2022-2023 Outstanding Thesis Award Winner James Burns

The Office of Graduate Studies is proud to present James Burns with the 2022-2023 Outstanding Thesis Award for his thesis, *Late Holocene Slip History of the Central Garlock Fault, Mojave Desert, California,* written for his Master of Science in Earth and Environmental Sciences. Burns won the Math, Computer Science, Biological Sciences, Physical Sciences, and Life Sciences category.

Burns' careful study makes significant contributions to our understanding of the activity of the Garlock Fault, which runs from the Mojave Desert to Death Valley. Although the Garlock Fault is the second-longest active fault in California, the information available on it is limited, making it a prime candidate for further research. Burns' thesis provides valuable data on both the magnitude and age of prehistoric earthquakes in the area and helps to support the Super-Cycle model of earthquake activity theorized by Donal et. al.

"We're starting to see how the Garlock Fault fits into its role in the Mohave Desert," Burns said. "What we found is consistent with previous models of the Basin and Range province. As we move farther west, the fault is moving faster – that is, the amount of stress on the fault is accumulating at a faster slip rate."

One of the remarkable features of Burns' thesis was the extensive amount of research he conducted both in the field and in the lab. His study involved meticulously mapping portions of the Garlock Fault, collecting soil samples, preparing the samples for testing in a high-tech laboratory in England, and carefully interpreting the data.

Burns decided to attempt to measure the amount of horizontal slip that occurred during the most recent prehistoric earthquakes along the fault near the town of Ridgecrest. To do so, he identified 8 landforms where slip had occurred. To gather the data he needed to create digital models of the landforms, Burns, with help from two other graduate students, used a drone to take aerial photos of the area. The team also explored the area on foot and collected data with a backpack-mounted LiDAR unit (a method for capturing 3-D data using pulsing lasers). By feeding the data into photogrammetry software, Burns created 3-D digital elevation models of each landform, which he used to measure the amount of lateral offset.

But Burns' field work didn't end there. He needed soil samples from each landform to estimate the age of the slip, which meant digging 1-meter-deep pits at each site for sediment collection. Because he would be using Infrared Stimulated Luminescence (IRSL) to date the samples, Burns had to be careful not to expose them to light. He collected the samples by pounding metal tubes into the wall of the pit and extracting sediment in light-proof containers. He then prepared the samples for testing using a luminescence lab at UCLA and sent them to the University of Sheffield in England for the IRSL dating technique.

Burns' hard work paid off. According to his thesis committee chair, Sally McGill, "James' research provides the first estimates of lateral slip in prehistoric earthquakes on the Garlock fault for which the slip amounts can be tied to specific, previously dated earthquakes…This, in turn enabled James to estimate the magnitude of these prehistoric earthquakes more accurately than was possible previously."

Burns credits his success to the support he received from his professors. “Sally McGill helped put the research process all together,” Burns said. “We didn’t initially plan on having the drone photography or LiDAR imaging, it was an opportunity that we took advantage of.”

Burns is currently exploring opportunities in the fields of environmental geology, engineering, and GIS mapping. The research skills he developed while working on his thesis, along with his natural diligence and inquisitiveness, will guarantee him success on whatever path he chooses.