

DEPARTMENT OF THE INTERIOR

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OF THE

UNITED STATES

GEOLOGICAL SURVEY

No. 112

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EARTHQUAKES IN CALIFORNIA IN 1892

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WASHINGTON  
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1893

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DEPARTMENT OF THE INTERIOR

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GEOLOGICAL SURVEY

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1893



UNITED STATES GEOLOGICAL SURVEY

J. W. POWELL, DIRECTOR

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# EARTHQUAKES IN CALIFORNIA

IN

1892

BY

CHARLES D. PERRINE

OF THE LICK OBSERVATORY



WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1893



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# EARTHQUAKES IN CALIFORNIA IN 1892.

BY CHARLES D. PERRINE.

## INTRODUCTION.

The following, undertaken at the suggestion of Prof. Holden, is a continuation of similar records by himself<sup>1</sup> and Prof. Keeler, and brings the list up to the end of the year 1892. It contains all the shocks observed or felt on Mount Hamilton, and all those reported to the Lick Observatory by letter, as well as newspaper reports of earthquakes occurring in the state that year. Many newspapers have been examined, and this bulletin is chiefly made up from their reports, but some may have escaped notice.<sup>2</sup>

## INSTRUMENTS.

The instruments used for recording earthquakes on Mount Hamilton are described in publications of the Lick Observatory, vol. 1, p. 82. The largest and most complete instrument records the three components of the earth's motion, viz: north and south, east and west, and vertical, separately, on a smoked glass plate, which is started by the preliminary tremors of the earthquake and rotates uniformly in about three minutes, the edge of the plate being graduated into seconds at the same time by the clock, which also serves to record the time of occurrence of the shock. This instrument has been called the Ewing seismograph in the notes.

Another simpler form consists of the heavy "duplex" pendulum adjusted to a long period of vibration, with a magnifying pointer or pen, which records on a smoked glass plate the two horizontal components of motion. The vertical component and the time are not recorded. The motion of the earth is magnified 4.0 times in the duplex seismometers.

The observatory possesses other seismographs of various patterns, but they are not constantly in use.

<sup>1</sup> List of recorded earthquakes in California, Lower California, Oregon, and Washington Territory (1769 to 1888); Sacramento: State Printing Office. Earthquakes in California in 1888; American Journal of Science, Vol. 37, May, 1889. Earthquakes in California in 1889; Bulletin of the U. S. Geological Survey, No. 68, 1890. Earthquakes in California in 1890 and 1891; Bulletin of the U. S. Geological Survey, No. 95, 1892.

<sup>2</sup> It has been the object especially to record earthquakes occurring in California, but included in the list will be found records of a number of disturbances observed outside the state.

## SCALE OF MEASUREMENTS.

In the record made by the Ewing seismograph both horizontal components are magnified 3.3 times, and the vertical component is magnified 1.6 times. The measures of the vibrations, as given in the notes, are taken directly from the tracings, and therefore represent the magnified motions.

If both the period,  $T$ , and the amplitude,  $a$ , of an earthquake wave are given, the maximum acceleration due to the impulse, which may be taken as a measure of the intensity or destructive effect of the shock, is given by the formula—

$$I = \frac{4 \pi^2 a}{T^2}$$

in which the motion is assumed to be harmonic.

## DIFFERENCES OF INTENSITY.

Estimates of the intensity of shocks are also given (in Roman numerals inclosed in parentheses) according to the Rossi-Forel scale, which for convenience of reference is inserted below. Experience has suggested that for observations in California a few additions should be made to this scale, and these are printed here in *italics*. When these are in quotation marks also, they are expressions actually used in the newspapers, etc., in describing earthquake shocks, whose intensity is otherwise known. The scale, as amended, is as accurate as anything of the kind can be.

## I.

Microseismic shocks recorded by a single seismograph, or by seismographs of the same model, but not putting seismographs of different patterns in motion; reported by experienced observers only.

## II.

Shock recorded by several seismographs of different patterns; reported by a small number of persons who are at rest. "*A very light shock.*"

## III.

Shock reported by a number of persons who are at rest; duration or direction noted. "*A shock,*" "*a light shock.*"

## IV.

Shock reported by persons in motion; shaking of movable objects, doors, and windows; cracking of ceilings. "*Moderate,*" "*strong,*" "*sharp,*" (sometimes) "*light.*"



## V.

Shock felt generally by everyone; furniture shaken; some bells rung; some clocks stopped; some sleepers waked; "*smart*;" "*strong*;" "*heavy*;" "*severe*;" "*sharp*;" "*quite violent*."

## VI.

General awakening of sleepers; general ringing of bells; swinging of chandeliers; stopping of clocks; visible swaying of trees; some persons run out of buildings; window glass broken. "*Severe*;" "*very severe*;" "*violent*."

## VII.

Overturning of loose objects; fall of plaster; striking of church bells; general fright, without damage to buildings. "*Nausea felt*;" "*violent*;" "*very violent*."

## VIII.

Fall of chimneys; cracks in the walls of buildings.

## IX.

Partial or total destruction of some buildings.

## X.

Great disasters; overturning of rocks; fissures in the surface of the earth; mountain slides.

The relation between the intensity (I) of a shock as determined by the formula already given, and the numbers of the Rossi-Forel scale, has been reduced from all available data up to 1888, and is given below in tabular form. It is, of course, a rough approximation only:

Rossi-Forel scale.	Intensity, milli- meters per second.	Difference.
I.....	20	.....
II.....	40	20
III.....	60	20
IV.....	80	20
V.....	110	30
VI.....	150	40
VII.....	300	150
VIII.....	500	200
IX.....	1,200	700

One of the objects of the earthquake observations on Mount Hamilton is to obtain data for correcting this table, so that the intensity of a shock, as defined mathematically by the formula  $I = \frac{V^2}{a}$  (where V is the maximum velocity of the vibrating particle), can be approximately inferred from the ordinary descriptions of its effects.

## STATIONS.

A number of duplex-pendulum seismographs, quite similar to the one used at the Lick Observatory, are placed at different points on the Pacific coast, but they are not all in operation. The stations are:

Students' observatory, Berkeley, in charge of Prof. Soule.

Chabot Observatory, Oakland, in charge of Mr. Burckhalter.

Private observatory of Mr. Blinn, in East Oakland.

Observatory of the University of the Pacific, San Jose.

Observatory of Mills College, near Oakland, in charge of Prof. Keep.

Residence of Mr. C. D. Perrine, 2133 Alameda avenue, Alameda.

Office of State Weather Bureau, Carson, Nevada, in charge of Prof. Friend.

## CHRONOLOGIC RECORD, 1892.

**January 16.**—MOUNT HAMILTON, 7:30 A. M.—Note by Prof. Holden: "Wind from north and northwest. Velocity 61 miles per hour. The motion of the third story of Prof. Holden's house from the wind made a tremor which would have been called II on Rossi-Forel scale."

**February 3.**—PORTLAND, OREGON.—A severe earthquake shock occurred here at 8:30 o'clock to-night. Brick buildings swayed and windows rattled, terrifying the inmates, who in many instances rushed into the street. The shock lasted about thirty seconds, and was probably the most severe earthquake ever felt in this city. As far as known no damage was done.

**February 3.**—ASTORIA, OREGON.—There was a distinct shock of earthquake here to-night at 8:27 o'clock. The vibrations were from southwest to northeast. It lasted about three seconds, causing houses to shake perceptibly, but no damage was done.

**February 3.**—SALEM, OREGON.—At 8:32 o'clock this evening Salem experienced an earthquake shock. The vibrations were from northeast to southwest. There were three distinct shocks. Windows rattled and buildings trembled, but no damage is reported.

**February 3.**—OMAHA, NEBRASKA.—A slight shock of earthquake was felt here about 10:30 o'clock to night, lasting for a few seconds. In Jones street a large bank of earth caved, partly wrecking a frame house, and burying P. H. Green, his wife, and two children in the debris. Green was badly injured, but the remainder of the family escaped unhurt.

**February 5.**—MOUNT HAMILTON.—Prof. Holden was awakened by a shock and noted the time as 6:27:42 a. m., which he says can not be far out of the way. Intensity = V to VI, Rossi-Forel scale.

Mr. Otto Erle was awake and dressing and noted time 6:27:50 a. m. Direction, north and south.

Prof. Campbell was awakened by the shock and noted the time as 6:27:50 ± 3s. Intensity, R. F. = V; duration, two seconds; north and south. Rattled windows, washbowls, etc.; rocked bed.

**February 23.**—CARSON CITY, NEVADA.—Prof. Friend sends a tracing of an earthquake which occurred between 9 p. m. February 23 and 7 a. m. February 24. He says: "No one here, it seems, has felt it, and consequently I can not give you the exact time."<sup>1</sup>

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<sup>1</sup>The maximum disturbance being about ESE. by WNW., having an extreme amplitude of 17° on the plate, with a motion at right angles to this of 7 mm.

**February 23.—SAN DIEGO.**—This city has been treated to earthquake shocks so frequently of late that the condition is regarded as almost chronic. Near midnight, February 23, the first shock, lasting seventy seconds, cracked walls of buildings, and people were thoroughly frightened. Six or eight more shocks were felt that night, the second shock occurring just thirty minutes after the first one. Nearly every night since there have been one to three slight shocks. So severe was the first shock that the undulations gave many the feelings of seasick patients. Along the Pacific coast from Mexico to British Columbia slight shocks were felt, especially in Oregon and Washington.

**February 23.—SAN DIEGO.**—The earthquake which visited southern California just before midnight last night was the worst San Diego ever experienced, and seems to have been more severe the farther south it was felt. In this city a large number of buildings were cracked and the plaster was dislodged, although no houses were shaken down.

There were six or seven quakes after the first severe shock, and there was very little slumber for San Diegans for the rest of the night. After the shock the occupants of lodging houses rushed into the streets nude and panic-stricken, and their fear was not dispelled until morning.

At a jewelry store on Fifth street a large ornamental lamp was thrown from its case and, crashing through a show case, did about \$200 damage. So far as is now known no one was hurt.

Reports from outside the city say that in Paradise valley a church and schoolhouse, which were built upon stilts, were thrown down and almost totally demolished. A telephone message from Campo, on the border of the desert in the southeast part of the county, says that the first shock, which occurred at 11:21 p. m., was preceded by a loud rumbling like the sound of distant thunder. Several sharp tremblings followed in quick succession. The rumblings and shocks kept up at intervals of twenty minutes or more through the night until 4:53 a. m., when a fearful shock, with vibrations lasting twenty-five seconds and accompanied by local rumblings, caused the inhabitants to rush out of their houses in terror.

Since 5 o'clock this morning over twenty distinct shocks have been experienced, the last one as late as 10 o'clock. The rumbling still continues at intervals.

At Jamul the walls of the stone kilns at the cement works were cracked and other damage was done. Rumblings have been heard all day in the hills and mountains thereabouts, and the inhabitants are panic-stricken.

Messages from Lower California are to the effect that Ensenada, Alamo, and San Quentin experienced the severest shocks within the memory of the oldest inhabitants. At Ensenada buildings swayed to and fro, and the people rushed into the streets, frightened by the unusual noises which followed the seismic disturbance. The mining town of Alamo was also severely shaken, and at San Quentin the Penin-

sular Railway sustained considerable damage to its roadbed. Reports from the latter place say the shocks there were simply unparalleled in duration, lasting fully seventy seconds.

**February 24.**—PALM SPRINGS.—An earthquake shock was experienced here about 11:25 p. m. yesterday which was severer than any that San Francisco has felt during the last ten years. It lasted over one minute and the direction of the vibration was southeast to northwest. It was followed by at least eight other shocks, all exceptionally severe. The last shock was at 4:30 a. m. The night was excessively warm and the earthquake was followed by cold and cloudy weather.

**February 24.**—INDIO.—A severe earthquake was felt here last night, commencing at 11:16 o'clock. There were five lighter shocks between that time and 11:45 o'clock, and there was one at 12:30 and one at 4:49 a. m. to-day. No damage was done, but considerable commotion was caused among the inhabitants.

**February 24.**—BEAUMONT.—A severe earthquake shock occurred here last night at 11:20 o'clock. The vibrations were from east to west and lasted several seconds.

**February 24.**—POMONA.—An earthquake was felt here last night at 11:15. Buildings shook and rocked for a few seconds, but no damage was done; not even a glass broken. The vibration was north and south.

**February 24.**—SANTA ANA.—Eight shocks of earthquake were felt here last night. The heaviest was at 11:15. The walls of the water-works building were cracked and plastering in several houses was broken. Visitors in all the hotels left their rooms and clocks stopped.

**February 24.**—SAN BERNARDINO.—Last night at 11:15 there was a shock of earthquake here, lasting about one minute and a quarter. The vibrations were northeast and southwest. No damage was done, except to break chinaware and stop clocks. The shock was heavy and was followed by light temblors all night.

**February 24.**—ONTARIO.—Two sharp shocks of earthquake were felt here last night at 11:15. The course of the wave seemed to be northeast to southwest. There was no damage.

**February 24.**—VISALIA.—A light earthquake shock was felt here at 11:40 o'clock last night.

**February 24.**—YUMA.—Two shocks of earthquake were felt here last night at 11 o'clock. The movement was from east to west. No damage was done.

**February 25.**—SAN DIEGO.—Two more earthquake shocks were felt in this city at 2 o'clock this morning, but neither was as bad as those of the preceding night, and no damage was done. They were severe enough, however, to cause another hasty and undignified exodus of lodgers from hotels and lodging houses into the streets in their night clothes. The fright was particularly great among the tourists

in the city, and the proprietors of several hotels report a material thinning out of this class of guests, who took the morning train for the East.

Word from Campo, on the desert, is to the effect that the rumbling and shocks continued last night, but no damage was done and the inhabitants are recovering from their terror. Up to this evening there have been about eighty distinct shocks in that locality since Tuesday night.

**February 25.**—ONTARIO.—There were two more, but light, shocks of earthquake last night, one at 9:30 and the other at 2 o'clock. The first occurred while a large audience was listening to George W. Cable at Workman Hall. Had it been heavier a panic would have resulted.

**February 25.**—SANTA ANA.—Two light shocks of earthquake were felt here last night about 2 o'clock.

**March 13.**—PETALUMA.—This morning at 5:25 o'clock a distinct shock of earthquake was felt in Petaluma. The vibration was from east to west.

**March 13.**—NAPA.—This morning at 8:35 o'clock a rather severe shock of earthquake was felt here. The vibrations were from north to south, continuing about twelve seconds.

**March 13.**—NAPA.—This morning at 8:23 came a slight shock of eight seconds duration.

**March 28.**—DRYTOWN.—A slight shock of earthquake was felt here at 7:30 o'clock this morning. It was accompanied by a rumbling sound. The vibrations were from west to east.

