Thermal and compositional evolution of magma by assimilation with fractional crystallization at the floor of crustal magma chamber

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We experimentally investigated the mechanisms involved in assimilation with fractional crystallization at the floor of magma chambers in continental crusts. Our results suggest that simultaneous crystallization and melting occurs, and that a mushy layer forms at the chamber floor, the liquid differentiating with time due to mixing with liquids released by crystallization and melting. Our results also suggest that the ratio of crystallization mass to melting mass decreases as the initial solid temperature and the initial NH4Cl concentration of the solid increase. We suggest that the diversity in the liquid line of descent due to in assimilation with fractional crystallization can be understood in reference to the variation of conditions of the crustal floor.

We experimentally investigated the mechanisms involved in assimilation with fractional crystallization at the floor of magma chambers in continental crusts using a cold solid mixture of variable initial composition and temperature and a hot liquid in a NH4Cl-H2O binary eutectic system. Our results suggest that simultaneous crystallization and (partial) melting occurs, and that a mushy layer forms at the chamber floor, the liquid differentiating with time due to mixing with liquids released by crystallization and melting. Our results also suggest that the ratio of crystallization mass to melting mass decreases as the initial solid temperature and the initial NH4Cl concentration of the solid increase. The effect of the solid composition can be explained by the suppression of the liquid exchange between the liquid and mushy layer by weaker convection. We suggest that the diversity in the liquid line of descent due to in assimilation with fractional crystallization can be understood in reference to the variation of temperature and composition of the crustal floor.