# Proposal for Patra Graphite Block, District Jhabua, Madhya Pradesh for Preliminary exploration (G_3 Stage) Mineral Exploration under NMET

# (Critical Mineral)

# By

# The MP State Mining Corporation Ltd, Madhya Pradesh

**Place- Bhopal**

**Date- 17th February, 2024.**

| List of Annexures | | |
|---|---|---|
| **Anx No** | **Description** | **Page no** |
| 1 | Location Plan | 24 |
| 2 | Geological plan | 25 |
| 3 | Lithological plan and spot sample location | 26 |
| 4 | Villages falling within the proposed block | 27 |
| 5 | Coordinates of the block | 28 |
| 6 | Toposheet and forest boundary | 29 |
| 7 | Result of spot samples | 30 |
| 8 | Elevation profile of the area | 31 |
| 9 | Proposed borehole location | 32 |
| 10 | Timeline for the work | 33 |

**Summary of the Block for G_3 Stage Exploration**

## GENERAL INFORMATION ABOUT THE BLOCK

| | Features | Details |
|---|---|---|
| 1 | Block ID | Patra Graphite Block |
| 2 | Exploration Agency | The MP State Mining Corporation Ltd |
| 3 | Commodity | Graphite |
| 4 | Mineral Belt | Meghnagar Group of rocks of Aravalli Supergroup |
| 5 | Completion Period with entire Time schedule to complete the project | 17 months |
| 6 | Objectives | The proposed block fall in Jhabua district of Madhya Pradesh (Anx-1 Location Plan).<br><br>The Meghnagar Group of rocks of Aravalli Supergroup consist of low-grade metasedimentary rocks. Kalinjara formation of the Meghnagar group contains Carbonaceous phyllite within which a thin band of graphite is observed.<br><br>The proposed block covers the Aravalli Super Group, which further extend in north having a trend of NE-SW.<br><br>GSI indicated presence of the graphite in the area.<br><br>The presence of supporting lithology in adjoining GSI Blocks, further positive sign & encourages taking up the G3 Exploration in the area.<br><br>The geological map & Lithological map (Anx-2)<br><br>On the basis of these evidence of mineralization, the present exploration program has been formulated to fulfill the following objectives.<br><br>i) To carry out Geological mapping on 1:5000 scale for demarcation of rocks & mineralization with the structural features to identify the surface manifestations and lateral disposition of the mineralized zones. |

| | | |
|---|---|---|
| | | ii) Shallow pitting / trenching will be done to expose the concealed host rock and minerals in systematic grid pattern of 100m*100m. This will guide for exact demarcation of the present ore bodies. The exploration will be helpful in estimation preliminary resources of graphite in the block area.<br><br>iii) 5 boreholes to be drilled and analysed to check depth continuity of the ore body and carry out resource estimation.<br><br>iv) In case the results of the Preliminary exploration are positive, it will help in planning of general exploration programme, which in turn will facilitate the state govt. for auctioning of block. |
| 7 | Whether the work will be carried out by the proposed agency or through outsourcing and details thereof. | Will be carried out by MPSMCL & few components through outsourcing. |
| 8 | Name/ Number of Geoscientists | Geologist:- 01 |
| 9 | Expected Field days (Geology) | Geologist:- 30 field + 10 HQ |
| 1 | **Location** | |
| | Latitude | Anx-5 |
| | Longitude | Anx-5 |
| | Villages | Anx-4 |
| | Tehsil/ Taluk | Meghnagar |
| | District | Jhabua |
| | State | Madhya Pradesh |
| 2 | **Area (hectares/ square kilometres)** | |
| | Block Area | 1.5 sq km |
| | Forest Area | NIL Sq Km<br>Forest map prepared based on the toposheet is attached as Anx- 6 |

| | | |
|---|---|---|
| | Government Land Area | Data not available. |
| | Private Land Area | Data not available. |
| 3 | **Accessibility** | |
| | Nearest Rail Head | Meghnagar and Dahod are the nearest railheads on Delhi-Mumbai section of Western Railway |
| | Road | NH 47 running more or less in east-west direction connects Jhabua and Dahod in western side at a distance of 50 km |
| | Airport | The Nearest Airport Devi Ahalyabai Airport Indore is Situated 170 Km Eastward |
| 4 | **Hydrography** | |
| | Local Surface Drainage Pattern (Channels) | Dendritic, sub-dendritic type drainage is seen in the area. |
| | Rivers/ Streams | Anas River is the main source of water for drinking, fishing and cultivation in this part of the state. It is a perennial river, but most of its tributaries dry out during the summer season. The Anas River flows from SE to NW near Doter and Dhebar areas. Near Rampura, Kachaldhara, and Rupakhera areas the flow of this river becomes from W to E. Again, it flows from SE to NW near Nagan Kheda, and Tandladara areas. The westerly flowing Pat River is a major tributary that joins Anas River near west of Rupakhera, whereas the northerly flowing Kali nadi joins Anas River near Patra village. The drainage basin formed by the Anas River in this area is of 4th order |
| 5 | **Climate** | Climate is generally moderate and seasons are well defined. The summers are hot, winters are short and the monsoon season is generally pleasant. The average annual rainfall in the District is 855.5mm. Most of the rainfall occurs in monsoon season while there is also a little of rainfall in winter season A hot summer and general dryness characterize the climate of Jhabua District, except during the southwest monsoon season. The year can be divided in to four seasons. The winter commences from middle of November and lasts till the end of February. The period from March to about middle of June is the hot summer season. May is the hottest month of the year. The southwest monsoon starts from middle of June and lasts till end of September. October and middle of November constitute the post monsoon or retreating monsoon season |

| | | |
|---|---|---|
| | Mean Annual Rainfall | Rain fall (annual) min max Avg: Avg: 855 mm. |
| | Temperatures (December) (Minimum) Temperatures (June) (Maximum) | Maximum temperature likely to be 41 degrees Celsius and Minimum temperature is 11 degrees Celsius. |
| 6 | **Topography** | |
| | Toposheet Number | 46J/5 Anx-6 |
| | Morphology of the Area | The highest peaks in the area are about 330 m above mean sea level south of Suken nala in Chokhwara reserve forest area. It is formed predominantly by quartzite. The lowest elevation point in the study area (240 m above MSL) is the junction where Khan Nadi meets Anas River in Doter village. The area exhibits dendritic pattern of drainage in and around the elevated ridges. |
| 7 | **Availability of baseline data** | |
| | Geological Map | 1:12.5 K Geological Map available |
| | Geochemical Map | Available |
| | Geophysical Map (Aeromagnetic, ground geophysical, Regional as well as local scale GP maps) | Available |
| 8 | **Justification for taking up Reconnaissance Survey / Regional Exploration** | In view of MMDR Amendments & Mineral Auction Rule, 2015, we have identified this block for exploration of Graphite to take up the work under NMET funding.<br><br>In the proposed study area, there are geological indications, like presence of Meghnagar Group of Aravalli Supergroup which contain several bands of carbonaceous phylites with intermittent graphitic horizon. Please refer Anx-3 for the same.<br><br>Field visit was carried out. Several graphite exposures were observed. Several samples were taken. |

| | | |
|---|---|---|
| | | Furthermore, there are several studies carried out by GSI for Graphite in nearby area. **The block also came in auction in phase XI for composite license.**<br><br>GSI is confirming presence of graphite in the area & have recommended for further detailed study for delineating the prospective zones for mineralization. The Meghnagar Group of Aravalli Supergroup formation occupies the area which is to be closely checked for further graphite occurrences. Additional trenching and pitting work has to be resorted to, for deciphering the shape of the different bands. As this sector holds the promise of high grade ore, drilling has to be initiated in this area immediately.<br><br>The details of the same are discussed in "Previous Work", each case wise.<br><br>These 3 points are guiding for the presence of Graphite in the area.<br><br>The exploration will be helpful in estimation of Preliminary Exploration mineral resources (333) of Graphite & other accessory minerals in the block area.<br><br>In case the results of the Preliminary Exploration are positive, it will facilitate the state govt. for auctioning of block. |

# Detailed description of the block

## Block summary:

## 2.Physiography:

The highest peaks in the area are about 330 m above mean sea level south of Suken nala in Chokhwara reserve forest area. It is formed predominantly by quartzite. The lowest elevation point in the study area (240 m above MSL) is the junction where Khan Nadi meets Anas River in Doter village. The area exhibits dendritic pattern of drainage in and around the elevated ridges.

Anas River is the main source of water for drinking, fishing and cultivation in this part of the state. It is a perennial river, but most of its tributaries dry out during the summer season. The Anas River flows from SE to NW near Doter and Dhebar areas. Near Rampura, Kachaldhara, and Rupakhera areas the flow of this river becomes from W to E. Again, it flows from SE to NW near Nagan Kheda, and Tandladara areas. The westerly flowing Pat River is a major tributary that joins Anas River near west of Rupakhera, whereas the northerly flowing Kali nadi joins Anas River near Patra village. The drainage basin formed by the Anas River in this area is of 4th order

The highest elevation is 372 m in while the lowest elevation is 349 m of the proposed block the average is 362 m.

## 3.Background Geology

### Regional Geology

The geological Formations in Jhabua and Alirajpur districts of M.P. regionally form the southern extension of the Aravalli Supergroup of rocks of western India, Rajasthan. The rocks extend in a NW-SE direction as a belt traceable over 100 km with a width of about 75 km. It continues northwards into Rajasthan and joins the main Aravalli belt extending in a NE-SW direction. Along their eastern and western margins, the rocks are covered by the Bagh Group and Deccan traps. The area is generally soil covered with sparsely distributed outcrops.

