Chemical modification of airborne mineral dust

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Introduction

Mineral dust aerosol, i.e. suspended soil particles, can impact a wide range of global processes including the chemistry of the Earth's atmosphere and the Earth's climate. Atmospheric processing of mineral dust through heterogeneous chemical and photochemical reactions will modify the properties of the dust particle and thus alter how these particles impact global processes [1-3].

Approach

Using a combined approach of applying state-of-the-art surface sensitive probes, aerosol instrumentation and reactivity studies provides for an understanding of reactions on dust particles and how these reactions can alter the global impacts of mineral dust aerosol. These laboratory studies can provide a conceptual framework from which to understand the details of chemical processes that modify the properties of mineral dust aerosol as these particles are transported through the atmosphere [4].

Discussion of Results

The importance of mineralogy, the link between interfacial chemistry and climate and the specificity of mineral dust aerosol chemistry will be discussed. Examples will be shown that clearly provide evidence to show that mineral dust modifies the chemical balance of the atmosphere through heterogeneous reactions and that heterogeneous reactions modifies the physicochemical properties of mineral dust particles.

[1] Usher *et al*. (2003) *Chem. Rev.* **103**, 4883-4940. [2] Cwiertny *et al*. (2008) Ann. Rev. Phys. Chem. *59*, 27-51 [3] Gasso *et al*. (2010) *Elements* **6**, 247-253. [4] Hatch and Grassian (2008) *J. Env. Mon.* **10**, 919 – 934.

Stable isotopes of organics and inorganics of Aptian lacustrine sediments in North-Eastern Brazil

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The Jatobá Basin is located in the Pernambuco-Alagoas massif, NE Brazil. The elliptical basin, orientated NE-SW, is characterized by a semi-graben structure with tilted blocks toward NW direction. The analysed section [1] consists of shales, marls, sandstones, limestones and dolostones.

Stable isotope analysis was carried out on carbonates and organic matter. TOC content varies from 0.5-13 wt%, Hydrogen and Oxygen Indecies from 6 to 715 and 4 to 44 respectively. The organic matter is immature (R_o % 0.28) and is represented by kerogen Type I in the lower section. In the upper section it is modified by the addition of terrestrial organic matter. A ~3 m thick clay-rich shale seperates the the sections.

	Lower section	Upper section
$\delta^{13}C$ Carbonates	-8.72 to -3.65	-3.57 to +2.47
$\delta^{18}O$ Carbonates	-8.09 to -4.98	-8.67 to -4.11
$\delta^{13}C$ Pr + Ph	-28.25 to -31.66	-31.66 to -30.28
$\delta^{13}C$ C_{29} Steranes	-26.39 to -30.12	-30.12 to -28.08
$\delta^{13}C$ C_{30} Hopanes	-27.40 to -32.96	n.d.

Table 1: Variation and trends in $\delta^{13}C_{PDB}$ ‰ and $\delta^{18}O_{PDB}$ ‰ of carbonates and $\delta^{13}C_{PDB}$ ‰ organic compounds.

$\delta^{18}O$ of carbonate minerals (Table 1) indicates fresh water conditions throughout the sediment column. In the deepest part of the lower section dolomite occures together with high TOC contents. Here $\delta^{13}C$ suggests intense microbial activity during carbonate formation. In contrast, $\delta^{13}C$ shift to more positive values in the upper part, indicating less microbial influence. The upward trend of organic $\delta^{13}C$ is towards lighter values in the lower section and heavier values in the upper section (see Table 1). This is interpreted as the result of changing environmental conditions and enhanced terrigeneous organic matter input.

[1] Vortisch *et al*. (2011). *MinMag*, this volume.