

**Enceladus: opposition of expanded north and compacted south – an impressive example of tectonic dichotomy.**

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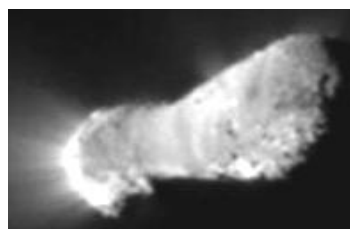
Ubiquitous tectonic dichotomy characteristic of all celestial bodies (Theorem 1 [1-3 & others]) has a very original face in the Enceladus' case. This rich in ice body continues to outgas and in this sense could be compared with comets. Spectacular outgassing continues only from the southern strongly squeezed terrains and does not show itself at the north where only numerous craters (partially impacts) reveal rather intensive outgassing in the past.

The double nature of celestial bodies (expansion and compression) is due to their movements in keplerian non-circular orbits with periodically changing accelerations causing inertia-gravity waves warping bodies. These warpings in rotating bodies (but all bodies rotate!) have interfering ortho- and diagonal directions, standing character and harmonic wavelengths. The fundamental wave is long  $2\pi R$  and the most intensive inevitably bulges out (expands) one hemisphere-segment and presses in (compacts) the opposite one. In the larger bodies like Earth keeping their spherical shape due to an important gravity there are the uplifted hemisphere and the subsided one. At Earth, for an example, the continental eastern hemisphere and the opposite Pacific western one. The smaller bodies like asteroids, comet cores and many satellites do not have sufficient gravity to withstand the warping wave force and thus acquire oblong convexo-concave shape of a bean or banana [4]. A transition between "smaller" and "larger" bodies lies often somewhere in between 400 to 500 km in diameter. Thus, Enceladus is at the limit of this interval. It is spherical but shows a clear difference between two hemispheres (North against South like at Mars). The outgassing scrambled south remind the recently acquired images of the Hartley 2 comet (EPOXI mission) where dust-gas jets "spit out" of intensively compact layered in a few directions areas [5].

Temperature dichotomous Mimas also resembles Enceladus in what concerns hemispheric distribution of heat.



**Itokawa, 0.5 km long,**  
 (Itokawa07 Hayabusa.jpg.)



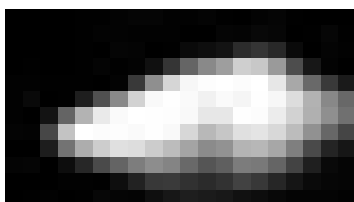
**Hartley 2, 2 km long,** Credit: NASA/JPL-Caltech/UMD



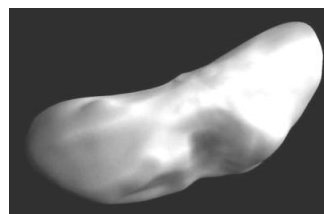
**8 km long,** Borrelli .



**22 km long,** Calypso, PIA07633



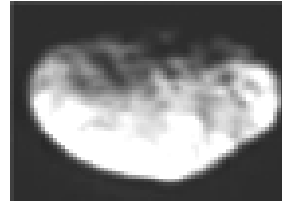
**32 km long,** Atlas.



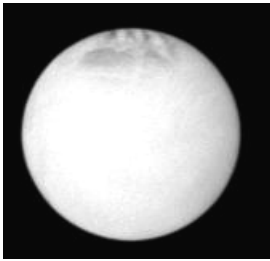
**33 km long,** Eros, PIA03111.



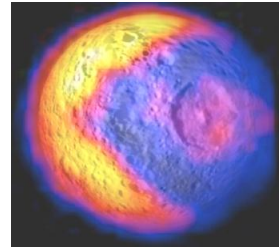
**102 km long**, Prometheus, PIA08192..



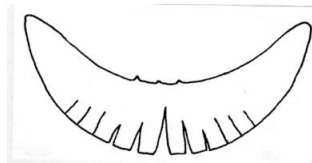
**350 km long**, Hyperion, PIA06645.



**505 km across**, Enceladus, PIA08980..  
Scrambled South is up.



Mimas' temperature map, PIA 12867.



Geometrical model of convex-concave oblong shape of a small celestial body caused by the wave warping. Deep cracks of the convex hemisphere and the concave hemisphere cause development of a "waist" or "neck" and finally lead to a body breakage (formation of binaries, polycomponental bodies, satellites).

### References:

- [1] Kochemasov G.G. Concerted wave supergranulation of the solar system bodies // 16<sup>th</sup> Russian-American microsymposium on planetology, Abstracts, Moscow, Vernadsky Inst. (GEOKHI), 1992, 36-37. [2] Kochemasov G.G. Theorems of wave planetary tectonics // Geophys. Res. Abstr.1999. V.1, №3, p.700. [3] Kochemasov G. G. Mars and Earth: two dichotomies – one cause // In Workshop on "Hemispheres apart: the origin and modification of the martian crustal dichotomy", LPI Contribution # 1203, Lunar and Planetary Institute, Houston, 2004, p. 37. [4] Kochemasov G.G.(1999) On convex-concave shape of small celestial bodies // Asteroids, Comets, Meteors. Cornell Univ., July 26-30, 1999, Abstr. # 24.22. [5] Kochemasov G.G. Similar shapes of asteroid Eros, satellite Atlas, and comet Hartley 2 despite of different classes, orbits, sizes and compositions of these bodies // 42<sup>nd</sup> Lunar and Planetary Science Conference (2011), March 7-11, 2011, The Woodlands, Texas, abstract 1125. pdf.