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# Preliminary Investigations for Iron Ore Occurrences in Warangal District, Telangana

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## ABSTRACT

***The mining of iron ore, an essential raw material for Iron & Steel Industry is arguably of prime importance among all mining activities undertaken by any country. India is amongst the leading producers as well as exporters of iron ore in the world. Iron ore deposits occur within the Pakhals in the area around Bayyaram and also in the adjacent area comprising of Dharwars. The deposits present in the Pakhals are exposed, generally on the hills comprising of ferruginous Sandstones and shale. Iron ore deposits of considerable importance, occurring at Motla Timmapur ($17^0$ 41'': $80^0$ 07) ; Bayyaram ($17^0$ 58' 00") $80^0$ 11' 00") & Irslapuram ($17^0$ 36'00" ; $80^0$ 8' 45''). Preliminary geological prospecting carried out to know the available resources.***

**KEYWORDS** : *Iron ore; Pakhal; Bayyaram; Prospecting; Mineralogy.*

## INTRODUCTION

The iron itself is usually found in the form of magnetite, hematite, goethite, and siderite. Iron ores are rocks and minerals from which metallic iron can be economically extracted. Hematite and magnetite ore would be available in plenty in India. Iron ores carrying greater than 60% iron are known as 'natural ore' or 'direct shipping ore', meaning that those can be fed directly into iron-making blast furnaces and it is called as 'A' grade. Less than 50 per cent is called as 'B' grade iron ore. Iron ore deposits occur within the Pakhals in the area around Bayyaram and also in the Adjacent area comprising of Dharwars. The deposits present in the Pakhals are exposed, generally on the hills comprising of ferruginous Sandstones and shales trending NNW-SSE. Nilancha ($17^0$ 45' 15'': $80^0$ 5' 45'') deposits constitutes the northern limit of occurrence while cheruvupuram deposits forms the southern limit. In between there are three are more deposits of considerable importance, occurring at 1. Motla Timmapur ($17^0$ 41'': $80^0$ 07'), 2. Bayyaram 3. Irslapuram ($17^0$ 36'00" ; $80^0$ 8' 45''). Besides, these numbers of small Isolated deposits are situated at various places towards the east of these deposits.

Iron ore occurrences in Warangal and Khammam districts are a matter of interest in the newly formed Telangana State. Iron ore occurrences in Warangal district are known previously and the impetus on iron ore exploitation in the recent years has gained momentum. The present study is to prospect iron ore resources of economic importance in the Pakhal belt .

## GEOLOGY

Greenstone belts in the Singhbhum, Bastar, Dharwar, and Bundelkhand Cratons India host iron ore deposits in Peninsular India (Mukhopadhyay, 2020). Concretions of Iron in the form of haematite have been reported from the sandstone of the Vindhyan basin in Peninsular India (Pati et al., 2016). Bayyaram iron ore prospect in the Proterozoic Pakhal basin forms part of the NW-SE trending Pranhita Godavari (PG) valley is to the Northern part of Eastern Dharwar Craton (EDC)

Study area is part of Bayyaram Iron Ore Belt, which extends in NNW SSE direction consisting of Proterozoic Pakhal metasedimentary rocks and granite-gneisses of Archaean age. Appavadhanulu, 1960. These rocks are occurring on either side

of the Pranahitha Godavari valley Pakhal Supergroup overlie the Archaean gneissic basement Balakrishna and Rao, 1960; Various physical properties of iron ores in Bayyaram was carried out by Ramana Rao, 1964; Rao, M.V. 1979. Compact and massive iron ores are believed to be derived from ferruginous sandstones of Pakhal basin. The Pakhal non-conformably rest over the Archaean basement. The Pakhal super group is divided into the Mallampally group, Mulug group and the Albaka sandstone. (Srinivasa Rao, 1984) The Mallampally and Mulug group are represented by variable proportions of conglomerate arkose, shale, phyllite, dolomite and quarzite. Pakhals are overlying granites & Gneisses of Pre-cambrian age and these inturn are intruded by dolerite dykes and pegmatite veins.

The Pakhal and Albaka belts may have been once continuous and now separated by the Gondwana basin, or formed as two independent basins with different cratonic provenances, the Pakhal belt resting unconformably on the Archaean Dharwar craton and the Albaka belt lying with a tectonic contact on the Bastar craton. The Pakhal belt extends from Khammam in the South to Adilabad in the North and the Albaka belt extends from Badrachalam in the South to Chandrapur in the North.

