Geochemical study of melt inclusions in Pitcairn basalts, South Pacific

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The existence of water and volatile element is important in thinking about mantle dynamics, and a lot of trials limiting volatile element content and distribution in mantle from the volcanic rock from mantle are made. In this study, we analyzed major element, trace element, volatile element, lead isotope at local site for the olivine melt inclusions that they were thought that had volatile element. As a result, we obtained a preliminary result about melt inclusions from the Pitcairn island, South Pacific. The isotope composition of the volcanic rocks of Pitcairn island show composition range to EM1 from DM. We chose two EM1-like basalt rock samples of PC-41 and PC-87A in this study, and prepared melt inclusions more than 50μm to analyze a local site by some analyzers. Each melt inclusion varied in a characteristic, and there were two kinds which crystallized amphibole and ilmenite and crystallized euhedral clinopyroxene in melt inclusions of PC-41. Melt inclusion of PC-87A includes homogeneous glass or dendritic clinopyroxene e equally. Therefore the analysis domain set it from the mineral which crystallized to the maximum in remote glass or the foundation stone domain. Firstly we measured volatile elements (H_2O, CO_2, F, P, S, Cl) at a 30μm diameter and lead isotope at a 30μm diameter using SIMS (IMS 1280-HR). In the next place, I measured main element at 10μm diameter using FE-EPMA. Finally I measured about a major element and trace element at 20μm or a 30μm diameter using LA-ICP-MS. There was not the difference with PC-41 and PC-87A about lead isotope ratio, and they were in the isotope ratio range same as all rocks. However, there was difference in both about the elementary composition. Compared with MgO and other major elements, PC-87A shows in same trend as all rock composition, but PC-41 clearly shows two different trends. Because these two trends of PC-41 relate to the difference in crystallized out minerals, they separated by crystallization after melt inclusions trapped by olivine. In adding PC-41 is congruent with crystallization advancing to MgO being lower than PC-87A more in PC-41. About trace elements, PC-87A accorded for the composition of all rocks, however there was different composition from like PC-87A in PC-41. Difference of two compositions in PC-41 were not concerned with crystallization and major elements. The latter has low HREE in characteristically, this seems that the melt coexisted with garnet under high pressure flows into the magma reservoir and produces heterogeneity of the composition in magma reservoir. About volatile elements, there is remarkable difference of quantity of H_2O in PC-41 and PC-87A. PC-41 has 0.03-0.10 wt.% and a low value whereas PC-87A has 0.37-0.81 wt.% . CO_2 does not maintain original value by degassing and enrichment of the gas phase. Halogen elements is hard to relatively degass, for example Cl has high 570-1700ppm and correlates with H_2O and other trace elements, and seems reflect composition of the mantle source. In conclusion, quenched homogeneous melt inclusions such as PC-87A seems maintain information of deep mantle, and are important in estimating H_2O and volatile elements composition from melt inclusions in the mantle source. Melt inclusions crystallized out well such as PC-41, however, greatly lost H_2O in degassing and diffusive process and are difficult to estimate composition of the primary magma.