THEME 4:
The Earth's Surface

Session 4:2

Metals in the environment: Molecular processes and the role of metals in soil, sediment and water

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Direct observations at the molecular scale by spectroscopic, stable isotope or microscopic techniques allow the study of metal speciation, adsorption, (co)precipitation and redox transformations, in unprecedented detail. Microscale measurements are now also possible by techniques such as analytical electron microsopy, laser-ablation or micro-EXAFS. The challenge for future progress is the application of such detailed molecular information to interpretations of large-scale phenomena, such as plant-soil interactions, contaminant transport in groundwater, trace metal mobilization by acidification or sulfide oxidation and the development of paleo-redox indicators for sediments. This session brings together specialists from a number of fields to discuss current trends in trace-metal research that bridge between molecular-level observations and the field scale.

4.2.11

Trace elements interaction with phototrophic anaerobic bacteria and cyanobacteria: A physico-chemical approach

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This study is aimed at characterizing the interaction of divalent metals (zinc, cadmium lead, manganese, strontium) with bacterial cultures via rigorous physico-chemical quantification of metals adsorption on the cells under controlled laboratory conditions. Gramm-negative thermophilic anaerobic phototrophic bacteria (*Chloroflexus auranticas*), mesophilic purple bacteria (*Rhodopseudomonas palustris*) and cyanobacteria (*Myxosarcina* and *Aphanocapsa*) isolated from natural sources of Kamchatka peninsula (Russia) were used in the present study. Within this track, macroscopic measurements (metal adsorption, surface titration, electrophoretic mobilities) and spectroscopic observations (XPS, FT-IR) were combined to determine the nature and concentration of the major specific surface functional groups (carboxyl, hydroxyl, phosphoryl, amine) responsible for the amphoteric behavior of cell surfaces and their interactions with adsorbed metals. Experiments of metal adsorption on bacterial cultures were performed as a function of pH (Figure) and metal concentration in solution.

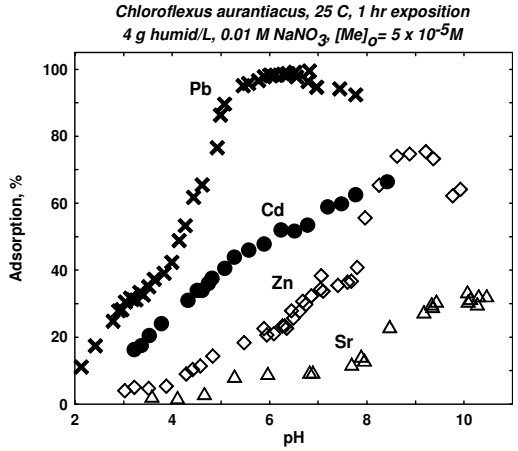

Figure. pH-dependent adsorption edge of divalent metals on *Chloroflexus a.*

Parameters of Langmuir adsorption isotherms were extracted from adsorption curves at constant pH and a Surface Complexation Model (SCM) of bacteria – aqueous solution interface was generated that allows prediction of metal adsorption edges at various environmental conditions.