# THE WAVE PLANETOLOGY AND SOME FUNDAMENTAL PROPERTIES OF THE ASTEROID-SIZE SATELLITES AMALTHEA AND PHOEBE AND THE MAIN BELT ASTEROIDS.

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The new wave planetology [1 – 4 & others] gradually presses the habitual impact planetology by means of its predictive power. Impacts are not able to explain regular shapes and structures of celestial bodies constantly appearing in images sent by the planetary missions and to give an adequate explanation of chemical fractionation processes related to morphology of the bodies. The wave planetology firmly states: "Orbits make structures", and proves this by numerous comparative data of cosmic experiments. The newest Cassini project already gave excellent images of the saturnian rings an the outermost satellite Phoebe. In [5] we stated that the Cassini project by its detailed studies will bring data supporting the wave planetology. Various interfering wave structures of the rings confirm this prediction. Fig.3 shows as crossing waves create evenly spaced round features of equal sizes, not impact craters! If the ring structures are wave-induced then satellites have to be affected by waves as well.

Earlier we have shown relations between waves and shape (structure, compositional regularity) in form of 4 theorems of planetary tectonics [3]: 1. Celestial bodies are dichotomic (the fundamental wave1 makes this); 2. Celestial bodies are sectoral (effects of overtones); 3. Celestial bodies are granular (effects of individual waves lengths and amplitudes of which are inversely proportional to orbiting frequencies); 4. Angular momenta of different level blocks tend to be equal (in a rotating body wave produced tectonic blocks of different planetary radii tend to keep their angular momenta by adjusting their densities). Small satellite Phoebe obeys all these requirements. It is dichotomic: one side of it is flatter than the opposite one. This can be seen in a shape model produced by the Space Science Inst., Boulder, Colo (Fig.4 ). The convexo-concave shape is typical for small celestial bodies [6]. Phoebe reveals perfect sectoring (Fig.5, 6; compare to Miranda's sectors, Fig. 8-10 ) and some polyhedral outlines made by wave2 longing made a diamond-shape (Fig.7 ). This shape is better seen in Amalthea (Fig. 1, 2 ) having more or less the same size and in some other small bodies [7].

Fortunately, the Phoebe's orbital period (550.45 days) is just between Earth' (365.3) and Mars' (686.7) ones (the only case for rather large satellites in the solar system). Hence, if the Earth's orbital frequency makes the tectonic granula size $\pi R/4$ (R – a body radius), the martian one – $\pi R/2$, then the Phoebe's granula size is $\pi R/3$ (more exactly $\pi R/2.65$). This makes 5 – 6 granulas in the great circle (Mars – 4, Earth – 8), what one observes in bumpy topography of Phoebe (Fig. 4).

Phoebe as a satellite has two orbits. One around Saturn (550 d.) and another together with Saturn around Sun (10761 d., ~30 years). The main orbiting frequencies produce $\pi R/2.65$- granulas and 7.5 $\pi R$-granulas. A modulation of the higher frequency by the lower one produces two side frequencies and corresponding granulas: $[1/2.65 \times 7.5]\ \pi R = 8.89$ R and $[1/2.65 : 7.5]\ \pi R = 0.157$ R = 17.3 km. The larger one exceeds the Phoebe's size, the smaller one (17 – 18 km) is observed on its surface as a typical crater size controlled by evenly spaced wave produced tectonic lines (grooves) (Fig. 7). So, in the saturnian system the wave planetology predicted granula sizes for Phoebe and Titan [8] and in other systems for the Moon, Phobos, Triton, Callisto and others.

Hypsometrically (tectonically) different level sectors ($\pi R$-structures) and granulas ($\pi R/3$-structures) of Phoebe appear to be more or less dark in images. The darker (deeper) regions are enriched in carbon dioxide, ferric iron and unidentified substance; with the brighter regions associates water-ice (less dense than $CO_2$ –ice) (Internet). Such distribution does not contradict with the 4$^{th}$ theorem.

Phoebe is comparable with Amalthea by its size and rotation period, but differs completely by its orbital period: Phoebe – 550 d., Amalthea – 0.498 d. Phoebe is ice-rich, Amalthea seems ice-free with the most reddish surface in the Solar system. We know that a high orbital frequency helps to release a celestial body of volatiles [9, 10]. "Sweeping" out volatiles of bodies is provoked and facilitated by body shaking (wave oscillations). This action was demonstrated in the planetary sequence: Mercury-Venus-Earth-Mars. Here Mercury is as a "candle-end" practically without volatiles and Mars is soaked with them.

