Nevada Bureau of Mines and Geology Educational Series E-45

Earth Science Week Field Trip October 7 or 8, 2006

Rockin' Along the River

A geologic tour along the Truckee River from Verdi to Wadsworth

This year's Earth Science Week public field trip begins at Crystal Peak Park in Verdi and roughly follows the path of the Truckee River east to Wadsworth with stops at several sites of geologic interest along the way. In keeping with the 2006 National Earth Science Week theme "Be a Citizen Scientist," we will discuss ways in which you can investigate natural geologic features in a scientific manner to come up with plausible answers to questions about the Earth's history. We will have the opportunity to collect samples of rocks along the way, including a variety of river rocks, granite, basalt, andesite, rhyolite, sandstone, diorite, and many varieties of volcanic tuff. Geoscientists will accompany us on the field trip to answer questions and discuss their research.

This approximately 100-mile round trip will take us to sites located along the Truckee River corridor and will attempt to show you how geologists reconstruct the geologic history of the area from the rocks exposed along the route. All stops are adjacent to paved or gravel roads accessible by high-clearance vehicles, but some roads may be rocky or rutted.

Participants will meet at Crystal Peak Park in Verdi by 8:00 A.M. After a brief overview of local geology, we will leave the park at 8:30 A.M. To reach the park from the Reno area, take I-80 west to Exit #2, Verdi/Gold Ranch Road. Turn right on Gold Ranch Road, follow the road east over the Truckee River and take the first right at Crystal Park Road. Turn right at the sign into the park.

Cumulative mileage:

0.0 Depart Crystal Peak Park turning left on Crystal Park Road.
0.1 Turn right (east) on 3rd Street (old U.S. Highway 40).
0.9 Turn right into the U.S. Post Office parking lot and park vehicles.

STOP 1: Carefully cross the highway to examine a large granodiorite boulder across the street. How do you think it may have been emplaced here? Recross street and examine sediment in cuts adjacent to the parking lot. Discuss river terraces and evidence for catastrophic glacial floods called *"jökulhlaups."* A jökulhlaup is an Icelandic term for a flood caused by the sudden, rapid draining of a glacier-dammed lake. Geologists who study glacial deposits believe that high-elevation tributaries to the Truckee River, such as Squaw Valley, were occupied by mountain glaciers that periodically advanced to block the flow of the Truckee River during the Pleistocene Epoch (1.8 million to 10,000 years ago), causing water to pond behind the glaciers. Ultimate failure of the ice dams caused catastrophic glacial floods with sufficient flow to transport boulders much larger than the size of the normal bed load of the river for many miles down–stream. Look for further evidence for jökulhlaups along the field trip route today. Return to vehicles and exit the Post Office lot, turning left (west) on Third Street.

Glacial flood transported rock. ***Photo by Mike Visher.***

1.4 Turn left on Bridge Street. At the stop sign continue straight across the railroad tracks past the Nevada State Historical Marker.
1.6 Turn left on South Verdi Road. We are climbing from one river terrace to the next.
1.8 Note large boulder on right side of road.
2.2 Note another large boulder on right side of road.
2.9 Turn right on Garson Road.
3.3 Pass through Boomtown Hotel & Casino. Watch for cross traffic and pedestrians.
3.5 Cross over I-80 overpass and bear slightly right past the cattle guard towards the Verdi Fire Station. Turn right at the Fire Station and open gate

Permission to pass is allowed on U.S. Forest Service access road if private property rights are recognized and "No Trespassing" signs are observed. Carefully cross the Steamboat Ditch on narrow wooden bridge.

3.7 Pull into the gravel pit on the left at U.S. Forest Service road marker 462.

STOP 2: Gravel Pit. Here we will examine the rock exposed at the top of the cut in the gravel pit. The Hunter Creek sandstone is composed of interbedded layers of gravel, conglomerate, volcanic ash, siltstone, and diatomite. It is Miocene to Pliocene (approximately 24 to 1.8 million years old) in age and varies widely in thickness and composition from place to place. Examine the outcrop to find out what conditions were like when it was deposited. We will try to deduce what has happened to the sedimentary beds exposed in the gravel pit since they were deposited. Retrace steps back to the main road.

