

Reductive dissolution of Fe(III) oxides by *Shewanella loihica* under submarine tailings disposal conditions

R. BENAIGES-FERNANDEZ^{1,2*}, J. PALAU², F.G. OFFEDDU², J. CAMA², J. URMENETA^{1,3}, J. M. SOLER²
AND B. DOLD⁴

¹Department of Genetics, Microbiology and Statistics. Universitat de Barcelona. Barcelona, Catalonia, Spain

²Institute of Environmental Assessment and Water Research (IDAEA, CSIC), Barcelona, Catalonia, Spain

³Biodiversity Research Institute (IRBio). Universitat de Barcelona. Barcelona, Catalonia, Spain

⁴ Division of Geosciences and Environmental engineering, Luleå University of Technology, Luleå, Sweden.

*Correspondence: robert.benaiges@idaea.csic.es

Shewanella is a well-known genus of marine bacteria capable of reductive dissolution of iron oxides (Dissimilatory Iron Reducing Bacteria, DIRB). DIRB may play an important role in biogeochemical reactions concerning iron oxides disposed on the sea bed. In particular, DIRB may interact with the iron oxides contained in mine tailings deposited offshore.

In this study, the capacity of *Shewanella loihica* PV-4 to bioreduce iron oxides under conditions similar to those in anaerobic sea sediments was evaluated. Results of batch experiments showed reductive dissolution of structural Fe(III) via oxidation of simple organic matter. In accordance with the amounts of Fe(II) released and acetate produced, the derived Fe(II)/acetate ratios and calculated bioreduction coefficients suggested an apparent reactivity of only 4% of the initial iron oxides.

A deficit of aqueous ferrous iron was caused by adsorption on the dissolving Fe-oxide and mineral transformation (e.g. ferrihydrite to magnetite). SEM images showed that *Shewanella loihica* attached on the Fe(III)-oxide surfaces during bioreduction. These findings suggest that dissimilatory reduction of Fe(III)-oxides contained in mine tailings disposed offshore could result in adverse ecological impacts.