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Abstract. The Chedu gold deposite is located in the south rim of bikou terrane. It is the first BIF-type gold deposit in shaanxi province. Magnetite and quartz bands can be seen in the magnetite quartzite type gold ore. According to the electronic probe analysis results, we find that the ratio of ^{T}FeO to oxide is from 98.90% to 99.87% and the levels of TiO_2, MgO, $A1_2O_3$ and MnO are low in single particle magnetite. It is suggested that the magnetite in gold ore is the cause of sedimentary metamorphism. In addition, a total of 22 of the 35 electronic probe analysis data implying that the magnetite was not visible. The maximum is 0.105%. Through the analysis of geochemical samples, the gold grade is proportional to the iron content.The isotope age of the Bikou group is between 764 and 1611 Ma. The indirect method proves that the Chedu magnetite quartzite gold deposit was formed in the Middle Proterozoic- Neoproterozoic.

1. Introduction

More than 20 gold deposits have been found in Bikou Block, of which the Jiufangliang and Jinchanggou are medium-sized gold deposits, and Lijiagou and Huodiya are small-sized gold deposits.The main types of gold ore are carbonate type, quartz vein type and tectonic altered rock type.The formation of the Bikou gold deposit is closely related to the thrust of the North China plate from the north to the south in Mesozoic [1].In addition, a small amount of magnetite quartzite type gold ores have been found in Chedu gold deposit, Xiaoyanzigou gold deposit and Jinchanggou gold deposit on the southern margin of Bikou block.The genesis mechanism of magnetite quartzite type gold ore needs further study.

2. Geological characteristics of gold deposit

Magnetite quartzite type gold deposit is located in the north of Yangpingguan fault about 30-100m.Gold grade is 1.50-9.82g/t.Alteration zones generally spread in NE direction.The total length of the gold ore body is 2800m and the width is 10-50m(Figure 1).Based on the data of geological survey and electrical sounding, the mineralization belt inclines steeply to the north and slowly wavy to the downward direction [2].

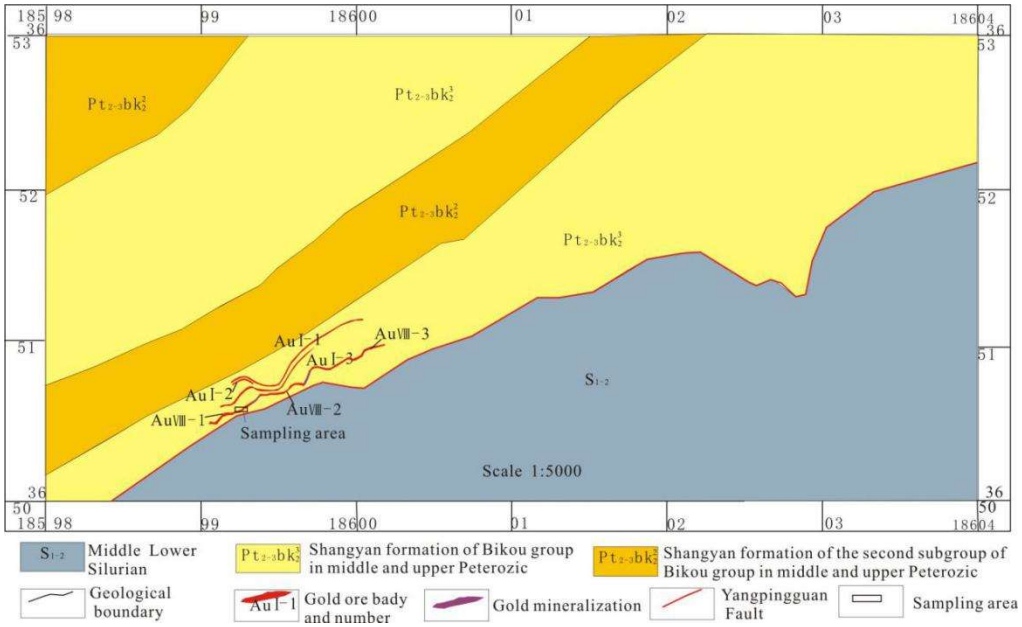

Figure 1. Geological map of the Chedu gold deposit

3. Electron Probe Analysis of Magnetite

Accroding electron probe testing results based on single granule magnetite in gold ore, we discuss the genesis of gold deposits.The sampling position is shown in Figure 1.

