

Magmatic and Hydrothermal Processes in the Wondong Area, Taebaeksan Metallogenic Belt, Korea

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The Wondong deposit is in the Taebaeksan metallogenic belt in northeastern South Korea. Cambrian-Ordovician carbonate-rich sedimentary sequences of the Josun Supergroup and the Carboniferous-Triassic sedimentary rocks of the Pyeongan Supergroup are exposed by the Wondong thrust fault. The Wondong quartz porphyry was emplaced in the area, and the limestones with garnet-pyroxene skarn are partly mineralized with W, Fe, and Pb-Zn. The Wondong quartz porphyry, with a zircon U-Pb age of 88.8 to 78.4 Ma, had phenocrysts of feldspar and quartz, but most feldspars were destroyed by strong acidic hydrothermal processes during phyllic to argillic alteration events. The Wondong quartz porphyry was cut by numerous sub-parallel quartz vein swarms. Magmatic melt inclusions and hydrothermal fluid inclusions coexist in quartz phenocrysts. The melt and fluid inclusions were studied to understand the magmatic-hydrothermal process in the Wondong area.

Coexistence of brine and vapor inclusions indicate phase separation. Maximum depth of the fluid trapping is estimated to be 4 km with a P-T range of 300° to 500°C and 50 to 400 bar. While changes in W and Mo concentrations in the fluids during the P-T changes are minimal, the fluids contain signatures of significant batholith-scale fractionation of plagioclase crystallization. Melt inclusion analysis indicates plagioclase fractionation as well. Trace element ratios in fluid and melt inclusions suggest that the Wondong quartz porphyry was the causative intrusion for the hydrothermal processes. We compared the melt and fluid inclusions compositions from the Wondong quartz porphyry with the fluid inclusions from the Sangdong W-Mo deposits, which are the largest W deposits in the Taebaeksan metallogenic belt. We suggest that the volume of magma for the Wondong quartz porphyry is relatively small compared to the magma for the Sangdong mineralization, and this indicates that the Wondong area could not host the same large-scale W mineralizations that have been recognized at the Sangdong W-Mo deposit.