



**Report on reconnaissance Survey (G-4 Stage) for Iron ore in
“Gilanguda-Padur Block” District- Gadchiroli, Maharashtra
(Toposheet No-65A/10, F.S-2023-24)**

**E.C- OM No- F. No. 23/371/2023 NMET/128, dated, 26th June 2023.
[NMET funded Project vide ID: 374/EC-39/G4/2023]**



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GILANGUDA-PADUR BLOCK			
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CHAPTER-1

Executive Summary

In accordance with the approved programme of the TCC, NMET, for the F.S. year 2023-2024, an investigation was conducted by M/s. Gemcokati Exploration Pvt. Ltd, a Notified Private Exploration Agency (NPEA) of Chandrapur, for Iron Ore exploration (G4) [Haematite Ore] in the Gilanguda-Padur Block, Tehsil- Etapalli, Gadchiroli district, through the Directorate of Geology and Mining, Maharashtra. The objective of this investigation was “to assess the potentiality of Iron ore mineralization and demarcation of mineralized lenses/bands/zone”.

The area (65 sq. Km), is falling within the Toposheet No-65A/10, located in the easternmost border of Gadchiroli District of Maharashtra and adjacent westernmost part of Kanker, Baster and Dantewara Districts of Chhattisgarh. The area is more or less disturbed and occupied by dense forest and hazardous mountain peaks and scrap faces. The area is bounded by latitude from 19°31' 09.42" N to 19°37' 13.62" N & longitude from 80°30' 00" E to 80°35' 53.33"E.

The present investigation has been taken up in this partly designated “OGP areas” through NMET funding. The area is potential in view of Iron Ore mineralization on Damkodwadvi Hill Range with an average Fe (T) content of 61.59 % for Haematite Ore. Total 70 BRS analyzed to 49.75% Fe(T) out of that 40 BRS is showing +45% & above Fe(T) with an average of 61.59% Fe(T).

The LSM was taken up initially on 1:12,500 scale and subsequently, revised in view of the local ground condition to 1:25,000 scale. In mid-way the PGRS study was conducted, where the mineralized zone tentatively identified, were validated and documented in the ground.

Geologically, the Gadchiroli district presents a variety of stratigraphic units ranging from Archean to recent alluvium and laterites. The rock types encountered belong to Bengpal Group of Archean and Bailadila Group of Paleo-Proterozoic age with overlying alluvium. The Bengpal Group comprises the meta-sedimentaries represented by quartzite (pyritiferous, micaceous and pyroxene bearing), Banded Magnetite quartzite (BMQ), magnetite quartzite, quartzite, quartz mica schist, amphibolite/hornblende schist, talc, actinolite, tremolite, anthophyllite schist, ultrabasics, occurring as bands in gneissic and migmatitic rocks. These rocks are later intruded by dolerite, Ultramafite and gabbroic dykes. The rocks of the area are highly deformed and bear evidences of three phases of folding.

The Bengpal Group of rocks is overlain by the Paleo-Proterozoic Bailadila Group of rocks i.e., characterized by Chlorite schist, shale, phyllite BHQ, BHJ, quartzite, ferruginous cherty and phyllitic sequence, Iron Ore (BIF) and meta-volcanics. These rocks are later intruded by dolerite and vein quartz.

The Bengpal meta-sedimentaries have suffered metamorphism under Amphibolite Facies conditions whereas, the overlying Bailadila Group of rocks has suffered low grade metamorphism under greenschist facies conditions.

The present geospatial study using multispectral imagery Sentinel 2B on 1:25,000 scale have depicted potential mineralized zones. The Remote sensing study helped in understanding the critical structural fabrics and aerial extent of BIF in this densely forested area. The mineral investigation work involved Large-scale geological mapping on 1:25,000 scale and collection of 70 primary bed rock samples, 7 check BRS, 5 each for PCS, Petrographic & Minerographic and 2 BRS for XRD studies.



Based on ground validation and major oxide analysis, an attempt was made to estimate the reconnaissance mineral Resource (G4) in the tune of **135.23 mt**, considering total (17 nos) detached mineralized (Iron) ore bodies (MOB) detached and displaced along faults, a single ore band further divided into a number of linear ore bodies on the outcrop as observed during our study with cumulative bands length of 32,198 m, average band width of 30m, average depth of **50 m** [up to first level of drilling] and Bulk Density of 3.5 gm/cc. The average grade is 61.59% Fe (T).

Resource of float ores surrounding the mineralized band in lesser altitude is estimated to be **21. 56mt**.considering the depth of 5m and bulk density of 2.5g/cc.

Finally, as outcome of this investigation, total 8 CL block have been carved out covering an area of 48.40 Sq. Km and proposing for auctioning as per authors judgement.



CHAPTER-2

Introduction

2.1.0- Introduction:

Haematite and Magnetite are the most important iron ores in India. About 79% haematite ore deposits are found in the Eastern Sector (Assam, Bihar, Chhattisgarh, Jharkhand, Odisha and Uttar Pradesh) while about 93% Magnetite ore deposits occur in Southern Sector (Andhra Pradesh), (Goa), (Karnataka) & (Tamil Nadu). Karnataka alone contributes 72% Magnetite deposit in India. Of these, haematite is considered to be superior because of its higher grade. Indian deposits of haematite belong to Precambrian Iron Ore Series and the ore is within banded Iron Ore formations occurring as massive, laminated, friable and also in powdery form. (Ref: GSI Brochure of Iron ore-2000).

2.1.1- Details of Project:

The geological mapping in this part, was carried out in way back, during F. S-1978-79 (Toposheet-65A/10) by GSI [H. P. Saxena, S. K. Das, B. Zaheer and S. K. Sengupta vide Acc. No- CR-014491.] Out of 15,433 sq.km area of Gadchiroli District, almost entire area is unexplored, except few 1000 sq km areas in the western part bordering Chandrapur District. Therefore, hardly any exploration data is available for this area in public domain.

In the instance of 53rd Technical-cum-cost committee meeting (TCC) dated 25th May'2023 of NMET meetings and subsequently, the Executive Committee (EC) in its 30th EC meeting held on 06th June 2023, has approved the "Gilanguda-Padur Iron Ore exploration block-65 sq km", to M/s. Gemcokati Exploration Pvt. Ltd, a Notified Private Exploration Agency (NPEA) of Chandrapur.

Accordingly, the investigation was carried out in the area within the Etapalli Tehsil, Gadchiroli District, Maharashtra, under the guidance and supervision of Subrata Sarkar, Vice-President, Gemco Kati & Director (R), G.S.I. and has been successfully accomplished with submission of report, in association with his team members. The sequence of project schedule in time bound manner is tabulated below:

Sl	Block name	Commo	Stg	Duration	Approved. cost
1	Reconnaissance Survey for Iron ore In Gilanguda-Padur block (65 sq. Km), District: Gadchiroli, Maharashtra (G-4)	Iron Ore.	G4	06 months	Rs-26,79,391/ Including-GST
	Revised during 60th TCC deliberation in view of change in mapping scale from 1:12500 to 1:25000.				Rs-25,25,581/ Including-GST
	Objective	to assess the potentiality of Iron Ore and Demarcation of mineralized zone.			

The work was executed through the DGM, Maharashtra, Nagpur vide Office Memorandum (OM) NO- F. No. 23/371/2023-NMET/128, New Delhi, dated the **26th June 2023** vide Item ID: 374/EC-39/G4/2023 during F.S-2023-24



for a period of 6 months. During Project review in 58th & 60th TCC meetings the time extension for one month was accorded, where **15th March 2024** was kept for submission of the report.

FLOW CHART OF THE PROJECT ACTIVITIES AND TIME SCHEDULE.		
01	In Principle Approval from DGM, MS.	Approved by the DGM, MS vide No-MNG Tech./1842/2023/1518, Dated the 9 th May'2023.
02	Approval from TCC, NMET Secretariat, MoM, New Delhi.	The proposal presented during 53 rd TCC, NMET held at Hyderabad, dated the 25 th May'2023, for approval.
03	Approval from EC	Approved by the 30 th EC meeting, held on 02.06.2023 (Online) / 06.06.2023 at Kolkata & subsequently, O.M was issued vide F. No- 23/371/2023-NMET/128, dated the 26 th June'2023 and vide [Project ID: 374/EC-39/G4/2023] for a period for six months duration i.e. up to 25 th December 2023.
04	Inspection visits by DGM	The Director DGM, MS had visited our office and took a note on progress of work on 30.09.2023.
05	Joint Inspection	The members from NMET Secretariat, New Delhi, GSI, CR, Nagpur & DGM, MS, Chandrapur had visited the field areas and inspected the work carried out in the field between 13 th Oct' 2023 to 16 th Oct' 2023.
06	Project review by the TCC	The members of the 58 th TCC, NMET held on 1 st November'2023 has reviewed the work, and suggested for re-submission in next TCC, incorporating additional field date.
		The members of the 60 th TCC, NMET held on 27 th December'2023 has reviewed the work and suggested to submit the report to the peer reviewer and to circulate the report by 15 th March'2024.
07	Nomination of Peer review	The request mail sent to NMET on 18 th January'2024 for nomination of peer reviewer for submission of draft Report as per the suggestions of the 60 th TCC. Shri Narayan Moorthy, DGM (R), MECL's nomination as external peer reviewer has been intimated by the NMET on 25 th Jan'2024, through mail.
08	Peer Review	Soft copy of the report is mailed to Moorthy Saheb on 25 th Jan'2024, whereas hard copy along with relevant plates have been handed over to him at his Nagpur residence on 26 th Jan'2024.
		Received back report from peer reviewer with comments on 5 th February 2024.
09	TCC, NMET	Attended to suggested modifications made by the peer reviewer and placed before 60 th TCC held on 7 th February 2024 with reviewers' comment for final review and permission for submission of Geological Report is obtained.
10	Submission of Report	Report submitted on 14 th February 2024.



2.2- Investigating Agency:

The item was taken up by M/s. GEMCO KATI EXPLORATION PRIVATE LIMITED, E-77, MIDC Road, Chandrapur-442406, a Notified NABL accredited Private Exploration Agency (NPEA).

2.3- Objectives of investigation:

The objective of proposing this item is to “assess the potentiality of Iron Ore and for demarcation of mineralized zone” thorough reconnaissance survey (G4) for facilitating auctioning process by Govt. of Maharashtra.

On the basis of evidences of mineralization as witnessed during first field visit, the present exploration program (G4) has been finally proposed to fulfill the following objectives.

- 1) To carry out Geological mapping on 1:12,500 scale for demarcation of mineralized zone (BIF) and Iron ore bearing host rock with the structural features to identify the surface manifestations and lateral disposition of the mineralized zones.
- 2) To collect bedrock samples and to analyze for Major Oxides through WD-XRF.
- 3) To collect Petrological/Mineralogical samples of possible host rock and their chemical analysis.
- 4) To analysis the check samples
- 5) Finally, to demarcate the mineralized zones for facilitating DGM, MS for initiation of auctioning process.

2.4- Basis for taking up investigation:

- i) The area falls within the Western Bastar Craton, which hosts numerous Iron Ore deposits in and around Surjagad, Gadchiroli District and adjacent Manpur and Kanker Districts of Chhattisgarh.
- ii) Iron ore Mines at Surjagad is the only operational mines, in the close vicinity of the block area.
- iii) Geological exploration hadn't been conducted in this part of Damkodwadvi Hill Range, Gadchiroli District, since last 40 years.
- iv) The Iron ore mineralization's associated with Banded Iron Formation (BIF) and ferruginous Phyllites, are recorded in the area, during geological traverses by GEMCO KATI team.
- v) Based on positive indication of mineralization, the Reconnaissance Survey at G-4 level has been proposed by Geological mapping and surface sampling.

2.5- The nature and quantum of work proposed vs achievement (Table):

Nature and Quantum of work (Target assigned and achieved)

S. No.	Nature of work	Target assigned	Achieved	Remarks.
1	Remote sensing studies (RSAS) (sq. km) on 1:25,000	65	65	Introduced midway, in view of the remoteness and rugged terrain conditions.

	scale			
2	Geological Mapping (LSM) (sq. km) on 1:12,500	65	65	As per TCC approval the mapping target is completed on 1:25,000 instead 1:12,500 scale due to limited coverage.
3	Geochemical survey			
	(a) Bed Rock Sample (Nos.)	70	70	Target is achieved.
	© Check samples	7	nil	Target is achieved.
5	Petrographic/ Minerographic studies			
	(a) Petrographic (Nos.)	5	5	The studies were carried out from G.S.I, C.R Nagpur.
	(b) Ore Microscopy (Nos.)	5	5	
	(c) XRD	2	2	
6	Chemical analysis (Nos.) (As per approved NQT)			
	a) Sampling (Primary)	70	70	Analysis was carried out by the Shiva Lab. Bengaluru.
	b) BRS for PCS analysis	5	5	
	c) Sampling (Check BRS) for 6 radicals Fe%, SiO ₂ %, P ₂ O ₅ , CaO, Al ₂ O ₃ % & Acid Insoluble	7	7	Received & incorporated.

2.6- Personnel involved

S/Shri Subrata Sarkar, V.P, Naveen Tobria, Salim Mustak Sheikh and Chinmay Rout Geologists.

2.7- Mode of operation of different work components and associated agencies:

2.7.1- Photo Geology and Remote Sensing (PGRS) study:

- 1) Outsourced from Smt. Deepshikha Ghosh, Kolkata-82, a domain expert & Freelancer.

2.7.2-Chemical analysis:

- 1) Shiva Lab, Hospet, Bengaluru.
- 2) DGM, MS, Nagpur.

2.7.3-Petrographic, Minerographic and XRD studies.

- 1) GSI, CR, Nagpur.

2.8 -Acknowledgement



The authors express their sincere thanks to Mr. Jijo George, Director & CEO, for his dynamic leadership and constant motivation, to Mr. Nigel Job, Director & CFO, for all out administrative and financial support. The authors are thankful to the members of the TCC, NMET for giving us an opportunity, that make us possible in bringing out a G4 report successfully from this extremely difficult terrain of Gadchiroli District. Our thanks are also due to Shri Gajanan Kamde, Director, Mr. Suresh Naitam, Deputy Director and the geological faculty of DGM, Chandrapur, MS for their valuable support and encouragement. We owe our thanks to all our stake holders and service provider for their valuable contributions from time to time in successful completion of the assignment. It is our privilege to extend our sincere thanks to the members of joint Inspection team from NMET, GSI & DGM, MS, Chandrapur for visiting our field area and witnessing our field work in this difficult terrain. The authors are grateful to the Reviewer Shri Narayana Moorthy, DGM (R) for improving the manuscript of the report. Help and co-operation extended by all individuals either in the Office or in the laboratory are gratefully acknowledged. Finally, expressing our sincere thanks to all members of Gemco Kati family, for their enormous support during the entire period of investigation.



CHAPTER-3

Property Description

3.1- Details of the area: (Village name, District, State, Toposheet number, Geo-coordinate with the corner points of the investigated area):

Gadchiroli District is located in the eastern most part of Maharashtra and surrounded by Rajnandgaon, Kanker, Baster and Dantewara Districts of Chhattisgarh to the east; Chandrapur of Maharashtra and Adilabad of Telangana to the west, Bhandara and Gondia of Maharashtra to the north and Karimnagar, Telangana to the South. The Gadchiroli District is covering by 15,433 sq.km area and divided into three sub-Divisions, each having four Talukas. The area is situated in the remote part of Gadchiroli District, Maharashtra adjacent to border of Chhattisgarh State.

The area consists of Pana Gudra, Yadaddami, Tadimakakoti metta, Mesa metta, Gudunjur koya, Pupil Dibba, Kadin-chakoti Metta, Padur and Kucher villages. The Gilanguda-Padur block is bounded by 4 points named 'A', 'B', 'C' & 'D' by latitude from 19°31'09.42"N to 19°37'13.62"N & longitude from 80°30'00"E to 80°35'53.33" E within the Toposheet No. 65A/10.

	LONGITUDE			LATITUDE		
(A)	80 ⁰	30'	00"	19 ⁰	34'	53.63"
(B)	80 ⁰	34'	58.56"	19 ⁰	37'	13.62"
(C)	80 ⁰	35'	53.33"	19 ⁰	33'	05.65"
(D)	80 ⁰	30'	00"	19 ⁰	31'	09.42"

3.2- Land use/ Land cover, forest with type of forests, free hold/lease hold details

The area is forming a high hilly hazardous terrain with scarp faces, dissected by several drainage lines. The block area displays high hill-ranges and densely mixed jungle covered mainly by teak and Bamboo Forest. The southern & northern parts of the are being covered by moderately low undulating terrain.

3.3- Location:

An area of 65 sq.km is falling within the Etapalli Tehsil, Gadchiroli District, Maharashtra. The same has been provided as plate-2



3.4-Accessibility:

Nearest Rail Head: - Mul is the nearest Railway Stations operated by Central and South-Central Railways connecting Chandrapur – Gondia through narrow gauge Railway line. Balharshah is the main Railway Station connecting Nagpur to the south and Southern States to the north.

Road: -The study area, well connected with Nagpur/Chandrapur towns by state highway No.70B and accessible throughout the year via the District Headquarters Gadchiroli, which is about 100 km NNW of Etapalli and connected by District Main Road. Bhamragarh a prominent tribal village in the area which is 20 km south of Jinjgaon. Etapalli and Ahiri are Tehsils Hqrs. and of 146 Kms away from Chandrapur and 289 km from Nagpur.

Airport: -Nagpur Airport: 290 km from the Block area.

3.5- Climate:

The area is having dry and partly humid climate. The southwest monsoon commences from June and continuous till September. The winter starts from late October/early November and continue to February.

Mean annual rain fall-The area experiences an annual average rainfall of about 140 cm during monsoon between June to October. A thick soil cover aided by a good rainfall has given rise to moderately thick vegetation cover forming deciduous type of forests.

Temperature-The highest and lowest temperatures of the area vary between 45°C and 15°C.May is the hottest month whereas, December is the coldest month of the season.

3.6- Flora and Fauna:

The forest of Gadchiroli endowed with mainly important species viz. Teak, Bija, Ain, Hirda, Haldu, Shivan, Moha, Salai, Movai, Dhawda, Khair, Tendu etc. tree species found growing luxuriantly.

The Gadchiroli area is home to many species of wild animals like tiger, leopard, jungle cat, sloth bear and wild dog, wild boar, spotted deer, sambar, barking deer, blue bull, jungle cat, jackal, peacock, jungle fowl and flying squirrel. Many of the species are included under the endangered species' list.

3.7- Geomorphology, Physiographic and drainage:

The area exhibits a matured topography surrounded by high hill ranges. The area is represented by hilly forested terrain with intermittent moderate undulating terrain in between. The relief difference is varying between 374m near Pana Gudra in the NW part to 580m near Pupil Dibba in the east central part.

The first order streams are controlled by both structures and lithology of the terrain. These streams later join to or small rivulets which can be categorized as second order streams, subsequently meeting Jambia river towards north and Parlakota River towards southeast.



3.8- Infrastructural facilities and Socio-economic condition:

Majority of the villages are small with very low population density. The socio-economic condition of the area is extremely pitiable with the inhabitants belonging to tribal (Adivasi) community. The literacy rate is very poor. Life sustainability for an average villager is solely based on seasonal paddy cultivation and forest products including Bamboo and Tendu leaf etc. Many are engaged as migrant labourer in adjacent Towns.

Villagers depend on bore-wells and few dug wells for water supply. Hand pumps are the source for potable water. There is scarcity of water in summer seasons since the rivers and Nala's dry out. Power/electricity supply is available to all villages. Fuel outlets are only available in Etapalli & Bhamragarh. No regular transport services are available between interior villages and adjacent Towns due to poor road network. Network facility is extremely weak in that part. Few Sub-Police Stations in this area operates only through wireless communication.

3.9- Archaeological, historical sites, National Parks etc.

The Charpala Wildlife Sanctuary is located in the Gadchiroli district of Maharashtra, spread over an area of approx. 140 km, it has thick forest growth with occasional stretches of grasslands. Wadadam Fossil Park is located in a village known as Wadadam in Sironcha taluka in the district of Gadchiroli of Maharashtra State. It is about 19 km from Sironcha and about 189 km South of District Headquarters Gadchiroli. In India, Sironcha is one of the five places in the country where a large number of fossils have been discovered. A full skeleton of a dinosaur was unearthed in 1959 in Kothapalli-Pochampally village, this fossil has been kept in a museum in Kolkata.

Few places of tourist interest in Gadchiroli are an old temple in Armori, Stone circle in Arsoda, Group of twenty cromlechs or Kistvaens in Chamurshi, Rock Caves in Jharapapra, Group of Temples in Markanda, Fortress of Tipagarh in Murumgaon, Large Temple in Thanegaon, Fort wall and Temple of Bhandadeshwar in Waira. (Plate-1 & 3)



CHAPTER-4

Previous work

4.1- Geological Exploration:

The Pascoe. E. H Vol. I, [1950]" has mentioned the Geology of Bengpal in parts of eastern Maharashtra and western Chhattisgarh in his "A Manual of Geology of India & Burma. Bengpals are described by Pascoe as the rocks which are pronouncedly rich in alumina in upper horizon and siliceous in the lower horizon. In support of this, the sillimanite bearing schist occurring in the proximity of Gundapuri, Nayalgurda and other places can be taken as middle to Upper Bengpals. Whereas the quartzite members comprising dominantly of detrital quartz, quartz magnetite rock occurring in the vicinity of Markel, Gundapuri, Gatta etc., can be classified as members of Lower Bengpals. The Bailadila Group of rocks, represented by low grade schist, banded hematite quartzite, quartzite and phyllite (ferruginous), shale represents both arenaceous and ferruginous sediments with a little amount of aluminous sediments. In fact, it is dominantly iron ore rich sediments with lava flows. DGM, MS carried out exploration for Iron Ore in Surjagarh area by C. N. Chari et.al between 1967-1975. First systematic geological mapping in this area within the Toposheet No-65A/06 & **65A/10** was carried out by H. P. Saxena, S.K. Das, B. Zaheer and S.K. Sengupta during Field Season-1978-79. The remaining part of the Toposheet 65A/06, 65A/07 & 65A/11 was subsequently mapped by S. S. Jain & S. K. Pattanaik during field season -1978-79. Systematic geological mapping in this area within the Toposheet No-65A/07 was carried out during 1977-78 by GSI [S.K. Pattanaik & S.K. Sengupta vide Acc.No-CR-013642] comprises metasediments, metabasics, magnetite's and gneisses belonging to the Archean Bengpal Group of rocks. Regional Integrated Survey for locating Base metal occurrences by Regional Stream Sediment Survey in the SE extension of the Chamursi-Ghot belt, in parts of Toposheet 65A/02 & 65A/06, was carried out by T. Krishnama Charlu & K. Kumaran during F.S-1978-79. A Preliminary appraisal of Sillimanite occurrence near Gundapuri was carried out by K. Kameswar Rao during field season-1980-81 within Toposheet No-65A/06 & 65A/07. Preliminary appraisal of the reported Base metal occurrences in Bhandara and Gadchiroli Districts was carried out by Shyamal Kumar Sengupta & Swapan Kumar Das, in toposheet No-65A/06, 65A/07 & 65A/10, during field season-1982-83. This work of Sengupta & Das, is the last geological activity in Gadchiroli District, prior to current iron ore reconnaissance survey by the Gemco Kati Exploration P. Ltd, a NABL accredited Notified Private Exploration Agency [NPEA] by MoM, Govt. of India.

4.2- Geophysical Exploration:

During the study of Preliminary Appraisal of the newly reported Base metal occurrences in Bhandara and Gadchiroli Districts during F.S-1982-83 by Sengupta & Das, the Geophysical studies were carried out in parts of Kothi(65A/10) and Vishamundi (65A/06) **beyond the block boundary** involving electromagnetic, self-potential, induced polarization and magnetic methods during F, S-1979-80 By Rao, MVP et.al. EM survey at Kothi area has brought out "Out of phase" anomalies suggestive of shear zones in an echelons pattern. These shear zones are encompassed by a broad S. P. low bounded 140 mv contours within which a few -ve centres extending over a strike length of about 1 km have been obtained. I. P. Surveys in the same area delineated zones of high chargeability and at places with high resistivity values the S. P- centres falling within the E.M anomaly zones and associated with high chargeability values were considered significant from the point of view of occurrence of sulphide mineralization at depth. E.M. conduct axis runs mainly through the BHQ and ultramafic rocks. The I.P. runs with -Ve centres are mainly on the sheared quartzite containing rare specks of Graphite. The en-echelon pattern of shear zone as demarcated by the Geophysical Investigation also corroborated with the Geological observation. The S.P anomaly zones are mainly because of the presence of graphite over the shear zone. The authors recommended that in view of fact that copper mineraliza-

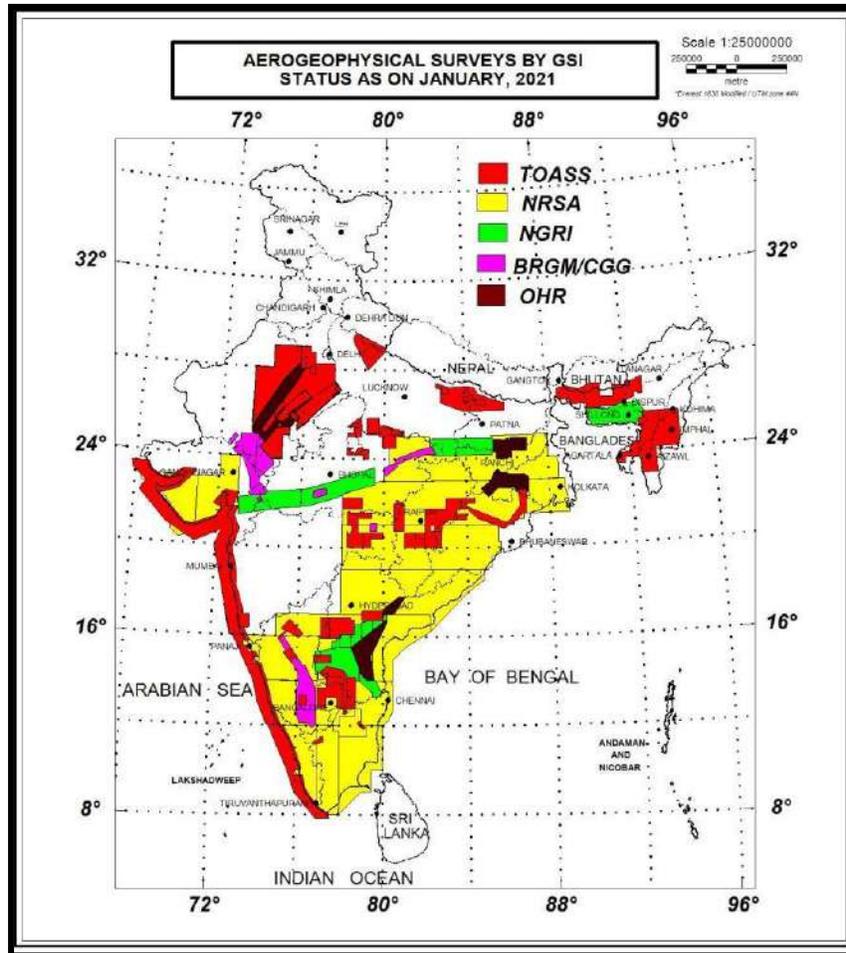


tion at Kothi west area is traceable over a strike length of 2 km and with a width of 2m and the shear zone is more or less persistent in the area, it is suggested to carry out Geophysical Survey of SP, EM, IP and magnetic methods to delineate the strike continuity of the sheared zone in concealed areas and to find out the nature and extent/of base metal mineralization associated with the shear zone along the strike and depth.

The test Geophysical Survey in Vishamundi area has brought prominent S.P. E.M. and I. P anomalies over the mineralized cherty quartzite. But these anomalies are small (S.P-130mv: (I.P – 30ms) do not appear to be extending in the strike direction as no significant indication has been obtained along the traverse about 400m towards east. This also corroborates with the geological observation and geochemical results of the area.

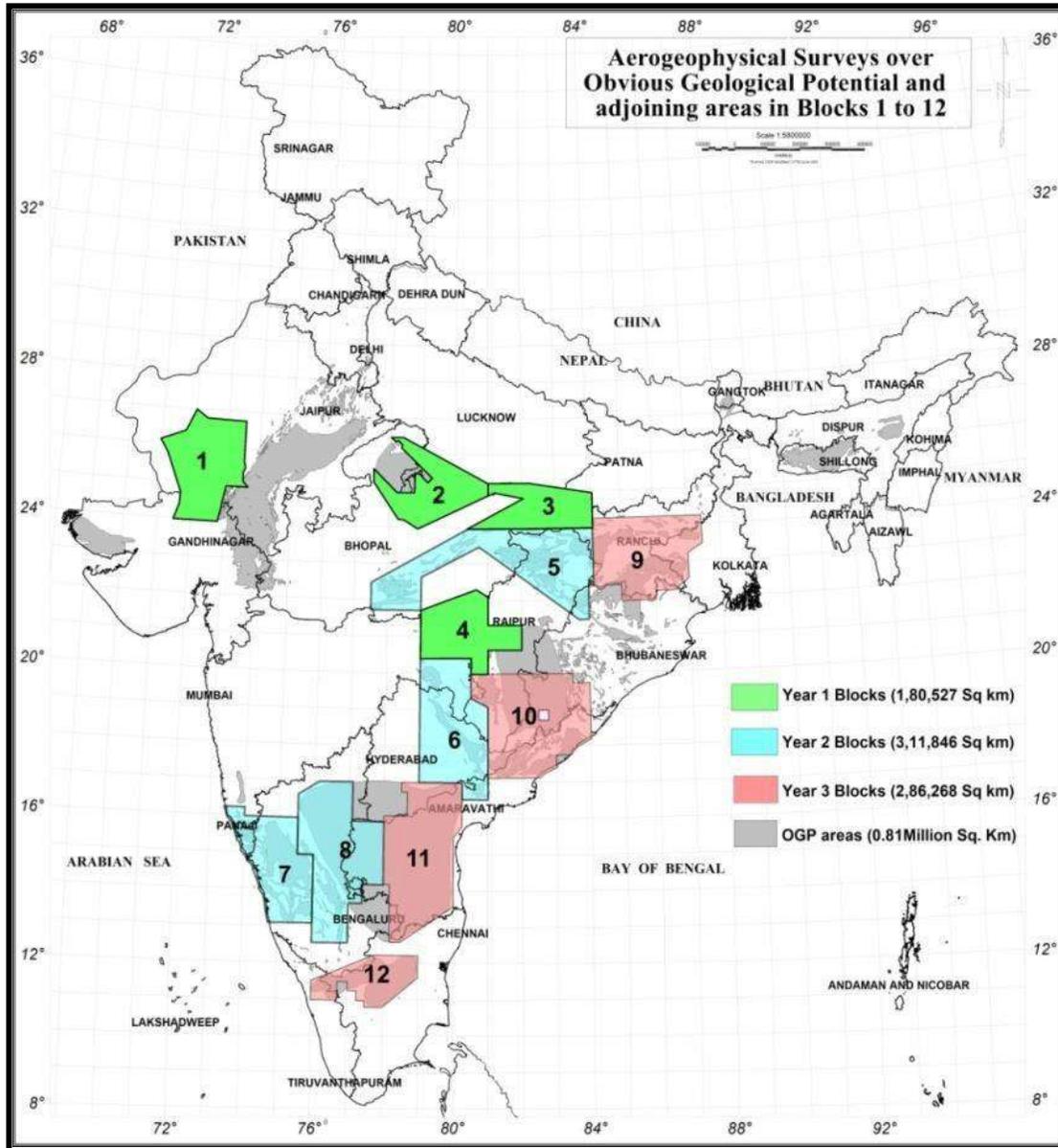
The GSI has started multi-phase national programme i.e. “Multi-sensor Aerogeophysical Surveys over Obvious Geological Potential (OGP) and adjoining areas” in 2017 under the national level programme “National Airborne Geophysical Mapping Programme (NAGMP)” which is funded by National Mineral Exploration Trust (NMET). National Aerogeophysical Mapping Programme (NAGMP) has been planned to acquire uniform aerogeophysical data initially over Obvious Geological Potential (OGP) and its adjoining areas to prognosticate suitable areas for mineral targeting. The surveys will be carried out with magnetic (Total Field) and spectrometric sensors using fixed wing aircrafts at an altitude of 80 m above ground level (AGL) with a survey linespacing of 300 m and tie line spacing of 3000 m (3 Km). The aerogeophysical surveys over OGP Blocks 1 to 4 and 11 were completed successfully during 2019, 2020 & 2021. Remaining Blocks of Phase-I survey is in various stages of execution. The status of Aero-geophysical survey by GSI are shown in Map-1 to Map-3 [Pg-No-15,16 & 17].

