Geological and geochemical characteristics and genesis of carbonate rocks in a certain area

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Abstract: Carbonate rock is a general term for the rock composed of carbonate minerals, which is mainly composed of carbonate sediments, with calcite (limestone) and dolomite (dolomite) as the main forms. Carbonate rocks are important oil storage rocks, storing more than half of the world's natural gas and oil, and co-existing with various types of solid sedimentary deposits. They are themselves a kind of mineral that can be used in construction, chemical industry, metallurgy and other processes, so they have very important economic value. This paper analyzes the geological and geochemical characteristics and genesis of carbonate rocks in a certain area in order to provide theoretical support for related work.

Key words: Carbonate geology; Geological and geochemical characteristics.

1. Introduction

All kinds of geological are certain conditions and factors in the long-term effects after formed, and the process has many influence factors, often difficult to completely after carved from the details, but for all kinds of geological condition of study also has its unique significance, and can help people in some decisive conditions under the condition of accurate understanding of geologic types, This includes the geochemical characteristics of geological types. In terms of the crystal characteristics and crystal habits of carbonate minerals, the chemical characteristics of carbonate minerals are mixed with gypsum, barite, rock salt, potassium and magnesium salt minerals, and a small amount of opal, glauconite, phosphate minerals and various kinds of organic matter, which show certain differences. For the carbonate rocks mixed with terrigenous impurities, when the amount of terrigenous impurities and minerals is more than half, the carbonate rocks will transition to clay or clastic rocks. However, in order to ensure the accuracy of analysis, the specific geochemical characteristics of carbonate rocks should be comprehensively considered according to the geological environment where they are located.

2. Basic geological features of the region

2.1 Location and development history

It carbonate geological basin is located in a local place, found that after the access to previous research data, the geological early in a passive state there terrigenous extensional environment, in the condition of the terrigenous clastic rock and volcanic sedimentary, and form a bi-model volcanic construction, most of the iron ore in the area of the main forms in this period; After the beginning of the Late Carboniferous period, the geological environment in this area was in a state of convergence as a whole. At this time, there was obvious deposition of flaystone formation, including the deposition of intermediate acid volcanic rock formation, and the two kinds of formations were invaded by calc-alkaline granite in different degrees. Until the middle and late Carboniferous period, the process of molasse construction appeared. The last stable period occurred after the Permian period [1].

2.2 Distribution characteristics

After conducting a large number of geological sections (14) in the area and analyzing the results, the existence of carbonate rocks was found in all the section results, and the rock types were mainly marble, limestone, ribstone and so on. It includes microcrystalline limestone, fine crystalline limestone, fine crystalline marble, marbleized limestone, fine crystalline tuffy-bearing marble, calcareous mylonite, calcareous mylonite, calcite structural schist, etc. Except for calcite structural schist, other rock lithologies can be summarized as limestone. After investigation of its distribution location and analysis combined with existing relevant data, it is found that limestone is distributed in the vicinity of the ore body, but also in the periphery of the mining area [2]. After the investigation of their regional distribution patterns, it is found that most of their shapes present lenticular, layered and so on, and a large number of them exist in the volcanic

rock strata in the state of bedding distribution, and their thickness shows disorder, ranging from tens of centimeters to tens of meters.

3. Geological and geochemical characteristics of carbonate rocks in this area

3.1 Sampling and Testing

After sampling the central and peripheral carbonate rocks in the area, the samples were sent to the HeI Beijing Institute of Geology for analysis. The main elements and trace elements of the samples were analyzed by X-ray fluorescence spectrum and ICP-MS method, and the analysis results were shown in Table 1 and Table 2 below.

