

## Spectroscopy of megacryometeor

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The fall of large ice block from the clear sky is one of the most interesting phenomena in the atmospheric science. These ice blocks are generally termed as ice-meteors or hydrometeors. The atmospheric anomalies like megacryometeors have been supposed to be a potential natural hazard or geo-indicator of larger-scale chemical and physical changes of atmosphere. It is important to understand the exchange processes between the stratosphere and the troposphere, for prediction of global change. The numbers of these ice falls has enormously increased in the whole world. From 2006 to 2009, there are two documented megacryometeors have been recorded in India, the last one was fallen near Mt. Abu (September 20, 2009). This study represents the spectroscopic characterization to understand the hydrochemical features of the megacryometeor fell at Ataliagaon (weighting 10kg) on October 4, 2004 at 11: 00 local time, near Jorhat town (Lat. 26°44'19" N, Long. 94°09'31" E, Assam, India)[1]. This characterization is performed using FTIR, AAS, and hydrochemical analyses (pH, electrical conductivity and ion concentrations). The pH value of the megacryometeor water varies from 7.76 to 7.91 ( $\pm 0.09$ ) and its conductivity value varies from 64.7 to 78.9 ( $\pm 5$ )  $\mu\text{S cm}^{-1}$ . The inorganic anions  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{HPO}_4^{2-}$ ,  $\text{HCO}_3^-$ ,  $\text{F}^-$ ,  $\text{Br}^-$ , and  $\text{NO}_3^-$  are observed. The major elements Fe, As, Pb, Na, Cu, Mg, Cr, K, Mn and Ca are found in the sample. The IR spectra indicate some peak of organic compounds in the water of the ice sample, which was specifically extracted from the interior of the megacryometeor fragments.

[1] A report in *Ajir Asom* (daily newspaper) October 5, 2004 .

## Redox transformation of arsenic by Fe(II)-activated goethite: Impact of Humic Acids and Fe(II)

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The redox state and speciation of the metalloid arsenic (As) determine its environmental fate and toxicity. Knowledge about biogeochemical processes influencing arsenic redox state is therefore necessary to understand and predict its environmental behavior. Here we quantified arsenic redox changes by anoxic pH-neutral goethite [ $\alpha\text{-Fe}^{\text{III}}\text{OOH}$ ] mineral suspensions amended with Fe (II) using wet-chemical and synchrotron X-ray absorption (XANES) analysis. Goethite itself did not oxidize As (III) and, in contrast to thermodynamic predictions, Fe (II)-goethite systems did not reduce As (V). However, we observed rapid oxidation of As (III) to As (V) in Fe (II)-goethite systems. Mössbauer spectroscopy showed initial formation of  $^{57}\text{Fe}$ -goethite after  $^{57}\text{Fe}$  (II) addition plus a so far unidentified additional Fe (II) phase. No other Fe (III) phase could be detected by Mössbauer, EXAFS, SEM, XRD, or HR-TEM. This suggests that reactive Fe (III) species form as an intermediate Fe (III) phase upon Fe (II) addition and electron transfer into bulk goethite but before crystallization of the newly formed Fe (III) as goethite. In summary this study indicates that in the simultaneous presence of Fe (III) oxyhydroxides and Fe (II), as commonly observed in environments inhabited by iron (III)-reducing or iron (II)-oxidizing microorganisms, As (III) oxidation can occur. This potentially explains the presence of As (V) in reduced groundwater aquifers. This presentation will also include ongoing studies attempting to elucidate the impact of humics and Fe (II) concentration on As (III) oxidation in these systems.

[1] Amstaetter, K., Borch, T., Larese-Casanova, P., Kappler, A. (2010) *Environ. Sci. Technol.* **44**, 102–108.