The area of the current NMET block is falling in NAGMP Block-6 & 10 and acquisition of data hasn't yet been concluded, however the TOASS data deploying Magnetic, Gamma Ray Spectrometric and Electro-magnetic (Frequency Domain) systems as received from GSI Bengaluru is shown in the subsequent text Plate-1,2,3 & 4.



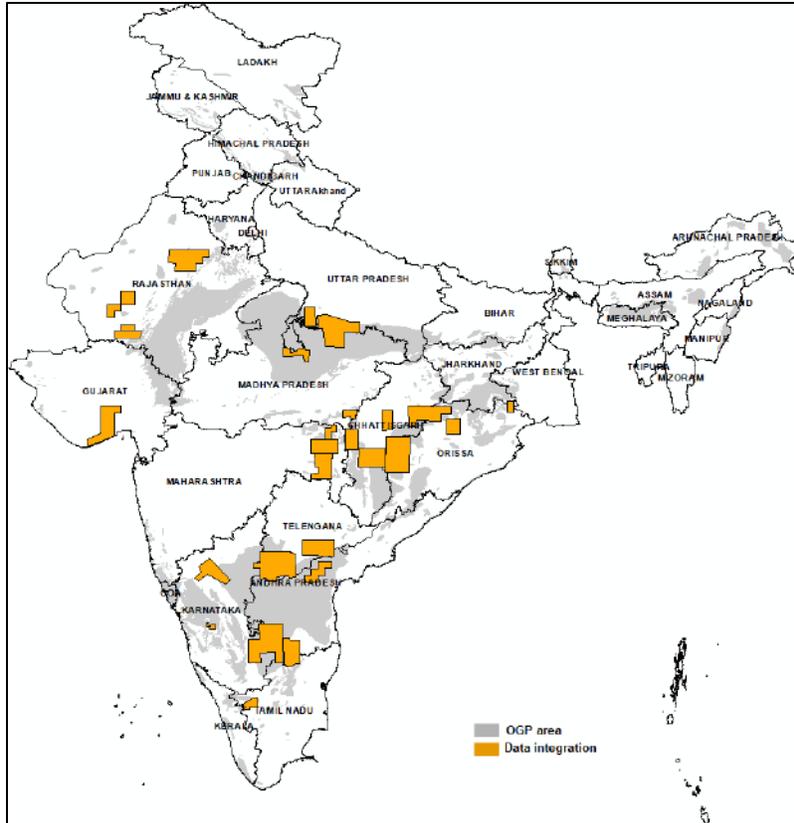
1-Map showing status of aero-geophysical surveys carried out by RSAS, GSI

(Source: Base document CGPB Committee Group-VII Remote Sensing & Airborne Survey (RSAS) Mission – IB July 2021 Bengaluru)



2-Location map showing OGP Blocks 1 to 12

(Source: Base document CGPB Committee Group-VII Remote Sensing & Airborne Survey (RSAS) Mission – IB July 2021 Bengaluru)



3-Multi thematic data integration studies in RSAS from 2010- 2020

(Source: Base document CGPB Committee Group-VII Remote Sensing & Airborne Survey (RSAS) Mission – IB July 2021 Bengaluru)



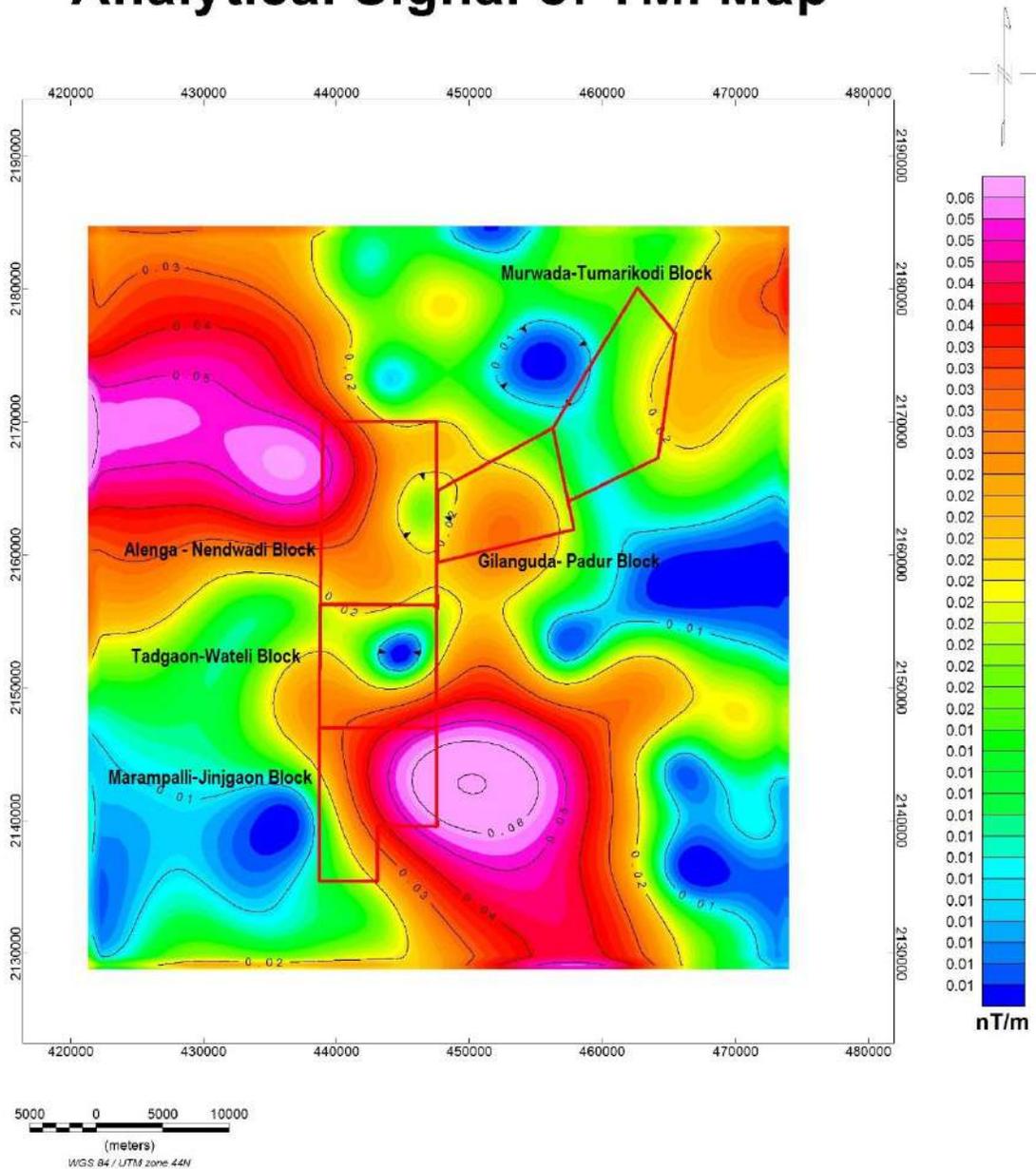
The Analysis of Airborne Magnetic Data

The available Airborne magnetic data has been carefully studied to evaluate the prospects of iron ore occurrences in the “Gilanguda-Padur Block”. The airborne data provides subsurface information of the geological sources which have depth continuity. Airborne magnetic anomaly and its derivative maps are the main inputs for the study. Out of these maps magnetic analytical signal map has registered diagnostic signatures which have bearing on the possibility of occurrence or absence of iron ore.

An important characteristic of the Analytic Signal (AS) map is that it is completely independent of the direction of magnetization of the source and as well direction of the Earth's magnetic field. The amplitude of the analytic signal is simply related to the amplitude of the magnetization. The analytic signal peaks occur directly over the edges of the wide bodies and directly over centre in case of narrow bodies and not affected by remanent magnetization.

In view of the efficacy of the analytical signal parameter of the magnetic data in bringing out susceptibility variations precisely, the analytical signal has been given importance for evaluation purpose. The careful analysis of the analytical signal map, high analytical signal zone has been identified which could indicate the presence of iron ore and hence, it can be concluded that the “Gilanguda-Padur Block” has potential for further geophysical studies.

Analytical Signal of TMI Map



4- Analytical Signal Map



CHAPTER-5

Geology of the area

5.1. Aerial Reconnaissance:

Advanced remote sensing is being used frequently in the past few decades as a potential tool in environmental geology and G4 stage in mineral exploration. It is the science of acquiring, processing, and interpreting images and related ancillary data, acquired from aircraft and satellites that record the interaction between Targets and electromagnetic energy. Space borne earth observation multispectral data which helps in detailed topographic variation of the terrain, detailed drainage, structural control of the terrain and mapping of drainage along the linear zones, geomorphic units like dissected terrains, structural control drainage, valley, triangular facets, mapping the existing geological litho boundaries and refining it based on the textural signatures and rock alteration zone mapping. Recognizing altered zones in a particular terrain due to weathering or due to ingress of hydrothermal fluid along the fracture zones using Sentinel 2A & B has been widely accepted method due to its ability to capture spectral signatures in VNIR and SWIR bands in Electromagnetic spectrum. The present geospatial study in Gilanguda-Padur Fe-ore Block using multispectral imagery Sentinel 2B have depicted potential mineralized BIF zone.

Data Used:

Genre	Data Type	Data Details	Resolution	Date of Capture	Product used	Projection
Satellite Data (Multispectral)	Sentinel2B, 12 Bands	T050749_N0509_R019	10m	Date of Acquisition 2023-02-27	Composite FCC (Band 2,3,4,8,10,11,12)	GCS-WGS84
Satellite Data (Elevation)	Google Earth Terrain		1m		Elevation Model	
	ASTER		30m		DEM, Hill shade	

Software used:

- Image processing for Sentinel 2B imagery (Layer stacking resolution merge, spatial & spectral enhancement products like contrast stretching, Principal component, Band Ratios) –ERDAS IMAGINE 2014
- Hill shade from ASTERDEM- ERDAS IMAGINE 2014
- Mapping (Physiography, Structure, Updated Litho-contacts, Detailed Drainage generation, alteration zone) -Arc Map 10.4.

Digital Image Processing Technique used in the Present Study:

- a. Acquisition of raw rectified Earth observation satellite datasets, Sentinel 2B, Google Earth Terrain & ASTER DEM in digital format (Geo tiff).
- b. Processing starts with multispectral image layer stacking -3 discrete band (Band 4,3,2) into a composite satellite data with fine spatial resolution of 10m in case of 12 bands in Sentinel 2B (Bands 2,3,4,8,10,11,12).
- c. Spatial enhancement has been performed to filter and enhance linear features which are directionally control whereas spectral enhancement deals with the enhancement of the DN (digital numbers) values for better visual in-



terpretation like contrast stretching for demarcation of types of vegetation, forest, depth of water, settlement and mining pits.

d. Topographical analysis of ASTER-DEM for generation of hill shade with better representation of relief variation and classification.

e. Arc GIS 10.4 software was used to fix 1:12,500 Scales. In the Arc GIS software without moving the scale, visible drainage, structures, geomorphology, litho-contacts and alteration features from Sentinel 2B enhanced data and its Band Ratio products has been mapped.

f. Spectral enhancement techniques in Sentinel 2B deals with enhancing the spectral characteristics of the digital image. Linear contrast stretching has been applied for color composite images of bands 4,3,2. Principal component analysis is another pre-processing transformation that creates new images from the uncorrelated values of different images. PC1, PC2, PC3, PC4 and PC5 are generated with different features enhancement for litho boundary mapping. Spatial enhancement for selectively emphasizing or suppressing image information at different spatial scales is known as image filtering. Edge enhancement filter is one of the spatial convolution filtering that detect lineaments in a specific direction, which expanding the width of the linear features and increasing the DNs across the feature as narrow lines against a background of contrasting brightness. Structural information has been extracted from these enhanced images.

g. Sentinel 2B bands 10 and 11 are used to differentiate areas of alteration from areas of vegetation. Clay minerals have higher reflectance in spectral region covered by Sentinel 2B bands 2, 3, 4, 8 and 10. Spectral regions covered by bands 8 and 10 are commonly used in the detection of clay minerals. False Color Composite for discriminating altered rock units from unaltered units is composed of $(5^*6)/7$, $(4^*6)/(5^*2)$ and $(5^*6)/(7^*2)$ spectral bands combinations. Accordingly, 3 images have been processed with Band Ratios $4/2$, $6/7$, $6/5$; $4/2$, $7/3$, $6/5$ & $(5^*6)/7$, $(4^*6)/(5^*2)$, $(5^*6)/(7^*2)$. Detection of Fe-Ore alteration areas from rest of the unaltered zone depends on the pixel brightness and darker pixels than surrounding and accordingly mapped.

Interpretation:

Observations based on Satellite imagery (Sentinel 2B, ASTER DEM) and different resolved band ratios depict study area is favorable geologically, structurally, terrain pattern wise, geomorphologically for Iron mineralization.

1. The terrain is a continuous litho-unit with BIF bands extended from Murwada-Tumarikodi block in the east. The Terrain shows actions of folding and faulting at different phases. Topography observed in satellite image is gently undulating with 500m maximum height in the central part and along the folded hinge in the NE which slopes down to North and southern elevation of 200m.

2. The general trend of the terrain is NE-SW. The strike ridge is maintaining the same strike direction. Streams originating at the hilly terrain gently runs down the slope towards S and towards N. Streams are anastomosing which signifies the terrain is under compression forces causing folded sequence. Perpendicular shifting of the stream course at few places shows structural control which depicts the terrain is under the influence of faulting.

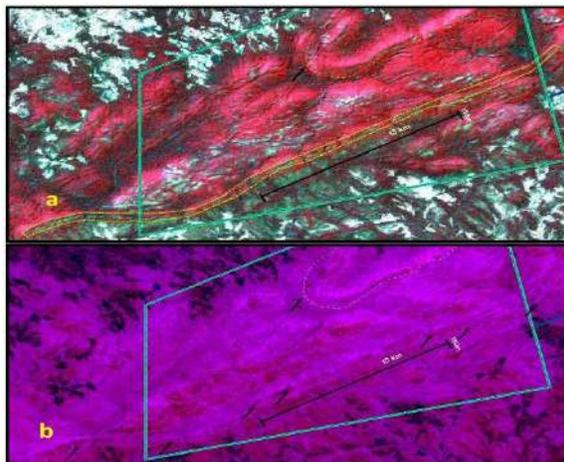
3. Geomorphologically the area is under the action of denudational process. The resistant structural hill trending NE-SW slopes down to the pediment zone in the north and south. The strike ridges in the south shows prominent bed-

ding planes of resistant rock type which is able to withstand the denudational process. Pediment zone adjacent to BIF bands are locale for float ore eroded from the ore rich band.

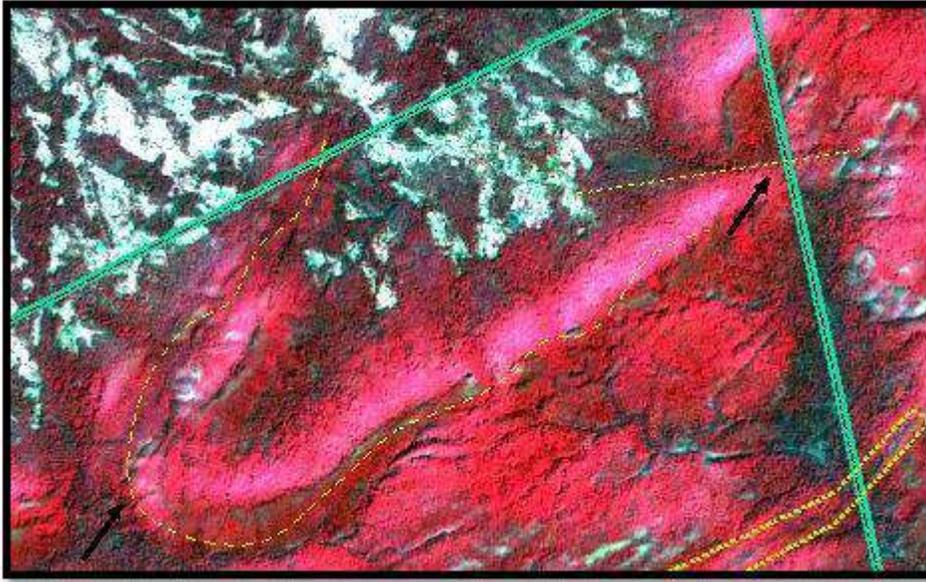
4. From different resolved imageries from sentinel 2B SWIR, NIR and thermal bands, litho units have been demarcated and nomenclature has been updated from published geology over this area. Prominent BIF bands are delineated from Hydrothermal image with band ratios as 5/7, 4/3,3/1 & PC5 image. Parallel resistant bands are identified by tonal different, high DN values from the surrounding. It is reddish brown in Hydrothermal image and green in S2B FCC image. Major litho unit meta basalt trending NE-SW in this block shows tonal properties of mafic rock type and texturally different from surrounding granite rock units as well as different from BIF banding.

5. Continuous BIF band in the north is disrupted and displaced by NW-SE trending normal faults. 580m clear shifting of the northern band is observed. The same BIF band is folded with western closure and NE-SW fold axis. Southern BIF band is continuous from east side block and few places disrupted by local N-S trending faults. **15 km long BIF band has been observed with 150 m** approximate thickness with tonal and textural quality refers to a prominent ore deposit.

6. Mineralized target zone has been mapped out based on the observations on BIF.

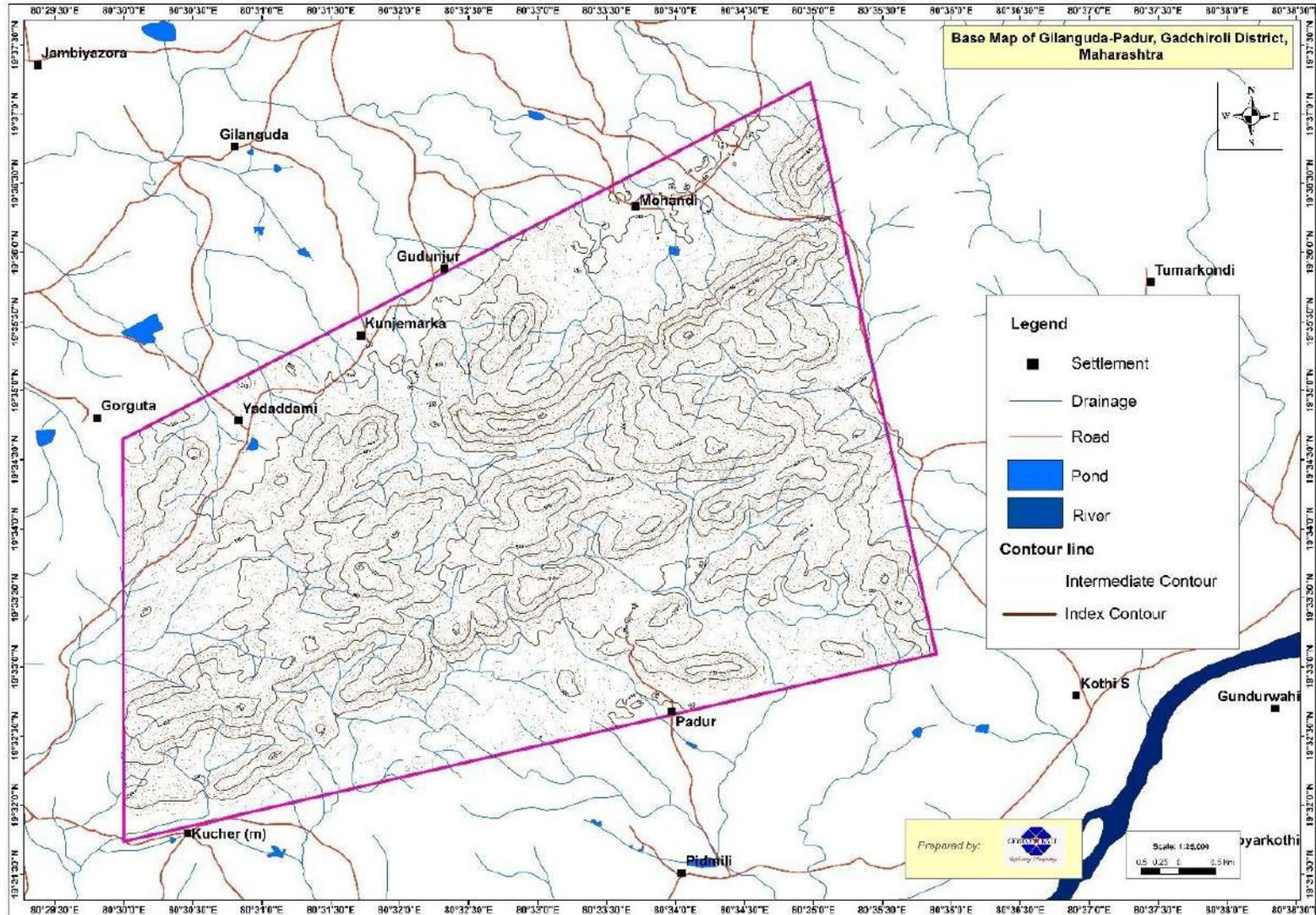


Pic 1: Iron bearing bands are seen in band ratio images represented as reddish toned parallel band as indicated by

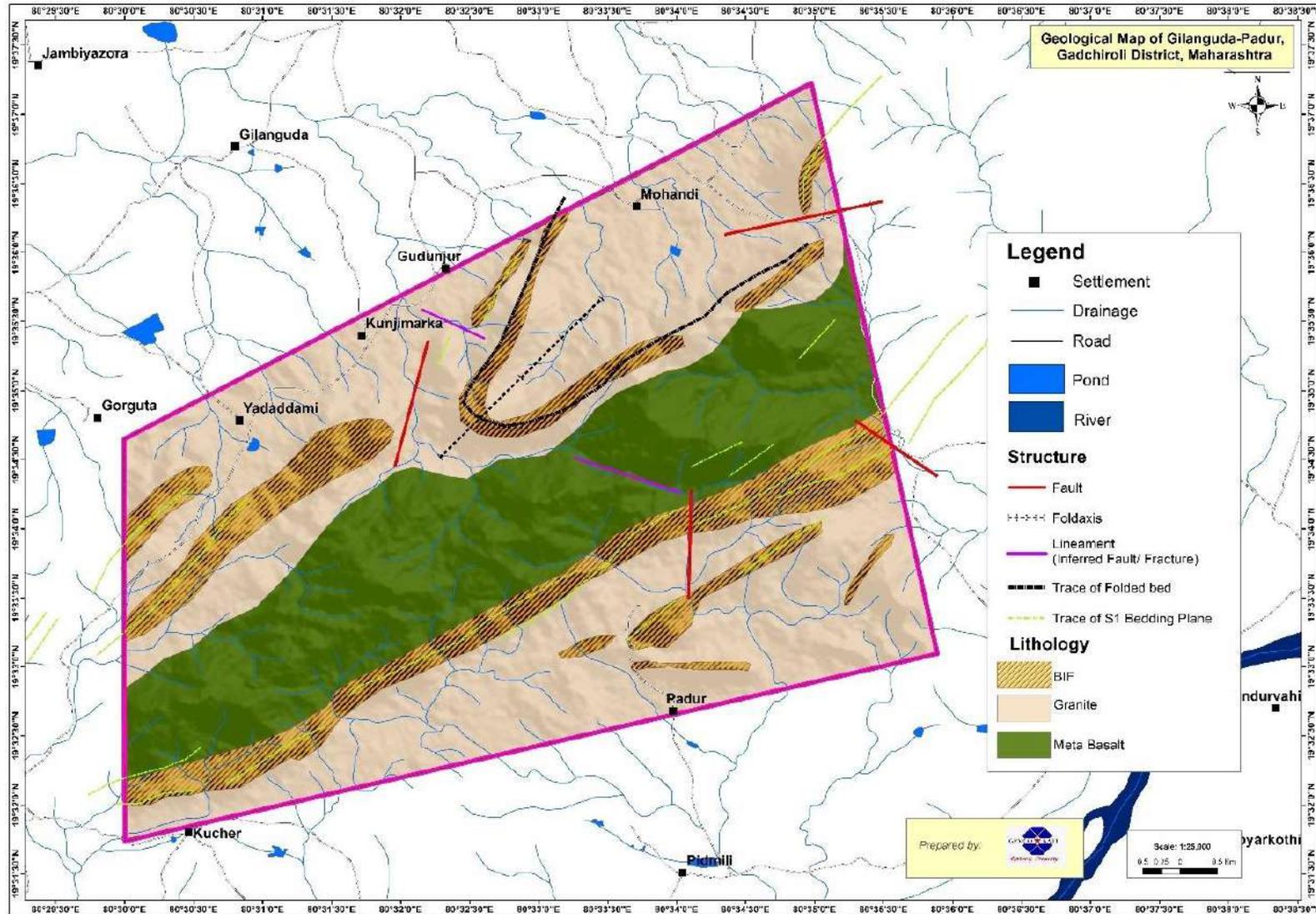


Pic 2: Fold closure shown in the image with N-S fold axis.

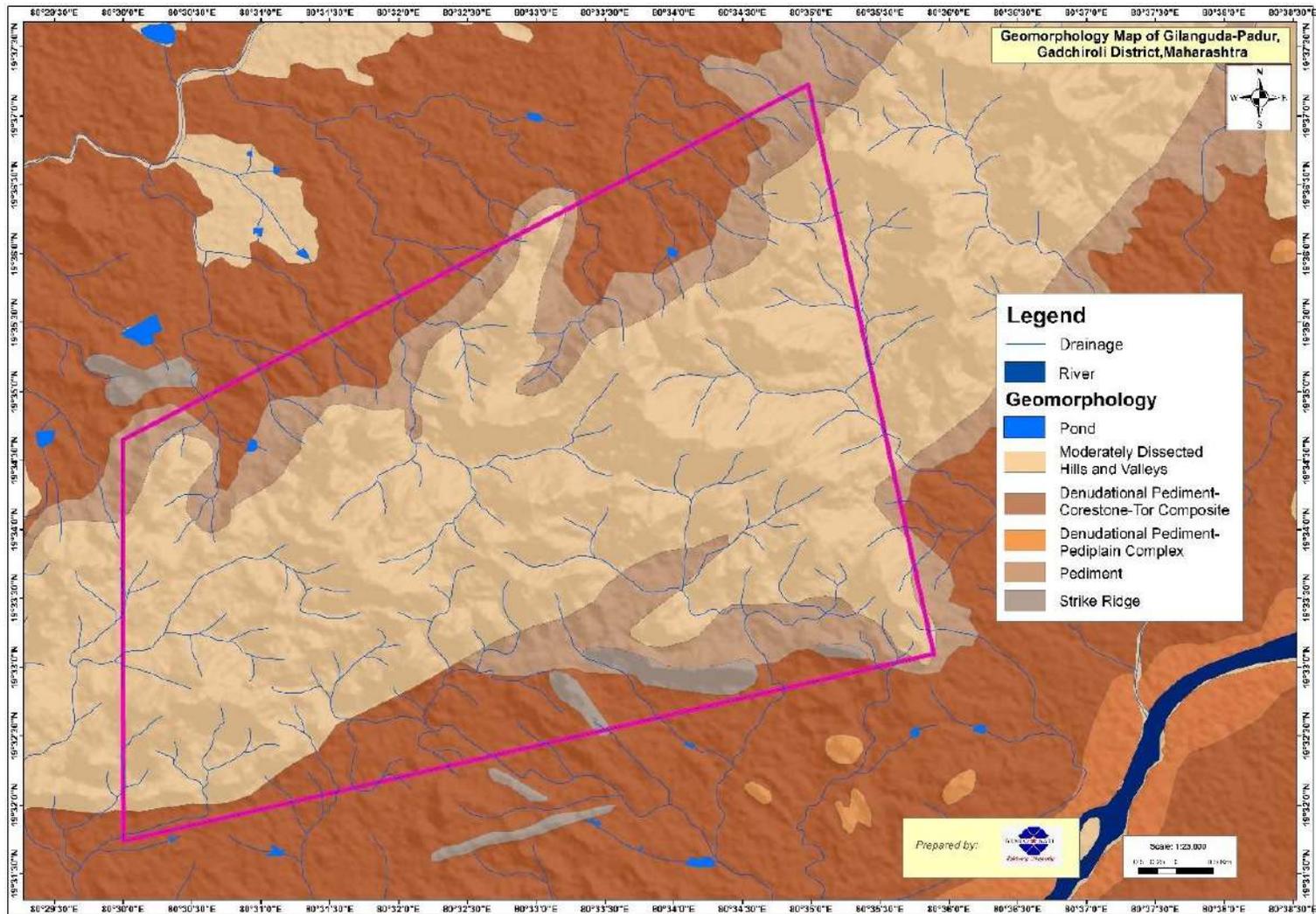
**5.1A- BASE MAP OF GILANGUDA-PADUR BLOCK, THROUGH PGRS,
ON 1:25,000 SCALE, GADCHIROLI DISTRICT, MS.**



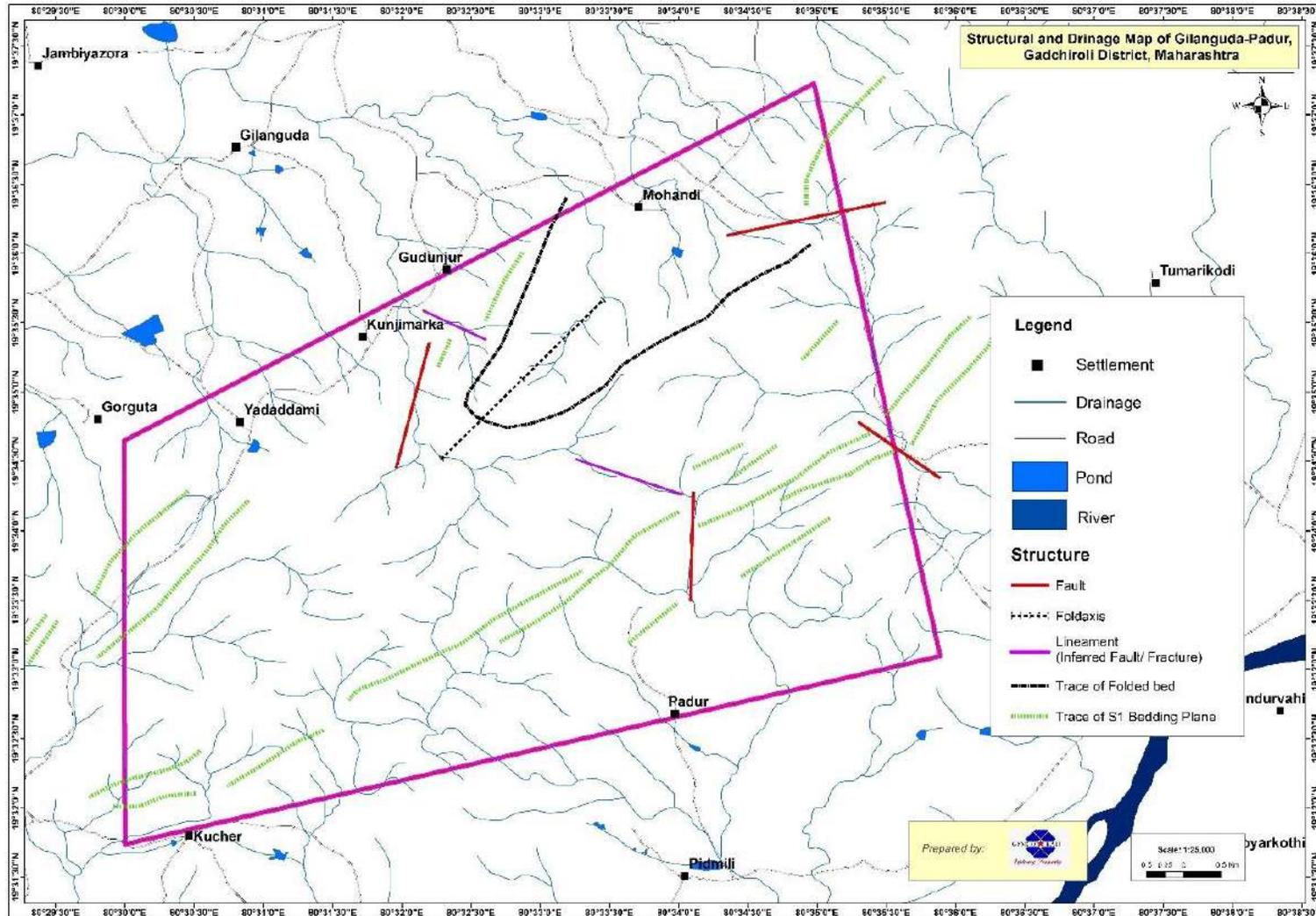
5.1B- GEOLOGICAL MAP OF GILANGUDA-PADUR BLOCK, THROUGH PGRS,
ON 1:25,000 SCALE, GADCHIROLI DISTRICT, MS.



