

# UNITED STATES EARTHQUAKES 1930

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U. S. DEPARTMENT OF COMMERCE  
COAST AND GEODETIC SURVEY - WASHINGTON



U. S. DEPARTMENT OF COMMERCE

R. P. LAMONT, Secretary

COAST AND GEODETIC SURVEY

R. S. PATTON, Director



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# UNITED STATES EARTHQUAKES

## 1930

BY

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AND

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Magnetic and Seismological Observer



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# UNITED STATES EARTHQUAKES, 1930

## INTRODUCTION

This publication includes earthquakes of regions under the jurisdiction of the United States, though in the case of the Hawaiian and the Philippine Islands earthquakes of volcanic origin are not included and only severe earthquakes are included in the case of the Philippine Islands since reports are published in Manila. Earthquakes adjacent to the United States and felt within its borders or those in the regions under its jurisdiction are described except that, in the case of the Canadian earthquakes felt within the United States, a general description only is given, as details are given in the Canadian report. As a reciprocal arrangement United States earthquakes felt in Canada are published in detail in this report. The principal earthquakes of the year which were very widely recorded are given regardless of location, and instrumental details for these are included.

It has been decided not to give individual credit for information by individuals. In omitting this the bureau wishes to express its appreciation to the various organizations and individuals who have made it possible to prepare descriptions of the earthquakes of this country with a completeness and accuracy that has never before been possible. The principal sources of information are as follows:

United States Weather Bureau.

Division of geology and geography of the National Research Council, Arthur Keith, chairman.

Central office of the Jesuit Seismological Association at St. Louis, Mo.

The San Francisco field station of the Coast and Geodetic Survey, cooperating with the Seismological Laboratory of the Carnegie Institution and California Institute of Technology (H. O. Wood, research associate, in charge), University of California (Perry Byerly in charge of the seismological station), and Stanford University. These persons are responsible for instrumental determination of epicenters in California when given. Among the commercial agencies in this section there are a number of cooperators, including the Pacific Telephone & Telegraph Co., Great Western Power Co., National Board of Fire Underwriters, Southern California Telephone Co., Standard Oil Co. of California, Associated Oil Co., Southern Pacific Railroad, San Diego & Arizona Railway Co., Associated Factory Mutual Fire Insurance Cos., and Clay Products Institute of California; also a large number of other organizations and individuals.

Press dispatches (received through the courtesy of Georgetown University).

Telegraphic reports collected by Science Service. This cooperative service was inaugurated in 1925.

Reports from individuals.

Bulletin Seismological Society of America, 1930.

As a number of organizations are actively interested in the collection of noninstrumental data, a plan was adopted whereby each organization will undertake to cover a specified territory, thus avoiding needless overlapping of effort. This work will be in addition to that now carried on by other agencies such as the Weather Bureau and is intended to cover the special investigation of earthquake areas. The



eastern half of the United States, except the central Mississippi Valley region, is covered by the division of geology and geography of the National Research Council. The central Mississippi Valley region is under the central office of the Jesuit Seismological Association at St. Louis. The Washington office of the Coast and Geodetic Survey covers the greater part of the western half of the country, while its field station at San Francisco serves as a central station for the various information services now being effectively organized in California. In addition the Coast and Geodetic Survey sends out questionnaires and makes field investigations, if necessary, in any part of the United States in case of an earthquake of wide extent.

The period up to 1927 for the United States is covered for all except minor earthquakes by Special Publication No. 149 of this bureau, *Earthquake History of the United States Exclusive of the Pacific Region*, and by several publications for the Pacific region. These include the Holden and McAdie catalogues<sup>1</sup> and a forthcoming publication of the Seismological Society of America which will extend the record through 1927. The period from 1928 on is covered by the series to which the present publication belongs.

It will be noted that the appraisal of intensities has not generally been made. Since isoseismal maps appear which are based on intensities, the Rossi-Forel scale (which will be used until there is general sentiment for the adoption of a more precise scale) is given below in abbreviated form:

#### ROSSI-FOREL SCALE OF INTENSITIES

1. *Microseismic shock*.—Recorded by a single seismograph or by seismographs of the same model, but not by several seismographs of different kinds; the shock felt by an experienced observer.

2. *Extremely feeble shock*.—Recorded by several seismographs of different kinds; felt by a small number of persons at rest.

3. *Very feeble shock*.—Felt by several persons at rest; strong enough for the direction or duration to be appreciable.

4. *Feeble shock*.—Felt by persons in motion; disturbance of movable objects, doors, windows; cracking of ceilings.

5. *Shock of moderate intensity*.—Felt generally by everyone; disturbance of furniture, beds, etc.; ringing of some bells.

6. *Fairly strong shock*.—General awakening of those asleep; general ringing of bells; oscillation of chandeliers; stopping of clocks; visible agitation of trees and shrubs; some startled persons leaving their dwellings.

7. *Strong shock*.—Overthrow of movable objects; fall of plaster; ringing of church bells; general panic, without damage to buildings.

8. *Very strong shock*.—Fall of chimneys; cracks in the walls of buildings.

9. *Extremely strong shock*.—Partial or total destruction of some buildings.

10. *Shock of extreme intensity*.—Great disaster; ruins; disturbance of the strata, fissures in the ground; rock falls from mountains.

Within the United States the same regional arrangement has been followed as in the case of Special Publication No. 149 mentioned above. In the case of the Pacific coast region, Washington and Oregon have for convenience been treated separately from California.

In this report time will be indicated as continuous from 0 to 24 hours, beginning and ending with midnight.

All the epicenters indicated in this report are either estimates from noninstrumental data or determined from instrumental results.

<sup>1</sup> Smithsonian Miscellaneous Collections, 1089. A Catalogue of Earthquakes on the Pacific Coast, 1769-1897. Edward S. Holden. Smithsonian Miscellaneous Collections, 1721. Catalogue of Earthquakes on the Pacific Coast, 1897-1901. Alexander G. McAdie.



When the epicenters are based on instrumental data, a statement to that effect is made in each case. As a rule the epicenters based on instrumental data represent the mean of the positions determined by the Coast and Geodetic Survey and the central station of the Jesuit Seismological Association cooperating with Science Service. When a strong shock is recorded at a number of stations the data are wired to Science Service, a scientific news agency, which cooperates by paying the cost of messages. Some messages are transmitted by Government radio for distant stations such as Manila, Honolulu, and Sitka. All messages are immediately transmitted to other organizations for interpretation. The results are then immediately available for publication through Science Service and are broadcasted to Europe through cooperation of the United States Weather Bureau and the United States Naval Radio Station at Arlington. In some cases epicenter data, published at Strasbourg, and occasionally from other stations, are incorporated in the epicenters published in this report.

## EARTHQUAKE ACTIVITY IN THE VARIOUS STATES

Only those States are listed in which earthquakes either occurred or, if occurring elsewhere, were felt during the year.

- Alabama: Shocks on December 1. Possibly not seismic.
- Arizona: Only minor shocks. Several Imperial Valley, Calif., shocks felt.
- Arkansas: Moderate shocks on January 26, February 18, and March 6. The last shock was the strongest.
- California: Considerable activity but no major shocks. The principal shocks occurred on January 15, February 11, 25, March 1, April 9, 19, August 5, 30, September 22, December 11: Three in the Imperial Valley (two of which were of force VIII over a small area), one centering near Venice (maximum intensity VII), one centering near Ventura (force VII), one in San Francisco Bay (maximum intensity V). A shock felt chiefly in California centered west of Lake Tahoe and two in vicinity of Cape Mendocino with maximum intensity of VI. Other activity was chiefly fore and after shocks of these and scattered activity.
- Florida: Moderate shock of July 14. Possibly not seismic.
- Idaho: Several shocks in Montana and Wyoming were felt in Idaho.
- Illinois: Two moderate shocks, that of August 29 the stronger.
- Kentucky: Shock of August 29 felt in western Kentucky.
- Louisiana: Shock of maximum intensity VII felt on October 19.
- Maine: Three light shocks.
- Maryland: One feeble shock.
- Massachusetts: Two shocks of moderate intensity. That of July 31 felt over a considerable area.
- Michigan: One slight shock.
- Missouri: Four moderate shocks.
- Montana: Five shocks. That of March 16 the strongest but those of July 9 and 12 most widely felt.
- Nevada: Shock of maximum intensity V-VI on April 12. Twelve or more light shocks. Several California shocks felt, especially that of April 9.
- New Hampshire: Two moderate shocks, stronger on March 18.
- New Mexico: Three shocks. Strongest on December 3.
- New York: Three light shocks.
- Ohio: Six shocks. Strongest on June 26.
- Oregon: One slight shock.
- South Carolina: Three shocks. Strongest on December 25.
- Tennessee: Two shocks in eastern portion, strongest on August 30. Three moderate in western portion.
- Virginia: One slight shock.
- Washington: Six slight shocks.
- Wyoming: Nineteen moderate shocks in the region south of Yellowstone National Park and nine in the park, of which that of August 24 was the strongest.



Alaska: Activity slight. Twenty-six shocks listed, none strong.  
 Hawaii: Three fairly strong shocks on island of Hawaii. Others not listed.  
 Porto Rico: One slight shock.