Gravel quarry with fault. ***Photo by Jon Price.***

Garson Road gravel pit cut. ***Photo by Mike Visher.***

Faulted gravel and sandstone in quarry wall. ***Photo by Jon Price.***

Gravel and sandstone offset by fault. ***Photo by Jon Price.***

4.0 Turn right onto 1-80 east.
6.0 Turn off at exit #7 Mogul.
6.2 Turn right at stop sign.
6.6 Cross railroad tracks and turn left into gravel area by river. Continue along the dirt road until all vehicles have enough space to safely park along the road.

STOP 3: The Mogul Landslide. Looking south across the river, you should be able to identify a landslide deposit on the hillside facing us. The most recent slide is characterized by an arcuate scarp at the top, and a crumpled-looking lobe of "hummocky" ground near the bottom by the river. This slide occurred sometime between 1880 and 1906 and was the direct result of human activity. Water leakage from the Steamboat Ditch, which at that time passed around this point of land, caused the slope to fail. The ditch was subsequently

moved to pass through a tunnel behind the hill. A line of green trees and bushes that crosses the slopes above the small, perched meadow to the right of the hill marks the present trace of the Steamboat Ditch.

If you observe the adjacent ground in this area, you will notice other, older scarps and hummocky lower ground, indicating that landslides have been active here for many thousands of years. The hill is still moving today, helped along by action of the Truckee River as it erodes and undercuts the toe of the slope at the river's edge.

Mogul landslide. ***Photo by Mike Visher.***

Continue along this road to rejoin the freeway.

7.0 Turn right onto I-80 east.

7.5 Turn off at Exit #8 on West Fourth Street and continue east along Fourth St. Drive through historical Laughton's Quarry. On the right, a few granodiorite boulders near the railroad tracks remain near the location of Laughton's Quarry, now covered by Fourth Street. From the 1860s into the early 1900s building stone was excavated here and transported to Reno for building early foundations, curbs, and sidewalks. A short distance past the quarry is the abandoned River Inn at the site of Laughton's Hot Springs, a spa that operated here in the 1880s.

8.1 There is an excellent exposure of Hunter Creek sandstone overlain by rounded river cobble deposits on the left.

8.7 TURN RIGHT ON WOODLAND AVENUE.

8.9 Turn right on White Fir Street.

9.2 Turn left at entrance to the Patagonia building, and park in employee parking lot (permission has been obtained for weekend parking).

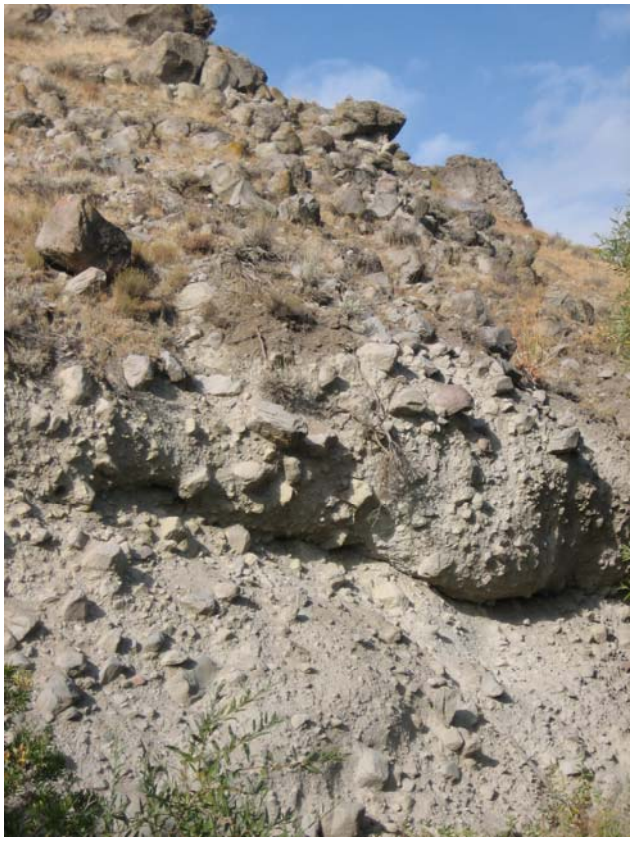
STOP 4: Patagonia Parking Lot - Kate Peak lahar.

