GEOS 495/695: INTERNATIONAL VOLCANOLOGICAL FIELD SCHOOL (3 CREDITS)

INSTRUCTORS

Pavel Izbekov  Research Assistant Professor, Geophysical Institute, University of Alaska Fairbanks, Fairbanks AK; email: peizbekov@alaska.edu; phone: +1-907-474-5269

John Eichelberger  Dean of the Graduate School, University of Alaska Fairbanks, Fairbanks AK; email: jceichelberger@alaska.edu

Sergey Samoylenko  Senior Researcher, Institute of Volcanology and Seismology, Petropavlovsk-Kamchatsky, e-mail: samsergey@kscnet.ru

Olga Khubaeva  Researcher, Institute of Volcanology and Seismology, Petropavlovsk-Kamchatsky, e-mail: grifon03@yandex.ru

Session A – Katmai (June 7-20, 2015)

The two-week field trip to the Katmai National Park, Alaska provides a unique opportunity to visit the site of the largest volcanic eruption on Earth in the 20th century. Participants learn about volcanic processes through direct examination of volcanic products while exploring the Valley of Ten Thousand Smokes and the neighboring volcanoes - Mount Katmai, New Trident, and Mageik. The session will be taught by Pavel Izbekov and possibly John Eichelberger.

Session B – Kamchatka (August 16-29, 2015)

The field trip to Mutnovsky and Gorely volcanoes in Kamchatka offers a chance to learn about full spectrum of volcanic processes using some of the best examples in the world. This includes ignimbrites of caldera-forming eruptions, lava flows, cinder cones, extrusive domes, and active fumaroles. A side trip to the 50 MW Mutnovsky Geothermal Power plant is used as an excellent opportunity to discuss the utilization of geothermal energy. This field trip will be led by Pavel Izbekov, Sergey Samoylenko, and Olga Khubaeva.

PREREQUISITES

- GEOS 495: Courses in introductory, college level Geology, Chemistry, and Physics at the students home institution are required, or permission of instructor.
- GEOS 695: Graduate standing in volcanology or related field or permission of instructor.
- All field trips are strenuous and require students to be in good health; capable of hiking for at least 20 km per day carrying heavy backpacks; willing to camp under primitive, remote, and possibly uncomfortable conditions.
- Basic conversational ability in either English or Russian is required. Students attending the class in Kamchatka will need a passport with an expiration date after March 2016.

OBJECTIVES

- GEOS 495 is a stimulating exploration of physical science in nature, suitable for undergraduate science majors with a zest for adventure and an interest in meeting students from other cultures.
- GEOS 695 should be taken by graduate students early in their graduate careers as an introduction to research possibilities in volcanism, tectonics, and related phenomena associated with subduction in the North Pacific.
Figure 1: Map showing the Kamchatka Peninsula (left) and a portion of Alaska (right). Yellow diamonds denote locations of the Mutnovsky/Gorely (left) and Katmai (right) school sites.

STUDENT LEARNING OUTCOMES

GEOS 495:
- Understanding basic processes of physics and chemistry through direct examination of active volcanic phenomena.
- Knowledge of the eruptive behavior of volcanoes and resulting products.
- Experience with different cultures and languages, and with the conduct of scientific field work in a harsh environment.
- Introduction to techniques of geology, geochemistry, and geophysics.
- Introduction to the possibility of extended foreign educational exchange.

GEOS 695:
- All of the above.
- Experience in presentation of scientific concepts and issues to peers and undergraduates.
- Introduction to a wide range of volcanic phenomena and research opportunities in the North Pacific subduction region.
- Establishment of collegial relationships with students from other countries for future collaborative research.
- Discussion of current controversies and themes in volcanology.

Graduate students completing this course will be able to make informed choices about research directions and feel confident about field work in a challenging environment. It is hoped that direct research collaboration among students from different countries will result.
COURSE STRUCTURE

The course consists of day-long field trip hikes interspersed with lectures. Lectures occur in the evenings and on days of bad weather. The following topics will be covered:

- Magmatic systems
- Ascent of magma
- Eruption processes and products
- Hydrothermal systems and processes
- Volcano monitoring
- Current themes in Volcanology
- Special topics depending upon expertise of guest scientists

During field trips, students will examine volcanic lava flows, pyroclastic flows, air fall tephra, craters, fissures, faults, vents, crater lakes, and fumaroles spanning the common range of volcanic rock types from basalt to rhyolite. Discussions in the field and following lectures will explore why and how these phenomena occur. A special feature of Session A is examination of the largest eruption on Earth of the 20\textsuperscript{th} century, including its newly formed caldera. Session B will examine volcanic features more “normal” – except for their exceptional level of activity - for the Pacific rim, including craters formed within the last few years and an extensive hydrothermal field. There will also be a visit to a geothermal power plant.

