YELLOWSTONE FOREVER

ROADSIDE GEOLOGY OF YELLOWSTONE COUNTRY

Itinerary & Details

FIELD SEMINAR - SUMMER 2023

INSTRUCTOR: Robert C. Thomas, Ph.D.

INSTRUCTOR BIOGRAPHY: Dr. Rob Thomas is a Professor of Geology in the Environmental Sciences Department at the University of Montana Western in Dillon, Montana. He is a Montana Regents Professor and Teaching Scholar, Montana Educator of the Year, and a Carnegie U.S. Professor. He is a Fellow of the Geological Society of America and recipient of their Distinguished Service Award. He earned B.A., M.S., and Ph.D. degrees from Humboldt State University, the University of Montana, and the University of Washington. He has authored or co-authored over 75 publications, including the book, *Roadside Geology of Yellowstone Country, and Roadside Geology of Montana*, which received the High Plains Book Award in 2021. He uses Montana Western's immersion learning system to engage students in field projects designed to benefit society and the environment. His personal passions are family, mountain recreation and playing guitar around a campfire.

ACTIVITY LEVEL: This course is an activity **level 1** and students enrolled in this course are expected to be active participants. Be prepared to hike up to 1 mile per day, comfortably, through relatively flat terrain on maintained trails.*

**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: Lamar Buffalo Ranch – Yellowstone National Park, WY

PROGRAM DATES & TIMES: The program begins at 7:00 p.m. on Thursday, June 29, 2023, and ends on Sunday, July 2, 2023, at 5:00 p.m.

LODGING CHECK-IN & CHECK-OUT: Lodging check-in begins at 4:00 p.m. on Thursday, June 29, 2023, and lodging check-out is at 9:00 a.m. on Monday, July 3, 2023.

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 Lamar Buffalo Ranch - Summer General Information document.

FROM THE INSTRUCTOR

One of the best ways to understand the geology of the Yellowstone country is to follow the road system in and around Yellowstone National Park. Over the span of three full days, we will explore this rich and varied geologic history of the region and contemplate the potential impacts to the humanity of the next eruption of the world's most violent volcano. This class is geared towards the layperson, so no prior geologic experience is necessary.

Within reach of the road system in and around Yellowstone National Park are rocks that record nearly the entire span of Earth's history. From rocks that once formed in the core of Himalayan-sized mountains over 3.5 billion years ago to mile-thick ice that covered the region as recently as 12,000 years ago, the Yellowstone country is one of the Earth's greatest geological laboratories. The centerpiece of the region is the Yellowstone Plateau volcanic field, which was produced by numerous volcanic eruptions including three of the most violent eruptions that have ever occurred on Earth. Geologists call the source of this anomalous volcanic activity the Yellowstone hot spot, and it is a one-of-a-kind feature on the planet.

In all recorded history, no human has experienced a volcanic eruption the size of the eruptions produced by the Yellowstone hot spot during the Quaternary Period (2.6 million to the present). These eruptions are so horrifying to contemplate that they have spawned several disaster films and countless apocalyptic websites with doomsday scenarios for the future of humanity. In recent human experience, volcanic eruptions range from placid tourist attractions like those on the Big Island of Hawaii to relatively minor events like the 1980 eruption of Mount Saint Helens in Washington. In contrast, a large eruption of the Yellowstone hot spot would likely cause global extinctions, climate change, and a significant reduction in the human population. The eruptions are so large that the popular science industry and the media have coined the term "supervolcano" to distinguish their destructive force from run-of-the-mill volcanoes. On days one and two of this program, you will see evidence for two of the three major eruptions that make up the Yellowstone Plateau volcanic field, as well as many of the smaller eruptions that filled in the eruptive centers or calderas that formed during the mega eruptions.