3.2 Principal element characteristics

Carbonate rocks in this area are mainly composed of calcite and contain a certain amount of volcanic material or silica on the basis of which the main component is silicate. Therefore, after combining CaO and SiO2 to draw a scatter plot and analyze, it is found that the main components in the samples are concentrated in a large number in the two areas. Among them, the content of CaO in microcrystalline limestone, fine crystalline limestone, marble, mylonite and calcalite structural schist ranges from 49.02% to 54.65%, which belongs to the high content of major elements (nearly half or more than half), while the content of SiO2 is between 0.72% and 8.27%, which belongs to the secondary content of major elements. Compared with CaO, the content of other major elements is generally low, not more than 1% and most of them not more than 0.5%. Considering the content characteristics of major elements, carbonate rocks in this area show high calcium content but low iron, magnesium and manganese content, and the variation of different element contents among different lithologies shows an irregular state [3]. For marble and mylonite containing tuff, the content of CaO ranges from 37.48% to 44.24%, which is relatively high. However, the content of SiO2 ranges from 18.29% to 22.98%, which is significantly higher than that of previous lithology, and the content of various compounds is also higher than that of carbonate rocks without tuff. However, the contents of TiO2, MgO, MnO and P2O5 compounds are not significantly different from those of carbonate rocks without tufts.

Table 1 Analysis results of major elements of carbonate rocks in a certain area

The sample name	ω（B）/%								
	SiO_2	Al_2O_3	TFeO	MgO	CaO	Na_2O	K_2O	MnO	Ignition loss
micrite	3.38	0.275	0.111	0.157	51.92	0.079	0.019	0.123	40.64
Fine grain limestone	1.77	0.123	0.510	0.312	53.46	0.037	0.060	0.049	41.79
marble	1.07	0.536	0.834	0.294	46.13	0.052	0.085	0.336	44.16
Tuffaceous marble	18.86	0.847	1.068	0.505	38.96	0.059	0.343	0.135	30.51
Calcite mylonite	7.18	0.505	0.252	0.248	50.61	0.066	0.037	0.149	43.93
Siliceous calcareous mylonite	18.38	0.352	0.219	0.145	44.24	0.035	0.038	0.158	38.52

Table 2 Analysis results of trace elements of carbonate rocks in a certain area

The sample name	ω（B）/10^{-6}								
	Sr	Ba	Rb	Li	Ca	Tl	Pb	Cu	Zn
micrite	765	13.46	0.68	2.31	0.06	0.13	15.65	3.86	5.35
Fine grain limestone	265	5.34	0.22	5.43	0.08	0.02	0.29	1.96	4.59
marble	199	17.89	1.13	2.52	0.06	0.000	6.38	63.17	8.38
Tuffaceous marble	608	49.13	12.3	13.46	2.93	0.16	0.05	6.38	5.07
Calcite mylonite	426	4.66	1.21	3.10	0.04	0.05	2.32	5.82	10.19
Siliceous calcareous mylonite	30.50	1.34	8.03	0.04	0.01	3.22	5.84	15.07	1.27

3.3 Characteristics of trace elements

It can be clearly seen from the data in Table 2 that the contents of trace elements (excluding rare earth elements) in the carbonate rocks in the central and peripheral areas of this area are significantly different, and show serious disorder, among which various ore-forming elements led by Cu and Zn have relatively obvious changes. In order to investigate the variation of trace elements in all carbonate rocks, the trace elements in microcrystalline limestone should be taken as the standard values, and then the trace elements in other samples should be processed. After this operation and data study, it is found that the contents of various trace elements in carbonate rocks containing tufts are significantly enriched compared with microcrystalline limestone. However, the content of trace elements in calcite schist showed obvious deficit. However, other types of carbonate rocks do not show the same characteristics, and there is no significant enrichment or deficit [4]. This situation indicates that during the tectonic-hydrothermal activity, impurities originally accumulated in the carbonate rocks are largely removed by the hydrothermal process, but the hydrothermal activity process basically does not bring new materials to the carbonate rocks.

