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Geological Characteristics and Re-Os Geochronology of Tongshanling Polymetallic Ore Field, South Hunan, China

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1 Introduction

The Tongshanling district of South Hunan province is located in the middle Nanling Range and southwestern part of Qinzhou-Hangzhou suture belt (Fig. 1). Ore deposits are

mainly controlled by NE-, NW- and EW-trending faults. Devonian and Carboniferous strata are the most important ore-bearing horizon (Fig. 2). As a part of Shuikoushan-Baoshan-Tongshanling Yanshanian granodioritic magmatic belt in South Hunan (Fig. 1), Tongshanling

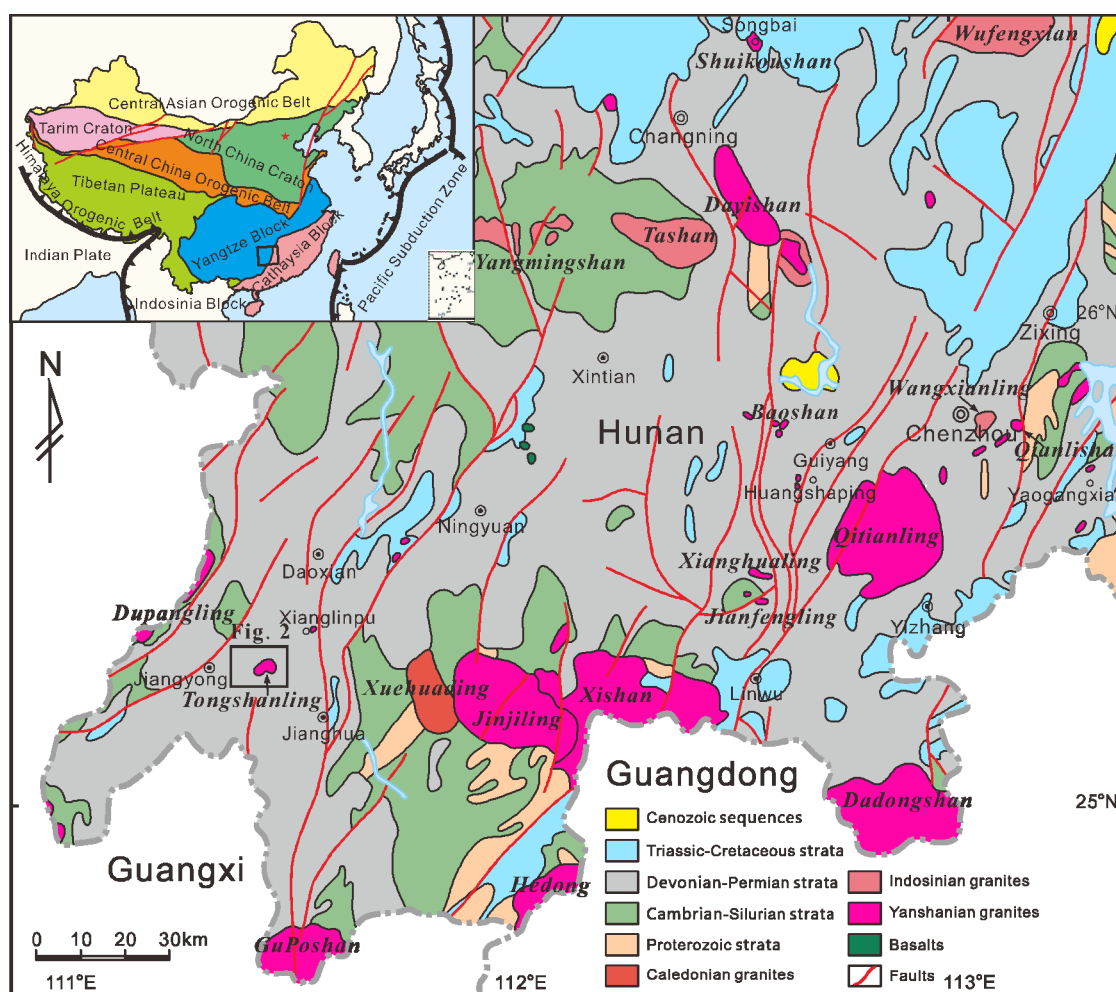


Fig. 1. Geological sketch of South Hunan

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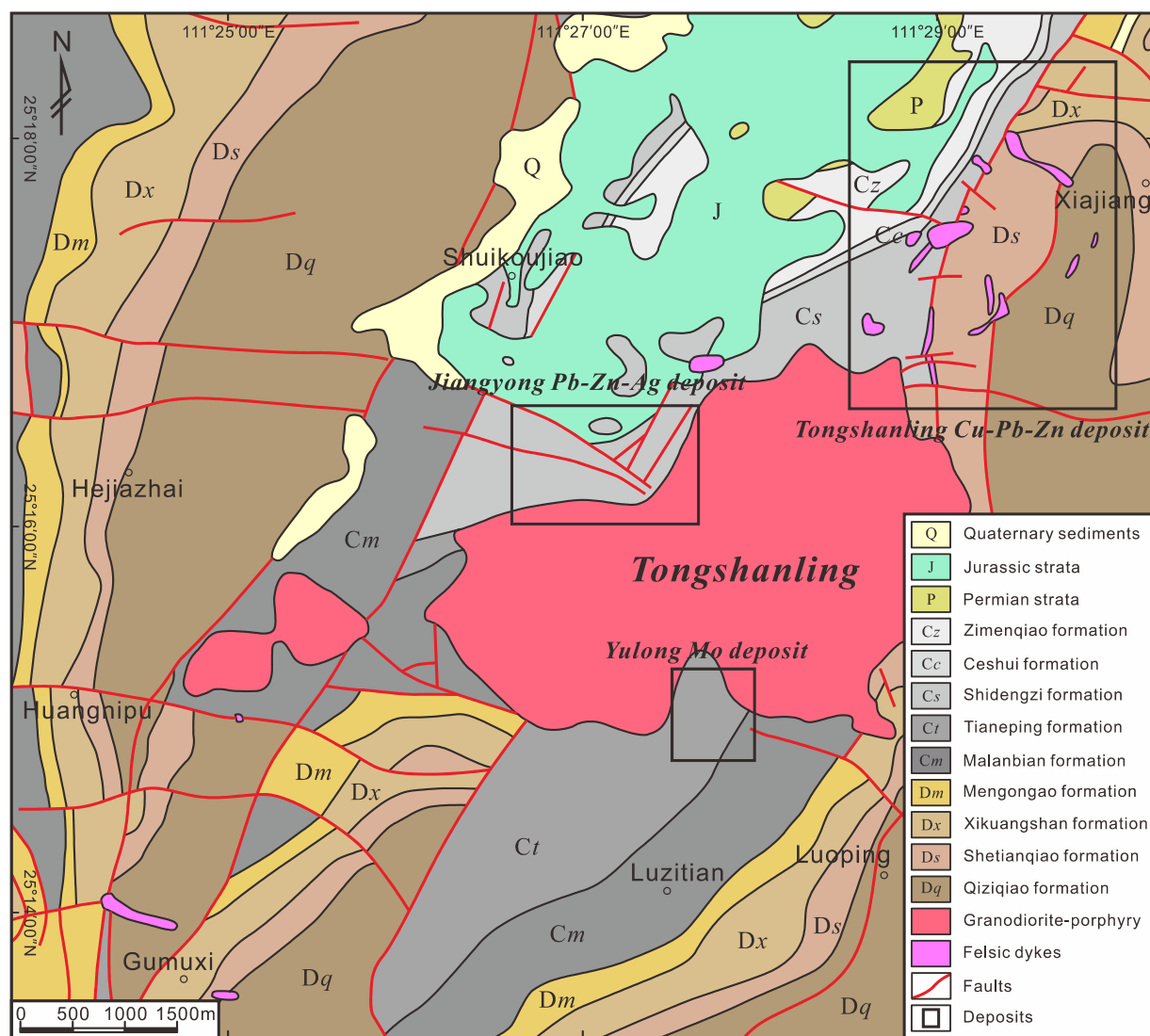


Fig. 2. Geological map of Tongshanling district

granodiorite-porphyry is formed by typical syntaxis and responsible for Cu-Mo-Pb-Zn-Ag polymetallic mineralization (Li et al., 2013).

