Proposal for Pastalaimal Basemetal Block, District Betul, Madhya Pradesh for G_3 Stage Mineral Exploration under NMET

(Basemetal)

By

The MP State Mining Corporation Ltd, Madhya Pradesh

Summary of the Block for G3 stage exploration

	Features	Details
	Block ID	PastalaimalBasemetal Block
	Current Exploration Agency	The MP State Mining Corporation Ltd
	Previous Exploration Agency	Geological Survey of India
	G4 stage Geological Report (Previous stage Geological Report)	GSI Report CR_22551 is attached.
	Commodity	Base metal (Mainly Zn)
	Mineral Belt	Betul Belt
	Completion Period with entire Time schedule to complete the project	24 months
	Objectives	To enhance the exploration level as this block was put twice for auction. This block is annulled by the MP Government.
	Whether the work will be carried out by the proposed agency or through outsourcing and details thereof. Components to be outsourced and name of the outsource agency	Will be carried out by MPSMCL & few components through outsourcing.
	Name/ Number of Geoscientists	02
	Expected Field days (Geology, Geophysics, Surveyor)	29
1.	Location	
	Latitude	Anx-2
	Longitude	Anx-2
	Villages	Pastalamal Ryatwari Somlapur
	Tehsil/ Taluk	Amla
	District	Betul
	State	Madhya Pradesh
2	Area (hectares/ square kilometres)	172.9938 Hect
	Block Area	172.9938 Hect
	Forest Land	Nil
	Government Land Area	N/A
	Private Land Area	N/A
3	Accessibility	
	Nearest Rail Head	Amla (on Nagpur-Delhi broad gauge line of central Railwa)
	Road	NH-69 (Connecting Bhopal-Nagpur via Betul)
	Airport	Nagpur
4	Hydrography	
	Local Surface Drainage Pattern (Channels)	Dendritic
	Rivers/ Streams	Nearest river Bel river
5	Climate	
	Mean Annual Rainfall	1129 mm

	Temperatures (December) (Minimum) Temperatures (June) (Maximum)	15-20^{0}C 37^{0}C
6	Topography	
	Toposheet Number	55K/5
	Morphology of the Area	Moderately Undulating
7	Availability of baseline geoscience data	
	Geological Map (1:50K/ 25K)	Available
	Geochemical Map	Available
	Geophysical Map (Aerogeophysical, Ground geophysical, Regional as well as local scale GP maps)	Bouguer Gravity contour map and magnetic (TF) anomaly contour map are available.
8	Justification for taking up G3 ~~or G2~~ stage mineral exploration	The central part of the Betul Belt encompasses various volcanic hosted massive sulphide (VHMS) type Zn- Pb- Cu prospects/deposits at a number of localities, e.g. Bhawra-Tekra, Bargaon –Tarora, Dehalwara, Banskhapa- Pipariya, Ghisi, Muariya, Jangaldehri, Biskhan, Kehalpur, Koparpani, etc. These Zn- Pb- Cu prospects/deposits were explored by GSI in the past through various stages of surface and subsurface exploration (Dutta, 1985, Dutta et.al., 1992, Shrivastava et.al., 1994, Mahakud, 1993, Mahakud and Raut, 1999, Mahakud et al., 2002,Shrivastava et al, 2001-03, Shrivastava et al. 2009 etc.). The area around Pastalaimal – Ryatwari lies in the central part of Betul Belt and has a similar geological setup as Dehalwara Prospect, which has been explored in the past by Shrivastava et al (2009). The detailed exploration in Dehalwara Block has established a resource of 1.12 million tons with 1.83% Zn, 0.45% Pb, 0.26% Cu besides 8.26 g/t Ag & 22 ppm Cd. The area around Pastalaimal – Ryatwari falls in Survey of India Toposheet No 55 K/5 and lies 4 km south-east of Dehalwara prospect. The geological mapping on 1:5000 scale and soil sampling in 200m x 20m grid in Pastalaimal-Ryatwari –Somalpur area, Betul district, MP by Roy (2009) indicate presence of four different anomalous zones for Zn mineralisation with value more than 1000ppm in soil samples. A copper anomaly zone of 450ppm Cu has also been demarcated just south of Rayatwari village. The favourable host rock for sulphide mineralisation is metamorphosed foliated rhyolite and garnetiferous quartz–biotite schist. The encouraging values of Zn

		in Pastalaimal-Ryatwari –Somalpur area has a similar geological setup as in Dehalwara Prospect. It exposes acid volcanic rocks comprises tuffs, rhyolite and its variants. The rhyolite, in general, is foliated and often pyritiferous and gahnite bearing. The other rock types comprise of garnetiferous quartz–biotite schist, Staurolite-garnet quartz-biotite schist and anthophyllite-tremolite-actinolite bearing rock assemblage. Since, all these anomalies are surface geochemical anomalies, which does not show exact nature/ dimension of ore bodies, it has to be explored through drilling. This is one of the annulled blocks & JWG has recommended for further enhancing the exploration level so that the block can be auctioned. This block was already explored by GSI, so presence of mineral is already confirmed. Drilling will enhance the level of exploration level.

1. Block Summary

REGIONAL GEOLOGY:

Betul belt is an ENE-WSW trending, about 135km long by 20 km wide Proterozoic inlier belonging to the Central Indian Tectonic Zone (CITZ). It extends from Chicholi, Betul District (T.S.No: 55 F/12) in the west to parts of Chhindwara District (T.S.No: 55 K/9) in the west. It lies between the Mahakoshal Group in the north and Sauser Group of rocks in the south. The Betul Belt is overlain by cover sediments of the Gondwana Supergroup in the western and northern sides while by Deccan traps in eastern and southern sides. A generalized stratigraphic sequence of the Betul Belt (After Mahakud, 1993) is as follows:

Generalized stratigraphic sequence of the Betul Belt (After Mahakud, 1993)

Cretaceous	Deccan Trap	Basalt flows
Permo-Carboniferous	Gondwana Supergroup	Lower and upper Gondwana rocks
	{Younger metasediments	Phyllites, quartz-mica schist.
Middle Proterozoic	{Volcano-sedimentary {sequence	{Acidvolcanics,metarhyolite, {tuffs with intercalations of {metasediments(anthophyllite {schist,calcsilicates, garnet + {gahnite + staurolite schist), {Basic volcanics- pillowed {and non pillowed basalt
	{Granitoid complex	Granite gneiss,porphyroblastic gneiss and pegmatoid granite
Early Proterozoic		
	{Older metasediments	Graphite schist marble, calc-silicate,tremolite-actinolite schist
	--- Base not seen----	

The Early Proterozoic's older metasediments comprising of graphite schist, calc-silicate, tremolite-actinolite schist are exposed in the western and north-western parts of the Betul Belt around Sonaghati and Chicholi, whereas, the Granitoid complex comprising mainly of granite gneisses are seen around places like Betul, Amla, Morkha. An age of 1550□50Ma (Rb-Sr) is assigned to Morkha granite (Barganje, AMD, Nagpur).The Middle Proterozoic's volcano-sedimentary sequence are mainly confined to the central part of the Betul Belt. Bimodal volcanism here is represented by Acid volcanics such as rhyolites/meta rhyolites, tuffs etc and basic volcanics represented by pillowed and nonpillowed basalts. Impersistent bands of quartz-biotite-muscovite-anthophyllite schist, calcsilicates, garnet-gahnite- staurolite schist, quartz veins, basic dykes also make up the area. The part of the present investigations falls in this area. The younger metasediments comprise phyllites, quartz-mica schist etc and are confined to the north-eastern part the belt around Bhopali, Ranipur, Ghoradongri etc. Mafics and ultramafics such as gabbros, pyroxenites, olivinte, peridotite, serpentinite etc are exposed near Padhar area.

GEOLOGY OF THE AREA:

The detailed map of 4.0 sq.km in 1:5000 RF in and around Pastalaimal-Ryatwari villages exposes mainly the acid part of bimodal volcanics along with other rock types such as garnetiferous-quartz-biot-muscovite schist, staurolite bearing garnet-qtz-biot-schist,calcsilicates, quartz veins etc. (Plate-III).

Rock Types:

The rock types of the area are as follows:

Rhyolite: Rhyolites in the area can be distinguished into two varieties viz., the foliated and massive variety. Foliated rhyolites are predominant in the area. It comprises of quartz, plagioclase, alkali feldspar with accessory hornblende, epidote, biotite, muscovite, sericite and iron oxides. Relict quartz phenocrysts are often present in the form of recrystallised quartz grains set in a finer groundmass. Epidote occurs as aggregates in the groundmass. The groundmass consists of quartz, plagioclase, alkali feldspar, biotite and sericite. The rock shows granoblastic texture with quartz in the groundmass showing triple junction boundaries. The development of foliations in rhyolite is defined by parallel alignment of micaceous minerals along with quartz and feldspar. Massive rhyolite occurs
as lenses within foliated rhyolite. It comprises of quartz (recrystallised at places), plagioclase, perthite, microcline etc. Presence of epidote and zoisite suggests sausaritisation. It is also silicified and often pyritiferous and gahnite bearing. The pyrites have a preferred orientation with their long axes parallel to the crudely developed foliation planes.

Tuffs/volcanoclastics: Tuff of mm size, elliptical to semi-elliptical shaped with quartzofeldspathic composition set in matrix also of quartzo-feldspathic composition) and later metamorphosed and deformed with a development of phyllosilicates minerals and rock is intensely foliated. The presence of bigger sized (of cm size) clasts is noted in the area.
Primary layering in tuffs are found in the northwestern part of the mapped area. Tuffs in this area are often garnetiferous.
Ryatwari village, south of Pastalaimal School and at few other places. The rock grey to brown in colour, hard but often fissile and is composed of quartz, muscovite and biotite with perfect development of schistosity and with development of subidiobastic porphyroblasts of garnet and often biotite. This rock type occurs as thin impersistent lenses of few hundred of meters length.

Mineralisation in form of visible galena and sphalerite is present and hence form the host rock of the area.

Staurolite-garnet-quartz-biotite-schist: It is exposed in a hillock south of Ryatwari village, and the outcrop is in form of a hillock. Appearance of staurolite-andalusite (?) in the garnetiferous-qtz-mus-biot-schist is gradational. Staurolite (occuring from mm size to 6-7cm or more) occurs as porphyroblasts (Fig-5). Minor folds are present in these outcrops. It is a medium grained rock with subidiobastic porphyropblasts of garnet along with a coarse altered porphyropblasts of staurolite which has at present been totally converted into a sericite. The foliation is defined by preferred orientation of phyllosilicates and flattened quartz. The foliation has swerved around the porphyropblasts.

Anthrophyllite-tremolite-actinolite bearing rock: It occurs as minor lensoid patches within the foliated rhyolite rock. This rock is light green in colour, massive, coarse grained and consists of randomly oriented anthophyllite, chlorite, actinolite and tremolite laths. This is an inequigranular rock with medium to coarse, randomly oriented, subidioblastic laths of actinolite and ferroactinolite within a fine grained mass of quartz+ plagioclase+ microcline. The quartz grains exhibit subgrain formation. The actinolites are deformed and folded.

