LUNAR FLUIDS FROM CARBON AND CHLORINE CONTENTS OF THE APOLLO LUNAR SAMPLES.

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Introduction: Contents of elements H, C, He, N and Cl do not be discussed so well for impact indicators and fluids for the collected lunar samples [1]. The present purpose of the present paper is that contents of H and C in the lunar rocos are very significant to estimate water and carbon dioxides (CO2) as fluids in the lunar interior for next exploration project [2, 3].

Three formation groups of lunar samples: Major three groups of the Apollo lunar samples are divided from the reported analyzed data to check behavior of elements H, He, N, C and l Cl [1] as shown in Table 1:

Table 1. Imformation of three groups of the Apollo lunar samples.

Mare basalt:	Interior contents (due to deep volcanism)
Regolith:	Impact and Solar winds (direct reservoir of impacts)
Polymict breccias	Information during impact (quenched impact materials)

Hydrogen content in the lunar interior: Few content of hydrogen (H) has been obtained in the Mare basalts [1]. Significant H amounts in the regolith and polymict breccias are obtained, which are transported from the solar winds activity with helium (He) content. This indicates that there are dry condition of water in the interior of the Moon as shown in Fig.1 which is the same results in the nitrogen (N) [1].

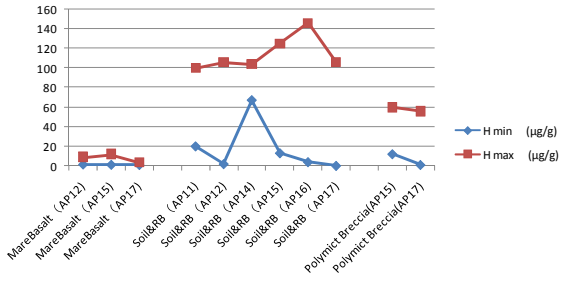

Fig.1 Hydrogen contents of three kinds of the Apollo lunar samples [1]. Poor hydrogen amounts of Mare basalts indicate short of water in the interiors.

Carbon contents in the Mare basalts: Significant content of carbon has been relatively obtained in the Mare basalts, compared with the hydrogen content [1]. Significant amounts in the regolith and polymict breccias are obtained, which are mainly transported from impact processes due to highest contenst in the polymict breccias samples. This indicates that there are CO2 fluids in the interior of the Moon as shown in Fig.2, which is the same results in the chlorine (Cl) [1].

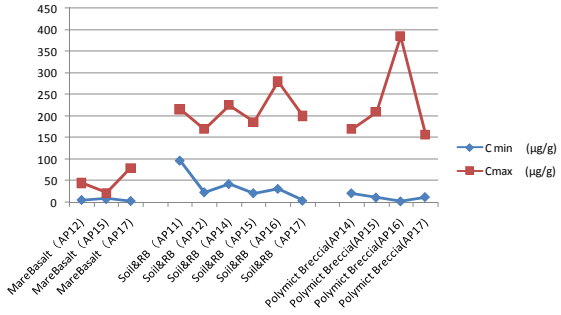

Fig.2. Carbon contents of three kinds of the Apollo lunar samples [1]. Significant carbon amounts indicate CO2-rich fluids in the lunar interiors.

Probable fluids of water and CO2 in the lunar interior: The lunar interior is considered to be CO2-rich fluids which are transported during impact condition shown in Fig.3, originally at giant impact process to deeper places of the Moon [2,3].

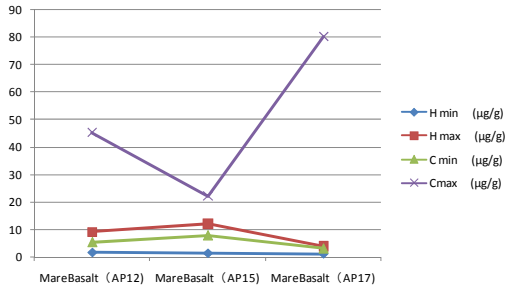

Fig.3. Higher carbon contents in the Apollo basaltic-samples, compared with hydrogen [1].

Summary: The Moon has carbon-rich fluids in the interior, compared with hydrogen (for water) amounts from the Apollo lunar samples. Main origons of carbon are dynamic giant impact between two original planets.

