

**SYLLABUS FOR GEOS 495/695:
INTERNATIONAL VOLCANOLOGICAL FIELD SCHOOL (3 units)**

(Application deadline through UAF Department of Geology and Geophysics: April 1, 2009)

Instructors

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For students registering through UAF (all non-Russian students and Russian students attending session A)

Session A (led by J. Eichelberger and P. Izbekov): June 7-20, 2009. Class meets at UAA in Anchorage for pre-trip briefing, organization, and visit to Alaska Volcano Observatory; flies to Katmai National Park by way of Anchorage, stays at Brooks Lodge and at Baked Mountain Hut in Valley of Ten Thousand Smokes; group disperses from Anchorage late June 20.

Session B (led by J. Eichelberger, P. Izbekov, and A. Manevich): August 7-21. Class meets in Petropavlovsk-Kamchatsky (Russia) for pre-trip briefing and organization; drives to Gorely and Mutnovsky volcanoes; stays at mountain hut on Mutnovsky Volcano; group disperses from Petropavlovsk-Kamchatsky on August 21.

Prerequisites (students registering through UAF)

GEOS 495: One year of university geology, chemistry, or physics, or permission of instructor.

GEOS 695: Graduate standing in volcanology or related field or permission of instructor.

Students must be in good health; be capable hiking at least 20 km in a day and carrying at least 20 kg; and be 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 February 2010.

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.

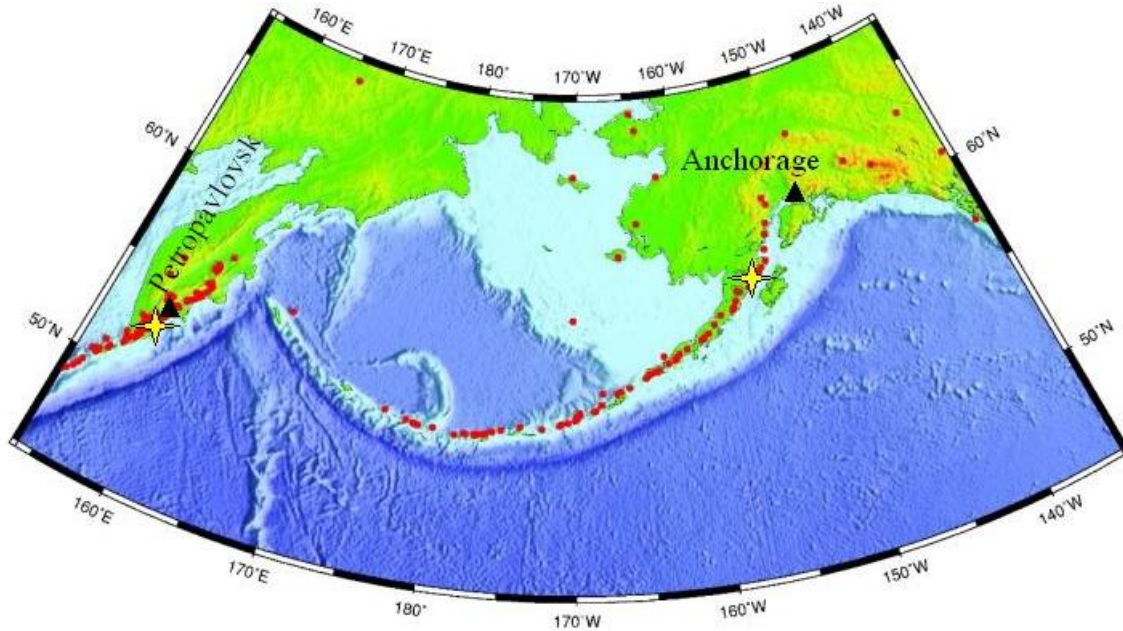


Figure 1: Map showing the Kamchatka Peninsula (left) and a portion of Alaska (right). Red dots are active or recently active volcanoes. Paralleling the volcanic chains, the dark blue crease in the ocean floor marks the deep-sea trench where the North Pacific plate dives beneath the North American plate (of which Kamchatka is also a part). Yellow stars denote locations of the Mutnovsky/Gorely (left) and Katmai (right) school sites.

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.

This course will provide students with a greatly expanded view of physical and human aspects of the North Pacific world.

GEOS 695:

- The above, at a more advanced level.
- 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:

- Thermal and chemical equilibrium, disequilibrium, and diffusion
- 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 20th 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.



Figure 2: *Huts used for the Katmai, Alaska (left, with Griggs Volcano in background) and Mutnovsky/Gorely, Kamchatka (right). 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 Mutnovsky/Gorely.*

Schedule

Session A – Katmai

- 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 3 Fly to Katmai National Park. Public lecture by John Eichelberger at Brooks camp. Spend night in cabins at lodge.
- 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).

