Hydrogeochemical survey of CO_2 geological leakage using noble gases: Application to the Furnas Caldera (Azores, Portugual)

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Significant natural CO_2 emissions have been measured across the caldera of Furnas (São Miguel Island, Azores) allowing us to consider the area as a CO_2 leakage analogue.

During two field trips, we have collected twenty springs in purpose to measure CO_2 contents (Dissolved Inorganic Carbon and $\delta^{13}C$) and noble gas isotopic compositions (He and Ne) and for seventeen water samples, major ions chemistry. The corrected $^3He/^4He$ ratios (normalized to air ratio R_A) range from 1.46 to 5.17, the carbon contents (DIC) range from 0.57 to 41,41 mmol/l and most of the waters have a $\delta^{13}C$ about -4 ‰.

With field observations and waters chemistry, we have characterized seven different types of water springs through the caldera, resulting from various mixing rates between three sources : soil equilibrated meteoritic water, gas emanations (CO_2, He…) from a magmatic intrusion and hydrothemal waters coming from a shallow depth aquifer. Saturation indexes and geothermometers indicate a trachytic aquifer at a temperature of about 145°C.

In order to confirm that noble gases are good tracers of CO_2 leakage, we are building a first mixing model using noble gases and carbon isotopes and a second one based on major ions chemistry with CHESS hydrochemical modelling software. Preliminary mixing models seem to be consistent thus confirming that noble gases can be used as tracors of CO_2 leakage.

Comparison of Diviner Lunar Radiometer Observations of Apollo sites and Apollo soils measured in simulated Lunar environment

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The Diviner Lunar Radiometer (Diviner), onboard NASA's Lunar Reconnaissance Orbiter, has made the first direct global measurements of lunar silicate mineralogy using multispectral thermal emission mapping [1]. Diviner has three spectral channels near 8 μm designed to characterize the Christiansen feature (mid-infrared emissivity maximum) [2], which systematically shifts to shorter wavelengths with increasing silicate polymerization [e.g. 3,4].

Only laboratory experiments conducted in simulated lunar environment (SLE) are directly comparable to Diviner data. The Lunar Thermal Environment Simulator at University of Oxford's Atmospheric, Oceanic, and Planetary Physics Laboratory is uniquely capable of measuring thermal emission of samples in SLE [5]. In the lunar environment, large thermal gradients develop in the top few hundred microns of the surface, driven by the difference in the solar and thermal skin depths (i.e. the surface is heated to greater depth than the infrared emitting layer). The thermal gradients generally result in a significant enhancement of Christiansen feature spectral contrast and significant decreases in Reststrahlen Bands spectral contrast.

Diviner observations include all six Apollo sites at approximately 200 m spatial resolution. Spectral differences between the Apollo sites caused by composition and space weathering are apparent in Diviner data [1]. Since the compositions of Apollo soils are known, the Apollo sites are important calibration points for the Diviner dataset. This presentation will include the first comparison of Diviner observations of Apollo sites and spectra of Apollo soils measured in SLE.

[1] Greenhagen *et al.* (2010) *Science* **329**, 1510. [2] Paige *et al.* (2010) *SSR* **150**, 125. [3] Logan *et al.* (1973) *JGR* **78**, 4983. [4] Salisbury and Walter (1989) *JGR* **94 (B7)**, 9192. [5] Thomas *et al.* (2010) *LPSC* **42**, #1364.