The Meghnagar Group mainly includes low grade metasedimentary rocks, e.g. phyllites, phosphatic limestone, quartzite, etc. It is divided into Anas Formation, Khatamba Formation and Ochhka Formation. The Meghnagar Group of rocks are intruded by basic and ultramafic intrusions known as Jobat mafic ultramafic suite of rocks. The Aravalli Supergroup and basement rocks are further intruded by Neoproterozoic granite which is comparable to the Godhra Granite of upper Proterozoic age (900-1600 ma). Godhra granite is distinguished as leucocratic granite, porphyroblastic granite and pink granite.

## Regional Stratigraphy of the study area

| Age | Supergroup | Group | Formation | Lithology |
|---|---|---|---|---|
| Recent | | | | Quaternary – Alluvium and Conglomerate |
| **Unconformity** | | | | |
| | | | | |
| Mesozoic (early to late cretaceous) | Deccan Trap Complex | | | Basalt lava flows, dolerite dykes |
| | **Discontinuity** | | | |
| | | Bagh Group | | Fossiliferous beds of Nodular limestone, Gritty sandstone and Pebbly conglomerate / breccia |
| Erosional Unconformity / Tectonic Contact | | | | |
| NeoProterozoic | Aravalli Supergroup | Younger intrusives | Dabcha Granites Post tectonic | Quartz/quartzo-feldspathic/pegmatite veins Quartz reefs Mega porphyritic, non-foliated granite Grey massive granite |
| | | ---------- Intrusive / Tectonic Contact---------- | | |
| | | | Ultrabasic | Pink Granite gneiss UltrabasicsSerpentinite,Pyroxenite, hornblendite, dunite etc. |
| | | ---------- Intrusive / Tectonic Contact---------- | | |
| Palaeo proterozoic | | Meghnagar group | Ochhka Formation | Purple brown quartzite Intraformational meta-conglomerate |
| | | | Khatamba Formation | Stromatolitic phosphatic limestone and chert |
| | | | Anas Formation | Phyllite/Carbonaceous Phyllite/manganiferous Phyllite Phyllite quartzite sequence |
| | | ----------Tectonic (?) Contact (Concealed)---------- | | |
| | | Hathni Group | | Low grade phyllite/Chlorite phyllite, metabasics |
| | | ---------- Tectonic contact ---------- | | |
| | | Badi Sardi Group (Volcano Sedimentary sequence | | Co-folded Metabasic / Amphibolite Phyllite/Quartz-mica schist/Granetiferous mica schist / Quartz chlorite schist / Graphite schist ‘Crystalline dolomitic marble/Calcgneiss/ Calc silicate/ Talc-tremolite schist/ impure calcareous rocks / chert quartzite / Bended hematite quartzite |
| | | ---------- Tectonic contact ---------- | | |
| Archaean | | Alirajpur Gneissic Complex | | Migmatite gneiss, grey granite gneiss with Palaeosomes of quartz hornblende gneiss amphibolite gneiss. |

**Meghnagar group:**

The Meghnagar Group mainly includes low grade metasedimentary rocks, e.g. phyllites, phosphatic limestone, quartzite, etc. It is divided into Anas Formation, Khatamba Formation and Ochhka Formation. The Meghnagar Group of rocks are intruded by basic and ultramafic intrusions known as Jobat mafic ultramafic suite of rocks. The Aravalli Supergroup and basement rocks are further intruded by Neoproterozoic granite which is comparable to the Godhra Granite of upper Proterozoic age (900-1600 ma). Godhra granite is distinguished as leucocratic granite, porphyroblastic granite and pink granite. The group is divisible into three formation:

1. Occhka formation,

2. Khatamba formation,

3. Anas formation

Geologically, the area forms the south eastern extension of Aravalli fold belt, in Madhya Pradesh and represented by Meghnagar Group of rocks. The lithologies exposed are phyllite, dolomite, quartzite, and biotite gneiss. The Meghnagar Group is unconformably overlain by rocks belonging to Bagh Series which are in turn overlain by Deccan traps, while it is underlain by Udaipur group of rocks represented by granite Gneisses and amphibolites. The rocks exposed in the study area are classified as Kalinjara Formation of Meghnagar Group of Aravalli Super Group, which comprises biotite gneiss, variegated phyllite, dolomites and quartzites forming the lower units and rest unconformably over granites, migmatites and gneiss of Alirajpur gneissic Complex, and occur as the major lithology in the area. Biotite Gneiss of Kalinjara Formation is extremely weathered and exposed in Pachhalibhit area near Pet nala section. Phyllite of Kalinjara Formation is the most dominant rock type and is omnipresent in the area. The phyllites of this formation is extensively seen in the northern, eastern and western corner of the study block. It is fine-grained, greenish grey to khaki blue in colour, crinkled and cleaved at places silty and sandy. Carbonaceous phyllite is the target lithotype for graphite in the area and it occurs as thin bands within the phyllite. The dolomite band in the eastern part of the mapped area continues to outcrop in the south-central part of Patra but does not contain stromatolites. The metaconglomerate (not exposed in the study area) occurs as an extensive exposure in Mandli Chhoti village near river Mod in the western part(46J/09) of the study area and as small boulder (unmappable) units in Harmatiya village near Sunar Nadi bank in the eastern(46J/09) of the study area. This unit varies in thickness from 1 to 2 metres and changes upward to a compact purple quartzite horizon. This conglomerate consists of elongated, sub rounded to rounded pebbles and cobbles of quartz, grey quartzite, metabasics, dolomite and chert. Quartzite belonging to the Kalinjara Formation of the Meghnagar Group occurs as distinct ridges in the study area most of which trend northwest-southeast. General trend of these quartzite lithounits is 350°N with dips vertical as well as northeast. Quartzite at places contain faintly intact current bedding, besides containing graded bedding.

**Ochhka formation**:

It is consisting of purple brown quarzite and intraformational metaconglomerate

***Khatamba formation***:
It is a major rock formation of meghnagar group. It comprises stromatolitic phosphatic limestone of lacustrine origin and and chert.

***Anas formation:***
This consist of phylites and carbonaceous phyllite and act as a host of graphite.

## 4.Geology of the Block:

The proposed area comprises the rock formations of Bhander Group of Vindhyan Supergroup. The following is the lithostratigraphic succession observed in the area.

| Supergroup | Group | Formation | Lithology |
|---|---|---|---|
| Deccan | Malwa | Mandaleshwar | Basalt |
| | Bagh | | Limestone |
| | | | Granite |
| Aravalli | Lunavada | Wagidora | Meta subgreywacke, mica-schist, quartzite |
| | | Kalinjara | Phyllite, Mica schist |
| | | | Quartzite |
| | | | Dolomite/Marble |
| | | | Meta-conglomerate |
| | | | Phyllite |
| | | | Biotite Gneiss |
| Unconformity | | | |
| Alirajpur Gneissic Complex (Migmatites, Granites and Gneisses) | | | |

## 5.Nature of Mineralisation

In the study area, the graphite mineralization is found in association with graphite schist/carbonaceous phyllite and grey phyllite. In general, the graphite schist mostly occurs as flaky and amorphous at places reflecting thermal effect of low to high grade metamorphism on carbonaceous sedimentary and carbonate rock (Lenka, B,2014). The flaky, graphite schist mainly comprises of flakes of silver grey to greyish black colour and graphite mixed intimately with fine grained quartz, muscovite, chlorite and calcite . In hand specimen it appears greyish black to silver grey in colour and usually soils hand with black to silver grey colour along with a metallic lustre. This is due to its softness and greasiness. Generally, the above mentioned physical and petrographic character is marked in the

graphite schist exposed in Doter and Dhebar bands, while in south Patra block, amorphous nature of graphite schist also marked along with flaky graphite schist. In Patra graphite schist band graphite mineralization is also marked along the foliation of grey phyllite and carbonaceous phyllite

**Details of Mineralised zone**

The Patra south graphite schist band (Longitudes 74.403-74.406, Latitudes 22.917-22.92) is located near Patra village of Meghnagar tehsil. It starts from south of Patra village (22.915534,74.407794) to 450m northwest of Patra and terminates on the Patra-Guvali Road. The length of this band is 450 m and thickness vary from 5m to 80 m. The overall strike direction of the Patra south band varies from N73W- S73E to N40W- S40E and dip ranges from 90o to 95 o towards NE. The northern portion of graphite schist band shows pinching as well as swerving in strike direction from N73W to N40W may be attributed to broad warping due to third phase of deformation (F3 folding). The host rock for graphite mineralization in the Patra south band is Aravalli metasediments, particularly carbonaceous phyllite. The graphite schist, carbonaceous phyllite of Patra south band is exposed near contact of younger Aravalli metasediments i.e., quartzite. Their contact is gradational/weathered. The graphite schist marked in northern part of this band is flaky, silver grey to greyish black in color and soils hand and shows greasiness. In the southern part, it becomes more silica rich, amorphous, hard and compact.

## 6.Mineral Potentiality

GSI carried out 1:12500 scale geological mapping of the area. They have also carried out pitting and trenching activity along with spot sample analysis from the area. Results are attached in Anx-7

Petrological studies have also been carried out which also showed presence of graphite in carbonaceous phyllite.

