Field Trip Details

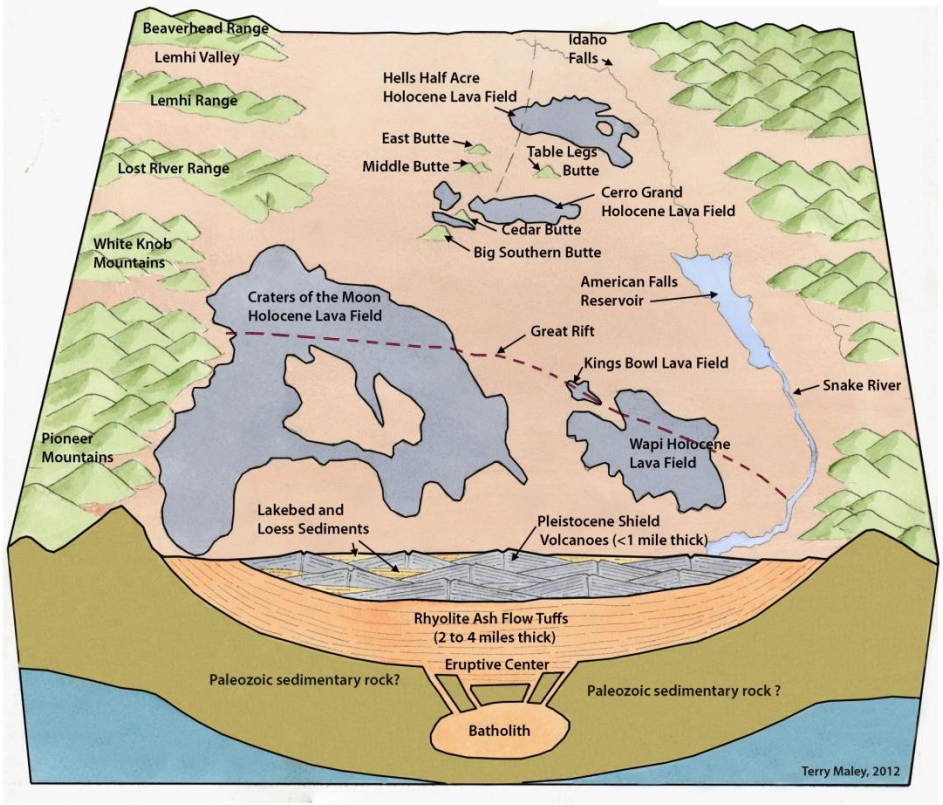
1. Field Trip Itinerary of the Geologic Attractions of South-Central Idaho (April 20-23, 2018)

We will meet at the Craters of the Moon visitor's center at 12:30 p.m. Some people will choose to arrive the night before.

April 20, 2018

1. Great Rift and Craters of the Moon Lava Field -Arrive 12:30 - depart 3:30
2. Geology of the Wood River Valley - Arrive 5:30 - depart 6:00

Arrive at **Wood River Inn at 6:30**



April 21, 2018

Depart Wood River Inn at 7:30 a.m.

3. Shoshone Lava Field and Black Butte Shield Volcano

(We will also investigate bedrock erosion in the Big Wood River at this site. Site 4 shown on the map has better examples but much more difficult to access, especially in the spring.)

Arrive 8:00 - depart 9:00

4. Bedrock Erosion in the Big Wood River - See explanation in Site 3.
5. Gooding City of Rocks - Arrive 10:00 - depart 11:30
6. Malad Gorge -Arrive 12:00, eat lunch, investigate site - depart 2:00
7. King Hill Melon Gravels (omitted unless we are ahead of schedule)
8. Bliss Land Slide, Arrive 2:30 - depart 2:45
9. Canyon-filling lavas in the Snake River Canyon - Arrive 3:00 - depart 3:15
10. Hagerman Museum and the Hagerman "Melon" Valley

