**F22.032: Mapping the Lake Mary Fault near Flagstaff, AZ**

Faculty mentor: Christine Regalla

**Overview**

The I2S student will perform GIS based geologic mapping of the Lake Mary fault, located ~5 mi east of and projects through Flagstaff. The Lake Mary fault system is considered by the US Geologic Survey and the Arizona Geologic Survey to be one of the active faults capable of producing a potentially damaging earthquake that could affect Flagstaff. However, little is known about the likelihood that such an event could happen, and what its magnitude could be. In order to make future projections of earthquake hazard, geologists must determine when earthquake events have happened on this fault in the geologic past, and what their past magnitude were. This information has not yet been determined for this fault system. To help address these gaps, the I2S student would participate in mapping the fault system from high resolution elevation models, and determining field sites where offset deposits can be mapped and dated. This project would be performed in collaboration with Dr. Regalla as the first steps in developing a new research project on active fault systems in on the Colorado Plateau.

**What the student will DO and LEARN**

Tasks: The I2S student will apply Digital Elevation Model (DEM) processing techniques using ArcGIS in order to map the locations of Quaternary active faults in the Flagstaff area, and to help determine sites for future drone based surveys and geologic mapping. Specifically, the student will: 1) Complete tutorials on DEM data manipulation in GIS, to learn research techniques 2) Download publicly available 10m DEMs and 0.5m lidar models of the Flagstaff area and generate hillshade, slope, aspect, and curvature derivatives. 3) Perform hydrologic routing techniques to define streams and watersheds in their field area from 10m DEMS and 0.5m lidar. 4) Combine the above data sets to produce a high-resolution map active fault strands. 5) Identify areas for future field and drone-based data collection (~1x1 km areas), and generate first order surficial geologic maps of these areas. 6) Present results at the Undergraduate research symposium I anticipate tasks 1-3 to be completed in fall 2022 and tasks 4-6 to be completed in spring 2022. Learning outcomes: As a result of this research internship, the student will learn how to: - perform map and DEM plotting and data manipulation in ArcGIS - calculate slope, aspect, and curvature and hydrologic routing techniques on DEMs - recognize and map active faults in elevation model data - apply tools geologists use to determine earthquake histories on faults - produce a map of active faults for a sub-region of the greater Flagstaff area.

**Additional benefits**

The student will gain skills in analysis of DEM data in ArcGIS and geologic mapping of active faults. These skills are commonly sought by employers in the geosciences. In addition to meeting regularly with Dr. Regalla to discuss project progress, the awarded student will join a vibrant joint research lab group hosted by four NAU geology faculty. As part of weekly group meetings, the I2S student will be able to see other students present results of research and be able to give updates to their own research. Several students in the research group are experienced in the GIS skills the I2S students will be learning, and this the I2S students will therefore be part of a community of graduate students who can help them with issues that may arise. This project is being submitted as one of two complimentary I2S projects. If both

I2S projects are awarded, this I2S student will have a partner who will be learning the same skills but applying them to a different fault. The two students will be able to learn from each other and assist each other with technical problems they may encounter, and teach each other about what they are discovering about their respective fault system.

**Additional qualifications**

Student pursuing a major, minor, or emphasis in Geoscience, Planetary Science/ Astrogeology, or related fields who has an interest in map making, surface processes, and/or earthquakes. Student must be comfortable with computer-based analysis (windows operating system) and be willing to trouble shoot technical issues with the help of supervisors and graduate students. The student must have taken an introductory Geology class (GLG 101 or GLG 112) and at least one 200 level or higher class in geoscience or related fields. Student preferably has taken a course in either Geomorphology, Field Geology, Physical Geography, or GIS/ Remote Sensing.

**Time commitment**

5 hrs/week for 30 weeks