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Characterization of Granites Associated With Gold Mineralization From Heishishan Area, Gansu Province

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1 Introduction

The Heishishan area lies about 7 km to the southwest of the Baiyinchang Cu-polymetallic orefield, both of them are located in the eastern section of the North Qilian orogenic belt. The study covers four plutons including Haoquangou, Baimawa, Heishishangou and Fangfuya (from south to north). A small epithermal gold deposit and some polymetallic mineralization have found in the Haoquangou and Baimawa plutons, respectively (Fu et al., 2005). That four plutons are closed related to Au mineralization was revealed in exploration. The four granites have been classified based on a rigorous use of mineralogical and geochemical classification schemes in this study. Further detailed geochemical study would determine the economic significance of the studied granitic rocks and allow understanding how the plutons were fit into tectonic setting of the region.

2 Petrography and Mineralogy

The Siqingdong-Duojiatan-Sujiawan fault in NWW dominates the distribution of the four plutons, which are mainly dioritic to biotite granodiorite of early Paleozoic and emplaced into Cambrian-Ordovician marine volcanic strata by the trend near EW direction as bandings (Zhao et al., 2013). And the scale of pluton increases gradually with the augments of distance between the pluton and the fault.

Fifteen fresh and representative samples (6 from Haoquangou, 3 from Baimawa, 3 from Heishishangou and 3 from Fangfuya) were collected from all of the plutons using a stratified sampling method.

Some initial observations through the field and microscope indicate the four plutons have the similar the petrographic features. Those samples are generally mesocratic to reddish, coarse to medium-grained, massive

structure, and mainly composed of plagioclase (55-60%), quartz (30-35%), biotite (5-10%), muscovite (~2%), chlorite (<2%). All samples from the plutons especially the Haoquangou have been slight carbonation.

3 Geochemistry

Geochemical studies of the rocks indicate that the four plutons also have the similar characteristic in the chemical composition of major and trace elements.

3.1 Major Elements

The intrusions associated with Au deposit in the study area have high SiO₂, Al₂O₃, total alkaline and low MgO concentrations of 68.60-72.15, 14.03-15.62, 5.47-7.15 and 0.82-1.31 wt.%, respectively. And A/CNK value ranges from 1.015 to 1.179 (the three data over 1.1 is 1.138, 1.171, 1.79) and a δ -value from 1.17 to 1.61. Based on the major element composition data and associated diagram (Fig. 1) of granites, it can be inferred that the

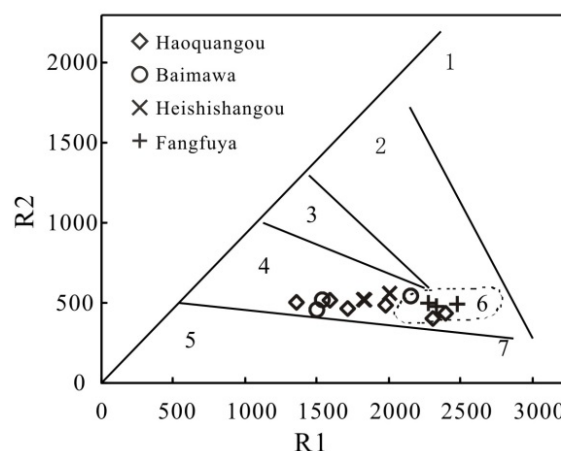


Fig. 1. R1 versus R2 tectonic discrimination diagram for the granites (the base map after Batchelor et al., 1985).

1. Mantle fractionation; 2. Pre-plate collision; 3. Post collision uplift; 4. Late-orogenic; 5. Anorogenic; 6. Syn-collision; 7. Post-orogenic.

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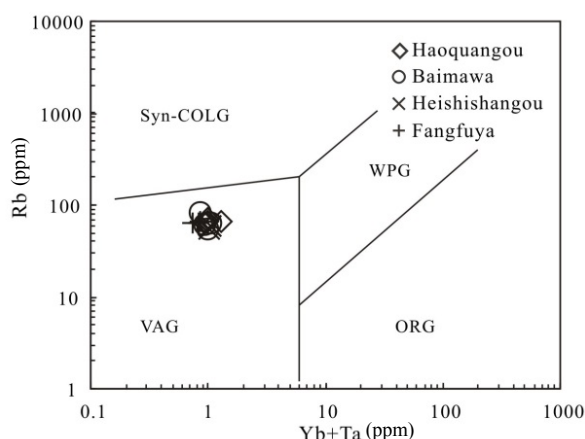


Fig. 2 Yb+Ta versus Rb tectonic discrimination diagram for the granites (the base map after Pearce et al., 1984). ORG: ocean ridge granites; WPG: within plate granites; VAG: volcanic arc granites; Syn-COLG: syn-collision granites.

granites are strongly peraluminous to peraluminous I-type granitoids (with the trend move to S-type granitoids) of the calc-alkaline suite and the product of anatexis of the crust.

3.2 Trace Elements

The majority of samples from intrusions are generally enriched in the LREE and depleted in the HREE, and have chondrite normalized $(La/Yb)_N$ values between 10.75 and 47.69. They have low ΣREE ranging from 41.59 ppm to 96.81 ppm, with right dipping chondrite normalized REE patterns curves that decrease from La to Ho and turn to flat from Er to Lu, have weak to negligible Eu anomalies ($\delta Eu=0.81-1.13$).

Ocean ridge granites (ORG) normalized trace element patterns of the studied granites are characterized by enrichments in K, Rb, Ba, Th, depletions in Y and Yb, which is similar with Jamaica oceanic arcs granites (Pearce et al., 1984). The majority of samples plot in

volcanic arc granites fields in tectonic discrimination diagrams (Fig. 2).

4 Conclusions

(1) These data show that the granites might have originated in the thickened lower crust. The mineralization material is mainly derived from Au-enriched post-magmatic hydrothermal solution which is from the cooling and crystal fractionation of granitic magma with large amounts of Au.

(2) The consistent data of geochemistry shows the four plutons are the evolution product of the same magma chamber. The exist of this granites can be the only possible mark to confirm the presence of an ore deposit.

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