EPSC Abstracts
Vol. 6, EPSC-DPS2011-1772, 2011
EPSC-DPS Joint Meeting 2011

Hints on Lutetia's surface composition

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Abstract

All the information available from space missions (Rosetta and Herschel) and ground observations has been put together to interpret the Lutetia's surface composition.

During the close encounter with (21) Lutetia on July 10, 2010, the instruments OSIRIS, VIRTIS, ALICE, and MIRO were turned on to characterize the surface properties of the asteroid and they provided important inputs to reach this goal.

We present a complete overview on the data obtained by Rosetta (Sierks et al, 2011, Coradini et al. 2011) and those from ground observations collected during more than 30 years with many different techniques (Barucci & Fulchignoni 2009), which give constrains to the surface composition of Lutetia.

Variations on Lutetia surface have been high-lighted and are clearly connected to different composition and morphology (at macro and micro scales). Instruments on board of Rosetta spacecraft observed only the northern hemisphere which is evidently different from the southern one.

After the Rosetta flyby, Lutetia composition remains still puzzling: Lutetia is different from any other asteroid visited so far from space missions and it's different from any known asteroid observed from ground. Even if analogies with known meteorites are not conclusive, the surface can be composed of different materials similar to chondrites. Some regions (predominantly in the southern hemisphere) are more similar to some carbonaceous chondrites (CV, CO, CK) while others (probably minors) are like enstatite chondrites.

Lutetia can have a surface of aggregate of different materials as was found in a particle sample of comet 81/P Wild 2 returned by Sturdust, and in the case of the extremely heterogeneous meteorite Kaidun which is formed by an assemblage of material ranging from CM to estatite chondrite clast (Zolensky & Ivanov 2003). The complicate Lutetia surface composition can be the consequence of the presence of peculiar materials resulting from collisions among objects with different composition. In fact OSIRIS images show an extremely variegate surface rich in craters, structures and regolith.

In conclusion, Lutetia is an old object (surface age of 3.5 Ga, Sierks et al. 2011), with a surface mixture of "incompatible" types of materials, principally carbonaceous and enstatite chondrites, which are the consequence of impacts that are at the origin of the present composition.

References

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