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Three dimensional study of Lutetia lineaments network

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The Scientific Imaging System for Rosetta, OSIRIS, acquired an imaging sequence of the Lutetia asteroid, allowing detection of a large number of lineaments distributed over most of its surface (Thomas et al., 2012, Planet. Space Sci., 66, 96-124; Massironi et al., 2012, Planet. Space Sci., 66, 125-136). In general these lineaments can be interpreted as the surface expression of discontinuities such as faults or fractures. Several categories of features has been observed, like troughs, scarps, faults, and ridges. These lineaments are generally more than 50 km long and up to 1.2 km in width, and seem to be arranged in systems (e.g. with common orientation). Moreover, in different geological regions of the asteroid a preferred orientation of lineaments can be recognized, but in all regions there are also lineaments which cross the local preferred trend. Noteworthy, lineaments radial to impact craters, that are common on other asteroidal bodies, are mostly absent on Lutetia (Thomas et al., 2012, Planet. Space Sci., 66, 96-124).

However, on a non-spherical body it is not obvious to reconstruct the relationships occurring between the different lineaments. Indeed, lineations that appear to be similarly oriented on different asteroid facets could have no correlation at all (Buczkowski et al., 2007, Icarus, 193, 39-52). In this context, the 3D mapping of lineaments, that we performed directly on the Lutetia shape model, allowed us to obtain a three-dimensional model of these structures that have been reconstructed as planes cutting through the asteroid. This innovative methodology allowed us to detect several structures concentric with respect to the North Pole Crater Cluster, suggesting that these lineaments were originated by these impact events. However most lineaments can be reasonably grouped in different systems of lineaments with no obvious correlation with any impact event detected on the imaged surface. This opens new questions on the origin of these structures and, in turn, on the internal structure and origin of Lutetia.