Analysis of Basic Analysis Items and Determination of Mineral Content in Wollastonite Exploration

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Abstract: In the exploration process of wollastonite, how to determine the basic analysis items and mineral content is the most important link in the whole exploration process, and its correctness will directly affect the quality of exploration results. Therefore, on the basis of expounding how to determine the basic analysis items of wollastonite exploration, this paper focuses on the interpretation of the working method of calculating mineral content by using the results of chemical analysis with the help of examples, so as to provide a reference for geologists in the exploration of the same type of deposits.

1. Introduction

Wollastonite is a silicate mineral with iron chain structure. It is formed under specific physical and chemical conditions and in specific geological environment. The formation mechanism is that under the specific temperature and pressure conditions, some quartz (separated) and calcite with rich limestone and limestone, and the chemical reaction of forming solid form of calcite will be changed[1]. When the saturated calcium silicate solution is saturated, can the saturated calcium silicate solution cause the chemical change of wollastonite. The chemical reaction equation is as follows.

$$CaCO_3 + SiO_2 \longrightarrow CaSiO_3 + CO_2 \uparrow$$

Wollastonite is an energy-saving raw material for ceramic industry and a reinforcing filler for high-performance engineering composite materials[2]. It is widely used in ceramic, coating, metallurgical protection slag, welding electrode and other industries.

2. Basic Analysis Items of Wollastonite During Exploration

In the exploration engineering of wollastonite, the basic analysis items are generally CaO, SiO_2, MgO, Fe_2O_3, AL_2O_3 and loss on ignition[3]; generally speaking, the determination of these six items can basically determine the quality of wollastonite. With the deepening of geological prospecting, when the ore is clear about different industrial uses, the sample chemical analysis items are as follows[3]:

$$CaCO_3 + SiO_2 \rightarrow CaSiO_3 + CO_2 \uparrow$$

Architectural ceramics: CaO, SiO_2, Fe_2O_3, CO_2, whiteness (natural whiteness or firing whiteness);

Paint and coating: CaO, SiO_2, Fe_2O_3, whiteness, oil absorption, water soluble matter, water extraction pH value;

Metallurgical protective slag: s, P and the chemical component content required for calculating the content of wollastonite, calcite and quartz minerals;

Electrodes: CaO, SiO_2, MgO, S, P;

The analysis of Fe_2O_3, MnO, TiO_2, MgO, S, P and other harmful components can be determined by industrial requirements and multi-element analysis data. Some components are stable

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under the specified content. Projects are recorded as portfolio analysis projects as needed. The multi-element analysis items can be determined according to the spectral analysis data.

At the same time, determine the physical and chemical properties of the ore. The physical and chemical properties of the ore can be determined by combining samples. According to different industrial uses, the following items are usually determined. Industrial gray stone, white (natural or burnt white), wollastonite for coating and coating industries, and Silas for plastics and rubber reinforced fillers to absorb melting, water, oil, water extraction and silicate stone particle size from or diameter to length ratio measurements.

3. Determination of Mineral Content of Wollastonite

In the process of the exploration of wollastonite deposits, the industrial evaluation of wollastonite deposits requires that the ore amount and mineral amount of wollastonite should be estimated respectively[4]. Then it is required to calculate and determine the mineral content of wollastonite in the sample. The mineral content of wollastonite can be determined by phase method and calculated by chemical analysis results.

3.1. Determination of Wollastonite Mineral Content by Phase Method

Chemical phase method can directly determine the content of silica and calcite in ore[5]. In general, the chemical phase method can be used to directly determine the content of siliceous and calcite minerals in the ore. Because of the complexity of other minerals and the high cost of experiment, the general grass-roots experiment equipment can not complete the method of silica mineral content. In the exploration of wollastonite deposits, the results of chemical analysis are generally used to calculate the mineral content. Using the results of chemical analysis and several problems that should be paid attention to, this paper focuses on the workflow of calculating mineral content.

3.2. Calculation of Wollastonite Mineral Content by Chemical Analysis Results

Generally speaking, geotechnical engineering is an engineering activity carried out by humans on the surface of the crust and shallow crust. By using information technology to build a database, resources can be shared[6]. You can supplement or change the original data and add it at any time. Please provide the latest construction results for the construction process to show the dynamic effects of construction changes.

According to the main mineral combination of minerals, the types of Wollastonite ore are divided into Skarn type and Wollastonite quartet calcite type: Skarn type ore, mainly produced in Skarn type ore deposits with composite mineral components[7]. Wollastonite quartz calcite ore is mainly produced by contact metamorphism and regional metamorphic sediments. Mineral composition is very simple, divided into silica quartz, silica calcite, silica quartz calcite.

The survey items of wollastonite ore have the appropriate number of representative rocks and minerals. It is necessary to collect samples. The characteristics of the mineral combination of the ore are determined by the type of the limestone ore identified in the room. Foundation ceremony.

