COURSE DESCRIPTION

GEOS 424/624: INTERNATIONAL VOLCANOLOGICAL FIELD SCHOOL

KATMAI TRIP

(3 CREDITS)

INSTRUCTORS

Pavel Izbekov — Research Associate Professor, Geophysical Institute, University of Alaska Fairbanks, Fairbanks AK; email: peizbekov@alaska.edu; office phone: +1-907-474-5269; cell phone: +1-907-978-4061; Skype: pavelizbekov.

Dates: June 5-19, 2024
Estimated costs: $2,830 plus UAF tuition & fees plus roundtrip airfare to Anchorage*
Application deadline: February 28, 2024

The strenuous, two-week field trip to the Katmai National Park, Alaska (figure 1) 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 (figure 2). The session will be taught by Pavel Izbekov.

PREREQUISITES

- GEOS 424: Acceptance into the course is contingent upon: (1) A completed application, (2) a reference letter, and (3) permission of the Instructor.
- GEOS 624: All of the above plus a graduate standing.

RESTRICTIONS

Students must be in good health, capable of hiking for at least 20 km per day carrying heavy backpacks, and be willing to camp under primitive, remote, and possibly uncomfortable conditions. Basic conversational ability in English is required.

OBJECTIVES

- GEOS 424 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 624 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.

KEY CONCEPTS ADDRESSED

- Magma processes
- Subduction-related volcanism
- Products of volcanic activity
- Volcanic features and landforms
- Petrology of the Katmai group of volcanoes
- Volcano monitoring and public safety

*Please refer to the section COST for details

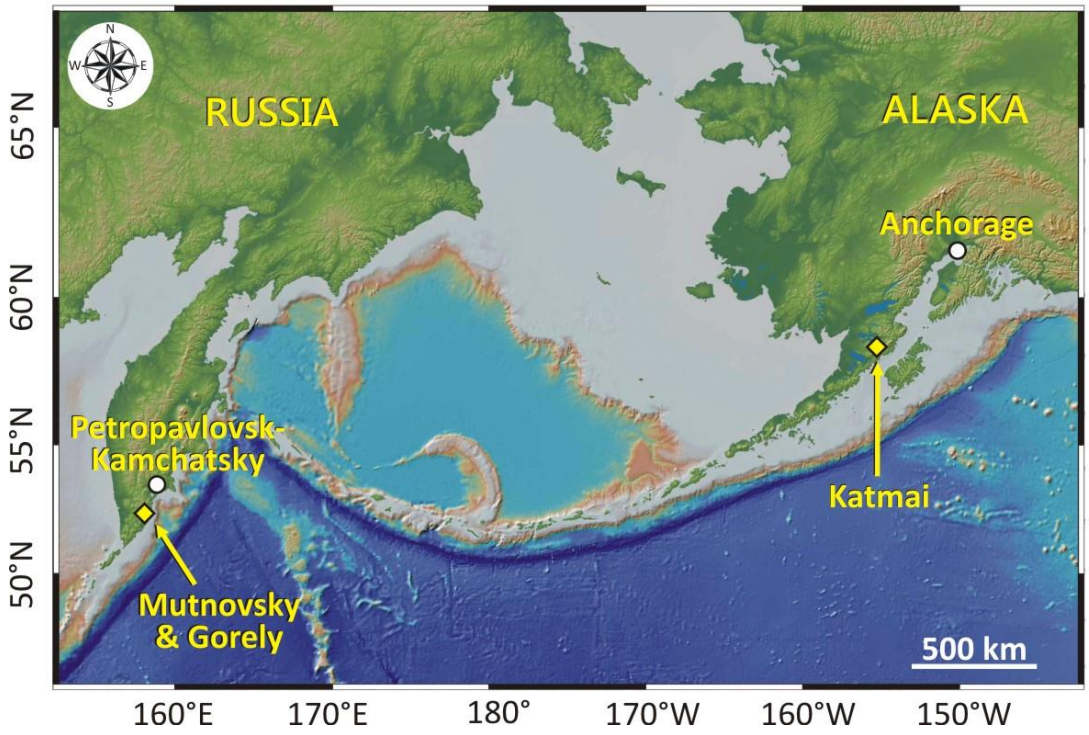

Figure 1: Map showing the Kamchatka Peninsula (left) and a portion of Alaska (right). Yellow diamonds denote locations of the Mutnovsky/Gorely (left) and Katmai (right) school sites.

