

## FORMATION OF RECYCLE FLUID WATER ON ANY SPACE SURFACE AS SUPPORTS OF LIFE.

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**Introduction:** Water and air on Earth-type planets of the Solar System has been discussed by *molecular existences* of global water and air based on facts of water- and air-planet of Earth, because "huge database of active planet Earth" accumulated precisely by human activity is considered to be applied easily to other Earth-type planets [1-3]. The main purpose of the paper is to elucidate new model of water volatiles of extraterrestrial planets and satellites compared with separated water and air molecules on Earth [3-6].

**Characteristics of three shock-wave events:** Shock-wave processes of meteoritic impact, earthquake and volcano are produced at high velocity over sound speed at high pressure and temperature (Fig. 1). The related activity of earthquake and volcano produced on the crustal rocky ground is used to be short duration (Table 1). On the other hand, activity of meteoritic impacts on the crustal rocks in the sky can be observed as first detection in air to be changed the orbits with human's defense strategy (Table 1) [1, 6].

Mercury	Venus	Earth	The Moon	Mars	Asteroids
Size	Medium	Large	Large	Medium small	Medium
Density	High	Higher	Highest	Lower	Medium
Materials	Rock	Air, Rock	Air, Water, Rock	Rock	Air, Rock
Water Molecules	Local?	Local? Air (minor)	Global, Local	Local?	Local? Air(minor)

Fig. 1. The size, density, materials and water volatiles of four Earth-type planets, the Moon and Asteroids. Earth shows global systems of three materials with global and local waters. Venus and Mars show two water-materials of H and O ions without global water system, but possible water ions on the rocks [3, 6].

**Water-related ions and volatiles of planets:** Materials are classified as rock (solids), air (gas) and water (liquid), where water-planet of Earth has all three materials globally in cyclic system [1]. Venus planet has global air and rocks as in Mars (Fig.1). Although global water molecules (or water ions) have been obtained only water planet of Earth, however local water molecular *ions* with smaller amount might be stored in all solid rocks of other planets (Mercury), the Moon and Asteroids, as shown in Fig.1 [3-6].

**Global systems of the Earth-type planets:** Earth-type planets have all solid rocks in global cyclic sys-

tems, where "*global and cyclic materials*" are used for cyclic system of rock (solids), air (gas) and water (liquid) on the surface to shallow interior. However, other global systems of air and water volatiles with light elements are completely different with the water-planet of Earth changed continuously and dynamically. The airless and waterless planets at the primordial period of the Solar System which are main images of the present planets (except water-Earth), show all solidified rocks which might have contained volatile elements and ions (including *fluid water* molecules) during the collision processes of the celestial bodies, where the main process mixed volatiles and heavy elements in the rocks should be explained by "local fluid water molecular ions related with irregular impact-related distribution". Figure 2 shows global distribution of three materials (air, water and rock) on Earth, whereas other planets of Venus and Mars have only two global materials (air and rock) without *global water* molecules [3-6].

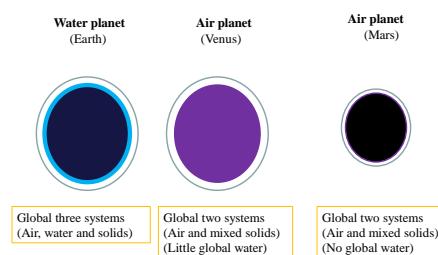


Fig.2. Schematic diagrams of global three systems of air-water-rocks (Earth) and two systems of air-rocks (Venus and Mars) [3, 6].

**Local and global waters of planets:** Local fluid water ions have been mixed with solid rocks from the primordial to present situations of each planet without global ocean system. However global water system on planet Earth is difficult to explain simply the huge amounts of *water* ( $H_2O$ ) and stable location between air and rock systems based on only one planet, which might be required by huge planetary collision process to produce fluid water by dynamic exchanges of three global materials (Fig.3). Therefore, it is proposed herewith for formation of global water system to be mixed with interior water and carbon dioxides ions of two planetary supplies by rapid process which are called by "giant-like impact process" on the primordial Earth planet to be remained fluid water molecules between the air volatiles and

the solid rocks with moderate temperature and gravity (Fig.3) [3-6].