3.1. Analytical method

Electron microprobe analysis was carried out in the Key Laboratory of Magma Mineralization and Prospecting, Ministry of Land and Resources, Xi'an Geological Survey Center.Electron microprobe analysis was carried out in the Key Laboratory of Magmatic Mineralization and Prospecting of Xi'an Geological Survey Center.The instrument is JXA-8100 electron probe.Before the test, the instrument is in the best state. The parameters of acceleration voltage, beam current, beam spot size and correction method are optimized to ensure the accuracy of the test data.

3.2. Component analysis of single-particle magnetite

The results of electron probe analysis are shown in Table 1. The content of SiO_2 in single magnetite is 0%-0.484%, and the average value is 0.797%. The content of ^{T}FeO was 91.18% - 94.29%, the average was 93.28%. The content of Al_2O_3 was 0% - 0.077%, the average was 0.171%. The content of TiO_2 was 0% - 0.067%, the average was 0.010%. The content of MnO is 0%-0.087%, the average is 0.011%.the content of V_2O_3 is 0.321%-0.468%, the average is 0.375%.the content of AuO is 0%-0.105%, the average is 0.026%. It means that there may be sub-micro gold in magnetite.

Table 1. Electron microprobe analysis of magnetite element content (w%)

Point number	Na_2O	Al_2O_3	MgO	SiO_2	TiO_2	^{T}FeO	K_2O	MnO	Au_2O	Cr_2O_3	NiO	Total
1	0	0.014	0	0.164	0	93.431	0.005	0	0	0.12	0.073	93.81
2	0	0	0.065	0.05	0.008	93.226	0.009	0.009	0	0.039	0.025	93.43
3	0.043	0	0	0.459	0.018	92.724	0	0.02	0	0.081	0	93.35
4	0	0	0	0.082	0.032	93.404	0	0	0	0.228	0.053	93.80
5	0.03	0.013	0	0.068	0	94.531	0	0	0.01	0.019	0.007	94.68
6	0	0.053	0.004	0.104	0	94.162	0	0.037	0.057	0.006	0	94.42
7	0.03	0.031	0.006	0.059	0	93.434	0	0	0	0	0	93.56
8	0.034	0	0	0.059	0	92.926	0.009	0.081	0.024	0.021	0.005	93.16
9	0.009	0.017	0	0.038	0	92.648	0	0	0.019	0.081	0.027	92.84
10	0.12	0	0	0.046	0	93.703	0	0.013	0.052	0.06	0	93.99
11	0.064	0	0	0.083	0.042	93.263	0	0	0.038	0.066	0	93.56
12	0	0	0	0.07	0.013	94.299	0.003	0.044	0.005	0.083	0.089	94.61
13	0.017	0.037	0	0.076	0	92.53	0.002	0	0.005	0.006	0	92.67
14	0	0.023	0.002	0.051	0	93.783	0	0.029	0	0.085	0.066	94.04
15	0	0	0	0.05	0	91.933	0	0.037	0	0.029	0	92.05
16	0.021	0.013	0	0.013	0.042	94.248	0	0	0	0.031	0	94.37
17	0	0	0	0.096	0	91.917	0.009	0	0.033	0	0	92.06
18	0	0	0.015	0.07	0.006	93.885	0	0.013	0.086	0.081	0	94.16
19	0.004	0.006	0.063	0.063	0	92.317	0	0.022	0.105	0.041	0.075	92.70
20	0.017	0.006	0	0.147	0.008	93.147	0.003	0.013	0.024	0.023	0	93.39
21	0	0.077	0	0.015	0.011	94.553	0.001	0	0	0.085	0	94.74
22	0.06	0.017	0	0	0.013	93.677	0.002	0.002	0.057	0.066	0	93.89
23	0.021	0.001	0.015	0.041	0	93.992	0.012	0	0	0.039	0	94.12
24	0.056	0	0	0.039	0	94.573	0	0	0.043	0.048	0	94.76
25	0.039	0.024	0	0.066	0	94.04	0	0	0.043	0.068	0.066	94.35
26	0	0.098	0	0.133	0	93.094	0.016	0.035	0	0.006	0.055	93.44
27	0.03	0.009	0	0.058	0.067	93.673	0	0	0.005	0.054	0	93.90
28	0.098	0	0	0.019	0	91.686	0.003	0	0	0.012	0.025	91.84
29	0.021	0	0	0.004	0	92.908	0	0	0	0.076	0	93.01
30	0.034	0.09	0.009	0.092	0.05	93.773	0.011	0	0.076	0.11	0	94.25
31	0	0.029	0.033	0.017	0.011	93.047	0.003	0.009	0.033	0.089	0	93.27
32	0.025	0.004	0.039	0.031	0	93.163	0	0	0.061	0.037	0.027	93.39
33	0.047	0	0.004	0.051	0.052	91.18	0	0.011	0.071	0.018	0.02	91.45
34	0.013	0	0	0.025	0	93.934	0.006	0	0	0.035	0.064	94.08
35	0.004	0.047	0.026	0.061	0	93.96	0	0	0.038	0.019	0.007	94.16
36	0.064	0.025	0.024	0.062	0	94.043	0	0.026	0	0.052	0	94.30
37	0	0	0.057	0.029	0	91.9	0.001	0	0.01	0.031	0	92.03
38	0	0.033	0.002	0.035	0	93.192	0	0.037	0	0.04	0.053	93.39