International  
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 Centre

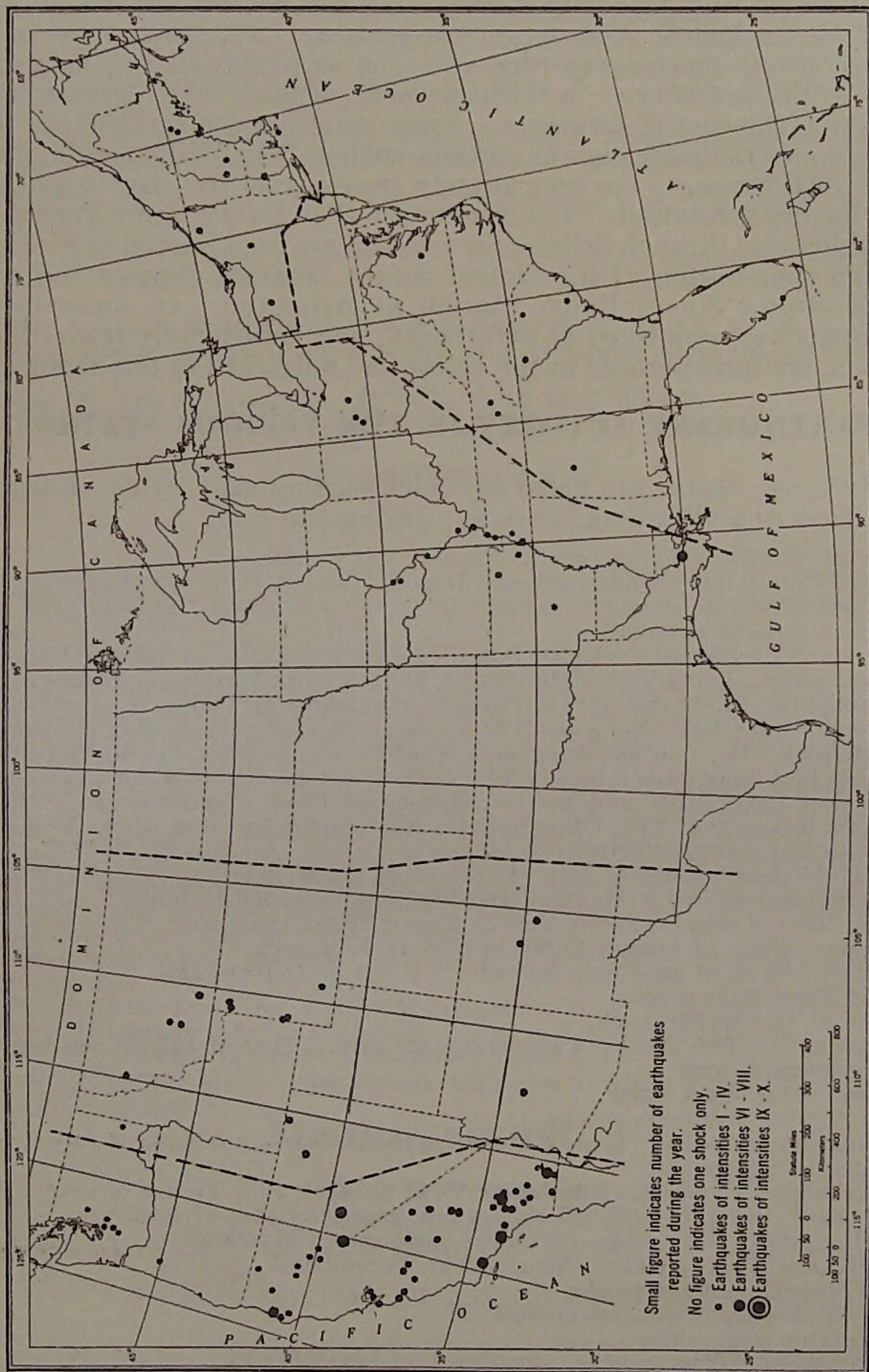


FIGURE 1.—Earthquake epicenters 1930

Philippine Islands: Four fairly strong shocks. Others not listed.  
 Panama Canal Zone: Two fairly strong shocks caused slight damage in the Canal Zone.



**NORTHEASTERN REGION**

[75th meridian or eastern standard time]



- January 4:* Time not known. Clinton, N. Y. ( $43^{\circ}.1$  N.,  $75^{\circ}.3$  W.). Slight.
- January 17:* P. m., Attica, N. Y. ( $42^{\circ}.8$  N.,  $78^{\circ}.3$  W.). Feeble.
- February 14:* 1.15, Franklin, N. H. ( $43^{\circ}.4$  N.,  $71^{\circ}.7$  W.). Two shocks felt also at several neighboring towns. Windows and dishes rattled.
- March 11:* 18.30, Topsham, Me. ( $44^{\circ}.0$  N.,  $70^{\circ}.0$  W.). Feeble. Felt also at Brunswick.
- March 18:* 19.15, Concord, N. H. ( $43^{\circ}.3$  N.,  $71^{\circ}.6$  W.). Felt at Bristol, Laconia, Franklin, and Hebron. Dishes rattled, houses swayed heavily, followed by rattling.
- March 27:* 14.30, West Springfield, Mass. ( $42^{\circ}.1$  N.,  $72^{\circ}.7$  W.). Shook buildings and small objects.
- July 31:* 21.00, New Bedford, Mass. ( $41^{\circ}.5$  N.,  $70^{\circ}.8$  W.). Slight shock, strongest at Nonquitt and Salters Point. Felt also in Marthas Vineyard and Edgartown.
- November 1:* 21.35, Malone and Chestnut Falls, N. Y. ( $44^{\circ}.8$  N.,  $74^{\circ}.3$  W.). Slight shocks lasting 10 seconds over a considerable area. Subterranean sounds.
- November 13:* 1.00, Corinna, Me. ( $45^{\circ}.0$  N.,  $69^{\circ}.2$  W.). Feeble.
- December 25:* P. m., Waterville, Me. ( $44^{\circ}.5$  N.,  $69^{\circ}.6$  W.). Feeble.

**EASTERN REGION**

[75th meridian or eastern standard time]

- July 19:* 13.53, Everglades and La Belle, Fla. ( $25^{\circ}.8$  N.,  $81^{\circ}.4$  W.). Moderate shock. Seismic origin doubtful; probably blasting. Felt also at Fort Myers.
- August 30:* 4.28, eastern Tennessee ( $35^{\circ}.9$  N.,  $84^{\circ}.4$  W.). One strong shock like heavy blast at Lenoir City. Moderately strong sound before shock at Kingston. Rapid trembling, 10 seconds in all, at Oliver Springs. At Lawnville a roar like thunder.
- September 2:* 20.30, Summerville, S. C. ( $33^{\circ}.0$  N.,  $80^{\circ}.2$  W.). Very local shock. Rumbling sound. Lasted three seconds.
- September 15:* 2.40, Richmond, Va. ( $37^{\circ}.5$  N.,  $77^{\circ}.5$  W.). Slight. Sleeper awakened. Lasted 15 seconds.
- October 16:* 16.50, Knoxville, Tenn. ( $36^{\circ}.0$  N.,  $84^{\circ}.0$  W.). One shock felt by nearly all. Objects swung east-west, windowpanes broken, dishes fell from shelves, furniture moved. Surface and subterranean noise.
- November 1:* 1.34 and 2.02, Anne Arundel County, Md. ( $39^{\circ}.2$  N.,  $76^{\circ}.5$  W.). Feeble at Round Bay and Severna Park.
- December 1:* 9.10 to 9.45, Bessemer, Ala. ( $33^{\circ}.4$  N.,  $87^{\circ}.0$  W.). An unusual series of tremors. Possibly not seismic.
- December 9:* 19.02, Due West, S. C. ( $34^{\circ}.3$  N.,  $82^{\circ}.4$  W.). Moderate. Felt over about 250 square miles. Aftershocks between 3 and 4 on the 10th.
- December 25:* Between 22 and 24, Chesterfield County, S. C. ( $34^{\circ}.5$  N.,  $80^{\circ}.3$  W.). Felt at Patrick, McBee, and Society Hill; also in adjacent portion of Darlington County.

**CENTRAL REGION**

[90th meridian or central standard time]

- January 2:* 10.30, Ripley, Tenn. ( $35^{\circ}.8$  N.,  $89^{\circ}.6$  W.). Feeble.
- January 23:* 21.45, Sault Ste. Marie, Mich. ( $46^{\circ}.4$  N.,  $84^{\circ}.3$  W.). One abrupt bump felt by several.
- January 26:* 15.00, Black Rock, Ark. ( $36^{\circ}.1$  N.,  $91^{\circ}.2$  W.). Slight shock felt by many.
- February 18:* 11.00, Marked Tree, Ark. ( $35^{\circ}.5$  N.,  $90^{\circ}.4$  W.). Feeble shock felt by a few. Subterranean sounds.
- February 25:* 6.45, Cairo, Ill. ( $37^{\circ}.5$  N.,  $89^{\circ}.2$  W.). A slight abrupt shock felt by several.
- March 26:* 2.50, Raleigh, Tenn. ( $35^{\circ}.3$  N.,  $89^{\circ}.9$  W.). Feeble. Probably same as shock reported on March 27.
- March 27:* 2.56, Memphis, Tenn. ( $35^{\circ}.3$  N.,  $90^{\circ}.0$  W.). Windows rattled.



- April 2:* 3.39, Caruthersville, Mo. ( $36^{\circ}.2$  N.,  $89^{\circ}.7$  W.). Slight. Rattled dishes and windows.
- May 28:* 11.31, Hannibal, Mo. ( $39^{\circ}.7$  N.,  $91^{\circ}.3$  W.). Shock felt by several. Light fixtures swayed.
- June 26:* 15.45, Bellefontaine, Lima, and Wapakoneta, Ohio ( $40^{\circ}.5$  N.,  $84^{\circ}.1$  W.). Two shocks felt by many. Gradual rocking and rumbling. Another on the 27th at 1.23. Felt at Sidney and Lima.
- July 10:* 18.15, Marion, Ohio ( $40^{\circ}.7$  N.,  $83^{\circ}.2$  W.). Slight. May have been blasting.
- August 8:* 12.31, Hannibal, Mo. ( $39^{\circ}.6$  N.,  $91^{\circ}.4$  W.). One to three abrupt shocks. Windows rattled. Hanging objects swayed.
- August 29:* 0.27\*, Blandville and Barlow, Ky., and Cairo, Ill. ( $37^{\circ}.0$  N.,  $89^{\circ}.1$  W.). Four shocks in quick succession felt at Blandville. Sounds variously described as cracking, thundering, rattling, roaring heard between 0.25 and 4.00. Several persons awakened. Loose objects rattled. Cairo, one shock with up and down motion. (See Bulletin of the Seismological Society of America, volume 21, No. 2, page 159, for further details.)

