



YELLOWSTONE FOREVER

GEOLOGY FIELD TRIP: YELLOWSTONE'S NORTHERN LOOP #180610

Start: 6/13/2018 at 7:30 a.m.

End: 6/13/2018 at 5:00 p.m.

Location: Yellowstone Forever's Gardiner Offices
308 Park Street, Gardiner, MT 59030

Welcome to Yellowstone National Park. If you are a newcomer to the Yellowstone Forever Institute, you will be amazed at what awaits you during each day of exploration. We are glad that you are able to join us, Gardiner is a wonderful Yellowstone gateway community that many of us at Yellowstone Forever call home. Our goal is to provide you with an enjoyable, high-quality educational experience and a safe and memorable visit to Yellowstone.

The following information is provided to help you prepare for your program. Please read it thoroughly and call us at 406.848.2400 or email contact@yellowstone.org if you have any questions. We recommend all first time visitors seek general park information through the National Park Service at 307.344.2107 or www.nps.gov/yell.

Important Information Included in this Document:

- Letter from Your Instructor
- What's Included
- How to Prepare for this Program
- Suggested Reading
- Yellowstone Forever Park Store Information
- Yellowstone Forever Supporter Information
- Code of Ethics
- Cancellation Policy
- Travel Information
- Supplemental Lodging Information

From the Instructor

This Northern Loop Field Trip will visit outcrops entirely within the Yellowstone Park. The route allow us opportunity to visit many varied sites with special focus on two of the pivotal geologic sites that were iconic in the creation of the world's first national park. There is extra focus on the formation and evolution of the Grand Canyon of the Yellowstone, where you will be asked to find clues, try out theories of your own, and compare them with your instructor's view. This course begins promptly at the Yellowstone Forever Institute office in Gardiner, Montana, sharply at 7:30 am on June 13. Please be on time so that we can get through the gate ahead of traffic. After introductions, an overview of geology, a look at maps, and a check to make sure that everyone is properly equipped, we'll load the bus and head out. Bring your own lunch. We expect to return at around 5:00 p.m.



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This class will spend an active day of roadside stops and very short hikes, trying to decipher some extraordinary geologic stories written in the rocks. The route passes proximate to Mt. Everts, Sepulcher Mountain, Mammoth Hot Springs, Terrace Mountain, Rustic Falls, Swan Lake Flat, Obsidian Cliff, Roaring Mountain, Norris Geyser Basin and the Grand Canyon of the Yellowstone, where powers of observation will be called upon during a scenic group hike along the rim. The return trip will pass over Dunraven Pass, allowing a view of the Yellowstone caldera proximate to the Mt. Washburn trailhead. There are many stories to tell.

Geologic highlights include thermophiles and calcium carbonate sources in the creation of travertine; the “ghost” hot spring and rotational landslide at Terrace Mountain; the un-erupted dacite core of the Eocene Bunsen Peak volcano; the Quaternary Huckleberry Ridge welded tuff; the Gallatin Range; Sheepeater Basalt; Obsidian Cliff National Historic Landmark and the value of obsidian over long distances along Native American trade routes; the Roaring Mountain hydrothermal crater and its acid-rich fumerals; the Norris-Mammoth thermal corridor; Norris Geyser Basin—the hottest place in the park, with the largest geyser in the world at the junction of multiple faults; the formation and evolution of the Grand Canyon of the Yellowstone; the andesite-rich debris flows (lahars) on the flank of the Eocene Washburn volcano; the inverted stratigraphy observed in the basalt flows and pebble conglomerates of the Narrows.

Geology is the foundation of the Greater Yellowstone Ecosystem. It the principal rationale to establish Yellowstone as the first national park on the planet. Ideal habitat and microclimate for a heterogeneous assemblage of beautiful flora and charismatic macrofauna are rooted in the diverse geology of the Northern Range.

