1 Introduction

The Nibao gold deposits are located in Louxia Town, Pu’an County, Guizhou Province, China, near the junction of Youjiang orogenic belts along the margins of Yangtze block. Economic deposits occur mainly in the F1 fault and its overriding collapse space within the Erlong Qiangbao anticline formed by means of folding. Some ore deposits occur within altered structural terrains (Sbt). In recent years, a breakthrough has been made in ore prospecting around the Nibao gold deposits, with an expected amount of gold exceeding 50 t, up to large scale. The No. III concealed gold deposit is the largest that is controlled by F1. Previous research has been conducted on the geochemistry of Nibao gold deposits (Liu et al., 2006; Chen et al., 2013), which was, however, focused on the tuff-type ore bodies. In contrast, little research has been carried out on the newly discovered F1 controlled No. III gold deposit. In order to analyze the relationships among different ore bodies and detect ore-forming metal sources within ore bearing rocks of F1 and its hanging and heading walls, a systematic study of the ore and host rock as well as an in-depth analysis of metallogenesis and its controlling factors have been carried out as part of this contribution.

2 Results and Discussion

Major element ratios of Al2O3/TiO2 (4.71~12.21) and TiO2/Al2O3 (0.08~0.21) suggest a mafic composition of tuff or tuffaceous materials in the study area. Trace element abundances show an enrichment value of about 10-100 times relative to primitive mantle. Arsenic has an average content of 1.5×10^-6 relative to upper crust with enrichment factor up to 6667 times, and is positively correlated with Au. The positive correlation between Au and As is more pronounced in the F1 fracture zone, and less obvious in the Sbt.

Each ore-bearing rock body shows a similar trace element distribution in spider diagrams characterized by weak or no depletion of high field strength elements such as Nb, Ta, Zr and Hf and by a significant depletion of active elements such as Ba and Sr. Trace element ratios of La/Nb (0.83~2.06), Th/Nb (0.08~0.21), and Th/La (0.07~0.19) are similar to those of Emeishan basalt in NW Guizhou Province (Song et al., 2002; Xu, 2006), indicating that ore-forming metal sources of Nibao gold deposits are closely related to the eruption of Emeishan basalt which have provided materials for gold mineralization. Trace element R cluster analysis of 5 groups of ore-bearing rocks suggest the combination of Au-Ag-Zn, Au-Ag-Sb-Tl-As, Au-As-Ag, Au-As-Sb-Bi-Co-Tl-Zn and Au-As-Ni-Sb-As-Tl. These element combinations suggest that As can be used as a preferred indicator element, and pyrite, arsenopyrite and other minerals can be used as indicator minerals for gold prospecting. In contrast, The decoupling of Pb from Zn can be used to indicate superimposed hydrothermal alteration or the extent to which alteration has occurred. The extent to which superimposed hydrothermal alteration occurred on the five groups of ore-bearing rocks can be inferred to be (strong to weak) Sbt structural alteration body → F1 fracture zone → F1 heading wall P3l2 and P3l1 ore-bearing rocks → F1 hanging wall P3l1+2 ore-bearing rocks, which is consistent with the geological characteristics of Nibao gold deposits. Additionally, a pedigree chart also suggests that factors inducing the obvious difference in element migration pattern, combination rules and degree of enrichment are related to the properties and extent of mineralization of
different types of ore bearing rocks.

The ΣREE content of ore host rocks of the Nibao gold deposits is relatively higher in pelitic rocks, and is relatively lower in siliceous rocks. The ore-bearing rocks having ΣREE contents in ascending order are clayey siltstone → tuff → tuffaceous bioclastic sandstone → tuffaceous secondary quartzite → altered tuff → siliceous rocks, which is consistent with the REE analysis results of 225 samples from 22 Carlin-type gold deposits in southern China (Wei et al., 1995). The five groups of ore-bearing rocks around the study area show an overall smooth right-dipping REE distribution pattern extremely similar to those of Emeishan basalt, indicating a close genetic relationship between them.

3 Conclusions

The comprehensive rock/ore trace and REE analyses suggest that the rocks hosting of Nibao gold deposit have the same ore-forming material sources that are closely associated with the eruption of Emeishan basalt. Late Permian large-scale Emei hot mantle plume activities provided gold forming deposits, ore-forming dynamics and heat sources which resulted in a regional geothermal anomaly. The accompanying hydrothermal precipitation prompted the initial formation of Nibao gold deposits. Subsequent Yanshanian low-temperature hydrothermal processes resulted in gold remobilization in ore-forming materials. Meanwhile, F1 faulting caused release of pressure, precipitation of gold-bearing hydrothermal fluids along the F1 fracture zone, and formation of gold-rich ore bodies. The Nibao gold deposits thus have sedimentary-hydrothermal alteration characteristics.

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References