**April 3.**—MOUNT HAMILTON.—Prof. Holden reports being waked by a shock at 2:50:9 a. m. Intensity=R. F. IV. "2:45:0±4s. P. S. T.<sup>1</sup> southeast and northwest. Duration, 1s.-2s. at least. Wakened. Intensity=III-IV. In second story of brick house."

**April 17.**—TACOMA, WASHINGTON.—Two shocks of earthquake were felt at 2:55 o'clock this afternoon. The second shock was scarcely perceptible. Buildings trembled. The vibrations were from south to north. There was a severe shock at Olympia at 2:39 o'clock this afternoon which lasted seven seconds.

**April 17.**—PORTLAND, OREGON.—At 2:50 o'clock this afternoon two heavy shocks of earthquake were felt here. The shocks lasted about ten seconds each and the vibrations were from west to east. Many persons became frightened and rushed into the street when the buildings began to tremble. No damage was done.

**April 19.**—SAN FRANCISCO.—On the morning of this day in the central portion of the state, occurred the heaviest earthquake of the year, and in the localities where it was most severe it was doubtless the worst ever experienced, rivaling that of 1868 in severity, and probably exceeding it in point of property destruction. Three important towns, viz, Vacaville, Winters, and Dixon, suffered severely and much dam-

<sup>1</sup> Pacific slope time.

age was done in many other places in the same vicinity. The second day following brought another severe shock which wrecked many buildings already weakened. It is, perhaps, worthy of remark that these disturbances did not follow the mountain contour of the country, but seemed to have their greatest range east and west or nearly at right angles to the direction of the mountain ranges; crossing the Sierras, they were distinctly felt in Nevada. The loss of property was great.—C. D. P.

**April 19.—MOUNT HAMILTON.**—"Long period gentle shock—waked sleepers—swung hanging lamps—R. F.—IV to V. 2:49½ P. S. T." (Prof. Holden.) The record on the duplex seismograph shows the greatest motion to have been east and west, amounting to 18.5mm.; the displacement north and south amounting to 8mm.

**April 19.—MOUNT HAMILTON (via San Jose).**—The earthquake was severe enough to awaken sleepers. But those who were up and at work felt it as a series of long, gentle undulations. It registered on our instruments. (E. S. Holden.)

**April 19.—SAN FRANCISCO.**—A little before 3 o'clock this morning an earthquake struck San Francisco. The shock was the heaviest experienced since the historic one in 1868, when the earth moved in waves on Mission street.

The greatest result that the shake occasioned in San Francisco was the downfall of the front wall of the old Academy of Sciences building on the corner of Dupont and California streets. Workmen were engaged in tearing it down. They are going to put in a new front and change the place into a theater. On Monday night when the men quit work the wall stood alone. The roof and side walls had been cut away, and to guard against a fall the wall was braced with long timbers.

When the quake came along the timbers were shaken off and down came several tons of brick and mortar. It woke up policemen on beats blocks away and nearly scared the life out of a theatrical party that was out on a late trip through Chinatown. The balconies came away with the wall and in a moment the sidewalk was piled high with bricks, beams, and plaster; no one was hurt.

The earthquake began with a thump that seemed to knock the earth to the west, then for about three seconds the world seemed to be sliding convulsively back into place. But before it came to rest there was another thump, followed by a lighter one. Altogether it took thirteen minutes for the earth to get over its fluttering.

Prof. Davidson, of the Coast and Geodetic Survey, happened to be in his observatory. He did not feel the earthquake, as he was just rising from his chair to study his instruments. He knew it was a-quaking, however, by the excitement in the bubbles of the levels.

The time was 2:51:41 this morning. The movement in minute waves was 0.9 second of arc, and the time of the pulsations about three seconds of time and not regular, at times almost subsiding and then starting out

afresh. The movement was apparently from the south. This continued for four or five minutes, and in six minutes the amplitude of the waves was from 0.2 or 0.3 second of arc, and the time of pulsation slower. The pulsation was faintly exhibited for nine minutes and at thirteen minutes it had ceased. At the close the north ends of the two levels were 0.5 second of arc higher than when first read.

Prof. Davidson says that this was one of those earthquakes that roars, and was the second of that kind that he had observed. Just

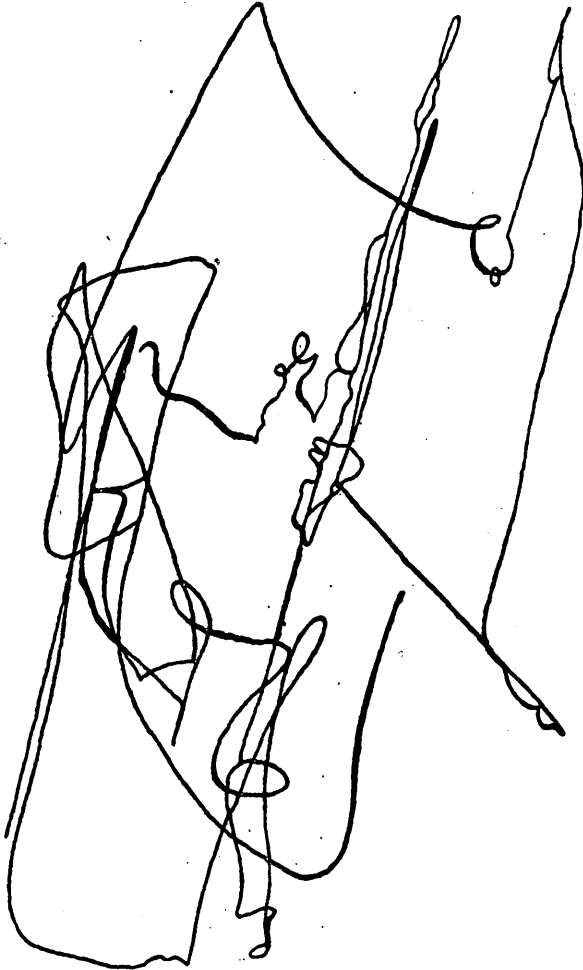


FIG. 1.—Tracing of the seismograph in San Francisco.

before the shaking there was a noise as of heavy wagons being hauled over hard ground a long way off.

The earth did not get back to where it started from, for Prof. Davidson's levels were 0.5 second of an arc higher after the shock had passed. This is not much, for the observatory on Mount Tamalpais was moved several feet by the earthquake of 1868.



The earthquake went through Oakland before it struck this city. Mr. Burckhalter, of Chabot Observatory, was ready for it, and his seismograph reduced the earth's movements to black and white. The earthquake registered in Oakland in bold handwriting, but its signature was different from that made in this city. When it registered on this side the curves were replaced by erratic angles. It took the earthquake two minutes and thirty-nine seconds to get here from Oakland.

Prof. Davidson said that the difference in the ground structure here and in Oakland, and in the buildings in which the instruments were, might account for the dissimilarity of the records made on the seismographs.

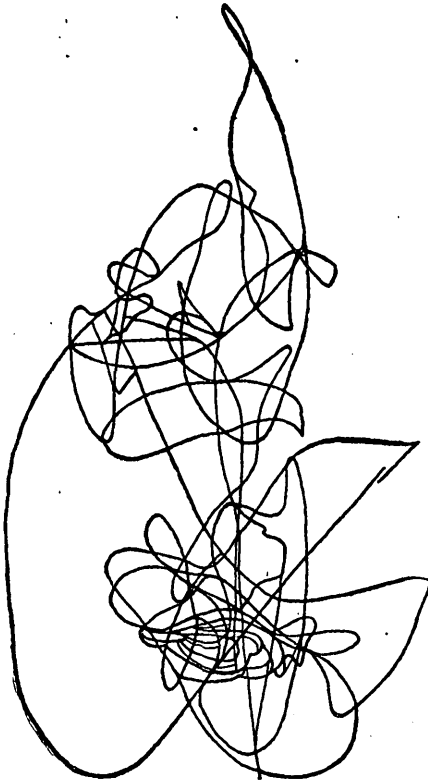


FIG. 2.—Tracing of the seismograph at the Chabot Observatory, Oakland.

The ferry depot rocked and creaked, and those inside of it started to run for the door. Every clock in the building, including the tower clock, stopped, and all showed the same time, viz, 2:53 o'clock. On board the ships a slight trembling was felt that lasted about ten or twelve seconds. The shock was felt only by those who happened to be on deck. The rest of those on board were ignorant of the fact that an earthquake had happened.

The ferry tower pendulum is between 50 and 60 pounds weight and is suspended by a steel spring 6 or 8 inches long and three-fourths of an inch wide, similar in appearance to a piece of scrap iron. The shock set the

pendulum to wriggling in an irregular manner from side to side and kept it up so long that the strong steel was warped in all sorts of shapes and finally broken.

The guests in the New Western hotel poured out into Kearney street when the shake took place, and made a bee line for the center of Portsmouth Square, believing that that was the safest place, should the surrounding buildings fall. All of them were in undress, but for a time that was forgotten. When the first effects of the fright wore off the ladies quickly remembered that their costumes were not the things for street wear, and hurried back to their rooms.

The guests in the Palace hotel were somewhat frightened, a number of them rushing into the corridors to ascertain the cause of the vibrations. The only damage sustained was the breaking of a few statuettes and some glass, which were thrown to the floor.

The shock was very much more severe in the region 50 or 75 miles north of the city and the residents there had much curiosity to know how great it had been in San Francisco.

**April 1<sup>o</sup>.—SAN FRANCISCO.**—The Chronicle of April 20: So far as damage to property was concerned, the earthquake that shook a limited portion of the state north of the meridian of San Francisco early yesterday morning was the most severe that has been experienced since the Lone Pine disaster of 1872. While the vibration of yesterday was felt from Gilroy and Fresno on the south to Oroville and Chico on the north, and from Santa Rosa on the west entirely across the state and into Nevada, the area within which damage was done was very small. This district includes portions of Solano and Yolo counties, and comprises a section some 20 miles wide by about 30 in length. Brick buildings in Vacaville, Winters, Dixon, Woodland, Esparto, Capay, and Fairfield were wrecked to a greater or less extent, but the entire damage, by the most liberal estimate, is so small that it is apparent that the injured structures were of a class easily damaged, and no great outlay for repairs or complete reconstruction will be involved. In a few cases injuries to persons are reported, but in no instance were there any seriously hurt, nor, wonderful as it may seem, was there any loss of life. By comparison with the cyclones that have recently visited the Mississippi valley, and which make a habit of so doing, leaving hideous death and total destruction in their path, the earthquake of yesterday was a mild visitation; yet, after all, the actual loss caused will be found far less in the aggregate than has been inflicted by many a storm at the East that has been dismissed with a dozen lines of telegraphic report.

**April 19.—VACAVILLE.**—An earthquake occurred here at 2:50 o'clock this morning. The damage in town was very great, there being few, if any, of the hundreds of residences that do not show evidences of the tremendous power exerted. Chimneys were razed entirely or twisted badly. Dishes, tinware, crockery, and everything

of a movable nature went down with a crash that was truly appalling. This statement will as well apply to the whole township as to the town.

This town presents a strange appearance to-night. There is apparently but one street in it, namely, Main street, and the south side is nothing more nor less than a row of wrecked brick structures, and the street is filled with pieces of brick and lumber, and the cracked edifices are propped up with huge beams to prevent them from falling into the roadway. The north side of the street was composed in the main of wooden buildings, and except in a few instances the loss on that side is confined to chimneys, which went by the run when the memorable temblor struck the town in the small hours this morning.

The worst cases of damage off Main street were sustained by W. J. Dobbins, who lived in a two-story brick building about 300 yards north from Vacaville, and by Garland Gates, who lived in a similar structure 3 miles west of the city. Both of the houses were totally wrecked and several persons who were sleeping in them at the time were injured.

On entering the town from the direction of the railroad depot the first demolished building met with on the south or brick side of Main street is H. Chittenden's grocery store. It is a complete wreck. Next to it is F. H. Hacke's hardware shop, split and rent asunder, and held together only by wooden props leaning in from the street. The bank of Vacaville, a one-story brick structure, did not suffer as extensively as its neighbors. The Odd Fellows' building, which stands next, was badly wrecked; the upper story is thoroughly destroyed, and those who had offices there are heavy losers.

Going west the one-story brick buildings which adjoined one another were all more or less damaged. Mr. Plates's building at the western extremity of Main street is in a deplorable condition. It is a one-story brick building, and in it are situated the opera hall, post-office, two dry-goods stores, one grocery, and the Enterprise office. The walls, both front and rear, were knocked out, and the building may be said to be a total wreck; the block has been temporarily walled in with sections of canvas, and those who have suffered from the big shake are busily employed within trying to restore order out of chaos. The post office has been temporarily removed to premises adjoining, on the north side of Main street. The buildings which suffered most are the Brunswick hotel and the Presbyterian church. They are wooden structures and are pretty badly damaged.

The total loss in and around Vacaville is variously estimated at from \$70,000 to \$150,000. There is not a brick building on the south side of the street which was not more or less wrecked, and some of them are a total loss. The shock struck the town at just 2:49 o'clock, and lasted fully three-quarters of a minute. The vibrations were at first from southwest to northeast and then changed suddenly to north and south. Fronts of buildings tumbled into the street, chimneys were

twisted and torn as if struck by a Kansas cyclone, and the entire population rushed into the streets. That there were no fatalities is little short of miraculous, though there were a number of very narrow escapes.

Vacaville seems to have been headquarters for the quake. Several have heretofore been felt here, but none ever approached this in severity. Business was at a standstill all day, and the streets were filled with sightseers from the country and adjacent towns. The injured buildings are being repaired as fast as possible and business will be resumed soon. The newspaper offices were badly pied. The aggregate loss in the town and township will foot up fully \$100,000.

Probably the first person in Vacaville to notice the approach of the earthquake was S. N. Bettis, the night watchman of the town. He reports that the morning was clear and starlit and that a cold breeze was blowing. He was walking down Main street, from west to east, with his lantern in his hand, when his attention was attracted by a rumbling sound which came from the hills west of the town. The noise resembled distant thunder or the roaring of water which had suddenly been let loose by the bursting of huge dam gates. Bettis stood still and listened a few seconds, while the noise increased to a roar and the ground beneath his feet seemed to heave up.

"The motion at first was west to east," said he, "and then several violent shocks passed from north to south. I felt as if I was on the deck of a vessel during a heavy storm, and I put my hands to the ground to prevent myself from falling on my face. After that brick walls and chimneys began to fall all around and the noise for a minute or so was deafening. Occasionally I could hear the shrieks of women above the din, and soon people began to rush into the streets in their night clothes. They were terrified and huddled together like sheep, but as soon as the shock passed away the men in the party regained their nerve, although the women still remained in a highly excited state and would not return to their dwellings."

