

The November 21, 1910 Tonopah Junction Earthquake, and the February 18, 1914 and April 24, 1914 Reno Earthquakes in Nevada

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“It began with a mumble and a rumble and a grumble, then a vibration, followed by an oscillation, a tango, a turkey trot, Castle glide, Century Club wiggle, Belle Isle joggle and a Verdi rag.”

Reno Evening Gazette
April 24, 1914

“We like these earthquakes in Nevada. They are indicative that the earth is settling and settlement is what Nevada wants.”

Reno Evening Gazette
April 24, 1914

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Abstract

The 1910 Tonopah Junction and 1914 Reno earthquakes, occurring in the decade following the great 1906 San Francisco earthquake, caused local nonstructural damage. These earthquakes are listed as magnitude 6 in most earthquake catalogs. This study compiled accounts of these earthquakes, developed a picture of the effects, and attempted to constrain their size and location.

Little information was found for the 1910 Tonopah Junction earthquake, only an account from the Goldfield Daily Tribune. Until more detailed letters or diaries are found, perhaps at the central Nevada museum, the current Tonopah Junction location (where windows were broken at the telegraph office) and reported size (M6) remain the best information available. However, the lack of reporting of the earthquake in the Reno and several regional newspapers may indicate the magnitude has been overestimated.

Over 106 accounts have been assembled and documented for the 1914 Reno earthquakes. Intensities were assigned to 26 locations for the February 18, 1914 earthquake and to 53 locations for the April 24, 1914 event.

The February 18th earthquake was the first major event of an earthquake sequence that repeatedly shook the Reno region in the spring of 1914. The earthquake occurred on February 18 at 10:17 a.m., while people were at work and children were in school. Shaking in Reno, Sparks, and Virginia City was so strong that people rushed to the streets fearing buildings might collapse. In Reno, the earthquake broke windows, cracked walls, and sent parts of the fire wall and ornamentation of the Saturno building crashing to the street. The courthouse was shaken severely, cracking the plaster inside. At the University of Nevada, a few bricks were thrown from the chimney of the physics building, and the “students and professors vied with one another in an attempt to be the first outside” of the buildings. In Virginia City, several windows of the Second Ward School were broken, plaster was cracked in buildings, an old house on A Street fell down, and a few bricks fell to the street from the Post Office building. At Carson City, the shaking was not as strong as at Reno and no damage was reported. The earthquake was also felt at Verdi, and Clark in Nevada, and at Truckee, Loyalton, Portola, and Susanville in California. The earthquake was not noted at Gardnerville, Yerington, or Neuzel (south of Lovelock).

The April 24th earthquake was the largest event in the 1914 Reno earthquake sequence, and it was the largest earthquake in the United States that year. The nighttime earthquake (12:34 a.m. PST) caused damage in Reno, and was felt as far north as Winnemucca, as far east as Elko, as far west as Berkeley, and as far south as Randsburg in California; it might have been felt even further out if it had occurred during the daytime. People were awakened from their sleep as far away as the Great Valley in California, and in Sacramento, people rushed to the streets from buildings in their nightclothes. At least five aftershocks were felt through the night following the mainshock; earthquakes were also reported on April 25 and 26, which were either aftershocks or possibly related to a second earthquake source area to the south, closer to Virginia City. In nearly every aspect, the April 24th earthquake had significantly higher intensities than the

February 18th quake, but the locations of the origins of the earthquakes were likely similar, indicating a larger magnitude for the April event. A major foreshock at 8:03 a.m. (PST) the day before was the third largest event of the sequence. In Reno, people scrambled to the streets from saloons, restaurants, and hotel lobbies. The earthquake was most severe at University Hill knocking down two chimneys at Manzanita Hall, leveling two chimneys at Lincoln Hall, and toppling the stack on the Hatch building. Glassware was broken and instruments were upset in the physical and chemical laboratories. At least one residence lost several square meters of plaster in a bedroom, had a chimney shaken to its foundations spilling bricks, and had a broken window. In Virginia City, people who were up dashed into the streets, pictures were jarred from the walls, dishes were thrown from shelves, and plaster was broken from ceilings of some residences.

In Carson City people were awakened, and those that were up rushed to the streets; the shock was of several seconds duration. At Loyalton, California, bricks fell from chimneys and the brick walls of the Montague drug store were cracked. The shock was also severe and lasted for about 10 seconds at Alta, California. At Winnemucca, Nevada, the earthquake was felt throughout the town, awakened many people from their slumbers, overturned a clock on a shelf, and set a rocking chair to rocking. The shock was also quite severe at the communities of Gerlach, Lovelock, and Seven Troughs.

An aspect that distinguishes the April 24th earthquake from the February 18th is the effect on the Great Valley of California. At Sacramento, many tall buildings rocked considerably and the guests of many uptown hotels were awakened and rushed to the streets in their nightclothes. At Marysville, people were aroused from their sleep by vibrations that lasted from 5 to nearly 15 seconds, and rushed into the streets. People were awakened in the Great Valley by a few to several seconds of shaking from Stockton in the south to Chico in the north.

There likely were two sources of earthquakes were active during early 1914, when the felt patterns of some of the aftershocks are considered. In particular, a small series of earthquakes on the morning of April 25, 1914 (main event 9:18 a.m. PST) appears to have shaken Virginia City and Carson City more than Reno. In Virginia City people rushed out of their homes to the streets from tall buildings, several women fainted, a brick chimney was shaken over at the Cole building, and plaster fell in a number of residences. At Carson City, four earthquake shocks occurred in the morning and caused people of the city to roll around for a few seconds and many ran into the streets. The shaking was also very strong at Bowers Mansion in Washoe Valley. All of these locations are to the south of Reno, indicating the April 25th event was south of the preceding events.

The damage patterns and sizes of the main 1914 earthquakes indicate an origin close to Reno. The intensity patterns and descriptions of effects are consistent with the two earthquakes having roughly the same epicenter; thus the distribution of relative effects was the same between events, but the effects of the April earthquake were more severe and far more widespread, consistent with its larger size. Both the February 18th and the April 24th earthquakes caused significant damage and panic in Reno. The estimated size of the February event (~M5.1) is an important

limiting factor for this common epicenter. Even though damage was very limited and nonstructural, this was a small earthquake and it must have occurred very close to Reno. As noted by Priestley (1981), the effects of the February 18th and April 24th quakes do not appear to be as severe in Carson City as those at Reno, Sparks, and Virginia City, thus the epicenters seem more likely to be in the Reno part of the MMI VI area.

In Table 5 several different magnitude estimates are presented for each of the earthquakes, but for both events the intensity MMI V isoseismal area is deemed the best for estimating the magnitude. The preferred magnitude estimates generated by this study are 5.1 ± 0.3 for the February 18, 1914 earthquake and 6.1 ± 0.3 for the April 24, 1914 earthquake.

1910, November 21, Tonopah Junction Earthquake

EARTHQUAKE SUMMARY

The 1910 Tonopah Junction Earthquake occurred on November 21 at about 3:23 p.m. (PST), and was preceded by at least four foreshocks, the largest occurring three days before the main event.

The largest earthquake, estimated to be a magnitude 6.1 by Slemmons and others (1965), broke windows and threw a watchman's car from the tracks (Townley and Allen, 1939). As a note, Tonopah, Nevada is significant distance from Tonopah Junction (~77 km; ~48 mi).

There are several interesting comments in the single newspaper account we have found of these earthquakes (the *Goldfield Daily Tribune*, 11/23/14). The account confirms that multiple earthquakes occurred and clearly mentions that Tonopah Junction is the location of one of these events (~6:00 a.m., Nov. 22? wrong date?). The account further suggests the earthquake was felt as far north as Mina and as far south as Rhyolite, an observation partially verified by a lack of reports of the earthquakes in newspapers to the north. Another interesting observation is that the "shocks felt recently ... seem to follow an adjacent range of mountains." Unfortunately there are several ranges in different directions around Tonopah Junction.

EARTHQUAKE SEQUENCE

November 1910 Tonopah Junction Earthquake Sequence (PST)

Nov. 7	9:20 a.m.	S. NV eq.	Windows and dishes broken in Goldfield
Nov. 18	6:25 p.m.	foreshock	15 sec. shock
Nov. 19	9:57 a.m.	foreshock	5 sec. shock
Nov. 20	6:20 a.m.	foreshock	rumbling
Nov. 21	3:20 p.m.	foreshock	5 sec. shock
	3:23 p.m.	mainshock	2 min. shaking
	4:30 p.m.	aftershock	15 sec. shock
	10:00 p.m.	aftershock	10 sec. shock
	10:05 p.m.	aftershock	25 sec. shock
Nov. 23	10:59 p.m.	aftershock	5 sec. shock
Nov. 24	8:30 p.m.	aftershock	5 sec. shock
Dec. 21-22	1145 p.m.	aftershock	
	night	aftershock	

EARTHQUAKE CATALOG ACCOUNTS

Townley and Allen (1939)

1910 November 7. 9:20 a.m. VII? Southern Nevada. This shock was felt from Goldfield, Esmeralda Co., to Rhyolite, Nye Co., a distance of about sixty miles. A few windows and dishes were broken in Goldfield.—Reid's Scrapbook, **3**, 105.

1910 November 18. 6:25 p.m. VIII? Tonopah Junction, Esmeralda Co. Reid assigns as intensity of VIII. The only other statements are that the duration was fifteen seconds and that the shock was accompanied by a loud rumbling noise. This information and that for the following shocks felt at Tonopah Junction was obtained from a letter from H. B. Vandersaal written November 29, 1910.—Reid's Card Catalog.

1910 November 19. 9:57 a.m. III-IV. Tonopah Junction. Duration five seconds; rumbling sound.—Reid's Card Catalog.

1910 November 20. 6:20 a.m. III-IV. Tonopah Junction. Rumbling sound.—Reid's Card Catalog.

1910 November 21. Tonopah Junction. The following shocks were reported by H. B. Vandersaal:

<i>Time</i>	<i>Duration</i>	<i>Intensity</i>
3:20 p.m.	5 sec.	—
3:23 p.m.	2 min.	VIII
4:30 p.m.	15 sec.	VI
10:00 p.m.	10 sec.	—
10:05 p.m.	25 sec.	VII

The second shock broke window glass and threw the watchman's car from the track. There was a succession of shocks during the two minutes and loud rumbling noise. Rumbling sounds also accompanied the third and fourth shocks.—Reid's Card Catalog.

1910 November 23. 10:50 p.m. III-IV. Tonopah Junction. Duration five seconds.—Reid's Card Catalog.

1910 November 24. 8:30 p.m. III to IV? Tonopah Junction. Duration five seconds each. The vibrations of all the eleven shocks felt at Tonopah Junction. November 18 to 24 seemed to be north-south, according to Mr. Vandersaal.—Reid's Card Catalog.

1910 December 21-22. Night. IV? Candelaria and Rhodes, Mineral Co.—Reid's Card Catalog.

Slemmons and others (1965)

Slemmons and others (1965) catalog 13 earthquakes from November 7 through December 22 that may have been part of this sequence; they fundamentally use and reference the Townley and Allen (1939) catalog. They assign the general location of 38° N. Latitude and 118° W. Longitude to all but the first event; they were driven by the need for location coordinates to make a seismicity map of Nevada. This general location is in the southern part of Columbus Marsh, just west of Tonopah Junction. The first event was assigned the coordinates of 37.5° N. Latitude and 117° W. Longitude, presumably to accommodate the more southerly reported felt area (Goldfield to Rhyolite), and thus may be a separate earthquake area. Slemmons and others (1965) converted all previous intensity values to the Modified Mercalli Intensity Scale, and these are reported in the earthquake sequence above.

Slemmons and others (1965) added an event on Nov.24, 11:45 p.m.

NEWSPAPER ACCOUNTS

Goldfield Daily Tribune
November 23, 1910

SERIES OF LIGHT EARTHQUAKES FELT

TEMBLORS DISTURB SERENITY OF THOSE LIVING IN VICINITY OF TONOPAH

Within the last few days a series of five distinct earthquake shocks have been felt between Mina on the north and Rhyolite on the south. One of the most distinct was about 6 o'clock yesterday morning and occurred at Tonopah Junction.

Windows in the telegraph office at that point were broken by the force of the temblor, and plaster was shaken from the walls and ceilings of adjoining buildings. One of the most peculiar conditions which arose, however, came about when a railway velocipede or "speeder" was thrown from the track.

A track inspector was approaching Tonopah Junction at the time and with the second movement of the earth his machine was derailed and he was sent sprawling to the ground.

A particularly interesting feature of the shocks felt recently is that they seem to follow an adjacent range of mountains and are felt on the surface only. Miners working underground have been amazed to find on coming to the surface that there had been an earthquake shock.

Several other newspapers were reviewed for any mention of the Tonopah Junction earthquake, but no other accounts were found. These included the Tonopah Daily Bonanza, Bullfrog Miner, Rhyolite Herald, Western Nevada Miner, and Reno's Nevada State Journal. This draws into question the reported size of this event. Another possible explanation is that newspapers were reluctant to report the earthquake in the wake of the 1906 San Francisco earthquake for fear of scaring investors away from the mining industry in central Nevada. It seems unlikely, however,

that newspapers further away from the source, such as in Reno, would have been so reluctant to report shaking. Thus, the magnitude of this event may be overestimated, but not enough information was gathered to make this determination.

Further research is needed for this event, especially going through local diaries and mining records.

1914, February 18, Reno Earthquake

EARTHQUAKE SUMMARY

The February 18th earthquake was the first major event of an earthquake sequence that repeatedly shook in the Reno region in the Spring of 1914. The earthquake occurred on February 18 at 10:17 a.m. PST, while people were at work and children were in school. Shaking in Reno, Sparks, and Virginia City was so strong that people rushed to the streets fearing buildings might collapse.

In Reno, “the earthquake began with a heavy shaking and continued for about a half a minute, gradually dying out” (REG 2/18/14). Another report gives 10 to 11 seconds of oscillation in Reno (CCDA 2/18/14). In Sparks, it is described as lasting for a few seconds (ST 2/18/14).

In Reno, the earthquake broke windows, cracked walls, and sent a section of the fire wall and ornamentation of the Saturno building (northeast corner of Second and West streets) crashing to the street (REG 2/18/14; ST 2/18/14). There were some narrow escapes of injury recorded as the bricks began to fall from the Saturno building wall: “a large number of bricks fell just west of the main entrance and other bricks fell along the length of the wall, but were caught up on the cornice” (REG 2/18/14). Eagle’s hall (northwest corner Virginia and 2nd Streets) suffered perhaps the severest damage of any building in Reno, with two corners cracked and another corner with an enlarged crack (ST 2/18/14); two windows in the building were also broken (REG 2/18/14). Nonstructural damage occurred in the Marymont Jewelry store and Byington and Hall real estate company that were located in the Eagle’s building, and the main pillar in front of the jewelry store was considerably twisted (ST 2/18/14). There was a slight crack in one corner of the Twentieth Century building and slight cracks in the Wells Fargo building (ST 2/18/14). Five windows were broken in the Journal office, and the fire wall of the Fraternal building was shifted a number of inches (CCDA 2/18/14). Preexisting cracks in the Gazette building were opened up to a considerable extent (ST 2/18/14). The courthouse was shaken, severely cracking the plaster inside (REG 2/18/14). In one block on East Second Street, half a dozen windows were cracked (REG 2/18/14).

At the University of Nevada, a few bricks were thrown from the chimney of the physics building (JCJ 2/18/14). The “students and professors vied with one another in an attempt to be the first outside” of the buildings (NSJ 2/19/14). At the Mackay School of Mines, Professor J. Claude Jones was lecturing to his geological class about earthquakes when “in the midst of his lecture” the earthquake occurred; the instructor and students rushed to the adjoining room and observed “the workings of the seismograph which continued active for about 20 seconds after the shake” (NSJ 2/22/14).

In Sparks, “the vibration of the windows in the store buildings in the town was pronounced” and buildings occupants ran into hallways or made a general exodus into the streets (ST 2/18/14). At

the Sparks school house, however, the fire alarm was sounded as soon as the shock was felt by Superintendent Melvin Jepson and every student marched out in an orderly manner without the “slightest trace of excitement or fear on any face” (REG 2/19/14; ST 2/18/14). [students were apparently more afraid of the school superintendent than of the earthquake] “In the superintendent’s office of the Southern Pacific company the shock stopped the clock and threw the large force of clerks into a state of confusion” (REG 2/18/14).

In Virginia City, the earthquake caused several windows of the Second Ward School to break (DTE 2/19/14). “The teachers maintained control of pupils and there was no danger of panic among the youngsters, though the building quivered perceptibly” (DTE 2/19/14). Plaster was cracked in buildings and an old house on A Street fell (REG 2/18/14). At the Post Office building a few bricks fell to the street (REG 2/18/14).

The Daily Territorial Enterprise (2/21/14) reports that a series of events on the night of February 19th and on the morning of the 20th awoke people and caused them to dress and prepare to rush to the streets, and considerable damage was done to chimneys and dishes. Two of these events were reported as heavy, but the strongest was at 3:40 a.m. on the 20th (PST).

In Carson City, the shaking was not as strong as in Reno and no damage was reported (REG 2/18/14). About eight seconds of movement occurred in Carson City (CCDA 2/18/14). “At different points in Carson Valley effects of the shaking are reported” (VC 2/18/14).

In Dayton, the earthquake was described as “very pronounced,” and the effects in Sutro were similar to Virginia City.

In Lovelock, the shock was described as slight although at one ranch dishes from a table were thrown to the floor (RM 2/20/14).

The earthquake was also felt in Verdi and Clark in Nevada, and Truckee, Loyalton, Portola, and Susanville in California. The earthquake was not noted in Gardnerville, Yerington, or Neuzel (south of Lovelock).

EARTHQUAKE SEQUENCE

February 1914 Reno Earthquake Sequence (PST):

“Last week”		foreshock?	slight earthquake felt in Virginia City
Feb. 18 (Wed.)	10:16 a.m.	mainshock	damage in Reno
		three aftershocks by noon	[reported in Virginia City]
	4:45 p.m.	aftershock	[reported in Virginia City]
Feb. 19 (Thur.)	9:19 p.m.	aftershock	[reported in Virginia City]
		continued at intervals till 3:40 a.m. (2/20)	in Virginia City (V.C.)
Feb. 20 (Fri.)	12:11 a.m.	aftershock	reported in V.C.
		beginning at 2:00 a.m. to 3:40 a.m.	severe, quick succession of quakes in V.C.
	3:20 a.m.	aftershock	reported in V.C.
	3:40 a.m.	aftershock	heaviest of all in sequence at V.C.
	4:06 a.m.	aftershock	
March 1 (Sat.)	4:17 a.m.	beginning of a small sequence	- Reno and V.C.
	8:22 a.m.	aftershock	reported in Reno and V.C.
	10:35 a.m.	aftershock	reported in Reno and V.C.
	5:15 p.m.	aftershock	reported in Reno

EARTHQUAKE CATALOG ACCOUNTS**Bulletin of the Seismograph Stations, Berkeley (1915?)****Reno Earthquake of February 18, 1914**

The records of this earthquake which were obtained at the Berkeley Station, were rather unsatisfactory. The horizontal records showed an irregular trace consisting of short period vibrations of small amplitude superimposed on vibrations of longer period and greater amplitude. The vertical record was illegible through over scoring of the pen. The shock was recorded by both components of the Omori seismograph, but neither of these records were good. It was not possible to recognize the characteristic phases in any of these records, and no determination of the epicentral distance was made.

At the Lick Observatory the North-South record showed the characteristic phases. The East-West record, however, was poor and the instrument did not appear to be working properly. No vertical record was obtained at the Lick Observatory.

Newspaper reports indicate that the earthquake was severe enough in Reno to crack walls and break windows, and it is said that this is the most severe earthquake ever experienced during the history of the city. The territory affected by the shock extended from the Sierra Nevada on the west to Palisade, Nevada, on the east. The earthquake was reported by nine telegraph operators at different stations in the region of the crest of the Sierra Nevada. This is the first earthquake felt in the high mountains for a considerable time.

Townley and Allen (1939)

1914 February 18. 10:15 a.m. VI to VII. Truckee Meadows, near Reno. A shock was felt as far south as Tonopah; intensity VI to VII at Virginia City and Reno; a few bricks being thrown from chimneys and plaster cracked in each place. Severe at Verdi, west of Reno, but not heavy at Carson City. Windows were broken in Sparks, three miles east of Reno. Recorded on instruments at Berkeley, and felt to Downieville, California. - Reno Evening Gazette, February 18, 1914; University of Nevada Records; WB Form 1009; Reid's Scrapbook, 3, 229.

1914 February 20. 2 a.m. to 4:06 a.m. Reno. A series of shocks rattled windows and awakened people. - S.F. Chronicle, February 21, 1914.

1914 March 1. 4:15 a.m. Reno. Several seconds duration. Two other shocks during morning and a fourth shortly after 5 p.m. - Reid's Scrapbook, 3, 238, S.F. Chronicle, March 2, 1914.

Slemmons and others (1965)

1914-02-18 18:17 [GMT] 39.5 [N. Lat.] 119.8 [W. Long.] 6.- [magnitude]
VII [MMI] under "reliability" they indicate "L" meaning "felt at one locality"

T-A & WB. Truckee Meadows area 2 distinct shocks lasting from 6 to 30 sec. cracked buildings Felt area 50,000 sq. mi. Palisades to Downieville Calif., as far south as Tonopah.
["T-A" is Townley and Allen (1939) and "WB" is the U.S. Weather Bureau at Reno, Nevada]

1914-2-20 10: : [GMT] 39.5 [N. Lat.] 120. [N. Long.] VI [MMI] L [reliability]

T-A & JCJ. aftershock series 10:00 to 12:06. Felt at Reno ["JCJ" is J. Claude Jones "diary"]

1914-3-1 12:12: [GMT] 39.5 [N. Lat.] 120. [N. Long.] III [MMI] L [reliability]

T-A. Several sec duration 2 others in morning, fourth shock after 01 GCT: WB. First shock 12:12 lasting 10 sec with E-W motion. Second 16:25 lasting 10 sec with motion first vertical then E-W: JCJ. 4 shocks on Ewing pendulum first at 12:17.

Bolt and Miller (1975)

2/18/1914 18-5-0 [GMT] 39.58 [N. Lat.] 120.83 [W. Long.] D F [felt]

VI-VII at Truckee Meadows, Reno, and Virginia City, Nevada. Strong at Verdi, Sparks, and Carson City, Nevada. Felt at Downieville. Recorded at Berkeley.

Topozada and others (2000)

1914 2 18 39.5 [N. Lat.] -119.8 [W. Long.] 5.6 [magnitude]

NEWSPAPER ACCOUNTS

Nevada Newspapers

Nevada State Journal (Reno) February 19, 1914

SEVERE TEMBLOR SHAKES RENO HOUSES

Severe Earthquake Is Felt in Reno and Small Amount Damage Results

One of the severest earthquakes recorded in Reno for a period of twenty years was a local visitor yesterday morning and the shakeup that followed was of sufficient length to cause a small amount of damage to buildings and furnishings. The quake occurred about 10:19 and was about two seconds in duration. According to the seismograph at the Mackay School of Mines at the university the main shake was preceded by a small temblor. The little fellow appeared to be traveling from east to west, while its presence was shown by a few dots on the instrument. The big shake traveled in a direct opposite course, the seismograph markings showing it to come from the north and headed south.

The earthquake was also felt at Carson, Virginia City, and Verdi, but it was of reduced force in those localities. School buildings in Reno were emptied almost instantly and at the university the students and professors vied with one another in an attempt to be the first on the outside. The damage resulting from the shake was not great. At the Saturno building a shower of bricks were precipitated from the fire wall, and at the university the chimneys on the physics building was knocked down.

Small cracks were noticed in plaster veneer of the west side of the court house and the big chandelier in Judge Moran's court room continued swinging for at least 20 minutes.

One window was broken in Miller and Dixon's law offices in the Journal building. In the residence sections of the city many dishes were broken and pans overturned.

Several cases of seasickness were reported immediately after the disturbance. M. B. Moore, assistant district attorney, was one of the victims of this sickness, as was Mrs. S. C. Gibson. The sickness was caused by the rolling sensation.

Downtown office buildings and stores were emptied instantly after the arrival of the quake, and those who ran from the buildings did not hesitate in expressing fear of disaster.

Nevada State Journal (Reno)
February 21, 1914

RENO FAVORED BY EARTHQUAKES

City is visited for second time in Week With Disturbances

TEMBLOR IS NOT STRONG

Occurs Early Yesterday Morning and Lasts for but Few Seconds

For the second time this week Reno experienced an earth disturbance at an early hour yesterday morning. The shock was felt shortly before 4 o'clock and was followed shortly afterwards by another quake of smaller size. Reports have been made that two disturbances followed the first, or parent visitor.

The first shock was the most severe and lasted possibly one to two seconds. No damage was caused, although residents of this city were awakened from their sleep.

The seismograph at the Mackay School of Mines failed to record the disturbances, barring a slight mark upon the smoked glass used in taking the measure of these visitors. The mark was directly beneath the pendulum and does not show from what direction the temblor came nor for where it departed.

In a number of homes the shaking aroused the sleeping occupants and gave cause to the belief that burglars were at work. In more than one instance the head of the family left his bed and made a search for the supposed intruders.

The shock was slight at Virginia City and Carson.

