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Gold mineralization associated with Emeishan basaltic rocks: Mineralogical, geochemical, and isotopic evidences from the Lianhuashan ore field, southwestern Guizhou Province, China

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ABSTRACT

A number of gold deposits are newly discovered in the Lianhuashan ore field, southwestern Guizhou Province, China. The gold orebodies are restricted to the Emeishan basaltic rocks and the interlayer fractures between the Emeishan basaltic rocks and the limestone of the Maokou Formation. Three generations of pyrite (Py0, Py1, and Py2) have been recognized in these deposits based on morphology and paragenetic relationships. Electron microprobe (EMP), laser-ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), and laser-ablation multi-collector inductively coupled plasma mass spectrometry (LA-MC-ICP-MS) analyses were carried out to characterize their chemical and sulfur isotopic compositions.

The framboidal Py0 is enriched in As but depleted in most of the other trace elements. It has negative $\delta^{34}S$ values of −14.5–−1.9‰, which are typical of diagenetic pyrites resulted from bacterial reduction of marine sulfate. Py1 and arsenopyrite exhibit high concentrations of Au and As, making them the most dominant auriferous minerals. They yield comparable $\delta^{34}S$ values of −2.8– + 2.1‰, consistent with the derivation of sulfur from the Emeishan basaltic rocks. Py2 is characterized by well developed oscillatory-zoned textures, that are interpreted in terms of internal self-organization processes. It contains low concentrations of Au and highly variable concentrations of As, Sb, Co, and Ni. The Py2 grains show slightly positive $\delta^{34}S$ values of + 0.4– + 7.0‰, indicating that the sulfur was mainly sourced from the Emeishan basaltic rocks with variable amounts of contamination from reduced marine sulfate.

The Emeishan basaltic rocks may have provided not only ore-hosting space but also Au, S, and other associated elements for gold mineralization in the Lianhuashan ore field. Similar gold deposits are expected to be discovered in the areas of Emeishan basaltic rocks with high Au backgrounds and small thicknesses.

1. Introduction

The Emeishan large igneous province (ELIP) in southwestern China has attracted worldwide attention because the age of the ELIP is believed to coincide with coincidence with the mass extinctions around the Permian-Triassic boundary (Wignall, 2001; Zhou et al., 2002; Liu et al., 2017). The province comprises predominant flood basalts and subordinate pyroclastic rocks, which were thought to be originated from a mantle plume (Xiao et al., 2004; Ali et al., 2010; Yu et al., 2017). The Emeishan LIP is subdivided into the inner, intermediate, and outer zones on the basis of stratigraphic and sedimentological characteristics (He et al., 2003; Xu et al., 2004; Li et al., 2017). Several world-class V-Ti magnetite and Cu-Ni-(PGE) sulfide deposits are hosted within mafic–ultramafic magmatic rocks in the Emeishan LIP (Song et al., 2003; Zhou et al., 2005; Wang et al., 2008), whereas gold deposits are seldom found in these rocks (Xue, 2007).

The southwestern Guizhou Province is located in the eastern outer zone of the Emeishan LIP. It is one of the most important gold-producing regions in China since dozens of sediment-hosted disseminated gold deposits, or Carlin-style gold deposits, are developed in this area (Hu et al., 2002; Zhang et al., 2003; Su et al., 2012; Chen et al., 2015). In recent years, a number of gold deposits and occurrences have been

