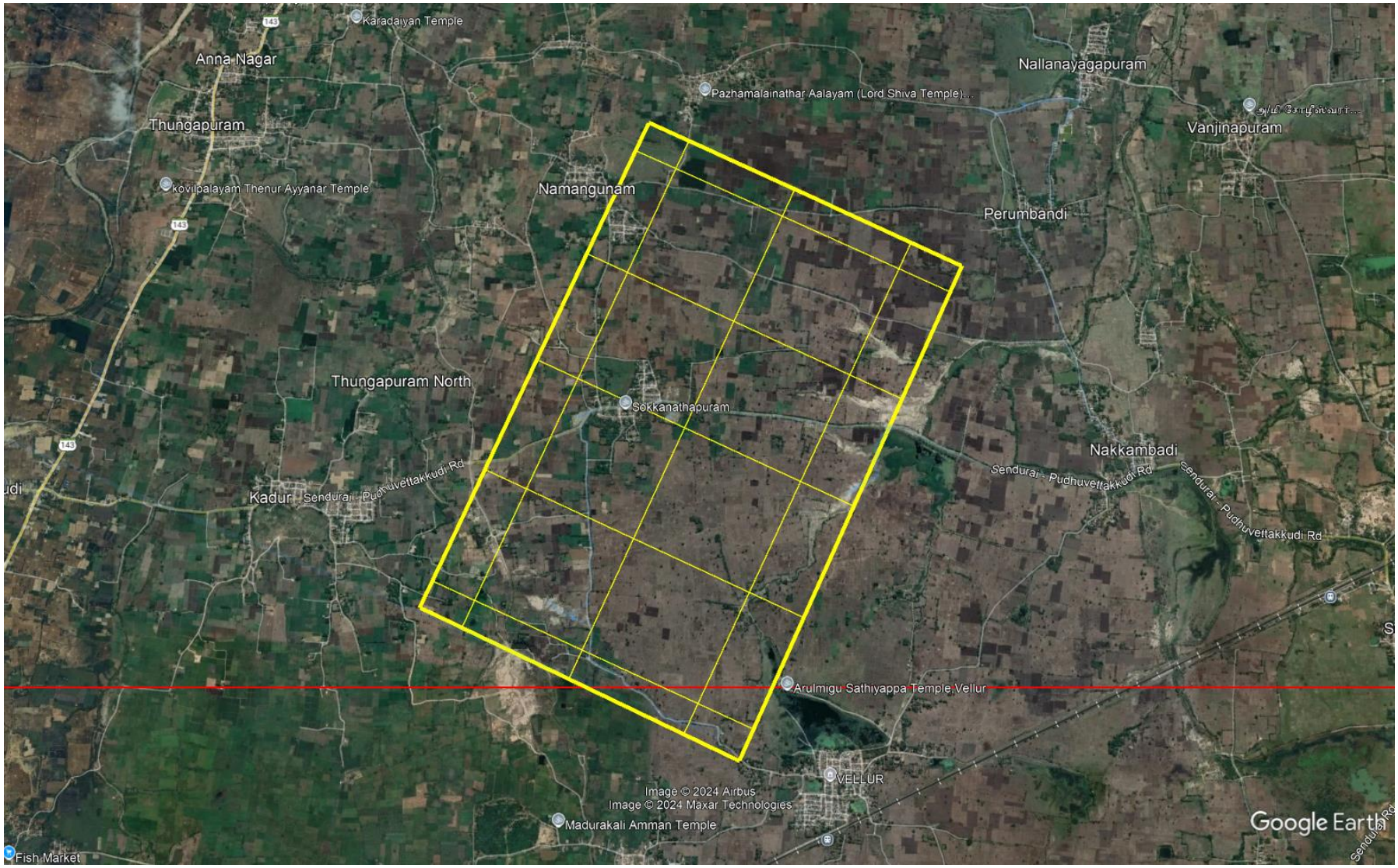


PLATE-IV

Proposed Borehole location map

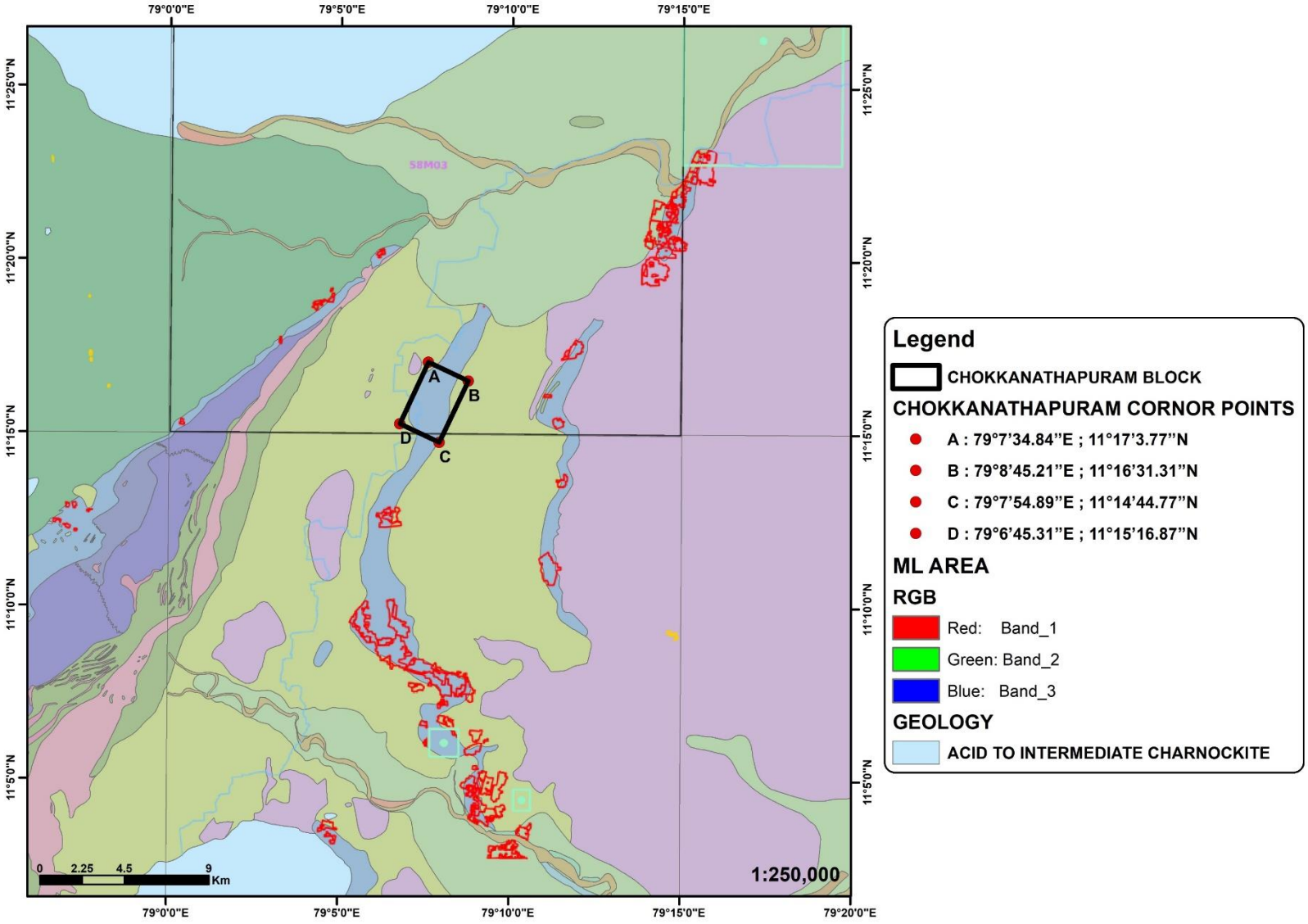


Satellite Map with Drilling Grid



MINING LEASE AREA AND THE PROPOSED CHOKKANATHAPURAM BLOCK

(Source : NGDR and GSI)



OTHER EXPLORATION BLOCKS AND THE PROPOSED CHOKKANATHAPURAM BLOCK
(Source : NGDR and GSI)