$\delta^{18}O$ of mid-Miocene rhyolites associated with Steens flood basalts

JILLIAN MALLIS[1]*, GAIL MAHOOD[1] AND JOHN VALLEY[2]

[1]Dept. of Geological and Environmental Sciences, Stanford University, Stanford, CA
(*correspondence: jmallis@stanford.edu)
[2]Dept. of Geoscience, University of Wisconsin, Madison, WI

High Rock Caldera Complex (HRCC), which straddles the $^{87}Sr/^{86}Sr_i$=0.704 isopleth in northwest Nevada, contains some of the earliest rhyolites of the Snake River Plain-Yellowstone (SRP-Y) trend. HRCC erupted about 700 km^3 of ignimbrites and lavas from 16.5 to 15.5 Ma, contemporaneous with main-stage Steens and Columbia River flood basalt volcanism. Laser fluorination analyses of quartz phenocrysts indicate that HRCC ignimbrites and lavas have exclusively "normal" $\delta^{18}O$ values ($\delta^{18}O_{(qtz)}$=6.17-8.65‰), in contrast to the commonly low values of rhyolites in the SRP [1-6].

We suggest that the lack of low-$\delta^{18}O$ values at HRCC is a result of the rhyolites having formed in a non-hydrothermally altered crustal section. Any significant involvement of hydrothermally altered sources would be detectable given the strongly negative $\delta^{18}O$ value for Miocene meteoric water (ca. -18‰) in NW Nevada [7]. In addition, the relatively small calderas only partially overlap, limiting opportunities for assimilating hydrothermally altered intracaldera fill. Our new data, combined with published values for the SRP-Y trend [1-5], demonstrate that the transition across the craton margin is marked by abrupt changes in O isotopes, as well as Nd, Sr, and Hf isotopes [8].

Trace element and O-isotope AFC modeling suggests that the most peralkaline rhyolites of HRCC (Zr > 500 ppm) can be derived by partial melting of alkali gabbro similar in composition to the upper Steens Basalt to produce a trachytic magma, followed by fractional crystallization accompanied by little or no crustal assimilation. Metaluminous to weakly peralkaline rhyolites are best modeled as representing a larger degree of partial melting of similar gabbro, followed by fractionation accompanied by ~30% assimilation of non-hydrothermally altered upper crust. Modeled *r* values are small, suggesting that the magma chambers resided in the upper crust.

[1] Hildreth *et al* (1984) *JGR* **89** [2] Boroughs *et al* (2005) *Geology* **33** [3] Bonnichsen *et al* (2008) *Bull. Volcanol.* **70** [4] Watts *et al* (2011) *J. Petrol.* **52** [5] Cathey *et al* (2007) Eos Trans. *AGU* **88** [6] Blum *et al* (2012) Eos Trans. *AGU* **94** [7] Horton *et al* (2004) *Amer. J. Sci.* **304** [8] Nash *et al* (2006) *Earth Planet. Sci. Letters* **247**