



## **Effect of the crushing process on Raman analyses: consequences for the Mars 2018 mission**

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The Pasteur payload of the international 2018 Mars mission comprises a Raman spectrometer as part of its instrument suite. Analyses with this instrument will be made on crushed samples. The crushing process will cause loss of important structural context and could change the physical properties of the studied materials resulting in misinterpretation of the data. We therefore investigated the influence of granulometry on the Raman spectrum of various minerals and rocks using laboratory equipment and the Raman instrument being developed for the Pasteur payload. The aim was to determine what influence the crushing process could have on the correct identification of rocks and minerals and the detection of possible traces of life.

Whatever the sample type, our study shows that the crushing process leads to a strong increase in the background level and to a decrease in the signal/noise ratio. This effect is all the more important when the grain size is small. Moreover, for certain minerals, the Raman spectra can be significantly modified: the peaks are shifted and broadened and new peaks can appear, implying a change in the crystal structure of the material. This effect is mainly due to the decrease of the thermal diffusion in the powder which leads to an increase in the heat induced by the laser. Since mineral identification using Raman spectroscopy is made by comparison with database spectra, this kind of change could lead to misinterpretation of the spectra and thus must be taken into account during the in situ investigation. The loss of texture is also shown to complicate identification of rocks with subsequent consequences for the eventual detection and interpretation of past traces of life. On the other hand, mixing of the components in the powder facilitates the detection of minor phases.