

**PROPOSAL FOR PRELIMINARY EXPLORATION (G-3 STAGE) FOR
GLAUCONITE IN VALKA MOTA BLOCK, DISTRICT- KACHCHH, GUJARAT
(AREA 7.86 Sq. Km)**

COMMODITY: GLAUCONITE

BY



**MINERAL EXPLORATION AND CONSULTANCY LIMITED
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SEMINARY HILLS
NAGPUR, MAHARASHTRA**

PLACE: NAGPUR

DATE: 27.07.2026

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Features	Details
Block ID	VALKA MOTA BLOCK
Exploration Agency	Mineral Exploration and Consultancy Limited (MECL)
Commodity	Glaucconite
Mineral Belt	The proposed block forms part of the Katrol Formation, which is of Late Jurassic to Early Cretaceous age.
Completion period with entire Time schedule to complete the project	10 Months
Objectives	The present exploration program (G3) has been formulated on the basis of the outcome of previous work to fulfill the following objectives: ○ To carry out detailed geological mapping (1:4,000 scale) for delineation of glauconite-bearing horizons and to establish their lithological, structural, lateral, and vertical continuity. ○ To carry out topographical survey (1:4,000 scale) with contouring at 2 m interval. ○ To undertake pitting and exploratory drilling (800 m × 800 m grid or closer, wherever warranted) to delineate the extent, continuity, thickness, and depth persistence of glauconite mineralization. ○ To assess the grade and quantity of glauconite resources and establish mineral resources under UNFC 333 category in accordance with the Minerals (Evidence of Mineral Contents) Rules, 2015.
Whether the work will be carried out by the proposed agency or through outsourcing and details thereof.	Drilling work will be carried out by the outsourcing agency.
Number of Geoscientists	Nos. of Geoscientists: 2
Expected Field days (Geology, Geophysics, surveyor)	Geologist Party days: 90 (At field) & 60 at HQ
	Survey Party days: 60 days (for Topographical Survey)

S No	Items	Details																																	
1.	Location																																		
	Latitude - Longitude	Block Boundary Coordinates <table> <tr> <th>Points</th><th>Latitude</th><th>Longitude</th></tr> <tr> <td>A</td><td>23° 36' 32.25" N</td><td>68° 57' 9.36" E</td></tr> <tr> <td>B</td><td>23° 36' 43.04" N</td><td>68° 58' 30.13" E</td></tr> <tr> <td>C</td><td>23° 37' 43.5" N</td><td>68° 58' 34.46" E</td></tr> <tr> <td>D</td><td>23° 37' 44.3" N</td><td>68° 59' 17.24" E</td></tr> <tr> <td>E</td><td>23° 37' 25.19" N</td><td>68° 59' 39.18" E</td></tr> <tr> <td>F</td><td>23° 37' 12.08" N</td><td>68° 59' 26.65" E</td></tr> <tr> <td>G</td><td>23° 36' 29.68" N</td><td>68° 59' 25.95" E</td></tr> <tr> <td>H</td><td>23° 35' 57.82" N</td><td>68° 58' 46.67" E</td></tr> <tr> <td>I</td><td>23° 35' 55.72" N</td><td>68° 58' 14.82" E</td></tr> <tr> <td>J</td><td>23° 35' 36.67" N</td><td>68° 57' 26.41" E</td></tr> </table>	Points	Latitude	Longitude	A	23° 36' 32.25" N	68° 57' 9.36" E	B	23° 36' 43.04" N	68° 58' 30.13" E	C	23° 37' 43.5" N	68° 58' 34.46" E	D	23° 37' 44.3" N	68° 59' 17.24" E	E	23° 37' 25.19" N	68° 59' 39.18" E	F	23° 37' 12.08" N	68° 59' 26.65" E	G	23° 36' 29.68" N	68° 59' 25.95" E	H	23° 35' 57.82" N	68° 58' 46.67" E	I	23° 35' 55.72" N	68° 58' 14.82" E	J	23° 35' 36.67" N	68° 57' 26.41" E
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	Villages	Paneli, Valka Mota, Junachay, Meghpar, Amiya																																	
	Tehsil/Taluk	Lakhpat and Nakhatrana																																	
	District	Kachchh																																	
	State	Gujarat																																	
2.	Area (hectares/ square kilometers)																																		
	Block Area	7.86 sq.km																																	
	Forest Area	The block area block is free from Forest Area. (Source: PM Gatishakti portal)																																	
	Government Land Area	Data not available																																	
	Charagaha	Data not available																																	
	Private Land Area	Data not available																																	
3.	Accessibility																																		
	Nearest Rail Head	Nearest railway station to the study area is Bhuj at about 100 km in south.																																	
	Road	The area is well connected by all-weather metalled roads. National Highway-754K is approx. 10-15 km from the block area which connects via Rawapar village to Mata No Madh village through metalled road. Lakhpat Tehsil is about 40 kms from the block.																																	
	Airport	The nearest airport is Rudramata, Bhuj																																	
4.	Hydrography																																		
	Local Surface Drainage Pattern (Channels), Rivers/ Streams	No perennial or seasonal river flows through the study block																																	
5.	Climate																																		
	Mean Annual Rainfall	The average annual rainfall is low and erratic, ranging between 300 and 400 mm.																																	
	Temperatures	The average annual temperature ranges from approximately Summer 39–40°C and winter 10–12°C.																																	

6.	Topography	
	Toposheet No.	Toposheet No 41A/14
	Morphology of the Area	The block area forms planar and gently undulating terrain.
7.	Availability of baseline geoscience data	Geological Map is available at 1:12500 scale.
	Geochemical Map	Available
	Geophysical Map	Not Available
8.	Justification for taking up Exploration	1. Strategic Importance of Glaucinite as a Potash Resource: India is almost entirely dependent on imports to meet its potash requirement, with the majority of global potash production being derived from bedded marine evaporite deposits such as sylvite, carnallite, kainite, polyhalite, and potash-rich surface and subsurface brines. In view of the country's increasing emphasis on resource security and import substitution, it is imperative to evaluate non-conventional indigenous sources of potash. Glaucinitic sandstone and potash-rich shale horizons represent a significant alternative source of potassium and therefore warrant systematic exploration to establish their economic potential and suitability for future beneficiation and potash recovery. 2. Glaucinite has been notified as a Critical Mineral by the Government of India owing to its strategic importance. The Ministry of Mines is actively promoting the exploration and auction of critical and strategic mineral blocks to ensure long-term mineral security. Accordingly, systematic exploration and resource augmentation of glauconite-bearing formations are essential to generate reliable geological data, establish auctionable mineral blocks, and support the objectives of the National Critical Mineral Mission. 3. MECL carried out Reconnaissance Survey (G-4) over the Ambara West Block (143.15 sq. km) during FY 2025–26, which established the occurrence of laterally persistent glauconite-bearing sandstone horizons within the Katrol Formation of the Kachhh Basin. Out of ten boreholes drilled, eight intersected glauconitic sandstone horizons containing K₂O values exceeding the threshold grade of 3%, thereby demonstrating continuity of mineralisation.

Based on the exploration results, 212.11 million tonnes of Reconnaissance Mineral Resources (UNFC 334) were estimated over an area of 18.44 sq. km, with an average grade of 4.30% K₂O using the Polygonal Method.