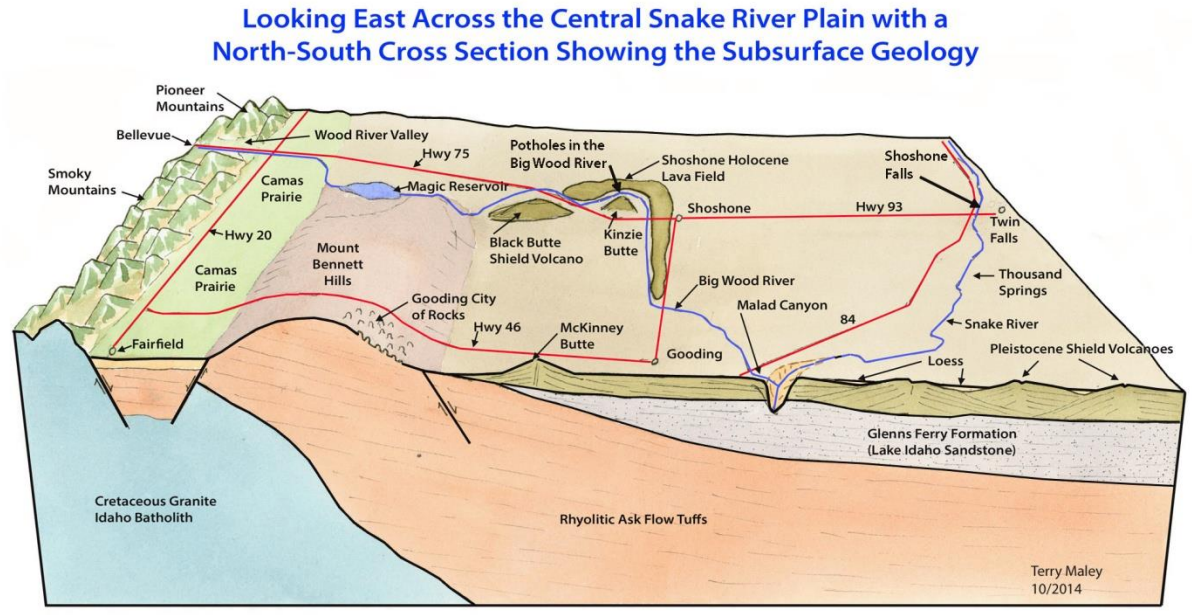
Arrive 3:30 - depart 3:45

11. Thousand Springs - Arrive 4:00 and depart 4:15
12. Colossal Flood Erosion Near Twin Falls
13. Shoshone Falls and Scabland
14. Snake River Plain Aquifer
15. Snake River Flood Gold

Sites 12, 13, 14, and 15 can all be seen at the overlook of Shoshone Falls

Arrive at Shoshone Falls 5:00 and depart at 6:00

Arrive at **Best Western Inn in Twin Falls at 6:15**



April 22, 2018

Depart Best Western Inn at 7:30 a.m.

16. Metamorphic Core Complex of the Albion Mountains

Arrive at 8:45; after several brief stops south of Oakley depart 9:00

17. City of Rocks National Reserve - Arrive at 9:30 and depart about 1:00

Our trip leader

Terry Maley has B.S. and M.S. degrees from Oregon State University and a Ph.D. in geology from the University of Idaho. He has been an avid field observer, photographer, and illustrator of geological features during more than 50 years of fieldwork. Now retired, he worked many years for the Department of the Interior conducting geologic investigations throughout the western United States. Before joining the Interior Department, He also served as Administrator for the Idaho Division of Earth Resources for five years with responsibility over all mineral resources, water resources, and geological research in Idaho. He has authored more than 50 technical papers on geological features and has written ten books on regional geology, field geology and mineral law, including a third edition of ***Exploring Idaho Geology*** to be published in February 2018.

Lodging

April 20, 2017

We will stay at the Wood River Inn April 20th; however, if any participant wants to come a day early, that will be covered at block rate. The participants should individually call the Wood River Inn at 208-578-0600 or go to the website https://www.woodriverinn.com. Then use the block discount code: 18WGA.

The price is $106.50 plus tax = $123.54 for a single king. Two queens in a room is a few dollars more. Cancellation must be made 48 hours before arrival. Breakfast is included.

April 21, 2017
Best Western Plus Twin Falls Hotel
1377 Blue Lakes Blvd. N.
Twin Falls, ID 83301

Call 208-736-8000 and ask to pick up a room off the block of **Jackson Hole Geologists.** The block of 15 rooms will be held until March 15.

