Microbial diagenesis of gypsum

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Sedimentary evaporitic gypsum deposits may come into contact with organic matter-rich sediments or hydrocarbon-rich fluids. If the temperature is below 80°C, such an association allows the development of microbial communities dominated by sulphate-reducing bacteria, which 'dissolve' gypsum and promote carbonate and sulphur precipitation. We investigated sulphur-bearing carbonate samples from Egypt, which are in close stratigraphical contact to Miocene evaporitic gypsum deposits [1, 2]. Mineralogical and petrographical observations indicated the presence of carbonate pseudomorphs after gypsum crystals which were often associated with euhedral elementary sulphur.

A new semi-automatic analytical method was developed to differentiate between carbon and oxygen stable isotopic compositions of each carbonate pool in mixtures of calcite and dolomite. All carbonates were depleted in ^{13}C ($-24.5‰ < \delta^{13}$C (vs PDB) $< -2.8‰$) but only calcite samples isotopic compositions showed a correlation with the isotopic composition of the organic matter found in the samples.

Lipid biomarkers analyses showed the presence of petroleum hydrocarbons together with specific bacterial and archaeal lipids indicating the presence of a mixed microbial community. New non-isoprenoidal macrocyclic DiAlkyl Glycerol Diethers (DAGEs) were identified, showing structural similarities with DAGEs associated with bacterial communities in extreme environments [3, 4]. Based on the methods we have developped, our results suggest the microbial formation of diagenetic carbonates by sulphate-reducing bacteria using petroleum hydrocarbons as carbon source and gypsum sulphate as terminal electron acceptor.

[1] Aref (1998) *AAPG Bulletin* **82**, 336–352. [2] Rouchy *et al.* (1998) *Sediment. Geol.* **121**, 23–55.[3] Pancost *et al.* (2006) *Geobiology* **4**, 71–92.[4] Stadnitskaia *et al.* (2003) *Archaea* **1**, 165–173.

Deployment of a compact sequential 2 Photon LIF detection system for gaseous elemental mercury at ambient levels

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Elemental mercury is the dominant form of mercury in the atmosphere and its concentration varies over a wide range from a few ng/m^3 in remote areas to up 1000 ng/m^3 near pollution sources. Most of the atmospheric sampling up to date is done by the Tekran 2537 mercury analyzer with a time resolution of a few minutes.

The experimental technique we developed for the analysis of gaseous mercury is based on the 2 Photon Laser Induced Fluorescence (LIF) described in [1]) The first excitation step is produced by the frequency double output of a dye laser pumped from the third harmonic of a Nd-YAG laser. The second excitation step is produced by the output of a dye laser that is pumped by the second harmonic of the Nd-YAG laser mixed with the fundamental of the Nd-Yag laser. The fluorescence is detected by a solar blind photo multiplier tube (PMT). Several PMTs and filter were tested

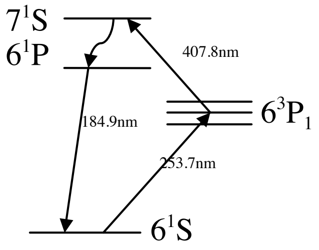

Figure 1: Two Photon LIF excitation scheme of elemental mercury with the excitation steps at 253.7nm and 407.8nm and the fluorescence at 184.9nm

The instrument was tested for the sampling of marine boundary layer air. We discuss the results in comparison to our laboratory measurements and the sensitivity and time resolution of the Tekran mercury analyzer.

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[1] Bauer *et al.* (2002) *J. Environ. Monit.* **4**, 339–343.