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Mineragraphic studies of iron ores of different hill ranges of Hospet-Sandur-Bellary sector, Karnataka, India.

Anand.V.Kulkarni[1], H. M. Jayasheela[2]

[1]Consulting Geologist, M/s B.S.Envi-Tech. (P) Ltd,
Bangalore –560092, Karnataka-India.

[2]Department of Studies in Geology, Karnatak University,
Dharwad-580003, Karnataka, India

Abstract

Mineragraphic studies are important and help not only to identify the minerals and associated gangue but also textural characters. The mineragraphic study of any Ore deposit is quite important as it reveals the environmental conditions under which the deposits form, which in turn helps in choosing the mineral beneficiation process. Samples of iron ores collected from different mining areas of the schist belt have been subjected to ore microscopic studies. The minerals present were analysed with the help of Infrared spectroscopic studies. The properties of the minerals like colour, texture, habit, bireflectance, micro indentation, hardness and etch test were analysed..

Keywords: *Hematite, Martite , Goethite , Specularite*

1. Introduction

The paper constitutes the results of various mineragraphic studies namely ore microscopy and infrared analysis studying the various minerals present in the iron ore samples collected from the different hill ranges of Hospet- Sandur- Bellary sector, including the textural characters and mineral paragenesis.

2. Study Area

The Sandur schist belt has rich iron ore and manganese deposits in the Bellary district, Karnataka, India. The Schist belt trends North North West-South South East, with a length of about 53 kms spreading over an area of 930 square kilometres. The Hills of schist belt are "Canoe" shaped, due to the valley on either side of the hill ranges, which extends towards each other with diminishing width, in an attempt to close up at both ends, resulting in the formation of a boat shaped structure. The iron ore deposits of the area fall within "Survey of India" toposheet number 57/8 and 57/12, falling between the longitude 76.5436 to 76.66840 E and latitude 14.9832 to15.08810 N.

3. Methodology

The samples were subjected to laboratory investigations like reflected light microscopy and infrared Spectroscopy. Ore microscopy : The polished samples were subjected to mineragraphic investigations using the ore microscope. The samples were subjected to infrared analysis with absorption ranging from 4000 to 400 cm-1 in frequency with a wavelength range of 2 to 25 microns. Totally 9 samples were considered for infrared spectral analysis. The analysis has been carried out on a SPECORD Model Bestellnumber 025228: 024. 28. KBr pellet method is used in sample preparation. The position of Band centres in the spectra are compared with the Vander Marel and Buetelspacher (1976) standard values for identification of minerals. The various wave number centimetre and the respective or types/minerals identified have been compared with the data of Donimalai iron ore samples with their respective wave numbers.

4. Results and Discussion

The samples belonging to various types of ore are found to be made up of iron ore minerals viz., Magnetite, Hematite, Martite and Specularite. It has been observed that the nature of the opaque minerals is nearly same in all the varieties of ores. The occurrence of goethite and specularite is quite irregular. Microscopic study has revealed the following order of abundance of or minerals: Hematite > Martite > Goethite > Specularite.

"Hematite" is the most abundant mineral. The mineral is anhedral and shows bright white colour. Anisotropism shows optical discontinuity suggesting that the mineral has resulted by alteration of primary magnetite through the process of martitisation. "Magnetite" is subhedral to euhedral in outline and occurs generally as relicts within hematite. Tiny magnetite grains are completely Martitized, whereas coarser ones are partially martitized with unaltered irregular magnetite core. In reflected light it shows whitish grey colour and the mineral is feebly anisotropic. "Specularite" shows beautiful needle like crystals coexisting with hematite and martite in all types of iron ores, suggesting their formation by recrystallization. "Martite" is a secondary mineral formed during conversion of magnetite to hematite. The mineral does not have any specific form but shows bright colour under reflected light. "Goethite" is predominant in laterite type of ores, where it is seen replacing hematite and martite along the borders. Botryoidal and stalactitic form is very common. Under microscope goithite does not show any regular form but is seen as veins and cavity fillings. They are also found as encrustations showing colloform texture. It shows reddish internal reflections. The Physical and Optical characters of iron ore minerals is tabulated in Table 1.

4.1. Infrared Spectroscopy Analysis

Infrared spectra were obtained for a Massive Ore from different mining blocks. The Fe_2O_3 bands are noticed at the band positions 474, 548, 912, 1011, 1029 and 1110 cm -1. All the spectra are more or less similar with a slight shift in band position by 5 to 15 cm -1. The shift in band position may be attributed to the variation in the concentration of Fe_2O_3 (figure 1,2 and 3).
The infrared spectra of 'Blue Dust' revealed the presence of hematite with the strong, very broad bands around 461, 455, 5:42 and 535 cm-1.. There is a slight shift in band position by 6 to 7 cm. The bands around 3600 to 3413 cm-1 may be due to the presence of O H molecules. (Figure 4 and 5).