4. **Geological Potential of the Valka Mota Block:** The Valka Mota Block (7.86 sq. km) has been delineated as a high-potential spin-off block from the Ambara West G-4 exploration based on favourable geological, geochemical, and drilling results. The block encompasses the continuation of the laterally persistent glauconite-bearing sandstone and shale horizons hosted within the Katrol Formation and represents one of the most prospective sectors for resource upgradation. The proposed G-3 exploration programme aims to establish the lateral and vertical continuity, thickness, grade distribution, geometry, and resource potential of the glauconitic horizons, thereby upgrading the existing Reconnaissance Mineral Resources (UNFC 334) to Inferred Mineral Resources (UNFC 333).
5. **Geochemical and Drilling Evidence Supporting Further Exploration;** Geochemical investigations carried out within the Valka Mota Block have confirmed significant glauconite enrichment. Analysis of 18 bedrock samples yielded K₂O values up to 6.14%, with multiple samples exceeding the threshold grades for glauconite mineralisation. Similarly, analysis of 10 pit samples recorded K₂O values up to 6.19%, with several samples assaying more than 4% K₂O, indicating widespread potassic enrichment.
6. Two exploratory boreholes (MKAW-02 and MKAW-04) located within the proposed block intersected cumulative mineralised thicknesses of 3.90 m and 17.50 m, respectively. Based on these intersections, an in-situ Reconnaissance Mineral Resource of 74.53 million tonnes has been estimated with an average grade of 4.52% K₂O. The analytical and drilling results collectively demonstrate the persistence and continuity of glauconite-bearing horizons and substantiate the block's potential for resource augmentation

		through systematic G-3 exploration. 7. Justification for G-3 Exploration: Considering the established lateral continuity of glauconitic sandstone horizons, encouraging K₂O grades, favourable thickness of mineralised zones encountered in drilling, and the substantial Reconnaissance Mineral Resources already established, the Valka Mota Block has been delineated as a priority exploration target. The block is characterised by favourable geological conditions for detailed exploration, and an area suitable for eventual mineral block auction. Therefore, the block is proposed for Preliminary Exploration (G-3 Stage) to generate the geological confidence necessary for resource upgradation to UNFC 333, facilitate future mine planning, and support the Government of India's objective of developing indigenous critical mineral resources.
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1. INTRODUCTION

- 1.1. Glauconite is a potassium-rich green silicate mineral that occurs within the sandstone and shale horizons of the Kutch Supergroup in the Kachchh region. Owing to its high potassium content, it is considered a significant mineral resource with potential applications as a natural fertilizer, soil conditioner, and an alternative source of potash. Potassium is one of the three essential macronutrients required for plant growth, the other two being nitrogen and phosphorus. It plays a vital role in various physiological functions, including enzyme activation, regulation of water balance, photosynthesis, and protein synthesis, thereby contributing significantly to crop productivity and quality. The increasing demand for potassium in modern agriculture has led to the continuous growth of the global potash industry over the past century to meet the rising requirement for potassium-based fertilizers.
- 1.2. Recognizing its strategic importance, glauconite has been included under national initiatives aimed at strengthening domestic mineral supply. Policy support through the Mines and Minerals (Development and Regulation) Amendment Act, 2023, along with exploration programs and tranche-based auctions of critical mineral blocks, promotes the systematic development of resources such as glauconite. These initiatives encourage participation of agencies like MECL and the private sector to enhance fertilizer security, reduce import dependence, and support India's long-term resource and agricultural sustainability goals. On enactment of MMDR Amendment Act-2015, Minerals (Evidence of Mineral Contents) Rule-2015 and Mineral Auction Rule-2015, Govt. of India directed State Governments to speed up exploration work for different Mineral Commodities in the respective states for auctioning of the blocks.

2. BACKGROUND

- 2.1. Exploration of strategic, critical, precious, rare-earth elements (REE), and platinum group elements (PGE) has been accorded high priority by the Government of India following the amendments to the Mines and Minerals (Development and Regulation) Act, 2015 and subsequent amendments up to 2023. The Government of India is presently auctioning critical and strategic mineral blocks in successive tranches, with MECL acting as the Nodal Agency. From the 1st to the 7th tranche, a total of fifty-

six critical mineral blocks have been successfully auctioned. Since glauconite has been notified as a critical mineral, the present proposal has been formulated for undertaking G-3 stage exploration under NMET funding.

- 2.2. Glauconite represents a strategically important indigenous source of potash, a mineral commodity for which India remains largely dependent on imports. Considering the need for resource security, import substitution, and long-term fertilizer sustainability, the Government of India has accorded priority to the systematic exploration and scientific evaluation of glauconite-bearing formations. The provisions of the MMDR Amendment Act, 2023, together with the National Critical Mineral Mission and tranche-based auction of critical mineral blocks, provide the necessary policy framework for accelerated exploration and development of glauconite resources in the country.
- 2.3. MECL carried out a Reconnaissance Survey (G-4 stage) for glauconite in the Ambara West Block (143.15 sq. km), located in Lakhpat and Nakhatrana Tehsils, Kachchh District, Gujarat, during FY 2025–26. The investigation comprised geological mapping on a 1:12,500 scale, pitting, and exploratory drilling. Based on the data generated, the Geological Report has been submitted.
- 2.4. Resource estimation for the Ambara West Block was carried out using the Polygonal Method with a cut-off of $>3.0\%$ K_2O . After applying a 20% deduction to account for geological uncertainties at the reconnaissance stage, net in-situ Reconnaissance Mineral Resources (UNFC 334) of 212.11 million tonnes, with an average grade of 4.30% K_2O , have been estimated. The investigation established that the glauconite mineralization is stratabound, laterally persistent, and geologically favourable for resource upgradation. However, the present level of exploration remains at the G-4 stage and is insufficient for higher-confidence resource classification under UNFC guidelines. Accordingly, closer-spaced drilling, detailed litho-structural mapping, systematic sampling, geological modelling, and advanced mineralogical studies are required to delineate the continuity, thickness, grade distribution, and economic potential of the mineralized horizons.
- 2.5. Based on the encouraging results of the G-4 investigation, a prospective area of 7.86 sq. km has been delineated and carved out from the larger Ambara West Block as the Valka Mota Block for detailed G-3 stage exploration. The investigation confirmed the occurrence of laterally persistent glauconite-bearing sandstone and shale horizons within the Katrol Formation of the Kachchh Basin. Integration of geological

mapping, geochemical investigations, and drilling data identified the Valka Mota area as the most prospective part of the larger block.

- 2.6. A total of 18 bedrock samples, 10 pit samples, and two boreholes (MKAW-02 and MKAW-04) fall within the proposed block boundary and form the basis of the present proposal. The two boreholes have intersected glauconite-bearing mineralized zones with cumulative thicknesses of 3.90 m and 17.50 m, respectively, demonstrating both lateral and vertical continuity of mineralization.
- 2.7. Based on the available borehole wise resource estimation data, total net in-situ Reconnaissance Mineral Resources (UNFC 334) of 74.53 million tonnes, with an average grade of 4.52% K₂O, have been estimated from the two boreholes (MKAW-02 and MKAW-04) falling in Valka Mota Block. The analytical results indicate significant glauconite enrichment within the Katrol Formation, with K₂O values exceeding the prescribed threshold for glauconite mineralization in several bedrock, pit, and borehole samples. The distribution of these anomalous K₂O values, together with the stratigraphic continuity of the mineralized horizons, suggests a strong possibility of extension of mineralization beyond the explored limits and warrants detailed G-3 stage exploration for resource upgradation to the Inferred Mineral Resource (UNFC 333) category.
- 2.8. Glauconite mineralization in the Valka Mota Block is predominantly associated with alternating bands of glauconitic sandstone and shale within the Katrol Formation. The mineralized horizons are stratabound, laterally persistent, and constitute the principal target zones for detailed exploration.
- 2.9. In view of the encouraging results of previous investigations and the recommendations of GSI, MECL proposes to undertake systematic G-3 stage exploration in the Valka Mota Block with the objective of establishing higher-confidence mineral resources (UNFC 333) and facilitating the eventual auction and commercial development of the block.

3. LOCATION AND ACCESSABILITY

- 3.1 The Valka Mota Block is located in Lakhpat and Nakhatrana Taluka, Kachchh District, Gujarat, on the western part of the Kachchh mainland. This block falls within the villages Paneli, Valka Mota, Junachay, Meghpar, Amiya villages and falls on Survey of India Toposheet Nos. 41A/14. The total area of the block is about 7.86 Sq. Km.
- 3.2 The area is well connected by all-weather metalled roads. National Highway-754 K is approx. 10-15 km from the block area which connects via Rawapar village to Mata

No Madh village through metalled road. Lakhpat Tehsil is about 40 kms from the block. The district headquarters Bhuj lies approximately 100 km towards the southeast of the block. The nearest railway station is Bhuj, situated at a distance of about 100 km in the southeast direction. Bhuj Railway Station is a Class-A station on the Western Railway (Western Line) network. The nearest airport is Bhuj Airport, located approximately 100 km southeast of the block area, providing regular air connectivity to major cities.