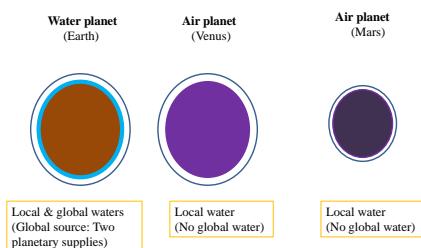


Fig.3. Schematic diagrams of global and local fluid water on three planets [3, 6].

**Characteristics of atmosphere formation:** Global atmospheric gas of planets should be continued to be erupted from the interior of the planets mainly with temperature and the gravity effects. Venus and Mars with volcanoes (non-Earth-type) along the equators followed with the planetary rotations have been released partly volatile molecules of carbon dioxides and water ions previously [3-6].

**Characteristics of global ocean-water system:** The presence of ocean-water of Earth planet has been applied for the evidence of past-global ocean water because of volatile ions in the interior deposits. However, the phase diagrams of the fluid (water and carbon dioxide) indicate that liquid phase can be stable only by sandwiched with solid and air phases [3-6]. Therefore, global ocean water system might be formed for global air system of any planets (Venus and Mars) from local interior resources of the fluids, though it is difficult supply continuously from local fluid ions enough for global ocean-water system.

**Possible processes for changes in air composition:** Primordial planet's atmosphere shows bulk composition with much carbon dioxide gas (than water ions or so) due to more stable at high temperature and pressure conditions generally. In short, it's significant challenge of changed atmospheric composition for future habitable planet on Venus or Mars. In fact, colder carbon dioxides on Martian air are generally possible relatively by probable process of the melting and solidification. On the other hand, hot carbon dioxides (on Venus) are generally difficult to be changed locally and globally. It might be possible to apply any natural collisions and our artificial method to change *hot carbon dioxides* gas solidified [3, 6] on the surface (to shallow interior) for global system in any planets (with compact machine) [1-6].

**The possible formation of water system:** Volatile systems of air and water separated from global

volatiles-bearing solid rocks produce planets of clear rocks with higher density as in Earth and Venus. In short, there are two dynamic methods to form globally water system on Venus and Mars of "step-by-step method", and "rapid evaporation to cooling method". The present study suggests that it should be not impossible to form *global water* system by any impact-collisions and recent manmade methods [7].

#### Formation of fluid from primordial rocks:

Pure water molecules can be produced from cooled vapor gas, but mixed fluid water (with mixed ions from primordial rocks) might be formed by our method by heating primordial rocks with volatiles ions [7]. The result might be applied for compact water-CO<sub>2</sub> gas production way from primordial rocks at 2050 space exploration to support astronauts and human activity on any extraterrestrial surfaces.

**Summary:** The present study can be summarized as follows:

- 1) Three materials of global rock, air and water can be found in the inner Solar System, though ocean-water system can be obtained mainly water- and air-planet of our Earth produced by planetary collisions of planets.
- 2) Formation of global air and/or global ocean water systems for waterless planets of Venus and Mars might be possible by planetary collisions, interior volatiles uplift process (by the planetary tidal rotation) and effective rock-fluid water exchange methods.
- 3) Larger air-planets of Venus and Mars have global air with higher pressure of water planets by natural impact processes and manmade method of heated volatile-bearing rocks widely.
- 4) Global changes of colder air (Mars) and hotter air (Venus) are possibly changed to global ocean-water systems by global processes of planetary collisions in future, together with manmade heated rock-fluid method widely.
- 5) The present result can be applied for compact water-CO<sub>2</sub> gas exchange method from any primordial rocks at next 2050 space exploration to support astronauts and human life activity on any extraterrestrial surfaces.

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**References:** [1] Miura Y. et. al. (1996) Antarctic Meteorites XXI(Tokyo), 107-110. [2] Miura Y., Fukuyama S. (1999) Journal. Materials Proc. Tech. (Elsevier), 85, 192-193. [3] Miura Y. (2011) International Venus Workshop of VEXAG Meeting-9 (Chantilly, Virginia), #45, #51. [4] Miura Y. (2012) LPSCXXXIII Abstract #2920. [5] Miura Y. (2015) LPSC2016 (LPI, USA), #1811, 1666. [6] Miura Y. et al. (2015) International Venus Workshop of VEXAG Meeting-13 (Virginia, USA), #4006. [7] Miura Y. (2016) J. Min. Sci. Japan (Kanazawa Univ.), #R5O1.