High-resolution metabolomics reveals unusual *N*-methyl *lyso* phosphatidylethanolamines as abundant and strain-specific lipids in acid mine drainage biofilms

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High-resolution untargeted metabolomics was applied to 14 distinct biofilm samples retrieved from the air-solution interface of acid mine drainage (AMD) solutions within the Richmond Mine (Iron Mountain, Redding, CA). Among the detected metabolites, we identified and characterized a group of *lyso* phosphatidylethanolamine lipids which were highly abundant. The unusual polar head group structure of these molecules is similar to lipids found in phylogenetically unrelated acidophilic chemoautolithotrophs and may be related to the affinity of these lipids for iron and calcium ions. Correlations of *lyso* phospholipid and strain-resolved protein abundance patterns suggest a link between the *lyso* phospholipids and the UBA-type substrain of *Leptospirillum* group II. By combining high-resolution molecular "omic" technologies, we demonstrat Focusing of upward fluid migration due to mineral grain size variation

e the ability to identify cryptic but organism-specific small molecules that may be of paramount importance to biogeochemical processes occurring in mining impacted environments.

A spatial perspective on Nd isotope records from the Western Indian Ocean: Evidence for a 'boundary exchange' control?

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Reconstructing past water mass mixing using Nd isotopes relies upon the quasi-conservative behaviour of this tracer. In contrast, recent studies in the modern oceans have demonstrated that 'boundary exchange' [1] and/or reversible scavenging [2] may be important processes in the Nd cycle. 'Boundary exchange' in particular would complicate our interpretation of down core Nd isotope records, since any significant addition of Nd from sediments would make the proxy behave non-conservatively. However, modelling studies at a global scale [3, 4] have been unable to distinguish between advection and 'boundary exchange' as the dominant control on the Nd isotopic distribution of seawater.

In this study, using 10 sediment cores from the deep western Indian Ocean, we address the importance of 'boundary exchange' from the Madagascar and Mascarene Plateau margins. Deep water ε_{Nd} composition is reconstructed using foraminiferal coatings, which agree within error with bulk sediment leachates. Holocene core tops located along the south-to-north flow path of Circumpolar Deep Water (CDW) record different ε_{Nd} values. Cores nearest to the inflow record an ε_{Nd} of -8.6, which shifts to -11.3 near Madagascar and -7.1 near Mascarene. Comparison to detrital ε_{Nd} in the same cores suggests a control by local sedimentary inputs from Madagascar and the Mascarene Plateau. This allows a first attempt to quantify 'boundary exchange' along this margin and potentially to reconstruct past changes. Cores to the south of the Madagascan margin (i.e. upstream in deep water flow) appear to record the changing advected composition of CDW across Termination I, whereas marginal sites record offset ε_{Nd} values and reduced glacial-interglacial variability. This underlines the importance of deciphering 'boundary exchange' before inferring global ocean circulation changes from Nd isotope records. Additionally, it may provide insight into temporal changes in the inputs, and therefore budget, of REE's and other particle-reactive elements in the oceans.

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