SPECTRAL PROPERTIES OF 2867 STEINS AND 21 LUTETIA, THE ROSETTA MISSION TARGETS.

M. Birlan[1], D.A. Nedelcu[2,1], P. Vernazza[3], M.A. Barucci[4], R.P. Binzel[5,1], M. Fulchignoni[4], [1]Institut de Mécanique Céleste et de Calculs des Ephémérides, Observatoire de Paris, CNRS-UMR8028, 77 av Denfert-Rochereau 75014 Paris cedex, France (Mirel.Birlan@imcce.fr), [2]Astronomical Institute of the Romanian Academy, str Cutitul de Argint nr 5, Bucharest 4, Romania (Nedelcu@astro.aira.ro), [3]Research and Scientific Support Department, European Space Agency, Keplerlaan 1, 2201 AZ Noordwijk, The Netherlands (pierre.vernazza@esa.int), [4]LESIA, Observatoire de Paris, 5 Place Jules Janssen, Meudon, F-92195, France (Antonella.Barucci@obspm.fr), [5]Department of Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, MA 02139, USA (rpb@mit.edu).

Introduction: The Rosseta mission flyby of the asteroid 2867Steins will occur in September 5, 2008 while the flyby of 21 Lutetia is scheduled for July 10, 2010.

2867 Steins is a small asteroid (4.8-6 km in diameter) located in the inner part of the main belt, in an orbit with low eccentricity (a=2.36 a.u., e=0.14, i=9°.9). Both polarimetric [1] and radiometric [2] albedos agree with the E-type taxonomic composition deduced from spectroscopy in the spectral region of visible [3].

21 Lutetia has an estimated diameter of (98.3 ± 5.9) km[4] and is the largest body in the main-belt ever visited by a space mission. The asteroid is located in the inner part of the main belt, in an orbit with low eccentricity and inclination (a=2.4348 a.u., e=0.16, i=3°.06). The large amount of colors and spectral data of Lutetia, and the polarimetric and radiometric albedoes are giving puzzling results, with non-unique solution of the asteroid taxonomy. This asteroid was classified as M-type[5,6], while recent NIR data show a C-type tendency [3,7,8].

Method: Near-infrared (NIR) spectra of both asteroids in the 0.8-4 µm spectral range were obtained with SpeX/IRTF in remote observing mode from CODAM - Paris Observatory, in order to cover the rotational periods (8.165 h and 6.048 h for Lutetia and Steins respectively). These runs are parts of the wide program of groundbased investigations of the Rosetta targets before the spacecraft encounter. The data will be used for increasing the knowledge about these objects before the flyby. Meanwhile, the data could be used a source of calibration for the embarqued instruments.

Results: 2867 Steins Four NIR spectra in the 0.8-2.5 µm spectral region were obtained in December 2006, January and March 2007. A run of March 2008 is in data-reduction procedure. The spectra reveal no major absorption features. The best-fit model for the constructed visible-plus-NIR spectrum is represented by a very rich-oldhamite mixture (57% enstatite, 42% oldhamite, and 1% orthopyroxene). These results place Steins in a subdivision of the E-type class with objects like 64 Angelina, 3103 Eger, and 4660 Nereus. Recently, numerical integrations found the existence of a dynamical pathway linking the current positions of Steins and Eger [11].Since they have strongly similar spectra these 2 asteroids could be remnants of an old family formed around the present location of Steins. This group is not sampled by the current collection of aubrite meteorites. Space-weathered aubrite ALH-78113 spectrum also provides a good match to the Steins VNIR spectrum[9].

21 Lutetia Several NIR spectra in the 0.8-2.5 µm spectral region were obtained [7,8,10], and one spectrum in the 2.2-3.8 µm spectral region[10]. A chi-square test for the available near-IR spectra (up to 2.5µm) of Lutetia since 2003 using the spectrophotometry data obtained by 52-Color Asteroid Survey, and some spectra of the RELAB database was performed. In all cases, C-type asteroids and carbonaceous chondrites yielded the best fit. These results are consistent with a primitive composition for 21 Lutetia. The best correlation coefficients for the best fit spectrum similar to the spectra of Lutetia span the range 91-95%.

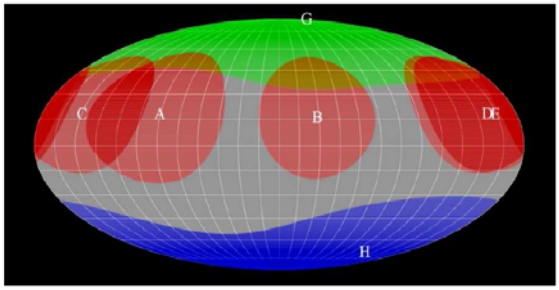

Figure: The asteroid 21 Lutetia surface is presented in the Mollweide-Babinet projection, assuming an ellipsoid shape model. The letters identify the region of the surface correspondent to the acquired spectra[8].

References:

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