\textbf{Figure 2:} Huts used for the Katmai, Alaska (upper left, with Griggs Volcano in background) and Mutnovsky/Gorely, Kamchatka (lower left). The huts provide a sheltered place for eating, lectures, and study for all, and accommodate some of the campers for sleeping. The remaining campers sleep in mountaineering tents. The huts also provide a safe haven for all during extreme weather conditions. Access to the regions is by float plane in the case of Katmai and all-wheel drive truck in the case of Kamchatka.
COURSE SCHEDULE (TENTATIVE)

Session A – Katmai (June 7-20, 2015)

Day 1 Students arrive in Anchorage.

Day 2 Visit to Alaska Volcano Observatory in the morning; lectures by and discussions with observatory staff on volcano monitoring and volcanology. The afternoon is spent acquiring food supplies and any equipment to students do not already have.


Day 4 Bus to Valley of Ten Thousand Smokes, hike to Baked Mountain Huts, stay at huts.

Days 5-12 Day hikes as weather permits; lectures other days:
- Novarupta Dome (effusive vs. explosive volcanism; eruption history)
- Katmai Caldera (caldera formation; magma chamber; internal structure of arc volcanoes)
- Trident Volcano lava flows and vent (cone building; normal arc volcanism; magma mixing)
- Upper Lethe Valley (ignimbrite emplacement; welding; glacier/tephra interaction; glacier/lava interaction; glacial retreat; magma intrusion)
- Upper Knife Creek Valley (more ignimbrite features; phreatic deposits; fumarolic systems)
- Griggs Volcano (cone growth and sector collapse; fumaroles)
- Baked Mountain (pyroclastic surges; sedimentary basement; valley overview).

Figure 3: Features visited during Katmai session: Katmai Caldera (top), which was formed by collapse of Mt. Katmai during the great eruption of 1912; 1912 ignimbrite sheet, the Valley of Ten Thousand Smokes (middle left); Novarupta Dome, marking the vent for the 1912 eruption (middle right); inside a welded portion of the 1912 ignimbrite sheet (lower left); Mageik volcano featuring massive lava flows and a rhyolitic sill exposed at its foothills.
Day 13  Hike from huts to trailhead; bus to lodge; spend night at lodge.
Day 14  Fly to Anchorage in time for evening departures to Seattle.

Session B – Kamchatka (tentatively August 16-29, 2015)
Day 1  Students arrive in Petropavlovsk-Kamchatsky; registration, preparation.
Day 2  Drive to Mutnovsky cabin (fig. 2)
Day 3 - 11  Day hikes as weather permits; lectures other days (fig. 5, 6):
   • Mutnovsky Crater
   • Mutnovsky pyroclastic flows
   • Gorely craters
   • Gorely caldera and pyroclastic flows
   • Gorely lava flows
   • Visit to geothermal well field and geothermal power plant
Day 12  Drive back from Mutnovsky. (Earlier return with optional climb of Avachinsky Volcano possible)
Day 13  Additional lectures, farewell celebration in Petropavlovsk or Paratunka.
Day 14  Flight back home (gain day crossing dateline)

*Figure 4:* Some of the volcanic features visited during the Kamchatka session: Gorely volcano (top right) featuring lava flows, cinder cones, and summit craters (top left, please note the Mutnovsky volcano at the background); fumaroles and glaciers in Mutnovsky Crater (lower right); dikes exposed at the walls of the Mutnovsky caldera (lower left).
GRADING POLICIES

Students are expected to participate in all class activities including day hikes, discussions, and lectures. If physical conditions prevent a student from full participation in a day hike, he/she will be given a writing assignment. Students are expected to record their field observations in their field notebooks. Students enrolled in GEOS695 are required to give a presentation on their research or research interests during the camp and to help guiding discussions. Students enrolled in 495 are encouraged but not required to give a presentation. Hearing presentations by other students from other countries is an experience that many students value most. At Katmai, presentations will be via whiteboard and whatever handouts the presenter wishes to distribute. At Mutnovsky/Gorely, a computer and projector will be available.