The geology of Yellowstone Country is many faceted. Central to the story is the active volcano that is an extraordinary energy source at the heart of Yellowstone’s Interior, where an exceedingly rare continental mantle hot spot—a unique volcanic blowtorch beneath burning red hot beneath Yellowstone—releases convective energy beneath the Yellowstone Caldera that alters and shapes the topography above. However, there is more, much more, to the story. In fact, the rocks tell an amazing story of orogeny and subsidence; compression and rifting; uplift and downdrop; ocean sediments at the tops of mountains; battling tectonic plates; and a shallow sea inhabited by marine reptiles that extended from the Gulf of Mexico to the Arctic Ocean. They tell of a time of estuaries, shore lines and river channels; a time of strata volcanos created by regional subduction near a ring of fire; abundant lahar debris slides; highly diverse, now-petrified forests; the arrival of the Yellowstone area of the North American Plate over the mantle hot spot; the three major eruptions of the supervolcano and their vacant calderas filled by rhyolite lava; the arrival of the Ice Age; the subsequent arrival of the first Paleoindian Homo sapien foragers and hunters; and the recent arrival of European Americans with an appetite for gold, silver, coal, travertine and basalt. Our ability to read and understand the rock record is limited, but evolving rapidly.

“To a naturalist who is reading in the face of the rocks the annals of a former world, the mossy covering which obstructs his view, and renders indistinguishable the different species of stone, is no less than a serious subject of regret”. - **James Hutton**



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John Gillespie

What's Included:

Your tuition includes daily outings and transportation during your program. It does not include transportation to the park, park entrance fees, meals, or lodging. Gratuities are not included in the price of programming. If you would like to recognize exceptional service by an Institute staff member, tips are appreciated. Donations to support Yellowstone Forever educational programs are also appropriate and will be used to improve and expand opportunities for people to make deep connections to Yellowstone.

Continuing Education Credit

Many of our Field Seminars are recognized by universities across the country. We are happy to provide a letter of completion and supporting documentation that you can submit to the institution of your choice to request approval for university credit or CEUs.

Lodging Option

Institute students in field seminars based out of Gardiner, Montana, may have the opportunity to stay in our comfortable lodging at the Yellowstone Overlook Field Campus for an additional charge. The Yellowstone Overlook features comfortable cabins on 80 acres, awe-inspiring views, and easy access to the northern section of the park. Cabins include self-serve kitchens for preparing meals and open-floor plans for group dining and evening activities. For more information please see the last page of this document. Feel free to call our contact center at 406.848.2400 to make your reservations today.

How to Prepare for this Program:

How fit do you need to be?

This program is an activity level 1 and students enrolled in this program are expected to be active participants. Be prepared to hike up to 1 mile per day, comfortably, through relatively flat terrain on maintained trails. We recommend you begin an exercise program right away if you have not already done so. Participants residing at lower elevations may want to arrive a day early to adjust to the altitude. To learn more about how specific medical conditions can be affected by Yellowstone's environment and our activities, please visit www.Yellowstone.org/experience/health-information/

General Clothing and Equipment List

Much of your time will be spent outdoors and all programs are held rain, snow, or shine. You should be prepared for a variety of mountain weather conditions and temperatures. Appropriate clothing, equipment, and footwear are very important. Spring, summer, and fall temperatures can range from below freezing in the mornings to 85 degrees Fahrenheit in the afternoons. The layered use of garments for protection against the wind, sun, and temperature extremes should guide your clothing choices. Loose-fitting layers allow you to maintain a comfortable and dry body as outside temperatures change, and as your own body temperature and



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moisture output changes with different levels of exertion. Some colder-weather items may not be needed in July or August, but please keep in mind that Yellowstone's weather is unpredictable.

Equipment:

Yellowstone Forever field staff assigned to your program will be carrying a first aid kit, bear spray, and emergency communication device.