The corner points of the Valka Mota Block boundary are provided below:

**Co-ordinates of Cardinal Point of Valka Mota Block (7.86 Sq Km) for Glauconite,
District: Kachchh, Gujarat**

Points	Latitude	Longitude
A	23° 36' 32.25" N	68° 57' 9.36" E
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Screenshot showing the status of Forest Land, Eco-Sensitive Zones, National Parks, ASI-Protected Monuments, and Mining Leases in and around the Valka Mota Block as depicted on the PM Gati Shakti Portal.

As per the PM Gati Shakti Portal, Valka Mota Block is free from the Forest area, Eco-Sensitive Zones (ESZ), Wildlife Sanctuaries (WLS), National Parks, and ASI-protected monuments. Further, no mineral concession area falls within the block boundary.

4. PHYSIOGRAPHY AND DRAINAGE

The terrain is characterized by gently undulating surfaces with intervening rocky uplands and Quaternary plains, typical of the stable mainland uplift of Kachchh. Based on interpretation of regional satellite data, the area shows a general north to north-east-ward regional slope.

5. CLIMATE

The climate of the area is arid to semi-arid, typical of the Kachchh region. Based on long-term meteorological data from Bhuj, the annual mean temperature is about 26.4°C. Summer temperatures may reach 39–40°C, while winter temperatures may fall to 10–12°C. The average annual rainfall is low and erratic, ranging between 300 and 400 mm, with most precipitation occurring during the southwest monsoon (June to September). Relative humidity varies from about 25–30% during summer to 65–75% during the monsoon season.

6. REGIONAL GEOLOGY

6.1. The study area is located in the northern part of the Kachchh Basin, a peri cratonic rift basin in western India. The block is mainly underlain by the Katrol Formation of Late Jurassic–Early Cretaceous age, which forms an important glauconite-bearing stratigraphic unit. The Kachchh Basin comprises a thick sedimentary succession ranging from the Middle Jurassic to Holocene, resting unconformably over the Precambrian basement.

6.2. The regional stratigraphy consists of the Pachchham, Chari, Katrol, and Umia Formations. Within the proposed exploration area, the Katrol Formation is predominantly exposed and comprises glauconitic sandstone, shale, marl, and ferruginous sandstone deposited under marginal marine conditions. The widespread occurrence of glauconite-bearing horizons and encouraging geochemical and radiometric anomalies indicate favourable conditions for glauconite mineralization, warranting detailed G3 stage exploration.

6.3. The Regional Stratigraphic Sequence of lithounits of area is given below.

Regional Stratigraphic sequence of Litho units (after Krishnan, 1982)

Age	Unit	Sub-division	Lithology
Post-Aptian	UMIA (1000 m)	Bhuj beds (Umia Plant beds)	Sandstone and shale
Aptian		Ukra beds	Marine calcareous shale
Upper Neocomial		Umia beds	Barren sandstone and shale
Valanginian		Trigonia beds	Barren sandstone
Upper Tithonian		Umia ammonite beds	Shale and sandstone

Age	Unit	Sub-division	Lithology
Middle Tithonian	KATROL (300 m)	Upper Katrol Shales	Shale
Middle Tithonian		Gajansar beds	Shale
Lower Tithonian		Upper Katrol (Barren)	Sandstone
Middle Kimmeridgian		Middle Katrol	Red sandstone
Upper Oxfordian		Lower Katrol	Sandstone, shale, marl
Oxfordian	CHARI (360 m)	Dhosa Oolite	Green and brownoolitic limestone
U. Callovian		Athleta beds	Marl and gypseous shale
Middle Callovian		Anceps beds	Limestone and marl
Middle Callovian		Rehmani beds	Yellow limestone
Lower Callovian	PATCHAM (300 m)	Macrocephalus beds	Shales with calcareous bands and golden oolites
Lower Callovian		Coral bed	Shale and limestone
Lower Callovian to Bathonian		Patcham shell limestone Patcham basal beds (Kuar Bet beds)	Limestone, shale and marl

6.2 Structure and Metamorphism:

The Study Area is situated within the structurally controlled Kachchh Basin, where the regional framework is governed by basement-controlled extensional tectonics. The basin is traversed by major E–W, ENE–WSW, and NW–SE trending faults, which control sedimentation and the distribution of lithological units. The Katrol Formation exhibits gentle deformation with low-angle dips and broad open warps, reflecting mild tectonic disturbances. Bedding generally strikes NE–SW to E–W, conforming to the regional structural grain. Faulting is predominantly normal to oblique-slip in nature and is interpreted to have influenced Jurassic–Early Cretaceous sedimentation. Subsequent tectonic activity caused only gentle warping without significant folding. The stable structural setting, together with favourable lithological horizons, provides suitable conditions for the occurrence and continuity of glauconite mineralization within the proposed exploration block.

7. BLOCK GEOLOGY

- 7.1. The Block is predominantly underlain by Mesozoic sedimentary rocks of the Katrol Formation (Late Jurassic–Early Cretaceous), with subordinate exposures of the Bhuj Formation (Early Cretaceous). The Bhuj Formation, exposed mainly in the western part of the block, comprises medium- to coarse-grained sandstone, shale, clay, grit, and conglomerate, with locally developed Trigonina-bearing fossiliferous horizons. The sandstones are generally ferruginous to feldspathic in nature and represent deposition under nearshore to fluvio-deltaic conditions.

- 7.2. The Katrol Formation constitutes the principal geological unit of economic interest in the block area and occupies most of the study area. It represents a dominantly marine siliciclastic succession comprising shale with calcareous sandstone, sandstone with *Trigonia* fossils, glauconitic sandstone, conglomerate. Glauconitic sandstone horizons occur as stratabound units interbedded with shale and sandstone and are interpreted to have formed in shallow marine shelf to nearshore environments under conditions of slow sedimentation during marine transgressive phases.
- 7.3. Structurally, the sedimentary succession is controlled by the regional tectonic framework of the Kachchh Basin. Bedding planes strike predominantly in NW–SE directions, broadly parallel to the Guneri Dome. The rock beds are generally horizontal to gently dipping towards the southwest, and lithological contacts are predominantly gradational, indicating uninterrupted sedimentation. No major faults or folds have been identified within the block at the reconnaissance scale, although gentle warping related to basin-scale tectonism is evident. The tentative stratigraphic succession of the litho-units exposed in the block area, as established by GSI, is presented in the table below.

**Stratigraphic sequence of the Valka Mota Block for Glauconite,
District: Kachchh, Gujarat (After GSI - Biswas, 1981; Krishnan, 1982).**

Age	Formation	Lithology
Holocene	Rann Formation	Calcareous clay and silty marl
Late Cretaceous– Palaeocene	Deccan Volcanics	Basaltic lava flows with associated Dayapar intrusive bodies
Early Cretaceous	Bhuj Formation	Medium to coarse-grained sandstone with shale and clay; locally conglomerate and fossiliferous horizons containing <i>Trigonia</i>
Late Jurassic– Early Cretaceous	Katrol Formation	Shale with calcareous sandstone; interbedded sandstone and shale; sandstone and shale with <i>Trigonia</i> fossils; glauconitic sandstone, shale and conglomerate
Middle–Late Jurassic	Chari Formation	Shale with fossiliferous limestone; shale with calcareous nodules; sandstone with ironstone bands

Various lithounits exposed in the proposed block area are described in the following paragraphs based on the previous works.

A. Glauconitic Sandstone:

Glauconitic sandstone forms an important lithological unit of the Katrol Formation. It is typically fine-grained, friable, and exhibits greenish-grey to whitish-green colours due to the abundance of glauconite. The unit is generally poorly to moderately indurated and commonly occurs in association with glauconitic shale and grey shale,

forming alternating sandstone–shale sequences. Structural observations indicate that the beds strike predominantly in a NW–SE direction with very gentle dips towards the southwest, suggesting a relatively undisturbed sedimentary sequence.