Raman spectroscopy study also revealed graphite peak from various samples collected from the area.

Furthermore, there are several studies carried out by GSI for graphite in adjoining areas.

GSI is confirming presence of Graphite in the area & have recommended for further detailed study for delineating the prospective zones for mineralization. Additional trenching and pitting work have to be resorted to and drilling activity, for deciphering the shape of the different bands. As this sector holds the promise of high-grade ore, drilling has to be initiated in this area immediately.

These 3 points are guiding for the presence of Graphite in the area.

The exploration will be helpful in estimation of Preliminary Exploration mineral resources (333) of Graphite & other accessory minerals in the block area.

## 7.Scope for Proposed Exploration

The proposed block fall in Jhabua district of Madhya Pradesh (Anx-1 Location Plan).

i. Geological mapping in the said block in 1:5000 scale.
ii. To expose the concealed Graphite and check the fixed carbon content by Proximate analysis at shallow depth, trenching/pitting will be done.
iii. To check the continuity of ore body in strike direction and depth extension.
iv. Sampling & their analysis.
v. To estimate the Preliminary Mineral Resources and grade for orebody in the block as per UNFC and MEMC-2015.

## 8.Observation and recommendations of previous work

The earliest reference on the geology of this region is found in the report of Major Full James (1852), titled "Geological and statistical notes on portion of Rewa Kantha districts". Other previous workers who contributed to the geological knowledge of the Precambrian rocks of this area include Blanford (1847), Bose (1884), Fermor (1909), Daru and Gupta (1909, 1931), Roy Chowdhury (1955) and Venkatesh et.al (1958). Their studies broadly indicate the similarities of the rocks occurring in the area with Aravallis, with which they have been correlated. Blanford (1867) surveyed the area and presented the results of his study in 1867, in his memoir "Geology of the Tapti and Lower Narmada Valley". He has mapped the area around Jobat and referred the brecciated, jasperoid rocks forming a low scarp plateau near Jobat as Bijawar rocks, according to him the northern area is composed mainly of granitoid gneiss while in the north-western corner he recorded a group of metasedimentary rocks. Bose (1884) Parts of this area was mapped by P.N. Bose of the Geological Survey of India, who correlated these rocks with Archean metamporphics. Fermor (1909) and Deru and Gupta (1909, 1931) mapped the adjacent area to the north and considered these rocks as the southern extension of the Aravallis in Rajasthan. Mukharjee (1936), have contributed to the knowledge of the Archeans in this part of M.P. Their studies broadly indicate the similarities of these rocks to the Aravallis with they been correlated. Roychoudhury (1955) identified schistose conglomerate, mica schists, lime silicate rocks, granite and ultrabasic rocks within the Archaeans of this area. The other rocks types, according to him, are Lametas (mostly limestone), serpentinised trap (limburgites) and plateau basalt of Deccan trap age. Venkatesh et.al. (1958) worked on the geology and manganese ore deposits of the northern part of Jhabua District, Madhya pradesh. He concluded that on the basis of the lithological similarities, the rocks of the area are considered to belong to Aravallies. Phyllite, quartzite and dolomitic limestone, granite and gneiss form the rock types of the area. The Aravallies are unconformbly overlain by nodular cherty limestone of Lameta. He also described about manganese ore deposits of Kajlidongri, Rampura, Mandli,Tundia- Bandiwer, Kelkaa, Amliapal and Jaikot- Talai. Munshi (1972) carried out work on the study of deccan trap contacts with other formations with special reference to mineralization in parts of Jhabua District, Madhya Pradesh. As per the author the oldest rock types of the area (46J/10) are grouped under Archaeans. They comprise biotite schist, biotite gneiss, quartzite, amphibolite and calc silicate intruded by granite, pegmatite and quartz veins. The gneisses are foliated along NW-SE, dipping steeply towards southwest, The Archaeans are succeeded by Bagh Bedsrepresented by an unconformable sequence of conglomerate, sandstone, limestone from Ranapur, Rajla, Gola, Kanakakra and Bowria have yielded marine fossils of Bagh beds. The Bagh Beds are disposed horizontally. These rocks are covered by Deccan Traps. In Jhabua area, four basaltic flows of tholeiitic composition are identified, between the altitudes 397-490m. Individual flows are 25-30m thick and are separated by bands of red bole and weathered zones. The region lying south of Bakhatgarh (46J/04) is occupied predominantly by Deccan Traps. There are eleven flows of tholeiitic composition between the elevations 303m and 635m. Porphyritic and non-porphyritic types of basalts are alternating. Flows are intruded by E-W trending dolerite dykes and calcite veins. The rocks are locally subjected to E-W trending faults. Some of the flows are dipping gently (dips 10° to 12°) towards south, as seen at Kherwara and Bhurata. In

general flows are disposed horizontally. Vishwakarma et.al. (1995) carried out specialized thematic mapping on 1:25,000 scale by covering an area of about 200 sq km on B1, B2, C1, C2 grids of toposheet No. 46J/05 and A1 grid of toposheet no. 46J/09 around Rambhapur and Meghnagar in Jhabua district. They reported that the Precambrian rocks of the area mainly comprise of low-grade metasedimentary sequence of Meghnagar Group including phyllite, dolomitic limestone, metaconglomerate and quartzite, which form a part of Aravalli Supergroup. The rocks of the Aravalli Supergroup have been intruded by basic and acidic younger intrusive of mainly quartz and pegmatite veins. The Precambrian rocks are overlain by rocks of Bagh Group consisting of gritty sandstone, conglomerate and nodular limestone. Bagh Group of rocks is overlain by Deccan Trap lava flows. The rocks of Meghnagar Group have undergone a regional metamorphism of green schist facies. They show three phases of deformation. Malachite stains are seen in the quartzite near Sajeli, Talvali, Kakrej and NW of Doter. It is highly sheared and traversed by later quartz veins. Manganese bearing calc phyllite bands associated with chert bands of about 2 to 10 meters thickness and showing lensoidal bodies of manganese ore have been traced all along the strike from Rampuranana to Amliyamal North. Stromatolite bearing dolomitic limestone containing phosphorite is being mined by State Mining Corporation near Kalkhuva-KhatambaDhanpura area. Biswajit Ghosh (2005) carried out Specialized thematic mapping on 1:25000 scale in and around Thandla area of Jhabua district. About 300 sq.km area was mapped on toposheet nos. 46I/8 and 46I/12 out of which 110 sq.km area is covered by Precambrian rocks and remaining 190 sq.km area is covered by Deccan traps. The Precambrian rocks to the west represent the southeastern extension of Aravalli Supergroup of rocks consisting of metabasics, phyllite, phyllitic quartzite, dolostone, quartzite, meta-conglomerate and granite gneiss which is covered by Deccan basalts towards east and northeast. He has tentatively been classified Aravalli Supergroup into two Groups viz. Hathni Group and Meghnagar Group based on the lithology, structure and metamorphism. The Hathni Group is represented by meta-basics whereas phyllites, quartzites and meta-conglomerates have been kept under Meghnagar Group. The area has experienced at least two phases of deformation with strong development of S2 schistosity, which is the dominant one and has an almost constant orientation of NNW-SSE strike with variable dips towards NE. S1 is bedding parallel, which got folded during later deformation (D2) and gave rise to the domainal cleavage (S2), which is best recognized in the phyllites. S0 and other primary sedimentary structures like cross bedding, graded bedding and ripple marks are preserved in quartzite. The rocks of the Aravalli Supergroup of rocks have undergone low grade green schist regional metamorphism, which is syn-deformational to the first phase of deformation. Dolomite bands are nonphosphatic and do not indicate potentiality of any base metal mineralization. Gogia et.al. (2012) carried out large scale mapping (1:12,500 scale) in ~15 sq km area in TS No. 46J/05 and traced five manganese bands, three in Mandli-Tunia block and one each in Rampura (Anas River block) and Doter villages, during investigation. The largest exposed manganese band in Mandli area is around 700 m (discontinuous) along strike with average width of 5m. Similarly, manganese ore bands in Rampura and Doter area have a strike length of around 100m and width around 4m each. The manganese bands are lensoidal and elongated in nature due to deformation and remobilization. Geophysical survey over

13.85 L Km was and a bipolar anomaly was detected in Mandli-Tunia area that indicates presence of iron ore body below the surface. During the course of investigation, it has been found that the manganese ore bearing horizons have limited strike continuity (100 - 200 m) and thickness (4 - 5 m). Drilling of three scout boreholes totaling 270.40 m (2 boreholes in Mandli-Tuniya block and 1 borehole in Anas River block) was carried out. Also, on the basis of scout borehole drilling the depth persistence of the manganese ore has been found to be less. Main ore minerals of manganese are braunite and pyrolusite. Rhodochrosite has also been found in the hydrothermal veins near the ore bodies. The nature of origin of manganese ore is syngenetic. The mineralization of manganese ore could be a marker event in the Proterozoic history of the Earth. In this area the primary deposition of manganese ore was followed by tight to isoclinal folding resulting in boudinaging of brittle manganese ore bearing horizon in the phyllitic country rock. After boudinaging the localization of manganese ore in the hinges of mesoscopic F2 folds might have taken place. The third phase of deformation resulted in broad warps in this area. Outcrops containing graphite minerals were discovered in Anas River section near Doter village and in Guvali village. Authors suggested that the area may be taken up for specialized thematic mapping on 1:25,000 scale in order to identify the prospective locations for further exploration. Mistry and Kumar, (2013) in their final report on Geochemical Mapping of Toposheet No. 46 J/05 covering Parts of Panchmahals District, Gujarat and Jhabua District, Madhya Pradesh, received a relatively high value of 0.16% for MnO was reported in composite samples. These high values follow a north south trend covering Satsera and Guwali villages thus encouraged a search for potential of graphite mineralisation in the area.

