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High-spatial-resolution isotope geochemistry of monazite (U-Pb & Sm-Nd) and zircon (U-Pb & Lu-Hf) in the Old Woman and North Piute Mountains, Mojave Desert, California

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Recent improvements in analytical capabilities allow us to reveal details of magmatic processes at an increasingly finer spatial and temporal scale. In situ analyses of the isotopic and trace element composition of accessory minerals at the sub-grain scale have proven to be effective tools for solving a wide range of geological problems. This study presents new data on accessory minerals including monazite & zircon, examined by in situ LA-ICP-MS and Laser Ablation Split Stream (LASS) techniques, analyzing multiple isotopic systems (U-Pb + Sm-Nd, and U-Pb + Lu-Hf in monazite and zircon, respectively) in order to track geochemical changes over time through a magmatic system.

The late Cretaceous granitoids of the Old Woman Mountains in the Mojave Desert, California, provide an excellent opportunity to apply these analytical techniques. The peraluminous granites of the Sweetwater Wash, Painted Rock, and North Piute plutons represent different depths of the magmatic system, and are well understood in terms of field relations and whole-rock geochemistry. A preliminary study on the Sweetwater Wash monazites (Fisher et al., in preparation) has revealed significant inter-grain isotopic heterogeneity in the εNd composition of the source region ($\sim$1700 Ma); however, the U-Pb ages show an isotopic resetting during emplacement at $\sim$75 Ma. This decoupling of U-Pb and Sm-Nd isotopic systems is suggested by Fisher et al. to be due to recrystallisation and/or dissolution-reprecipitation of monazite. If grain boundary diffusion of Pb overrides the more kinetically limited volume diffusion, then the U-Pb systematics will be reset while Sm and Nd remain immobile in the monazite structure as essential structural components of the lattice.

This new data will allow the further investigation of these preliminary results, providing new insights into the observed isotopic disequilibrium, with the LASS technique accurately linking the multiple isotopic systems. This will provide important insights into monazite isotope systematics, which will have implications for the geochronology community. Systematic sampling through transects of each pluton will also allow the geochemical homogeneity of each pluton to be assessed. Additionally, this study is the first application of the LASS technique to a magmatic system, and thus will provide further insight into the petrogenesis of the Old Woman and North Piute Mountains, and continental arc granites in general.