Photograph showing Glauconite Horizons near Paneli Village.

B. Glauconitic Shale:

It is typically fine-grained and exhibits a greenish-grey to dark green coloration. The shale is generally fissile in nature and commonly occurs interbedded with bands of glauconitic sandstone. These alternating beds impart a characteristic rhythmic lithological pattern to the sequence. The rhythmic interbedding of shale and glauconitic sandstone indicates periodic fluctuations in depositional energy and sediment supply.

The unit is well developed in both surface exposures and borehole cores within the study area. In outcrops, it appears as compact to moderately friable shale with well-developed fissility. Borehole core samples reveal similar characteristics, showing shale enriched with disseminated glauconite grains. The presence of glauconite imparts the distinctive greenish colour to the rock.



Photograph showing glauconite & Alternate band of glauconite horizons (Sandstone and Shale) in Borehole no- MKAW-04 (Depth-12.00m to 16.00m).



Photograph showing Glauconite Shale Horizons near Paneli Village

C. Calcareous Clay and Silty Marl Formation

Calcareous clay and silty marl represent the youngest lithological unit. it appears as a soft, light grey to buff coloured; fine-grained deposit composed mainly of calcareous clay mixed with silt-sized particles. The material is generally poorly consolidated and exhibits a plastic consistency when moist. It displays weak stratification or a massive structure, suggesting deposition under relatively low-energy conditions.

D. Trigonia Fossil-Bearing Horizon: The block is marked by the occurrence of a distinct and laterally persistent fossiliferous horizon containing *Trigonia*, which serves as an important stratigraphic marker within the Mesozoic sequence. The interpreted geological map indicates that the *Trigonia*-bearing units occur as elongated belts within sandstone–shale interbedded strata, predominantly associated with the Bhuj

Formation and Katrol Formation. These fossiliferous horizons exhibit notable lateral continuity across the block and are mainly composed of medium-grained sandstone interlayered with shale, occasionally showing calcareous characteristics. Such lithological associations indicate sedimentation under shallow marine to marginal marine conditions.

8. PREVIOUS WORK

- 8.1.0 The Geological Survey of India (GSI) has carried out various geological, mineral investigation, and reconnaissance studies in different parts of the Kachchh Basin, including areas proximal to the Ambara West Block. The salient contributions relevant to glauconite and associated minerals are listed below.
- 8.1.1 Early regional investigations by GSI focused on industrial and fertilizer minerals in Kachchh District. Z. G. Ghevariya carried out investigations for bentonite deposits in Kachchh District during FS 1978–80, covering Survey of India Toposheet Nos. 41R/10, 41R/11, 41R/14, and 41R/15, and documented the geological framework of sedimentary formations hosting industrial minerals.
- 8.1.2 Occurrences of glauconite in the Mesozoic and Tertiary formations of the Kachchh Basin were reported by several workers, including Kulkarni and Agarwal (1963–64), Kulkarni and Desikan (1965–66), Vijaya Sarthi and Sable (1984–85), Ghevariya (1980–81), and Ghevariya and Srikarni (1990–91). These studies established the widespread presence of glauconite within sandstone and shale units of the basin.
- 8.1.3 Jain, R. L. (1994–95) carried out investigations for potash in glauconite-bearing shale and sandstone over an area of about 100 Sq. Km on 1:25,000 scale in Kachchh District, Gujarat. Based on a glauconite-bearing band with a cumulative thickness of ~1.5 m, strike continuity of 3–4 km, and exploration up to 2 m depth, a tentative reserve of 0.02 million tonnes of glauconite with an average K₂O content of 5.33% was estimated.
- 8.1.4 Sarkar and Banerjee (2011) suggested an authigenic origin for glauconite occurring in the Naredi Formation. Rathore, S. S. et al. (1999) carried out K–Ar dating of glauconite from the Ukra Member, and reported ages of approximately 105.2 ± 1.3 Ma, indicating glauconite formation during Early Cretaceous time.
- 8.1.5 Ajaya Kumar Sahu, Dhananjai Verma, et al. (FS 2016–17) conducted a G-4 Reconnaissance Survey for lateritic bauxite and lithomargic clay around Umarsar and Guneri areas (Toposheet No. 41A/13), Western Kachchh. The study estimated a reconnaissance mineral resource of 3.04 million tonnes of bauxite at 30% Al₂O₃ cut-

off, with an average grade of 38.40% Al_2O_3 , and 101,840.92 tonnes of lithomargic clay with an average 36.62% Al_2O_3 . During this investigation, two glauconite samples were also analysed, reporting K_2O values ranging from 5.07% to 7.27%, indicating the presence of potassic glauconite in the region.

- 8.1.6 Basheer, H. K. and Kumar, A. (FY 2014–15) carried out detailed investigations for potash in glauconite-bearing shale and sandstone around Guneri village, Kachchh District. The study estimated glauconite resources in different grade brackets, with K_2O contents ranging from <2% to >4%, and based on the exploration results, the Guneri block was placed on the auction platform.
- 8.1.7 As part of the Geological Survey of India's National Geochemical Mapping Programme (NGCM), systematic stream sediment sampling was carried out in and around the Ambara West Block on a 2 Km $\times$ 2 Km grid pattern, following standard NGCM protocols. The objective of this regional geochemical survey was to identify elemental dispersion patterns and delineate areas favourable for mineralisation.
- 8.1.8 The present Preliminary Exploration (G-3 Stage) for Glauconite in Valka Mota Block has been proposed in the NW part of the MECL explored Ambara West Block (FY 2024-25). The proposed area is inferred to host glauconite-bearing sandstone and shale units of the Katrol Formation, as established by regional stratigraphic continuity. The Reconnaissance Survey established the occurrence of laterally persistent glauconite-bearing sandstone and shale horizons within the Katrol Formation of the Kachchh Basin. Integration of geological, geochemical, and drilling data identified the 7.86 sq. km Valka Mota area as the most prospective part of the larger block. Accordingly, the area has been delineated for Preliminary Exploration (G-3 stage) to establish the continuity, thickness, grade, and resource potential of the glauconitic horizons and to upgrade the resource classification from Reconnaissance Mineral Resources (UNFC 334) to Inferred Mineral Resources (UNFC 333).

9. OBJECTIVES OF THE EXPLORATION

- 9.1. To carry out detailed geological mapping (1:4,000 scale) for delineation of glauconite-bearing horizons and to establish their lithological, structural, lateral, and vertical continuity.
- 9.2. To carry out topographical survey (1:4,000 scale) with contouring at 2 m interval for preparation of detailed base maps.
- 9.3. To undertake pitting and exploratory drilling (800 m $\times$ 800 m grid or closer, wherever warranted) to delineate the extent, continuity, thickness, and depth persistence of glauconite mineralization.

- 9.4. To assess the grade and quantity of glauconite resources and establish mineral resources under UNFC 333 category in accordance with the Minerals (Evidence of Mineral Contents) Rules, 2015.

