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Atmospheric masses of four Solar system solid bodies (Venus, Earth, Mars, Titan) in relation to their tectonic granulations

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Only four solid bodies of the Solar system have significant atmospheres (Fig. 1-4). Their compositions reflect processes of outgassing and evolution of solid geospheres. Main atmospheric components are at Titan N_2 and CH_4, Mars CO_2, Earth N_2 and O_2, Venus CO_2. Minor components mainly give them spectacular colors: orange, red, blue, and white. An important regularity concerns masses of atmospheres. They are inversely proportional to sizes of wave tectonic granulations of solid bodies and are also influenced by other physico-chemical conditions as temperature, gravity, and planetary masses. Relief ranges of solid bodies increase with increasing tectonic granule sizes [1]; atmospheric masses, on the contrary, increase with diminishing granule sizes [2]. Thus, intensity of "sweeping" out volatiles of planets increases with frequency of their wave "shaking" that is in an inverse correlation with their orbital frequencies.

Planetary atmospheres as inseparable parts of planetary geospheres have close structural and compositional ties with underlying solid formations. Atmospheres are produced by solid bodies as a result of their outgassing ("sweeping out" volatiles) that apparently is tied to their oscillations and tectonic granulations [2, 3]. The comparative wave planetology having stated that "orbits make structures" finds that two fundamental properties of all celestial bodies are most important for their structurization: movement and rotation. All bodies move in non-circular keplerian elliptic (and parabolic) orbits that imply periodic acceleration changes and appearance of inertia-gravity forces producing warping waves. In rotating bodies (but all celestial bodies rotate!) these waves are ordered in four ortho- and diagonal directions. Having stationary character and various lengths they interfere producing positive (+), negative (-) and neutral (0) tectonic blocks [4].

The fundamental wave 1 long $2\pi R$ gives ubiquitous tectonic dichotomy, the first overtone wave 2 long πR makes tectonic sectoring. Individual for any body waves whose lengths are inversely proportional to their orbital frequencies produce tectonic granules: higher frequency – smaller granule, lower frequency – larger ganule. The following row shows increasing granule sizes (a half of a wavelength): Titan $\pi R/91$, Sun's photosphere $\pi R/60$, Mercury $\pi R/16$, Venus $\pi R/6$, Earth $\pi R/4$, Mars $\pi R/2$, asteroids $\pi R/1$[1, 2, 4]. One may say that Venus is tectonically "fine-grained", Earth "medium-grained", Mars "coarse-grained". The wave produced granulation and known atmospheric masses indicate that fine-grained Venus is more thoroughly shaken out and released of its volatiles (degassed) than Earth and Mars. The atmospheric masses increase from Mars through Earth to Venus as ~ 0. 01 : 1 : 90. This is proved not only by its massive atmosphere containing a large amount of nitrogen but also by a very low ratio of radiogenic to primordial argon (Venus 1, Earth 300, Mars 3000) [5]. The smaller volatile rich satelliteTitan with high orbital frequency has an important atmosphere -probably only a remnants of what was totally outgassed during eons [2].

Most outgassed planets (and Sun!) having transferred important part of their angular momentum to gaseous envelope and farther out were forced to slow down their rotation rate. Thus, there are slowly rotating Venus, Mercury, and Sun , moderately rotating Earth and Mars, and fastly rotating outer gaseous giant planets.

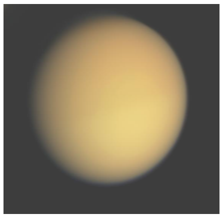

Fig. 1

Fig. 3

Fig. 2

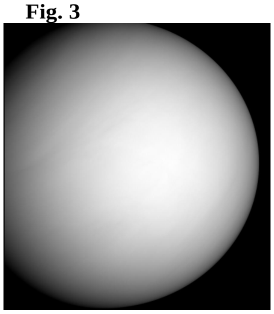

Fig. 4

Fig. 1. Titan, PIA09858, "Orange", Natural color view, imaged by Cassini SC from distance of 2.3 mln. km. **Fig. 2.** Mars, PIA11029, "Red Planet", Mars Global Surveyor's image. Olympus Mons at center. **Fig. 3.** Earth, PIA10120, "Blue Planet", MESSENGER Space craft's image. **Fig. 4.** Venus, PIA10124, "White Planet", MESSENGER SC's image.

References:

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