USGS NSF GRIP, GSP Opportunity

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USGS Center:	Crustal Geophysics and Geochemistry Science Center
Project Title:	Water, ice, and alteration - airborne geophysical imaging of active volcanic systems
Summary:	The USGS will soon collect airborne geophysical data over the iconic hydrothermal features of Yellowstone National Park to study the subsurface plumbing, alteration, and mineralization. Other airborne data over Iliamna Volcano, Alaska are also being used to address flank collapse, a hazard which may trigger lahars and eruptions. Expertise is needed to analyze the geophysical data over these active volcanoes.
Project Hypothesis or Objectives:	Flank collapses of volcanoes pose significant potential hazards, including triggering lahars, eruptions, and tsunamis. Controls on the stability of volcanoes include the distribution of hydrothermal alteration and the location of groundwater. Groundwater position, abundance, and flow rates within a volcano affect the transmission of fluid pressure and the transport of mass and heat. Detecting the presence and volume of hydrothermally altered rocks and shallow groundwater is therefore critical for evaluating landslide hazards. Groundwater perched within the edifice also plays a significant, though largely unknown, role in phreato-magmatic eruptions. This project will leverage existing and soon-to-be-collected USGS high-resolution airborne geophysical surveys of Iliamna Volcano in Alaska and Yellowstone to further develop 3D images of alteration, ground water and volumes of ice and snow for input into computational groundwater and slope stability models. Objectives are to determine how hydrothermal alteration and fluids are distributed vertically and laterally within the volcanic edifice and to investigate the mechanisms for storing and releasing water within a volcano. Expertise is needed in analyzing the geophysical data over these volcanoes.
Duration:	Up to 12 months

Internship Location:	Denver, CO
Field(s) of Study:	Geoscience
Applicable NSF Division:	EAR Earth Sciences
Intern Type Preference:	Either Type of Intern
Keywords:	Geophysics, Geology, Volcanology, Landslides, Earth Science, Remote Sensing
Expected Outcome:	This research will inform landslide hazards assessments of Iliamna Volcano and our understanding of the complex hydrothermal systems at Yellowstone. The results of this effort will be 3D magnetic and resistivity models of the volcanoes with estimates of the resolution of the EM modeling. The intern will be able to acquire skills unique to the USGS—the experience of interpreting magnetic and electromagnetic data in rugged, magnetic and resistive terrain, will gain experience in software that are industry standards (e.g. ArcGIS, Oasis Montaj) as well as stochastic inversions developed at the USGS. In addition, the intern will gain understanding of the influence of alteration and perched aquifers on slope stability—a relatively new topic for volcano hazards. The USGS will benefit by having help advancing project work by talented young scientists who will bring new ideas and enthusiasm.
Special skills/training Required:	Completion of a bachelor's or master's degree in geophysics or a related field. Experience in data integration (e.g. ArcGIS), processing (e.g. MATLAB, Oasis Montaj), including electromagnetic and/or magnetic data inversion is desirable, but not required. Applicant should have at least basic programming experience and ability to learn software packages independently.
Duties/Responsibilities:	Process airborne electromagnetic and magnetic data and integrate these data sets into a GIS (either in ArcGIS or Oasis Montaj). Standard processing methods exist and need to be applied. Develop preliminary magnetic and resistivity models of the volcanoes. Standard modeling software exists. Integration of geologic, geochemical, and topographic information into the models will be required--such as mapped distribution of alteration. Provide support to USGS scientists on the interpretation of the data processing and modeling results. Understanding the risk that weak zones of alteration poses for landslide hazards depends on understanding the 3D geometry of the alteration from the geophysical models.