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Spectral analysis of lunar analogue samples

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Analyses of samples derived from terrestrial analogue sites are used to study lunar processes in their geological context (Foing, Stoker, Ehrenfreund, 2011). For this study samples from the volcanic region of the Eifel, Germany collected during field campaigns (Foing et al., 2010), are analyzed with a variety of spectrometers. The aim is to obtain a database of analyzed samples that could be used as a reference for future in situ measurements. Equipment used in the laboratory consists of a Fourier Transform Infrared (FTIR) spectrometer, an X-Ray Fluorescence (XRF) spectrometer, a Raman laser spectrometer, as well as UV-VIS and NIR reflectance spectrometers. The Raman, UV-VIS and NIR are also used in combination with the EXoGeoLab mock-up lander during field campaigns (Foing, Stoker, Ehrenfreund, 2011). Calibration of the UV-VIS and NIR reflectance spectrometers is the main focus of this research in order to obtain the clearest spectra.

The calibration of the UV-VIS and NIR reflectance spectrometers requires the use of a good light source as well as suitable optical fibers to create a signal that covers the widest range in wavelengths available. To eliminate noise towards the edges of this range, multiple measurements are averaged and data is processed by dividing the signal by reference spectra. Calibration of the devices by creating a new dark and reference spectra has to take place after every sample measurement. In this way we take into account changes that occur in the signal due to the eating of the devices during the measurements. Moreover, the integration time is adjusted to obtain a clear signal without leading to oversaturation in the reflectance spectrum.

The typical integration times for the UV-VIS reflectance spectrometer vary between 1 – 18 s, depending on the amount of daylight during experiments. For the NIR reflectance spectrometer the integration time resulting in the best signals is approximately 150 ms in combination with a broad spectrum light source. Together with taking an average over $\pm$600 measurements per sample this leads to the best spectral signals that can be acquired with this set-up.

Obtained spectra can be tested for accuracy by comparing them with stationary laboratory spectrometers such as the FTIR spectrometer. Future campaigns involving the employment of the spectrometers on the ExoGeoLab lander would prove the applicability of the equipment in the field.