Liposome study of MtrABC: A Porin cytochrome electron transport system from *Shewanella oneidensis*

G.F. WHITE*, M.J. EDWARDS, N.A. BAIDEN, A. HALL, J.N. BUTT, D.J. RICHARDSON AND T.A. CLARKE

University of East Anglia, Norwich NR4 7TJ, UK (*correspondence: gaye.white@uea.ac.uk)

S. Oneidensis are able to respire in the absence of oxygen because they can use oxidised metals, external to the cell, as terminal electron acceptors. This involves electron transfer across the bacterial cell envelope to the surface of minerals such as Fe(III) and Mn(IV) oxides. Genetic knockout studies have identified a suite of proteins associated with electron transport through the outer membrane [1]. This includes the MtrABC complex. Studies of these proteins led to the putative model for Porin-Cytochrome Electron Transport (PCET) shown in Fig. 1 below [2, 3].

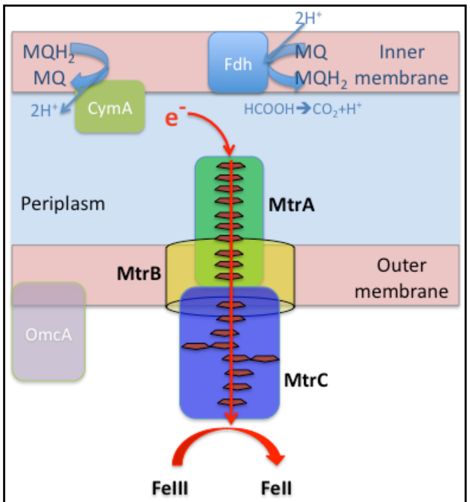

Fig. 1. Electron transport via the putative PCET system, MtrABC from *S. Oneidensis*

In this model the decaheme cytochromes MtrA and MtrC meet inside the transmembrane sheath, MtrB. The 20 hemes are closely aligned allowing electrons to flow through the MtrAC "wire". To test this model, we have inserted MtrABC into liposomes containing a hydrophyllic electron source, reduced methyl viologen, that also acts as a redox indicator. We describe the development of this technique and present our investigations into PCET via MtrABC across a lipid bilayer to a range of soluble and insoluble minerals.

[1] Myers *et al*. (2002) *App. Env. Microbiol*. **68**, 2781-2793. [2] Ross *et al*. (2007) *App. Env. Microbiol*. **73**, 5797-5808. [3] Hartshorne *et al*. (2009) *PNAS*. **106**, 22169-22174.

Correlated uranium concentration, radiation damage, and increased SHRIMP U/Pb ages of zircon

LLOYD T. WHITE* AND TREVOR R. IRELAND

Research School of Earth Sciences, The Australian National University (*correspondance: lloyd.white@anu.edu.au)

SHRIMP U-Pb age calibrations require an accurate calibration of the observed ion ratios. Previous work has shown that there is a correlation between highly elevated uranium concentrations (>3000 ppm) and an increase in apparent age [1]. This "high uranium effect" has been attributed to U, Pb gain or loss, matrix-dependent sputtering, and changes in secondary ionisation effeciency of different species. If this process is systematic, then it may be possible to obtain a calibration that will allow correction of high U spots and allow comparison with more normal zircon.

We report results from SHRIMP I, II and RG analyses of several samples of varying uranium concentration and age (~20 Ma, ~50 Ma, ~100 Ma and ~180 Ma). Our results suggest that the "high uranium effect" can vary between different geometries of SHRIMP (i.e. I, II and RG) and may (at least in part) relate to how the machine is calibrated. It also appears that the "high-uranium effect" is more pronounced in the older zircons.

Raman spectroscopy was used to analyse some of the zircons that had been analysed previously with SHRIMP. This was done so that the uranium concentration and U/Pb age was known for each Raman analysis. The Raman results suggest that the correlation between uranium concentration and age is complex, but implies that the older apparent ages obtained from SHRIMP are related to zircons that have lost some, or all of their crystalline structure. Thus, the "high-uranium effect" is more problematic in older zircons because of accumulated radiation damage, which will also promote Pb redistribution.

[1] Williams & Hergt (2000), *Beyond 2000: New Frontiers in Isotope Geoscience*, Woodhead, Hergt, & Noble (eds), Lorne, Abstract Proceedings, p. 185-188.