Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.12336

New insights into the isotopic composition of the Zechstein Kupferschiefer unit based on the in-situ Cu and Fe isotopic data

KATARZYNA DERKOWSKA[1,2], DR. MARINA LAZAROV[3], JAKUB CIAZELA[4], PAWEÅ, DERKOWSKI[2] AND PIOTR WOJTULEK[1]

[1]University of Wroclaw
[2]Polish Geological Institute - National Research Institute
[3]Leibniz University Hanover, Institut of Mineralogy
[4]Institute of Geological Sciences, Polish Academy of Sciences
Presenting Author: katarzyna.derkowska@uwr.edu.pl

The Kupferschiefer ore bodies present in SW Poland and Germany belong to the largest sediment-hosted Cu deposits in the world. Multiple stage mineralization occurs within the Zechstein sediments associated with the SW margin of the South Permian Basin. This study will use the term Kupferschiefer sensu lato, considering the whole Cu-bearing series, i.e., the Weissliegend, the basal limestone, the Kupferschiefer, and the Zechstein Limestone.

We present in-situ Cu and Fe isotope compositions from the currently mined Lubin-Sieroszowice copper district massive vein and surrounding dispersed mineralization. The vein mineralogy is complex and in different areas dominated by other minerals. Chalcocite, chalcopyrite, bornite, and pyrite are associated with minor marcasite, tennantite, galena, and sphalerite. Minerals are often overgrown and occur as nest-like aggregates as well as spherulitic clusters, sometimes presenting mineral-related zonation. The analyzed distal part of the vein continues through 240m with a varying width of 6 to 38m. Besides, we present the first-ever data from the historically-mined oxidized Cu-mineralization in marls and shales from the North Sudetic Basin (NSB).

Massive mineralization shows large δ^{65}Cu isotopic variation in chalcopyrite, chalcocite, and bornite from lightest values of around -1 ‰ δ^{65}Cu in the central-southern area and heavy, up to ~ 0.5 ‰, in the central, central-eastern area. This large isotope variation may indicate a long and slow process of mineral formation, followed by host fluid redox changes. Iron isotopic variation is more extensive with δ^{56}Fe between -1.26 and +1.91 ‰ with no evident link to the mineralization type (massive-dispersed). Early-formed bornite and chalcopyrite are isotopically the lightest (δ^{56}Fe -1.26 to 0.0 ‰), whereas pyrite and secondary bornite are heaviest (δ^{56}Fe 0.07 to 1.91 ‰). For the NSB samples, the Cu isotopic composition was determined. Samples show considerable δ^{65}Cu variations with isotopically lighter covelline (-2.84 to -1.55 ‰) compared to malachite (-1.92 to 0.97 ‰).

Our results may shed light on the formation of the massive veins and their relation in time and origin to the dispersed mineralogy within the deposit.

The study was funded by the Polish National Science Centre grant to KD (2019/35/N/ST10/04524).