Automated characterization of Eyjafjallajökull ash cloud particles

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The Eyjafjallajökull (EFJ) ash cloud crisis caused an airspace closure over Europe in April 2010 and had an important impact on economy. During this crisis the Dusseldorf University of Applied Sciences performed several measurment flights over north-western Germany with a light aircraft equipped among other with an optical particle counter (OPC) [1]. The primary goal of the airborne campaign (two flights F1 and F2, 18th May, different routes) was to compare the model calculation of the Volcanic Ash Advisory Center (VAAC) with *in situ* observation. The aim of this work is to present results of computer controlled scanning electron microscopy (CCSEM) coupled with engergy dispersive X-ray spectroscopy (EDX) applied on particles sampled on PTFE filters obtained from the OPC outlet. CCSEM/EDX generates morpho-chemical data of over 1000 particles in a few hours.

Many of the particles sampled during F1 were silicate dominated particles with compositions similar to the ones obtained from ash particles sampled on Iceland during and after the eruption of EFJ. Augitic clinopyroxenes could be identified morphologically. X-ray diffraction analyses of the eruption products confirm the presence of augite phenocryst. This points to the conclusion that the aerosol sampled during F1 was indeed volcanic ash from EFJ. Volcanic particles up to 6.5 μm were present, much larger than the conventional dispersion model would predict. The maximum mass concentration recorded inside the ash cloud by OPC was 330 $\mu g/m^3$. On the filter, sampled during F2, clays, carbonates, sulfates and quartz were present. Volcanic ash particles, however, were almost absent.

Chemical fingerprints of *in situ* collected samples are one way to ascertain the volcanic nature of an aerosol cloud. CCSEM can deliver such fingerprints. We were able to confirm the presence of the volcanic cloud over some parts of north-western Germany the 18th May 2010, but also to show that not all higher aerosol concentrations in the free troposphere could be attributed to the presence of volcanic ash. The obtained results from the measurement flights agree with the model of VAAC at its scale.

[1] Weber *et al*. (2011) *Atm. Env*. S-11-00415, submitted.

A record of Paleoproterozoic sulfur cycling from ~2 Ga Zaonega Formation, NW Russia

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Major environmental upheavals of global nature characterize the early Paleoproterozoic including the deposition of unprecedented amounts of organic matter during the Shunga Event ~2 billion years ago. Within the depositional environment, this organic matter fueled respiratory processes, among them the microbial reduction of an oceanic sulfate pool that developed in the aftermath of the Great Oxidation Event (GOE ~2.4 Ga). Ample evidence for microbially driven turnover of sulfate is provided by sedimentary pyrite in the organic-rich deposits of the Zaonega Formation, Onega Paleobasin, NW Russia.

Three drillcores were obtained from the Zaonega Formation in the course of the Fennoscandian Arctic Russia – Drilling Early Earth Project (FAR-DEEP) under the auspices of the International Continental Drilling Program (ICDP). Organic carbon rich samples from the Zaonega Formation contain abundant sedimentary Fe-sulfides exhibiting different morphologies suggestive of multiple stages of sulfide generations. In terms of diagenetic timing, these range from early diagenetic sedimentary pyrite to late generation pyrite and pyrrhotite occurring in cross cutting veins together with migrated bitumen.

Different forms of sulfur (AVS: acid volatile sulfide; CRS: chromium reducible sulfur) extracted from bulk rock samples throughout the succession yielded highly variable $\delta^{34}S$ values ranging between -8.1 and +25.6‰. Stratigraphic variations are discernible. The observed range in $\delta^{34}S$ values is consistent with a microbial origin via sulfate reduction and confirms previously published sulfur isotope data [1]. Guided by petrographic observations using transmitted and reflected light microscopy, a detailed sampling of different pyrite generations for subsequent sulfur isotopic work has been performed.

[1] Melezhik *et al*. (1999) *Earth-Science Reviews* **47**, 1–40.