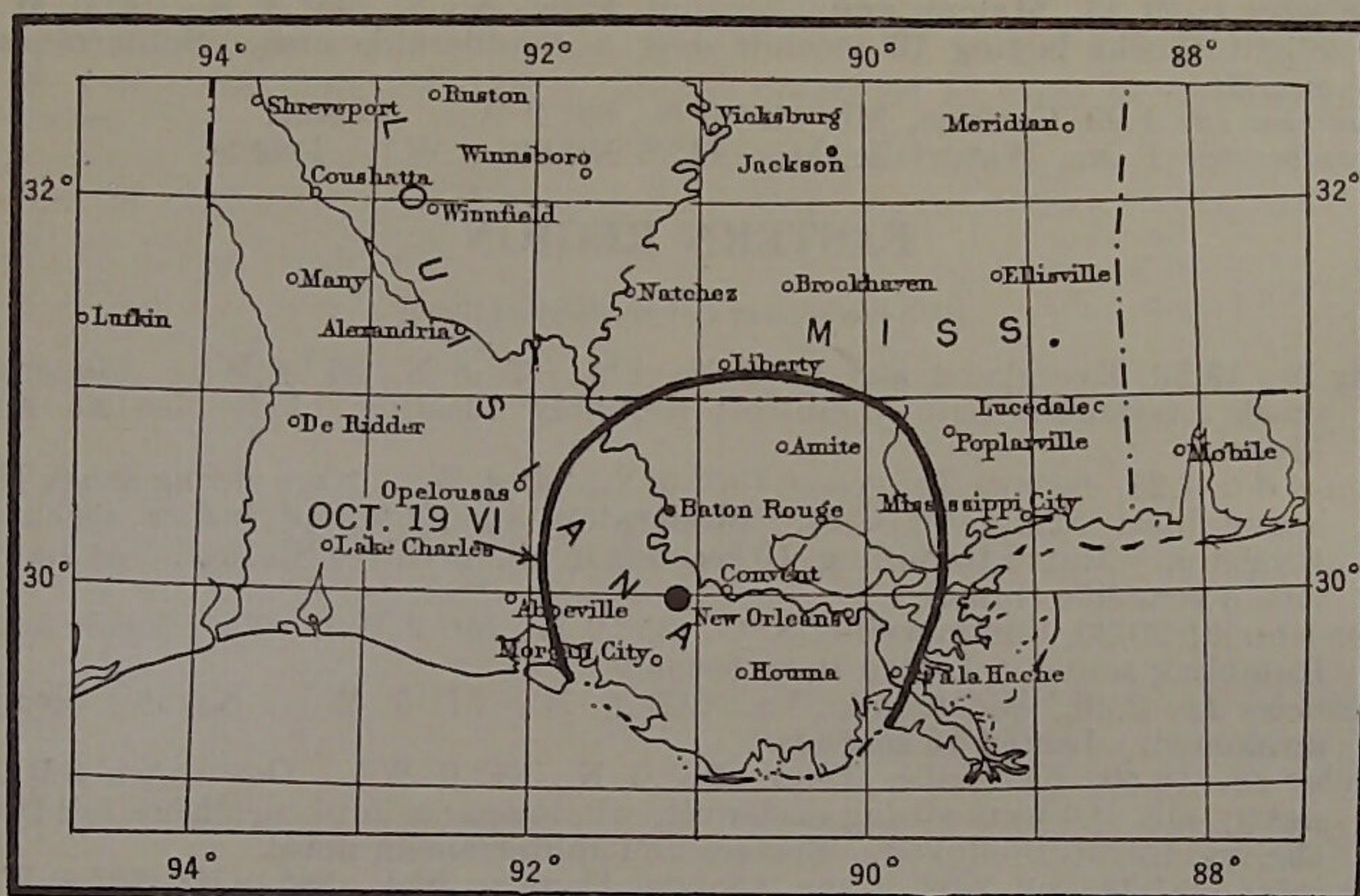


FIGURE 2.—Area affected by Louisiana shock of October 19

- September 1:* 14.30, New Madrid region ( $36^{\circ}.5$  N.,  $89^{\circ}.5$  W.). Hickman, Ky., generally felt, shock abrupt. New Madrid, Mo., north-south motion felt by many. Three seconds duration. Tiptonville, Tenn., two shocks, rapid trembling and bumping. (See Bulletin of the Seismological Society of America, volume 21, No. 2, page 159, for further details.)
- September 3:* 6.00 and 23.30, Blandville, Ky. ( $37^{\circ}.0$  N.,  $89^{\circ}.1$  W.). Slight shocks.
- September 29:* 15.15, Sidney, Ohio ( $40^{\circ}.3$  N.,  $84^{\circ}.2$  W.). Very brief shock felt by many.
- September 30:* 17.50, Sidney, Ohio. Brief shock generally felt.
- October 19:* 6.17, Louisiana ( $30^{\circ}$  N.,  $91^{\circ}$  W.). Widespread shock centering about 60 miles west of New Orleans. See page 16 for details.
- November 16:* 6.30, Malvern, Ark. ( $34^{\circ}.3$  N.,  $92^{\circ}.7$  W.). Residents on Baker Hill rudely awakened. Slight damage to house. Felt at Huskey Creek, Perla, Damascus and Leola.
- December 23:* 8.44, St. Louis, Mo. ( $38^{\circ}.5$  N.,  $90^{\circ}.2$  W.). Light shock shook houses.

## WESTERN MOUNTAIN REGION

[105th meridian or mountain time]

- March 16:* Shock reported variously at 5.54, 6.13, 6.23 but not certain that there was more than one shock. Helena, Mont. ( $46^{\circ}.5$  N.,  $112^{\circ}.0$  W.). Felt by half of population, others not awakened. Shock started with vertical





- motion followed by north-south motion. First shock accompanied by a loud crash. Desks moved slightly, windows rattled. Some cracks in plaster.
- March 23:* 12.00, Albuquerque, N. M. ( $35^{\circ}.0$  N.,  $106^{\circ}.6$  W.). A very brief shock shook houses and rattled dishes.
- June 12:* 2.15, Grover, Wyo. ( $42^{\circ}.6$  N.,  $111^{\circ}.0$  W.). Fairly strong shock felt by nearly all. One brick building cracked. Concrete swimming pool 3 miles northwest cracked. Plaster cracked; clocks on west walls stopped. Sounds like loud cracking and roaring.
- June 12:* 2.25, same. Rumble.
- June 12:* 2.40, same. Shock lasting 10 seconds; stopped clocks and strongly rattled windows.
- June 12:* 3.35, same. A few distinct shocks, then a pause and then a lurch. Felt near Bear Lake, Idaho. Sound like loud rumbling of truck or train.
- June 12:* 5.30, same. Abrupt shock. Disturbed objects. Lamps swung north-west-southeast.
- June 12:* 10.45, same. Slight shock.
- June 12:* 13.00, same. Slight shock.
- June 13:* 5.30 and 11.17. Slight shocks at Grover, Wyo.
- June 14:* 0.00. Slight shock at Grover, Wyo.
- June 16:* 1.30, 1.45, 1.50, 4.00, 5.00. Shocks described as lurch or tremble at Grover, Wyo.
- July 9:* 18.00, Western Montana ( $47^{\circ}.5$  N.,  $115^{\circ}$  W.). Shock felt at Paradise, Hangan, St. Regis, and Saltese, Mont., and at Falcon, Idaho. Shock was also felt at Missoula, Mont.
- July 12:* 18.00, west central Montana ( $46^{\circ}$  N.,  $112^{\circ}$  W.). A moderate shock was widely felt at Butte, Helena, Three Forks, Fort Benton, and in Yellowstone Park, 5 miles south of Gardiner.
- July 16:* The fourth light earthquake in three days was felt in the vicinity of Three Forks on the night of July 16. Felt at Bozeman, Lombard, and Gateway.
- July 16:* 12.00 and 14.40, Constellation, Ariz. ( $34^{\circ}.2$  N.,  $112^{\circ}.5$  W.).
- July 17:* 5.15, Livingston, Mont. ( $45^{\circ}.6$  N.,  $110^{\circ}.6$  W.). Slight shock.
- July 28:* 2.35, Rock Springs, Wyo. ( $41^{\circ}.5$  N.,  $109^{\circ}.3$  W.). One shock. Buildings creaked, lights swayed.
- July 31:* 0.31, Livingston, Mont. Slight shock.
- August 24:* 19.40, Yellowstone Park ( $44^{\circ}.5$  N.,  $110^{\circ}.5$  W.). Light shock with large number of aftershocks. Dishes thrown down; lights swung.
- August 25:* 7.45, shook south end, Lewis Lake, Yellowstone National Park. Water disturbed.
- August 26:* 4.00, Snake River ranger station, Yellowstone National Park ( $44^{\circ}.4$  N.,  $110^{\circ}.8$  W.). Swaying northeast-southwest felt by several, rattling of doors and windows; many awakened.
- August 26:* 7.40, shock disturbed water in Lewis River, Yellowstone National Park.
- August 27:* 17.00, Snake River ranger station. Three shocks.
- August 31:* 23.45, north end, Yellowstone National Park. Light.
- September 10:* 9.30, 13.30, Midas, Nev. ( $41^{\circ}.1$  N.,  $116^{\circ}.9$  W.).
- September 11:* 19.30, Midas, Nev. All light.
- September 12:* 1.30 and 2.00, Midas, Nev.
- September 15:* 20.10, Norris Junction, Yellowstone National Park. Light.
- September 16:* 4.30, Red House, Nev., 7 miles south of Blossom Ranch. Light.
- September 16:* 16.50, 17.00, 20.20, 20.30, Midas, Nev. Light.
- September 18:* 5.00 Midas, Nev. Light.
- September 19:* Time unknown, Grover, Wyo. ( $42^{\circ}.6$  N.,  $111^{\circ}.0$  W.). Feeble shock felt by a few.
- September 21:* Time unknown. Feeble shock at Grover, Wyo.
- September 25:* 4.00, Snake River ranger station. Moderate.
- October 3:* 20.25, Duran, N. M. ( $34^{\circ}.5$  N.,  $105^{\circ}.4$  W.). Moderate shock felt by many. Rolling motion, rumbling sound, rattled windows. No damage.
- November 15:* 20.15, Rowland, Nev. ( $41^{\circ}.9$  N.,  $115^{\circ}.4$  W.). Light.
- November 16:* Time unknown. Grover, Wyo. Feeble shock.
- December 3:* 14.36, Albuquerque, N. M. ( $35^{\circ}$  N.,  $106^{\circ}.5$  W.). Two distinct shocks vertical movement generally felt. Cracked plaster and dishes. Aftershock on the 4th at 15.30.
- December 8:* 23.50, Jarbidge, Nev. ( $41^{\circ}.8$  N.,  $115^{\circ}.3$  W.). Light.



*December 22:* 9.15, Snake River ranger station (44°.4 N., 110°.8 W.). Rapid rocking, west to east, felt by all. Subterranean and surface sounds heard.

NOTE.—Reports were received concerning rumblings or quakes which were both “heard and felt” near Ibex Mountain in Utah. The location is near what is known locally as the House Range but shown on maps as the Confusion or Wah Wah Valley Range. These “quakes” are commonly experienced during the cold season of the year from November to March. They are strong enough to scare horses so they will not stay in the canyons but are not felt at the town of Garrison, 40 miles west. There is some doubt whether they are true earthquakes. However, it is known that sharp shocks did occur in this general region on November 13 and 19, 1901. Records show that at various times earthquake “swarms,” that is, large numbers of small earthquakes occurring frequently in the same general locality, have occurred in various parts of Utah. Possibly these sounds are a related phenomenon.

## PACIFIC COAST REGION

[120th meridian, or Pacific standard time]

California and western Nevada

*January 4:* 3.27,\* San Jacinto Fault (Wood). Mecca.

*January 8:* 23.30 to January 9: 1.56. A series of fairly strong shocks originating along the San Andreas Fault in San Benito or Santa Cruz Counties (Wood). At Santa Cruz there were several shocks from 23.30 to 1.56 on the 9th. There were three principal shocks in the region—two on the 9th at 0.06 \* and 0.16 \*—felt from Lonoak to Santa Cruz and from points eastward of the Salinas Valley to the coast (a land area of about 1,800 square miles), and one at 1.56 felt from Camphora to Santa Cruz. Aftershocks occurred on the 10th at 23.18 \* and on the 12th at 2.41,\* both felt 11 miles south of Salinas.

*January 15:* 16.24 \* and 16.34,\* probably San Bernardino mountains, north of Forest Home and south of Great Bear Lake (Wood). See map. First shock strongest. At least 50 instrumental shocks recorded at Pasadena during the day. Felt over an area of about 48,000 square miles. Force ranged from IV to VI in epicentral region. Telephone service temporarily disrupted at Pomona. Chimneys fell and dishes broken in Fawnskin and Summit. Three distinct shocks at Pine Knot. Force VI at Fawnskin and Summit; V-VI at Coachella, Forest Home, Lake Arrowhead, Pine Knot, Pomona, Victorville, and Yucaipa; V at Barstow, East Highland, Los Angeles, Ludow, Mecca, Riverside; IV at Adelanto, Alber Hill, Banning, Cabazon, Cedarpines Park, Crestline, Crucero, Dalton, Devore, Edom, Hemet, Hesperia, Laguna Beach, Long Beach, Pomona, Riverside, Running Springs, Santa Cruz, Seven Oaks, Tustin, and Twenty-nine Palms; III at Anaheim, Avalon, Baldwin Lake, Baldwin Park, Barstow, Beaumont, Blythe, Cajon, China, Chula Vista, Coachella, Colton, El Modeno, Fullerton, Gardena, Hollywood, Huntington Beach, Keen Camp, La Canada, La Verne, Long Beach, Los Nietos, Lucerne Valley, Needles, Newhall, Niland, North Hollywood, Orange, Phelan, San Bernardino, San Dimas, Santa Ana, Silver Lake, Swartout, Valyermo, Van Nuys, and Yorba Linda.