Walk across the footbridge over the Truckee River, then turn left and walk along the Last Chance Ditch trail. The resistant rock that forms the blocky knob across the ditch to the south was deposited by a volcanic mudflow called a lahar. The rock itself is a mixture of fragments of volcanic rock and other rock picked up by the mudflow as it traveled across the ground, with mud as a matrix material. This rock is mostly andesitic in composition (more silica than basalt, but less than rhyolite), and is associated with the Kate Peak Formation of Miocene age. As you walk back to the bridge look at the cobbles and boulders in the river. What rock types can you find in the river channel? Look for rocks like these later in the day.

Closeup of the matrix-supported volcaniclastic sediments. ***Photo by D.D. Lapointe***

Resistant knobs of lahar deposit on hillside and tilted sediments in ditch cut. ***Photo by Mike Visher.***

Faulted Kate Peak lahar deposit. ***Photo by D.D. LaPointe.***



Rubbly outcrop and ditch cut of the lahar deposit. ***Photo by D.D. LaPointe.***

Tilted beds of the volcaniclastic sediments along the Last Chance Ditch. ***Photo by Mike Visher.***

9.2 Leave Patagonia parking lot. Turn right and retrace route to West Fourth Street

10.8–11.3 The road cuts on the left expose Hunter Creek sandstone, the same unit that we saw in the gravel pit, and in the cuts along Steamboat Ditch high above the river at the last stop. Although this is a dangerous spot to look at rocks while driving, passengers can look at the diatomaceous, white, chalky-looking layers of the Hunter Creek sandstone in the road cuts at Chalk Bluff. These layers are offset by many faults of small displacement. Look at the top of the road cuts where the Truckee River eroded channels into the top of the layered diatomite deposits and left thick layers of river cobbles. Where is the river now, relative to the earlier road cut cobble deposits? What does this tell you?

12.0 Turn left on West McCarran Blvd.

12.7 Turn right onto I-80 east on ramp.

19.7 Turn off on East McCarran Exit #

20.5 Turn left on Greg St.

20.7 Turn right on Spice Islands Drive.

21.3–21.5 Cottonwood Park.

STOP 5: Park along the side of the road. Here we will look at a map of flooding of the Truckee River during the 1997 New Year's Day flood. We will discuss river deposits, floodplains, and natural levees. What kind of material is in the river here? Is it the same or different from what we have seen in the river at earlier stops? This will be our lunch stop. After lunch, return to vehicles and continue west on Spice Islands Drive.

22.3 Bear left onto Franklin Way.

22.6 Turn right on Greg St.

22.9 Cross Sparks Blvd., continue straight on Greg St.

23.5 Bear left as Greg St. becomes Vista Blvd.

23.8 Turn right on to I-80 east via the Vista on ramp.

23.9 The reddish rocks on the left (north) side of the freeway are metamorphosed sedimentary rocks of Mesozoic age. Prior to 1959, south of this part of I-80, the Truckee River contained a section of rapids and several bends referred to as the "Vista Reefs." Between 1959 and 1963, the Army Corps of Engineers executed a massive flood control program in the Truckee Meadows that included dynamiting the Vista Reefs and straightening the river. In spite of the improvements, a flood that crested on February 1, 1963, flooded 20 blocks of downtown Reno to depths of 4 feet.

26.4 On the left (north) side of freeway is a quarry, operated by Granite Construction Company, where andesitic volcanic rock is mined for use mainly in road construction.

