



## **Impact of phot-redox chemistry on dust dissolution in cloud droplets**

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It is now well known that transition metals play an important role in the atmospheric cloud chemistry. Indeed, these elements are involved both in catalytic and oxido-reduction reactions (Jacob et al., 1986; Grgic et al., 1999; Weschler et al., 1986; Faust and Hoigné, 1990). Dissolution processes, leading to trace metals incorporation in aqueous phase, have already been studied and shown a great dependence on different parameters such as pH, aerosol nature and surface properties of the particles. (Zhuang et al., 1992; Spokes and Jickells, 1996; Desboeufs et al.; 2001). The aim of this work was to determine the photochemical impact on dust dissolution and indirectly on the speciation of the dissolved trace metals by experimental investigation.

Laboratory experiments were conducted in an open flow dissolution reactor in which particles are leached by simulated atmospheric water, i.e. an aqueous solution acidified to pH 4.7 with sulfuric acid. We worked with different kinds of dust coming from arid or semi arid regions (Niger, Capo Verde, Tunisia, and China).

At first, three series of experiments were carried out, respectively in darkness conditions, in light conditions and in switching on the light after 20 minutes of experiment. Among the four soils studied, only Capo Verde and Niger showed a clear dissolution variation in function of light parameter but only transition metals, Fe and Mn, were affected. By example for the manganese, the lightning increases the dissolution rate up to 900% in the case of Capo Verde soil and up to 68% for the Niger one. Redox reactions and mineralogical metal speciation are then envisaged to explain this speciation of light action.

In order to verify the implication of photo-redox chemistry, we have carried out experiments on Nigerian dust with a leaching solution compound with sulfuric acid and hydrogen peroxide like oxidant agent. Thus, photochemical dissociation of H<sub>2</sub>O<sub>2</sub> with

radical production ( $\text{OH}$  and  $\text{HO}_2$ ) occurred. Experiments point out a different behavior for manganese and iron. For the manganese, the comparison between  $\text{H}_2\text{SO}_4$  solution and  $\text{H}_2\text{SO}_4/\text{H}_2\text{O}_2$  solution experiments in still illuminated conditions indicates an increase of 170% of the dissolved concentrations. In the case of iron, the increase of the dissolution, when the light is on after 15 minutes, is about 300% with a sulfuric solution whereas this increase is only of 50% when  $\text{H}_2\text{O}_2$  is present in the solution. Thus, the addition of hydrogen peroxide increases dissolution rate of manganese, whereas it represents an inhibiting factor for iron dissolution.

Finally it appears that dust dissolution is really linked to the light parameter and that redox processes are greatly implicated in transition metals dissolution.