Uptake and release of traces gases at the mineral dust surface

D'Anna Barbara[1], Marieme Ndour[1],
Maria Sassine[1], Melanie Nicolas[1], Oumar Ka[2]
and George Christian[1]

[1]Institut de recherches sur la catalyse et l'environnement de Lyon, UMR5256, Université de Lyon 1, CNRS, Villeurbanne, France
[2]Faculté des Sciences et Techniques, Université Cheikh Anta Diop, Dakar-Fann, Sénégal

Approximately 2000Tg of mineral aerosol are uplifted annually into the mid troposphere and transported over very large distances. Evidence from field, laboratory and modelling efforts are increasingly pointing towards an important role of mineral dust as provider of reactive surfaces for several trace gases. The interaction of mineral dust with atmospheric NO*x* – NO*y* trace gases is particularly interesting due to its potential impact on photochemical ozone production. And an increase in the nitrate content of dust during transport over polluted regions has been documented on several occasions and model studies have confirmed that this is consistent with the uptake of reactive NO*y* traces gases. Nitrate formation on dust particles is therefore considered a sink for atmospheric NOy (such as HNO_3).

The present work shows that mineral dust is an effective photocatalyst (due to Ti, Al and Fe traces) and can enhance some chemical reactions that otherwise would be unfavourable. Our recent results demonstrated that NO_2 conversion into HONO and nitrate ions is highly enhanced on mineral dust and proxy (SiO_2-TiO_2) under near-UV irradiation. In addition to NO_2 conversion, the photoinduced loss of other important traces gases as O_3 and formaldehyde at the surface of the minerals oxides (SiO_2-TiO_2) is demonstrated. Considering the photocatalytic properties of mineral dust, the stability of nitration anions on dust and the possibility of a 'renoxification' process, with NO or NO_2 production, has also been investigated. We further present results of photodissociation of nitrate ion doped mineral oxides such as SiO_2 and/or TiO_2 at mixing ratios related to atmospheric issues.

Bioavailability of Hg in presence of anthropogenic ligands

Amy L. Dahl[1], J. Sanseverino[2] and J.-F. Gaillard[3]

[1]Frontier Geosciences, 414 Pontius Ave N, Seattle, WA 98109. (amyd@frontiergeosciences.com)
[2]Center for Environmental Biotechnology, University of Tennessee, Knoxville, Tennessee 37996-1605 (jsansev@utk.edu)
[3]Department of Civil and Environmental Engineering, Northwestern University, Evanston, IL, 60208-3109 (jf-gaillard@northwestern.edu)

The introduction of anthropogenic ligands into the hydropshere enhances the mobility of metals. The common view is that when a metal is bound to a strong ligand such as EDTA its bioavailability is drastically reduced. We have tested this hypothesis in the laboratory by contrasting the results of analytical and equilibriun based chemical speciations with the response provided by a whole cell biosensor constructed by inserting a ***merR::luxCDABE*** fusion into the chromosome of ***Escherichia coli.*** In parallel, square-wave voltammetry (SWV) measurements and thermodynamic calculations were performed to study the chemical speciation of Hg.

Results and Discussion:

The amount of electro-labile Hg(II) measured by SWV was similar to the amount of free Hg(II) predicted from equilibrium calculations but the bioavailable fraction measured by the bioreporter was greater than the one expected by either equilibrium calculation or electrochemical analysis.

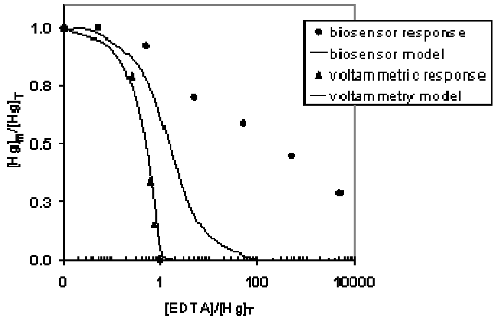

Figure 1: The biosensor response departs significantly from the chemical assessment of the bioavailable fraction.

These results will be dicussed in terms of the receptor ligands located at the surface of the cell that compete with EDTA.