STUDENT LEARNING OUTCOMES

GEOS 424:

- Students will learn to identify pyroclastic flow deposits, lava flows, and tephra fall deposits, as well as to describe characteristics and to discuss origin of aforementioned volcanic deposits
- Students will be able to make informed decisions conducting scientific field works in a remote environment while following safety requirements and communication protocols
- Students will develop / improve skills of effective communication with peers from different cultures

GEOS 624:

- All of the above.
- Students will develop / improve skills of presentation of scientific concepts to peers
- Students will be able to make informed decisions on research opportunities in the North Pacific subduction region and discuss current topics and controversies in volcanology
- Students will establish collegial relationships with students from other countries for future collaborative research

COURSE STRUCTURE

The course consists of daylong hikes interspersed with lectures. During hikes, students will examine 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.

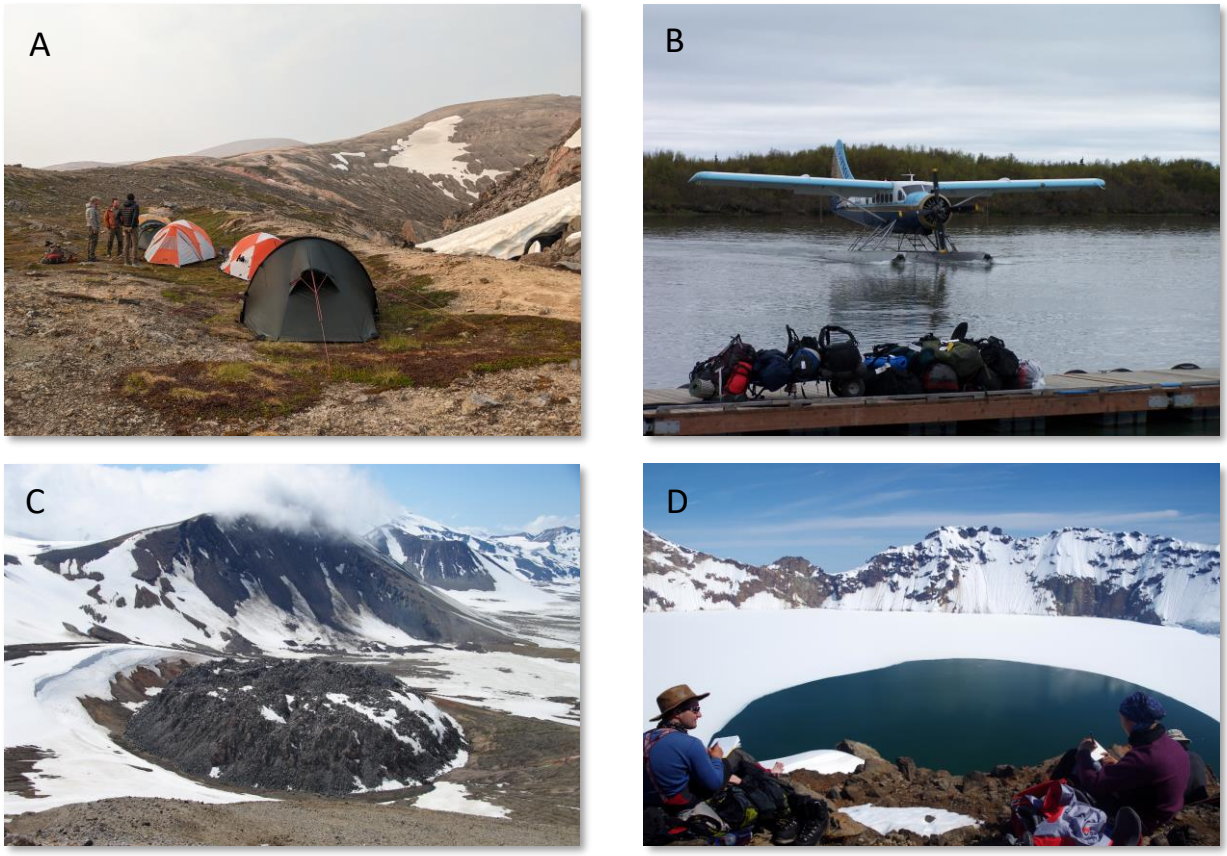

Figure 2: One of our camping sites next to the Novarupta Dome during the 2022 field trip (A). The Baked Mountain huts, our prior base camp has been destroyed by series of storms during 2017-2020. All participants will sleep in mountaineering tents. We will camp at wind-protected sites moving our basecamp 1-3 times, depending on weather conditions. Access to the region is by floatplane (B). Novarupta dome (C) and Katmai caldera (D) are amongst primary landmarks visited by course participants.

SCHEDULE AND ROUTE

The course will begin and end in Anchorage, Alaska. Students are expected to arrange their own transportation to/from Anchorage with arrival by late evening of Day 1 and departure in late evening of Day 14. Please refer to the official course web page for actual dates of the field trip: https://www.uaf.edu/geosciences/academics/international-volcanology/index.php

Day 1: Arrival to Anchorage

Upon arrival to Anchorage please take a taxi to our rental house, where we will have *pre-paid* reservations for Day 1 and Day 2. Exact address and check-in instructions will be sent to participants a few days prior to day 1. If you choose to arrive to Anchorage before Day 1 or leave it after Day 14, please make your hotel arrangements in advance as it might be problematic to find an affordable housing in Alaska in the summer. We will share a dinner together on Day 1 and discuss our plans.

Day 2: Preparation for the field trip in Anchorage

