Geophysical Research Abstracts, Vol. 8, 02241, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02241


# 1 On the crust thickness of Enceladus


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In the satellite systems of the giant planets, the surfaces of some icy moons show up linear fracture systems attributed to tidal stresses. The most conspicuous and most investigated example is the global fracture system on the Jovian moon Europa.

In this paper the case of Enceladus, a small moon of Saturn is studied. Already the Voyager images indicated that a part of Enceladus is old, while the other is young. The new Cassini images confirmed this finding and clearly demonstrate that the vicinity of the North Pole is old (full with impact craters) contrary to the South Pole (no impact craters have been found) where fractures are present. These fractures follow the direction what is expected on the basis of tidal stresses depending on the degree

of latitude. If the tidal stresses could fracture the icy crust in the vicinity of the South Pole but could not do the same in the vicinity of the North Pole, one can assume that the thickness of the icy crust is not the same at the two poles. The cause of such a difference in thickness can be a one-cell water-mantle circulation, the down welling branch of which being on the North Pole while the upwelling plume near the South Pole. Here, because of the thermal erosion, the ice-crust became thinner and so the tidal stresses were capable to fracture it.

Using a simple two-layer model describing the total stresses we can give a rough estimate for the maximum thickness of the icy crust at the South Pole and a minimum thickness at the vicinity of the North Pole. The thickness of the crust of Enceladus obtained this way is no more than 25 km in the vicinity of the South Pole where the tidal stresses were capable to fracture it, but more than 45 km near the North Pole where they were unable to split the crust.