Nevada State Journal (Reno)
February 22, 1914

COLLEGE IN NEED OF SEISMOGRAPH

Desire Instrument That Will Record Duration of Earth Shocks

CO-OPERATION REQUESTED

California Institutions Ask Aid in Determining Center of Disturbance

"A seismograph of modern manufacture is needed at the University of Nevada if complete records are to be made of future earthquakes," declared Prof. J.C. Jones of the Mackay school of mines yesterday. Professor Jones has charge of the seismograph now in use at the university, but the instrument is of such a design that but little record can be obtained.

California authorities have been corresponding with the Nevada university officials ever since

the San Francisco disaster, and have urged that a modern seismograph be installed here that a cooperative plan might be followed in locating the exact center of the earth's disturbance. Such locations can be definitely found with the three seismographs situated in triangular positions and it is for the purpose of completing the triangle that the Nevada officials are desirous of securing an up-to-date instrument.

The old seismometer now in use formerly belonged to the Friend estate, the instruments of which were purchased by the state through legislative act five years ago. It only measures the direction of the temblor and has no timing device wherein the duration of the shock can be detected. In order to obtain a record of a second shock it is necessary to change the smoked glass upon which the record is made.

With a modern instrument, as explained by Prof. Jones, a series of quakes can be recorded without a change being made, and a timing device will give the duration of each disturbance. This is performed by means of clockwork attachments.

The disturbance of last Wednesday occurred while Prof. Jones was lecturing to his geological class upon earthquakes. The subject appeared a timely one, for in the midst of the lecture the quake happened along. The instructor rushed to the seismograph, located in the adjoining room, and with the students was able to observe the workings of the seismograph, which continued active for about 20 seconds after the shake.

**Nevada State Journal (Reno)
March 3, 1914**

QUARTETTE OF TEMBLORS FELT

Reno Visited Yesterday by Entire Handful of Earthquakes

Four distinct earthquakes were felt in Reno yesterday, but in every shake no damage resulted. The first of the earthly disturbances happened at 4:12 o'clock during the morning, and this was the severest of the quartette, causing a general shaking up of the earth's crust. The rattling of windows served to awaken many sleepers and investigation failed to reveal where any damage had been sustained to the town.

The second temblor occurred at 8:12 o'clock and was nearly a twin brother of its immediate predecessor, according to length and strength. At 10:35 number 3 arrived unheralded and uninvited. This was a weak shake and was unnoticed except in several localities. At the Catholic church Father Tubman was in the midst of his sermon, which was upon earthquakes. During the afternoon the last of the disturbances happened, the visitor coming out at 5:15 o'clock. Like No. 3 this was a small one and barely worth mentioning. The prevailing direction of the shocks was from east to west.

**Reno Evening Gazette
February 18, 1914**

EARTHQUAKE SENDS MANY INTO STREETS

Buildings Rocked and Glass in Windows Broken at 10:17 This Morning

BRICKS FROM WALL FALL TO SIDEWALK

Several Have Narrow Escape When Tremblor Shakes Saturno Block

SPARKS CLOCK STOPS AS SHAKING STARTS

Excitement Reigns When Earth Rocks; Old House at Virginia Falls

With a rocking shake that broke windows, cracked brick walls and sent a section of the fire wall of the Saturno building crashing to the street an earthquake visited Reno at 10:17 o'clock this morning. Simultaneous shocks were felt at Verdi, Carson and Virginia City. Telegraph reports from Palisade say the shock was not felt that far east. Neither was it felt west of the Sierras. It passed apparently from northwest to southeast and appear to be strongest in Reno.

Rush from Buildings

Downtown buildings and many residences even in the outskirts were emptied in record time when the shock was felt. One man on the fourth floor of the Clay Peters building says his stenographer began to cry and threw her arms around his neck, begging to
(Continued on Page Three)

EARTHQUAKE SENDS MANY INTO STREETS

(Continued from Page One.)

be saved from harm. He tried to calm her fears, but the shaking continued so long that he became frightened himself and they went out together. His wife called up from his residence later and said she had run into the street when the earthquake began.

At the city hall a score of men ran from the building when the windows began to rattle and the cry earthquake was raised. City Electrician Butler, who went through the San Francisco earthquake, was in the tower of city hall, yet was the first to reach the street. He said he felt a lump in his throat at the identical spot where he felt it in April, 1906.

Cracks in the plaster were found in the courthouse following the quake. The windows rattled and the shock was quite severe. Many of the occupants of the building made a hurried exit. A glance down Virginia street gave them a glimpse of hundreds of people standing in the rain and gazing about with more or less trepidation.

Thought Boiler Blew Up

At the Mt. Rose school where superintendent B. D. Billingham was making an official visit this morning, the shock made those in the building think the boiler had blown up and they rushed to the basement to lend assistance if needed. The pupils of the school were at home, pending the conclusion of the repair work on the boiler.

Two slight cracks said to have been in existence before the earthquake, were materially widened in the Byington block at the northwest corner of Virginia and Second streets. Two windows in the building were broken and in another block on east Second street half a dozen windows were cracked.

The earthquake began with a heavy shaking and continued for about half a minute, gradually dying out. No second shock was noted, although all who had felt the first one were watching for it.

At Carson the shock was not heavy, reports by telephone say. It occurred just as the morning train from Reno pulled in. No damage was reported. At Verdi the shaking was more severe. While the principal part of the temblor seemed to be in a direction from southeast to northwest, some say that it snapped off just at the finish with a shake from east to west.

Some Narrow Escapes

Some narrow escapes were recorded when the top of the Saturno building's fire wall again toppled to the street as the earthquake began. A large number of bricks fell just west of the main entrance and other bricks fell along the length of the wall but were caught on the cornice. City Engineer Meskimons proposed to rope off the sidewalk, but it was decided to put a watchman on duty while the damage is repaired.

Excitement in Sparks

Much excitement prevailed in Sparks following the earthquake and the streets were crowded with people who had rushed from their homes fearing the buildings were about to tumble. Although dishes were displaced in several homes and buildings rocked perceptibly no damage was reported.

In the superintendent's office of the Southern Pacific company the shock stopped the clock and threw the large force of clerks into a state of confusion. Several employes who had undergone the terrible experience of the San Francisco quake voiced the opinion that the shake of this morning was equally as heavy and were surprised to learn no damage had resulted.

Officials' First Experience

Assistant Superintendent Hickey and General Foreman Jones were in the latter's office at the shops when the shock came and both rushed down the stairs fearing some large piece of machinery had toppled over and caused the building to totter. Mr. Hickey remarked that it was the first earthquake he had ever experienced and although he did not realize at the time that it was a quake he was not anxious to feel another. He said the office moved fully four inches. Mr. Jones said his office could not have shaken more if one of the large pieces of machinery, weighing hundreds of tons, had fallen to the floor of the shops and his first impression was that such an accident had occurred.

In Virginia City the earthquake did a little more than crack the plaster. It caused an old house on A street to fall. Also it loosened a few bricks of the post office building which fell to the street and broke two windows in the Fourth Ward schoolhouse.

Reno Evening Gazette

February 19, 1914

STUDENTS LEAVE BUILDING FOLLOWING EARTHQUAKE

The earthquake yesterday morning served to demonstrate the fact that the Sparks school has a well-organized fire drill. As soon as the shock was felt, Superintendent Melvin Jepson rang the fire alarm and every student marched out in a perfectly orderly manner without the slightest trace of excitement or fear on any face.

A report was circulated that several teachers had fainted from the shock, but the superintendent gives the assurance that such was not the case and that no excitement of any nature prevailed. No damage was reported to school property.

Reno Evening Gazette

February 20, 1914

QUAKE WAKES SLEEPING CITY

Three Shocks This Morning: Rattling Windows Cause Fear of Burglars

After have been frightened into running out of their homes and offices by an earthquake occurring in the daytime, Reno people made an early morning hunt for burglars today, impelled by a rattling of windows caused by renewed earthquake shocks.

At least three shocks occurred, although some reports say there were five and some say eight. Some say they felt light shocks about 2 o'clock, but most of the light sleepers felt a series of two or three shocks about 3:30 to 4 o'clock. The last series occurred at 4:06 o'clock, according to Deputy Constable Sol Hilp, who was awakened by it and looked at his watch. He felt two shocks, the second one being very perceptible and lasting 10 or 12 seconds. The vibration seemed to be from north to south.

Reports today say Virginia, Carson and Gold Hill felt the earthquake. A Goldfield dispatch says the earthquake was not felt there.

Light Sleepers Wakened

In Reno persons living in widely-separated parts of town felt the earthquake and were awakened by it. Some say they were awakened at both 2 o'clock and 4 o'clock only. Sound sleepers were not disturbed.

At the Mackay school of mines the seismograph made a very slight record of the earthquake. It is an old-style Ewing duplex pendulum machine and does not record the time, but simply marks the earth's motion on a piece of smoked glass. The record last night show the quake was very much lighter than the one of two days ago. It was so faint that the number of shocks is doubtful, but Prof. J. C. Jones as

(Continued on Page Three)

QUAKE WAKES SLEEPING CITY

(Continued from Page One)

assistant in the department of geology, regards it as bearing out the statements that three shocks occurred. The seismograph made an excellent record of the other earthquake.

Several instances were reported today in which householders were alarmed by the earthquake this morning and feared that burglars had effected an entrance. One man said his wife insisted on his getting up and searching the house, looking behind doors, under the beds and in the closets.

Earthquake Underground

How an earthquake feels to miners deep underground is told in the following account from the Virginia Chronicle of the earthquake of day before yesterday:

Engineer Brown, stationed at the 2,200 station of the Ophir winze reports that the shock was severe at this point, loose rocks falling in the drifts with a cracking noise like a cave in. His first thought was that the old stopes near the station had started to cave. He came to the conclusion that an earthquake had occurred and phoned to the surface at once to ascertain if any damage had been done about town.

Men working in the winze reported a grinding noise and loose rock sluffing off, and sounds of distant thunder. Their first belief was that a stope had caved somewhere, although there was very little vibration and very slight concussion.

Elsewhere in the north end mines the shock was felt with about the same sensations reported. On the 1,000-foot level of the Con. Virginia, heavy 6x12 splitters, between two tunnel sets, were broken off like toothpicks, but no further breaking of the timbers was found on that level. The engineer at the surface felt the shock and thought at first there was trouble on the cage, and slowed down until it was found out that all was right in the main shaft.

Mr. Dignowity's Views

In the opinion of Charles L. Dignowity, the earthquake season for this locality has not yet closed.

He was expecting a recurrence of the shocks last night and for that reason slept lightly and experienced several of the temblors which visited Reno during the night. He believes that there will be others before the surface of the earth is at rest, but does not think that any of them will be dangerous to life or property.

Mr. Dignowity has made a thorough study of earthquakes and volcanoes finding close relationship between the two phenomena. He has paid particular attention to Aetna, Vesuvius and Colena. He ascended the last named in June, 1905, for Harvard university and was the second man to scale this peak.

He found conditions there different from those at Aetna and Vesuvius and other volcanoes he has visited and describes the eruptions of the Mexican mountain and its attending earthquakes to tidal action, theorizing that there is a vent through which the water of the ocean finds its way to the heated interior only at high tide.

Due to Caving

The local earthquakes he believes due to caving at points far below the surface of the earth,

where cooling and contraction have created fractures and the earth above sinks into the chambers from which lava was expelled in ages past.

While studying the San Francisco earthquake, Mr. Dignowity came to the conclusion that it was due entirely to electrical disturbances in the crust of the earth, a cause unattached to that which produces the Nevada shakes.

Editorial Page

NATURE'S FORCES SIGN TREATY

A layman in seismography becomes liable to scoffing criticism if he attempts to explain what savants who have devoted a life to study declare still shrouded in mystery.

But the recent tremblings of the earth, felt locally, have inspired so much interest and created such general interest that the Gazette feels it obligatory to contribute its mite.

The geological structure of the region at the eastern base of the Sierra is unique in many respects. In remote ages it was the scene of titanic upheavals and subsidences. The forces centrifugal and centripetal were arrayed in battle line. The phalanxes of gravity sought to oppose legions of flame and steam. Expansion and contraction were at war.

After the vast world roof of granite had been reared to the westward fault lines grew and multiplied in the intermountain region. Through these cleavages issued the secondary flows that metamorphosed into the porphyries, variously known as the andesites, the dacites, and the rhyolites.

But the peace of the earth's warring forces was not yet consummated. Whether it be electrical energy or the expansion of superheated matter in the underworld or any other forces hitherto named, the crust of the earth had not yet been permitted to assume rigidity, permanency and calm. The old crevices were reopened and transverse as well as parallel fissures opened.

The mountains became flaming torches, the valleys lakes of lava. Ancient granites and later porphyries were covered with what later became the malpais, otherwise the malapai of Nevada, hiding, until erosion came, the cracks and breaks, the faults and fissures that were enriched by the primary, secondary, even the tertiary flow of siliceous waters, carrying with them the uphurled solutions of gold, silver, lead, copper and other elements that because of their superior specific gravity, had hitherto sought the greater depths.

Thus out of the throes of labor and travail came the priceless wealth of Nevada, due to the earthquakes of which those of this week are but the dying echoes or reverberations.

The faint tremors preceding the rigor mortis of the desert, the latest breath of the world building forces, are now being felt. The work has been completed. The peace of the elements has been declared.

**Reno Evening Gazette
February 21, 1914**

"U" PROFESSOR EXPLAINS QUAKE

...

Notwithstanding the inclement weather last evening, the Grand theater was crowded for the first performance to hear Prof. Jones of the university explain the phenomena of the earthquake shocks of Reno and vicinity. Toward the close of the program he gave a short talk illustrated with pictures of the seismograph and its photographic record of the shock.

Prof. Jones assures the people there is no danger of any disasters to the community resulting from shocks such as the city has experienced, and that it is quite improbable there will be any more. His talk was very interesting and was received with much applause. At the close of the first performance tonight he will lecture again for the benefit of those who were not present last night.

**Reno Evening Gazette
February 23, 1914**

SAYS PEAVINE CAUSED QUAKE

Slipping Rocks in Fault in Eastern Edge of Sierras Thought Responsible

That a little earthquake once in a while, such as the ones last week, is a favorable symptom and to be preferred to a big earthquake at longer intervals, is the declaration of J. C. Jones, professor of geology of the University of Nevada. Commenting on the recent earthquakes, Prof. Jones says:

In former years it was customary to consider any natural phenomenon the cause of which was beyond the comprehension of mankind, as being of supernatural origin. As our knowledge of earth forces is increased, the terror and superstitious fears aroused by such phenomena largely disappeared. Earthquakes as a class have possibly inspired more needless apprehension by their unheralded and sudden oncoming and occasionally disastrous effects than any other phenomena of natural origin, with the possible exception of volcanoes. With a clear understanding of their causes and significance, we learn to take them as a matter of course, as we at present take storms and floods that probably have caused many times the destruction of both life and property. An earthquake is simply the vibration of some part of the earth's crust initiated by some natural cause.

Principle of Seismograph

Earthquakes have been known ever since man began to record his experiences, but it has been only during the last 40 or 50 years that they have been studied with any degree of scientific accuracy. Instruments known as seismographs have been devised to record vibrations of the earth during the passage of an earthquake. The underlying principle of all seismographs is that a heavy mass freely suspended as a pendulum, remains practically at rest while the frame or support is vibrating in harmony with the earth. By attaching a suitable recording device to the pendulum, such as a penpoint, and allowing it to rest on a plate of smoked glass fixed to the

frame, the movements of the glass under the stationary penpoint show the amount and direction of the horizontal movement of the earth under the machine. The seismograph at present at the University of Nevada is of this type and does not register either vertical motion of the earth nor the time at which the earthquake occurs. It is to be hoped we will be able to replace this with a modern machine that will register these important factors in the near future. The better types of seismographs take the record on strips of paper moved at a uniform rate of speed by clockwork and make it possible to record the time and incidentally the distance of the center of the disturbance from the machine.

Geologic studies made in shaken regions immediately after an earthquake have shown that in the majority of cases there has been a differential movement along breaks in the crust of the earth known as faults. Sometimes one side of the fault has moved downward with respect to the other side and has left a visible wall, known as a fault scarp, separating the sunken area from the surrounding country. In other cases the movement has been chiefly in a horizontal direction and is indicated by offset fences, roads, etc., as in the case of the San Francisco earthquake in 1906. The fault line, the movement along which caused this particular earthquake, was promptly traced for several hundred miles from Cape Mendocino to the Mojave Desert.

Causes of Faults

The immediate cause of faults is the unequal elevation and depression of the earth's surface. That such movements have taken place in the past is shown by the present sea terraces along the coast of California, which were formed by the waves of the ocean and at present are several hundred feet above the level of the sea. Such a terrace found near Mount St. Elias in Alaska is 5,000 feet above the sea level and the movements that caused its elevation have taken place so recently that on the ancient beach shells of animals similar to those living in the sea at present may be found. Again we know of areas such as San Francisco bay and Chesapeake bay that have sunk below sea level and the waters of the ocean now occupy the old river valleys. The mountains on either side of the valley in which Reno is situated owe their present altitude to elevation along fault planes found along their fronts. The valley itself is a block of the earth's crust that has been relatively depressed between the two mountain ranges. The steep eastern face of the Sierras, of Peavine mountain and the western face of the Virginia range are all fault scarps along which differential movements totaling many thousands of feet have taken place. It must not be thought, however, that this was accomplished by a single movement. The displacement of two or three thousand feet on a single fault represents the sum total of a multitude of small movements, each measured in inches or a few feet at most, and separated by considerable intervals of time. Each was the cause of an earthquake.

Slipping Causes Quakes

While other causes of earthquakes are known, yet the majority are caused by the slipping of the rocks along faults. The fundamental cause of the readjustment of the blocks of the earth surface is at present little understood, yet it is known to be taking place constantly. As the readjustment is resisted by the friction and irregularities of the walls of the faults dividing the blocks the movement along the fault planes is not a continuous one, but is rather a series of jerks with periods of rest between. The strains accumulate until they overcome the resistance and the rocks really give way suddenly, moving a short distance until the strains are relieved. As long as the cause of differential movement of the earth's blocks continues, the process is continued until all

movement ceases. It is as if an elastic cord were attached to a block of wood and by taking the end of the cord in one's hand the block were dragged over the surface of a rough board, the block moving by jerks even though the hand is moved at a uniformly slow rate.

The jar resulting from the sudden yielding along the fault is the earthquake. This is transmitted as vibrations of expanding waves through the earth's crust to a distance depending on the strength of the initial jar. The actual movement of solid rock during the passage of an earthquake is very small and is measured in tenths of inches. Objects resting loosely on the surface of the earth are apt to be moved greater distances, as is illustrated by placing a marble on the floor and then tapping the floor at some distance away with a hammer. This explains the larger movement often manifested at the surface.

Originated on Peavine

As nearly as can be judged from the meager data at hand, the recent earthquake was caused by a movement on one of the faults along the eastern face of the Sierras, possibly in the vicinity of Peavine mountain.

While it is possible for geologists to recognize the presence of faults in any given area and determine thereby the possibility of earthquakes, yet we have no method at present available of predicting the time at which they will occur. It is with the hope that this may be accomplished that earthquake investigations are being prosecuted throughout the world at present and many scientists are making the study their life work. As far as can be seen at present, there is little if any relation between the time of occurrence of earthquakes and the state of weather, tides, electrical storms, eclipses and other natural phenomena. The only influence they seem to have is to possibly hasten by a few hours the earthquake that is due when the rocks along the fault line are about to give way.

The fact that we have an occasional slight earthquake in this valley is to be construed as a rather favorable symptom rather than as a cause for alarm, as surrounded as we are by mountains still in a period of formation by elevation along the numerous fault planes found along their fronts and through the ranges. It is best that the movements be frequent and small rather than that the strains accumulate over a considerably longer period to the point where the resulting slip and jar would be much greater and possibly of destructive dimensions.

Reno Evening Gazette
March 2, 1914

EARTHQUAKES ARE RECORDED

Sleepers Awakened by Light Temblor; Lines Written on Seismograph

Two and possibly more, earthquakes of the four reported in Reno yesterday were recorded on the seismograph at the Mackay school of mines. The records being superimposed, it was impossible to separate the shocks as marked on the smoked glass of the instrument, but two shocks at least

are discernable in the tangle of lines.

The first shock, which occurred at 4:17 o'clock in the morning, was the strongest and disturbed many Sunday morning naps. It rattled windows and dishes.

At 8:22 o'clock a second shock occurred, which again rattled windows and shook houses as a terrier shakes a bone.

The other earthquake shocks reported were so light that they were felt only in different quarters. They occurred at 10:35 and at 5:15 o'clock.

THINKS EARTHQUAKE SIGN FROM HEAVEN

Unsigned Letter Addressed to Mayor from Toledo

Away back in Toledo, Ohio, some person of a religious turn of mind sees signs of the Almighty's wrath in recent earthquakes in Reno.

[letter to the mayor of Reno stating]"Quake Hits the Divorce Center"

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Sparks Tribune
February 18, 1914

SPARKS VISITED BY HEAVIEST TREMBLOR EXPERIENCED IN YEARS

Momentary Alarm is Caused When Quake Rocks Buildings

At 10:16 this morning Sparks experienced a pretty heavy earthquake shock. The shock brought people scampering out of the stores and houses with quizzical looks upon their countenances, with only one remark, Did you feel the quake? All along B street in the places of business, the chandeliers and fixtures made lively music for a few seconds.

The people of this city that felt the quake state that it was the most severe that they have ever felt in this vicinity. The vibration of the windows in the store buildings in the town was pronounced.

Women engaged in their household duties all state that the movement was an extremely heavy one.

The weather bureau officials report that they noticed the shock and that it was from north to south. The Odd Fellow's building, where the weather bureau is located, swayed three to four inches. There is no seismograph at Reno, the only two government instruments being at San Jose and San Francisco.

The shock was perhaps the heaviest that has ever been experienced in this section and is following along a line across the entire world. Frequent reports have been received from all sections in the world lately of similar disturbances that have occurred. This section has been considered rather out of the zone of those disturbances and only at rare intervals have slight shocks been observed.

The clock in the dispatchers' office stopped at exactly 10:16 on account of the shock. It was felt at Dayton, and also at Hazen. The shake was severe at all places heard from. A report came in

from three miles from Lovelock to the effect that the shock was rather severe there and that the dishes from the table were thrown to the floor.

Assistant Superintendent Hickey was in the gallery of the machine shops at the time and he stated that the building vibrated three to four inches. The same feeling was experienced in all the buildings in the town that are of any height.

No Shock at 'Frisco

Reports from the coast and from San Francisco tell of no disturbance being felt in that district. The shock was from the north to the south and was confined to the district this side of the Sierras and as far east as Hazen. At Neuzel this side of Lovelock, there was no disturbance felt. The operator at Clarks report it heavy at that station. Reno experienced the same shock that was noticeable in Sparks the sensation there was more pronounced on account of the height of the buildings.

Consternation reigned in the upper stories of the Thoma-Bigelow building. The upper floors of this building are divided into departments and offices and there was a general exodus of the occupants of these rooms, some of the more timid ran screaming into the halls of the structure. Other of the taller buildings in Reno experienced the same actions.

At the Sparks school house the shock was felt, and the children were quickly removed from the building by fire drill. There was no confusion.

Eagle's hall, at the corner of Virginia and Second streets, Reno, suffered probably the severest of any building in Reno. Both corners of the building on the side facing Virginia street were cracked. One corner had a slight crack before this morning, but it was considerably opened up. The Marymont Jewelry company and the Byington and Hall real estate company located in the Eagle building, showed signs of the visitation of the quake. The main pillar in front of the Marymont store was considerably twisted as the result of the shock.

At the Saturno building on Second street there was about 60 bricks that were thrown to the ground. The brick came from the ornamentation on top of the structure. A slight crack in one corner of the Twentieth Century building and slight cracks in the Wells Fargo building marked the progress of the disturbance.

The rear north wing of the Gazette building was cracked some time ago, but was opened up to a considerable extent and gave every indication of the severity of the shock.

The people were considerably agitated over the shock. Reports from all over the section gave the same description of furniture being shaken and dishes rattling, doors moving and clocks stopping.

From Carson City comes word that the shock experienced there was very slight while there was no quake at all felt at Gardnerville. Virginia gives news of a couple of slight shocks that were noticeable at the mining camp.

Sparks Tribune February 20, 1914

Another Quake is Felt

In the early hours of the morning there was another quake that visited this section of the country and a number of the inhabitants of Sparks were aroused from their peaceful slumbers.

According to the majority of those that noticed the disturbance, the shock occurred between three and four o'clock. The Mackay School of Mines has a seismograph, and the markings on the record show for about an eighth of an inch. The big tremblor that we had Wednesday was over an inch and a half.

Slight quakes as we are experiencing now obviate all danger of a heavy shake, that would cause trouble to the country. Relieving the earth of the tension that exists in the internal regions, we experience a few small shocks that are immaterial.