The morning is spent for orientation and acquiring food supplies at local department stores. In the afternoon, we will visit the Alaska Volcano Observatory, where you will be briefed on the current state of volcanic activity at Katmai, current snow conditions, and weather forecast. We will distribute cooking sets, tents, field

guides, and have a dinner together. We will discuss safety requirements and communication protocols. We will practice using MSR cooking stoves and setting up our tents.

Day 3: Flying to Brooks Lodge via King Salmon

We will leave Anchorage for King Salmon on the Alaska Peninsula. We will fly above Cook Inlet volcanoes and, if weather permits, we will see Redoubt, Iliamna, and St. Augustine volcanoes. In King Salmon, we will be distributed among two-three small floatplanes and fly to Brooks Lodge located at Naknek Lake. We will be briefed about bear safety by the National Park Service and get assigned to cabins. Each cabin sleeps four and has a shower. We will have a dinner at the lodge (all meals at the Brooks Lodge are included into the class fees) and prepare our backpacks for a long hike next day.

Day 4: Getting to the Valley of Ten Thousand Smokes

After breakfast we will board a 4WD bus for a slow ride to the trailhead at the Valley of Ten Thousand Smokes. We will start hiking about noon. This first hiking day is the hardest because we will be carrying full packs (about 50-80 pounds; 23-36 kg). If we choose to camp at the Baked Mountain site, then it is 10 miles (15 km) and about 2000 ft. (600 m) elevation gain with most of the gain at the end. There are two river crossings, the routine for which is to take off long pants, put on water shoes or other lightweight shoes (or no shoes if you have extremely tough feet), and walk through them. The river crossings and the steep climb on loose ash at the end of the hike are the main challenges of the day. One section of trail is a steep side-hill, which may bother people who do not like heights, but it is not dangerous (a fall would not be injurious). The first half of the trail is also used by bears – which again can be disconcerting to those not accustomed to this hazard. However, no bear is going to risk an encounter with a large group of loud humans. We will reach the Baked Mountain Huts site located in the middle of the Valley of Ten Thousand Smokes at about 8-11 pm. We will collect water from nearby snowfields. There is an unobstructed view of the Griggs Volcano and no vegetation, just pumice and ash. The elevation at the site is about 2600 ft. (~800 m). Since Baked Mountain Huts no longer provide us with their relative comfort and protection from elements, we may choose to establish our camp in a few other wind-protected sites, depending on weather conditions, abundance of the snow in the upper part of the Valley, and other factors.

