1 Geological Setting

The Liwan Cu-Mo deposit is a typical skarn deposit in the Lower Yangtze River metallogenic belt, and belongs to Anqing-Guichi Cu-Fe-Au-Mo district which is located at the northern margin of the Yangtze craton. The Liwan Cu-Mo deposit, located in the Yangtze paraplatform, lower Yangtze depression, and regionally situated on the NE-trending Zilaishan anticline core, part of the west of the Guichi anticline belt and the southwest outside of Bashan outcrops. The magma and hydrothermal activity along the anticline core is frequent and intense, such as granite porphyry distributed along the anticlinal axis.

2 Geochemistry and Geochronology

Geochemical characteristics of the Liwan Cu-Mo bearing diorite show adakitic features with high Al₂O₃ (16.07-17.55%), Na₂O/K₂O (0.53-1.53), low Y (29.9-37.7ppm). The Liwan diorite is enriched in large ion lithophile elements (LILEs), such as Rb, Sr, Cs, and has negative anomalies of high field-strength elements (HFSEs), such as Th, Zr, Hf and P.

The chondrite-normalized REE patterns of Liwan Cu-Mo bearing diorite plots in the field of the volcanic arc granite, indicating that Liwan diorite may be under the condition of plate subduction. According to the correlation between SiO₂ content and TiO₂, P₂O₅ content, Liwan adakite is formed in high temperature about 800~900°C. The contents of Al₂O₃+Fe₂O₃+MgO+TiO₂ range from 28.08~31.36%, with Al₂O₃/(Fe₂O₃+MgO+TiO₂) ratios of 1.05~1.53, suggesting that the Liwan adakitic magma should be formed by plate subduction with high temperature and low pressure environment.

In Yb vs. U diagram, the Yb and U of zircons is relatively concentrative with high positive correlation. These samples mainly fall in the overlapping region of magnesia, continental and oceanic crust zircon, which...
suggests that magma mixing may occur in the source region of diorite. Notably, with the increasing Yb and U content, these samples offset the oceanic crust zircon area, suggesting that the oceanic crust plays an important control in the magma source region. While some zircon components fall in the continental crust zircon region, which implies that some continental crust zircon may be captured in the rising process. Besides, the average Zirconium Saturation Temperature of Liwan diorite is 786°C, and the low temperature (≤800°C) generated by partial melting of diorite magma within the crust need the decompression effect and the source region with a certain amount of fluid which may be from the subduction of the pacific plate.

With the decrease of Ti contents or the reduction of temperature, the HF and most trace elements (e.g. U, Th, Y, P and HREE) of oceanic crust zircon are obviously enriched. Features of oxygen fugacity obtained by zircon also further prove the characteristics of source area. The zircon Ce⁴⁺/Ce³⁺ and Eu anomalies show higher oxygen fugacity. Previous research indicates that the oxygen fugacity in subduction zone is higher than the plate and MORB (Sun et al., 2013). Therefore, the oxygen fugacity of the Liwan diorite indicates this area should be under the background of pacific oceanic subduction zone. These characteristics show that the Liwan diorite was most likely derived from partial melting of subducted oceanic crust, with the occurrence of enriched lithospheric mantle components crystallization differentiation in the rising process.

Ling et al. (2009, 2011) and Liu et al. (2010) suggest that the distribution of metallic ore deposits in the Yangtze River metallogenic belt is associated with the ocean ridge or oceanic crust subduction between the Pacific and the Aizawa Nayoshii Plate. Oxygen fugacity can also serve as an empirical index to distinguish mineralized and non-mineralized. Partial melting of subducted oceanic crust produces adakite melts with high oxygen fugacity, than mantle melting, and Cu, Mo tends to concentrate in the sulfide melt. Only the local mantle melting source region with a high oxidation state, the S elements can enter into the silicate melt, the Cu, Mo and other ore-forming elements can be enriched in the silicate melts. So the high oxygen fugacity indicates that the Liwan diorite has strong potentiality in the Cu-Mo mineralization.

4 Conclusions

The Liwan diorite of Early Cretaceous has similar geochemical characteristics with that of adakite, which is closely related to the Liwan Cu-Mo deposit. The tectonic background of the Liwan Cu-Mo deposit belongs to the subducted ocean environment. Both adakitic rocks and regional Cu-Mo deposit resulted from crystallization differentiation of the subducted oceanic crust. This formation mechanism is the pacific plate subduction to the east China continent at Mesozoic. Identification of the Liwan adakitic rocks is significant to understand the genesis of the regional Cu-Mo mineralization, and to further guide the prospecting work. According to the former study of tectonics (e.g., Ling et al., 2009), we deduced that they were derived from partial melting of the subducted oceanic crust towards LYRB during the Early Cretaceous.

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References