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On the conditions of mafic-felsic magmas mixing and its bearing on andesite production in the crust

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Mixing between magmas is thought to affect a variety of processes, from the growth of continental crust to the triggering of volcanic eruptions, but its thermophysical viability remains unclear. Here, using high pressure mixing experiments, we show that mixing only occurs at low viscosity contrast, when the touching crystal network of the more viscous magma breaks down. Using thermal calculations, we show that hybridization requires injection of high proportions of the replenishing magma during short periods. The incremental growth of crustal reservoirs limits the production of hybrids to the waning stage of pluton assembly and to small portions of it. Large scale mixing appears to be more efficient at lower crustal conditions, but requires higher proportions of mafic melt, hence produces hybrids more mafic than in shallow reservoirs. Altogether, hybrid arc magmas correspond to periods of enhanced magma production at depth.