Days 5-12: Exploring the Valley of Ten Thousand Smokes and its surroundings

We will conduct day hikes as weather permits and will study staying in our tents during inclement weather conditions. Our typical day-hike destinations include

- 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)
- Baked Mountain (pyroclastic surges; sedimentary basement; valley overview)

The longest hike is 18 miles and 4000 ft. gain (29 km; 1200 m) to the rim of Katmai Caldera and back. This takes about 12 hours including a rest at the top - and we usually rest the next day too! It is, however, arguably one of the most incredible sights on Earth. GPS tracks of our typical day hikes can be sent to interested students by e-mail upon request prior to the field trip. Depending on the weather conditions we may choose to move our camp from the Baked Mountain site to Novarupta, Mageik Lakes, and Knife Creek sites for a better wind protection and access to streams with clean drinking water.

Day 13: Return to the Brooks Lodge

After many wonderful experiences, we march out from the Valley to the waiting bus on Day 13. This is easy because it is downhill and our packs will be lighter. We will get back to the lodge about 5 pm, where we will

have dinner and again spend the night in the cabins. That evening we will play "tourist" and watch the bears catch salmon at Brooks Falls – where most of the brown bear pictures you have seen were probably taken.

Day 14: Flying back to Anchorage via King Salmon

We will have breakfast at the Lodge, following which you will take a test with 15-20 multiple-option questions. We will collect your field notebooks for grading. The notebooks will be returned back to you prior to our departure from Brooks Lodge. You will be able to visit Brooks Falls again and/or explore other "tourist" activities at the Brooks Lodge, such as an excursion to the archeological site, kayaking, and fishing amongst others.

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 following guidelines and examples given prior to the field trip. Students taking this course at the 400 level are encouraged, but not required to give a presentation on their research or a relevant topic, which can be chosen with instructor's assistance prior to the trip. Students taking this course at the 600 level are required to give a presentation on their thesis research. As an alternative, they may choose to give a presentation on one of the aspects of Katmai volcanism, in which case the topic of presentation must be discussed with an instructor prior to the field trip. Hearing presentations by other students from other countries is an experience that many students value most. All presentations will be via whiteboard and whatever handouts the presenter wishes to distribute.

The course is graded based on the following accomplishments:

- 60% on quality and completeness of field notes. Field notes may be interspersed with lecture notes in chronological order. Lecture notes will not be evaluated. Field notes will be evaluated based on the completeness of observations and quality of descriptions at each visited landmark and/or observation site using scores outlined below.

3 (Proficient)	2 (Competent)	1 (Novice)
Complete detailed description with annotated drawings; thoughtful discussion raising questions.	Good, intelligible description with some drawings; basic interpretation lacking in-depth discussion.	Unintelligible notes; primary observed features are not described; interpretation is either missing or incorrect.

- 40% and 20% on final test for 400 and 600 levels, correspondingly.
- 20% on presentation for 600 level. Presentation will be evaluated based on (1) organization and content, (2) subject knowledge, (3) effective use of whiteboard and handouts, and (4) presentation skills. Students taking this course at the 400 level can use this opportunity to earn 20% as an extra credit.

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

F	D	D+	C	C+	B	B+	A-	A
<60%	≥60%	≥67%	≥70%	≥77%	≥80%	≥87%	≥90%	≥93%

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

Students are subject to the UAF Student Code of Conduct. University of Alaska is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: www.alaska.edu/nondiscrimination.

STUDENT PROTECTIONS AND SERVICES STATEMENT

Every qualified student is welcome in our classroom. As needed, we are happy to work with you, disability services, veterans' services, rural student services, etc. to find reasonable accommodations. Students at this university are protected against sexual harassment and discrimination (Title IX), and minors have additional protections. As required, if we notice or are informed of certain types of misconduct, then we are required to report it to the appropriate authorities. For more information on your rights as a student and the resources available to you to resolve problems, please go the following site: www.uaf.edu/handbook/

COST ($3,437-$6,438 plus round trip airfare to Anchorage, Alaska)

The cost of the Katmai trip in 2024 includes $2,830 course fee, which covers all transportation, lodging, and food for the duration of the class, which begins and ends in Anchorage. In addition, registered students will be responsible for three credits of UAF tuition, a few smaller UAF fees, and costs of transportation to/from Anchorage. Estimated total costs can be found in the table below.