Nadollconsiders that the magnetite in BIF deposit has the characteristics of low Al, Ti, V, Mn, Cr, Co, Ni, Ga and Sn[3].DuPuis and Beaudoin [4] statistics the composition characteristics of magnetite in different genetic types of ore deposits in the world. Magnetite in BIF type iron deposits has very low content of TiO_2, MgO, $A1_2O_3$, MnO.These elements are very low in the magnetite of Chedu Gold Mine. It is suggested that the banded magnetite in Chedu magnetite quartzite gold ore is the genesis of sedimentary metamorphism. Wang Jinshun (1984) and Chen Guangyuan (1987) summarized the typomorphic characteristics of magnetite.They established a diagram of TiO_2-Al_2O_3-MgO[5].Using these results, we can distinguish the genesis of magnetite in Chedu Gold Mine.As can be seen from Figure 2a, the magnetite data is plotted in the sedimentary metamorphism-contact metasomatism zone.As can be seen in Figure 2b, the magnetite data is projected onto the deposited metamorphic region. Therefore, we believe that the strip-shaped magnetite quartzite is the cause of sedimentary metamorphism.

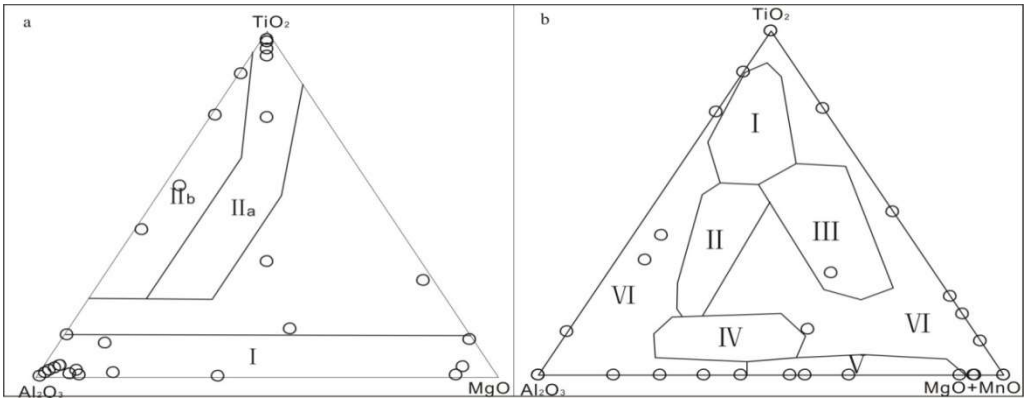

Figure 2. The magnetogenic origin figure of TiO_2-Al_2O_3-MgO in Chedu gold deposit (I- Sedimentary metamorphism -contact metasomatism area;IIa -Ultra basic-basic- neutral magmatic area;IIb -Acidic-alkaline magmatic area)(a)The magnetogenic origin figure of TiO_2- Al_2O_3-(MgO+MnO) in Chedu gold deposit (I-Accessory mineral type; II- Magmatic type;III-Volcanic type;IV-Contact metasomatic hydrothermal type;V-Skarn type;VI-Sedimentary metamorphic type) (b)

