Mineralization characteristics, genetic type and metallogenic time of stratiform ore bodies in Hongtaiping copper polymetallic deposit in Yanbian area, NE China

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The Yanbian area in northeast (NE) China is located in the eastern segment of the Central Asian Orogenic Belt. Due to its special tectonic location and complicated geologic evolution history, this area has been taken as a crucial region for studying late Paleozoic and Mesozoic tectonics, magmatism and metallogeny. There are a series of late Paleozoic volcanic-sedimentary formations in Yanbian area which host several copper polymetallic deposits including Hongtaiping in Wangqing area and Dongfengnanshan in Tianbaoshan ore district.

- **Rock assembles of ore-hosting volcanic-sedimentary formations**

  Filed survey and petrography researches indicate rock types in the late Paleozoic ore-hosting volcanic-sedimentary formations within and around the Hongtaiping and Dongfengnanshan deposit, Miaoling Formation, are mainly composed of tuffaceous sandstone, andesitic tuff, rhyolite, andesite, basalt, dacite, sandstone, carbonate, as well as minor silicolite and fluorite. These rock assembles imply the ore-hosting rocks belong to shallow-marine terrigenous sedimentary-volcanic-pyroclastic rock formation.

- **Mineralization characteristics and genetic type of stratiform ore bodies in Hongtaiping copper polymetallic deposit**

  Sixteen ore bodies in Hongtaiping deposit can be classified into two types, the stratiform and vein-type. The major stratiform ore bodies are flat and nearly horizontal, consistent with the Miaoling Formation in occurrence. The largest ore body is 570m long, 50 to 150m wide. The ore in the stratiform ore body is mainly characterized by the banded, lamellar and massive structure. The metal minerals mainly include pyrrhotite, pyrite, chalcopyrite and sphalerite, and most of the metal minerals show allotriomorphic granular and weak metasomatic texture. The microscopic characteristics of the ore show that the boundary between sphalerite and pyrite is relatively flat. According to the ore-hosting rock assembles, some typical alternation and mineralization characteristics, including exhalite in ore-hosting rock series, banded and layered
ore bodies, as well as comparisons between the Hongtaiping and some typical VMS-type (e.g. the Laochang in Yunnan Province and the Dabaoshan in Guangdong Province), the Hongtaiping deposit can be classified into the VMS-type.

- Metallogenic time of Hongtaiping copper polymetallic deposit

LA-ICP-MS zircon U-Pb dating of 69 igneous zircon grains in four volcanic clastic rock samples from the ore-hosting Miaoling Formation in the Hongtaiping deposit yields $^{206}\text{Pb}/^{238}\text{U}$ ages from 258±8 Ma to 293±10 Ma, and weighted mean age of 268.2±3.3Ma (MSWD=0.42), 273.8±4.7Ma (MSWD=1.3), 268.0±3.2Ma (MSWD=0.66) and 272.4±3.2Ma (MSWD=1.04), respectively. Rb-Sr isotope dating of seven sulfides (one pyrite, one sphalerite, two pyrrhotite and three chalcopyrite) yields the isochron age of 268.3±2.6Ma, which nearly consistent with LA-ICP-MS zircon U-Pb dating results of four ore-hosting volcanic rock samples. Isotope dating results demonstrate the VMS-type stratiform copper polymetallic mineralization in Hongtaiping deposit formed in the early-middle Permian period instead of late Triassic or early Jurassic period.

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