Back to Amalthea and near Io. Io is still intensively outgassing but in a peculiar way: it spits out a lot of heavy volatiles – sulphur and sulphates, less dense species, as $H_2O$ were wasted much earlier. Amalthea situation is worse: even sulphur compounds (say, heavy troilite) are gone away and the small satellite with many cavities not able to compact them to give a significant overall density surprises scientists. Its low overall density [Internet, Galileo,Dec.9, 2002] is due to high porosity, not to "pile of rubbles" (its indivisible united through structurization is against "rubbles", Fig. 1). So, properties of Amalthea and Phoebe are drastically different despite their similar sizes, rotations and possibly densities. Phoebe is an icy satellite, Amalthea has a similar density but produced by completely different “tortureous” outgassing processes (a “candle-end”).

Outgassing plays very important roles in development of planetary scenarios. The mysterious asteroid belt has some unanswered questions. Why it is “layered”; why asteroids are flat, not isometric; why larger asteroids rotate faster than smaller ones. The impact planetology has difficulties answering them. The wave planetology, having as an example the sequence of the inner planets, states that the inner asteroid belt orbiting faster than the outer parts is better outgassed. So, “leavings” are denser and acquire metallic character. In the outer parts prevail less outgassed carboniferous C-asteroids. Larger asteroids keep their near original mass and rotation velocities. Sweeping out volatiles means mass reduction (bodies become smaller), loss of angular momentum and hence slower rotations (compare Mercury and Venus, from one hand, and Mars and Earth, from another*). Universal flat bodies of asteroids – a result of squeezing them by the fundamental wave that bulges out one hemisphere and presses in the antepodean one. The convexo-concave shape is a consequence of the universal wave shaping [6].

*A new finding of this kind is, possibly, fractionation of saturnian rings revealed by “Cassini”: icy fragments of the inner parts are “dirty”, of the outer parts –purer, ice-rich. Explanation: enhanced degassing of the inner parts leaves dirtier particles and surfaces.

**References**: **[1]** Kochemasov G.G. (1994). $20^{th}$ Russian-American microsymposium on planetology. Abstr. Moscow, Vernadsky Inst., 46-47; **[2]** Ibid. (1998) Proceedings of international symposium on new concepts in global tectonics (’98 TSUKUBA), Tsukuba, Japan, Nov. 1998, 144-147; **[3]** Ibid. (1999) Geophys. Res. Abstr., v. 1, # 3, 700; **[4]** Ibid. (1999) The fifth international conference on Mars, July 18-23, 1999, Pasadena, California. Abstr.# 6034. LPI Contribution # 972. LPI, Houston, CD-ROM; **[5]** Ibid. (2004) $35^{th}$ COSPAR Scientific Assembly, 18-25 July 2004, Paris, France. Abstr. # COSPAR04-A-00909, CD-ROM; **[6]** Ibid. (1999) “Asteroids, Comets, Meteors” conference, Cornell Univ., USA, July 1999, Abstr. # 24.22; **[7]** Ibid. (1999) The $30^{th}$ microsymposium on comparative planetology, Abstr., Moscow, Vernadsky Inst., 49-50; **[8]** Ibid. (2000) Geophys. Res. Abstr., v. 2, CD-ROM; **[9]** Ibid. (2002) The $36^{th}$ microsymposium “Topics in comparative planetology”, Abstr., Oct. 14-16, 2002, Moscow, Vernadsky Inst., CD-ROM; **[10]** Ibid. (2002) $34^{th}$ COSPAR Scientific Assembly at the World Space congress, 10-19 Oct. 2002, Houston, Texas, USA, Abstr., CD-ROM.

**Fig.1** Amalthea, leading side, PIA01074. Diamond shape and intersecting wave warpings. Indivisible through structure. **Fig.2** Amalthea, trailing side, PIA01074. Cellular texture, evenly spaced “spots”. **Fig.3** Saturnian ring, a part of the NASA/JPL image “Cassini enters Saturn’s orbit”,soi-3, 20.07.04. Intersecting waves create ring structures. **Fig.4** Phoebe’s dichotomy and bumpy topography. Outlined are low areas making tectonic granulation ~πR/3. The view centered at 90˚ west. Drawing after the NASA/JPL/Space Science Inst. colorful graphic “The true shape of Phoebe”, pia06070, 23.06.04. **Fig.5** Phoebe sectoral structure. The NASA/JPL/Space Science Inst. image “Battered Moon”, pia06066, 12.06.04. **Fig.6** Drawing stressing the sectoral structure of Phoebe (see Fig.5). **Fig.7** Phoebe drawing after the NASA/JPL/Space Science Inst. image “Battered Moon”, pia06066, 12.06.04. Faintly visible intersecting grooves make cellular appearance (granulation) of the Moon’s surface. Also visible are on the whole polyhedral outlines of the satellite. **Fig.8** Miranda’s sectoral structure (NASA/JPL P-29541). Subsided squeezed sector (below) shows layered formations; uplifted extended sector (up) is full of degassing craters; to the left and right are neutral sectors. **Fig.9** Drawing of the Miranda’s tectonic sectors (after Fig.8). **Fig.10** Scheme of the wave interference origin of the sectors in Fig.8, 9 & Fig.5, 6.