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Ceres, Pallas, Vesta: tectonic dichotomy is a common shape character of these three largest asteroids

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Abstract

In compliance with the first theorem of the wave planetology –"Celestial bodies are dichotomous" [1-4 & others] – three largest asteroids of the main asteroid belt show striking tectonic similarity. Though not sharply imaged by the HST, and having differing sizes and compositions, they all show somewhat different hemispheres. A flattening one side (up to development of a depression) is accompanied by a bulging of the opposite one. This dichotomous shape feature is a fundamental tectonic character of celestial bodies caused by their movements in non-circular keplerian orbits with alternating accelerations: speeding + and braking -. Arising inertia-gravity forces warp any moving and rotating (but all bodies move and rotate!) bodies in four ortho- and diagonal directions. An interference of these directions brings about uprising (+), subsiding (-) and neutral (0) regularly disposed tectonic blocks. They have a stationary character (move up and down with certain periods) the same as giving them rise inertia-gravity waves are stationary waves (endless movements in non-circular orbits make them standing). Sizes of the tectonic blocks depend on lengths of the warping waves. The most pronounced tectonic wave produced feature is the tectonic dichotomy caused by the longest in any body fundamental wave 1 (long 2πR, where R is a body radius). To think that this ubiquitous dichotomy is a result of a random giant impact hitting any body in a special place is completely unacceptable.

The theorem 3 of the comparative wave planetology [1-4] states: "Celestial bodies are granular". Sizes of these tectonic granules are inversely proportional to orbital frequencies: higher frequency – smaller granule, lower frequency – larger granule. There is the following row of granule sizes (a half of a wavelength): Mercury πR/16, Venus πR/6, Earth πR/4, Mars πR/2, asteroids πR/1. It follows that in the asteroid belt there is a remarkable resonance 1:1 between the fundamental wave and an individual wave also long 2πR. This causes an enormous scattering of planet building material from the main asteroid belt, impossibility of gathering a planet (no Phaethon is possible!) and severe flattening of asteroids of all sizes including the largest ones (all asteroids have a well known oblong shape). Normally, along with an oblong one observes a convexo-concave shape (the best studied example is the approaching Earth asteroid Eros) [5].

This severe resonance enhanced treatment causes visible distortion of not only relatively small bodies (less than 300-400 km across), that is widespread among celestial bodies of various classes [6 , 7], but also the largest of them, more

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than about 500 km across. Thus, an oblong body of (1) Ceres has major/minor axes 898/788 km [8] or 970/930 km, according to J. Parker & Stern, and has a prominent dusky dark spot (Piazzi) from one side (Fig. 2). It occupies a significant part of the asteroid (a dwarf planet) – about 250 km, more than a quarter the size of Ceres and probably might be assigned to a depression (Fig. 2). Tectonically one may compare this depression with the Pacific basin hollow on Earth [9]. A NASA HST color image of Ceres PIA10235 (Fig. 1) shows spectrally different regions: relatively red and blue, hinting on different types of material and compositional dichotomy.

(2) Pallas has the radii of 291 x 278 x 250 km [10] and also represents a dichotomous shape with one bulging hemisphere and the other antipodean one more flat and dark (Fig. 3). (4) Vesta, about 525 km across, has a deep dark depression from one side opposed to a bulging shining hemisphere [11] (Fig. 4). So, in all three cases of the largest asteroids there is one tectonic peculiarity clearly showing their dichotomous nature (The Tempel 1 comet nucleus is shown in Fig. 5 to stress a common character of the wave structurization). Inferred impacts have nothing to do with this inherent to all heavenly bodies wave induced structurization. The dichotomy is caused by the fundamental wave 1 weaving a structural tetrahedron. The first overtone wave 2 makes a structural octahedron (a diamond shape) described in an accompanying abstract "Three "diamonds" in the sky – not enough to evoke interest in not before considered planetary processes?" (EPSC2009-28). To reinforce this appeal one may add an interpretation of the Pallas UV image (Fig. 3) as showing a flattened **roughly octahedron shape** (2Pallas HST2007.jpg). So, a new planetologic thinking is strongly required

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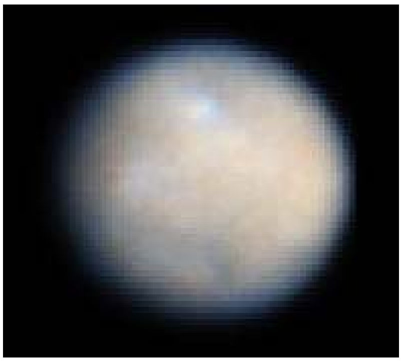

Fig. 1. (1)Ceres. Dwarf planet. PIA10235. Credit: NASA/ESA/J. Parker, P. Thomas, L. McFadden, and M. Mutchler and Z. Levay.

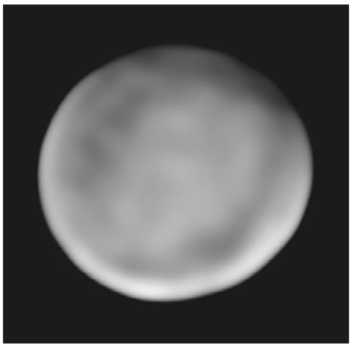

Fig. 2. (1)Ceres. Piazzi basin – the huge darker oval. Credit: Keck Observatory by C. Dumas (NASA-JPL).

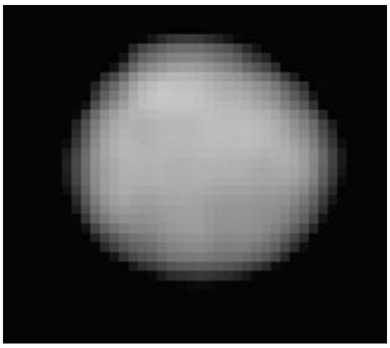

Fig. 3. (2)Pallas [10]. HST2007. jpg. An UV image of Pallas showing a flattened roughly octahedron shape.

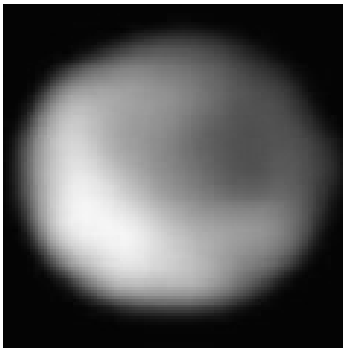

Fig. 4. (4)Vesta. A dichotomous celestial body. Press release #: STScl – PR95-20. Asteroid or mini-planet? A portion of HST.WFPC2, B. Zellner, NASA, April 19, 1995.

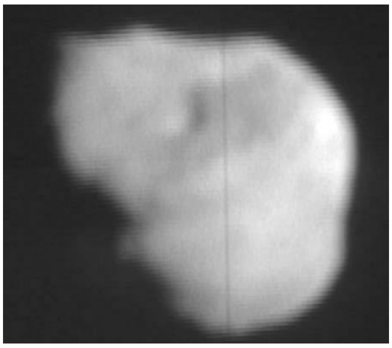

Fig. 5. Tempel 1 comet nucleus (Deep Impact Mission), PIA02119. Example of an oblong convexo-concave shape typical for small bodies. Credit: NASA/JPL – Caltech/ UMD.