Implications for extracellular iron-oxidation and production of biogenic iron oxides by Fe-oxidizing bacteria

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Neutrophilic Fe-oxidizing bacteria are known for production of a variety of morphotypes of extracellular biogenic iron oxides. These structures have multiple purposes. They remove the insoluble product of iron oxidation, Fe-oxyhyroxides, away from the cell in a coordinated matter – preventing entrapment of cells. They can also act as positioning systems allowing the cells to maintain positon in dynamic gradients of Fe(II) and O_2, as well as serve as a means for cells to translocate wthin key environmental gradients.

Our work has shown there are a variety of morphotypes of biogenic oxides associated with both marine and freshwater Fe-oxidizing bacteria. These range form a variety of tubular structures to helical stalks to morphotypes with no determinant shape. Mineralogically the biogenic oxides are composed primarily of poorly crystalline ferrihydrite that is relatively stable and resists diagenesis to more crystalline forms. They also contain exopolymers produced by the cells; however the nature of these exopolymers remains poorly understood. We will present a model that couples Fe-oxidation and exopolymer production, and present genomic data from a range of different isolates of Fe-oxidizing bacteria to better understand the diversity of mechanisms that may be involved in exopolymer production, as well as the nature of the exopolymer. The implications of these structures for processes like biocorrosion and adsorption of elements like phosphorus will also be addressed.