10. PROPOSED SCHEME OF EXPLORATION

- 10.1. **Geological mapping:** The available geological map of MECL in 1:12,500 scale which will be used as base map and geological mapping will be carried out in 7.86 sq.km block, on 1:4000 scale.
- 10.2. **Topographical Survey:** The block area under investigation will be surveyed in 1:4000 scale. Contouring is to be carried out at 2m interval. Reduced level of the boreholes and survey stations are to be determined with reference to the Survey of India Bench Mark as available. The block boundary and the borehole points will be surveyed by DGPS & Total Station in WGS-84 datum.
- 10.3. **Core Drilling:** The present exploration scheme envisages drilling 10 boreholes on an approximate 800 m × 800 m grid pattern, with an average proposed borehole depth of 30 m and a total drilling meterage of 300 m. All proposed boreholes are planned as vertical holes to establish the depth persistence and continuity of the glauconite-bearing horizons intersected in boreholes MKAW-02 and MKAW-04. The core drilling programme is designed to delineate mineral resources at the G-3 level of exploration in accordance with the provisions of the Minerals (Evidence of Mineral Contents) Rules, 2015, thereby facilitating the consideration of the block for auction by the Government of India. The boreholes will be terminated judiciously by the field geologist after completely intersecting the glauconite-bearing horizons. The proposed borehole locations and depths are tentative and may be modified based on geological and drilling conditions encountered during exploration. The final decision regarding the location, depth, and closure of individual boreholes shall be taken by the field geologist in consultation with the controlling officers.
- 10.4. **Drill core logging:** Geological core logging will be carried out systematically by recording carefully the minute details and physical/lithological characters of the rock formations including colour, core recovery, grain size, weathered zone, texture, banding, mineralogical composition, micro-structural/structural details, lithological variations along with visual estimate in respect of targeted mineral content encountered in boreholes.
- 10.5. **Drill core sampling:** Borehole cuttings, the material obtained during drilling, will be sampled at uniform intervals of 1.0 m in all boreholes. Subsequently, considering the nature of the deposit, sampling intervals may be modified based on lithological

changes. The collected samples will first be crushed, then ground in a pulveriser, and finally homogenised using a mortar and pestle to obtain a fine powder of -200 mesh size. After processing each sample, all equipment, including the crusher, pulveriser, trays, and tools, will be thoroughly cleaned to prevent cross-contamination. Representative samples weighing approximately 100 grams each will be prepared from the homogenised material. One portion will be sent for primary analysis, while the other portion will be retained for check analysis.

- 10.6. **Chemical Analysis:** All the primary samples (280 nos.) and 10% of the primary samples (28 nos.) selected as external check samples will be analysed for eight radicals, namely K_2O , SiO_2 , MgO , CaO , Na_2O , P_2O_5 , Al_2O_3 , and Fe_2O_3 . Approximately 10% of the primary samples will be sent to a NABL-accredited external laboratory for check analysis of these eight radicals. In addition, a total of 30 samples will be analysed for trace element studies comprising 34 elements.
- 10.7. **Petrological Studies:** Thin section studies of the collected samples will be carried out to ascertain their petrographic characteristics. The samples for petrographic studies will be selected from the different lithological units encountered within the block area. A total of 10 specimens has been proposed for petrographic studies in the block.
- 10.8. **X-Ray Diffraction Analysis:** A total of 20 Nos samples representing the deposit will be subjected to X-Ray Diffraction studies to know about the general distribution pattern (Mineral identification, Alteration mineral assemblages, mineralogy) of the constituent minerals of the ore.
- 10.9. **Modal Analysis:** To determine the modal mineralogical composition of the representative lithological units encountered within the study area 10 nos representative rock samples will be selected for modal analysis. The samples will be chosen based on variations in lithology, texture, alteration.
- 10.10. **SEM Studies:** SEM studies (3 Hrs) are proposed to characterize the morphology, maturity, mineral associations, and potassium-bearing phases of glauconite occurring within the Katrol Formation of the Kachchh Basin.
- 10.11. **Determination of Bulk density:** To calculate the resource, volume of the ore body needs to be multiplied with a density factor. Hence, 5 nos. of samples will be drawn from the mineralize zones for determination of Bulk density.

11. QUANTUM OF WORK

The following quantum of work have been proposed for Preliminary Exploration (G-3 stage) for Glaucinite in Valka Mota Block, District: Kachchh, Gujarat:

S. No	Item details	Unit	Proposed Quantum
1	Geological Mapping (1:4000 scale)	Sq. Km.	7.86
2	Topographic Survey (Contour interval 2m) at 1:4000 scale	Sq. Km.	7.86
3	Surface samples	Nos.	Nil
4	Pit/Trench	Cu.m.	Nil
5	Bore Hole Fixation and determination of co-ordinates & Reduced Level (RL) of the boreholes and demarcation of lease hold boundary points by DGPS	Nos.	20 (10 Core BH & 10 Corner points)
6	Core drilling	m	300m (10 BH)
7	Sampling & Chemical Analysis		
a)	Borehole Core samples	Nos.	280
b)	Primary samples for 8 radicals (K ₂ O, SiO ₂ , MgO, CaO, Na ₂ O, P ₂ O ₅ , Al ₂ O ₃ & Fe ₂ O ₃).	Nos.	280
c)	10% External check samples for 8 radicals (K ₂ O, SiO ₂ , MgO, CaO, Na ₂ O, P ₂ O ₅ , Al ₂ O ₃ & Fe ₂ O ₃)	Nos.	28
d)	iii) Trace Element (34 elements)	Nos.	30
8	Physical Studies		
a)	Preparation of thin section	per sample	10
b)	Preparation of polished section	per sample	0
c)	Complete petrographic/ ore microscopic study/ mineragraphic report of rock sample (along with 5 nos digital photo micrographs)	per sample	10
d)	Bulk Density - Dry/Saturated	Nos	5
e)	Modal Analysis	Nos	10
f)	SEM Studies	Hrs	3
9	XRD Mineral Phase Analysis	per sample	20
10	Geological Report Preparation {As per Mineral (Evidence of mineral contents) Rule-2015}	Nos.	1

12. TIME SCHEDULE AND ESTIMATED COST

12.1. The proposed exploration programme envisages geological mapping, Surface sampling, Pitting/Trenching, drilling, sample preparation and laboratory studies, which will be completed within 10 months, geological report preparation and peer review.

TIMELINE FOR PRELIMINARY EXPLORATION (G-3 STAGE) FOR GLAUCONITE IN VALKA MOTA BLOCK, DISTRICT- KACHCHH, GUJARAT (AREA 7.86 Sq. Km)

S. No.	Particulars	Unit	1	2	3	4		5	6	7	8	9	10
1	Camp Setting	months					Review						
2	Geological Mapping & Sampling	months											
3	Core Drilling	m											
4	Geologist days	days											
5	Sampling days	days											
6	Camp winding	months											
7	Laboratory Studies	months											
8	Geologist days HO	days											
9	Report Writing with Peer Review	months											

12.2. Cost has been estimated based on actual schedule of rates mandated in the circular OM No. F.No: 6/2/2015-NMET/588 dated 04/12/2025 for NMEDT funded Projects. The total estimated cost is Rs. 105.50 Lakhs. The summary of cost estimates for this Preliminary Exploration (G-3 stage) is given below:

Sl. No.	Item	Total Estimated Cost (Rs.)
1	Geological Mapping, Other Geological Work	3,845,466
2	Trenching/Pitting	0
3	Drilling	3,157,500
4	Laboratory Studies	1,488,130
	Sub Total (1 to 4)	8,491,096
5	Geological Report Preparation	250,000
6	Proposal Preparation	169,822
7	Peer review charges	30,000
8	Sub Total (1 to 7)	8,940,918
9	GST 18%	1,609,365.23
10	Total:	10,550,283.15
	Say Rs. In Lakh	105.50

13. References:

1. Geological Report on Reconnaissance Survey (G-4 Stage) For Glaucinite in Ambara West Block (Area-143.15 Sq. Km) Tehsil-Lakhpur and Nakhatrana, District- Kachchh, Gujarat
2. NGDR Portal
3. PM Gatishakti Portal

14. List of Plates:

1. Plate-I: Location Map of Proposed Valka Mota Block for Glaucinite, District: Kachchh, Gujarat
2. Plate-II: Regional Geological Map of Valka Mota Block Within the Kachchh Basin Showing Geological Formations
3. Plate-III: Block Geological Map of Valka Mota Block for Glaucinite, District: Kachchh, Gujarat
4. Plate-IV: Geological Map with Sample Location of Valka Mota Block for Glaucinite, District: Kachchh, Gujarat
5. Plate-V: Geological Map with Proposed Borehole Location of Valka Mota Block for Glaucinite, District: Kachchh, Gujarat.
6. Plate-VI: K₂O Anomaly Map of Valka Mota Block for Glaucinite, District: Kachchh, Gujarat

