



YELLOWSTONE FOREVER

GARDINER TO GRAND CANYON OF THE YELLOWSTONE GEOLOGY FIELD TRIP

Itinerary & Details

FIELD SEMINAR - SUMMER 2021

INSTRUCTOR: John Gillespie

INSTRUCTOR BIOGRAPHY: John Gillespie has been fascinated by the geology of Yellowstone since his first visit in 1972. After completing studies at the University of Delaware, John worked as a field geologist, eventually founding, and running two geologic consulting firms. He now applies his 40-year career in natural resources to Yellowstone. He is a certified interpretive guide, believes in life-long learning and regularly explores Yellowstone Country geology from his home just north of the park in Paradise Valley.

ACTIVITY LEVEL: This course is an activity **level 2** and students enrolled in this course are expected to be active participants. Be prepared to hike up to 3 miles per day, comfortably, with elevation gains up to 600 feet. Some off trail hiking possible.*

**All field activities will be conducted as a group. If you cannot meet the activity level expectations during your program, you may be restricted from participation in daily outings. We will not alter program itineraries or activities to accommodate participants who cannot meet the expectations of the stated activity level.*

LOCATION: Course begins at the Yellowstone Forever classrooms located in Gardiner, MT.

PROGRAM DATES & TIMES: The course begins at 7:30 a.m. on Friday, July 9, 2021, and ends on Friday, July 9, 2021, at 5:00 p.m.

LODGING CHECK-IN & CHECK-OUT: No lodging is provided for this course. You can find more information on Gardiner based lodging here: [Gardiner, MT - Lodging](#)

MEALS: You will need to bring your own food; lunch should be able to travel in the field with you.

For general information about the facilities, preparing for classes, what to expect, cancellation policies, and more, please see the [Gardiner Field Seminars - Summer General Information](#) document.

FROM THE INSTRUCTOR

This Northern Loop Geology Field Trip visits iconic outcrops and landforms entirely within the Yellowstone Park. The route allows the opportunity to visit many remarkable and varied sites with special focus on two of the pivotal geologic sites that were critically important to the politics of creating the world's first national park. There is extra focus on the creation 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 Friday, July 9. Please be on time so that we can enter the park 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. Please bring a day pack with water, lunch, etc. We expect to return at ~5:00 p.m.

Geology is the foundation of the Greater Yellowstone Ecosystem and the principal rationale for establishing Yellowstone as the planet's first national park. Ideal habitat and microclimate for a heterogeneous assemblage of beautiful flora and charismatic macrofauna are rooted in the diverse geology seen in the outcrops, roadcuts and landforms along this route. This Yellowstone Institute seminar will spend an active day of roadside stops and short hikes trying to decipher some extraordinary geologic stories written, without bias, 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. There are many stories to tell.

Geologic highlights include evidence of the Cretaceous Western Interior Seaway; Quaternary thermophiles and calcium carbonate sources in the creation of travertine; the rotational landslide at Silver Gate, the "ghost" hot spring at Terrace Mountain; the un-erupted dacite neck of the Eocene Bunsen Peak volcano; the Quaternary Huckleberry Ridge welded tuff at Golden Gate; 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 explosion crater(s) 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 – Steamboat -near the junction of the Yellowstone caldera and multiple faults.

We will break for lunch at Canyon long enough to casually take in the Visitor Center's geology, then check out the evidence of Glacial Lake Hayden. After hiking the canyon rim, we will consider the creation and evolution of the spectacular Grand Canyon of the Yellowstone and the evidence of a now-dormant geyser basin there.

The geology of Yellowstone Country is many faceted, much varied. 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 burning red hot beneath Yellowstone—releases convective energy beneath the Yellowstone Caldera, altering and shaping 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 down drop; 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 along a ring of fire; abundant lahar debris slides upending and transporting highly heterogeneous botanical life that is now-petrified forests; the arrival of the North American Plate - over the mantle hot spot, creating the place we know as Yellowstone; the three major supervolcano eruptions and their vacant calderas filled primarily by rhyolite lava; the arrival of the Ice Age burying Yellowstone by nearly a mile of ice several times and carving topography in ways that only glaciers can; the subsequent arrival of the first Paleoindian Homo sapiens foragers and hunters for whom lithic fragments were more valuable than gold; and the recent arrival of European Americans with an appetite for gold, silver, coal, travertine and basalt. Rocks write an unbiased record. Our ability to read and understand the rock record is limited, but it is evolving rapidly.

"Fathoming deep time is arguably geology's single greatest contribution to humanity. Just as the microscope and telescope extended our vision into spatial realms once too minuscule or too immense for us to see, geology provides a lens through which we can witness time in a way that transcends the limits of our human experiences."— Marcia Bjornerud, Timefulness

- John Gillespie

PROGRAM ITINERARY

The itinerary is designed to take advantage of the best opportunities in the park, but may be adjusted to adapt to weather conditions, wildlife activity, holidays, and road construction.

The details and timing of the agenda are subject to change.