Earth Quakes

Earth quakes ??? this section yesterday ??? the day frequent visits ??? made by tremblors. In all we experienced four shakes. According to the records the first quake ??? at 4:12 in the morning and ??? traveling from east to west. The ??? was similar in intensity to ??? first and came as the good people were thinking about getting up ? At 8:12. Following at 10:35 was another. The third however ??? lighter than the first two. The fourth occurred at 5:15 p.m. ??? slight was it and so used ??? to the shocks that it was ??? . [it was hard to read the microfilm]

Carson City Daily Appeal February 18, 1914

Earthquake Strikes Western Nevada

At about 10:20 this morning a noticeable shock of earthquake struck Carson, but as far as can be learned it did no damage. The movement was from east to west and lasted about eight seconds. At Reno it is stated it oscillated for ten or eleven seconds and caused considerable damage. The walls of the Eagle hall were cracked in two places, as were the walls of the buildings on the corner of Second and Virginia streets. Five windows were broken in the Journal office, and the fire wall of the Fraternal building was shifted a number of inches.

At Virginia the shock was quite severe, but did no damage other than the breaking of a few windows in the Second Ward school.

Carson City Daily Appeal February 19, 1914

How Shock Felt to those Underground

Inquiry of miners coming off shift this afternoon, relative to the effects of today's earthquake underground, brings out some interesting statements.

Engineer Brown, stationed at the 2,200 station of the Ophir winze reports that the shock was severe at that point, loose rocks falling in the drifts and cracking noise like a cave-in. His first thought was that the old stopes near the station had started to come. He came to the conclusion that an earthquake had occurred and phoned to the surface at once to ascertain if any damage had

been done about town.

Men working in the winze report a grinding noise, and loose rock sluffing off, and sounds like distant thunder. Their belief was that a stope had caved somewhere, although there was very little vibration and very slight concussion.

Elsewhere in the Northend mines the shock was felt with about the same sensation reported. On the 1000-foot level of the Co. Virginia, heavy 6 x 12 splitters, between two tunnel sets, were broken off like toothpicks, but no further breaking of timbers was found on that level. The engineer at the surface felt the shock and thought at first there was trouble on the cage, and slowed down, until it was found out that all was right in the main shaft - Virginia Chronicle

The Carson City News February 19, 1914

Earthquake Severe in Reno and Virginia

Yesterday was Rock a Bye Baby day in Nevada and we of the Silver state will say more about it than the entire press of California would say about a shake a dozen times the size. Nevada is on such a firm foundation that a little earthquake is just a pleasure and is about the only thing that can shake us. It is the first time since they were hung up that Abe Cohn's neckties had a shaking and an old clock that Henry Bath was going to throw away started running and is keeping good time. The hanging lights in the saloons shook a little and several of the nervous ladies of the town shook also for a short time but that was all the damage.

In Reno things are somewhat different but they were so badly shook up over there when the divorce law passed the last legislature that they did not mind this shake much. Part of the fire wall on the roof of the Saturno building was shaken to the ground, the Eagles Hall on the corner of Second and Virginia streets received several cracks in the wall, windows were broken and sidewalks cracked.

The Virginia Chronicle says:

Virginia City people were thrown into a panic this morning at 17 minutes past 10 o'clock, when the most severe earthquake shock experienced since 1906 was reported from all sections of the town, and people everywhere rushed into the street, not knowing whether their own buildings were about to fall, or whether the complaint was general. It was soon discovered that the shaking and grinding heard, and the rocking of buildings was universal throughout the city, and everyone then began to compare notes. While no damage is reported of a serious character, the shake was so severe that extreme nervousness ??? for a considerable time for fear that a more serious shock would follow immediately. The disturbance lasted for about three full seconds and was from southeast to northwest. People on the streets heard the buildings in all directions groaning and cracking and the first thought that was that another building had collapsed from a snow slide. The noise was very pronounced, and all eyes were on the buildings, especially the brick structures.

First there came a slight shock, and this was followed almost immediately by the severe shake, which rattled dishes on the shelves, and swayed chandeliers in all the houses. Had it lasted a few seconds longer, there is no doubt but that great damage would have resulted to the buildings and

residences throughout camp. As it was, the only damage reported was the loosening of bricks, and disarranging of interior decorations such as pictures, etc. Shortly before and after 12 o'clock, noon, there were three other shocks noticeable. On the street, people felt the ground move under their feet, and were mystified until they realized that a real earthquake was underway. Many clocks stopped throughout the city.

A few moments after the quake in this city, a wire was sent to the San Francisco Stock Exchange, and it was reported that no earthquake had been felt in that city. The first inquiry in this town was relative to San Francisco, the tremblors felt in Nevada following the disaster at the Golden Gate city in 1906.

At Dayton the report is that the earthquake was very pronounced, and at Sutro, the general effect was the same as Virginia City.

Word comes from Yerington that it was not felt at all in that city, at least not generally.

**The Carson City News
February 21, 1914**

Earthquake Again Visits This Section

Several slight earthquake shocks were felt in this city at about 3:30 o'clock yesterday morning but no damage resulted.

At Virginia City the "shakes" started at 9:15 o'clock, and continuing at intervals up to 3:40. Beginning at 2 o'clock and increasing in velocity and severity, the earthquakes followed one another in quick succession, the culmination coming at about twenty minutes to four. This was the heaviest one of all, but the one at 3:20 was not far behind in intensity. The last quake was accompanied by a distinct rumbling sound, rattling windows and arousing nearly everyone in town from their slumbers. Many people dressed and went out doors, but it proved to be the climax of the night's disturbances. It is reported that one or two chimneys were shaken down. Underground, the earthquake was again much in evidence causing a sluffing off of loose rocks and causing the night shift considerable uneasiness.

**The Carson City News
February 26, 1914**

Nevada Reporter Puts Over Whopper On Denver Times

The Nevada correspondent of the Denver Times is certainly a liar and a good one. His account of the recent earthquake is certainly a masterpiece. Describing the shake he paints it horrors in most lurid colors, telling how men and women were frightened out of their senses, ran out of their houses terror stricken, and all that sort of thing, and gives some splendid exaggerations of the damage inflicted by the terrible tremblor. Here is what he says about Carson, and the rest of his story is of the same cloth:

In Carson, Virginia City and Dayton wire messages state the people had difficulty in keeping

their feet during the disturbance. Frightened horses broke from their drivers and dashed through the streets, adding to the danger from falling masonry that showered the pavement. Occupants of the statehouse fled for their lives.

It is believed that the capital building was not materially damaged. The city water works is said not to have fared so well, numerous breaks being reported. It is feared that the sewer system has been so damaged that an epidemic may result. Several small fires followed the quake, but they were not allowed to gain dangerous headway.

**Daily Territorial Enterprise (Virginia City)
February 19, 1914**

Severe Earthquake Startled Comstock Residents Yesterday

Yesterday morning at 17 minutes past 10 o'clock the residents of this city experienced an earthquake which sent them scurrying into the street. The shake was preceded by a noise which sounded like a building was falling and then a severe shake. People rushed for the street, and joked about the occurrence when it was learned that no damage resulted. Other quakes followed and by noon three more had been felt. After the first shake snow began falling, but melted almost as soon as it struck the ground. At about a quarter to 5 o'clock last evening another tremor was felt.

Dishes were rattled in cupboards, but the only damage was at the Fourth [missing] ...ol, where several windows [missing] broken. The teachers maintained control of pupils and there was no danger of a panic among the youngsters, though the building quivered perceptibly. Men employed on the 2200 level of Con. Virginia felt the shock, but thought an explosion had occurred on the surface. At other mines it was also felt, the employees saying the jar was similar to a car being run over the tracks.

The earthquake seemed to be confined to a small area, as it was barely felt in Carson, but in Reno, Dayton, Sutro and other nearby places it was about the same as in this city. Yerington felt the shock but slightly.

**Daily Territorial Enterprise (Virginia City)
February 20, 1914**

More Earthquake Shocks

The earthquakes still linger with us a shock being felt at 3 o'clock yesterday morning and another at 19 minutes past 9 o'clock last evening.

As the above lines were being put in type at 11 minutes after 12 o'clock this morning another shock was felt. This one was more severe than the one early in the evening and windows were rattled and people awakened from their sleep, one citizen calling this office on the phone and inquiring whether there was an earthquake or whether he had been dreaming. It was no dream, however.

**Daily Territorial Enterprise (Virginia City)
February 21, 1914**

Eight Earthquakes Were Felt

This city was given a shake up Thursday night and Friday morning that the people will not soon forget, as eight earthquakes were felt in that time, two of them being extremely heavy. Many people were awakened from their slumbers early yesterday morning and got up and dressed themselves, ready to rush into the streets if any severer quakes occurred. Considerable damage resulted to chimneys and dishes. Weather men seemed to have a grudge against this section, and rain or snowstorms prevailed all of yesterday.

**Daily Territorial Enterprise (Virginia City)
February 24, 1914**

No Danger From the Earthquakes

Notwithstanding the inclement weather last evening, the Grand theater was crowded for the first performance to hear Prof. Jones of the university explain the phenomena of earthquake shocks of Reno and vicinity. Toward the close of the program he gave a short talk illustrated with pictures of the seismograph and its photographic record of the shock. Prof. Jones assures the people there is no danger of any disasters to the community resulting from shocks such as the city has experienced, and that it is quite improbable there will be any more. His talk was very interesting and was received with much applause - Reno Gazette.

**Daily Territorial Enterprise (Virginia City)
February 25, 1914**

No Need of Worry Over the Occurrence of Earthquakes

That a little earthquake once in a while, such as the ones last week, is a favorable symptom and to be preferred to a big earthquake at longer intervals, is the declaration of J.C. Jones, professor of geology of the University of Nevada. Commenting on the recent earthquakes, Prof. Jones says: In former years it was customary to consider any natural phenomenon the cause of which was beyond the comprehension of mankind, as being of supernatural origin. As our knowledge of the earth forces is increased, the terror and superstitious fears aroused by such phenomena largely disappeared. Earthquakes as a class have possibly inspired more needless apprehension by their unheralded and sudden oncoming and occasional disastrous effects than another phenomena of natural origin, with the possible exception of volcanoes. With a clear

understanding of their causes and significance, we learn to take them as a matter of course, as we at present take storms and floods that probably have caused many times the destruction of both life and property.

An earthquake is simply a vibration of some part of the earth's crust initiated by some natural cause. As nearly as can be judged from the meager data at hand, the recent earthquake was caused by a movement on one of the faults along the eastern face of the Sierras, possibly in the vicinity of Peavine Mountain. - Reno Gazette.

**Daily Territorial Enterprise (Virginia City)
March 3, 1914**

More Earthquakes Sunday

This city was visited by more earthquakes Sunday morning, one at twelve minutes past 4 o'clock being very severe. Another at 8:30 a.m. shook buildings violently, while a lighter shock was felt about 11:30 a.m. No damage to property resulted, however, but the nerves of many people were strained.

The Reno Journal of Monday says: Four distinct earthquakes were felt in Reno yesterday, but in every shake no damage resulted. The first of the earthly disturbances happened at 4:12 o'clock during the morning, and this was the severest of the quartet, causing a general shaking up of the earth's crust. The rattling of the windows served to awaken many sleepers and investigation failed to reveal where any damage had been sustained to the town.

**Virginia Chronicle
February 18, 1914**

EARTHQUAKE CAUSES EXCITEMENT IN THIS CITY

Shock General in Reno and Western Nevada

Virginia City people were thrown into a panic this morning at 17 minutes past 10 o'clock, when the most severe earthquake shock experienced since 1906 was reported from all sections of the town, and people everywhere rushed into the street, not knowing whether their own buildings were about to fall, or whether the complaint was general. It was soon discovered that the shaking and grinding heard, and the rocking of the buildings was universal throughout the city, and everyone then began to compare notes. While no damage is reported of a serious character, the shake was so severe that extreme nervousness resulted from a considerable time for fear that

a more serious shock would follow immediately. The disturbance lasted for about three full seconds and was from southeast to northwest. People on the streets heard the buildings in all directions groaning and cracking and the first thought was that another building had collapsed from a snow slide. The noise was very pronounced, and all eyes were on the buildings, especially the brick structures.

First there came a slight shock, and this was followed almost immediately by the severe shake, which rattled dishes on shelves, and swayed chandeliers in all of the houses. Had it lasted a few seconds longer, there is no doubt but that great damage would have resulted to the buildings and residences throughout the camp. As it was, the only damage reported was the loosening of bricks, and disarranging of interior decorations such as pictures, etc. Shortly before and after 12 o'clock, noon, there were three shocks noticeable. On the street, people felt the ground move under their feet, and were mystified until they realized that a real earthquake was underway. Many clocks stopped throughout the city.

A few moments after the quake in this city, a wire was sent to the San Francisco Stock exchange, and it was reported that no earthquake had been felt in that city. The first inquiry in this town was relative to San Francisco, the severity of the shaking here being strongly reminiscent of the temblors felt in Nevada following the disaster at the Golden Gate city in 1906.

A dispatch received from Reno states that the earthquake was very severe in that city, especially in the residential section south of the Truckee River. No damage of consequences resulted, but people rushed into the street as in Virginia City. In the business section there was a much slighter disturbance felt. Reno reports are to the effect that the quake passed from southeast to northwest as on the Comstock. The girls at the telephone office in Reno were greatly alarmed, as where everyone else.

Carson City was in the pathway of the shake, but from all reports it was felt much less in that city than here. Chandeliers and pictures were swaying for a full half minute.

At Dayton, the report is that the earthquake was very pronounced, and at Sutro, the general effect was the same as in Virginia City.

Word comes from Yerington that it was not felt at all in that city, at least not generally.

At different points in the Carson Valley effects of the shaking are reported.

Last week, there was a slight earthquake in this city, which was generally commented on, but not sufficiently severe to cause anywhere near the apprehension of this morning.

Virginia Chronicle February 19, 1914

Felt Earthquake as Far East as Hazen on S. P.

The Sparks Tribune says of yesterday earthquake:

The clock in the train dispatcher's office stopped at exactly 10:16 on account of the shock. It was felt at Dayton and also at Hazen. The shake was so severe at all places heard from. A report come in from three miles from Lovelock to the effect that the shock was rather severe there and that the dishes from the table were ... [blemish].

Assistant Superintendent Hickey was in the gallery of the machine shops at the time and he

stated that the building vibrated three or four inches. The same feeling was experienced in all the buildings in the town that are of any height.

Reports from the coast and from San Francisco tell of no disturbance being felt in that district. The shock was from the north to the south and was confined to the district this side of the Sierras and as far east as Hazen. At Neuzel, this side of Lovelock, there was no disturbance felt. The operator at Clark reports it heavy at that station.

**Virginia Chronicle
February 20, 1914**

Last Night Was Shaky One in Virginia City

Virginia City is evidently not yet done with the "shakes," for beginning last night at 9:15 o'clock and continuing at intervals up to 3:40 o'clock this morning, another series of earthquakes passed across this part of the country. Beginning at 2 o'clock and increasing in velocity and severity, the earthquakes followed one another in quick succession, the culmination coming at about twenty minutes of four. This was the heaviest one of all, but the one at 3:20 was not far behind in its intensity. The last quake was accompanied by a distinct rumbling sound, rattling windows and arousing nearly everyone in town from their slumbers. Many people dressed and went out of doors, but it proved to be the climax of the night's disturbances. It is reported that one or two chimneys were shaken down.

Underground, the earthquake was again much in evidence causing a sluffing off of loose rocks and causing the night shift considerable uneasiness.

**Virginia Chronicle
February 23, 1914**

Mill Starts at Silver City After Shut Down

Wednesday forenoon many people experienced their first earthquake shock. Those who had been in the San Francisco quake report this to have been a heavier one. Five minutes after the heavy shock there was a lighter one. No particular damage was done around the camp.

Thursday morning about four inches of new snow lay on the ground, having fallen through the night and early morning hours. Mr. Indermuhl, our energetic teamster, soon had the road cleared so that the teams could haul to the mill.

**Virginia Chronicle
February 26, 1914**

Weird Stories Sent Out Regarding Nevada Earthquakes

The Nevada correspondent of the Denver Times is certainly a liar an a good one, says the Carson News. His account of the recent earthquake is certainly a masterpiece. Describing the shake he paints its horrors in most lurid colors, telling how men and woman were frightened out of their senses, ran out of their homes terror stricken, and all that sort of thing and gives some splendid exaggerations of the damage inflicted by the terrible temblor. Here is what he says about Carson, and the rest of his story is of the same cloth:

“In Carson, Virginia City and Dayton, wire messages state that the people had difficulty in keeping their feet during the disturbance. Frightened horses broke loose from their drivers and dashed through the streets, adding to the danger from falling masonry that showered the pavement. Occupants of the state house fled for their lives.”

“It is believed that the capital building was not materially damaged. The city water works is said not to have fared so well, numerous breaks being reported. It is feared that the sewer system has been so damaged that an epidemic may result. Several small fires followed the quake, but they were not allowed to gain dangerous headway.”

Virginia Chronicle
March 2, 1914

U.S. Geological Survey Issues a Statement Giving the Cause of Earthquakes

Interesting Discussion of Phenomena Both East and West

WASHINGTON, Mar. 2 — The recent earthquake in New York, so far can be decided from information now at hand, was strongest in the northeastern part of the state and less intense in all directions from that section, according to a statement by Arthur Keith, of the United States Geological Survey, who has made a special study of the geologic history and structure of the Appalachian Mountain region. As earthquake shocks are regularly weaker outward from the center, the area of greatest intensity at the surface is nearest the point of origin, although this point probably is not at the surface. The earthquake center, therefore appears to be in or north of northeastern New York.

Earthquake shocks are caused by the breaking and moving past each other of great masses of rock in the earth's crust. Rocks are more or less clastic, particularly crystalline and igneous rocks like granite, and they transmit shocks for very long distances. Rocks in the earth's crust are always in a state of strain, and release from this strain by a fracture causes a displacement and rebound that may be violent. Even at the surface of the earth this movement is continually noted in quarries when new layers of stone are set free, and it is still stronger in the depths of the earth. When the strain finally exceeds that strength of some of the rocks they break and snap, and there is an elastic rebound from each movement. This causes the lesser tremblings after the first shock.

Earthquakes are commonly associated with faults or rifts, which are breaks or fractures in the rock crust along which the rocks move past one another. Some faults are characterized by

repeated motion along a given plane or narrow zone, like that which caused the San Francisco earthquake. The vast majority of faults, however, are practically dead, and no motion takes place on them because the strain has been satisfied or diverted into other directions. Of this kind are most of the old faults in the Appalachian area, from Alabama to Canada of the East. Younger faults are also found in the East, but most of these are dead and their strains have long ago been satisfied. The latest set of faults displaces the youngest geological formations although their source is in the underlying hard rocks.

It is unusual to associate earthquake shocks with the greatest of faults, on which the motion is measured in miles. These, however, are the oldest and the most certainly dead of the faults, and later and differential strains have acted on their areas and produced different faults. Neither length nor great motion on a fault is needed to make a disastrous shock, as was plain at San Francisco, where a few feet of motion caused the ruin. The factor which makes the shocks dangerous or not is their intensity and this is directly due to the rapidity of growth and vigor of the strain. Quick and violent strains accompany the growth and rise of new parts of the earth's crust, where it is being compressed until it moves. In the old Appalachian country of the eastern part of the United States such a rise is so exceedingly slow as to make its existence in historical times a matter of dispute. In any case, it is not now of the compressive character that causes lateral or violent movements and dangerous shocks.

**Review-Miner (Lovelock)
February 20, 1914**

Lovelock Visited By Earthquake

At 10:20 a.m. Wednesday Lovelock experienced a slight shock of earthquake, and again at an early hour on Thursday morning a second and more severe shock alarmed the more sensitive sleepers. The first one was comparatively mild and with those who were not in elevated positions as the second story of a building, it passed unnoticed. But the second one was of a more serious nature and rocked some very substantial buildings. No damage is reported so far from the valley, though a report was current that at one ranch three miles from town the dishes were thrown from the table to the floor.

The shock was from the north to the south and was confined to the district this side of the Sierra and as far east as Lovelock. The operator at Clark's reported it heavy at that point.

Reno suffered the worst of any of the towns visited. Eagle's hall, at the corner of Virginia and Second streets, probably got the worst shaking of any building in the city. Both corners of the building on the side facing Virginia street were cracked. The Saturno building had some of the ornamental brick from the top of the structure thrown to the street. Cracks in many buildings were also noticeable.

The shock appeared to be from east to west at Carson and lasted about eight seconds, doing no damage.

At Virginia City the reports say the shock was quite severe, but no damage other than the breaking of a few windows in the school house resulted.

**Churchill County Standard (Fallon)
March 11, 1914**

At a cost of \$500 the Nevada school of mines in Reno has ordered a seismograph for the recording of earthquake shocks. Recently there have been numerous in Reno vicinity and more are expected. To record their severity and direction is the purpose of this investment.

**The Humboldt Star (Winnemucca)
February 20, 1914**

SLIGHT QUAKES ARE FELT HERE

SEVERAL SHOCKS FELT HERE BETWEEN 4 AND 8 O'CLOCK THIS MORNING

Though it will be news to most people here, it is a fact that Winnemucca was visited by several earthquake shocks this morning. Evidently this place is on the outed edge of that area of seismic disturbance of which Reno seems to be the center.

The first shock this morning occurred at 4:40 and the last at 7:59 with a few slight intervening quivers. The shakes were felt very perceptibly at the Western Union office and Night Clerk Chenoweth states that the one which occurred at 4:40 set the electric lamps to swinging very noticeably. He asked Reno if the shake had been felt there and was informed that it had and that the shock was nearly as severe as the one which shook that town up last Wednesday morning. The shock at 7:59 was light, but was also noted at the Western Union office.

**The Silver State (Winnemucca)
February 19, 1914**

Earthquake Shock in Western Nevada Yesterday

An earthquake shock occurred at Reno at 10:18 a.m. yesterday. The shock was violent and lasted three seconds, the direction was from southeast to northwest.

The only damage done by the earthquake consisted of broken windows, and in a few cases cracked walls. Hundreds of persons, badly frightened, rushed into the streets from business buildings and residences. A portion of the front wall of an apartment house fell to the pavement, and several pedestrians narrowly escaped.

Miners Leave Work

Reports from Virginia City and Carson say that the shock was severe there. Miners left work in the Comstock and made their way to the surface. Windows and walls were cracked at both places.

The Silver State (Winnemucca)
March 3, 1914

TWO MORE EARTH QUAKES FELT IN RENO SUNDAY

Two more earthquakes shocks were felt in Reno Sunday. More are feared. Both shocks were heavy, but did no damage, although the first one frightened many people from their beds and sent them into the streets. The first shock occurred at 4:13 and the second at 8:20. The first was the heavier of the two.

Daily Free Press (Elko)
February 19, 1914

WESTERN NEVADA IS TERRIFIED BY BIG EARTHQUAKE

Virginia City, Reno and Carson Have Worst Shaking Since the Frisco Disaster

CONSIDERABLE DAMAGE IS DONE

Washoe County Courthouse Suffers - People, Panic-Stricken, Flee to Streets for Safety

Virginia City, Nev., Feb 18. — Virginia City people were thrown into a panic this morning at 17 minutes past 10 o'clock, when the most severe earthquake shock experienced since 1906 was reported from all sections of the town, and people everywhere rushed into the streets, not knowing whether their own buildings were about to fall, or the complaint was general. It was soon discovered that the shaking and grinding heard, and the rocking of buildings was universal throughout the city, and everyone then began to compare notes. While no damage of a serious character is reported, the shake was so severe that extreme nervousness resulted for a considerable time for fear a more serious shock would follow immediately. The disturbance lasted for about three full seconds and was from southeast to northwest. People on the streets heard the buildings in all directions groaning and cracking and the first thought was that another building had collapsed from a snowslide. The noise was very pronounced and all eyes were on the buildings, especially the brick structures.

First there came a slight shock, and this was followed almost immediately by the severe shake, which rattled the dishes on the shelves and swayed the chandeliers in all the houses. Had it lasted a few seconds longer, there is no doubt but that great damage would have resulted to the buildings and residences throughout the camp.

Shortly before and after 12 o'clock noon, there were three other shocks noticeable. On the street people felt the ground move under their feet, and were mystified until they realized that a real earthquake was underway. Many clocks stopped throughout the city.

RENO, Feb 18. — With a rocking shake that broke windows, cracked brick walls and sent a

section of the wall of the Saturno building crashing to the street, and earthquake visited Reno at 10:17 o'clock this morning. Simultaneously shocks were felt at Verdi, Carson and Virginia City. Telegraph reports from Palisade say the shock was not felt that far east. Neither was it felt west of the Sierras. It passed apparently, from northwest to southeast and appeared to be strongest in Reno.

Downtown buildings and many residences even in the outskirts were emptied in record time when the shock was felt. One man on the fourth floor of the Clay Peters building says his stenographer had her arms around his neck, begging to be saved from harm. He tried to calm her fears, but the shaking continued so long that he became frightened himself and they went out together. His wife called up from his residence later and said she had run into the street when the earthquake began.

At the city hall a score of men ran from the building when the windows began to rattle and the cry "earthquake" was raised. City Electrician

(Continued on Second Page)

(Continued from First Page)

Butler, who went through the San Francisco earthquake, was in the tower of the city hall, yet was the first to reach the street. He said he felt a lump in his throat at the identical spot where he felt it in April 1906.

Cracks in the plaster were found in the courthouse following the quake. The windows rattled and the shock was quite severe. Many of the occupants of the building made a hurried exit. A glance down Virginia street gave them a glimpse of hundreds of people standing in the rain and gazing about with more or less trepidation.