The rate is a single king bed for $87 plus $7 tax for a total of $94.

Two queen beds in one room is $97 plus tax.

2. Geologic Field Trip to South-Central Idaho (April 20-23, 2018)

INTRODUCTION

South-central Idaho contains a remarkably diverse group of geologically significant features and landscapes. The regional geologic setting includes world-class tectonic features such as the basin-and-range faults, the Idaho-Wyoming Thrust Belt, the Snake River Plain and the Idaho batholith. Rocks in the area range in age from 2200-year-old volcanic rocks at Craters of the Moon National Monument to the 2.7-billion-year-old gneiss in the Albion Range. The most recent geologic event to affect the area is the catastrophic Bonneville flood that swept across southern Idaho 17,500 years ago and left spectacular large-scale erosional and depositional features along the Snake River. This unique concentration of so many diverse and scientifically significant features such as the Big Wood River, the Snake River Canyon, the Gooding City of Rocks, the Bonneville Flood, Black Butte Shield Volcano, Shoshone Caves, Quaternary lava fields and the volcanic rift system has created a remarkable outdoor geological museum.
During the field trip, I will discuss the regional geology of southern Idaho and contiguous states to give context to the geologic sites that we visit. I will also focus on the origin and evolution of Snake River Plain—a remarkable, globally significant geologic feature.
After visiting Craters of the Moon, we will drive northward in the Wood River Valley through Bellevue, Hailey, Ketchum and Sun Valley. The topography was established by Basin and Range faulting of the Wood River and Milligan formations of Paleozoic age. The Eocene Challis volcanic rocks overlie the older rocks. On April 21, we will follow a very significant stretch of the Snake River in south-central Idaho. The sites we will visit are key to understanding the role of volcanism and the catastrophic floods in the history of the 720-mile-long Snake River. On the morning of April 22, we will visit the City of Rocks National Reserve and see spectacular examples of pinnacles in the Almo pluton modified by spheroidal and cavernous weathering.

GEOLOGIC SITES

1. The Great Rift and Craters of the Moon Lava Field

The Great Rift system consists of a series of north-northwest-trending fractures; this fracture system extends from the northern margin of the ESRP, southward to the Snake River. It is 60-mile-long and 1.8- to 4.8-mile-wide belt of shield volcanoes, cinder cones, lava flows and fissures. A variety of volcanic features including tephra cones, shield volcanoes and both eruptive and noneruptive fissures are positioned along the Great Rift. From south to north, the Wapi, Kings Bowl and Craters of the Moon Lava Fields occur on the Great Rift.

Craters of the Moon National Monument, situated at the north end of the Great Rift, is a veritable outdoor museum of volcanic features. It covers an area of 640 square miles and is the largest Holocene (less than 10,000 years old) lava field in the conterminous United States. Craters of the Moon is the largest and most complex of the late Pleistocene and Holocene basaltic lava fields of the eastern Snake River Plain (ESRP.) This lava field is a product of eight major eruptive periods with the earliest about 15,000 and ending 2100 years ago. The eruptive vents have produced almost every type of feature associated with

basaltic volcanism. Lava features include pahoehoe, aa, and block lava flows, bombs, blocks, scoria and glassy basalt, spatter cones, cinder cones, mini-shield volcanoes, inflation pits, squeeze-ups, pressure ridges, rifts, lava tubes, levees, hornitos, driblet cones and spires, levees, lava stalactites and stalagmites, tumuli, kipukas extension cracks, scarps, rafted blocks and tree molds.

2. Geology of the Wood River Valley/Sun Valley

The north-northwest-trending Wood River valley is a graben (down-dropped block) caused by Basin and Range faulting. Most of the rock exposed on the higher ridges is carbonate rock of the Permian-Pennsylvanian Wood River formation. The darker Devonian Milligan formation and the Cretaceous Idaho batholith is also exposed in places. Eocene Challis volcanics crop out in some of the lower foothills.

