

DPS 34th Meeting, October 2002

Session 41. Europa

Oral, Chair(s): W. McKinnon and E.B. Bierhaus, Friday, October 11, 2002, 10:45am-12:05pm, Room M

[41.02] Global patterns of diurnal tensile cracking on Europa

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Diurnal tidal stress has been invoked to explain the cycloidal lineaments common on Europa. We have computed and mapped theoretical global patterns of cracks formed by tensile stress. The calculations assume a range of values for the critical parameters, such as cracking strength of the ice and propagation speed. The model assumes that the ridges that are visible in Galileo and Voyager imagery were initiated by cracks formed under tensile stress. We confirm that the shapes and location fit prominent cycloids as shown by Hoppa et al (e.g. *Science*, 285, 1899-1902 (1999); *Icarus* 153, 208-213 (2001).) When the theoretical plots are compared with our new maps of cycloid features and other global lineaments, we find non-synchronous rotation and/or polar wander must be included to achieve agreement.

Moreover, other types of crack shapes are predicted by the theory. In certain regions the tensile patterns follow stair-step shapes or very tightly curved paths (some almost closed). The latter are similar in size and shape to cracks that are seen in the anti-jovian wedges region and the sub-jovian fracture zone, and they occur in our theoretical plots in the western part of those regions. Like cycloids, the crack patterns in the wedges region may result from diurnal variations of tidal stress. If the observed crack patterns formed this way, they have since been carried several tens of degrees east by non-synchronous rotation. These considerations may help constrain rotation rates relative to resurfacing rates.

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