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Silicic magma eruption: integrated study of crustal xenolith petrology and numerical modelling

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Crustal xenolith features like foliation, equilibrium mineral assemblages, and the size, abundance, distribution and age of minerals, may help to build an accurate picture of silicic magma ascent and its behaviour in the conduit from the moment of its inception to the state just prior to eruption. Numerical models of conduit dynamics are based on assumptions that need input from petrologic studies on the evolution of silicic magma systems. Seen from another perspective, to fully interpret the petrological dataset requires key numerical parameters on melt conduit dynamics. We utilized recent thermodynamic modelling of a wall-rock/magma conduit of an anatectic process that appropriately describes the petrologic evolution of crustal xenoliths in high-silica systems. As a case study we selected natural silicic systems in the Neogene Volcanic Province (SE Spain), where rapidly erupted crustal xenoliths were incorporated into dacitic lava by rooting up from the wall-rock and/or dropping into the magma conduit/chamber. Therefore these partial melt zones record the thermal history of magma flow in the conduit and, consequently, both the emplacement behaviour of the flow it fed, and the xenolith history before and during the eruption event. The results of our study help to link observations on xenoliths and xenocysts to eruption style and intensity.