Study of sphalerite geochemistry in the Taebaeksan metallogenic region for Zn-Pb exploration

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The Taebaeksan (TBS) region, located in the northeastern part of South Korea, is an important metallogenic province for Zn-Pb-W-Mo-Fe-Cu (-Au-Ag). The Zn-Pb orebodies are hosted in the early Paleozoic carbonate-rich sedimentary sequences, and they are associated with magmatic-hydrothermal activities from late Cretaceous to early Paleogene. We collected sphalerite-bearing ores from 15 areas including metal deposits, marble deposits and some exploration sites in the TBS region to understand its regional Zn-Pb mineralization process and to provide an exploration strategy.

The sphalerites in the TBS region contained detectable amounts of Fe, Mn, Cd, Co, Cu, Ga, Ge, Mo, Ag, In, Sn, Sb and Pb. High-temperature sphalerites from skarn and vein-breccia are relatively enriched in Co and In, while Ga, Ag and Sn tend to be concentrated in the relatively low-temperature sphalerite from carbonate replacement. Lead isotope ratios in the sphalerites show a well-defined linear trend with those of the local Cretaceous intrusions and the sedimentary sequence of the TBS region. Sphalerites from economically significant Zn-Pb deposits characteristically have high Mn, low Cd and non-radiogenic Pb isotope signatures closer to the intrusions, as compared to the minor and sub-economic Zn-Pb orebodies.

The major Zn-Pb deposits are confined within the southern part of the TBS region, possibly because ore-bearing magmatic-hydrothermal fluids of high-Mn and non-radiogenic Pb experienced low fluid-rock interaction. The minor Zn-Pb deposits, on the other hand, are dominant in the northern part in the TBS region, because of relatively higher degree of fluid-rock interaction with Cd-rich sedimentary hosts.