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Mineralogical composition of terrestrial feldspathic rocks using reflectance spectroscopy data from HySpex hyperspectral cameras

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New feldspar detections made by visible-near infrared (VNIR) spectroscopy last year on Mars [1], raise questions on the nature of the rocks involved and the magmatic processes responsible for their formation.

Following these new findings, a range of terrestrial feldspathic rocks, which are possible analogs to the feldspar-bearing Martian rocks, were analyzed using a VNIR point-spectrometer (ASD Fieldspec 4) in a laboratory [2]. A spectral library referencing the average reflectance spectrum of uncrushed terrestrial feldspathic rocks, including granites, granodiorites, phenocryst basalts, dacites, anorthosites, was assembled. One of the conclusions from this work was that a more detailed, grain-by-grain spectral analysis is needed.

In this study we used a new instrument that made it possible to determine the grain-by-grain mineralogical composition of these same terrestrial analog rocks. VNIR spectra were acquired with the HySpex hyperspectral cameras VNIR-1800 and SWIR-384 that acquire high-resolution data in the visible near-infrared and short-wave infrared wavelength ranges. The cameras image the scene line by line using the pushbroom scanning technique. Using interchangeable lenses, cameras were used to acquire spectroscopy data at a distance of 30cm and at 8cm from the sample. In the VNIR, this results in a pixel size of about 53 µm and 24µm at sample-sensor distance of 30cm and 8cm, respectively, while in the SWIR, the pixel size is 250 µm and 55µm at a distance of at 30cm and 8cm, respectively. The hyperspectral cubes are analyzed with the ENVI software to classify the image pixels according to their spectral signature. Thus, the different minerals present in the rock, which are often on a millimeter scale, are grouped into different classes. The statistics give the average spectrum of each class, and therefore each mineral group.

This study, complementary to that of *Barthez et al.* (2020), makes it possible to associate, for each studied rock sample, an average reflectance spectrum of the bulk rock to a precise mapping of the different minerals present in the rock. This study allows us to determine if the feldspar minerals are contributing to the observed rock spectrum, and to assess each mineral group's contribution to the spectral signature of the whole rock. Detailed petrographic characterization of rocks are also being conducted to evaluate characterizations done with spectral data.

References

[1] J.Flahaut et al. (2020). EGU Abstracts, EGU2020-13377

[2] M.Barthez et al. (2020). EPSC Abstracts, EPSC2020-606