Location Map of Proposed Valka Mota Block (Extent 7.86 sq.km.), Part of Toposheet No.41A14 Kachchh District, Gujarat

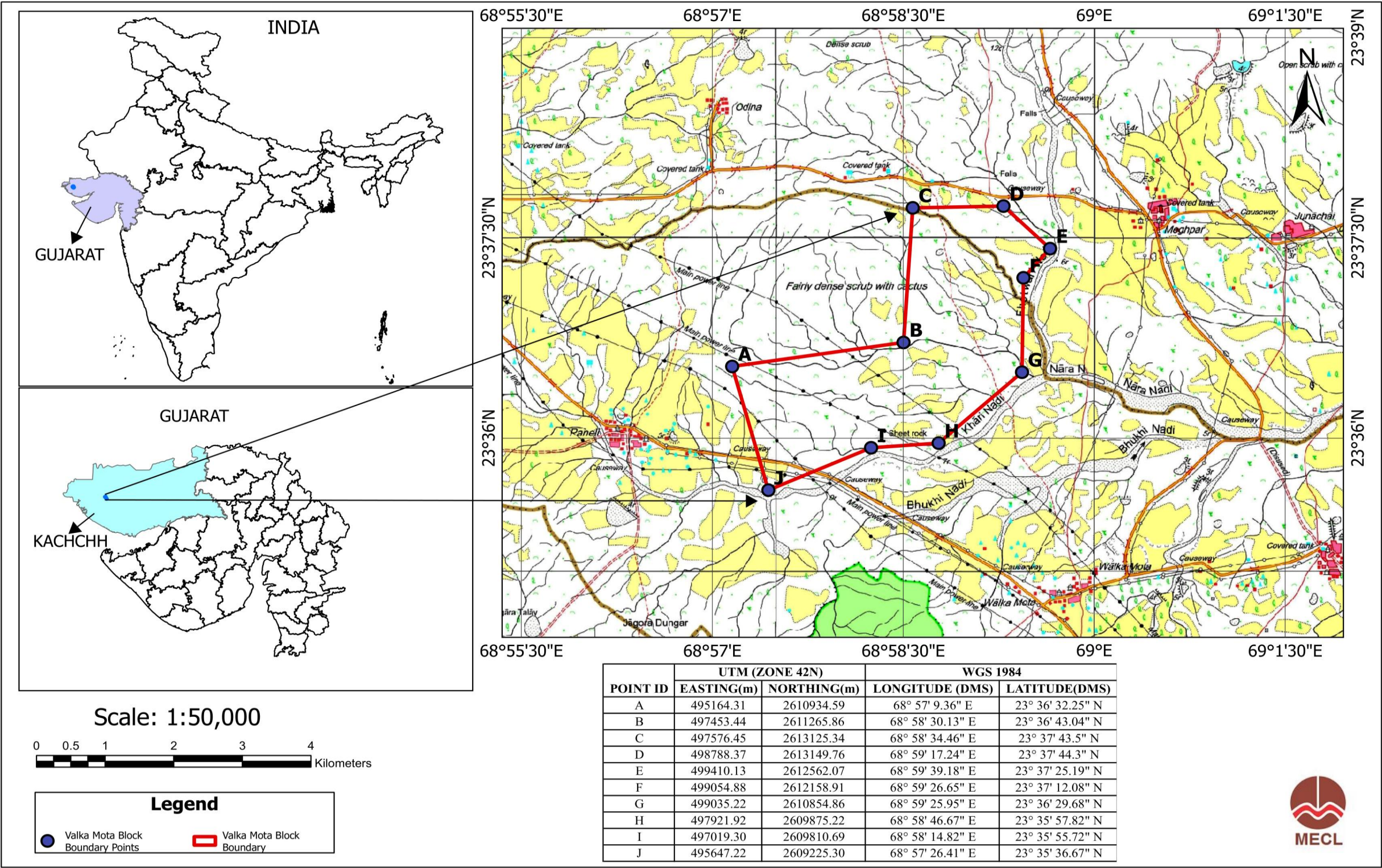


Plate-I: Location Map of Valka Mota Block for Glauconite, District: Kachchh, Gujarat

REGIONAL GEOLOGICAL MAP OF VALKA MOTA BLOCK WITHIN THE KACHCHH BASIN SHOWING GEOLOGICAL FORMATIONS

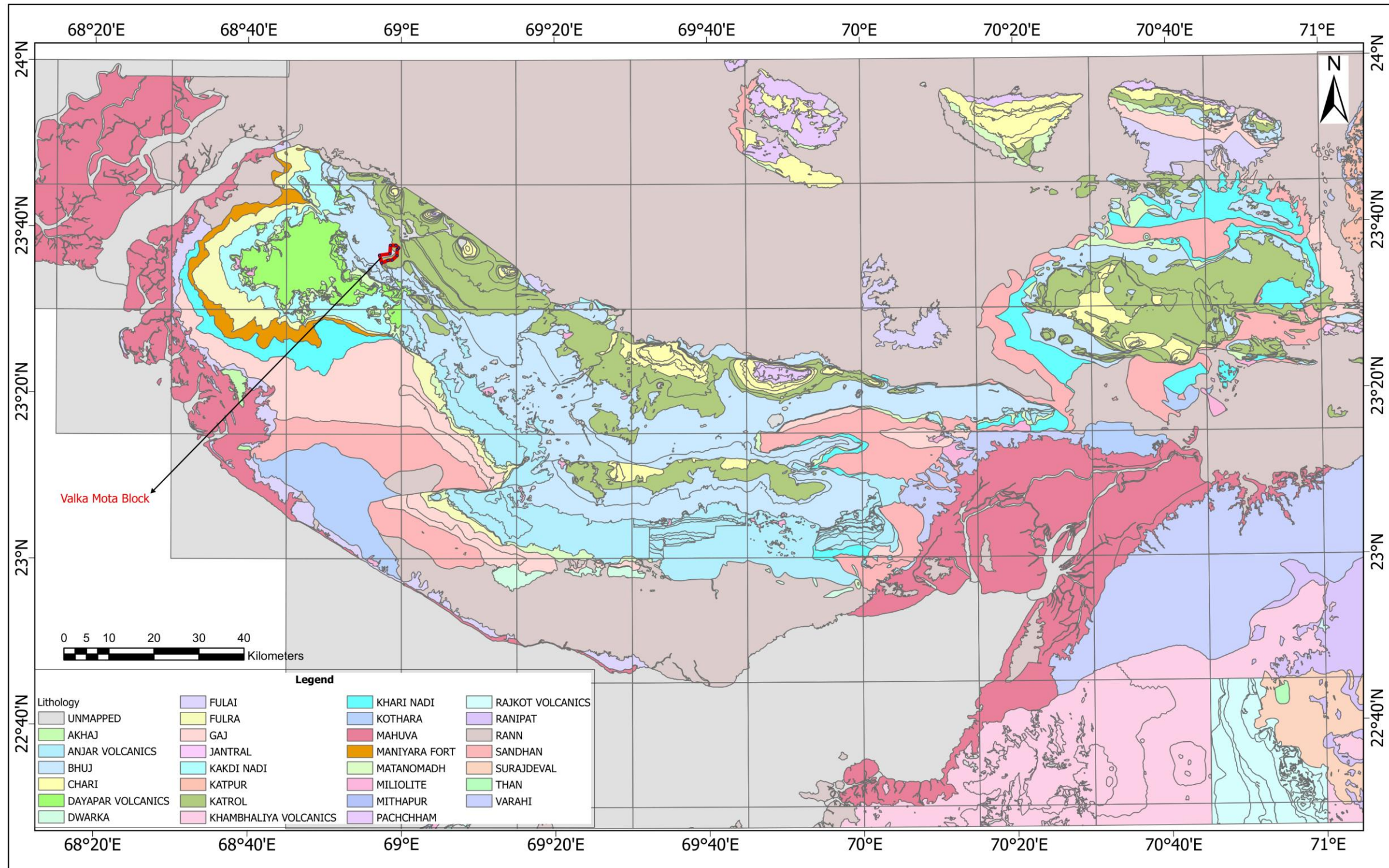


Plate-II: Regional Geological Map of Valka Mota Block Within the Kachchh Basin Showing Geological Formations

