Characterization of re-suspended ash from the Eyjafjallajökull

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The 2010 eruption of the Eyjafjalla volcano had a great impact on international air traffic as well as on the local population and illustrated the potential risks of active volcanism. The explosive reaction between magma and glacier ice produced an ash plume of up to 20 km in height in the atmosphere. The present study is focussed on re-suspended ash in ambient air samples collected near the volcano and aims to develop automated analysis techniques for airborne particles in volcanic environments.

Ambient air samples of airborne re-suspended ash were collected in winter 2010/11 with a passive sampler (Sigma-2, Deutscher Wetterdienst), positioned 12 km south of the eruption zone. In a first step, approximately 200 particles were characterized individually using an optical microscope under transmitted, polarized and cross-polarized light and an electron microprobe with BSE and EDX analysis. Subsequently, the light optical images from the same sample were processed with an automated image analysis program, which allowed for classification of the individual particles as glass, mineral, composite or agglutinated particles. Chemical compositions of individual particles were determined from EDX spectra. To gain a statistically relevant dataset for the sample and to maximize the efficiency of the analytic work, a larger area of the same sample, including the area studied manually, was examined using automatic single-particle SEM analysis (EDAX Genesis program), which resulted in characterisation of approximately 1600 particles. The results of both methods were compared against each other to evaluate the advantages and disadvantages of the different approaches and to advance this combined analytical approach. Additionally, one sample of re-suspended ash was examined using X-ray diffraction supplemented by Rietveld-refinement to determine its mineral content.

The examined particles range from 2.5-80 µm in size (equivalent diameters), and their size distribution is typical of ambient aerosol, particles, i.e., decreasing number of particles with increasing diameter. Only ~10% (surface area) of the particles consist of glassy material, i.e. most particles are crystalline. With a surface-area fraction of 63%, feldspar is the predominant mineral (plagioclase 43%, K-feldspar 20%), followed by pyroxene (18%), and quartz (12%). Minor quantities (≤1%) of olivine, ilmenite and titanite are found as well. The sample is also contaminated with salt of oceanic and/or volcanic origin. These results are consistent with the data obtained from the Rietveld-refinement.

Our study shows that a combination of automated and manual analysis is required to obtain best results. Only an automated method allows for examination of a large number of particles, but the manual control is necessary to collect more detailed information about the composition and the crystallinity of the individual particles.

Geochemical evaluation of the karstified Bangestan reservoirs in the Dezful Embayment, SW Iran

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Geochemical composition of carbonate sediments are in equilibrium with the contemporaneous sea-water composition in absence of considerable biotic fractionation. However, in carbonate sediments, diagenetic imprints may have considerable effects on primary sediments textures, mineralogy, reservoir quality and finally geochemical characters. Depending on some factors including primary (depositional) sediments characteristics, governing climate and diagenetic history, geochemical composition of carbonates has been altered by post-depositional overprints. Stable isotopes and trace elements analyses can be used as a good tool to measure the extent of these alterations[1,2]. Coupled imprints of tropical climate and recurring emersions had considerable effects on Middle-Upper Cretaceous carbonate reservoirs of the SW Iran (Dezful Embayment) and Middle East region[3]. Petrographic studies (from core to thin section scales) and geochemical analyses (stable isotopes and trace elements) were carried out on 478 samples from five giant and supergiant oilfields in these embayment to reveal the main diagenetic alterations of these karstified carbonate sequences (Fig. 1). Variations in $\delta^{18}O$ and $\delta^{13}C$ compositions and trace elements (Mn, Fe and Sr) concentrations are useful diagenetic indicators that resulted in classification of studied intervals into four diagenetic classes according to their meteoric diagenetic features, intensities and developments.

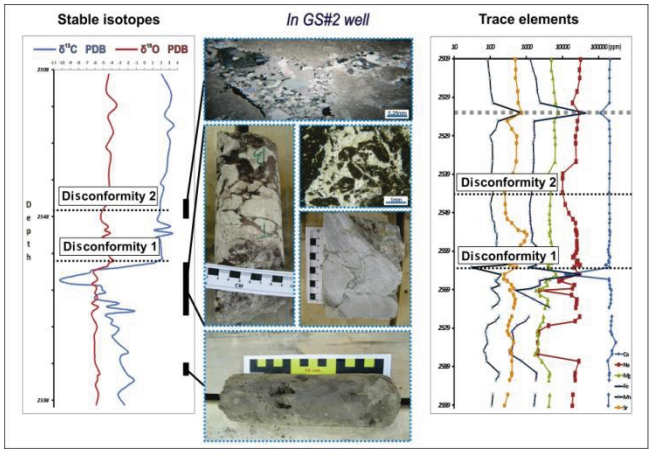

Figure 1: Plot of stable isotopes and trace elements versus depth including the petrographic evidences of karstified intervals of the Bangestan reservoir in GS-2 well.

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