A new *Gallionellales* isolate: A model system for comparative studies of Fe-oxidizer physiology and biomineralization

CLARA S. CHAN*, SEAN T. KREPSKI AND GAURAV SAINI

Dept. of Geological Sciences, University of Delaware, Newark, DE 19716 (*correspondence: cschan@udel.edu)

The Fe-depositing bacterium *Gallionella ferruginea* was first described in the early 19th century based in part on its twisted ribbon-like stalk, which has since been widely used in its identification. In 1993, Hallbeck *et al.* [1] reported the 16S rRNA sequence of a stalk-forming isolate. Recently, researchers have isolated several Fe-oxidizing bacteria (FeOB) related to *Gallionella*; however, none produce biomineral structures that typically comprise Fe microbial mats, so we have made relatively little progress characterizing and linking FeOB physiology, biomineralization, and mat formation. Towards these goals, we have isolated a novel stalk-forming FeOB, strain R-1, from a freshwater Fe seep in Delaware, USA. R-1 is a neutrophilic, obligate Fe-oxidizing Betaproteobacterium. Despite strong morphological similarity to *G. ferruginea* [1], this isolate shares only 93.6% 16S rRNA gene sequence similarity. It is more similar (94.0-94.4%) to *Sideroxydans* isolates [2,3], which do not produce morphologically-distinct minerals. Its phylogenetic distance from other *Gallionellales*, especially its distance from *G. ferruginea* shows the high diversity of FeOB in this order.

R-1 is remarkably similar to the marine Zetaproteobacterial Fe-oxidizer *Mariprofundus ferrooxydans* PV-1, presenting an opportunity for comparative study. Both organisms are obligate FeOB isolated from Fe mats. R-1 oxidizes ~1-2x10^{-14} mol Fe/cell, comparable to PV-1 (0.9x10^{-14} mol Fe/cell). Like PV-1, R-1 cells are relatively Fe-free, with a fibrillar, ribbon-like Fe and polysaccharide-rich stalk, binding multiple lectins. We postulate that the R-1 stalk plays similar roles to that of PV-1, especially as a mechanism for removing Fe(III) waste from the cell [4]. TEM studies have shown that cell surface structure differs from PV-1, which may imply different surface chemistry. We have been investigating surface characteristics by atomic force microscopy, electrophoretic mobility, hydrophobicity tests, and probing by charged nanoparticles. Results to date suggest that both R-1 and PV-1 surfaces have near-neutral charge, which helps explain how cells avoid encrustation.

[1] Hallbeck *et al.* (1993) *J. Gen. Microbiol.* **139**: 1531-5. [2] Emerson and Moyer (1997) *Appl. Env. Microbiol.* **63**: 4784-92. [3] Lüdecke *et al.* (2010) *Env. Microbiol.* **12**: 2814-25. [4] Chan *et al.* (2011) *ISME J.* **5**:717-27.

Evaluation of relationships used to model sea surface iodide concentrations

R.J. CHANCE[1]*, A.R. BAKER[1], L.J. CARPENTER[2] AND T. JICKELLS[1]

[1]School of Environmental Sciences, University of East Anglia, UK (*correspondence: r.chance@uea.ac.uk)
[2]Department of Chemistry, University of York, YO10 5DD, UK

Sea-to-air exchange supplies reactive iodine to the atmosphere, where it contributes to tropospheric ozone depletion and particle formation, and allows the dispersal of radioactive iodine discharges. A major contributor to this process is the reaction of ozone with iodide at the air-sea interface. Sea surface iodide concentrations range from 5 to 200 nM, varying with latitude and proximity to the coast; the controls on this distribution are not well understood. Recent attempts to quantify the contribution of the ozone–iodide reaction to large scale ozone deposition [1,2] have modelled sea surface iodide concentrations using observed relationships between iodide and nitrate [3] or chlorophyll [4].

Here, we present new iodide measurements from the tropical eastern Atlantic and the Southern Ocean, incorporate these into a preliminary global surface iodide climatology and use this to evaluate the two different modelling approaches. We find that neither model was able to fully explain the observed global iodide distribution. We propose the compilation of a global iodide climatology which can be used to rigorously test models and new hypotheses concerning the marine biogeochemical cycle of iodine. If spatial resolution is sufficient, such a database might also be used directly in modelling studies.

[1] Ganzeveld *et al.* (2009), *Glob. Biogeochem. Cyc.* **23**, GB4021. [2] Oh *et al.* (2008), *Atmos. Environ.* **42**, 4453-4466. [3] Campos, Sanders & Jickells (1999), *Mar. Chem.* **65**, 167-175. [4] Rebello, Herms & Wagener (1990), *Mar. Chem.* **29**, 77-93.