The Patra-Guvali-Satsera-Gopalpura area of Jhabua District, Madhya Pradesh and Dahod District, Gujarat indicates by visual estimation, the presence of graphite mineralisation in the area in the form of graphite schist/carbonaceous phyllite. Also, the presence for graphite is confirmed with the Raman spectroscopy. Though the occurrence of graphite has been marked at four locations namely south Patra, north Patra, Doter and Dhebar graphite bearing mineralization zones, only one low grade, impersistent zone are noteworthy with low average grade of fixed carbon component that just surpasses the cut off grade of 2% fixed carbon . The carbonaceous phyllite band marked around south Patra area has commutative length of 450 m T3 trench samples in the amorphous graphite bearing zone have given fixed carbon content of 1.17% to 3.48% which is less than the cut off grade of 10% fixed carbon for amorphous variety. Flaky variety although present in this zone, are very thinly banded and are soil covered and/or within cultivated lands. The only potential zone of graphite mineralisation has been marked in north Patra area where the length of graphite hosting carbonaceous phyllite body is 650m long and maximum width of 140m. The values of 8 nos. of spot samples with maximum values in north Patra zone are :B036(7.30%), B042(6.26%), B044 (7.21%), B045 (8.21%), B046 ( 6.21%), B047 (6.45%), B049 (6.87%), B050 (7.25%). The potentiality of this band can be further investigated by systematic trenching and geophysical methods. This will enable us to understand the actual structural control of the area to know the depth persistence as well as for assessment of total resource of graphite in the area.

## 9.Planned Methodology

Work will start with geological mapping of the block on 1:5000 scale.
Core drilling will be carried out at G3 level of exploration as per "The Minerals (Evidence of Mineral Contents) Rule 2015.

Pitting & trenching will be carried out at G3 level of exploration as per "The Minerals (Evidence of Mineral Contents) Rule 2015.

Fixed carbon analysis of all the samples will be done from departmental laboratory as well as NABL accredited laboratories.

Samples will check in several ways. They are listed below: -

| Sr No | Sample Check Type | | Percentage |
|---|---|---|---|
| 1 | Internal Check | :- | 5% |
| 2 | External Check | :- | 10% |
| 3 | Composite Samples | :- | 10% |
| 4 | Moisture absorption & Bulk Density | :- | 2% |
| 5 | Mineralogical analysis | :- | 5% |

These activities will be followed by data interpretation and report writing work.

## 10. Nature Quantum and Target

| Components | G3 Stage | Proposed Quantum |
|---|---|---|
| **Aerial reconnaissance** | Remote sensing, airborne geophysical survey etc. | Not needed |
| **Geological Survey** | i 5K/ 5K<br>ii Assessment of lithology, structure, surface mineralisation and analysis of old history of mining, if any. | Detailed mapping on 5K scale – 1.5 Sq Km |
| **Geochemical Survey** | i Regional Grab / chip / Stream Sediment / Soil Sampling<br>ii Recording of broad geomorphology, drainage, etc. | NIL |
| **Geophysical Survey** | Aero-geophysical / Regional ground geophysical survey (Refer another table below) | NIL |
| **Pitting/ Trenching** | It will be done in 100m*100m grid pattern covering the mineralized area in three lines. | 60 (120m3) |
| **Systematic drilling /** | Few boreholes if required along the positive profiles delineated by surface sampling/pitting trenching (Mts) | 10 (1500 meterage) |
| **Groove Sampling /Grab and Chip Sampling** | A few samples from bed rock (few representative samples from all the exposed rocks in the area for first-hand information and more samples from rocks which host the mineralization). | 120 |
| **Core sample** | Sample from mineralised zones as well as hanging wall/footwall Side to be collected. Sample length to be specified (Mts) | 600 |
| **Petrographic and mineragraphic studies** | Principal rock types, mineral assemblage, identification of minerals of interest (Numbers) | 36 |
| **Synthesis of all available data** | i) Integration of regional geophysical, geological and geochemical data.<br>ii) Synthesis of all available data and Report writing | As required |

## 11. Manpower Deployment

| For Geologist | |
|---|---|
| Area (Sq Km) | 1.5 |
| Field Work Days | 30 |
| HQ Work Days | 10 |
| Labour | 60 |
| Core Drilling | |
| No of Boreholes | 10 |
| Drilling Depth | 50 |
| Meterage | 1500 |
| Let 40% be analyzed (Numbers) | 600 |
| Pitting & Trenching | |
| Numbers of pits / Trenching | 60 |
| Length (Mts) | 1 |
| Breath (Mts) | 1 |
| Depth (Mts) | 2 |
| Total Volume (M3) | 120 |
| Number of Samples & Analysis | |
| From BH | 600 |
| Surface Sample numbers | 120 |
| Total Samples | 720 |
| Internal Check @ 5% | 36 |
| External Check @ 10% | 72 |
| Composit Samples @ 10% | 72 |
| Total Samples | 900 |
| For Preparation | |
| One Person/ Nos of Samples / Day | 2 |
| No of samples | 900 |
| Sample Man days | 450 |
| Labour | 900 |
| Logging | |
| Logging per day (Mts/Day) | 50 |
| Meterage | 1500 |
| BH Logging | 30 |
| Pit / Trench Logging per day (Pits/Day) | 2 |
| Number of Pits / Trenches | 60 |
| Man days for pit logging | 30 |
| Total Logging Man days | 40 |
| For HQ Man days | 15 |
| Petrological Study | |
| Mineralogical Study @ 5% | 36 |