**5.1C- GEOMORPHOLOGICAL MAP OF GILANGUDA-PADUR BLOCK, THROUGH PGRS,
ON 1:25,000 SCALE, GADCHIROLI DISTRICT, MS.**

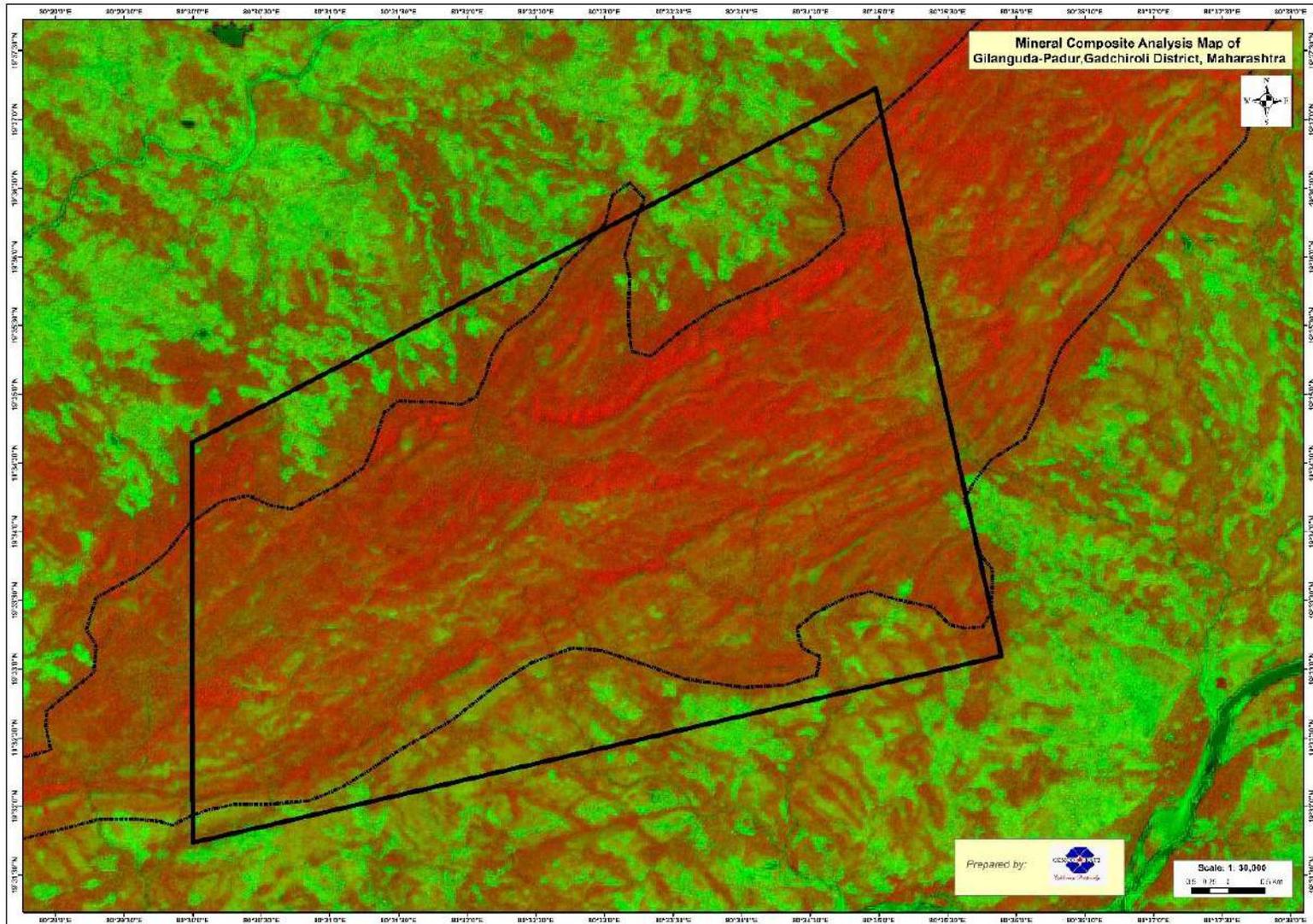


**5.1D- STUCTURAL & DRAINAGE MAP OF GILANGUDA-PADUR BLOCK, THROUGH PGRS,
ON 1:25,000 SCALE, GADCHIROLI DISTRICT, MS.**

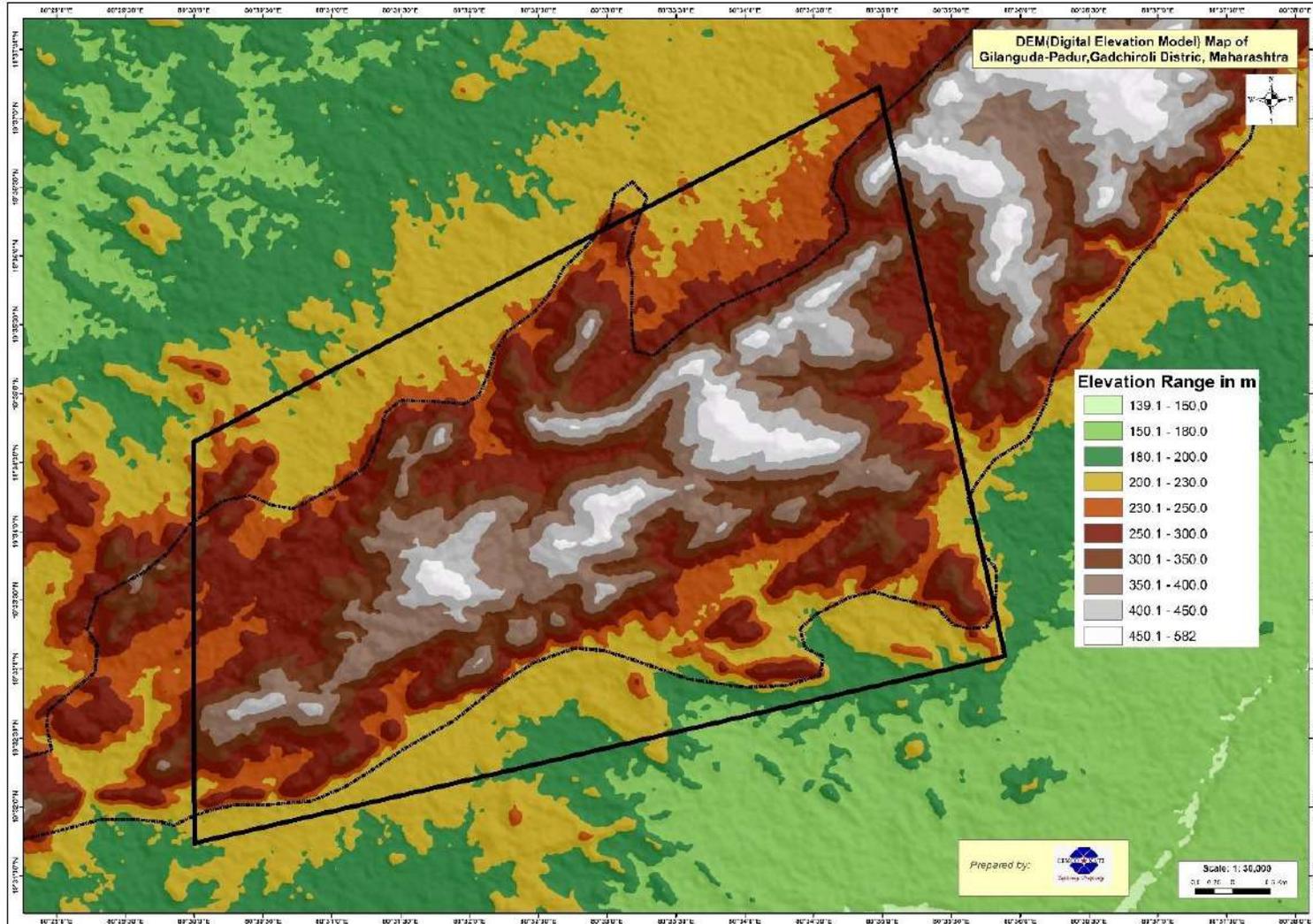




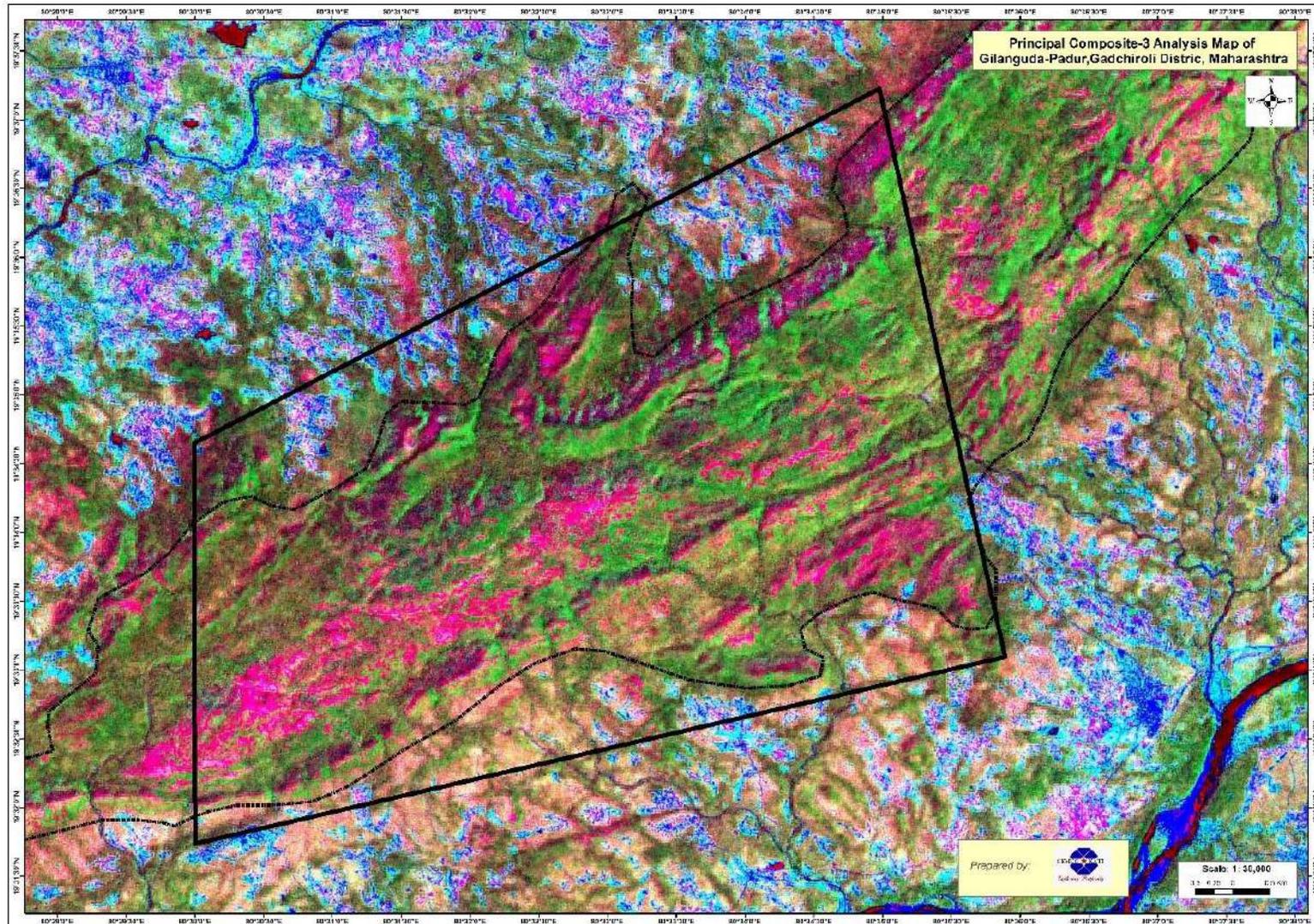
5.1E- MINERAL COMPOSITE MAP OF GILANGUDA-PADUR BLOCK, THROUGH PGRS,
ON 1:25,000 SCALE, GADCHIROLI DISTRICT, MS.



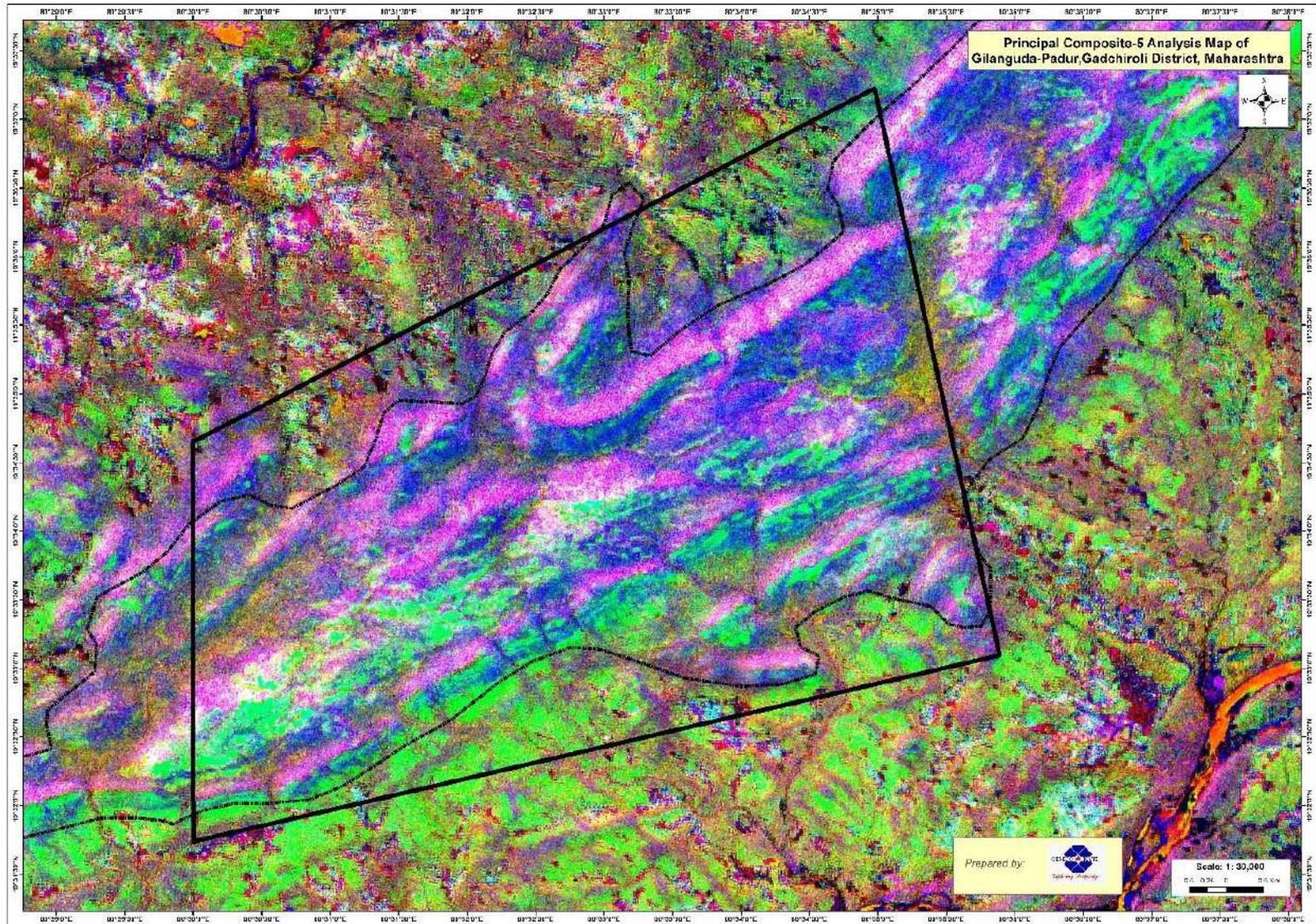
**5.1F- DIGITAL ELEVATION MAP (DEM) OF GILANGUDA-PADUR BLOCK, THROUGH PGRS,
ON 1:25,000 SCALE, GADCHIROLI DISTRICT, MS.**



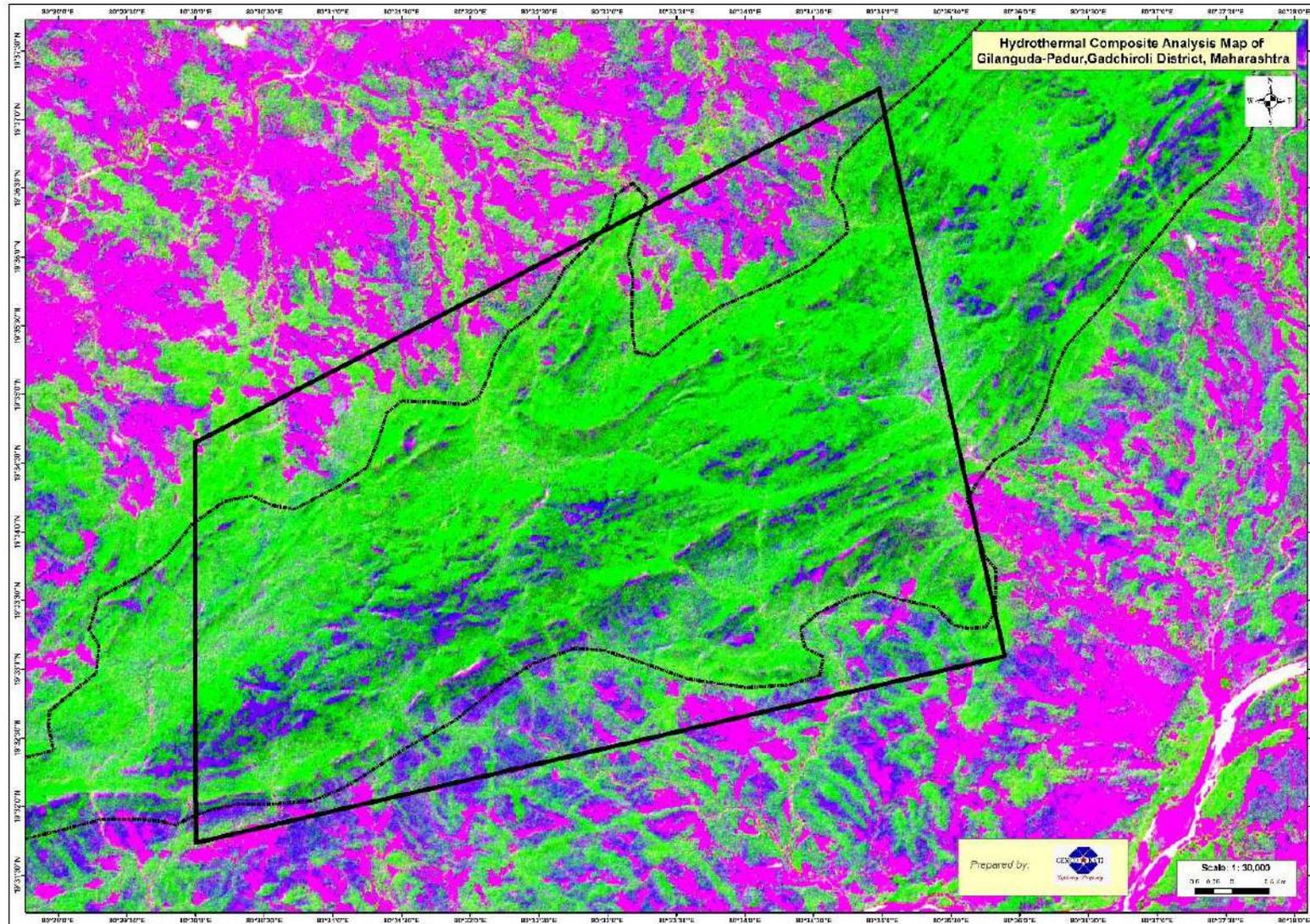
5.1G- PRINCIPAL COMPOSITE-3 ANALYSIS MAP OF GILANGUDA-PADUR BLOCK, THROUGH PGRS, ON 1:25,000 SCALE, GADCHIROLI DISTRICT, MS.



5.1H- PRINCIPAL COMPOSITE-5 ANALYSIS MAP OF GILANGUDA-PADUR BLOCK, THROUGH PGRS, ON 1:25,000 SCALE, GADCHIROLI DISTRICT, MS.



5.1I- HYDROTHERMAL COMPOSITE MAP OF GILANGUDA-PADUR BLOCK, THROUGH PGRS, ON 1:25,000 SCALE, GADCHIROLI DISTRICT, MS.



5.2 - Regional Geology and Stratigraphy.

The rocks exposed in this area display strong resemblance in petrological and structural characters with the Iron Ore Super Group of rocks occurring over major part of adjoining Bastar District. The Iron Ore Super Group of Bastar has been divided into Bengpal Group, Bailadila Group and Abhujmar Group of rocks in the order of antiquity. The area mapped comprises metasedimentaries and metavolcanics belonging to Iron Ore Super Group. These occur mostly as enclaves/bands within an extensively migmatized country. The gneisses/migmatites of the area represent several episodes of granitic influx, and might be containing remnants of older basement gneisses within them. The block area falls under Western Bastar Craton which hosts numerous Iron Ore occurrences along three distinct parallel arcuate ridges in this area of Gadchiroli District, MS starting from Surjagad Hill range towards north followed by Damkodwadvi and Bhamragarh Hill Ranges in the south. The present Gilanguda-Padur block area falls within the Damkod-Wadvi Hill Range (65A/10), where Iron ore is seen exposed in association with BHQ, quartzite, Shale, phyllite and micaeous schistose rock around the hill along with float ore in the slopes.

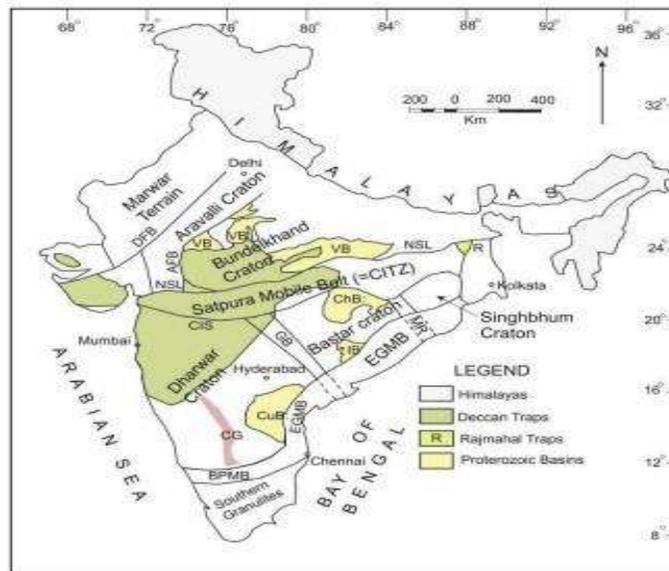
The litho assemblage consists of granite gneisses with enclaves of chlorite-kyanite-schists, staurolite-garnet mica schists, chloritoid-garnet mica schists, kyanite-staurolite schists, biotite-garnet-cordierite gneisses, sillimanite-biotite gneisses and orthopyroxene-garnet granulite's, gneisses [banded], amphibolite, (BIF/BMQ/BHQ/BJQ), quartzite, ultra mafites, intrusives of basalt, dolerite and gabbro. Mafic rocks often contain calcium-rich varieties of plagioclase feldspar described as ferromagnesian and younger granites under Bengpal Group. Bailadila Group comprises Banded Haematite quartzite, Banded Haematite Chert, Banded Magnetite quartzite, Banded Magnetite chert, chert, phyllite, quartz arenite, ferruginous shale and meta volcanics. They form linear strike ridges with a regional NE-SW trend, and complex folding. The main ridges are exposed in the Bailadila Range, Rowghat, Sonadehi, Dalli Rajhara and Surjagad Hill Ranges.

Regionally, the area, is bounded on the northeast by the Mahanadi Graben, on the northwest by the Satpura Mobile Belt, on the southwest by Godavari Graben and to the southeast by the Eastern Ghats Mobile Belt. The Baster Craton shows some tectonic trends parallel to the Mahanadi, Godavari and Satpura. The Baster Craton consists of five major supracrustal belts, viz. i) the Sausar – Chilpi Belt, ii) the Sakoli Belt, iii) the Dongargarh Belt, iv) the Bailadila Belt and, v) the Bengpal –Sukma Belt.

The tentative geological succession established on the basis of field observations is given below:

Description of Stratigraphic units:

Intrusive	: Pegmatite and Quartz Vein Intrusive (dolerite, and pyroxenite) : Banded magnetite quartzite and Banded hematite quartzite.
Bailadila Group (Lower Proterozoic)	: Quartzite (Pyritiferous quartzite, Diopside quartzite, with or without chloride and epidote and quartz : Schist with intercalation of ferruginous Schist and phyllite. : Ultramafite (Serpentine, talc, Chlorite schist, talc-actinolite, schist, chlorite schist etc.)
--- Unconformity---	
Bengpal Group (ARCHEAN)	: Migmatite and gneiss with enclaves of amphibolite, quartz mica schist of Bengpal Group and quartzite (Fuchsite quartzite (ARCHEAN) : Kyanite quartz schist, Garnetiferous and ferruginous quartzite and quartz schist.
--- Base is not Exposed ---	



Generalized tectonic map of Indian subcontinent: Precambrian Cratons, Mobile Belts and Lineaments. AFB = Aravalli Fold Belt, DFB = Delhi Fold Belt, EGMB = Eastern Ghats Mobile Belt, SMB = Satpura Mobile Belt, NSL = Narmada-Son Lineament, CIS = Central Indian Suture and BPMP = Bhavani–Palghat Mobile Belt. Proterozoic Rifts and Basins include IB = Indravati Basin, ChB = Chhattisgarh Basin, GB = Godavari Basin; MR = Mahandi Rift; CuB = Cuddapah Basin, VB = Vindhyan Basin. CG = Closepet Granite (after from Rao and Reddy, 2002 and Meert et al., 2010).

The previous work carried out by H. P. Saxena et.al within the Toposheet No-65A/06, during F.S-1978-79 depicts the extensive granitic activity concomitant with the major folding episodes have granitized a vast thickness of Bengal meta sediments and the associated metabasics leading to the formation of a variety of migmatites and gneisses.

The rocks of Bailadila Group exposed in the area is a store house of vast resources of iron ore within BHQ are located in the Surjagarh, Damkodwadvi and Bhamragarh Hill Ranges. **Wurera hill** in the Surjagarh hill range being developed by M/s Lloyd Metals, is the only mining activity prevailing in the district. As per Detailed Information Dossier (D.I.D) for iron part-2, vide page-154,GSI, the total resource in Wurera hill in Surjagarh is 138mt (59mt estimated under 331 category, 66.6mt under 332 category and 12.7mt of float ore under 334 category). However, information about latest resource is not available in public domain.

The current block is about 15 km southeast of Wurera mine, situated on Damkodwadvi Hill Range, where iron ore bearing lithology (Concentrate iron ore, BHJ, BHQ) is meta-sedimentary rocks of Bailadila Group of Paleo-Proterozoic age. The general trend of the ore body is NE-SW, steeply dipping almost sub-vertical.

The iron ore exposed as lenticular bodies disposed at the crest of the high rising ridges and comprises primarily of BHQ, ferruginous shale in association with quartzite, meta-basalts and phyllites. The iron ore deposit of this area is genetically related to leaching and supergene enrichment of iron oxides from parent rock BHQ. It occurs in varied

physical forms from massive to soft ore surrounded by float ores in the lower slopes up to ground level at places.

5.3. Structure and Metamorphism

Available field evidences about structural features, the metasedimentary sequence and the metabasics have undergone extensive migmatization in different periods of their geological history. The area has undergone three phases of folding; the first two being tight appressed types while the third one is broad and open type. Regional strike of the rocks coincides with that of the tight fold axis i.e., NW-SE with south westerly dips. A number of basic intrusive and quartz veins which are emplaced in NW-SE direction also exhibit the same structural trend. A series of normal faults mostly north south slip are evident in the area effecting the dislocation and shifting of bands along fault plane.

