Determination and comparison of acidic gas ratios at the Stromboli Volcano and Mount Etna obtained by various active alkaline traps

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Determining volcanic gas composition by direct plume sampling is still challenge in volcanic research. At most volcanoes (e.g. Stromboli volcano, Italy) scientists have to deal with difficult access to the plume, strong atmospheric dilution and varying weather conditions making a high sampling performance necessary.

Besides a more accurate quantification of the main acidic gas compounds (CO_2, SO_2, H_2S, HCl) a reduction of detection limits for less abundant species (HF, HBr, HI) were achieved in this work. For this purpose a Raschig-Tube [1] was modified and utilized for the application on volcanic plumes. The theoretical and experimental absorption properties of the Raschig-Tube (RT) and the Drechsel bottle (DB) [2] set-ups were characterized and afterwards applied simultaneously to the well-established Filter packs technqiue (FP) in the field (on Stromboli and Mount Etna). The obtained results make a comparison between the set-ups possible and help to point out the potential weakness and strength of each set-up. Additionally, the analytical procedure, including sample preparation, analysis by Titration, Ion Chromatography and Inductively Coupled Plasma Mass Spectrometry, was optimised to accurately quantify molar concentrations of dissolved compounds.

The progress in sampling and analysis led to a significant data set that covers most of the important elements. In particular, less abundant species were quantified more accurately due to the RT technqiue. Therefore, even iodine could be detected at Stromboli. Besides difficulties to determine fluorine and carbonate, influences of saturation effects on the FP results could be observed and characterized.

[1] Levin *et al.* (1980) *Radiocarbon* **22**, 379-391. [2] Liotta *et al.* (2012) *Geochem. Geophys. Geosyst.*, **13** (5)

Spectroscopic studies of radionuclide adsorption and diffusion

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Solute mobility in geochemical fluids depends strongly on both the physical properties of the host lithology as well as mineral surface reactivity. Due to the extremely slow rates of diffusion and the typically dilute concentrations of radionuclides involved in disposal scenarios, constraining physical and chemical processes for use in risk models is challenging. Therefore predictions about the mass transfer of contaminants over time periods pertinent to geological disposal facilities (10^5 to 10^6 years) require both reliable measurements of adsorption and robust determinations of diffusive flux. Here we will present results from spectroscopic measurements designed to provide chemical details of the process of surface attachment of key radionuclides (U, Tc, Sr, Cs) to a number of mineral surfaces (magnesite, brucite, portlandite, magnetite, phyllosilicate, K-feldspar, plagioclase feldspar) that will be exposed under a range of repository conditions (pH 6-13, reducing and oxidizing conditions, low and high PCO_2). EXAFS, both standard and polarization dependent, has been used to provide unambiguous information regarding surface adsorbate bonding geometries. Evolution of surface morphology and details of thin films or surface precipatates has been studied using x-ray reflectivity and glancing incidence XRD. Bulk adsorption experiments have also been completed in order to meaasure mass uptake as a function of concentration. In addition, diffusion through low permeability rock matrices (which include the minerals used in the adsorption studies) has been directly determined via both flow-through (micro-reactor) and *in situ* (Multiple internal reflection-FTIR) experimentation. Direct measurements of contaminant uptake and diffusion length have been completed using proton induced x-ray emission (PIXE) coupled with Rutherford Back-Scattering (RBS).

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