Newsletter

Center for GeoHazards Studies

Fall/Winter 2015

Special points of interest:

STUDENTS:

Interested in becoming more involved?

E-mail David Hyman at davidhym@buffalo.edu to learn about the student committee.

Inside this issue:

The Center for Geohazards is jointy sponsored at UB by the College of Arts and Sciences and by the School of Engineering and Applied Sciences.

Letter from the Director

Geohazards colleagues:

Welcome to another academic year full of activities for the Center for Geohazards Studies. This issue features Center-sponsored student research and training. UB graduate students Peter Johnson, Avriel Schweinsberg, and Andrew Harp each received a Center research grant in 2015 that supports part of their dissertation projects. Peter is working on rapid water discharges that have been documented at several volcanoes prior to magma eruptions. Avriel is working on glacial outburst flood reconstruction in Colorado. These floods are a major hazard in mountainous areas (e.g., Alps, Himalayas) where glaciers are rapidly retreating and their meltwaters pond in unstable lakes. Andrew is working on better constraining the shapes and sizes of magma intrusions in volcanoes. This work will feed into better understanding volcano deformation, which is a key monitoring parameter.

All three of these graduate students are in the Geology Department, but I want to emphasize that the Center for Geohazards Research Grants are open to all UB graduate students who are doing research related to natural hazards, no matter what their home department is. Potential examples include: (1) Enhancing communication between scientists and the public on topics related to natural hazards; (2) Urban planning to minimize impacts of the hazards; (3) Engineering solutions to make our built infrastructure more resilient to natural hazards. I strongly encourage graduate students from around the campus to submit proposals (see "Upcoming Events" in this Newsletter).

Dr. Alison Graettinger, a postdoctoral researcher who has had important impacts on our work to establish a Geohazards Field Station, summarizes a FEMA training event that the Center hosted earlier in 2015. This training focused on managing severe winter weather hazards, and on the use of social media in managing disasters. In the coming weeks we are hosting another FEMA training event, focused on volcanic crisis awareness and management.

Speaking of the Geohazards Field Station, exciting events are unfolding there. A new induction furnace capable of melting 30 liters of rock is, as I write, being installed at the site under the leadership of Dr. Ingo Sonder. This will be a one-of-a-kind-in-the-world apparatus for studying explosive magma-water interaction and other magmatic processes. We are in the initial phases of designing an apparatus to study some aspects of pyroclastic flows. And, our final run of subsurface blast experiments, headed up by Dr. Graettinger, was successfully executed in May.

Finally, mille grazie to Prof. Abani Patra for sheparding the Center last academic year while I was on sabbatical. I was still working on geohazards issues, but with daily enjoyment of French wine and fromage, German sauerkraut and schnitzel, and Italian pizza and cacio e pepe pasta (among many others!). Maybe there was some Italian wine in there too.

Kind regards,
Greg Valentine, Director

Student Research Award Recipient — Peter Johnson

Experiments to examine mechanical impacts of dikes on groundwater with applications to precursory fracturing and dewatering of volcanic edifices .

By: Peter Johnson

After erupting, many volcanoes have quiet periods lasting hundreds or even thousands of years. Rain, snow, and glacier ice melted by volcanic gases all cause all the tiny pores of the volcano to slowly fill with water.

In renewed activity, hot molten rock begins pushing up into the volcano. All of this accumulated water, which may have achieved some form of equilibrium, is suddenly subjected to mechanical compression and expansion from heat as this hot wedge moves higher into the volcano. These forces acting on the water have two major effects. First, some of that water can be pushed out of the volcano, either as liquid or in violent explosions of steam. Flooding from releases of water can damage infrastructure and take lives, as seen in the villages near Nevado del Huila Volcano in Colombia in 2007 and 2008. But these groundwater disruptions may also provide a lot of information about what is actually happening inside the volcano. Combined with other geophysical data, understanding exactly what magma intrusions do to groundwater may help us develop better monitoring and warning systems in the future.