3. Shoshone Lava Field and Black Butte Shield Volcano

The Shoshone lava field is located north of the town of Shoshone at the eastern end of the Bennett Hills. Black Butte is the source all the lava in the Shoshone Lava Field. Black Butte is located approximately 17 miles north of the town of Shoshone. Flows from Black Butte Crater followed the alluvial valley of the Big Wood and Little Wood Rivers for a distance of about 36 miles. The Black Butte or Shoshone Lava Field covers approximately 71,000 square miles and has a radiocarbon date of 10,130 years old.

Black Butte is a large shield volcano in south-central Idaho located about 17 miles north of Shoshone, Idaho. The cone rises approximately 200 feet above the surrounding lava plain and has a 1.9-mile diameter. In the center of the shield is an irregularly shaped subsidence crater approximately 0.5 mile wide. The crater was once occupied by a lava lake, which overflowed the rim and washed thin sheets of foamy pahoehoe down the flanks.

Shoshone Lava Cave System. Lava tubes are the subsurface passageways that transport lava from a vent to the site of emplacement. They form only in the fluid pahoehoe flows. Lava tubes exist as a single tunnel or as complex networks of horizontally anastomosing tubes and may occupy up to five levels. Features in tubes include glazed lava, lava stalactites and ice. Lava tubes and channels originating from fissures and low shields are commonly more than 11 miles long and range from 3 to 30 feet across. The Shoshone lava tube system covers approximately 80 square miles with smaller subsidiary tubes branching off from the main tube.

4. Bedrock Erosion in the Big Wood River

The Big Wood River has major tributaries running off the Boulder Mountains to the northeast, the Pioneer Mountains to the east and the Smoky Mountains to the West. When the present position of the Big Wood River channel was established approximately 10,000 years ago, there were enormous flows of glacial melt water running off the high country. These large flows carried heavy sediment loads and were instrumental in developing the spectacular potholes and other forms of exotic bedrock erosion during the first few thousand years of the Big Wood River's existence in its present position. The Big Wood River channel may have the best examples of pothole development on Earth.

5. Gooding City of Rocks

The Gooding City of Rocks is a forest of rock pinnacles or hoodoos composed of tuffaceous volcanic rock (ash flow tuffs) rising to 45-feet high. This impressive geologic attraction is located about 11 miles north of Gooding, Idaho and can be accessed by a dirt road on the west side of highway 46. The pinnacles, hoodoos and bizarre forms that characterize City of Rocks are developed in the City of Rocks tuff, which has been dated at 9.2 million years. The City of Rocks tuff has hard lithoidal layers alternating with soft tuffaceous layers allowing differential weathering to create unusual forms. Two sets of vertical extension fractures intersecting at right angles create blocky forms. The rectangular blocks are subjected to subsurface weathering by solutions accessing the rock along the vertical fractures. The pinnacles and hoodoos are almost entirely formed while still completely buried. Streams, sheet wash and wind remove the weathered material and expose the hoodoos and pinnacles.

6. Malad Gorge

Malad Gorge refers to the segment of the Big Wood River that joins the Snake River north of Hagerman approximately 30 miles northwest of Twin Falls. It is the canyon occupied by the Big Wood River before its confluence with the Snake River. The Malad River, which begins near Gooding, is 12.5-long and the Malad gorge is 2.5 miles in length and 250-feet deep. The area, which has been designated at Malad Gorge State Park, includes the Malad Gorge, Cove Creek and Box Canyon. The Big Wood River cut through the Madson Basalt at a depth of 200 ft. and this exposed the Malad Springs system. The canyon is considered to be "underfit" because the present Big Wood River could not have cut such a large canyon, indicating ancestral water flows must have been much greater. Large slump blocks cover the lower canyon walls. The lake at the 60-foot waterfall of the Big Wood River is referred to as Devil's Washbowl.

Dry Canyons of the Snake River. The dry canyons draining into the Snake River were primarily carved by subaerial waterfalls and knickpoint retreat. **Devil's Corral** occurs on the north side of the Snake River Canyon where the Eden flood overflow channel reconnects with the Snake River. This feature differs in morphology from the other downstream blind canyons and the heads of the lobes have no active spring. **Blue Lakes Canyon** has a 312-feet-high amphitheater-shaped headwall with an active spring and a well-developed spillway with a plunge pool. **Box Canyon** is situated partly within the floodwater path. It is 3-km long and has a 115-foot-high headwall fed by a spillway with two dry plunge pools. **Stubby Canyon** at Malad Gorge is similar in morphology to Box and Blue Lakes Canyons. It has a flat floor and perennial spring with a cosmogenic 3He age of 18 to 24 ka.