References: [1] Heiken G., Vaniman D. & French B. (1991): Lunar source book (Cambridge Univ.Press). 468-474. [2] Miura Y. (2009): *LPS XL*, Abstract #1090. [3] Miura Y. (2009) *LPS XL*, Abstract #1468.

LUNAR CRUST COMPONENTS FROM PLANETS AT THE GIANT IMPACT EVENT. Yasunori Miura, Graduate School of Sci. & Eng., Yamaguchi University, Yoshia 1677-1, Yamaguchi, Yamaguchi 753-8512 Japan. yasmiura@yamaguchi-u.ac.jp

Introduction: Origins of lunar crust components with anorthosite composition is not discussed so far, though there are various discussions on separation of light crust and heavy mantle components on the Moon applied by magma ocean process [1].

Impact elements of carbon and chlorine [2] can be used for new impact elements remained after as carbon- and chlorine-bearing materials in the lunar rocks of deeper basalts as "metamorphosed impact remnants" [2, 3, 4, 5, 6], which can be applied for the giant impact event between primordial Earth and Mars-size planet to form the Moon after removing of anorthositic components mainly from primordial Earth.

The present purpose of the paper is that lunar crust components are originally from Earth planet at the giant impact process.

Problem of original sources of the lunar crust: Origin of lunar crust components shown as anorthositic composition is considered to be main problem, except separation of light anorthositic crust and heavy basaltic mantle components on the Moon explained by magma ocean process of isotopic heat sources [1].

The following items listed in Table 1 are main problems for estimation of original components of the lunar crust which is considered to be formation mainly by normal planetary accretion model so far. The present model can be explained energy sources (explained by impacts on airless Moon and heat sources of the giant impact and isotopic mixing from target Earth) [1] as shown in Table 1.

Table 1. Main problems for origin of the lunar crust.

1) Origin of light anothositic components:
(previous model) All rocks planetary bodies with light anorthositic rocks
(present model) Separation from primordial Earth by the giant impact event
2) Origin of separated anorthositic crust:
(previous model) normal planetary accretion and giant impact
(present model) Main source of separated planet mainly from primordial Earth

Impact changes of H, He, C, N and Cl elememts: All light elements should be decreased during impact process [1], though only carbon (C) and chlorine (Cl) elements are fixed to solid states [2, 3, 4, 5, 6] as shown in Fig.1. This is mainly because carbon is fixed to solids of graphite, carbites and carbonates during impact process [2, 3]. On the other hand, hydrogen (H) and helium (He) elements are decreased during impact process [1, 2, 3] (cf. Fig.1). Chlorine (Cl) can be remained as chlorine-bearing materials of akaganeite and halite [2, 3, 4, 5, 6] (cf. Fig.1).

This indicates that C and Cl elements are indicators which can remained even after impact process.

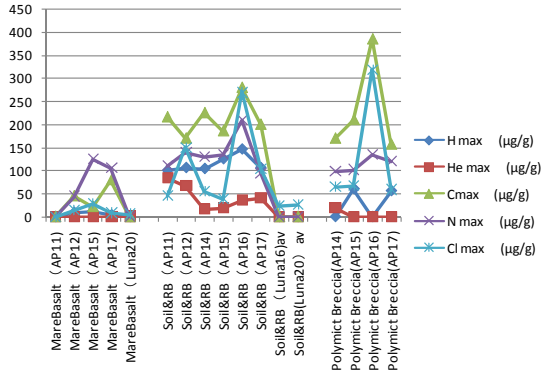

Fig.1 Five elements of H, He, C, N and Cl of three kinds of the Apollo lunar samples [1, 2]. Only C and Cl can remained at polymict breccias during impact process [2].

Impact elements C and Cl in the Mare basalts: The highest amounts of C and Cl of the polymict breccias in the Apollo lunar samples [1, 2] indicate that carbon and chlorine found in the crust of Earth can be remained in deeper lunar basalts [2] during giant impact event [1].

Remnant of terrestrial crust in the Moon: The lunar anorthositic crust is considered to be remnant of primordial Earth during giant impact process [1], which can be explained without terrestrial plate tectonics, earthquake and volcanism [2, 3, 4].

Summary: The lunar crust with anothositc compositions is considered to be derived from primordial Earth during impact, which is found in C, N and Cl elements of lunar basalts.

