

Analysis of Characteristics of Ore about Iron Deposit of Da Hong Mountain in Yun Nan Province

Zhang Yuefeng^{1a}, Li Jun¹, Tian Yimin¹, Yao Yanling¹, Zhang Yaguang¹, Ma Mengling²

¹ Faculty of Land and Resource Engineering, Kunming University of science and technology, Kunming, Yunnan

² Regional Geology and Mineral Resources Survey Institute of Hebei Province Lang fang

Abstract: This thesis aims to analyse the deposit characteristics about Da Hong Mountains Iron ore in Yunnan province. The texture and structure, especially the chemical composition, is different in every section of deposit after comparing. Moreover, the content of SiO₂ is much higher than general iron ore. However, the content of other noble metals cannot reach the lowest industrial grade. Da Hong Mountains Iron ore has unique features because of metallogenic periods.

1 Introduction

The great red iron ore in Xiping County Yunnan province. It is a large Iron-copper deposit, a typical submarine volcanic eruption and depositional deposit. There are unique form between different section of mineral deposit with the multiply metallogenic period

2 Distribution of Ore Bodies in the Mining Area

According to the distribution of ore bodies, output position, buried depth, tectonic boundaries and other factors. Mining area Can be divided into five ore blocks, that is shallow iron ore, Deep iron ore, No. 1 East of iron-copper, the north shore of Mangang river and Hamubai group iron.

Shallow iron ore: Shallow iron mine is located in the south of Mangang river, the north of F₂ fault, which exposed surface buried shallow orebody. The main ore body located in more than 700 meters in elevation, it included industrial orebody 30.

Deep iron ore is located in between F1 and F2 fault location, buried deep blind ore bodies. Most main orebody reserves distributed in below 600 meters in elevation.

No. 1 East of iron-copper is located in between the eastern F3 and the east A49, which contain iron and copper ore bodies.

Mangang River is located the north of the river surface of the exposed surface of the iron ore. The ore body is the same as that in the southern bank of the south bank. The ore body is buried in shallow depth, the depth is not large, the scale is small, and there are 4 industrial ore bodies^[1].

Hamubai group iron is the ore deposit that is between the easts of A39 line to the A45 Line East Hamubai group stratum. The orebody and the south shore shallow strata are the same horizon, the surface of the scattered, small size, a total of 3 industrial ore body.^[2] (photo1)

The main of metal mineral is magnetite, siderite, followed by chalcopyrite. The main of gangue minerals is feldspar, quartz, garnet, biotite, and dolomite. According to the main of metal mineral and gangue mineral is divided into five types: Quartz with brass magnet ore, felsic brass magnet ore, garnet biotite contain brass magnet ore, felsic dolomite with brass magnet siderite mixed ore, felsic dolomite with brass siderite ore.

3 The Texture and Structure

Metal mineral is mainly composed of magnetite, followed by hematite, with a small amount of martite (magnetic hematite), ilmenite, pyrite and chalcopyrite, occasionally it can see bornite. Gangue mineral is mainly composed of sodium feldspar, quartz, followed by white mica, carbonate and iron silicate minerals (mainly chlorite). Although the content of apatite and tourmaline is less, but its distribution is broad, and occasionally it can see rutile, zircon, epidote and hornblende, etc.

The main structure of mineral is granular structure, followed by slab structure and lamellar structure. The part of the structure is porphyritic structure, commonly it can see metasomatic texture, and the local of structure is granular clastic texture. The structure characteristic of

^aCorresponding author: 18687210822@163.com

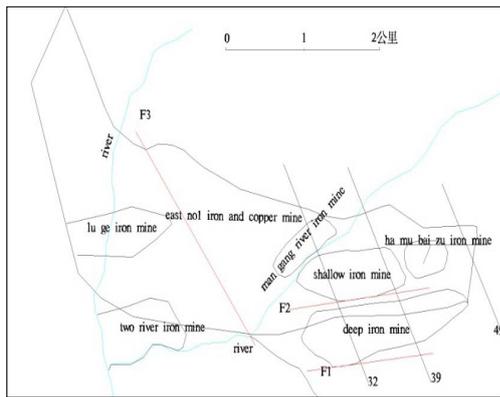


Figure 1 Ore block dividing plane projection draw

Magnetite is granular structure (**Figure 2**). The structure characteristics of hematite is allotriomorphic granular texture (**Figure 3**), the structure of hematite also has slab structure and lamellar structure. Magnetite is phenocryst of the mixed ore and the mixed ore has porphyritic structure. Hematite replaces the magnetite, which results the replacement texture, normally it can see that the hematite fills and replaces magnetite particles along its edge, cleavage and fissure, the shape of hematite replaces magnetite is needle, lattice, grid or net vein, and even when magnetite is replaced by hematite, the shape of the residual magnetite seems like an island or all the magnetite is replaced by hematite and appears the illusion of hematite (magnetic hematite); Granular blasted texture is only can be seen in Striped and banded magnet.