A good many state that for some time after the shock the air was filled with sulphurous fumes, which were emitted from the fissures in the ground, of which there are many hereabout. In all about one hundred people were deprived of sleeping quarters by the earthquake, but those have all been absorbed by the hotels and families with spare apartments, so that, barring the prevailing feeling of uncertainty as to what an hour may bring forth, there is very little discomfort or distress.

The public schoolhouse and the college, a couple of two-story brick buildings near the railroad depot, have also been badly racked and a survey will be made to ascertain the amount of damage done. It is thought that the upper story of the school building will have to come down.

**April 19.—DIXON.**—At 2:45 o'clock this morning people were awakened by an ominous rumbling, followed almost immediately by a

heavy shock and the twisting and groaning of timbers. The exact duration of the shock is not known, but to the terror-stricken people waiting for the end it seemed hours.

Scarcely had the first vibration ceased before a second of shorter duration began. Quiet had hardly been restored before the mournful tolling of the fire bell commenced, followed shortly afterward by the wailing of the whistle on the waterworks, both of which seemed to announce a terrible calamity to the anxious listeners. People were almost afraid to leave their homes for fear that a third shock would bring the threatened end. A crowd soon gathered, and a scene of devastation was witnessed; toppled walls and crushed roofs presented themselves on every side, and the sidewalks and streets were strewn with wreckage and debris. To add to the terror fire broke out in several places simultaneously in the midst of the ruins. but the firemen worked hero-

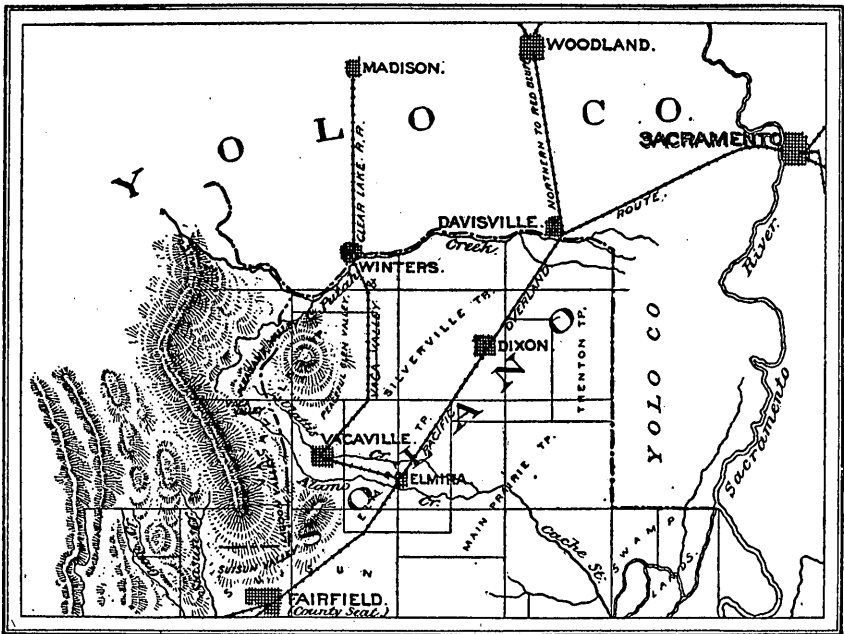


FIG. 3.—Map showing the area where the earthquake was most severe.

ically and soon had several streams playing on the flames, which were finally extinguished, although the damage will amount to many thousands of dollars. If it had occurred several hours earlier or several hours later the damage might have been far greater and many lives might have been sacrificed. As it was the streets were deserted, with the exception of the night watchman who discovered the blaze and rung in the alarm. No oil lamps were burning except a night lamp in Dugan's store which was broken when the roof was crushed in by the falling fire wall. If the earthquake had occurred earlier or later there would have been numerous fires.

Many of the finest residences in town are wrecked and not more than five chimneys in the town are standing. The total loss on residences is \$6,000.

In the country the loss was very serious; hardly a house rests on its foundation and some of them are not habitable. The losses to farmers will aggregate \$10,000.

Every monument in the local cemetery was either broken or badly twisted and thrown from position.

There were several miraculous escapes from death. John Rhemke and George Haarms were buried in the ruins of the former's saloon, and were extricated after hard work. Both are badly injured. Shannon Keaton was buried in the wreck of Rochford's butcher shop, but escaped unhurt.

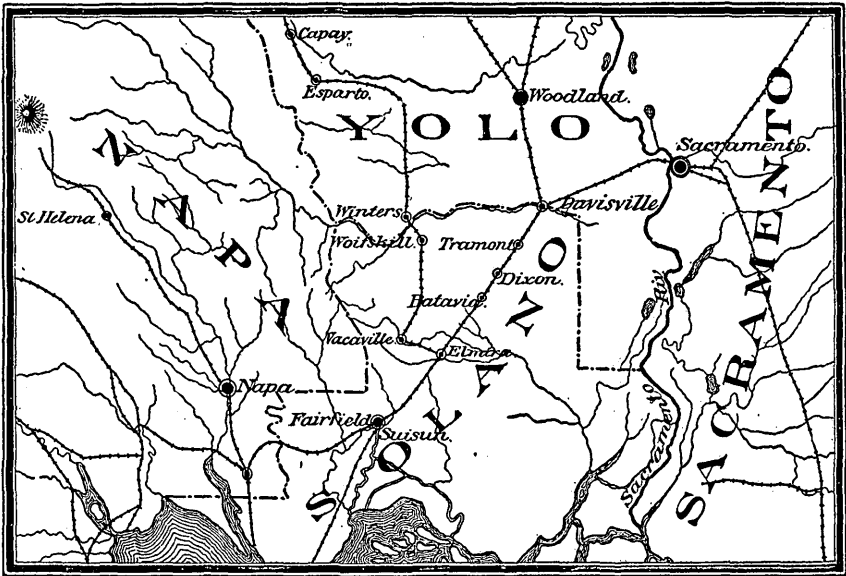


FIG. 4.—The earthquake center.

The fires in Brown & Coleman's and Dugan's stores threatened for a time to destroy the town. The firemen worked in constant danger from the toppling buildings, but overcame the flames after a stubborn fight.

Mr. Ross, one of the sufferers, says that the loss on buildings alone will be not less than \$15,000 or \$20,000. Probably the heaviest loser in the city was John Dugan, who suffered not only from the earthquake, but also from the fire.

The schoolhouses are badly wrecked; one, costing \$8,000, is twisted off the foundation, and the roof has caved in. The contractors have been making estimates all the afternoon, and it is safe to say that it will cost \$75,000 to make repairs—\$50,000 in town and \$25,000 in the vicinity. People are walking about with a haggard and dazed aspect,

arising partly from want of sleep, partly from shock, and partly from expectations of another shakeup. The stoppage of clocks confirms the general impression that the main shock occurred at 2:50 a. m. There was a distant rumbling and detonation, and a nasty, vicious twist at the wind up. It was the twist that did most of the damage. The facts seem to show that the wave traveled much nearer the surface than in the earthquake of 1868, or even in the Napa shock of last year. It was indeed a heavier shaking up than that which Charleston experienced in 1886, only that the energy was expended over a larger area. Every article of glass was turned upside down and nothing was broken; while at a saloon not half a block away the proprietor did not even know that an earthquake happened till the ringing of the fire bell summoned him to duty—not an article of glass in this place was broken or disturbed.

**April 19.—WINTERS.**—The heaviest shock of earthquake that was ever experienced here occurred this morning at 2:50 o'clock, every brick and stone building in the town being damaged more or less, and some of them being total wrecks. Among the business houses almost totally wrecked was the Masonic Temple, occupied on the first floor by Griffiths & Hazelrigg, general merchandise.

Scarcely a house in town escaped. The fine new schoolhouse, just completed, lost its chimneys; the plaster is cracked, and the brick foundation is badly shattered. It is estimated that the loss to the town will be from \$50,000 to \$60,000.

Main street presents a badly wrecked appearance, although buildings are still standing. The large new Devilbiss hotel suffered considerably, much of the brick front caving into the street. There were about 40 guests asleep in the hotel when the shock occurred, and the men, women, and children ran terror-stricken down the stairs. On reaching the office they found chaos all around, the plaster fallen, the walls opened, and the furniture scattered in confusion. The kitchen was also badly shaken, and Mrs. Bertha Roberts, the wife of the cook, was severely hurt by falling plaster. So far as known she is the only person receiving injuries, although many narrow escapes are reported. Crowds are gathered around the scene of the wreck, and business men are figuring their losses, which range in individual cases from \$250 to \$5,000.

Sixty feet of the fire wall of the new Cradwick building on Main street toppled westward upon the frame roof of Judy Brothers' stable, and crashing through completely buried six horses in their stalls, though singularly not badly hurting them. To-day the schoolhouse, just finished by Contractor Silas Carl, of Sacramento, was to have been turned over to the trustees. The brick foundation was cracked, the chimneys thrown to the ground, and the plaster torn. The old schoolhouse is so badly wrecked that no school is being held to-day. The loss to the town is estimated at between \$70,000 and \$100,000. At the graveyard tombstones were wrenched around or completely shattered. Near the town

the bank of Putah creek, ten feet wide, caved in, and along the bottom of the creek for a great distance rents were made by the shocks. West of here about three miles, an acre of ground slid into the creek. Reports are just beginning to come in of damage in the country hereabouts.

Two miles southeast of Winters, J. R. Wolfskill's stone house was totally wrecked. He was asleep with his wife when the wall crushed in, just missing the bed and sparing their lives. In Pleasanton valley a lamp in J. N. Thissell's house was thrown down. It exploded and a fire followed. The house was wholly consumed. In the residence of

J. A. Devilbiss the wall was separated from the floor so that a man might put his leg down the aperture. Up the Berryessa road the passage is blocked by immense bowlders, some weighing several tons, which were thrown with mighty force down the hillsides into the road. It is near this point where the rents in the road were noticed. William Barker's adobe house across the creek was so shaken that it is dangerous to enter it, and other houses were wrenched from their foundations. From all around come reports of wells filling up with caving earth and narrow escapes from awful fires and death by the falling of burning lamps in sick rooms. What is most mystifying in the face of all the damage done is that no lives were lost and very little injury to persons is reported. The bank building on Main street was wrecked. There is not a

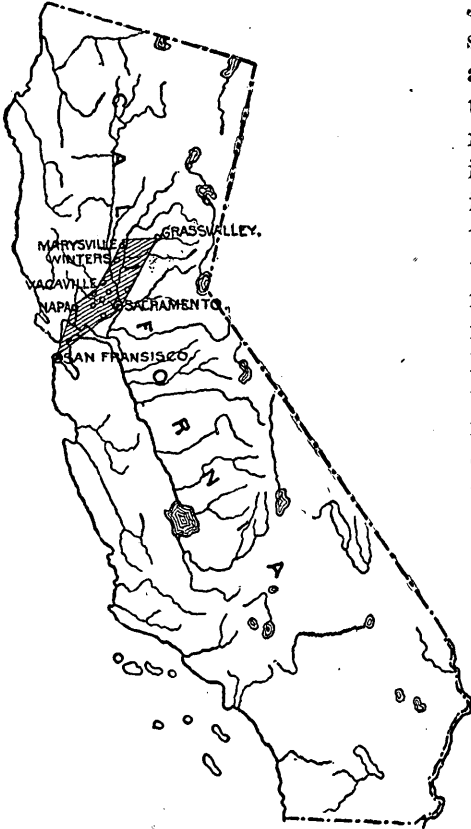


FIG. 5.—District affected by the temblor.

whole window left in any house on that street. In the office of the Express forms were pied, type emptied from cases, and the old Washington press, weighing over a ton, knocked over. A big job press suffered similarly.

On Putah creek, half a mile west of Winters, a phenomenon was witnessed by a young man named Fred Willis, who was riding past at the time of the big shake. There seemed to be an explosion, and the water was thrown from the creek to a distance of 20 feet on either bank. Then followed a hissing sound as of gas escaping. At day-



light several fissures were found in the bed of the creek and in the roadway and fields adjoining. On each side of the creek where the explosion took place the banks caved in, the landslides being 75 feet in length and 12 feet deep.

Such as were enabled to see the sky through split roofs after the big shock passed state that the heavens were livid with fire, and when they reached the street there seemed to be a haze in the atmosphere, while odors of sulphur were distinctly discernible. The people of Winters are extremely positive on these points.

**April 19.—WOODLAND.**—A deep rumbling noise at 2:45 a. m. to-day was the forerunner of the most severe shock of earthquake ever experienced in this portion of the state. The shock was a series of rapidly intermittent vibrations which lasted for thirty seconds, at first almost north and south and changing frequently from east to west, producing the impression of circular motion. Fortunately the casualties in this immediate vicinity are not great, but the public never experienced a worse fright.

Evidences of the force of the shock are numerous everywhere. Chimneys are cracked and occasionally toppled over, brick walls are cracked and fire walls suffer through loss of brick. The destruction of glass in stores and private residences is very large. The Byrnes hotel loses a part of its ceiling; the Capital hotel, a chimney; Masonic Hall suffers in chimneys and plaster; Mezgar's bakery furnishes broken glass and cracked walls. The Grammar school building suffers a broken fire wall and cornice. So far there is no evidence of any damage to the waterworks. In the Croft hotel a number of the rooms are almost denuded of plaster, and most of the business blocks are slightly damaged. One of the Capital hotel chimneys is out of plumb. The walls of both the jail and court room are cracked. The plastering has fallen off in Superintendent Banks's office. The wall at the southwest corner of the Bank of Woodland is cracked. At the Byrnes hotel the walls were cracked and the plaster fell to the floor in several rooms. Many of the guests were so badly frightened that they ran down stairs without stopping to dress.

**April 19.—GRASS VALLEY.**—This morning a little before 3 o'clock two shocks of earthquake woke the people and rattled things. The direction was north to south. No damage was done.

**April 19.—AUBURN.**—There was an earthquake this morning about 2:45. There were two distinct shocks, about ten seconds apart. The course was northerly. No damage is reported.

**April 19.—CHICO.**—A heavy shock of earthquake was experienced in this city at 2:45 this morning, followed immediately by two others. They seemed to pass northwest to southeast. Many clocks in the city were stopped. In some places articles sitting near the edges of shelves were knocked off. No damage was done to the windows or glassware.

**April 19.—STOCKTON.**—A severe shock of earthquake was felt here

at 2:50 o'clock this morning. No damage is reported, but the fright was great.

**April 19.—NICOLAUS.**—There was a severe earthquake at 2:50 o'clock in the night. The direction was doubtful. A loud rumbling noise followed the shock.

**April 19.—MERCED.**—Two distinct shocks of earthquake were felt here this morning. The first occurred at 2:47, stopping the clock at El Capitan hotel. The second shock was three minutes afterward, starting the clock again. No damage was done.

