Crystal Size Distribution (CSD) of plagioclase in 1-atmosphere melting/crystallization experiments on the 1707 basalt of Mt Fuji

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1-atmosphere melting/crystallization experiments were conducted by using pressed powder of basaltic scoria (SiO2=51 wt.%) erupted at the 1707 eruption of Mt. Fuji. Number density, CSD (Crystal Size Distribution) and modal content of plagioclase in the run products were analyzed. The aims of this experiment are to examine textural change of plagioclase with time, how linear correlation between crystal size and logarithms of population density in the CSD of plagioclase are produced in a closed system, and the relation between nucleation and growth of plagioclase. The electric furnace, consisted of vertical double spiral heating element of SiC, was used for experiment. The oxygen fugacity was controlled by a mixed gas of H2 (10 ml/min) and CO2 (500 ml/min), yielding a redox condition near the Ni-NiO buffer condition at the temperature of the experiment. Two types of experiments were conducted. The first type is annealing experiments. The sample was firstly held at a certain temperature around 1200 C, 1220 C, 1227 C and 1235 C (within 2 C) for 1 hour, then rapidly cooled till room temperature by distilled water by electrically cutting the platinum wire hanging the wire loop. The second type is melting/crystallization experiments. The sample was firstly held at a certain temperature around 1200 C, 1220 C, 1227 C and 1235 C (within 2 C) for 1 hour, then rapidly cooled to 1120 C and 1170 C within 8 minutes and kept at the temperature for a certain period (0, 15, 30, 60, 180, 360 and 720 minutes). Modal content and number density of plagioclase in the run products quenched to 1120 C (9.6-42.8 vol.%, 9.7∗10ˆ12-1.1∗10ˆ15 mˆ-3 respectively) or 1170 C (1.6-30.3 vol.%, 1.4∗10ˆ13-5.4∗10ˆ14 mˆ-3 respectively) from initial melting temperature (1200 C, 1220 C, 1227 C and 1235 C) show rapid increase in short time during cooling period (within 8 minutes), compared with the run products of the annealing experiments at 1200 C, 1220 C, 1227 C and 1235 C. Modal contents of plagioclase slightly increase and number density of plagioclase slightly decrease during the annealing period of constant temperature around 1120 C or 1170 C. There is a linear relation between crystal size and logarithms of population density of plagioclase in the run products. Intercepts of CSDs decrease and slope of CSD become steep to gentle with the increase of crystallization time. At large size of CSD, CSD shows slightly concave downward. These results indicate that crystallization processes are divided into two processes. The first process is nucleation-dominated crystallization. Growth of nucleated plagioclase, i.e., growth-dominated crystallization is the second process of crystallization. During the period of nucleation-dominated crystallization, nucleation and growth dispersion of nucleated plagioclase may cause linear shape of CSD with steep slope. Change of CSD slope from steep to shallow and decrease of intercepts of CSD take place during the period of growth-dominated crystallization. These changes of the shape of CSDs from steep to shallow with time is most likely the results of growth dispersion and size-dependent growth of plagioclase.