The ore structures have various styles. Such as disseminated structure, banding and barred structure, piebald structure, breccia structure, mottling structure, patch structure, massive structure and dense massive structure^[3] (**Figure 4**, **5**, **6**)

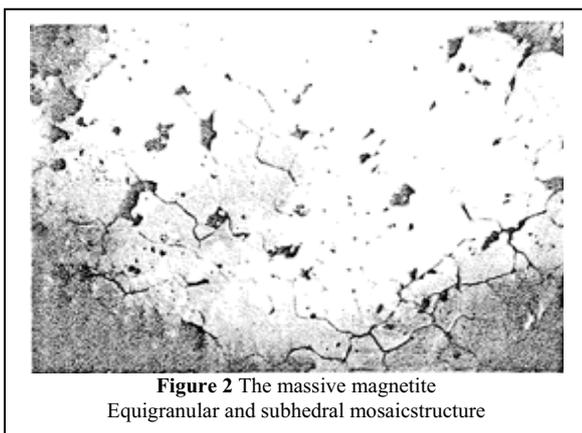


Figure 2 The massive magnetite Equigranular and subhedral mosaic structure

Structure characteristics of the mineral composition and structure of the iron ore bodies and mineralization with common characteristics, But different ore belt iron ore body also has obvious difference. Especially in the deep iron ore more features, that the main metal mineral and gangue mineral, structure, ore types and mineralization, and so on have its own way, making it different from other Iron Orebody

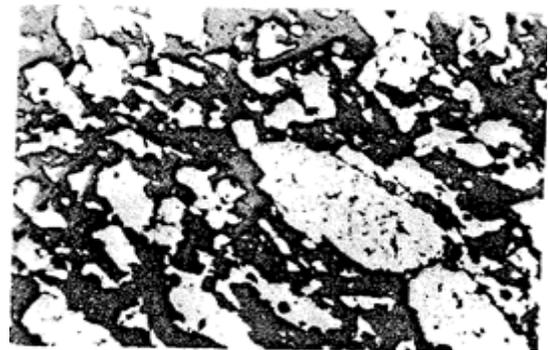


Figure 3 granular structure the white object is hematite, subhedral and anhedral form hematite

