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Geochemical Characteristics and Tectonic Environment of Quartz Porphyry in Northwestern Guangxi

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1 Introduction

Northwestern Guangxi is one of the primary Carlin-type gold deposit concentrated areas in China. The preworkers have researched gold deposits in this area from different aspects, such as ore-forming ages, the source of ore-forming materials and the mineralization process. However, there are few studies involving regional tectonic environment and its dynamic setting of mineraliztion.

We surveyed quartz porphyry dikes in Liaotun gold deposit, Mingshan gold deposit and outskirt of Bama county. Totally 13 quartz porphyry samples were collected. Major element, rare-earth element (REE), trace element of these samples have been analyzed at ALS Chemex (Guangzhou) Co Ltd. Based on these geochemical data, tectonic environment and the geodynamic setting of large-scale metallogenesis in this area are discussed.

2 The Feature of Geology and Geochemistry of Quartz Porphyry

Quartz porphyry in northwestern Guangxi mainly distribute in Bama, Fengshan and Lingyun counties. The quartz porphyry occur in stocks and dikes and they intrude in the Carboniferous carbonate rocks, Permian carbonate rocks and Triassic clastic rocks. The general strike of the quartz porphyry dikes are NE and NW. The contact interfaces between igneous rocks and wall-rock are steep（70°~80°）. Small dikes stick to each other forming vein zones up to 10-20 km in length. The quartz porphyry is light grey with porphyrotopic texture. Quartz, feldspar and muscovite are the main phenocrysts. Matrix composed of tiny quartz and feldspar shows flaky granular texture under

microscopy. The quartz porphyries were formed during 80-100Ma(Chen et al., 2012).

The results of major element analysis show that the quartz porphyry belongs to ultra-acid, high potassium low sodium, calc-alkaline and strongly peraluminous granites. High differentiation index (86.71~89.44) indicates that the magma went through complete fractional crystallization.

Compared with the primitive mantle, quartz porphyry intensely enrich strong incompatible elements and slightly enrich weakly incompatible elements. Most of the samples show obvious enrichment in LILE such as Rb, Cs, Th and U. And Ba shows a relative depletion. High Cs content and low Ba content indicate that the fraction was complete. Some of the HFSE are enriched such as Ta while others are depleted such as Nb. The samples are also obviously depleted in Sr.

All the samples have similar REE distribution pattern. The quartz porphyry is characterized by obvious Eu and Ce negative anomaly. The analysis of rare earth elements show a high degree of differentiation of heavy REE and light REE. The REE distribution pattern have the characteristics of right-sloped “W”. It shows that all the quartz porphyry has a similar magmatic origin and evolution process.

3 Tectonic Environment Discrimination

In the tectonic environment discrimination diagrams (omit) based on major elements (Maniar, 1989), most of the samples are dropped in IAG+CAG+CCG area. The rocks belong to orogenic granite. It suggests that the source rocks of the granites are formed in continent-continent collisional setting. At the same time, some of the quartz porphyry have the characteristics of post-orogenic granite and occasionally continent epeirogenetic uplift granite.

It seems we can infer that these granitoids were formed at the stage of tectonic transformation from

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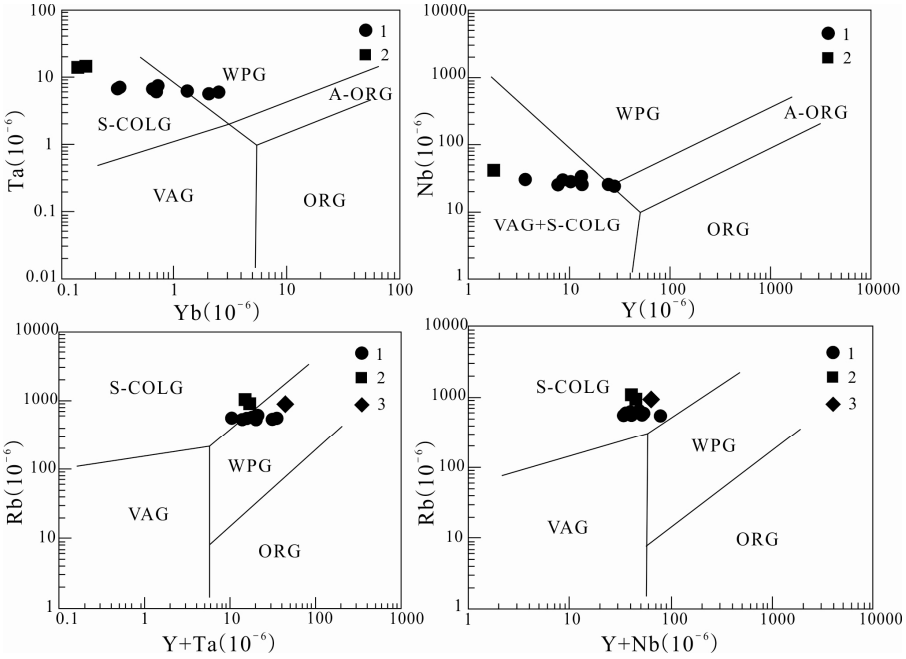

Fig. 1. Rb vs Y+ Nb, Rb vs Yb+ Ta , Ta vs Yb and Nb vs Y discrimination diagrams for tectonic setting of granites (from Pearce et al. , 1984).
1- Liaotun; 2- Mingshan; 3- Bama

orogenic setting to intraplate setting.

On the diagrams(Fig.1) of Rb vs Y+Ta, Rb vs Y+ Nb, Ta vs Yb and Nb vs Y discriminating regional geological setting, most samples dropped in syn-collisional granite area, intraplate granite area and volcanic arc granite area. It shows a tectonic transformation from orogenic setting to intraplate setting during the formation of the granite. The Rb-Ta-Hf diagram also indicates that most samples belong to continental collision granitoids.

4 Conclusion

The petrographic and geochemical study of quartz porphyry from northwestern Guangxi shows that they belong to orogenic granitoid. When these igneous rockformed, the tectonic environment at northwestern Guangxi seems to be shifting from orogenic setting to continental intraplate setting. After Yanshanian orogeny, the stress caused by collision orogeny relaxed. The thickened crust extended. The thickened crust extended and thinned as a result of gravity adjust. The crust partly melted and formed acidic magma. The extensional collapse and thinning of the crust, trigged by regional tectonic transformation, generated normal fault network system which created good environment for the migration of fluids and enrichment of ore-forming material. Maybe there is a connection between the formation of Carlin-type gold deposit and the tectonic environment transformation in this area.

Acknowledgments

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