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[57.01] Lithospheric Heat Flows in Europa and Implications for Convective Subsurface (Title Only)

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Comparison of brittle and ductile strength in the ice lithosphere of Europa, that has at most 2 km of thickness, involves the existence of heat flows have at least ~100-200 mW m-2 [1]. Furthermore, heat flows greater than ~400-500 mW m-2 correspond to a lithosphere thinner than 0.5 km. These values are much higher than those that were predicted by tidal heating models [2], made for solely conductive ice shell. A possible explanation could appeal to tidal heating in the warm ice from a layer in active convection under the surface. In this way, in [3] an adiabatic temperature de ~260 K is calculated for a convective layer that is floating on an internal ocean of liquid water in Europa. With this value, from [2] we can estimate that the average contribution to heat flow, by tidal heating, de an ice layer in adiabatic conditions would be ~3-10 mW m-2 per each kilometre of thickness, so, a convective layer should be ~10 km deep at least to provide as far as ~100 mW m-2 (independently of dissipation in the core, tidal or radiogenic). On the other hand, if we admit the existence of a convective subsurface layer, we can establish an upper limit approximate to grain size in the ice shell, taking into account the extreme situation which the rheological lithosphere's base coincides with the stagnant lid's base of convective system, ~1 mm, in acordance to prospective in order to make possible the beginning of convection in a relatively thin ice shell [3].

References: [1] Ruiz and Tejero, 1999, LPSC XXX. [2] Ojakangas and Stevenson, 1999, Icarus 81, 220-241. [3] McKinnon, 1999, GRL 26, 951-954.

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