*January 16:* 0.15, Mendota.

*January 16:* San Bernardino Mountains. Seven aftershocks of January 15 shock felt at Riverside, Baldwin Lake, and Big Bear City (nine reports).

*January 17:* 4.25, San Dimas and East Highlands.

*January 17:* 16.20 and 16.30, Camp Angelus. Felt at Montrose and San Gabriel.

*January 18:* 21.43, Storrie.

*January 19:* 13.00, Castroville.

*January 22:* 20.17,\* near North Oakland. Maximum intensity IV. Felt from San Francisco to Concord and from San Rafael to Alvarado. Aftershock at Canyon.

*January 23:* 11.27, Baldwin Lake.

*January 27:* 12.26, Arcadia. Fairly strong. Four shocks, motion same as heavy swell. Shock plainly heard approaching before it was felt.

*January 27:* 19.00, Big Bear City.

*January 28:* 0.23, vicinity of Tulare, Porterville, and Lindsay. Felt near Bakersfield.

*January 28:* 1.32, La Canada.

*February 1:* 15.00, White Water.

*February 2:* 2.00, El Granada.

\* After time means that earthquake has been instrumentally recorded. When only one place is named the shock is slight and local. Hour and other details not given for slight fore and after shocks. There is considerable unpublished detail available at the Washington office of the Coast and Geodetic Survey and the field station of that bureau in San Francisco, Calif. However, no important information is omitted.





- February 3: 17.00, Caribou.  
 February 4: 10.00, Big Bear City.  
 February 5: 17.00, Caribou.  
 February 7: 7.55, Big Bear City.  
 February 7: 15.23,\* in Mexico, south of Jacumba (Wood). Maximum intensity IV-V. Felt from San Diego to Calexico and to the north in Mecca, Descanso, and Westmoreland, an estimated area (including the probable area in Mexico) of 8,000 square miles. Reported perceptible in San Pedro. Felt at Agua Caliente, Mexico.  
 February 11: 13.00, Ager.  
 February 11: 13.21, probably near Los Altos (Byerly). See map. Felt from Aptos on the south to San Rafael, Vallejo, and Antioch on the north and from the coast to the Orestimba Valley east of Mount Hamilton, an area

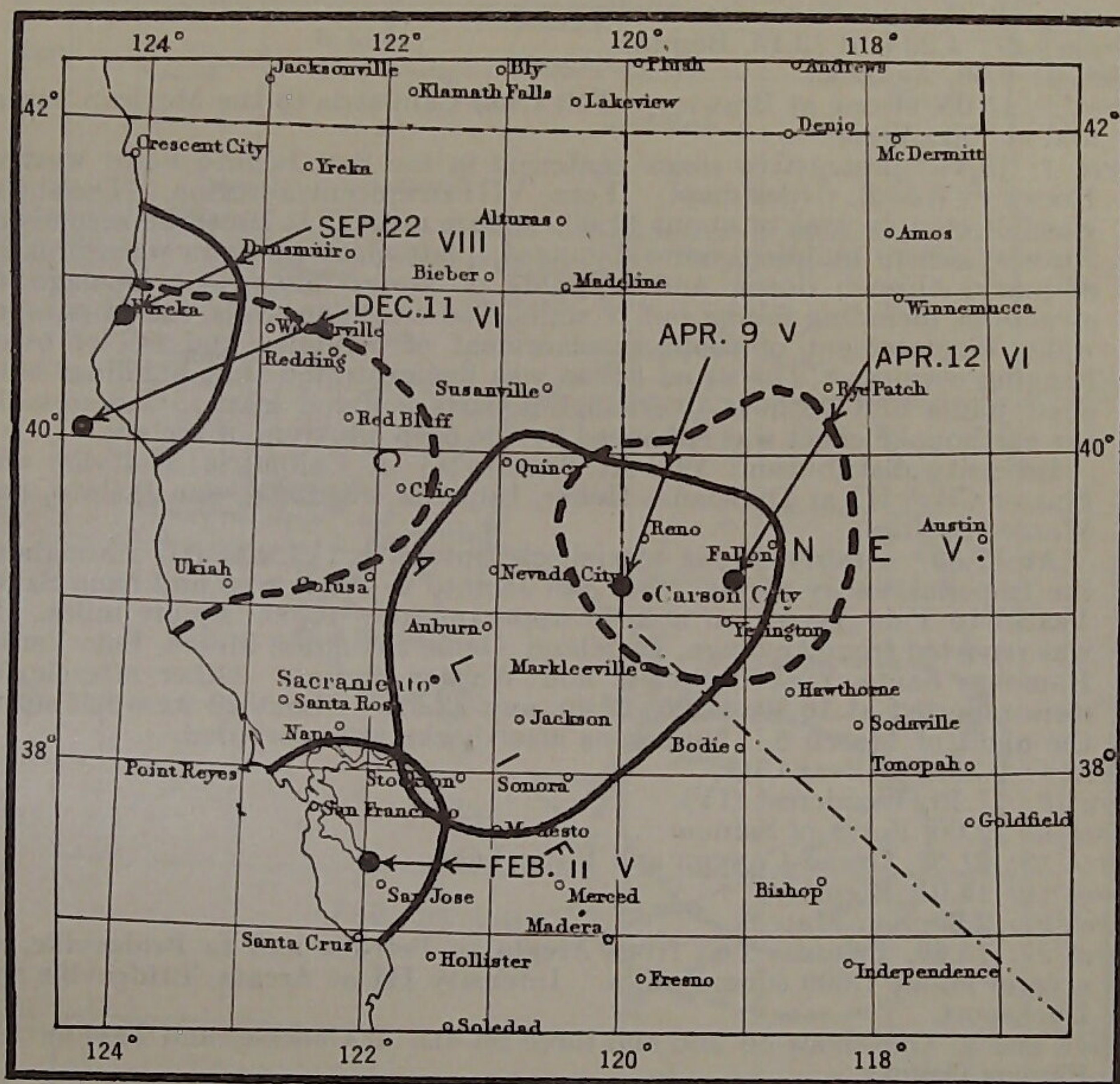


FIGURE 3.—Areas affected by shocks of February 11, April 9, April 12, September 22, and December 11

of about 4,700 square miles. Felt as follows: IV to V at Alviso, Cupertino, La Honda, Palo Alto, and Los Altos; III at Agnew, Aptos, Bonny Doon, Brookdale, Colma, Corte Madera, San Francisco, San Rafael, Santa Cruz, Santa Clara, Sausalito, and Swanton.

February 11: 16.00, Mount Signal.

February 25: 18.30,\* very probably San Jacinto Fault, a few miles southwest of Westmoreland (Wood). See map. Intensity upper range of VIII over small area; vertical motion at first followed by north-south movement. Probably felt over about 21,000 square miles. Craters were found where mud and water had been forced up out of the ground. In Westmoreland walls cracked, plate glass was broken, joints in walls cracked, plaster fell. Damage confined to buildings of inferior construction. Modern buildings all withstood the shock. No damage to piping.



Intensity distribution: VIII at Westmoreland; V at Blythe, Brawley, Mecca, Palo Verde Valley, Plaster City, and Seeley; IV at Bonita, Calexico, Holtville, and Thermal; III or less at Aguanga, Dixieland (8 miles east of Mecca), Heber, Ramona, San Jacinto, Warner Springs, and in Arizona at Parker and Yuma.

The most important of about 11 foreshocks occurred as follows: 6.00, Brawley and Calexico; 16.43,\* Calipatria and Westmoreland; 16.58,\* Niland and Seeley; 17.23,\* Niland; 17.28,\* Mount Signal.

Aftershocks were felt as follows: 18.45, Blythe and 10 miles east of Mecca; 19.30, Palo Verde and Warner Springs; 19.50, Palo Verde and Dixieland, 8 miles east of Mecca, Warner Springs and Quartzsite, Arizona; 20.20, Imperial and Mecca; 20.30, Blythe and Holtville; 20.55, Palo Verde and Holtville; 23.30, and 23.50, Dixieland, Palo Verde, and Blythe and Gadsden, Ariz. Hundreds of small aftershocks recorded instrumentally (Wood).

*February 26:* Same. Four aftershocks.

*February 27:* 4.26 and 13.15, Bigpine.

*March 1:* 6.00, Aguanga.

*March 1:* 15.05, strong at Brawley. Felt from Calipatria to the Mexican border and at Palo Verde.

*March 1:* 15.44,\* destructive shock centering in the San Jacinto Fault west of Brawley (Wood). (See map.) Force VIII in epicentral region. The shock was felt over an area of about 11,000 square miles. It lasted 30 seconds at Brawley where buildings were damaged, plate-glass windows were broken, chimneys thrown down, and contents of stores damaged. Damage to structures including falling out of walls, bad cracks in walls, fall of parapet walls, displacement of roofs, displacement of columns, and fall of overhanging cornices. The usual lesson was demonstrated that buildings with good joints and without overhanging parts suffered least. Undoubtedly the earthquake effect was enhanced by the deep alluvium of the site.

Intensity distribution: VIII at Brawley; V at Calipatria, Holtville and Plaster City; III at Dixieland, Heber, Imperial, Jacumba, San Jacinto, and Warner Springs.

At 17.50\* a fairly strong aftershock (intensity IV) was felt throughout the Imperial Valley region, from San Jacinto to the border and from Santa Ysabel to Palo Verde, an area of approximately 10,000 square miles. It was reported from Aguanga, Dixieland, Goffs, Jacumba, Mecca, Palo Verde, Ramona, Santa Ysabel, Seeley, and Warner Springs. Other aftershocks were reported at 16.30, 17.26, 23.49, and 23.51. About 20 were felt up to the night of March 6. Numerous aftershocks were recorded.

*March 5:* 9.35, Big Bear City.

*March 6:* 17.10, Woodcrest (IV).

*March 9:* 22.00, Forks of Salmon.

*March 13:* 21.52, Grand Canyon and Little Lake.

*March 19:* 18.01, Bigpine.

*March 27:* 2.30, San Mateo.

*March 27:* 13.30, Loleta. Felt from Arcata to Petrolia and to Bridgeville, an area of about 1,600 square miles. Intensity III at Arcata, Bridgeville and Bucksport.

*April 2 and 4.* One shock on 2nd and three on 4th at Genessee and Taylorsville, Plumas County.

*April 5:* 20.23,\* Sierra west of Independence (Wood). Felt feebly at Sugar Pine, Big Creek and Laws. Another shock at 20.28.\*

*April 9:* 14.00, near Lake Tahoe. (See map.) Felt over an area of approximately 19,000 square miles. Plaster cracked near Lake Tahoe. Intensity distribution was as follows: VI at Lake Tahoe and Glenbrook, Nev.; V at Truckee and apparently at Stockton, though a considerable distance away; IV at Clements, Georgetown, Sacramento, Stanislaus, and Strawberry Valley, and (in Nevada) at Carson City, Genoa, Minden, and Reno; III at Angeles Camp, Bijon, Camino, Cisco, Cromberg, Davis, Floriston, Forest, Log Cabin, North Bloomfield, Omo Ranch, Railroad Flat, Stockton, Tahoe Pines, and Valley Springs, and (in Nevada) at Dayton, Gardnersville, Luning, Stewart, and Verdi. Aftershock at 14.14.



