How robust is sedimentary pyrite trace element geochemistry as a geochemical proxy?

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Trace element concentrations in marine black shales, measured using conventional bulk rock techniques, have been used as paleo-redox indicators of the atmosphere-ocean system for decades. More recently, redox sensitive trace element concentrations of sedimentary pyrite, measured using Laser Ablation - Inductively Coupled Plasma - Mass Spectrometry (LA-ICP-MS), have been used to track changes in redox conditions through time. This paper assesses pyrite trace element distribution along a single black shale unit across a basin in order to validate the pyrite LA-ICP-MS technique as a geochemical proxy.

This study focusses on the organic-rich black shales of the Middle Cambrian Lower Arthur Creek (*"Hot Shale"*) Formation (from deep water to shallow water facies) in the Georgina Basin, northern Australia. Sedimentary pyrites and black shale matrix from nine stratigraphic drill holes across the Lower Arthur Creek Formation over ~450 km were analysed for trace element concentrations using the LA-ICP-MS, resulting in a total of ~2000 analyses.

Results indicate sedimentary pyrites in the Arthur Creek Formation are enriched in trace elements (Se, Mo, Au, Ag, Zn, Cd, Cu, V and Cr) by one to two orders of magnitude above the background pyrite. Our data presentation focuses on the variation in pyrite chemistry with sedimentary facies across the basin and factors controlling these variations.