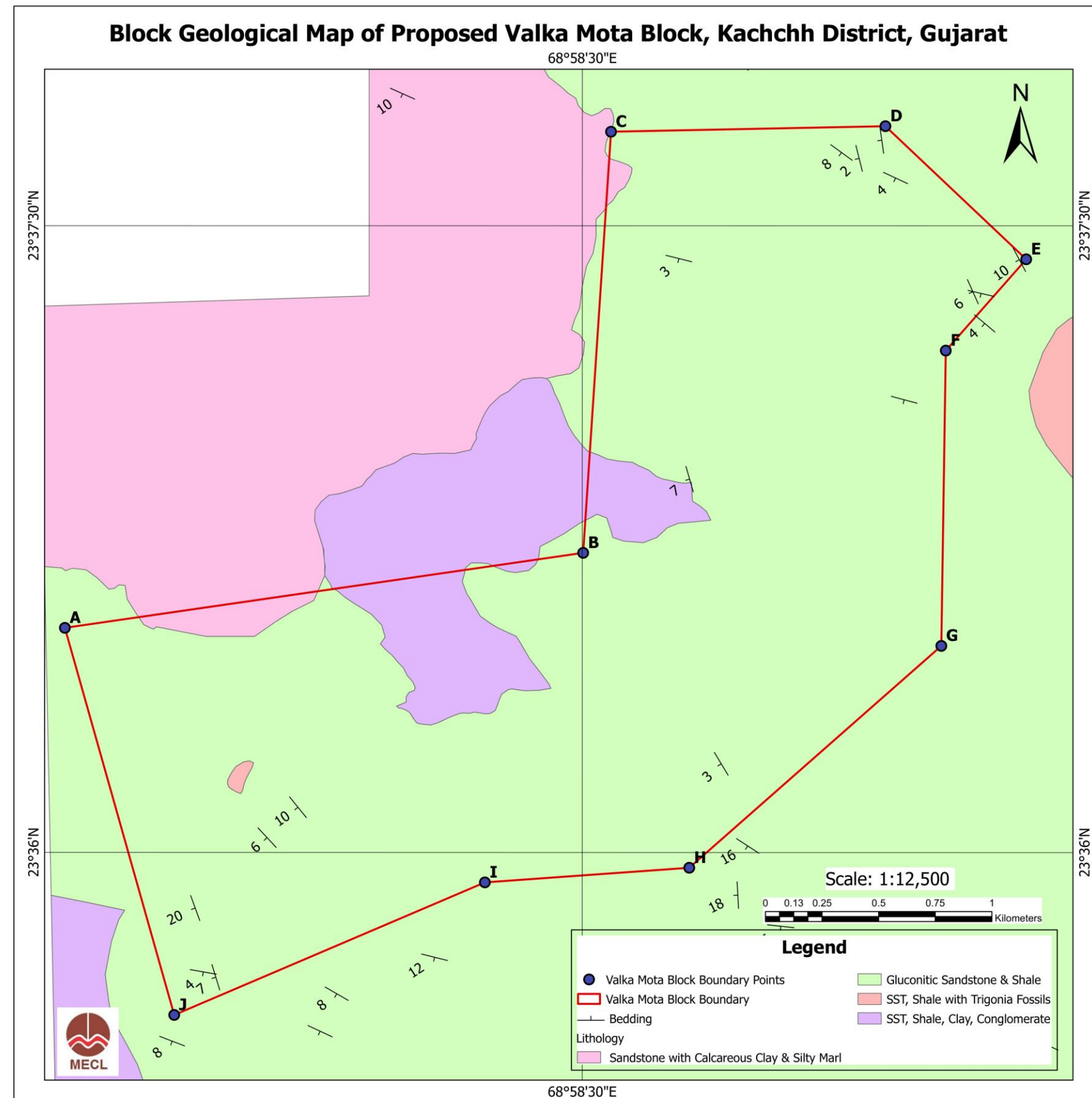


Plate-III: Block Geological Map of Valka Mota Block for Glauconite, District: Kachchh, Gujarat

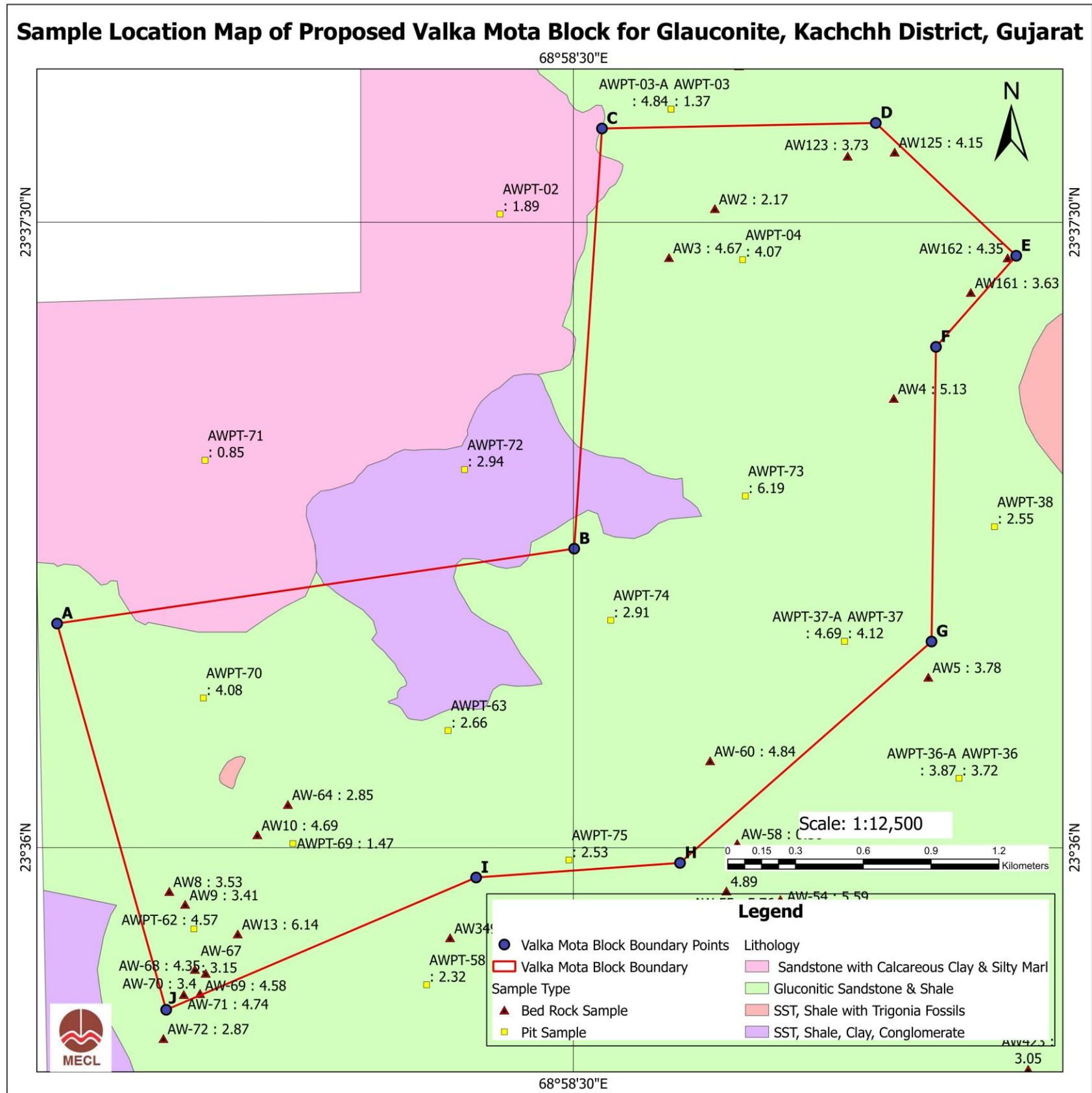


Plate-IV: Geological Map with Sample Location of Valka Mota Block for Glauconite, District: Kachchh, Gujarat

