

PhD thesis summary

Geological conditions of copper grades' variability in the Kupferschiefer in the selected parts of "Rudna" and "Sieroszowice" deposits

Agata Sokalska MSc

Due to the shift of exploitation front towards north and west in copper mines of KGHM, a change of prevailing ore type from sandstone to shale and carbonate is observed. As an effect, one of the key issues in current exploration and production planning is to specify detailed relations between shale and carbonate rock features and copper mineralization. Thorough recognition of these regularities has a crucial significance for the Fore-Sudetic Monocline copper deposit geometalurgical model, which is currently developed in KGHM. The aim of this model is to distinguish "domains" of similar processing and flotation parameters in copper deposit area, in order to facilitate processing optimization.

The main purpose of this thesis is to identify relations between geological factors: the Kupferschiefer (copper shale) lithology and thickness, ore mineralization, location in relation to depressions of the Weissliegend relief and copper grades' spatial variability in the copper deposits "Rudna" and "Sieroszowice" areas.

In the thesis the depressions of the Weissliegend relief are understood as lowered areas of the Rotliegend sandstones top surface. They are located between elevations, which constitute semi-parallel sandy bars, with boundaries defined by 10 cm's isopach of the Kupferschiefer, basing on the fact of reduction of this lithological unit thickness at the summits of the elevations. Analyses were carried out in the area of three depressions: Central Depression of Rudna, North Depression of Rudna and Tarnówek Depression. In each depression separate zones were determined: the centre and two slopes.

The research was conducted in three stages. In the first stage 150 samples of the Kupferschiefer were collected from 42 profiles located in underground workings of central and northern part of "Rudna" and "Polkowice-Sieroszowice" mines. Macro-, microscopic studies and chemical analyses of copper grades were carried out on these samples. Based on them and 277 profiles from KGHM database, eight different types of lithological successions were distinguished and subsequently frequency of their occurrence along 13 cross-section lines was analysed. In the second stage petrographic studies were conducted, including reflected light microscopy with planimetric analyses and recognition of the predominant mineral in the sample. In the third stage a wide range of statistical tests was performed, including analyses of variance and hierarchical regression modeling. The aim of these studies

was to determine relations between copper grade and productivity with lithology and thickness of the Kupferschiefer, its mineralization, location in the whole deposit area and position in relation to Weissliegend relief elevations, based on the data from author's samples and data obtained from KGHM. Six different areas of average size around 2,5 km² were studied, on the basis of 15 237 profiles. Each stage of work was preceded by a literature review, comprising of an actual state of knowledge on the subject, and in the summary the conclusions were compared with the previous studies.

In the Kupferschiefer, at slopes and centres of depressions of Weissliegend relief, a certain increase in frequency of occurrences of particular types of lithological successions were observed, as a result of lithological studies. Occurrences of a few profiles with non-standard shale sequences may suggest wider variability of sedimentation conditions in the most north-eastern Tarnówek Depression. As a conclusion of petrographic analyses, not only earlier documented lateral and vertical zonation of copper ore minerals distribution was confirmed, but also discrepancies in distribution of ore minerals in different lithologies of the Kupferschiefer at slopes and centres of depressions were proved. These discrepancies may indicate different influence of mineralizing liquids on shale in different parts of depressions. Statistical analyses revealed higher negative correlation between copper grade and shale thickness at depression slopes than at centres. This relation is stronger in the studied areas with higher copper grades, located in the "Sieroszowice" deposit area. In these areas copper productivity mainly depends on copper grades at depression slopes and on shale thicknesses at depression centres. In the studied areas located within the "Rudna" deposit boundaries, shale thicknesses seem to be more important factor for copper productivity than copper grades at the both depression zones. Concerning the practical aspect, for the purpose of the Kupferschiefer geometalurgical model, certain similarities between different studied areas were observed, especially within the same depressions.

Agata Sokalska