*April 12:* 4.57,\* near Fernley and Fallon, Nev. (See map.) Felt over an area of approximately 15,000 square miles. At Fernley, Nev., chimneys cracked and dishes broke; at Fallon plaster cracked and objects were thrown from shelves. Intensity distribution: VI (in Nevada), at Fernley and Fallon; V (in Nevada) at Gardnersville, Mason, Steamboat, Wabuska, and Weeks, and at Tahoe, Calif.; IV (in Nevada) at Carson City, Hazen, Lovelock, Schurtz, Stewart, and (in California) at Greenville and Unionville; III (in Nevada) at Glenbrook, Hudson, Minden, Nixon, Verdi, and Yerington, and (in California) at Boca, Camp Richardson, Loyalton, Tahoe, and Vinton.

*April 20:* a. m., Whitmore.

*April 20:* 0.52,\* southeast of Barstow (Wood). Felt at Victorville.

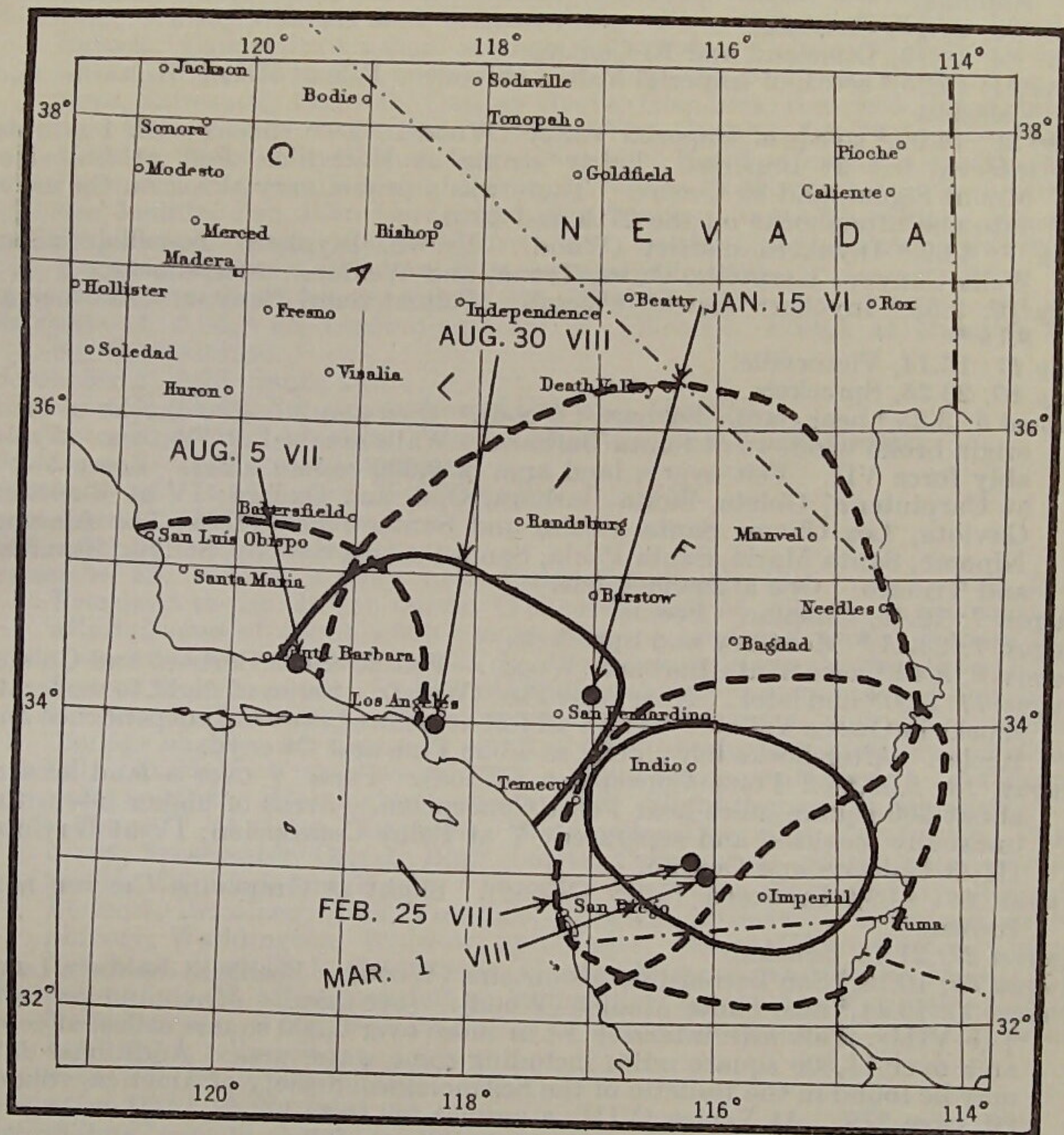


FIGURE 4.—Areas affected by shocks of January 15, February 25, March 1, August 5, August 30

*April 23:* 5.20, Perris.

*April 29:* 12.13,\* Millville, Redding, Kennet, and Paynes Creek (Inship power house). Felt sharply at the latter place.

*May 1:* 23.03, Lafayette.

*May 7:* 5.38, Aptos, Capitola, Santa Cruz, and Watsonville.

*May 8:* 12.55, Holtville, moderate.

*May 11:* 15.59, near Pinnacles, San Benito County.

*May 11 and 12:* Southeast of Warner. Principal shocks at 20.14\* on the 11th and 21.25 on the 12th were felt at Warner Springs, Ramona, Julian, and Santa Ysabel. There were at least three shocks on the 11th and seven on the 12th. The main shocks were not strong.

*May 13:* 2.18, Livermore, Arroyo Sanitarium.



- May 15:* 7.30, Alton, Loleta, Upper Matole, and Scotia. Felt from Brideland to Loleta and east to the Eel River, an area of about 1,500 square miles, not including probable undersea area to west. Aftershocks on 20th, 22d, and 26th.
- May 18:* 3.15, Agnew.
- May 28:* 11.05, Atolia. Another shock at 23.13\* felt in Atolia and Panamint Valley, San Benito County (Wood).
- May 29:* 5.15,\* probably San Andreas fault. Felt at Dos Palos, Trent, Los Banos, and Brito. Preceded and followed by numerous smaller (recorded) shocks only two of which were felt.
- June 8:* 18.38,\* San Jacinto fault (Wood). Laguna Mountains and 3 miles east of Ramona.
- June 20:* 21.15, Casmalia.
- June 24:* 14.45, Dixieland and El Centro.
- June 24:* 15.25,\* south of Imperial Valley (Wood). Felt at Heber, Holtville, and Calexico.
- June 26:* 14.09,\* south of Imperial Valley (Wood). Two shocks with 1 minute interval felt at Imperial. Fairly strong at Holtville. Felt at Calexico, Mount Signal, and El Centro. There was a preliminary shock on the same date and aftershocks on the 27th and 29th.
- July 7:* 4.09,\* Inyokern district (Wood). Brown, Inyokern, Isabella, Indian Wells Canyon, Kernville, Onyx, Trona, and Weldon. Aftershocks.
- July 12:* 2.55,\* Inyokern district (Wood). Felt at Sand Canyon. Another at 9.18.\*
- July 17:* 15.14, Victorville.
- July 20:* 23.25, Spreckels.
- August 5:* 3.25,\* near Santa Barbara (Wood). (See map.) Two shocks of local origin broke windows at Santa Barbara. Walls cracked at Ventura. Probably force VII. Felt over a land area of 9,000 square miles. Force V-VI at Carpinteria, Goleta, Santa Barbara, Ojai, and Oxnard; IV at Buellton, Gaviota, Los Olivos, Santa Paula, and Santa Yuez; III at Los Alamos, Nipomo, Santa Maria, Santa Paula, Santa Susana, Saticoy, Saugus, Stauffer, and Triunfo. One aftershock felt.
- August 7:* 19.45, Chualar. Feeble.
- August 7:* 23.41,\* Monterey and Spreckels.
- August 8:* 8.46,\* near Santa Barbara (Wood). Felt at Santa Barbara and Goleta.
- August 11:* 5.00\* and later. Near Lone Pine (Wood). Series of slight to moderate shocks in Owens Valley. Ten in all felt at points between Independence and Keeler. Aftershocks felt chiefly at Lone Pine and Owenyo.
- August 18:* 5.09,\* off Point Concepcion (Wood). Force V over a land area of about 500 square miles near Point Concepcion. Areas of higher intensities unusually localized and separated; V at Point Concepcion; IV at Gaviota; III at Halcyon and Oceano.
- August 26:* 4.09,\* Inyokern Valley (Wood). Slight at Grapevine Canyon near Brown.
- August 27:* 21.15, Soledad.
- August 29:* 10.13,\* San Bernardino Mountains (Wood). Feeble at Baldwin Lake.
- August 30:* 16.41,\* near Santa Monica (Wood). (See map.) Maximum intensity VII-VIII. Felt with intensity VI or more over 2,500 square miles; affected area over 11,500 square miles including some water area. Additional data may be found in the Bulletin of the Seismological Society of America, volume 20, page 279. At Venice (VIII) a cornice fell from hotel. At Los Angeles (VIII) there were minor cracks in buildings, fallen plaster, and broken dishes. Shock lasted 30 seconds; people rushed into streets. Two reports indicated force V and VI. At Pasadena and Hollywood (VII) dishes broke and plaster fell. At Santa Monica (VIII) a distinct upward thrust, followed by rolling motion, lasted 30 seconds. Goods were thrown from shelves, vases fell, pictures moved. Crack appeared along edge of Palisades Park bluff. At Chatsworth plaster cracked, objects fell. At Roscoe clocks facing west stopped. Dishes were thrown from shelves at San Fernando; population generally frightened. At North Hollywood small objects moved and overturned, walls cracked, plaster fell. At Owensmouth plaster and chimneys cracked, water spilled in an easterly direction.
- Force VI at Huntington Beach. Clocks facing west and northwest stopped, doors and windows rattled. Hanging objects moved at San Dimas, North Los Angeles, North Hollywood, and Topanga. Nearly VII at Olive View. Clocks stopped at Norwalk. Force V at Alberhill, Agoura, Arlington, Bell, Beverly Hills, Cahuenga Park, Calabasas, Chatsworth, Chino,



Compton, Dominguez, El Segundo, Fullerton, Hawthorne, Highway, Highland, Hollywood, Huntington Park, Inglewood, La Crescenta, Lawndale, Littlerock, Long Beach, Manhattan Beach, Mar Vista, Maywood, Montebello, Montrose, Orange, Pacific Palisades, Pacoima, Palos Verdes Estates, Reseda, San Fernando, Santa Ana, Santa Monica, Santa Susana, Saugus, Sunland, Triunfo, Tujunga, Universal City, Van Nuys, and Wilmington.

