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Geochronology and magma oxygen fugacity of Ehu S-type granitic pluton in Zhe-Gan-Wan region, SE China

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ABSTRACT

In this paper, we determined the U-Pb isotopic and trace element compositions of zircons from the Ehu S-type granite in the Zhe-Gan-Wan region, SE China, using in-situ laser ablation (LA) ICP-MS. The weighted mean $^{206}Pb/^{238}U$ age of 132.0 ± 0.6 Ma for the Ehu granite indicates that the pluton was formed in the Early Cretaceous and during the Late Mesozoic Cu-Mo mineralization quiescence in Zhe-Gan-Wan region. The calculated logarithmic magma oxygen fugacities for Ehu granite range from −19.19 to −11.43 with an average magma oxidation state of FMQ-0.29, which is much lower than those of Cu-Mo bearing granites in the Zhe-Gan-Wan region. Since Ehu granite was derived from partial melting of metasedimentary basement without fractional crystallization and mantle-derived magma contamination, the low oxidation state of this granite suggests that the assimilation of metasedimentary basement component may not significantly increase the oxidation state of reduced melts from asthenospheric mantle and could not generate oxidized magmas that are favorable for Cu-Mo mineralization.

1. Introduction

The adjacent region of Zhejiang, Jiangxi, and Anhui Provinces (Zhe-Gan-Wan region) in east China is located along the southeastern margin of the Yangtze Block (Wong et al., 2011). This region was in a convergent plate boundary during the Yanshanian epoch (Jurassic-Cretaceous) (Zhou and Li, 2000; Zhou et al., 2006; Li and Li, 2007; Wang et al., 2011; Wang et al., 2013b) where numerous porphyries (Zhou and Li, 2000; Li and Li, 2007) and characteristic occurrence of many deposits of copper, gold, molybdenum, lead and zinc (Wang et al., 2003; Zeng et al., 2012; Qiu et al., 2013b). Previous studies suggested that the Mesozoic porphyry Cu, Mo, or Cu-Mo deposits in the Zhe-Gan-Wan region are mostly related to Jurassic porphyry stocks (older than 150 Ma), while those formed during the Cretaceous era (younger than 150 Ma) are generally barren of Cu and Mo. (Zeng et al., 2012; Qiu et al., 2013b, 2014b).

The magma oxygen fugacity has been demonstrated as one of the essential factors that control Cu-Mo-Au mineralization (e.g, Candela and Holland, 1986; Candela and Bouton, 1990; Blevin and Chappell, 1992; Candela, 1992; Lynton et al., 1993; Hedenquist and Lowenstern, 1994; Mengason et al., 2011). For example, classical Cu-Mo porphyries or Cu-Mo-bearing granites are related to oxidized melt systems (e.g, Ballard et al., 2002; Mengason et al., 2011; Li et al., 2012). Qiu et al. (2013b) determined the magma oxygen fugacities of several Mo bearing and barren porphyries in west Zhejiang area, and proposed that the Late Mesozoic "Cu-Mo mineralization quiescence" in Zhe-Gan-Wan region may be related to the low oxygen fugacities of magmas during the Cretaceous era. This view point was supported by the widely distributed Cretaceous reduced A-type granites in the Zhe-Gan-Wan region (Wong et al., 2009; Jiang et al., 2011; Yang et al., 2012; Qiu et al., 2013b). Petrogenetic studies suggest that some of these reduced A-type granites were derived from the asthenospheric mantle with limited assimilation from old crustal components (Wong et al., 2009), which may imply a relatively reduced mantle condition. However, as crustal components may also contribute to the formation of Cu or Mo bearing granites, the oxidation state of the magma that was derived from this end member should be investigated before we get a better understanding of the Cretaceous Cu-Mo mineralization quiescence in the Zhe-Gan-Wan region.

In this study, we determine the U-Pb isotopic and trace element compositions of zircons from the Ehu S-type granitic pluton in Jiangxi Province using Laser Ablation ICP-MS, in an attempt to provide new constrains on oxidation states of magmas that were derived from crustal components in the Zhe-Gan-Wan region.

