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Petrological Study of the Funiu Mountain Granite in Henan Province

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Abstract

This paper mainly introduces the potassium feldspar and quartz minerals in Funiu Mountain area. The Funiushan pluton is located at the southern margin of the North China Plate and at the transition position between the Qinling orogenic belt and the North China Plate. There is a large amount of potassium feldspar in the rock mass, which can be used as a potash feldspar mine. On the basis of petrology of Funiushan granite, mineral chemistry of potassium feldspar macroporphyry is studied, and the crystallization conditions of granite are discussed, which has certain theoretical and productive significance. This paper mainly introduces the general situation of potassium feldspar and coarse quartz in this area.

Keywords

Granite; Potash Feldspar; High Purity Quartz.

1. Introduction

The southern margin of the North China Plate lies between the Baoji-Xi 'an - Lushan-Huainan fault and Luonan - Luanchuan - Shangcheng fault.In the middle part, the crystalline basement is composed of Archean Taihua Group complex and Paleoproterozoic Tietonggou Group, both of which are structurally disorganized.Close contact. The Taihua Group is the oldest metamorphic basement in Qinling area, belonging to the upper part of the early Precambrian crystalline basement of North China Plate, and the Tietonggou Group is mainly composed of metamorphic clastic rocks. Granites with large rock base and small rock strains are widely distributed in the southern margin of North China Plate.Rock types include monzonitic granite, syenite granite, granodiorite and quartz diorite. Some studies suggest that the evolution of tectonic magma in this period may be a part of the giant magma around the Pacific Ocean, which was caused by the remote effect of continental margin or intraplate magmatism, and the magma formed by partial melting of the ancient crust was emplaced along the weak zone of the Qinling-Dabie orogenic belt.

The Funiu Mountain granite body in Henan province is located at the junction of the southern margin of the North China Plate and the Qinling orogenic belt, with an outlying area of more than 4200 square kilometers. The Funiushan granite body was formed in the Mesozoic Jurassic - White period

The Cretaceous is a complex rock mass formed by multi-stage magma intrusion. It is believed that the origin of the Funiushan granite body is related to the subduction of the paleo-Pacific plate to the Eurasian plate. The eastern section of the Funiu Mountain granite body in Henan province is mainly located in the transition position between the Qinling orogenic belt and the North China Plate, and the stratigraphic division belongs to the North China stratigraphic region, where magmatic activity is frequent and the regional minerals are mainly potassium feldspar, fluorite and talc. Acid intrusive rocks are developed in the area, and no faults and folds are found in the area. The porphyritic

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monzonitic rock mass of the middle and late Yanshan is mainly formed. The surface weathering is strong and the vertical zonation is obvious.

2. Regional Mineral Survey

2.1 Regional Overview of Potassium Feldspar

Potassium feldspar ($KAlSi_3O_8$) is chemically stable, and its theoretical chemical composition is K_2O16.9%, Al_2O_3 18.4%, SiO_2 64.7%. Potassium feldspar is a kind of frame structure silicate, there are orthoclase, sanidine, microplagioclase three kinds of homogenous multi-image variants, due to the mutual solubility of feldspar, potassium feldspar and albite at high temperature conditions will form a complete homomorphism, so rare pure feldspar in nature, generally exists in the way of homomorphism. Potassium feldspar is an ordinary rock-forming mineral, which is widely distributed in various types of rocks, accounting for about 1/2 of the crust, mainly the product of magmatism and metamorphism, is an important rock-forming mineral in magmatic rocks and metamorphic rocks, its reserves are large and widely distributed, but only when it is quite enriched will become an industrial mineral[1]. Potassium feldspar itself is a potassium-rich silicate mineral resources, the main use is to make ceramics, glass, enamel main ingredients, paper and plastic fillers, firing cement and processing a mineral resource for potash fertilizer. Due to the low melting point of potassium feldspar, it has fluxing properties and can be used as a flux substance in ceramic billets and glazes. Used as raw materials in glass, among which K_2O can make the glass more bright and not easy to mold, so high-quality potassium feldspar is more popular with high-grade glass products. However, the iron content in general potassium feldspar is high, and it must be used after iron removal. Therefore, the study of the occurrence state of iron in minerals is an important content of process mineralogy research, and it is also one of the key scientific issues in the economic evaluation, mineral processing and effective utilization of non-metallic mineral resources, which is of great significance for the transformation of mineral resource advantages into economic advantages.