**April 19.—MARYSVILLE.**—An earthquake was felt in this city and in the country for a number of miles at about 3 o'clock this morning. The duration of the shock was from seven to nine seconds. The vibrations were north of northwest and south of southeast. It was the severest and longest of any ever experienced in this vicinity, but did no damage. Buildings were swayed, bells rung, and clocks stopped. The result was a general scare, which kept many timid ones awake until daybreak.

**April 19.—NEVADA.**—Two sharp shocks of earthquake occurred here at 2:50 o'clock this morning. The first was of brief duration, but the second, which immediately followed, lasted eight or ten seconds, awakening the soundest sleepers and creating widespread alarm among timid people. The vibrations extended from northeast to southwest.

**April 19.—FOLSOM.**—The prisoners in the jail were greatly alarmed at the earthquake shocks. They thought the day of judgment had come. The guards at first thought the rattling on the locks was caused by a general break of the prisoners. No material damage resulted.

**April 19.—ANTIOCH.**—A severe earthquake shock startled our citizens at 2:45 a. m. The vibrations were from west to east and of about forty seconds duration. No damage to property.

**April 19.—BENICIA.**—The heaviest shock of earthquake felt in this city since 1868 occurred at 2:40 o'clock this morning. The vibrations lasted for several seconds and were north and south. The whole town was aroused, and our people were badly frightened. Little or no damage is reported here beyond the cracking of a few chimneys and some plastering.

**April 19.—DAVISVILLE.**—The hardest shock of earthquake ever experienced here was felt this morning, but the damage is very slight. One or two chimneys were overthrown and brick houses cracked, but not so as to be dangerous. Perhaps \$200 will cover all damage.

**April 19.—ELMIRA.**—The most severe shock of earthquake ever experienced here occurred this morning at 2:50 o'clock, destroying almost every chimney in the town, and badly wrecking the brick store of J. Allison & Co. The damage is small, as the buildings are all frame.

**April 19.—COLUSA.**—At 2:50 o'clock this morning one of the heaviest shocks of earthquake ever felt at Mills station occurred, lasting about twenty seconds. The vibrations were from north to south.

There were several severe shocks. Opinion is divided as to the direction. Clocks were stopped and there was a general shaking up of crockery.

**April 19.—WHEATLAND.**—A very marked earth disturbance was noted here at 3 o'clock this morning. The vibrations appeared to be west to east, and were so pronounced as to awake the soundest sleeper.

**April 19.—ORLAND.**—Two distinct shocks were felt here about 2:40 a. m. The vibrations were apparently north and south.

**April 19.—BIGGS.**—Three heavy shocks of earthquake occurred here this morning at 3 o'clock. The vibrations were northeast and southwest. Clocks were stopped and plastering cracked.

**April 19.—PETALUMA.**—About 2:55 o'clock this morning one of the heaviest and longest earthquake shocks experienced here for some time passed through this city. The vibration was from east to west, and the duration three to four seconds.

**April 19.—SUISUN.**—The severest earthquake ever experienced in this vicinity occurred at 2:52 this morning. The shock, although very severe in Suisun, was not nearly as hard as it was a few miles north and east of town. The principal damage here was to the new Masonic Hall, where the plastering is very badly tumbled down and cracked.

The Methodist church in Fairfield is so seriously damaged that it will have to be taken down. The bell tower is all down, and the walls of the building so badly cracked and broken as to render it unsafe. The court-house and jail were also slightly injured.

There were also a large number of brick chimneys in Fairfield leveled to the tops of the houses.

In the Arlington Hotel many of the boarders were so frightened that they grabbed what clothing they could and rushed to the streets, where they dressed.

The vibrations appeared to be from the northwest to southeast and lasted fully one minute. The damage in this town and immediate vicinity, with the exception of the church in Fairfield, will not exceed \$500.

**April 19.—SACRAMENTO.**—Some attempts have been made to make a sensation of the earthquake shock here this morning. The truth is the only damage done was the shaking down of one old chimney and the breaking of a chandelier pipe which had rusted at the ceiling joint. Even pyramids of wine glasses in the show windows of the crockery stores were not disturbed. In a few old buildings a little plastering was loosened. The shock was lively enough and many persons were frightened, but that was all.

**April 19.—FRESNO.**—A shock of earthquake was felt this morning at 2:45 o'clock. No damage was done, the shock being slight, and only sufficient to rattle dishes and disturb those who do not sleep soundly. Not one person in ten felt the shock.

**April 19.—RENO, NEVADA.**—A slight earthquake shock occurred

here this morning at 2:50 o'clock. The vibrations were from north to south.

**April 19.—VIRGINIA, NEVADA.**—The earthquake that shook up Vacaville and other interior California towns at 2:50 o'clock this morning was felt here at the same hour and at all points throughout Nevada, so far as heard from. The vibration was from east to west, but no damage is reported.

**April 19.—CARSON CITY, NEVADA.**—Reported by Prof. C. W. Friend as occurring at 2:50:40 a. m., P. S. T. Duration, 30 seconds. The tracing shows a total displacement of the pointer in a northeast and southwest direction of 49 mm., and a displacement in a northwest and southeast direction of 29 mm.

**April 19.—ALAMEDA.**—Tracing made by duplex seismograph shows a total displacement in a northeast and southwest direction of 30 mm. and in a northwest and southeast direction of 26 mm. Time, 2:49 a. m.—C. D. Perrine.

**April 19.—SMITH CREEK.**—Time noted by Mr. King, 2:50±½ minute, p. m. Prof. Holden reports King's watch right at 10 a. m.

**April 19.—WILLOWS.**—Received a severe shock at 2:51 o'clock, lasting fifteen seconds. Scores of people are practically homeless here, because fear of a repetition of the convulsion has seized many of those who had hairbreadth escapes, and they are unwilling to occupy their houses to-night. But this fever is as nothing compared with that of the Japanese, hordes of whom are employed in orchards around Winters. In their native country the first earthquake is taken as a fore-runner of more, and they are momentarily expecting a return of the tremor. Many of them refused to go to work this morning and are wandering in the streets. Reports received within a radius of 5 miles around place the amount of damage up to \$200,000, at a moderate estimate. This is a dead loss, as the fire insurance companies do not reimburse for such damage.

**April 19.—SAN JOSE.**—An earthquake of considerable length occurred about ten minutes to 3 o'clock this morning, but was not severe enough to cause any damage in this city. Its duration was about forty seconds and the vibrations were from east to west. It was not felt by everybody. It started with a jerk and then settled into a trembling with an evenness that seems remarkable and was the cause of much comment. As one person expressed it, "It seemed as if a cradle was rocking."

**April 19.—ESPARTO.**—The severest earthquake that was ever experienced in this locality took place at 2:50 a. m. to-day. Considerable damage was done, though fortunately no one was injured. The greatest damage was done to the Barnes Hotel. A section of the east wall fell down and a great deal of plastering fell in the rooms. Three chimneys were knocked down, one of them crashing through the roof.

It will take \$1,500 to cover the damage to the hotel. The fire walls of Levy & Schwab's building were displaced 5 inches. There was also loss from damaged goods and broken crockery.

The large grain warehouse at this place was also slightly wrecked and the drug store considerably damaged. Other buildings were more or less damaged.

The earth opened in several places between here and Capay.

**April 19.—CAPAY.**—The earthquake gave the town of Capay a lively shakeup. The west wall of B. Waldrich's building caved in and the east wall fell out. Mrs. Peach, an occupant of the building, was struck by several falling bricks and had a very narrow escape. The damage is fully \$1,000. The stock of merchandise in stores was thrown down from the shelving and considerably damaged. The walls of the Nash building were cracked and nearly all the chimneys in the town were thrown down.

**April 19.—SANTA ROSA.**—The earthquake which visited Santa Rosa this morning at 2:50 o'clock was the most severe felt since 1868, and many think it was worse than that. It lasted over a minute, and the vibrations seemed to be of an undulatory nature east to west, and lasted three minutes. Windows were broken in many houses and plaster was torn from some of the houses. A panic prevailed at hotels, guests getting up and running out in their nightgowns. No very serious damage was done.

**April 19.—MARTINEZ.**—This morning about ten minutes to 3 o'clock one of the severest shocks of earthquake ever felt here awoke the slumbering residents. The vibrations seemed to be from west to east, although some seem to think they vibrated from north to south, and lasted about thirty five seconds. A few cans toppled over in some of our stores, several clocks stopped, a few cracks occurred in the court-house plastering, and several chimneys were shattered.

**April 19.—FAIRFIELD.**—The hardest shock of earthquake ever experienced here occurred at 2:50 a. m. The vibrations were northeast and southwest. Windows and glassware were broken and the stoves and bookcase in the schoolhouse were overturned. The bell tower on the brick Methodist Episcopal Church fell in and the gable end on the north side fell out. The church was ruined. The court-house and jail were not much damaged.

**April 19.—NAPA.**—A heavy earthquake shock was experienced here about 2:50 this morning, followed within half an hour by two lighter shocks. The vibrations were east and west, continuing several seconds. People very generally were alarmed, but no damage was done. The shock was the heaviest felt in several years, excepting that of last October.

**April 19.—HEALDSBURG.**—An earthquake visited this section at 3:10 o'clock this morning. It was one of the most severe shocks ever felt in this locality. The vibrations seemed to be from south to north. There were three distinct shocks, the first being the most severe. The last of them seemed to take a rotary motion. The plaster in several stores was badly cracked.

**April 19.—SAN RAFAEL.**—The severest earthquake shock experienced here in a number of years occurred this morning at 2:50 o'clock. The vibrations were from north to south and the shock was perceptible for about fifteen seconds. No serious damage was done here, but in numerous residences clocks were stopped, crockery thrown from shelves, and water pipes wrenched.

**April 19.—MARCUSE.**—The severest earthquake that has been felt in this neighborhood for years occurred this morning at about 3 o'clock and lasted for nearly half a minute. The vibrations were from north to south. No damage has been heard of.

**April 19.—VALLEJO.**—The earthquake this morning stopped the two standard clocks in the Naval Observatory at Mare island, it being the first time they were ever so affected. The heavy mercury pendulum of one of the clocks was swung out on the ledge of the case and was removed with difficulty. The transmitting clock was not stopped and time was sent out as usual to the 1,650 clocks regulated by it.

**April 19.—MILTON.**—At 2:45 o'clock this morning two heavy shocks of earthquake were felt here. The vibrations were southwest to northeast. Buildings trembled and many persons were severely frightened, but no damage was done.

**April 19.—PLACERVILLE.**—A very distinct shock of earthquake was felt at 2:50 o'clock a. m. to-day. The vibrations were from east to west.

**April 19.—UKIAH.**—No seismic disturbance occurred in this section.

**April 20.—VACAVILLE.**—When the terrible shock of Tuesday morning occurred every one expected a repetition. During last night there were constant shocks, beginning about midnight and continuing to 8 this morning. The belief in the likelihood of a recurrence has induced many to go to the country. The only effect of to-day's quakes has been to weaken the walls already shaken.

The townspeople of Vacaville have had seven more shocks to unnerve them. The heaviest came a little before 2 o'clock this morning and shook down several walls which were already tottering, but did no other damage. No one has been hurt since the big shock for the reason that the majority have preferred the open street to the sanctuary of even a frame house. How many went without a bed it is difficult to say, but the number of bloodshot eyes and shaking, nerveless forms seen on the street this morning would lead to the conclusion that most people made a night of it. Many visitors came in from Dixon, Elmira, and other points, but they did not stay long, and they were accompanied in their exodus by those of the townspeople who had relatives or friends in other villages and towns. It is safe to say now that the danger is over, and that it will take \$100,000 at least to repair damages.

**April 20.—PETALUMA.**—About 10 minutes to 2 o'clock this morning a quick, sharp shock of earthquake passed through Petaluma.

**April 20.—NAPA.**—Another shock of earthquake was felt here this morning about 2 o'clock. It was much lighter than that of Tuesday morning. No damage was done.

**April 20.—MARTINEZ.**—A slight shock of earthquake was felt here this morning about 6 minutes past 2 o'clock, but did no damage.

**April 20.—STOCKTON.**—Timid people who were frightened by the sharp earthquake shocks at 2:50 o'clock Tuesday morning noticed two more gentle temblors at 2:05 this morning. No damage was done by the shocks.

**April 20.—WOODLAND.**—There was a slight earthquake shock at 2:05 o'clock this morning. No further damage than that reported.

**April 20.—GRASS VALLEY.**—There was an earthquake shock here this morning at about 2 o'clock, lasting twelve or fourteen seconds. There was no damage.

**April 20.—NEVADA CITY.**—Mild shocks of earthquake were felt here at 10 o'clock last night and at 2:05 o'clock this morning.

**April 20.—SUISUN.**—There were three slight shocks of earthquake here to-day, the first occurring shortly before 2 o'clock this morning and the last at about 8:30.

**April 20.—ELMIRA.**—This place enjoyed the distinction of having no fewer than seven fresh shocks, the heaviest at 2 a. m. and the last at 9 a. m. As in other places along the line the vibrations were north-east and southwest. Most of the chimneys went down on Tuesday morning and no further damage has been done.

**April 20.—FAIRFIELD.**—As in the case of other villages along the line between Sacramento and Benicia, Fairfield had another shakeup to-day, the most noticeable tremor being at 2 o'clock this afternoon. No damage was done.

**April 20.—NAPA.**—Another shock of earthquake was felt here this morning about 2 o'clock. It was much lighter than Tuesday morning's. No damage was done.

**April 20.—SACRAMENTO.**—Mild shocks of earthquake were felt here at 10 o'clock last night and at 2:05 o'clock this morning.

**April 20.—WINTERS.**—The citizens of this place are satisfied now that the earthquake scare is over for good, though there have been three small shocks during the early hours of this morning. The hardest was at 2:05 o'clock; the second came a little before 4:30 o'clock and the third at 8:40.

There is one feature in the results of the shock here which has not been noticed to anything like the same extent elsewhere. It repeats the case of the Charleston earthquake, when all the superficial effects were noted at the neighboring town of Summerville. At Winters there have been developed a number of fissures in the earth, water has been ejected, gas has escaped, and the bed of the creek has been filled up for a distance of over 70 yards. Many of the wells have been filled up by the collapse of the walls.

**April 20.—DIXON.**—This town has had three more shocks since the big one of yesterday, but the people are regaining confidence, and are clearing away the ruins in hearty style. Most of the brick buildings

that were damaged by the first shock will have to come down, and the most noteworthy fact in this connection is the composure with which the issue is being faced. Earthquakes do not, as a rule, come within the insurance chapter of accidents, and many of the townspeople will be heavy losers.