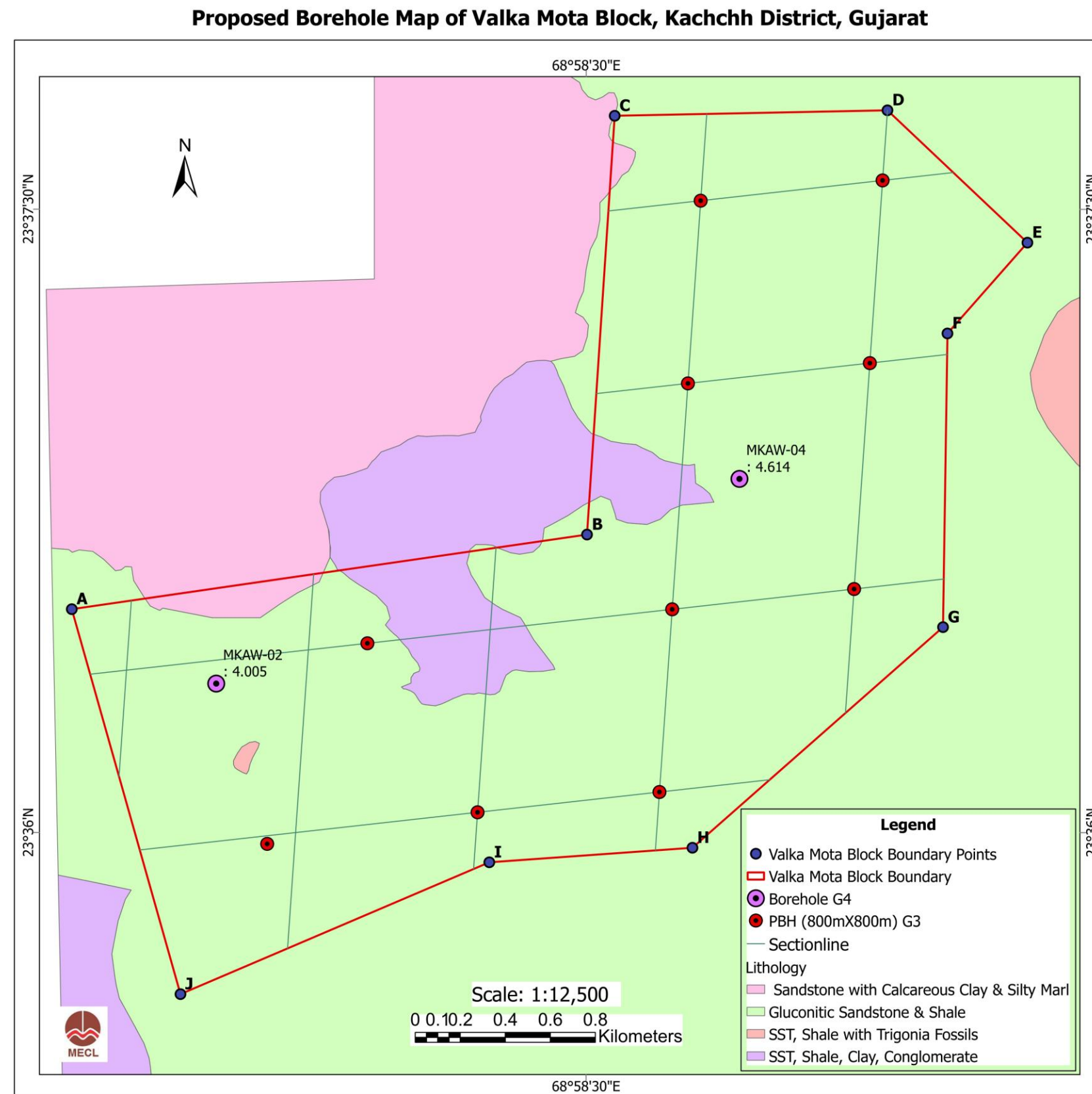


Plate-V: Geological Map with Proposed Borehole Location of Valka Mota Block for Glauconite, District: Kachchh, Gujarat

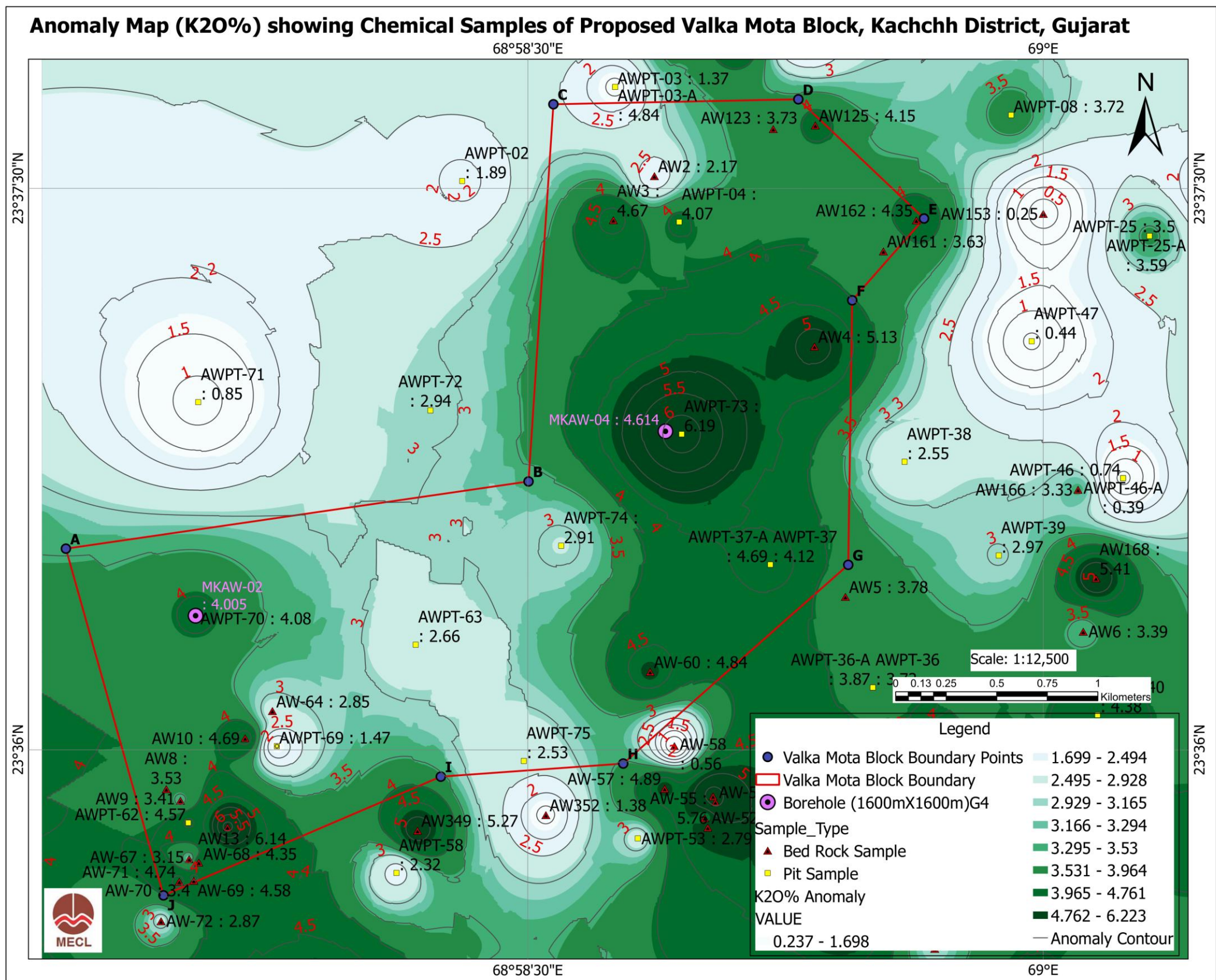


Plate-VI: K₂O Anomaly Map of Valka Mota Block for Glauconite, District: Kachchh, Gujarat