Quartz vein: Quartz veins cutting across the impersistent schist bands as well as tuffs, foliated rhyolites are seen at various places in the area.

Structure:

The most prominent planer geometrical elements that are present in the mapped area are rare primary layering in tuff (Photo-3), and flow banding in acid volcanics. The different other geometrical elements like minor folds, crenulation cleavages, foliation plane, joints etc resulted out of deformational episodes have been identified. The rock of the area has undergone more than one stages of folding with accompanied metamorphism. The So planes (strike N45ºE-S45ºW to N55ºE-S55ºW) are represented in the area by rare primary layering in tuffs and flow banding in acid volcanics in the area. The So planes were folded into first generation folds (F1 folds), which were further refolded into second generation folds (F2 folds). Small close to tight folds with low plunge of 12º to 16º towards N 65º-70ºE belongs to the F2 folds. F1 folds(strike of axial plane N69ºE-S69ºW to N72ºE-S72ºW) are rare and are mostly brought into parallelism with the F2 folds. Strong pervasive foliations (N60□E to N75□E with south easterly dip of 45□to 60□) that control the map pattern and mineralisation of the area are definitely associated with F2 folding.

Metamorphism:

The rocks in the area exhibit different metamorphic assemblages like garnetiferous- quartz-muscovite-biotite schist, staurolite-garnet-quartz-biotite-schist etc.

A lot of porphyroblasts like garnet, staurolite, gahnite, sillimanite, biotite are present. Metamorphic minerals like anthophyllite, actinolite, tremolite, chlorite, and muscovite are also abundant in the area. Shrivastava and Chellani (1994) based on mineral assemblage and textural criteria has expressed greenschist facies retrograde metamorphism from an earlier prograde amphibolite facied metamorphism. Ghosh et.al. (2003), based on textural evidence on garnet-gahnite relations from nearby Koparpani prospect proposed two prograde events with an retrograde event in between. Praveen.etal. (2005) based on mineral assemblages and textural relationship, suggested that the area might have been subjected to middle to upper amphibolite facies regional metamorphism.

Field observations and petrological studies indicate the formation of porphyroblasts like biotite, garnet, gahnite, staurolite, sillimanite etc in basically quartzfeldspar-mica schist rock. Presence of triple junctions in quartz boundaries, granoblastic textures in massive rhyolites as well as recrystallisation in quartz also exhibits metamorphic episodes. The appearance of these and their field relationships indicates that they are gradually increasing in metamorphic grade up to at least lower amphibolite grade.

Whole rock analysis:

Samples from the different assemblage (alteration zones) were collected and crushed to 200 mesh size and then analysed by XRF (PANanalytical MAGIX2424) for major, minor and traces at Central Geochemical Laboratories, Geological Survey Of India, Nagpur (table-). Immobile elements can reflect precursor volcanic rock type and magmatic affinity, and their abundances can be used to estimate mass and volume changes during alteration (Winchester and Floyd, 1977). The Zr/TiO2 vs Nb/Y discrimination diagram (Winchester and Floyd, 1977) values of the rocks of Pastalaimal samples shows dominantly rhyolites to rhyodacite composition with a little scatter which may be attributed to little mobility due to intense hydrothermal alteration.

The Betul Belt forms a narrow conspicuous lithotectonic unit of the Central Indian Tectonic Zone (CITZ) between Mahakoshal in the north and Sausar in the south. It is a ENE-WSW trending 135 km long and 15 km wide linear Proterozoic Inlier surrounded by Gondwanas in the north and west and Deccan Trapin the south and east.

Geologically, the central part of Betul Belt is underlain by bimodal volcano- sedimentary sequence of Banskhapa Formation of Kherli Bazar Group. The sequence is represented by metarhyolite, pillowed / non- pillowed metabasalts, aluminium and magnesium rich altered metarhyolite.

The central part of the Betul Belt encompasses various volcanic hosted massive sulphide (VHMS) type Zn- Pb- Cu prospects/deposits at a number of localities, e.g. Bhanwra-Tekra, Bargaon –Tarora, Dehalwara, Banskhapa- Pipariya, Ghisi, Muariya, Jangaldehri, Biskhan, Kehalpur, Koparpani, etc. These Zn- Pb- Cu prospects/deposits are explored by GSI in the past through various stages of surface and subsurface exploration (Dutta, 1985, Dutta et.al., 1992,Shrivastava et.al., 1994, Mahakud, 1993, Mahakud and Raut, 1999,Mahakud et al., 2002,Shrivastava et al, 2001-03, Shrivastava et al. 2009 etc.).

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The area around Pastalaimal – Ryatwari exposes acid volcanic rocks compriing tuffs, rhyolite and its variants. The rhyolite, in general, is foliated in nature, however, lenses and patches of massive rhyolite, which are often pyritiferous and gahnite bearing are found within foliated rhyolite. The other rock types comprise of garnetiferous quartz–biotite schist, Staurolite-garnet quartz-biotite schist and anthophyllite-tremolite-actinolite bearing rock assemblage.

Roy (2009) carried out geological mapping on 1:5000 scale and soil sampling in 200m x 20m grid in Pastalaimal – Ryatwari - Somlapur areas, Betul district, Madhya Pradesh and reported presence of four anomalous zones for Zinc mineralisation with values exceeding 1000 ppm in geochemical soil samples. The dimension of these zones are i) 300m x 20m. ii) 260m x 60m, iii) 340m x40m and iv) 120m x 20m. Besides, a Cu anomaly zone of 450m x 60m with Cu value of 450 ppm is also demarcated just south of Ryatwari village. It partially overlaps one of the Zn anomaly zone (Zone-ii). These zones occur in a linear fashion. An anomalous zone of 250m x 100 m for Pb with values exceeding 100 ppm is also demarcated. All these geochemical anomalies are depicted by surface soil samples, which does not show exact nature and dimension of the causing ore bodies. Hence, it has to be explored through drilling.

In view of encouraging values of Zn in Pastalaimal – Ryatwari - Somlapur area and having similar geological setup as in Dehalwara prospect, a G-3 stage exploration aided by detailed geological mapping of 1 sq km on 1:2000 scale in the block ABCD (A-21^{0}57’43’’

$78^0 17'04''$, B $21^0 57'50''$, $78^0 17'42''$,C $21^0 57'32''$,$78^0 17'55''$, D $21^0 57'26''$, $78^0 17'16''$) and subsurface exploration by drilling at 100m strike interval to assess the potentiality and depth persistence of surface geochemical anomaly by the subsurface exploration through drilling may be taken up.

2. Previous work

Bhattacharya (1940) first mapped and described the presence of Archaen gneisses and younger trap rocks covering south eastern part of Betul Belt. Dutta et al (1992) carried out regional geochemical survey in and adjoining areas in T.S.No:55 K/5.

Ramchandran and Pal (1992) introduced the term "Kherli Group" for the rocks of this area, which included impersistent bands of the metasediments, meta ultramafics, metabasics and metamorphosed granitic rocks of tonalitic, trondhjemitic, granodioritic, granitic and quartz-monzonite compositions without any evidences of migmatisation.

Geochemical prospecting around Bhawra-Tekra was done by Datta and Akolkar (1986). Mahakud (1993) carried out detailed exploration at Bhawra-Tekra and established 1.58 MT resources of ores with 4.5% Zn.

Shrivastava and Chellani (1994) carried out special thematic mapping near Amla and Kherli Bazar areas (T.S.No: 55 K/5) and brought out the Archean – Proterozoic rocks comprising older metasediments, granite gneisses, greenstone type assemblages including basic-ultrabasic intrusives, acid and basic volcanics with associated metasediments. These rocks are capped by Deccan trap basalt. Betul gneissic complex of the area is classified into older metsedimentaries of Golighat Group and Amla gneisses. Golighat Group of rocks in the area is represented by Kosmi formation which is dominantly an argillaceous sequence comprising quartz mica schist and small intercalatory bands of quartzite and amphibolites. Amla gneisses include unclassified granite gneisses, banded gneisses and injection gneisses with intercalatory bands of tremolite –Actinolite schist and amphibolites in it.

Mahakud and Raut (1999) carried out detailed basemetal exploration at Bargaon-Tarora block, Kehalpur block and Banskhapa-Pipariya block and established reserve of 0.7 MT of ore with 2.26% Zn at Kehalpur. Mahakud et al. (2002) again established 3.12 MT of resource with 2.31% Zn, 0.50% Cu and 45.08 ppm Cd. in Banskhapa-Pipariya block.

S.K. Chakraborthy and A. P. Thapliyal, Suresh A.Chore and L.L.Vishwakarma.. (FS 2000 to 2002) have carried out Specialised thematic mapping on 1 : 25,000 scales (compiled on 1 : 50,000 scale), which led to the establishment of a revised tectono-stratigraphic succession of the Betul belt which is based mainly on the physical continuity of different lithounits and its broad lithologic similarity. The Betul Supracrustal rocks in the mapped area are mainly exposed in three spatially distinct geomorphic domains viz. 1) along prominent and linear ENE-WSW trending sub parallel ridges from Sonaghati (i.e. north of Betul) in the west, 2) along NNE-SSW trending ridge from east of Padhar towards NNE in the east and 3) as undulatory hilly terrain around Muariya and Kherli Bazar in the central part. This hilly terrain is represented by bimodal volcanics and associated tuffaceous horizons hosting Zn-Cu mineralization. Tentatively a four fold lithostratigraphic subdivisions of the Betul supracrustal rocks is proposed on the basis of present study.

The basal sequence of calc-arenite; marble, B.I.F., phyllite, metabasalt and carbonaceous phyllite, best exposed in Ranipur and Bhopali areas is termed as ***"Ranipur Formation".*** This lithoassemblage, earlier shown as "Bhopali Group" as younger metasediments (Chaturvedi, 2001). The migmatitic gneisses occurring as basement to the supracrustals of the Betul Group are termed as ***"Amla Gneiss".*** Unconformable basement: cover relation is observed at several locations and is best exposed in the Machna River sections, NW of Bhadus. In this location the basal calcareous gritty quartzite preserve well developed graded bedding and cross-stratification, suggesting shallow water sedimentation on a sialic crust basement.

The lithounits of the basal "Ranipur Formation" are folded and conformably overlain by the interbanded sequence of micaceous ferruginous quartzite (± magnetite) and quartz-mica schist/ phyllite and is termed as ***"Sonaghati Formation".*** In the central part of Betul Belt around Bargaon, Muariya and Kherli Bazar; bimodal volcanosedimentary lithoassemblage of meta rhyolite and meta basalt with minor intercalations of meta-tuff and metapelite are exposed and is termed as ***"Bargaon Formation".***

Large intrusive body of pyroxenite, gabbro, diorite and foliated mafic-ultramafics, mainly exposed in the northwestern part of Betul Belt has been termed as ***"Padhar Mafic--Ultramafic Suite".*** Several small exposures of gabbro, pyroxenite and hornblendite are also seen within the bimodal lithoassemblage of Bargaon Formation.

Shrivastava et al (2007a) carried out detailed exploration in Muariya Block and established a resource of 1.51 mt with 7.88% of Zn.