2.2 Overview of Regional Quartz

Quartz (SiO_2), commonly referred to as quartz, is a low-temperature α-quartz that can exist stably in the surface environment, and it is one of the important homogenous multi-image variants of silicon dioxide; In addition, there are other homogeneous polymorphic variants of crystalline and amorphous silica. At one atmosphere of pressure, α-quartz can be stable below about 573 °C. With the increase of pressure, the higher the temperature at which it can be stable; The maximum temperature and pressure at which α-quartz can exist stably are 1380℃ and 3.44 GPa (α-β-quartz-Coxite triple point), respectively. Quartz exists widely in magmatic rocks, metamorphic rocks, sedimentary rocks and hydrothermal veins in nature, and is an important rock-forming mineral and an important component of the lithosphere. According to statistics, quartz accounts for about 20% of the mineral composition of the exposed upper crust, second only to feldspar (about 35%).

High purity quartz is the material basis for the development of high-tech industry, and its application fields involve optical fiber, military, aerospace industry and so on. These fields have very strict requirements for the purity of quartz sand raw materials, requiring very low impurity content in quartz sand, especially for Fe, Al and other impurities. Therefore, China's semiconductor, solar photovoltaic, new high-efficiency electro-optical source of high-purity quartz glass used in high-tech industries, because the raw material of high-purity quartz sand has long been dependent on imports from abroad, purification technology is also monopolized by the United States, Germany and other countries, the price is expensive, therefore, ultra-pure quartz sand purification technology is related to the long-term development of China's high-tech field, master ultra-pure quartz purification technology is of great significance. In the current international political and economic environment, as a strategic mineral resource, the resource security situation of high-purity quartz is particularly severe. On the one hand, based on the domestic quartz resources, China should vigorously strengthen the geological investigation and quality evaluation of gangue quartz, pegmatite and algranite, pay attention to the quartz in the tailings of granodiorite, pegmatite and kaolin after mining, and carry out beneficiation experiments to evaluate the resource potential. On the other hand, it should break the situation of high-purity quartz sand import channels relying on the United States for many years, increase the import efforts of Norway, Russia, Mauritania and other countries, expand the source channels of high-purity quartz, and maintain national strategic security.

In this study, kalithic macrocrystals and coarse-grained quartz in the granite mass of Funiushan, Henan Province are mainly used as research objects to determine the occurrence form and content of iron in kalithic macrocrystals in this area, the characteristics and material composition of fluid inclusions in coarse-grained quartz, and evaluate the quality of kalithic macrocrystals and coarse-grained quartz from a microscopic perspective.

3. Research Status of Potassium Feldspar

Potassium feldspar resources in China are extremely rich, mainly distributed in Anhui, Inner Mongolia, Heilongjiang, Xinjiang and other 23 provinces and regions, the distribution is very wide. Among them, the distribution of potassium feldspar in Anhui, Inner Mongolia, Xinjiang, Sichuan, Shanxi and other provinces is relatively concentrated, and the reserves are rich, which has become the local advantage of non-metallic mineral resources. Potassium feldspar mineral deposits were found in 12 places in Anhui Province. Five large and medium-sized potash feldspar deposits and more than 10 small deposits have been found in the northern Liaoning Province.

3.1 Research Progress of Potassium Feldspar Macrocrystals in Granite

A large number of hemidiomorphic potassium feldspar macrocrystals are commonly found in granite, which are generally flesh-red, plate-columnar, and have a zonal structure. Johnson and Glazner defined potassium feldspar megachrystals as crystals with a long axis greater than 5cm, and this size corresponds to the maximum value of potassium feldspar megachrystals found in volcanic rocks[2]. The kali-feldspar megacrysts in granitic rocks have important indicative significance for the genesis of rock mass.

The genesis of kali-containing feldspar macrocrystalline granites in different geological periods and tectonic units began to be discussed at the end of the 19th century, and the early debate focused on metamorphic metasomatism. It is common in granites.Since the late 1980s, with the improvement of testing methods, it has been possible to study the evolutionary history of large semi-idiomorphic - idiomorphic potassium feldspar crystals, and the problems discussed have become more and more in-depth, which has produced two opposing views: One view is that there is still a large amount of melt in the magma chamber when kalifeldspar megachrystals crystallize, and various rock inclusions with small grain size around the megachrystals form rings around kalifeldspar porphyry through migration under the action of crystal attraction, and kalifeldspar freely displaces to form directional structures. Another view is that potassium feldspar is the product of late crystallization, giant crystals are mainly composed of coarse structure, at this time most of the crystals in the magma chamber have been crystallized, potassium feldspar can no longer move freely[3].

