Crystal capture and settling in silicic magma chambers consisting of a eutectic melt and preexisting crystals

Koshi Nishimura[1]

[1] Inst. for Geothermal Sciences, Kyoto Univ.

Effects of the settling of preexisting crystals on the compositional structure in silicic magma chambers are investigated numerically. The model assumes a two-dimensional magma chamber consisting of 20 vol.% preexisting crystals and a eutectic melt with melt viscosities of 10^8, 10^6 and 10^4 Pa s. The distribution of preexisting crystals is regarded as a compositional structure. The compositional structure is controlled by balance of the rate of crystal settling and the migration rate of the solid wall (capture front). In the case of a magma chamber with melt viscosity of 10^8 Pa s, an almost homogeneous distribution of preexisting crystals is maintained throughout the cooling history because the migration rate of the capture front is much faster than the rate of crystal settling. In the case of a melt viscosity of 10^6 Pa s, crystal capture and settling processes form concentrically zoned structure which can be characterized by (1) normally zoned structure at the shallow level and (2) reversely zoned structure at the deeper level. In the case of a melt viscosity of 10^4 Pa s, vertically zoned structure is formed on a short time scale. In general, vertically zoned structure is found in rhyolitic magma chambers and, while concentrically zoned structure is found in granitic magma chambers. This contrast comes from viscosity difference between granitic melts and rhyolitic melts.