The geologic history of the Yellowstone country is much more than its recent volcanic history, however. These relatively recent eruptions blasted their way through nearly 4 billion years of geologic history that is well exposed around the margins of the Yellowstone Plateau volcanic field. Day three of our travels will take us to see the older geologic history of the Yellowstone country. In the Beartooth country, we will see Precambrian metamorphic and igneous rocks formed when continents collided, Paleozoic sedimentary rocks deposited in tropical oceans and fossil forests that were buried by volcanic eruptions that preceded the Yellowstone volcanic field by nearly 50 million years. In addition, we will see how glaciers modified the landscape over the last 130,000 years and how continued climate change is impacting the Yellowstone geo-ecosystem and impacting land-management decisions that are crucial to maintaining the nation's first national park for future visitors.

Most of our time will be spent traveling the road systems in and around the park, with frequent stops to discuss the geologic history. The class will start with an overview on the first morning and will be followed by three days of field excursions. We will start after breakfast, so be prepared to take lunch into the field. The first evening after dinner, we'll spend an hour or so discussing the geology of the Yellowstone country. While this class is being held in summer months, weather on the Yellowstone Plateau and surrounding areas can be quite variable. It is important to bring all gear listed in this letter as well as a box lunch, ample water, and snacks.

- *Rob Thomas, Ph.D.*

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.*

Day 1 **Evening Orientation**

Evening course overview, orientation, and group introductions.

Day 2 **The Yellowstone Caldera**

We will meet in the classroom at the Lamar Buffalo Ranch after breakfast for a short overview and discussion of the plans for the day. The field day will begin with an overview of the Precambrian history of North America at the Lamar Canyon. We will continue to The Narrows and Tower Fall, where we will see and discuss the Cenozoic Absaroka volcanic rocks and several spectacular lava flows that were extruded downstream valleys that flowed out of the calderas that form the Yellowstone Plateau volcanic field. From Tower Fall, we will climb the northern margin of the Yellowstone caldera, which is the youngest of the three calderas that make up the Yellowstone Plateau volcanic field, forming only about 639,000 years ago. We will stop for lunch and an overview discussion of the Yellowstone caldera.

Day 3 **Outside of the Yellowstone Caldera**

We will begin our day by driving to Mammoth Hot Springs, one of the most spectacular travertine hot springs in the world. Along the way, we will make several stops to view volcanic flows outside of the Yellowstone caldera and a petrified tree. After a stop for lunch and ice cream in Mammoth, we will walk to an overview spot to see a spectacular angular unconformity (period of uplift and erosion) between Cretaceous sedimentary rocks and the overlying Huckleberry Ridge Tuff. From Mammoth, we will continue south, stopping at the Golden Gate to see the Huckleberry Ridge Tuff up close, the obsidian deposit at Obsidian Cliffs, and eventually Norris Geyser Basin, where we will walk through one of the hottest and most active geyser basins in the world.

Day 4 **The Beartooth Country**

We will leave the Lamar Buffalo Ranch and head northeast towards Cooke City, Montana. Our first stop will be an overview of the Lamar Valley to discuss the tectonic origins of this drainage and see the evidence for active uplift along the frontal edge of the Yellowstone hot spot. We will continue to Soda Butte, the eastern-most thermal feature in the park. At Silver Gate, Montana, we will stop at the geologically famous and enigmatic Heart Mountain Detachment, a mega landslide that occurred during the height of the Absaroka volcanic field around 50 million years ago. After a quick stop in Cooke City, we will head up to Beartooth Pass, where we will discuss the origin of the flat surface of the Beartooth Plateau and view numerous alpine glacial features and tundra flora. It is truly the top of the world. From the pass we will work our way back to the Lamar Buffalo Ranch with geology stops to look at Beartooth Butte, a gorgeous remnant of Paleozoic sedimentary rock resting atop the Precambrian basement rocks, and we will stop at an overview spot to look at glacial features in the Clarks Fork Valley and surrounding mountains.

Day 5 **Check-Out**

Check out of the ranch by 9:00 a.m.

PROGRAM EQUIPMENT

For a full list of recommended equipment for all courses see the Lamar Buffalo Ranch - Summer General Information document.

There are no items specific to this course.

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 percent discount and proceeds directly support the park.

- Fritz, W.J. and Thomas, R.C., 2011. *Roadside Geology of Yellowstone Country*. Mountain Press Publishing, Missoula, MT.

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