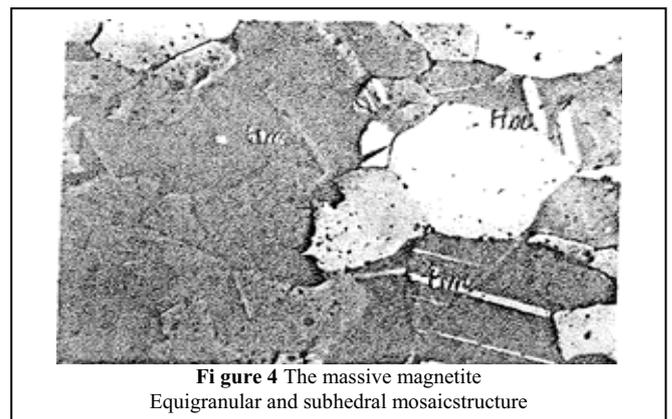


Figure 4 The massive magnetite Equigranular and subhedral mosaic structure

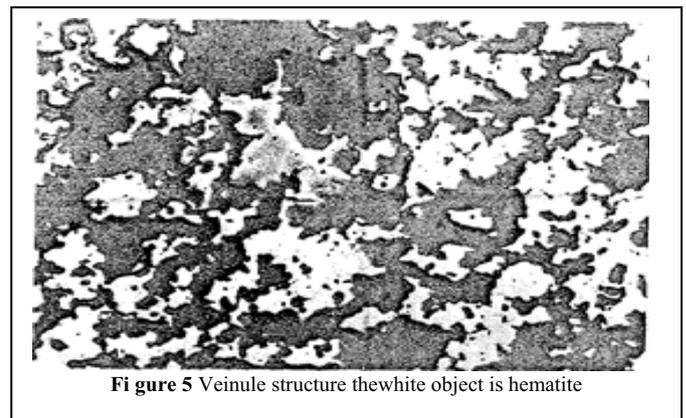


Figure 5 Veinule structure the white object is hematite

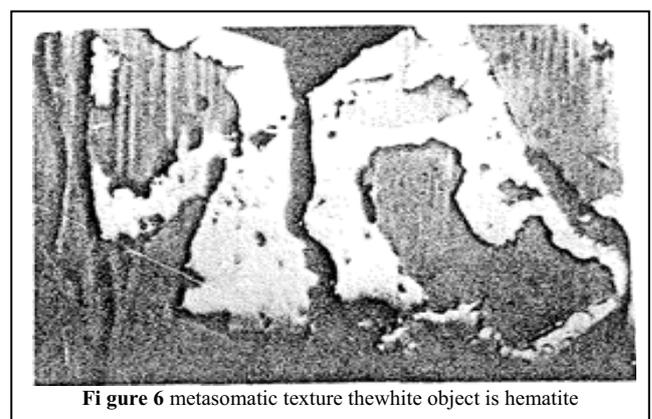


Figure 6 metasomatic texture the white object is hematite

4 Ore chemical composition analysis

Main element content of different ore block of Iron orebody percentage shown in the following table (1)
 Rich iron ore. The scope of TFe is 51.39~59.08% the average content of TFe is 54.71%. poor iron ore, the scope of TFe is 30.36~34.90% the average content of

TFe is 52.74%. TFe in the second deep orebody is higher than shallow orebody. The content of the SiO₂ in iron ore is usually higher, In Rich iron ore it is 12.49~24.19% and the average is about 18.91%. in Poor iron ore the data is 37~44.55%, the average is 40.60%.

Table 1 The main elements content of ore

Orebody numbering	Ore type	Ore level	The number	The main elements content									
				TFe	SFe	FeO	S	P	SiO ₂	Al ₂ O ₃	CaO	MgO	K ₂ O
V3	Magnetite	Poor	5	31.33	30	14.06	0.02	0.24	40.45	4.26	2.25	1.44	0.05
		Rich	1	59.08	58.52	26.89	0.01	0.14	12.49	0.76	1.76	0.65	0.05
V2	Magnetite	Poor	15	30.36	29.03	16.01	0.03	0.45	37	8.03	3.52	2.12	0.08
		Rich	5	56.40	56.35	26.22	0.00	0.12	15.22	1.51	1.64	0.36	
IV1-1	Magnetite and red-magnetite	20~25	1	24.15	23.05	13.25	0.10	0.11	41.49	11.80	1.02	3.40	
		25~30	3	28.82	28.15	7.94	0.03	0.15	43.59	8.12	1.34	0.59	0.50
		Poor	3	32.60	32.17		0.04	0.15	44.55	3.56	0.82	1.05	0.35
		Rich	7	51.95	50.87	23.19	0.01	0.07	24.19	0.73	1.05	0.33	0.06
		Average		38.75	38.13	17.21	0.03	0.13	37.90	3.90	1.18	0.81	0.32
III1	Magnetite	20~25	4	22.24	21.63	11.12	0.08	0.12	40.86	11.75	2.51	1.79	
		25~30	2		28.44	10.53	0.00	0.14	40.38	7.63	1.93	0.98	1.69
		Poor	1	34.90	32.37	11.31	0.06	0.08	41.98	3.70	2.64	0.88	
		Average		25.27	24.50	1.76	0.06	0.12	40.77	8.64	2.35	1.32	1.69
II1	Magnetite and red-magnetite	20~25	44	21.99	21.65	5.83	0.05	0.16	45.75	10.24	1.87	1.13	1.04
		25~30	50	27.41	27.16	5.92	0.03	0.17	45.03	5.83	1.74	0.63	0.61
		Poor	51	34.53	34.24	8.96	0.02	0.17	39.01	4.34	1.77	0.61	0.48
		Rich	174	51.39	49.96	13.77	0.02	0.13	23.73	1.26	1.19	0.44	0.09
		Average		39.91	39.62	10.38	0.02	0.15	30.08	3.65	1.49	0.59	0.33

There is an inverse correlation between the content of SiO₂ and TFe, especially in the rich ore usually, the value of TFe+SiO₂ is a constant (Table 2)^[4], which indicates that mineral composition is simple and consist of iron minerals and quartz. For example, enriched iron ore of II metallogenic belt, which has a high grade of TFe (more than 55%), the value of TFe+SiO₂ is 73.50%. Magnetite with 60% grade of TFe is consisting of 84.25% magnetic mineral and 13.50% SiO₂, that means the value of magnetic mineral and quartz is 97.75%. Because lean ore has other minerals like albit and other silicate, the law is not as regular as rich ore.

Table 2 relationship between different grade ore TFe and SiO₂

Grade (%)	TFe (%)	SiO ₂ (%)	TFe+SiO ₂ (%)	For note
65 以上	66.71	5.73	72.44	As TFe is 55~65%
60~65	62.46	10.90	73.36	TFe60.06%、 SiO ₂ 13.94%
55~60	57.73	16.97	74.70	TFe+SiO ₂ =74%
Average	62.30	11.20	73.50	

MyO, CaO: The content of CaO and MgO is low in the Iron orebody, The content of CaO usually is 1.53~2.51%, The highest content of the CaO is 7.61%, The lowest levels of the CaO is 0.65% and the average content is 2.39%; The content of MyO usually is 0.59~2.50% and the average content is 1.34%. The content of CaO in Late Palaeozoic basin of the first and third ore-group and the average content is 4.04%, The content of MyO is relatively high Iron Orebody, The content of MyO usually is 1.5~4.5% and the average content is 3.38%. The content of Different grades and different types Iron Orebody changed little, irrelatively stable.