	AK resident rate*		**WUE****		**Non-resident rate**		**Lecturer Sp. guest**
	GEOS424	GEOS624	GEOS424	GEOS624	GEOS424	GEOS624	
Course fee	$2,830	$2,830	$2,830	$2,830	$2,830	$2,830	$2,830
Tuition, 3 credits	$867	$1,617	$1,302	$3,315	$2,565	$3,315	N/A
UA network fee	$36	$66	$36	$66	$36	$66	N/A
Consolidated fee	$159	$159	$159	$159	$159	$159	N/A
Department of Geosciences fee	$50	$50	$50	$50	$50	$50	N/A
Facilities fee	$18	$18	$18	$18	$18	$18	N/A
Administrative fee	N/A	N/A	N/A	N/A	N/A	N/A	$607
Total:	**$3,960**	**$4,740**	**$4,395**	**$6,438**	**$5,658**	**$6,438**	**$3,437**

* Students attending University of Alaska, military personnel on active duty, their spouses and dependent children etc. Please refer to the full list of eligible students at https://www.alaska.edu/studentservices/student-resources/residency/

** Western Undergraduate Exchange: Arizona, California, Colorado, Hawai'i, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming

The tuition rate and other UAF fee estimates are preliminary. Please find official published fees at https://www.uaf.edu/finaid/costs/index.php. A special rate of $3,437 is reserved for invited lecturers and special guests, who do not register through UAF for course credits. All vacancies not filled by February 28, 2024 will be offered at this rate to all eligible waitlisted students.

EQUIPMENT

Students will need to bring their own backpacking equipment appropriate for high mountains. The following list is based on our prior experience and may guide you through your preparation for the field trip. Essential items are underlined.

- ☐ Backpack (internal frame type recommended)
- ☐ Good rain suit (jacket and pants; not poncho; this is most important; light-weight gear will tear in the wind; heavy-duty Gore-Tex-Pro gear seems to be the most adequate)
- ☐ Long underwear
- ☐ Long sleeve fleece sweater or pullover

- Packable down/synthetic sweater or jacket
- Cold-weather hat (fleece or wool)
- Cap or hat for rain
- Clothing: socks, underwear, shirts, pants (quick drying material recommended)
- Trekking poles - highly recommended, yet not required
- Goggles (for ash; glacier goggles or cheap plastic safety goggles will do)
- Sunglasses
- Sun block
- Gloves or mittens
- Gaiters (mostly to keep snow and loose pumice out of your boots)
- Sleeping bag good to at least 0°C, maybe a bit colder to be safe
- Sleeping pad
- 1L water bottle. For a hike to Katmai caldera we recommend to carry 2L of water. Please consider bringing a spare plastic 1L water bottle. You can substitute water bottles with a 2-3L water bladder, of-course.
- Personal eating gear (bowl, cup, spoon)
- Waterproof hiking boots (we will hike on wet snow over long distances, so it is important to make sure that your boots are waterproof, broken in, suitable for all-day hikes)
- Light athletic shoes or water shoes (for stream crossings - ice-cold rivers with rocky bottom and for wearing at our basecamp)
- Camera (brings plastic bag or good case to protect from rain and ash)
- Day pack sufficient to carry lunch, water bottle, rain gear, extra sweater *or use your main backpack as a day pack*
- Field notebook and pencils
- Hand lens
- Flashlight might be useful inside huts
- Handheld GPS
- Personal first aid kit that fits your needs and a personal survival tool

Note that the idea with clothing is to have a spare of everything (except boots and rain suit) so that you can get soaking wet and be able to change into something dry when we get back to the huts. Synthetic gear dries faster than cotton and wool, please chose it if you have an option.