- Daypack**, with enough capacity to carry extra clothes, water, lunch, camera, binoculars, field guides, etc.
- Water bottle**, one-quart is the minimum recommended. Camelback or similar hydration systems work well in summer but can freeze in winter.
- Sunglasses**
- Sunscreen/lip protector**, sun at high altitude can burn unprotected skin quickly.
- Camera, binoculars**
- Notebook/pencil**
- Pocket hand and foot warmers**, recommended November through May.
- Flashlight/Headlamp**, a small light for walking to and from your cabin in the evenings and mornings.
- Alarm**, so you're on time for the day's activities.

Summer Clothing:

- Insulating underwear**, capilene, polypropylene, or similar wicking fabric.
- Midweight insulating layer**, light, 200-weight synthetic fleece or wool shirt/pullover.
- Heavyweight insulating layer**, wool, down, or heavy-weight fleece jacket, for less-active times.
- Waterproof and windproof outer layer**, lightweight and breathable. Jackets and pants are recommended.
- Short sleeved shirt**, cotton okay in summer, but synthetic wicking shirts are ideal.
- Pants**, synthetic hiking pants, lightweight pile/fleece pants or tights or similar. Jeans are not recommended.
- Hats**, both a brimmed sun hat and an insulating hat for cool weather.
- Gloves**, lightweight glove liners and a pair of wool/fleece gloves or mittens.
- Socks**, light wool or synthetic liner sock with heavier wool or synthetic outer sock. The inner-outer sock combination helps prevent blistering, wicks moisture and reduces friction. Cotton socks do not wick moisture and are not recommended.
- Hiking boots**, that provide stability, traction, and comfort. Unless you've consistently hiked in athletic shoes, bring boots that provide ankle support.
- Off-duty shoes**, sandals, athletic shoes, or other leisure footwear.

Suggested reading

While these books and papers are not necessary for your program, they are some of the instructor's favorites and may add to your understanding and enjoyment.



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- Fraser, George D., Waldrop, Henry A., and Hyden, Harold J. *Geology of the Gardiner Area Park County, Montana*. Geological Survey Bulletin 1277. 1969. United States Government Printing Office.
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- Lopez, David A. and Reiten, Jon C. *Preliminary Geologic Map of Paradise Valley South-Central Montana*. Open File 480. 2003. Montana Bureau Of Mines and Geology.
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- Feldman, Robert. *The Rockhound's Guide to Montana*. 1985. Folsom Press.
- Marschall, Mark. *Yellowstone Trails: A Hiking Guide*. 2008. Yellowstone Association.
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- Merk, Frederick and Merk, Lois Bannister. *Manifest Destiny and Mission in American History: A Reinterpretation*. 1963. Knopf.
- Morgan, Lisa A.; Shanks, W.C. Pat; Lowenstern, Jacob B.; Farrell, Jamie M; Robinson, Joel E; *Geologic Field Guide to the Volcanic and Hydrothermal Landscape of the Yellowstone Plateau*. USGS Scientific Investigations Report 2017-5022-P. 2017. United States Geological Survey.
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Park Stores

Our Park Stores feature more than 900 books, maps, and videos to help you plan your visit, along with a wide selection of shirts, hats, and other logo items to remind you of your visit to Yellowstone. Yellowstone Forever supporters receive a 15 percent discount on merchandise online or at any of our 11 locations in and around Yellowstone. Proceeds directly support Yellowstone. Visit: Shop.Yellowstone.org

Supporter Program

Yellowstone Forever Supporters directly fund priority park programs and projects. Supporters also provide scholarships for teachers and help expand programming for underserved youth. Benefits include a subscription to our magazine *Yellowstone Quarterly*, early registration and discounts for Yellowstone Forever Institute programs, and discounts on retail purchases throughout Yellowstone (exclusions apply). If you are not yet a supporter of Yellowstone Forever, an introductory subscription (one year) to our magazine *Yellowstone Quarterly* is included with your tuition. For more information, visit: Yellowstone.org/donate

Code of Ethics

The Yellowstone Forever Institute is committed to demonstrating a high standard of appropriate and ethical behavior in Yellowstone. As a participant in a Yellowstone Forever Institute program, we ask you to adhere to the following Code of Ethics. In addition to the ethics highlighted below, the Institute abides by all National Park Service rules and regulations. We also practice Leave No Trace guidelines for traveling responsibly in the wilderness.

