1 million years of volcanism on Ascension Island: insights from stratigraphy, $^{40}Ar/^{39}Ar$ dating and petrology

K. PREECE[1*], K. CHAMBERLAIN[2], J. BARCLAY[3], D. MARK[1], R. BROWN[4], C. VYE-BROWN[5], B. COHEN[1]

[1]Scottish Universities Environmental Research Centre, UK. *Katie.Preece@glasgow.ac.uk
[2] JAMSTEC, Japan.
[3]School of Environmental Sciences, UEA, UK.
[4]Dept. of Earth Sciences, Durham University, UK.
[5] British Geological Survey, Edinburgh, UK.

Ascension is an ocean island volcano located in the South Atlantic, ~ 90 km west of the Mid-Atlantic Ridge axis. The volcanic rocks of Ascension define a transitional to mildly alkaline basalt-hawaiite-mugearite-benmoreite-trachyte-rhyolite sequence that spans a wide range of eruptive styles across only ~ 98 km^2 of land. The central and eastern sectors of the island are predominantly composed of pyroclastic deposits, trachyte and rhyolite lava flows and domes. The northern, southern and western regions comprise mafic lava flows punctuated by scoria cones.

Here we integrate a new stratigraphy, $^{40}Ar/^{39}Ar$ ages, and petrological data to reveal the timing, style and driving forces behind volcanic activity on Ascension. During the last 1 Myr, > 75 sub-aerial explosive eruptions have occurred, with the last one at ~ 60 ka. Throughout this period, sub-Plinian and phreatomagmatic eruptions have been common, sometimes associated with pyroclastic density currents. In addition, felsic lava flows and domes, as well as basaltic lava flows have been dated to shed light on timescales of effusive volcanism on Ascension. The most recent eruptions occurred at < 1 ka and only just pre-date the beginning of Ascension's historical record [1]. Petrological data reveal the closed-system nature of the magmatic plumbing system and highlights the role of fractional crystallisation in the production of the range of magmatic compositions found on Ascension Island [2]. There is no evidence for magma mixing acting as an eruptive trigger, and high volatile concentrations suggest that potential triggers are either volatile over-pressurisation or external factors not recorded in the erupted crystals. This has significant implications for anticipating any future activity at Ascension Island.

[1] Preece et al. (In review) Nature Communications
[2] Chamberlain et al. (2016) J. Volcanol. Geotherm. Res., 327, 349-360