FORMATIONS OF MARTIAN PLAGIOCLASES AND FLOW TEXTURES BY CARBON-DIOXIDES-RICH GAS AND FLUIDS COMPARED WITH NATURAL ROCKS AND ARTIFICIAL PRODUCTS ON THE EARTH. Yasunori Miura, Inst. Earth Sciences, Graduate School of Science & Engineering, Yamaguchi University, Yoshida 1677-1, Yamaguchi, 753-8512, Japan, yasmiura@yamaguchi-u.ac.jp

Introduction: Water liquid has been considered to be main fluid in cold Mars, though major sources of liquid water are not clearly found on Martian surfaces. Recently author (Y.M.) found carbon-bearing grains on plagioclase composition in druses of terrestrial volcanic basalts in Shimonoseki, Yamaguchi, Japan [1], where many scientists have been reported as normal “plagioclases” formed at hydrothermal condition from volcanic magmas [2]. The main reason to report such crystals is analytical mistake without detection of light carbon (C) by normal X-ray detection and the EPMA-TEM analyses (heavier than Na element) [3-7].

As main sources of carbon-bearing grains are carbonate minerals (limestone etc.) of sedimentary rocks on the Earth and carbon dioxides (CO_2) on Mars. Carbon dioxides of gas and liquid states are main molecules of the Martian atmosphere and probably in the undergrounds.

The purpose of this paper is to elucidate carbon-bearing Martian plagioclases compared with terrestrial and artificial carbon-bearing Ca-rich minerals and rocks from CO_2 gas and liquid, which can be applied to explain carbon cycles and flow textures of Martian surfaces and undergrounds related with Martian atmosphere [3, 4, 6].

Carbon-bearing plagioclase grains as relicts of carbon cycles in terrestrial volcanic basalts: The terrestrial samples used in this study are crystalline grains from druses of basaltic lavas, which are collected from Ryono and Kifune-cho, Shimonoseki-shi, Yamaguchi-ken, Japan [1], which are the same rocks of well-known phlogopites from the Mutsure-jima at the same City [2]. Fe and Ti-bearing phlogopite crystal observed by the FE-SEM with EDX analyzer (JEOL7000F), Yamaguchi, Japan, shows

1) various vein-textures intruded irregularly by carbon-rich fluid (mixed with phlogopite in composition), and

2) various carbon-bearing grains mixed with plagioclase composition (reported as “plagioclase” in composition with more than Na element [2]) (Fig.1).

Zonal and growth spirals reported previously on the similar samples are not “phlogopite crystal growth” but micro-grain assemblages on phlogopite crystals which are formed by rapid reaction as vapor-gas carbon dioxides on phlogopite plates during quenching processes from basaltic magma. This is the first report of carbon-rich grains in volcanic basalts on the Earth connected to Martian rocks and minerals with carbon.

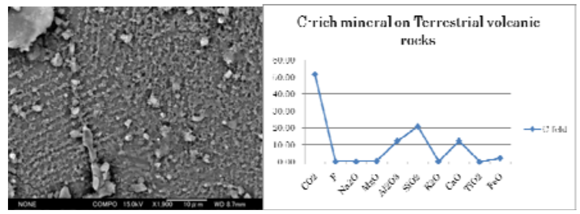

Fig.1. SEM electron micrograph (left) of C-bearing grains with Al, Si, Ca (right) on phlogopite crystal of basalts from Yamaguchi, Japan [1].

Artificial formation of carbon fixing to phlogopite crystals. Phlogopite crystals are so significant to have similar composition crystallized from magma melting of basalts which is considered to be mantle composition of Fe and Mg silicates on the Earth and Mars. Artificial carbon fixings on large phlogopite plates from Canada, Sri Lanka and Finland have been carried out at author’s laboratory to compare with natural carbon-bearing minerals by an in-site observation with the FE-SEM with EDX analyzer to avoid any contamination of carbon from sample preparation. It is found in this study as first artificial syntheses that carbon- bearing materials are

1) fixed mainly along cracked vein of phlogopite, and

2) fixed as growth pattern with crystal face angle on the phlogopite plate [1].

Carbon-bearing plagioclase (maskelynite) as relicts of carbon cycles on Mars: Although diaplectic plagioclases (maskelynites) on Martian meteorites are considered to be impact glassy feldspars so far, but the present FE-SEM analyses on Zagami SNC meteorite show carbon-bearing minerals of plagioclase composition as shown in Fig. 2. It is found in this study that carbon contents of Martian minerals are considered to be relict of carbon cycles on Martian atmosphere and upper rocks as listed in Table 1.

Flow texture of fluids on Mars: Although various flow textures on Mars taken by spacecrafts are considered to be water in deeper place so far, present results indicate that carbon dioxides behaves gas and fluids on Mars as follows (Table 1):

1) CO_2 gas can exist in air and rock interior on Mars.

2)CO_2 gas can change to “liquid state ” at higher

pressure produced by
a) rock pressure in deeper place, or
b) impact pressure on surface.
Therefore, various flow textures can be explained by the above "liquid CO_2" formed by impact pressure and rock pressure.

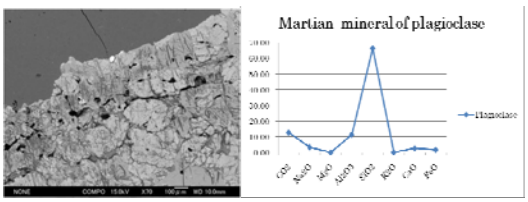

Fig.2. FE-SEM electron micrograph of the Zagami SNC meteorite (left) on plagioclase composition (maskelynite) with Si, Al Ca and C (right) [1].

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Carbon cycles on Mars compared with the Earth: Although there are no clear liquid states of sea water on present Mars, liquid state can be found by cooler CO2 gas produced by high pressures of rocks and/or impact on surface on Mars. It is found in this study that liquid states on rocks are produced by high temperature magma on terrestrial interiors (crust and/or mantle), but by high pressure events on Martian interiors as listed in Table 1.

Table 1. Carbon circulation system on Mars compared with the Earth [3,4,5,6,7].

	Mars (Polar)	Earth
Air:	Gas (CO_2)	Gas (N_2, O_2>>CO_2)
	↓	↓
Sea:	(none)	Liquid (H_2O)
	↑↓ -----***Interior***----	↑↓
Rock:	Solid (CO_2)	Solid (C-Minerals/Rocks)
	↑↓	↑↓
	Liquid (CO_2) high P	(**magma liquid**) **high T**
	↓ ----***Surface***---------	↓
Air:	Gas	Gas

P: Pressure, T: Temperature.

Summary: The present results are summarized as follows:
1) The first report of carbon-rich grains formed in natural volcanic basalts (Yamaguchi, Japan) on the Earth is applied to Martian rocks and minerals with carbon as relict minerals.
2) The first artificial syntheses are carried out as carbon-bearing materials fixed as growth pattern on phlogopite of basalt melting composition, which can be also applied carbon-fixing on Martian rocks as relict minerals .
3) Carbon contents of Martian minerals are considered to be relict of carbon cycles on Martian atmosphere and upper rocks.
4) Various flow textures taken by spacecrafts can be also explained as formation by impact pressure and rock pressure to main gas states of carbon dioxides.
5) Liquid states on rocks are produced by high pressure events on Martian interiors, though terrestrial liquid states are formed by high temperature magma on terrestrial interior (crust and/or mantle).

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