

Geochemistry and Geochronology of Early Paleozoic Volcanic Rocks in the Dabaoshan Orefield, South China: Implication for the Genesis of Stratiform Fe-Cu-Pb-Zn Mineralization

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The Dabaoshan Fe-Cu-Pb-Zn-Mo-W orefield, located in the eastern part of the Nanling region, is one of the most important base metal reserves in south China. The veinlet-disseminated Mo-W mineralization is genetically related to Jurassic porphyry stocks. But the genesis of stratiform Fe-Cu-Pb-Zn orebodies still remains controversial. Some studies advocated that the Fe-Cu-Pb-Zn orebodies are the products of Paleozoic submarine exhalation and the layered volcanic rocks below the orebodies are related to the massive sulfide mineralization. In contrast, other researchers proposed that the Fe-Cu-Pb-Zn mineralization is a distal product of the Jurassic magmatism.

Profiles based on geological observations and detailed drill core logging demonstrate that the Fe-Cu-Pb-Zn orebodies are distributed in the lower part of the Qiziqiao Formation. The lower Qiziqiao Formation consists of dolomitic limestone, carbonaceous mudstone, limestone, and dolomitic and calcitic sandy shale, and these rocks overlie the layered volcanic rocks. The orebodies are largely in the form of stratiform bodies and lenses with thicknesses generally ranging from 100 m to 150 m; they are deformed synchronously with the host rock sequences. Below the stratabound orebodies, there are numerous quartz-pyrite veinlets with strong alteration, which have been interpreted as fluid conduits for seafloor VMS or SEDEX type mineralization.

Three zircon U-Pb dating results show the volcanic rocks formed at 442 to 439 Ma (439.2 ± 3.2 Ma, 439.4 ± 2.7 Ma, 442.0 ± 2.2 Ma), coevally with the Early Silurian volcanic rocks distributed to the north in Guangdong Province. The Dabaoshan volcanic rocks are composed of metaluminous to peraluminous dacite, dacitic lava, and breccias. The volcanic rocks show high SiO_2 , and low MgO and Fe_2O_3 content. On a SiO_2 - K_2O diagram, the samples can be classified as high-K calc-alkaline series. On an Nb/Y-Zr/ TiO_2 diagram, the volcanic rocks plot in the dacite field. The dacitic lava is characterized by LILE (Rb, K, and Pb) enrichment and HFSE (Nb, Zr, and Ti) depletion. Zircons from dacite have $\epsilon_{\text{Hf}}(t)$ values ranging from -5 to -15.5, clustering from -8 to -12.5 and two-stage depleted mantle Hf model ages (TDM2) range from 1.9 to 2.2 Ga, which indicates their Paleoproterozoic source. The volcanic rocks are contemporaneous with widespread post-orogenic felsic magmatism (440–400 Ma), which demonstrates that the volcanic rocks are related to post-orogenic extension in an intercontinental orogenic setting.

The Qiziqiao Formation was previously considered to be Devonian in age. The large time gap (>40 m.y.) between the formation of volcanic rocks and the supposed mineralization age are not in line with the VMS/SEDEX model. However, some research shows the strata above volcanic rocks may have been deposited in Silurian and a remnant sea basin may have existed in the

Dabaoshan area during Silurian. So the Fe-Cu-Pb-Zn mineralization may be associated with Silurian submarine volcanism.