2002 EARTH SCIENCE WEEK FIELD TRIP 1

In Search of “The Right Tuff” but you can just "Take it for Granite"

This approximately 60-mile loop tour will take you to areas of geologic interest north of Reno that also happen to be remarkably beautiful and photogenic landscapes. In a single day, you will walk along a fault plane cutting the granite of “Moon Rocks”, eat lunch atop an aplite-pegmatite dike swarm on Warm Springs Mountain, compare ancient wind-eroded features on welded tuff boulders, ponder evidence for movement along the Honey Lake-Bedell Flat strike-slip fault, scramble over volcanic tuffs of the Red Rock area, and look for elusive scepter quartz crystals on the flanks of Petersen Mountain.

You will have the opportunity to collect granitic rocks, aplite, pegmatite, and several different kinds of volcanic tuff, as well as quartz crystals (smoky, citrine, clear quartz and possibly amethyst) and alkali feldspar.

Road Log:

Field trip participants will meet at 8:30 A.M. at Washoe County’s **Lazy 5 Regional Park.**

Odometer mileage

cumulative

0.0 **Lazy 5 Washoe County Regional Park;** *rest rooms, water, playgrounds*

Depart parking lot and turn right (north) on the Pyramid Highway

10.7 Turn left on Winnemucca Ranch Road. You are following roughly the trend of the Warm Springs Valley Fault zone for the next several miles, one of many NW-trending fault zones that comprise the Walker Lane faults, which extend as far south as the Death Valley area.

15.0 Pavement ends

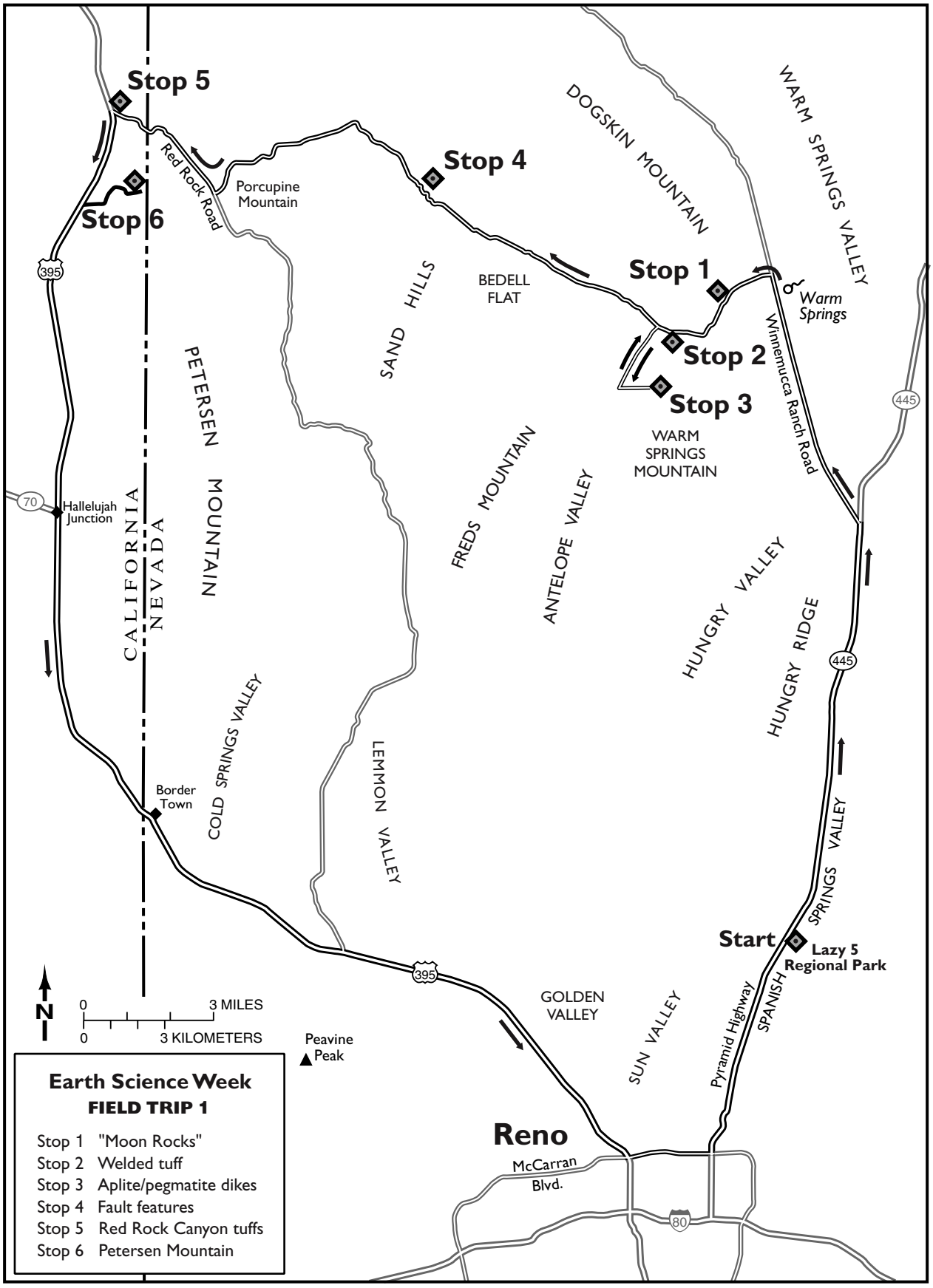
16.7 Warm Springs (ponds, springs)on the right, for which Warm Springs Valley is named. Hot spring water is sprayed into ponds to cool it for irrigation use. Hot springs are common in Nevada, and several of these areas are tapped by geothermal power plants to produce electricity. Nevada produces about $100 million worth of electricity annually from geothermal power plants.

17.1 Turn left on unnamed dirt road immediately after alfalfa fields on the left.

18.2 Park in the large gravel turnout on the right.

STOP #1. The area of rounded granite outcrops on the right is informally called “Moon Rocks” by locals. Granite bedrock outcrops here exhibit **spheroidal weathering** typical of granites worldwide. The granite has been jointed or cracked in a rectilinear pattern to form blocks. Water seeps into the rocks along the cracks and breaks down the minerals in the granite. The corners of the jointed blocks are most susceptible to weathering because water attacks them from 3 sides at once. As the corners decompose and are eroded away, the remaining granite develops the characteristic rounded stacked boulder landscape we see here. The

Spheroidal weathering and liesegang banding at "Moon Rocks"



Earth Science Week
FIELD TRIP 1

Stop 1 "Moon Rocks"
Stop 2 Welded tuff
Stop 3 Aplite/pegmatite dikes
Stop 4 Fault features
Stop 5 Red Rock Canyon tuffs
Stop 6 Petersen Mountain

path of the water infiltrating the rocks can be seen as **"liesegang bands,"** concentric rings of iron-oxide staining visible in the boulders as water oxidizes the iron contained in the darker minerals of the granite.

Several fault planes cut the granite of the Moon Rocks area. Movement along these planes is marked by grooves in the smooth surface, known as "**slickensides,**" which indicate the direction of movement along the fault. The black mineral that forms along some of these fault planes is tourmaline.

There are some pegmatite zones in the granite of Moon Rocks; the minerals are coarser-grained than the surrounding granite. Look for pieces of the minerals feldspar and quartz, which weather out of these pegmatite zones.

Leave Moon Rocks and continue west on the same dirt road.

19.4 Turn left on unnamed dirt road to the south.

19.7 Turn right on intersecting dirt road back to the northwest and park vehicles along the roadside.

STOP 2. Walk up the ridge on the west side of the road to outcrops of rock on the crest of the ridge. The pinkish colored rock is called **the Tuff of Whiskey Springs, or more informally as the"Big Sanidine Tuff."** Tuff is a volcanic rock that forms when material is erupted from a volcano or caldera. The ash, fragments of pumice, and other volcanic rock fall back to earth, travel down the slopes of the volcano, and are deposited in topographically low areas. If the material is still very hot, it will form what is known as a "welded tuff" like this one, where the interstitial material is a volcanic glass surrounding mineral crystals and rock fragments. Pumice fragments are often constituents of tuffs and may be flattened by the weight of the overlying volcanic material. Look for flattened pumice fragments and for rectangular–shaped crystals of the mineral sanidine - a high-temperature form of potassium-rich feldspar- in the tuff. This rock has been radiometrically dated at 30.75 million years old, a time that predates the rise of the Sierra Nevada. The Big Sanidine Tuff has been found occupying low areas of the paleotopography over hundreds of square miles of northwestern Nevada and adjacent California. Mapping of the distribution and thickness of the tuff by NBMG geologists suggests that the volcanic caldera that was the source of the tuff was in the Clan Alpine Range in eastern Churchill County.

Ventifact = Wind-eroded boulder of "Big Sanidine Tuff"

On top of the ridge, look for boulders of tuff that have been eroded and carved by wind action. Sediment-laden winds have "sand-blasted" some of the rocks in exposed places leaving characteristic pitted and grooved surfaces. These wind-eroded rocks are called "**ventifacts.**" Find several ventifacts and compare the orientation of the pits and grooves to try to determine the prevailing wind direction that caused the features.

Return to vehicles and proceed to the northwest on the same dirt road,

20.1 Turn left on the main Moon Rocks dirt road.

20.9 Turn left on unnamed dirt road to the south.

22.2 Turn left on unnamed dirt road to the east.

22.9 Turn right and park as many vehicles as possible in circular “drive” in the flat area on right.

Aplite-pegmatite dike cutting quartz monzodiorite

STOP 3: LUNCH STOP. Dike swarm. Take lunches and collecting tools and walk across the dirt road north and uphill a short distance to area of outcropping rocks. The most prevalent country rock here is a gray and black speckled intrusive rock called a **quartz monzodiorite**. It is similar to the rock that makes up most of Dogskin Mountain to the north. Here on the west flank of Warm Springs Mountain, the quartz monzodiorite is intruded or cut by a series of dikes of igneous rocks of different compositions and textures. Look for very light colored quartz-feldspar-mica rock called **aplite**. The rock is similar to granite, but it lacks the dark minerals that give granite its speckled “salt-and pepper” appearance. The very large-grained version of aplite is called **pegmatite**. You should be able to find dikes of aplite grading into the coarser pegmatite. Also present are dikes or inclusions of rock that is darker and finer-grained than the quartz monzodiorite; these are called “**microdiorite.**” Try to work out the relative ages of the different rock types, keeping in mind the “Law of cross-cutting relations” that says any rock that cuts across another rock is younger than the rock it cuts. Find your favorite boulder and enjoy your lunch while you ponder the sequence of intrusions! Also look for **ventifacts** here – the wind erosion features may be more subtle than at the last stop. Do they indicate a similar prevailing wind direction?

After lunch, return to vehicles and retrace route back down the hill.

23.6 Turn right on dirt road back to the north.

24.9 Turn left (west) back onto main dirt road from “Moon Rocks.”

25.1 Cattle guard

26.0 The long flat valley ahead is Bedell Flat. For the next few miles, we will be roughly following the Honey Lake-Bedell Flat fault zone, a right-lateral strike-slip fault similar in orientation and movement to the Warm Springs Valley fault zone along Winnemucca Ranch Road. Both are similar to the San Andreas Fault zone and reflect similar plate tectonic forces at work in northwestern Nevada as in coastal California. NBMG geologists mapping the geology of this area find that creeks draining the west side of Dogskin Mountain (north of the road) are offset to the right as a result of right-lateral strike-slip motion along the Honey Lake-Bedell Flat fault zone.

29.5 Turn right at dirt road “T” intersection.

31.5 Pull off road and park for a brief (ten minute?) stop.

STOP 4. Short stop by roadside to discuss fault features visible from this area. *(Watch for wild mustangs in this area too.)* We have just passed several low hills to the north that rise slightly above the flat valley floor. One is marked by a white caliche layer that has been exposed by erosion as the hill rose. Other hills are marked by bouldery alluvium deposited during Pleistocene wetter climatic periods and now exposed by erosion. These recently uplifted hills are interpreted as "pressure ridges" that are forming as a result of movement along the Honey Lake-Bedell Flat right-lateral strike-slip fault zone. The reddish and multicolored hills on the far side of the valley are volcanic tuffs. On the left side of the road are the Sand Hills, underlain by granite and uplifted along a Basin-and-Range type normal fault.

33.9 Turn left at dirt road "T" intersection. (The following directions will guide you through a few maneuvers to reach Red Rock Road avoiding washouts, gates and private property.)

34.6 Turn left on Dry Valley Road (no sign).

35.6 Turn right on Marshal.

36.5 Turn right on Deputy

36.6 Turn right on Frontier

37.1 Turn left on Gymkhana (no sign).

39.0 Turn right on Red Rock Road (paved).

40.8 Entering Red Rock Canyon

41.5 Cross California State Line

41.8 Turn right on dirt road, park among juniper trees near trailhead.

STOP 5: Red Rocks trailhead

Hike along trail to north to base of volcanic tuffs that form the red, gray and white cliffs visible to the north. These tuffs are for the most part younger than the "Big Sanidine Tuff" of Whiskey Springs seen at Stop 2. Look closely at the tuffs and notice how they differ from the tuff seen earlier. The first gray tuff we come to appears to contain fragments of many other rock types, but look closely to try to figure out whether the boulders are parts of younger sediments deposited against the tuff. These tuffs are softer and less welded tuffs than the one seen at Stop 2. Return to vehicles.

Three volcanic tuffs at Red Rock Canyon

41.9 Turn right from parking area back onto paved Red Rock Road.

42.5 Turn left onto U.S. Highway 395.

44.8 Turn left on dirt road, proceed through gate*; (last vehicle through, please close the gate).* Follow main dirt road east toward Petersen Mountain.

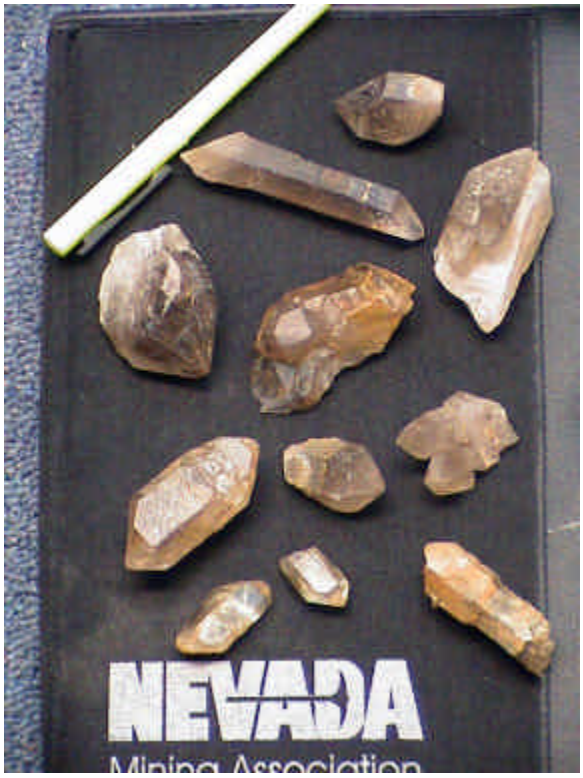
46.2 Bear left in area of junipers….some may want to park vehicles here and carpool the last steep, rocky, rutted half-mile up to collecting area, which has parking for only about ten vehicles.

46.7 End of navigable road. Park carefully so as not to block any other vehicles' exit.

STOP 6: West side of Petersen Mountain *(Patented claims cover the top of the hill so please respect private property boundaries and stay outside posted areas).*

Here we can search for and collect quartz crystals that formed in volatile-rich pockets in the granite as it cooled. Varieties that may be found include smoky, citrine, milky and clear quartz, and more rarely, amethyst. The most spectacular specimens of quartz to be found here are "scepter quartz" consisting of a "stem" quartz crystal with a larger diameter quartz crystal on the end. Scepters represent multiple episodes of crystal formation, probably due to changes in temperature, pressure, or volatile content of the cooling magma.

Crystals may be found anywhere on the slopes above and near the parking area; look for crystal faces that reflect the sun and pick them up to see if they are whole, six-sided prisms with terminations (points on the ends). Hammering is usually not necessary. Some collectors have success looking for crystals in the dirt that eroded off the slopes above or carefully examining or screening the dirt for crystals. You can often find crystal "twins" here - two crystals growing in different directions from the same plane. Happy hunting!



Quartz crystals collected on Petersen Mountain

When done, retrace your route back to Highway 395 and turn left (south) back to Reno.

Thank you for helping us celebrate Earth Science Week, which has been officially designated as the second full week of October by the Nevada Governor, the U.S. Congress, and the Association of American State Geologists to recognize the importance of geology and other Earth sciences to society. This field trip is sponsored the Nevada Bureau of Mines and Geology, with help from volunteers from the W.M. Keck Museum at the Mackay School of Mines, University of Nevada, Reno; Geological Society of Nevada; American Institute of Professional Geologists; Association of Engineering Geologists; Nevada Petroleum Society; Nevada Paleontological Society, Society for Mining, Metallurgy, and Exploration; Nevada Division of Minerals, U.S. Geological Survey; U.S. Bureau of Land Management.; and Nevada Mining Association.

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