MicrOmega: an hyperspectral NIR microscope on board Hayabusa2.

J-P. Bibring[1], C. Pilorget[1], C. Evesque[1] and V. Hamm[1], [1]IAS, France (Institut d'Astrophysique Spatiale, 91405 Orsay Campus, France, bibring@ias.u-psud.fr).

Introduction: The coupling between imaging and spectrometry has proved to be one of the most promising way to study remotely solar system objects [1]. MicrOmega aims at using this concept for *in situ* analyses, and is presently designed to operate on board Mars *in situ* vehicles (ExoMars mission) and primitive bodies. Specifically, MicrOmega will characterize the surface material of the asteroid target of the Hayabusa2 mission, on board the MASCOT Lander. The goal is to contribute to the understanding of the processes by which the asteroid accreted and evolved, and in particular to identify and constrain the origin of volatiles and carbon-rich species, which played a major role in the later evolution of inner solar system objects.

Instrument concept: MicrOmega will acquire reflectance spectra of 5 mm-sized surface spots with a spatial sampling of 20 µm, thus characterizing the asteroidal surface composition at a grain scale. A monochromator, based on an AOTF (Acousto Optical Tuneable Filter) [2], will illuminate sequentially each surface spot in up to 500 contiguous wavelength channels (spectral sampling of ~ 20 cm^{-1}) covering the spectral range (0.9 - 3.5 µm). For each channel, an image is acquired on a 2D detector, building a tridimensional (x,y,λ) image cube.

Instrument expected performances: the spectral range, 0.9 to 3.5 µm, and its spectral sampling of ~ 20 cm^{-1}, have been chosen to enable the identification of most potential surface constituents: silicates, oxides, salts, hydrated minerals, ices and frosts, as well as organic compounds, discriminating between specific members in each family (e.g. low and high Ca pyroxenes, forsterite and fayalite, Mg and Al rich phyllosilicates, aliphatic and aromatic compounds, etc.). Importantly, Micromega will be able, and for the first time, to identify carbon-rich phases at a microscopic scale, and to ascribe the mineralogical context in which they nucleated, through the unique capability of coupling spectroscopy to imaging. A breadboard has been built, enabling to evaluate the performances on test terrestrial samples, as illustrated in figure 1 for a mixture of mafic and altered minerals.

We shall present the status of our instrument, and discuss its performances in the framework of the Hayabusa2 goals and objectives, emphasizing the huge, unique and unprecedented potential of the coupling between the MicrOmega *in situ* characterization at a microscopic sacle, the remote sensing from the main spacecraft, and the analyses of returned samples.

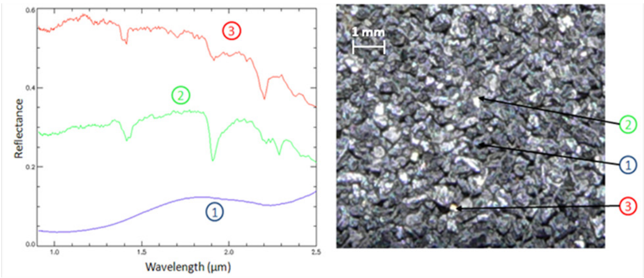

Fig. 1. A sample made of mafic minerals, kaolinite type clay and nontronite type clay, tested on a representative breadboard of the MicrOmega instrument. In blue: pyroxene spectrum ; in green: nontronite type clay spectrum ; in red: kaolinite type clay spectrum. Grains can be clearly identified and kaolinite and nontronite through their 1.4, 1.9 and 2.2-2.3 µm spectral features can be discriminated. Spectra acquired on a 20x20 µm pixel.

References: [1] Bibring J.-P., et al. (2006), *Science,* 312, 400 – 404, [2] Goutzoulis A.P. and Pape D.R. (1994), *Design and fabrication of acousto-optic devices*. Edited by Dekker Inc.