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Raman and cathodoluminescence imagery: complementary tools for Martian Geology and the search Early Life on Mars.

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In the new double rover scenario for the 2018 NASA-ESA mission to Mars, the science objectives of the European rover, ExoMars, are to search for traces of past or present life and to document the water/geochemical environment as a function of depth in the shallow subsurface.
A collection of Mars analogue rocks is being prepared by the Observatoire de l'Univers en région Centre (OSUC) in Orléans to help calibrate the future flight instruments for the ExoMars in situ mission. The rock library is being coupled to a database with information about the textural, compositional and geotechnical properties of the rocks. We have characterised a preliminary range of Mars analogue materials using standard laboratory techniques, in particular with a Raman spectrometer. The Raman spectrometer (WITec Alpha500 RA) of the CBM, appears to be a key instrument for analyses. This system allows large and fine scale compositional mapping (from a tens of micrometers to up than 10 cm) with a submicrometric resolution. This necessary information can be used to fully characterise the composition of the samples, just as well the mineralogy and any eventual fossil microbial remains. Cathodoluminescence (CL) is not in the ExoMars instrument payload but this instrument is a useful compliment to the Raman spectrometer for search for early life on Mars. This instrument permits detection of trace contents of elements, such as Mg, that can potentially reveal fossil bacterial activity in sedimentary rock. Mg has been detected zoned carbonate globulesin basalts from Svalbard that are regarded as analogues of the martian meteorite ALH84001 [1]. This instrument can be miniaturized for *in situ* space missions and to this purpose we have developed an electron gun [2].
[1] Treiman A.H. et al. (2002) *EPSL*, *204*, 323-332.
[2] Thomas R. et al. (2009). Cathodoluminescence and its Application in the Planetary Sciences, *111-126*.