RADIOGENIC INGROWTH OF ^{40}CA FROM DECAY OF ^{40}K PROVIDES A POWERFUL TRACER FOR UNDERSTANDING THE ORIGINS OF FELSIC MAGMAS

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Over time high K/Ca continental crust produces a unique Ca isotopic reservoir, with measurable ^{40}Ca excesses compared to Earth's mantle ($\varepsilon Ca=0$). Thus, values of $\varepsilon Ca_i > 1$ indicate a significant crustal contribution to a magma. Values of εCa_i (<1) indistinguishable from mantle Ca indicate that the Ca in those magmas is either directly from the mantle, or is from partial melting of newly formed crust. So, whereas ^{40}Ca excesses clearly define crustal contributions, mantle-like ^{40}Ca/^{44}Ca ratios are not as definitive. Here we present Ca isotopic measurements of intermediate to felsic igneous rocks from the western United States, and two crustal xenoliths found within the Fish Canyon Tuff (FCT).

The two crustal xenoliths found within the 28.2 Ma FCT of the southern Rocky Mountain volcanic field (SRMVF) yield εCa values of ~4 and ~7.5, respectively. The ^{40}Ca excesses of these possible source rocks are due to long-term in situ ^{40}K decay and suggest that they are Precambrian in age. However, the FCT (εCa_i ~0.3) is within uncertainty of the mantle ^{40}Ca/^{44}Ca. Together, these data indicate that little Precambrian crust was involved in the petrogenesis of the FCT. Nd isotopic analyses of the FCT imply that it was generated from 10-75% of an enriched component, and the Ca isotopic data appear to restrict that component to newly formed lower crust, or enriched mantle. However, the Ca isotopic data do permit assimilation of some crust with low Ca/Nd; decreasing the ^{143}Nd/^{144}Nd without adding much excess ^{40}Ca to the FCT. Several other large tuffs from the SRMVF and from Yellowstone have εCa_i indistinguishable from the mantle. However, a few large tuffs from the SRMVF show significant ^{40}Ca excesses. These tuffs (Wall Mountain, Blue Mesa, and Grizzly Peak) are likely sourced from near, or within the Colorado Mineral Belt.

New isotopic measurements of Mesozoic and Tertiary granites from across the northern Great Basin show a range of εCa_i from 0 to ~3. In these samples εCa_i is generally correlated with εSr_i and is broadly negatively correlated with εNd_i. However, for granites with similar εNd_i at a given general location εCa_i can vary significantly (1 to 2 epsilon units). In rocks where low εNd_i could also be due to melting from enriched reservoirs in the mantle lithosphere, the combination of high εCa_i with low εNd_i clearly identifies crustal melts.

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