4. Geological origin analysis of carbonate rocks in this area

4.1 Formation of the environment

After reviewing the previous relevant data, it is found that the carbonate geology in this area may be formed in the submersible environment above the wave base. The reference factors to provide this conclusion are mainly the constituent contents found in the carbonate rocks. The rocks composed of biodebris were found in the carbonate rocks in this area. After taking out the samples and disassembling them for analysis, it was found that the biodebris mainly consisted of coral, crinoid stem blocks and other Marine biological fossils, and the bamboo leaf-like gravel was also found in the samples. Considering that the distribution of carbonate rocks and volcanic rocks in this area shows obvious overlapping characteristics, and there are tuffite and carbonate tuffite rocks, which usually appear as overrock in the deposition process. The deposition of carbonate rocks and volcanic rocks on the surface of the above signs occurred successively in the same period, and it can be seen from the bioclasts that the sedimentary environment is shallow sea sedimentary environment, because the bioclasts do not contain deep-sea Marine biological fossils [5]. From the positive europium anomaly and negative cerium anomaly in carbonate rocks, it can be found that the seawater was relatively oxygen-rich during the sedimentary process, which coincides with the absence of deep-sea Marine fossils in the rocks.

4.2 Evolution process

The evolution of carbonate rocks in this area is mainly due to recrystallization process under the action of heat. The microcrystalline limestone is transformed into fine crystalline limestone or fine marble after recrystallization process. On the other hand, it also leads to the deformation of rock mass during the tectonic process, and the products are mainly calcite structural schist and calcite mylonite. After the analysis of its petrographic characteristics, it is found that the carbonate rocks in this area appear under the action of strong tectonic stress and heat at the same time, that is to say, the recrystallization is accompanied by the deformation of the rock strata. Combined with the analysis results of the main elements, the contents of the main elements in different lithologies show obvious disorder, which means that the later metamorphic process has not affected the main components in the lithology.

And characteristics of trace element analysis results, according to the area of fine limestone, calcite mylonite and marble on the trace elements were not significant change, that is to say, never happened in the process of carbonate in the subsequent deterioration of high strength of material exchange, and the only change of trace element calcite tectonic schist, its present as a result of the loss of all kinds of trace elements, This proves that some impurities may be removed from the calcite schist during the formation process, or that the calcite schist is formed because a part of the material is removed. In general, although the carbonate rocks in this area suffered a certain degree of material loss in the process of transformation, they did not receive other material inflow in the same period, and the content of ore-forming elements indicates that the ore-forming elements are not brought in.

4.3 The geological formation

Considering the formation environment and process of carbonate rocks in this area, its genesis may be related to skarn. This is because skarn is also accompanied by hydrothermal diffusion (or percolation metasomatism), and there is a large amount of material in and out of the process. Carbonate formation in the region, however, there is obvious difference with traditional silicon card lithification process, prospecting line profile skarn marble and between orebody and fault isolation, both almost no effective contact formation, and the field survey also found that contact with skarn, carbonate, basically did not show the characteristic of the silicon card lithification. Therefore, whether the carbonate rocks in this area are formed under the influence of skarn still needs to be further explored. But from a higher level, skarn type ore deposit can be divided into broad and narrow two kinds of concepts, domestic card lithification is usually determined by the silicon based on the special concept, namely must contact and have an impact to determine formation, skarn deposits, whereas in the broadest sense of the term in the skarn deposit, as a condition of determination not to contact or not. Therefore, from a broad perspective, the carbonate rocks in this area belong to the broad skarn category, which is similar to the continental volcanic lithologic iron ore and Hongyuntan iron ore in Ningwu area in the middle and lower reaches of the Yangtze River.

5. Conclusion

THE study on the formation process of carbonate rocks in this area shows that the carbonate rocks and volcanic rocks were deposited in shallow Marine environment at the same time. Combined with the results of trace element analysis, it is found that there is no obvious skarn mineralization in the carbonate rocks in this area, but it belongs to the generalized skarn mineralization due to the existence of skarn rocks. This analysis reasonably explains the stroke process of carbonate rocks in this area to a certain extent, so the final analysis results can provide reliable theoretical support for peers to a certain extent.

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