Force IV at Alhambra, Altadena, Avalon, Azusa, Balboa Island, Bryn Mawr, Burbank, Claremont, Cypress, East Pasadena, El Monte, Fillmore, Gardena, Glendale, Guasti, Home Gardens, Hynes, Inglewood, La Canada, Laguna Beach, La Verne, Llano, Monrovia, Montrose, Mount Wilson, Norwalk, Oceanpark, Palmdale, Rialto, Rivera, Roberts Camp, Rosemead, San Gabriel, Santa Ana, Simons, Somis, Terminal Island, Torrance, Verdugo City, Watts, Wilmar, and Willowbrook. Force III at Anaheim, Arcadia, Balboa, Camarillo, Casitas Springs, Clearwater, Colton, Cornell, Corona, Costa Mesa, Covina, Cucomonga, Downey, Eagle Rock, El Modeno, El Toro, Etiwanda, Fontana, Garden Grove, Glendora, Hermosa Beach, Highland Park, Hondo, Hueneme, Irvine, La Vina, Lomita, Los Nietos, Lynwood, Moneta, Moorpark, Mount Lowe, Newport Beach, Ontario, Oxnard, Pico, Placentia, Pomona, Redondo Beach, Riverside, Rosamond, San Bernardino, San Jacinto, San Juan Capistrano, San Marino, Santa Fe Springs, Saugus, Seal Beach, Sespe, Sierra Madre, Simi, South Gate, Stanton, Swartout, WALTERIA, Whittier, Wilmar, Wilsona, and Wineville.

One aftershock felt on August 30; six on the 31st.

*September 2:* 5.35,\* off coast about 35° N. (Wood). Feeble at Halcyon and San Luis Obispo.

*September 2:* 8.25, Santa Cruz.

*September 3:* 11.44, Big Creek, Bass Lake, and The Pines.

*September 8:* 13.13,\* Imperial Valley, Calipatria, and Westmoreland.

*September 8:* 21.27, Santa Barbara.

*September 11:* 11.16,\* near Whittier (Wood). Felt.

*September 18:* 23.55, Bolinas.

*September 22:* 14.00, Lafayette.

*September 22:* 18.58,\* Eureka and Fields Landing. (See map.) Felt from Briceland to the Oregon border (115 miles) and 55 miles from the coast, an affected area of about 4,600 square miles on land and probably more than this under the sea. At Eureka (VIII) chimneys were thrown down, dishes thrown from shelves. At Fields Landing chimneys were cracked and dishes thrown from shelves. At Capetown (VI) windows and doors rattled; damage slight. At Crannell, small objects overturned, pictures and dishes fell. At Holmes vases overturned. Slight damage at Korbel. At Samoa walls creaked; clock facing west stopped. Slight damage at Stumpville.

Force V at Alton, Bayview, Bridgeville, Dyerville, Fernbridge, Fieldbrook, Freshwater, Grizzly Bluff, Loleta, Pepperwood, Scotia, Showers Pass, Skelly, Trinidad, and Weott. Force IV at Arcata, Bayside City, Beatrice, Benbow, Briceland, Falk, Ferndale, Fortuna, Hydesville, Kneeland, Orick, Shively, Waddington, Whitlow, and Yager. Force III at Cutten, Denny, Eel Rock, Fort Dick, Garberville, Hoopa, Miranda, and Upper Matole.

*September 23:* 5.55, aftershock felt at Bridgeville, Fernbridge, Ferndale, Eureka, Trinidad, and Whitlow, a land area of about 1,200 square miles. Another light shock followed.

*September 23:* 19.30, Escondido.

*September 26:* 1.30, Portola.

*September 27:* 19.00, Arcata.

*September 30:* 16.40, Culver City. Fairly strong.

*October 2:* 6.18,\* off Point Arguelo (Wood). Halcyon.

*October 28:* 5.57,\* off coast near Cayucos (Wood). Felt at Nipomo.

*October 29:* Shasta and Tehama Counties. There were a series of 13 shocks felt from Mineral and Viola in the east to Redding and Lamoine in the West. The principal ones were felt as follows: 2.30 at Redding; 3.30 at Ingot, Baird, and Redding; 4.37\* at Inwood, Mineral, Millville, Redding and Lamoine (this is probably the shock reported without time given as causing damage at Whitemore and Lamoine); 11.28 at Inwood and Millville; 11.38 at Baird and Mineral; 11.50\* at Redding (slight damage) and Ingot; 20.29\* at Mineral and Millville.

*October 30:* 12.45, 13.00,\* 13.59,\* Newhall.

*October 31:* p. m. Two shocks at Kennet.

*November 6:* 23.13, Iowa Hill.

*November 9:* 21.11, 6 miles south and 2 miles east of Aberdeen depot. Moderate.





- November 11:* 0.55, Forest Glen. Moderate.  
*November 17:* 6.30, Claremont.  
*November 17:* 9.43, Forest Glen.  
*November 20:* 17.30, Bridgeville.  
*November 25:* 4.34.\* Felt near Calxico.  
*December 7:* 12.45, Upper Matole.  
*December 7:* 17.23\* and 17.29,\* near Santa Barbara (Wood). Felt also at Goleta.  
*December 8:* 14.00, Ukiah.  
*December 11:* 1.00,\* northern California, probably at sea. Epicenter indeterminate. (See map.) After two preliminary shocks an earthquake affecting an area of 11,500 square miles on land was felt with force VI at Ferndale where articles were thrown from shelves and all awakened. Similar effects at Spyrock, Harris, and Waddington. Force V was observed at Alton, Chico, Ettersburg, Fernbridge, Weott, Zenia; IV at Beatrice, Blocksburg, Branscomb, Cummings, Hydesville, Kneeland, Littleriver, McCann, Miranda, Samoa, Whitlow, Willits; III at Alderpoint, Arcata, Bell Springs, Covelo, De Sabla, Island Mountain, Orland, and Westport.  
 There were at least 15 aftershocks on the 11th, 4 of which were at Shelter Cove to south of central area. The principal ones were: 4.28\* at Hydesville, Samoa, Bridgeville, Eureka, Fernbridge, Scotia; and 20.50 at Hydesville, Ferndale, Scotia, Alton, and Weott.  
 Twenty-one aftershocks in northern California. The principal ones on December 12 were as follows: At 1.32\* a shock was felt over 3,600 square miles on land with force V-VI at Cummings; V at Waddington; IV at Upper Matole, Weott, Alder Point, Harris, Ettersburg, and Whitlow; III at Punta Gorda Light, Ettersburg, Eureka, Island Mountain, Briceland, and Forest Glen. Another at 12.16\* was felt with force V at Fernbridge, Weott and Waddington; IV at Ferndale and Cummings; III at Alton, Eureka and Scotia. Shocks at 2.00 and 14.00 were felt at Ukiah, far to south. On December 13 three aftershocks felt. The strongest, at 17.39,\* was felt at Scotia and Alton.  
*December 14:* 12.00, aftershock at Upper Matole.  
*December 15:* 0.39,\* Eureka and Whitlow.  
*December 15:* about 12.35, Blocksburg and Scotia.  
*December 23:* 1.10, Eureka and Scotia. Two light shocks followed.  
*December 24:* Four aftershocks in north California region. Strongest at 1.11,\* felt at Bridgeville, Ferndale, Alton, Scotia, Whitlow, and Upper Matole.  
*December 27:* 14.14, Ferndale, Loleta, and Alton.  
*December 28:* 2.22, Spreckels.  
*December 29:* 5.30, Pollock, and Antler.  
*December 30:* 5.37,\* felt at Sims, Redding, Dunsmuir, and Castella.  
*December 30:* 6.00, Walteria.  
*December 31:* 17.15, near June Lake.

## WASHINGTON AND OREGON

[120th meridian, or Pacific standard time]

### WASHINGTON

- June 16:* 20.30, Elbe (46°.7 N., 122°.5 W.). Slight.  
*June 17:* 7.40, Eatonville, La Grande, and Alder (46°.8 N., 122°.3 W.). Buildings swayed, windows rattled.  
*June 17:* 23.00, Carbonado (47°.1 N., 122°.0 W.). Slight.  
*August 18:* 23.05, Sultan (47°.8 N., 121°.8 W.). Slight.  
*September 3:* 5.00, Rodna (47°.3 N., 117°.8 W.). Slight.  
*October 7:* 20.00 Lemanasky Lake. Slight.

### OREGON

- July 8:* 12.30, Perrydale. Slight.  
*July 18:* 18.38, Perrydale (45°.0 N., 123°.2 W.). Also McCoy, cracked plaster, rattled windows. Crack appeared in roadbed about one-half mile west of Perrydale.

\* After time means that earthquake has been instrumentally recorded. When only one place is named the shock is slight and local. Hour and other details not given for slight fore and after shocks. There is considerable unpublished detail available at the Washington office of the Coast and Geodetic Survey and the field station of that bureau in San Francisco, Calif. However, no important information is omitted.



## ALASKA

[150th meridian time unless otherwise stated]



- January 12:* 1.46, Matanuska ( $62^{\circ}$  N.,  $146^{\circ}.5$  W.). Slight.  
*January 22:* 14.30, Whale Island, Afognak and Kodiak Island ( $57^{\circ}.5$  N.,  $152^{\circ}$  W.). Feeble.  
*February 20:* 15.15, Matanuska. Slight.  
*February 28:* 6.38, and 6.41, Fairbanks ( $65^{\circ}.5$  N.,  $147^{\circ}$  W.). Slight.  
*March 9:* 11.30, Chernofski ( $53^{\circ}.5$  N.,  $167^{\circ}$  W.). Slight.  
*March 22:* 9.50, Fairbanks. Generally felt. Abrupt bumping.  
*April 1:* 1.28, Fairbanks. Slight.  
*April 20:* 0.15, Fairbanks. Felt by many awakened from sleep.  
*April 23:* Time unknown, probably accompanying an eruption of Shishaldin Volcano, Unimak Island.  
*April 29:* 18.55, Seward ( $60^{\circ}$  N.,  $149^{\circ}$  W.). Slight.  
*May 13:* 21.28, Whale Island. No details.  
*May 26:* 6.46 and 10.12, Matanuska. No details.  
*June 17:* 19.55, Chignik ( $56^{\circ}.5$  N.,  $158^{\circ}.5$  W.). Feeble.  
*June 20:* 20.45, Fairbanks. Generally felt.  
*June 24:* 22.05, Matanuska. Slight. No details.  
*August 2:* 15.13, Fairbanks. Slight.  
*August 12:* 15.20, Matanuska. No details.  
*August 15:* 12.50, Fairbanks. Generally felt. Walls, doors, and tables swayed.  
*September 28:* 20.05, Seward. Slight.  
*October 1:* 7.30 (120th meridian time), Juneau ( $58^{\circ}.5$  N.,  $136^{\circ}.5$  W.). Slight.  
*October 25:* 1.40, Steelmute ( $62^{\circ}$  N.,  $157^{\circ}$  W.). No details.  
*November 2:* 6.40, Chignik. Slight.  
*December 8:* 16.30 and 20.15, Circle Hot Springs ( $65^{\circ}$  N.,  $145^{\circ}$  W.). Slight.  
*December 24:* 18.58, Whale Island. No details.  
*December 26:* 2.59, Kodiak, Alaska. Three shocks.  
*December 31:* 9.41, Fairbanks. Slight.

