Characterising trace element distribution in pyritised microfossils: A tool to test biogenicity

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Recent techniques that help ascertain biotic vs abiotic origins involve synchrotron X-ray fluorescence imaging of vanadium in microfossils*. This study involved imaging a suite of nutrient elements using a more rapid and relatively cost-effective LA-ICP-MS technique coupled with high-resolution microscopy, compared to synchrotron X-ray fluorescence imaging. The main objective was to determine biogenicity of putative microfossil-like structures in the rock using the distribution of bio-essential trace elements in pyritised and non-pyritised samples.

Detailed petrography using reflected light microscopy as well as high resolution microscopy using the SEM were used to reveal primary biogenic textures in the samples. Combined elemental and EBSD mapping of the microfossils were undertaken to investigate changes in crystal structure, crystal size, and crystal orientation & determine correlation with the trace element distribution. This was followed by imaging of the microfossil structure using the LA-ICP-MS. Statistical analysis involved a Bayesian treatment of spatial correlations to determine whether trace element distributions can distinguish between biogenic vs abiogenic samples.

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