Acid-base Ratio: Thanks to the content of CaO and MyO are low however, SiO₂ is high, the Acid-base Ratio of Iron Orebody is small. The ratio of major Iron Orebody is 0.04~0.15%. They belong to the acidic ore.^[5] The ratio of Different grades, different types Iron Orebody changed little and there are the trends of the ratio decreases change low with The decline of ore grade. By the magnetite and hematite ratio from large to small (table3).

Table 3 II₁ Acid-base Ratio

Ore type	TFe (%)	slagging components (%)				$\frac{CaO+MgO}{SiO_2+Al_2O_3}$
		CaO	MgO	SiO ₂	Al ₂ O ₃	
Rich magnetite	55.01	1.18	0.56	19.46	1.19	0.084

Red-magnetite	45.14	1.48	0.45	31.76	1.88	0.057
rich Red-magnetite	40.60	1.13	0.38	32.47	4.12	0.041
rich Red-magnetite	50.62	1.02	0.33	24.84	0.83	0.052
Poor magnetite	34.10	1.80	0.83	36.33	5.88	0.062
Poor Red-magnetite	37.75	2.17	1.14	29.88	5.65	0.093
Poor magnetite	27.78	1.13	0.43	46.09	6.14	0.029
Poor Red-magnetite	30.95	0.96	0.20	46.35	3.53	0.023

5 Beneficial Associated component content and Occurrence state

Through the combination of analysis, artificial placer, optional test, in a single iron ore body was not found with comprehensive utilization value of accompanying useful components, but in the I、III ore Au、Ag、Co、Pt、Pd can be integrated recovery, Its content is shown in table 1-4. From table (4) ore grade is low, no separate recovery value, but it can get in sulfide concentrates after beneficiation different degree of enrichment, that can consider to comprehensive recovery.

Gold, silver: IN ore belt iron copper (I₃、I₂) Au 0.08 and 0.11 g/t, Ag 0.53 and 0.63 g/due to the run of mine ore content with little, Au, Ag are not found in mineral alone. But we can get in sulfide concentrates after beneficiation good enrichment. This description Au, Ag occurrence in sulphide minerals easy for comprehensive recovery. The distribution of its distribution is obviously related to the Cu, namely when the Cu-rich, Au, Ag content is also relatively increased.

According to the III copper ore analysis the mineral sample, Au 0.33 g/t, Ag, 2.6 g/t. According to the selected 18 sample test results show that the copper concentrate in Au enrichment cannot get enrichment, but it can get enriched in iron concentrate.

Table 4 Copper associated components

Ore body number	head grade (g / ton)					concentrate grade(g / ton)				
	Au	Ag	Co(%)	Pt	Pd	Au	Ag	Co(%)	Pt	Pd
I 3	0.08	0.53	0.012	0.00	0.01	1.62	11	0.027	0.03~0.09	0.14
I 2	0.11	0.63	0.012	0.00	0.02	1.69	13	0.0594	0.03~0.09	0.17
III	0.33	2.60	0.006	0.00	0.012	0.28	12.84	0.045	0.00	0.02

Co: No.1 ore containing Co generally not less than 0.01%, average 0.012%. Sulfide concentrate containing Co 0.027 ~ 0.0594%, compared with about five times ore enrichment, different types of ore concentrate containing Co are quite different taste, marble-type ore is higher, up to 0.514%; Biotite schist type ore is low. Cobalt in class in the sulfide mass with like and adsorption state, mainly because some of the iron cobalt replace when entering the pyrite lattice, so the value of the lattice parameters of pyrite increases

6 Conclusions

1. From rock slice, original rock of ore district can be deduced as mafic-intermediate volcanic rocks, which was obviously affected at hydrothermal alteration from early time, some rocks got regional metamorphism later.

2. Big red mountain iron ore is a kind of magmatic eruption - sedimentary hydrothermal deposit, which suffered metamorphism during the ore-forming process. Especially, the mineralization of ore is obviously at the ore enriched zone.

3. There is an inverse correlation between the content of SiO₂ and TFe, especially in the rich ore. Usually, the value of TFe+SiO₂ is a constant

4. The content of CaO and MgO is poor and stable, and it doesn't change a lot at different grade and types of iron ore.

5. Except the content of Au and Ag for parts of No.1 or 3 mine can reach the grade of pay utilization; other ore can't reach the grade. Moreover, though Au can't enrich at the copper concentrate, Au can enrich at the iron concentrate. It's a new question waiting for further research.

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