## 12.Break up of Expenditure

| Cost Estimate - Patra Graphite Block, 1.5 sq. km, No.of BH: 10, Borehole depth range 150 m; Schedule timeline 17 months Review: After 5 Months] | | | | | | |
|---|---|---|---|---|---|---|
| **S. No.** | **Item of Work *** | **Unit *** | **Rates as per NMET SoC 2020-21** | | **Estimated Cost of the Proposal** | |
| | | | **SoC-Item No. *** | **Rates as per SoC * (a)** | **Qty. (b)** | **Total Amount (Rs) (a*b)** |
| **A** | **Geological Mapping Other Geological Work & Surveying** | | | | | |
| | Geological mapping, (1:2,000 scale) & Trenching, drilling work | | | | | |
| i | a. Charges for Geologist per day (Field) for geological mapping & trenching work, drilling work | day | 1.2a | 11,000 | 30 | 330,000 |
| ii | b. Labours Charges; Base rate | day | 5.7 | 504 | 60 | 30,240 |
| | c. Charges for Geologist per day (HQ) | day | 1.2b | 9,000 | 10 | 90,000 |
| | d. Charges for one Sampler per day (1 Party) | one sampler per day | | | | |
| | e. Labours (4 Nos) | day | | | | |
| | **Sub Total- A** | | | | | **450,240** |
| **C** | **Survey work** | | | | | |
| a | DGPS Survey for BH fixation & RL determination | Per Point of observation | 1.6.2 | 19,200 | 15 | 288000 |
| b | Charges of Surveyor (1 party) for Geophysical survey layout work & Block boundary demarcation | one surveyor per day | 1.6.1a | 8,300 | 20 | 166000 |
| c | Labours Charges for survey work; | day | | 504 | 40 | 20160 |
| | **Sub-Total C** | | | | | **474,160** |
| **D** | **Trenching/Pitting** | | | | | |
| | a) Excavation of Trenches | per cu.m | 2.1.1 | 3,330 | 120 | **399600** |
| **E** | **DRILLING (after review)** | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Drilling up to 300m (Hard Rock) | m | 2.2.1.1b | 11,500 | 1,500 | 17,250,000 |
| 2 | Borehole deviation Survey by Multishot Camera | m | | | | |
| 3 | Land / Crop Compansation (in case the BH falls in agricultural Land) | per BH | | | | |
| 4 | Construction of concrete Pillar (12"x12"x30") | per borehole | | | | |
| 5 | Transportation of Drill Rig & Truck associated per drill (2 rigs) | Km | | | | |
| 6 | Monthly Accomodation Charges for drilling Camp (up to 2 Rigs) | month | | | | |
| 7 | Drilling Camp Setting Cost | Nos | | | | |
| 8 | Drilling Camp Winding up Cost | Nos | | | | |
| 9 | Road Making (Flat Terrain) | Km | | | | |
| 10 | Drill Core Preservation | per m | 5.3 | 1,590 | 1,500 | 2,385,000 |
| | **Sub Total E** | | | | | **19,635,000** |
| **F** | **Borehole Geophysical Logging** | | 3.12 | | - | **-** |
| **G** | **LABORATORY STUDIES** | | | | | |
| 1 | **Chemical Analysis** | | | | | |
| i) | **Geochemical Sampling-Surface samples (Bedrock/Channel /Soil/Stream sediment)** | | | | | |
| | a. Au by Fire Assay | Nos | | | | |
| | b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method | Nos | 4.1.7a | 2,506 | - | - |
| | c. For PGE by Fire Assay | Nos | | | | |
| ii) | **Surface Check samples (10% External)** | | | | | |
| | a. Au by Fire Assay | Nos | | | | |
| | b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method | Nos | 4.1.7a | 2,506 | - | - |
| | c. For PGE | Nos | | | | |
| iii) | **Trench & Check Samples from Trench** | | | | | |
| | **Trench samples** | | | | | |
| | a. Au by Fire Assay | Nos | | | | |
| | b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method | Nos | 4.1.7a | 2,506 | - | - |
| | c. For PGE | Nos | | | | |
| | Proximate analysis of Graphite | Nos | 4.1.9 | 3,000 | 120 | 360,000 |
| iv) | **Trench Check samples (10% External)** | | | | | |
| | a. Au by Fire Assay | Nos | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method | Nos | 4.1.7a | 2,506 | - | - |
| | c. For PGE | Nos | | | | |
| | Proximate analysis of Graphite | Nos | 4.1.9 | 3,000 | 12 | 36,000 |
| v) | **BH Core samples** | | | | | |
| | a. Au by Fire Assay | Nos | | | | |
| | b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by ICPMS-34 elements | Nos | 4.1.14 | 7,731 | - | - |
| | c. For PGE | Nos | | | | |
| | Proximate analysis of Graphite | Nos | 4.1.9 | 3,000 | 600 | 1,800,000 |
| vi) | **BH Core samples (10%External)** | | | | | |
| | a. Au by Fire Assay | Nos | | | | |
| | b. For Ag, Ni, Co, Cr, Cu, Pb, Zn, V, Ti by AAS Method | Nos | 4.1.14 | 7,731 | - | - |
| | c. For PGE | Nos | | | | |
| | Proximate analysis of Graphite | Nos | 4.1.9 | 3,000 | 60 | 180,000 |
| 2 | **Physical & Petrological Studies** | | | | | |
| i | Preparation of thin section | Nos | 4.3.1 | 2,353 | 30 | 70,590 |
| ii | Study of thin section | Nos | 4.3.4 | 4,232 | 30 | 126,960 |
| iii | Preparation of polish section | Nos | 4.3.2 | 1,549 | 30 | 46,470 |
| iv | study of polished section | Nos | 4.3.4 | 4,232 | 30 | 126,960 |
| v | Digital Photographs | Nos | 4.3.7 | 280 | 60 | 16,800 |
| vi | Whole Rock Analysis | Nos | | | | |
| vii | Sp. Gravity | Nos | 4.8.1 | 1,605 | 10 | 16,050 |
| | SEM Studies | per hour | | | | |
| viii | EPMA studies | per hour | | | | |
| | | | | | | **2,779,830** |
| **H** | **Total A to G** | | | | | **23,738,830** |
| **I** | **Geological Report Preparation** | **5 Hard copies with a soft copy** | **5.2** | **5.2 (i/ii/iii/iv)** | | **1,186,942** |
| **J** | **Peer review Charges** | | **As per EC decision** | | | **30,000** |
| **K** | **Preparation of Exploration Proposal (5 Hard copies with a soft copy)** | **5 Hard copies with a soft copy** | **5.1** | 2% of the Cost or Rs. 5.0 Lakhs whichever is less | | **474,777** |
| **L** | **Total Estimated Cost without GST** | | | | | **25,430,548** |
| **M** | **Provision for GST (18% of J)** | | | | | **4,577,499** |
| **N** | **Total Estimated Cost with GST** | | | | | **30,008,047** |
| | | | | **or Say Rs. In Lakhs** | | **300.08** |

**Reference:**

Snehasis S, Report on Reconnaissance survey for graphite and associated mineralization in Patra-Guvali-Satsera Gopalpura area in Jhabua districT, Madhya pradesh and dahod district, Gujarat (STAGE-G4).

Banerjee, D.M., Basu P.C. and Srivastava, N. (1980): Petrology, mineralogy, geochemistry and origin of the Precambrian Aravalli Phosphorite deposits of Udaipur and Jhabua. Indian Econ. Geol., v. 75, pp. 1181-1199.

Babu, Ramesh P.A. and Vishwakarma, L.L. (1994-95): A report on specialized thematic mapping of the Aravalli Supergroup of rocks around Rambhapur and Meghnagar in Jhabua district,M.P.

George J. Simandal, Suzanne Paradis and Carlee Akam (2015); Graphite deposit types, their origin, and economic significance. Symposium on critical and strategic materials. British Columbia Geological Survey Paper 2015-3.

Itaya T., (1981); Carbonaceous material in pelitic schists of the Sanbagawa metamorphic belt in Central Shikoku, Japan. Lithos, 14, 215-24.

Crowley et al. 1989; Sabine, 1997; Gupta, 2003; Airborne Imaging Spectrometer Data of the Ruby Mountains, Montana: Mineral Discrimination Using Relative Absorption Band-depth Images.

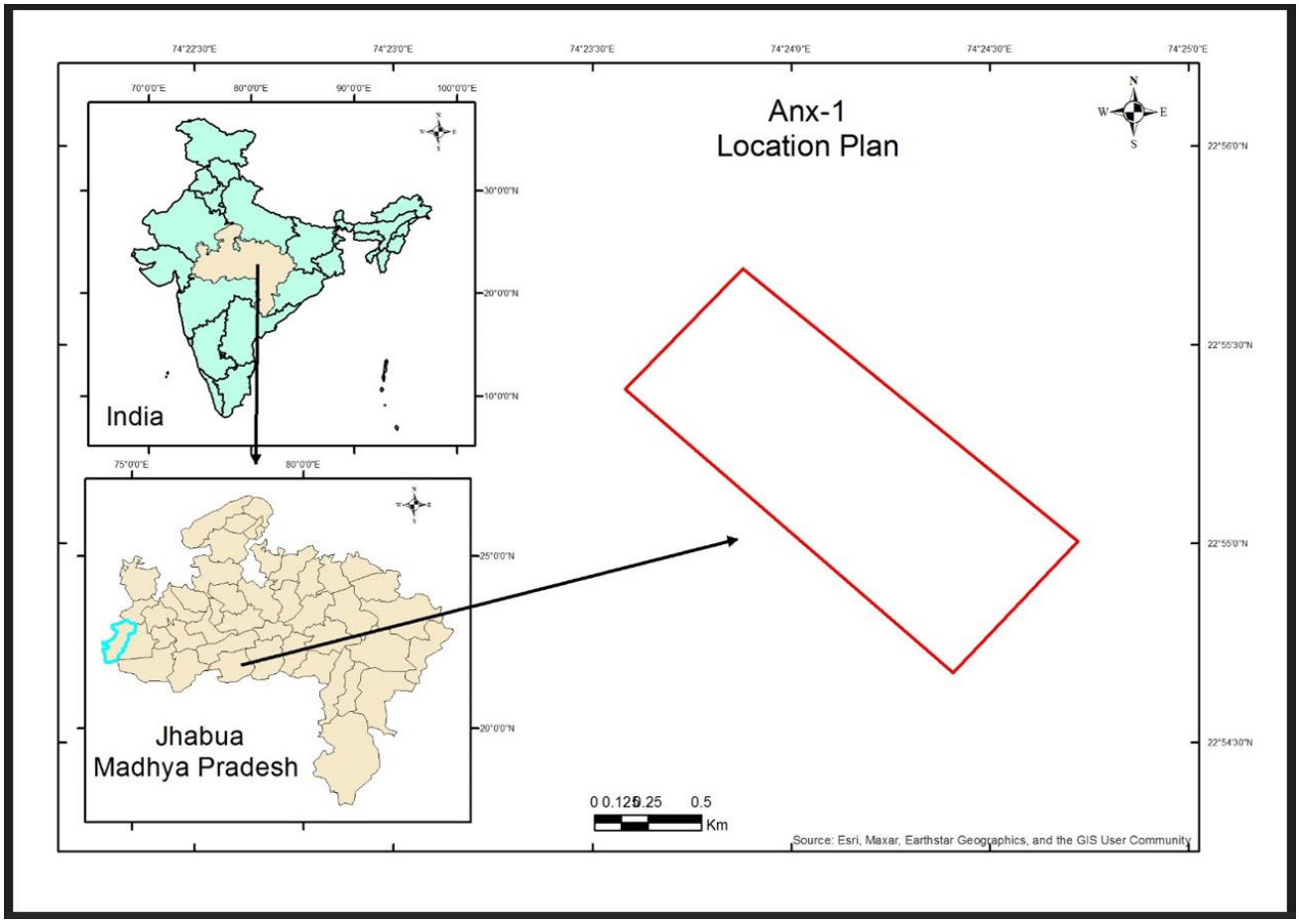
Prasad, K.N. et.al., (2016): A Report on Geophysical Mapping in Toposheet Nos. 46J/2, 3, 5, 6 & 7, Parts of Jhabua and Panchmahal Districts, Madhya Pradesh and Vadodara District, Gujarat.

Rajendran, et.al., (2013); Mapping of manganese potential areas using ASTER satellite data in parts of Sultanate of Oman (arsgiso). International Journal of Geosciences and Geomatics, Vol. 1, Issue 2, 2013, ISSN:2052-559; p-92.

Mukhopadhyay, S. Kumar A. and Agrawal, R. (2017); Geochemical Mapping in toposheet No. 46J/11 in parts of Jhabua district, Madhya Pradesh Geological Survey of India, Central Region FS: 2016-17.