California Newspapers

Truckee Republican February 19, 1914

About ten o'clock Wednesday morning a slight shock was felt here, the shock was quite heavy around Reno. The water in Moana Springs boiled quite wildly. Several Truckee residents say they also felt the earthquake.

Mountain Messenger (Downieville) February 19, 1914

Two distinct shocks of earthquake were felt in Downieville at 10:15 a.m. on Wednesday, February 18th.

The first shock was light, but was succeeded in a few seconds by one that was quite heavy. Both shocks were preceded by the roaring that usually accompanies earth tremors.

The motion seemed to come from the south and go north, or at least that was the way we felt in The Messenger office.

Strange to say but very few persons in Downieville felt the quake, and no damage was done.

**Mountain Messenger (Downieville)
February 28, 1914**

The earthquake that was felt in Downieville last Wednesday was, according to the News, quite severe in Loyalton. "The tremor lasted about five seconds and to those in the second stories of buildings it lasted long enough."

**Lassen Advocate (Susanville)
February 20, 1914**

A slight shock of earthquake was felt in Susanville at about the same time as that felt in Reno last Wednesday forenoon. But a few people here noticed it. Reno had an earthquake Wednesday forenoon which jarred off the firewall of the Saturno block, broke a number of windows and frightened the people considerably. There was but one shock and it was of short duration, yet it was long enough to suit the people of the riverside town. No one was hurt, and Reno was apparently the center of the disturbance.

**Georgetown Gazette
February 19, 1914**

Slight shocks of earthquake were felt in Georgetown at 10:30 a.m. and twelve hours later yesterday.

**Sacramento Bee
February 18, 1914**

QUAKE PASSED FROM NORTHWEST TO SOUTHEAST

RENO (Nev.). - February 19 - The severe earthquake which shook Reno passed from the northwest to the southeast. While it caused much excitement and some damage in Reno, Carson and Virginia and Verdi, it was not felt west of Truckee nor east of Palisade.

Damage in Reno.

In the Gazette Building, Reno, several windows were cracked and books were knocked from shelves in the offices of the attorneys.

In the Saturno Building the plaster was cracked and a portion of the fire wall of the building was

knocked into the street. Women became hysterical and several fainted.

Rush From Court House.

In the Court House the plaster was cracked, but no other damage was noticed. All rushed from the building and the courts were dismissed without any ceremony.

The Clay Peters Building, especially the upper stories, was heavily shaken.

Sparks Chimneys Fall.

In Sparks the shock caused several chimneys to fall, cracked walls and caused many buildings to totter.

Two Story Building Falls.

The shock was not severe in Carson but in Virginia it caused a two story building on A Street to fall and knocked over chimneys in other parts of the city.

FELT AT PORTOLA.

PORTOLA (Plumas Co.). February 18. - An earthquake of several seconds duration was distinctly felt in this city. Dishes on shelves were rattled and houses creaked.

Sacramento Bee February 20, 1914

Two More Earthquakes Felt in Nevada

Reno (Nev.), February 20. - Two distinct and quite severe earthquake shocks were felt in Reno, Carson, Virginia and Gold Hill this morning at 4 o'clock.

The shocks were from northwest to southeast. No damage is reported.

San Francisco Chronicle February 19, 1914

Miners Leave Their Work in the Comstocks, Fearing They Are in Peril.

RENO (Nev.), February 18. - An earthquake shock occurred here at 10:18 A.M. The shock was violent and lasted about three seconds. The direction was from the southeast to northwest.

The only damage done here by the earthquake consisted of broken windows and in a few cases cracked walls. Hundreds of persons, badly frightened, rushed to the streets from businesses and residences. A portion of the front wall of an apartment house crashed to the pavement below and several pedestrians had a narrow escape.

Reports from Virginia City and Carson say that the shock was very severe there, although the amount of damage done is not known. Miners left their work in the Comstocks and made their

way to the surface, believing themselves to be imperiled in the mines. Windows and walls were cracked in both places.

**Courier-Free Press (Redding)
February 18, 1914**

NEVADA HAS EARTHQUAKE

RENO SHAKEN UP SO THAT WALLS WERE CRACKED AND WINDOWS BROKEN

[United Press Dispatch.]

RENO, February - 18 - A strong earthquake shock was observed here at 10:17 this morning. The temblor lasted half a minute. The vibration was north to south. The shock was strongest in Reno and light in Virginia City, Carson City, Gold Hill and Verdi. A few walls were cracked and windows broken here.

OTHER ACCOUNTS

Professor J. Claude Jones Notebook, University of Nevada

Earthquakes near Reno
1914

Feb 18 Main shock record 1 ½ “ received 10:17 AM. Felt chiefly in Reno & Sparks. Felt in Carson, Virginia, Fernley, Sutcliff, Nevada(?)

Not felt at Astor (?) gravel pit

effect threw few bricks from chimney of Physics Building, broke a few window panes downtown - movement apparently from west.

Intensity V R-F scale.

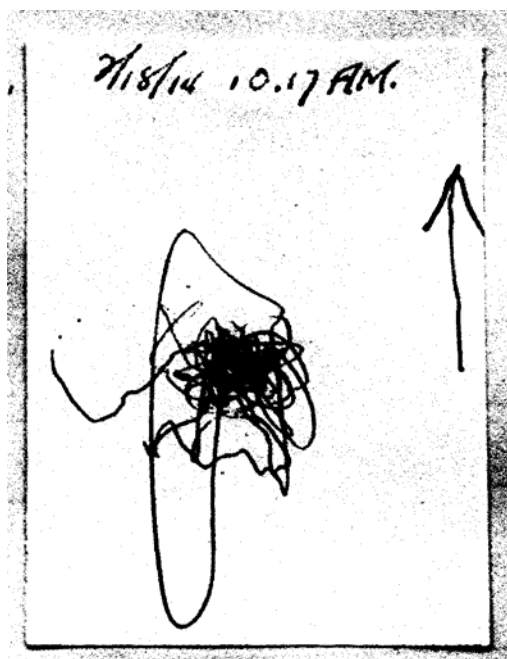
Feb 20 aftershock (?) 4:00 AM slight record.

Mar 1st 4:17 AM [Combined records with 8:22] 3/16 “
8:22 AM

10:35 small shocks
5:15

Figure 1 Ewing-Duplex Seismoscope record from J.C. Jones's notebook.

This record was recorded in the Mackay School of Mines building at the University of Nevada, Reno. The record is enlarged for viewing and originally had a maximum amplitude of "1½ inches."



Two letters from Dr. Gianella's documents housed in Special Collections from the University of Nevada, Reno mention the February earthquake. The correspondence is between Dr. Gianella and Maxwell W. Allen (of Townley and Allen, 1939 fame) presumably to give Allen information for Townley and Allen's earthquake catalog.

Letter from Dr. Vincent P. Gianella to Mr. Maxwell W. Allen dated Feb. 8, 1934

...

Professor Jones lists the following:

A shock of intensity 5 R.F. scale, is listed as occurring at 10:17 a.m. February 18, 1914. It was felt in Carson, Fernley and Truckee. A few bricks were thrown from the chimney of the physics building at the University and broke a few window panes down town. Movement apparently east-west.

Letter from Dr. Vincent P. Gianella to Mr. Maxwell W. Allen dated Feb. 14, 1934

...

In looking up the above [Nevada State Journal] I found the following shock.

February 18, 1914. 10:17 a.m. Felt at Carson, Virginia City, Verdi. People generally panicky. Cracks in the courthouse plaster in Reno. Two windows cracked in the Byington building, 2nd & Virginia Sts. and old cracks in the brick walls opened. Not heavy at Carson but severe at Verdi. Movement (Ewing Seismograph) NW-SE. Dishes thrown from shelves and a few windows broken in Sparks. The people there were much disturbed. A few windows were broken in Virginia City and some bricks dislodged from walls. This one was probably along the west base of the Virginia Range in Truckee Meadows. Stated to be the most severe in 20 years.

Modified Mercalli Intensity Assignments

Modified Mercalli Intensities are estimated or reported for 25 localities in Nevada and California for the February 18, 1914 earthquake; these are listed below in Table 1 along with the basis and reference for the intensity estimate. Brief descriptions of the Modified Mercalli Intensity scale can be found in Appendix A.

The highest intensity was in Reno (VII) where there was partial collapse of chimneys and a firewall, broken windows, and people were alarmed. In Sparks and Virginia City people also panicked and rushed to the streets from buildings, and windows were also broken, but the amount of brick work that was damaged appears to be overall less than at Reno, thus they were assigned Modified Mercalli Intensity VI+. The region encompassing these three communities appears to be the near field of this earthquake. As will be developed later, a moderate magnitude is estimated for this event ($M_L = 5.1 \pm 0.3$), thus the epicenter is likely very close to Reno, or between Reno and Virginia City, given the human response and damage that occurred.

Modified Mercalli Intensity V occurred at Verdi, Carson City, Loyalton, Sutro, Clark, and Hazen. This forms a small triangular area for Intensity V from the Sierra Nevada towards the east near Hazen.

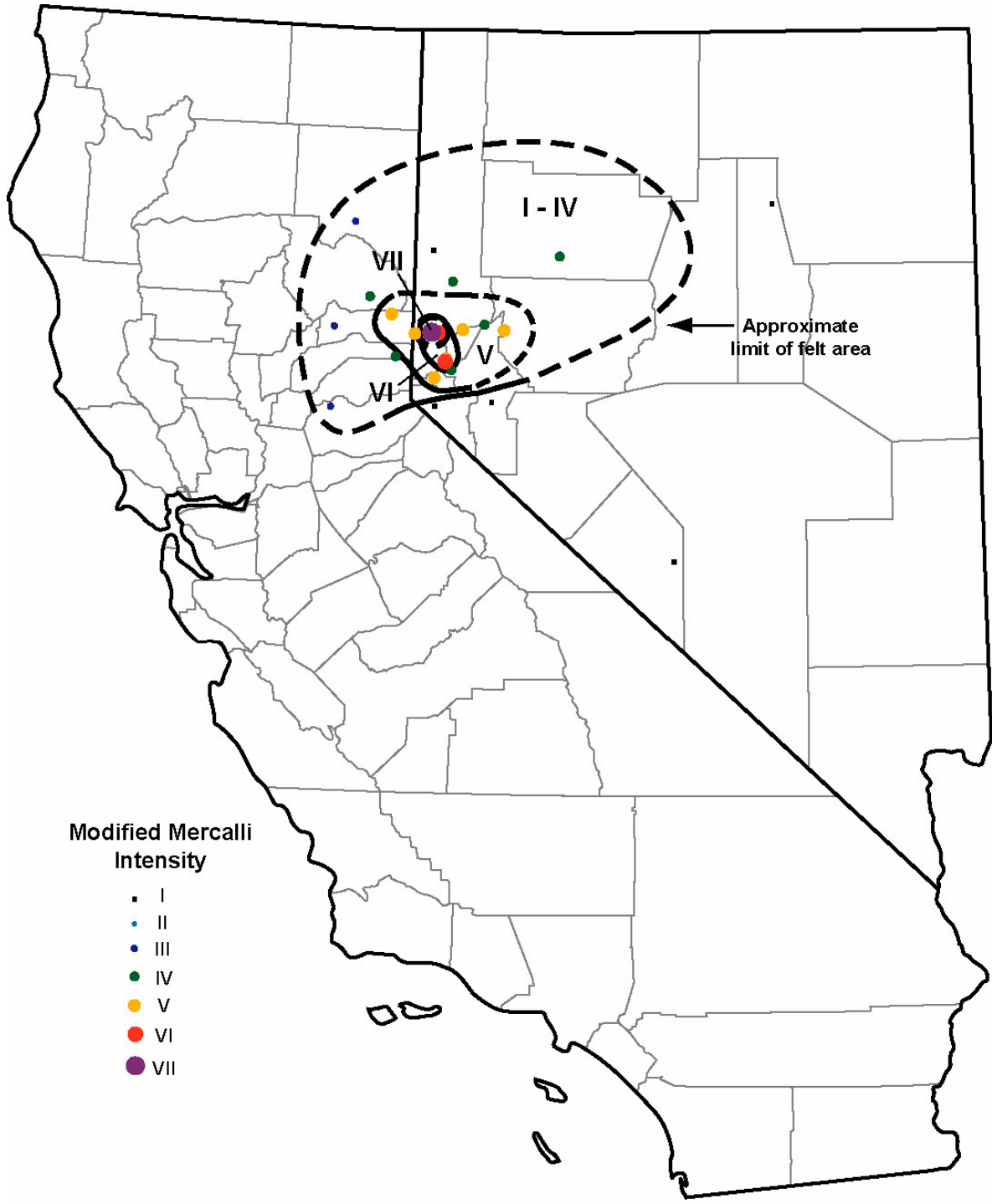
The felt area includes western Nevada and part of the central Sierra Nevada.

Isoseismal Map

Figure 2 is a Modified Mercalli Intensity isoseismal map of the February 18, 1914 earthquake using the data generated in this report. It is the first intensity map ever produced for this earthquake. The intensity VI area is fairly small, basically surrounding Reno, Sparks, and Virginia City. The intensity V area is a quasi-triangularly shaped area that includes Carson City, Hazen, and Loyalton, CA. The felt area is poorly defined and largely inferred because of the sparse settlement of Nevada, but the event was not generally felt in the Sierra Nevada, southern Carson Valley, or throughout much of Nevada. There appears to be an asymmetry to the felt area with more area to the north of the earthquake.

Table 1 Intensity Assignments for the February 18, 1914 Reno Earthquake

<u>Place</u>	<u>Modified Mercalli Intensity Estimate</u>	<u>Comments and Sources</u>
NEVADA		
Astor Gravel Pit	I	not felt (JCJ 2/18)
Carson City	V	noticeable shock felt, very severe?, walls cracked? (CCDA 2/18, SFC 2/19)
Clark	V	heavy (VC 2/19)
Dayton	IV	very pronounced shock (VC 2/18)
Fernley	III-IV	felt (JCJ 2/18)
Gardnerville	I	not felt (ST 2/18)
Goldfield	I	not felt (REG 2/20)
Hazen	V	severe (ST 2/18)
Lovelock	IV-V?	slight shock, dishes thrown from table to floor one place (R-M 2/20)
Neuzel	I	not felt (VC 2/19)
Palisade	I	not felt (REG 2/18)
Reno	VII	partial collapse of chimneys and firewall, broken windows, people alarmed (NSJ 2/19; SS 2/19)
Sparks	VI+	windows broken, people alarmed (REG 2/18)
Sutcliff	III-IV	felt (JCJ 2/18)
Sutro	V-VI?	similar to Virginia City (VC 2/18)
Verdi	V	severe, some damage? (G 2/14/34, SB 2/18)
Virginia City	VI+	windows broken, people rushed to streets and were panicked, old house fell (DTE 2/19; VC 2/18, REG 2/18)
Yerington	I?	not generally felt (VC 2/18)
CALIFORNIA		
Downieville	III	heavily felt by a few (MM 2/19)
Georgetown	II-III	slight shocks felt (GG 2/19)
Loyalton	V	quite severe - lasted 5 secs. (MM 2/18)
Portola	IV	distinctly felt, dishes rattled (SB 2/18)
Sacramento	I?	
San Francisco	I	not felt (ST 2/18, CCN 2/19)
Susanville	III	few people noticed it (LA 2/20)
Truckee	IV	several felt it (TR 2/19)



Modified Mercalli Intensity Map of the February 18, 1914 Reno Earthquake

Figure 2

1914, April 24, Reno Earthquake

EARTHQUAKE SUMMARY

The April 24th earthquake was the largest event in the 1914 Reno earthquake sequence, and it was the largest earthquake in the United States that year (Townley and Allen, 1939). The nighttime earthquake (12:34 a.m. PST) caused damage in Reno, and was felt as far north as Winnemucca, as far east as Elko(?), as far west as Berkeley, and as far south as Randsburg in California; it might have been felt even further out if it had occurred during the daytime. At least five aftershocks were felt through the night following the mainshock (CCDA 4/25/14). Earthquakes were also reported on April 25 and 26, which were either aftershocks or possibly related to a second earthquake source area, closer to Virginia City. In nearly every aspect the April 24th earthquake had significantly higher intensities than the February 18th quake. The locations of the origins of the earthquakes were likely similar. A major foreshock at 8:03 a.m. (PST) occurred the day before (Thursday), and was the third largest event of the sequence.

The shaking in Reno was described as being stronger than the February earthquake and between 6 and 15 seconds in duration (REG 4/24/14); duration in Virginia City is reported as about ten seconds (TE 4/25/14). The shaking was extra severe and was followed by a rolling motion in Sparks (ST 4/24/14). Although no scale is provided, the April seismoscope record from the Mackay School of Mines in Reno appears to have significantly larger amplitudes and is richer in lower period waves than the February record.

In Reno, people scrambled to the streets from saloons, restaurants, and hotel lobbies (VC 4/24/14). “The exodus from this [Riverside Hotel] and other hostelries was general, but the centers of the streets became thronged promenades for an hour or two.” (REG 4/24/14). There was also a general exodus from a party being given at a residence on the asylum grounds, where several of the ladies present fainted (REG 4/24/14). People were awoken from their sleep as far away as the Great Valley in California, and in Sacramento, people rushed to the streets from buildings in their nightclothes (SU 4/24/14).

There were a lot of bricks thrown on the sidewalk in front of the office of the Reno Mill and Lumber Company on East Fourth Street (REG 4/24/14). A hotel on commercial row had fallen plaster and soot from a disarranged stovepipe, and there was a possible stovepipe disarrangement at “Lake and Plaza” (REG 4/24/14). There were other unverified reports of fallen plaster, cracked window panes, and broken dishes (REG 4/24/14). The earthquake was most severe at University Hill knocking down two chimneys at Manzanita Hall, and two chimneys at Lincoln Hall were leveled (REG 4/24/14). The stack on the Hatch building was toppled over, and glassware was broken and instruments were upset in the physical and chemical laboratories (REG 4/24/14). At the state asylum, the main asylum building was slightly damaged when a cracked appeared in one wall (NSJ 4/35/14). A residence at 507 Washington Street lost several square meters of plaster in a bedroom, had a chimney shaken to its foundations and spilling bricks, and a window was broken (REG 4/24/14). At 435 Ridge Street, treasured chinaware was

thrown down and broken (REG 4/24/14). At Colorado Grocery, canned goods and other materials fell, but there was no breakage; in “the warehouse” tiers of boxes fell (REG 4/24/14).

In Virginia City, people who were up dashed into the streets (DTE 4/24/14). Pictures were jarred from the walls, dishes were jarred from shelves, and plaster was broken from some of the ceilings of some residences along C Street (VC 4/24/14). Miners underground reported a rumbling could be heard before the shocks were felt, and that timbers cracked and some drifts were filled with dust (DTE 4/26/14).

In Carson City, people were awakened, and those that were up rushed to the streets; the shock was of several seconds duration (CCN 4/24/14). At Loyalton, California, “bricks fell from chimneys and the brick walls of the Montague Drug Store were cracked” (SB 4/24/14). At Winnemucca the earthquake lasted about “a half a minute,” was felt throughout the town, awakened many people from their slumbers, overturned a clock on a shelf, and set a rocking chair to rocking (HS 4/24/14). The shock was quite severe at Gerlach, Lovelock, and Seven Troughs (HS 4/24/14). The shock was also severe and lasted for about 10 seconds at Alta, California (SB 4/24/14).

An aspect that distinguishes the April 24th earthquake from the February 18th is the effect on the Great Valley of California. At Sacramento, “many tall buildings rocked considerably” and the guests of many uptown hotels were awakened and rushed to the streets in their nightclothes (SU 4/24/14; ER 5/1/14). At Marysville, people were aroused from their sleep by vibrations that lasted from 5 to nearly 15 seconds, and rushed into the streets (SB 4/24/14; SWA 4/24/14). A lumber pile at the Shasta Lumber Company in Marysville was shaken down (SB 4/24/14). People were awakened in the Great Valley by a few to several seconds of shaking from Stockton in the south to Chico in the north (SER 4/24/14; CR 4/24/14).

There likely were two sources of earthquakes were active during early 1914, when the felt patterns of some of the aftershocks are considered. In particular, a small series of earthquakes on the morning of April 25, 1914 (main event 9:18 a.m. PST) appears to have shaken Virginia City and Carson City more than Reno. In Virginia City people rushed out of their homes to the streets from tall buildings, several women fainted, a brick chimney was shaken over at the Cole building, and plaster fell in a number of residences. At Carson City, four earthquake shocks occurred in the morning and caused people of the city to roll around for a few seconds and many ran into the streets. The shaking was also very strong at Bowers Mansion in Washoe Valley. All of these locations are to the south of Reno, indicating the April 25th event was south of the preceding events.

EARTHQUAKE SEQUENCE

The April 1914 Reno Earthquake Sequence (PST):

April 23	4:02 a.m.	slight foreshock
	8:03 a.m.	foreshock; caused excitement in Reno
April 24	12:34 a.m.	mainshock [most severe in years in Reno and Sparks]
	- 8:04 a.m.	five aftershocks reported felt in Carson City between mainshock and ~8:04 a.m. - heaviest a few minutes past 8:00 a.m.
April 25	8:21 a.m.	3 aftershocks? [felt & damage in Virginia City]
	9:18 a.m.	3 aftershocks? [felt & damage in Virginia City]
April 26	9:48 p.m.	aftershock [felt in Sparks, Reno, V.C., C.C. & Dayton]
	10:03 p.m.	aftershock [felt in Sparks, Reno, V.C., C.C. & Dayton]
May 5	morning	slight aftershock

[June 1 - Mt. Lassen, northeastern California, erupts for the first time]

Note: To aid in reading some of the reports, April 23 was a Thursday, the 24th was a Friday, the 25th was a Saturday, and the 26th was a Sunday.

EARTHQUAKE CATALOG ACCOUNTS

Bulletin of the Seismographic Stations, University of California, Berkeley

Earthquake of April 24, 1914

The records of this earthquake which were obtained at Berkeley were exceptionally well written, while only one component was recorded at Lick Observatory. The distance of origin from Berkeley was about the same as that of the Reno earthquake of February 18, 1914, but the amplitudes of the vibrations of this earthquake were several times as great at Berkeley as those of the Reno earthquake. When it was remembered that the Reno earthquake was strong enough to produce cracks in masonry walls in the region of its epicenter, it was naturally supposed that this latter earthquake had been one of considerable intensity.

The earthquake was felt at Sacramento, Stockton, Grass Valley, and at many other places which reported this earthquake made mention of any unusual intensity. It was not reported felt either at Berkeley or at Mount Hamilton.

An attempt was made to locate the epicenter from the observations at the University of California stations and at other stations. The observations thus used were obtained at Berkeley, Lick Observatory, St. Louis University, Washington University, Sacred Heart College in Denver, and the Tucson Magnetic Observatory. It was not found possible, however, to locate the position of origin in this way. This was doubtless due to errors in interpretation of the records.

The earthquake was not felt in southern Oregon, as far as could be judged from reports there. It was not felt at Cedarville, California, yet it was strong enough at Susanville to displace loose objects and to waken sleepers. At Sacramento it was strong enough to cause a few people

to run into the streets. At Randsburg and Markeleville the earthquake was reported felt. At Bodie sleepers were awakened. The earthquake was felt at Candelaria, Winnemucca, Genoa, and Belmont in Nevada, but was not severe at any of these points. At Lida, Nevada two shocks were felt. Newhall, Nordhoff, Piru, Maricopa, and Santa Paula, in Southern California, reported that no shock was felt.

The reports of intensity at various points were not numerous enough nor complete enough to enable the isoseismal lines to be drawn. It was therefore, not possible to determine the approximate position of the epicenter in that way.

The wide area over which this earthquake was felt, together with the fact that no very high degree of intensity was reported at any point, seems to indicate that it was an earthquake whose depth of origin was greater than is usual for the ordinary earthquakes of this region.

Townley and Allen (1939)

1914 April 24. 12:35 a.m. VIII [RFI] Western Nevada. Seismograms indicated that this was the strongest shock of the year in the United States. The hour of occurrence was unfavorable for perception, but reports were turned in from points as far south as Randsburg, Kern Co., California, on the south; Stockton, California, on the southwest; Susanville, Lassen Co., California, on the northwest; and Winnemucca, Humboldt Co., on the northeast. The intensities at Stockton, Susanville, and Winnemucca were about IV, showing that at a more favorable hour the shock would have been felt considerably beyond those points. The area of perceptibility was of the order of 100,000 square miles.

The statement of the *Bulletin of the Seismographic Stations of the University of California*, that the shock was less strong at Reno than the earthquake of the previous February is incorrect. This shock was of intensity VII to VIII in Reno, one grade higher than the previous shock; four chimneys were toppled on University of Nevada buildings, and many other chimneys fell throughout Reno. The shock was "severe" at Hazen. It is probable that the shock originated northeast of Reno, toward Fernley or Wadsworth.

Estimated intensities are: In California; Sacramento, IV; Stockton, III to IV; Susanville, IV to V; Grass Valley, V; In Nevada: Reno, VII to VIII; Sand Pass and Gerlach, central Washoe Co., V;

Winnemucca, IV; Belmont, Nye Co., IV. Duration 30 seconds at Yerington, Lyon Co. - *Reno Evening Gazette*, April 24, 1914; *Nevada State Journal*, WB Form 1009; BSSUC, **1**, 158, 163, 167; University of Nevada Records.