The structures of different Groups have been described separately which are as follows:

BENGAL GROUP: -

Structural data collected from field indicate that the Bengal Group of metasediments and metavolcanics have undergone more than two phases of folding viz-a-viz deformation and subsequent migmatization obliterated the primary structure. The metamorphosed micaceous quartzo-feldspathic rock (such as quartzite and banded-magnetite-quartzite) due to their resistance to migmatization have however preserved their primary structures. Bedding, axial plane schistosity and gneissosity are the most dominant planar fabric prevalent in the area. But the planar fabric associated with bedding in these rocks may not be S1 planes, but more likely to be S2 planes which is dominant in the area. The different types of planar fabric observed in the Bengal Group of metasediments are described below:

Bedding (S0): -

Bedding is the most important non-diastrorphic planar fabric in the area. But due to the subsequent phases of folding and migmatization, the bedding is almost obliterated in most of the rock units excepting quartzites. In quartzite, the S0 plane is marked by colour banding in BMQs compositional banding in micaceous quartzites and litho unit contacts in case of other rocks. The contemporaneous lava flows within the metasediments is also taken as bedding because it is considered that the lava flows are parallel to bedding. The attitude of S0 plane varies from place to place. These planes as observed in different places are described viz. such as. Δ 504 hill north of Kucher the S0 plane is observed in micaceous quartzite with attitude of the bedding is NNE-SSW dipping 45° to 50° towards west. In Kaitapur range (western outside) S0 is $N70^\circ S$ to E-W dipping 60° towards south.

Axial Plane Schistosity (S1): - Due to high degree of metamorphism and deformation, the axial plane schistosity is thrown into tight isoclinal fold (crenulation cleavage) but wherever S0 is present S1 is parallel to S0 planes and attitude is almost same.

Gneissosity/Schistosity (S2): -

The S2 is the most dominant planar structure prevailing in the area. The attitude of this plane varies from place to place. The trend varies from NW-SE to NE SW. In most of the places it is very steep dipping almost vertical which probably indicates a second phase of folds having vertical axis. The gneissosity is marked by the alternate arrangement of biotite, muscovite, hornblende and quartzo-feldspathic units. In augen gneiss, the augens is also parallel to the present foliation.

Lineations: -

Folding and faulting in the rocks, bearing the imprints of directional stress and strain in the form of fold axis, boudinage, intersection of planes has been noticed in the different parts of Toposheet No. 65A/6 and 65A/10.

Folds: -

Megascopic folding in Bengpal metasediments has been observed, but the available structural data supported by the mesoscopic folds indicates three main phases of folding in the area- F1 i.e. ENE-WSW; F2 i.e. NW-SE and F3 i.e. N-S. The F1 fold is clearly observed in micaceous quartzite only in the area south of Akera Buzuruk. The trend of the axial plane is ENE-WSW and plunging 12° towards north. The fold is of varied geometry but the open type is more prevalent in the area. F2 fold is the most dominant fold in the area mapped. This is represented by prominent foliation in gneisses, schists and in micaceous quartzites. In gneisses, the stretching of augens and amygdules within meta-lava also supports the trend of F2 fold. This fold is mostly tight isoclinal appressed type with the axis plunging 15° to 20° towards southeast. The trend varies from place to place due to the superimposition of later F3 fold. Near Gundapuri in Bande river section, the fuchsite-quartzite is folded in a doubly plunging antiform. It shows general NW-SE axis and plunges 10° NNW and SSE. Folding of augens and the crenulations of older schistosity trend is along NW SE to WNW-ESE. The dip of this plane is vertical to sub-vertical and towards southwest. The present disposition of dykes along NW-SE direction also confirms the dominance of F2 fold in the area.

BAILADILA GROUP: -

The F3 fold is seen in the form of broad warping and is preserved in all the litho units having a trend of N-S and plunging towards south. The structure of Bailadila Group is somewhat simpler than the underlying Bengpal Group. Field data indicate that rocks of Bailadila Group have also been subjected to more than one phase of folding. The bedding and schistosity are well developed and their relationship is clear. The BIF band is folded with western closure and NE-SW fold axis. From the bedding cleavage relationship, it is inferred that the northeast limb of the block is overturned whereas in the other part of the hill ranges show normal sequence.

The structural elements of Bailadila Group are described below:

Planar structures: -

Bedding (S₀): -

Bedding in Bailadila Group of rocks is well preserved in banded hematite, jasper, BHQ, highly recrystallised banded quartzite and phyllites.

The S₀ plane in arenaceous unit is marked by coloured banding, compositional banding, contact between two units are well preserved in Surjagarh, Damkodwadvi & Matawarsi hill ranges.

The attitude of bedding varies from place to place. It is $N60^\circ W-S60^\circ E$ to $N45^\circ W-S45^\circ E$ in Surjagarh hill range near Lanjhi and Todsatola, Petha and Bande metta range (outside the block: along Surjagarh Hill Range: north-western part) dipping 60° to 65° south whereas near Modaske it is NE-SW and is almost vertical. At Damkodewadvi hill range in Toposheet No. 65A/10 the attitude of S₀ is NNE-SSW to NE-SW dipping 50° to 55° towards both north-west and southeasterly and it is almost vertical in the hill ranges to the west of Tumarkodhi. The width of the individual compo-

sitional bands varies from a few millimeters to more than three centimeters. In Gundervahi-Kothi hill range the S0 is almost N-S dipping 60° to 65° towards east.

A small outlier of banded-haematite-quartzite/haematite ore has been found in the Toposheet No.65A/10 east of Gudunjurkoya, where the attitude is discontinuous with the adjoining older metasediments. Here S0 is NW-SE dipping almost vertically.

Schistosity S1: -

This is the only prevailing diastrophic structure present in the Surjagarh hill range. This is well developed in ferruginous phyllite, shale, carbonaceous phyllite and chlorite actinolite schists observed in all the above hill ranges described in bedding chapter. It also shows varied attitude from place to place. Near Mardahkahi the dip of the S1 plane is less than the S0 plane indicating overturned limb. In the Toposheet No. 65A/10, it is almost parallel to bedding and having more dip than S0.

S2 plane: -

Development of S2 planes in Surjagarh Group of rocks is not very prominent as the F2 itself is very feeble one. Of course, at places south of Surjagarh hill range near Pamajiguda in Toposheet No. 65A/06, within granite crude foliation of N-S plane (Parallel to F3 of Bengal) has been developed. This is mostly in the form of fracture plane and fracture cleavage.

Folds in Bailadila Group: -

Megascopic folds reveal that the rocks of the Surjagarh Group had undergone at least two phases of folding movement in the area viz., F1 NNE-SSW and NW-SE, F2 N-S appears to be cross folds.

F1 Bailadila: -

In Toposheet No.65A/06, F1 fold is clearly observed in Surjagarh hill ranges. The trend of the axial plane is NW-SE. The geometry shows that the F1 fold of Surjagarh hill is tight chevron type plunging 6° to 12° towards N60°W. The F1 is well developed in the Matwarsi hill ranges where it is forming synclinal hill ranges and the core is occupied by younger metavolcanics. Two distinct bands of banded-haematite jasper have been found to show the synclinal structure. The western limb of Matwarsi hill shows a tight asymmetrical fold having NNE-SSW axis plunging south-westerly.

Gunduwahi-Kothi hill range: -

F1 is NNE-SSW plunging steeply to northeast. The geometry of fold is symmetrical anticline. S1 is developed as major joint in NNE-SSW direction whereas in the older phyllite it is developed as fracture cleavage and axial plane schistosity. The F2 fold in Surjagarh hill range is in the form of broad, open fold having a steep plunge about 70° to 80° towards south with almost N-S axial plane. This is having cross cutting relation with the F1 fold in the Surjagarh hill range giving rise to slight flexing of F1 axis.

Correlation of folds in the Iron Ore Super Group: -

It is indeed very difficult to correlate the folds delineated in the Iron Ore Super Group. But an attempt has been made to correlate them in the following paragraphs.

The oldest metasediments occur as bands and lenses within the gneisses and migmatites and showing three phases of folding. The younger Bailadila Group has suffered two phases of folding.

Presence of contemporaneous volcanic flows in both Bengpal and Surjagarh Groups posed problem in unraveling the structural and stratigraphic history of the area mapped. The pelitic enclaves within migmatite showing puckering and crenulation cleavage oblique to the gneissosity might indicate at least two generations of folding prior to migmatization/granitization.

The first phase of folding in Surjagarh, i.e. NW-SE, is very much seen as F2 fold in Bengpal (preserved as mesoscopic isoclinal fold in metasedimentaries). Similarly, the last phase of Surjagarh (F2 folds/upright) is very much represented as broad open folds in Bengpal (F3).

But in the Toposheet No. 65A/10, the Bailadila Group of rocks exhibits the totally different structural pattern. Here F1 is NNE-SSW to NE-SW plunging northeasterly. The adjoining gneisses of Bengpal also exhibits almost same trend of foliation.

The intensity of F3 fold movement is somewhat less in the Toposheet No. 65A/10, especially in Matawarsi and Gunderwahi-Kothi hill range.

The feldspathisation and migmatization appears to be syn to post-tectonic to F2 as the major trend of migmatite is NW-SE. From the field evidences, it has been observed that the tectonic activity reached its climax during the F2 fold movement.

Faulting: -

Two major mega lineaments are observed in aerial photographs and land-sat imageries:

1. NNW-SSE trending lineament passing through west of Mesamatta to NW of padur represented by a shift in the drainage pattern. In the area it is confirmed by the presence of quartz veins as fracture fillings at places mineralized with metallic sulphides.
2. N-S trending and following the course of Paralkot River. In the area it is supported by gravity faulting with a down-thrown side towards west It is supported by the following field evidences

a) Brecciated quartz veins;

The contact between the Bengpal Group and Bailadila Group appears to be faulted as different litho-units of the Surjagarh, are coming in contact with the pyritiferous cherty quartzite band of Bengpal Group near Padur and Pupil Diba. The trend of this fault is NE SW.

Another minor fault is interpreted southeast of Gatta trending NW-SE dipping towards southwest offsetting the litho-units of Surjagarh Group exposed in the Matawarsi hill range.

Joints:

Joints are developed in all the rock types but are more prominent in gneisses and migmatites, granites and andesitic flows. The main joint sets are as follows:



- (1) NNW-SSE to NW-SE with sub-vertical dips towards east or west.
- (2) NNE-SSW to NE-SW with sub-vertical dips towards east or west.
- (3) E-W joints with sub-vertical to vertical dips.

5.4: Nature of host rock and mineralization:

Development of a series of sub-parallel N-S trending faults along F3 axis, displaced the BHQ/BHJ with Iron ore bodies in this part of the area. The BIF-hosted iron ore system within the metasedimentary sequence represents the world's largest and highest grade iron ore districts and deposits. BIF, the precursor to low- and high-grade BIF hosted iron ore, consists of Archean and Paleoproterozoic.

The block area is falling in the western part of the Damkodwadvi hill range. Lithologically, the area is covered with Granite-gneiss, metabasic schist, BHQ, ferruginous shale and phyllite in general. BHQ is prominently exposed and occurring as detached bands forming peak of the Hills. The peaks are followed downwards by steep slopes and are mostly covered with float of iron ore. The lenticular iron ore bodies are associated mainly with BHQ and phyllite.

Phyllite:

It is brown to reddish brown/purple in colour and dense with prominent bedding and cleavage but incipient foliation. Weathered outcrops are porous and have marked low specific gravity giving an appearance of leaching out of some crystalline metallic (probably haematite) constituents from it.

Quartzite:

Varies in colour from milky white to smoky grey. It is fine grained and show multiple sets of joints.

Banded Haematite Quartzite (BHQ):

It is exposed in higher altitudes following the regional strike NE-SW, comprises of alternate bands of steel grey haematite and brownish/whitish quartzite. The BHQ shows a typical laminated form with laminae of fine grained almost cherty-silica alternating with dense purple ferruginous material. The thickness of laminae varies from 2 to 5 mm. The laminae show intense micro-folds and consequent pinch and swell structure.

It is apparent that the iron mineralization is syn-sedimentary and later concentrated rich ore bodies along suitable structural traps like fold closures are due to Supergene enrichment mechanism. Gilanguda-Padur block falls within the Damkod-Wadvi Hill Range (65A/10), where Iron ore is seen exposed on hill tops with spreading of float ore in the slope.

Iron ore mineralization:

The in-situ Iron ore exposed as linear bodies parallel to strike on the ridge top of the Damkodwadvi Hill range (Toposheet-65A/10) with slope covered with float ores, having thickness varying from 5m to 7m. The Iron ore bands displaced by a series of subparallel NS trending Faults. In the nearby nala section mine section of ore band found to continue beyond 50m depth.

The iron mineralization is syn-sedimentary and later concentration rich ore bodies along suitable structural traps like fold closures are due to supergene enrichment. (Plate-4a)



CHAPTER-6

ACTIVITY DURING THE PERIOD (GEOSCIENCE INVESTIGATION)

6.1- Geological mapping:

6.2- Large scale mapping:1:25,000 scale.

An area of 65 sq.km has been geologically mapped with a focus of delineation of mineralized zone i.e. Haematite Ore and assess the Iron ore potentiality.

The rocks exposed in the block area, belong to Bengpal Group of rocks, is characterized by diopside quartzite, quartz schist, banded magnetite quartzite, quartz-kyanite rock, amphibolite, hornblende schist, talc-tremolite actinolite schist occurring as bands and enclaves in gneissic and migmatitic rocks. These rocks are later intruded by dolerite, Ultramafite and gabbro dykes. The Bengpal Group is overlain by green-stone suite of rocks i.e. Bailadila Group, characterized by Meta Ultramafite-serpentinite association with ferruginous chert, Banded Haematite Quartzite and basic meta volcanic. These rocks are later intruded by dolerite and vein quartz. The area was mapped on 1:25,000 scale instead of initial proposal on 1:12,500 scale in view of data density due to local disturbances and difficult terrain conditions. The lower southern band forms a part of the Iron Ore sequence of Bailadila Group of rocks which are seen in great force discontinuously from Bailadila in adjacent Baster District in the south to northwards at Rowghat Hills in Kanker District and then further North at Dalli Rajhara Hills in Rajnandgaon District, all of them in Chhattisgarh State.

On the arch shaped Hill range from SSW to NNE, phyllite, cherty quartzite, which grade laterally as well as vertically to Banded hematite quartzite (BHQ) with development of elongated parallel Iron ore bands at some geologically favorable locations, are exposed on hill range proper in suitable structural traps in the upper slopes of hill ranges. These are intruded within Bengpal gneiss with sharp contact in the area. On lower slopes upto the ground level floats are seen scattered along the slopes and nala cutting.

Parallel bands of BIF are seen observed in the hill ranges trending northeast-southwest. The terrain is a continuous litho-unit with BIF bands extended from Murwada-Tumarikodi block in the east. The Terrain shows actions of folding and faulting at different phases. Topography is gently undulating with 500m maximum height in the central part and along the folded hinge in the NE which slopes down to north and southern elevation of 200m.

The area between the bands are occupied by phyllitic rock associated with BHQ/BHJ. Beyond BHQ on either side on the lower part float ore zones are well visible on both side of the slopes with great aerial extent. The development of Iron ore in suitable location on high hill is locally known as Meta.

6.3- Description of rock types.

Bengpal Group: -

The Bengpal Group consists of meta sedimentaries, contemporaneous lava flows and the migmatites. The metasedimentaries comprise banded-magnetite quartzite, magnetite quartzite, quartzites, tremolite/actinolite/anthophyllite schist, quartz-mica schist and hornblende schist which occur as bands, lenses and relict patches within the gneissic and granitic rocks. They are of varied shapes and dimensions and sometimes unmappable on 1:25,000 scale.

Granite, Gneisses and Migmatites: -

The major part of this area is covered by these rock types and these are well exposed to the southeast of Surajgarh and Matwarsi hill ranges. This suite of rocks is mostly confined to the plains within which the meta-sedimentaries occur as enclaves. The three rock types are intimately associated in the field and are seen to grade into the other. The granite gneiss is grayish white in colour, medium to coarse grained showing a well-developed gneissic banding with preferred orientation of flaky mineral like biotite and muscovite flakes and quartzo-feldspathic material. Increase in mafic constituents gives rise to mesocratic varieties. Around Mohandi and Padur, exposures of augen gneiss are seen. The rock is coarse grained, well foliated consisting of quartzo-feldspathic material, amphibole and biotite. The augens comprise quartzo-feldspathic material, their long axis showing parallelism with the trend of foliation. Migmatites are stromatic and folded structure types. The leucosomes and the melanosome bands vary in thickness from few millimeters to as much as five centimeters. The leucosomes are essentially composed of quartzo-feldspathic material and the melanosomes consist of minerals like amphiboles and biotite. The associated granite is grayish to pinkish in colour, one grading into the other.

Banded Magnetite Quartzite (BMQ): -

The banded magnetite quartzite occurs as lenticular isolated patches along the regional strike in Mohandi and east of Gudunjurkoya. The banded magnetite quartzites are well banded and fine to medium grained in nature. The individual bands vary in thickness from a few millimeters to as much as 5 cm. These rocks essentially consist of alternate bands of quartz and magnetite. The BMQ bodies identified are smaller in nature, thus not mappable on 1:25,000 scale.

Pyritiferous Cherty Quartzite: -

The rock occurs as band varying width (2m to 10m) in association with micaceous quartzite and is exposed all along the southern flank of the hill ranges from north of Visamundi (western outside of the block) (65A/06) to the north of Padur, Pupil Dibba & Tumarkodi (eastern outside of the block area) (65A/10) crossing entire block area trending similar to the regional strike. Besides, isolated outcrop is seen north of Badsai. It is a light coloured, hard and compact rock with well-preserved bedding. Pyrite occurs as disseminations.

Micaceous quartzite: -

Outcrops of micaceous quartzite have been observed in the hills south of Alenga, Pamajiguda and many other places. The rock is medium grained and consists of quartz, sericite and muscovite. Bedding is marked by compositional banding. At places quartzite contains flakes of green coloured fuchsite mica. The fuchsite quartzite is seen in the hill section north of Gundapuri and north of Khandi in Toposheet No. 65A/10. Megascopically, the rock is medium to coarse grained with well-developed schistosity and at places, north of Gundapuri.

Mica schist: - This rock type is seen mostly along the nala beds and occurring usually as lenses. At places, intercalations of quartzite with gneiss are seen as in Pun Doda nala section. The rock is weathered, highly schistose and puckered at places. Large mica flakes are seen in Pun Doda nala section, otherwise the flakes do not vary in size. At places the mica schist grades into gneisses in the areas such as nalas south of Rekenar, Udera, NE of Karpanpundi near Kothi, Pupil Dibba & Padur.

Tremolite-actinolite schist: -

This rock unit occurs as bands and is associated invariably with BMQs and micaceous quartzites. A good exposure of this rock is exposed along Pun Dibba nala section in proximity to the Padur village. Megascopically, it is a light-colored medium grained rock. Radial crystals of actinolite are easily identifiable in the hand specimen. It has a smooth surface which may be due to either talc or fibrolite/pyrophyllites.

Ultrabasics (pyroxenites): -

Thin bands of ultrabasic rocks have been encountered to the Gudunjur and Kanjimarka nala section The rock is medium grained and melanocratic.

Metavolcanics: -

Thick piles of basic lavas have been observed in the Matwarsi hill, 504 peak, 557 peak and Pupil Dibba on Damkodwadvi hill range. It is exposed in the central part of Damkodwadvi hill range. It is green coloured, fine grained, crudely foliated rock, composed mostly of amphibole and pyroxene. Chert is found to occupy the vesicles. The metavolcanics are represented by hornblende schists and actinolite schists. The meta lavas had been observed to be associated with almost every unit and are generally parallel to the So planar surface of Bengpal Group which probably indicates that the lava is contemporaneous with metasediments. The volcanogenic origin is indicated in basic rock by the presence of amygdules (at places stretched) and close association with cherts (inter bedded types). In hand specimen, it appears to be almost mono-mineralic comprising mostly of amphiboles. But at places, feldspar veins are seen. Thin banding is due to the aggregation of lighter material during the process of metamorphism.

Bailadila Group

The Bailadila Group of rock unconformably overlies the Bengpal Group of rocks and occurs in the following areas:

a) The necklace outcrop along Damkodwadvi Hill Range exposed from west of Bodmeta in the southwestern part to Murwada in the northwestern part via Pupil Dibba in between, within this block.

b) Continuous High hill range of Damkodwadvi is trending E-W to NNE-SSW.

c) Western flanks of hill ranges to the east of Poyerkothi in the eastern part of the area.

The Bailadila Group of the rock is represented by ferruginous phyllites, shale, carbonaceous phyllites, BHQ/ BHJ, metavolcanics and meta-rhyolites. The description of these rock types is as given below.

Ferruginous phyllite/shale/carbonaceous phyllite: -

This rock is well exposed in Damkodwadvi hill range, Matawarsi hill range and Gundurwahi-Kothi hill range and is commonly associated with the banded iron formations, and seems to grade into each other. They are fine grained, almost aphanitic, greyish white to red in colour. Individual minerals are difficult to be identified at places but quartz, iron ore and mica can be identified. These are well foliated and foliation is parallel to banding of iron ore formation. The black shale/phyllite is associated with metavolcanic of Bailadila Group. It is well exposed in Matawarsi hill range, where bedding is well developed and marked by alternate bands of quartz and phyllitic material.

BHQ/BHJ: -

Exposure of banded iron ore formation is found in Matwarsi hill range, Gundurwahi Kothi hill range. These rocks are steel grey; reddish (where jasper is high in comparison with iron content) coloured and fine grained. The bedding is marked by alternate bands of silica (quartz-jasper) and iron ore. The individual band varies in thickness from few millimeters to 2 centimeters. Bands are irregular in nature and show variable thickness. They are characterized by branching, coalescing, puckering, and minor fracturing as observed in the above-mentioned hill ranges. Iron ore are mostly of hematite and martite. At few paces especially in the Surajgarh hill range minor amount of magnetite is also found along with the hematite. These rocks show penecontemporaneous structures.

Banded quartzite: -

Banded quartzite devoid of iron ore have been observed in Bodmetta hill, Surjagarh hill and part of Matwarsi hill range, where the bedding is marked by alternate quartz and jasper bands. It is highly recrystallised, light coloured essentially composed of quartz.

Metavolcanics: - Thick piles of basic lavas have been observed in the Matwarsi hill, and Damkodwadvi hill range. In the Matwarsi hill range, it occupies the core of major fold axis. It is green coloured, fine grained, crudely foliated rock, composed mostly of amphibole and pyroxene. Chert is found to occupy the vesicles. Chalcopyrite, pyrrhotite, and pyrite are also found in this rock.

Meta-rhyolites: - Outcrop of this rock types are exposed in the Gatta-Gudunjur road section in Toposheet No. 65A/10. The rock is medium to fine grained, grey coloured and contains phenocrysts of quartz and feldspar.

6.4-Petrological studies (PS):

Sample no - 01	GP-8
Physical properties	In hand specimen the rock is very fine grained, pink colored. Dominantly composed of quartz showing vitreous luster & conchoidal fracture (Fig. 1)
Petrographic study	Under the plane polarized light rock is fine grained, highly deformed, dominantly composed of felsic minerals. Opaque occur as dissemination and veins at places (Fig. 2). Under the cross nicol, felsic mineral identified as predominantly quartz., shows anhedral shaped and undulosed extinction (Fig. 3). Effects of deformation is manifested within quartz represented by ribbon shaped stretched grain, recrystallized grain boundaries with sub grain formation (Fig. 4). At places some grains are showing sigmoidal nature.
Name of the rock	Based on above megascopic and microscopic studies the rock is identified as sheared Quartz.



Fig. 1 Hand specimen/rock pieces are very fine grained, pink colored, massive and compact in nature.



Fig. 2 Photomicrograph showing fine grained felsic minerals with dissemination and veinlets of opaque. Under PPL (2.5X).

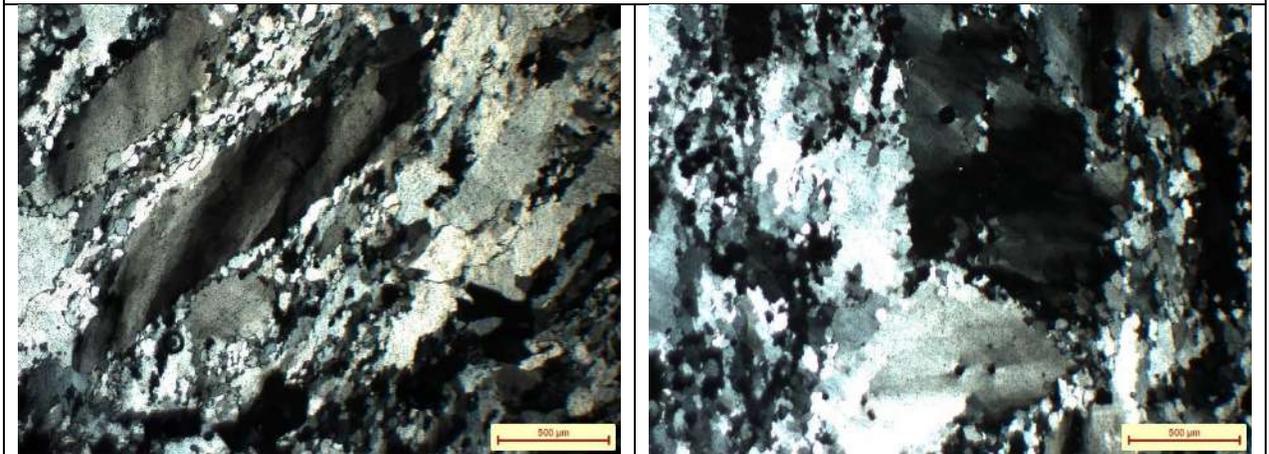


Fig. 3 Photomicrograph showing deformed nature of quartz with undulose extinction and ribbon shaped stretched grain, recrystallized grain boundaries with sub grain formation under XPL (5X).

Fig. 4 Photomicrograph showing deformed quartz with recrystallized grain boundaries with sub grain formation under XPL (5X).

Sample no - 02	GP-12
Physical properties	In hand specimen the rock is fine to medium grained, hard and compact, grey in color. Dominantly composed of mafic & felsic minerals (Fig.1).
Petrographic study	Under plane polarized light (PPL), rock shows presence of dominant altered mafic minerals, which are feebly pleochroic in shades of colourless to pale yellowish green as phenocrysts (Fig. 2). Phenocrysts of quartz are also seen. Altered felsic minerals are seen in subequal proportion in groundmass. It also contains fine dissemination of opaques. Under cross nicol (XPL) the dominant alteration mineralogy is represented by amphiboles, chlorite, sericite. Grains of quartz with embayed grain boundary are seen with undulose extinction. Relict grains of pyroxenes are seen with amphibole, chlorite at the peripheral part (Fig.3, Fig.4). Groundmass is sericitised. Opaques are sulfides, oxides (Pyrite, chalcopyrite, magnetite), occur as fine dissemination (Fig. 5).
Name of the rock	Based on above megascopic and microscopic studies the rock may be Altered mafic volcanic rock.



Fig. 1 Hand specimen/rock piece is green in color, fine grained, massive, hard and compact in nature. Crude alignment defined by alternated mafic and felsic minerals are seen.

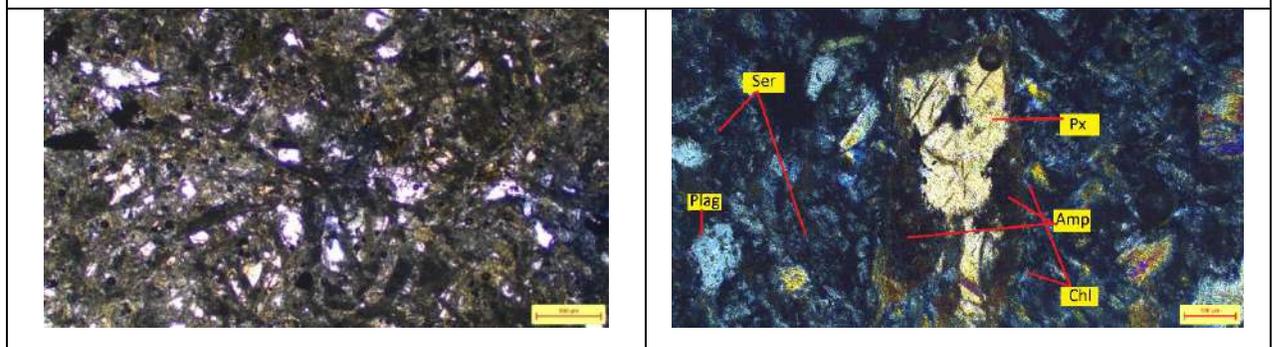


Fig. 2 Photomicrograph showing overall texture of rock. Grains are altered. Considerable numbers of quartz are also present as phenocrysts. Under PPL (2.5X).

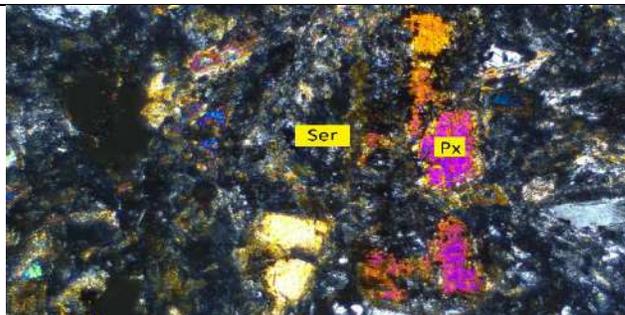


Fig.3 Photomicrograph showing relict pyroxene altered to amphibole, chlorite at the peripheral part. Sericite are occupying groundmass. Relict of plagioclase are seen at few places. Under XPL (10X).

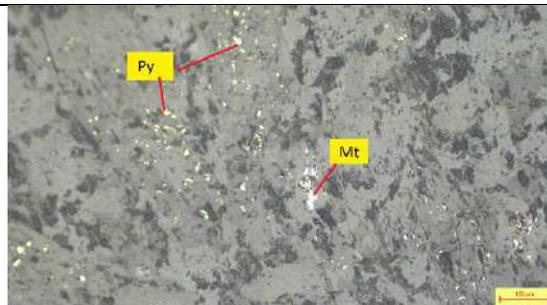


Fig.4 Photomicrograph showing relict pyroxene associated with alteration mineralogy i.e., chlorite, sericite. Under XPL (5X).

Fig.5 Photomicrograph showing disseminated tiny grains of pyrite, magnetite along interstitial spaces to the silicates, Under RL (10X).