Observing wildlife: We will do our best to have as little impact on wildlife as possible. Animals will be observed from a distance, using high-powered spotting scopes to help keep our presence from affecting their behavior. Participants should not expect to get close-up photographs of wildlife. The Yellowstone Forever Institute will adhere to National Park Service regulations by keeping a minimum distance of 25 yards from bison, elk, bighorn sheep, deer, moose, coyotes and nesting birds and 100 yards from bears and wolves. We will not entice wildlife with food, animal calls or any actions that change their behavior.

Leave what you find: It is illegal to remove natural or cultural artifacts (plants, animals, bones, rocks, etc.) from Yellowstone. Yellowstone Forever Institute instructors have permission from the National Park Service to manipulate plants, rocks, bones, etc. for educational purposes and will return them to their natural positions and locations.

General etiquette: Yellowstone Forever Institute groups will be considerate of other visitors and respect the quality of their experience. Voices and vehicle sounds carry great distances and affect both wildlife and people—remaining silent or very quiet while watching wildlife lets the sounds of Yellowstone (including wolf howls) prevail.



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Roads and vehicles: Expect wildlife on the road, and drive at or below the posted park speed limits. When stopping to observe wildlife or other park features, the Yellowstone Forever Institute will move vehicles entirely off the road. If there is no safe pullout available, we will drive to the next safe place and walk back to observe the wildlife. We will not stop in the middle of the road, and should a traffic jam develop as a result of our activities, we will cease the activity.

Properly dispose of waste: We will pack out all trash, leftover food and litter. Your instructor will discuss techniques for properly disposing of human waste in the field.

Traveling lightly: When hiking or walking in Yellowstone, we will use existing trails and boardwalks. We will follow appropriate techniques when walking off-trail. Walking around muddy or wet places in the trail increases erosion and negatively affects the resource; proper equipment is essential to hiking ethically. Participants should come adequately prepared with the equipment listed for their course and should expect to walk through mud, snow or puddles in the trail.

Thank you for helping us set a good example in Yellowstone!

Field Seminar Cancellation and Refund Policy

If you cancel within seven calendar days of your registration date, your payment is refundable less a \$50 per person per course processing fee. Under most circumstances, if you cancel on the eighth calendar day or after, from the date of registration, 100% of registration payments will be forfeited. If lodging is cancelled after the eighth calendar day from the date of registration, 100% of lodging payments will be forfeited. Applicable taxes will be refunded in the event of program or lodging cancellations. We reserve the right to cancel a course up to 30 days before the first class day. If we cancel, you will receive a full refund of your payment. We urge you to take out accident, baggage, and trip cancellation insurance through a travel agent or website such as [TravelGuard.com](https://www.travelguard.com). Travel insurance can help protect you against financial loss if you must cancel or interrupt your trip.



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Yellowstone Map **YELLOWSTONE FOREVER**



POINT TO POINT DISTANCE		Miles/Kilometers
North Entrance to Mammoth Hot Springs	5 mi/8 km	
Mammoth Hot Springs to Norris	21 mi/34 km	
Norris to Canyon	12 mi/19 km	
Norris to Madison	14 mi/23 km	
Madison to West Entrance	14 mi/23 km	
Madison to Old Faithful	16 mi/26 km	
Old Faithful to West Thumb	17 mi/27 km	
West Thumb to South Entrance	22 mi/35 km	
West Thumb to Bridge Bay	21 mi/34 km	
Fishing Bridge to East Entrance	27 mi/43 km	
Fishing Bridge to Canyon	16 mi/26 km	
Canyon to Tower Falls	19 mi/31 km	
Roosevelt to Northeast Entrance	29 mi/47 km	
Roosevelt to Lamar Buffalo Ranch	11 mi/17 km	
Roosevelt to Mammoth Hot Springs	18 mi/29 km	

