New insights into the evolution of the 1914-15 Plinian eruption of Sakurajima volcano, Japan

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Sakurajima, on the rim of the Aira caldera, is the most active volcano in Japan. It threatens a population of >800,000 and lies just 50 km from the Sendai Nuclear Power Plant. Over the last 26 ka it has produced effusive lava flows and seventeen Plinian eruptions, including four recorded in historical time. The most recent Plinean event, in 1914 (VEI 4), was deadly, destructive, and the largest eruption of the 20th century in Japan. It was characterised by several eruptive stages and styles over a period of 1.5 years, including simultaneous lava discharge from craters on opposite sides of the volcano.

Four samples representing different stages of the Plinian event and seven samples from the following lava effusion events have been analysed to provide an insight into the magma conditions and migration prior to and during the 1914-15 event. Erupted pumice deposits are characterised by glomerocrysts, representing different levels of a transcrustal magma system. Interestingly, the subsequent effusive eruptive stages, seem to be driven by injections of more mafic magma derived from the mantle, as testified by: (1) the changing composition of discharged lava and increasing number of olivine phenocrysts as the eruption progressed; (2) a signature of increasing partial melting and decreasing crustal assimilation, indicated from trace element modelling; (3) significantly higher temperatures and pressures towards the end of the erupion (from 950°C and 2.6 kbar for the Plinian deposits to 1100°C and 6.5 kbar for the last effusive stage, assessed from two pyroxene geothermobarometry); (4) a decrease in pyroxene residence times and an increase in magma ascent rates over time.