Shrivastava et al (2009) carried out detailed exploration in Dehalwara Block and established a resource of 1.12 million tons with 1.83% Zn, 0.45% Pb, 0.26% Cu besides 8.26 gpt Ag & 22 ppm Cd. Base metal mineralization in Dehalwara block is associated with hydrothermally altered and metamorphosed felsic volcanics and volcaniclastic rocks represented by qtz- bio- sericite- muscovite ± chlorite ± garnet ± gahnite ± anthophyllite ± actinolite ± tremolite rock.

Roy (2009) carried out geological mapping on 1:5000 scale and soil sampling in 200m x 20m grid in Pastalaimal – Ryatwari - Somlapur areas, Betul district, Madhya Pradesh and reported presence of four anomalous zones for Zinc mineralisation with values exceeding 1000 ppm in geochemical soil samples. The dimensions of these zones are i) 300m x 20m. ii) 260m x 60m, iii) 340m x40m and iv) 120m x 20m. Besides, a Cu anomaly zone of 450m x 60m with Cu value of 450 ppm is also demarcated just south of Ryatwari village. It partially overlaps one of the Zn anomaly zone. These zones occur in a linear fashion.

Dr. Pradeep kumar T, Lopamudra Bhol, Rekha, P.R, Chhaya Minz and Uttam Chakraborty carried out geochemical mapping in parts of Toposheet No.55K/1 and 55K/5 Betul and Chhindwara district of Madhya Pradesh during FS: 2010-12. During the geochemical mapping more than 55 elements were analysed for their concentration and represented in the form of anomaly contour along with histogram and descriptive statistics. There was no anomalous concentration reported during geochemical mapping.

Details of 1st borehole (B.H. No.MPBP-01)

The first borehole MPBP-01, which was initiated on 17.07.2017 and closed on 19.08.2017 has been logged completely for 110.20m depth. The litho types marked during logging were garnetiferous massive rhyolite and garnetiferous foliated rhyolite, garnetiferous quartz-mica-sericite schist with quartzo-feldspathic veins.

A total of 09 nos. of mineralized zone has been marked in the first borehole where the zones has been demarcated based on visual estimation of 0.5%, 1% , 2% and 3% sulphide concentration. The sulphides include pyrite, sphalerite and occasional chalcopyrite. Two types of sphalerite mineralization have been marked in the borehole. From the depth of 66.10m to 75 m, the sphalerite occurs as concentrated circular, semicircular and elongated masses. At other places, sphalerite occurs in disseminated form. The details of mineralized zones summarized litholog and borehole cross section of 1st borehole MPBP-01 is given below.

Mineralised zones with sulphides (Pyrite, sphalerite and occassional chalcopyrite)

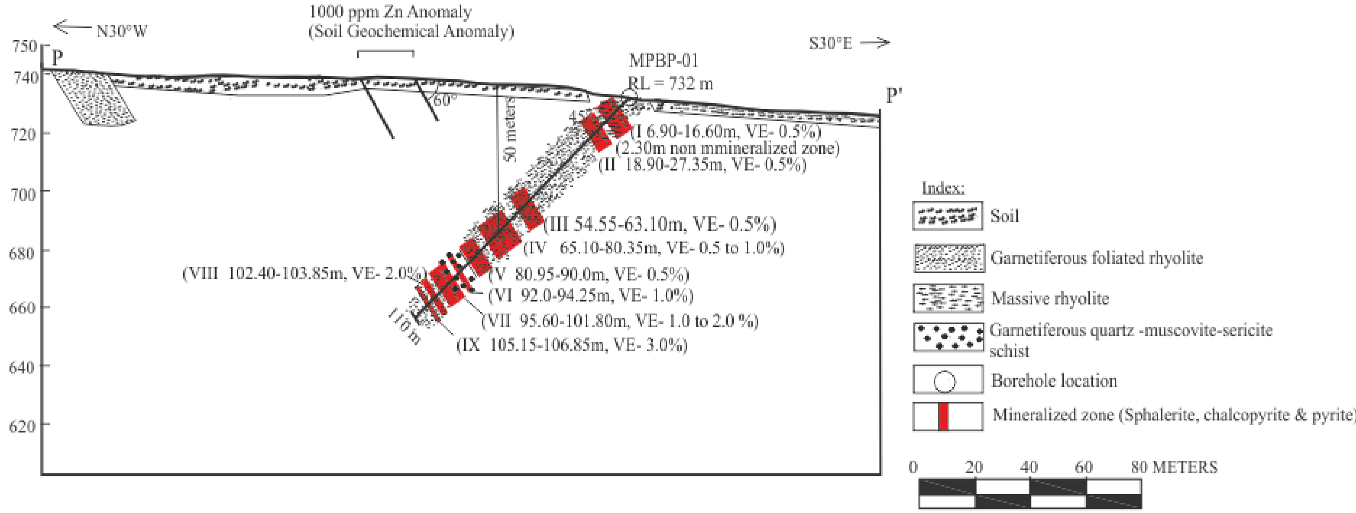
Range	Widh	Description
06.90m-16.60m	9.7m	Crudely foliated garnetiferous rhyolite and garnetiferous massive rhyolite with visual estimate (VE) of **0.5% sulphide mineralisation mainly pyrite and chalcopyrite.**
18.90m-27.35m	8.45m	Crudely foliated garnetiferous rhyolite with VE of **0.5 % sulphide mineralisation mainly pyrite and chalcopyrite**
54.55m-63.10m	8.55m	Crudely foliated garnetiferous rhyolite with VE of **0.5% sulphide mineralisation mainly pyrite, chalcopyrite and sphalerite.**
65.10m - 80.35m	15.25m	Crudely foliated garnetiferous rhyolite with VE of 0.5 to 1.0**% sulphide mineralisation mainly sphalerite and rare chalcopyrite. The sphalerite mineralisation occur in circular, semicircular or elongated concentrated masses in first 9.9m and the same mineralisation is marked in disseminated form from 75m to 80.35m (5.35m).**
80.95m-90.00m	9.05m	Crudely foliated garnetiferous rhyolite and garnetiferous quartz-muscovite -biotite –sericite schist with VE of **0.5% sulphide mineralisation mainly pyrite, chalcopyrite and sphalerite.**
92.00m-94.25m	2.25m	Garnetiferous quartz-muscovite -sericite schist with **1.0% sulphide mineralisation mainly sphalerite and chalcopyrite**
95.60m-101.80m	6.20m	Crudely foliated garnetiferous rhyolite with VE of **1.0 to 2.0% sulphide mineralisation mainly sphalerite and chalcopyrite.**
102.40m-103.85m	1.45m	Crudely foliated rhyolite with VE of **2.0 % sulphide mineralisation mainly sphalerite and rare chalcopyrite.**

105.15m-106.85m	1.70m	foliated rhyolite with VE of 3**.0 % sulphide mineralisation mainly sphalerite and rare chalcopyrite.**

Summarised lithology of borehole MPBP-01

Range	Width	Discription
0.00m to 11.25m	11.25 m	Garnetiferous crudely foliated rhyolite, dark grey in colour, mesocratic, medium to coarse grained, inequigranular in texture
11.25m – 18.90m	7.65 m	Garnetiferous massive rhyolite, dark grey in colour, mesocratic, medium to coarse grained, inequigranular in texture
18.90m– 83.00m	64.10 m	Garnetiferous crudely foliated rhyolite, dark grey in colour, mesocratic, medium to coarse grained, inequigranular in texture
83.00 m– 94.70m	11.70 m	Garnetiferous quartz- muscovite-sericite schist, medium grained, mesocratic, inequigranular in texture.
94.70m – 101.80m	7.10 m	Garnetiferous crudely foliated rholite, dark grey in color, mesocratic, medium to coarse grained, inequigranular in texture
101.80m-103.85m	2.05 m	Garnetiferous crudely foliated rholite, dark grey in color, mesocratic, medium to coarse grained, inequigranular in texture. Patches of alteration as also been marked.
103.85m – 110.20m	6.35 m	Garnetiferous crudely foliated rholite, dark grey in color, mesocratic, medium to coarse grained, inequigranular in texture. Patches of alteration as also been marked.

BOREHOLE CROSS SECTION OF BH NO. MPBP-01 PASTALAIMAL - RYATWARI AREA, BETUL DISTRICT MADHYA PRADESH



Details of 2nd borehole (B.H. No.MPBP-03)

The first borehole MPBP-01, which was initiated on 06.09.2017 and closed on 22.10.2017 and drilled up to 110.25 m depth. The litho types marked during logging were garnetiferous massive rhyolite and garnetiferous foliated rhyolite and garnetiferous quartz-muscovite-biotite schist.

A total of 02nos. of mineralized zone has been marked in the second borehole where the zones has been demarcated based on visual estimation of 0.5% to 1% sulphide concentration. The sulphides include pyrite, sphalerite and occasional chalcopyrite. The sphalerite occurs both as concentrated circular, semicircular and elongated mass and disseminated fashion. A total of 16 nos. of core samples have been generated and are under preparation for chemical analysis. The details of mineralized zones summarized litholog and borehole cross section of 2nd borehole MPBP-03 is given below.

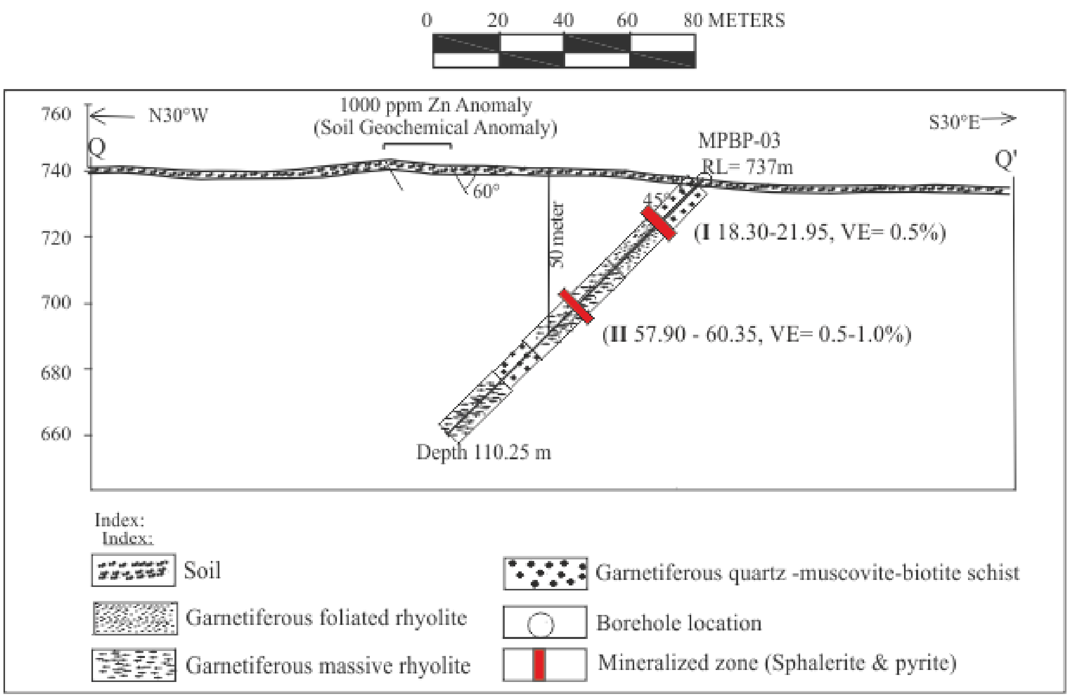
Details of mineralized zones of borehole MPBP-03.