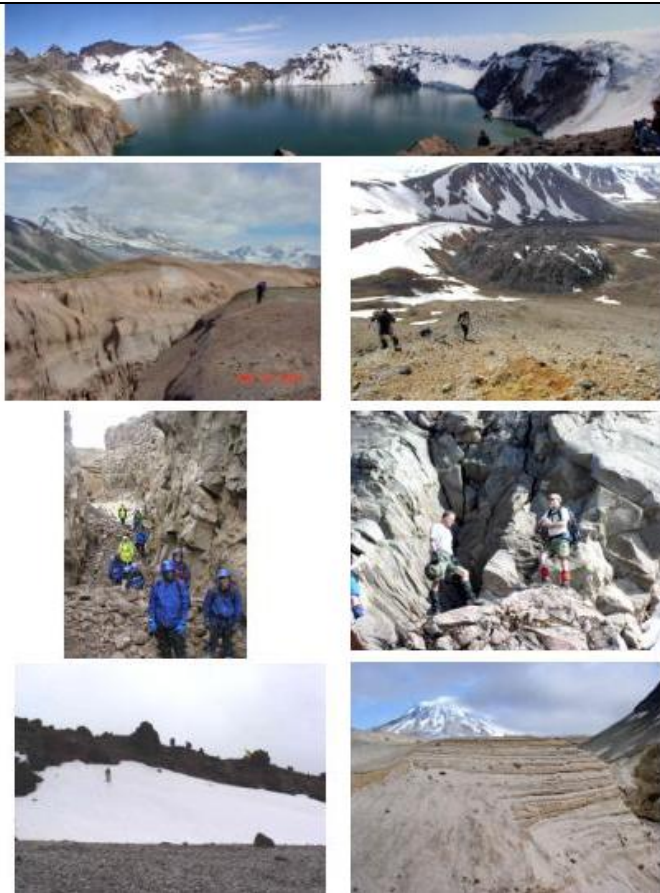


Figure 3: Features visited during Katmai session (left to right and down): Panorama of Katmai Caldera (G. Davidson photo), which formed by collapse of Mount Katmai during the great eruption of 1912. 1912 ignimbrite sheet, lower Valley of Ten Thousand Smokes. Novarupta Dome, marking the vent for the 1912 eruption. Inside a welded portion of the 1912 ignimbrite sheet. Inside a fissure in Novarupta rhyolite lava dome. Ascending the lateral levee of the 1959 andesite/dacite flow on Trident Volcano. Phreatic deposits from glacier/ ignimbrite interaction, Griggs Volcano in background.

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 (schedule dependent on weather and snow conditions)

Day 1 American participants arrive in Petropavlovsk-Kamchatsky (coming from the West coast it is a 4 hour flight from Anchorage, lose day crossing dateline); registration, preparation.

Day 2 Drive to Mutnovsky cabin

Day 3 - 11 Day hikes:

- Mutnovsky Crater
- Mutnovsky pyroclastic flows
- Gorely craters
- Gorely caldera and pyroclastic flows
- Gorely lava flows
- Visit to geothermal power plant and geothermal well field

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 (left to right and down): Fumaroles and glaciers in Mutnovsky Crater. Huge dikes exposed in Mutnovsky cone. Mutnovsky hydrothermal system. Pyroclastic flow deposit on Mutnovsky. Beginning ascent of Gorely Volcano. Newly formed crater with hot lake on Gorely, with students Galina Ivanysko (Russia) and Andrea Steffke (USA).*

Course procedures

The course is graded, based 50% on participation in field trips, 25% on presentation (if given), and 25% on a short final exam (50% if no presentation). Students enrolled in 695 are expected to give a presentation on their research or research interests during the camp and to help to guide 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.

Cost

The cost is registration for 3 hours of undergraduate or graduate tuition at the in-state rate plus the course fee, which is \$1,738 for Katmai and \$990 for Kamchatka. 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 session A and B, respectively. Since travel arrangements require significant financial commitments from organizers, we request a non-refundable deposit of \$500 by April 15 for Katmai session and \$500 by June 21 for Kamchatka session. The remaining portion of the payment should be received by Summer Sessions no later than 2 weeks before the trip. **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

Interest is expected to exceed places available in the school. In addition, 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 (www.uaf.edu/geology). 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. The due date for applications is April 1. Once students have been notified of their acceptance, they should register and pay fees for the class through the UAF Summer Sessions at www.uaf.edu/summer.



Primary reading

Coombs, M., J. Eichelberger, and M. Rutherford, 2000, Magma storage and mixing conditions for the 1953-1968 eruption of Southwest Trident Volcano, Katmai National Park, Alaska, *Contr. to Mineral. and Petrol.* 140: 99-118.

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- Eichelberger, J.C., P. Izbekov, and B. Browne, Bulk chemical trends at arc volcanoes are not liquid lines of descent, *Lithos*, 87, 135-154, 2006.
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- Hildreth, W. and J. Fierstein, 2000, The Katmai volcanic cluster and the great eruption of 1912, *Geol Soc Amer Bull* 11: 1594-1620.
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- Selyangin, O.B., 2006, Guide to Mutnovsky and Gorely Volcanoes (copy provided to registered students).