

Characterization of trace elements and $\delta^{34}\text{S}$ variability in natural pyrite using N_2O reaction gas.

MRS. ESTIDA VEZI¹, PÄÄRN PAISTE², KÄRT PAISTE³,
KALLE KIRSIMÄE¹, DAVID A. FIKE³ AND CLIVE JONES³

¹University of Tartu

²University of Tartu,

³Washington University in St Louis

Presenting Author: estida@ut.ee

Characterization of trace elements and $\delta^{34}\text{S}$ variability in natural pyrite using N_2O reaction gas.

Estida Vezi¹, Päärn Paiste¹, Kärt Paiste^{1,2}, Clive Jones², David
A. Fike², Kalle Kirsimäe¹

¹Department of Geology, University of Tartu, Tartu, Estonia

²Department of Earth and Planetary Sciences, Washington
University in St. Louis, St. Louis, Missouri 63130, USA

Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) is a well-established and powerful analytical technique specialized in determining concentrations and spatial distributions of elements and isotopes in solid samples. However, the variety of polyatomic and isobaric interferences and the lack of suitable matrix-matched reference materials are two key factors that limit the conventional use of quadrupole-based LA-ICP-MS systems. For this reason, interference handling and development of new matrix-matched reference materials is a trending research topic in the LA-ICP-MS community.

This study reports a method applicable for natural pyrite samples' trace element and sulfur isotope characterization and possible candidates for matrix-matched standards using triple quadrupole LA-QQQ-ICP-MS. Trace element and $\delta^{34}\text{S}$ analysis of pyrites and reference materials is performed in no-gas mode and using N_2O as a reaction gas. Introducing N_2O gas into the reaction chamber removes polyatomic interferences that limit simultaneous collection of trace element and sulfur isotope ratio signals; however, its effectiveness and limitations have not been thoroughly tested. We show that even though N_2O gas allows for the removal of some key interfering species, i.e., O_2^+ and NO^+ at $m/z=32$ and $m/z=34$ that overlap with S and polyatomic interferences overlapping As and Se, the formation of cluster ions and decreased signal intensity for non-reactive ions limit the efficacy of trace element mapping together with sulfur isotope analysis by LA-QQQ-ICP-MS. Normalization of $\delta^{34}\text{S}$ data was performed using in-house hydrothermal pyrite standard from the Washington University in St Louis. The quality and accuracy of the $\delta^{34}\text{S}$ data is further validated by mapping natural pyrite samples via micro-drilling of the crystal surfaces and subsequent analysis by Isotope-Ratio Mass Spectrometry (IRMS).