Sample no - 03	GP-19
Physical properties	In hand specimen the rock is fine grained, hard and compact, green in color (Melanocratic) (Fig.1). Dominantly composed of mafic minerals with small amount of felsic minerals.
Petrographic study	Under the plane polarized light (PPL) rock is fine to medium grained and mainly composed of mafic minerals with subordinate felsic mineral phases along with disseminated opaques (Fig. 2). Under cross nicols (XPL) rock shows ad-cumulate texture defined by cumulates of subhedral pyroxenes along with feldspar as an intercumulates (Fig. 3). Pyroxene and amphibole are at places show twinned nature. At places pyroxene grains show alteration to amphibole, chlorite and epidote (Fig. 4). Feldspar is lath shaped, fresh in nature and shows relict polysynthetic twinning. Opaques are occurring as fine disseminations and distributed uniformly within groundmass.
Name of the rock	Based on above megascopic and microscopic studies the rock is identified as Altered Pyroxenite .



Fig. 1 Hand specimen/rock piece is greenish in color, fine grained, massive and compact in nature.

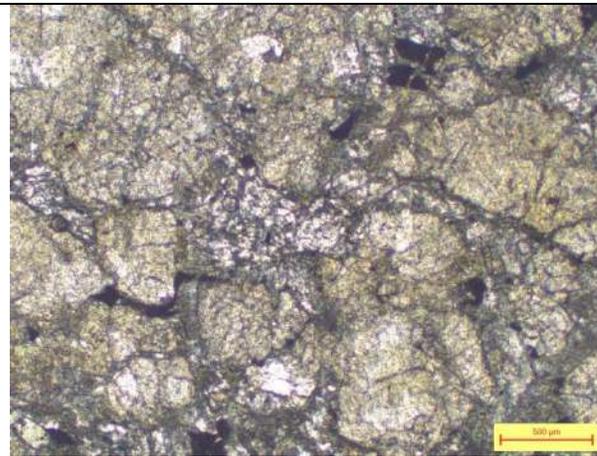


Fig. 2 Photomicrograph showing ad-cumulate texture with cumulates of mafic minerals and intercumulus felsic mineral with interstitial opaques Under PPL (5X).

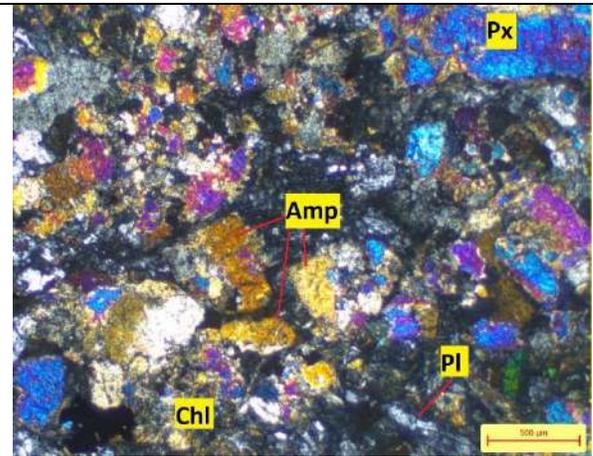


Fig. 3 Photomicrograph showing ad-cumulate texture with cumulates of pyroxenes and intercumulates of plagioclase feldspar (note-amphibole, chlorite is alteration of pyroxene) Under XPL (2.5X).

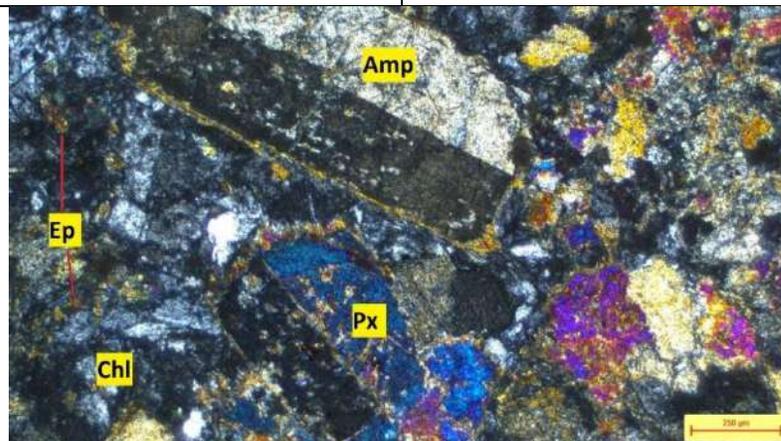


Fig. 4 Photomicrograph showing pyroxene and amphibole cumulates shows twining Under XPL (10X).

Sample no - 4	GP-23
Physical properties	In hand specimen the rock is fine to medium grained, hard and compact, dominantly composed of mafic minerals with subequal amount of felsic minerals (Fig.1).
Petrographic study	Under plane polarized light (PPL) rock shows presence of altered mafic minerals, which are feebly pleochroic in shades of colourless to pale yellowish green and felsic quartz as phenocrysts, embedded on altered felsic groundmass (Fig. 2). Under cross nicol (XPL) the dominant alteration mineralogy is represented by amphiboles, chlorite, epidote, sericite. Grains of chlorite, are occurring as phenocrysts (Fig.3). These are embedded on sericitised groundmass (epidotised at places). Relict grains of pyroxenes are seen to be altered to amphibole, chlorite at places (Fig.4). Subequal proportion of quartz with subhedral to anhedral shape, undulose extinction are present as phenocrysts. A quartz vein is also seen (Fig.6).
Name of the rock	Based on above megascopic and microscopic studies the rock may be identified as Altered mafic volcanic rock.



Fig. 1 Hand specimen/rock piece is fine to medium grained, hard and compact, grey colored, composed mainly of mafic minerals with felsic minerals.

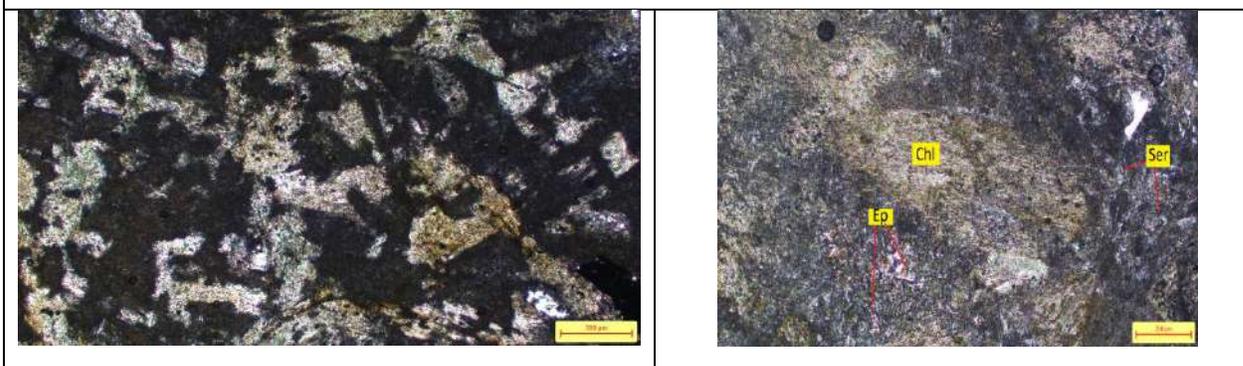


Fig. 2 Photomicrograph showing overall texture of rock specimen. Minerals are altered. Under PPL (2.5X).

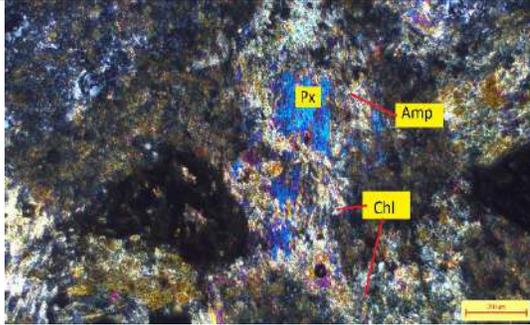


Fig.3 Photomicrograph showing Chlorite phenocryst within sericitised, epidotised groundmass. Under PPL (5X).

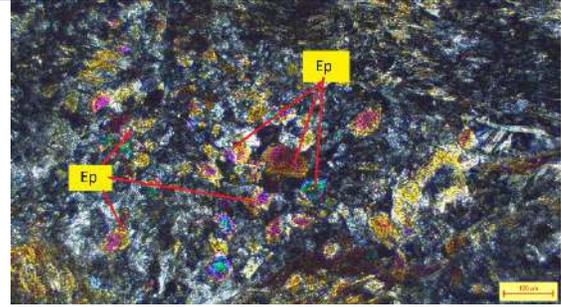


Fig.4 Photomicrograph showing relict pyroxene associated with altered amphibole, chlorite. Under XPL (5X).

Fig.5 Photomicrograph showing epidote grains in groundmass. Under XPL (10X).

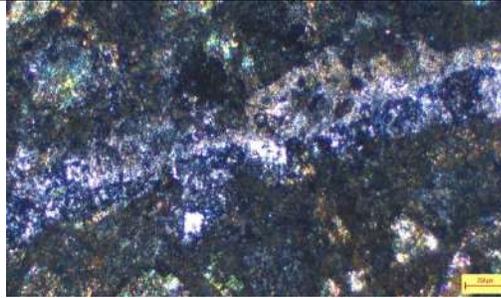


Fig.6 Photomicrograph showing quartz vein. Under XPL (2.5X).

Sample no -5	GP-25
Physical properties	In hand specimen the rock is fine grained, hard, compact, brownish red colored, high specific gravity, nonmagnetic with brownish red streak. Surface is smooth, nodular. (Fig. 1).
Petrographic study	Under plane polarized light and cross nicols rock is medium grained and mainly composed of opaques (iron oxide) (Fig. 2). Under reflected light iron oxides are identified as Hematite with bright to steel grey color, pitted surface. A few stringers and interspaces are filled up with needle shaped Specularite. At places magnetite are also seen to be present as relict (Fig.3)
Name of the rock	Based on above megascopic and microscopic studies the rock is identified as Hematite Ore.



Fig. 1 Hand specimen/rock piece is fine grained, brownish red colored, hard and compact in nature with smooth nodular surface.

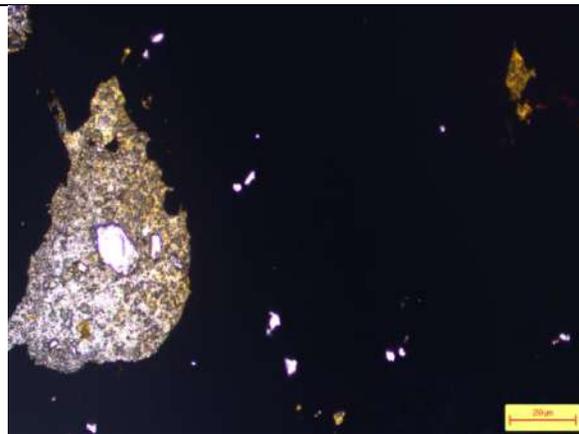


Fig. 2 Photomicrograph showing iron oxide. under PPL (5X).

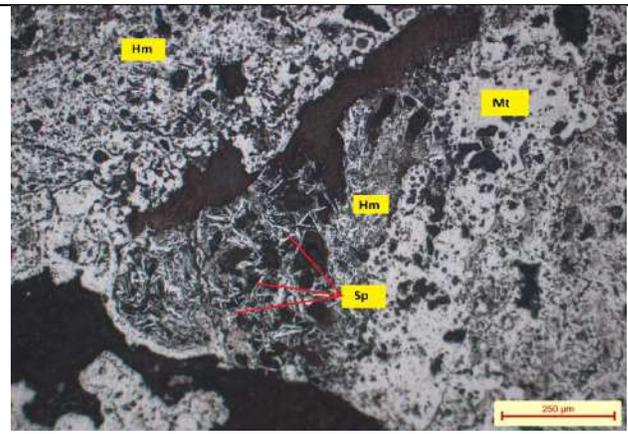


Fig. 3 Photomicrograph showing distribution of hematite in association needles of specularite with relict of Magnetite. under RL (10X).

6.5-Chemical analysis of major oxides & interpretation

A total of 70 BRS have been analysed across the lithology and substantial numbers are from mineralized zones. Total 40 BRS from mineralized zone are showing an average of 61.59% Fe(T) ,SiO₂ from 1.08 to 23.32%, Al₂O₃ from 0.17% to 8.76%, “P” from less than 0.01% to 0.27% and “S” from less than 0.01% to 0.17%.(Anexure-1)

6.6-Chemical analysis for PCS of BRS sample:

Five BRS have been analyzed for both PS & PCS. The complete analytical values of different radicals are tabulated under annexure-4.

6.7-Mineralographic study of the ore zones:

Sample no - 01	GP-9
Physical properties	In hand specimen the rock is very fine grained, hard and compact, grey to brown colored with brown streak, feebly magnetic (Fig. 1).
Petrographic study	<p>Under the plan polarized light and cross nicol rock is medium to coarse grained, mainly composed of iron oxides associated with very fine grain sub angular quartz (Fig. 2) Iron oxide is dark brown in color occur as predominant phase (90%) with subordinate gangues (quartz-10%). The rock is traverse by quartz veinlets.</p> <p>Under the reflected light iron oxides are anhedral to subhedral in shape and composed of hematite. It occurs as very fine dissemination associated with quartz (Fig. 3), generally shows bright steel grey appearance and pitted in nature (Fig. 4 and Fig. 5). Magnetite is occurring as minor in amount as relict phase within hematite shows grey color with brown tint. Also observed tiny grains of pyrite at places associated with hematite.</p>
Name of the rock	Based on above megascopic and microscopic studies the rock is identified as Hematite (Iron Ore) .



Fig. 1 Hand specimen/rock piece is very fine grained, grey to brown color, hard and compact in nature.

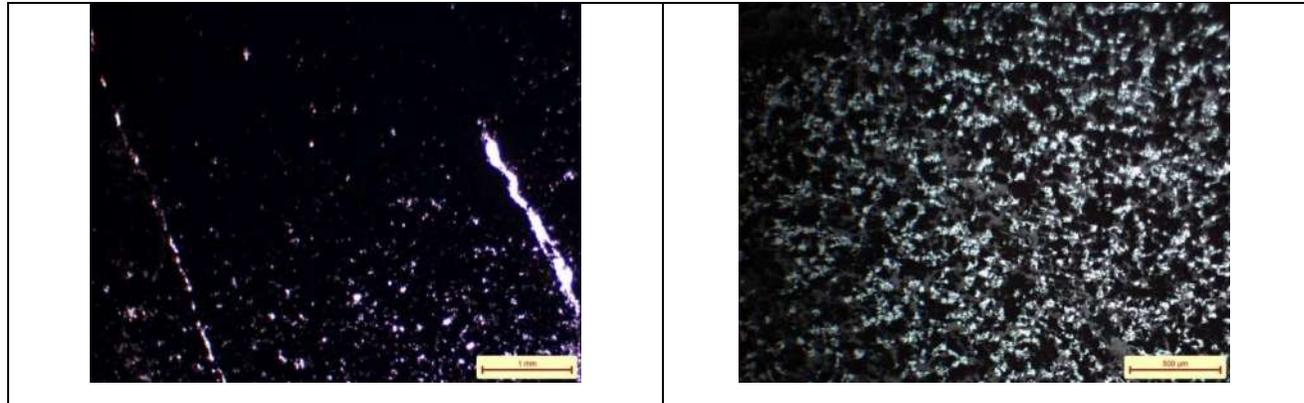


Fig. 2 Photomicrograph showing subangular tiny quartz grains embedded within brown color iron oxide (Note-later intrusive quartz veinlets also present). under PPL (2.5X).

Fig. 3 Photomicrograph showing fine distribution of subhedral shape hematite in association with gangue minerals (quartz). under RL (5X).

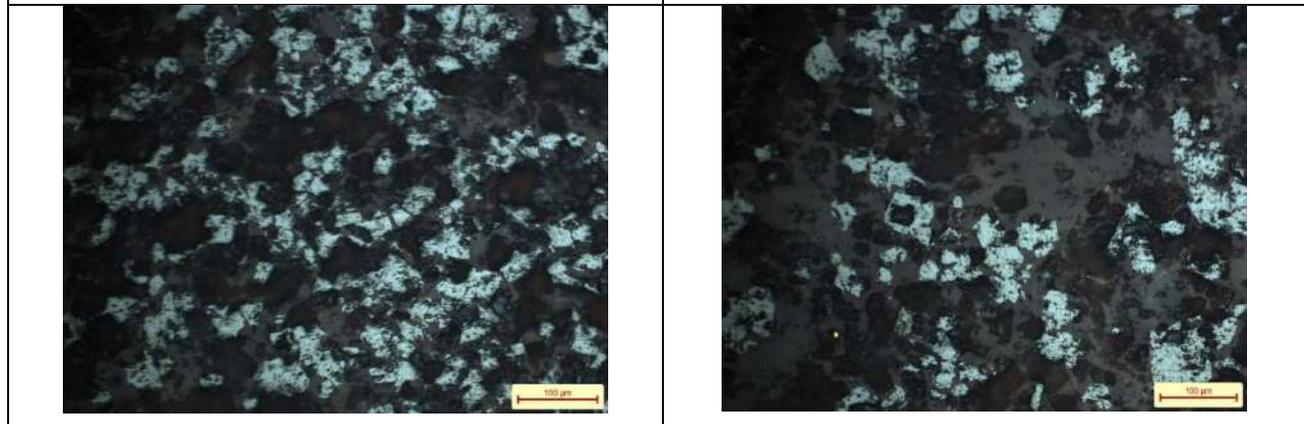


Fig. 4 Photomicrograph showing subhedral hematite with bright steel grey appearance under RL (20X).

Fig. 5 Photomicrograph showing subhedral hematite with pitted nature and bright steel grey appearance (Note- tiny yellow grain of pyrite) under RL (20X).

Sample no - 02	GP-10
Physical properties	In hand specimen the rock is very fine-grained, reddish-brown color, hard and compact. It shows brown streak and nonmagnetic nature. It is also traversed by crisscross felsic veins.
Petrographic study	Under the plan polarized light and cross nicol rock is medium to coarse grained, mainly composed of sub angular to sub rounded quartz grains embedded in iron rich matrix (Fig. 2) Iron oxide is dark brown in color in the matrix occur as predominant phase (90%) with subordinate gangues (quartz-10%). Under the reflected light iron oxides are anhedral in shape and dominated composed of hematite along with magnetite (Fig. 3 and Fig. 4). Hematite proportion is more that magnetite. Hematite appears bright steel grey and pitted in nature, occur as replacement of magnetite, flaky or platy appearance at places. Magnetite is grey in color with brown tint.
Name of the rock	Based on above megascopic and microscopic studies the rock is identified as Hematite (Iron Ore) .

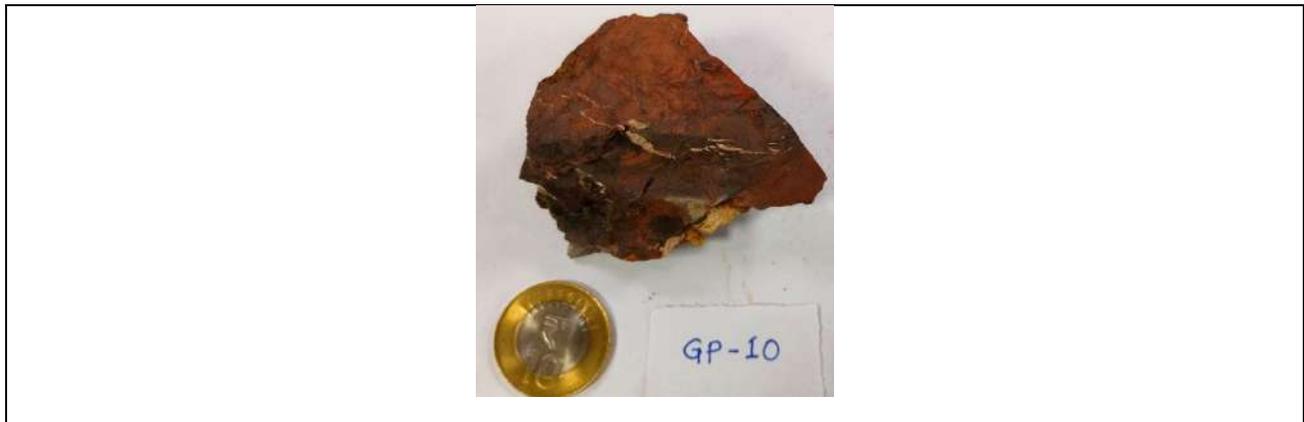


Fig. 1 Hand specimen/rock piece is are brown in color, massive and compact in nature and traverse by felsic veins.

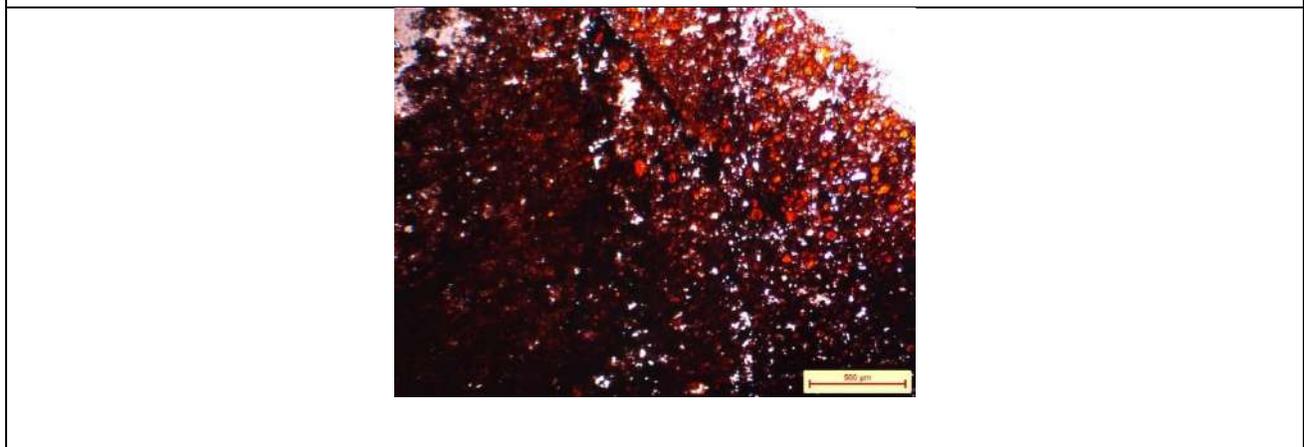


Fig. 2 Photomicrograph showing subangular to subrounded tiny quartz grains embedded within brown color iron oxide under PPL(5X).

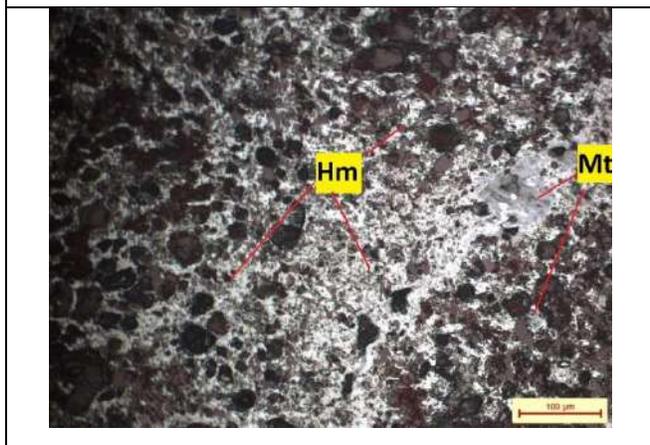


Fig. 3 Photomicrograph showing hematite replacement with relict magnetite. Under RL (20X).

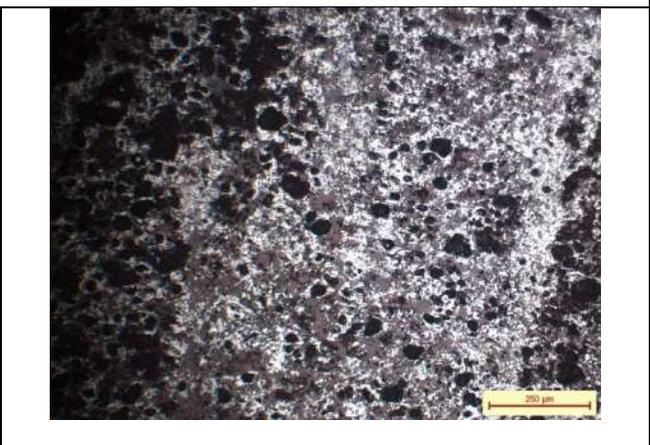


Fig. 4 Photomicrograph showing fine distribution of dominant hematite phase under RL (10X).

Sample no - 03	GP-26
Physical properties	In hand specimen the rock is very fine grained, hard and compact, predominantly composed of black metallic minerals (Fig. 1). It shows brown color streak, non-magnetic and have high specific gravity.
Petrographic study	Under the reflected light iron oxides is very fine grained, shows radiating or spherulitic structure (Fig 2). Iron oxide is dominantly predominantly composed of hematite. The hematite is anhedral in shape, have bright steel grey appearance and pitted nature (Fig 3). The radiating specks or needles are represented by specular hematite (Fig.4).
Name of the rock	Based on above megascopic and microscopic studies the rock is identified as Hematite (Iron Ore) .



Fig. 1 Hand specimen/rock piece is fine grained, hard and compact in nature, shows brown streak and metallic luster also have high specific gravity and non-magnetic nature.

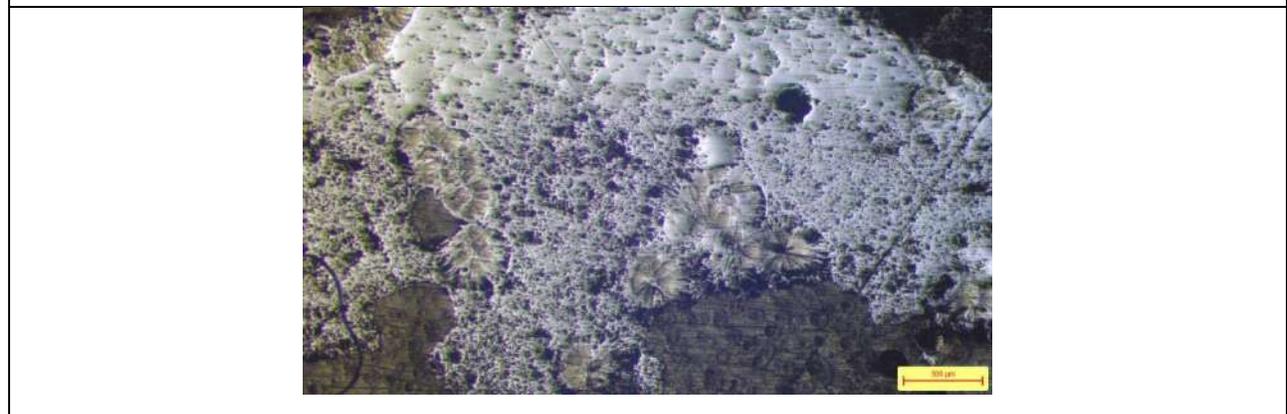


Fig. 2 Photomicrograph showing rounded or spherulite structure with radiating hematite grain within pitted hematite under Reflected Light (2.5X).



Fig. 3 Photomicrograph showing rounded or spherulite structure with radiating hematite grain within pitted hematite under Reflected Light (5X).



Fig. 4 Photomicrograph showing radiating hematite grain under Reflected Light (10X).

Sample no - 04	GP-30
Physical properties	In hand specimen the rock is very fine grained, hard and compact, predominantly composed of black metallic minerals (Fig. 1). It shows brown streak, non-magnetic and have high specific gravity.
Petrographic study	Under the reflected light iron oxides occur as very fine grained granular as well as in vein form and fractured in nature (Fig 2). Iron oxide is dominantly composed of hematite with negligible amount of gangue minerals. Granular hematite is anhedral in shape and shows alteration or oxidation. Relict fresh hematite is bright steel grey in appearance and pitted nature (Fig 3). Along the fracture remobilized vein form fresh hematite shows bright steel grey appearance and pitted nature (Fig.4).
Name of the rock	Based on above megascopic and microscopic studies the rock is identified as Hematite (Iron Ore) .



Fig. 1 Hand specimen/rock piece is fine to medium grained, hard and compact in nature, black in color and shows metallic luster.



Fig. 2 Photomicrograph showing granular as well as vein form hematite ore under Reflected Light (5X).

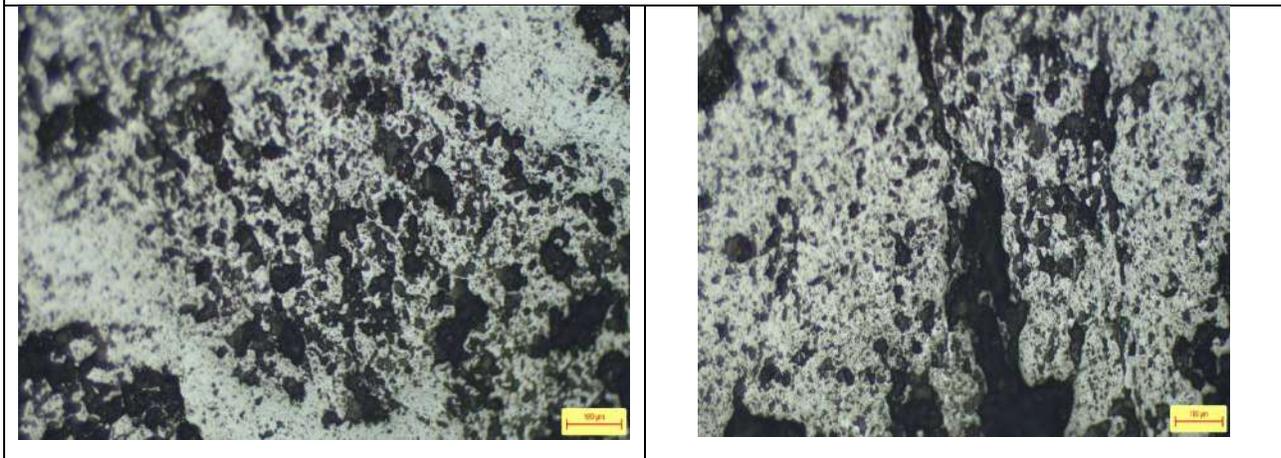


Fig. 3 Photomicrograph showing subhedral steel grey granular hematite along with vein form hematite under Reflected Light (10X).

Fig. 4 Photomicrograph showing partly altered/oxidized hematite grains under Reflected Light (20X).

Sample no - 05	GP-34
Physical properties	In hand specimen the rock is very fine grained, hard and compact, predominantly composed of black metallic minerals (Fig. 1). It shows brown streak, non-magnetic and have high specific gravity.
Petrographic study	Under the reflected light iron oxides is very fine grained, highly fractured in nature (Fig 2). Iron oxide is dominantly composed of hematite shows granular nature. The hematite is euhedral in shape have with mutual boundary texture, bright steel grey in appearance and pitted nature and also occur as relict phases with corroded borders within the altered or oxidized ore (Fig 3) and (Fig.4). It also shows oxidation/alteration of the main iron oxide.
Name of the rock	Based on above megascopic and microscopic studies the rock is identified as Hematite (Iron Ore) .



Fig. 1 Hand specimen/rock piece is fine to medium grained, hard and compact in nature, shows dissemination of black metallic iron oxide grain within light color gangue/silicates.