The spectra of friable ore reveal the bands for the presence of Hematite around 467,548, 542,799, 1011, 1029, 1097 cm -1 . The spectra are similar in nature and shift in band position by 5 to 10 cm -1 is observed with some bands (figure 6 and 7). The infrared spectra (figure 1 to 7) obtained for different ores are more or less similar in nature and indicate the dominance of hematite in all the varieties of Ores. The infrared spectra from different mining blocks under study are compared with those of Donimalai iron ore. (Jayasheela 1982). The spectra are similar in nature with their absorption peak centred around 1020, 935, 600, 545, 460, 330 cm -1.

4.2. Textural characters

Megascopic and microscopic examination of several samples of ores has disclosed the presence of following types of texture. In the ores showing "Granular texture", grains of hematite are nearly of equal size. The texture maybe coarse granular, medium granular or fine granular depending on size of individual grains. Rupturing and fracturing of mineral grains due to deformative forces has given rise to "Cataclastic texture". In polished sections of iron Ores, it is seen that alteration of magnetite through martite has given rise to hametite. Alternation is controlled by crystallographic directions. Martitization generally advances from the Periphery inwards. In the earlier stages a thin layer of hematite encircles or surrounds magnetite which gives rise to "Replacement Rim texture". In some ores pseudomorphs of magnetite are left over indicating that the replacement is complete without any relief of magnetite. "Colloform texture" is shown by goethetic ore. Colloform texture is due to colloidal precipitation of ferruginous material in concentric layers.

4.3. Mineral Paragenesis

From the mineragraphic studies following conclusions can be drawn. a). Magnetite is primary mineral of iron ore. b).. Martite, Hematite, Specularite and Goethite are secondary minerals. c). Alteration of Magnetite has given rise to Hematite through martitization. d).Rrecrystallization of Hematite and Martite has given rise to Specularite.

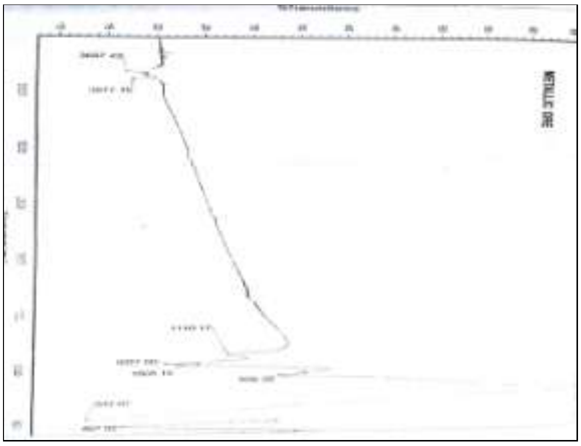
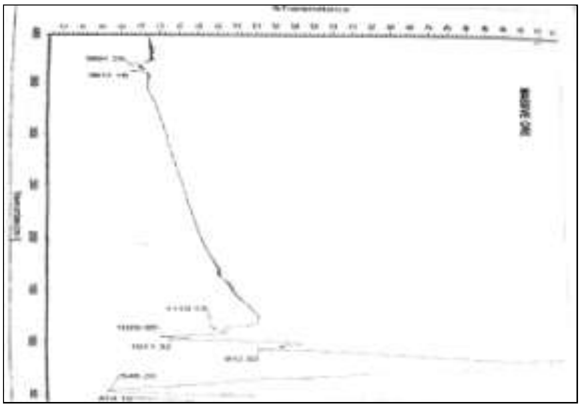


Fig-1



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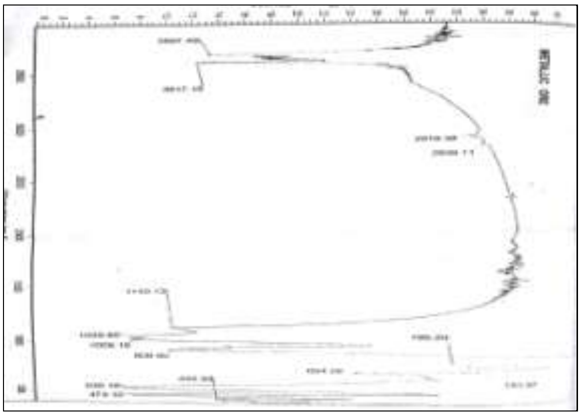

