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Editorial

# Mesozoic large scale magmatism and mineralization in South China: Preface

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ABSTRACT

South China is famous for its polymetallic deposits, with more than 50% of the world's W and Sb reserves and 20% of the Sn reserves, as well as abundant Cu–Mo–Pb–Zn–Au–Ag, Ta, Nb, HREE and U. This special issue reports recent progress on the tectonic evolution, magmatism and ore deposits of South China, which leads to a more comprehensive understanding of the Mesozoic large scale magmatism and mineralization events: (1) South China has been located in backarc settings during multiple subductions since the Paleozoic, which may have contributed to pre-enrichments of the ore-forming materials. (2) The Pacific plate subduction was a principle factor that controlled the late Mesozoic large scale magmatism and mineralization in South China, through flat subduction, ridge subduction/slab tearing and slab rollbacks.



## 1. Introduction

South China is famous for its large scale magmatism and mineralization in the Mesozoic, with more than 50% of the world's W and Sb reserves and 20% of the world's total Sn reserves, all of which rank No. 1 in the world. Its Nb, Ta, Cu and U reserves rank No. 1 in China, and its heavy REE in weathered granites dominates China's REE markets.

There are three major mineralization belts in South China (Fig. 1), the Nanling W–Sn, Nb–Ta, HREE belt in the south (Chen et al., 1992; Guo et al., 2011; Hsu, 1943; Hu et al., 2009; Hua et al., 2005a; Mao et al., 2007), the Lower Yangtze River Cu-polymetallic, iron oxide copper gold belt in the north (Deng et al., 2011; Mao et al., 2006; Pan and Dong, 1999; Sun et al., 2003; Yang and Lee, 2011; Yang et al., 2011) and the Xiang-Qian-Gui Sb belt in the west (Peng et al., 2003; Wu, 1993; Yang et al., 2006; Zaw et al., 2007). The Dexing porphyry Cu–Mo–Au and Xiang-Gan Pb–Zn–Ag deposit regions are located between the Nanling and Lower Yangtze River belts (Hua et al., 2005b; Li and Sasaki, 2007; Li et al., 2007a; Wang et al., 2006b; Wang et al., 2011b; Zaw et al., 2007), which are analogous to subduction related mineralization belts in South America (Fig. 1) (Mlynarczyk and Williams-Jones, 2005; Wang et al., 2011b). Most of these deposits are closely associated with a large igneous event in South China that started in the Jurassic and ended in the Cretaceous (Zhou et al., 2006).

Igneous rocks are widely exposed in South China with a total outcrop area of nearly 220,000 km$^2$, of which ~90% formed in the Mesozoic (Chen et al., 2005; Ding et al., 2006; Li et al., 2007b, 2009; Zhou et al., 2006). Early Mesozoic (251–205 Ma) magmatic rocks occur only as small plutons, with a total outcrop area of ~14,300 km$^2$. Large scale late Mesozoic igneous rocks are mainly Jurassic (180–150 Ma) in the Nanling region, and become progressively younger northeastward (Zhou et al., 2006) to 140–125 Ma in the Lower Yangtze River Belt and coastal region in northeast Zhejiang Province. Such an age distribution pattern is coincident with a northeastward slab rollback following the southwestward flat subduction (Wang et al., 2011b). A-type granites formed within short period (125±2 Ma) in the Lower Yangtze River belt and nearby regions (Li et al., 2011; Wong et al., 2009). Igneous rocks <125 Ma become progressively younger southeastward, which is consistent with the drifting direction of the Pacific plate (Sun et al., 2007).

## 2. Tectonic models for Mesozoic geological events in South China

There are hundreds of W–Sn deposits in the Nanling region which are related to the Yanshanian large scale magmatism at 165–155 Ma (Hua et al., 2007; Wang et al., 2011a; Wu et al., 2011; Zhao et al., 2011; Zhou et al., 2006). Nb–Ta deposits are related to highly evolved Li–F enriched granites (Huang et al., 2002; Xiong et al., 2002), whereas HREE are related to weathered highly evolved granites (Hua et al., 2007; Yang et al., 2012a).

