Natural and anthropogenic aerosols and their effects on clouds, precipitation and climate

M.O. ANDREAE

Max Planck Institute for Chemistry, Mainz, Germany

The aerosol in today's atmosphere is a blend of particles of natural and anthropogenic origin. Because the lifetime of aerosol particles is comparable to the time scale of intra-continental and intercontinental transport, anthropogenic aerosols are ubiquitous and the natural 'background' aerosol is difficult to observe and quantify with confidence. From *in situ* measurements of aerosol concentrations at remote sites, together with data on appropriate pollution tracers, estimates of the natural concentrations of aerosols can be derived. The concentrations of cloud condensation nuclei (CCN) can be obtained using either direct measurements or information on size spectra and aerosol hygroscopicity. Adding remote sensing information makes it possible to up-scale the *in situ* observations to a global picture of the natural continental aerosol and its anthropogenic perturbation. The results show that natural CCN concentrations are low over both oceans and continents, which implies that cloud processes in much of today's atmosphere are substantially different from those in the pre-anthropogenic system. A conceptual model to describe the effects of these perturbations on precipitation and cloud dynamics, as well as examples of observations of these effects will be presented.

Experimental study of carbon sequestration reactions controlled by the percolation of CO_2-rich brine through peridotites

M. ANDREANI[1], L. LUQUOT[2], P. GOUZE[2], M. GODARD[2], E. HOISÉ[3] AND B. GIBERT[2]

[1]Laboratoire des Sciences de la Terre, UMR5570, Université Lyon1-ENS, 2 rue Raphaël Dubois, 69622 Villeurbanne, France (muriel.andreani@univ-lyon1.fr)

[2]Géosciences Montpellier, UMR 5243, Université Montpellier2, 34095 Montpellier, France.

[3] Laboratoire de Géologie, UMR8538, Ecole Normale Supérieure, 75231 Paris, France.

Carbonation of ultramafic rocks in geological reservoirs is, in theory, the most efficient way to trap CO_2 irreversibly; however, possible feedback effects between carbonation reactions and changes in the reservoir permeability must be considered to assess realistically the efficiency and sustainability of this process. We investigated changes in the hydrodynamic properties of sintered dunite samples by means of percolation experiments, under conditions analogous to that of *in situ* carbonation [1].

Our results show that carbonation efficiency is controlled by the local renewal of the reactants and the heterogeneity of the pore structure. Preferential flow zones are characterized by the formation of magnetite and of a silica-rich layer at the olivine surfaces, which eventually inhibits olivine dissolution. Conversely, magnesite and siderite are formed, together with Mg-TOT-phyllosilicates, within reduced-flow zones. Thus, carbonate precipitation decreases porosity, but only in zones where diffusion-controlled transport is dominant, which does not affect sample permeability (controlled by the main flow paths). Consequently, while high flow rates will decrease the carbonation efficiency of the reservoir and low flow rates may reduce the permeability irreversibly close to the injection point, moderate injection rates will assure a partial carbonation of the rock and maintain the reservoir permeability.

[1] Andreani *et al.* (2009) *Envir. Sci. Technol* **43(4)**, 1226-1231.