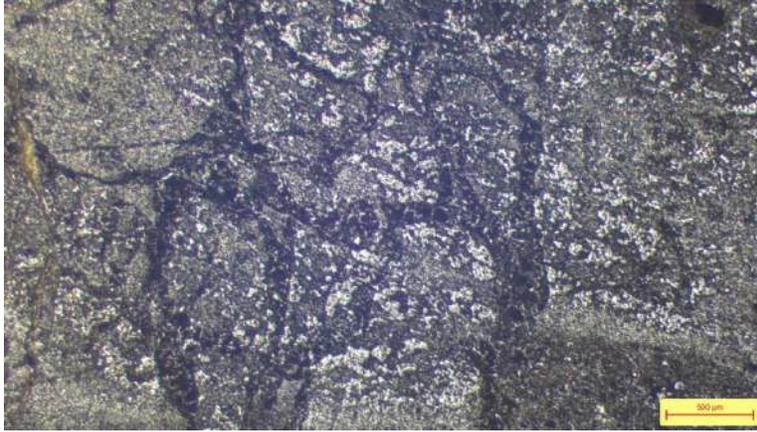


Fig. 2 Photomicrograph showing highly fracture nature of ore under Reflected Light (2.5X).



Fig. 3 Photomicrograph showing euhedral steel grey hematite shows granular nature with mutual boundary texture under Reflected Light (10X).

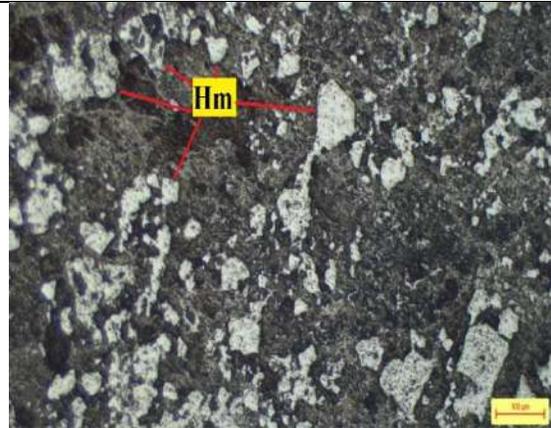
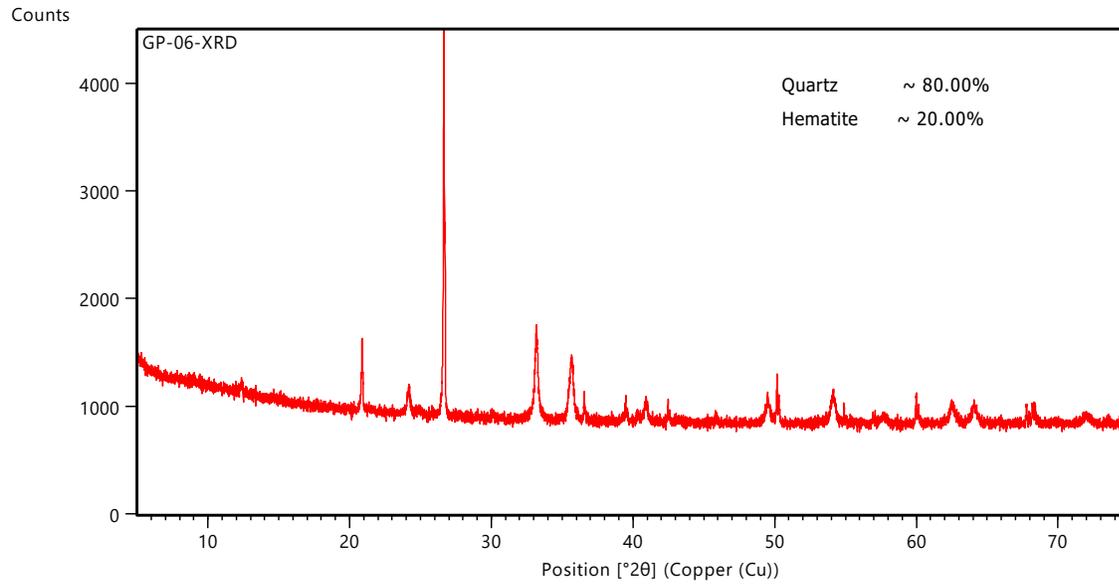


Fig. 4 Photomicrograph showing relict euhedral to anhedral hematite grains within the altered or oxidized ore under Reflected Light (10X).

6.8-XRD studies:

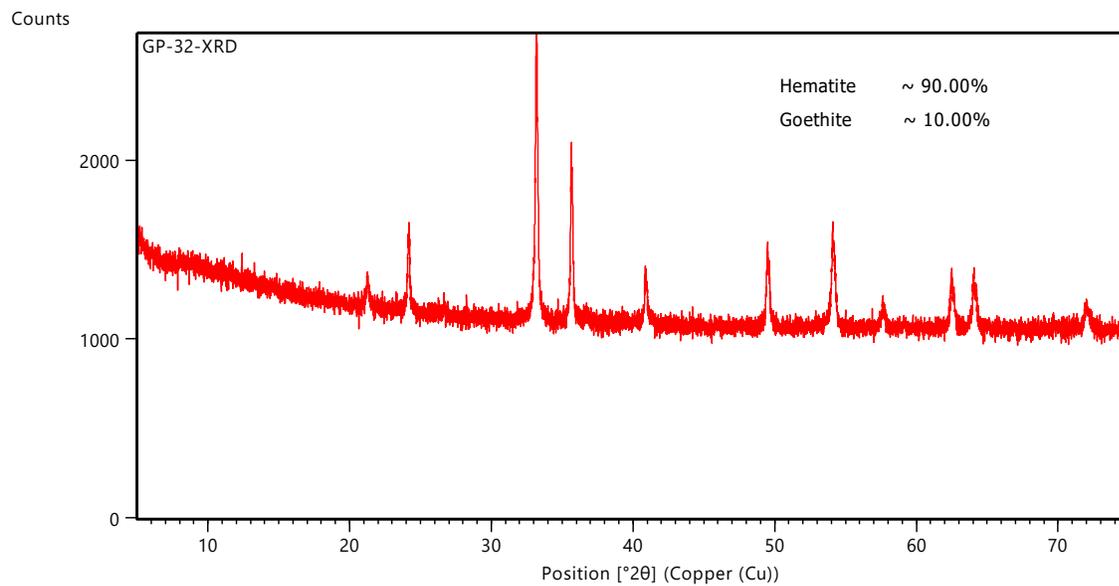
01- Dataset Name

GP-06-XRD



02- Dataset Name

GP-32-XRD





Chapter-7

MINERAL PROSPECT

Surface indication, mode of occurrence, strike length and width on mineralized zone:

A Reconnaissance survey (G4) on 1:25,000 scale has been accomplished through Large scale geological mapping on 1:25,000 scale, Remote Sensing Studies and surface Geochemical Surveying of Bed rock samples from mineralized zone. Sub-surface sampling through Pitting and trenching couldn't be undertaken, owing to disturbed terrain condition.

The objective of this NMET funded project was to “demarcate the mineralized zone and to assess the potentiality of Iron Ore”. Continuous BIF band in the north is disrupted and displaced by NW-SE trending normal faults. 580m clear shifting of the northern band is observed. The same BIF band is folded with western closure and NE-SW fold axis. Southern BIF band is continuous from east side block and a few places disrupted by local N-S trending faults. **15 km long BIF band has been observed with 150 m** approximate thickness with tonal and textural quality refers to a prominent ore deposit. (Plate-4b)

The Iron mineralization is in the form of Haematite Ore at an average grade of +61.59% Fe(T) content.

Total seventeen detached mineralized bands have been identified ranging in strike length from 418m (Band-5) to 8303m (Band-3) with estimated reconnaissance resource of 135.231 mt, considering band width of 30 m, approx. depth of 50 m taking Bulk Density of 3.5g/cc.

Out of 70 samples analysed for major oxides, 40 BRS are yielding Fe(T) value more than 45% with an average grade of [+] 61.59% Fe(T)., “P”- is less than 0.01% and “S” is less than 0.01%. Few samples have also been analyzed/studied for PS, PCS, OM, XRD. The details of analytical values are appended in attached annexure. The gist of study is summarized below:

- a) From the Petrographic study the Iron ore minerals are mainly Haematite with magnetite and goethite.
- b) Mineralized bands are separated by a series of normal faults.
- c) The dip of the BHQ/BHJ with Iron ore is varying from steep to sub-vertical.
- d) The Iron ore bands are discontinuous, being separated by faulting and shows pinch and swell structure along the strike.
- e) As the host lithounits suffered three phases of folding, rich concentration Iron ore should be confined at folds closures.
- f) The ore localization of Iron ore is controlled both by lithology and structure of the area.



CHAPTER-8

RESOURCE ESTIMATION

Introduction

The reconnaissance survey on G4 level has been accomplished through Large scale mapping on 1:25,000 scale, Remote Sensing Studies and surface Geochemical Surveying. The field observations on structural trends of Ore bodies from surface exposures and analytical values of the Geochemical survey the reconnaissance resource was estimated as per UNFC norms and Minerals (Evidence of Mineral Content) Rules-2015 at G-4 level. Pitting & Trenching couldn't be taken up. It is observed that Iron Ore Bands/lenses demarcated in the area, were formed as a result of supergene enrichment of underlying ferruginous formations. The Iron ore bodies viz. massive. Iron ore bodies found in the area, occur as elongated lenticular bodies of variable dimensions both laterally and depth wise. The area clearly depicted lateral continuation of ore bodies at depth. Consequently, based on field observations, the surface width measured ranging from 20 m to 50 m. In the absence of sub-surface geological information, the altitudinal differences of band disposition on the ground based on contour interval, a **50m** depth has been assigned for estimation of reconnaissance mineral resource (334). Similarly, the Bulk density of the massive Iron ore has been considered to be of 3.5g/cu.cm The grade of the ore body has been derived out of the weighted average of all the samples of mineralized zone. Finally, an estimated reconnaissance resource of 135.231 **mt** from a cumulative band length of 32,198m within an area of 9,65,940 m² and 4,82,97,000 volume (m³) of mineralized zone has been established. A summarized account of resource related estimation the following point have been outlined.

- a) In the absence of pitting, trenching, the depth continuity of ore body can be ascertained from the study on nala section and nearby mine/ pit sections in the mapped area, to arrive at a logical conclusion at this stage of survey (G4).
- b) The area falls within known mineral belt with existing mines (Brown field area). So projecting mine data, dimension of ore bodies can be inferred.
- c) As the ore bodies are sub-vertical, the difference of contour gives an exposed thickness in the outcrop, beyond it ore orebody continuous at depth.
- d) So, it is logical to estimate the resource maximum upto 50m. keeping the first level of drilling in mind in this case.
- e) Resource for float and in-situ ores have been separated.

Resource of float ores surrounding the mineralized band in lesser altitude is estimated to be 21. 56mt. considering the depth of 5m and bulk density of 2.5g/cc.

The details of resource estimation (in-situ ores) are **tabulated below**.



DIMENSION AND GEOLOGICAL RESOURCE (334) OF MASSIVE IRON ORE BANDS IN GP BLOCK							
Dimension of ore body					Area of Iron ore (m ²)	Vol. of Iron Ore Bands (m ³)	Ore Resource Estimation Band wise (MT)
BAND	Length (m)	Width Range (m)	Average Width (m)	Approx. Depth (m)			
1	1905	15-30	30	50	57150	2857500	10.00125
2	2855		30	50	85650	4282500	14.98875
3	8303		30	50	249090	12454500	43.59075
4	1041		30	50	31230	1561500	5.46525
5	418		30	50	12540	627000	2.1945
6	691		30	50	20730	1036500	3.62775
7	717		30	50	21510	1075500	3.76425
8	733		30	50	21990	1099500	3.84825
9	2507		30	50	75210	3760500	13.16175
10	1607		30	50	48210	2410500	8.43675
11	1379		30	50	41370	2068500	7.23975
12	3436		30	50	103080	5154000	18.039
13	2876		30	50	86280	4314000	15.099
14	822		30	50	24660	1233000	4.3155
15	1438		30	50	43140	2157000	7.5495
16	656		30	50	19680	984000	3.444
17	814		30	50	24420	1221000	4.2735
17 nos.	32198				965940	48297000	169.0395
Massive Iron Ore. Bulk Density of 3.5g/cc has been consideration for calculation							

As the sampling couldn't be done systematically covering all the bands, therefore 20% resource is discounted and thus final reconnaissance resource is reported to be 135.231 mt



Float Ore				
LITHOLOGY	band name	Area	Volume	Resource
Float Ore	GP-01	145091.696	725458.48	1.8136462
Float Ore	GP-02	239850.004	1199250.02	2.99812505
Float Ore	GP-03	92870.394	464351.97	1.160879925
Float Ore	GP-04	26738.078	133690.39	0.334225975
Float Ore	GP-09	106864.378	534321.89	1.335804725
Float Ore	GP-10	140407.353	702036.765	1.755091913
Float Ore	GP-12	200942.376	1004711.88	2.5117797
Float Ore	GP-13	379788.585	1898942.925	4.747357313
Float Ore	GP-15	121825.677	609128.385	1.522820963
Float Ore	GP-16	270669.584	1353347.92	3.3833698
Total	10 no's	1725048.13	8625240.625	21.56310156



CHAPTER-9

Conclusion and recommendation

An area of 65 sq km area was geologically mapped in parts of Ettapalli tehsil, Chandrapur district, Maharashtra in Toposheet No. 65A/10 with PGRS support. Metasedimentary bands such as banded magnetite quartzite, cherty quartzites, mica schists/quartz muscovite schist sericitic, phyllite, Banded hematite quartzite and ferruginous shales occur as enclaves in the gneissic terrain. These have been classified in to Bengpal and Bailadila Groups on the basis of contrasting lithology and grade of metamorphism. The rocks of Bengpal Group comprise high grade metamorphites and are low in ferruginous content as compared to the Bailadila which comprise low grade metasediments having more iron content. The Bengpal Group thus consists of Quartzite, cherty quartzite/BMQ and mica schist /quartz mica schist. The rocks of Bailadila Group are represented by sericitic phyllite containing bands of ferruginous shales /phyllite and iron ore.

The metasedimentary sequence is intruded by ultramafics, granites, quartz veins and dolerite. The ultramafics are metamorphosed and altered and are represented by serpentinites, talc-tremolite schists, chlorite-actinolite schists, chlorite phyllites/schists etc. The intense granitic activity has given rise to formation of gneisses and migmatites which display an array of migmatitic structures.

The rocks of the area are highly deformed into numerous mesoscopic and macroscopic folds and evidences of two phases of folding have been observed. The earlier folds (F1) are open upright and tight isoclinal, plunging towards WNW to WSW and also towards E to ESE. The later folds (F2) are upright and slightly asymmetrical plunging towards SSE or SSW.

Total seventeen Iron ore bands have been identified ranging in strike length from 418m (Band-5) to 8303m(Band-3) with estimated reconnaissance resource of 135.231 mt, considering band width of 30m, approx. depth of **50** m taking Bulk Density of 3.5g/cc.

Out of 70 samples analysed for major oxides, 40 BRS are yielding Fe(T) value more than 45% with an average grade of [+]**62%** Fe(T)., "P"- is less than 0.01% and "S" is less than 0.01%.

- a) In the absence of pitting, trenching, the depth continuity of ore body can be ascertained from the study on nala section and nearby mine/ pit sections in the mapped area, to arrive at a logical conclusion at this stage of survey (G4).
- b) The area falls within known mineral belt with existing mines (Brown field area). So projecting mine data, dimension of ore bodies can be inferred.
- c) As the ore bodies are sub-vertical, the difference of contour gives an exposed thickness in the outcrop, beyond it ore orebody continuous at depth.
- d) So it is logical to estimate the resource maximum upto 50m. keeping the first level of drilling in mind in this case.
- e) Resource for float and in-situ ores have been separated.

Tentatively eight CL blocks have been carved out and proposed for auctioning.

Recommendations:

The G-4 stage exploration have been carried out in Gilanguda-Padur block, Gadchiroli District, Maharashtra employing large scale mapping on 1:25,000 scale and rocks/ ore sampling, analysis have given encouraging results for Iron (Haematite). The area is promising in view of reporting mineralized zone and grade of Iron ore.



1. Based on field data generated through G4, the area can be taken up for auctioning under "CL" by DGM, MS.
2. During our current field work many adjacent areas have been potentially identified for future exploration under G4 for both Haematite and Magnetite ores within the Toposheet areas of 65A/6 & 65A/11. Even adjacent area of Chhattisgarh State is presumed to be potential for Iron ore exploration.
3. DGM Maharashtra can take up this block for auctioning under CL.



Appendix-1

Expenditure

Sl no.	Item of Work	Total Amount (Rs)	Remarks
1	Large scale (LSM) Geological mapping/Trenching.		
1.1	Geologist man days (1 No) for large scale (LSM) Geological mapping/Trenching	11,00,000	100 days @ Rs-11,000K/
	Geologist man days was reduced to 80 days	9,68,000	80 days @ Rs-11K/. Decision of 60 th TCC vide pg-23 of the minutes.
1.2	Geologist man days (1 No) for Geological mapping & Report (HQ)	4,50,000	50 days @ Rs-9,000/
1.3	Labour (field) for (Total 4 Nos i.e. 2 workers per one geologist) for 200 days @ Rs-500/	1,00,000	Amount will be reimbursed as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher @ Rs-500p/day/per..
	*Field Labour days also to be reduced to 160 days(80x2)	80,000	*60 th TCC decision.
	Sub-Total (1)	14,98,000	
2	Laboratory Studies		
3	Chemical Analysis		
3.1	Surface sampling (Bed rock samples/channel/trench)		
a	Primary Sample- for 6 radials for total Fe, Total Mn, Al ₂ O ₃ , P ₂ O ₅ , CaO, SiO ₂ & Acidic Insoluble	2,94,000	BRS samples: 70 @ Rs-4200/
3.2	Check Samples (Bed Rock/Soil/Stream Sediment Samples)-5% Internal & 10% External		
a	Check Sample- for 6 radicals for total Fe, Total Mn, Al ₂ O ₃ , p ₂ o ₅ , CaO, Sio ₂ & Acidic Insoluble	29,400	BRS check-7 @ Rs-4200/
3.3	Primary Samples for PCS by fire assey	38,655	5 samples @ Rs-7731/
3.5	Petrological/ Minerographic studies		
a	a) Preparation of thin section	11,765	5 samples @ Rs-2353/
b	b) Study of thin section for petrography	21,160	5 samples @ Rs-4232/
c	c) preparation of polished section	7,745	5 samples @ Rs-1549/
d	d) Study of thin polished section for minerography	21,160	5 samples @ Rs-4232/
	Sub- Total (3)	4,23,885	
4	Total (1 to 3)	19,21,885	
5	Miscellaneous Charge		
i	Preparation of Exploration Proposal	38,438	EA has to submit the hard Copies and the soft copy of the final proposal along with Maps and plan as suggested by the TCC-NMET meeting while clearing the Project
ii	Report Peer Review Charges	30,000	
iii	Geological Report Preparation	1,50,000	EA has submitted the final Geological report in Hard copies (5 Nos) and the soft copy to NMET
9	Total - 5	2,18,438	
10	Total Estimated Cost without GST (5+9)	21,40,323	
11	Provision for GST (18%)	3,85,258	GST will be reimbursed as per actual and as per notified prescribed rate
12	Total Estimated Cost with GST	25,25,581	



Appendix-2

References

Sl	Authors	Title	Year
01	Pascoe. E. H	"A Manual of Geology of India & Burma Vol.I"	1950
02	King, W	The Geology of the Pranhita-Godavari valley, Mem. Geol Surv. Ind. Vol.18.pt-3.	1981
03	Crookshank, H	Geology of the southern Baster and Jeypore from Bailadila range to Eastern Ghats (Mem. Geological Survey of India Vol.87)	1963
04	C. N. Chari et.al	DGM, MS was carried out exploration for Iron Ore in Surjagarh area. in parts of Toposheet 65A/06.	Between 1967-1975.
05	H. P. Saxena, S. K. Das, B. Zaheer and S. K. Sengupta	First systematic geological mapping in this area within the Toposheet No-65A/06 & 65A/10 was carried out vide Acc No- CR-014491.	Field Season-1978-79.
06	S. S. Jain & S. K. Pattanaik	The remaining part of the Toposheet 65A/06, 65A/07 & 65A/11 was subsequently mapped vide Acc No- CR-014572.	Field Season - 1978-79.
07	T. Krishnama Charlu & K. Kumaran	Regional Integrated Survey for locating Base metal occurrences by Regional Stream Sediment Survey in the SE extension of the Chamur-si-Ghot belt, in parts of Toposheet 65A/02 & 65A/06 was carried out. vide Acc No- CR-015778.	F.S-1978-79.
08	K. Kameswara Rao	A Preliminary appraisal of Sillimanite occurrence near Gundapuri was carried out in parts of Toposheet 65A/06 & 65a/07. vide Acc No- CR-015239.	Field Season- 1980-81
09	Shymal Kumar Sengupta & Swapan Kumar Das	One more Preliminary appraisal of the newly reported Base metal occurrences in Bhandara and Gadchiroli Districts was carried out in parts of Toposheet 65A/06 & 65a/07 vide Acc No- CR-016829.	Field Season- 1982-83.
10	Pattanaik & Sengupta	Geology of parts of Sironcha Tehsil, Chandrapur District in parts of Toposheet 65A/07 vide Acc No –CR-013642.	Field Season 1977-78.
11	K. Kameswara Rao	On the reported occurrences of Kyanite and Sillimanite around Palli and Kusansur in parts of Toposheet 65A/11, vide Acc No-CR-015779.	Field Season 1979-80
12	S. K. Pattanaik	Regional Stream Sediment Survey between Hetalkasa & Dudepalli in parts of Gadchiroli District, vide Acc No in parts of Toposheet 65A/02 & 65A/07. vide Acc No-CR-017760	Field Season 1982-83
13	Hemmady, A, K, R.,	Geology of parts of Sironcha Tehsil, Chandrapur District in parts of Toposheet 65A/03 vide Acc No –.	Field Season 1967-68
14	R. Raman	Geology of parts of Sironcha Tehsil, Chandrapur District in parts of Toposheet 65A/01 vide Acc No –.	Field Season 1969-70



Appendix-3

Locality Index

Sl. No.	Village	Toposheet	Latitude			Longitude		
			Deg	Min	Sec	Deg	Min	Sec
1	Pana Gudra	65A/10	19°	34	15	80°	30	15
2	Yadaddami		19°	34	45	80°	31	00
3	Tadimakakoti Metta		19°	34	30	80°	31	15
4	Mesa Metta		19°	34	40	80°	32	45
5	Gudunjur koya		19°	35	45	80°	33	00
6	Pupil Dibba		19°	34	45	80°	33	45
7	Kadinchakoti Metta		19°	35	15	80°	34	45
8	Padur		19°	32	45	80°	34	10
9	Kucher		19°	30	30	80°	31	40
10	Mohandi		19°	36	20	80°	33	50
11	Matwarsi		19°	36	42	80°	35	00
12	Mardakohi		19°	41	40	80°	34	00
	Gundavahi		19°	32	40	80°	38	30
13	Kothi		19°	32	35	80°	37	00
14	Gilanguda		19°	36	50	80°	30	50
15	Gudunjur	19°	35	50	80°	32	55	
16	Bejur	65A/11	19°	43	00	80°	25	30
17	Pamajiguda	65A/06	19°	35	50	80°	25	03
18	Modaske		19°	39	20	80°	28	40
19	Petha		19°	38	00	80°	18	40
20	Gundapuri		19°	30	05	80°	02	00
21	Akera Buzurk		19°	37	10	80°	16	35
22	Karampalli		19°	30	15	80°	18	30

List of plates (maps in true scale in hard copy and softcopy)

PLATE-1: Location of Gilanguda-Padur Block.

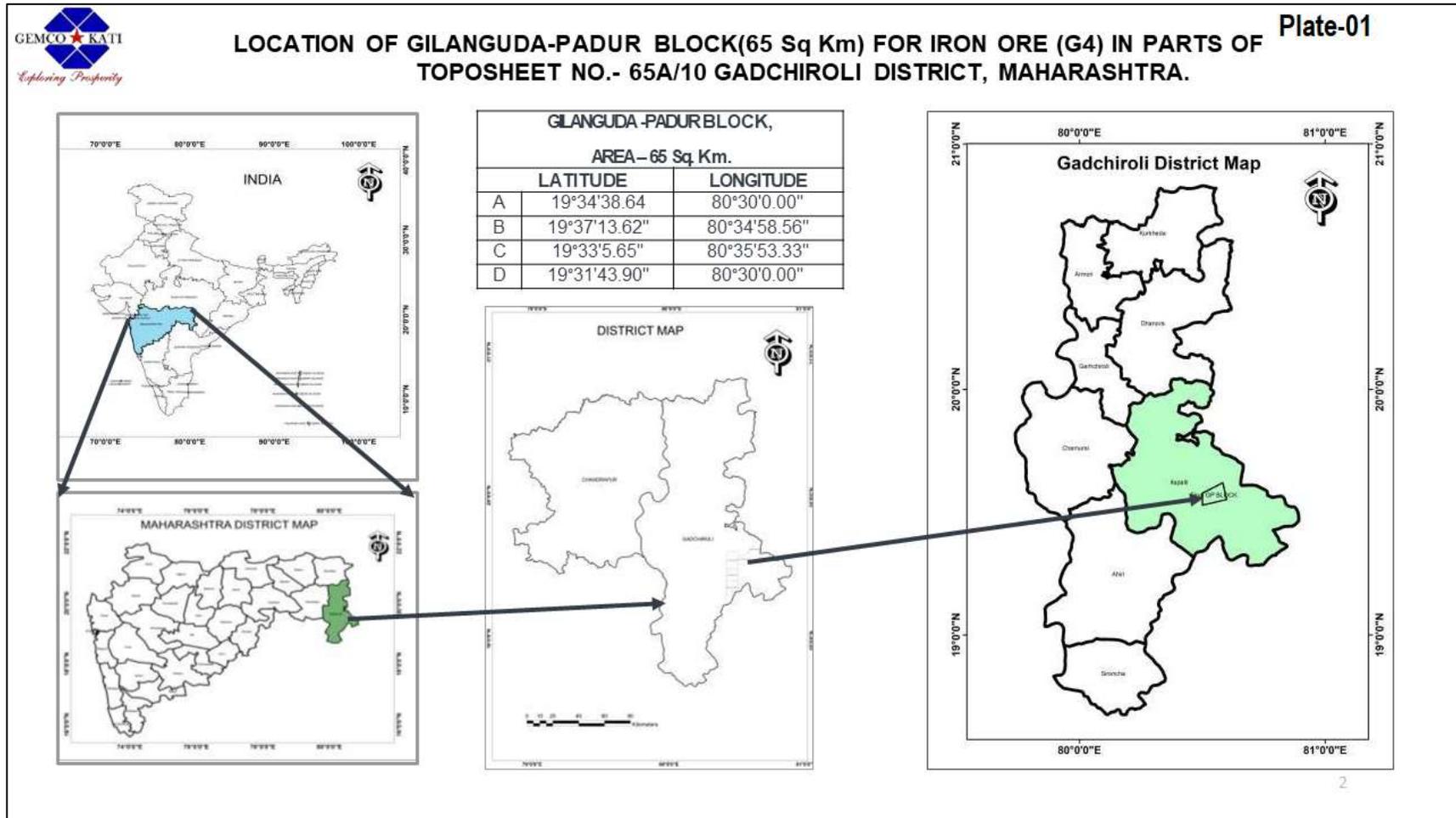


PLATE-2: Demarcation of Block boundary shown on Toposheet-65A/10.

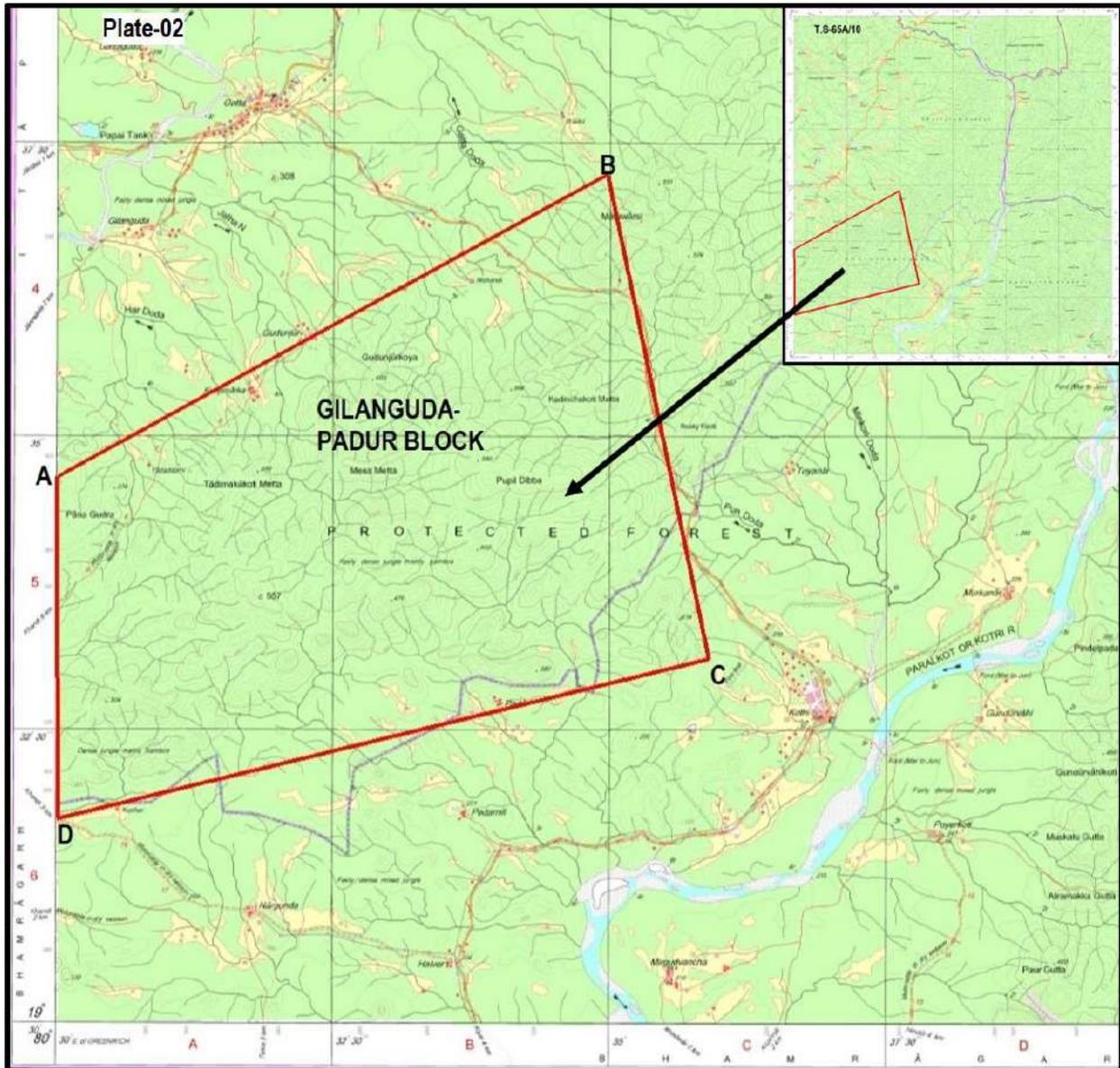


PLATE-3: Demarcation of Block boundary shown on Google MAP.

