21-7 - Booth No. 22: QUANTIFYING THE SPATIAL DISTRIBUTION OF INHERITED ZIRCON IN THE TUOLUMNE INTRUSIVE SUITE, SIERRA NEVADA, CALIFORNIA

Thursday, 3 April 2025

8:00 AM - 5:30 PM

Sierra Ballroom (Holiday Inn Sacramento Downtown - Arena)

Booth No. 22

Abstract

The evolution and emplacement of granitic rocks in magmatic arcs have broad implications for the formation of continental crust and the storage of magma beneath volcanic centers. The Late Cretaceous Sierra Nevada batholith is characterized by several zoned plutonic bodies including the Tuolumne Intrusive Suite (TIS) in Yosemite National Park. The TIS exposes 5 texturally distinct granitic units that are inwardly more felsic and younger, and provide an opportunity to study pluton geochemical evolution and emplacement. Competing models for TIS construction suggest it formed via numerous pulses of sub-km-scale intrusions not capable of mixing at the level of emplacement, or through several multi-km-scale pulses that periodically formed a dynamically mixing upper-crustal magma chamber. These models make predictions regarding the spatial distribution of inherited material. If the TIS units mixed at the level of emplacement, we predict that inherited antecrystic mineral cargo would be more concentrated near unit contacts. Alternatively, if mixing and magma evolution was limited to lower-crustal processes, we predict that there would be no spatial trend in the distribution of inherited material across individual TIS units.

We present LA-ICPMS zircon geochronology and geochemistry from cores and rims of 100 individual grains in each of 19 samples collected from a transect across the TIS. Our results reveal that zircon < 89 Ma separated from the Cathedral Peak granodiorite (CP—within the interior of the TIS) displays high U/Ta and Nb/Ta, whereas older analyses > 89 Ma are strongly correlated with distinctly lower U/Ta and Nb/Ta characteristic of zircon from older TIS units, and provide a means to identify antecrystic zircon within CP samples. When samples from across the CP are compared, CP samples collected within 100 m of contacts with older units contain at least 2 times as many antecrystic grains as roughly homogeneous CP samples collected from across the 10–15 km width of the interior of the CP. The spatial distribution of antecrystic zircon within the CP is consistent with mixing between TIS units at the level of emplacement and existence of a dynamic upper-crustal magma chamber, and provides evidence supporting the possibility of a direct link between upper-crustal arc plutonism and volcanism.

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