3.2 Research Status of Development and Processing of Potassium Feldspar

The development and utilization of potassium feldspar can be traced back to the Neolithic Age. People used potassium feldspar and other raw materials to produce a large number of exquisite colored pottery. With the development of science and technology, people realized that potassium feldspar has a wide range of uses. China's research on the use of potassium feldspar has a relatively early time, and there are more research directions, mainly in the preparation of glass, ceramics,cement, fertilizer, lithium battery, etc., other application fields are chemical, abrasive, glass fiber, electric welding rod, enamel and filler, etc., and have achieved remarkable results. In the ceramic industry, the amount of potassium feldspar can account for 30%, when used as the ceramic body ingredients, can reduce the firing temperature, improve the light transmittance; When used as a ceramic glaze, the addition of potassium feldspar can enhance its own strength, toughness and durability. However, whether it is billet, glaze, color will often use potassium feldspar, and the amount is large, is one of the three major

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raw materials of ceramics[4]. Potassium feldspar not only has a strong fluxing ability, but also has a great effect on the fluidity, refractive index, gloss, weathering resistance, hydrolysis resistance, corrosion resistance, thermal stability and other properties of the glaze.

4. Research Status of High Purity Quartz

Although high purity quartz has a long history of research, there is no unified consensus on the concept of high purity quartz. Foreign scholars mainly classify high-purity quartz according to the content of harmful elements in quartz. Domestic scholars on the classification of high purity quartz is divided into two camps. Some scholars classify high-purity quartz only based on the purity of SiO_2; other scholars classify high-purity quartz based on the purity of SiO_2 and the upper limit of the content of harmful impurity elements.

Most of our quartz sand is monopolized by the United States Unimine company. In the United States, the raw ore of high purity quartz sand is granitic pegmatite, and the original industrial value of pegmatite is used to produce feldspar and Muscovite. The Sprouse Pine high-purity quartz raw material mine is located in the town of Sprouse Pine in Mitchell County, western North Carolina, the mine supplies more than 90% of the world's high-purity quartz sand demand, and is even the only source for a long time[5]. In 2009 the BBC called it "the most strategically valuable square acre on Earth". The Drage deposit in northern Norway and the Nesodden deposit in southern Norway are the main sources of high-purity quartz raw materials in Norway, and the quartz deposits in Australia are distributed in northern Queensland, Victoria and Western Australia, among which northern Queensland is the main source of high-purity quartz raw materials. Several deposits have been discovered, such as Lighthouse, Sugarbag Hill, White Springs, Quartz Hill, and the Umm Aquinina and Chami deposits in Mauritania.

4.1 Application of High Purity Quartz

Quartz glass materials are widely used in semiconductor and solar cell production of quartz crucible and other devices, high-quality advanced optical prism, lens, light transmission window, absorption box, colorimetric groove and other optical materials, aerospace quartz fiber, cotton, cloth and national defense in the laser weapon matrix.

In China, the product quality of high purity quartz sand needs to be improved, and it is difficult to form an efficient and stable production process. The preparation technology of quartz glass can eliminate the associated impurity minerals in mineral raw materials, but can not remove the structural defects in minerals. The impurity ions and fluid inclusions in the crystal structure of quartz are the main factors for the formation of quartz glass bubbles and impurity defects. The presence of impurities has a great influence on the inherent properties of quartz glass materials, which greatly reduces the performance indexes of quartz glass such as permeability, softening point, light transmission, refractive index, fluorescence, expansion coefficient and so on. For example, alkali metals such as potassium, sodium and lithium are harmful impurities that are easily diffused into silicon wafers, and the alkali metal impurity content of quartz crucible is extremely strict in the semiconductor industry

5. Conclusion

In summary, the potassium feldspar ore produced in Funiu Mountain area can be used for the development and utilization of potassium feldspar ore.The development prospect is good.The K-feldspar giant phenocrysts in Funiu Mountain area can be used as daily porcelains.But the high purity quartz in Funiu Mountain area needs to be studied in the next step.

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