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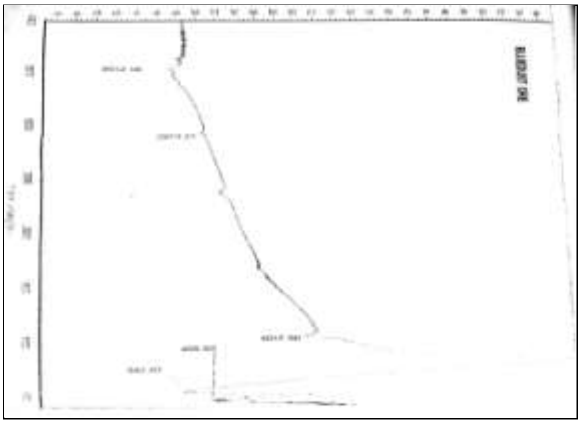

Fig -4

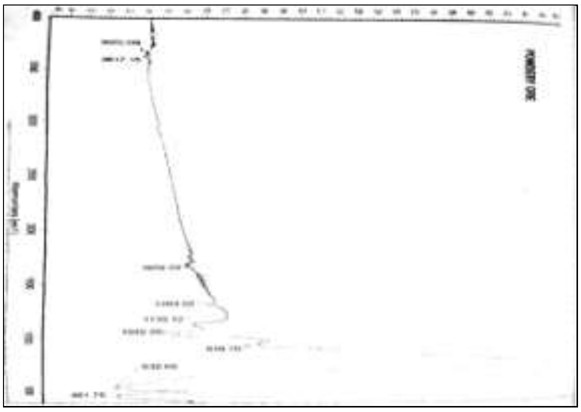

Fig-5

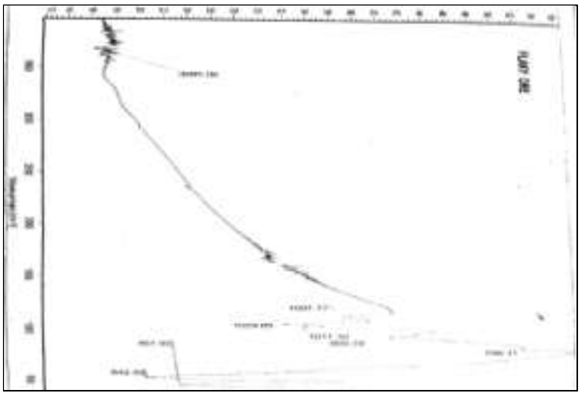

Fig -6

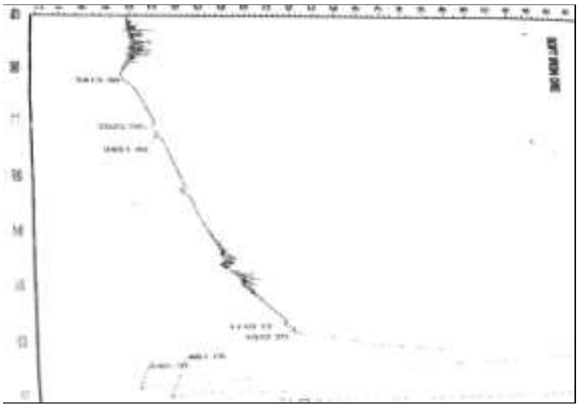

Fig-7

Table-1: Physical and Optical Characters of Iron Ore Minerals

Sample	Mineral	Color	Habit	Bireflectance	Anisotropism	Hardness VHN	EtchTest Hcl
M/sHRG	Goethite	Grey	colloform	absent	Distinct	540	-ve
Donimalai Range	Hematite	Greyish white	Anhedral	Weak	Shades of Blue and Grey	810-900	-ve
	Magnetite	Grey	Anhedral	Absent	Isotropic	720	-ve
M/s RPP	Goethite	Grey	Botryoidal	absent	Grey	490	-ve
NEB Range	Specularit	Greyish white	Bladed	Weak	Grey	--	-ve
	Hematite	Greyish white	Anhedral	Absent	Grey	850	-ve
BHQ	Goethite	Grey	Botryoidal	absent	Grey	580	-ve
NEB Range	Specularit	Greyish white	Bladed	Weak	Shades of Grey	--	-ve
	Hematite	Greyish white	Anhedral	Weak	Shades of Grey	810-850	-ve
	Magnetite	Grey	Subhedral	Absent	Isotropic	760	-ve

5. Conclusion

The mineragraphic studies conducted to know the mineral composition and texture have thrown light on their Genesis. It is observed that, the Magnetite occurs as a remnant in core of Hematite mineral and can be regarded as primary mineral. Other minerals namely Martite, Hematite, Goethite and Specularite are considered as secondary minerals exhibiting replacement texture. Hematite is found to be the most predominating mineral occurring in laminated, massive, friable and bluedust ores, as confirmed by infrared spectra studies. The analysis will be helpful in selecting the appropriate beneficiation processes.

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