Range	Widh	Description
18.30m-21.95m	3.65m	Crudely foliated garnetiferous rhyolite with VE of 0.5 sulphide mineralisation (mainly sphalerite and pyrite). The sphalerite mineralisation occurs along the fractures and cracks and in the form of stringers.
57.90m-60.35m	2.45m	Garrnetiferous massive rhyolite with visual estimation of 0.5 to 1.0 % mineralisation. Mineralisation occurs in circular, semicircular or elongated concentrated masses and rarely in disseminated form.

Details of litholog of borehole MPBP-03.

Range	Width	Discription
0.00m to 2.45m	2.45 m	Soil, dark grey in color, rich in micacious fragments having rock fragments of garnetiferous quartz-muscovite – biotite schist.
2.45m – 18.30m	15.85 m	Garnetiferous quartz muscovite –muscovite – biotite schist, mesocratic, inequigranular texture rich in quartz, muscovite, biotite and garnet as essential minerals, medium to coarse grained. Rare specs of sulphide
18.30m– 35.00m	16.70 m	Garnetiferous foliated rhyolite, dark grey in colour, mesocratic, medium to coarse grained, inequigranular in texture. Sphalerite and pyrite mineralisation has been marked.
35.00m-75.50m	40.50m	Garnetiferous massive rhyolite, dark grey in colour, mesocratic, medium to coarse grained, inequigranular in texture. Sphalerite and pyrite mineralisation has been marked.
75.50m-86.40m	10.9m	Garnetiferous quartz muscovite –muscovite – biotite schist, mesocratic, inequigranular texture rich in quartz, muscovite, biotite and garnet as essential minerals, medium to coarse grained. Rare specs of sulphide
86.40m-110.25m	23.85m	Garnetiferous massive rhyolite, dark grey in colour, mesocratic, medium to coarse grained, inequigranular in texture. Sphalerite and pyrite mineralisation has been marked in patches (<0.5%).

BOREHOLE CROSS SECTION OF BH NO. MPBP-03, PASTALAIMAL - RYATWARI AREA, BETUL DISTRICT MADHYA PRADESH



Detailed Mapping

Detailed mapping has been carried out

Summary

(i) Detailed Mapping has been carried out on 1:2000 scale.
(ii) A total of 220.45m drilling has been carried out in two boreholes. The 1st borehole MPBP-01, closed at a depth of 110.20m and 2nd borehole MPBP-02 closed at a depth of 110.25
(iii) Geophysical borehole logging has been completed in both the boreholes.
(iv) A total of 141 core samples are under preparation from 1st and 2nd boreholes.
(v) A total of 07 nos of petrological samples and 07 nos. of bedrock chip samples have been collected.

Nature of work	**Target for FS 2017-18**	**ACHIEVEMENTS**			
		Till August 2017	**Sept. 2017**	**Oct-17** (till 31.10.2017)	**Total for the FS 2017-18 (as on 31.10.2017)**
I. Geological Survey					
(a) DM (1:2000)	1.0 sq km	Nil	0.15 km^2	-	0.15 km^2
II . Technological Survey					
(b) Surface Exploration					
(i) PT	50 cu m	Nil	-	-	Nil
(c) Sub surface Exploration					
(i) Drilling	1000 m	110.20m	35.85m	74.40m	220.45m
(ii) BH logging	1000m	80m	30.20m	110.25m	220.45m
III. Geophysical Survey					
(a) GP:Survey (IP, SP, Magnetic, Resistivity)	5 L km (1 sq. km)	Nil	**-**	-	Nil
(b) GP BH LOG	As necessary	107.05m	-	108.43m	215.48m
IV.SMPL					
(a) PTS	50 Nos	Nil	-	-	Nil
(b) Core Samples (10% check analysis)	300 Nos	Nil	60 nos	81nos	141
(c) PS	20 Nos	02 nos	05 nos	-	07 nos
(d) PCS	15 Nos	Nil	-	-	Nil
(e) BRS/Chip sampling	50 Nos	02 nos	05 nos	-	07 nos.
(f) SEM-EDX	10 Nos	Nil	-	-	Nil

(g) EPMA#	05 Nos.	Nil	-	-	Nil
V. Chemical analysis					
(a) Core samples (Cu, Pb, Zn, Cd, Au, Ag)	300 Nos	Nil	-	-	Nil
(b) PTS (Cu, Pb, Zn, Cd, Au, Ag)	50 Nos	Nil	-	-	Nil
(c) PCS	15 Nos	Nil	-	-	Nil
(d) BRS (Cu, Pb, Zn, Cd, Au, Ag)	50 Nos	Nil	-	-	Nil
VI, Bulk Density	01 no	Nil	-	-	Nil

3. Block description

The Pastalaimal-Ryatwari block is situated in Betul district of Madhya Pradesh and falling under toposheet No.55K/5. The co-ordinates of corner points of block are as follows:

BP_ID	x	y
A	21° 57' 52.728" N	78° 16' 57.656" E
B	21° 58' 9.089" N	78° 17' 46.128" E
C	21° 57' 33.181" N	78° 18' 2.575" E
D	21° 57' 16.494" N	78° 17' 13.931" E

4. Planned Methodology

Remote sensing studies:

Remote sensing study will be carried out in order to prepare a composite geological map and to delineate probable mineral prospect zone for zn, Cu & Pb in the block.

The methodology includes digital image processing and interpretation techniques for preparation/updation of lithological, structural and mineral target maps. Different lithological units will be marked by Landsat 8 and LISS-IV image using colour composite, band ratioing and principal component analysis techniques. The satellite image interpretations have been supplemented with field inputs derived through geological and geochemical sampling in the area.

Based on the filter process and image interpretation, a number of lineaments will be identified. The frequency of lineaments direction will be represented as per the rose diagram show structural trend. Based on the study of collateral data, field data vis-à-vis the image characteristics of the existing deposit, the band ratio image will be developed the basis to ascertain the mineralised zones. In order to identify the hydrothermally altered minerals associated with Pb, Zn & Cu from Landsat-8 bands ratio technique will be used. Individual band ratio of Landsat-8. Four probable mineralised zones based on the integrated study of all aspects including 1) Image interpretation, 2) Geological map, 3) lineament map, 4) field data collection, 5) Collateral data and 6) alteration mapping of the study area.

Geophysical Survey:

The geophysical survey will be carried out by using Magnetic, Self Potential, Resistivity and Induced Polarisation methods in a grid pattern covering the area of 173 Hect. The lines will be kept at a spacing of 100 m with 50 m station interval. A total of 440 stations will be used for recording magnetic and gradient SP values with 114 stations. The total coverage of IP and resistivity profiling survey will be around 20 lkm with 5.2 lkm

Recorded magnetic data will be corrected for diurnal variation of geomagnetic field with respect to the base where data will be recorded at the start and end of everyday field work. Similarly, gradient SP data recorded was corrected using loop method and the total potential with respect to a particular base will be calculated.

Channel Sampling, Topographic Survey, Exploratory Drilling, Core Logging, Core Sampling, Chemical Analysis of Primary Samples, Composite Samples, Petrological Studies, Mineragraphic Studies and Specific Gravity Determination of drill core samples, X-Ray Diffraction Studies, Spectroscopic Studies and Mineralised Zone intersected in Boreholes will be carried out.

5. Nature Quantum and Target

Nature of work	Target	Already Carried out During FS 2017-18	Present Target
I. Geological Survey			
(a) DM (1:2000)	173 Hect	15	173
II . Technological Survey			
(b) Surface Exploration			
(i) PT (m3)	50 cu m	Nil	50
(c) Sub surface Exploration			
(i) Drilling (m)	1440	220.45	1220
No of BH	12		
Depth	120		
(ii) BH logging	1440	220.45	1220
III. Geophysical Survey			
(a) GP:Survey (IP, SP, Magnetic, Resistivity)	14300	Nil	14300
	173 Hect		
(b) GP BH LOG	As necessary	215.48m	1220
IV.SMPL			10
PTS	5	Nil	5
(b) Core Samples (10% check analysis)	123	141	123
(c) PS	22	07 nos	15
(d) PCS	15	Nil	15
(e) BRS/Chip sampling	50	07 nos.	50
(f) SEM-EDX	15	Nil	15
(g) EPMA#	15	Nil	15
V. Chemical analysis			
(a) Core samples (Cu, Pb, Zn, Cd, Au, Ag)	1220	Nil	1220
(b) PTS (Cu, Pb, Zn, Cd, Au, Ag)	5	Nil	5
(c) PCS	15	Nil	15
(d) BRS (Cu, Pb, Zn, Cd, Au, Ag)	50	Nil	50
VI, Bulk Density	5	Nil	5

6. Exploratory Drilling

A total of 5 more bore holes are proposed in the area with average depth of 120 meters.

The proposed bore hole location plan is given in the attached anx.

7.00 Manpower Deployment

For Geologist	
Area (Sq Km)	1.73
Field Work Days	29
HQ Work Days	20
Labour	58
Core Drilling	
No of Boreholes	5
Drilling Depth	120
Meterage	600
Let 90% be analyzed (Numbers)	570
Pitting & Trenching	
Numbers of pits / Trenching	25
Length (Mts)	1
Breath (Mts)	1
Depth (Mts)	2
Total Volume (M3)	50
Number of Samples & Analysis	
From BH	570
BRS	50
Total Samples	620
Internal Check @ 5%	31
External Check @ 10%	62
Composit Samples @ 10%	62
Total Samples	775
For Preparation	
One Person/ Nos of Samples / Day	2
No of samples	775
Sample Man days	388
Labour	775
Logging	
Logging per day (Mts/Day)	50
Meterage	600
BH Logging	12
Pit / Trench Logging per day (Pits/Day)	2
Number of Pits / Trenches	25
Man days for pit logging	13
Total Logging Man days	26
For HQ Man days	25
Petrological Study	
Mineralogical Study @ 5%	39