27.9 Pass Lockwood Exit #22. The subdivision below this exit has been flooded numerous times in the past few decades.

28.1 Exit freeway at the Mustang Exit #23. Turn left at the stop sign, go under the freeway and turn left again. Bear right (DO NOT RE-ENTER THE FREEWAY) and continue along road to a wide spot at a gate, where you can make a U-turn, heading back down the road.

28.7 Park along the side of the road.

STOP 6: Walk to large outcrop of basalt east of the road. This is a remnant of some of the most recent volcanic material in the region, the McClellan Peak basalt, dated at 1.2 million years old — a relative new-corner geologically. This rock originated from a volcano a few miles to the south from which lava flowed north here and beyond, probably temporarily blocking the flow of the Truckee River. The river eventually eroded through the lava flow, but this outcrop remains. It is a mafic volcanic rock (basalt, a dark-colored rock with low silica content). Look for vesicles or spherical holes that indicate gas was trapped in the lava as it cooled and hardened. Look also for tiny greenish and brownish crystals of the minerals olivine and pyroxene, which are common in basalt. A change from Cascade-type continental arc volcanism (characterized by abundant andesite, a volcanic rock intermediate in silica content between basalt and rhyolite) to bimodal rhyolite-basalt volcanism occurred about 10 million years ago when extension or pulling part and right-lateral shear (like the San Andreas fault) became the more prevalent style of regional tectonics and still persists today.

McClellan Peak-age basalt at Mustang. ***Photo by D.D. Lapointe.***

Vesicular basalt at Mustang. ***Photo by Mike Visher.***

Retrace route back under the freeway.

29.0 Turn left towards Fernley.

29.2 Join I-80 on the east-bound on-ramp.

32.7 Exit at Scenic View. Form a double line of vehicles on the right leaving enough space for other vehicles to pass by on the left.

STOP 7: Giants Throne can be seen across the river. This is an intrusion of dacite, a volcanic rock that contains slightly more silica than andesite. Also visible here is the pit from a gravel operation along the river and work on a river-restoration project.

Giant's Throne dacite lava dome behind Nature Conservancy's Truckee River riparian habitat restoration project. ***Photo by Mike Visher.***

32.8 Merge back onto freeway.
36.7 Exit at Tracy Clark Exit #32. Turn left (east) at bottom of off-ramp.
37.1 Turn right at stop sign towards "Mine-Mill."
37.3 Carefully pull off the road and park as far to the right as possible.

STOP 8: Lake Lahontan sediment outcrop. Closely examine the large exposure of sediments deposited in Pleistocene Lake Lahontan on the north side of road. Lake Lahontan covered much of northwestern Nevada for thousands of years, last draining about 12,000 years ago. The water level fluctuated greatly over time and had at least four highstands in the last 75,000 years. The most recent highstand (also the highest, reaching an elevation of 4385 feet about 13,000 years ago) is the one that is best documented in the geologic record by outcrops such as this one. What can the sediments tell you about conditions at that time? How do these sediments differ from those we saw in the gravel pit near the Scenic View stop, or at Crystal Peak Park in Verdi?

37.6 Proceed to turn out and make a U-turn and retrace route to freeway.
38.3 Rejoin I-80 east.
40.0—40.5 Lahontan sediments plastered on volcanic units, left side of road.

Horizontal layering and ripples in Lake Lahontan sediments. ***Photo by Mike Visher.***

Lake Lahontan sedimentary rocks. ***Photo by Mike Visher.***

Lake Lahontan sediments exposure. ***Photo by Mike Visher.***

42.9 Derby Dam exit. Turn right and drive along frontage road.
44.0 Historical Marker — Derby Dam.
44.1 Bear right along dirt road.
44.2 Cross the railroad tracks and bear left into the turning circle.

STOP 9: Derby Dam: This is a diversion dam for the Newlands Irrigation Project, which took water from the Truckee River and put it in the Carson River for irrigation in the Fallon area.