1914 April 25. 9:03 a.m. Bowers Mansion, twenty miles south of Reno. Heavy. Slight at Reno. - University of Nevada Records.

1914 April 26. 9:53 p.m. III. [RFI] Reno. Duration four seconds. Felt at Nevada City, California. - University of Nevada Records; WB Form 1009

1914 April 26. 10:07 p.m. Reno. Slight. - University of Nevada Records.

1914 May 5. 10:30 a.m. I. [RFI] Reno. Very slight. - University of Nevada Records.

1914 May 8. 3:47 a.m.; 4:07 a.m.; 8:42 a.m. Reno. Slight. - University of Nevada Records.

1914 May 12. 4:10 a.m. III. [RFI] Reno. Slight; awakened some. - University of Nevada Records.

1914 May 20. 2:03 a.m., 8:44 p.m., 9:16 p.m. II, I, II. [RFI] Reno. - University of Nevada Records.

1914 May 28. 3:16 p.m. Reno. Slight. - University of Nevada Records.

1914 October 31. 7:45 a.m. Reno. Slight. - University of Nevada Records.

1914 November 18. 9:38 p.m. Reno. Slight. - University of Nevada Records.

1915 February 6. 6:30 a.m. Reno. Slight. - University of Nevada Records.

Slemmons and others (1965)

1914-04-23 16:02: [GMT] 39.5 [N. Lat.] 120 [W. Long.] II [MMI]
WB. Moderate shock of 2 sec N-S and E-W motion. NRE [not reported elsewhere]

1914-04-24 08:34: [GMT] 39.5 [N. Lat.] 119.8 [W. Long.] 6.4 [magnitude]
VIII [MMI]

under "reliability" Slemmons and others (1965) list an "E" meaning "(S-P) distances from three stations or felt in an area that is near the intersection of two distances or aftershock of a well located main shock with distance from one station."

WB. T-A. BKS & JCJ. Heaviest shock in Reno since 1868, in U.S. this year. Lasted 10 sec. Toppled chimneys. Felt area CA. 100,000 sq. mi. Intensities at Winnemucca, Stockton, Susanville were IV.

[WB = U.S. Weather Bureau at Reno, Nevada; T-A = Townley and Allen (1939); BKS = Seismographic Station or Bulletin, Univ. of CA., Berkeley; JCJ = J. Claude Jones "diary"]

1914-04-25 17:03: [GMT] 39.4 [N. Lat.] 117.7 [W. Long.] II [MMI]

under "reliability" they list an "L" meaning "felt at one locality"

T-A, WB & JCJ. Heavy 20 mi. S. of Reno, 2 distinct light shocks at Reno with 2 sec duration.

1914-4-27 05:53: [GMT] 39.5 [N. Lat.] 120. [W. Long.] III [MMI]

under "reliability" they list a "K" meaning aftershock of H quality epicenter ["H" is an "epicenter from well drawn isoseismals."] or felt at two places"

T-A, WB & JCJ. Heavy shock in Reno (4 sec.) & Nevada City, Calif. Felt area CA 7,500 sq.

mi.

1914-04-27	06:10: [GMT]	39.5 [N. Lat.]	120. [W. Long.]	II [MMI]	L [reliability]
T_A & WB. 1 sec. Slight aftershock felt in Reno					
1914-05-05	18:30: [GMT]	39.5 [N. Lat.]	119. [W. Long.]	I [MMI]	L [reliability]
T-A, WB & JCJ. Slight shock at U. of Nevada. [note: latitude was listed as "19.5" in catalog which is an obvious error; the latitude of "39.5" is almost certainly what they meant to list.]					
1914-05-08	11:47: [GMT]	39.5 [N. Lat.]	120. [W. Long.]	III [MMI]	L [reliability]
T-A, WB, JCJ. Slight shock awakened some in Reno. Some claim to have felt 2 aftershocks.					
1914-05-08	12:07: [GMT]	39.5 [N. Lat.]	120. [W. Long.]	I [MMI]	L [reliability]
T-A & JCJ. Slight aftershock in Reno.					
1914-05-08	16:42: [GMT]	39.5 [N. Lat.]	120. [W. Long.]	I [MMI]	L [reliability]
T-A & JCJ. Slight aftershock in Reno.					
1914-05-12	12:10: [GMT]	39.5 [N. Lat.]	120. [W. Long.]	III [MMI]	L [reliability]
T-A. BKS & WB. Awakened some in Reno.					
1914-05-20	10:03: [GMT]	39.5 [N. Lat.]	120. [W. Long.]	II [MMI]	L [reliability]
T-A, WB & JCJ. Light shock in Reno. Woke only very light sleepers. Low rumble.					
1914-05-21	04:44: [GMT]	39.5 [N. Lat.]	120. [W. Long.]	I [MMI]	L [reliability]
T-A, WB & JCJ. Slight aftershock of above.					
1914-05-21	05:16: [GMT]	39.5 [N. Lat.]	120. [W. Long.]	II [MMI]	L [reliability]
T-A, WB, & JCJ. Aftershock. Single jerk.					
1914-05-28	23:16: [GMT]	39.5 [N. Lat.]	120. [W. Long.]	III [MMI]	L [reliability]
T-A & JCJ. Reno. Slight. Felt.					
1914-10-31	15:45: [GMT]	39.5 [N. Lat.]	120. [W. Long.]	I [MMI]	L [reliability]
T-A & JCJ. Reno. Slight.					
1914-11-19	05:38: [GMT]	39.5 [N. Lat.]	120. [W. Long.]	I [MMI]	L [reliability]
T-A & JCJ. Reno. Slight. 1 sec. E-W motion.					
1915-02-06	14:30: [GMT]	39.5 [N. Lat.]	120. [W. Long.]	I [MMI]	L [reliability]
T-A & JCJ. Reno. Slight.					

Bolt and Miller (1975)

4/23/1914 16- 4--0. [GMT] 39.42 [N. Lat.]120.00 [W. Long.] F [felt]
Floriston.

4/24/1914 8- 3--0. [GMT] 39.42 [N. Lat.]120.00 [W. Long.] F [felt]
Strongest shock of the year in the U.S. Felt over an area of 100,000 square miles.
Epicenter probably NE of Reno, toward Fernley or Wadsworth, Nevada. VII-VIII at
Reno, Nevada. V at Susanville and Grass Valley, and Sand Pass and Gerlach, Nevada.
IV at Sacramento and Stockton.

4/25/1914 18-- 0-- 0. [GMT] 39.42 [N. Lat.]120.00 [W. Long.] F [felt]
Floriston. Probably an aftershock of the Nevada quake.

Topozada and others (2000)

1914 4 24 39.5 [N. Lat.] -119.8 [W. Long.] 6.0 [magnitude]

NEWSPAPER ACCOUNTS**Nevada Newspapers**

Nevada State Journal (Reno)
April 24, 1914

SEVERE QUAKE AWAKENS RENO

TEMBLOR OF TEN SECONDS' DURATION PROVES MOST SEVERE YET REGISTERED
HERE

One of the most severe earthquakes felt in Reno in years was recorded at 12:33 o'clock this morning. The shock was of at least ten seconds duration and traveled in a southwesterly-northeasterly direction.

No damage was reported, although the temblor was of sufficient force to shake down any unstable structure. On Second and Virginia streets saloons and restaurants were emptied of all occupants in record breaking time and at the Journal office the entire staff vied with one another in seeking a safe retreat. Hotel lobbies were likewise emptied. As several of those who beat a hasty retreat explained it, they were not scared, but merely wished to see another day.

At Carson City two temblors were reported, but no damage occurred at the capital city. The quake of this morning was preceded by a minor disturbance shortly after 8 o'clock yesterday morning. The earlier temblor was of but a second or two duration. The seismograph at the

University of Nevada barely recorded the quake.

Nevada State Journal (Reno)
April 25, 1914

SMALL DAMAGE FROM TEBLOR

Brick Chimneys Are Thrown to Ground at University and Throughout City

QUAKE BREAKS UP DANCE

Four Women Attending Social Affair Faint When Earth Trembles

Reno did not escape unscathed from the severe earthquake that awakened this city shortly after midnight yesterday morning. Although no serious damage occurred, the force of the shock was sufficient to dismantle several brick chimneys at the University of Nevada and at a few dwellings in various parts of the city. It was reported yesterday that the tower at the Central fire station was jolted out of plumb but this was vehemently denied and it was declared the tower was not and never had been out of plumb. A second rumor that the Nevada hotel had been jarred and was likewise out of plumb, was denied last evening by the hotel management when it was stated the building had not been injured in any manner and was just as substantial as when first erected. At the state asylum Dr. and Mrs. John A. Lewis were entertaining a number of friends at a dance. A dance was in progress when the quake occurred and four of the ladies were so terrified that they promptly fainted. The main asylum building was slightly damaged when a crack appeared in one wall.

Several residents reported yesterday that the main temblor was preceded by a tiny shake about five minutes before the main cut-up registered an arrival. In many instances the presence of the earlier disturbance was not noticed. Several minor shocks also followed the big boy but the shaking was barely perceptible.

Yesterday morning Prof. J. C. Jones, head of the Mackay school of mines at the University of Nevada, inspected the seismograph at the mining building and the plate had recorded a disturbance of extreme dimensions. Prof. Jones is of the belief that the movement was sufficient to move the brick walls of the building at least three-quarters of an inch. The record shows the movement was from east to west.

M. C. O'Connel visiting yesterday from Hazen, said the shock was severe there.

Nevada State Journal (Reno)

April 26, 1914

Reno Earthquake Performed the Figure Eight On Seismograph

[figure showing seismoscope record from UNR - caption: Earthquake Movement as Recorded by Seismograph at University of Nevada]

BY PROF. J. C. JONES

Head of the Mackay School of Mines
of the University of Nevada

The above autograph of the recent earthquake represents the path in a horizontal direction multiplied by five through which a given point moved during the passage of the quake. It was produced by the working of a pen point attached to a pendulum which remained practically at rest on the plate of smoked glass firmly attached to the wall at the Mackay school of mines. It shows that the wall actually moved back and forth at least $\frac{3}{4}$ of an inch in an east and west direction and vibrated nearly as far north and south.

It is exceedingly difficult if not impossible, to trace the entire movement in detail but enough can be given to allow anyone who wishes to attempt the complete solution of the maze. The beginning of the earthquake is represented by the extremely irregular line about the center of the plate. The earth moved southerly with many slight vibrations to the east and west for a distance of one quarter of an inch. Then there was a sudden jerk to a somewhat greater distance to the east followed by a greater swing to the north. The vibrations increased in length in all directions and about the climax the earth moved suddenly westward about $\frac{3}{4}$ of an inch, did a figure of eight, and then as suddenly resumed its former position. At one time the movement was severe enough to move the pen completely off the 4 x 5 plate as is shown by the single scratch at the bottom of the plate. The vertical movement of the earth is indicated by the dotted line appearing in the record where the pen was jarred up from the plate and making a record only at the moments when it hit the plate.

Too little is known at present of the general extent of the earthquake to safely indicate the problem source of the disturbance but from the character of the record it would seem as if the fault along which the slip occurred was located at no great distance to the west of Reno.

Nevada State Journal (Reno)

April 26, 1914

VIRGINIA CITY FELT THE QUAKE

At 12:33 o'clock Friday morning the severest shock of earthquake ever felt here visited the Comstock.

Nevada State Journal (Reno)

April 27, 1914

ANOTHER SHOCK FELT IN RENO

Vigorous Short Shake Followed by Slight Tremble; No Damage Reported

Reno received another shaking up last night at 9:54 o'clock which provided a sharp reminder of the more pretentious jar of early Saturday morning. It was followed in about a quarter of an hour by a scarcely perceptible vibration. No damage was done.

The first shock was sharp and emphatic but not long continued. It lasted perhaps more than a second, compared with the Saturday night shock of some 8 seconds. Patrons of the theaters felt the shake and many rose but soon resumed their seats. One or two left the buildings but without any sign of panic. At the Majestic during the performance of the moving picture play "Les Miserables" the electrician turned on the lights full when the shock came that the patrons might see their way in case of need for a hasty exit.

The shock was reported at Sparks and also at Hines ranch near Washoe City.

Reno Evening Gazette
April 24, 1914

EARTHQUAKE WAKES RENO SLUMBERS

Uninvited Guest Calls Shortly After the Hour of Midnight

MOST SEVERE SHOCK EVER FELT LOCALLY

More Damage to Nerves Than to Personal Property Or Real Estate

The earth trembled. Gosh, how it trembled! This all happened at 34 ½ minutes past midnight. Western Union clocks which stopped at that moment are witness to the exact time as also the university clock in the comptroller's office.

It began with a mumble and a rumble and a grumble, then a vibration, followed by an oscillation, a tango, a turkey trot, Castle glide, Century club wiggle, Belle Isle joggle and a Verdi rag.

The seismograph at the university got rattled and mixed up the points of the compass, starting to construct a cobweb and winding up with Valenciennes lace tapestry. The duration is variously placed at from 6 to 15 seconds.

The proprietor of a hotel on Commercial row this morning said that he did not feel it at all, but he was engaged bossing the sweeping out of plaster. A lady at Lake and Plaza complained of the soot which the wind knocked down the chimney after it had disarranged the stovepipe.

Some say the Hotel Nevada is out of plumb and others say it happened prior to the earthquake. "All eyes were turned" upon the Central fire station and guesses as to the extent of the tower being forced out of plumb range from 19 inches to four feet, but not a crack shows in the structure.

There were a lot of bricks this morning on the sidewalk in front of the office of the Reno Mill and Lumber company on East Fourth street, but they have probably been replaced by this time. A number of reports come from falling plaster, broken dishes and cracked window panes, but these rumors are extremely difficult of verification, because they rarely occur. As a matter of fact, the earthquake, while several seconds in duration and of larger dimensions than any felt in this city for many years, was not violent. It was
(continued on Page Six)

RENO SHAKEN BY TEMBLOR

Chimneys Are Knocked over and People Frightened by Severe Quake
(continued from Page One.)

undulating in its nature, taking no sharp curves, but sort of the swaying, rhythmic sort, really more conducive to sleep than insomnia.

The shake was most severe on University hill. Two chimneys were knocked from Manzanita hall. The same number from Lincoln hall were leveled and the stack on the Hatch building toppled over. In the physical and chemical laboratories a quantity of glassware was broken and some instruments upset.

Prof. J. C. Jones reports that the needle of the university seismograph went clear off the disk, recording a movement of at least three-fourths of an inch in the general direction of the shock, which was easterly and westerly, with lateral vibrations. There was also a considerable vertical motion, which the instrument did not record, but which probably indicated that Reno was the center of the disturbance.

At 1:33 there was a slighter shock and probably others through the night, but the record plate at the university seismograph was not changed so that they could be recorded.

Prof. Jones believes that this was the principal shock in the series. Others may occur, but it is unlikely that they will be of equal severity. The tremors that may be expected will be due to subsequent settlements after the slip on the present fault.

T. J. Bradshaw and family of 507 Washington street were greatly perturbed when several square yards of plastering fell from the bedroom ceilings and a chimney, shaken to its foundation, began spilling bricks. One window was broken.

A party was being given by Dr. and Mrs. John A. Lewis at their residence on the asylum grounds. The shock was so severe that several of the ladies present fainted and there was a general exodus from the building.

Reports from Sacramento this morning are that the shock was quite severe there. No matter how bad it might have been at San Francisco, earthquake news is censored there.

W. C. Noteware, who arrived on No. 5 this morning reports that the shock was heavy at Imlay and Lovelock, while it was reported over the railroad wires that it was also felt in Elko and other points east.

When the clerks arrived at the Colorado grocery this morning they found a great mass of canned goods on the floor. Other merchandise fell from the shelves, but there was no breakage. In the warehouse tiers of boxes fell.

Mrs. D. H. Bruce of 452 Ridge street laments the loss of some treasured chinaware, which was thrown from a sideboard and broken.

A guest at the Riverside succeeded in negotiating two flights of stairs without waiting for the

elevator, and then fainted on the lobby floor. The exodus from this and other hostleries was general, but the centers of the streets became thronged promenades for an hour or two. In a room of one of the students in Lincoln hall at the university a clock was stopped by the February quake. The student did not start it again, but placarded it with the date and a brief history of the tremor. But he might have saved himself the trouble, for the quake last night set the timepiece going again.

NO CAUSE FOR ALARM

Lest we become somnolent, inattentive to business, given to too leaden slumber, there comes at intervals a suggestion from our mentor, El Temblor. He does not use a bludgeon, as in certain localities elsewhere, but a mirth provoking slapstick. We like these earthquakes in Nevada. They are indicative that the earth is settling and settlement is what Nevada wants.

Prof. Jones has a theory, but he needn't grow chesty about it for there are thousands of other people in this City who wouldn't be able to differentiate between an ague seizure and a seismograph, who also have them. As a matter of fact, everybody is willing, no matter whether his coffee grows cold or not, to relate just where he was, what time it happened to be, how he felt, the duration of the shock, its direction, the oscillation of the chandeliers, all the circumstances attending and why they attended.

Meanwhile people peer forth and discover a building that has slanted ever since it was erected, a wall that cracked when bricks were laid, a window pane that was broken by a suffering kid, a crevice due to ground that settled when the country was.

Taken together, by and yon, analytically and synthetically, the earthquake last night merely added to the zest of living. If dry bones were rattled, they are better for it. If a brick fell, it missed its mark. If the earth trembled, it was in view of the Mexican outlook and the possibilities of what might take place on the first Tuesday after the first Monday of next November.

Reno Gazette Journal April 25, 1914

NO DAMAGE TO HOTEL NEVADA

Structure in Same Condition As Before Shock

In the early dawn after yesterday morning's earthquake people saw angles and curves that would on other occasions have been pronounced tangents. They gave rise to the rumor that the Hotel Nevada had been put out of plumb by the shock.

Later it appears, according to people who are familiar with this building, survival of the great fire and landmark of the northwestern part of the city, that the earthquake did no damage to the structure and that it is perfectly safe and as substantial as ever, it being one of the most, honestly and carefully constructed buildings in the city.

Despite the heavy oscillation caused by the quake, there was no furniture moved in the building, no windows cracked and no fragile articles broken. An architect made a careful inspection of the

building and finds it to be in as safe condition as before the shock.

EL TEMBLOR BEGINS TO WEAR OUT WELCOME

“Speaking of these annoying little earthquakes, so oft recurring,” said Justice of the Peace Lee J. Davis this morning, “It reminds me of a sow a neighbor of ours owned back in Missouri. She was breaking the fence continually until the owner hit upon a scheme. He found a hollow log angled like a stovepipe elbow, and he put it in the fence, with both ends in the hog pasture. “The sow, seeing what looked like a good avenue of escape, ran through the log and found herself back in the pasture. The animal grunted in perplexity, crawled through again and kept this up until it became a bore.”

Reno Evening Gazette May 5, 1914

EARTHQUAKE SHOCK FELT AT UNIVERSITY

An earthquake of slight force and duration was noted at the University of Nevada this morning and was recorded by the seismograph at the Mackay school of mines, covering a space no larger than a pinhead. Person who were seated noted the shock, but others did not perceive it. Whether the little shake was the forerunner of more to come, or simply a windup of those that have passed, Prof. Jones of the department of geology was unable to say.

Sparks Tribune April 24, 1914

HEAVY SHOCK FELT

Last night shortly after 12:30 the people of this vicinity experienced the strongest earthquake shock that has been felt in this section. The exact time of the disturbance was 12:33 a.m. It was extra severe and was followed by a rolling that seemed to presage considerable damage. So far as we can learn there has been no ill effects follow in the path of the temblor. It is reported that the tower of the fire house in Reno is slightly askew as the result of the visit. The heavy earthquake of this morning was preceded by a slighter one yesterday morning. The prevailing direction of the shock was northeast to southwest. Carson City reports the visitation of two of the temblors.

Sparks Tribune
April 27, 1914

QUAKES

Two earthquakes within about 15 minutes were felt by the people of this section last evening. The first shock occurred about 9:48, while the second was a short time later. They were not as heavy as the one last Saturday morning.

The Carson City Daily Appeal
April 25, 1914

A Series of Temblors

Commencing about 1:30 this morning till about 9 o'clock, there were no less than six distinct shocks of earthquake felt in Carson City and vicinity. The first one was severe enough to arouse people from their slumbers, but did no damage. The heaviest was a few minutes after 9 this morning, and was of the jerky kind, but no damage is reported as the result of it. The shocks were also felt in Reno and Virginia, but no damage is reported as having been done.

The Carson City News
April 24, 1914

Earthquake

An earthquake shock at 12:35 this morning awakened the city and those who were up rushed into the streets. The shock was for several seconds duration and was followed about five minutes later with a lighter shock. The earthquake was felt in Reno and many there rushed to the streets.

RENO HAS SHAKE

An earthquake in Reno yesterday morning at 8:30, shook the city up in good shape and caused some excitement for a short time.

The Carson City News
April 26, 1914

SHOCKING ACTIONS

Four earthquake shocks in this city yesterday morning at 8:23 caused the people of the city to roll around for a few seconds and many ran into the streets. These earthquakes are getting to be a habit around here and will pass by unnoticed.

Daily Territorial Enterprise (Virginia City)
April 24, 1914

Two Severe Earthquake Shocks

A sharp earthquake at 8:04 o'clock yesterday morning was felt in this city and dishes and windows rattled. It was a double-jointed shock.

At twenty-five minutes to 1 o'clock in the morning the severest shock of the series of earthquakes which have been felt in this city in several years occurred, and people who were up dashed into the street.

Daily Territorial Enterprise (Virginia City)
April 25, 1914

Earthquake Severe Elsewhere

One of the most severe earthquakes felt in Reno in years was recorded at 12:33 o'clock this morning. The shock was of at least ten seconds duration and traveled in a southwesterly-northeasterly direction. No damage was reported, although the tremblor was of sufficient force to shake down any unstable structure - Reno Journal.

An earthquake shock at 12:35 this morning awakened the city and those who were up rushed into the streets. The shock was for several seconds duration and was followed about five minutes later with a lighter shock. - Carson News.

Daily Territorial Enterprise (Virginia City)
April 26, 1914

Jarred By Six Earthquakes

Six earthquakes - did you stop to count them - were felt in this city yesterday forenoon, and the way doors and windows rattled sounded like a cannonade in the Mexican war. The first came at 8:21, followed by two more at an interval of about one minute each. At 9:18 another occurred and two more quickly followed. People rushed out of their homes to the street from tall buildings and several women fainted.

A brick chimney was shaken over at the Cole building and in a number of residences plaster fell. All of the shocks were severe. Carson felt the same number of shocks as here, while at Dayton they were unusually severe. At Reno and Sutro the shocks were barely noticeable, though at the latter place a severe shock occurred during the night.

Men who were employed underground state that a rumbling could be heard before the shocks were felt and that timbers cracked, and in some places the drifts were filled with dust. In another place a wave could be seen in the ground as the shock came and it felt as though some giant

cannon had been fired against the side of the drift.

**Virginia Chronicle (Virginia City)
April 23, 1914**

Sharp Earthquake Startles Natives From Their Bunks

A sharp earthquake shock at 8:04 this morning startled the natives and in spite of its short duration caused many of them to run for their doors. It was over in a second and seemed to be in but one direction, but it brought people to their feet in a jiffy and many made record time to the street. Dishes were rattled on the shelves and a sand sprinkling of plaster were the only audible effects. But according to reports, some who were not yet out of bed, waiting for the psychological moment to arise, discovered it at just 8:04.

**Virginia Chronicle (Virginia City)
April 24, 1914**

Heavy Earthquake Shakes Comstock Early This Morning

At 12:35 this morning another heavy earthquake shock roused the citizens from their slumbers and sent many of them in a mad scramble to the streets, thinking Mount Davidson was about to erupt or Carranza was using a crowbar on the Mexican border. Some described the shock yesterday as "a corkscrew effect." The one last night was more like a milkshake or gin fizz, whichever you like best.

Plastering was broken from the ceilings of some of the residences along C street, pictures were jarred from the walls and dishes from their shelves. It lasted for about five seconds and was the longest and severest of the many recent temblors. No other damage was reported.

At Reno, no damage was reported, but the shock caused a scramble for the streets from saloons, restaurants and hotel lobbies. At Carson, there were two temblors, but no damage reported. The seismograph at the University of Nevada barely recorded the quake. We would like to see a seismograph record of this shake. It would look like a cross letter from Charley Sam trying to collect a bad debt.

A distinct rumbling accompanied the movement as is testified by those who were awake at the time. Reports of those who were working in the lower levels are to the effect that in the Con Virginia 2500 and 2300 level the shock was very severe and accompanied by rumbling. Those working underground at the Union say they did not feel any temblor at all. On the 2100 of the Ophir, a carman was running five joined ore cars filled with rock to the station at the time. The track rail gave way with the shock and upset the cars.

A couple of residents who were visiting overnight with a neighbor who lives in a brick house, suddenly remembered at 12:20 that they had forgotten to lock the door, had left the water running in the sink and had not put out the cat. They went right home to attend to these things. Be it ever so humble there's no place like home - especially if it's a wooden cottage, when an

earthquake comes. One young fellow jumped out of bed and rushed out the doors very quickly. He was doing the shivering Salome on the back step and would be there yet, probably, if somebody didn't remind him that it was early in the season to be wearing ducks. One of the old boys, whose landlady was out of town, said this morning: "When I woke up the plaster was sprinkled all over the bed, carpet and wash-stand. I'm afraid the old lady will think there was something up when she comes back, but honest, I ain't touched a drop for fully six days.