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| Day 1 | Come prepared for the entire day |
| 7:30 a.m. | Welcome and Introductions Load up on bus and head out for the day |
| 5:00 p.m. | Return to Yellowstone Forever classrooms Class end |

PROGRAM EQUIPMENT

For a full list of recommended equipment for all courses see the [Gardiner Field Seminars - Summer General Information](#) document.

Items specific to this course are:

- Crazy Creek-type chair**, optional
- Light day pack**
- Waterproof clothing**, top and bottom
- Light hiking boots**
- Layers**, suited for spending time outside at elevations as high as 11,000'
- Lunch**

RECOMMENDED READING

No prior reading is required, but participants might enjoy the following publications, that complement the program. Most publications are available at Yellowstone Forever's online store at

shop.yellowstone.org Yellowstone Forever supporters receive a 15% discount and proceeds directly support the park.

- Bjornerud, Marcia. Reading the Rocks; The Autobiography of the Earth. 2006. Westview Press
- Bjornerud, Marcia. Timefulness; How Thinking Like A Geologist Can Save The World. 2018. Princeton University Press
- Coffin, Harold G. The Yellowstone Petrified Forests. 1997. Origins 24: 5-44
- Craighead, Frank. A Naturalist's Guide to Grand Teton and Yellowstone National Parks. 2006. Falcon. Yellowstone Association.
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- Sutherland, Stuart. A New History of Life. 2013. The Teaching Company.
- Fritz, William J. and Thomas, Robert C. Roadside Geology of Yellowstone Country. Second Edition. 2011. Mountain Press Publishing Company
- Hyndman, Donald W. and Thomas, Robert. Roadside Geology of Montana. Second Edition. 2020. Mountain Press Publishing Company
- Hendrix, Marc S. Geology Underfoot in Yellowstone Country. 2011. Mountain Press Publishing.
- Hale, Elaine Skinner and Fritzke. Trilobite Point Paleontological Resource Survey Report – Mount Holmes, Yellowstone National Park, Wyoming. 2004. National Park Service.
- Iddings, Joseph Paxon. The Eruptive Rocks of Electric Peak and Sepulcher Mountains, Yellowstone National Park. 2009. USGS.
- Johnson, Kirk and Clyde, Will. Ancient Wyoming – A Dozen Lost Worlds Based on The Geology Of The Bighorn Basin. 2016. Denver Museum of Nature & Science

- Good, John M. and Pierce, Kenneth C. Interpreting the Landscape – Recent and Ongoing Geology Of Grand Teton and Yellowstone National Parks. 1969. Grand Teton Association.
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- Hazen, Robert M. The Story Of Earth; The First 4.5 Billion Years, From Stardust T Living Planet. 2012 Viking-Penguin
- Parrie, Traute N. and Logan Jesse A. Voices of Yellowstone's Capstone; A Narrative Atlas of the Absaroka-Beartooth Wilderness. 2019. Absaroka-Beartooth Wilderness Association
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- Park County Planning Department. Atlas of Park County. 2013. Park County, Planning Department
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- Rodman, Ann. Shovic, Henry and Thopma, David. Soils of Yellowstone National Park. 1996. Yellowstone Center for Resources.
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- Shovic, Henry. Landforms and Associated Surficial Materials of Yellowstone National Park. 1996. Yellowstone Center for Resources.
- 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.
- Locke, William W. Lageson, David R. Mogk, David W. Montagne, John. Schmitt, James G. et al. The Middle Yellowstone From Livingston to Gardiner: A Microcosm of Northern Rocky Mountain Geology. Northwest Geology. GSA v.24 pg 1-65. 1995. Tobacco Root Geological Society.
- 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.
- Winchester, Simon. The Map That Changed the World. 2001. HarperCollins Publishers
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- Whittlesey, Lee H. Gateway to Yellowstone: The Raucous Town of Cinnabar at the Montana Frontier. 2015. Two Dot – An Imprint of Rowan and Littlefield.
- Whittlesey, Lee H. Yellowstone Place Names. 2006. Wonderland Publishing Company.
- Dupuy, David. Paradise and Beyond. 2023. David Dupuy.
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- MacDonald., Douglas H. & Hale, Elaine S. Yellowstone Archeology: Northern Yellowstone. 2011. The University of Montana.
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- Whithorn, Doris. Paradise Valley on The Yellowstone. 2001. Arcadia Publishing
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- Kolbert, Elizabeth. The Sixth Extinction – An Unnatural History. 2014. Henry Holt and Company, LLC
- Leopold, Aldo. A Sand Country Almanac. 1966. Oxford University Press

WHOM TO CONTACT

For any questions, concerns, or additional information please contact the following:

- Program itinerary, health forms, payment, and activity questions please contact Yellowstone Forever at institute@yellowstone.org or 406-848-2400
- Road updates, park conditions, and general park information please contact Yellowstone National Park Service at <https://www.nps.gov/yell/contacts.htm>
- If running late for a program, please contact 406-848-2400