In order to study this phenomenon, the Center for Geohazards Studies provided grant money for me to construct a set of analog experiments in which solid wedges are pushed into the base of wet, porous sand. These ongoing experiments aim to examine where and how much groundwater is mechanically affected by intrusion of magma. Results from these experiments will be compared to numerical models, which in turn can be scaled up to begin describing magma effects on pore water at volcanoes. Thanks to this generous grant from the Center, these analog experiments will form a major portion of my PhD dissertation, and will help us gain a fundamental understanding of how groundwater in volcanoes responds to intrusions.

Photo of Peter Johnson in Valles Caldera, New Mexico

Student Research Award Recipient — Andrew Harp

Intravolcanic emplacement mechanisms of radial dikes based on observations from Summer Coon stratovolcano, Colorado, USA *By Andrew Harp*

During the summer of 2015 thanks, in part, to the support from the Center for Geohazards Studies my field assistant Nicole Leach and I completed geologic mapping and a geophysical survey at Summer Coon Volcano in southern Colorado. Summer Coon is an early Oligocene stratovolcano where erosion has removed the entire upper edifice. The resulting exposure, in map view, is a roughly circular central intrusive complex (CIC) ~3.5 km wide composed of several intrusive stocks and sparse dikes surrounded by a radial dike (tabular intrusion) sequence ~13 km in diameter. Summer Coon provides a rare opportunity to study the horizontal extent of a stratovolcano's plumbing system and how magma propagates within volcanoes.

Intravolcanic propagation of magma is an important field of study as it determines the location and probability of an eruption. From a volcanic hazards perspective, during periods of unrest, scientists often measure signals indicating magma has intruded into the volcano using seismicity, deformation, remote sensing, or geophysical methods. Next, scientists attempt to model the location and geometry of the intrusion to provide informed volcanic eruption forecasts. Direct measurements of propagating intrusions are difficult for obvious reasons, therefore it is necessary to investigate the plumbing system of eroded volcanoes to provide ground truths for theoretical models.

Over a period of two weeks we completed detailed geologic mapping, sample collection, and a ground based magnetic survey of Summer Coon's central intrusive complex (inferred conduit). Geologic mapping entailed locating and describing previously unmapped dikes and outcrops of lapilli tuff and collecting hand samples for later thin sectioning. The resulting geologic map is a more comprehensive and detailed record of locations, geometries, and orientations of the magmatic plumbing within a volcanic conduit. A recent publication, using the published geologic map of Summer Coon, made the assumption that the lack of basaltic-andesite dikes within the CIC is supportive field evidence for their theoretical model. We completed a ground based magnetic survey to test the hypothesis that the basaltic-andesite dike's absences from the geologic map are the result of alluvium cover and not necessarily due to the factors put forward in the publication. The magnetic survey comprised 40 profiles and 2,785 measurements, with a station spacing of 10 m. The goal is to locate linear magnetic anomalies of the total magnetic field which may indicate the presence of buried dikes. The data are currently in the final stages of processing and preliminary interpretation, however geologic mapping does reveal several exposed basaltic-andesite dikes within the CIC.

The exposure at Summer Coon is one of the world's best examples of a stratovolcano's lower intravolcanic plumbing system. Field studies similar to the one completed this summer are imperative to link theoretical models, a technique used with increasing frequency in volcanology, to real world examples.

Andrew collecting hand samples from a radial dike for later thin section analysis. Photo by Nicole Leach

Student Research Award Recipient — Avriel Schweinsberg

Improving late Pleistocene age and periodicity of glacial lake outburst floods, Colorado, USA
By Avriel D. Schweinsberg

With funds provided from the Center for GeoHazard Studies, a successful field campaign was completed in the Twin Lakes region of the upper Arkansas River valley, Colorado, in July 2015. Building on previous research conducted by the UB Paleoclimate Lab, this work investigates the connection between past glacier fluctuations and glacial lake outburst floods (GLOFs) to provide a better understanding on the interaction between moraine deposition and flooding, and timing and periodicity of former GLOF events in this region.

