NEW CONCEPT OF PLANETARY SURFACES BY IMPACT GROWTH PROCESS WITH REMNANTS OF PHASE CHANGES. Yasunori MIURA[1, 2, 3]. Yamaguchi University, Chuou 4-1-23, Yamaguchi, 753-0074, Japan. yasmiura50@gmail.com. [2]Al.I.C-EUA University and [3]Caltech-JPL.

Introduction: Almost all surfaces of planets, satellites, the Moon and the Asteroids (except water planet of present Earth) are considered to be all solid phases of minerals and rocks (composed of minerals) [1]. This is mainly because there is generally phase definition of "solid" clearly against liquid and vapor (gas) [2]. The present definition of remote-sensing measurements on the surfaces of various bodies is based on average solid-states estimated by crystalline minerals and bulk chemical composition through electro- magnetic measurements (IR etc.), though the detailed heterogeneity cannot be included by the indirect measurements. On the other hand, we can investigate direct solid surface textures of extraterrestrial materials by meteorites (Mars, the Moon and Asteroids etc.) and the Apollo lunar collected samples to compare with indirect observations of the various solid surfaces [1]. The main purpose of the present paper is to elucidate new concept of solid surfaces mainly by impact growth processes through phase changes among vapor, liquid and solid (called as VLS in this paper).

Breccias of extraterrestrial samples: Homogeneous rock textures related with the formation process should be discussed by the size of analyzed samples, though recent data of micro- to nano-grains are usually difficult to analyze the following sizes and textures (Table 1) [3-8]:

1) All samples of extraterrestrial meteorites and the Apollo lunar samples are less than a few ten centimeters generally, which are all breccias or broken fragments which have been formed the brecciated samples by impact growth during its melting and/or vaporization of impact processes.

2) Terrestrial standard rocks samples used for extraterrestrial correlations with homogeneous texture relatively are wider ranges from centimeters to a few (ten or hundred) meters-and- kilometers, which are definitely formed at underground magmatic melting and solidification for long reaction time (Ma unit in geological time) observed at the present continental crusts of water-planet of our Earth [2]. Therefore, terrestrial standard rocks (composed of crystalline minerals) are previously based on its geochemical and crystalline standards, but not on size or texture standard related with its formation process [3-8]. In short, previous formation models analyzed by extraterrestrial compositions and crystal properties are based on Earth's rock formation processes with special and limited conditions of water Earth (Table 1) [3-5].

Table 1. Two types of Earth rocks and meteorites.

1) *Earth's rocks*: Bigger and hard crust-rocks (Continental rocks by ocean-magma process)

2) *Extraterrestrial rocks*: Smaller and soft rocks *(Breccias of Moon, Mars, Asteroids* & old Earth)

Evidence of lunar rocks by porosity: Heterogeneous properties of the Apollo lunar rocks are obtained by the porosity and density (with carbon impact-mixture) data. Figure 1 shows the lunar anorthosite (15418) reveals Inter- mediate values of density and porosity between the Mare basalts (12051, 15555) and the breccias (14303, 14321) [1], which indicates the upper lunar-crust with less density and higher porosity (by impact growth processes with higher carbon contents) than interior mantle basalts [3, 5].

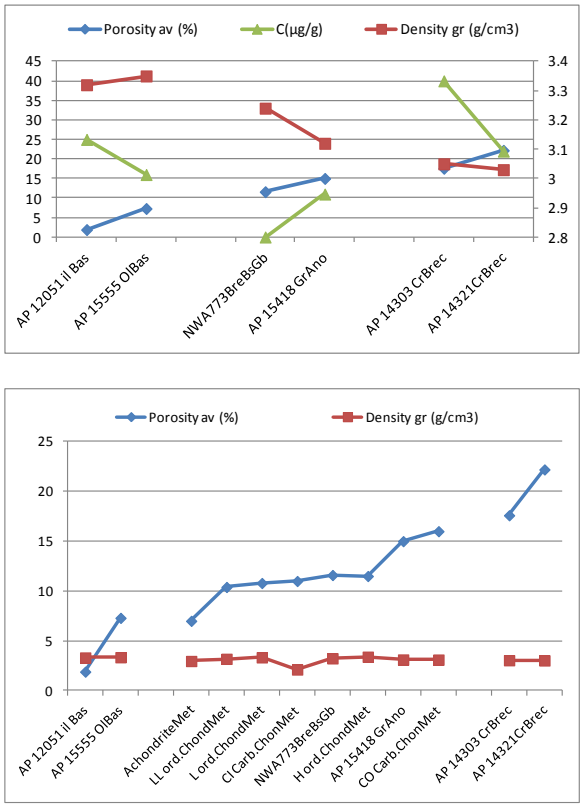

Fig.1. Density, porosity and carbon contents of the lunar rocks of Mare basalt (left), anorthosite (middle) and breccias (right).

Impact growth of terrestrial crust rocks: Impact processes on wide and homogeneous rocks of the Earth's crust are used to be completely evaporated to form air system from hard target rocks, which can be seen impact craters on the continental crusts (ca. 30% in the surface volume). Impacts on ocean water (ca. 70 volume %) are similar impact process (on larger impact to sea-bottom) with almost all rapid cooling products mixed with fluids (found as many spherule glasses or breccias) which are remnants of the VLS impact growth processes (Table 2) [3, 5].

. **Impact growth of extraterrestrial breccias:** Impact processes on smaller heterogeneous rocks of extraterrestrial samples (the Moon, Mars and Asteroids, together with primordial Earth without ocean-system) are used to be less evaporated from fine (soft) target rocks, which are formed as breccias or fine broken fragments and regolith soils on the surface with penetration to the interior direction resulted in the underground fluids or gas with water molecules (OH or H2O)-bearing grains which are remnants of the local VLS impact growth processes (Table 2) [3-8].

Table 2. Impacts of Earth and extraterrestrial rocks.

1) Crust:	Homogeneous hard impact rocks with impact craters or impact structures (VLS changes on water planet Earth)
2)Breccias:	Heterogeneous soft impact rocks with extraterrestrial breccias (VLS changes on the Moon, Mars and Asteroids, and primordial Earth without ocean (as micro water-grains).

Examples applied by impact growth processes: The present concept of impact growth is discussed following two types:

1)Terrestrial impact growth processes which are complicated due to broken by the continental shift process, can be classified by impact circular-craters (the Barringer, Ries, Wolf Creek, Henbury and Gosses Bluff *etc*.) and impact broken-structure (Sudbury, Santa Fe in New Mexico and buried Takamatsu-Akiyoshi etc.) [3, 5]. All hard target rocks are found in igneous and sedimentary continental crust. Ejected direction by hard impact target is opposite side to form air system and finally ocean water found in water planet Earth

2) Extraterrestrial surfaces of waterless Moon and planets with void-rich texture of spoils and breccias [3-8] are applied for Martian surface (cf. NASA Curiosity's data 2012 [9]). Ejected direction by impact is mainly along transmitting to deeper interior.

Remnants of the VLS phase changes can be observed by the FE-ASEM in the samples of terrestrial and extraterrestrial impacts reported the other related papers [3-8].

Summary: New concept of planetary, lunar and Asteroid surfaces is proposed by impact growth process through the three VLS material states. Target impact materials are divided into impacts on wider hard rock and smaller soft rocks.

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