4. Conclusion

4.1. Determination of Magnetite as an Important Gold-carrying Mineral

In the elemental analysis of electron probe, gold was found in 22 of the 38 determined points.The universality of gold content in magnetite is confirmed in microscopic aspect.In the analysis of relatively macroscopic geochemical samples, if magnetite is the main gold-bearing mineral, the gold grade should be proportional to the iron content.Based on the results of chemical analysis of gold ore samples, the ^{T}Fe-Au diagram of gold ore is drawn.In the figure, the gold grade has a significant proportional change with the iron content (Figure 3).It can be proved that magnetite is the main gold-bearing mineral of magnetite quartzite type gold ore.

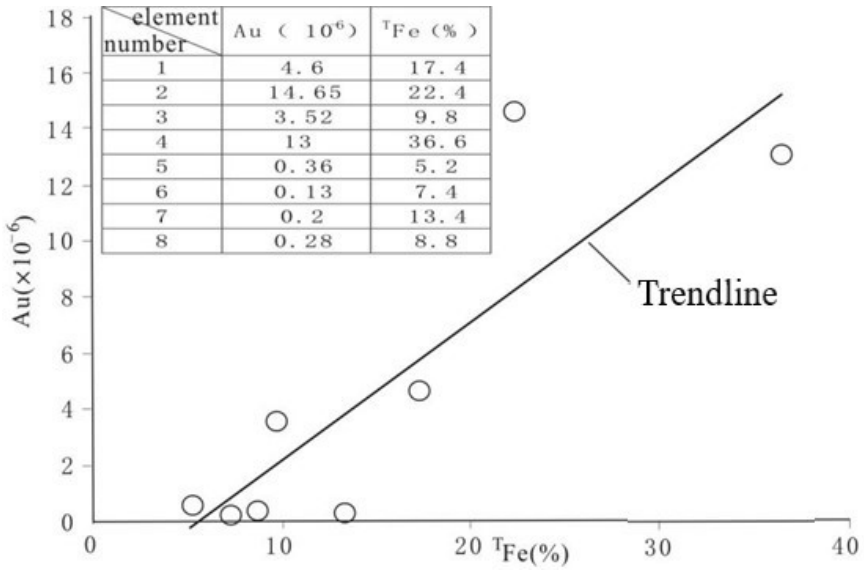

Figure 3. The ^{T}Fe-Au figure of magnetite quartzite type gold ore

4.2. The Study of Metallogenic Chronology

I have not carried out isotope metallogenic chronology experiments.However, the discovery of gold encapsulated in magnetite can strongly prove that the BIF band and gold formed in the same era.BIF band and surrounding rock are deposited at the same time.Therefore, the age of the wall rock can represent the metallogenic age.According to previous research results, the isotopic age of Bikou Group ranges from 1611 to 764 Ma[6].Therefore, it is proved by indirect method that Chedu magnetite quartzite type gold deposit was formed in Mesoproterozoic-Neoproterozoic.

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