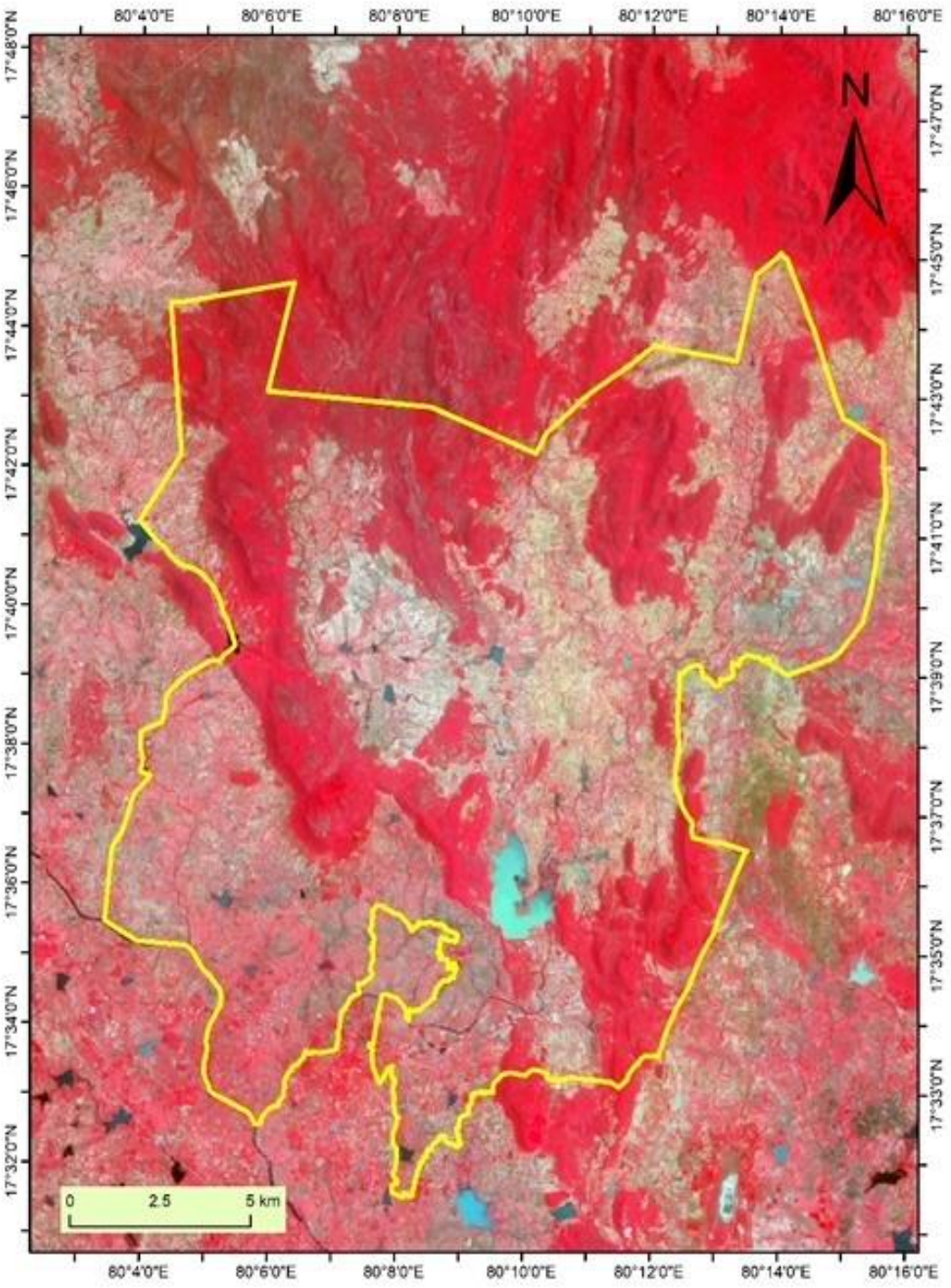


***Fig.1. Study area demarcated on the satellite Image***

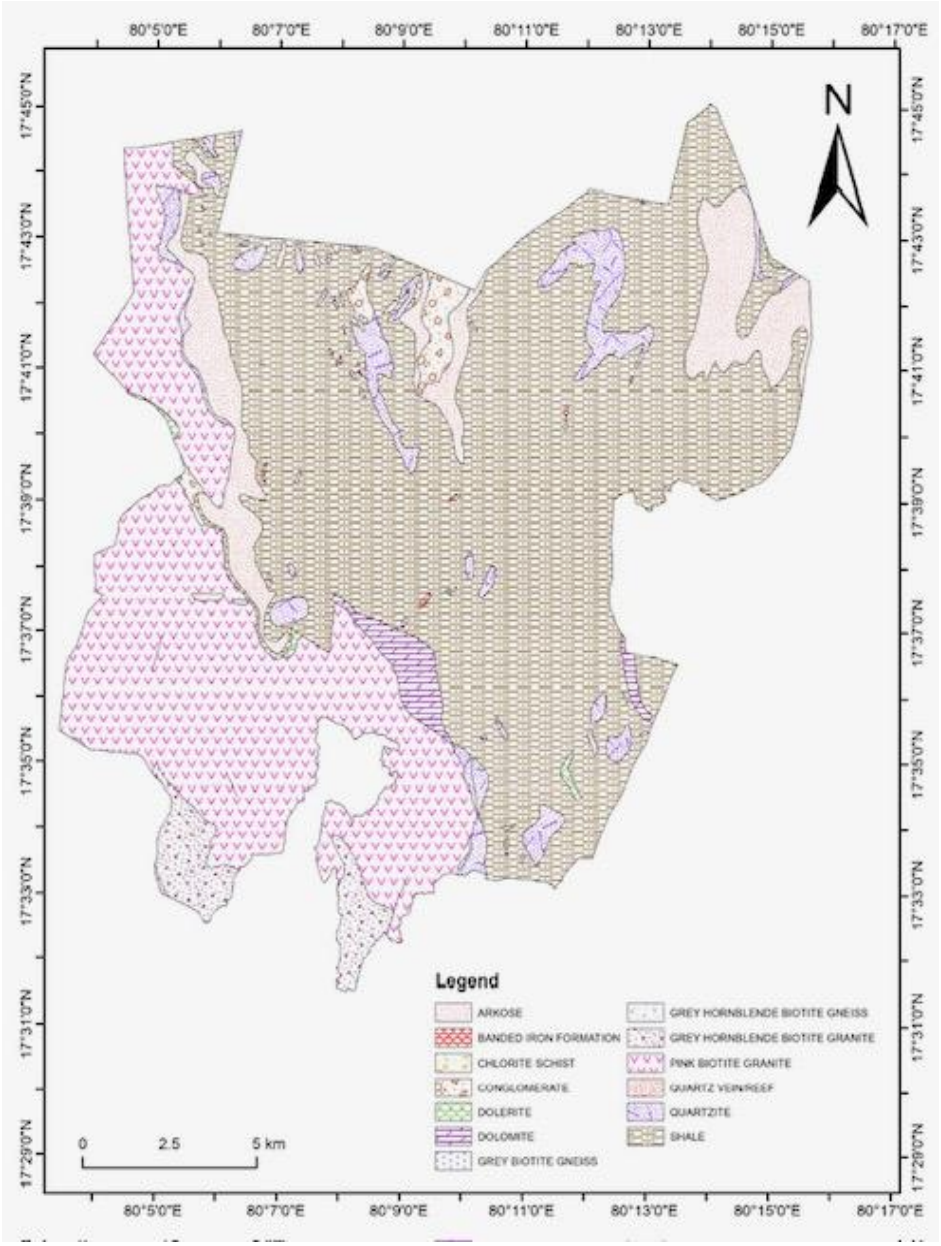


***Fig.2. Geological map of the study area***

Generalised stratigraphy of the study area (after GSI)

| | | |
|---|---|---|
| Penganaga Group | | |
| | ----------Disconformity---------- | |
| Mulug Group | Laknavaram shale with inter beds of Qtz | |
| | Pattipalli Qtz | |
| | Enchencheruvu Dolomite, | Mesoproterozoic |
| | Quartzite shale | |
| | Polaram Formation - Shales, Dolomites | |
| | Jakarmam Formation – Arkose, Qtz, Shales | |
| | ---------- Disconformity ---------- | |
| Mallampalli Group | Pandikunta shales, Dolomite, Qtz | |
| | Gunjeda dolomite, Bayyaram Qtz | |
| | Mesoproterozoic | |
| | Bollapalli Qtz, shale with interbeds | |
| of Dolomite | | |
| | ---------- Non Conformity/Angular Unconformity---------- | |
| PGC | Granites & Gneisses | |
| and migmatite | Archaean | |

## STRUCTURE

The strike of Banded Magnetite Quartzite is NW-SSE direction with vertical/steep dips. The strike of Pakhal rocks varies from WNW-ESE to NE-SW and the dips are shallow ranging from 6° – 38° NE. Quartzites showing two sets of joints. The study area has preserved both primary and deformational structures. The primary structures in BMQ, are moderate to steep dips towards/either NE or SW direction. The secondary structures such as foliation/schistosity, folds, local faults, joints, shear zones/planes were observed n the study area. Three sets of joint planes observed in the study area, which are trending in NW-SE, N-S, NE-SW and E-W direction. The most common joint plane has a strike of NW-SE & NE-SW with very steep to vertical dip.