S. No.	Item of Work *	Unit *	Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal		Remarks
			SoC-Item No. *	Rates as per SoC * (a)	Qty. (b)	Total Amount (Rs) (a*b)	
Cost Estimate - Pastalaimal Base Metal Block, 173 sq. km, No.of BH: 5, Borehole depth range 120 m; Schedule timeline 24 months Review: After 6 Months]							
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	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher.
	c. Charges for Geologist per day (HQ)	day	1.2b	9,000	20	180,000	
	d. Charges for one Sampler per day (1 Party)	one sampler per day					
	e. Labours (4 Nos)	day					
	Sub Total- A					**540,240**	
B	**Ground Geophysical Survey**						
1	IP. Induced Polarization (I.P) cum Resistivity S.P and Magnetic (30 Lkm)	8-10 Line Km					
3	Geophysicist party days (Field)	per day					
4	c. Labours Charges	day					
5	Geophysicist party days (HQ)	per day					
	Sub Total- B					**-**	
C	**Survey work**						
a	DGPS Survey for BH fixation & RL determination	Per Point of observation	1.6.2	19,200	12	230400	
b	Charges of Surveyor (1 party) for Geophysical survey layout work & Block boundary demarcation	one surveyor per day	1.6.1a	8,300	30	249000	
c	Labours Charges for survey work;	day		504	60	30240	
	Sub-Total C					**509,640**	
D	**Trenching/Pitting**						
	a) Excavation of Trenches	per cu.m	2.1.1	3,330	50	**166500**	
E	**DRILLING (after review)**						
1	Drilling up to 300m (Hard Rock)	m	2.2.1.1b	11,500	600	6,900,000	
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	540	858,600	
	Sub Total E					**7,758,600**	
F	**Borehole Geophysical Logging**	5 Bhs of 350m each	3.12	1,088,941.00	1	**1,088,941**	
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	50	125,300	
	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	5	12,530	
	c. For PGE	Nos					

S. No.	Item of Work *	Unit *	Rates as per NMET SoC 2020-21		Estimated Cost of the Proposal		Remarks
			SoC-Item No. *	Rates as per SoC * (a)	Qty. (b)	Total Amount (Rs) (a*b)	
iii)	**Trench & Check Samples from**						
	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	50	125,300	
	c. For PGE	Nos					
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	5	12,530	
	c. For PGE	Nos					
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	570	4,406,670	
	c. For PGE	Nos					
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	57	440,667	
	c. For PGE	Nos					
2	**Physical & Petrological Studies**						
i	Preparation of thin section	Nos	4.3.1	2,353	20	47,060	
ii	Study of thin section	Nos	4.3.4	4,232	20	84,640	
iii	Preparation of polish section	Nos	4.3.2	1,549	20	30,980	
iv	study of polished section	Nos	4.3.4	4,232	20	84,640	
v	Digital Photographs	Nos	4.3.7	280	40	11,200	
vi	Whole Rock Analysis	Nos					
vii	Sp. Gravity	Nos	4.8.1	1,605	5	8,025	
	SEM Studies	per hour					
viii	EPMA studies	per hour					
						5,389,542	
H	**Total A to G**					**15,453,463**	
I	**Geological Report Preparation**	**5 Hard copies with a soft copy**	**5.2**	**5.2 (i/ii/iii/iv)**		**772,673**	Reimbursement will be made after submission of the final Geological Report in Hard Copies (5 Nos) and the soft copy to NMET.
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		**309,069**	EA will be reimbursed after submission of the Hard Copies and the soft copy of the final proposal along with Maps and Plan as suggested by the TCC-NMET in its meeting while clearing the proposal.
L	**Total Estimated Cost without GST**					**16,565,205**	
M	**Provision for GST (18% of J)**					**2,981,737**	GST will be reimburse as per actual and as per notified prescribed rate
N	**Total Estimated Cost with GST**					**19,546,942**	
					or Say Rs. In Lakhs	**195.47**	

Table-VII.C

S. No.			1	2	3	4	5	6		7	8		9	10	11	12
1	Camp Setting	Months/Days														
2	Geological Mapping & Sampling	days														
5	Pitting/Trenching	cu.m														
6	Surface Drilling (1 rigs)	m														
7	Survey Party days	days														
8	Geologst Man days	days														
9	Sampler Man days	days														
10	Camp Winding	months														
11	Laboratory Studies	Nos.														
12	Report Writing with Peer Review	months														

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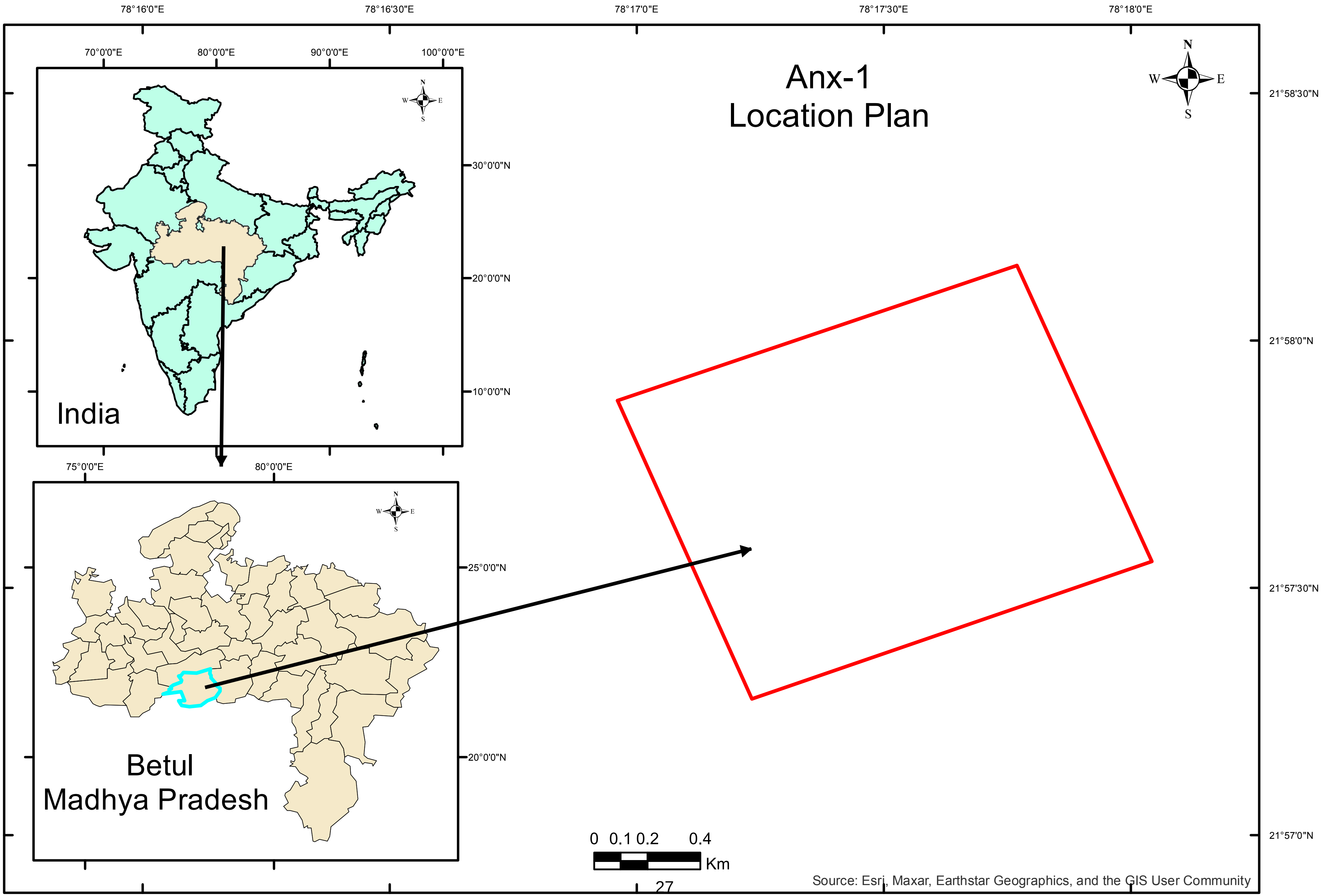
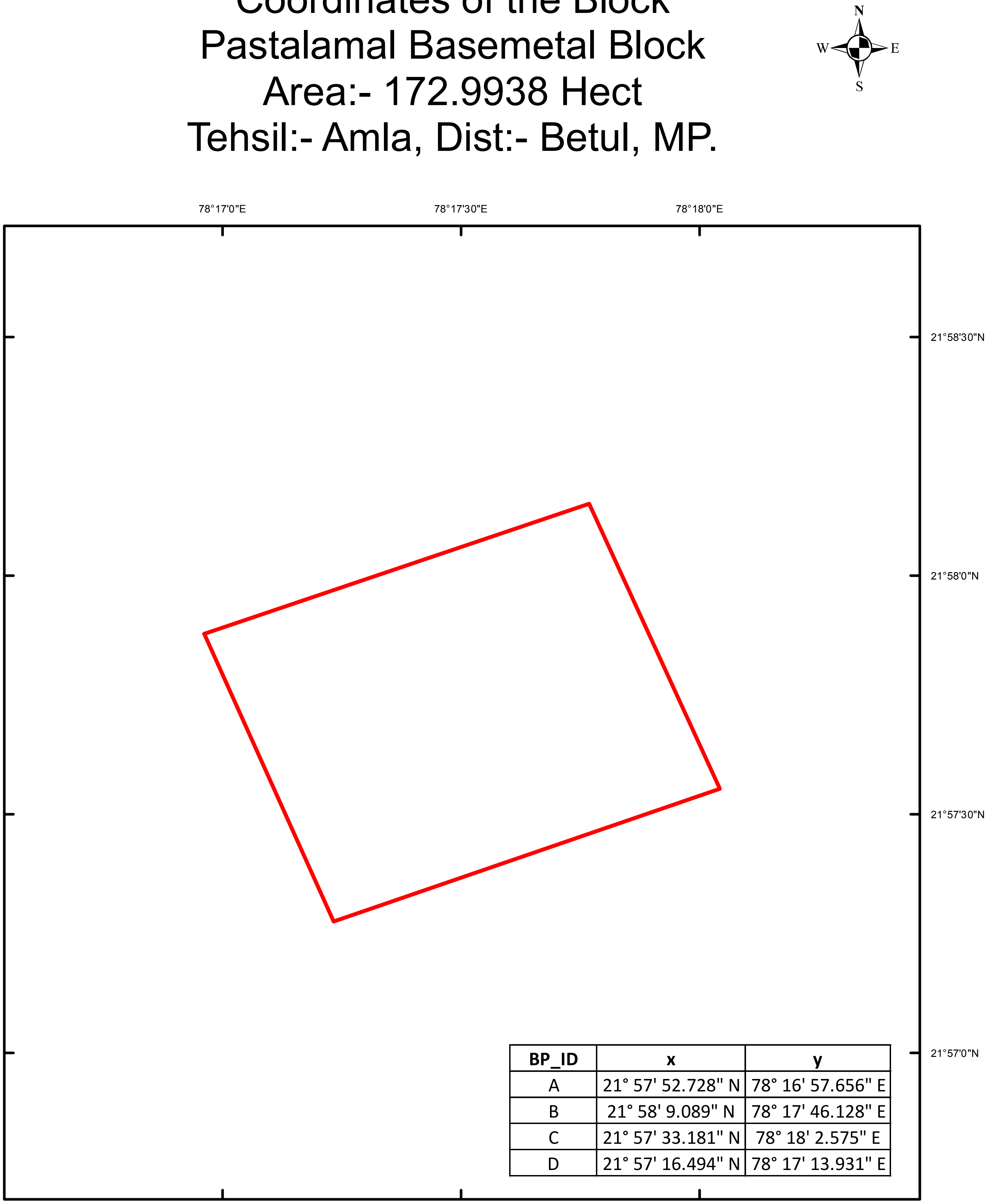

Anx-1
Location Plan
78°16'0"E
78°16'30"E
78°17'0"E
78°17'30"E
78°18'0"E
21°58'30"N
21°58'0"N
21°57'30"N
21°57'0"N
70°0'0"E
80°0'0"E
90°0'0"E
100°0'0"E
30°0'0"N
20°0'0"N
10°0'0"N
India
75°0'0"E
80°0'0"E
25°0'0"N
20°0'0"N
Betul
Madhya Pradesh
N
S
E
W
0 0.1 0.2 0.4
Km
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Coordinates of the Block
Pastalamal Basemetal Block
Area:- 172.9938 Hect
Tehsil:- Amla, Dist:- Betul, MP.



