Tectonic activity and the development of igneous layering

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Tectonic activity may be responsible for triggering the development of igneous layering at various levels in a magma chamber. Hypothetical examples are presented associated with dilation of a magma chamber and motion on adjacent faults. Near the roof and floor of the chamber, crystal-rich mushes are capable of transmitting tectonic stress and layering may result in progressive and multiple injection of magmas into fractures developed by brittle failure. In the liquid-rich portion of the chamber, pressure-release associated with dilation of the magma chamber may temporarily reduce pressure exerted by the magma on the host rock. This allows (1) influx of water from the host-rock and volatile fluxing to promote compositional zoning by Soret diffusion or convective fractionation and (2) magma replenishment from a subjacent magma reservoir. If the new magma is less dense, then magma mixing may occur depending on the Reynolds number and the intensity of penecontemporaneous tectonic activity. If the new magma is denser, it will pond at the base of the magma chamber and spread out laterally under the influence of horizontal pressure gradients. Deceleration of the incoming magma leads to a progressively wider static zone and incorporation of crystal nuclei. Growth and deposition of these crystals into layers may be aided by tectonic agitation, which reduces the yield strength and the effective viscosity of the magma. Tectonic agitation may facilitate escape of solute, local fluidization of the layer and rise of less dense crystals to the top of the layer.