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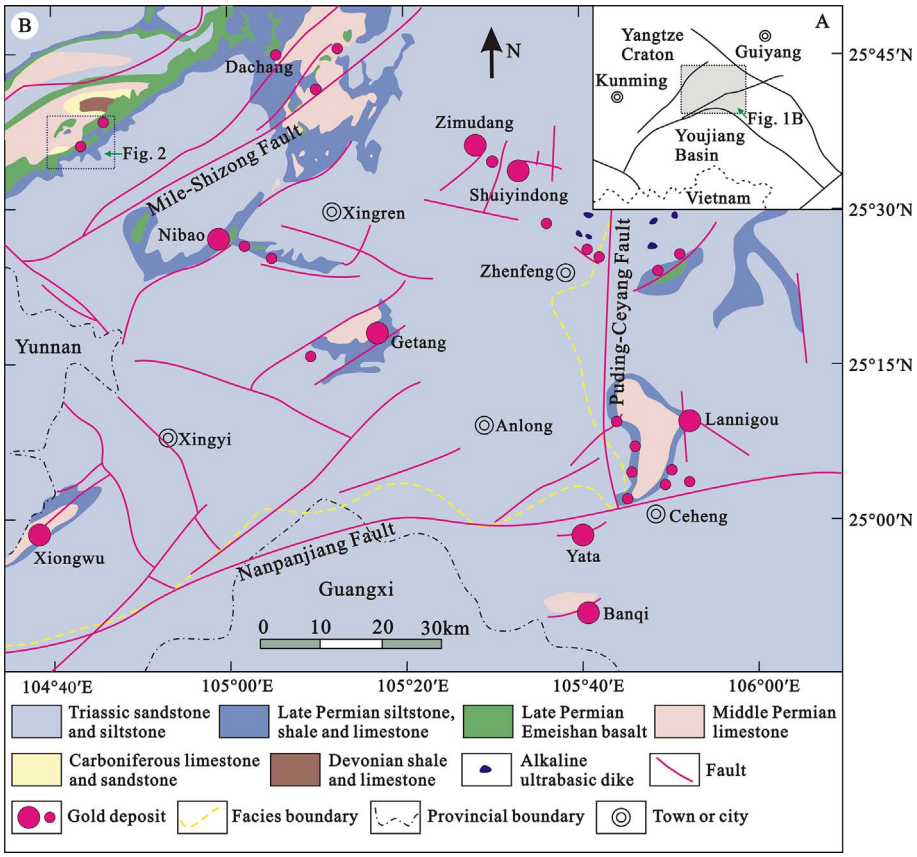

Fig. 1. (A) Tectonic framework of the Yunnan–Guizhou–Guangxi golden triangle. (B) Regional geological sketch map of southwest Guizhou, showing the distribution of major gold deposits (modified after Zhang et al., 2003).

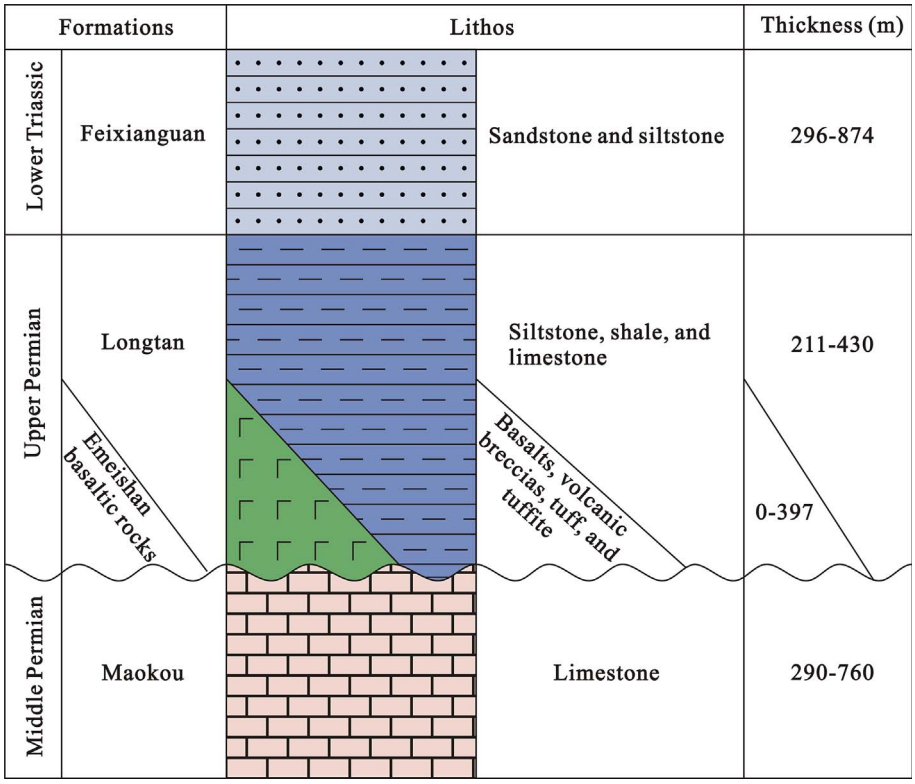

Fig. 2. Generalized Permian and Triassic stratigraphy in the southwest Guizhou (compiled from He et al., 2003; Zhang et al., 2003).