

Eros' Rahe Dorsum: Surface expression of a plane of strength?

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An intriguing discovery of the NEAR imaging and laser-ranging experiments was the ridge system known as Rahe Dorsum and its possible relation with global-scale internal structure. The curved path of the ridge over the surface roughly defines a plane cutting through Eros. Another lineament, Calisto Fossae, seems to lie nearly on the same plane on the other side of Eros. The NEAR teams describe Rahe as the expression of a compressive fault (a plane of weakness), because it seemed to be steeper on one flank than the other (an asymmetry suggesting a scarp), and to have rubble fallen down the steeper side. On Earth, such characteristics would be indicators of horizontal compression, where shear displacement along a dipping fault has thrust the portion of the lithosphere on one side of the fault up relative to the other side. However, given the different geometry of Eros, such application of terrestrial experience may not be appropriate for several reasons: The irregular surface gravity means down-slope motion of loose material may not have the same relationship to underlying structure as it does on Earth. The plane through Eros runs nearly parallel to, and just below, the surface facet adjacent to Rahe Dorsum. The plane then continues lengthwise through the elongated body, a surprising geometry for a plane of weakness. Moreover, a more complete assessment of the topography at Rahe Dorsum indicates that scarp-like geometry is not typical along the ridge. These observations are more consistent with the plane being one of strength, not weakness. Perhaps, in Eros' parent body a fluid intrusion (e.g. a dike) through undifferentiated material created a plane of stronger rock. However the plane of strength formed, such structural reinforcing might have enabled and controlled the elongated irregular shape of Eros, as well as Rahe Dorsum.