The field survey was completed over three days and was part of an informal field conference involving a large number of collaborators, including USGS scientist Ralph Shroba, the primary author of a new geologic map of the research area, Jason Briner (UB), Cal Ruleman (USGS), Joe Licciardi (UNH), Eric Leonard (CC), Keith Brugger (UMN), and University at Buffalo M.S. geology students Charles Porreca and Joe Tulenko. In order to constrain the timing of past GLOFs and their frequency in the Arkansas River basin, we targeted moraines south of the Twin Lakes reservoir for sampling to: 1) develop a chronology using cosmogenic ^{10}Be exposure dating to identify the timing and extent of undated moraine crests, 2) provide age control for undated USGS map units of glacial till, and 3) utilize the age of former glacier maxima to place limits on the timing and periodicity of GLOFs in the Arkansas River valley. Results from this research will improve our understanding of factors related to GLOFs, and may be useful for regions where GLOFs today are an important geological hazard.

We collected 26 samples from boulders across the Twin Lakes moraine sequence, which are currently being processed at the Cosmogenic Isotope Laboratory at the University at Buffalo. We anticipate results from this project early next semester (February 2016) and plan to present our findings at the Northeast GSA Sectional Meeting in late March.

We are very grateful for the funding provided by the Center for GeoHazards Studies which granted this project partial financial support for analytical analyses of our ^{10}Be samples. This research opportunity has provided me with instrumental experience designing and leading a research project and field campaign.

FEMA Classes

By Dr. Alison Graettinger

On February 25 and 26 , 2015 The Center for Geohazards Studies hosted two courses run by the Natural Disaster Preparedness Training Center (NDPTC) and certified by FEMA. These courses covered how social media can be used during Disaster Response, and on managing winter weather. The courses had a wide range of participants representing Emergency Services, Public Health, University Researchers, University Staff, and community volunteers.

The Social Media for Disaster Response and Recovery course covered the ways to use social media can and should be used before, during and after natural disasters by a range of communicators. Social Media can be used to share important up to date information to reduce unnecessary traffic on emergency lines and provide a targeted response to what your audience is really concerned about. Conversations during the course involved tips on how to manage the time investment required by social media and tools to make communication efficient and effective.

The Winter Weather Awareness course discussed not only the science behind winter weather, but highlighted the chain of communication and the meaning behind the National Weather Service official terminology for watches and warnings.

While full of information, what makes these courses so beneficial is the participation of the audience in providing individual stories of both success and struggle that help other understand how best to use the material in their field.

Winter Weather participants engaged in a disaster management scenario to test out their new knowledge. (*Photo by A. Graettinger*)

Upcoming events

Center for Geohazards Student Research Grant
The UB Center for Geohazards Studies is pleased to announce a research grant opportunity for graduate students to support research in any discipline that is related to natural hazards. Proposals are due 29 February 2016. The total amount of available funding is $2,000.

Please follow the link for the call for proposals:

http://geohazards.buffalo.edu/news/

The Center for Geohazards Studies is sponsoring a workshop “Uncertainty in Geo-science: A workshop on Hazard Analysis. To be held at the University of Buffalo, March 15th,16th and 17th 2016. For more information and to register for the workshop, please follow link below:

http://geohazards.buffalo.edu/conference/

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Send your research updates to Barb Catalano (bac6@buffalo.edu) to be included in the next newsletter or e-blast!

Have changes to your employment, research interests, or contact information? Let us know at geohaz@buffalo.edu.

Center for GeoHazards Studies

The ***Center for GeoHazards Studies*** seeks to decrease harmful societal effects of natural phenomena such as volcanic eruptions, landslides, mudflows, and avalanches through research, service, and education. Our team of scientists and engineers works together with social scientists, urban planners and public health researchers to evaluate the broader harmful impact of hazardous natural phenomena. One of our principal goals is to integrate analyses of various hazards with predictions of their effects on human infrastructure and ecosystems in order to evaluate approaches that could lead to a reduction of injury and death. Hazards that are affected or triggered by changes in climate are included within the Center's scope.

Special thanks to:

Advisory Committee Members:

Amjad Aref, *University at Buffalo*
Marcus Bursik, University at Buffalo
Beata Csatho, University at Buffalo
Alison Graettinger, University at Buffalo
Abani Patra, University at Buffalo
Chris Renschler, University at Buffalo
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