## HAWAIIAN ISLANDS

[157½ meridian time]

NOTE.—In the case of these islands with their many earthquakes of volcanic origin only the more severe ones are listed. Reports of the Volcano Research Laboratory under the jurisdiction of the United States Geological Survey and the Hawaiian Volcano Research Association give more details.

- May 20:* 18.52, Hilo. Felt strongly on eastern side of Hawaii and also in Kona district to the west. A similar shock occurred May 25, at 20.17.  
*October 20:* 8.25, Hilo. Rattled chandeliers and threw bottles from shelves.  
*October 30:* 8.26, Waiohinu, Hawaii. Generally felt.

## PORTO RICO

[60th meridian time]

- June 25:* 8.05, San Juan and central Canovanes. Moderate.

## PHILIPPINE ISLANDS

[Time is Greenwich civil time]

Only the more important shocks are included in this report. The source (through June 30) is the seismological bulletin of the Philippine Weather Bureau. That for the second half had not been received when this publication was ready for the printer, but advance information was available from the same source.

- January 21:* 4.48, northwest Luzon ( $18^{\circ}.2$  N.,  $120^{\circ}$  E.). Force VI at Laoag. Felt from Pasaguin to Baguio.  
*January 25:* 1.40, Mindanao ( $6^{\circ}.6$  N.,  $126^{\circ}.7$  E.). Felt over the southeast section of the island.  
*May 19:* 15.06, Luzon ( $20^{\circ}.4$  N.,  $120^{\circ}.5$  E.). Felt force V at Basco, Batanes Islands, and less on the north coast of Luzon.  
*December 22:* Time unknown. Basco and northend of Luzon. Epicenter probably in Balintang Channel.



## PANAMA CANAL ZONE

[75th meridian time]



*March 7:* 22.44, Vicinity of Gulf of San Blas. Some walls were cracked at Balboa Heights and Cristobal. People rushed into the streets. Dishes were broken. Strongest shock since 1914.

*July 30:* 13.52, Balboa and Panama City. Cracks in buildings. People rushed into streets. Slight damage at Colon and Cristobal. No special damage reported from interior but widely felt. Epicenter probably 70 miles southwest of Balboa between Aguadulce and Penomone.

*September 10:* Time unknown. A series of strong shocks reported from Boquete in Chiriqui Province, Panama. Five shocks during the day and night.

## LOUISIANA EARTHQUAKE OF OCTOBER 19

This earthquake was not recorded in a satisfactory manner on any seismograph. The instruments at New Orleans and Spring Hill, Ala., were not in operation at the time. A study of the isoseismal lines indicates that the epicenter was at about  $30^{\circ}.0$  N.,  $91^{\circ}.0$  W., or about 60 miles due west of New Orleans. It was felt over an area of approximately 15,000 square miles, including some water area. The maximum intensity reached VII at a few places. As usual there were wide variations in reports from the same region. Earthquakes are almost unknown in this region. Information of interest concerning the previous history of the region has been obtained from the files of Harry Fielding Reid as follows: February 14 and 15, 1843, and April, 1882, slight shocks occurred. Also there was a slight shock on the Mississippi Delta at Burrwood on December 15, 1927. Details regarding the shock as felt at various places follow:

## INTENSITY V—VII

*Morgan City, La.*—Felt by nearly all, many awakened; small objects overturned, doors and windows rattled, rapid motion lasted about 30 seconds. Entire church rocked, congregation rushed from church but returned shortly after. Another report says ground heaved gently 6 or 7 seconds.

*Allemands, La.*—Felt by several; pictures fell, whole house shaken, rapid motion lasted about  $1\frac{1}{2}$  minutes.

*Donaldsonville, La.*—Felt by many; trees and bushes shaken moderately, hanging objects swung, walls creaked, windows rattled, rapid motion lasted 2 seconds; 2 shocks; transom window shook open. Timber roof of Ascension Catholic Church creaked loudly. Guests left 100-year-old lodging house when the structure began swaying.

*Franklin, La.*—Felt by many, many awakened; some inside objects overturned, walls creaked and windows rattled, slow motion lasted about 15 seconds; trees and bushes shaken slightly.

*Napoleonville, La.*—Felt by many, many awakened; chimneys damaged, windows broken, inside objects disturbed, furniture moved, walls creaked.

*White Castle, La.*—Felt by all, many awakened; plaster cracked, small objects overturned, walls creaked, windows rattled, rapid motion lasted 10 to 15 seconds.

## INTENSITY IV—V

*Berwick, La.*—Felt by nearly all, many awakened; inside objects disturbed, windows rattled, one pendulum clock facing west stopped; rapid motion lasted about 6 seconds.

*Covington, La.*—Felt by many; students of St. Paul's College rushed from their beds into the yard, sisters at St. Scholastica's Academy thought trembling resulted from blasting in neighborhood; nearly all residents awakened.

*Plaquemine, La.*—Felt by many, many awakened; trees slightly shaken; hanging objects moved and windows rattled; rapid motion lasted 30 seconds; glass shaken from street lights.

*Springville, La.*—Felt by all; walls creaked, windows rattled, rapid motion lasted about one minute.

*State University, 2 miles south of Baton Rouge.*—Felt by nearly all; buildings creaked, beds shaken violently, barograph pen at university made vertical mark about one-eighth inch high; alarm quite general.



INTENSITY IV

Algiers, Baldwin, Baton Rouge, Clinton, Convent, Franklinton, Houma, Lafourche Parish, New Orleans, Paincourtville, Port Allen, Port Vincent, Slidell, St. Francisville, St. Martinville, Tangipohoa Parish, Thibodaux, and Westwego.

INTENSITY III

Bayou Gonla, Bougalousa, Centerville, Hahnville, Olga, Opelousas, Lettsworth, Lutcher, Mandeville, New Iberia, New Roads, Patterson, Ramsey, Reserve, Rogillioville, and Tylertown.





## INSTRUMENTAL REPORTS ON PRINCIPAL EARTHQUAKES

## STATION SYMBOLS

APIA	Samoa.	DEN	Denver, Colo.	OTT	Ottawa, Canada.
BER	Berkeley, Calif.	GEO	Georgetown, D. C.	PAS	Pasadena, Calif.
BROM	West Bromwich, Eng- land.	HAR	Cambridge, Mass.	SIT	Sitka, Alaska.
CHA	Charlottesville, Va.	HON	Honolulu, Hawaii.	STL	St. Louis, Mo.
CHIU	Chicago, University of.	MAN	Manila, P. I.	TUC	Tucson, Ariz.
CIN	Cincinnati, Ohio.	MICH	Ann Arbor, Mich.	VIC	Victoria, B. C.
CZB	Balboa Heights, Canal Zone.	NOR	New Orleans, La.	ZIK	Zikawei, China.
		NYF	New York (Fordham).		

[Provisional epicenters are usually based on the tabulated data and preliminary reports from the additional stations listed]

Date and station	Phase	Greenwich civil time			Date and station	Phase	Greenwich civil time		
March 26					April 26				
[Origin, 7 <sup>h</sup> 12 <sup>m</sup> 05 <sup>s</sup> . Epicenter reported by Jesuit Seismological Association, 7.6° S., 124.8° E. GEO, BER, OTT, VIC, STL, PAS, APIA, MAN]					[Origin, 16 <sup>h</sup> , 18 <sup>m</sup> , 13 <sup>s</sup> . Epicenter, 50.5° N., 179.5° E. Aleutian Islands. VIC, OTT, MAN, CAM]				
Charlottesville.....	PP	H.	m.	s.	Charlottesville.....	eS	H.	m.	s.
	PS	7	34	49		eL	16	38	12
	SS		44	29		eL		47.1	
	eSSS		53	23		F		59	00
	L	8	58.2		Chicago.....	eP	16	28	26
	F		09.1			iS		36	37
Chicago.....	ePP	7	36			iS		36	31
	ePP		34	18		e		43	00
	ePS		34	31		eL		45.1	
	eSS		43	48	Honolulu.....	F	18	10	
	eSS		51	18		ePP	16	26	10
	L	8	51	38		iS		30	34
	F	9	08.4			eSS		32	14
Honolulu.....	eP	7	32			eL		33.0	
	iS		25	12		eL		34.2	
	L		34	29	Sitka <sup>1</sup> .....	F	17	35	
	L		44.8			e	16	25	00
	F	8	51.5			e		28	38
Sitka.....	eS	7	07			e		29	51
	ePS		37	31		L		33	40
	iSS		39	12	Tucson.....	F	17	36	
	eSSS		44	32		eP	16	27	36
	eL		48	16		S		35	01
	F	9	51.3			e		37	18
Tucson.....	e	7	50			e		38	34
	ePP		32	30		eL		41.3	
	eS		33	00		F	17	55	
	ePS		40	42	May 5				
	eSS		42	34	[Origin, 13 <sup>h</sup> , 45.5 <sup>m</sup> . Epicenter, 17° N., 95° E. Approximate location. OTT, MICH, STL, MAN, ZIK]				
	e		49	21	Balboa, Canal Zone.....	e	15	05	00
	eL	8	49	28		F		10	00
	eL		02	20	Charlottesville.....	PP	14	06	31
	F		03	06		ePS		16.0	
April 16						eSS		24.0	
[Origin, 14 <sup>h</sup> 30 <sup>m</sup> 12 <sup>s</sup> . Epicenter reported by Jesuit Seismological Association, probably 50° N., 132° W. VIC, STL, BER, GEO]						eL		42.0	
Charlottesville.....	e	14	46	36		eL		52.0	
	e		50.5		Chicago <sup>2</sup> .....	F	18.2		
	L		51.3			SS	14	22	44
	F	15	14			e		33	44
Chicago.....	eS	14	41	53		L		47.0	
	e		46.0			eL		54.5	
	L		46.9		Honolulu <sup>3</sup> .....	F	17	05	
	F	15	22			e	14	10	44
Honolulu.....	eL	14	45.7			e		10	25
	F	15	37			PS		12	59
Sitka.....	e(P)	14	32.6			eL		27.2	
	e(S)		34	28		eL		34.8	
	L		35	18		F	17.0		
	F	15	48			S	14	10	27
Tucson.....	P	14	35	40	Sitka.....	SS		16	56
	S		39	51		L		35.2	
	eL		41.8			F	15.8		
	eL		44.6						
	F	15	10						

See footnotes at end of table.