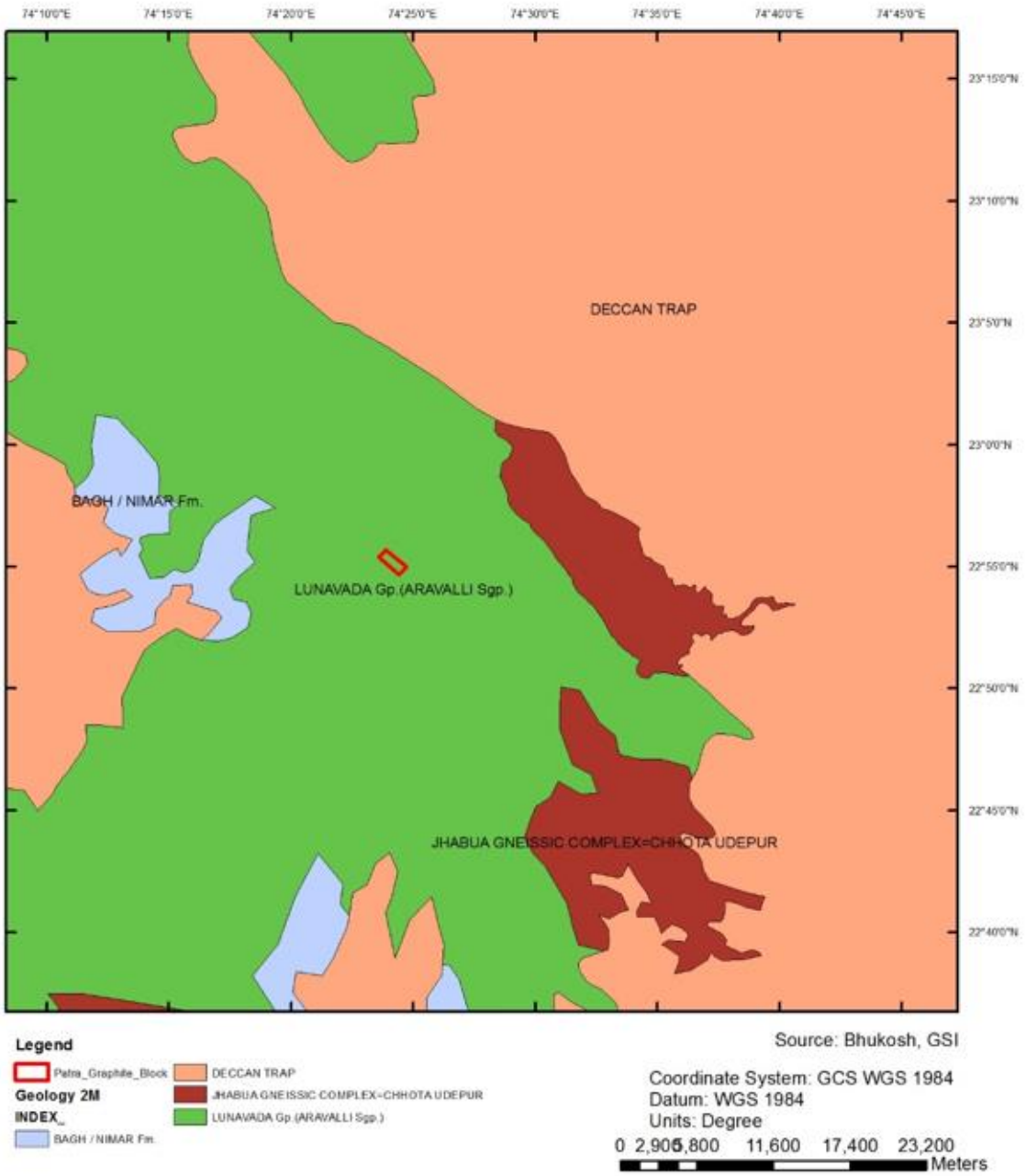
Chintada ,A., Deshmukh ,R. and Singh,K.K.(2017-18):Regional Gravity-Magnetic (G-M) mapping in parts of Toposheet Nos.46I/4, 6, 7, 8 & 46J/1 in Banswara district of Rajasthan and Panchmahal district of Gujarat.

# Annexure


Anx-1
Location Plan
India
Jhabua
Madhya Pradesh
0 0.125 0.25 0.5
Km
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

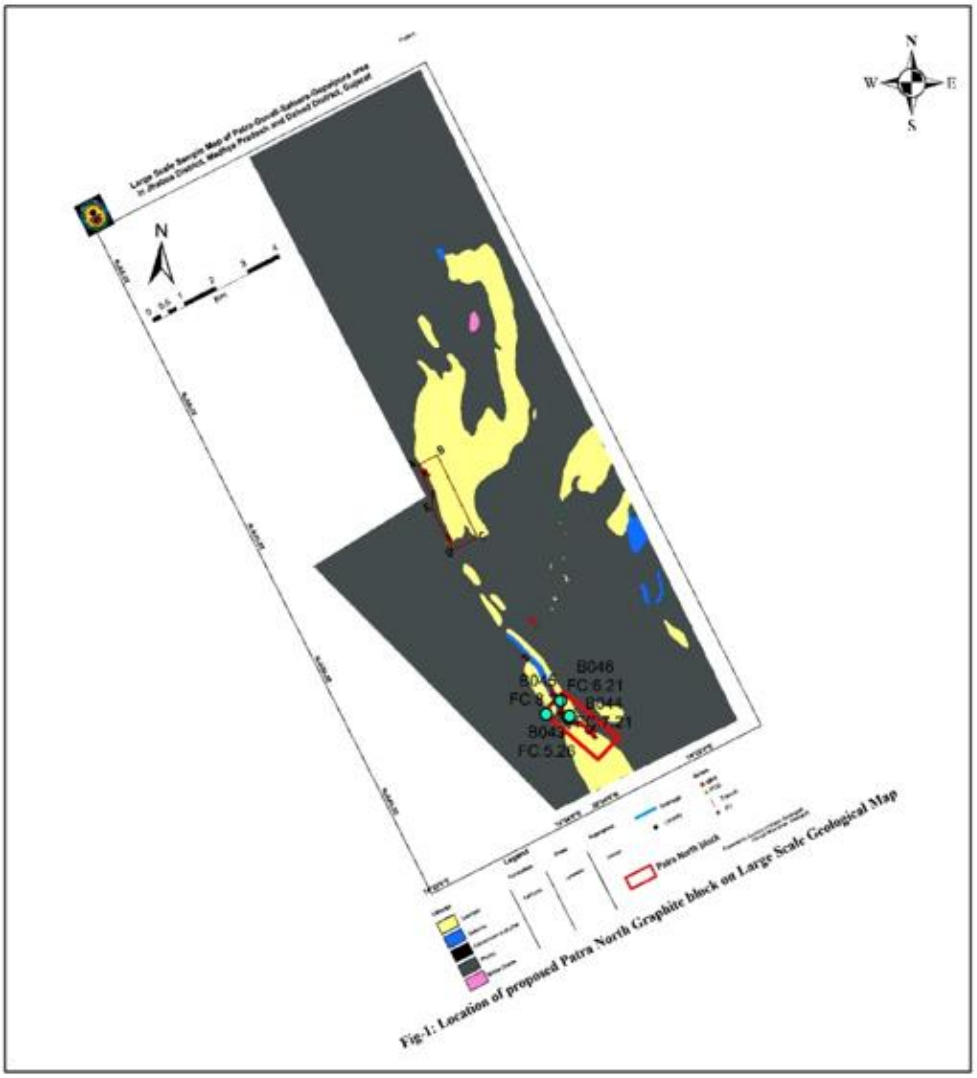
# Anx-2

## Geological Map
## Patra Graphite Block
## Area:- 150 Hect,
## Tehsil:- Meghnagar,
## Dist:- Jhabua, MP.



# Anx-3

## Geological Map & Grab Sample Analysis
## Patra Graphite Block
## Area:- 150 Hect,
## Tehsil:- Meghnagar,
## Dist:- Jhabua, MP.




