

Temperature-Time-Transformation (TTT) diagrams for hydrous groundmass composition of Unzen dacite at 100 MPa: a preliminary result

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We conducted an experiment to obtain temperature-time-transformation (TTT) diagrams for the hydrous groundmass composition of Unzen dacite at 100 MPa. The aim of the experiment is to obtain complementary data on the crystallization behavior of the melt to decompression experiments in which crystallization is affected by water exsolution process. The starting material is a quenched dry glass of fused groundmass separate of the 1992 dacite of Unzen volcano ($\text{SiO}_2=68.2$), which were sealed in Au70Pd30 capsules with 2 and 4 wt% of water. The charges were run at 100 MPa in a gas media high pressure apparatus (Dr.HIP; Kobe University), firstly melted at 1100C for ca.50 hours, then cooled down to 900, 800, 700, 600C within ca 4 minutes, and annealed at those temperatures for ca. 0.2, 2, and 20 hours and subsequently quenched. The run products were mounted in epoxy resin, polished and examined with electron-probe microanalyzer to obtain back-scattered electron images and X-ray maps. The crystallinity was estimated from the BSE image semi-quantitatively. Equilibrium liquidus temperatures are ca.1070C and 970C for water contents of 2 wt% and 4 wt%, respectively at 100 MPa (Sato et al. 1999JVGR). The TTT diagram thus constructed shows C-shaped curves with the shortest time scale of crystallization attained at ca. 750-800C for the system with $\text{H}_2\text{O}=2\text{wt}\%$, and at ca.700C for the system with $\text{H}_2\text{O}=4\text{wt}\%$. For run products of annealing temperature less than 800C, crystal size is very small, less than 3microns, whereas run products of annealing temperature at 900C contains crystals more than 5 microns across. For runs with the annealing temperature of 900C and $\text{H}_2\text{O}=2\text{wt}\%$, crystallinity increases from 0 for the annealing time (t_2) of 0.2 hr, through 5% for $t_2=1.0\text{hr}$ to 15% for $t_2=30.4\text{hr}$. For $\text{H}_2\text{O}=4\text{wt}\%$ runs, crystallinity increases from 0 for $t_2=0.2\text{hr}$, through 2% for $t_2=1\text{hr}$ to 4% for $t_2=30.4\text{hr}$. The extruded dacite of the 1991-1995 Unzen eruption contained 20-40 vol.% of microlites in the groundmass (Nakada and Motomura,1999), and it is conceived that the crystallinity of these lava samples may be attained by integration of the crystallization at various depth and water contents during the ascent of magmas. Present experimental results may conform a part of the data set to constrain the crystallization processes of microlites in the Unzen dacite.