Microbially-induced carbonate precipitation, Moodies Group (3.2 Ga, BGB, South Africa)

M. HOMANN [1]*, C. HEUBECK[1], A. AIRO[1], M. TICE[2] AND S. NABHAN[1]

[1]Freie Universität Berlin, Institute of Geological Sciences, Malteserstr. 74-100,
12249 Berlin, Germany (*correspondence: martin.homann@fu-berlin.de)
[2]Texas A&M University, College Station, Texas 77843, USA (mtice@geos.tamu.edu)

The Archean Moodies Group, Barberton Greenstone Belt (BGB), ~3.2 Ga, represents Earth's oldest known tidally influenced siliciclastic sequence and includes well-preserved microbial mats which can be traced laterally for >15 km.

We investigated the microstructure of crinkly intertidal-facies mat morphotypes and tufted supratidal-facies mats, both preserved as abundant kerogenous laminae ~1mm thick overlying individual depositional events in medium- to coarse-grained sandstones. Mats are widely underlain by up to 40 cm long and few mm-thick monomineralic layers; microbial tufts (1-2 cm in height) show increased calcification within their interior. XRF elemental scanning of fresh slabbed and polished handsamples indicates (1) that the monomineralic layers underlying the microbial mats consist of pure carbonate (calcite, dolomite), now largely replaced by microcrystalline quartz, and that (2) Fe is enriched in the kerogenous mat remnants. SEM observations of freshly exposed kerogenous surfaces show interwoven, bundled and twisted filaments 1-3 μm in diameter, confirming mat biogenicity.

The close association of carbonate layers and microbial mats suggests that mat metabolic activity promoted their formation. An autotrophic metabolism, such as CO_2 fixation, would have increased the alkalinity of the pore fluid beneath the mat and induced carbonate precipitation. Alternatively or additionally, carbonate could have formed as a byproduct of a Fe-reducing metabolic pathway. Middle Archean photic-zone filamentous microbial mats may have, at least in its upper layers, employed a photosynthetic strategy.

Trace metal inputs from river-fed and river-starved margin sediments of the South Atlantic Ocean

WILLIAM B. HOMOKY[1]*, RACHEL A. MILLS[1], YU-TE HSIEH[2,3], DEBORAH J. HEMBURY[1], E. MALCOLM S. WOODWARD[4] AND GIDEON M. HENDERSON [2]

[1]Ocean and Earth Science, National Oceanography Centre Southampton, University of Southampton, SO14 3ZH, UK (*Correspondence: w.homoky@soton.ac.uk, rachel.mills@soton.ac.uk, d.hembury@noc.ac.uk)
[2]Department of Earth Sciences, Univeristy of Oxford, South Parks Road, OX1 3AN, UK (gideonh@earth.ox.ac.uk)
[3]Program of Atmosphere, Ocean and Climate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA 02139, USA (yuteh@mit.edu)
[4]Plymouth Marine Laboratory, Prospect Place, The Hoe, Plymouth, PL1 3DH (EMSW@pml.ac.uk)

Trace metal exchange between sediments and seawater may play an important role in providing micronutrients to the ocean. Continental margin fluxes of metals such as Fe remain poorly constrained but may be important in the global carbon cycle [1]. A selection of micronutrient trace metals have been measured in porewaters and sediments from the slopes on both sides of the South Atlantic Ocean to determine such margin fluxes to a region of high primary productivity in the surface ocean. Intact surface sediments were collected by coring activities on two UK GEOTRACES expeditions (D357 and JC068; GA10) from 12 sites between the River Plate-fed Uruguyan margin and the comparatively river-starved Cape margin of South Africa.

Macronutrient and micronutrient concentrations are principally coupled to organic carbon oxidation at all sites. Fe and Mn inputs to the South Atlantic are calculated from the relationship between porewater metal and high-resolution oxygen data. Dissolved fluxes of Fe and Mn on the Uruguyan and South African margins have notable differences in their magnitude and down-slope distribution. We show the variability of metal supply reflects (a) enhanced organic carbon respiration on the river-fed Uruguyan margin, and (b) the depleted metal substrate reservoir on the comparatively river-starved Cape margin of South Africa. This study provides new constraints on dissolved micronutrient inputs to South Atlantic deep waters which subsequently upwell in the Fe-starved Southern Ocean. It also provides information about the general role of sediments in micronutrient fluxes to seawater.

[1] Boyd and Ellwood (2010) *Nature Geoscience*, **25**(10), 675

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