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Can rhyolite melts be extracted in the upper crust? New perspectives from numerical modelling of melt redistribution by dikes

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The source of rhyolites has been controversial due to the rapid cooling of magma reservoirs in the cold upper crust, and two nonexclusive explanations has been suggested: (i) rhyolitic eruptions can be sourced from differentiated melts in the middle or lower crust, that rapidly migrate upward to construct upper crustal crystal-poor magma reservoirs; (ii) rhyolites are residual liquids extracted from shallow and intermediate magma reservoirs. The latter is supported by geochemical evidence indicating that rhyolites are more differentiated than their plutonic counterparts. However, thermal models show that abnormally high magma emplacement rates are needed to build and maintain large silicic mushes, which could be thought unrealistic compared with the injection rates documented in granitic plutonic complexes. We present a study case of a shallow zoned pluton (La Gloria Pluton), where leucogranite dikes are ubiquitous and seem to bring out residual melts from the pluton to the country rocks. New U-Pb zircon ages, together with compositional and magnetic data were combined in time-dependent numerical simulations of convecting cooling magma reservoir and late-stage diking to provide information about the timescales and mechanisms of melt redistribution by dikes in the upper crust. Results indicate that shallow magma reservoir construction requires a feeding from intermediate magma source to survive by 106 years. On the other hand, the last stage of magma reservoir history is recorded by the mineral and magnetic fabrics and the compositional zonation pattern derived from the silicic melt redistribution by dikes. Timescales of diking is about 103 years, which is much faster than crystal settling and compaction. Dikes would also represent testimonies of drained melts out of the shallow source of the rhyolitic volcanism.