44.4 Cross through railroad underpass and bear right on dirt road, retracing route back to I-80.
45.4 Rejoin I-80 eastbound.
47.3 Pass Exit #38, Orchard. The conical whitish pile of material visible high up the canyon to the right (south) is Eagle Picher Company's Celatom diatomite pit.
48.9 Pass Painted Rock Exit.
52.2 **Exit at Wadsworth, Exit #43.**
52.5 **Turn right at stop sign on Cantlon Drive.**
53.2 Turn right under the freeway on single-lane road.
53.4 Bear left on gravel road heading west, parallel to the freeway.
55.2 Park along the side of the road without blocking through traffic passage.

STOP 10: Derby Mine Area. There is a wide variety of rocks we can find, examine, and collect in this small area. The prominent knob on the south side of the gravel road is hydrothermally altered and silicified rhyolite, a light-colored volcanic rock. The rock is fractured and on some fracture surfaces you may find drusy coatings of glittering tiny quartz crystals, limonite, and hematite. The volcanic rock overlies Mesozoic (248 to 65 million years old) basement rock that has been intruded by a Mesozoic age granodiorite, also exposed as a prominent outcrop. Near the contact zone between these two rocks, you may find contact metamorphic rocks such as garnet skarn. There is also an inclined mine shaft, on the hill to the south, which was part of the Derby Mine. THE ENTRANCE TO THE MINE IS FENCED BUT IS NOT VERY SECURE SO BE VERY CAREFUL IN THIS AREA. KEEP SMALL CHILDREN UNDER CONTROL AND AWAY FROM THE MINE SHAFT AREA.

The mine was sunk along the contact zone to develop a tungsten prospect. The main portal of the Derby Mine was an adit about 600 feet to the south-southeast that is now obliterated by I-80. The adit went back 320 feet with several hundred feet of workings on either side. This inclined shaft connects to the west drift of these underground workings about 150 feet below your feet. The workings accessed pods of scheelite-bearing skarn. Rare Metals Corp. produced 400 tons of ore containing 0.5% WO_3 during 1940 and 1941 and shipped it to the Toulon Mill on the railroad near I-80 about 50 miles to the northeast. The mine was active again briefly in 1958, Tungsten mineralization occurs as the mineral scheelite (calcium tungstate) in the skarn. It is not easily identifiable in hand specimen, but with the aid of a "black light" or ultraviolet lamp in the dark, you would see specks of scheelite in the rock glow a brilliant bluish-white color.

You may pick up pieces of the skarn material on the mine dump. A small area (about 500 x 300 meters) of dark hornfels and quartz-garnet-skarn crops out at the Derby Mine. Dark Mesozoic rocks are intruded by biotite-hornblende granodiorite and biotite granite dikes. Local, small patches of phyllite and tremolite marble are present, and probably are remnants of more extensive sedimentary rocks replaced by skarn. Medium- to coarse-grained diorite is also present. After collecting a variety of rocks here, return to vehicles and continue west along the same gravel road.

55.6 Pull off road and park, not blocking through traffic.

STOP 11: Several Oligocene tuffs and Lahontan gravels. There is a small gravel quarry or cut on the left (south) side of road. What do you notice about the gravel layers? How might this have formed? The Lahontan gravels in this area are nearly 4400 feet above sea level and may mark the 4385-foot highstand of Lake Lahontan. A bench mark near the crossing of the Truckee River by the railroad tracks about ¾ mile to the south is at 4162 feet, which indicates Lake Lahontan reached a depth of about 220 feet in this area.

