# Occurrences and stability of Pb precipitates in bacterial biofilms

T. COUASNON[1*], A. GELABERT[1*], G. ONA-NGUEMA[2], S. ZANNA[3], B. MENEZ[1*], F. GUYOT[2]

[1]IPGP, 1 rue Jussieu, 75238 Paris Cedex 5, France, ([*]correspondence :couasnon@ipgp.fr, gelabert@ipgp.fr, menez@gmail.fr)

[2] Institut de Minéralogie, de Physique des Matériaux et de Cosmochimie, Sorbonne-Universités, MNHN, UPMC, IRD, UMR 7590 CNRS, 75252 Paris Cedex 05, France, (georges.ona-nguema@impmc.upmc.fr, francois.guyot@mnhn.fr)

[3] Physico Chimie des Surfaces, Chimie Paris, 11 Rue Pierre et Marie Curie, 75005 Paris (sandrine.zanna@chimie-paristech.fr)

Biofilms are one of the most common organizations of bacteria in the environment. A biofilm is a 3D organic framework composed of bacteria and microbially-secreted exopolymeric substances (EPS). Due to the high density and variability of functional groups present in this structure, and to the microbial activity that locally influences physical and chemical conditions at the microscale, biofilms are the loci of various mineral precipitations in the environment. In the case of lead, evidences of lead phosphates within biofilm structures have been reported [1]. These minerals are known for their high thermodynamic stability, and are thus considered to reduce the lead bioavailability and toxicity in polluted environments. However, the influence of the chemical and biological characteristics of biofilms on the lead phosphates stability remains largely unknown.

In order to understand the dynamics of bio-induced lead precipitation within biofilms, *Shewanella oneidensis* MR-1 biofilms were grown under aerobic conditions onto $Al_2O_3$ substrates, and exposed to various lead concentrations in a Mo-bearing solution. Results showed that precipitation occurred rapidly with the formation of pyromorphite $Pb_5(PO_4)_3Cl$ mainly at the liquid/biofilm interface. Precipitates were found either on cell surfaces or heterogeneously distributed within the EPS, suggesting a role of both the biopolymers' nature and the cell metabolism in the control of the supersaturation conditions with respect to Pb-bearing minerals. However, it's only after one week of exposure that was observed, instead of Pb-phosphates, the precipitation of wulfenite, a lead molybdate corresponding to the thermodynamically-stable mineral phase in these media,. These time-series observations hence underline the dynamic nature of bio-induced precipitation within biofilms with implications for Pb-phosphates stability and lead mobility in natural and human-impacted environments.

[1] Templeton et al. (2001) *PNAS*, 98, 11897–11902