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# Tomographic analyses of pore-scale occlusion in hydrothermal mineral seals: implications for pressurisation prior to gas-driven eruptions

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The most common style of eruption at andesite volcanoes are gas-driven, with little to no magmatic material ejected. Pressurisation in the lead up to eruption can be subtle, centred beneath the eventual vent area and in the shallow surface. Other signals may include gradually reducing gas flux and periodic geysering activity. Establishing the timing of an eruption is therefore challenging, requiring detailed modelling of the governing processes, supported by experimental data.

The postulated driver of pressurisation before a gas-driven eruption is the precipitation of hydrothermal minerals in the (generally permeable) conduit or shallow subsurface. To understand the underlying processes, we reacted andesite granules with a highly acidic crater lake fluid. Our conceptual model seeks to recreate the reactions likely occurring due to ingress of seeping crater lake fluid into fumaroles. Through a programme of ever-increasing experimental complexity, and over a range of timescales, the experiments formed an efficient mineral seal composed of variably altered rock, connected by a sulphate mineral lattice.

To assess the pressurisation efficiency of the experimentally generated hydrothermal seals, we conducted micro-computed tomography (microCT) on the samples to quantify the porosity. We find that relatively shortened experiments (10 and 30 days) showed expected porosity decreases with time, albeit with connected pore networks that enabled continued flow. In contrast, the relatively long experiments (~40 - 60 days) showed that isolated pores were dominant with negligible connected porosity.

Our results demonstrate the evolving efficiency of seal formation, providing unique insights into hydrothermal system processes beneath acid crater lakes. We expect that with additional modelling, we will be able to transfer these results to nature, developing a new understanding of the unrest in the lead up to these extremely challenging eruptions.