7. King Hill Melon Gravels

Large rounded boulders of basalt characterize many deposits left by the flood along the Snake River Plain. H. A. Powers, who recognized that these boulders were of catastrophic origin, and Malde applied the name of "Melon Gravel" to the boulder deposits. In 1962, Malde and Powers, were inspired to use this term after observing a road sign in 1955 at King Hill that called the boulders "petrified watermelons." The melon gravels, which consist of rounded basaltic pebbles, cobbles and boulders, are easy to recognize and useful to define the flood path. Melon gravel bars are similar in shape to the bars of braided streams except for their enormous size.

8. Bliss Landslide

On July 24, 1993, a landslide affecting an area about 100 acres occurred about 0.6 mile south of the town of Bliss Idaho. According to eye-witness accounts the toe of the slide temporarily blocked the Snake River and forced the river to cut a new channel south of the slide. Outstanding textbook examples of most of the features typically associated with landslides could be observed at the Bliss Landslide for several years following the slide. These features include textbook examples of arcuate highwall or head scarps, rotated slump blocks, strike-slip fault planes at the sides of the slide, tension cracks, grabens, compressional folds and thrusts, water (sag) ponds, staircase topography, tilted telephone poles, and hummocky surface at the earth flow portion near the toe.

9. Canyon-filling lavas in the Snake River Canyon

Downstream from Milner dam many ancestral canyons of the Snake River are filled with lava, which originated from volcanic vents in the vicinity. Each time the canyon was filled from the north side, the river was displaced to the south and cut a new canyon, which in turn was filled. This succession of canyon-filling activity moved the Snake River about 18 miles to the south. Canyon-filling lava flows can be observed in the northern wall of the Snake Canyon between Bliss and King Hill. The first three ancestral canyons are at least 60-m deep and the fourth canyon was 394-feet deep or as deep as the present canyon. And the fifth canyon near Bliss had cut 98 feet deeper than the present canyon.

10. Hagerman Museum and the Hagerman "Melon" Valley Hagerman Fauna.

In 1988 the Hagerman Fossil Beds National Monument was established by Congress. In 1928, a local rancher named Elmer Cook discovered fossil bones and showed them to H.T. Stearns, a U.S. Geological Survey Geologist. Stearns forwarded the bones to J.W. Gidley at the U.S. National Museum. Gidley interpreted the bones to be a fossil horse and during the next two summers he removed tons of bones.

The horse, identified as *Equus simplicidens,* is the earliest recognized example of the modern horse genus *Equus*. In 1988 the Idaho State Legislature designated the Hagerman horse the State fossil. The Glenns Ferry sediments in the Hagerman area have yielded the world's greatest variety and numbers of animals from the late Pliocene.

11. Thousand Springs

The Thousand Springs area is located on the north side of the Snake River Canyon between Bliss and Twin Falls. Between Milner Dam and King Hill, the Snake River has cut a canyon several hundred feet deep for a distance of almost 90 miles (150 km). The north wall of the canyon intercepts the Snake River Plain aquifer where many spectacular springs pour out of the truncated pillow basalts and other permeable zones. This north wall of the canyon in this area embraces 11 of the 65 springs in the United States that produce more than 72,400 acre-feet of water annually. Until the early part of this century when the water was developed for power and irrigation, the springs were a spectacular scenic feature with springs pouring from outlets along the canyon forming an almost continuous wall of water over the north side of the canyon for hundreds of meters.

12. Colossal Flood Erosion Near Twin Falls

Partly because of the reentry of the Bonneville floodwaters into the Snake River Canyon, the Twin Falls area experienced the most exceptional bedrock erosion of any place on the Snake River canyon. In fact the size and features are analogous in many respects to the Dry Falls cataract complex in central Washington. This highly eroded canyon segment is almost a mile wide in places, 500-feet deep and more than 10-miles long. The most extraordinary features are the huge spillway alcoves on the north rim of the canyon where the water from the overflow channel reentered the canyon. The largest alcoves, from east to west, are Box canyon, Blue Lakes Alcove and Devils Corral. Blue Lakes Alcove and Devils Corral are enormous features, almost one mile in length and more than a quarter mile in width.