We suggest putting your backpack in a military-style duffel bag for checking it on the plane. Otherwise, you will risk losing items attached to your backpack and/or getting your backpack damaged in transit. This happens every year. We will provide MSR cooking sets, MSR multi-gas stoves, fuel bottles, and a few two-way radios with spare batteries. We will provide four-season mountaineering tents, which will be shared by 2-3 participants. Although there will be limited opportunities for hard-core mountaineering, we will provide ice axes. We will have 2-way radios, inReach, one satellite phone, and a basic first aid kit with us.

MEALS

In the morning of Day 2 we will assign people to food teams, each of which will consist of 3-4 team members. Each team will share the same cooking preferences (e.g. vegetarians, meat lovers etc., etc., etc.), as well as a cooking stove, two cooking pots, and three fuel bottles. Each group will have a leader who will make sure that equipment is complete and meals are planned. Our typical menu will include the following.

- Breakfast: We will boil water for hot cereal and coffee/tea
- Lunch: Power bars, cheese, crackers, nuts, jerky, dried fruits with cold drinks (stream water with optional additives such as Gatorade powder)

- Dinner: We will prepare Mountain House dry-freeze dinners with boiled water 5 times. Each of you will carry five pouches of the Mountain House food. We will use them after strenuous day hikes. In addition, we will cook four dinners on the days of light physical activity. Each member of a food group will have to provide one (1) dinner for his/her group, which will include him/herself and 2-3 peers. There is always some sort of competition in culinary art between groups, so please think ahead, if you wish to impress your team members. Food groups will be shopping together to make sure that there are no big surprises in terms of the dinner selections.

People will be individually responsible for selecting and carrying their food for breakfasts and lunches. All camp food will be purchased at Fred Meyer during the first half of Day 2. This is covered by course fees. All meals in Brooks Lodge are covered by course fees as well. Students are responsible for their meals in Anchorage during Day 1-3.

During our field trip, we will use water collected from the snowfields, which is safe to drink untreated. You are welcome to bring your own water purification/treatment means if you choose to do so.

COMMUNICATION

There will be no cell phone reception in the Valley of Ten Thousand Smokes. I will carry Iridium satellite phone, which will be used for daily weather updates, checking in with my colleagues at AVO, and checking my office voicemail (+1-907-474-5269). The phone accepts text messages, which can be sent via https://messaging.iridium.com/ at no charge, but with some delays. You parents will be able to contact you in case of emergency during Days 3-13 by (1) sending a text message to the satellite phone AND (2) leaving a message on my voicemail. Unfortunately, there will be hours of delay before you will call them back as we will be turning on the satellite phone once a day to conserve battery power. The number of the satellite phone will be sent to accepted students prior to the trip. We will have 5-6 two-way radios with spare AAA batteries for communication during hikes. Please call/text me at my cell phone +1-907-978-4061, if you experience any delays with your flights on Day 1 or any other complications during transit.

INSURANCE

UAF will provide all students registered for three UAF credits with a complimentary student accident insurance. The Special guest rate does not include insurance.

LIABILITY FORM

UAF requires all participants of its field-based courses to sign the release of all claims form. I will bring the completed forms with me to Anchorage and collect your signatures before our departure to Katmai. The form will be sent to all accepted students by e-mail prior to the trip.

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 (https://www.uaf.edu/geosciences/academics/international-volcanology/index.php). Prospective students are asked to fill out the 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.

Application deadline is February 15, 2024. Once students have been notified of their acceptance, they will be able to register and pay fees. Since travel arrangements require significant financial commitments from organizers, *we request a non-refundable deposit of $250 to reserve a spot in the group*. The remaining portion of the payment should be received by UAF no later than two weeks before the trip. The available spots will

be first offered to students registered through UAF and willing to pay the cost of UAF tuition and fees. On February 28, 2024 all remaining vacancies will be made available at the special guest price to qualified participants. Please contact Pavel Izbekov to check if you qualify for that option.

READING MATERIALS

* Required for all students

** Required for students taking this course at the 600 level

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.

Coombs, M.L., and J.E. Gardner, 2001, Shallow storage conditions for the rhyolite of the 1912 eruption at Novarupta, Alaska, *Geology*, 29: 775-778.

Coombs, M.L., J.C. Eichelberger, and M.J. Rutherford, 2002, Experimental and textural constraints on mafic enclave formation in volcanic rocks*, J. Volcanol. Geotherm. Res*., 119: 125-144.