ELEVATIONS		feet / meters
North Entrance	5314 / 1620	
West Entrance	6667 / 2032	
South Entrance	6886 / 2099	
East Entrance	6951 / 2119	
Mammoth Hot Springs	6239 / 1902	
Old Faithful	7365 / 2254	
Grant Village	7733 / 2357	
Lake	7784 / 2373	
Canyon	7734 / 2357	
Roosevelt	6270 / 1911	



OPEN ROADS

YF FACILITIES

ENTRANCE GATES

COMMON POINTS OF INTEREST

1 mile (mi) = 1.609344 kilometers (km)



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YELLOWSTONE OVERLOOK FIELD CAMPUS INFORMATION

Directions:

From Livingston, travel south on Highway 89 into Gardiner, Montana. Just before you cross the Yellowstone River, you will see the Conoco gas station on your right and 4th Street on your left. Turn left on 4th Street (you'll see a green sign indicating 5 miles to Jardine) and go up the hill for 1.5 miles. Turn right on Above the Rest Lane at the sign for the Yellowstone Overlook Field Campus (by the mountain man carving) and follow the signs to the cabins.

From Yellowstone, leave the park through the North Entrance and go through the Roosevelt Arch. Turn left on Highway 89 towards Livingston. Cross the bridge over the Yellowstone River. You will see the Conoco gas station on your left and 4th Street on your right. Turn right on 4th Street (you'll see a green sign indicating 5 miles to Jardine) and go up the hill for 1.5 miles. Turn right on Above the Rest Lane at the sign for the Yellowstone Overlook Field Campus (by the mountain man carving) and follow the signs to the cabins.

What to bring:

Each cabin includes a fully equipped kitchen for you to prepare meals. You will need to bring your own food and toiletries. Groceries are available nearby in Gardiner. Linens and towels are provided. Smoking is not allowed in the cabins. Camping and pets (with the exception of service animals) are not permitted.

Arrival and departure:

Our volunteer campus host will be available to greet you between 4:00 and 8:00 p.m. on the day of your arrival. Check out is by 9:00 a.m. the day of your departure to allow our volunteers to begin preparing the cabins for the next group. Parking is available in front of your cabin. Please do not store food in your vehicle as it can attract animals.

If you are visiting during the winter we recommend an all-wheel- or 4-wheel-drive vehicle as roads can be snow-packed and icy. Feel free to call our office at 406.848.2400 Monday through Friday from 8 a.m. to 4:30 p.m. to check the local weather and road conditions.

During your stay:

Our volunteer caretakers live on-campus in the cabin with the "Welcome" sign. They will help orient you to the Overlook campus. An emergency phone is available all hours outside their cabin. We do not have a housekeeping staff at the Overlook. Quiet hours are observed between 10:00 p.m. and 6:00 a.m.

Verizon is the only cell phone provider currently providing reliable coverage at the campus. In the event of an emergency during your stay, the caretaker's cabin phone number is: 406.848.9128. Wireless Internet is available in the cabins and at several businesses in Gardiner.

The campus has a picnic table and pond. A marked, 1-mile-long trail leads down to the Yellowstone River. Wildlife is abundant. You may see bison, wolves, elk and deer. You may also see rattlesnakes. Please exercise caution, and notify someone of your plans if you will be away from the campus alone. Each cabin has a TV/DVD player and an educational library with books and videos. The Overlook is designed to be a comfortable and peaceful base from which to explore and learn in America's first national park. We look forward to your visit!