2 Geological Characteristics of Deposits

Tongshanling Cu-Pb-Zn deposit, Jiangyong Pb-Zn-Ag deposit and Yulong Mo deposit are distributed around the Tongshanling granodiorite-porphyry (Fig. 2), constituting a polymetallic ore field.

2.1 Tongshanling Cu-Pb-Zn deposit

Tongshanling Cu-Pb-Zn deposit occurs in the NE-trending concealed contact zone between intrusive body and Devonian carbonate rocks. From proximal to distal, the ore types are proximal skarn type, sulfide-quartz vein type, distal skarn type and carbonate type, respectively.

Proximal skarn ore bodies occur as stratoid, lentoid or

irregular and change with the shape of contact zone. The predominant skarn minerals are garnet and diopside, and ore minerals are mainly chalcopyrite, sphalerite and galena. Sulfide-quartz vein type ore bodies mainly fill in NWW- and NEE-trending fractures in Devonian carbonate rocks, and chalcopyrite is the dominant sulfide mineral. Distal skarn ore bodies occur as stratoid, roughly parallel to Devonian carbonate strata, and ores show a disseminated structure with a low grade. Carbonate type ores are of low economic importance in the whole deposit.

2.2 Jiangyong Pb-Zn-Ag deposit

Jiangyong Pb-Zn-Ag deposit reveals two main ore types, i.e. skarn type and carbonate type.

Skarn ore bodies show stratoid or lentoid forms. Skarn minerals are dominated by diopside and ore minerals are mainly pyrrhotite and pyrite with minor sphalerite and galena. Carbonate ore bodies occur in NW-, NWW- and

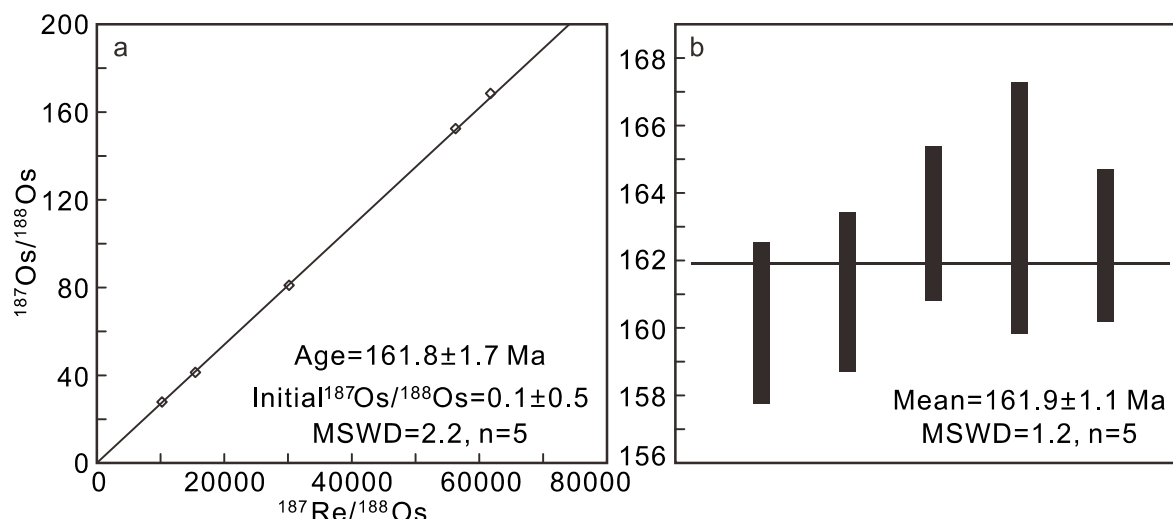


Fig. 3. Re-Os isochron (a) and weighted average of model age (b) for molybdenites from Tongshanling Cu-Pb-Zn deposit

