Light $\delta^{18}O$ zircon xenocrysts from the deep crust of the Great Basin, North American Cordillera

E. GOTTLIEB[1] E. MILLER[1] J.W. VALLEY[2] K. KITAJIMA[2]

[1]Geological Sciences, Stanford Univ., Stanford, CA, USA
[2]WiscSIMS, University of Wisconsin, Madison, WI, USA

Preservation of pre-magmatic (inherited) domains in zircons within magmatic rocks reflects zircon-oversaturated thermal and/or chemical attributes of melts. Integrating modern high spatial resolution U-Pb age, trace element (TE), and $^{18}O/^{16}O$ isotope analyses guided by CL+BSE imagery can provide invaluable insights about otherwise inaccessible deep crustal region(s). This study characterizes inherited zircon domains in a suite of 40 Ma muscovite porphyry dikes from east-central Nevada and Utah that are associated with the Early Cenozoic ignimbrite flareup in the interior of the North American Cordillera (NAC). The predominant inheritance is 2.45 Ga (and lesser 2.62 Ga) cores with typical magmatic TE overgrown by 1.7 Ga domains with magmatic and metamorphic TE. The remainder of inheritance is 0.7-2.7 Ga cores *lacking 1.7 Ga overgrowths* or wholly Jurassic or Late Cretaceous age cores. The predominant group (2.45/1.7 Ga) yields significantly lighter $\delta^{18}O$ results (+1 to +4‰) than the latter (0.7-2.7 Ga) group (+6 to +12‰). Significantly younger overgrowths (ranging ~100-45 Ma) are also observed on most Precambrian cores from both groups, and commonly exhibit core-like $\delta^{18}O$ results, or in rare cases, several ‰ heavier.

Low $\delta^{18}O$ Precambrian domains typically exhibit 15-30% discordance with calculated mean, min, and max α-dosages of 5, 0.5, and 15 ($x10^{15}$/mg) respectively, suggesting radition damage facilitated alteration, although zircon OH/O ratios near background and intradomain reproducability of $\delta^{18}O$ results in single grains are less consistent with $\delta^{18}O$ depletion of metamict domains (Wang et al., 2014). At the grain scale, ≤100 Ma annealing provides a minimum age for the acquisition of the low $\delta^{18}O$ signature. At the crustal scale, ≤100 Ma overgrowth suggests depth below the BDTZ and thus below the reach of isotopically light fluids. Although regional subsurface crustal architecture is controversial, low and high $\delta^{18}O$ Precambrian zircons were likely derived from basement and cover of the NAC miogeocline, respectively. If zircon $\delta^{18}O$ is inherited from bulk crust, basement alteration timing is uncertain, but likely predated deposition of the miogeocline sequence. ≤100 Ma domains indicate zircon growth spanned the Sevier and Laramide orogenies at depth, continuing until the onset of the ignimbrite flare up. Magmatism and high heat flow ca. 40-35 Ma likely re-equilibrated deep crust bulk rock $\delta^{18}O$ to more normal values.