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# (U,Th)-He dating of pyrite as a tool for determining the age of tectonothermal activity

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Establishing the precise timing of faulting and other tectonic deformations presents a significant challenge in isotope geochronology. In many cases, these events are inferred indirectly from geological relationships. More direct age constraints are possible when hydrothermal minerals formed during deformation, such as calcite, hematite, and micas, can be dated.

In sulfur-enriched host rocks, deformation often leads to the formation of pyrite, typically presented by well-developed idiomorphic crystals. Recent research has demonstrated that pyrite can be dated using the (U,Th)-He method [1]. This technique has been successfully applied to sulfide ores from the Uzelga deposit, South Urals; the Karyernoe occurrence, Polar Urals; metasomatites from the Novogodnee-Monto and Petropavlovskoe deposits, Polar Urals; epithermal ores of the Kalarskoye occurrence, Gornaya Shoria; and epigenetic pyrite in oil source rocks of the Bazhenov Formation, Western Siberia.

Herein, we have tested the possibility of dating tectonic deformations on the example of pyrite from the strike-slip fault zone at the southeastern framing of the Rassokhinsky Massif (Yakutia). (U,Th)-He ages of pyrite were reproducible and have shown the presence of early paleogene tectono-thermal activity in the area. These findings contribute to the broader understanding of post-collisional deformation in northeastern Asia and highlight the potential of (U,Th)-He dating of pyrite for constraining the timing of faulting and associated hydrothermal processes.

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