Analysis on Lithogeochemistry and Progressive Mineralization of Laojunshan Ore Field, Yunnan, China

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1 Geology of Laojunshan ore Field

Laojunshan ore field is located in Maguan county and Malipo county in southeast of Yunnan province. The Tianpeng Group in the middle Cambrian is widely exposed in the region and is also the main host rock. Yanshanian Laojunshan granite is distributed in the core of Laojunshan anticline. The faults developing all over around Laojunshan granite make great contribution to the formation of rocks and deposits.

A variety of deposits with different metal combinations and occurrences of ore bodies are located in Laojunshan ore field. For example, layered Zn-In-Sn-W deposit, layered-liked Pb-Zn deposit, felsic veined Sn-W deposit and quartz veined Sn-W deposit. The Dolong deposit is the largest one in Laojunshan, and belongs to the layered Zn-In-Sn-W deposit. Besides, The Xinzhai and Tongjie deposits (Fig. 1) also have a certain degree of scale.

2 Principal Component Characteristics of the Rocks

Silicate analyses of the main elements showed that the Laojunshan granite was rich in Si and alkaliand supersaturated in Al. In the TAS classification map of granites in Laojunshan, Bainiuchang and Gejiu, Laojunshan and Gejiu rocks were classified as granites, and Bainiuchang as quartz monzonite. In the Na2O-K2O classification map of granites, most of the granites fell in A type granite with the feature of post-orogenic continental margin granite, which is named as A2 type. The metamorphic samples from Cambrian fell on the sedimentary rocks region in c-n-f triangular diagram, indicating that the metamorphic rocks came from sedimentary rocks.

3 Rare Earth Elements Characteristics

Rare earth elements analysis shows that Laojunshan granite has a low content of $\sum$REE ($\sum$REE=69.33-152.78) and Eu($\delta$Eu=0.2-0.37); L/H=11.49-13.75. The distribution curve inclines to the right, showing that the lava came from deep under the ground and the variation degree is high.

Schist and gneiss from Middle Cambrian have same rare earth elements characteristics with granite, showing close relationships with each other initially.

Distribution curve of skarn can be divided into two groups: one inclines to the right with normal Eu content ($\delta$Eu= 0.74-0.98), another has more Eu ($\delta$Eu=2.58-2.67). The difference illustrates that the formation of skarn took at least two periods of time.

One of the important founds was the discovery of the laminated and stripped silicolite (Fig. 2) which had similar features of microelements and rare earth elements as those
of hydrothermal sedimentary silicolite according to the correlation analysis.

Fig. 2 Hand specimen of siliceous rocks in Laojunshan ore field A-laminated; B-stripped

### 4 Trace Elements Characteristics

Element combinations and contents vary in different types of rocks from Middle Cambrian. Among the rocks analyzed, Laojunshan granites contain the most W and As, and compared to general carbonate rocks, clastic rocks are much richer in these microelements.

Afterwards, Cr, Co, Ni, As and Sb were chosen as reference factors to make a Q-type cluster analysis in order to compare siliceous rocks from different deposits and of different causes. Results showed that most of exhalative sedimentary rocks can be the same group with siliciclastics from Laojunshan, showing that the siliciclastics belong to the cause of exhalative sedimentary.

### 5 Analysis on the Progressive Mineralization of Laojunshan Ore Field

According to Diwa Theory and Progressive Metallogenic Theory, the formation process of Laojunshan ore field is divided into three thermal events: Geosyncline period-hydrothermal sedimentary mineralization in Cambrian; initial Diwa period-regional metamorphism transforming in Indosinian; Diwa period-Magmatic-hydrothermal telescoping -transforming mineralization in Yanshanian.

Based on the theories, a deposit formed in one certain geotectonic stage. On one hand, it had exclusive mineral composition, and on the other hand, it inherited ore-forming materials from deposits of former periods. In addition, the deposit which formed later at last becomes larger and more complicated. As the result of the progressive mineralization, superpositions and transformations of metallogenesis from different geotectonic stages took place in Laojunshan area, to make Laojunshan ore field a polygenetic compound deposit with multiple geotectonic stages, multiple material sources, multiple metallogenesis, multiple genetic types and multiple ore-controlling factors.

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