Mineral formation in Euglena as a marker for biologically driven sediments

Michelle Ryan[1], Jason Reynolds[1], Hayden Davies[1]
[1]*Western Sydney University*

Euglena mutablis is a photosynthetic protest often found in acidic aquatic environments including; geothermal lakes, peat bogs, and acid mine drainage systems. These environments are generally considered toxic to biota with E. mutablis considered a bioindicator of these landscapes. Capable of both photosynthesic metabolism and organic matter synthesis, it is highly-likely that these protists not only cope with extreme environments, but may act to drive mineral formation and precipitation. Acid mine drainage (AMD) landscapes total to over 300 significant sites in Australia at which Euglena spp. have been identified at over half. Formation of organo-mineral complex may accrue organic materials and meta-stable environments. This alteration to thermodynamics may explain several phenomena related to various mineral formations found in sediments in soils from acid mine drainage (AMD) systems. .

In this work E. mutablis from pure culture and sourced from AMD systems was cultured in synthentic AMD. The growth characteristics of the protists were studied in a range of typical AMD waters (pH 0.5 to pH 4.0) and precipitates collected and identified using scanning electron microscopy and powder x-ray diffraction. Confocal microscopy techniques were utilised to better understand the dynamics of mineral precipitation both internal and external of the protists.

Collected precipitates from the experiments were compared to sediments and soils that were collected in AMD systems. The E. mutablis precipitates were dominated by highly-crystalline hydronium-jarosite with a decreased likelihood of potassium- and plumbo-jarosite (even when the experiment was tailored to preference these forms). The experimental results were reflected in the collected sediments but not in the collected soils which were dominated by potassium-jarosite. Overall, this research demonstrates that standard thermodynamic models for mineral formation may not hold true when E. mutablis is present.