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Geochemistry of intrusive rock in Dachang tin−polymetallic ore field, Guangxi, China: Implications for petrogenesis and geodynamics

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Abstract: The major element, trace element and rare earth element (REE) of the intrusion rock from the Dachang ore field in Guangxi, China, were analyzed. The results show that the phenocryst (about 15%) and matrix (about 85%) mainly consist of quartz, K-feldspar and plagioclase. The rock is composed of low content of Si and high content of Al_2O_3, low contents of Ca, Fe_2O_3, Na, TiO_2, etc. The intrusion rock has the medium alkali content, attributing to K-rich type rock; and contains medium to low REE contents, of which light rare earth elements (LREEs) and heavy rare earth elements (HREEs) are highly fractionated, showing a weak negative Ce anomaly and a negative Eu anomaly. These rocks are enriched in LREE, and the large ion lithophytes elements (LILE) are rich in Rb, Sr, and U; the high-field-strength elements (Nb, Th, etc) are relatively depleted. The REE chondrite−normalized patterns are consistent with the overall, roughly indicating their similar characteristics, sources and evolution. The intrusion rock mainly formed during the collisional and within-plate periods.
Key words: geochemistry; petrogenesis; tectonic setting; magma evolution; Dachang ore field; Guangxi

1 Introduction

The genesis of granite has been one of the most important topics in geology. It is not only the basic problem of petrology, but also has a close relationship with the geological structure, ore genesis and stratigraphy [1,2]. In 1979, PITCHER [3] proposed granite typology, which classified the types of granites, guided by plate tectonics and combined the theory of geological environment and melting system. From the perspective of development, the genesis of granite should combine material resource, formation mechanism and tectonic setting, aiming to make new breakthroughs on some unsettled basic geological questions [2]. DONG et al [4] put forward the granite topology concept, which was defined as: the granite topology mainly studying the granite genesis and its relationship with tectonic environment, reflecting the source and evolution of granite natural system as a whole, and revealing the relationship between the granite formation and tectonic evolution. The concept emphasized the viewpoint that the granite formation was related to some certain stages of tectonic evolution, and moreover, they further developed PITCHER's ideas about granite tectonic setting. XIAO et al [5] pointed out that the granite the scientific frontiers primarily are the relationship among the granite formation, continent growth and the deep process in lithosphere; the relationship between the granite anatexis and the heat source in the granite formation; and the relation of genetic type of granite to the tectonic environment [5,6].

The Danchi metallogenic belt is a NW trending tin polymetallic metallogenic region, located in Nandan−Hechi of the northwest Guangxi, China, and there are four ore fields including Mangchang, Dachang, Beixiang and Wuxu from north to south. As one of the most important ore fields, the Dachang ore field is

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featured with rich resources, large scale, concentrated reserve, complex ore-type [7−9], and the production of Sn, Zn, Pb, Sb, Cu, W, Ag, In, S, As, and so on, among which the main content is composed of cassiterite−sulfide deposit followed by skarn zinc−copper deposit and quartz vein type Sb−W deposit [10−12]. Based on the mineral resource distribution, structural assemblage and occurrence of Longxianggai intrusion, the Dachang ore field is divided into three ore belts: the west belt, central belt, and east belt (Fig. 1). Tin−polymetallic ore is the typical deposit in the west and east ore belts, whereas Zn−Cu−Sb−W ore is the typical deposit in the central ore belt. Tongkeng−Changpo deposit is the most typical ore and its form is the most complete. For a long time, the relation between the mineralization and magmatic rock has been the debate [11,13−16], which not only relates to the ore genesis, but also affects the current prospecting exploration, being considered one of the key scientific problems in the Dachang ore field in Guangxi, China.