BP_ID	x	y
A	21° 57' 52.728" N	78° 16' 57.656" E
B	21° 58' 9.089" N	78° 17' 46.128" E
C	21° 57' 33.181" N	78° 18' 2.575" E
D	21° 57' 16.494" N	78° 17' 13.931" E

Source:- DGM, Bhopal.

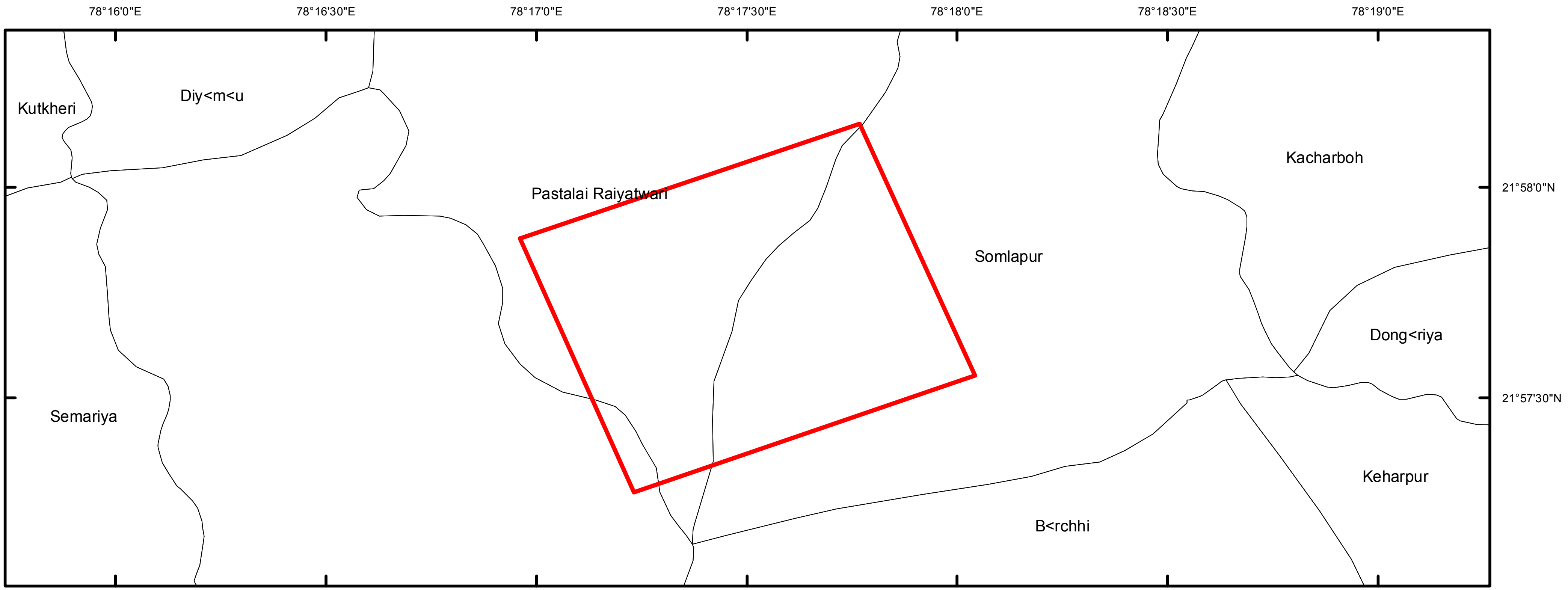
Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

Legend

Pastalaimal_Block

Meters
275137.5 0 275 550 825 1,100

Village Map of the Block
Pastalamal Basemetal Block
Area:- 172.9938 Hect
Tehsil:- Amla, Dist:- Betul, MP.



Legend

Pastalaimal_Block

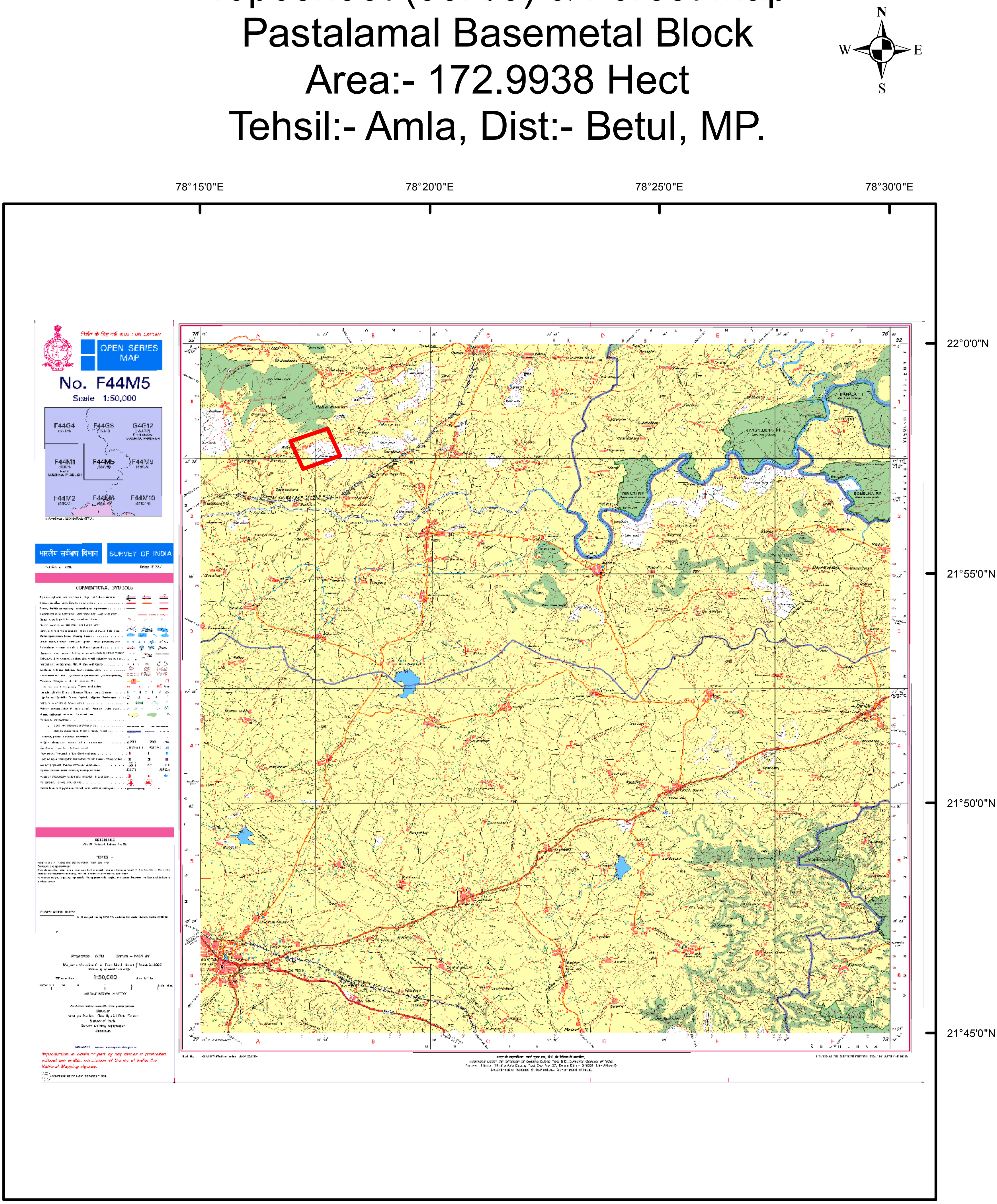
BETUL

Source:- Village Boundary Map from SOI

Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

Meters
340 170 0 340 680 1,020 1,360

Toposheet (55K/5) & Forest Map
Pastalamal Basemetal Block
Area:- 172.9938 Hect
Tehsil:- Amla, Dist:- Betul, MP.



Legend

Pastalaimal_Block

F44M5_55K5.tif

RGB

Red: Band_1

Green: Band_2

Blue: Band_3

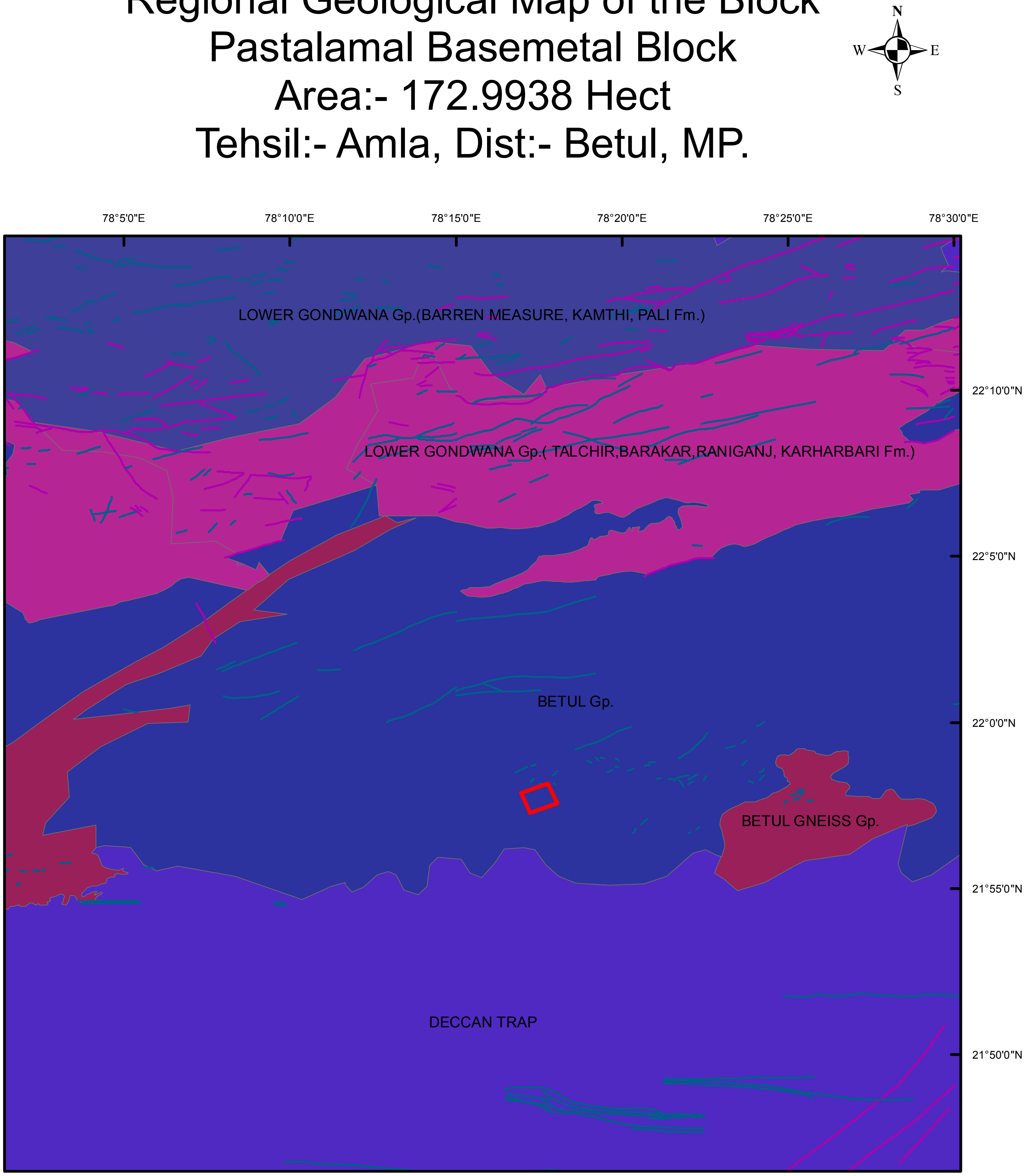
Source:- Toposheet from SOI

Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

Meters

2,800 1,400 0 2,800 5,600 8,400 11,200

Regional Geological Map of the Block
Pastalamal Basemetal Block
Area:- 172.9938 Hect
Tehsil:- Amla, Dist:- Betul, MP.



