ANOMALOUS CA-RICH PLAGIOCLASE COMPOSITIONS WITH IMPACT CARBON IN THE APOLLO LUNAR SAMPLES. Yas. Miura, Yamaguchi University, 1677-1 Yoshida, Yamaguchi University, 753-8512, Japan (yasmiura@yamaguchi-u.ac.jp)

Introduction: Plagioclase minerals on the Earth's crust are not obtained on the lunar crust, which indicates formation condition of the Moon with impact processes [1-4]. The main purpose of the paper is to elucidate anomalous Ca-rich plagioclase compositions with carbon, of which carbon and hydrogen are increased in the lunar breccias in bulk composition [3].

Anomalous compositions of lunar plagioclases: Lunar Ca-rich plagioclase minerals are considered to be main characteristics as follows [3, 4] (Table 1):

1) Progressive changes from Na- (albite) to Ca-(anorthite) end members on terrestrial crust formed by progressive magmatic crystallization are not obtained in the lunar crust which is mainly Ca-rich anorthite [1].

2) Lunar plagioclases contain significant contents of Mg and Fe elements [2], which are mixed from magic silicates by impact-related mixing events [3].

Table 1. Anomalous data of lunar plagioclases .

1) Ca-rich anorthite:
Isolated growth only Ca-end member (with C)

2) Significant contents of Fe an Mg:
Rapid mixing of crust-mantle mafic minerals.

3) Compositional vacancies at major elements:
Storages of light carbon for plagioclase elements.

Contents of carbon in lunar Ca-breccias: Significant contents of carbon are found in lunar rocks of basalts, regoliths and breccias in bulk sample data [1], which higher contents of carbon are found in lunar polymict breccias with higher Ca contents [2, 4] by rapid mixing with impact events (Table 1 and Fig.1).

Vacancies of plagioclase structure: Although the terrestrial plagioclase mineral crystal formed magmatic crystallization shows stoichiometric composition with M(K, Na, Ca), T(Al, Si) and O (with traces of FM(Fe and Mg)) [1, 3, 4], however impact-generated plagioclases of the Moon, Mars, Earth and meteoroids reveal anomalous composition and structure of plagioclases with significant M and FM (Fe and Mg) and vacancies (VT or M(MT)) [2, 4]. The Apollo samples based on our EPMA data show the following main calculated data of lunar Ca-rich plagioclases (Fig.2):

1) The Apollo breccias (63355, 73215 and 77515) show high value of vacant SiO tetrahedra VT (in Fig.2), of which vacancies are filled mainly by carbon.

2) Two types of the Mare basalts are obtained as a) high value of M(MT) with Ca-replacement in vacant SiO tertrahedra (14310), and b) high value of VT(15555, 70017). The above two data correspond with lunar volcanic basalt and lunar impact-related basalts, respectively, as shown in Table 1 and Fig.2.

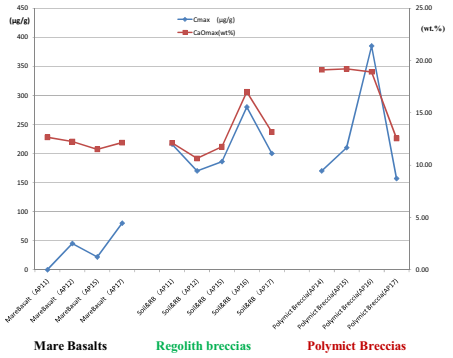

Fig.1. Average contents of carbon (max. value) and Ca (XRF bulk data) in the reported samples of the Apollo basalts, regoliths and breccias [1, 3].

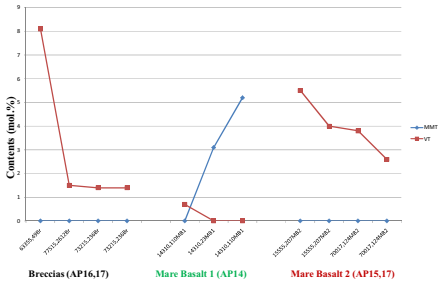

Fig.2.Bulk EPMA data of two vacant VT and M(MT) of SiO tetrahedral in the Apollo basalts, regoliths and breccias [4]. The VT means vacancy of SiO tetrahedral (with C). M(MT) reveals vacant SiO tetrahedral with Ca-replacement [4] from the EPMA calculated data based on stoichiometric composition M-T-O [2, 4].

Summary: Calculated EPMA data with vacancies of SiO tetrahedra of the lunar Apollo breccias and some basalts based on the EPMA data are correspondent with Ca, carbon to the vacancies by filling during impact-related processes.

References: [1] Heiken G.,Vaniman D. & French B. (1991): L*unar source book* (Cambridge Univ. Press). 468-474. [2] Wenk H.-R and Wilde W.R. (1973) : Contrib. Mineral. Petrol., 41, 89-104. [3] Miura Y. (2009). LPI Contrib. No. 1515 (LEAG 2009), 2042, 2043. [4] Miura Y. (1984): Mem. Natl Inst. Polar Res., Spec. Issue (NIPR, Tokyo), 35, 210-225; 226-242.