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

Eichelberger, J.C., and P.E. Izbekov, 2000, Eruption of andesite triggered by dyke injection: Contrasting cases at Karymsky Volcano, Kamchatka and Mt. Katmai, Alaska*, Phil. Trans. Royal Soc. of London*, 358: 1-21.

Eichelberger, JC, P Izbekov, and B Browne, 2006, Bulk chemical trends at arc volcanoes are not liquid lines of descent, *Lithos*, 87: 135-154.

Hammer, J.E., M.J. Rutherford, and Wes Hildreth, 2002, Magma storage prior to the 1912 eruption at Novarupta, Alaska, *Contr. to Mineral. and Petrol*., 144: 144-162.

Hildreth, W. and J. Fierstein, 2000, The Katmai volcanic cluster and the great eruption of 1912, *Geol Soc Amer Bull,* 11: 1594-1620.

** Hildreth, W. and J. Fierstein, 2012, The Novarupta-Katmai eruption of 1912—largest eruption of the twentieth century; centennial perspectives: *U.S. Geological Survey Professional Paper* 1791, 259 p. (Available at http://pubs.usgs.gov/pp/1791/.)

FREQUENTLY ASKED QUESTIONS

Q: Is Internet, cell phone connection, and electricity available in the Valley of Ten Thousand Smokes?

A: None of the above is available. You will be able to charge your gadgets at Brooks Lodge. Please make sure that you bring enough batteries or power banks for your electronics. Portable solar panels are very effective at Katmai, as we will have more than 19 hours of daylight.

Q: Is it possible to take a shower?

A: There is no civilized shower facilities in the Valley of Ten Thousand Smokes. People bring wet wipes (baby wipes) or use a collapsible jar filled with snow-melted water as a rudimentary shower. Wet towels work fine as well.

Q: May I bring my own tent?

A: We will provide Mountain Hardwear Trango 3.1 and Hilleberg Tarra 2 tents. It is more practical to carry one large tent and share it with one or two more students. If you really prefer to have a private tent accommodation, please consult with one of the instructors and get their approval. Small, lightweight tents have very little chances of survival – you will need to use a four-season mountaineering tent, which specifications meet or exceed specifications of the abovementioned tents.

Q: Would you expect me to carry anything in addition to my personal gear and food?

A: In addition to your personal gear and food you will need to carry (1) your share of the cooking group gear, i.e. either a cooking set or a fuel bottle (about 2 lb), (2) supplies for one dinner, which you will prepare for your cooking group in one of the evenings (weight depends on your cooking preferences, but typically about 3-4 lb), (3) 1/3 or 1/2 of a tent, 4 lb or 9 lb correspondingly, depending on whether your tent is 3-person or 2-person, and (4) two-way radio with 4 spare AAA batteries, if provided (0.5 lb). You will be provided an ice axe, unless you choose to bring your own.

Q: May I leave some of my travel gear in Anchorage and/or in Brooks Lodge?

A: We will have a large SUV parked at the long-term parking lot of the Anchorage airport for the duration of the field trip. You are welcome to leave your travel gear in it (civilized clothes, luggage, etc.). You will be able to pick your gear up immediately upon our return to Anchorage. In addition, it is wise to leave a small plastic bag with a clean set of clothes at Brooks Lodge. Brooks Lodge does not have any storage facilities available for visitors, however they will store a couple of our duffle bags as a courtesy. Please do not plan to leave excessive amounts of gear at Brooks. Please do not plan to leave any valuables either in the truck or at Brooks.

Q: I have no backpacking experience. Do you think I will survive the trip?

A: Students with no backpacking experience have survived this trip in the past thanks to their excellent physical shape, good choice of field gear, careful preparation to the trip, and high level of enthusiasm. Please discuss any possible limitations and concerns with us before signing up for the course. We will help you to make an informed decision.

Q: May I get some advice on field gear?

A: There are many on-line resources discussing backpacking gear. For example, some useful information could be found at http://www.adventurealan.com/recommended-backpacking-gear/. We can certainly provide our advice on your field gear as well.