Virginia Chronicle (Virginia City)
April 25, 1914

Six More Heavy Earthquakes Stir Virginia City

Another series of earthquake shocks were felt this morning, at the first of which the brick chimney on the old Cole residence on B street went down. An old crack in the Steffan building, next to the postoffice building, was opened a little wider, and plaster was broken from the walls and ceilings in some residences.

No other damage was reported. The shocks were rather severe and two of them were preceded by rumblings. They had a northwesterly direction. The first came at 8:21 and was followed by two more at an interval of about a minute each. The second series of shocks began at 9:18, followed by two more at an interval of a half minute.

Six heavy shocks were felt at Carson, and at Dayton they were unusually severe. At Reno the temblors were scarcely felt. During the night a heavy shake was felt at Sutro, but this morning there was only one slight shock felt in that place. Judging from these facts these temblors are caused by local disturbances of some kind.

Virginia Chronicle (Virginia City)
April 27, 1914

Brief Earthquake Was Felt Here Last Evening

Two more earthquakes were felt here at about 9:45 last night. The first was the heavier of the two and both lasted a very short time probably not a full second. Carson, Reno, Dayton and Sparks felt them also, but no sign of a quake was felt at Sutro. At Reno the theaters were filled with people at the time. This shock is also reported to have been felt near Washoe City.

Virginia Chronicle (Virginia City)
May 13, 1914

Earthquakes on Six Days During April

The Reno weather bureau for last month summarizes the general condition as follows:
 “. . . Earthquake shocks occurred on six different days.”

New Time Seismograph is Expected Soon

Another slight earthquake of about the same intensity as the one four days ago was noted early this morning, the shock occurring at 4:10 o'clock. The movement of the earth was three-eighths of an inch, the same as in the previous earthquake. Some reports were received of earlier light shocks, but the records of these, if made, were tangled with the record of the heavier shake. Prof. Jones of the Mackay school of mines, says it will probably be a month or two before the new time-registering seismograph is received from Germany. - Gazette.

Garnerville Record-Courier
May 1, 1914

Last Friday morning at 12:30 this valley was shaken up by one of the heaviest earthquakes that has occurred here in some years. Windows rattled and for a few seconds the earth trembled quite violently, giving a scare to those awakened from their slumbers.

Review-Miner (Lovelock)
April 24, 1914

Severe Earthquake Shock Alarms Lovelock Sleepers

The most severe earthquake yet felt here occurred at about 12:35 o'clock this morning. It lasted nearly nine seconds and frightened a great many through its intensity.

Clocks were stopped all over town and a watch belonging to Dr. McDonald stopped on the hour of 12:37 o'clock. Second story occupants felt the shock severely. About half an hour after the shock a slight rain fell.

In Reno the duration of the tremor was fully ten seconds, traveling in a southwesterly-northeasterly direction, similar to what was experienced here. Hotel lobbies, saloons, and restaurants in Reno were emptied in a hurry, and while there was no damage reported, many were badly frightened. A short disturbance Thursday was noted, but it only lasted for a second or two.

Sparks was shaken considerably and at Hazen clocks were stopped and the shock was quite severe. Imlay reported a quake, but not so bad as the other towns.

Winnemucca did not feel it nor did Rochester, but Mill City reported a slight shake. Seven

Troughs however shook sufficiently to make everything in the store rattle though no damage is reported.

**The Churchill County Standard (Fallon)
April 22, 1914**

Earthquakes in Nevada have been common for a week past. Timorous ones have slept with one eye open lately and stand ready to break out the doors at the first inkling of a quake. Beyond cracking a few of town's business structures, no damage has been done. The district affected seems to be confined to this state, no reports of heavy shocks having come from the coast.

**The Churchill County Standard (Fallon)
April 29, 1914**

Two pronounced earth shocks of quakes were felt in Susanville this morning shortly before 1 o'clock. In some parts of the town they were of sufficient force to awaken light sleepers, although beyond the shaking of doors and windows and the peculiar sensations attending the oscillations of the earth, there was nothing to cause alarm. The movement seemed to be from west to east, and the tremors were of brief duration, lasting but a few seconds. No reports from other sections have as yet been received and it may be possible that the shake was a purely local disturbance. - Susanville Advocate

**The Humboldt Star (Winnemucca)
April 24, 1914**

SHARP EARTHQUAKE SHOCK LAST NIGHT

Winnemucca experienced an earthquake shock at 12:45 o'clock this morning which lasted about half a minute. The shock was felt throughout the town, being strong enough to awaken many people from their slumbers. In one home a clock was overturned on a self and in another a rocking chair was set to rocking. No damage is reported to any building in town.

Reports received this morning were that the shock was quite severe in Lovelock and Seven Troughs. It was not felt in Rochester.

Reports from Gerlach state that the shock was very severe at that place. The clock in the Western Pacific depot was stopped. The big safe in the depot was also moved several inches.

**Daily Free Press (Elko)
April 24, 1914**

Reno experienced another earthquake shock this morning says the Gazette, which lasted for

about a half a minute and which shook tall buildings very perceptibly. With an easy undulating rock, it started from south to north, then whipped around to the east and shook back and forth with a strong rocking motion.

The shock occurred at about 8:03 o'clock. It was not as violent as the earthquake felt in February when people ran from downtown buildings, but was probably next to that one in intensity.

According to the seismograph at the University of Nevada, the motion of the earth was only through a space of about 25 thousands of an inch. The machine multiplies the earths motion 10 times, and the machine indicator moved about a quarter of an inch.

Prof. J. C. Jones of the department of geology assumed that the shock must have come from the same spot as the February shock and must be due to similar causes because of the fact that the record of the seismograph, although smaller, was very similar. It was almost identical in form in fact. Without a series of reports covering the district in which the shock was felt, or a modern machine, it would be impossible to form definite conclusions about the shock, Professor Jones says. The new seismograph which has been ordered for the university will not arrive for about a month. The shock this morning was felt throughout Reno, being strong enough to be noticed by people standing on the street.

Daily Elko Independent
April 25, 1914

An earthquake early yesterday morning shook up Reno, Carson, and other towns in the state as far east as Winnemucca. It was quite severe at Reno and Gerlach. So far as we have learned the disturbance was not felt at Elko.

Daily Elko Independent
April 27, 1914

Four earthquake shocks in this city yesterday morning at 8:23 caused the people of the city to roll around for a few seconds and many ran to the streets. These earthquakes are getting to be a habit around here and will pass by unnoticed. — Carson Appeal.

Weekly Independent (ELKO)
May 1, 1914

JARRED BY SIX EARTHQUAKES

Sunday's Virginia Enterprise says:

Six earthquakes - did you stop to count them - were felt in this city yesterday forenoon and the way doors and windows rattled sounded like a cannonade in the Mexican war. The first came at 8:21, followed by two more at an interval of about a minute each. At 9:18 another occurred and

two more quickly followed. People rushed out of their homes to street from tall buildings and several women fainted.

A brick chimney was shaken over at the Cole building and in a number of residences plaster fell.

All of the shocks were severe. Carson felt the same number of shocks as here while at Dayton they were unusually severe.

At Reno and Sutro the shocks were barely noticeable, though at the latter place a severe shock occurred during the night.

Men who were employed underground state that the rumbling could be heard before the shocks and that timbers cracked and in some places the drift were filled with dust. In another place a wave could be seen in the ground as the shock came and it felt as though some giant cannon had been fired against the side of the drift.

Salmagundi (from Friday's Daily)

Reno and Virginia City were stricken up by an earthquake shortly after eight o'clock yesterday morning. No damage was done in either place.

Salmagundi (from Saturday's Daily)

An earthquake early yesterday morning shook up Reno, Carson and other towns in the state as far east as Winnemucca. It was quite severe at Reno and Gerlach. So far as we have learned the disturbance was not felt in Elko.

Salmagundi (from Monday's Daily)

Four earthquake shocks in this city yesterday morning at 8:23 caused the people of the city to roll around for a few seconds and many ran into the streets. These earthquakes are getting to be a habit around here and will pass unnoticed. — Carson Appeal.

Salmagundi (from Wednesday's Daily)

Reno had another earthquake shock Monday night.

The Commonwealth (Deeth) **April 29, 1914**

Reno did not escape unscathed from the severe earthquake that awakened that city on the morning of the 24th. Although no serious damage occurred the force of the shock was sufficient to dismantle several brick chimneys at the University of Nevada and at a few dwellings in various parts of the city.

**Reese River Revelli (Austin)
May 2, 1914**

WESTERN NEVADA BADLY SHAKEN UP

Commencing about 1:30 Saturday morning till about 9 o'clock, there were no less than 6 distinct shocks of earthquake felt in Carson City and vicinity. The first one was severe enough to arouse people from their slumber, but did no damage. The heaviest was a few minutes after 9 this morning, and was of the jerky kind, but no damage is reported as the result of it. The shocks were also felt in Reno and Virginia, but no damage is reported as having been done.

**White Pine News (East Ely)
April 26, 1914**

RENO HAS ANOTHER CASE OF THE "SHAKES."

Reno experienced another earthquake shock Wednesday morning which shook tall buildings very perceptibly, says the Gazette. With an easy, undulating rock, it started from south to north, then whipped around to the east and shook back and forth with a strong rocking motion. The shock occurred at about 8:03 o'clock. It was not as violent as the earthquake felt in February when people ran from downtown buildings, but was probably next to that one in intensity.

According to the seismograph at the University of Nevada, the motion of the earth was only through a space of about 25 thousands of an inch. The machine multiplies the earths motion 10 times, and the machine indicator moved about a quarter of an inch.

Prof. J. C. Jones of the department of geology assumed that the shock must have come from the same spot as the February shock and must be due to similar causes because of the fact that the record of the seismograph, although smaller, was very similar. It was almost identical in form in fact. Without a series of reports covering the district in which the shock was felt, or a modern machine, it would be impossible to form definite conclusions about the shock, Professor Jones says. The new seismograph which has been ordered for the university will not arrive for about a month. The shock this morning was felt throughout Reno, being strong enough to be noticed by people standing on the street.

California Newspapers

The Sacramento Bee

April 24, 1914

TEMBLOR INTERRUPTS SLUMBER AT MIDNIGHT

Shocks Vibrating From Northeast to Southwest, Rock the City

Sacramento and vicinity experienced an earthquake at 12:24 this morning. The temblor lasted for about three seconds. The motion was from northeast to southwest, and while distinct, the shocks were gentle and no damage was done.

Several clocks, including the one at the Weather Bureau, were stopped. There were three shocks. Little or no excitement was caused by the quake.

Local Forecaster N. R. Taylor declares it was one of the most severe Sacramento has experienced in many years.

RENO SHOCKED TWICE

(The Bee's Special Service.)

RENO (Nev.), April 24 - A sharp earthquake shock was felt here at 12:32 this morning. It lasted eight seconds.

The shock stopped many clocks in the city, shook dishes from shelves and knocked down chimneys. It also damaged several buildings.

Women at Party Faint

At a party at the Nevada Insane Asylum, given by Dr. and Mrs. John Lewis, several women fainted when the shock came.

All saloons and restaurants were cleared in short order. The big shock was followed by two of less force.

Shock Yesterday Morning

Another earthquake shock shook up the people of Reno yesterday morning at 8:02 o'clock.

It shook buildings. It was not as strong as the shock in February, which did some damage in the city.

The shock yesterday first shook from the north to the south, and then seemed to come from the east to the west. Professor J. C. Jones says that he believes the shock was due to the same cause as the shocks in February.

SEVERE AT ALTA

(The Bee's Special Service.)

ALTA (Placer Co.), April 24 - A severe earthquake was felt here at 12:30 this morning. The shock continued for about 10 seconds, and seemed to range in an east and west direction.

A severe frost also occurred, and it is feared that some damage has been done to fruit.

LAS PLUMAS WINDOWS BROKEN.

(The Bee's Special Service.)

OROVILLE (Butte County), April 24 - A heavy earthquake shock lasting fully fifteen seconds and having an east to west movement was felt in Oroville at 12:35 o'clock this morning. The shock rattled the windows in upper stories of buildings, and was even enough to awaken many residents.

Windows Shattered

According to reports received by the Western Pacific here, the shock was felt as far east as Gerlach, Nev.

At Las Plumas where the plant at the Great Western Power Company is located, a number of windows were shattered.

FELT AT GRASS VALLEY.

GRASS VALLEY (Nevada Co.), April 24 - An earthquake shock was felt here at 12:35 a.m. No damage was reported.

MILD AT STOCKTON

STOCKTON (San Joaquin Co.), April 24 - A mild earthquake was felt here at 12:34 this morning.

LUMBER PILE UPSET

(The Bee's Special Service)

MARYSVILLE (Yuba Co.), April 24, A severe earthquake shock was felt here at 12:35 last night. People aroused from their slumbers by the north and south vibrations, which lasted nearly fifteen seconds, were rushing into the streets.

The falling of a pile of lumber in the yard of the Shasta Lumber Company added to the excitement. No other damage to property is reported. Chandeliers and window weights chimed in unison for fully a minute following the shake.

BRICK BUILDING CRACKED

(The Bee's Special Service.)

LOYALTON (Sierra Co.), April 24, The earthquake felt here at 12:33 o'clock this morning was the severest in years. Bricks fell from chimneys and the brick walls of the Montague drug store were cracked.

Reports received here state that the shock was felt at Downieville, Quincy, Truckee, Cal., and at Carson and Virginia, Nev.

GRIDLEY FEELS SHOCK.

GRIDLEY (Butte Co.), April 24 - A severe earthquake was felt here this morning early. It lasted for about 15 seconds. No damage was done.

The Sacramento Union

April 24, 1914

Three distinct earthquake shocks were felt in Sacramento in rapid succession, the first shake occurring at 12:35 A.M. followed in rapid succession by two more shocks. The oscillations in all three shakes were from the southeast to northwest. The shocks commenced at a point near Gerlach, Nev. and continued to Berkeley. No damage occurred at San Francisco. The shocks were distinctly felt in Sacramento, many tall buildings rocked considerably. The guests of many uptown hotels rushed to the street in their night clothes. In the block on K Street between 9th and 10th the shock was severe. Woman guests in the Sequoia Hotel ran to the lobby and two male guests fled to the street carrying their trousers over their arms. In the block on K Street between 7th and 8th lodging houses were emptied of their guests in rapid order. Below 7th Street the shocks were so severe as in the upper portion of the city. In the Sacramento Union building the printers working on the 3rd floor rushed to the street, the building rocking considerably, stopping the office clocks.

Stockton also received a shakeup, but no damage was done. The shocks were so severe at Portola that of the town thought that two Western Pacific trains passing the town had collided. Marysville, Oroville, and Chico all reported severe quakes but no damage.

Eldorado Republican May 1, 1914

EARTHQUAKE SHOCK FELT IN PLACERVILLE

Timed at 12:40 A.M. Friday Though no Damage Results - General Over Central California
Placerville was in the path of an earthquake shock which seemed to extend from Reno to San Francisco. A distinct vibration was felt by several residents here at 12:40 but did not cause unnecessary apprehension. In other portions of the county the quake was more distinct, rattling dishes on shelves and shaking window panes. Only one shock was felt here and it lasted a mere second.

In Sacramento, three distinct shocks were felt at 12:35. The oscillation there seemed to be from the southeast to northwest. People in hotels were awakened and fled to the street in their night clothes. In the Sacramento Union building the printers working on the third floor rushed to the street, the building rocked considerably stopping office clocks. Stockton also received a shaking up, but no damage was done. The shocks were so severe at Portola that the people of the town thought that two Western Pacific trains passing the town had collided. Marysville, Oroville, and Chico all reported severe quakes, but no damage.

Marysville Evening Democrat

April 24, 1914**THE EARTH QUAKED**

An earthquake shock of about five seconds duration was felt in Marysville about 12:35 this morning, shaking lights, rattling windows and waking up scores of residents. The shock was the most severe in Gerlach, Nev., and was felt in degree in Grass Valley, Sacramento and Marysville. Its course was from east to west.

**The Semi Weekly Appeal (Marysville)
April 27, 1914****TEMBLOR FELT HERE EARLY THIS MORNING**

- San Francisco did not feel Quake -
- From Friday's Daily -

A severe quake was felt here this morning at 12:35. The temblor was felt all over town and waked many of the citizens from their slumbers. It stopped a clock in the Appeal office and rattled window panes and weights all over town. Those who were up at the time ran out into the streets as soon as the first quake was felt. To give some idea of how plain it was it might be stated that although the press in the Appeal office was running the shock was felt above the vibration of the press. A telephone message from San Francisco was to the effect that the temblor was not noticeable at that place.

**The Sutter Independent (Yuba City)
April 30, 1914**

MERDIAN, April 28. - There was an earthquake shock Friday morning at 12:35 which awakened people in this vicinity. Doors rattled and some light articles upset, but no damage was done.

AN EARTHQUAKE

About half past twelve [sic] o'clock Thursday night there was a very noticeable tremor in the earth which reached from Sacramento Valley east into Nevada. The shock was felt quite strongly in Live Oak, but no damage was done. In some vicinities a few windows were broken but no serious consequences are yet reported.

**Modesto Morning Herald
April 24, 1914****EARTHQUAKE FELT DOWN THE VALLEY NOT NOTICED HERE**

Information was received by telephone this morning that a sharp earthquake was felt at 12:45 generally throughout the valley. There were no reports that it was apparent in this city.

D. Dowst, night watchman of the Merced court house, reported it was sufficiently strong to rattle the windows in that building and it was stated that clocks were stopped by the shake at Lodi. Turlock, Stockton, and Sacramento all noticed the movement. It was stated that it was not noticed in San Francisco.

Stockton Evening Record
April 24, 1914

Shortly after 12:30 o'clock last night an earthquake shock was felt in Stockton. Many people were awakened by the shock which lasted for a few seconds. No damage has been reported here. Other California cities felt the shock. In Reno, Nevada, the earthquake shock lasted 8 seconds. No damage was reported in that state.

LODI LOCALS

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Earthquake in Lodi

A slight earthquake shock was felt here at 12:35 this morning. It lasted only a few seconds and was severe enough to stop several clocks in town and cause the furniture to move slightly.

The Angels Camp Record
April 29, 1914

A slight earthquake shock was felt here about two o'clock Friday morning. It was also felt at other points throughout the state. No damage was reported.

Modesto Evening News
April 24, 1914

Sacramento, April 24: severe earthquake shocks occurred at Sacramento, Gerlach, Nevada; Stockton, Portola, Chico, and Oroville early this morning. While several buildings were rocked in all the cities mentioned, no serious damage resulted.

The Semi-Weekly Appeal (Marysville)
April 27, 1914

From Friday's Daily: A severe quake was felt here this morning at 12:25. The temblor was felt all over town and waked many of the citizens from their slumbers. It stopped a clock in the appeal office and rattled window panes and weights all over town. Those who were up at the time ran out into the streets as soon as the first quake was felt.

To give some idea of how plain it was it might be stated that although the press at the Appeal

office was running, the shock was felt above the vibration of the press.

Woodland Daily Democrat
April 24, 1914

Three distinct earthquake shocks were felt in Woodland and vicinity at 12:35 a.m. this morning. Sacramento, Marysville, Oroville, Chico, and Stockton report heavy shocks, but no damage. There was no quiver in San Francisco.

The Winters Express
May 1, 1914

A very light shock of earthquake was felt by some of our residents about one o'clock Friday morning. The vibration was from northeast to southwest.

The Sutter County Farmer
May 1, 1914

Last Friday morning about 12:45 o'clock there was quite a shock here which awakened the residents and caused houses to shake and windows to rattle. The center of the quake is reported to have been near Reno, Nev. It was not felt in San Francisco.
 Sutter City: The earthquake shock was felt here distinctly by light sleepers and those who were awake early last Friday morning.

The Mountain Messenger (Downieville)
April 25, 1914

At least three distinct shocks of earthquake were felt in this neighborhood at about 12:30 o'clock this (Friday) morning. The tremors were preceded by the roaring that usually heralds a quake and the motion of the earth was unusually pronounced. The quake seemed to come from a southerly direction and move northward and the final shock seemed to be a jerk upwards and then suddenly fall.

The people living on Dungan Flat, nearest the serpentine belt that passes through Downieville, seemed to feel the quake more than those who resided in other parts of town, but no damage was done to any property so far as we have heard.

Georgetown Gazette
April 30, 1914

Last Friday three distinct earthquake shocks were felt in Georgetown in rapid succession, the first shake occurring at 12:35 A.M. followed in rapid succession by two others. The oscillations in all three shakes was from the southwest to northwest. The shocks commenced at a point near Gerlach, Nev., and continued to Berkeley. The shocks were distinctly felt in Sacramento, many tall buildings rocking considerably. Stockton also received a shaking up. The shocks were so severe at Portola that the people of the town thought that two Western Pacific trains passing the town had collided. Marysville, Oroville, and Chico all reported severe quakes. Another severe shock occurred about 10 o'clock Sunday night.

Chico Record
April 24, 1914

An earthquake shock of about 5 seconds duration was felt in Chico about 12:40 this morning shaking lights, rattling windows, and waking up scores of residents. The shock was the most severe in Gerlach, Nev. And was felt in less degree in Grass Valley, Sacramento, and Marysville. Its course was from east to west.

Alturas Plaindealer
May 1, 1914

The heaviest earthquake shock ever known in Reno visited that city on the morning of the 24th. Chimneys were knocked down and residents badly frightened. The shock was felt also in Sacramento, Quincy, and other points, but much lighter.

The Placer Herald
April 25, 1914

A slight shock of earthquake was felt in Auburn Friday 12:30 A.M. No damage was reported.

The Banner (Sonora)
April 24, 1914

Many persons in this city were awakened at twenty minutes to one o'clock last night by the shaking of their homes. An earthquake passed through from east to west and dallied on its journey a dozen or more seconds to let insignificant mortals know that there was a giant, powerful uncontrolled force in revolt in the subterranean depths of the old earth. The vibrations were moderately steady and slow, yet forcible.

The Tuolumne Independent (Sonora)
April 25, 1914

Quite a number of residents of Sonora noticed a slight earthquake shock Thursday night between 12 and 1 o'clock.

The Morning Union (Grass Valley)
April 25, 1914

**SHOCKS EARLY YESTERDAY WERE PRECEDED
 BY LIGHT DISTURBANCE THURSDAY MORNING**

Little slumber there was that was not interrupted by the quake early yesterday morning, and while the temblor caused much uneasiness for three seconds no damage was reported. Old timers declare that the disturbance was the most severe Grass Valley has experienced for many decades. Another shock is said to have been experienced in this city shortly after 8 o'clock Thursday morning.

A severe earthquake was felt at Alta at 12:30 yesterday morning. The shock continued for about 10 seconds, and seemed to range in an east and west direction.

Lassen Advocate (Susanville)
April 24, 1914

Two pronounced earth shocks or quakes were felt in Susanville this morning shortly before 1 o'clock. In some parts of town they were of sufficient force to awaken light sleepers, although beyond the shaking of doors & windows and peculiar sensations attending the oscillations of the earth, there was nothing to cause alarm. The movement seemed to be from west to east and the tremors were of brief duration, lasting but a few seconds. No reports from other sections have yet been received and it may be possible that the quake was a purely local disturbance.

The Red Bluff News
May 1, 1914

We refrained from mentioning the earthquake Thursday night for fear it would hurt our chautaugua. By so doing we got into the same class with the metropolitan dailies of San Francisco.

Courier-Free Press (Redding)
April 24, 1914

EARTH QUAKED AT 12:40 THIS MORNING

CHICO, April 24. - An earthquake shock of about five seconds' duration was felt in Chico at 12:40 this morning, shaking lights, rattling windows and waking up scores of residents. The shock was most severe in Gerlach, Nev., and was felt in less degree in Grass Valley, Sacramento and Marysville. Its course was from east to west.

SACRAMENTO, April 24. - Severe earthquake shocks were felt at Sacramento, Stockton, Portola, Oroville, Chico and Gerlach, Nev., this morning. Though buildings rocked, no serious damage was done.

OTHER ACCOUNTS

Notebook of Professor J. Claude Jones
Mackay School of Mines
University of Nevada

April 23rd [1914] 8:02 a.m. Slight record similar to that of Feb. 18 except maximum movement only 1/4" on record. Showed a strong N & S movement followed by E & W. Intensity II R.F. scale.

[photograph of Ewing-Duplex Seismometer Record]

Susanville 12:28 see letter of O.J. Kinniss(sp?)

Carson 12:34 W.J. Maxwell

very strong at Lake Tahoe JE Chase (sp?)

Fernley 12:33? mrs geo A Steele

Gerlach 12:35 W.J. Duiterman (sp?) W.P. 2 Ca agents

Lewis Ranch 24th & 25

Sand Pass 24th Charlie Auuumm (sp?) Via Calvera (sp?) Col.