13. Shoshone Falls and Scabland

Shoshone Falls. The underfit Shoshone Falls is a remarkable erosional remnant of the Bonneville Flood. The falls, as well as all the associated spectacular erosional features in the 10-mile segment of the Snake River canyon, were created by the flood. Although the falls is a remarkable 212-foot-high (65.6 km) feature, it is framed by diverse, large-scale, flood-caused features such as cataracts, spillway alcoves, and scablands.

Scabland. J. Harlan Bretz (1923) coined the word "scabland" to describe the stripped basalt surface in southeastern Washington. The term, now well established in the geological literature refers to not only the bare basalt where the loess was swept off by the sweeping action of the flood, but it also covers a variety of gigantic erosional features associated with the flood such as anastomosing channels, coulees, dry falls, and emptyrock basins. Similar features exist along the path of the Bonneville Flood, especially where the flood overflowed the canyons such as north of the canyon in the vicinity of Twin Falls. All loess has been stripped of the basalt surface along the flood path.

14. Snake River Plain Aquifer

The unique geology of the Snake River Plain and the surrounding area make it one of the world's most productive groundwater aquifers. The Snake River Plain aquifer underlies most of the Snake River Plain covering about 10,000 square miles. The aquifer is immense and contains vast quantities of water. The storage capacity may be equal to several hundred times the annual flow of the Snake River. In the eastern plain, the aquifer consists primarily of flat-lying Pleistocene basalt flows with interbedded sedimentary deposits. Rhyolite of low permeability forms most of the base of the aquifer throughout the plain. The aquifer is fed by precipitation from drainage areas in the northern mountains before sinking into the permeable lavas at the north end of the plain and entering the aquifer.

15. Snake River Flood Gold

The Snake River in southern Idaho has the best-known flood gold occurrences in the United States. Flood gold is finely divided gold that may be transported very long distances under flood conditions. The particles of such gold are so small that it may take 1,000 colors to be worth a few cents, so as a general rule such deposits have little economic significance. Flood gold is distributed throughout the 720-mile length of the Snake River from the headwaters near Yellowstone National Park to Lewiston, Idaho.

Unlike most gold placers, the Snake River flood gold is not concentrated on or close to bedrock.

16. Metamorphic Core Complex of the Albion Mountains

The Albion Mountains are a representative portion of a larger region referred to as the Raft River-Grouse Creek-Albion Mountains metamorphic core complex. This metamorphic core complex has resulted in diverse igneous, metamorphic and sedimentary rocks with ages extending back more than 2.6 billion years brought together in a small geographic area. Consequently, the area is an exceptional place to study these well-exposed rocks and deformational structures. The spectacular pinnacles and unusual rock forms at the City of Rocks National Reserve and the remarkable building stone extracted from Middle Mountain were formed as a result of this metamorphic core complex.

17. City of Rocks National Reserve

The City of Rocks National Reserve was established in 1988; it is situated 15 miles southeast of Oakley and about 4 miles west of Almo. You can reach the City of Rocks by traveling through Oakley on the west side or through Almo on the east. Miller and colleagues (2008) have used the term pinnacles as a general description of the various projecting granitic landforms in the reserve. They further proposed three forms of pinnacles called loaves, spires and domes to cover most of the common shapes within the reserve. Granitic rock of the 28 Ma Almo pluton is particularly suitable for the creation of the pinnacles due to its susceptibility to spheroidal and cavernous weathering.

Archean Rocks in the Albion Range. In the Albion Range of south-central Idaho, the 2.6-billion-year-old Archean Green Creek Complex is exposed in a metamorphic core complex. These metamorphic core complexes create windows to examine the deep basement rocks in the North American Cordillera. They represent exposures of the 3.1-2.6 Ga Wyoming Province. The best-known exposure of Archean rock is the Twin Sisters at the City of Rocks National Reserve. One sister is 2.6 billion years old and the other is only 28 million years old.

Cost and Lodging details will be posted soon.