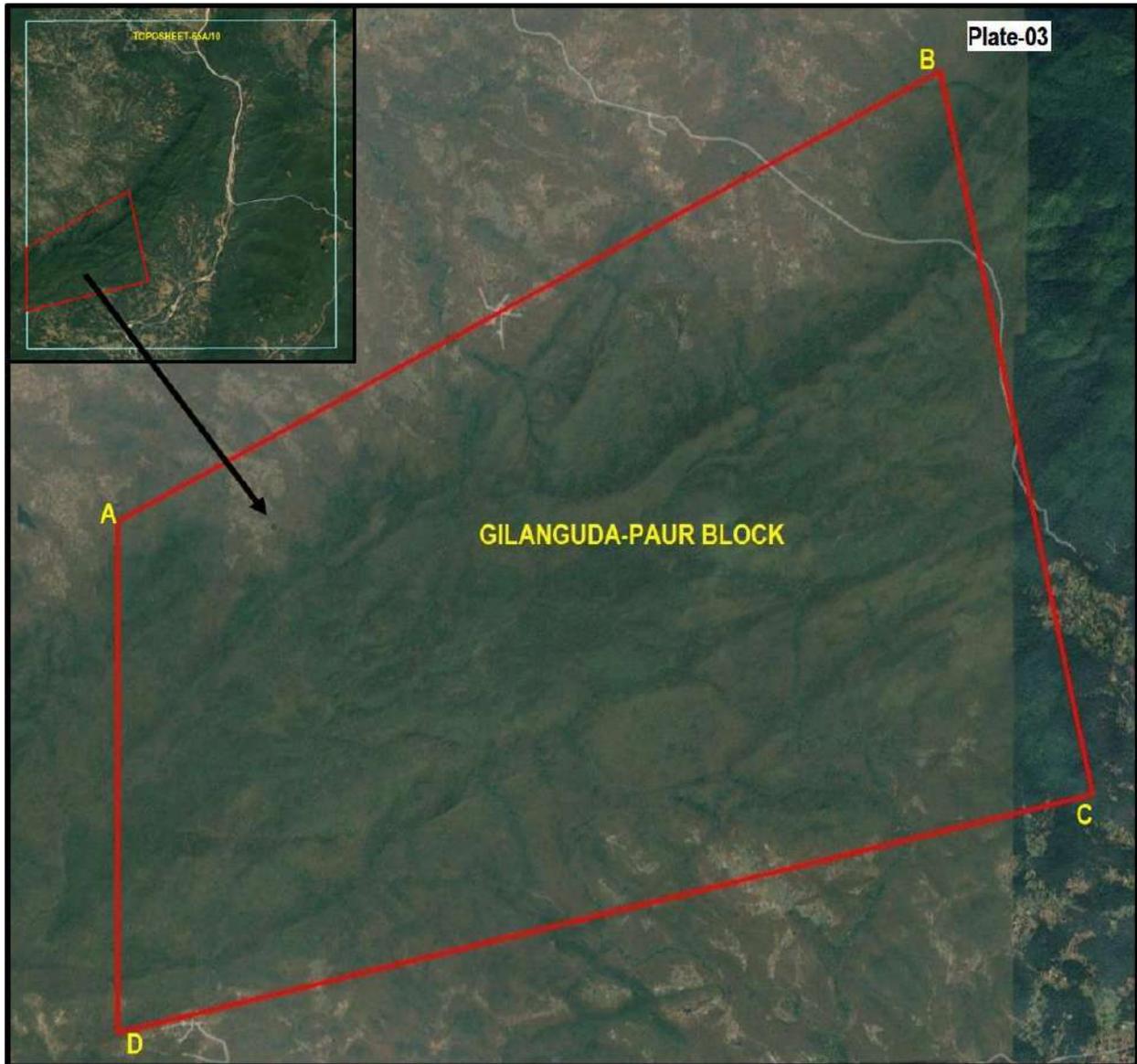


PLATE-4a: Geological map on 1:50,000 scale.

[By GSI: H.P. Saxena, S.K. Das, B. Zaheer and S. K. Sengupta Field Season-1978-79 vide Acc No- CR-014491.

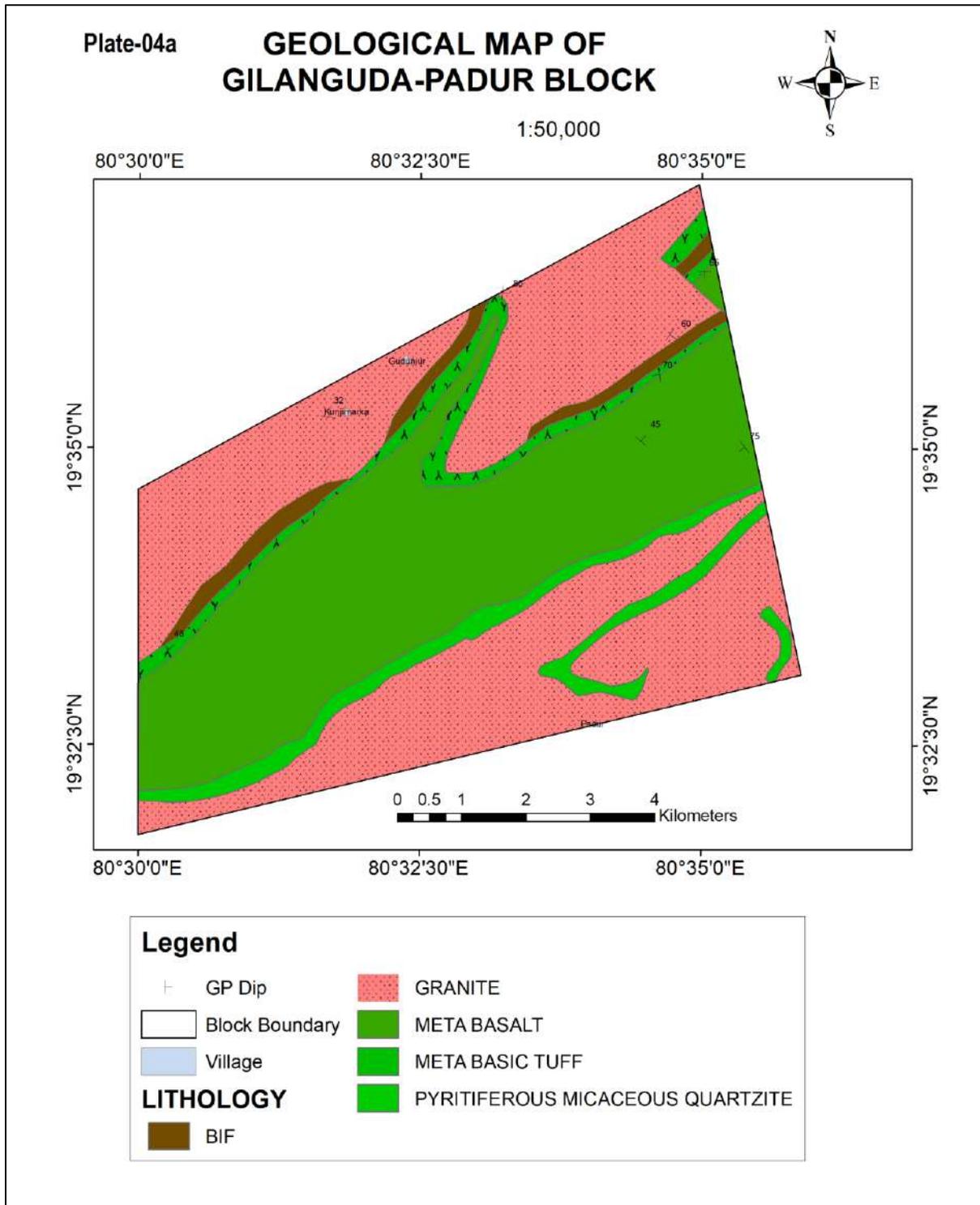


PLATE-4b: Geological map on 1:25,000 scale.

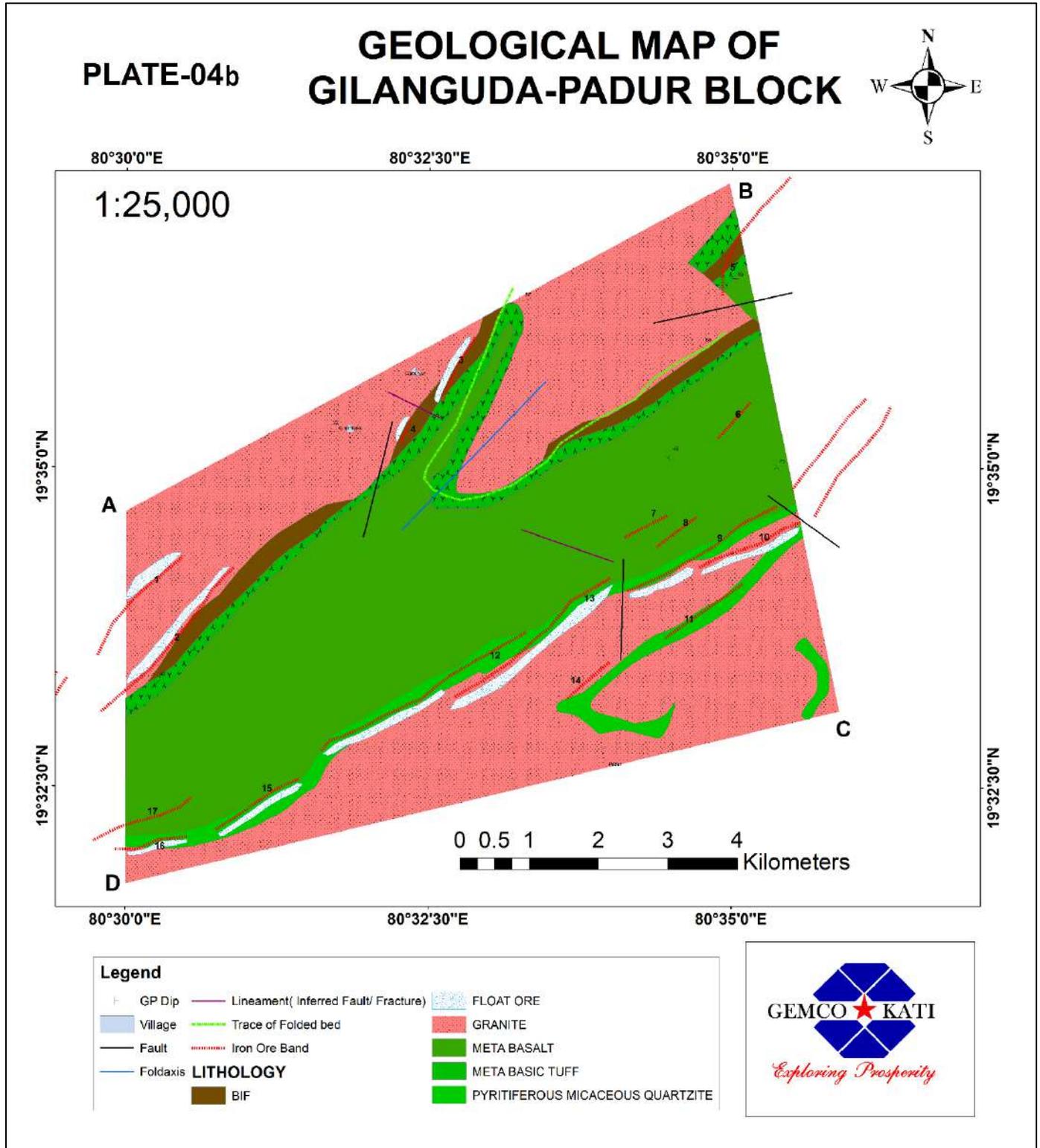


PLATE-5: Sample location map (Major Oxides) on 1:25,000 scale.

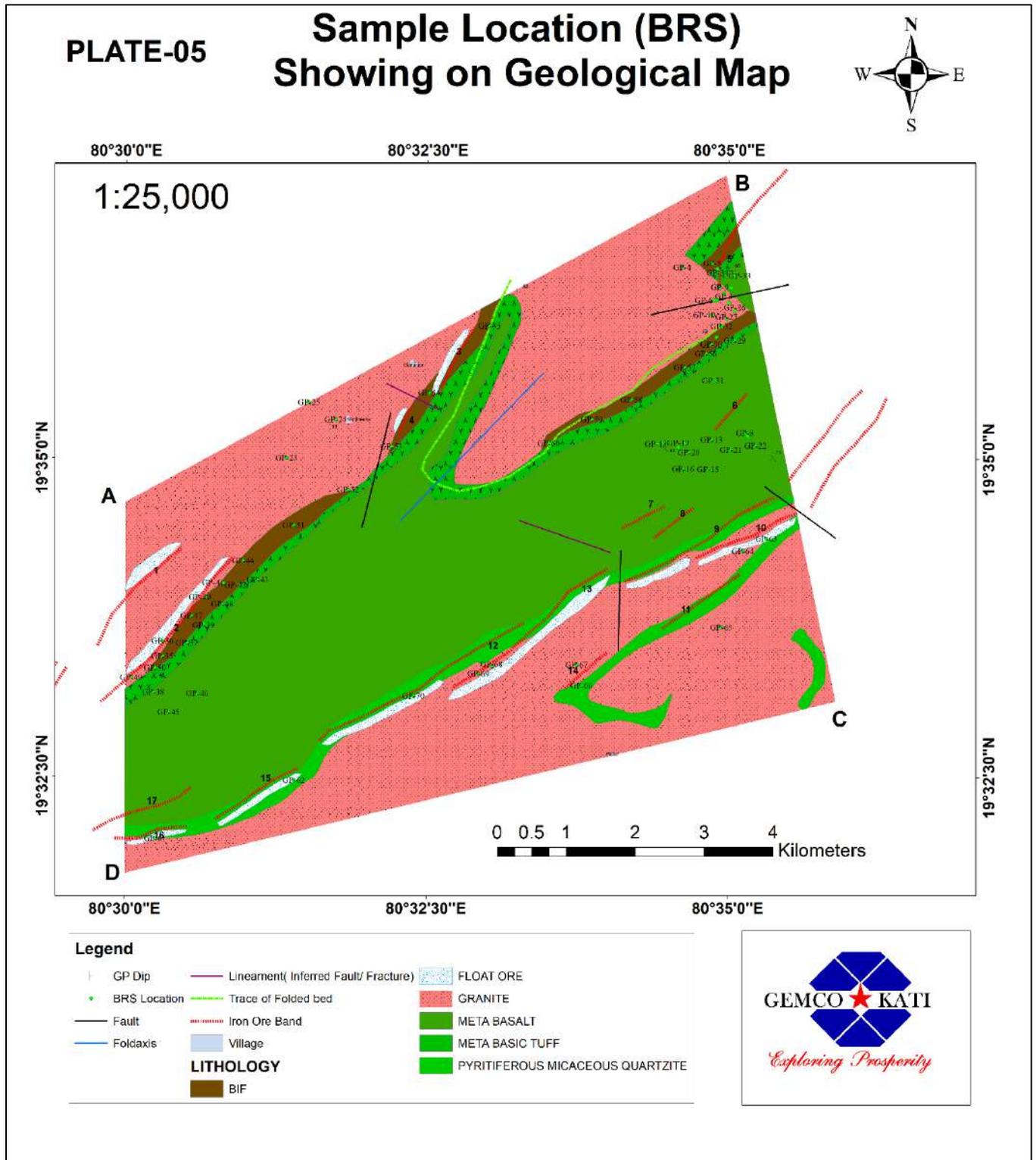


PLATE-6: Sample location map (Major Oxides) (+) 45% Fe(T). on 1:25,000 scale.

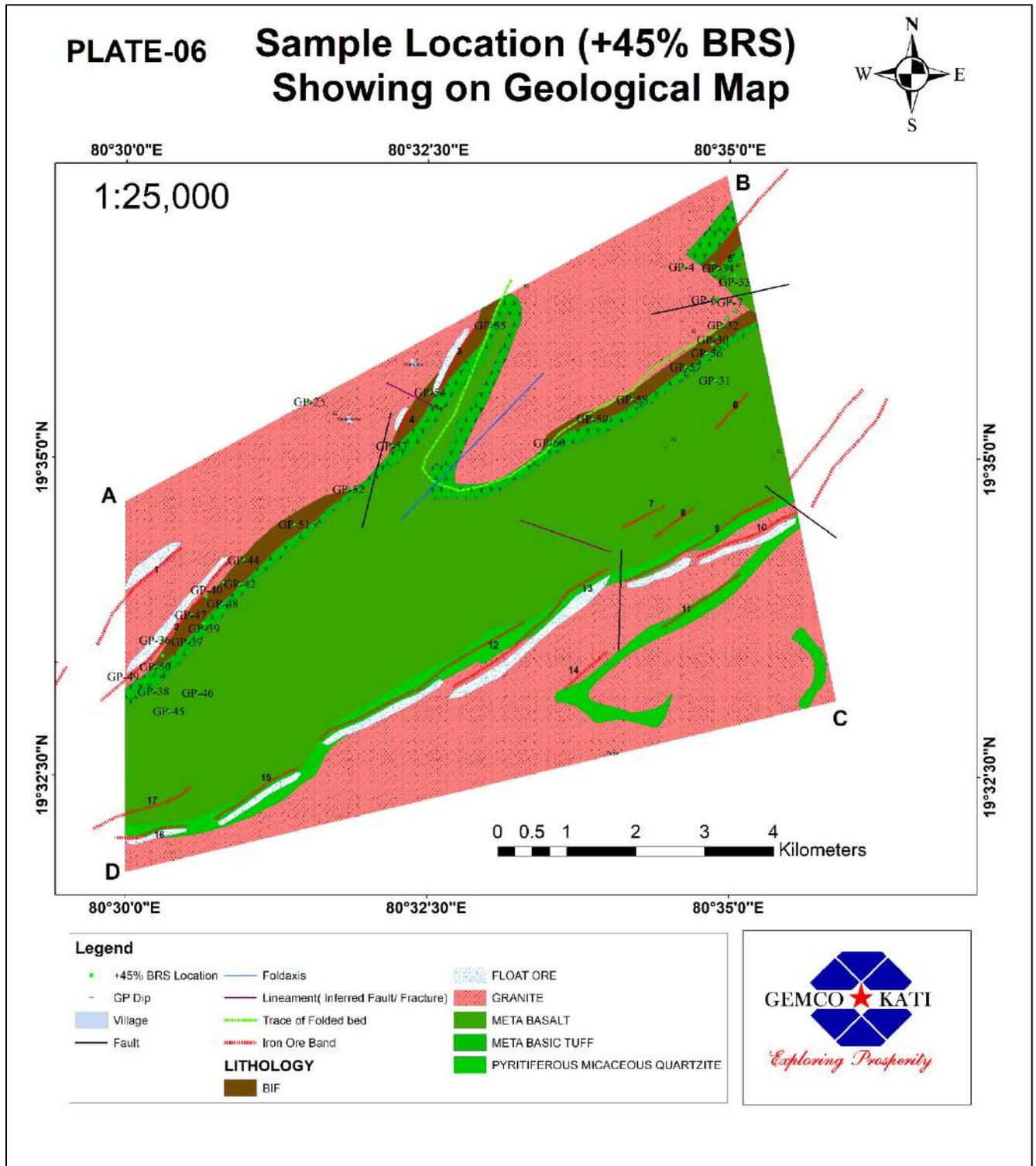


PLATE-7: Sample location map (PCS, Petrology, Mineralogy & XRD) on 1:25,000 scale.

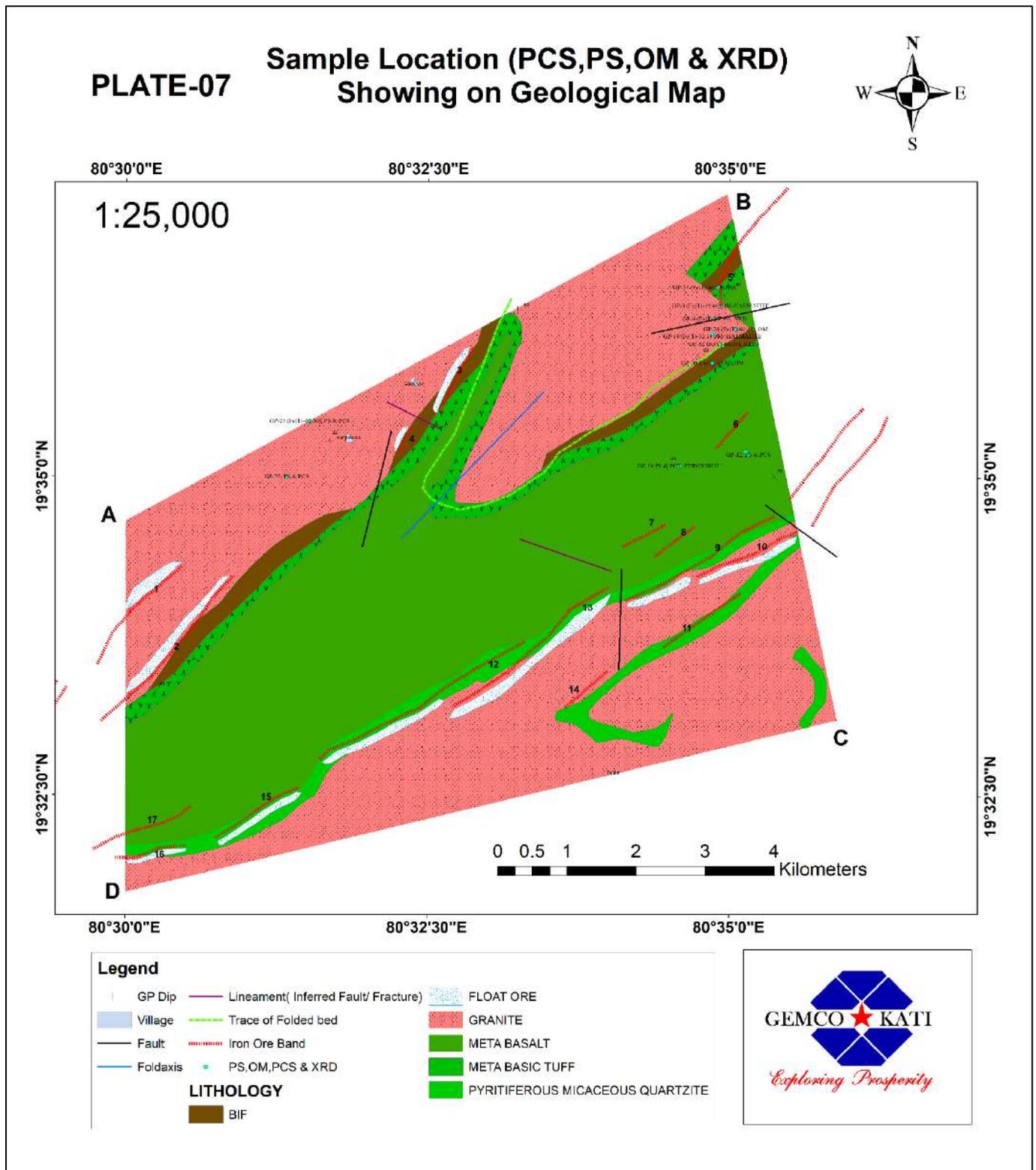
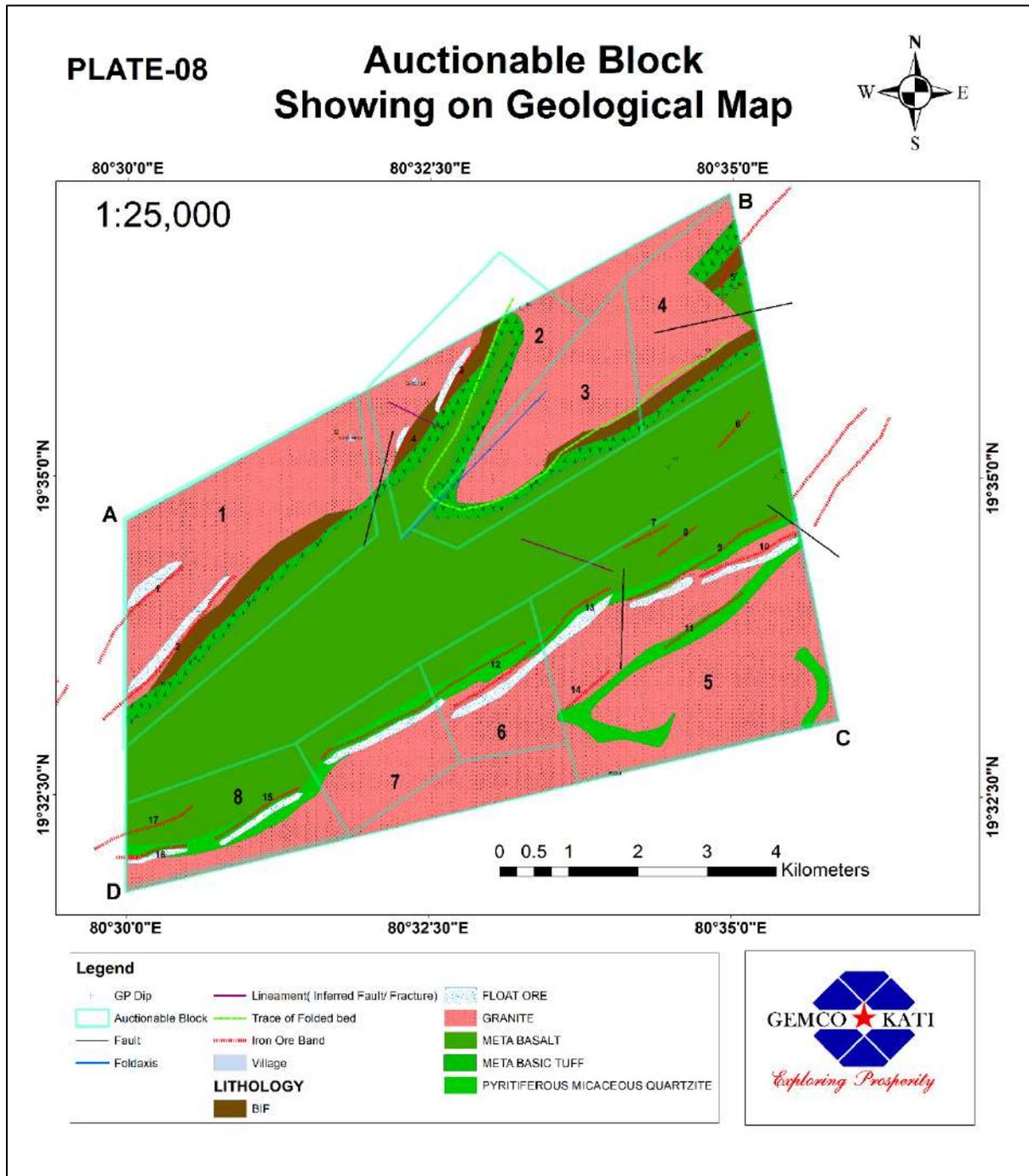


PLATE-08- Auctionable blocks showing in Geological map on 1:25,000 scale.





ANNEXURE:1

1- Chemical analysis of Primary Bed rock samples.