Yerington 12:40 n & s 30 secs A.E. Richardson

Hobart Mills S.E. Patterson 23, 24, 25

[even larger photograph of seismogram - includes main shock and night of aftershocks]

1914

April 24, 12:34½ A.M. Severe shock, cracking chimneys of Hatch Station, Lincoln Hall and several residences, bricks loosened and thrown(?) down. Chimney on N. side of Hatch Station twisted 1 1/4" tension(?) cracks(?) leveling(?) down(?), bottles and apparatus thrown from shelves, especially on second floor of chemistry building. Tower of fire station thrown slightly out of plumb, minerals on west wall of museum thrown from shelves probably due to sudden

movement of building to west. Total movement at least 3/4" E & W. Pen apparently displaced from glass at one time. Intensity VII at Reno. Gazette 4/24 states shock felt at Sacramento and as far east as Elko. Western Union clocks stopped at 12:34.30 AM. 3 aftershocks at 1:33 AM, 2:30±, & 5:00 AM all on attached record.

People in town generally awakened by shock and several report feeling vertical movement & rocking of bed as if earth in waves.

[page 28 has four or five small seismograms on it with writing around them]

Sacramento Bee April 24 -

Alta (Placer Co.) Cal. 12:30 am

Sacramento Cal. 12:34 NE-SW stopped clocks, 3 shocks(?)

Oroville Butte Co., 12:35 rattled windows, E-W

Las Plumas windows broken

Grass Valley 12:35 no damage

Stockton mild 12:34

Marysville Yuba Co. 12:35 shook down piles of lumber.

Loyalton Sierra Co. 12:33 cracked brick walls and bricks fell from chimneys.

also felt at Downieville Quincy Truckee(?)

1914

April 25 9:03 AM slight aftershock movement of seismograph 1/16" duration 2 sec. intensity II Reported very strong at Bowers Mansion

April 26 9:53 PM heavy aftershock intensity III duration 4 sec. Seismograph movement E&W 5/16", N&S 1/4"

10:07 PM slight shock Intensity II plate removed from seismograph

May 5 10:30 AM very slight shock I slight record

May 8 3:47 AM. slight shock wakened some movement 3/8" E&W 1/4" N&S on seismograph

4:07 AM very slight aftershock record included in first.

8:42 AM slight aftershock 3/16" E&W 1/8" N&S

May 12 4:10 AM short shock wakened some movement 3/8" E&W 3/8" N&S record shows strong jerk(?) E&W with another NE&SW. Two slight shocks reported to have preceded main shock.

May 20 2:03 AM very slight shock II single movement a little north of east, woke light sleepers duration 1 second - accompanied by low rumble.

8:44 PM extremely slight shock I, record 1/16 of an inch slightly E&W

9:16 P.M. Slight shock single jolt slightly N of E 1/8" E&W II
 May 28 3:16 P.M. Slight shock III? Single movement 5/16" E&W + 3/16 N&S noted by Webster(?) sitting down all standing failed to feel shock.

Three letters from Dr. Gianella's documents housed in Special Collections from the University of Nevada, Reno mention the April earthquakes. The correspondence is between Dr. Gianella and Maxwell W. Allen (of Townley and Allen, 1939 fame) presumably to give Allen information for Townley and Allen's earthquake catalog

Letter from Dr. Vincent P. Gianella to Mr. Maxwell W. Allen dated Feb. 8, 1934

...

Professor Jones lists the following:

...

April 24, 1914, 12:34½ a.m. - severe shock. Several chimneys were badly cracked - materials thrown from shelves. Intensity about 7 in Reno. Reno Evening Gazette states it was felt at Sacramento and Elko. People here felt vertical movements. Also felt at Susanville, Sacramento, Oroville, Grass Valley, Stockton, Marysville and Alta, Calif. See Sacramento Bee, April 24, 1914.

April 25, 1914, 9:03 a.m. Slight earthquake, intensity 2. Reported strong at Bower's Mansion which is 20 miles south of Reno at the foot of the Sierras on the west side of Washoe Valley.

April 26, 1914, 9:53 p.m. Heavy aftershock, intensity 3 duration 4 seconds. Same day 10:07 p.m., slight shock intensity 2.

May 5, 1914, 10:30 a.m., very slight shock, intensity 1.

May 8, 1914, 3:47 a.m., slight shock. 4:07 another slight shock, 8:42 a.m. another slight shock.

May 20, 1914 2:03 a.m. Slight shock, intensity 2, duration 1 second, accompanied by low rumble. 8:44 p.m. another shock intensity 1. 9:16 p.m., slight shock. A single jerk, intensity 2.

May 18, 1914, 4:10 a.m. Slight shock, awakened some people.

May 28, 1914, 3:16 p.m., slight shock. Single movement.

October 31, 1914, 7:45 a.m., slight shock, intensity 1.

November 18, 1914, about 9:38 p.m., slight shock, duration 1 second. Intensity 1.

February 6, 1915, 6:30 a.m., slight shock, intensity 1 duration 1 second. There was then listed the shock of October, 1915, of which you have ample records. This closes the record. Various other slight shocks have been felt here.

Letter from Dr. Vincent P. Gianella to Mr. Maxwell W. Allen dated Feb. 14, 1934

...

More data on the April 24, 1914 earthquake.

The Evening Gazette states that much plaster was shaken down and the people in general were alarmed and practically all felt it.

Much crockery broken, many chimneys thrown down, four at the University Ewing seismograph

showed the strongest movement EW. There was considerable vertical movement and the shock was accompanied by rumblings heard by many. It was heavy at Imlay, Lovelock and Sacramento.

Nevada State Journal reports it to have been heavy at Hazen. I should judge that it was located along the Virginia Range probably near Fernley or Wadsworth. This is but a guess as the information is too incomplete.

Letter from Mr. Maxwell W. Allen to Dr. Vincent P. Gianella dated Feb. 16, 1934

...

I see your guess as to the origin of the shock of April 24, 1914 is about the same as mine - and as you say it can only be a guess with the information so incomplete. I have tried for information in the Owens Valley papers both for this and the 1916 earthquake, with no result.

...

For the April, 1914, earthquake the most distance report is from Randsburg, California, where the intensity probably was II-III R.F. All other reports were from places within the isoseismal of intensity IV. Toward the west, as you note, the shock was reported at Sacramento where the intensity was a strong IV. This indicates that the shock must have been perceptible, although it is unreported, to the west of Sacramento, and with little question the San Francisco Bay area was within the isoseismal of intensity II. The boundary of the area actually reported is the polygon in which lie Sacramento, Stockton, Randsburg, Lida, Belmont, Winnemucca, Gerlach, and Susanville, but of these only Randsburg was near the actual limit of the area of perceptibility. Such as they are, the isoseismals center north of Yerington for the lower degrees, the center drawing toward Fernley and Hazen for the higher intensities, and I think the actual origin probably was not many miles from Fernley.

UCCSN Board of Regents' Meeting Minutes, July 15-16, 1914

...

The bill of City Engineer Meskimons for \$25 for inspection of Lincoln Hall after the earthquake last Spring, was considered excessive and it was the sense of the Committee the bill be reduced to \$10, and this amount was ordered paid.

Modified Mercalli Intensity Assignments

Modified Mercalli Intensities are estimated or reported for 53 localities in Nevada and California for the April 24, 1914 earthquake. These are listed below in Table 2 along with the basis and reference for the intensity estimate. Descriptions of the Modified Mercalli Intensity Scale can be found in Appendix A.

Three aspects limit a full accounting of the April 24 earthquake: 1) it was a nighttime earthquake, 2) the region was sparsely settled, and 3) the Mexican War with the United States was dominating the news. To a lesser extent, earthquakes were old news because they had occurred earlier in the year; more details were considered interesting and reported for the February 18 event even though it was a smaller event. The nighttime aspect means fewer people witnessed the event than would have if it occurred during the day; this results not only in fewer accounts but less of a need to talk about the event to deal with anxieties generated by the shaking.

The highest intensity was in Reno, with a solid MMI VII, best described by the newspaper subtitle, “Chimneys are knocked over and people frightened by severe quake” (REG 4/24/14). Other intensity estimates for Reno have been slightly higher (MMI VIII, Slemmons and others, 1965; MMI VII-VIII, Bolt and Miller, 1975). People in Reno clearly panicked from the shaking and nonstructural damage was significant.

People were awakened and rushed to the streets in Virginia and Carson Cities, and in Virginia City, nonstructural damage of building contents is reported; these communities were assigned MMI VI+ for Virginia City and MMI VI- for Carson City. Loyalton, California also had some nonstructural damage (dislodged bricks) and was assigned MMI VI.

Intensity MMI V can be described as strong shaking that awakens people, stops pendulum clocks, or is described as heavy or severe. For a nighttime earthquake, this is the lowest intensity that can be used where people being asleep and not reporting the event that they would have reported had they been awake does not have a large effect on the isoseismal area. There were few people and structures in this area and much of the intensity V isoseismal line is inferred. The intensity MMI V area includes an elongate, northeast-trending area in western Nevada, with a northeast corner near Winnemucca, and a range in westernmost Nevada from Gardnerville to Gerlach. Several locations in the Sierra Nevada and the Great Valley also were assigned MMI V; in Sacramento, people showed signs of panic as they exited buildings in nightclothes, and a MMI V+ was assigned. An elongation of the MMI V area in the Great Valley is indicated, which is similar to other western Nevada earthquake patterns; in the Great Valley intensity MMI V from the April 24 earthquake was from Stockton to Chico. There are two outliers of intensity MMI V at Bodie and Sonora, both in California.

The overall felt area suffers the most from the nighttime nature of the event, and Townley and Allen (1939) comment that “at a more favorable hour the shock would have been felt considerably beyond” the outermost points the shock is noted (e.g., Winnemucca). There is very

little constraint on the extent of the felt area for the April 24, 1914 earthquake.

Isoseismal Maps

Priestley (1981) produced an isoseismal map for the April 24, 1914 earthquake and compared it to the isoseismal map from 1948 Verdi earthquake (taken from Topozada, 1975) which originated in roughly the same region (fig. 5).

The isoseismal map produced by this study is shown in Figure 3. This map benefits from the number of accounts gathered, and an even consideration given to all locations.

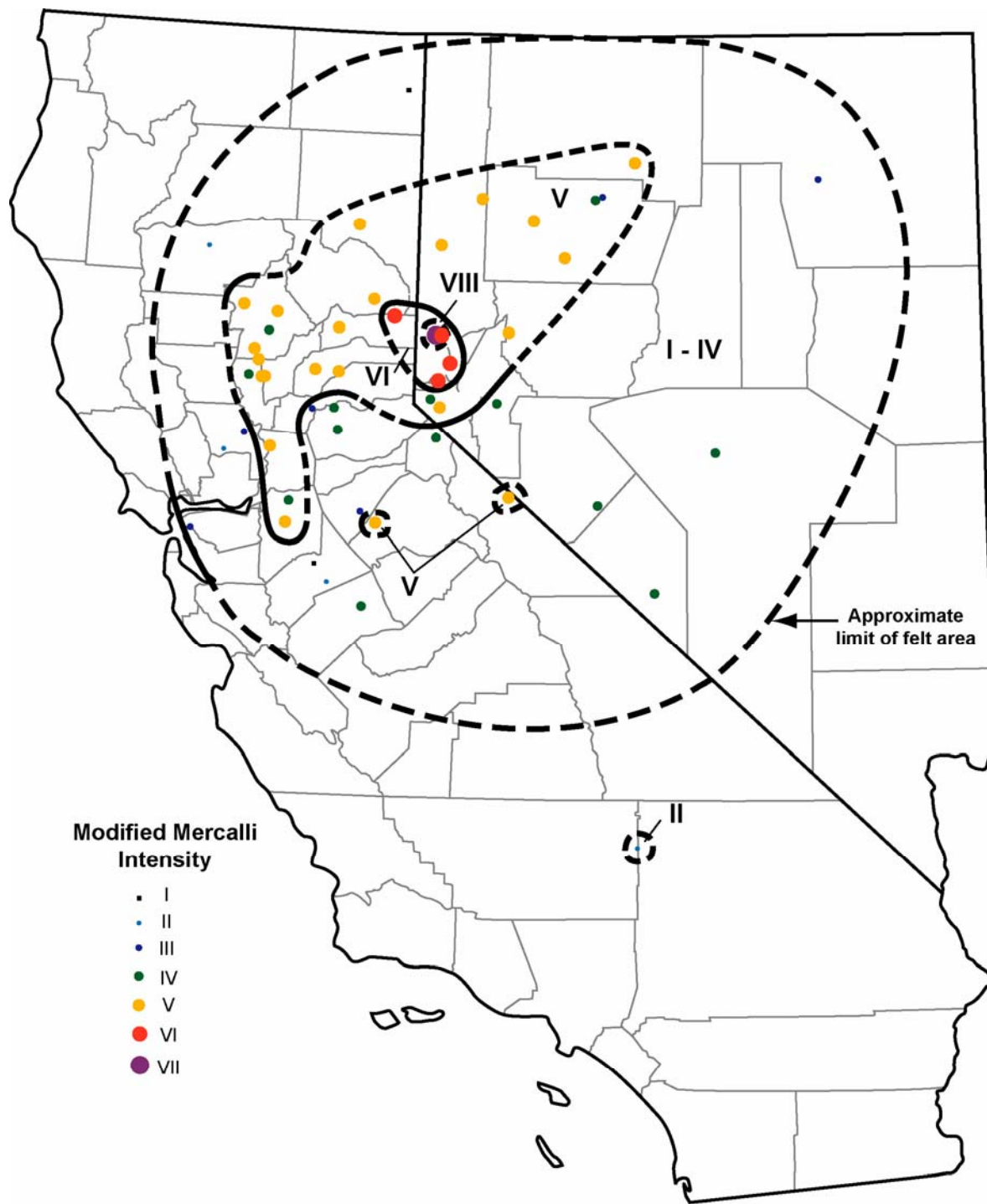
The intensity MMI VII area is limited to Reno, underscoring that the community was in close proximity to the earthquake. The intensity VI area extends from Carson City, NV in the south to Loyalton, CA in the north, and from Virginia City, NV in the east to the Sierra Nevada in the west, making a northwest-trending oval. The exact definition of the intensity VI area is limited by the sparseness of communities and reports. The intensity V area is one of the best defined, but is also limited by a sparseness of communities, especially in Nevada. Much of the intensity V area is inferred (dashed). Two outliers of intensity V exist in Sonora and Bodie, both in California, where residents were awakened. The limit of the felt area is greatly affected by the nighttime nature of the April 24 earthquake, and most of the limit is inferred. The felt area was not continued into Oregon because of the comment of no reports of the earthquake in Oregon (BSSCB, 1914), but again this may be because it was a nighttime event. There is an outlier of the felt area at Randsburg in southern California.

Table 2 Intensity Assignments for the April 24, 1914 Reno Earthquake

<u>Place</u>	<u>Modified Mercalli Intensity Estimate</u>	<u>Comments and Sources</u>
NEVADA		
Belmont	IV?	T & A 39 intensity assignment
Candelaria	IV?	felt (BSSCB, 1914)
Carson City	VI-	awakened city, awake rushed to streets (CCN 4/24)
Elko	III?	felt (REG 4/24)
Gardnerville	V	awakened people, violent (GRC 5/1)
Genoa	IV	felt (BSSCB, 1914)
Gerlach	V+	clock stopped, safe moved, very severe (HS 4/24; B&M 73)
Hazen	V	severe, clocks stopped (NSJ 4/25; RM 4/24)
Imlay	IV+?	quake not so bad as other towns, heavy (RM 4/24; REG 4/24)
Lida	IV	felt two shocks (BSSCB, 1914)
Lovelock	V	clocks stopped (RM 4/24)
Mill City	III	slight shake (RM 4/24)
Reno	VII	Several chimneys down, people alarmed (NSJ 4/25; REG 4/24)
Rochester	I	not felt (HS 4/24)
Sand Pass	V	T & A 39 intensity assignment
Seven Troughs	V	severe (HS 4/24)
Sparks	VI	extra severe, people alarmed (ST 4/25)
Virginia City	VI+	awakened city, people rushed to streets (VC 2/24)
Winnemucca	V	awakened many, clock overturned (HS 4/24)
Yerington	III-IV?	T & A 39 intensity assignment
CALIFORNIA		
Alta	V	severe (MU 4/25)
Angels Camp	III	slight shock felt (ACR 4/29)
Auburn	III?	slight shock (PH 4/25)
Berkeley	III	felt (SU 4/24)
Bodie	IV-V?	sleepers awakened (BSSCB, 1914)
Cedarville	I	not felt (BSSCB, 1914)
Chico	V	awakened scores, shook lights, rattled dishes (CR 4/24)
Downieville	V	many or most are implied to have felt it (MM 4/24)
Georgetown	III-IV	felt (GG 4/30)
Grass Valley	V	T & A 39 intensity assignment (MU 4/25; SB 4/24)
Gridley	V	severe earthquake felt (SB 4/24)
Las Plumas	V	windows broken (SB 4/24)

Live Oak	V	felt strongly, few window panes broken (SI 4/30)
Lodi	IV	slight earthquake, stopped clocks (SER 4/24)
Loyalton	VI	bricks fell from chimneys, walls cracked (SB 4/24)
Markleeville	IV	felt (BSSCB, 1914)
Marysville	V	people aroused from sleep, rushed to streets (SB 4/24)
Merced	IV	rattled windows (MMH 4/24)
Modesto	I	not noticed (MMH 4/24)
Oroville	IV	heavy shock, many not awakened (SB 4/24)
Placerville	IV	rattled dishes & window panes (ER 5/1)
Portola	V	severe, people thought trains collided (SU 4/24)
Susanville	V	T & A 39 intensity assignment, (LA 4/24)
Quincy	III?	felt (SB 4/24)
Randsburg	I	felt (T & A, 39)
Sacramento	V+	many ran outside in nightclothes (SU 4/24)
San Francisco	I	not felt (WDD 4/24)
Sonora	V	awakened many (TB 4/24; TI 2/24)
Stockton	V	many were awakened (SER 4/24)
Sutter City	IV	felt by light sleepers & those who were awake (SCF 5/1)
Turlock	II?	noticed (MMH 4/24)
Winters	II	light shock felt by few (WE 5/1)
Woodland	III	felt (WDD 4/24)
Yuba City	V	awakened people, light articles upset (SI 4/30)

Additionally reported as not felt in Southern California by BSSCB (1914) are Newhall, Nordhoff, Piru, Maricopa, and Santa Paula. BSSCB (1914) also reports that the earthquake is not reported as felt in southern Oregon.



Modified Mercalli Intensity Map of the April 24, 1914 Reno Earthquake

Figure 3

Epicentral Locations of the 1910 and 1914 Earthquakes

The specific locations of the 1910 and 1914 earthquakes are still poorly understood at this time, although the general locations of the two 1914 mainshocks can be inferred, and more specific locations may be possible in the future.

No real refinement on the location of the 1910 Tonopah Junction earthquakes has been made, beyond the location of “Tonopah Junction” and Slemmons and others (1965) geographic location of 38° N latitude and 118° W longitude. The U.S. Dept. of Commerce catalog (Wood and Heck, 1961 and Coffman and von Hake, 1973) list at west longitude of “117°” but this would be just east of Tonopah sensu-strictu, and although Tonopah might not reveal a strong nearby earthquake for fear of scaring investors, other competing mining towns would have surely have tattled, and we have found no evidence or mention of that. There are two fundamental accounts of the earthquakes at this time, a Goldfield Daily Tribune article dated November 23, 1910, and a letter by a man named H.B. Vandersaal dated November 29, 1910 (saved in Reid’s notebook and mentioned in Townley and Allen, 1939); there may be some interdependency between these two accounts if Mr. Vandersaal read the tribune article. Both accounts mention damage to the windows of the telegraph office at Tonopah Junction, which is closer to 118° W longitude.

Professor Jones was the first to speculate on the location of the 1914 earthquakes, “Too little is known at present of the general extent of the earthquake to safely indicate the problem source of the disturbance, but from the character of the record [Ewing-Duplex seismoscope record] it would seem as if the fault along which the slip occurred was located at no great distance to the west of Reno.” (REG 4/24/14).

At least a few people or sources have ascribed different locations for the February and the April 1914 earthquakes. Dr. Vincent Gianella mentions two possible locations in his 1934 letters to Maxwell Allen, referring to the February earthquake as located “along the west base of the Virginia Range in Truckee Meadows,” and the April event as located “along the Virginia Range probably near Fernley or Wadsworth,” [the latter location appears to attempt to put a location between Reno and Hazen, where the shock was reported as severe], but qualifies this with, “This is a guess as the information is too incomplete.” A reply letter by Mr. Maxwell echos this notion with the statement, “Such as they are, the isoseismals center north of Yerington for the lower degrees, the center drawing toward Fernley and Hazen for the higher intensities, and I think the actual origin probably was not many miles from Fernley.” Townley and Allen (1939) give a generic “Truckee Meadows, near Reno” for the February earthquake and for the April event comment that, “It is probable that the shock originated northeast of Reno, toward Fernley or Wadsworth.” Bolt and Miller (1975) echo Townley and Allen’s (1939) comment about the April earthquake. Priestley (1981) comments on the February earthquake that, “The higher intensities in the vicinity of Verdi as compared to those at Carson City, suggest the epicenter lay to the west or northwest of Reno.” For the April earthquake Priestley (1981) comments, “The intensity pattern indicates the epicenter was in the vicinity of Fernley or Hazen, 30 or 40 km east of Reno.” Priestley’s intensity map for the April event is shown in Figure 5.

Most catalogs have reported Slemmons and others (1965) location of 39.5° N latitude and 119.8° W longitude. Note that Slemmons and others are the first to present the same location for the February and April earthquakes. A notable departure from this is the dePolo and dePolo (1999) catalog, which listed 39.5° N, 120.0° W for the February earthquake, and 39.52° N, 119.35° W for the April earthquake. This was an attempt by dePolo and dePolo (1999) to incorporate the professional opinions given above into the earthquake epicenter map of Nevada, and they did not conduct any specific work on the earthquakes themselves. DePolo and others (1997) emphasized this speculated difference in locations by giving the names “Verdi earthquake” for the February event and “Northern Virginia Range earthquake” for the April event.

This study produced the most specific intensity maps of the 1914 earthquakes to date, and concludes that both mainshocks were likely located where Professor Jones originally suspected, under or just west of Reno.

The damage patterns and sizes of the main 1914 earthquakes indicates an origin near Reno. The intensity patterns and descriptions of effects are consistent with the two earthquakes having roughly the same epicenter; thus the distribution of relative effects is the same between events, but the effects of the April earthquake are more severe and far more widespread, consistent with its larger size. Both the February 18th and the April 24th earthquakes caused significant damage and panic in Reno. The size of the February event (~M5.1) is an important limiting factor for this common epicenter. Even though damage was very limited and nonstructural, this was not a very large earthquake and it must have occurred very close to Reno. Similarly, the highest intensity for the April 24th earthquake was also in Reno. As noted by Priestley (1981) the effects at Carson City do not appear to be as severe as those at Reno, Sparks, and Virginia City for the February 18th and April 24th events, thus the epicenters seem more likely to be in the Reno part of the MMI VI area.

A bullseye of the Modified Mercalli Intensity map for the April 24, 1914 earthquake would center the intensity MMI VI area just to the west or southwest of Reno. Reno had the highest intensity (MMI VII) and there is no specific mention of damage in the Verdi area, possibly supporting an epicenter closer to Reno.

There is likely some important information contained in the Ewing-Duplex seismoscope record of the April 24, 1914 earthquake recorded in the Mackay School of Mines building at the University of Nevada, Reno. Although these observations are highly speculative at this time, detailed study and the creation of synthetic seismograms to match the record will likely be of great benefit and will potentially test them. When the smoked glass plate is installed and enough stylus pressure used to produce a good record, the Ewing-Duplex seismoscope has an equivalent undamped period in the range of 3.7 to 3.9 seconds and the effective dampening was in the range of 0.15 to 0.2 (Jennings and Kanamori, 1979); thus this is a fairly long-period instrument. The beginning of the record (fig. 4) is the top, or north part, of the highly irregular line near the central part of the record (JCJ in NSG 4/26/14). Perhaps the most important observation is that the seismoscope did not return to the origin after the shaking had stopped. This indicates some permanent deformation (tilting?) had occurred during the earthquake. The machine was firmly

attached to the wall at the School of Mines building (NSJ 4/26/14). Thus, the two most likely hypotheses for this deformation are: 1) permanent deformation of the ground in the near field of the earthquake, and 2) deformation of the building housing the instrument (an unreinforced masonry building). A second observation that may be important is that assuming the irregular line is a wave train of body waves, they appear to be riding on a longer period pulse; this longer period pulse may be near-field movement of the seismoscope. We are very fortunate that this “autograph of the earthquake” was preserved in J. Claude Jones’s notebook, and further research on this record is warranted.

There is the mention that “several [people] reported feeling vertical motion” (JCJ, 4/24/14) which could support normal movement on northward extension of range front faults of the Carson Range (the Mount Rose fault zone) that would project west of, and underneath, Reno. However, the 1914 earthquakes are of background earthquake sizes (c.f., dePolo, 1994), and could easily have occurred on higher order faults that are likely prevalent throughout the area.

Although instrumental recordings of the 1910 and 1914 earthquakes exist, no instrumental location has succeeded due to the long distances to the recordings, limited number of recordings available, potential timing errors, complicated ray paths, and limiting early location routines. These records should be revisited using modern location routines and master events to calibrate ray paths including the 1948 Verdi earthquake, the 1966 Boca Valley earthquake, and possibly the 1915 Pleasant Valley earthquake (although this latter event is a significant distance away it would have likely been recorded by the exact same instruments that recorded the 1914 earthquakes which may be of value.