Source:- Bhukosh,GSI.

Legend

Pastalaimal_Block
Dyke
Fault
Fold

Geology 2M

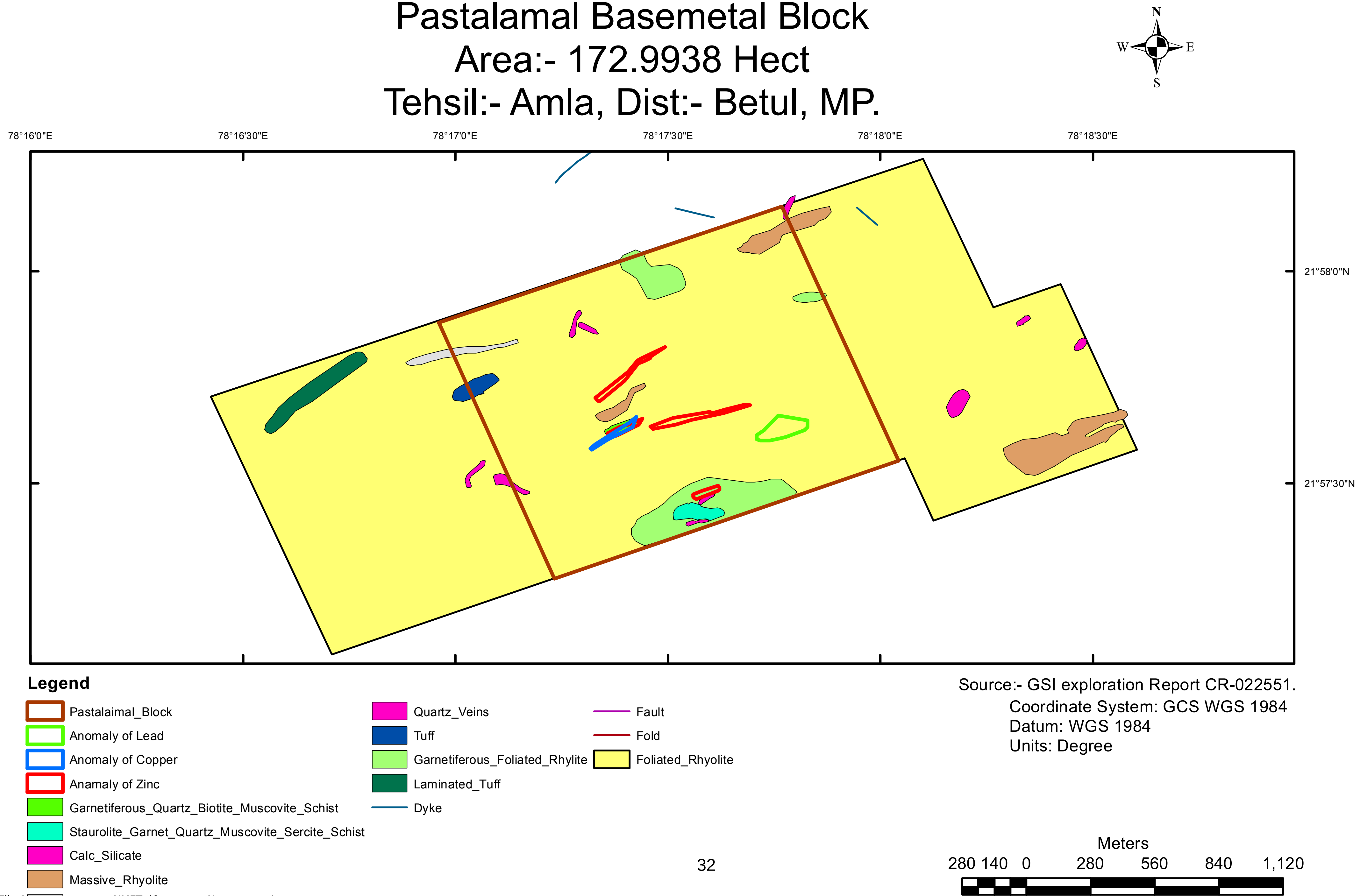
INDEX_

BETUL GNEISS Gp.
BETUL Gp.
DECCAN TRAP
LOWER GONDWANA Gp.(TALCHIR,BARAKAR,RANIGANJ, KARHARBARI Fm.)
LOWER GONDWANA Gp.(BARREN MEASURE, KAMTHI, PALI Fm.)

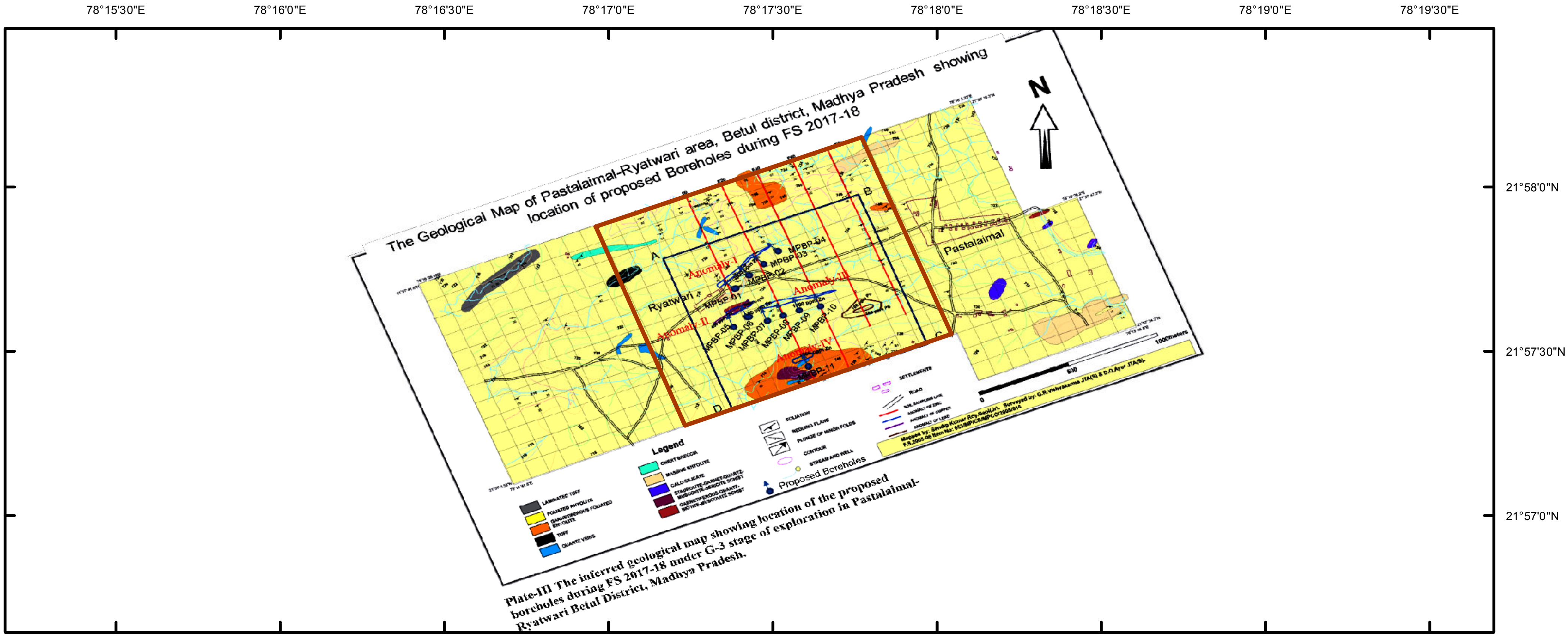
Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

Meters
4,000 2,000 0 4,000 8,000 12,000 16,000

Geological Map of the Block
Pastalamal Basemetal Block
Area:- 172.9938 Hect
Tehsil:- Amla, Dist:- Betul, MP.



Proposed Drilling by GSI (FS 2017-18)
Pastalamal Basemetal Block
Area:- 172.9938 Hect
Tehsil:- Amla, Dist:- Betul, MP.



Legend

Pastalaimal_Block

Pastalamal_BH.tif

RGB

Red: Band_1

Green: Band_2

Blue: Band_3

Source:- GSI exploration Report CR-022551.