Most of the families in Dixon slumbered fitfully last night, for, weary as they were, the shock which came at 2 a. m. was a boomer, and it was followed by another of a milder sort at 4 o'clock. At 8:30 o'clock came a third, which was felt lightly all along the line to Benicia.

**April 21.—DAVISVILLE.**—At 9:43 this morning another severe shock was felt at this place, the vibrations running from southeast to northwest. It was of brief duration, lasting no more than five seconds, yet in severity it seemed to exceed that of the morning of the 19th. The additional damage is scarcely noticeable, save in the rear of the Masonic and Odd Fellows' halls, where the fissures show considerable enlargement and are now really dangerous, should the vibrations continue. In a drug store several bottles were thrown from the shelves and the glass was crushed in the front. The shocks, fortunately, passed quickly and without the gyratory motion mentioned in that of the 19th, and to these circumstances we are indebted for our slight loss. People are growing intensely nervous, and families living in brick buildings are looking for other and less dangerous quarters. There is no news from the surrounding country, but at Mrs. C. E. Greene's residence the damage from the first shock will reach \$200. This embraces broken bric-a-brac and cracked plastering. So far as heard from, no one is injured in this locality. It is now learned that B. F. Liggett's building is badly shattered, the damage being much greater than was at first supposed. Many brick chimneys will have to be torn down and rebuilt.

**April 21.—WINTERS.**—Another slight shock of earthquake was felt here at 3:05 o'clock this morning. A few persons were frightened, but no damage resulted.

Another shock of earthquake occurred here at 9:40 o'clock, throwing down the Masonic hall, Cradwick's building, Bertholet's two-story stone building, Humphrey Bros.' one-story stone building, and generally demolishing goods, fixtures, etc. One man was badly hurt by a falling wall, and Miss Clara Jessen, milliner, was hurt. Others were more or less injured. Business is all suspended. Main street is a scene of desolation. A fire broke out but was extinguished.

J. Devilbiss's house, 1 mile west of here, is a total wreck; also Mr. Baker's adobe and J. R. Wolfskill's stone dwellings.

**April 21.—WOODLAND.**—The shake at 9:40 a. m. continued for thirty seconds. The vibrations were from east to west. The actual damage was not great, but many buildings were wrenched and weakened. The brick coping of the Capital hotel fell into the main street, smashing the porch. Byrnes's hotel is seriously damaged, the fresco broken, and the walls cracked. Nobody was injured in town. The chimneys on



the top of the court-house were rendered unsafe and have been taken down. The heavy steel ornaments at the top of the tower of the Hall of Records were dislodged from the pedestal and nearly overturned.

The walls of the county jail were badly cracked and prisoners were much alarmed. The upper story of the Thomas building was badly cracked and the city prison has been rendered unsafe. The Exchange and Craft hotels were both badly damaged. On Main street the two-story brick school building was cracked. There was no school at the time, on account of a holiday being declared. Experts have examined the building and report it unsafe. Two large plate-glass windows in the Medal bakery were broken. All the stores sustained some loss from the breakage of bottled goods, china, and glassware.

The play of "Damon and Pythias" at the opera house to-night was postponed on account of the nervousness of the people. Many chimneys were twisted and overturned. The general loss is estimated at \$5,000. The wildest excitement prevailed at the time of the shock. Much anxiety is felt for Madison, Capay, and Winters.

**April 21.—NEVADA CITY.**—At 9:44 o'clock this morning a series of earthquakes, lasting forty-five seconds, were felt here. The waves were from S. to N. The first four were so sharp as to attract the attention of persons afoot, and then gradually diminished in force. Doors and windows rattled and some clocks stopped. No damage was done in this section. There was another shaking up shortly after 9 o'clock last night. A cold rainstorm set in early this morning and considerable rain is falling.

**April 21.—MARYSVILLE.**—This morning a slight shock of earthquake was felt at 9:43 o'clock. The vibrations were north and south. Many people were alarmed. One of the public-school buildings was slightly damaged—that is all.

To-night at 7:15 o'clock another shock was felt and the timid ones are slightly alarmed.

**April 21.—GRASS VALLEY.**—At 9:35 o'clock this morning quite a heavy earthquake shock occurred. It sent everybody into the streets. Several brick buildings in the town are cracked. A gentle shower of rain was falling at the time.

A very sharp shock of earthquake occurred at 7:25 this evening.

**April 21.—PLACERVILLE.**—A sharp earthquake shock, followed by slight tremors, was felt here at 9:43 o'clock this forenoon. The course was apparently from west to east. No damage to property was done here.

**April 21.—CHICO.**—Another heavy earthquake was felt here this morning at 9:47, lasting thirty seconds. The vibrations were north to south. Lamps in buildings all over the city were set swinging. The ceilings in some places cracked and clocks stopped. No damage is reported.

**April 21.—BIGGS.**—A very heavy shock of earthquake occurred here  
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this morning at 9:45. The vibrations were north and south, lasting about eight seconds. Eight distinct vibrations were felt. Clocks stopped and plaster fell. No serious damage is reported.

**April 21.—SAN FRANCISCO.**—Quite a sharp shock of earthquake was felt in the city this morning a few minutes before 10 o'clock. The tremor appears to have extended over a good portion of the central and northern part of the state, though, happily, in most sections no damage was done. In Solano and Yolo counties, however, the destruction was considerable. The town of Winters appears to have suffered most. The scenes witnessed there and in Dixon and other places within the center of the seismic disturbance are graphically described by the Cal's correspondents. It is highly probable that when the excitement and alarm naturally attending such a disaster shall have passed away it will be found that the losses are not so severe as were at first estimated. The earthquake felt in this city to-day extended over a wide area. The disturbance was felt as far east as Reno, as far north as St. Helena, and as far south as Fresno. According to reports, it was of longer duration in the interior than in this city, where the period of vibration was not less than three nor more than six seconds.

Upon the question of duration, there is the testimony of two experts with chronometers at their elbows. Mr. F. W. Edmonds, who is employed in the Geodetic Survey Office, noted the time as follows:

	h.	m.	s.
Beginning.....	9	42	27.4
Ending.....	9	42	30.2

He noted further that the direction of the vibrations was from east to west.

Thomas Tennant, the well-known nautical instrument maker, was standing with his face to a chronometer. His record is as follows:

	h.	m.	s.
Beginning.....	9	42	30
Ending.....	9	42	36

Vibrations from northeast to southwest.

Those in the upper stories of buildings were the most startled, and the effect upon the majority was to make them hasten to their doors, reaching there, however, only in time to appreciate that the critical moment had passed and they were safe. The average clock is very sensitive to jars of any kind, and the earthquake stopped the swing of many a pendulum. But no serious damage is reported from any part of the city. The ceiling sagged in one of the offices over the Granger's Bank. It was, however, immediately braced up,

A second very slight shock was felt in this city at 7:15 o'clock last evening.

**April 21.—VACAVILLE.**—Another earthquake was felt here this morning, but not so severe as those of the preceding days. Some shaky walls were demolished and a number of ceilings cracked, but no serious damage is yet reported. Slight shocks were felt at 6:15 and

at 7:23 this evening. There was no special damage done, though the people were badly frightened. Governor Markham has sent twenty-five tents. Occupation of tents is general.

**April 21.**—SACRAMENTO.—Governor Markham received the following dispatch this morning:

WINTERS, *April 21, 1892*—11:55 a. m.

Governor H. H. MARKHAM:

A third shock of earthquake has almost demolished our town. Many people are without shelter and there are indications of rain. Can you send any tents belonging to the State, or have you any?

E. C. RUST, *Editor.*

To this Governor Markham immediately replied:

E. C. RUST,

*Winters, Cal.:*

Our tents will shelter from five to six persons each. How many do you want? Will do for your afflicted people all that can be done.

H. H. MARKHAM, *Governor.*

**April 21.**—MARTINEZ.—This morning at 9:44 o'clock a heavy shock of earthquake was felt here, frightening the residents to such an extent that almost every one rushed into the street. The vibrations were from northwest to southeast and lasted for thirty-five seconds. Clocks were stopped in some parts of the town, the vibrations seeming to be stronger in the level than on the slopes. The lamp hangings in the county assessor's office was thrown down and broken and the courthouse was cracked in one or two places, but not seriously.

The brick building used by the free library was cracked so badly that it is considered unsafe, and the books will be removed as soon as another building can be fixed for their reception, the library being closed in the meantime. The teachers in the public schools, with the exception of those in one room, became-terrified, and told the children to run out of doors, and, in the mad rush, one or two were hurt, but not seriously. No other damage has been reported. A light rainfall preceded the shock, but it has been warmer since and the sun is brightly shining.

**April 21.**—ELMIRA.—At 9:40 o'clock this morning there was another very severe shock, badly frightening the people, but doing no damage.

**April 21.**—BENICIA.—Quite a pronounced shock of earthquake was felt here this morning at 9:43. It was nearly as heavy as that of Tuesday morning. Windows rattled, and buildings swayed in a sickening manner. No damage was done here, however. There was a slight shock yesterday morning about 2 o'clock.

Another severe shock of earthquake occurred at 7:13 o'clock this evening. It was, if anything, more severe than that of this morning.

**April 21.**—NAPA.—A heavy shock of earthquake was felt at 9:42 this morning. The shock was even heavier than that of Tuesday

morning. Several brick buildings were cracked, and much plaster fell. Nobody was hurt, and no serious damage was done. The vibrations were east and west.

Another earthquake shock was felt here at 7:13 o'clock this evening. It was heavy, but no damage was done.

**April 21.—PETALUMA.**—At 9:43 o'clock this morning two sharp, quick earthquake shocks passed through Petaluma from east to west. The first was light, but was instantly followed by a much heavier shock. Clocks were stopped, and some plastering was shaken down. Almost everybody went into the streets. Another slight shock occurred to-night at 7:13 o'clock.

**April 21.—SONOMA.**—Another shock of earthquake was felt here this evening at 7 o'clock.

**April 21.—SAN RAFAEL.**—A slight shock of earthquake was felt here this morning at 9:43 o'clock. The vibrations were from north to south. There was another slight shock this evening at 7:10 o'clock, but no damage is reported.

**April 21.—SACRAMENTO.**—Another earthquake shock was felt here at 9:42 o'clock this morning. No accidents have been reported. The State capitol building was slightly damaged. In the assembly chamber the ceiling was badly cracked, and two statues were thrown from their pedestals. Personal injuries were few.

**April 21.—STOCKTON.**—At 9:43 this morning Stockton was visited by another earthquake shock, which rattled the windows, swung chandeliers, and caused people to run into the streets. No damage was done.

**April 21.—WOODLAND.**—At 9:46 this morning a low, rumbling sound warned the people of Woodland of the approach of another earthquake, and in less time than it takes to write it the streets were filled with frantic people rushing pell mell in search of a place of safety. The greatest confusion prevailed for some time, and even at this hour (8 p. m.) people are still walking the streets in evident dread of further disaster.

**April 21.—SAN FRANCISCO.**—The shock was felt with more or less severity at the following points: Colusa, Willows, Marysville, Elmira, Benica, Chico, Biggs, Merced, Livermore, and Haywards.

**April 21.—WINTERS.**—Another earthquake shock this morning has almost completely laid Winters in ruins. Buildings that were damaged Tuesday are entire wrecks, and the streets are strewn with debris of the destroyed structures. Seven people were injured.

**April 21.—DIXON.**—At 9:45 this morning we had a very hard shock of earthquake. Buildings swayed, and the crashing of brick and noise was—(At this juncture the operator who was sending this item added: "I can't stay here any longer, as this building is liable to fall any minute.")

**April 21.—MAXWELL.**—A heavy shock of earthquake was felt here

about 9:45 o'clock this morning, lasting thirty seconds, vibrations east to west. No damage was done, but many people are too scared to venture indoors.

**April 21.—SACRAMENTO.**—At 9:45 a. m. a severe shock of earthquake occurred. The duration was about nine seconds.

Many chimneys came crashing to the ground and glass doors and windows were badly shattered.

**April 21.—ESPARTO.**—A terrible shock of earthquake took place here this morning at 9:40 o'clock, completely leveling the brick portion of the town. Every brick chimney was thrown to the ground and wooden buildings were wrenched out of shape.

An engineer was seriously, if not fatally, injured by a portion of the walls of the blacksmith shop falling on him.

Levy & Schwab's brick store is almost a complete wreck. The entire fire wall and part of the east and west walls are down. Loss to the building and contents, \$5,000. The Barnes hotel suffered severely and has a hole 8 by 6 in the east wall. The bricks crashed through the roof and floor of the balcony and the cement walk was torn out of shape. The loss is \$2,500.

**April 21.—SUISUN.**—The shock of earthquake this morning did great damage in this vicinity. The brick residence of J. M. Baldwin at Rockville was wrecked, while the stone mansion of L. B. Abernathie and those on the Barbour and Sproul ranches were rendered unsafe for occupancy. The stone church in Suisun valley was also greatly damaged. The plastering in the court-house was ruined, while the walls are considerably cracked. The front wall of the Masonic Temple was also damaged. The few brick chimneys in Suisun valley which withstood the shock of Monday night were all toppled over this morning.

At 7:15 o'clock this evening another severe shock occurred and twenty minutes later another milder quake followed. All business houses were at once closed. The people are now thoroughly frightened.

**April 21.—HEALDSBURG.**—Another severe shock of earthquake was felt in this city at 9:45 o'clock this morning. The shock was fully as severe as the one felt on Tuesday morning.

**April 21.—CARSON, NEVADA.**—Two more earthquake shocks have been felt here to-day, one at 9:43 a. m. and another at 7:15 p. m. No material damage has been done in Carson by any of the three shocks.

**April 21.—RENO, NEVADA.**—A slight shock of earthquake was felt here this morning at 9:45.

**April 21.—SACRAMENTO.**—A couple of loose plaster statuettes on the wall of the capitol were thrown off and a small piece of plastering in one room fell. There was no other damage in this city except that two or three old chimneys tipped over. The shock did not exceed three seconds and was east to west and sharp.

**April 21.—LODI.**—Another shock of earthquake was felt here this morning about 9:45 o'clock which lasted for fully fifteen seconds. It

was not so hard as Monday night's shock. The oscillation was from northeast to southwest.

Another earthquake was felt here this evening at 7:17 o'clock, causing every one in the brick buildings to leave in short order. The one this morning was so heavy it rang the school bell and shook buildings so hard that the plastering fell from several buildings, but none are badly damaged.

**April 21.—ACAMPO.**—Quite a severe earthquake shock occurred here at 9:45 o'clock this morning. The vibrations were from east to west, lasting about thirty seconds.

**April 21.—FRESNO.**—A sharp shock of earthquake was felt here at 9:46 this morning. It was from northwest to southeast.

**April 21.—STOCKTON.**—Quite a heavy shock of earthquake was felt here this morning at 9:45, lasting about ten seconds. The vibrations were from north to south.

