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Geochemistry of porphyry-style pyrite as a tool for vectoring boiling horizons: an example from Myszków Mo-Cu-W deposit (Poland)

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The boiling of hydrothermal solutions remains the most effective ore depositional process in many pyrite-forming environments, including porphyry Cu deposits. Román et al. (2019) and Keith et al. (2020) demonstrated that compositional and textural features of pyrite could be used for tracking the boiling events in active and fossil hydrothermal environments. The transition horizons between boiling and non-boiling conditions were captured based on microtextures and solid inclusion assemblages hosted in pyrite originating from different mineralization stages of the Myszków Mo-Cu-W porphyry-type deposit (Naglik et al., 2021). Further geochemical analysis (EMPA, LA-ICP-MS) of pyrite from this system, has shown that its composition follows the geochemical trends, reported from other porphyry systems worldwide, representing a poor budget of trace elements incorporated into its structure, except for Co, Ni, Se, and Te. The most distinctive feature of pyrite formed under boiling conditions is a non-uniform trace elements distribution of Co, Ni, Se, and Te reaching contents up to 3966 ppm, 2552 ppm, 183 ppm, and 118 ppm, respectively. This remains in good agreement with the recent results of Román et al. (2019) and Keith et al. (2020) arguing that the pyrite's zonality suggests abrupt physicochemical changes in the hydrothermal fluids (e.g. temperature, pH, fO_2, ligand availability, chemical composition). However, further systematic studies are needed for defining geochemical indicators that could be used for discriminating boiling horizons and their marginal or shallower areas and thus, providing new exploratory tools.

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