A Thermochronological Study of the Central Appalachian Mountains
Shona Ortiz, Class of 2021

The Appalachian mountains were initially formed over 250 million years ago, when the North American and Northern African plates were colliding during the formation of Pangea. Then, the Atlantic Ocean opened, disassembling Pangea, and leading to the modern continental configuration we are familiar with today. Active, convergent plate boundaries are the primary mechanism by which mountains are created, yet, since the opening of the Atlantic, the Eastern North American Margin (ENAM) has been a passive margin for the last ~200 million years. Thus, the mechanism by which the Appalachian mountains have remained so high, even after collision has ended and they have been subject to hundreds of millions of years of erosion, remains disputed, and the timing and magnitude of the most recent uplift of the Appalachian mountains remains unconstrained. This summer, I helped collect new data on the Central Appalachian's uplift history to address this longstanding geologic

I spent the first few weeks of my summer reading recently published papers to familiarize myself with the geologic concepts and existing research relevant to our area of interest, and discussing them with my professor, Jacky Baughman, and the other research fellow on our team, Luke Basler '20. We read geophysical, and geomorphological papers about our region of study, and methodological papers about the thermochronologic methods we planned to use. During this time, we also pre-processed the samples that Jacky and Luke had collected from Virginia and West Virginia earlier in the summer using equipment available at Bates College, and crushed the rocks down into individual sand-sized grains appropriate for our processing methods. Then, with the help of fellowship funding, the three of us traveled to Colorado for two weeks to conduct lab work at the Thermochronology Research and Instrumentation Lab (TRaIL) at CU Boulder. At the TRaIL lab, we finished processing our samples using magnetic and density separation, then searched for the mineral apatite in each sample under petrographic microscopes. We were unable to find apatite in our samples, which was unexpected, and forced us to change the direction of our study somewhat. We instead collected zircon grains for zircon helium dating. Zircon (U-Th)/He (ZHe) dating is a thermochronometric method used used in orogenic (mountain building) settings to determine the mid-temperature exhumation history of the region. Although ZHe dating is not the method we initially intended to use, it will still provide valuable insight into the uplift history of this region, because no ZHe data have been published for the area of our transect.

The transect crosses the Central Appalachian Anomaly (CAA), another active area of research. The Central Appalachian Mountains are of particular interest currently in the field because they display more relief (elevation change) than is to be expected for a mountain range of their age, considering estimated erosion rates. Thermal springs and recent volcanism (in the past 50 million years) have also been documented in this region, the drivers of which current researchers are also trying to understand. These characteristics suggest that such lithospheric anomalies as the CAA may be driving uplift in this region. These anomalies are also likely driving topographic rejuvenation in much of the mountain chain along eastern North America, for example in the Green Mountains of Vermont which overlie the Green Mountain Anomaly, where we conducted field work to collect more samples at the end of my summer research experience for Jacky's upcoming related projects.

Due to the long-term timeline of this project and standard sample processing procedures, we will not receive data on the zircon grains we processed until September. Therefore, we do not yet have results to present. However, Luke and I plan to present a poster at the President's Summer Research Symposium in October, by which time we will have received the data and had time to interpret it. We also co-authored an abstract which we submitted to the American Geophysical Union fall meeting in San Francisco this coming December, where Luke and I will present our poster and findings.

Faculty Mentor: Jaclyn Baughman

Funded by the Hughes Family Summer Research Fellowship.