Role of plutonics in the generation of felsic magmas at ocean island volcanoes —Oki Dozen and Ascension Island

*Katy Jane Chamberlain[1], Jane H Scarrow[2,3], Yoshihiko Tamura[1]

1. Japan Agency for Marine-Earth Science and Technology, 2. School of Environmental Sciences, University of East Anglia, UK, 3. University of Granada, Spain

Ocean island volcanoes have the potential to erupt both effusively and explosively, with magmatic compositions ranging from basalt to rhyolite, similar to ocean islands such as the Canaries[I] and the Azores [II]. The generation of highly-evolved magmas in thin oceanic crust remains enigmatic with various islands preserving evidence for open-system magmatic processes, and generation by partial melting of oceanic crust[III]. The eruption of felsic magmas can also greatly increase the hazards they pose, and thus the more that can be understood about the processes leading to the generation of these evolved-magma compositions, the more we can hope to understand any potential future activity. Plutonic xenoliths represent the crystallized remains of magma storage regions, and can yield significant insights into the nature of magmatic processes, which may not be otherwise determined from looking at volcanic products alone. This contribution addresses the mechanisms for the production and eruption of evolved magma compositions at two contrasting ocean island volcanoes of Ascension Island in the Atlantic and at Oki Dozen in the Sea of Japan. While Oki Dozen is now extinct - K-Ar dating reveals the majority of activity occurred between 7.4 Ma and 5.4Ma[IV]-, recent Ar-Ar dating of Ascension Island has shown subaerial eruptions began around 1094 ka[V] with the most recent eruption to have occurred in the last 1000 years[VI] thus making future eruptions likely, and the importance of understanding the nature of the magmatic plumbing system even more vital.
We present whole rock XRF analyses, FTIR analyses of melt inclusions -and major and trace element concentrations within their host crystals- and textural information from BSE and CL images of crystal from the plutonic rocks from both Ascension Island and Oki Dozen. Our new data reveals that while the plutonic rocks from Ascension Island are generally more-evolved that the exposed volcanics, they still show no evidence for magma mixing or repeated use of a single storage region. While plutonics from Oki Dozen are of similar composition to the volcanic products, again there is no evidence for magma mixing in crystal textures, which is very different from the felsic magmas of the Canaries or Iceland[I,III]. Our data is used to highlight the importance of fractional crystallisation in the production of evolved magmas in ocean island volcanoes not directly related to any plate tectonic boundary, and reveals the importance of a pre-established crustal structure in the evolution of magmas in relatively thin oceanic crust.

[I] Wiesmaier, S., Troll, V. R., Wolff, J. A., & Carracedo, J. C. 2013. *Journal of the Geological Society*, *170*, 557-570.
[II] Mungall, J. E., & Martin, R. F. 1995. *Contributions to Mineralogy and Petrology*, *119*, 43-55.
[III] Carley, T. L., Miller, C. F., Wooden, J. L., Bindeman, I. N., & Barth, A. P. 2011. *Mineralogy and Petrology*, *102*, 135-161.
[IV] Tiba T, Kaneko N, Kano K 2000. Geology of the Urago District.
[V] Jicha, B. R., Singer, B. S., & Valentine, M. J. 2013. *Journal of Petrology*, *54*, 2581-2596.
[VI] Preece, K., Barclay, J., Mark, D.F., Cohen, B.E., and Chamberlain, K. 2016. In: Cities on Volcanoes 9, Puerto Varas, Chile, 20-25 Nov 2016.

Keywords: Volcanic-plutonic connection, Ocean island volcanism, Magma plumbing systems

