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Geochemical signature of pyrite as a new proxy toward mineralization center – a case study from the Myszków Mo-Cu-W porphyry deposit, Poland

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Recent advances in quantitative LA-ICP-MS analysis have stimulated debates about the possibility of using pyrite geochemistry as a potential vector toward the core of the mineralized system in some ore deposits of hydrothermal origin (e.g. Dehnavi et al., 2018; Xiao et al., 2023). Therefore, this study was focused on the trace element distribution in porphyry-type pyrite as a function of distance-to-center using the concelead Variscan Myszków Mo-Cu-W deposit (Poland) as a case study.

The low-temperature, post-hydrothermal pyrite, associated with the youngest calcite veins, shows a diversified set of elements either solely structurally bound (e.g. Co, Ni, Se, Te, As, Sb, Tl, Hg, Au, Ti, Cr, Mn, V) or held both in crystal lattice at low concentrations and as micro-scale inclusions (e.g. Pb, Cu, Zn, Bi, Ag, In, Sn, La, Ce, Hf, Rb, Y). Within the deposit, the elements with the most diverse distribution are Co, Ni, As, Sb, Te, Se, Au, Ag, Bi, while Tl, Ti, Cr, Mn, and V have relatively constant values. As a result, the Sb/Te, Co/Bi, Ag/Ni, and Co/As ratios turned out to be the most promising tools for ore prospecting. The Sb/Te, Ag/Ni, and Co/Bi ratios increase with proximity to ore, while the Co/As ratio shows the opposite trend (Table 1). Moreover, pyrite from the deposit periphery is characterized by the abundant presence of REE-bearing inclusions.

Table 1. Average trace element ratios of Sb/Te, Ag/Ni, Co/Bi, and Co/As in late-stage pyrite from the Myszków Mo-Cu-W porphyry deposit.

	Sb/Te	Ag/Ni	Co/Bi	Co/As
Deposit zone	1.621	0.140	34.234	0.222
Circum-deposit zone	0.697	0.030	25.154	0.360
Peripheral zone	0.062	0.006	3.322	0.458

References:

Dehnavi et al. Assessment of pyrite composition by LA-ICP-MS techniques from massive sulfide deposits of the Bathurst Mining Camp, Canada: From textural and chemical evolution to its application as a vectoring tool for the exploration of VMS deposits. *Ore Geology Reviews*, **2018**, 92, 656–671.

Xiao et al. Pyrite geochemistry in a porphyry-skarn Cu (Au) system and implications for ore formation and prospecting: Perspective from Xinqiao deposit, Eastern China. *American Mineralogist*, **2023**, 108(6), 1132–1148.

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