Phase separation in mushy magma reservoirs

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Phase separation in crystallizing magma reservoirs plays a fundamental role in the generation of silica-rich magmas and influences the long and short term evolution of volcanic systems. As more evidences suggest that reservoirs are dominantly in a mush state for most of their lifespan, phase separation from permeable but rheologically locked-up reservoirs is likely efficient, despite the high viscosity of the melt and and crystal framework involved in these processes. In this presentation, we use a combination of field data, laboratory experiments and physical modeling to study phase separation in crystal mushes. We specifically focus on the different modes of exsolved volatiles and melt transport through mushy magmas, with an emphasis on constraining the processes and timescales involved. We find that the broad range of crystal volume fraction over which phase separation takes place impacts the mode of mush deformation that accommodates phase separation. Furthermore, these different modes of extraction have distinct efficiencies with some able to operate even with relatively low driving stresses, and are likely to leave different footprints in the rock record.

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