## GEOMORPHOLOGY

The area under study is in the hilly terrain, the highest Bayyaram hill is 1904 feet above msl. The hill comprises of Dharwars and Pakhal rocks and in the plains Granites and Gneisses of Archaean are exposed. Most of the area is under Reserved Forest category. Drainage is towards South – South-East. Numerous geomorphic features were mapped (Fig. 3) for this analysis based on the interpretation of satellite images and the SOI topo sheet. Denudation Hills, which comprise 1.90 km2 in the research area, are the geomorphic features in the study area are highly dissected hills and valleys; low dissected hills and valleys; Moderately dissected hills and valleys; Moderately dissected plateau; pediment pediplain complex; water bodies – other and water bodies – river.

## MINERALOGY

The magnetite is occurring in the form of BMQ alternative iron and silica rich bands. The chief ore is magnetite. The BMQ having alternate magnetite and silica rich layers with average ratio of 1:3. mineralization of BMQ is bedded in nature with moderate to steep dip and almost all the mineralized portions exposed on the surface except some portions covered with soil/rubbles.

Iron ore occurs as lens shaped bodies of haematite of various grades all along the Pakhal belt. Iron is associated with grits and arkoses west of Motla Thimmapur. Iron ore bodies confined to the hill tops ranging in elevation from 50 m – 200 m. They are ferruginous grits and quartzites which grades into high grade haematite. Haematite is brown and steel grey in colour and usually massive. Since, the haematite ore bodies occurring on top of the hills, mechanical disintegration in geological past has resulted in huge quantity of float boulders at the foot of these hills and plains. Float ores vary in grade within short distances. Bayyaram Deposit forms a very prominent landmark rising into two or three steps to the peak the hill is comprised of quartzites, ferruginous sandstones and shales and phyllitic shales. The Iron ore bed is exposed at three different altitudes. The lower one spreads mostly in the north and southwestern part while the other two towards the top of the hill in the northeastern part. The southeastern and southwestern slopes are covered completely by float ore. Petrographic analysis of the samples collected in Bayyaram indicates the presence of Iron oxide matrix occupying the pores spaces between the ferruginous sandstone, feldspathic sandstone. During the study 12 samples collected from Bayyaram to assess the quality of iron ore and the results are given in the table.

***Table-1. Analysis data of random samples collected in Bayyaram***

| Sample No. | $SiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | MnO | MgO | CaO | $Na_2O$ | $K_2O$ | $TiO_2$ | $P_2O_5$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BRM-01 | 53.07 | 0.33 | 43.22 | 0.11 | 1.49 | 0.13 | 0.05 | 0.05 | 0.005 | 0.12 | |
| BRM-02 | 56.51 | 0.18 | 39.8 | 0.08 | 1.89 | 0.14 | 0.05 | 0.05 | 0.005 | 0.15 | |
| BRM-03 | 55.87 | 0.77 | 39.19 | 0.08 | 0.53 | 0.21 | 0.05 | 0.05 | 0.02 | 0.16 | |
| BRM-04 | 56.6 | 0.22 | 40.29 | 0.04 | 1.16 | 0.05 | 0.05 | 0.05 | 0.005 | 0.11 | |
| BRM-05 | 53.3 | 0.36 | 43.09 | 0.09 | 0.74 | 0.16 | 0.05 | 0.05 | 0.005 | 0.16 | |
| BRM-06 | 53.35 | 0.31 | 40.41 | 0.45 | 0.99 | 0.76 | 0.05 | 0.05 | 0.005 | 0.42 | |
| BRM-07 | 49.6 | 1.11 | 43.39 | 0.25 | 0.49 | 1.08 | 0.05 | 0.05 | 0.02 | 0.15 | |
| BRM-08 | 42.96 | 1.87 | 48.75 | 0.26 | 0.62 | 0.89 | 0.05 | 0.05 | 0.03 | 0.15 | |
| BRM-09 | 46.11 | 1.75 | 45.29 | 0.24 | 0.61 | 0.74 | 0.05 | 0.05 | 0.02 | 0.09 | |
| BRM-10 | 40.96 | 1.46 | 51.06 | 0.2 | 0.49 | 0.25 | 0.05 | 0.05 | 0.02 | 0.12 | |
| BRM-11 | 39.46 | 1.94 | 51.94 | 0.18 | 0.54 | 0.23 | 0.05 | 0.05 | 0.03 | 0.12 | |
| BRM-12 | 42 | 2.03 | 50.24 | 0.16 | 0.66 | 0.72 | 0.05 | 0.05 | 0.05 | 0.18 | |

