Magmatic processes at persistently active arc volcanoes

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Worldwide, a number of volcanoes display persistent eruptive activity for years to millenia. The Vanuatu Arc hosts a number of these volcanoes, including Yasur and Ambrym. Gas flux and whole rock uranium-series isotope data are used here to investigate magmatic processes that maintain such activity at these volcanoes. Persistent elevated gas fluxes (>>100 tons SO_2/day) require regular magma replenishment on timescales of days to years. Replenishment at these rates is envisaged to chemically buffer the magma chamber. As such, uranium-series isotope ratios in lavas erupted from these volcanoes are predicted to be invariant. This is not the case at any persistently active volcano. Instead, modelling of uranium-series isotopes suggests magma replenishment occurs every few thousand years. These disparate estimates of replenishment interval raise the possibility that uranium-series isotopes are effected by other shallow-level magmatic processes at these volcanoes. Disparity between the volume of magma required to sustain degassing budgets at persistentlty active volcanoes and the actual magma output has long been recognised. As such, significant volumes of magma are likley stored beneath these volcanoes as intrusive bodies or crystal mushes. Recycling of this material and its mixing with recharge magma offers the best explaination for the variation in uranium-series isotopes witnessed at these volcanoes. As such, persistent volcanic activity is most likley associated with regular magma replenishment on timescales of years to decades, with recharge magma mixing with a crystal mush component in the shallow plumbing system.