References: [1] Heiken G., Vaniman D. & French B. (1991): Lunar source book (Cambridge Un iv.Press). p.468-474. [2] Miura Y. (2009): LEAG-2009 (in this volume), abstract #2049. [3] Miura Y. (2009): *LPS XL*, Abstract #1090. [4] Miura Y. (2009) *LPS XL*,Abstract #1468. [5] Miura Y. (2008): LPI Con trib. No. 1439.CD#3001. [6] Miura Y. (2008): LPI Contrib. No. 1446, CD#4047.

LUNAR CEMENT CONSTRUCTION WITH SURFACE AND UNDERGROUND ROOMS BASED ON CARBON CIRCULATION SYSTEM. T.Tanosaki1 and Yasunori Miura2, 1 Central Research Inst., Taiheiyo Cement Co. Ltd., 2Graduate School of Sci. & Eng., Yamaguchi University, Yoshia 1677-1, Yamaguchi, Yamaguchi 753-8512 Japan. yasmiura@yamaguchi-u.ac.jp

Introduction: Lunar building construction on the surface with various design are reported so far [1]. On the other hand, various designs of underground building on the Moon are proposed so far [1]. However, these models are not based on material circulation system including carbon (C).

The purpose the paper is to show joint house with surface and underground with lunar cement materials based on carbon cycle system.

Problem and model of lunar surface building: Serious problem for surface building on the airless Moon should be considered to continuous destruction by extra-lunar materials. Previous building models on planet Earth are based on beautiful and economical building on the terrestrial surface without any meteoritic bombardments, which is based on thick atmosphere against serious hazards [1]. Present model for surface building is hard cement building with carbon cycle to show marking location of underground lunar base as shown in Table 1

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Table 1. Problem and model for surface building on the Moon.

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1) **Problem:** Continuous destruction by extra-lunar materials.
2) **Characteristics of surface builing:** Marking spot for the lunar base.
3) **Present model for surface building:** Cyclic building mainly for location of the lunar base

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Problem and model of lunar underground building: Main problem for underground building on the airless Moon is strong hazard building against moonquake, lunar volcanism and bombardments by extra-lunar materials. Previous underground building models are mainly based on material circulation with food supply and chemical reaction of waste material [1]. Present model for underground building is hard and cyclic cement building with carbon cycle to maintain underground lunar base as shown in Table 2.

Material circulation on the Moon in the present model is shown as state changes of carbon (C) by vapor-liquid-solid (VLS) reactions as follows:

Building materiasl with C etc. ⇔C state-changes (VLS) ….(1)

Table 2. Problem and model for underground buildings on the Moon.

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1) **Problem:** Continuous destruction by extra-lunar materials.
2) **Characteristics of underground building:** Main living and working spaces for the lunar base.
3) **Present model for underground building:** Cyclic building for any hazard of the lunar base with material waste cycles

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Material circulation including destruction of hazard activity: All materials on Earth (and previous Moon) are how to avoid from strong hazards or destructions which are formed by harder and anti-destruction building with cement and so on. From natural system of materials, destruction by any movements

are normal process to material cycle with collection and destruction. The present model is different point of material cycle with any destruction process. It is so expensive to build against any destruction, but it is economical way to material cycles including waste cycle on the Moon and Earth finally [2, 3, 4]. This is mainly because scale of hazard should be endless and no upper limit against any hazard.

Main sources of light elements from lunar rocks: Light elements of hydrogen (H), carbon (C) and nitrogen (N) are inevitable for carbon cycle on the Moon, where all elements are found on the Apollo lunar samples of regolith and polymict breccias [1, 2, 3, 4].

Summary: The lunar base with joint system of surface and underground buildings with carbon-bearing cement should be included as material cyclic system against any hazard and destruction on the Moon as shown by equation (1), which is the most economical way to maintain the lunar base finally.

References:

[1] Heiken G., Vaniman D. & French B. (1991): Lunar source book (Cambridge Univ.Press). p.468-474.
[2] Miura Y. (2009): LEAG-2009 (in this volume), abstract #2049.#2043.
[3] Miura Y. (2009): *LPS XL*, Abstract #1090.
[4] Miura Y. (2009) : *LPS XL*, Abstract #1468.