

## Planets and satellites: tectonic twins

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There are only three solid planet-satellite pairs in the Solar system: Earth – Moon, Mars – Phobos, Pluto – Charon. For the first two pairs tectonic analogies were shown and explained by moving them in one circumsolar orbit. As it is known from the wave planetology [3, 4, 6], “orbits make structures”. For the third pair the same was stated as a prediction based on this fundamental rule. Global tectonic forms of wave origin appear in cosmic bodies because they move in keplerian orbits with periodically changing accelerations. Warping bodies waves have a stationary character and obeying wave harmonics lengths. Starting from the fundamental  $2\pi R$ - long wave 1 making the ubiquitous tectonic dichotomy (two-face appearance) warping wave lengths descend along harmonics. Very prominent along with the wave 1 are waves 2 responsible for tectonic sectoring superimposed on the wave 1 segments. Practically all bodies have traces of shorter waves making numerous polygons (rings) often confused with impact craters.

Earth and the Moon moving in one circumsolar orbit both are distorted by wave 1, wave 2 and wave 4 features aligned along extent tectonic lines [4, 5]. At Earth they are: Pacific Ocean ( $2\pi R$ -structure) and Indian Ocean ( $\pi R$ -structure) from both ends with Malay Archipelago ( $\pi R/4$ -structure) in the middle. At Moon they are: Procellarum Ocean ( $2\pi R$ ) and SPA Basin ( $\pi R$ ) from ends and Mare Orientale ( $\pi R/4$ ) in the middle. A regular disposition is surprising. Both Oceans and Basin occur on opposite hemispheres, lying in the middle both ring structures occur in the boundary between two hemispheres and are of the same relative size. These triads stretch along lines parallel to the equator (Earth) and with the angle about 30 degrees to it (Moon) indicating at a different orientation of the rotation axes in the ancient time [2]. On the whole, one could speak about a “lunar mould” of Earth [5] (Fig. 1-3).

Another tectonic twin is the pair Mars – Phobos. Both bodies sharing one circumsolar orbit, twice as long as the Earth – Moon orbit, acquire slightly oblong ellipsoidal shape (Fig. 4, 5). Very pronounced on both so much different in size and composition bodies the deepest basins – Hellas and Stickney (sectoral  $\pi R$ -structures) are comparable features.

The structural unity is predicted also for the third solid body pair – Pluto – Charon.

**References:** [1] Andrews-Hanna, J.C., Besserer, J., Head III, J.W. et al. 2014b. Structure and evolution of the lunar Procellarum region as revealed by GRAIL gravity data. *Nature*, v. 514, #7529, 2014, 68-71, doi: 10.1038/nature1369; [2] Garrick-Bethell, I., Perera, V., Nimmo, F., and Zuber, M.T. 2014. The tidal-rotational shape of the Moon and evidence for polar wander. *Nature*, v. 512, issue 7513, 14 Aug. 2014, 181-184; [3] Kochemasov G.G. Theorems of wave planetary tectonics. *Geophys. Res. Abstr.* 1999. V.1, №3, P.700; [4] Kochemasov G.G. Earth and Moon: similar structures – common origin // NCGT Journal, 2014, v. 2, # 2, 28-38; [5] Kochemasov G.G. A lunar “mould” of the Earth’s tectonics: four terrestrial oceans and four lunar basins are derivative of one wave tectonic process // NCGT Journal, v. 3, # 1, March 2015, 29-33; [6] Kochemasov G.G. Ceres’ two-face nature: expressive success of the wave planetology // NCGT Journal, v. 3, # 1, March 2015, 63-64; [7] Oberst, J., Shi, X., Elgner, S., Willner, K. 2014. Dynamic shape and down-slope directions on Phobos. The fifth Moscow Solar system symposium. Space Research Institute (IKI) RAS, 13-18 October 2014, Abstract 5MS3-MS-11.

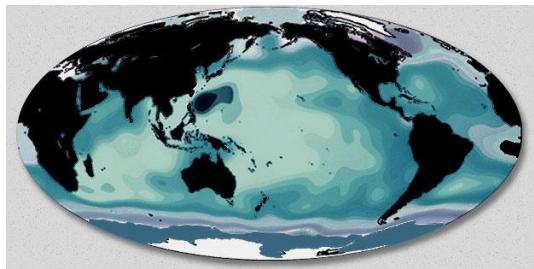


Fig. 1, 2.

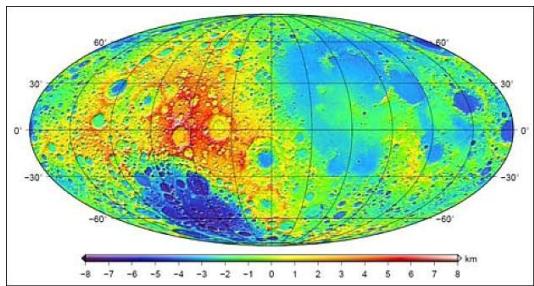
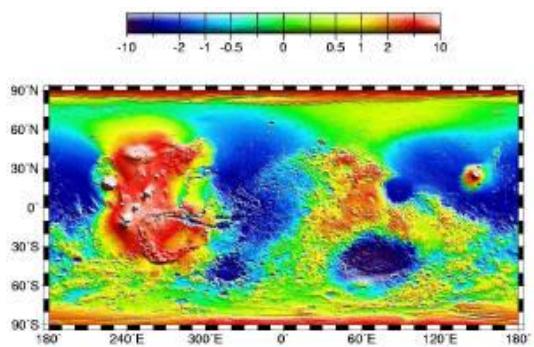
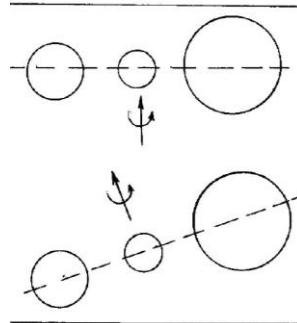


Fig. 3.



Phobos Dynamic Topography Model

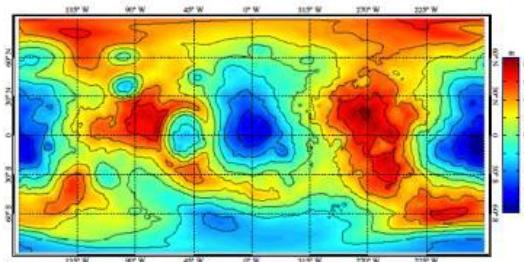


Fig. 4 (above) and Fig. 5.

**Fig. 1, 2.** Earth's oceans; Lunar topography; **Fig. 3.** Schematic sizes and relative dispositions of terrestrial (above) and lunar wave born tectonic features. Pacific Ocean and Procellarum Ocean at the right -  $2\pi R$  structures. Indian Ocean and SPA Basin on the left -  $\pi R$  structures. Malay Archipelago and Mare Orientale at the center -  $\pi R/2$  structures. Equators (axis of rotation) positions at present (Earth) and at ancient Moon; **Fig. 4, 5.** Mars (above) and Phobos topography [7]. Global tectonic parallel.