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Bands on Enceladus: morphology and implications

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Abstract

Saturn's moon Enceladus has undergone substantial resurfacing. There are extended areas with just a few impact craters including band-like features, as Cassini images show (Fig. 1a). Here, we report on pinch and swell topography across one of the bands (Fig. 1b) that may have formed by an extensional necking instability [1]. Such instabilities can result from extension of a brittle layer atop a ductile substrate, and are proposed to be involved in grooved terrain formation on Ganymede [2]. The occurrence of this instability on Enceladus implies high surface thermal gradients [3] and is consistent with high heat flows previously derived in this area [4]. From the wavelength of topography (~ 5 km) the theory predicts brittle layer thicknesses of ~ 1.5 km, which matches the lithospheric thickness derived from flexure studies nearby the band [4].

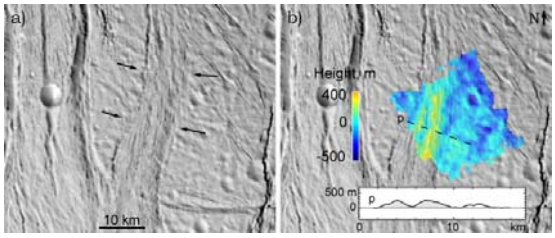

Figure 1: Cassini frame N1489048222 (150 m/pxl) showing an extensional band (arrows) formed at 10°S, 138°E (a). A stereo-derived elevation model (horizontal/vertical resolution ~ 800 /50 m) reveals high-standing pinch and swell topography across the band (b).

References

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