A few of a variety of tuffs found on the hill at Stop 11. ***Photo by D.D. Lapointe.***

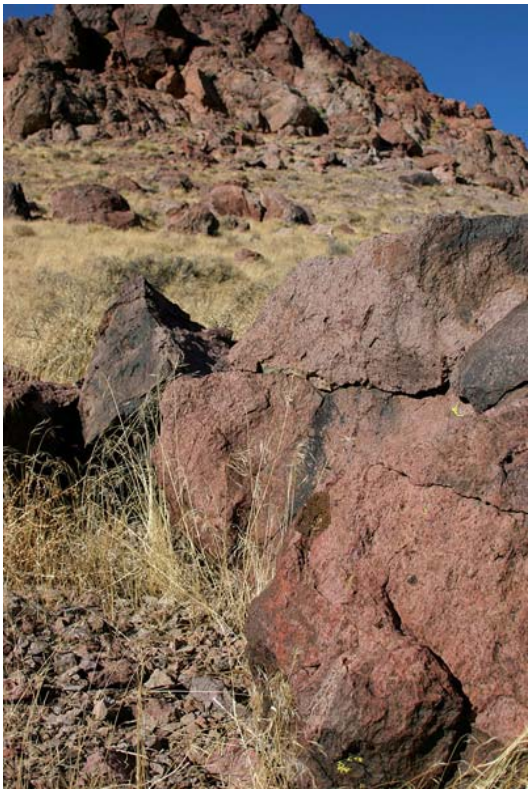
Coarse Lahontan-age gravel layers

Layering of flat pebbles in ancient Lake Lahontan shingle beach deposit.

Across the gravel road to the north is a sequence of several layers of different volcanic tuff units (fragmental rocks composed of pieces of rock erupted from a volcano). Collect and compare the different tuffs; how do they differ? We will discuss the tuffs and how they formed and their ages. After this stop, continue west on the same gravel road.

55.9 Pull off on the right side and park in the broad flat area off the road.

STOP 12: Nine Hill welded tuff. The large reddish boulders and the cliff above them (whence they came) are composed of what is called the Nine Hill Tuff. It is a densely welded tuff, meaning that it erupted as a hot cloud of pyroclastic material that traveled here and hardened into a rock when still very hot, fusing the volcanic material into a dense mass. This rock is red because of its high hematite (iron oxide mineral) content. Look closely at the rock and you will see wispy strands within the rock called *fiamme*. These are fragments of hot volcanic



Nine Hill welded tuff.

Looking for fiamme in the Nine Hill welded tuff.

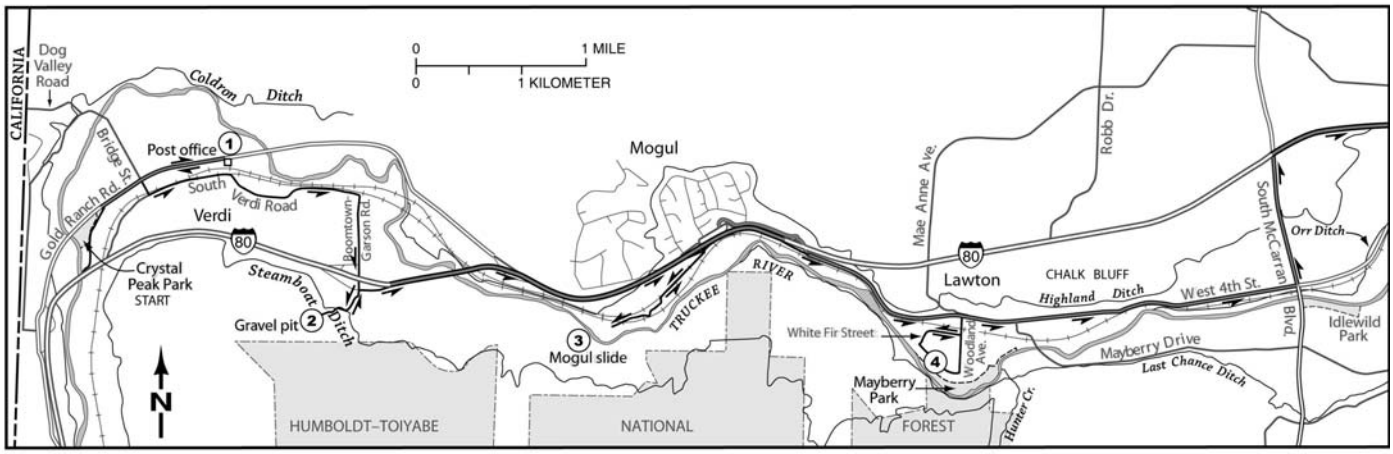
Fiamme in the Nine Hill welded tuff.