**Legend**

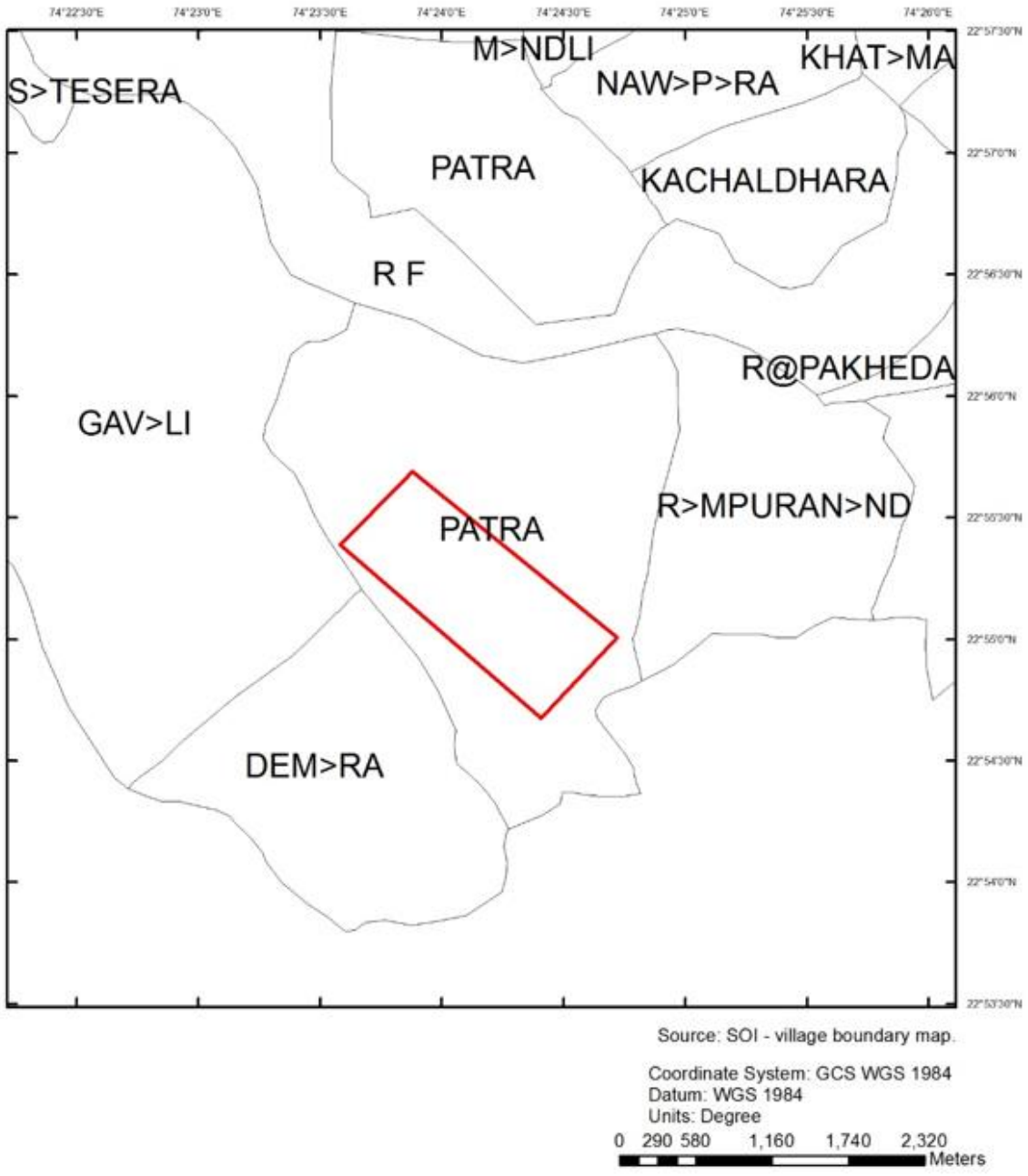
Patra_Graphite_Grab_Samples

Patra_Graphite_Block

0 1,150 2,300 4,600 6,900 9,200
Meters

# Anx-4

## Village Boundary Map
## Patra Graphite Block
## Area:- 150 Hect,
## Tehsil:- Meghnagar,
## Dist:- Jhabua, MP.

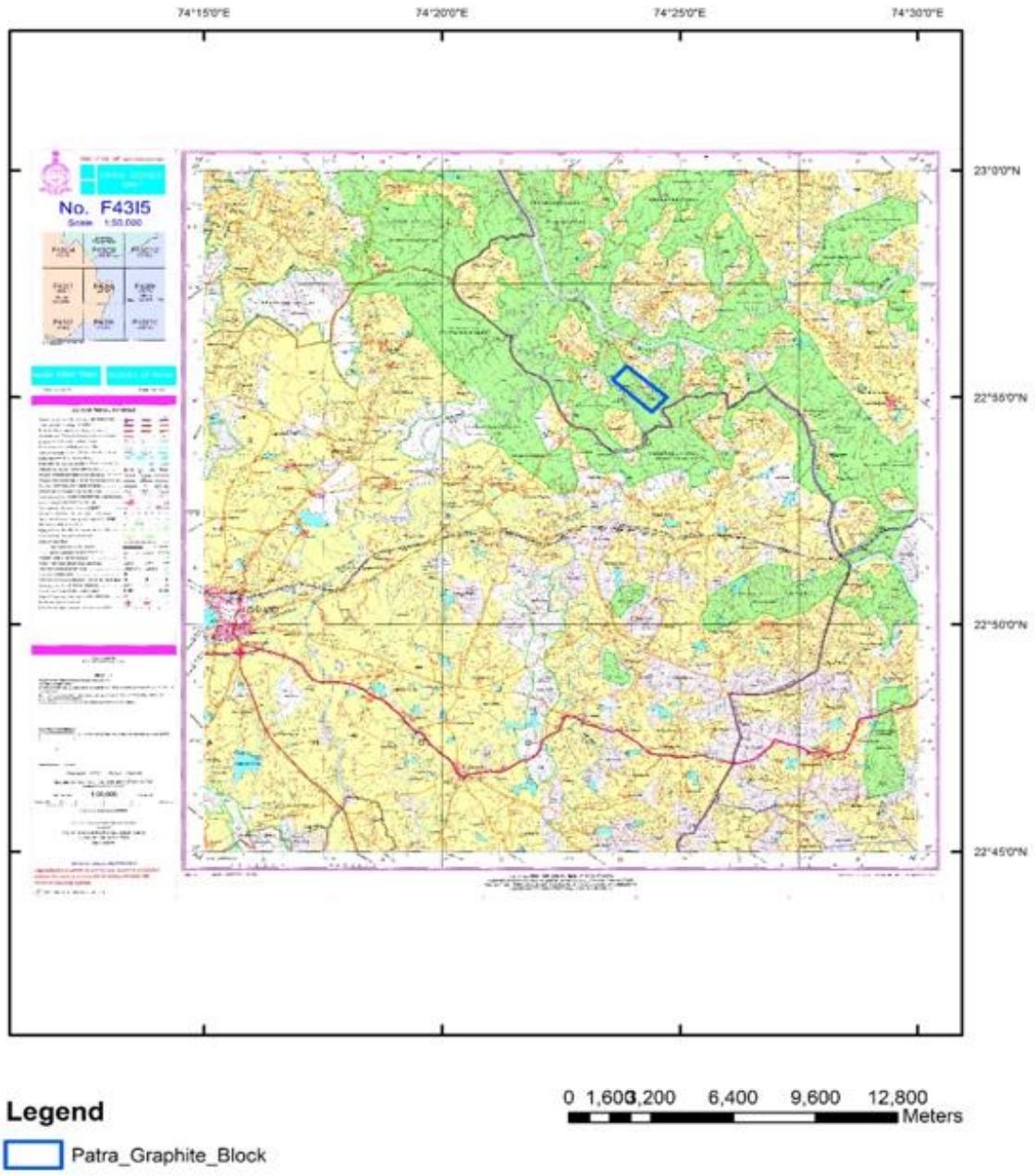


# Anx-5

| POINT ID | LATITUDE | | | LONGITUDE | | |
|---|---|---|---|---|---|---|
| ID | D | M | S | D | M | S |
| A | 22 | 55 | 41.430 | 74 | 23 | 52.690 |
| B | 22 | 55 | 0.330 | 74 | 24 | 43.280 |
| C | 22 | 54 | 40.530 | 74 | 24 | 24.460 |
| D | 22 | 55 | 23.290 | 74 | 23 | 34.920 |

# Anx-6

## Toposheet Map (46 J/05)
## Patra Graphite Block
## Area:- 150 Hect,
## Tehsil:- Meghnagar,
## Dist:- Jhabua, MP.



# Anx-7

| Spot sample result in Patra Block | | | |
|---|---|---|---|
| **Sl no** | **Lat** | **Long** | **FC %** |
| B042 | 22.92144 | 74.39871 | 6.26 |
| B043 | 22.92189 | 74.39939 | 5.26 |
| B044 | 22.9221 | 74.39962 | 7.21 |
| B045 | 22.92261 | 74.39738 | 8.21 |
| B046 | 22.92261 | 74.39744 | 6.21 |

# Anx-8

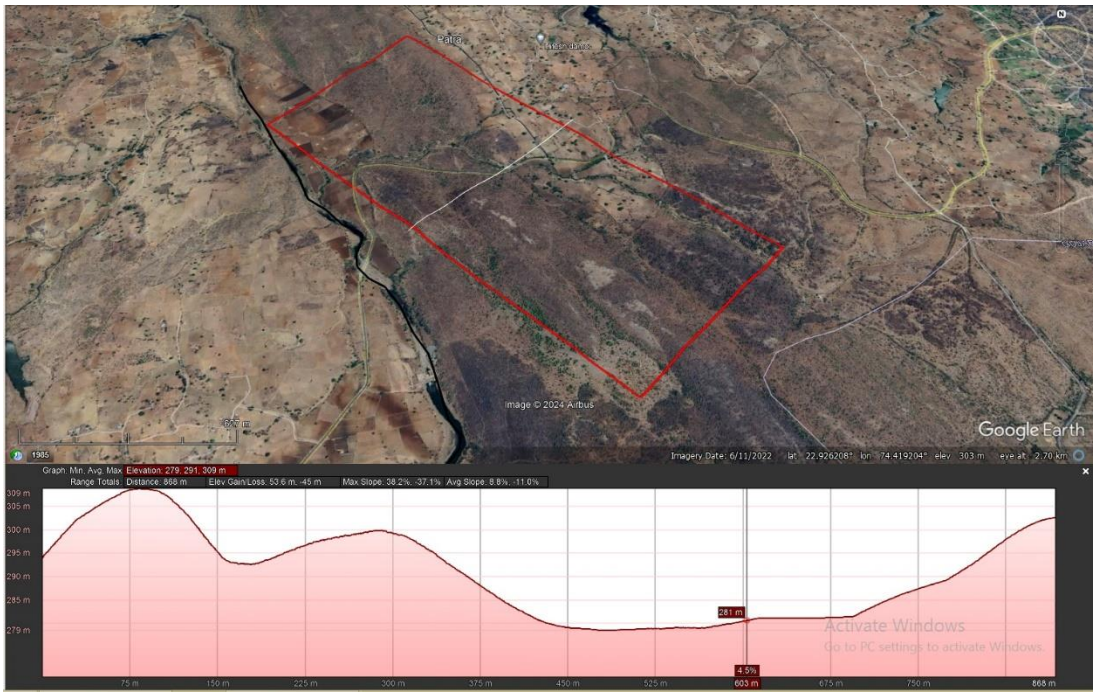


Image © 2024 Airbus
Google Earth
Graph: Min, Avg, Max Elevation: 279, 291, 309 m
Range Totals: Distance: 868 m Elev Gain/Loss: 53.6 m, -45 m Max Slope: 38.2%, -37.1% Avg Slope: 8.8%, -11.0%
281 m
4.5%
603 m
868 m
Activate Windows
Go to PC settings to activate Windows.

