EGU22-1067, updated on 25 Apr 2022
https://doi.org/10.5194/egusphere-egu22-1067
EGU General Assembly 2022

Cobalt and REE distribution at the Zinkgruvan Zn-Pb-Ag and Cu deposit, Bergslagen, Sweden

Nils Jansson[1], Ingeborg Hjorth[1], Filip Ivarsson[2], Thomas Aiglsperger[1], Amir M. Azim Zadeh[1], Ellen Kooijman[3], Melanie Kielman-Schmitt[3], Foteini Drakou[4], and Gabriela Kozub-Budzyń[5]

[1]Luleå University of Technology, Sweden (nils.jansson@ltu.se)
[2]Zinkgruvan Mining AB, 696 81 Zinkgruvan, Sweden
[3]Department of Geosciences, Swedish Museum of Natural History, Frescativägen 40, SE-104 05 Stockholm, Sweden
[4]Department of Geology, School of Natural Sciences, Trinity College Dublin, Ireland
[5]AGH University of Science and Technology, Faculty of Geology, Geophysics and Environmental Protecition, Al. Mickwiewicza 30, Kraków, Poland

The metamorphosed, stratiform, c. 1.9 Ga Zinkgruvan Zn-Pb-Ag deposit is one of Europe's largest producers of Zn. Since 2010, disseminated Cu mineralization is also mined from dolomite marble in a hydrothermal vent-proximal position in the stratigraphic footwall. Local enrichments of Co and REE exist in the vent-proximal mineralization types, albeit their distribution is poorly known. This contribution provides new data on the distribution of Co and REE within the Zinkgruvan deposit.

LA-ICP-MS analysis suggest that lattice-bound cobalt in sphalerite range between 44 ppm and 1372 ppm, with the lowest and highest values occurring in distal and proximal mineralization, respectively. Proximal Co-rich sphalerite is always Fe-rich. Lattice-bound Co also occur in pyrrhotite; ranging from 52 ppm in distal ore to 1608 ppm in proximal ore. There is a concurrent increase in lattice-bound Ni from 3 ppm to 529 ppm. In proximal ore, Co is also hosted by cobalt minerals such as costibite (27.37 wt.% Co), safflorite (16.21 wt.% Co), nickeline (7.54 wt.% Co), cobaltite (32.74 wt.% Co) and cobaltpentlandite (25.49 wt.% Co). Automated quantitative mineralogy suggest that these minerals are highly subordinate to sphalerite (<70.11%) and pyrrhotite (<14.69%), amounting to <2.88% cobalt minerals with safflorite being most common (up to 2.67%). Cobalt deportment calculations suggest that the proportion of whole-rock Co that is lattice-bound to sphalerite and pyrrhotite ranges from 7.80% to 100%, with sphalerite being the main host. Whole-rock As and Ni contents pose a strong control on whether Co occurs lattice-bound or as Co minerals.

LA-ICP-MS analysis show that accessory apatite in proximal, marble-hosted Cu mineralization carries a few thousand ppm ∑REE, but locally up to c. 1.6 wt.% ∑REE. The apatite can be subdivided into two types. Type 1 apatite is characterized by dumbbell-shaped chondrite-normalized REE profiles with relative enrichment of in particular Sm-Tb, depletion of Yb-Lu relative to La-Pr, local positive Gd anomalies, and weak positive to negative Eu anomalies. Type 2 apatite is characterized by flat to negatively sloping REE profiles from La to Gd and relative HREE depletion. Additional REE

is hosted by monazite. Type 1 apatite was only found as a gangue to Cu mineralization. The Type 1 apatite REE signature is characteristic of hydrothermal apatite, and a direct genetic association with vent-proximal Cu mineralization can be inferred.

Comparison with published REE contents in apatite suggest that vent-proximal Zinkgruvan apatite is locally as REE-rich as apatite from Kiruna-type apatite iron oxide deposits, and more REE-rich than apatite in other metamorphosed sediment-hosted sulphide deposits in the world, such as the Gamsberg deposit (RSA).