Geophysical Research Abstracts, Vol. 9, 08111, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08111

The effect of extracellular polymers (EPS) on the proton adsorption characteristics of the thermophile *Bacillus licheniformis* S-86.

J.Tourney (1), B.T. Ngwenya (1), J.F.W. Mosselmans (2), L. Tetley (3)

(1) Grant Institute of Earth Sciences, The University of Edinburgh, West Mains Road, Edinburgh, UK, (j.tourney@sms.ed.ac.uk / +44 131.650 8517), (2) Diamond Light Source Ltd, Diamond House, Chilton, Didcot, Oxfordshire, UK, (3) Division of Infection & Immunity, IBLS, Integrated Microscopy Facility, Joseph Black Building, University of Glasgow, Glasgow, UK.

Owing to their abundance and high relative surface area, bacteria and other microscopic organisms are recognized as an important component of many geochemical processes, particularly cycling of trace metals. Characterising and quantifying the proton and metal adsorption mechanisms of the bacterial cell wall is the first step towards a better understanding of the role of bacterial cells in metal adsorption and mineralisation. Furthermore, the potential industrial applications of bacteria as biosorbents for heavy metals and other environmental contaminants merit further development.

Previous studies have concluded that the proton and metal adsorption characteristics of bacterial strains from different environments are sufficiently similar to be described by a generalised 'universal' model, involving a single set of stability constants. However, slight differences according to species, growth medium, temperature and previous metal exposure have not been satisfactorily explained. More recently, the potentially important role of bacterial extracellular polymers (EPS) has become widely recognized. These polymers may have a significant effect upon the metal adsorption properties of bacterial cells, but their contribution is difficult to quantify owing to the current lack of understanding of bacterial EPS, in terms of compositional variability as well as adsorption behaviour.

This study investigated the contribution made by EPS to the adsorption of protons by the thermophile *Bacillus licheniformis* S-86. Acid- base titrations were conducted

using both intact cells and cells from which the EPS layer had been removed. Non-electrostatic surface complexation modelling was then undertaken in order to quantify the contribution made by the EPS to proton adsorption by this species. Results indicate the presence of four functional groups for both intact and EPS- free cells, tentatively identified as phosphodiester (site 1), carboxyl (site 2), phosphoryl (site 3) and amine (site 4). Site concentrations were found to be similar in intact and EPS- free cells for sites 2 and 3, but approximately 50% lower in the EPS- free cells for sites 1 and 4. These findings suggest that future studies should consider the potential involvement of EPS as a contributory factor to metal adsorption behaviour. The study also provides further constraints on the environmental conditions under which proton adsorption by bacterial species can be modelled with a single set of stability constants.