 

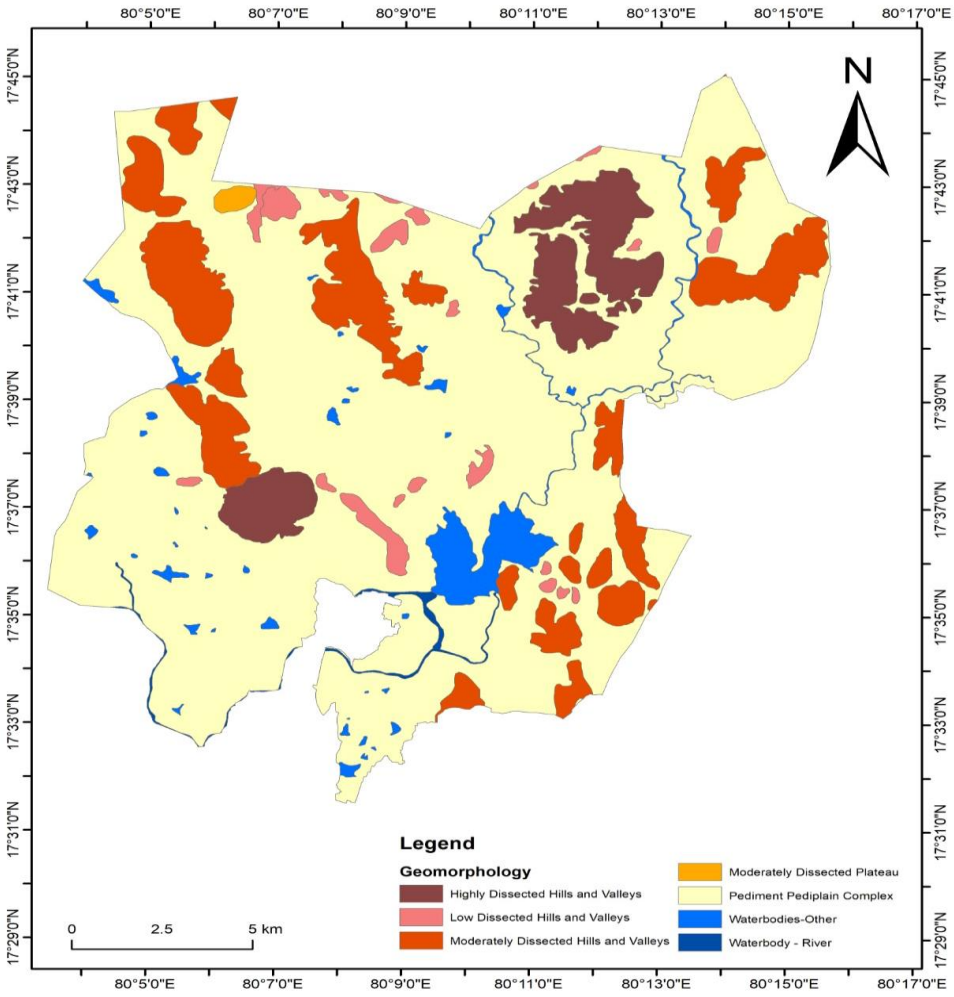


*Fig.3. Geomorphological map of the study area*

## CONCLUSION

The iron ore occurrences in the study area can be broadly be divided in to two viz., Haematite within the Pakhals & Banded haematite –magnetite-quartzites of Dharwar age. Lens shaped bodies of haematite of all grades are seen discontinuously all along Pakhal belt of rocks extending in a NNW- SSE direction.

The ores are essentially ferrugenous grits and quartzites which grade into bodies of high grade haematite to the near exclusion of silica. 12 Random samples analysed and the following are the observations, $SiO_2$ ranges from 30.36 to 82.84% with average of 50.08%; $Al_2O3$ varies between 0.05 to 5.21% and average is 1.39% ; The average analytical value of Fe is 31.03%, which considered as low-grade iron ore category with high silica and alumina content.

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