Quantifying magma generation mechanisms of large-volume silicic eruptions of Afro-Arabian flood volcanics through mineral chemistry, radiogenic isotope analyses and numerical modelling of melt evolution

J THINES[1]*, I.A. UKSTINS[1], D.W. PEATE[1], L.K. HORKLEY[1], D. COULTHARD JR.[2]

[1]University of Iowa, Iowa City, IA 52242, USA (*correspondence: jennifer-thines@uiowa.edu)
[2]Massey University, Palmerston North, New Zealand

The Afro-Arabian volcanic province is distributed between the Yemen and Ethiopian conjugate rifted margins and locally silicic units represent up to 50% of the volcanic stratigraphy [1]. While there have been many recent publications exploring the petrogenesis of basalts in the region, understanding the formation and eruption mechanisms of the silicic portion has remained an elusive task. Previous work identified eight major silicic eruptive units ranging in age from 30.2 to 27.7 Ma based on $^{40}Ar/^{39}Ar$ dating [1]. Two distal Indian Ocean tephras correlated to Afro-Arabian silicic ignimbrites [2] preserve some of the largest geochemical heterogeneities observed in individual eruptions (43 to 74 wt % and 58 to 77 wt % SiO_2). Minimum eruptive volume estimates from on-land and Indian Ocean deep-sea tephra are as high as ~2700 km^3, making them among the largest known silicic eruptions on Earth [3].

Detailed mineral chemistry of feldspar, pyroxene, and Fe-Ti oxide have been used to assess the chemical evolution of the province as well as variability recorded within individual eruptions. These data, along with new bulk major and trace elements, Pb, Sr, Nd and Hf isotopes will be will be used to assess the various roles of fractional crystallization, magma recharge and crustal contamination. The petrogenesis of Afro-Arabian rhyolites will be modeled using the Magma Chamber Simulator [4], a powerful tool that allows for modeling open-system processes in silicic magmatic systems. This approach will provide insight into the temporal and compositional histories of these magmas and the generation of large-volume silicic magmas as a whole.

[1] Ukstins Peate *et al.* (2005) *Bull Volcanol* **68**, 135-156. [2] Ukstins Peate *et al.* (2008) Lithos **102**, 260-278. [3] Bryan *et al.* (2010) *Earth Sci Rev* **102**, 207-229. [4] Bohrson *et al.* (2014) *J Petrol* **55**, 1685-1717.