The catalog locations (Table 3) are not precise and are generally based on looking at the intensity distributions, with the exception of U.C. Berkeley’s location of the Feb. 18, 1914 earthquake (this location is nearly a degree of longitude west of the other locations and the highest intensity effects).

This study endorses the location of Slemmons and others (1965) as the best representation of the epicenter of the February 18th and April 24th earthquakes (39.5° N, 119.8° W). The range in potential locations indicated by the intensity maps created in this report are 39° 25' to 39° 45' north latitude, and 119° 40' to 120° west longitude.

April 25, 1914 Virginia City Earthquake

There likely were two sources of earthquakes were active during early 1914, when the felt patterns of some of the “aftershocks” are considered. In particular, a small series of earthquakes on the morning of April 25, 1914 (main event 9:18 PST) appears to have shaken Virginia City and Carson City stronger than Reno. In Virginia City people rushed out of their homes to the streets from tall buildings and several women fainted (DTE 4/26/14). A brick chimney was shaken over at the Cole building and in a number of residences plaster fell (DTE 4/26/14). At Carson City, “Four earthquake shocks in this city yesterday morning at 8:23 caused people of the

city to roll around for a few seconds and many ran into the streets.” (CCN 4/26/14). The earthquake was “reported very strong at Bowers Mansion” (JCJ 4/14). All of these locations are to the south of Reno.

This contrasts with what apparently happened in Reno. The “early Saturday morning” is described as a “pretentious jar” and “sharp and emphatic but not long continued” (NSJ 4/27/14). No damage was done in Reno, and this earthquake is commented as being notably smaller than the one that occurred on Saturday night in Reno (NSJ 4/27/14). The Virginia City papers seem struck by the lack of note of the Saturday morning earthquake in Reno. “At Reno the temblors were scarcely felt” (VC 4/25/14). “At Reno and Sutro the shocks were barely noticeable” (DTE 4/26/14). The April 25, 1914 Virginia City earthquake was measured on the Mackay School of Mines seismoscope record in Reno as having a maximum amplitude of 1/16 an inch (versus 12/16 an inch from the strong earthquake on April 24, 1914).

A logical conclusion from these descriptions is that the April 25th earthquake occurred to the south of the epicentral area of the February 18th and the April 24th earthquakes. The difference in the shaking at Carson City from these earthquakes is important in this consideration, as is the difference in shaking between Virginia City and Reno. During the February and April 24th events, damage and shaking effects were stronger and more widely noted in Reno. Reno is located on the alluvial fill of a basin, versus the shallow alluvial cover or bedrock that Virginia City is built on, so site effects should favor shaking in Reno versus Virginia City. Therefore, less shaking in Reno versus Virginia City during the earthquake on April 25th is significant, as is the difference between the respective shaking at these two locations between the February 18th and April 24th events and the April 25th event. Taken together these accounts indicate the April 25th earthquake was south of the February and April 24th earthquakes, and that two earthquake sources were active during early 1914. A possible source would be the Washoe Valley fault zone (the fault zone that is adjacent and to the south of the Mt. Rose fault zone, a possible source of the February and April 24th earthquakes, but part of the same fault system). This would help explain the strong shaking at Bowers Mansion in Washoe Valley. This event may also be an aftershock located at the southern end of the fault rupture from the April 24th earthquake.

Table 3 Earthquake Catalog Listings of the Locations of the 1910 and 1914 Earthquakes

1910, Nov. 21 Tonopah Junction Earthquake:

Townley and Allen (1939)	“Tonopah Junction”		
Wood and Heck (1961)	38° N*,	117° W*	*Nov. 18 (PST)
Slemmons and others (1965)	38° N,	118° W	
Coffman and von Hake (1973)	38° N,	117° W	
Topozada and others (1978)	38° N,	118° W	
Askew and Algermissen (1983)	38° N,	118° W	

1914, February Reno Earthquake:

Townley and Allen (1939)	“Truckee Meadows, near Reno”	
Wood and Heck (1961)	39.5° N,	120° W
Slemmons and others (1965)	39.5° N,	119.8° W
Coffman and von Hake (1973)	39.5° N,	120° W
Bolt and Miller (1973)	39.58° N,	120.83° W
Topozada and others (1978)	39.5° N,	119.8° W
Real and others (1978)	39.5° N,	119.8° W
Askew and Algermissen (1983)	39.5° N,	119.8° W
dePolo and dePolo (1999)	39.5° N,	120.0° W
Topozada and others (2000)	39.5° N,	119.8° W

1914, April Reno Earthquake:

Townley and Allen (1939)	“Western Nevada”		
Wood and Heck (1961)	39.5° N,	120° W	
Slemmons and others (1965)	39.5° N,	119.8° W	
Coffman and von Hake (1973)	39.5° N,	120° W	
Bolt and Miller (1973)	39.42° N,	120.0° W	“epicenter probably NE of Reno, toward Fernley or Wadsworth”
Topozada and others (1978)	39.5° N,	119.8° W	
Real and others (1978)	39.5° N,	119.8° W	
Askew and Algermissen (1983)	39.5° N,	119.8° W	
dePolo and dePolo (1999)	39.52° N,	119.35° W	
Topozada and others (2000)	39.5° N,	119.8° W	

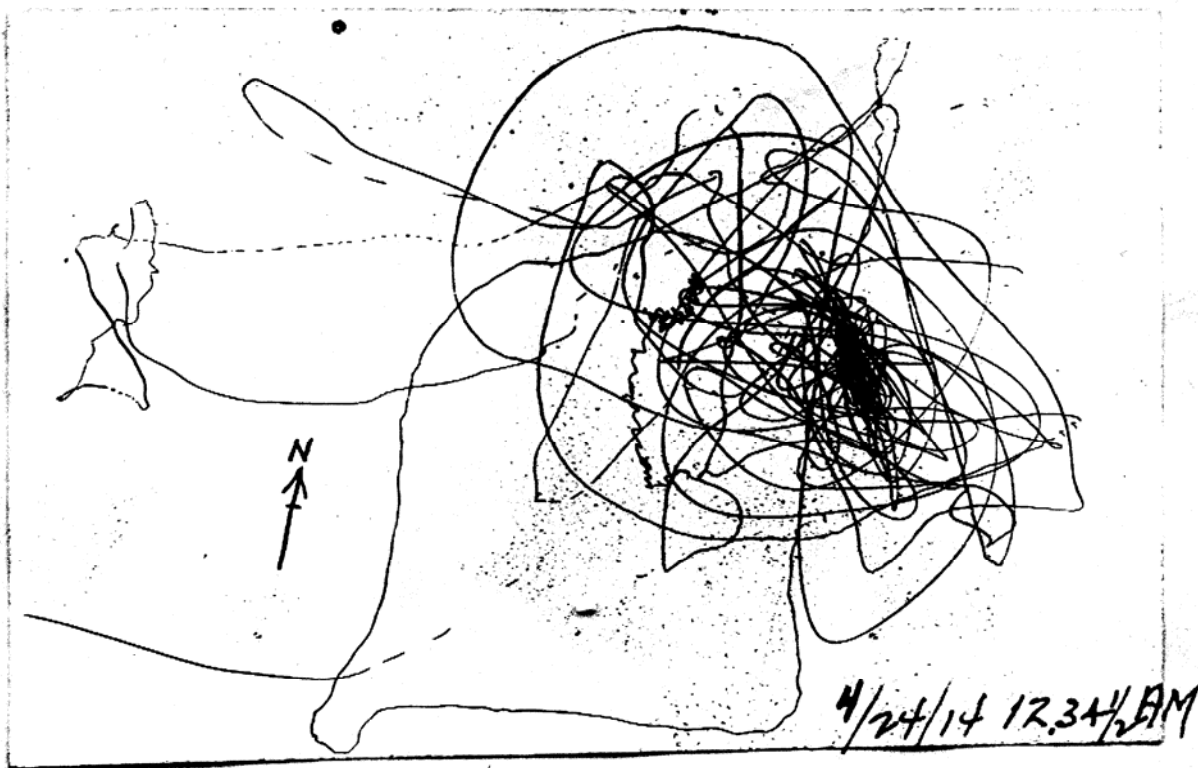


Figure 4 Ewing-Duplex seismoscope record taken from J.C. Jones's notebook. The original size of the plate for the record was 4 x 5 inches. See the discussion of the location of the April 24, 1914 earthquake for further information about the seismoscope and this record.

Magnitude Estimations of the 1910 and 1914 Earthquakes

This study makes no refinement on the size of the 1910 Tonopah Junction earthquake, but estimates the sizes of the February 18th and April 24th 1914 Reno earthquakes using moderately well determined intensity areas and relationships developed by Topozada (1975). We believe these to be the best estimates of the sizes of these events to date and include uncertainties with our estimates to account for uncertain information and statistical uncertainty. First we'll review Priestley's (1981) study of the earthquake and then present the results of the current intensity study. Published magnitudes of the 1910 and 1914 earthquakes are presented in Table 4.

Priestley's (1981) study

Priestley (1981) worked on the magnitude and to a lesser degree the location of the 1914 earthquakes. Priestley made an intensity map of the April 24, 1914 event, and used amplitudes from the Ewing-Duplex seismoscope records from the University of Nevada, Reno to estimate local magnitudes directly. An intensity map for the April 24, 1914 earthquake that was made by Priestly is shown in Figure 5; his data set for this map appears to be the Townley and Allen (1939) catalog, the Bulletin of the Seismograph Stations from the University of California, Berkeley, and notes from J. Claude Jones, a professor from the University of Nevada, Reno. In his Table 2, Priestley showed the area of perceptibility of the February 18 and April 24 events were 100,000 km² and 150,000 km², respectively. Using magnitude versus intensity relations developed by Topozada (1975) for eastern California and western Nevada, Priestley estimated a local magnitude of 5.7 for the Feb. 18 event and a local magnitude of 6.0 for the April 24 earthquake, based on these areas (note the April event was a nighttime earthquake and the perception area is likely underestimated because of this). He further estimates a area of Modified Mercalli Intensity VI shaking for the February 18 earthquake to be 3000 km² in Table 2 that correlates to a local magnitude of 5.5. Priestley stated, "From the intensity data the local magnitude of the 2/18/14 earthquake was 5.4±0.2 and the magnitude of the 4/24/14 earthquake was 5.8±0.2."

To use the Ewing Duplex pendulum records, Priestley needed the amplitude of the record and the distance from the seismometer to the earthquake. He then used a relationship between Wood-Anderson amplitudes (the basis for local "Richter" magnitude) and seismoscope amplitude. Copies of the seismoscope records were available from J. Claude Jones's notebook at the Nevada Seismological Laboratory [note: the record was also published in the NSJ 4/26/14].

Priestley determined that, "The 2/18/14 earthquake had a maximum east-west amplitude of 25 mm and a maximum north-south amplitude of 37 mm. These values correspond to zero-to-peak Wood-Anderson amplitudes of 472.5 mm and 699.3 mm, respectively." For a distance Priestley noted that, "The higher intensities in the vicinity of Verdi as compared to those at Carson City, suggest the epicenter lay to the west or northwest of Reno." Priestley also noted that other historical events have occurred in that region, assigns an epicentral distance of 30±10 km, and estimated a local magnitude of 4.9±0.3 for the February 18 event.

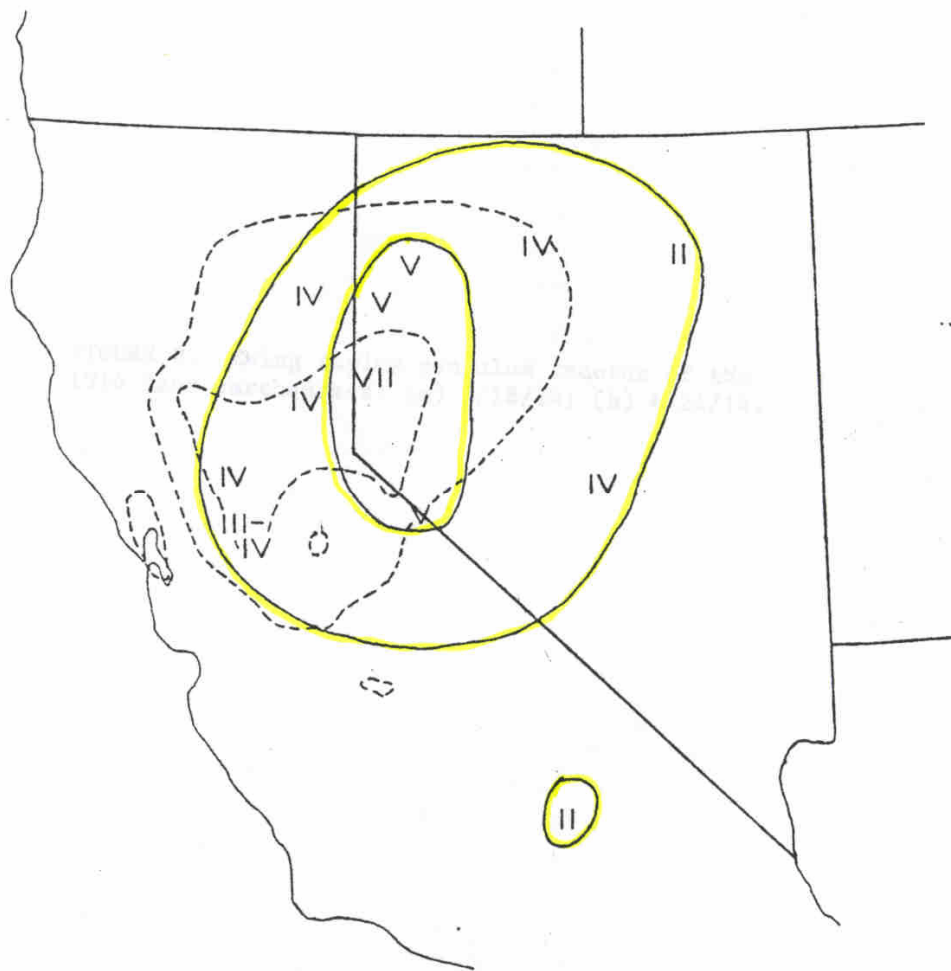


Figure 5 **Isoseismal map for the April 24, 1914 earthquake made by Priestley (1981); Solid lines are the April 24, 1914 earthquake and the dashed lines are for the December 29, 1948 Verdi earthquake (taken from Topozada, 1975) for comparison.**

Priestley's analysis of the April earthquake was as follows, "The 4/24/14 earthquake has a maximum east-west amplitude of 72 mm and a maximum north-south amplitude of 92 mm. These correspond to zero-to-peak Wood-Anderson amplitudes of 1360 mm and 1740 mm, respectively. The epicentral distance is again uncertain. The intensity pattern indicates the epicenter was in the vicinity of Fernley or Hazen, 30 to 40 km east of Reno. Taking the epicentral distance as 40 ± 10 km gives a local magnitude of 5.5 ± 0.2 ."

There are two notes to be made about using this particular record (fig. 4). The first, and most important, is that the seismoscope was knocked off the plate (c.f., Nevada State Journal 4/26/14) and thus, for at least one movement the seismometer was off scale and had larger amplitudes. "Prof. J.C. Jones reports that the needle of the university seismograph went clear off the disk, recording a movement of at least three-fourths of an inch" (Reno Evening Gazette 4/24/14). In J.C. Jones' notebook he stated, "Pen apparently displaced from glass at one time." The second note about this record is that the earthquake occurred in the middle of the night and no one changed the record until morning (Reno Evening Gazette 4/24/14; Nevada State Journal 4/25/14), thus immediate aftershocks muddle up the "east" central part of the record; these were

probably relatively small, however. Another interesting aspect of this record is that some vertical motion is indicated by the discontinuous or skipping parts of the traces.

Priestley (1981) summarized his work as follows: “There was considerable uncertainty in the magnitudes calculated from the duplex pendulum records. Neither the instrument response as it operated in 1914 nor the epicentral distance for the two earthquakes is precisely known. However, with reasonable bounds on both these values, neither earthquake appears to be greater than magnitude 6. This is in agreement with intensity data.”

Thus, Priestley’s best estimates appear to be the intensity based estimates, and these are magnitude $5.4-5.7 \pm 0.2$ for the February 18 event and magnitude $5.8-6.0 \pm 0.2$ for the April 24 event.

Analysis of the new intensity maps

The new intensity maps created by this study are used along with the relationships from Topozada (1975) to estimate magnitudes for the February 18 and April 24, 1914 earthquakes. The areas for different intensities and associated magnitudes are presented in Table 5.

Topozada (1975) used California and western Nevada earthquakes to calibrate relationships between earthquake magnitude and isoseismal area for several different intensity levels. We used the perceived or felt area (generally the area enclosed by intensity MMI I), MMI V, and MMI VI. Topozada’s (1975) relationships for these are:

$$\begin{aligned} M_L &= -1.88 + 1.53 \log A_{(I)} & \sigma &\pm 0.22 \\ M_L &= 0.86 + 0.86 \log A_{(V)} & \sigma &\pm 0.27 \\ M_L &= 2.56 + 0.85 \log A_{(VI)} & \sigma &\pm 0.3 \end{aligned}$$

In Table 5 several different magnitudes are presented for each of the earthquakes, but for both events the intensity MMI V isoseismal area is deemed the best for estimating the magnitude. The intensity VI areas are too sparsely settled for this kind of analysis. The felt area also suffers from sparseness in population, and the nighttime affect for the April earthquake, but may also suffer from differences in regional attenuation between California where most of the calibration earthquakes for the relationships come from and western Nevada; the largest area, the felt area would be the most subject to these potential differences. Our results are for the February 18, 1914 earthquake, magnitude 5.1 ± 0.3 , and for the April 24, 1914 earthquake, magnitude 6.1 ± 0.3 .

Table 4 Published Magnitudes of the 1910 and 1914 Earthquakes

1910, Nov. 21 Tonopah Junction Earthquake:

Askew and Algermissen (1983)	6.3
Rogers and others (1991)	6.3
dePolo and dePolo (1999)	6.1

1914, February Reno Earthquake:

Slemmons and others (1965)	6.-	
Topozada and others (1978)	5.0	
Real and others (1978)	5.0	
Askew and Algermissen (1983)	6.0 (MI)	5.8 (Ms)
Rogers and others (1991)	6.0	
dePolo and dePolo (1999)	6.0	
Topozada and others (2000)	5.6	
this study	5.1±0.3	

1914, April Reno Earthquake:

Slemmons and others (1965)	6.4	
Topozada and others (1978)	6.4	
Real and others (1978)	6.4	
Askew and Algermissen	6.4 (MI)	6.3 (Ms)
Rogers and others (1991)	6.4	
dePolo and dePolo (1999)	6.4	
Topozada and others (2000)	6.0	
this study	6.1±0.3	

Table 5 Intensity Areas and Associated Magnitudes Determined in this Study for the 1914 Earthquakes

February 18, 1914 Reno Earthquake

<u>Intensity</u>	<u>Estimation Type</u>	<u>Area (km²)</u>	<u>M_L[*]</u>
MMI V	preferred	8,055	5.1 ± 0.3
MMI V	minimum	2,631	4.6 ± 0.3
MMI V	maximum	15,300	5.4 ± 0.3
MMI VI	preferred	847	5.0 ± 0.3
MMI VI	minimum	250	4.6 ± 0.3
MMI VI	maximum	1,880	5.3 ± 0.3
Felt Area	preferred	33,199	5.0 ± 0.2

April 24, 1914 Reno Earthquake

<u>Intensity</u>	<u>Estimation Type</u>	<u>Area (km²)</u>	<u>M_L[*]</u>
MMI V	preferred	65,830	6.1 ± 0.3
MMI V	minimum	42,734	5.9 ± 0.3
MMI V	maximum	118,853	6.4 ± 0.3
MMI VI	preferred	3,000	5.5 ± 0.3
MMI VI	minimum	1,742	5.3 ± 0.3
MMI VI	maximum	9,952	6.0 ± 0.3
Felt Area	preferred	325,480	6.6 ± 0.2
Felt Area	minimum	196,485	6.2 ± 0.2

* Local magnitudes calculated using magnitude versus intensity area relationships by Topozada (1975).

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Appendix A Abridged Modified Mercalli Intensity Scale

Intensity I Not Felt

Not felt except by a few people under especially favorable circumstances. Lowest on the scale so also used for faraway places where the earthquake could never be felt.

Intensity II Scarcely Felt

Felt only by a few people at rest, especially on upper floors of buildings.

Intensity III Weak

Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize as an earthquake. Hanging objects may swing.

Intensity IV Largely Observed

During the day, felt indoors by many, outdoors by few. At night some awakened, especially light sleepers. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like a heavy truck striking building.

Intensity V Strong

Felt by nearly everybody indoors, felt by many outdoors, awakened many if not most. Frightened a few. Some dishes and windows broken. Overturned vases or small unstable objects.

Intensity VI Slightly Damaging

Felt by all, many frightened and run outdoors. Some alarm. Awakened all. People move unsteadily. Damage slight in poorly built buildings, small amounts of fallen plaster, cracked plaster, broken dishes and glassware in considerable quantities, also some windows, fall of knickknacks, books, pictures, some heavy furniture moved and overturned.

Intensity VII Damaging

Frightened all, general alarm, all run outdoors, some or many find it difficult to stand. Waves in ponds, lakes, running water; water turbid from being stirred up. Suspended objects made to quiver. Some rockfalls. Damage considerable in poorly built or badly designed buildings, adobe houses, unreinforced masonry buildings, old walls, and spires. Chimneys cracked to a considerable extent. Fall of plaster in large amounts. Numerous windows broken. Loosened brickwork and tiles shaken down. Fall of cornices; bricks and stones dislodged. Damage considerable to concrete irrigation ditches.

Intensity VIII Heavily Damaging

General fright, alarm approaches panic. Trees shaken strongly, branches and trunks broken off. Liquefaction occurs locally accompanied by ejected sand and mud in small amounts. Changes in levels and temperatures of springs. Many rockfalls and landslides. Damage slight in well-built structures designed for earthquake resistance, considerable in ordinary substantial buildings, weak structures partially collapsed, racked, and tumbled down. Fall of walls. Seriously cracked and broken stone walls. Twisting, fall of chimneys, columns, monuments, factory stacks, towers. Very heavy furniture moved conspicuously or overturned.

Intensity IX Destructive

General panic. Conspicuous cracked ground. Damage considerable in specially designed structures, great in substantial masonry buildings with some collapse in large part. Buildings wholly shifted off foundations. Well designed frame structures thrown out of plumb and racked. Reservoirs damaged and underground pipes sometimes broken.

Intensity X Very Destructive

Cracked ground, especially when loose and wet. Fissures parallel along canal and stream banks. Landslides considerable from river banks and steep cliffs. Changed levels in many water wells. Water thrown on banks of canals, lakes, and rivers. Some well-built structures destroyed. Most masonry buildings destroyed along with their foundations. Rails bent slightly. Serious damage to dams, dikes, and embankments.

Intensity XI Devastating

Widespread ground disturbance, broad fissures, earth slumps, and land slips in soft, wet, ground. Ejection of large amounts of water charged with sand and mud. Few, if any, masonry structures

remain standing. Severe damage to wood-frame structures. Great damage to dams, dikes, and embankments. Bridges destroyed by wracking of support piers or pillars. Rails bent greatly. Underground pipelines completely out of service.

Intensity XII Completely Devastating

Damage total. Waves seen on ground surface. Objects thrown up in air. Ground greatly disturbed. Waterways blocked by landslides. Large rock masses wrenched loose. Fault displacement of surface with notable horizontal and vertical displacements.

Appendix B Acronyms Used in this Report

<u>Acronym</u>	<u>Reference</u>	<u>Location</u>
ACR	The Angels Camp Record	Angels Camp, NV
BSSCB	Bulletin of the Seismograph Stations	Berkeley, CA
CCDA	The Carson City Daily Appeal	Carson City, NV
CR	Chico Record	Chico, CA
DFP	Daily Free Press	Elko, NV
DTE	Daily Territorial Enterprise	Virginia City, NV
ED	Eldorado Republican	Placerville, CA
GG	Georgetown Gazette	Georgetown, CA
GRC	Gardnerville Record-Courier	Gardnerville, NV
HS	Humboldt Star	Winnemucca, NV
JCJ	Prof. John Claude Jones notebook	University of Nevada, Reno, NV
LA	Lassen Advocate	Susanville, CA
MMH	Modesto Morning Herald	Modesto, CA
MM	Mountain Messenger	Downieville, CA
NSJ	Nevada State Journal	Reno, NV
PH	The Placer Herald	Placerville, CA
REG	Reno Evening Gazette	Reno, NV
RM	Review-Miner	Lovelock, NV
SB	The Sacramento Bee	Sacramento, CA
SCF	The Sutter County Farmer	Sutter City?, CA
SER	Stockton Evening Record	Stockton, CA
SFC	San Francisco Chronicle	San Francisco, CA
SI	Sutter Independent	Yuba City, CA
ST	Sparks Tribune	Sparks, NV
SU	The Sacramento Union	Sacramento, CA
SWA	The Semi-Weekly Appeal	Marysville, CA
T&A	Townley and Allen (1939)	Bull. of the Seismological Soc. of America
TR	Truckee Republican	Truckee, CA
VC	Virginia Chronicle	Virginia City, NV
WDD	Woodland Daily Democrat	Woodland, CA