Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.6328

Biogeochemistry of late Ediacaran mineral-organic associations

FUEN CAÑADAS, DOMINIC PAPINEAU AND GRAHAM A SHIELDS

University College London

Presenting Author: fuencisla.canadas.16@ucl.ac.uk

Black shales from the uppermost Doushantuo Fm. (South China) record the recovery from the global Shuram excursion, the longest and most negative carbon isotopic excursion in Earth history. However, little is known about the sedimentary characteristics of the organic matter in these rocks. Here, we use Raman and energy dispersive spectroscopy to identify and then characterize original sedimentary and mineralogical signatures that can be linked to microbial and/or abiotic diagenetic processes.

Raman spectra of organic matter from several sections along a platform-to-basin transect reveal a systematic difference in kerogen structure between depositional environments. Sedimentological and mineralogical characteristics of the studied samples point towards massive oxidation of biomass during diagenesis. For example, the presence of ^{13}C-depleted carbonate concretions or OM enclosed by lenticular dolomitic structures within the host shale unit suggest organic matter remineralization and anaerobic oxidation which resulted in authigenic carbonate precipitation during the earliest stages of sediment diagenesis. In this light, OM degradation would have favoured the dissolution of titanium-bearing minerals leading to sufficient supply of Ti^{4+}. This resulted in the precipitation of authigenic anatase, generally rounded in shape, and sometimes replacing acritarch-like shapes where anatase could be interpreted as a biomediated early diagenetic product. Other mineralogical features, however, point to high levels of primary production like for example the presence of apatite as bands that host spheroidal microfossils with highly fluorescent quartz with OM within concretions, or the occurrence of 30-50 μm barite grains with euhedral morphologies and associated with phosphate, or partially replacing organic rich spheroidal morphologies.

New Raman spectroscopy and SEM results suggest a dynamic late Ediacaran environmental scenario with mineralogical and sedimentological signals of OM remineralization and photosynthetic primary production. These observations would support the recently proposed scenario, whereby the variable dominance of primary and secondary production yielded different signals in the C-isotope composition of OM and carbonate.