The course is graded based on the following accomplishments:
- 40% on participation in day trips and associated lectures and discussions
- 20% on presentation (if given)
- 20% on a short final exam (40% if no presentation)
- 20% on quality and completeness of field notes

This percentage score is transformed into a plus-minus letter grade using these cutoffs:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>&lt;60%</td>
</tr>
<tr>
<td>D</td>
<td>≥60%</td>
</tr>
<tr>
<td>D+</td>
<td>≥67%</td>
</tr>
<tr>
<td>C</td>
<td>≥70%</td>
</tr>
<tr>
<td>C+</td>
<td>≥77%</td>
</tr>
<tr>
<td>B</td>
<td>≥80%</td>
</tr>
<tr>
<td>B+</td>
<td>≥87%</td>
</tr>
<tr>
<td>A-</td>
<td>≥90%</td>
</tr>
<tr>
<td>A</td>
<td>≥93%</td>
</tr>
</tbody>
</table>

The grades “B-”, “C-”, “D-”, “F+”, and “F-” will not be given. “A+” is reserved for truly extraordinary work.

COST

The cost of the Katmai trip is $2772 and $3351, for 475 and 695 levels correspondingly. The cost of the Kamchatka trip is $1741 and $2320, for 475 and 695 levels correspondingly. The cost includes tuition at the in-state rate plus the course fee. Except for a few meals, incidental expenses, and visa costs (about $150), the course fee covers all transportation, lodging, food, and insurance for the duration of the class, which for Katmai begins and ends in Anchorage and for Kamchatka begins and ends in Petropavlovsk-Kamchatsky, Russia. Students will be responsible for their own travel arrangements to/from Anchorage and Petropavlovsk-Kamchatsky for Katmai and Kamchatka sessions, respectively. For Kamchatka, careful attention must be paid to visa procedures in order to receive your visa in time. We will provide detailed instructions.

EQUIPMENT

Students will need to bring their own backpacking gear consisting of a backpack, sleeping bag, foam pad, person dish, cup, eating utensils, medium weight hiking boots, clothing appropriate for high mountains, and – most important - durable rain gear. Details on equipment and expected conditions will be sent to accepted students.

SELECTION PROCEDURE

The success of the school depends on everyone being able to travel on foot together. It will be very difficult if not impossible for students who find themselves unable to adapt to field conditions to leave before the session is completed. Therefore, an application procedure has been established (http://www.uaf.edu/geology/academics/international-volcanology/). Prospective students are asked to fill out the accompanying application form. Preference will be given to students who exhibit enthusiasm for field science and a strong interest in establishing collaborative relationships with students and scientists.
from other cultures. For the Kamchatka session, we will consider students who do not intend to pursue careers in science but who have a strong interest in Russian culture and language.

**Applications will be accepted and reviewed on the continuous basis until all vacancies are filled. If interested, please apply as soon as possible to reserve your space in the group.** Once students have been notified of their acceptance, they will be able to register and pay fees through the UAF Summer Sessions at www.uaf.edu/summer. Since travel arrangements require significant financial commitments from organizers, we request a non-refundable deposit of $250 to reserve a space. The remaining portion of the payment should be received by Summer Sessions no later than 2 weeks before the trip.

**Figure 5:** Education aspects of the field experience (left to right and down): Impromptu Russian/English/Japanese language session. Pavel Izbekov lectures on instrumental techniques. Students assisting each other during the strenuous hike to Baked Mountain Huts, Katmai. Evgenii Gordeev lectures on Kamchatka seismology and tectonics at science field station. Jackie Caplan-Auerbach describes seismic monitoring of volcanoes at Baked Mountain seismic station, Katmai. Katmai class participants examine an airfall tephra deposit with USGS volcanologist John Pallister(yellow hat). The entire group at the end of class, Kamchatka field station. The entire group in Katmai in front of Novarupta Dome. The Kamchatka camp pictures were taken during the “trail run” of the field school in 2003, and involved 3 American students plus both instructors (JE and PI). The Katmai camp has been an informal UAF field trip for many years. Since 2004, both sessions are offered as a formal class.
PRIMARY READING

Katmai session

Eichelberger, J.C., 2006, *The Valley of Ten Thousand Smokes, Alaska, University of Alaska Fairbanks, 60p. (Copy provided to students registered for Katmai session)*


Kamchatka session
Selyangin, O.B., 2006, *Guide to Mutnovsky and Gorely Volcanoes (copy provided to students registered for Kamchatka session)*