Sierra Rack - Project Profile

2023 AGeS-Grad awardee

Project Title: Timing and Paleogeography of Mesozoic Arc Accretion in the Northern Sierra Nevada

Lab: University of California - Santa Barbara

Lab Mentors: *John Cottle, Andrew Kylander-Clark*

What scientific question(s) does your research address and what motivates this work?

I realized early on in my research experience that geochronologic data is extremely limited in the Sierra Nevada Foothills. The geologic complexity and lack of data has led to many differing ideas or models for the paleogeography of the Sierra Nevada foothills, so I targeted a key volcanic complex, the Lake Combie Complex, to address those models. Some of the fundamental questions I asked were: Do Mesozoic Arcs in the Sierra Nevada foothills have ancient and distant origins that were accreted by an unseen subduction zone? Do those arcs intrude oceanic or continental crust? Are there two distinct episodes of volcanism or is there evidence of one long-lived volcanic arc? How old is the Lake Combie Complex and what can it tell us about the existing paleogeographic models?

What chronometric tool did you employ and why?

I used U-Pb in zircon geochronology paired with Lu-Hf isotope analyses to determine the age of rocks within the Lake Combie Complex and determine what type of crust it intruded. I analyzed plutonic and detrital samples from my research area and attempted to retrieve zircons from volcanic samples to determine the age of the Lake Combie Complex.

What were some of the key takeaways of your research?

1. The Lake Combie Complex was proximal to the continental North American margin by 205 Ma.
2. The Lake Combie Complex preserves 160 Ma and 200 Ma magmatism, but there is no evidence of long-lived arc activity.
3. The Lake Combie Complex intruded primitive, oceanic crust.

Figure 1: Field work in the Sierra Nevada Foothills often happens at road cuts and stream cuts. Wear your Hi-vis and bring a sledge!

Figure 2: Lab safety is important while crushing hundreds of kilograms of rock.

What new experiences, opportunities, and collaborations did you gain as an AGeS-Grad awardee?

As an AgeS-Grad awardee, I worked with a lab that helped me problem solve during lab time and while I wrote up the results. John, Andrew, and Gareth at UCSB helped me navigate the problems I had and were reliable in helping me understand the complexities of the instrumentation and calculations. Additionally, the work I have done led to collaborations with other scientists within and outside of academia including the California Geologic Survey. The knowledge I have now allows me to better communicate with people doing similar or relevant work.

What is one piece of advice you have for future AGeS-Grad award applicants or awardees?

Start early and think about how your technique works early on. Doing so will allow you to ask better questions when you're in the lab.