Geophysical Research Abstracts, Vol. 8, 03381, 2006
SRef-ID: 1607-7962/gra/EGU06-A-03381

Stagnant lid convection in the mid-sized icy satellites of Saturn

K. Multhaup (1), T. Spohn (1,2)

(1) Institut für Planetologie, Westfälische Wilhelms-Universität, Wilhelm-Klemm-Str. 10, D-48149 Münster, Germany, (2) Deutsches Zentrum für Luft- und Raumfahrt e.V., Institut für Planetenforschung, Rutherfordstr. 2, D-12489 Berlin, Germany

Thermal history models for the mid-sized Saturnian satellites Mimas, Tethys, Dione, Iapetus, and Rhea have been calculated assuming stagnant lid convection in undifferentiated satellites. Of all five satellites under consideration, only Dione, Rhea and Iapetus do show significant internal activities related to convective overturn for extended periods of time. The interiors of Mimas and Tethys do not convect or do so only for brief time spans early in their thermal histories. Although we use lower densities than in previous models, our calculations suggest higher interior temperatures but also thicker rigid shells above the convecting regions. Temperatures in the stagnant lid will allow partial melting of ammonia dihydrate. Depending on the bulk concentration of ammonia Dione, Rhea and Iapetus may differentiate early and form early oceans. Dione and Rhea also may differentiate due to temperatures above the ice I melting curve below the stagnant lid a few hundred Ma after they start convecting. These satellites would then have rock cores of roughly half the satellite radius for Dione and Rhea and one third of the satellite radius for Iapetus. It is possible that the oceans survive to the present day, in particular in Rhea, but only for thermal conductivities smaller than typical ice I values. The ice shells above the oceans will remain primordial in composition and volatile rich. Cryovolcanism may be caused by heating from below.