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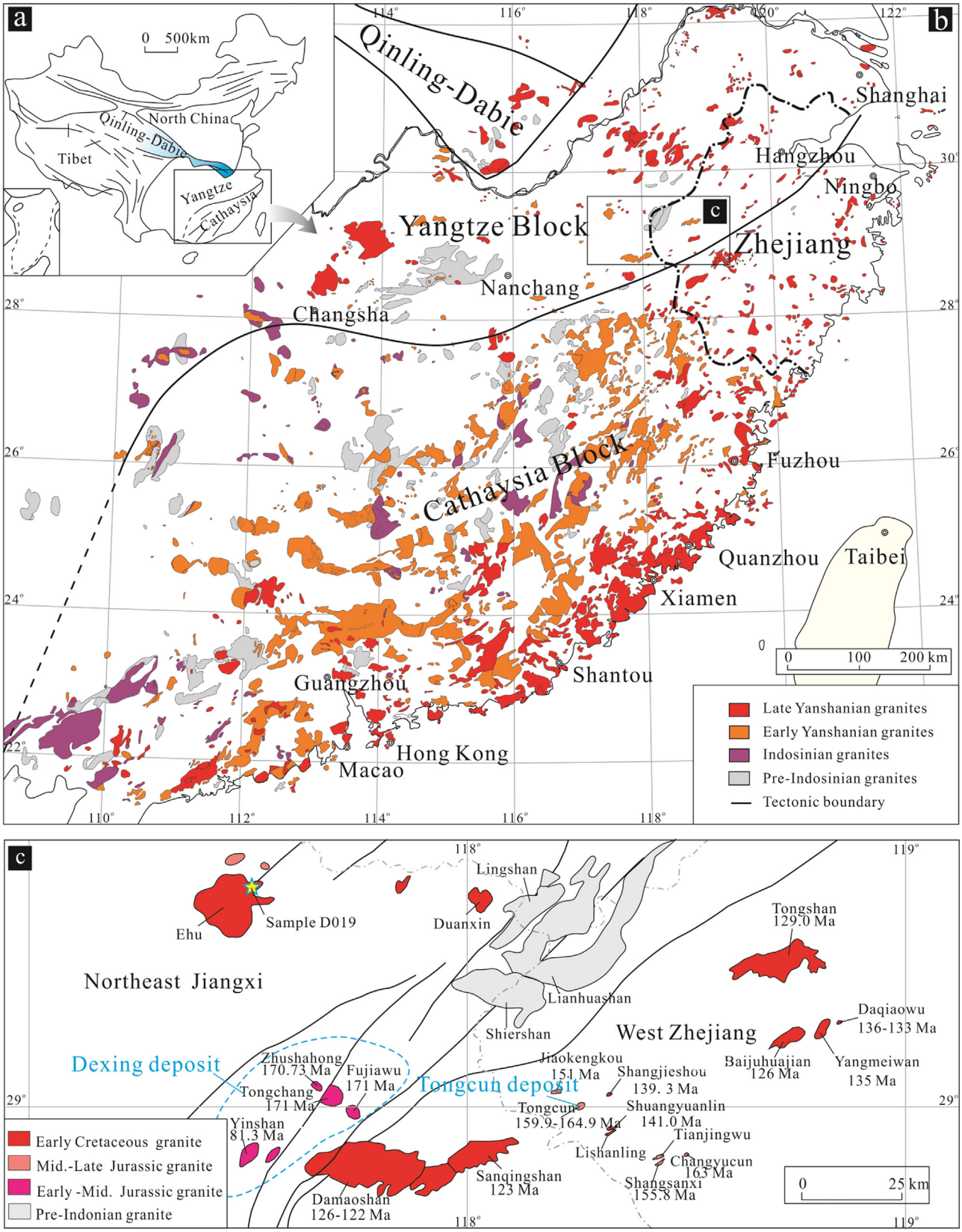

Fig. 1. Geological sketch map of China with plate boundaries. (b) Distribution of Mesozoic granites in South China (revised after Qiu et al., 2014b). (c) Distribution of Mesozoic granites in west Zhejiang and northeast Jiangxi with U-Pb ages (U-Pb ages are from Qiu et al., 2014b).

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