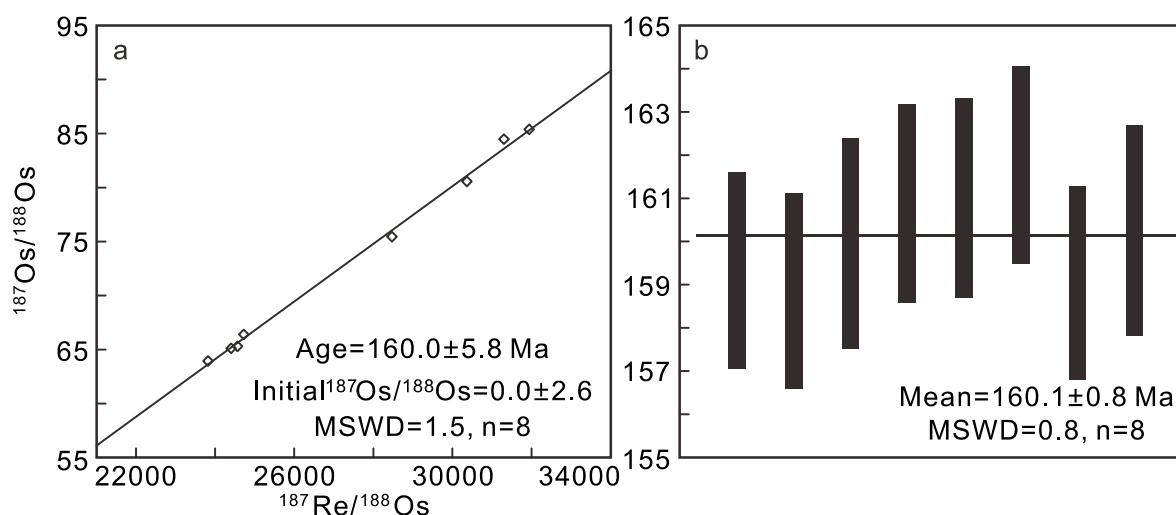


Fig. 4. Re-Os isochron (a) and weighted average of model age (b) for molybdenites from Yulong Mo deposit

NE-trending fractures with vein and lentoid shapes. Banded structure is common and ore minerals are mainly composed of pyrite, sphalerite and galena. From proximal to distal, the grade of Pb and Zn increases gradually. Furthermore, the grade of Ag is positively proportional to that of Pb.

2.3 Yulong Mo deposit

Skarn type is the sole ore type in Yulong Mo deposit. Ore bodies occur in marble of Tianeping formation as a vein shape with NWW strike. The gangue minerals mainly consists of garnet and diopside, and molybdenite as the main sulfide mineral occurs as disseminated, lumpy and stockwork structure.

3 Re-Os Geochronology

Five molybdenite samples from Tongshanling Cu-Pb-Zn deposit yield an ^{187}Re - ^{187}Os isochron age of 161.8 ± 1.7 Ma and a consistent weighted average age of 161.9 ± 1.1 Ma

(Fig. 3).

Eight molybdenite samples from Yulong Mo deposit yield an ^{187}Re - ^{187}Os isochron age of 160.0 ± 5.8 Ma, and a consistent weighted average age of 160.1 ± 0.8 Ma (Fig. 4).

4 Magmatism and Mineralization

The above two Re-Os ages are consistent with the available zircon U-Pb age of 163.6 ± 2.1 Ma of Tongshanling granodiorite-porphyry (Jiang et al., 2009) within error range. The close spatiotemporal relationship between magmatism and mineralization reveals that these ore deposits were the direct products of granodioritic magmatism. Furthermore, The $\delta^{34}\text{S}_{\text{CDT}}$ values of sulfides vary from 1.42‰ to 6.28‰ with a mean value of 3.66‰, representing a magma origin.

Tongshanling granodiorite-porphyry is considered as a poorly fractionated metaluminous and high-K calc-alkaline granitoid, and commonly contains mafic magmatic

enclaves, suggesting a crust-mantle interaction. Re concentrations of molybdenites range from 16.3×10^{-6} to 98.2×10^{-6} which are between crustal source and mantle source (Mao et al., 1999), indicating that metallogenic materials are from a crust-mantle mixed source.

Acknowledgements

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