

## Denitrification driven by pyrite oxidation and colonization of pyrite surface by *Thiobacillus denitrificans*

C. TORRENTÓ<sup>1</sup>, J. URMENETA<sup>2</sup>, K. EDWARDS<sup>3</sup>, J. CAMA<sup>1</sup>  
AND A. SOLER<sup>4</sup>

<sup>1</sup>Inst. of Environmental Assessment and Water Research  
IDAEA, CSIC, Barcelona (clara.torrento@idaea.csic.es)

<sup>2</sup>Dept. of Microbiology, University of Barcelona

<sup>3</sup>Dept. of Biological Sciences, University of Southern  
California

<sup>4</sup>Dept of Crystallography, Mineralogy and Ore Deposits,  
University of Barcelona

Denitrification is the most significant attenuation process of nitrate-polluted groundwaters, involving the reduction of nitrate via a chain of microbial reduction reactions to nitrogen gas. Some denitrifiers are autotrophs, obtaining their energy from the oxidation of inorganic species (e.g., pyrite). Although autotrophic denitrification regulated by pyrite oxidation has been suggested in field studies and positively tested in laboratory experiments [1], feasibility of denitrification driven by pyrite oxidation has been questioned several times. The present laboratory experiments aim at (1) studying the ability of *Thiobacillus denitrificans* to colonize pyrite surface and (2) to clarify whether pyrite acts as electron donor in the bacteria mediated denitrification. To this end, two series of batch experiments using either pyrite slabs or pyrite powder were performed under an anoxic atmosphere of N<sub>2</sub> and CO<sub>2</sub> (90%/10%).

Colonization and bacteria growth were studied on polished surfaces of the pyrite slabs (approx. ca. 3x1x1 mm) fully immersed in modified medium solution (thiosulfate, iron and sulfate-free specific medium for *T. denitrificans* growth) and inoculated with pure culture of *T. denitrificans*. Pyrite slabs were taken out every week. Cells adhered to pyrite surface were observed by SEM and quantification of cell density was made by UV-fluorescence microscopy. Results show that *T. denitrificans* colonize pyrite surface slowly with formation of microcolonies after 3 weeks of reaction.

To test denitrification driven by pyrite oxidation, similar experiments were performed, using pyrite powder (size fractions of 25-50 µm or 50-100 µm) instead of pyrite slabs. Aqueous samples were taken every 10 d. Results show that as pyrite oxidizes nitrate reduces with no accumulation of nitrite. Moreover, the nitrate reduction rate was dependent on pyrite reactive surface area.

[1] Torrentó *et al.* (2007) *GCA* **71**, A1032.

## Aerosol indirect effects on the global scale: Activation using parameterisations versus explicit hygroscopic growth

H. TOST<sup>1,2</sup>, K. PRINGLE<sup>1</sup>, S. METZGER<sup>1</sup>  
AND J. LELIEVELD<sup>1,2</sup>

<sup>1</sup>Max Planck Institute for Chemistry, Air chemistry  
department, Mainz, Germany (tost@mpch-mainz.mpg.de)

<sup>2</sup>Energy, Environment and Water Research Center, The  
Cyprus Institute, Nicosia, Cyprus

The processes of aerosol activation to form cloud droplets represent a major uncertainty in global atmospheric chemistry and climate modelling. In addition to the available moisture, the mass, number and chemical composition of the aerosol particles determine the amount of cloud droplets originating from activated aerosols.

This study analyses the process of aerosol activation in the general circulation model EMAC (ECHAM5/MESy Atmospheric Chemistry version) in which the microphysical and thermodynamical characteristics of the atmospheric aerosol are determined by the GMXe submodel. Aerosol activation into cloud droplets can be calculated either using state-of-the-art parameterisation schemes or alternatively it is explicitly derived from the hygroscopic growth of the particles.

Effects on both cloud and precipitation properties from model simulations using the different approaches are inter-compared and thus the impact of this process on the indirect aerosol effects is determined.