The analysis results of samples in the mining area were statistically analyzed to see if the total analysis results of each component of a single sample were close to 100%[8]. If ω (total) is close to 100%, it shows that the basic analysis items are reasonable and comprehensive, and the analysis results can be used to calculate the mineral content of wollastonite.

If ω (total) is far less than 100%, it means that the basic analysis items of samples are not comprehensive and can not be used for the calculation of wollastonite mineral content. The basic analysis items should be adjusted and increased according to the ore rock and ore appraisal results and the ore full analysis results to meet the chemical component content required for calculating the mineral content.

According to the requirements of the calculation method of wollastonite mineral content in the "Geological Survey Standards for Raw Materials of Glass Silica Gel, Gypsum, Gypsum, Wollastonite, Silica, Talc, and Graphite Minerals", when the total amount is greater than

$CaO + 1.6MgO$, the total amount formula is used A. The total measurement is the total amount B of $SiO_2 + 1.3CaO$ in the ore is less than or equal to $CaO + 1.6MgO$,formula B is adopted:

$$\omega(W0) = 1.933\omega(SiO_2)$$
$$\omega(W0) = 2.071\omega(CaO)$$

In the above formula, ω (WO) is the mineral content of wollastonite, and ω (SiO2 *) and ω (Cao *) are the amount of SiO2 and Cao consumed by Wollastonite respectively[9]. That is to say, the total amount of CaO or SiO2 in the ore minus the remaining amount of CaO or SiO2 consumed by calcium iron garnet, calcium aluminum garnet, travertine and calcite. The calculation formulas are as follows:

$$\omega(CaO) = \omega(CaO) - [1.054 \times \omega(Fe_2O_3) + 1.650 \times \omega$$
$$(AL_2O_3) + 1.392 \times \omega(MgO) + 1.275 \times \omega(CO_2)]$$

A certain number of phase analysis samples are taken at the corresponding location of representative basic analysis samples for inspection. If the error between the results of phase analysis and the calculated value of mineral content is small, the calculation formula is suitable for the mining area. Otherwise, the calculation formula suitable for the mining area needs to be studied.

Table 1 Calculation of wollastonite content in mining area

Sample number	SiO2	CaO	MgO
BT3-3	43.196	49.29	0.424
BT3-5	47.257	45.58	0.429
BT3-8	55.554	39.06	0.549
TC1-23	47.286	45.76	1.56

4. Case Analysis

A wollastonite deposit in southern Hunan has gone through two stages of geological exploration, i.e. general survey and detailed survey[10]. Due to the different degree of research on wollastonite in different stages, the formula used in the calculation of wollastonite mineral content by using chemical analysis results is different, resulting in obvious differences in the final wollastonite mineral content.

4.1. Census Stage

During the mineral census, the mineral assemblage of the ore is not studied in depth and detail, and the ore is determined to be marble type wollastonite ore and skarn type wollastonite ore. It is determined that the basic analysis items of samples in the mining area are CaO, SiO_2 and Fe_2O_3. The analysis results of most samples ω (total amount) are far less than 100%. Generally, the formula for determining the mineral content of wollastonite between 64% and 89% is as follows:

$$\omega(W0) = 1.933 \times \omega(SiO_2) - 7$$

According to the reserve estimation, the ore quantity of 333 + 334 wollastonite is 190 × 104 T, and the mineral quantity is130 × 104 T.

4.2. Detailed Investigation Stage

During the detailed investigation, a large number of rock and ore identification samples were collected from four main wollastonite ore bodies in the mining area. Through the comprehensive analysis of the identification results, it was found that the mineral combination of wollastonite ore body in the area is wollastonite calcite quartz, and the wollastonite ore body is skarn type with complex mineral components. Wollastonite is often associated with quartz, calcite, tremolite, garnet and other minerals The basic analysis items of the sample are: CaO, SiO_2, Fe_2O_3 Fe_2O_3, Al_2O_3,

MgO, etc. the analysis results of the sample ω (total amount) are close to 100%, which can basically meet the needs of calculating the chemical component content of wollastonite mineral content.

Select a certain number of deputy samples of representative samples to determine the mineral content of wollastonite by phase method, and compare the results of determination and calculation. The data of the two are close to each other and meet the requirements. The calculation formula is suitable for the mining area. Then the mineral content of wollastonite is calculated based on the analysis results of ore related samples in the mining area, and then the resource reserves of the deposit are estimated. The mineral content of wollastonite is 5.9 × 104 T. The estimated results show that the resource reserves are greatly reduced. Through field geological work and deep engineering verification, the calculation results of wollastonite mineral content and resource reserves are basically consistent with the actual situation.

5. Conclusion

Based on the analysis and study of mineral assemblage in the process of exploration and evaluation of wollastonite, this paper, with the help of examples, mainly interprets the method of calculating mineral content by using the results of chemical analysis, clarifies how to determine the basic analysis items of wollastonite exploration samples, and expounds the exploration and evaluation methods of wollastonite for the reference of geologists in the exploration of the same type of deposits.

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