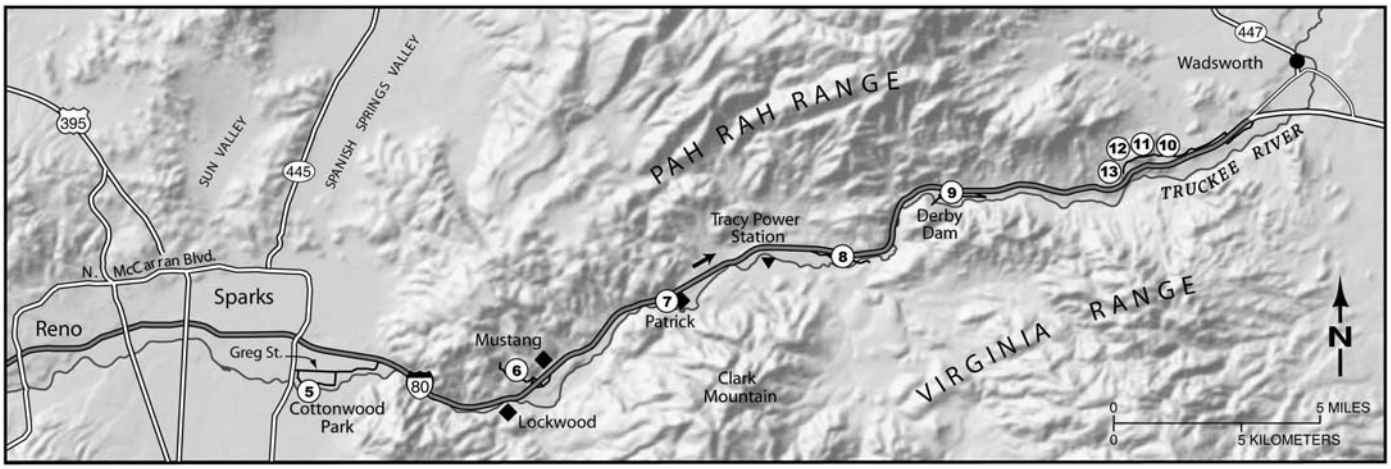
ejecta, generally pumice, that have been deformed by flow and compaction in a pyroclastic deposit. The name *fiamme* comes from the Italian word for flame. After this stop, return to vehicles and continue west.

56.4 Stop at a small pass and pull off to the side of the road and park.

STOP 13: Porphyritic andesite. Look for and collect porphyritic andesite, a dark gray volcanic rock containing small crystals of grayish white feldspar and dark crystals of hornblende in outcrops along the road.

Continue west to easy turn-around area at 56.7 miles and retrace route back to I-80, and return to the Reno-Sparks area.





Thank you for helping us celebrate Earth Science Week, designated the second full week of October by the Governor of Nevada, the U S. Congress, the American Geologic Institute, and the Association of American State Geologists to recognize the importance of geology and other Earth sciences to society. If you have questions about Nevada geology, natural hazards, mineral or energy resources, please contact the Nevada Bureau of Mines and Geology by telephone (775 784-6691), or on the Internet (www.nbmg.unr.edu). The NBMG offices on the UNR campus are open weekdays, 7:30 a.m. to 4:30 p.m.

This field trip was made possible by volunteers from the Nevada Bureau of Mines and Geology; W.M. Keck Museum, Mackay School, University of Nevada, Reno; Geological Society of Nevada, Nevada DOE Nevada Site Office and the Desert Research Institute in Las Vegas. This field trip guide was prepared by D.D. LaPointe, David Davis, and Jon Price, Nevada Bureau of Mines and Geology and by Rachel Dolbier, W.M. Keck Museum, Mackay School of Earth Sciences and Engineering, University