Geophysical Research Abstracts,
Vol. 11, EGU2009-2759, 2009
EGU General Assembly 2009
© Author(s) 2009

Comparative relief-forming potential of rocky terrestrial planets and icy saturnian satellites

G. G. Kochemasov

IGEM, RAS, Moscow, Russian Federation (kochem.36@mail.ru, +7 095 230-2179)

Comparative relief-forming potential of rocky terrestrial planets and icy saturnian satellites.

G. Kochemasov

IGEM of the Russian Academy of Sciences, Moscow, Russia, kochem.36@mail.ru

The wave planetology [1-3 & others] states that "orbits make structures". Its third theorem ("Celestial bodies are granular") is to say that sizes of tectonic granules are inversely proportional to orbital frequencies: higher frequency – smaller granule, and vice versa, lower frequency – larger granule. Thus, Mercury is very fine-grained, Venus fine-grained, Earth medium-grained, Mars coarse-grained. The following row of granule sizes confirms it: Mercury R/16, Venus R/6, Earth R/4, Mars R/2 (R-a planet radius). A geometrical model of this presents a circle with inscribed in it standing waves: for Mercury 16 waves, for Venus 6 waves, for Earth 4 waves (a cross!), for Mars 2 waves [4]. This geometrization is rather descriptive as it shows how waves amplitudes increase with the Solar distance and oscillations around a circle (wave heights) can be measured [5]. These heights are as follows: Mercury 2R/64.08, Venus 2R/24.34, Earth 2R/16.44, Mars 2R/8.8. These heights reduced to the Earth's one (taken as 1) are as follows: Mercury 0.256, Venus 0.675, Earth 1.0, Mars 1.868. Now we are looking at the real relief ranges (spans). They are as follows in km: Mercury $\tilde{5}$ (a bit less than 5 km according to one laser altimetry profile by Messenger spacecraft in 2007), Venus $\tilde{1}4$, Earth $\tilde{2}0$, Mars $\tilde{3}0$. This last figure may be increased by heights of collapsed cones of huge marcian volcanoes having calderas radii 40-50 km and presumed slope angle 5-6 degrees that gives additional 4-5 km for the martian relief range making it $\tilde{3}5$ km. Taking the Earth range as 1, one gets the following row of relative heights: Mercury 0.25, Venus 0.7, Earth 1.0, Mars 1.75. Comparing two rows of relative heights (theoretic and real) one sees that they are rather similar: Mercury 0.256 (0.25), Venus 0.675 (0.7), Earth 1.0 (1.0), Mars 1.868 (1.75). So, the wave warping celestial bodies increasing with the solar distance determines relief-forming potential of rocky terrestrial planets. Recently this wave induced relation could be verified with another row of orbiting celestial bodies: six saturnian icy satellites: Mimas, Enceladus, Titan, Dione, Rea, Iapetus orbit Saturn with diminishing frequencies, the closest to Saturn is Mimas. Studying shapes of icy saturnian satellites P. C. Thomas with colleagues [6] measured roughness of their limbs. On a plot they have shown values of the rms residuals in km to the overall shape fit (scaled by the satellite gravitational acceleration and assuming the same density material in the topography on all satellites, and scaled to Iapetus). The farthest from Saturn Iapetus has the roughness 4.1 km, close to the planet Enceladus only 0.44 km. The plot shows increasing roughness (means the relief range) with increasing distance from Saturn (Dione has a small departure from the curve). It is interesting that Iapetus (ice) and Mercury (rock) having near orbital periods (79.331 and 87.97 days) show near relief roughness. This link witnesses a close causal relation between the waves warping celestial bodies and their potential to produce relief. References: [1] Kochemasov G.G. Concerted wave supergranulation of the solar system bodies // 16th Russian-American microsymposium on planetology, Abstracts, Moscow, Vernadsky Inst. (GEOKHI), 1992, 36-37. [2] Kochemasov G.G. Tectonic dichotomy, sectoring and granulation of Earth and other celestial bodies // Proceedings of the International Symposium on New Concepts in Global Tectonics, "NCGT-98 TSUKUBA", Geological Survey of Japan, Tsukuba, Nov 20-23, 1998, p. 144-147. [3] Kochemasov G.G. Theorems of wave planetary tectonics // Geophys. Res. Abstr., 1999, V.1, №3, 700. [4] Kochemasov G.G. Wave warping as a reason (impetus) of density (chemistry) differentiation of planets at very early stages of their formation // Workshop on early planetary differentiation: a multi-planetary and multi-disciplinary perspective, LPI, 2006, Abstr. # 4010. [5] Kochemasov G.G. Relief-forming potential of planets // 18th Russian-American microsymposium on planetology, Abstracts, Oct. 9-10, 1993, Moscow, Vernadsky Inst. (GEOKHI), 27-28. [6] Thomas P.C., Veverka J., Helfenstein P., Porco C. et al. Shapes of the saturnian icy satellites // LPS XXXVII, 2006, Abstr. 1639 pdf.