Another sharp shock of earthquake was felt this evening at 7:15 o'clock. Crockery rattled in the dwellings and gas fixtures swung in the stores, but no damage was done.

**April 21.—LATHROP.**—This place was visited by three distinct shocks to-day; two in quick succession this morning at 9:43 o'clock, and one this evening at 7:15 o'clock, lasting twenty-five seconds. No damage whatever resulted, but the people are beginning to feel nervous in anticipating the final result.

**April 21.—RENO, NEVADA.**—Mr. C. W. Irish reports an earthquake under this date as follows: "It occurred at 9:44:15  $\pm$  3s. a.m., one hundred and twentieth meridian time, as given by the synchronized clock actuated by impulse from your observatory. The above observation is within the limit of error given. The direction of the movement was apparently from N. 40° W. towards S. 40° E.; was gyratory, giving a sharp twist to chairs in which persons happened to be seated, and was accompanied by a muffled sound, which seemed to come from the summits of the Sierra Nevada mountains in the exact direction from which the waves came, and preceded them two or three seconds in time. The waves of motion were three in number, lasting about five seconds. No damage was done beyond throwing books from shelves and tables and the displacement of other articles of household furniture."

**April 21.—MOUNT HAMILTON.**—Prof. Holden reports a shock at 7:14:59 p. m., P. S. T. Intensity=III on the Rossi-Forel scale. It was stronger than this in San Jose. Registered on duplex seismograph. Started the clock of the larger machine at 7:31:23, P. S. T., p. m.

The duplex seismograph gives a tracing of the shock at 7:14:59 p. m., with a displacement of the pen in an east and west direction of 4.8 mm., and north and south of 2 mm. It also gives a tracing of the shock occurring at 9:45 a. m., with a displacement of the pen in an east and west direction of 6 mm., and in a north and south direction of 3.2 mm.

**April 21.—CARSON CITY, NEVADA.**—Prof. C. W. Friend sends tracings of two shocks occurring at 9:44 a. m. and 7:17 p. m., the former showing a displacement of the pointer of 24 mm. in a north and south direction, and of 25 mm. in an east and west direction, the latter having a displacement of the pointer of 4.5 mm. in a north and south direction, and 6 mm. in an east and west direction.

**April 21.—MILLS COLLEGE.**—Tracings from this station at 9:46 a. m. give a displacement of the pointer in an east and west direction of 23 mm., and in a north and south direction of 16.5 mm. The tracing at 7:15 p. m. shows a displacement in a northwest and southeast direction of 14 mm., and in a northeast and southwest direction of 7.5 mm.

**April 21.—OAKLAND.** Chabot Observatory.—Mr. Burckhalter reports a shock at 9:44 a. m., P. S. T., as timed by Mr. F. H. McConnell, lasting fifteen seconds, but doing no damage. The tracing shows a displacement of the pointer in an east and west direction of 14.5 mm., and in a north and south direction of 11 mm. Another shock is also reported as occurring at 7:15 p. m.  $\pm$  2 m., with a duration of five or ten seconds, and causing no damage. The total displacement of the pointer in a southeast and northwest direction of 8.5 mm., and in a northeast and southwest direction of 3 mm.

**“April 21.—WINTERS.**—I have just arrived here, after a 12-mile drive from Dixon, where I left the townspeople restlessly pacing in the middle of the streets, and in no way reassured by a sharp shock which happened precisely at the moment of the arrival of the evening train. The state of affairs in Dixon is bad enough, but in Winters it is simply deplorable. All the lights are out for fear of fire; the hotels and even the saloons are closed, and at this moment a crowd of haggard-looking men and terror-stricken women are standing around a car on Railroad avenue, awaiting the distribution of tents. No one dreams of sleeping in any brick house, and few of the frame houses are safe.

“The tents were those regularly used by the Fifth Artillery of Sacramento, and were put on board of the train leaving Sacramento at 6:05 p. m. The railroad company gave the train the right of way to Elmira, and then it was run up to Vacaville, where, after depositing its quota for that town, it came on to Winters, arriving here at 9 o'clock.

“Two tourist cars came on the same train, having been sent by the railroad company from San Francisco for the accommodation of the homeless ones who can not get a tent. The work of setting up these tents is going on while I write. A few hand lamps seem only to make the darkness visible, and it is slow work at the best. There will be many who are too weary to set up the tents, and scores of people are stretched on the ground and even on the doorsteps, too tired to heed the danger of another shock.

“To-day's trouble began at 9:40 a. m. The buildings which had been badly shaken by the Tuesday temblor collapsed at once, and those which had stood the test so long began to yawn, to creak, and to open

out in a manner terrible to witness. The north end of the Masonic Temple fell with a crash. Next, the Cradwick building fell in, and the Morrison building followed. All these structures are on the north side of Main street. On the opposite side the shock caused the Berthollet stone building to collapse, and the Humphreys building shared the same fate. The Devilbiss hotel, already badly shaken, caved in completely, the front of the bank building dropped, and the pier fell out.

“Among the victims of this shock were a man named Darby, who had his skull fractured and was sent to the county hospital at Woodland, and Miss Clara Jessen, a milliner, who was badly hurt by the falling of an awning from the Humphreys building. Among other buildings wrecked by the second shock was Wyatt's tailor store and Day & Wyatt's drug store, the stock in trade of which is a complete loss.

“In the vicinity of town several fine dwellings are utterly wrecked. Main street has been closed by ropes stretched across the end of it. The street is about 400 feet long, and most of the structures are of brick or brick and stone. Not one of them is left in a habitable condition, and it is needless to say that every article of glass and crockery all along this street has been smashed to pieces. The railroad track is all right, and telegraphic communication has been uninterrupted, but there are many nasty cracks and fissures in the roadways, and driving is dangerous.

“The previous estimate of the damages of about \$75,000 or \$80,000 will have to be increased about 50 per cent as the result of to-day's shock. The atmosphere is perfectly still, sultry, and oppressive. It may be fancy only, but one feels in breathing it a sense of impending calamity.

“The chief danger is from fire, and this has been guarded against as far as possible by a house-to-house inspection and a cry of “Lights out” wherever an offending glimmer is seen. Engineer Lechleiter has his steam pump and 500 feet of hose available for instant service but he is uneasy on account of the boiler. This morning the shock knocked the brickwork of the furnace into an unsightly heap, and steam is only kept up by a temporary furnace built up for the occasion and with the cracks stopped with clay.

“The hotels have been shut up entirely; in fact it is dangerous to enter them. A bakery and restaurant on Main street contains a supply of provisions, but it is as much as a man's life is worth to enter it. The proprietor, Peter Graham, has been feeding the people as well as he can during the day, but the street itself is closed in.

“It is quite unnecessary to add that nothing of an exaggerated or alarmist character has been infused into this dispatch. Things are so bad that exaggeration is well-nigh impossible.

“There has been no shock since that at 7:30 p. m., but the suspense is even worse than the shock. It is now 11 o'clock, and as I look down Railroad avenue I still see the weary ones struggling to put up the



tents. By the light of to-morrow's sun the place will look like an encampment in a ruined city.

"It is midnight, and I have been one of a privileged few conducted by a watchman and a guard of honor through the town. The first object I was shown was the calaboose or jail. There was one man in it, a tramp, when the shock came. He escaped with his life and they let him go on general principles. The jail would be improved in appearance if it had a roof and walls.

"In the Cradwick building there were three women and a man when the shock came. The women escaped by the front door in the nick of time. The man was the poor fellow sent with a crushed skull to Woodland. The building itself is a heap of bricks, unsymmetrically piled in the center of the lot on which it stood. Morrison's hardware store, next door, has the walls standing, and that is all.

"By a side alley Main street was reached, and here the havoc wrought could only be compared to the aspect of Paris during the last days of the Commune. The most furious bombardment could have done no more.

"Substantially built structures were demolished even more completely than those of lighter order. Some of the granite blocks lying on the sidewalk measured two feet by one, and as for safes and similar heavy objects, they had been tossed about like chaff.

"The encampment was visited of course. Some of the men were laughing for fear they should cry, and all of them preferred to sleep on the ground with a friendly blanket between them and mother earth, lest they should fall out of bed. Sixteen women were found sleeping in one tent.

"A large campfire had been lighted on the east side of the railroad and around this sat a number of figures. The tourist cars were not in the same favor as the tents and their tenants were not numerous.

"Every few yards one encountered melancholy specters walking about in the open streets, because, as they said, they wanted to be awake and have their wits about them when the next shock came.

"It is quite clear that the focus of to-day's disturbance has been shifted to the north, and has been located near Winters. Elmira and Vacaville got off lightly. The direction of the shocks has also perceptibly changed.

"It must have been a fearful shock. The sand bars in Putah creek near Winters opened and from the fissures the water spurted high up on the banks. In some places the creek became dry, in others it changed to a torrent. The banks caved in some places and almost dammed the stream.

"Some of the farmers say that the earthquake was foretold by the action of the fowls and animals. Horses were restive and neighing, chickens fluttered all about, and dogs whined anxiously for some minutes before the earth trembled. It was reported that several boiling

springs had burst from the foothills on the north and west and were flowing steadily. Frame houses did not suffer much in Winters. What was in them was badly shaken up, but the buildings held together as a rule.

"An old man in the west end of town was putting up a brick chimney. When the shake came he hugged the chimney and both went down together, the chimney fortunately underneath.

"On the Hotel Devilbiss a brick chimney was broken off close to the roof by the shock of the 19th and twisted halfway around. It was not broken more than that, and a couple of men easily twisted it back again and mortared it well. Yesterday's shock simply resolved that chimney into loose bricks and powdered mortar.

"The loftiest structures seemed to those looking on to have suffered most, as their walls fell outwardly, but in the one-story buildings the greatest havoc occurred, for the walls collapsed, burying valuable stock and furniture in the ruins. Some of the escapes from instant death were exceedingly narrow.

"In Mr. Clarke's restaurant, in the Cradwick building, a young man named Wick Darby was in the kitchen, and when the walls began to crumble he ran for life. He managed to reach the open air in the rear yard of the restaurant, but tons of falling brick enveloped him and threw him to the ground. Those who witnessed the accident ran quickly to his rescue and he was dragged to a place of safety. His injuries were very serious. He was sent to the county hospital at Woodland with all possible dispatch, but he shortly died of his injuries. In a solid stone structure a young lady named Clara Jessen had a narrow escape. She was in her millinery store when the shock came, and the big blocks of stone from Bertholet's building next door began to fall on the roof above; she ran to the sidewalk, where a mass of falling bowlders struck the porch above her, carrying her to the ground, and before she could rise the upper front of the Bertholet building pitched forward into the street, the big stones rolling over her. Yet she was not hurt very much.

"The bank of Winters is now deserted. Its walls are full of wide cracks, its front is bulged, and piles of bricks lie on the sidewalk. There is not a vestige of glass in the windows, and the stout beams which were placed beneath the doorways a day or two ago to uphold the badly strained building are all awry and look as if a quake of moderate caliber would cause them to snap. The bank will need to be entirely reconstructed, and \$5,000 will barely cover the loss."

**April 21.**—**SAN JOSE.**—There was a very slight shock of earthquake felt in San Jose about 9:43 o'clock yesterday morning. It was one of only a couple of seconds' duration, and many did not feel it. The shock was a little more pronounced in San Francisco, and severe shocks were felt but no damage done at Grass Valley, Santa Rosa, Newcastle, Elmira, Centerville, Fresno, Fairfield, Yuba, Nicolaus,

Stockton, Nevada City, St. Helena, Napa, Antioch, Spanishtown, Benicia, Chico, Oroville, Biggs, Gearytown, Gold Run, Red Bluff, Sonoma, Auburn, Willows, Placerville, Downieville, Orland, and Maxwell. There was another light shock here at 7:15 last evening. It was hardly perceptible.

Shocks were also reported in the evening from San Rafael, Vacaville, Lodi, Benicia, and other places in the state, and also from as far east as Carson, Nev. The tremors seemed to be very light and no damage was reported.

**April 21.**—SACRAMENTO.—There was another severe earthquake shock at 9:45 o'clock this morning, lasting twenty seconds. Buildings got a lively shaking and plastering fell from many ceilings.

Several old chimneys toppled over and much glassware was broken in the crockery stores. The state capitol building suffered. A large portion of one of the plaster statues over the portico, 150 feet from the ground, fell and struck 40 feet from the building. The gigantic building trembled violently and the occupants in the state offices were badly frightened, and there was a general exodus of clerks.

It was discovered that a crack was made in the ceiling, extending from one end of the building to the other and going through the office of the superintendent of public instruction into the assembly chamber. The beautiful ceiling of the latter, which is formed of stucco work tipped with gold, was rent in places, as were also the Corinthian columns supporting the gallery. Books were thrown from the shelves and general disorder reigned.

The public schools were dismissed. All the pupils got out without creating a panic. A panic was narrowly averted in one of the public schools. When the shock was felt the children rushed to the doors, intending to escape from the building. The teachers blocked their egress and several of the worst frightened children jumped through open windows. Fortunately no one was hurt. At the city prison the greatest excitement prevailed. A number of police officers rushed into the street, expecting the collapse of the old building. Jailer John McManus stood at his post, with key in hand, prepared to turn loose the prisoners in case the building showed signs of collapsing.

**April 21.**—DIXON.—At 9:40 this morning the people of Dixon were warned of the approach of another earthquake, and the streets were soon filled with people rushing out of buildings in search of a place of safety. Small shocks continued at intervals all day, and to-night the houses are nearly all deserted and people are walking the streets. They are afraid to retire, as they are in dread of further disaster.

The brick buildings are still standing, but every shock cracks them worse, and people expect them to fall down. The frame buildings are receiving so much shaking that many of the occupants have fled to the country for safety.

In the country things are getting to be in a frightful condition.

Hardly a farmhouse has escaped injury, and many of them have been moved off their foundations. Most of the occupants have put up tents out in the fields and now consider themselves safer. It seems that every shock frightens the people more. Reports of damage coming in to-day place the losses much higher than at first estimated, and it is now considered that \$100,000 will not cover the loss.

**April 21.**—**SANTA ROSA.**—Santa Rosa received a severe earthquake shock at 9:40 a. m. to-day. The vibrations were from east to west, and lasted fully fifteen seconds. A deep rumbling sound was heard just before the first movement was felt, which frightened many persons. There were five vibrations, increasing in intensity to the last, which cracked many brick buildings and precipitated a good deal of plaster to the floor. In two places brick walls were slightly bulged out, iron columns moved, and in some parts of the town chimneys were wrecked.

Many think that the shocks of to-day were much severer than were the shocks of Tuesday morning. The rumble of the earthquake was preceded by perfect stillness in the atmosphere, resembling the ominous calm that foretells the approach of the dreaded cyclone.