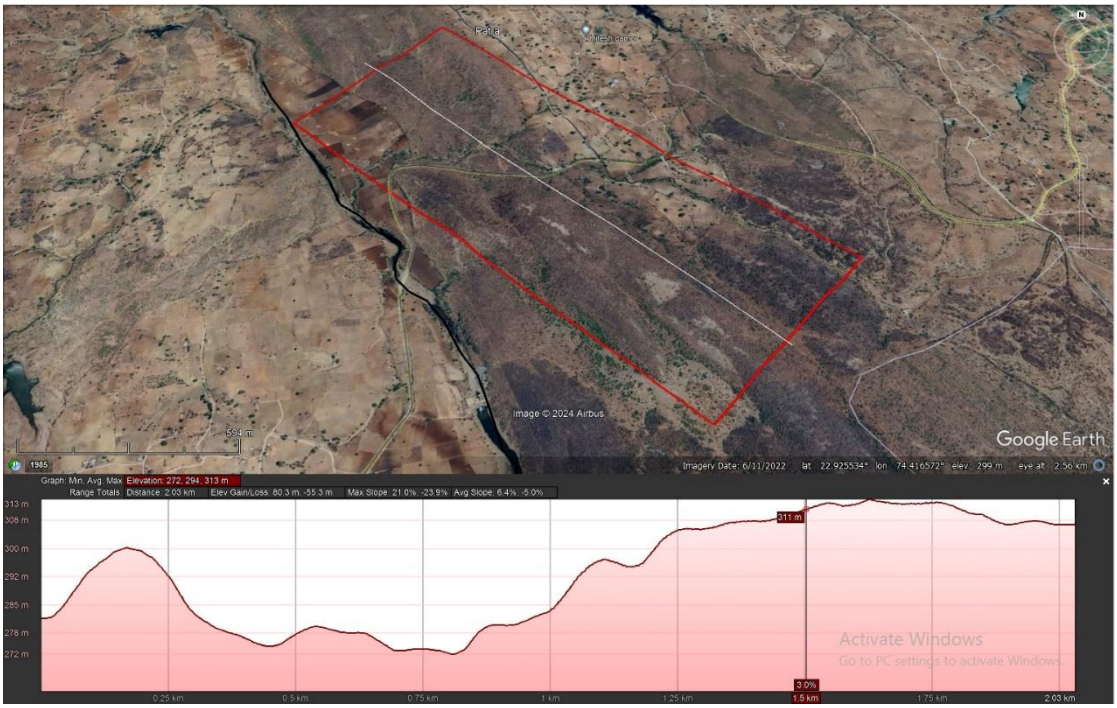
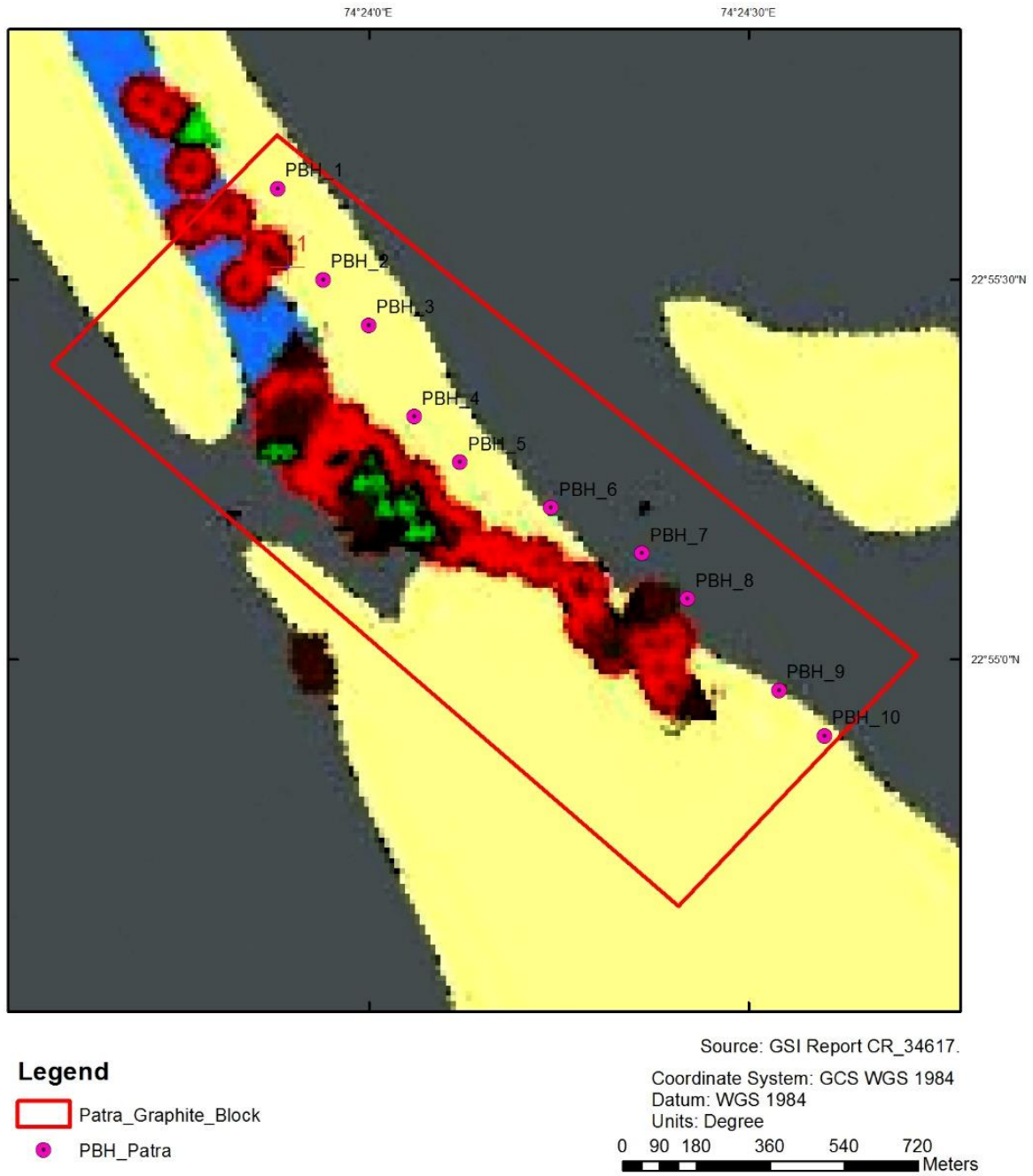


Image © 2024 Airbus
Google Earth
Graph: Min, Avg, Max Elevation: 272, 294, 313 m
Range Totals: Distance: 2.03 km Elev Gain/Loss: 80.3 m, -55.3 m Max Slope: 21.0%, -23.9% Avg Slope: 6.4%, -5.0%
311 m
3.0%
1.5 km
2.03 km
Activate Windows
Go to PC settings to activate Windows.

# Anx-9

## Proposed Bore Hole Plan
## Patra Graphite Block
## Area:- 150 Hect,
## Tehsil:- Meghnagar,
## Dist:- Jhabua, MP.



# Anx-10

Time Schedule (in month) for exploration program

| Sr No | Activities | Unit | Months | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 1 | Camp Mobilization & Setting | Months | | | | | | | | | | | | | | | | | | |
| 2 | Geological & Topographical Survey Work | Months | | | | | | | | | | | | | | | | | | |
| 3 | Pitting & Trenching | Months | | | | | | | | | | | | | | | | | | |
| 4 | Core Drilling, Core Logging, | Months | | | | | | | | | | | | | | | | | | |
| 5 | Sample Preparation & Analysis | Months | | | | | | Review work | | | | | | | | | | | | |
| 6 | Geological Report | Months | | | | | | | | | | | | | | | | | | |
| 7 | Report Study, enlisting of various modification & Final Copy of the report | Months | | | | | | | | | | | | | | | | | | |

**Note: -**

Commencement of Project may be reworked from the day of exploration area is available with all Statutory Clearance.

Time loss due to monsoon / agricultural activity / forest clearance / local law & order problem(s) may be additional to the above timeline.