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One-atmosphere melting experiments on basalts of Oginosen volcano: Phase relationship and element partitioning

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Growth and fusion experiments were performed between 1050C and 1250C at one atmosphere on two natural samples: intraplate-type alklic-basalt (type-1) and Island arc type tholeiitic basalt (type-2) from Oginosen monogenetic volcano. The experimental samples were crushed into very fine powder (less than 10 micrometer). The silica(46-48wt%), Al_2O_3 (15-16wt%), FeO(9-10%) and MgO(5-6%) contents and FeO$*$/MgO ratio are similar, but TiO_2 (2.5/1% for type-1/type-2 respectively, the same as follows), CaO(8/10%), Na_2O+K_2O(5/3%), P_2O_5 (2/1%) are different between the two samples. Chemical compositions of phenocryst olivine and plagioclase are similar ($Fo_{core,max}$=85 and 84, $Fo_{rim,avg}$=75 and 72 and $An_{rim,avg}$=64 and 67, for type-1 and type-2 samples, respectively) but anorthite content in the core of plagioclase of Type-1 and type-2 are different ($An_{core,max}$69 versus 85).

The experiments were performed using platinum wire-loop method. Oxygen fugacity was controlled to nickel - nickel oxide buffer by mixing CO_2 and H_2 gases. The temperature calibration was carried out by the melting point of gold. We used growth experiments and fusion experiments. The growth experiments were conducted by heating the charge to 1250C for 1 hr, and then cooled within several minutes to a fixed temperature (Tg1) and held at that temperature for 1 or 10 hour. The sample was quenched in water by electrically cutting the platinum wire loop. The fusion experiments were performed just heating the charge to a certain temperature (Tf1), and held at that temperature for a certain period of time before dropping the sample into water for quench. The temperature (Tf1) in the growth experiment ranges from 1150 C to 1250 C by 10 C to 20 C step. Growth experiment was performed at temperature (Tg1) from 1130C to 1190C by 20C step. In this study, we examine relationship between duration time and chemical composition of melt and crystals. On the other hand, we compared our results with the thermodynamics model calculation of MELTS (Ghiorso and Sack, 1995).

In the fusion experiments of type-1, plagioclase first appeared at 1190 C, followed by olivine at 1170 C and by clinopyroxene at 1080 C. In the fusion experiments of type-2, plagioclase first appeared at 1210 C, followed by olivine at 1190 C and by clinopyroxene at 1150 C. In the growth experiments of type-1, both olivine and plagioclase appeared only at 1130 C in 10 hour runs. In the growth experiments of type-2, plagioclase first appears at 1150 C in 1 hour runs, and plagioclase appeared at 1190 C and olivine at 1150 C in 10 hours runs. The Mg/(Mg+Fe) value of olivine in the type-1 growth experiment at 1130 C is 0.76, which is lower than the value of natural olivine phenocryst (0.84). The An content of plagioclase in the type-1 growth experiment at 1130 C is 59.6, lower than the phenocryst core composition (An 69) in the natural sample, suggesting either the effect of water in the natural sample or kinetic disequilibrium in the experimental plagioclase. The Mg/(Mg+Fe) values of olivine in the type-2 growth experiment at 1130 and 1150 C are 77-78, which is lower than those of the core of olivine phenocryst in the natural sample (84). The An contents of plagioclase in the type-2 growth experiments range from 65-68, much lower than the phenocryst core composition (An 85), which may be reconciled either by the effect of water on the element partitioning or mixing of more primitive plagioclase-phyric magmas in the type-2 basalt.