The court-house was slightly damaged and everybody in it more or less frightened.

**April 21.**—**SUISUN.**—Two severe shocks of earthquake and one or two slight ones were experienced here to-day. The first heavy shock occurred about 9:40 a. m. and the next at 7:15 p. m. Although not so severe as that of Tuesday morning, they have terrified the people. All the stores were closed at 7:30 o'clock in the evening. Plaster was torn from many buildings, window panes were broken, clocks stopped, and many chimneys thrown down.

**April 21.**—**MADISON.**—The town was again shaken by the heaviest shock that has been felt, at 9:48 this morning. The total damages are about \$10,000. The town would not stand another shock like that of this morning.

**April 21.**—**CHILE.**—Special cables to the New York Herald from Santiago, Chile, under date April 21, say that during the past week details were received of severe and light earthquake shocks at Taltaval, Serena, and several coast towns.

**April 21.**—**YUBA CITY.**—At 9:43 o'clock this morning an earthquake occurred here, but it was not quite so heavy as that of Tuesday. Several clocks were stopped, but no damage occurred.

**April 21.**—**NICOLAUS.**—An earthquake occurred here at 9:48 o'clock. The vibration was northeast to southwest. Its duration was twenty seconds.

**April 21.**—**NEWCASTLE.**—There was a slight earthquake shock here about 5 o'clock this morning and another at 9:43 o'clock. No damage was reported.

**April 21.**—**ST. HELENA.**—A very perceptible earthquake occurred

here at 9:40 o'clock this morning, sending the people into the streets and stopping clocks. No damage was done.

**April 21.—FAIRFIELD.**—The principal damage by the earthquake in this vicinity is the almost total wreck of the Fairfield M. E. Church, a brick building 40 by 60, built in 1861, at a cost of \$10,000. The belfry is demolished, the walls cracked and sprung, and will have to be taken down. Many chimneys fell and considerable plastering was thrown down. Several houses were badly injured.

**April 21.—RED BLUFF.**—Two perceptible earthquake shocks were felt here this morning. The first was very slight and occurred about 8:10 o'clock. The second stopped several clocks at 9:45 o'clock.

**April 21.—WILLOWS.**—Another heavy earthquake was felt here at 9:43 o'clock to-day.

**April 21.—ORLAND.**—Another slight earthquake was felt here at 10:45 o'clock this morning. The vibrations were northeast and southwest. It was of eight seconds' duration.

**April 22.—ESPARTO.**—Another shock occurred here at 7 o'clock last night and a slight tremor at 2 o'clock this morning. A force of men are at work tearing away the debris, and all the damaged buildings will be repaired immediately. Five thousand dollars will cover the total loss.

**April 22.—DIXON.**—At 7:20 o'clock last night we had another sharp shock, but not as hard as the one in the morning. There were several more tremors during the night, but no further damage done. The people are still greatly excited and very few went to bed last night.

**April 22.—WOODLAND.**—Dunnigan, Blacks, and Yolo, all experienced slight shocks last night, but no further damage is reported.

**April 22.—MADISON.**—Slight shocks of earthquake were felt here at 7 o'clock last night and at 2 o'clock this morning. Workmen are busy repairing Mills & Haines's store. The total loss here is estimated at \$5,000.

**April 29.—GRASS VALLEY.**—An earthquake shock lasting ten seconds was felt here at 4:10 o'clock this afternoon. No damage was done.

**April 29.—MARYSVILLE.**—A slight earthquake shock was felt here at 4:06 o'clock this afternoon.

**April 29.—VACAVILLE.**—A sharp shock of earthquake was felt at 4:07 o'clock this afternoon, but did no damage. It caused the temporary suspension of work of repairing the damaged buildings. The timid living in tents will continue their out-door life.

**April 29.—WOODLAND.**—Another shock of earthquake was felt here at about 4:10 o'clock this afternoon. The vibrations seemed to be north and south. No damage is reported.

**April 29.—DAVISVILLE.**—At 4:11 o'clock another shock was felt here, although slight. No damage was done, except that some bricks fell from the Odd Fellows' building, which were shaken loose by the first shock last week.

**April 29.**—PETALUMA.—This afternoon about 4:05 o'clock quite a sharp earthquake shock was felt. The vibrations were east to west.

**April 29.**—WINTERS.—An earthquake shock was felt here this afternoon at 4:10 o'clock. No damage was done, although the people generally were alarmed. The shock lasted about five seconds.

**April 29.**—SANTA ROSA.—A very distinct earthquake shock was felt here at 4:10 o'clock this afternoon. The vibrations were from east to west and were of about eight seconds' duration.

**April 29.**—SAN RAFAEL.—A slight shock of earthquake was felt here this afternoon at 4:10 o'clock.

**April 29.**—NAPA.—A short, sharp shock of earthquake was felt here at 4:10 o'clock this afternoon. The vibrations were from north to south. No damage.

**April 29.**—FAIRFIELD.—At 4:10 o'clock this afternoon a heavy shock of earthquake was felt. No damage was done, but the county officials all ran out of the courthouse, as the walls are sprung. Workmen are repairing them.

**April 29.**—BENICIA.—A very severe shock of earthquake occurred here about 4:10. So far no damage is reported.

**April 29.**—STOCKTON.—At 4:08 o'clock this afternoon a light shock of earthquake, lasting twenty seconds, was felt here.

**April 29.**—HAYWARDS.—Two sharp shocks of earthquake were felt here this afternoon, one occurring at about 4, and the other at 7:35 o'clock. The vibrations were from east to west in each case.

**April 29.**—SAN LEANDRO.—A sharp earthquake shock was felt here at 7:30 o'clock this evening. It was a "twister," seeming to come from all points of the compass. The duration was about  $1\frac{1}{2}$  seconds.

**April 29.**—SAN FRANCISCO.—At ten minutes past 4 o'clock this afternoon a slight earthquake shock was felt here, but no damage was done.

**May 11.**—MOUNT HAMILTON.—The duplex seismograph shows a displacement of the pen of 1.5 mm. in a northeast and southwest direction, and of 2.5 mm. in northwest and southeast direction, the time recorded by Prof. Holden, 9:48:32 p. m., P. S. T. Intensity = IV on the Rossi-Forel scale.

**May 28.**—ONTARIO.—There were two light earthquake shocks this morning. The first was at 3:15 o'clock and the second five minutes later. They were heavy enough to stop clocks. The course of the wave was northeast and southwest.

**May 28.**—SANTA ANA.—Earthquake shocks were felt here between 2 and 3 o'clock this morning. The first shock was quite heavy and lasted a minute or more.

**May 28.**—SAN BERNARDINO.—Two shocks of earthquake were felt here this morning at 3:15 and 3:20 o'clock. The first shock was very heavy, throwing down dishes and stopping clocks. The second was much lighter. The vibrations were from east to west.

**June 9.—INDEPENDENCE.**—Mr. C. Mulholland reports a disturbance under this date occurring at 3:40 p. m. A rumbling sound was heard and was almost immediately followed by the shock, which had an undulatory movement from north to south. A strong north wind had been blowing all day and continued after the shock. Weather partially cloudy and unusually cold for the season. The building shook so as to make all loose things rattle, but no harm was done. No damage appears to have been done in the town. Only one shock was felt and that was of short duration, probably lasting not longer than two seconds.

**June 14.—RIVERSIDE.**—The heaviest earthquake felt here in many months occurred this morning at 5:30 o'clock. No damage was done.

**June 14.—SANTA ANA.**—A shock of earthquake lasting nearly thirty seconds was felt here this morning. The vibrations were from east to west.

**June 14.—POMONA.**—There was a sharp earthquake here at 5:25 o'clock this morning. It lasted a few seconds.

**June 14.—SAN DIEGO.**—At 5:17 o'clock this morning there was a quite perceptible earthquake shock in this city and county. No damage was done.

**June 14.—SAN BERNARDINO.**—A slight earthquake was experienced here this morning at 5:20 o'clock, lasting at least twenty seconds. It was not severe, but the shaking lasted unusually long. The vibrations were from northwest to southeast.

**June 22.—HOLLISTER.**—Two slight shocks of earthquake were felt here last night.

**June 22.—SAN DIEGO.**—Messrs. Rose and Rikert, when on a prospecting expedition in the Santa Clara Valley, near Alamo, Lower California, last Friday, noticed two peaks four miles to the north alternately spouting smoke and flames at short intervals. The eruption was accompanied by rumbling sounds and an occasional quiver of the ground.

Though frightened, they stopped long enough to satisfy themselves that two veritable volcanoes had opened. Later travelers report the volcanoes real, but not so active as at first. The region is undoubtedly volcanic, sulphur springs being in the vicinity, where the waters are so strongly impregnated that horses refuse to drink.

**July 9.—SAN FRANCISCO.**—San Francisco was shaken this morning by a remarkable series of explosions. The giant powder works at Highland Station, fully fifteen miles away, across the bay, exploded, completely wiping out the works, killing five men, wounding more than a score, and causing the effect in this city and Oakland of a severe earthquake.

Nothing like the effects of the great shock has ever been known here. The shock caused a rush of air like the first breath of a tornado. Then

came a series of shocks attended by a dull roar, like the discharge of heavy artillery at sea. Hundreds rushed out of tall buildings and hotels, pale with fear. Broken glass fell all about them. Scores of heavy plate-glass show windows came crashing into the streets.

The heavy earthquake several months ago was not so terrifying a shock as this. The high new office buildings swayed perceptibly. In old structures plaster fell from the walls and all movable articles on shelves came tumbling to the ground. Seven minutes after the first shock came another, even more severe, which shattered windows all over town, rocked buildings, blew in skylights, broke plate glass on Montgomery avenue, Montgomery street, Kearney street, and other thoroughfares, and caused people to rush into the streets as though an earthquake was about to tumble all buildings about their ears. The consternation was still at its height when two more shocks followed, little less severe than the terrific one which had just been felt. Glass rattled into streets all over the city, and not a few buildings came near collapsing.

The men in the tower of the fire-alarm station were sure that structure was going to go down. At the Palace hotel there was great fear among the guests, and all over the city there was alarm. No one knew what had happened, but all were fearful that a terrible calamity had occurred. They dreaded to hear the news.

The motion was entirely unlike that of earthquakes, and all who have lived here for any length of time knew at once that it must be due to the explosion of one of the powder works across the bay. Soon a great pillar of fire and a cloud of smoke indicated the location of the disaster. Investigation showed that the giant powder works at Highland Station had exploded, and this had involved the Judson Chemical Works, near by. At this writing three white men are known to be killed, two Chinese are dead, and about twenty Chinese are badly wounded. The explosions started in a nitro-glycerine tank about fifty yards from all the other buildings at the works.

What caused this will never be known, for the men who were in the building were blown into fragments. All that saved the 150 who were at work in the outer buildings was the interval between the original explosion and the next. This was six minutes, and in this time all the hands, white and Chinese, made a rush over the neighboring hill to put that elevation between themselves and the awful death that they knew was so near at hand.

The force of the first explosion was heavy, but it was slight compared with the others. First, the powder-mixing house, about a rod from the nitro-glycerine house, went up in a shot of flame and with a roar that could be heard clear across the bay.

A moment later a storehouse followed, also about one rod distant. The houses all caught from the flames, but full 100 rods farther, over a



little hill, were three great magazines of giant powder, black powder, and dynamite, all of which were exploded by the concussion. The first three explosions had been heavy, but they were dwarfed by the terrific effect of the blowing up of the first magazine, which contained 350 tons of giant powder. This enormous amount of explosive was in a brick house about 30 by 140 feet, and 20 feet high, lying close to the bank, near the water's edge. In quick succession followed the blowing up of a magazine containing 150 tons of black powder and another containing an unknown amount of dynamite. These terrific explosions caused so great a shock that a large pile of sulphur on a neighboring wharf was set on fire by the concussion and a vessel that was unloading it was allowed to drift away to save it from the same fate. The force of the explosion wrecked the strong wooden buildings of the Judson Chemical Works a quarter of a mile away. The walls fell in, and the chemicals began to blaze fiercely. Within one hour the large plant of both works was totally destroyed.

The only building of the powder works remaining is a large magazine of gun-cotton which the firemen are trying to save. It stands some distance from the scene of the explosion. It will probably not explode. No greater scene of desolation could be conceived than that presented after the explosion. Everything belonging to the buildings was smashed into matchwood.

Over the little hill were the cottages of workmen and residences of Judson and his superintendent. Here most curious freaks were seen. One whole side of Judson's house was ripped off, and the plastering was all torn off and covered his fine furniture. In the other house the main stairway was twisted completely around, and one chimney had also been whirled completely about, the top falling off outside. All the little cottages were wrecked so badly that they can never be repaired. All that can be done is to tear them down. The escape of the inmates was miraculous. Only one boy was seriously hurt. He had his arm broken.

No one can explain the great force with which the explosion was felt in Oakland and San Francisco. The three powder magazines are located near the bay, at the foot of a little hill. Before the explosion they were about ten feet above the water level. After the explosion a great hole was found in the bank, and loose dirt was piled up.

Fully twenty Chinese were badly hurt. Some were taken up by rush of air after the explosion and thrown fifty feet. Others had eyes blown out or ears torn off. Several had one side of the head made raw and bleeding from the flame which came so near ending their lives.

How the loss of life was confined to so few is not understood. Chinamen are distributed all over the grounds formerly occupied by the buildings and were huddled together as closely as possible. From none of them could an accurate description be obtained. The escape from death was wonderful. A good idea of the situation was obtained from

Thomas R. Grady, employed in the vitriol works a short distance from the magazines containing tons of black and giant powder.

"My idea of the explosion," said he, "is that the first shock came from the nitroglycerine works, in which a number of Chinese were employed, together with Dickerson, Bowe, and Gabertie. It was severe enough to shake buildings all around. The windows rattled at a fearful rate. Fearing something serious had happened, I rushed from the house, and my first thought was of my sister, Mrs. Carter, and her little babe. I rushed toward the house, and as I did one of the magazines exploded. I was thrown flat on my face, but was not unconscious. Recovering my feet I made another start for house, and, grabbing the baby and half pushing my sister out of doors, made for open air. I could hardly see—the smoke had not cleared away—and during my endeavor to locate myself the second magazine exploded. I lost hold of Mrs. Carter and was again thrown to the ground. A general wreck followed the explosion of the magazines, and timbers of all the houses were wrecked in less time than it takes to tell. George Carter was blown through a window of the engine house and escaped without injury. Egbert Judson and his nephew, Charley Judson, were driving past black-powder magazine when the explosion came. Both were hurled from their vehicle to the ground, but were not seriously injured. The buggy was smashed to atoms."