Sl no	Sample ID	Latitude	Longitude	Fe	SiO ₂	Al ₂ O ₃	S	P	MnO	P ₂ O ₅	TiO ₂	MgO	CaO	Na ₂ O	K ₂ O	Fe ₂ O ₃	SO ₃	BaO	V ₂ O ₅	LOI	SrO
1	GP-1	19° 36' 14.86"N	80° 34' 54.17"E	65.16	2.92	2.08	<0.01	0.05	<0.05	0.11	0.05	<0.05	0.08	<0.05	<0.05	93.16	<0.05	<0.05	0.06	1.33	
2	GP-2	19° 36' 20.65" N	80° 35' 1.06" E	37.25	45.43	0.49	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	53.26	<0.05	0.11	<0.05	0.63	
3	GP-3	19° 36' 17.79" N	80° 34' 57.5" E	9.60	85.36	0.38	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	13.73	<0.05	0.19	<0.05	0.28	
4	GP-4	19°36'30.11"N	80°34'36.72"E	25.89	0.93	<0.01	0.01	<0.05	<0.05	0.09	<0.05	<0.05	<0.05	<0.05	71.79	<0.05	0.07	<0.05	<0.05	1.06	
5	GP-5	19° 36' 32.11" N	80° 34' 51.59" E	58.07	15.71	0.39	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	83.03	<0.05	0.06	<0.05	0.68	
6	GP-6	19° 36' 14.69" N	80° 34' 52.37" E	67.93	1.44	0.42	<0.01	0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	97.12	<0.05	<0.05	<0.05	0.82	
7	GP-7	19° 36' 13.59" N	80° 35' 0.05" E	61.46	1.08	0.25	<0.01	0.04	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	87.87	<0.05	0.06	<0.05	10.60	
8	GP-8	19°35'12.08"N	80°35'8.03"E	1.70	96.54	0.29	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	2.43	<0.05	0.20	<0.05	0.33	<0.05
9	GP-9	19° 36' 20.91" N	80° 34' 55.3" E	19.48	69.80	0.80	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	27.85	<0.05	0.17	<0.05	1.34	
10	GP-10	19° 36' 7.76" N	80° 34' 51.31" E	32.10	49.46	1.48	0.02	<0.01	<0.05	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	45.89	<0.05	0.14	<0.05	2.81	
11	GP-11	19°35'10.16"N	80°35'9.56"E	48.13	13.80	0.23	0.02	0.19	0.06	1.12	7.60	8.53	1.57	0.10	14.63	0.57	0.18	<0.05	<0.05	3.29	
12	GP-12	19°35'10.79"N	80°35'9.32"E	57.76	11.94	0.17	0.02	0.15	<0.05	0.95	5.94	6.31	1.12	0.34	11.58	0.43	0.19	<0.05	<0.05	3.06	
13	GP-13	19° 35' 8.85" N	80° 34' 51.46" E	15.22	52.65	11.25	<0.01	0.04	0.18	0.08	2.37	1.55	0.94	<0.05	<0.05	21.75	<0.05	0.18	<0.05	8.99	
14	GP-14	19°35'7.69"N	80°34'38.63"E	7.76	47.25	17.55	0.02	0.02	0.19	<0.05	0.79	6.35	10.58	2.79	0.21	11.09	0.05	0.15	<0.05	2.70	<0.05
15	GP-15	19°34'54.97"N	80°34'49.75"E	10.02	49.27	15.92	0.05	0.22	0.20	0.51	1.71	2.78	8.26	2.89	0.97	14.32	0.13	0.17	<0.05	2.66	<0.05
16	GP-16	19°34'55.13"N	80°34'37.33"E	10.43	48.91	15.29	<0.01	0.19	0.21	0.43	1.79	3.32	7.84	3.49	0.70	14.91	<0.05	0.17	<0.05	2.75	<0.05
17	GP-17	19°35'7.66"N	80°34'27.55"E	10.12	48.93	13.85	0.05	0.02	0.20	0.06	1.04	6.16	8.27	3.61	0.10	14.47	0.13	0.17	<0.05	2.77	<0.05
18	GP-18	19°35'6.85"N	80°34'24.58"E	9.19	51.30	10.21	0.02	0.08	0.18	0.18	1.11	8.59	9.90	2.84	0.24	13.14	<0.05	0.15	<0.05	1.84	<0.05
19	GP-19	19°35'5.35"N	80°34'34.98"E	8.62	52.63	9.25	0.02	0.06	0.18	0.14	0.97	9.16	10.57	2.00	0.98	12.32	<0.05	0.17	<0.05	1.36	<0.05
20	GP-20	19°35'2.98"N	80°34'40.02"E	8.86	51.60	9.86	0.03	0.06	0.18	0.14	1.01	8.87	9.71	2.46	1.18	12.67	0.07	0.18	<0.05	1.75	<0.05
21	GP-21	19°35'4.24"N	80°35'1.12"E	8.86	51.60	9.86	0.03	0.06	0.18	0.14	1.01	8.87	9.71	2.46	1.18	12.67	0.07	0.18	<0.05	1.75	<0.05
22	GP-22	19°35'6.14"N	80°35'13.40"E	10.67	48.40	13.29	0.08	0.03	0.24	0.07	1.11	6.41	9.99	2.08	0.11	15.26	0.20	0.20	<0.05	2.57	<0.05
23	GP-23	19°34'59.85"N	80°31'20.04"E	10.17	48.34	14.27	<0.01	0.03	0.23	0.07	1.16	6.04	9.95	2.10	0.66	14.54	<0.05	0.17	<0.05	2.27	<0.05
24	GP-24	19° 35' 18.16" N	80° 31' 44.33" E	32.73	46.09	1.20	<0.01	0.03	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	46.80	<0.05	0.09	<0.05	5.62	
25	GP-25	19° 35' 26.11" N	80° 31' 31.2" E	61.30	7.12	2.33	<0.01	0.06	<0.05	0.14	0.06	<0.05	0.07	<0.05	<0.05	87.65	<0.05	0.07	<0.05	2.44	
26	GP-26	19°36'9.81"N	80°35'2.83"E	66.45	2.31	1.40	<0.01	0.02	<0.05	<0.05	0.07	<0.05	<0.05	<0.08	<0.05	95.00	<0.05	<0.05	<0.05	1.14	



27	GP-27	19°36'6.08"N	80°34'58.78"E	65.00	1.82	0.86	<0.01	0.04	0.07	0.10	0.08	<0.05	<0.05	<0.08	<0.05	92.93	<0.05	<0.05	<0.05	4.03	
28	GP-28	19°35'57.36"N	80°34'53.90"E	66.32	2.03	1.05	<0.01	0.05	0.08	0.12	0.09	<0.05	<0.05	<0.08	<0.05	94.81	<0.05	<0.05	<0.05	1.64	
29	GP-29	19°35'55.72"N	80°35'2.86"E	41.32	37.72	1.14	0.02	<0.01	<0.05	<0.05	0.06	<0.05	<0.05	<0.08	<0.05	59.08	<0.05	0.06	<0.05	1.83	
30	GP-30	19°35'52.10"N	80°34'49.93"E	65.95	1.74	1.12	<0.01	0.09	<0.05	0.20	0.16	<0.05	<0.05	<0.08	<0.05	94.29	<0.05	<0.05	<0.05	2.28	
31	GP-31	19°35'36.83"N	80°34'52.72"E	65.40	3.95	1.07	<0.01	0.03	<0.05	0.07	0.06	<0.05	<0.05	<0.08	<0.05	93.50	<0.05	<0.05	<0.05	1.15	
32	GP-32	19°36'0.75"N	80°34'55.35"E	66.04	1.86	1.04	<0.01	0.10	<0.05	0.23	0.09	<0.05	<0.05	<0.08	<0.05	94.42	<0.05	<0.05	<0.05	2.13	
33	GP-33	19°36'26.25"N	80°35'2.51"E	66.87	2.08	1.23	<0.01	0.02	<0.05	<0.05	0.05	<0.05	<0.05	<0.08	<0.05	95.60	<0.05	<0.05	<0.05	0.77	
34	GP-34	19°36'29.53"N	80°34'54.25"E	66.58	1.96	0.96	<0.01	0.06	<0.05	0.14	<0.05	<0.05	<0.05	<0.08	<0.05	95.19	<0.05	<0.05	<0.05	1.60	
35	GP-35	19°33'26.40"N	80°30'18.47"E	62.83	2.71	1.68	<0.01	0.21	<0.05	0.48	0.15	0.07	0.11	<0.08	<0.05	89.83	<0.05	<0.05	<0.05	4.78	
36	GP-36	19°33'33.53"N	80°30'18.56"E	48.60	12.51	8.76	<0.01	0.13	<0.05	0.31	1.69	0.07	0.11	<0.08	<0.05	69.49	<0.05	0.09	0.12	6.79	
37	GP-37	19°33'32.70"N	80°30'30.59"E	57.94	3.08	3.60	<0.01	0.08	<0.05	0.18	0.16	<0.05	<0.05	<0.08	<0.05	82.83	<0.05	<0.05	<0.05	9.91	
38	GP-38	19°33'9.44"N	80°30'14.02"E	57.68	4.82	3.46	<0.01	0.05	<0.05	0.11	0.18	<0.05	<0.05	<0.08	<0.05	82.47	<0.05	<0.05	<0.05	8.79	
39	GP-39	19°33'41.69"N	80°30'38.96"E	58.75	2.99	2.05	<0.01	0.19	<0.05	0.44	0.06	<0.05	0.06	<0.08	<0.05	84.00	<0.05	<0.05	<0.05	10.36	
40	GP-40	19°33'54.27"N	80°30'40.16"E	63.13	3.07	1.38	<0.01	0.13	<0.05	0.31	0.07	<0.05	<0.05	<0.08	<0.05	90.25	<0.05	<0.05	<0.05	4.86	
41	GP-41	19°34'1.01"N	80°30'48.93"E	61.25	2.27	1.43	<0.01	0.24	<0.05	0.56	0.10	<0.05	<0.05	<0.08	<0.05	87.57	<0.05	<0.05	<0.05	7.84	
42	GP-42	19°34'0.01"N	80°30'56.81"E	61.93	2.49	1.28	0.17	0.12	0.06	0.28	0.06	<0.05	0.05	<0.08	<0.05	88.54	0.43	0.06	<0.05	6.65	
43	GP-43	19°34'2.40"N	80°31'5.84"E	40.00	38.59	0.68	<0.01	0.05	<0.05	0.10	<0.05	<0.05	0.06	<0.08	<0.05	57.19	<0.05	0.10	<0.05	3.11	
44	GP-44	19°34'11.39"N	80°30'58.53"E	64.83	1.53	0.93	0.13	0.10	0.10	0.23	0.10	0.10	0.09	<0.08	<0.05	92.68	0.33	<0.05	<0.05	3.74	
45	GP-45	19°32'59.97"N	80°30'21.66"E	45.32	23.23	5.59	<0.01	0.03	<0.05	0.08	0.27	<0.05	<0.05	<0.08	<0.05	64.79	<0.05	0.06	<0.05	5.84	
46	GP-46	19°33'8.71"N	80°30'35.94"E	47.99	22.52	3.10	<0.01	0.09	<0.05	0.20	0.15	<0.05	0.06	<0.08	<0.05	68.61	<0.05	0.09	<0.05	5.13	
47	GP-47	19°33'45.39"N	80°30'32.94"E	63.24	3.57	2.41	<0.01	0.27	<0.05	0.61	0.19	<0.05	<0.05	<0.08	<0.05	90.41	<0.05	0.05	<0.05	2.53	
48	GP-48	19°33'50.89"N	80°30'48.20"E	59.44	3.85	2.66	<0.01	0.21	<0.05	0.47	0.16	<0.05	<0.05	<0.08	<0.05	84.98	<0.05	<0.05	<0.05	7.64	
49	GP-49	19°33'16.28"N	80°30'3.01"E	59.19	2.89	1.94	<0.01	0.15	<0.05	0.33	0.08	<0.05	0.05	0.37	<0.05	84.62	<0.05	0.05	<0.05	9.89	
50	GP-50	19°33'20.87"N	80°30'14.79"E	51.64	16.35	3.30	<0.01	0.10	<0.05	0.23	0.24	<0.05	0.06	<0.08	<0.05	73.83	<0.05	0.09	<0.05	5.81	
51	GP-51	19°34'28.21"N	80°31'23.73"E	67.10	1.25	1.48	<0.01	0.03	<0.05	0.06	0.09	<0.05	<0.05	<0.08	<0.05	95.93	<0.05	<0.05	<0.05	0.97	<0.05
52	GP-52	19°34'44.97"N	80°31'50.71"E	66.87	1.22	1.69	<0.01	0.03	<0.05	0.07	0.10	<0.05	<0.05	<0.08	<0.05	95.61	<0.05	<0.05	<0.05	1.15	<0.05
53	GP-53	19°35'5.35"N	80°32'12.15"E	61.48	4.90	4.42	<0.01	0.02	<0.05	0.05	0.14	<0.05	0.12	<0.08	<0.05	87.89	<0.05	0.05	<0.05	2.25	<0.05
54	GP-54	19°35'30.72"N	80°32'31.02"E	67.11	1.79	1.10	<0.01	0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.08	<0.05	95.94	<0.05	<0.05	<0.05	0.99	<0.05
55	GP-55	19°36'2.33"N	80°33'0.97"E	63.08	3.99	3.41	<0.01	0.03	<0.05	0.06	0.05	<0.05	0.10	<0.08	<0.05	90.19	<0.05	<0.05	<0.05	1.98	<0.05



56	GP-56	19°35'49.47"N	80°34'48.50"E	64.75	3.31	2.28	<0.01	0.02	<0.05	0.06	0.09	<0.05	<0.05	<0.08	<0.05	92.58	<0.05	0.06	<0.05	1.50	<0.05
57	GP-57	19°35'42.93"N	80°34'38.09"E	65.35	3.53	1.36	<0.01	0.03	<0.05	0.06	0.09	<0.05	<0.05	<0.08	<0.05	93.43	<0.05	0.05	<0.05	1.28	<0.05
58	GP-58	19°35'27.65"N	80°34'11.55"E	65.40	2.86	2.05	<0.01	0.01	<0.05	<0.05	0.08	<0.05	<0.05	<0.08	<0.05	93.50	<0.05	<0.05	<0.05	1.23	<0.05
59	GP-59	19°35'18.38"N	80°33'51.84"E	65.30	2.89	2.17	<0.01	0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.08	<0.05	93.35	<0.05	<0.05	<0.05	1.42	<0.05
60	GP-60	19°35'7.07"N	80°33'30.43"E	64.95	3.90	1.63	<0.01	0.03	<0.05	0.07	0.08	<0.05	<0.05	<0.08	<0.05	92.87	<0.05	<0.05	<0.05	1.31	<0.05
61	GP-61	19°32'0.43"N	80°30'15.03"E	67.34	1.63	0.87	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	0.09	0.08	<0.05	96.23	<0.05	<0.05	<0.05	0.97	<0.05
62	GP-62	19°32'28.00"N	80°31'24.04"E	67.41	1.67	0.76	<0.01	0.01	<0.05	<0.05	<0.05	<0.05	0.06	0.08	<0.05	96.33	<0.05	<0.05	<0.05	0.96	<0.05
63	GP-63	19°34'22.34"N	80°35'18.89"E	67.05	1.73	1.06	<0.01	0.01	<0.05	<0.05	<0.05	<0.05	0.12	0.08	<0.05	95.81	<0.05	<0.05	<0.05	1.06	<0.05
64	GP-64	19°34'16.46"N	80°35'7.18"E	66.55	2.03	1.17	<0.01	0.03	<0.05	0.07	<0.05	<0.05	<0.05	0.08	<0.05	95.10	<0.05	<0.05	<0.05	1.46	<0.05
65	GP-65	19°33'40.49"N	80°34'56.52"E	66.06	2.42	1.66	<0.01	0.03	<0.05	0.07	<0.05	<0.05	<0.05	0.08	<0.05	94.40	<0.05	<0.05	<0.05	1.28	<0.05
66	GP-66	19°33'12.97"N	80°33'47.05"E	67.99	1.30	0.59	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	97.16	<0.05	<0.05	<0.05	0.76	<0.05
67	GP-67	19°33'22.70"N	80°33'44.69"E	67.55	1.64	0.88	<0.01	0.01	<0.05	<0.05	0.06	<0.05	<0.05	0.08	<0.05	96.53	<0.05	<0.05	<0.05	0.71	<0.05
68	GP-68	19°33'22.17"N	80°33'2.23"E	67.12	1.77	1.26	<0.01	0.01	<0.05	<0.05	0.06	<0.05	<0.05	0.08	<0.05	95.92	<0.05	<0.05	<0.05	0.81	<0.05
69	GP-69	19°33'18.37"N	80°32'55.75"E	66.39	2.39	1.46	<0.01	0.01	<0.05	<0.05	0.05	<0.05	<0.05	0.08	<0.05	94.87	<0.05	<0.05	<0.05	1.05	<0.05
70	GP-70	19°33'7.88"N	80°32'23.43"E	65.50	2.65	2.17	<0.01	0.02	<0.05	<0.05	0.06	<0.05	<0.05	0.08	<0.05	93.60	<0.05	<0.05	<0.05	1.35	<0.05



ANNEXURE-2: Chemical analysis of Primary Bed rock samples showing location of (+) 45% Fe(T).

Sl no	Sample ID	Latitude	Longitude	Fe	SiO ₂	Al ₂ O ₃	S	P	MnO	P ₂ O ₅	TiO ₂	MgO	CaO	Na ₂ O	K ₂ O	Fe ₂ O ₃	SO ₃	BaO	V ₂ O ₅	LOI	SrO
1	GP-1	19° 36' 14.86"N	80° 34' 54.17"E	65.16	2.92	2.08	<0.01	0.05	<0.05	0.11	0.05	<0.05	0.08	<0.05	<0.05	93.16	<0.05	<0.05	0.06	1.33	
2	GP-5	19° 36' 32.11" N	80° 34' 51.59" E	58.07	15.71	0.39	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	83.03	<0.05	0.06	<0.05	0.68	
3	GP-6	19° 36' 14.69" N	80° 34' 52.37" E	67.93	1.44	0.42	<0.01	0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	97.12	<0.05	<0.05	<0.05	0.82	
4	GP-7	19° 36' 13.59" N	80° 35' 0.05" E	61.46	1.08	0.25	<0.01	0.04	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	87.87	<0.05	0.06	<0.05	10.60	
5	GP-11	19°35'10.16"N	80°35'9.56"E	48.13	13.80	0.23	0.02	0.19	0.06	1.12	7.60	8.53	1.57	0.10	14.63	0.57	0.18	<0.05	<0.05	3.29	
6	GP-12	19°35'10.79"N	80°35'9.32"E	57.76	11.94	0.17	0.02	0.15	<0.05	0.95	5.94	6.31	1.12	0.34	11.58	0.43	0.19	<0.05	<0.05	3.06	
7	GP-25	19° 35' 26.11" N	80° 31' 31.2" E	61.30	7.12	2.33	<0.01	0.06	<0.05	0.14	0.06	<0.05	0.07	<0.05	<0.05	87.65	<0.05	0.07	<0.05	2.44	
8	GP-26	19°36'9.81"N	80°35'2.83"E	66.45	2.31	1.40	<0.01	0.02	<0.05	<0.05	0.07	<0.05	<0.05	<0.08	<0.05	95.00	<0.05	<0.05	<0.05	1.14	
9	GP-27	19°36'6.08"N	80°34'58.78"E	65.00	1.82	0.86	<0.01	0.04	0.07	0.10	0.08	<0.05	<0.05	<0.08	<0.05	92.93	<0.05	<0.05	<0.05	4.03	
10	GP-28	19°35'57.36"N	80°34'53.90"E	66.32	2.03	1.05	<0.01	0.05	0.08	0.12	0.09	<0.05	<0.05	<0.08	<0.05	94.81	<0.05	<0.05	<0.05	1.64	
11	GP-30	19°35'52.10"N	80°34'49.93"E	65.95	1.74	1.12	<0.01	0.09	<0.05	0.20	0.16	<0.05	<0.05	<0.08	<0.05	94.29	<0.05	<0.05	<0.05	2.28	
12	GP-31	19°35'36.83"N	80°34'52.72"E	65.40	3.95	1.07	<0.01	0.03	<0.05	0.07	0.06	<0.05	<0.05	<0.08	<0.05	93.50	<0.05	<0.05	<0.05	1.15	
13	GP-32	19°36'0.75"N	80°34'55.35"E	66.04	1.86	1.04	<0.01	0.10	<0.05	0.23	0.09	<0.05	<0.05	<0.08	<0.05	94.42	<0.05	<0.05	<0.05	2.13	
14	GP-33	19°36'26.25"N	80°35'2.51"E	66.87	2.08	1.23	<0.01	0.02	<0.05	<0.05	0.05	<0.05	<0.05	<0.08	<0.05	95.60	<0.05	<0.05	<0.05	0.77	
15	GP-34	19°36'29.53"N	80°34'54.25"E	66.58	1.96	0.96	<0.01	0.06	<0.05	0.14	<0.05	<0.05	<0.05	<0.08	<0.05	95.19	<0.05	<0.05	<0.05	1.60	
16	GP-35	19°33'26.40"N	80°30'18.47"E	62.83	2.71	1.68	<0.01	0.21	<0.05	0.48	0.15	0.07	0.11	<0.08	<0.05	89.83	<0.05	<0.05	<0.05	4.78	
17	GP-36	19°33'33.53"N	80°30'18.56"E	48.60	12.51	8.76	<0.01	0.13	<0.05	0.31	1.69	0.07	0.11	<0.08	<0.05	69.49	<0.05	0.09	0.12	6.79	
18	GP-37	19°33'32.70"N	80°30'30.59"E	57.94	3.08	3.60	<0.01	0.08	<0.05	0.18	0.16	<0.05	<0.05	<0.08	<0.05	82.83	<0.05	<0.05	<0.05	9.91	
19	GP-38	19°33'9.44"N	80°30'14.02"E	57.68	4.82	3.46	<0.01	0.05	<0.05	0.11	0.18	<0.05	<0.05	<0.08	<0.05	82.47	<0.05	<0.05	<0.05	8.79	
20	GP-39	19°33'41.69"N	80°30'38.96"E	58.75	2.99	2.05	<0.01	0.19	<0.05	0.44	0.06	<0.05	0.06	<0.08	<0.05	84.00	<0.05	<0.05	<0.05	10.36	
21	GP-40	19°33'54.27"N	80°30'40.16"E	63.13	3.07	1.38	<0.01	0.13	<0.05	0.31	0.07	<0.05	<0.05	<0.08	<0.05	90.25	<0.05	<0.05	<0.05	4.86	
22	GP-41	19°34'1.01"N	80°30'48.93"E	61.25	2.27	1.43	<0.01	0.24	<0.05	0.56	0.10	<0.05	<0.05	<0.08	<0.05	87.57	<0.05	<0.05	<0.05	7.84	
23	GP-42	19°34'0.01"N	80°30'56.81"E	61.93	2.49	1.28	0.17	0.12	0.06	0.28	0.06	<0.05	0.05	<0.08	<0.05	88.54	0.43	0.06	<0.05	6.65	
24	GP-44	19°34'11.39"N	80°30'58.53"E	64.83	1.53	0.93	0.13	0.10	0.10	0.23	0.10	0.10	0.09	<0.08	<0.05	92.68	0.33	<0.05	<0.05	3.74	



25	GP-45	19°32'59.97"N	80°30'21.66"E	45.32	23.23	5.59	<0.01	0.03	<0.05	0.08	0.27	<0.05	<0.05	<0.08	<0.05	64.79	<0.05	0.06	<0.05	5.84	
26	GP-46	19°33'8.71"N	80°30'35.94"E	47.99	22.52	3.10	<0.01	0.09	<0.05	0.20	0.15	<0.05	0.06	<0.08	<0.05	68.61	<0.05	0.09	<0.05	5.13	
27	GP-47	19°33'45.39"N	80°30'32.94"E	63.24	3.57	2.41	<0.01	0.27	<0.05	0.61	0.19	<0.05	<0.05	<0.08	<0.05	90.41	<0.05	0.05	<0.05	2.53	
28	GP-48	19°33'50.89"N	80°30'48.20"E	59.44	3.85	2.66	<0.01	0.21	<0.05	0.47	0.16	<0.05	<0.05	<0.08	<0.05	84.98	<0.05	<0.05	<0.05	7.64	
29	GP-49	19°33'16.28"N	80°30'3.01"E	59.19	2.89	1.94	<0.01	0.15	<0.05	0.33	0.08	<0.05	0.05	0.37	<0.05	84.62	<0.05	0.05	<0.05	9.89	
30	GP-50	19°33'20.87"N	80°30'14.79"E	51.64	16.35	3.30	<0.01	0.10	<0.05	0.23	0.24	<0.05	0.06	<0.08	<0.05	73.83	<0.05	0.09	<0.05	5.81	
31	GP-51	19°34'28.21"N	80°31'23.73"E	67.10	1.25	1.48	<0.01	0.03	<0.05	0.06	0.09	<0.05	<0.05	<0.08	<0.05	95.93	<0.05	<0.05	<0.05	0.97	<0.05
32	GP-52	19°34'44.97"N	80°31'50.71"E	66.87	1.22	1.69	<0.01	0.03	<0.05	0.07	0.10	<0.05	<0.05	<0.08	<0.05	95.61	<0.05	<0.05	<0.05	1.15	<0.05
33	GP-53	19°35'5.35"N	80°32'12.15"E	61.48	4.90	4.42	<0.01	0.02	<0.05	0.05	0.14	<0.05	0.12	<0.08	<0.05	87.89	<0.05	0.05	<0.05	2.25	<0.05
34	GP-54	19°35'30.72"N	80°32'31.02"E	67.11	1.79	1.10	<0.01	0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.08	<0.05	95.94	<0.05	<0.05	<0.05	0.99	<0.05
35	GP-55	19°36'2.33"N	80°33'0.97"E	63.08	3.99	3.41	<0.01	0.03	<0.05	0.06	0.05	<0.05	0.10	<0.08	<0.05	90.19	<0.05	<0.05	<0.05	1.98	<0.05
36	GP-56	19°35'49.47"N	80°34'48.50"E	64.75	3.31	2.28	<0.01	0.02	<0.05	0.06	0.09	<0.05	<0.05	<0.08	<0.05	92.58	<0.05	0.06	<0.05	1.50	<0.05
37	GP-57	19°35'42.93"N	80°34'38.09"E	65.35	3.53	1.36	<0.01	0.03	<0.05	0.06	0.09	<0.05	<0.05	<0.08	<0.05	93.43	<0.05	0.05	<0.05	1.28	<0.05
38	GP-58	19°35'27.65"N	80°34'11.55"E	65.40	2.86	2.05	<0.01	0.01	<0.05	<0.05	0.08	<0.05	<0.05	<0.08	<0.05	93.50	<0.05	<0.05	<0.05	1.23	<0.05
39	GP-59	19°35'18.38"N	80°33'51.84"E	65.30	2.89	2.17	<0.01	0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.08	<0.05	93.35	<0.05	<0.05	<0.05	1.42	<0.05
40	GP-60	19°35'7.07"N	80°33'30.43"E	64.95	3.90	1.63	<0.01	0.03	<0.05	0.07	0.08	<0.05	<0.05	<0.08	<0.05	92.87	<0.05	<0.05	<0.05	1.31	<0.05



2- Chemical analysis of Check Bed rock samples.

ANNEXURE-3: Analysis is awaited from DGM, MS and will be incorporated in final report.

Sl no	Sample ID	Latitude	Longitude	Fe	SiO2	Al2O3	S	P	MnO	P2O5	TiO2	MgO	CaO	Na2O	K2O	Fe2O3	SO3	BaO	V2O5	LOI	SrO	Cr2O3
1	GP-6	19° 36' 14.69" N	80° 34' 52.37" E	67.93	1.44	0.42	<0.01	0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	97.12	<0.05	<0.05	<0.05	0.82		~
				65.04	3.78	1.32			0.02	0.04	0.04			0.02						0.03		
2	GP-25	19° 35' 26.11" N	80° 31' 31.2" E	61.30	7.12	2.33	<0.01	0.06	<0.05	0.14	0.06	<0.05	0.07	<0.05	<0.05	87.65	<0.05	0.07	<0.05	2.44		~
				55.39	13.10	4.75			0.04	0.18	0.09	0.11	0.10			0.04				0.07		0.03
3	GP-32	19°36'0.75"N	80°34'55.35"E	66.04	1.86	1.04	<0.01	0.10	<0.05	0.23	0.09	<0.05	<0.05	<0.08	<0.05	94.42	<0.05	<0.05	<0.05	2.13		~
				64.90	2.87	1.54			0.04	0.23	0.10			0.04		0.02				0.02		
4	GP-34	19°36'29.53"N	80°34'54.25"E	66.58	1.96	0.96	<0.01	0.06	<0.05	0.14	<0.05	<0.05	<0.05	<0.08	<0.05	95.19	<0.05	<0.05	<0.05	1.60		~
				65.88	2.58	1.41			0.0327	0.15	0.0464			0.0493						0.0468		
5	GP-20	19°35'2.98"N	80°34'40.02"E	8.86	51.60	9.86	0.03	0.06	0.18	0.14	1.01	8.87	9.71	2.46	1.18	12.67	0.07	0.18	<0.05	1.75	<0.05	
				8.81	53.4	10.2			0.16	0.204	0.891	7.79	8.86	2.61	1.18				0.138	685	422	1.69
6	GP-47	19°33'45.39"N	80°30'32.94"E	63.24	3.57	2.41	<0.01	0.27	<0.05	0.61	0.19	<0.05	<0.05	<0.08	<0.05	90.41	<0.05	0.05	<0.05	2.53		
				57.77	8.1	4.89					0.563	0.199	0.62	0.147	0.215	201				540		
7	GP-48	19°33'50.89"N	80°30'48.20"E	59.44	3.85	2.66	<0.01	0.21	<0.05	0.47	0.16	<0.05	<0.05	<0.08	<0.05	84.98	<0.05	<0.05	<0.05	7.64		
				57.14	5.72	3.67			318	0.416	0.157	0.22	694	710	163				316			7.69

	Analyzed from DGM, MS.
	Analyzed from Shiva Analyticals, Bengaluru



ANNEXURE-4: Chemical analysis for PCS of BRS samples.

Sl. No.	Sample no	Latitude	Longitude	Ag	Al	As	Ba	Bi	Ca	Cr	Cu	Fe	K	Mg	Mn	Na	Ni
1	GP-8	19°35'12.08"N	80°35'8.03"E	<1	1368	10.5	80	<10	466	165	35	30692	1940	891	144	1145	29
2	GP-12	19°35'10.79"N	80°35'9.32"E	<1	73758	1.1	78	<10	66485	74	136	96458	2084	53413	1250	9193	22
3	GP-19	19°35'5.35"N	80°34'34.98"E	<1	51156	<0.5	455	<10	77053	158	130	83183	6900	66211	1246	13971	106
4	GP-23	19°34'59.85"N	80°31'20.04"E	<1	72506	1.1	300	<10	113083	34	120	94721	4134	37653	1548	4125	41
5	GP-25	19° 35' 26.11" N	80° 31' 31.2" E	<1	10651	6.0	136	<10	757	115	69	522897	1382	818	220	683	<5

Sl. No.	Sample no	Latitude	Longitude	P	Pb	S	Sb	Sn	Sr	Te	Ti	Tl	V	W	Zn	Li	Be
1	GP-8	19°35'12.08"N	80°35'8.03"E	120	<5	<100	<10	<10	26	<10	<100	<10	<10	<10	<5	1.03	<0.5
2	GP-12	19°35'10.79"N	80°35'9.32"E	283	36	2191	<10	<10	106	<10	6112	<10	320	<10	45	2.54	<0.5
3	GP-19	19°35'5.35"N	80°34'34.98"E	659	<5	<100	<10	<10	220	<10	5817	<10	256	<10	34	4.57	2.14
4	GP-23	19°34'59.85"N	80°31'20.04"E	357	151	<100	<10	<10	403	<10	6506	<10	331	<10	50	4.44	0.76
5	GP-25	19° 35' 26.11" N	80° 31' 31.2" E	495	95	<100	<10	<10	60	<10	390	<10	128	<10	<5	1.61	0.88



Sl. No.	Sample no	Latitude	Longitude	B	Sc	Co	Ga	Ge	Se	Rb	Y	Nb	Mo	Cd	In	Cs	La
1	GP-8	19°35'12.08"N	80°35'8.03"E	<10	43.4	5.8	0.74	<0.5	<0.5	1.99	15.36	<0.5	6.8	<0.5	<0.5	<0.5	2.19
2	GP-12	19°35'10.79"N	80°35'9.32"E	<10	49.3	56.5	18.85	<0.5	0.77	4.27	44.29	2.49	<0.5	<0.5	<0.5	<0.5	4.58
3	GP-19	19°35'5.35"N	80°34'34.98"E	<10	20.8	57.8	15.82	<0.5	0.64	22.98	15.25	3.85	<0.5	<0.5	<0.5	<0.5	18.10
4	GP-23	19°34'59.85"N	80°31'20.04"E	<10	2.6	53.0	24.78	<0.5	<0.5	22.94	24.06	1.97	<0.5	<0.5	<0.5	<0.5	4.17
5	GP-25	19° 35' 26.11" N	80° 31' 31.2" E	<10	<0.5	6.8	4.51	<0.5	1.20	2.02	13.23	1.92	25.0	<0.5	<0.5	<0.5	41.10

Sl. No.	Sample no	Latitude	Longitude	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
1	GP-8	19°35'12.08"N	80°35'8.03"E	3.60	<0.5	1.45	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2	GP-12	19°35'10.79"N	80°35'9.32"E	11.15	1.66	8.36	2.61	1.14	3.57	0.67	4.65	0.99	2.94	<0.5	2.86	<0.5
3	GP-19	19°35'5.35"N	80°34'34.98"E	38.61	4.78	19.56	4.21	1.52	4.28	0.67	3.33	0.64	1.77	<0.5	1.49	<0.5
4	GP-23	19°34'59.85"N	80°31'20.04"E	10.88	1.71	8.84	2.85	1.15	3.71	0.68	4.75	0.98	3.08	<0.5	2.91	<0.5
5	GP-25	19° 35' 26.11" N	80° 31' 31.2" E	142.00	10.08	48.10	15.16	4.99	15.31	1.93	6.64	0.92	1.85	<0.5	1.18	<0.5

Field photographs:



1. In-situ Iron ore band in parts of SE of Wadvi village.



2.In-situ BHQ body , NW part of Toynar village



3. In-situ iron ore mineralization in parts of south of Gorgatta



4.BHQ bands on Gatta-Kothi road within the block



5.Float ores on hill slopes around Gundjur



6.Float ores valley flores near north of Padur