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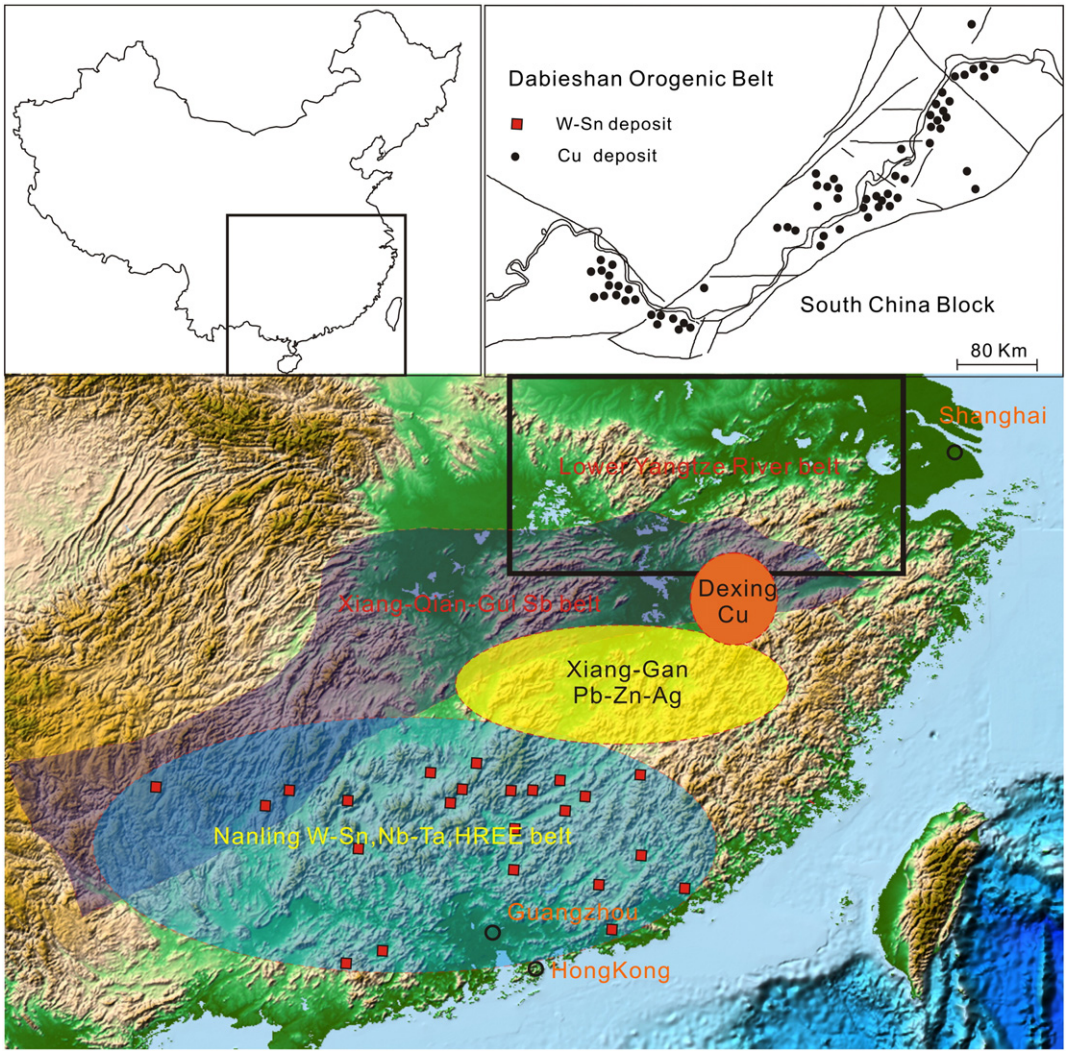


**Fig. 1.** Cartoon showing the major mineralization belts in South China: Nanling W–Sn polymetallic in the south; Xiang-Qian-Gui Sb belt in the west and the Lower Yangtze River belt in the north. Also shown are the Dexing porphyry Cu–Mo–Au and Xiang-Gan Pb–Zn–Ag deposit regions, which together with the Nanling mineralization belt form a mineralization zonation analogous to subduction related mineralization belts in South America (Mlynarczyk and Williams-Jones, 2005; Wang et al., 2011b).

A variety of tectonic models has been proposed to account for the Mesozoic geological evolution, in particular, the large scale magmatism and mineralization, of South China. These models include the following: (1) an Andean-type active continental margin related to the northwestward (Jahn et al., 1990; Li and Li, 2007; Li et al., 2012c; Zhou and Li, 2000; Zhou et al., 2006) or southwestward followed by northwestward (changed at ~125 Ma, Sun et al., 2007) subduction of the Pacific plate in the Mesozoic (Wang et al., 2011b); (2) intraplate lithospheric subduction as a result of the closure of an oceanic basin in the interior of South China (Hsü et al., 1990); (3) post-collisional extension (Chen et al., 2008); (4) continental rifting and extension (Gilder et al., 1991; Liu et al., 2012a; Wang et al., 2003, 2005); and (5) Mesozoic mantle plume activities (Deng et al., 2004). The subduction models are becoming more and more popular. However, it is still not clear why so many deposits formed within a short period of time in the region.

The Lower Yangtze River belt is known for its typical skarn type of Cu-polymetallic deposits (Deng et al., 2011; Pan and Dong, 1999; Yang and Lee, 2011). Copper deposits are closely associated with Early Cretaceous adakites (Li et al., 2010; Wang et al., 2006a; Xie et al., 2009; Yang et al., 2011; Zhang et al., 2001). Recent studies show that these adakites are geochemically similar to those of the circum-Pacific Ocean (Ling et al., 2011; Liu et al., 2010; Sun et al., 2012), which are favorable for Cu mineralization (Sun et al., 2011). However, it is still debated whether the adakites from the Lower Yangtze River belt are derived from lower continental crust or from subducted oceanic crust (He et al., 2011; Ling et al., 2011; Liu et al., 2010; Liu et al., 2012c; Sun et al., 2012; Wang et al., 2006a; Zhang et al., 2001). Based on the drifting history of the Pacific plate (Sun et al., 2007) and the distribution of adakites, A-type granites, Nb-enriched basalt/andesite, as well as sedimentary rocks, a ridge subduction model has been proposed to explain the formation of the Lower Yangtze River belt (Ling et al., 2009; Sun et al., 2010).

## 3. Contribution to this special issue

This special issue contains comprehensive studies on the tectonics, petrology and ore deposits of South China, which provide stronger constraints and better understanding of the Mesozoic magmatism and mineralization events. The main points are the following:

(1) Multiple plate subductions have contributed to the magmatism and mineralization in South China (Chu et al., 2012; Wang et al., 2012b; Zhang et al., 2012). The Kwangsian and Indosinian events of the South China Block are limited at 396–462 and 202–248 Ma, respectively. The deformation, metamorphism and magmatism of these two events occurred over a similar spatial extent (Wang et al., 2012b; Zhang et al., 2012). Metasedimentary granulite enclaves suggest large scale crustal