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The Metallogenic Material Source of the Hongshan Porphyry Copper Deposit: Evidence From the S Isotope Geochemistry

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1 Introduction

Alkaline rocks are often associated with extensional tectonism and regards as the characteristic products occurring in continental margins or rift zones. They were usually generated in deep-large-fault zone and closely connected with basic/ultrabasic rock in space. Therefore, alkaline rocks are of significance in tectonic petrology. A set of Cretaceous alkali-rich syenite occurs in the Hongshan complex, at the southern Taihang Mountain, western Hebei Province. The studies of the Hongshan complex mostly focused on geology, petrochemistry and geochronological. But the mineralization in Hongshan complex has rarely been reported. Our recent investigation indicates that some potential Cu mineralization has close relation with the orthophyre.

In this study, we presented new geological data and mineral isotopic composition for the minerals such as pyrites and chalcopyrite from ores rocks from the Hongshan porphyry Cu deposit and studied the source of ore-forming materials in order to predict the potential of the deposit.

2 Geological Setting

The North China Craton (NCC) is one of the major Precambrian blocks within Asia that was subjected to extensive lithospheric thinning and craton destruction during Mesozoic through extensive magmatism. The Mesozoic magmatism is characterized by intrusion of voluminous granitoids and related rocks and widespread volcanism throughout the eastern NCC.

The Hongshan complex in northern Taihang Mountain of middle NCC invaded in Paleozoic lime- stone. The composition of Hongshan complex predominately consists of alkali-syenite with a few granite located in nearly Hongshan temple(Xu et al., 2001). It has outcrop of 46km^2 with stock occurrence. With regards to the lithological attributes, the syentie mainly consists of an assemblage of fine to coarse-grained orthoclase alkali-syenite. The main phaserock, syenite, is composed of 70% K-feldspar,5% plagioclase,5% clinopyroxene,5% amphibole, and 5% biotite. The different degrees of alteration are widespread in the complex, such as chloritization, epidotization and magnetite.

3 S isotopic Composition

The leaching and decomposition of pyrite and chalcopyrite for S isotopic analyses were conducted in Beijing Geological Institute of Nuclear Industry Academy. The sulfur isotopes for samples were analyzed following the procedure outlined in Glesemann et al. (1994) and the samples were measured in a MAT-251EM mass spectrometer. Data are reported to an accuracy of ±0.2‰, relative to Vienna Canon Diablo Troilite (V-CDT)sulfide. We selected 4 pyrite samples and 1 copper pyrite sample which derived from ore-contained syenite porphyry in Hongshangou. Results of test showed the δ^{34}S values of the sulfide minerals are constrained to between -2.7‰ and -1.3‰ for the pyrite and 3.0‰ for the chalcopyrite.

4 Discussion

The mineralization in the deposit finding in the north of Hongshangou is hosted by orthophyre that was emplaced into fine syenite shows a close relationship with the Mesozoic intrusive rocks. Sulfur isotope studies can offer an opportunity to determine the origin of the sulfur in a sulfide ore-body and constrain the mechanism of ore deposition. The data of δ^{34}S of the sulfide minerals are apparently different from the metamorphic and sedimentary source of sulfur and broadly similar to the meteoritic values, indicating the uniform sources. All the δ^{34}S values sulfides from the porphyry copper deposits are within the range of -2.7‰ to 3.0‰, close to the mantle to

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the ore-forming fluids(0±3‰). All of this showed the sulfur has the characteristics of the sulfur of deep seated magma source. This is almost consistently with our previous studies of Hongshan complex on Sr-Nd isotopic.

5 Conclusions

(1) The orthophyre with the Cu mineralization are closely associated with the Mesozoic intrusive rocks. The craton-scale destruction that initiated the material interaction was derived from both mantle and lower crust. The heat and mass exchange contributed to the ore mineralization in southern Taihang Mountain, forming the Hongshan Cu deposit.

(2) The S isotopic data suggest that magmatism and mineralization resulted from the interaction of both deep crustal and mantle-derived materials.

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