Coordinate System: GCS WGS 1984

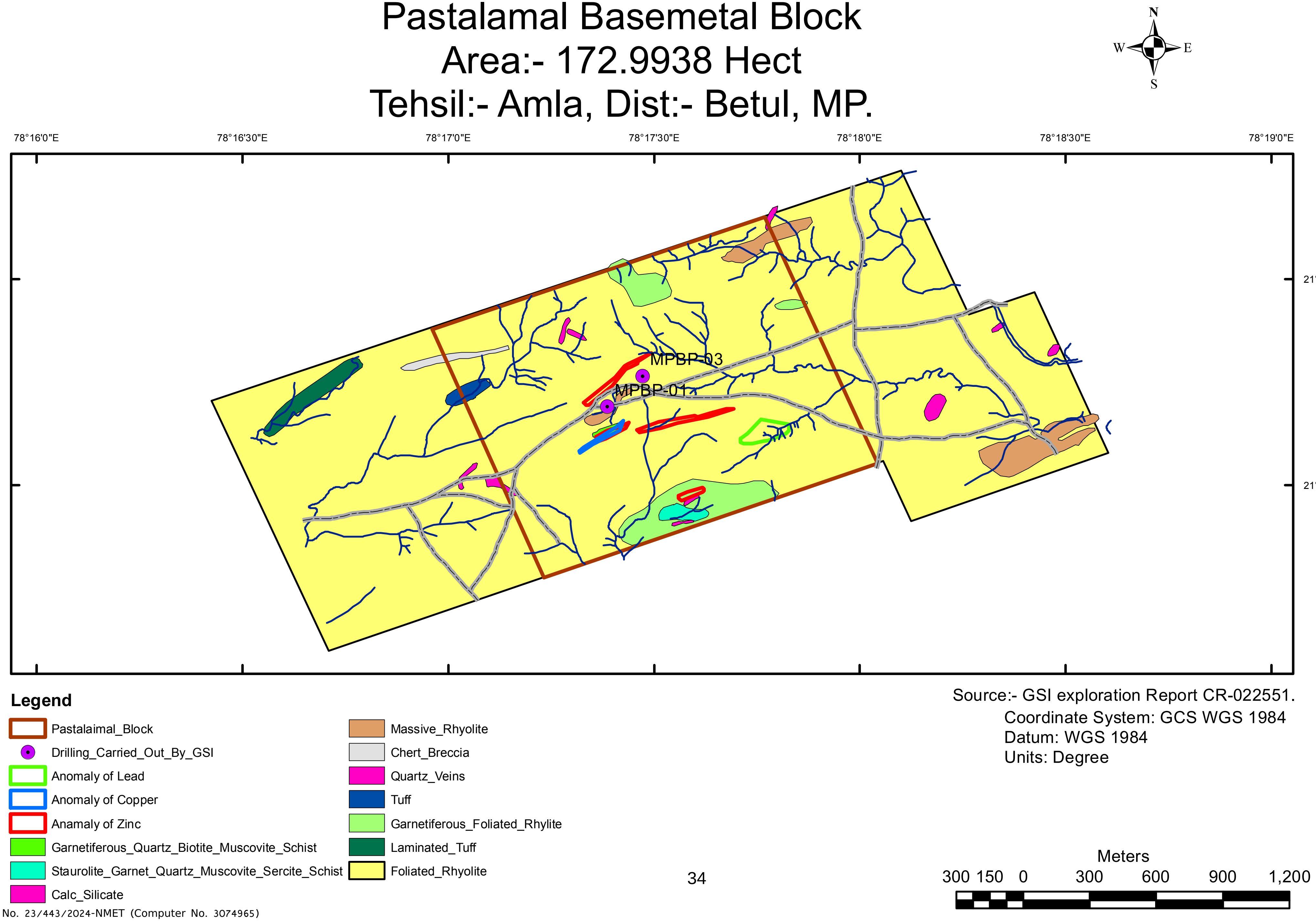
Datum: WGS 1984

Units: Degree

Meters

440 220 0 440 880 1,320 1,760

Drilling Carried out by GSI
Pastalamal Basemetal Block
Area:- 172.9938 Hect
Tehsil:- Amla, Dist:- Betul, MP.

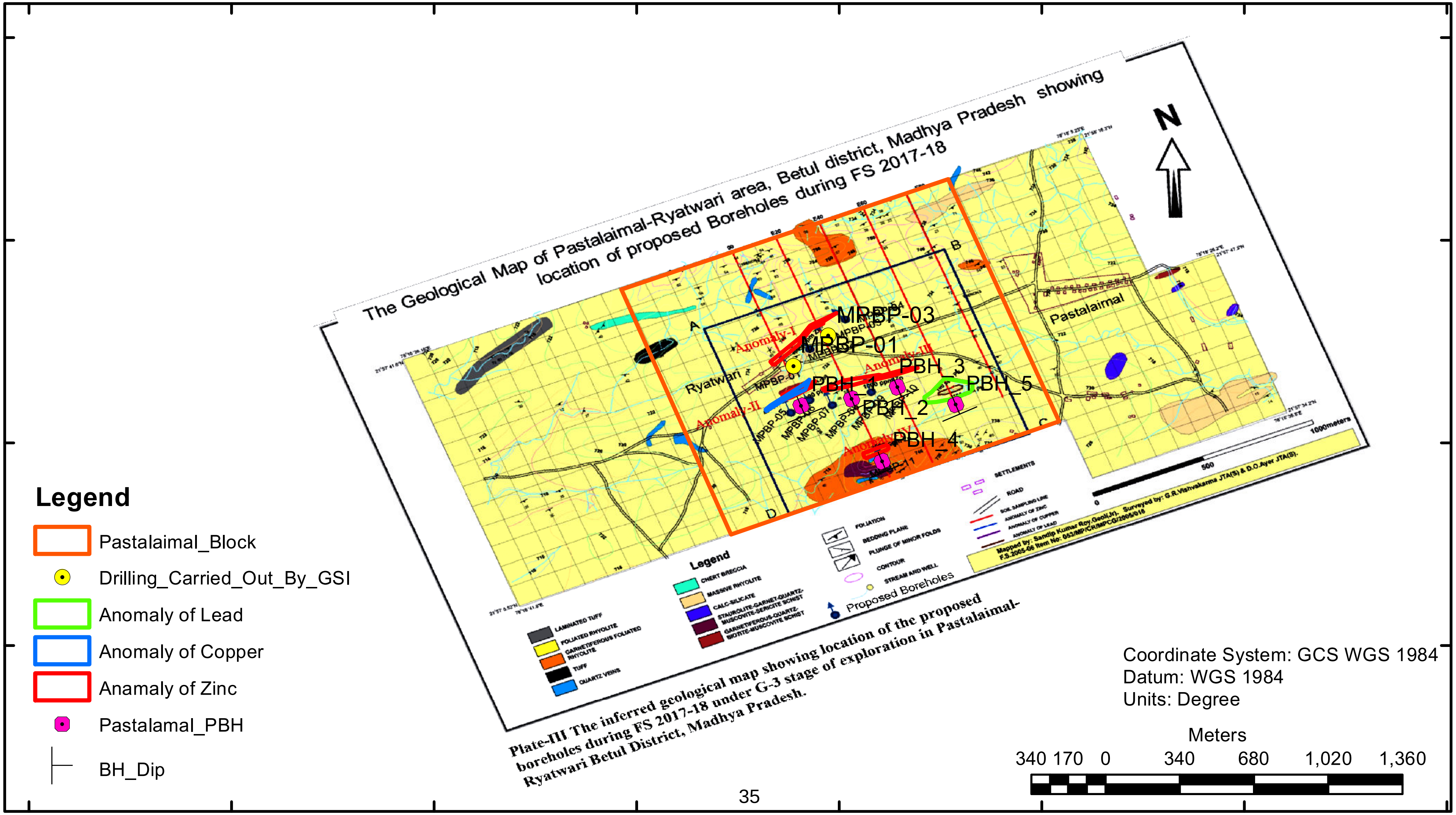


Legend

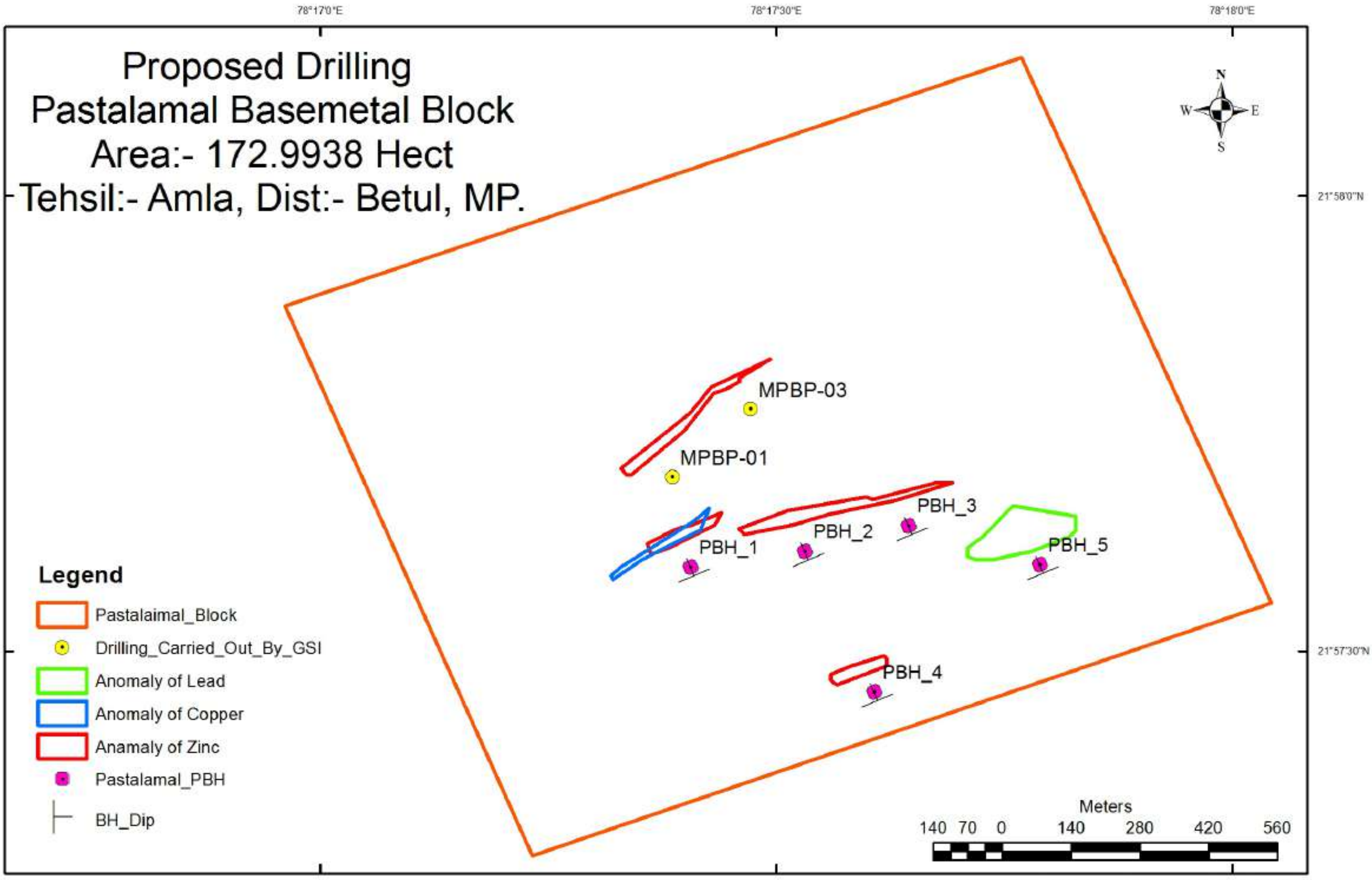
Pastalaimal_Block	Massive_Rhyolite
Drilling_Carried_Out_By_GSI	Chert_Breccia
Anomaly of Lead	Quartz_Veins
Anomaly of Copper	Tuff
Anamaly of Zinc	Garnetiferous_Foliated_Rhylite
Garnetiferous_Quartz_Biotite_Muscovite_Schist	Laminated_Tuff
Staurolite_Garnet_Quartz_Muscovite_Sercite_Schist	Foliated_Rhyolite
Calc_Silicate	

Source:- GSI exploration Report CR-022551.
Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

Proposed Drilling
Pastalamal Basemetal Block
Area:- 172.9938 Hect
Tehsil:- Amla, Dist:- Betul, MP.



Source:- GSI exploration Report CR-022551.



Source:- GSI exploration Report CR-022551.

Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree