Nevada Bureau of Mines and Geology Educational Series E-58

1915 Pleasant Valley Earthquake Centennial Field Trip Guidebook

A Public Field Trip to Visit the Largest Earthquake in Nevada's History

by

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Overview of Trip

The centennial anniversary of the 1915 Pleasant Valley earthquake is an opportunity to reflect on this event, what it did, what it means, and how it should influence us. This was the largest earthquake to date in Nevada's written record. It had some of the strongest and widest effects from shaking of all the historical events. And the earthquake offers many lessons and examples on how to live with earthquakes in ways to protect ourselves, our valuables, and our standard of living from earthquakes. In short, the 1915 earthquake reminds us that Nevada is earthquake country.

This handout provides a general guide to a half-day trip from Winnemucca to see the fault scarps at Golconda Canyon on the east side of Pleasant Valley. The drive passes by diverse geologic features, including rocks that date back 300 million years, basalts that were erupted 15 million years ago, and hot springs and earthquakes that have been active over just the past few hundred years. The area also has seen human habitation for thousands of years, starting with the Native Americans who called this area home. European settlers arrived in the mid-1800s, and many of them settled in the Winnemucca, Grass Valley, and Pleasant Valley areas starting in the late 1850s. This guide cannot begin to cover the entire geologic and human history of the area, so it just focuses on the features and people that were here when the big earthquake struck in early October 1915. The general route and place names are shown in figure 1 and described in a later section.

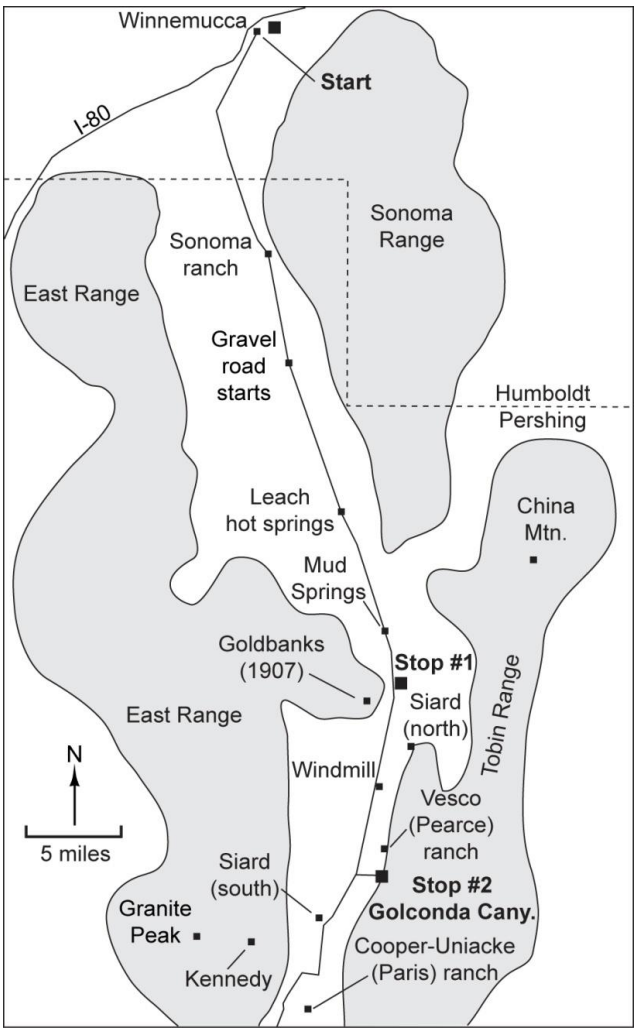

Figure 1. Route of the trip to see the fault scarps formed during the 1915 earthquake in Pleasant Valley. See the road log for descriptions of features and mileages along the way.

Why Are the Mountains and Valleys Here?

Nevada is part of the Basin and Range topographic province that has alternating mountain ranges and valleys. In the Winnemucca and Pleasant Valley areas, many of the mountain tops have elevations above 9,000 feet, and the floors of the valleys typically are 4,000 to 4,500 feet above sea level. What many people do not realize is that northern Nevada was nearly flat twenty million years ago, and that all of the mountains and valleys began to form about fifteen to ten million years ago. Actually, Nevada was not perfectly flat: it was a little higher to the east in the Carlin and Eureka areas, and all of the rivers drained to the west into the ocean in California. The Sierra Nevada, just like the ranges

near Winnemucca, is young, so the rivers and streams just flowed across what now is a mountain range.

To get an idea of how the ranges and basins formed, take a look at figure 2 in this guide. As shown at the top, the landscape was pretty subdued about 15 million years ago, when basalt flows were erupted across the land surface. They flowed out across a variety of much older rocks, some dating back into the Paleozoic era.

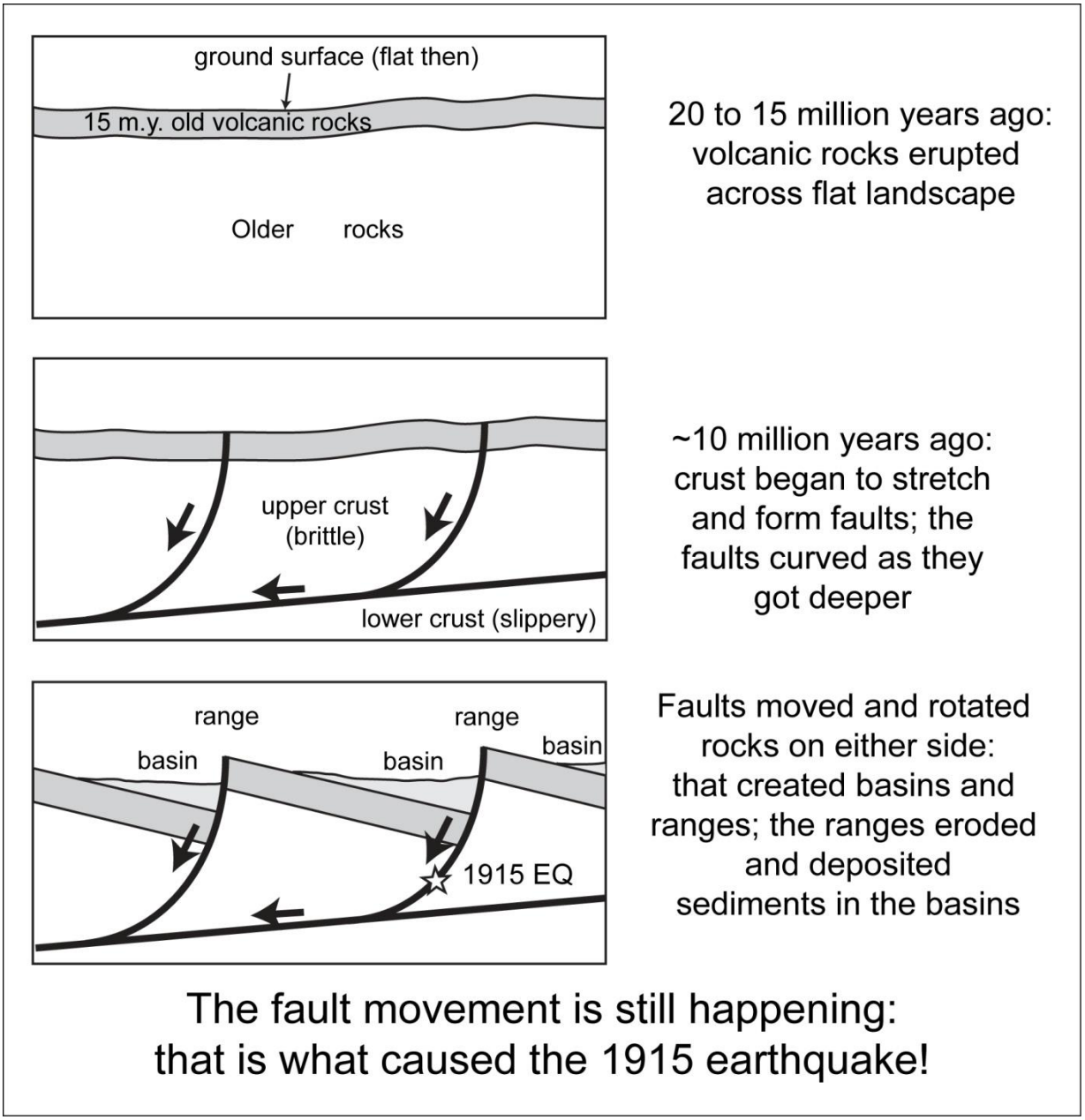

Figure 2. Formation of the mountains and valleys in the Winnemucca and Pleasant Valley areas. See the text for a description of each step.

About 10 million years ago, the Earth's crust in this part of Nevada began to stretch to the northwest, as shown in the middle part of figure 2. The upper part of the crust was brittle, and it was more slippery much farther down, perhaps five to ten miles beneath the surface. With the stretching, the brittle upper crust broke apart along faults, which extended down to a slide surface just above the slippery zone. The nature of the extension caused the faults to curve as they got deeper, and movement on the faults caused the blocks on either side of the faults to rotate. The once-flat basalt flows became tilted, which is a great way to see the rotation of each block. As you drive along, you'll see east-tilted basalt flows that cap the central part of the East Range and the Goldbanks Hills (figure 3); a good place to see them is ahead of you and off to the right just south of Leach Hot Springs. These tilted blocks and lava flows are called *louderbacks*; the prominent geologist George Louderback first recognized their significance to the formation of mountain ranges and faults in other areas, and they were named in his honor in 1930 by other geologists.

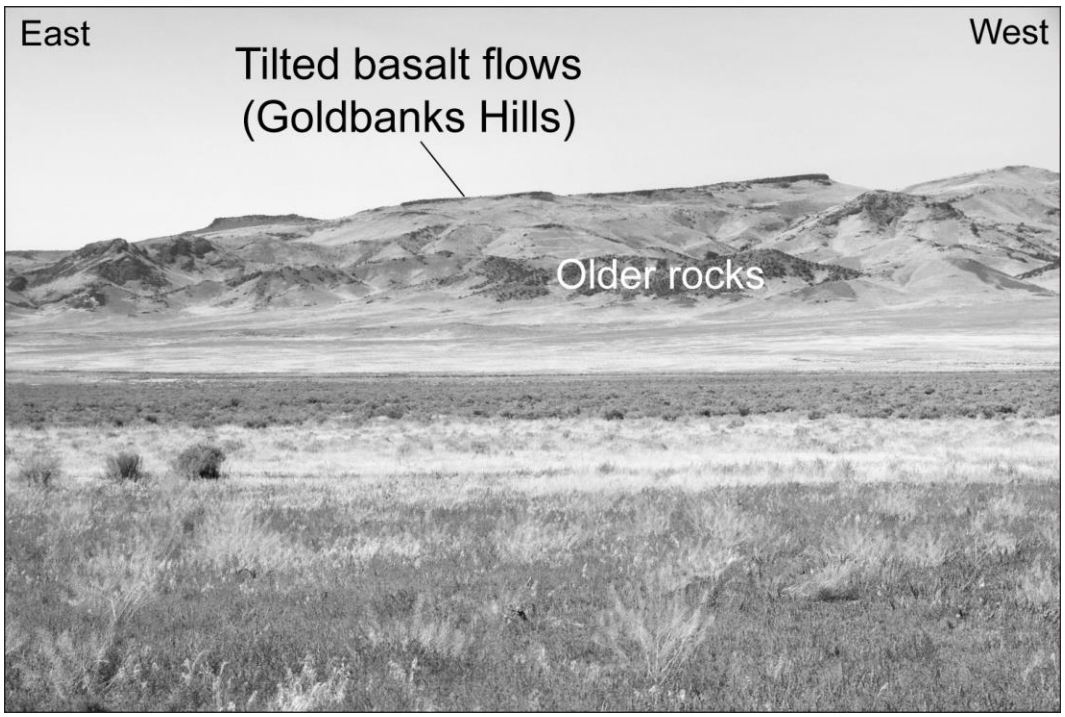

Figure 3. Photograph of basalt flows that tilt to the east in the Goldbanks Hills, which are along the driving route. These are the basalt flows that are shown in figure 2. The photograph was taken at Leach Hot Springs and looks to the southwest.

As the blocks rotated, they created mountains and valleys, shown in the bottom of figure 2. In geology, the mountains or ranges are called "horsts," and the valleys or basins are called "grabens." In this area, faults cut the west sides of the ranges. In the East Range, the basalt flows extend to the crest of the range and then are cut off, as shown in the figure. Just like today, rain and snow fell on the ranges, which caused erosion. Creeks carried all of the sand and gravel that was eroded in the ranges down to the valleys. With nowhere else to go, all of those materials gradually piled up in the valleys as the continued faulting progressively lowered the valley floors. The thickness of the sand and gravel in many valleys varies but can be a mile or more close to the range-front fault, as shown in figure 2. This valley fill is great for farmers and ranchers in the area because a lot of the water from the adjacent mountain ranges percolates downward and forms a nice aquifer that can be pumped with deep wells. As you drive along, you'll see center-pivot

irrigation systems that use these deep wells to tap the water far beneath the surface. In a few places, such as at Leach Hot Springs, the water descends deep along faults and gets heated. This hot water rises to the surface along the fault (the plumbing system) to form the hot springs at the surface.

This part of Nevada continues to stretch, and the result is that the faults continue to move. It takes a long time (thousands of years) for enough stress to build up to cause the faults to move. When they do, they created big earthquakes like the one that happened in 1915. The place where the fault broke during the 1915 earthquake was about 6 miles beneath the surface (see figure 2), and much of the fault—both up and down and along its length—moved as a result. Today, the fault scarps along the western side of the Tobin Range are beautiful evidence of the movement of that fault. It may have been terrifying to be there at the time, and the scarps are a sobering reminder of how powerful these earthquakes can be.

Road Log from Winnemucca to Pleasant Valley

The mileage for this trip begins at the intersection of Hanson Street, West Haskell Street, and Grass Valley Road in southern Winnemucca. The intersection has a stop light, and the Winnemucca Post Office is on the southeast corner of the intersection. The trip will go south along Grass Valley Road from that intersection. Winnemucca Boulevard is the main north-south street in Winnemucca. To reach the starting point at Hanson Street and Grass Valley Road, go along Winnemucca Boulevard to the stop light at Hanson Street in the southern part of town (the Holiday and Pyrenees motels are at the corner). Turn east (uphill) and drive about half a mile over the Union Pacific Railroad overpass to the stop light at Grass Valley Road.

NOTE AND CAUTION: The total round-trip distance of this route from Winnemucca is about 100 miles. The first third of the route going south is paved, with a few miles of treated gravel at the end, and it then is a reasonably good graded gravel county road for the remaining two thirds of the route. The route does not have any services, especially gasoline and water. Fill up your gas tank before you leave Winnemucca. Depending on your cell phone and service provider, your cell-phone service will end not far beyond where the gravel road starts. Do not make this trip unless your car is in good condition, with good tires (and spare and a jack), and make sure that you have extra water and food in case of an emergency; warm clothing is a must in cooler weather. A few ranches are scattered along the route: they are widely spaced and could require miles of walking to reach them, and the residents might not be at the ranch buildings to provide help. The road continues south into Dixie Valley and west (over McKinney Pass) to Lovelock. Both routes are even more remote, and the road to Lovelock does not have any ranches or shelters. All of the non-paved roads can become treacherous in wet and snowy weather, and getting stuck is always a hazard that could be life threatening if you are not properly prepared.

Mileage:

(Note: left and right are based on driving south from Winnemucca. Thus, left is to the east and right is to the west.)

0.0 **START.** Intersection of Hanson Street, West Haskell Street, and Grass Valley Road. Reset trip odometer and proceed south along Grass Valley Road. You will pass by various business and then Grass Valley Elementary School (3.0 miles) and housing areas. Please obey the speed limits, especially when school is in session and the lights are flashing.

7.5 Cattle guard and the unmarked border between Humboldt and Pershing counties. The route will become more rural as one enters the ranchlands of Grass Valley.

10.7 Sonoma Creek road turn off to left. The rocks in the Sonoma Range are a complex mixture of Paleozoic and Mesozoic sedimentary rocks that have undergone several intense episodes of deformation. That deformation folded and deformed the rocks and created many faults.

11.3 Sonoma Ranch on the left (east) side of the road.

John Guthrie from Unionville bought the land here in about 1870 and started what became one of the largest ranches in the area. Springs rising along a fault at the base of the mountains just to the east provided ample water for fields and cattle. His son, Will Guthrie, was the Humboldt County Assessor from 1890 to 1908, and Will's siblings and children owned or managed several other ranches in Grass Valley and Pleasant Valley over the decades. The ranch also was the first stage stop on the route from Winnemucca to the Kennedy mining district starting in the early 1890s.

13.2 End of the pavement and start of the treated (magnesium chloride) gravel road. Clearwater Creek forms the deep canyon in the Sonoma Range to the left.

16.6 End of the treated gravel road and begin graded gravel road. Depending on your vehicle and driving skills, try to not exceed 45 miles per hour because of local washboard conditions and the longer distance to stop on a gravel road. Also, be aware of RANGE CATTLE that have wandered into or next to the road. For some reason, they always want to be on the *other* side of the road when they see you coming and will cross in front of you at the last second. Slow down if you see cattle ahead of you and be prepared to slow down or stop.

25.2 Leach Hot Springs on the left (east) side of the road.

NOTE: This is private property immediately on both sides of the road. Do not leave the road itself. The water in the hot springs is literally boiling hot and will cause severe burns in just seconds. You can look from the road, but do not wander off the road or touch the water.

The Leach family first claimed the hot springs in the 1800s, and stage lines down to the Kennedy district in the 1890s and 1900s stopped here to water the horses (the water ran down ditches to cool). The hot water rises along a fault that cuts northeast through this area, connecting the Goldbanks Hills to the southwest to the range-front faults along the west side of the Sonoma Range. Nevada's crust is being pulled apart to the northwest, so northeast-trending faults like this tend to be better "plumbing" systems that allow the deep, hot water to rise to the surface (Sorey and Olmsted, 1994).

29.0 Panther Canyon Road to left (east), leading to the southern end of Pumpernickel Valley and over Smelser Pass to Buffalo Valley. The low pass divides the Sonoma Range to the north from the Tobin Range to the south. The high, flat-topped peak on the east horizon is China Mountain. The northernmost fault scarps related to the 1915 Pleasant Valley fault are along the western base of the mountain (Wallace, 1984).

Just past the turnoff, mine workings are visible along the base of the Tobin Range. This was the Big Mike open-pit copper mine that was active in the late 1960s and early 1970s. The host rocks for the deposit are Pennsylvanian (about 290 to 323 million years old) rocks that were deposited at the seafloor: this part of Nevada was covered by an inland ocean at that time. The metals were discharged from hot, ocean-floor vents—similar to the "black smokers" that are active today in the Gulf of California and other places—and deposited in the ocean-bottom sediments and volcanic rocks (Snyder, 1977; Rye and others, 1984).

31.3 Mud Springs Ranch. The ranch is on the right, and the springs are on the left side of the road just beyond the ranch. The water flows through a culvert beneath the road, and the cattle love to hang out in this area. DRIVE VERY SLOWLY AND LET THE CATTLE GET OUT OF THE WAY.

The ranch, like many others in Grass and Pleasant Valley, started in the late 1860s and 1870s and went through a series of owners into the 1900s. The springs provided water for the stage and freight wagons to Kennedy, and the ranch also had a way station for travelers. Will Pearce and his nephew Louis Pearce were heading back to Pearce's ranch in Pleasant Valley when the first earthquakes hit on the afternoon of October 2, 1915. Pearce told Leon St. D. Roylance that the ground was "in such turmoil he was afraid to proceed further owing to the rumbling around and the convulsive motion of the ground" (Roylance, 1915). With each foreshock, "the water of the spring spurted up in the air." Not surprisingly, he waited until morning to finish his trip to his ranch. The shaking also moved a wood-framed house about a foot off of its foundation, but it otherwise remained intact (Jones, 1915).

34.2 **STOP #1**. Main road above the windmill down the hill.

This is a good place to see the Tobin Range and think about the fault scarps that formed along its entire western base. The range just to the southeast has two parts (see figure 4): the high eastern part called the Mount Tobin block that extends south from China Mountain, past the high point at Mount Tobin (named after rancher Clement Tobin), and on to the north end of Dixie and Jersey Valleys. The lower, slightly more western part of the range, called the Pearce block because it passes next to the Pearce (now Vesco) ranch, starts just to the south of us and continues to Dixie Valley. The two blocks are very visible behind the northern Siard ranch just to the south (figure 5). The faults along the western side of the high, eastern part die out to the south, and the two segments of the range merge into one as one goes south. The 1915 fault scarps, shown in dark lines in figure 4, formed along the western sides of the two blocks. The fault scarps along the Mount Tobin fault die out to the south at about the same place where the faults along the Pearce block begin. In geology, this pattern is called *en echelon* faulting. This pattern probably began to form when the ranges first began to rise millions of years ago, and it continues to the present day.

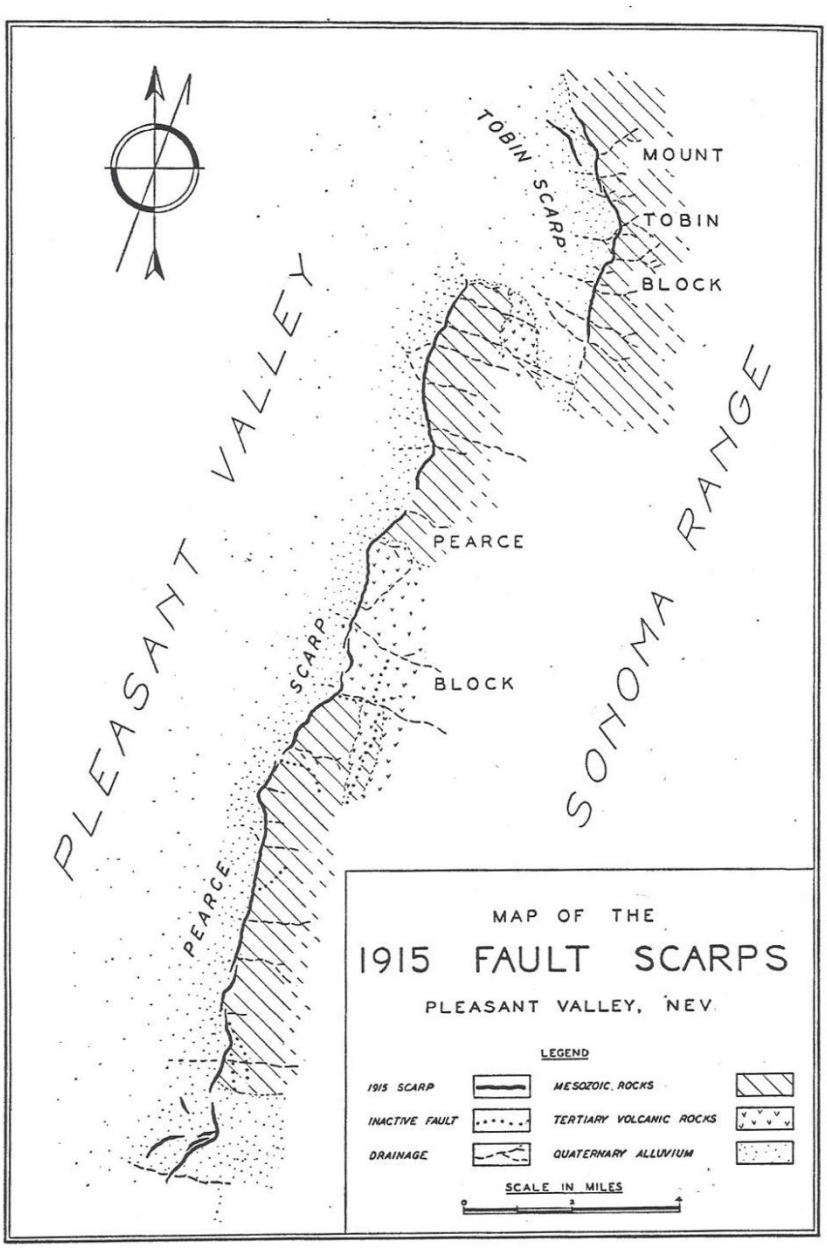

Figure 4. Map showing the western range front of the Tobin Range and the Mount Tobin and Pearce blocks. Stop #1 of the field trip will be near the top left border of the figure, just north of the direction symbol. From Page (1935). See the photograph in figure 5 to see the differences between the two blocks.

Figure 5. The northern Siard ranch (once the Schell ranch), looking east, showing the northern end of the Pearce block just behind the ranch and the much higher Mount Tobin block behind it. The semi-horizontal white lines along the hillside to the right (south) of the ranch are fault scarps that formed during the 1915 earthquake.

It is possible to see vestiges of the fault plane along which the Pleasant Valley earthquake occurred along near the base of the Tobin Range. Look at some of the spur ridges that are perpendicular to the range front: you can pick out some flattish lower parts just above the fault scarp. Almost like the bottom of an iron. These are eroded remnants of a fault plane and are called fault facets. Then imagine putting a board along all those facets and that the board extends down beneath the surface; that board mimics the plane of the fault. The fault plunges westward at an angle beneath the valley, and it is actually beneath where we are standing. In geology, the "tilt" on a fault or bed of rocks is called the "dip."

People commonly do not appreciate how truly large earthquake faults are. The seismogenic, or earthquake producing, part of this fault extends down to 8 to 10 mile depths (figure 2). As a reference frame, the valley here between the Tobin Range and the Goldbanks Hills is about 5 miles wide. We aren't certain where the epicenter for the 1915 earthquake was. The earthquake could have initiated on any of the range-bounding faults, but if it started on the China Mountain fault or Tobin fault, the epicenter was likely to the west of us. This is because the lower part of the seismogenic zone is the strongest, and the strongest part is thought to fail first.

The 1915 earthquake likely nucleated down deep and ruptured both upward towards the surface and sideways. As the rupture propagated along, it jumped from fault to fault until it ran into some sort of barrier in the system and stopped. At the southern end of the rupture, faults dip more towards the east, which may have arrested the propagating rupture. Depending on where exactly the

epicenter was in the overall earthquake (was it in the middle or on one end?) the entire earthquake rupture probably took between 15 to 30 seconds to occur. Where the earthquake broke out at the surface is where the fault scarps were formed. Seismic waves were being produced the entire time the earthquake rupture was taking place. They travelled out from the rupture in all directions. Some hit the surface, some travelled along the surface, and some were trapped in the valley sediments. Damaging levels of shaking spread out much farther than the immediate earthquake area, although the Pleasant Valley area received the strongest shaking.

A large earthquake deforms a large area and releases a lot of energy. Stored elastic stress in the Earth from extension and wrenching is released as the rupture propagates across the fault, abruptly sliding rock against rock. Most of the deformation is the valley falling down, but the mountains are relieved by the shift of the weight off of them, and rebound upwards. The mountains tilt a little because of this, with the largest offset near the fault that tapers away to zero several miles back away from the fault. The deformation of the valley and mountains causes water tables to tilt and springs can increase flow or dry up as they did following the 1915 earthquake; these changes commonly are only temporary. Newspaper reports in 1915 described many new springs in the area, and most of these had dried up by a year later. Geothermal systems are more dynamic in nature and can be disrupted by seismic waves passing through them for hundreds of miles from an earthquake. Geothermal systems were affected by the shaking from the 1915 earthquake as far away as Elko and Carson City.

The hills just to the west of the road here are called the Goldbanks Hills. The rocks in that area include Paleozoic and early Mesozoic (Triassic) sedimentary rocks that, like the Sonoma and East Ranges, have been deformed. Starting at about 15 million years ago, volcanic eruptions produced basalt lava flows that were erupted across the landscape. These form the flat-topped cap on the Goldbanks Hills and central East Range on the far horizon (see figure 3). As shown in figure 2, the later formation of the mountains and valleys tilted those once-flat-lying basalt flows to the east.

The mine workings that are visible along the hillsides just west of the road were related to the Goldbanks mining district (Dryer, 1940). A.P. Smith discovered rich veins in 1907, and a small boom town sprang up within a few months. The veins produced good ore from the shallow, oxidized zone, but the boom ended a year later after the ore was mined out. The town had several businesses, such as saloons and livery stables. In the 1910s and again in the 1930s, areas farther to the west in the Goldbanks Hills were mined for mercury. Hot springs formed near the volcanic centers about 14 million years ago, and the hot water carried mercury and gold that were deposited near the surface in a setting similar to that at Leach Hot Springs (which does not have mercury or gold) (Connors and others, 1999). Gold exploration starting in the late 1900s, and continuing episodically to today, has tried to identify a gold deposit that can be mined.

You are now in Pleasant Valley, which is the broad valley to the south between the Tobin Range to the left and the East Range to the right.

37.0 Turnoff (left/east) to the Siard ranch. Private road: do not enter.

The ranch started in the late 1860s to early 1870s. The John Schell family purchased it in 1893 (along with much of the land in the northeastern part of Pleasant Valley) and then sold it to sheep

rancher Sylvain Siard in 1910. Siard later also purchased the former Sweeney ranch farther south along the valley, and the two ranches were known for many decades as the northern (Schell) and southern (Sweeney) Siard ranches. Today, signs at the entrances to both ranches say Siard, although the southern ranch has a new owner.

Siard was the owner of the Schell ranch at the time of the 1915 earthquake. The fault scarp formed right behind the ranch buildings at the mouth of the canyon. Roylance (1915) stopped by the ranch and was told that "everything was down—house and stables." One house made of unmortared blocks apparently remained standing (Watson, 1986). The fault scarps at the ranch are still very visible (figure 5).

39.4 Windmill to the left. The site once held Frank Long's house, barn, hayfield, and small orchard. Siard purchased the site in the late 1900s after Long's death and likely used the water for his livestock.

42.5 Turnoff left to the Vesco ranch. Private road: do not enter.

Moses Bushee from Unionville started the ranch in the late 1860s and used the perennial creek water to develop a large orchard and hayfields. He sold the ranch to Will and Nick Pearce in 1900; Will bought out his brother a few years later and then expanded the ranch – with his daughters and one son as the primary ranch hands – into the 1950s.

The Pearce's owned the ranch at the time of the 1915 earthquake. The fault scarp formed right behind the ranch, and many of the buildings sustained heavy to complete damage. The main barn collapsed in the main earthquake, not long after the family herded the horses outside. One of the Pearce's daughters, Mabel, provided many first-hand descriptions her oral history (McCoy, 1987), and Folgate (1987) recounted some of those and many other descriptions from the region.

The geology in this part of the Tobin Range in this area is different than in other parts. The underpinnings are the Mesozoic sedimentary rocks (the grayish rocks that are evident in many places) that underlie most of the range, but the area also has a large package of middle Tertiary (about 30 million years old) volcanic rocks. Those are the brightly colored rocks that are very evident just behind the ranch. This area, before the Tobin Range formed, had a canyon that drained from central Nevada west to beyond Lovelock. Huge volcanic eruptions to the east (such as near Cortez south of Battle Mountain and in the Fish Creek Mountains a little closer) poured out large quantities of hot volcanic ash that traveled west like a flood down the canyon (Gonsior and Dilles, 2008). Those are the brightly colored rocks that you see. In the Miocene, about 15 million years ago and before the Tobin Range formed, a northwest-trending fault cut the volcanic rocks and tilted them to the east-northeast, sort of into the mountain range itself. At Stop #2 at the mouth of Golconda Canyon, we'll be standing in the Mesozoic rocks, but the original base of the volcanic rocks will be just above us and in the hillsides just to the north. One of the questions that still has not been answered is if the nature of the fault scarps changed because of the type of rock that they cut. Samples of both the Mesozoic limestones and the Tertiary rhyolite volcanic rocks can be collected at Stop #2.

As you continue south down the road, the high peak in the East Range (about 2 o'clock on the horizon) is Granite Mountain. The Kennedy mining district was tucked into Cinnabar Canyon at its eastern base. Charley Kennedy discovered the first veins in Cinnabar Canyon in 1891, and the town boomed with more than 500 people in 1894. After a six-year decline, several mining companies arrived in the early 1900s and created a second boom that lasted until 1905. Later mining was on a much smaller scale, and two companies were using the mills at the time of the 1915 earthquake. The owner of one of the companies—Leon St. D. Roylance—was a trained engineer and had lived in San Francisco during the 1906 earthquake. His wrote up his observations of the earthquake shaking and the damage in Kennedy and at the ranches, and he sent them to the *Silver State* newspaper in Winnemucca a few days after the event (Appendix). Those first-hand reports were extremely important for geologists and seismologists who studied the earthquake and its causes, from Professor J.C. Jones in the weeks after the earthquake (Jones, 1915) to very recent studies. The earthquake shaking damaged many of the underground mines and caused one of the settling tanks at Roylance's mill to collapse (Roylance, 1915; Berry, 1916; numerous articles in the *Silver State* in late 1915 and early 1916). After the town's residents were thoroughly shaken by the major foreshocks in the afternoon, they were rudely awakened by the main shock, which occurred at about 10:53 p.m. Several people were thrown out of bed and one leapt out through a bedroom window. Most of the residents spent the chilly night outside.

The ranch that is visible in the valley went by various names over time. It started in the 1860s, and Patrick Sweeney owned it from the 1870s to 1900, so it was known as the Sweeney ranch. Various people and companies owned or managed it in the 1900s (including Will Guthrie's brother Frank and son John I. Guthrie), and Sylvain Siard, William Cooper, and Crofton Uniacke owned various parts of it starting in the 1910s. At the time of the earthquake, Siard owned the part that had the ranch buildings, and it was known as the southern or lower Siard ranch. Farther south in the valley is another large ranch owned for decades by Susan Miller and then William Cooper and Crofton Uniacke by the time of the earthquake. Topographic maps show it as the Paris ranch, after the family that purchased it in the late 1940s. Buildings at both ranches suffered moderate to severe damage during the earthquake (Roylance, 1915; Folgate, 1987; McCoy, 1987).

44.0 Turnoff (left/east) to Golconda Canyon. A faded sign says Golconda Canyon. Drive about a mile and a half towards the Tobin Range to the mouth of the canyon. Do not go beyond this point. Flash floods in the summer of 2015 damaged many sections of the canyon road, one near the mouth of the canyon, and the road beyond this point passes through private property. We are parking before we get to the range front in an area that facilitates several cars and turning around.

Looking south from the Golconda Canyon turnoff, the hills in the middle ground are the Sou Hills. The southernmost section of the 1915 surface rupture is along the west side of these hills.

45.3 **STOP #2**. 1915 fault scarp (figure 6). Walk up to where the road is about to enter the canyon. The fault scarp that formed in 1915 is visible as a fresh scar near the base of the hillslope to the south of the road. The ground is offset 13 feet along this hillside. We will gather for Stop #2 where the road crosses the fault scarp. You can see that the surface rupture offset the canyon floor, leaving the 1915 surface projecting out into air. A small channel has been downcut into the surface and sediment has been deposited at the base of the fault scarp. As a result, the scarp is only about 10

feet high. South of the road, the upper parts of the scarp are vertical exposures of bedrock and colluvium (dirt and rocks that build up on the slope), which is called the free face of the scarp. The lower parts are debris slopes that have built up on the scarp since 1915, as rain and snowmelt have washed materials downward. Eventually the entire scarp will be covered with the debris slope. One of the largest scarp faces related to this earthquake had 18 feet of vertical offset, and it is a little less than a half mile to the north of the road, along this same rupture zone.

Figure 6. Fault scarp that formed during the 1915 Pleasant Valley earthquake at the mouth of Golconda Canyon. This is what you will see at Stop #2. The road leading up Golconda Canyon is on the left. Do not drive beyond this point.

Shaking from the main shock lasted for 40 to 55 seconds over a large area of northern Nevada. At Kennedy, people were "violently thrown out of bed and buffeted in all directions" according to Roylance (Appendix). Nearly continuous aftershocks created nearly constant ground motion in Kennedy for at least 15 minutes after the main shock. Based on reports from people farther away from Pleasant Valley, Jones (1915) characterized the motion as a "rapid series of swings, with little jerking or vertical motion." Most of this fault scarp probably formed in a matter of seconds as the earthquake rupture passed this point. There also may have been small cracks and fault offsets that formed from foreshocks and aftershocks, and some afterslip or surface settlement in the months following the earthquake. Roylance climbed up a hill after the afternoon foreshock and noticed a line of dust "skirting the east side of the valley, from about Mount Tobin south to Pearce Ranch." That dust may have been from movement of the fault during the foreshock. Every ranch in Pleasant Valley suffered severe effects and damage from the 1915 earthquake, including collapsed and partially collapsed houses and barns, broken water lines, and badly cracked ground that had liquefied. The surface rupture formed under one house that was tipped into the fault line; the lone resident in the house was so frightened that he ran three miles barefoot to the main ranch. Damage

from the shaking took place more than 50 miles from the earthquake area. For example, in Fallon, about 66 miles southwest from the earthquake, brick buildings were cracked and plaster fell. In the town of Rochester, about 25 miles east of the earthquake area, a kerosene lantern was knocked over in a cabin and burned the cabin down.

The fault scarp at the road and the large free face south of the road make great places to get a picture of yourself next to the surface rupture. We will take two short walks to look at the character of the rupture. Please be careful walking in the field and watch where you are placing your feet. The scarp is spectacular, but please stop walking when you are looking around so you do not trip.

The 1915 Pleasant Valley earthquake reminds us that Nevada is earthquake country and that we can experience an earthquake like this at any time. Nevadans need to be prepared so they can protect themselves from strong shaking and so that the economic losses from earthquakes are bearable, through mitigation or insurance. When you first feel strong shaking, **Drop, Cover, and Hold On**, protecting yourself from falling objects. Valuable objects should be placed where they will not get broken or be secured. In the event of possible shaking, make sure you are safe first then check on your neighbors after strong shaking. A pioneering spirit to work hard to right things and help one another will help recover from an earthquake. That is exactly what the Pleasant Valley residents did after the earthquake: they checked on their neighbors and helped out where they could. Please see ***Living with Earthquakes in Nevada*** for a guide to earthquake safety (available at the Nevada Bureau of Mines and Geology website; www.nbmg.unr.edu).

After visiting the Golconda Canyon fault scarps, go back down to the main road and make sure that you turn right back towards Winnemucca. Please have a safe drive back and remember to slow down for the cattle. If the sun is out, the surface rupture will be highlighted in the afternoon and may be more distinct along the range front.

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Appendix: Leon St. D. Roylance's Earthquake Account [1]:

The first indication of disturbance was felt at exactly 3:40 p.m. Saturday, 2nd inst., when with a terrific report, similar to a large dynamite blast, the mountain side of Kennedy gave a lurch due north and then vibrated for about five seconds in a manner which I would say was rather violent, considering California disturbances. This shock had hardly subsided when another deep rumble was heard, followed by swaying motion, which appeared to be in a northerly direction. From this time on it was one continuous disturbance; one quake hardly died before a rumble announced another. This state of affairs occurred continuously until 5:45 p.m. when the only indication that conditions were not right was a sort of subdued rumble, such as might be experienced were there a great cauldron boiling and bubbling under foot, just beneath the earth's surface. About this time the inhabitants at Kennedy apparently became accustomed to this condition and settled down satisfied that the disturbance had spent itself and was a thing of the past, when all of a sudden without the slightest warning a great roar was heard and the earth's surface began to roll and sway up and down, evidently in all directions. This convulsion continued without stop for fully one and a half minutes. This disturbance was in my estimation about twice as violent as that experienced in San Francisco in 1906.

During this performance of the earth it was next to impossible for a person to stand erect. From this disturbance on, it was incessant continued disturbance, the earth never appeared quiet. About 9 p.m. we retired for the night and as near as I can imagine the situation, one could shut his eyes and imagine he was occupying a berth in a moving Pullman car, accompanied with creakings and rattling of windows, to be abruptly awakened by outbreaks at intervals of twenty to thirty minutes, lasting from five to ten seconds. At 10:55 things had quieted, or perhaps we were unconscious in sleep, when without the slightest warning a great roar and rumbling was heard and we were thrown violently out of bed and buffeted in all directions continuously for not less than fifteen minutes. During this disturbance it would appear to tire itself and would hesitate for an instant as if it were changing hands and fumbling in trying to get a good grip and would then shake violently with the other hand; then it would change hands and repeat the operation. This shake started at 10:55 p.m. Western Union time, as recorded[2]. I did not note the time of starting, but when the disturbance subsided sufficiently to allow one to enter the house in quest of sufficient apparel, as it was next to freezing outside, I noted the time was 11:10 p.m.

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[1] Account from Letter to the Editor of the Silver State, October 5, 1915 edition, by Leon St. D. Roylance.
[2] The best estimate for the origin time of the earthquake is approximately 10:53 p.m. PST on October 2, 1915.