



## THE ACCURACY OF THE ASSESSMENT OF THE VOLUMETRIC DENSITY OF Cu-Ag LGCD ORE DEPOSITS AND ITS EFFECT ON THE VALUATION OF MINING PRODUCTION

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### Introduction

A reliable assessment of the volumetric density of the ore is necessary for accurate estimation of resources and ore quality in the deposit and for periodic valuation of mining production. Since 1994, fixed values of volumetric density are assigned to the main lithological units in the LGCD deposits (Legnica-Głogów Copper District): 2,60 Mg/m<sup>3</sup> for carbonate ore, 2,50 Mg/m<sup>3</sup> for shale ore and 2,30 Mg/m<sup>3</sup> for sandstone ore. Later studies determined 18 smaller units, referred to as individual lithological units, within the main lithological units (Kaczmarek et al., 2014, 2017). Therefore, it is justified to assess their volumetric densities and, on this basis, to verify the correctness of volumetric densities determined for main lithological units and to determine the impact of changes in this parameter on the valuation of mining production.

### Material and methods

The analysis was based on the results of experimental sampling of the 10 most ore-rich individual lithological units carried out in mining excavations of the Rudna, Lubin, and Polkowice-Sieroszowice deposits (LGCD). A total of nearly 1,5 thousand samples were collected. Their volumetric density on a dry basis was determined using the wire basket method according to the PN-EN 1936:2010 standard. The obtained data sets were subjected to statistical analysis and the results were visualized with contour maps.

### Results

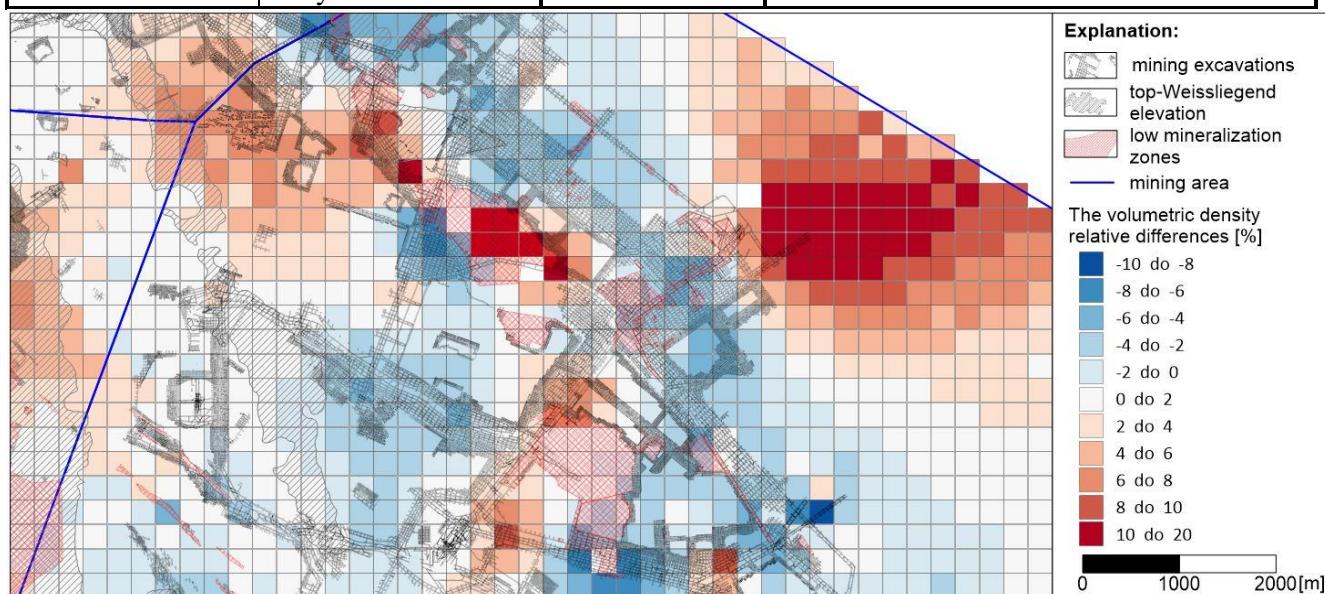
The average volumetric densities of individual lithological units differ to a greater or lesser extent than the volumetric densities attributed to the main lithological units treated as reference values (Table 1). The volumetric densities of three individual units, namely: argillaceous sandstone in the Lubin deposit and clay shale and pitchy shale in the Rudna deposit, are lower than the reference values. The volumetric densities of the remaining individual lithological units are greater than the reference values. This means that the lack of one or more individual lithological units in the profile of the deposit or a change in their proportion may, at the local scale of observation, result in the need for a significant correction of volumetric densities of the main lithological units in relation to the reference values. The scale of possible differences in volumetric density estimates determined on the basis of experimental sampling of individual units and reference values for the main lithological units is presented with a block map of a part of one of the economic deposits (Figure 1). The relative differences of both assessments can be significant and range from -10% to 20%.

### Conclusions

The variable share of individual lithological units within the main ore units can contribute to significant differences between their actual volumetric densities and those routinely attributed to the main units during the exploration of the Cu-Ag LGCD deposits. This leads to errors in the assessment of metal resources and ore quality in parts of the deposit where mining activities are to be carried out in the near future and, consequently, difficulties related to the valuation of mining production. In order to reduce the difference between the forecasted and the actual mass and metal content in the excavated material, the estimation of resources and ore quality in the deposit should be based on the volumetric densities of individual lithological units determined on the basis of experimental sampling (Table 1).

**Table 1.** The average volumetric densities of the ore within individual lithological units determined based on the results of experimental sampling.

Lithological ore type		Fixed volumetric density (reference values) [Mg/m <sup>3</sup> ]	Volumetric density for individual lithological units in the deposits of LGCD [Mg/m <sup>3</sup> ]		
Main lithological units	Individual lithological units		Rudna	Lubin	Polkowice-Sieroszowice
CARBONATE SERIES	Streaky dolomite	2,60	2,69	2,61	2,70
	Clay dolomite		2,64		
	Calcareous dolomite		2,73	2,65	2,73
SHALE SERIES	Dolomitic shale	2,50	2,54	2,52	2,59
	Silty shale		2,36		
	Organic shale				
	Border dolomite		-	2,70	-
SANDSTONE SERIES	Carbonate sandstone	2,30	2,64	2,53	2,55
	Silty sandstone		2,33	2,25	2,35
	Anhydrite and silty-anhydrite sandstone		2,68		



**Figure 1.** The block map (250x250m blocks) of the volumetric density differences in the Cu-Ag deposit determined on the basis of experimental sampling and reference values used in KGHM Polska Miedź S.A. for the main lithological units.

### References

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