One of the largest windows broken in San Francisco was that on the south side of the First National Bank building, corner of Bush and Sansome streets. The Baldwin Hotel was damaged, and windows on several floors were smashed to pieces. The two panes of plate glass in the windows of the San Francisco clearing house, at 211 Sansome street, were the largest in the city. The one on the south side was shattered into small pieces, and the pane on the north side was uninjured. They were seven-sixteenths of an inch thick, and each cost \$600. The glass in most of the windows of the American sugar refinery was broken.

**July 9.—ALAMEDA.**—The explosion of the giant-powder works made a record on my seismograph, the maximum displacement of the pen in a north and south direction being 4 mm. and in an east and west direction 4 mm. (C. D. Perrine.)

**July 9.—EAST OAKLAND.**—Mr. F. G. Blinu reports that his seismograph was not in working order; owing to the fact that the soil is adobe, and as it had not been irrigated for some time the working of the soil caused the pen to creep so much that any attempt at records was abandoned. After the powder works explosion the pen was found off the plate on the east side making a nearly straight line, and this would indicate a motion of the ground to the west. (The powder works were about northwest.) A pipe lying on a shelf in the observatory was thrown on the floor to the east, thus confirming the motion of the seismograph. There was an item in the San Francisco Evening Bulletin

saying that the sealing schooner *Emma and Louise*, then 150 miles off shore, felt the shock heavily, and it was thought she had struck a rock.

**July 9.**—OAKLAND.—Mr. Chas. Burckhalter reports that the seismograph at the Chabot Observatory showed a V-shaped mark about 4 mm. in height.

**July 16.**—MOUNT HAMILTON.—Prof. Holden reports a shock at 12:6:34± p. m. P. S. T. Intensity = III on the Rossi-Forel scale. The duplex seismograph shows a small mark about 1.5 mm. north and south by 1 mm. east and west.

**July 24.**—COLTON.—The San Francisco Examiner reports a shock of earthquake at this point at 6 a. m.

**July 26.**—NAPA.—“A heavy shock” at 2:10 a. m. Vibrations north to south. No damage.

**July 26.**—PETALUMA.—“Quite a lively shock.” Vibrations east to west.

**July 26.**—SAN FRANCISCO.—A slight shock 2 a. m.

**July 26.**—MOUNT HAMILTON.—The duplex seismograph shows a light shock, the displacement of the pen in a north and south direction being 1 mm. and in an east and west direction 2 mm. The shock was not felt by any one.

**August 1 or 2.**—MOUNT HAMILTON.—A shock occurred August 1 or 2 and was found recorded on both seismographs, not being of sufficient intensity to start the Ewing instrument, and no one felt it. Displacement of duplex pen northwest and southeast, 4 mm. Almost a straight line.

**August 2 or 3.**—MOUNT HAMILTON.—Another slight shock was found recorded by the duplex, but was again unfelt by any one here. Displacement of pen east and west, 3 mm. Almost a straight line.

**August 5, 6.**—MOUNT HAMILTON.—A slight shock was found registered by the duplex seismograph, but felt by no one. Displacement of pen north and south, 2 mm. East and west, 1 mm.

**August 8-9.**—MOUNT HAMILTON.—A slight shock was found registered by the duplex instrument, but unnoticed by any one. Displacement of pen north and south, 1.5 mm.; east and west, 2.5 mm.

**August 18.**—MOUNT HAMILTON.—Prof. Holden reports a shock estimated at intensity V of the R. F. scale as occurring at 8:8:27 p. m. ± 3s or 4s P. S. T. 8:8:23 p. m. standard Pacific time: a diffused shock extending three or four seconds; fairly heavy. Time refers to about middle of shock. (E. E. Barnard.)

**August 24.**—MOUNT HAMILTON.—12:22:14 P. S. T. Decided shock of one or one and one-half seconds duration. Examining Mars at the time. Image of the planet jumped through five or six seconds. The shock consisted of three or four jerks or jars. The motion seemed to be vertical in the telescope. The shock was felt outside of the telescopic vibration. (E. E. Barnard.)

**August 25.**—MOUNT HAMILTON.—The duplex seismograph shows a

slight shock, the displacement of the pen being 2 mm. in a north and south direction and 1.5 mm. in an east and west direction.

**August 28.**—SEATTLE, WASHINGTON.—A volcanic eruption of great magnitude took place on one of the Aleutian islands, Alaska, on August 28. Black Peak, a mountain of great height between Chignik canneries on the Aleutian islands, and Oonangashik, a station of the Alaska Commercial Company, is supposed to be the volcano in action.

A letter received from Olef M. Olson, sailing master of the schooner *Clara*, of Sitka, formerly the *Ethel*, of San Diego, dated from Sand Point, Alaska, September 8, gives the following points:

“On Sunday, August 28, the eruption took place. The *Clara* was lying at anchor in Chignik bay abreast of the canneries, and observed a beautiful cloud. It first made its appearance at 4 o'clock in the morning, rose straight in the air from behind the mountains in the southwest until at an angle of about 35°, when it lost its beautiful color, which was blue, and seemed to burst lightly. It remained until after noon, when it got perfectly black.

“The barometer was all the time steady at 30. About 11 o'clock the earth was shaken heavily. Accompanying the shock were thunder and lightning, which continued all that day and all the evening.

“Monday morning when I came on deck my mouth and nose were filled with some stuff that fell heavy and thick about us. The air itself was full of sulphur smoke, which even permeated the cabin, and the decks were covered with fully 2 inches of black sand. Nothing could be cooked because of it. It penetrated everywhere.

“At noon when the stuff was getting lighter we could see the canery. We went ashore and found everything one color, black.

“The schooner *Nellie*, of Sand Point, coming from Vossnessensky, reported that the storekeeper, N. Zwian, had seen on the day of the eruption rocks on fire thrown in the air at an angle of 20° in the direction of Portage bay, which seemed to be a mass of fire and flames. The Alaska Commercial Company's steamer *St. Paul* experienced the same shower of sand 250 miles off shore that day.

“On Monday afternoon some stuff, different from what fell on us the night before, came down from the direction of the mountain known as Black peak, between Chignik and Oonangashik. It appeared more like burned paper.

“The following day, Tuesday, another light shower fell the whole afternoon. Chignik bay itself had a muddy appearance and all the high grass was knocked down by the heavy sand. It will take some time for the glaciers to get their natural color. The fall was heaviest on Monday morning between 2 and 4 o'clock.”

**August 31.**—INDEPENDENCE.—Mr. C. Mulholland reports a shock occurring at 5 p. m. It was quite sharp and was preceded, three or four seconds, by a sound like distant thunder. There appeared to be three or four sharp vibrations coming from the south, from which

direction a moderate breeze was blowing at the time. No reports of any damage have been received, and it is not thought to be heavy enough to cause any harm.

**September 8.**—PETALUMA.—This morning about 4:45 o'clock a light shock of earthquake passed through Petaluma. The vibration seemed to be from east to west.

**September 15.**—DUTCH HARBOR, ALASKA.—The origin of the immense cloud of volcanic dust which was reported by Capt. Erskine as having passed over the steamer *St. Paul* on her last trip up to Oonalaska, and which he estimated to be more than 100 miles in extent, has been definitely ascertained. The sea otter hunting schooner *Everett Hayes* arrived here last week from the Shumagin Islands, and from her owner, I. J. Applegate, the following particulars of the eruption of a new volcano have been obtained:

On Sunday, August 28, the *Hayes* put into a small harbor known as Ivanef bay at the extreme western end of the Alaskan peninsula, and anchored for the purpose of securing fresh water and of allowing the crew to hunt for deer. The position of the schooner, as estimated by Mr. Applegate, was in lat.  $55^{\circ} 52'$  north and long.  $159^{\circ} 20'$  west. The weather at the time of anchoring was calm and clear. About midnight of the 27th the crew of the schooner were aroused by a subdued rumbling noise, which sounded not unlike the steady breaking of surf on the beach. Knowing that such a noise would hardly be heard in the inclosed bay, the captain and Mr. Applegate went on deck to ascertain, if possible, the cause of the disturbance. The night was then calm and clear and not a thing could be seen, so that the two watchers returned to their bunks with the mysterious noise still unexplained.

About 2 o'clock a. m. the mate of the vessel went on deck and shortly afterward reported seeing what appeared to be a small black cloud low down in the northwestern sky. The rumbling noise now gradually increased in volume and soon the whole sky was filled with dense volumes of smoke.

Before daylight the crew of the schooner saw a vast column of smoke suddenly shoot straight up to a distance of a mile into the clear atmosphere and then slowly expand in the form of an immense cauliflower from 10 to 12 miles in diameter. From the lower edges and periphery of this black cloud blinding flashes of lightning shot downward toward the base of the column, and the air was filled with almost continuous and deafening detonations as if of thunder. The display was magnificent beyond description. It lasted until daylight.

Feeling that the vicinity was anything but pleasant or safe the schooner got under way as early as possible Monday morning, and made her way out into the open waters of the Pacific. A brisk northerly wind swept the smoke cloud clear of the schooner, but the country to the southward must have been covered for miles with ashes and cinders, which fell like a heavy rain from the cloud. At Metrofem, a

small native settlement 80 or 90 miles away, the inhabitants witnessed the eruption and distinctly heard reverberations of the thunder, and at all the islands lying to the southward of the peninsula quantities of dust and cinders fell during the greater part of three days.

The exact locality and appearance of the new volcano could not be obtained, for the reason that it is inland some 30 miles, as estimated by Mr. Applegate, and hidden from view by the higher mountains which border the sea. It must, however, be of considerable extent, as there can be no doubt now that the rain of volcanic dust which fell on the decks of the *St. Paul* during five hours of August 28 came from the new volcano. The scientific public will, of course, be anxious to learn more about this new eruption, but at present it is doubtful if any power on earth would induce any of the natives to visit the spot. In connection with this upheaval it is of interest to recall the fact previously noted by the Chronicle correspondent of the unusual activity of all the volcanoes situated along this part of the Aleutian islands during this season.

On September 23, while the revenue-cutter *Rush* was cruising in the vicinity of Akutan island, the volcano situated thereon suddenly opened up its hidden batteries, and blast after blast of dark purple smoke shot upwards from the crater to a distance of nearly 1,000 feet, accompanied by a rumbling noise like distant thunder. At the same instant, as was subsequently ascertained, a distinct earthquake shock—something very unusual in this region—was felt at Oonalaska, 30 miles away. Attempts were made to photograph the volcano while in a state of eruption, but owing to want of light the results were not very satisfactory.

**September 25.**—MOUNT HAMILTON.—Prof. Holden reports a shock of slow period and intensity=III of the R. F. scale, as occurring at 2:10:43 p. m., P. S. T. The duplex seismograph shows a displacement of the pen of 9 mm. in north-northeast and south-southwest direction with a displacement of the pen at right angles to this of 3 mm.

**September 25.**—MILLS COLLEGE.—Prof. Keep sends a tracing of the shock occurring at 2:10 p. m. in which the greatest displacement is in a north-northeast and south-southwest direction, and appears to be about 11.5 mm. and at right angles to this the displacement is only 3 mm.

**September 25.**—ALAMEDA.—A shock of earthquake estimated at about V of the R.-F. scale occurred at 2:11 p. m., the chandeliers swaying for several minutes. The duplex seismograph gives a record in which the displacement of the pen in a northwest and southeast direction, measures 77 mm., which is probably exaggerated, although the greatest disturbance was noticed to be in this direction. The displacement of the pen in the northeast and southwest direction is 20 mm. (C. D. Perrine).

**October 26.**—SAN BERNARDINO.—A slight shock of earthquake was felt here this morning at 7:05 o'clock. The vibration was from north to south.

**October 30.**—MOUNT HAMILTON.—12:17:12 a. m., P. S. T.; south-east to northwest; two slight shocks two seconds apart. Intensity=III. (W. W. Campbell).

The duplex seismograph gives a record of about 2 mm. in both the north and south and east and west directions.

**October 30.**—INDEPENDENCE.—Mr. C. Mulholland reports a shock occurring at 11:53 a. m. The shock was quite heavy and appeared to come from the Sierras about 6 miles west of the town, but the greatest motion appeared to be vertical or nearly so. Only one shock was felt. The earth rumbling was not very noticeable owing to the rattling of the building. The air was quite still and the sky nearly covered with clouds. No damage is reported.

**November 13.**—MOUNT HAMILTON.—Prof. Holden reports two shocks of earthquake close together of intensity V of the R.-F. scale.

Time of the second shock 4:45:14 a. m. The duplex seismograph gives a condensed tracing 4:5 mm. by 3:5 mm. The plate is not orientated. Mr. Townley, who was photographing in the Crocker dome at the time of the shock, noted the time as 4:44:41, P. S. T.

**November 13.**—BERKELEY.—“The earthquake of Sunday was hardly felt here. Very small vibration. Record on duplex and Ewing, but vibration not strong enough to start the seismograph.” (A. O. Leuschner).

**November 13.**—MILLS COLLEGE.—Prof. Keep sends a tracing of the earthquake as occurring at 4:46 a. m., showing a displacement of the pen of 12 mm. in a north-east and south-west direction, and 8 mm. in a northwest and southeast direction.

**November 13.**—ALAMEDA.—A slight shock of earthquake occurred at 4:48 a. m., giving a tracing on the duplex seismograph, which begins with a displacement of the pen of about 5 mm. toward the southeast and end with a number of tremors covering an area 2 mm. in a north and south direction by 1:5 mm. in an east and west direction. (C. D. Perrine.)

**November 13.**—PETALUMA.—About a quarter to 5 o'clock this morning a lively shock of earthquake passed through Petaluma. The vibrations were from north to south.

**November 13.**—GILROY.—A very heavy earthquake shock was felt here this morning at 4:45 o'clock. It was of several seconds' duration. Clocks were stopped and small articles thrown down. No damage was done to buildings.

**November 13.**—HOLLISTER.—An unusually severe shock of earthquake was felt here about 4:45 o'clock this morning. The heavy shock was followed by three of less severity. Aside from the falling of plaster no material damage was done.

**November 13.**—SALINAS.—At about 4:30 o'clock this morning a heavy earthquake was felt here, doing considerable damage to large window

lights, glassware, and crockery. The vibrations were from northeast southwest. They lasted fully forty seconds.

**November 13.**—**MONTEREY.**—An extremely lengthy and heavy shock of earthquake was felt in this city at 4:45 o'clock this morning. The vibration was north and south. It rattled large buildings as if they were chips, shaking crockery and glassware off the shelves, cracking chimneys and playing havoc in general. The oldest citizens say that they have never experienced such a heavy tremor as they felt this morning, the shock being of ten seconds' duration and followed by smaller ones.

**November 13.**—**SAN RAFAEL.**—A shock of earthquake was felt here at 4:46 this morning, the vibrations lasting eleven seconds. The movement was from north to south.



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