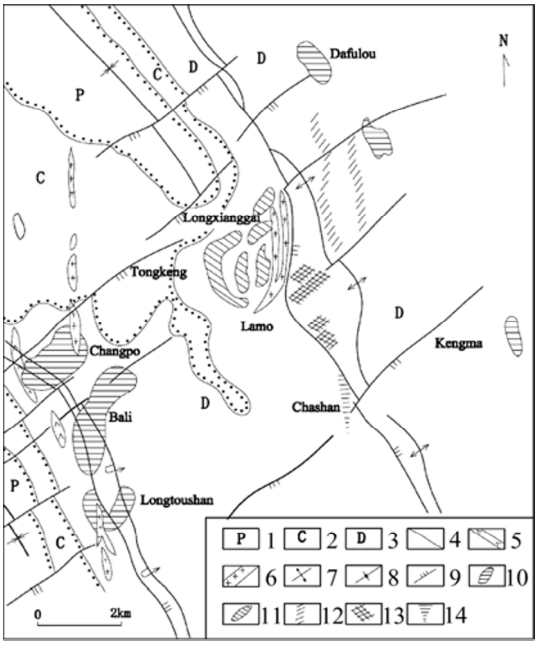

Fig. 1 Mineralization zoning of Dachang ore field, China: 1—Permian limestone and siliceous; 2—Carboniferous limestone; 3—Devonian limestone, shale and siliceous; 4—Parallel unconformity stratigraphic contact; 5—Diorite porphyrite; 6—Granite and granite porphyry; 7—Anticline axis; 8—Syncline axis; 9—Faults; 10—Tin ore; 11—Zn−Cu ore; 12—Scheelite veins; 13—Wolframite veins; 14—Antimony veins (compiled from China Nonferrous Metals Industry Corporation, 1987)

In recent years, about Dachang rock genesis, it has made some new progresses, which is favorable to promoting the theory research and practice exploration. CAI et al [17] analyzed the major element, trace element and REE of magmatic rock from Dachang ore field in Guangxi, China, and pointed out that different granite stages formed in the transshipment period of the post-orogenic and within-plate tectonics, mainly in the stable regional extensional tectonic environment. Recently, CHENG [18] has been found that the magmatic rock is not the unique material source, and some other material sources exist.

Based on the previous academic results, in the current study some representative samples of the recently developed area and newly found ore body were supplemented, and the geodynamic background based on the chemical analysis was discussed, which provided new materials for understanding the genesis of Dachang tin ore deposit in Guangxi, China. Most importantly, these research results have practical significance for deep geological prospecting in Dachang area, Guangxi, China.

2 Petrography

According to the thin section and field observation, the intrusion rock is characterized by porphyritic texture and massive structure. Phenocryst and matrix, accounting for 15% and 85% respectively, mainly consist of quartz, K-feldspar and plagioclase. The features and contents of the minerals are as follows:

1) Quartz: It is in the form of phenocryst and matrix, and the quartz phenocryst mainly consists of a xenomorphic granular usually corroded that are round or harbor-shaped with dimensions of 0.2 mm×0.3 mm in shape. The quartz matrix is of xenomorphic fine grains with a size of 0.02 mm and a content of 35%.

2) K-feldspar: It is usually in the form of phenocrysts and matrix, and the K-feldspar phenocryst mainly consists of a subhedral tabular shape of roughly 0.2 mm×0.4 mm. The K-feldspar matrix is approximately dimensions of 0.02 mm×0.05 mm and is of fine tabular shape with a content of 40%.

3) Plagioclase: It mainly consists of plagioclase phenocryst and plagioclase matrix. The plagioclase phenocryst mainly has a subhedral tabular shape, with dimensions of 0.2 mm×0.4 mm. The plagioclase matrix is roughly 0.03 mm×0.06 mm, with a fine-grained tabular shape and a content of approximately 25%.

3 Samples and analytical methods

All of rock samples were collected from Tongkeng mine area of Dachang ore field in Guangxi, China. In order to ensure the freshness of the samples, the alteration of rocks has been avoided to the greatest extent. The samples showed typical features and could reflect the general characteristics of intrusive rock in this area. No. Y014 sample emplaced in Liujiang group. No. Y030 sample was characterized by massive structure, and

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