Constraints from Pyrite Micro-Structures on Gold Mineralization Processes of Multi-Stage Fluid Episodes

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Most hydrothermal mineralization systems are characterized by multi-stage fluid episodes, resulting in multiple types of mineralization and sequential alteration of pre-existing minerals. Chemical zonings of pyrite can provide records of time-integrated sequences of fluid flow episodes. However, multiple mineralization events within a hydrothermal system lead to overlapping of pyrite of multiple generations, and obscuring of the primary textural features. As a reslult, interpretation of complicated chemical zonings can be ambiguous and challenging. The complexity of chemical zonings require new constraints to obtain a comprehensive understanding of the multi-stage fluid episodes and related mineralization processes.

The Wulong gold deposit is a large tonnage, located at the northeastern margin of the North China Craton (NCC), which is known as the most gold-productive region in China. As an important host mineral for Au, pyrite in the auriferous quartz veins exhibits complicated textural features due to multiple re-activations of the hydrothermal system. Here, we use XRF and EPMA mappings to reveal the chemical zonings in pyrite. Atom probe microscopy (APT) is also used to provide nano-scale distributions of Au and other trace elements in pyrite. EBSD is used to reveal the morphology, micro-structure and other texture features of pyrite, based on the intra-grain and inter-grain orientation variations of pyrite. This study highlights that morphology and micro-structure featuers (e.g., dislocations, low- and high-angle boundaries) of pyrite can provide evident clues to elucidate the mineralization events in hydrothermal systems.