FIELD SPECTROSCOPY, IMAGING AND SAMPLING AT THE EIFEL MOONMARS ANALOGUE.

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Introduction: Several spectroscopy analyses in the UV/VIS spectrum were performed using the remotely controlled USB4000 spectrometer during a field campaign in the Eifel volcanic area in Germany. The data that was obtained during the field measurements is compared to the spectrum of the same geological sample from analyses done in a laboratory to determine the reliability of field spectroscopy analyses. By determining the errors that can occur during field measurements we hope to establish better conditions for field spectroscopy and a calibration method to minimalize these errors for future field measurements.

Background on ExoGeoLab and the Eifel: The field spectroscopy was performed during a campaign following previous ILEWG EuroMoonMars campaigns [0 - 9]. The campaign was done in the Eifel volcanic area in Germany at an outcrop near the Laacher See. The outcrop consisted of volcanic deposits from the Laacher See eruption from approximately 13,000 years ago. During the campaign four analogue Moon Extravehicular Activities (EVAs) where executed. During two of these EVAs an astronaut would collect geological samples and bring them to the lander for spectrometry analyses, see figure 1.

Figure 1, Two astronauts and the ILEWG ExoGeoLab lander during an analogue Moon EVA.

Method: The spectrometer USB4000 was installed on the ILEWG ExoGeoLab lander and controlled remotely, see figure 2. During the field campaign sunlight was used as light source for the spectroscopy measurements. However, a high integration time of 4 to 6 seconds was necessary to reach a usable light intensity. Because of the high integration time a measurement took relatively a lot of time which is why 5 scans to average was applied instead of 10 to 20 scans to average [8]. The high integration time also could have made the analyses more sensitive to changes, such as weather changes. A dark spectrum was measured before the EVA, which means that the dark spectrum could have changed slightly when the analyses was done.

Fig. 2, ILEWG ExoGeoLab lander with remotely controlled USB4000spectrometer and rover

In Situ results: Figure 3 shows the reference spectrum from the sample analysis and figure 4 shows the spectrum of one of the volcanic rocks that was sampled during the field campaign. This graph shows a number of anomalies that are likely not caused by absorption bands from the sample. A high reflection value around 760 nm and relatively more absorption around 430 nm and 590 nm are examples of such anomalies.

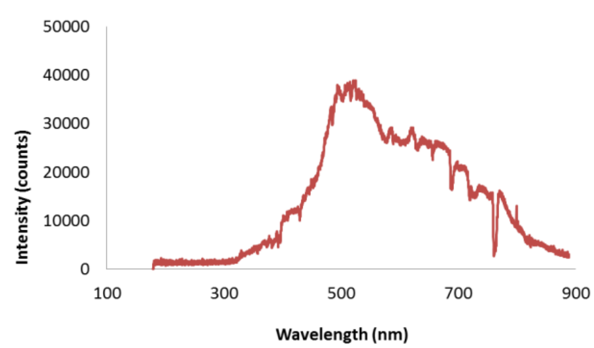

Figure 3, The reference spectrum that was used to analyse the sample during the field campain.

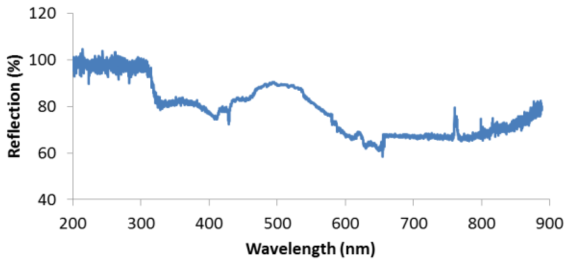

Fig. 4, The spectrum of a volcanic sample from the Eifel volcanic area measured during a Moon EVA corrected by the reference spectrum from the same measurement.

Post campaign measurements: The same that was measured during the Moon analogue mission was also analysed in a laboratory with a strong incandescence light source to prevent light contamination. When comparing the results from the field measurements, both the reference spectrum and the sample reflection, with the laboratory measurements, some differences in the spectrum are visible. These differences can be caused by changes in weather conditions, errors in the reference spectrum and the high integration time.

The measurements will be repeated during a planned field experiment in February 2017 to determine the changes in the spectrum by changing certain parameters. For example, by adding an extra light source near the spectrometer we expect to improve the results from the spectroscopy analyses.

We hope to improve the conditions for the measurements and create a calibration method by being aware of the errors that can occur during field spectroscopy analyses. Spectroscopy analyses in the UV/VIS spectrum is limited in its practical use. However, being aware of the problems that arise during field spectroscopy in this spectrum can also be taken into account during measurements in the NIR and IR spectrum.

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