Date and station	Phase	Greenwich civil time			Date and station	Phase	Greenwich civil time		
May 6					June 11				
[Origin, 22 <sup>h</sup> , 34 <sup>m</sup> , 24 <sup>s</sup> . North Persia. MAN, ZIK, NYF, OTT, VIC, MICH]					[Origin, 0 <sup>h</sup> 48.7 <sup>m</sup> . Epi- center, 6° S., 144° E. Epicenter reported from Wellington. GEO, VIC, STL, APIA]				
Charlottesville.....	iSKS	H.	m.	s.	Charlottesville.....	ePS	H.	m.	s.
	eS	22	57	47		SS	1	20.5	
	eL		58	53		SS		26.4	
	F	23	15.4			SS		28.0	
Chicago <sup>4</sup> .....	iSKS	22	57	55		eL		41.0	
	S		58	19		F	3.2		
	iPS		59	18	Chicago.....	PP	1	09.9	
	eSS	23	04.5			ePS		19.5	
	eSSS		08.1			SS		26.3	
	eL		11.8			SSS		30.4	
	eL		14.0			L		39	
Honolulu.....	ePP	22	55.1			eL		42	
	ePS	23	04	10	Honolulu.....	F	3.2		
	eSS		10.5			eP	1	58.8	
	L		21.9			S	2	07	41
	eL		28.0			eL		14.0	
	F	24.5				L		16.9	
Sitka.....	ePP	22	50	50		F	3	09	
	eSP		59.9		Sitka.....	S	1	12	51
	eSS	23	05.7			SS		20.7	
	iL		23.7			L		36.2	
	F	24.5				F	3.1		
Tucson <sup>5</sup> .....	eP'	22	53	08	Tucson.....	S	1	14	15
	PP		53	21		eSS		22.1	
	SKS		59	23		iLq		31.6	
	S	23	00	35		iLr		36	38
	S		00	46		F	3	24	
	iPS		02	28					
	SS		08.0						
	eL		18.3						
	F	25.5							
May 20					June 12 <sup>8</sup>				
[Origin, 11 <sup>h</sup> 15.0 <sup>m</sup> . Epi- center, 51° N., 180° W. OTT, VIC, STL, MAN, ZIK]					Charlottesville <sup>9</sup> .....				
Charlottesville.....	S	11	35	00		eL	9	59.1	
	eL		49.0			F	10	08	
	F		46		Chicago <sup>10</sup> .....	P	9	50	42
Chicago.....	P	11	25	10		e(L)		55	12
	iS		33	16		iL		55	49
	eL		42.0			L		57	20
	F	12	44			F	10	11	
Honolulu.....	i(S)	11	27	22					
	e(L)		29.5						
	iL		30.8						
	F	12	41						
Sitka.....	P	11	25	13					
	S		29	38					
	L		31.8						
	F	13.9							
May 31					June 13				
[Origin, 10 <sup>h</sup> 21.4 <sup>m</sup> . Epi- center, 46° N., 132° W. VIC]					[Origin, 0 <sup>h</sup> 53 <sup>m</sup> 55 <sup>s</sup> . Epicenter, 52° N., 172° W. NYF, STL, MAN]				
Charlottesville.....	L	10	41.0		Charlottesville.....	eS	1	12	44
	F	11	10			L		24.7	
Chicago <sup>6</sup> .....	iL	10	38	05	Chicago.....	F	2	22	
	F		55			iS	1	11	08
Honolulu.....	L	10	36.8			e		16.1	
	F		58.0			eL		21.3	
Sitka.....	e(S)	10	26	03	Honolulu.....	F	2	26	
	iL		26	32		e(S)	1	05.7	
	F	11.9				eL		08.7	
Tucson <sup>7</sup> .....	P	10	25	32		F	2	38	
	S		29	34	Sitka <sup>12</sup> .....	e	1	02	43
	L		32			L		07.2	
	F	11.5			Tucson.....	eP	1	02	42
						P		02	37
						PP		04	34
						e		09	18
						e		09	26
						L		15.4	
						F	2	04	

See footnotes at end of table.



Date and station	Phase	Greenwich civil time			Date and station	Phase	Greenwich civil time		
June 25					July 2—Continued				
[Origin, 10 <sup>h</sup> 17 <sup>m</sup> 38 <sup>s</sup> . Epicenter, 16° S., 75° W. GEO, OTT, NYF, STL]					Tucson.....				
Charlottesville.....	eS	H.	m.	s.		PP	H.	m.	s.
	eS	10	34	17		e	21	22	50
	e		34	32		PPP		23	50
	eL		38.0			S		26	06
	F	11	43.1			ePS		29	44
Chicago.....	iS	10	14			eSS		33	32
	i		37	18		eSSS		40	40
	L		44.2			F	23.6	45	24
	L		45.0						
Honolulu.....	(S)	11	37		July 13 <sup>13</sup>				
	e	10	41.2		Charlottesville <sup>14</sup> .....				
	L	11	46.5			e	1	11	52
	F		52			i		12	48
Sitka.....	SKS	10	41.2			F		23	
	L		55.2			e?	1	06	35
	L	11	02.8			e		06	49
	F	12.0				S, L		08	05
Tucson.....	eP	10	27	54		iL		08	31
	eP		27	46		L		09	03
	iS		35	44		L		10	08
	e		37.3			F		46	
	eL		43.2		Sitka <sup>15</sup> .....	eP	1	02	49
	F	11	29			iS		06	36
June 25						iL		08	09
[Origin 12 <sup>h</sup> 05 <sup>m</sup> 45 <sup>s</sup> . Approximate epicenter, 17° N., 63° W. GEO NYF, STL]						eL		09	20
Charlottesville.....	e(P)	12	11	16		P	1	02	47
	(S)		15	08		S?		05	33
	F	13	04			S?		05	43
Chicago.....	(S)	12	17	00		eL(S)		06	26
	(L)		22.6			L		06	55
	eL		21.5			L		07	06
	F		42			L		09.0	
Sitka.....	e	12	25.1			F	1	30	
	L		39.2		July 14				
	F	13.2			[Origin, 22 <sup>h</sup> 40.2 <sup>m</sup> . Epicenter, 13° N., 89° W. GEO NYF, OTT, CAM, STL, BER]				
Tucson.....	(P)	12	14.1		Balboa, Canal Zone.....				
	(S)		20.3			P	22	43	24
	L		33			S		45	50
	F		50			L		46	34
July 2						L		47	28
[Origin, 21 <sup>h</sup> 03.6 <sup>m</sup> . Epicenter, 27.5° N., 90° E. Epicenter reported by Strasbourg. GEO, OTT, STL]						F	23	30	
Charlottesville.....	ePP	21	23	36		eP	22	46	12
	eS		30	55		ePP		47	50
	ePS		33	24		iS		50	44
	eL		51.0			L		53	00
	L	22	00.0			F	0	36	
	F	23	37		Chicago <sup>17</sup> .....	ePP	22	46	47
Chicago.....	PP	21	22	51		e		49	23
	PPP		25	34		iS		51	07
	SKS		28	54		i		53	15
	i		30	52		iL		55	10
	iPS		32	32		F	24	58	
	SS		38	47			h.	m.	s.
	L		46.7			ePPP	22	55	35
	L		57			iS	23	00	00
	F	23	48			e		01	50
Honolulu.....	PP	21	21	48		L		07	40
	S		28	25		L		10	15
	SS		35	30		F	1	30	
	L		45	00	Sitka <sup>1</sup> .....	eP	22	50	07
	F	22	48			ePP		53	00
Sitka.....	iP	21	16	35		iS		57	54
	iPP		20	05		iSS	23	01	52
	S		27	00		iL		11	59
	SS		33	34		F	2	12	
	SSS		38	50		P	22	46	12
	iL		47	20		S		50	52
	iL		50	06		L		54	08
	F	24	55.0		Tucson.....	F	1.0		

See footnotes at end of table.

International  
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Date and station	Phase	Greenwich civil time			Date and station	Phase	Greenwich civil time		
July 22					July 29				
[Origin, 19 <sup>h</sup> 26.1 <sup>m</sup> . Epicenter, 44° N., 148° E. Hukuoka reports "S. E. of Itrup Island, Tisima Islands." GEO, NYF, OTT, VIC, STL]					[Origin, 6 <sup>h</sup> 23.7 <sup>m</sup> . Epicenter, 12° N., 89° W. GEO, NYF, STL]				
Charlottesville	eP	H.	m.	s.	Balboa, Canal Zone <sup>20</sup>	e	H.	m.	s.
	iS	19	38	31	Charlottesville	F	6	27	
	eSS		49	00		P	6	29	56
	F	20	45		Chicago	F		56	
Chicago	eP	19	37	51		e	6	33	50
	eS		47	45		eS		34	44
	F	20	30			e		35	40
Honolulu	iS	19	41	40		eL		38.0	
	L		45	30		F		59	
Sitka <sup>1</sup>	F	20	25		Tucson <sup>17</sup>	eP	6	30	00
	iP	19	34	20		eS		35	09
	iS		41	09		eSS		37	38
	L		44	39		eL		40	36
	F	21	02			F	7	00	
Tucson	eP.	19	37	26	August 18				
	eS		46	57	[Origin, 9 <sup>h</sup> 53.7 <sup>m</sup> . Epicenter, 54° S., 31° W. NYF, TUC, STL, GEO]				
	eL		57	30	Charlottesville	eP	10	08.0	
	F	20	25			ePP		11.7	
July 23						eSKS		17.5	
[Origin, 0 <sup>h</sup> 09.1 <sup>m</sup> . Epicenter, 41° N., 14° E. Approximate determinations. GEO, NYF, BROM, VIC]						eSS		26	40
Charlottesville	ePPP	0	24	36		L		34	00
	eS		28	52		eL		41	20
	eSS		34.0		Chicago	F	11	33	
	eL		42.0			eP	10	11	28
	F	1	28			ePP		12	42
Chicago	eS	0	29.3			ePPP		14	50
	e		29	41		e		18	36
	e		40	58		e		20	10
	L		51	18		ePS		21.9	
	F	1	30			eSS		27.7	
Honolulu <sup>18</sup>	e	1	10.0			eL		38	50
	L		25		Honolulu	F	12	32	
	F		31			ePP	10	14.0	
Sitka <sup>1</sup>	iS	0	30	40		iPS		25	20
	eL		44	35		L		54	00
	F	1	53			F	12	00	
Tucson	eL	0	50	52	Sitka <sup>1</sup>	iP	10	13	05
	eL		51.9			iPP		16	34
	F	1	30			iSS		34	51
July 27						eSSS		39	13
[Origin, 18 <sup>h</sup> 58.2 <sup>m</sup> . Epicenter, 12° N., 91° W. GEO, NYF]						e		47	55
Balboa, Canal Zone <sup>9</sup>	e	19	02			eL		56	13
	F		40			F	12	19	
Charlottesville	eP	19	04	40	August 29				
	eS		09	00	[Origin, 8 <sup>h</sup> 27.2 <sup>m</sup> . Epicenter, 8° N., 83° W. NYF, GEO, STL]				
	eL		14.5		Balboa, Canal Zone	P	8	27	12
	F		57			S		27	44
Sitka <sup>1</sup>	iP	19	08	06		L		27	54
	iS		15	52		F		41	26
	eL		26	00	Charlottesville <sup>21</sup>	eS	8	38	44
	F		59			e		41.0	
Tucson	P	19	04	06		eL		44	16
	S		08	33		F	9	30	
	eSS		09	54	Chicago <sup>23</sup>	eS	8	39	47
	L		11	55		eSS		42.1	
	F		50			eL		45	35
						F	9	34	
					Tucson <sup>22</sup>	eP	8	34	33
						eL		44.0	

See footnotes at end of table.



Date and station	Phase	Greenwich civil time			Date and station	Phase	Greenwich civil time		
October 8					November 9—Continued				
[Origin, 10 <sup>h</sup> 19.5 <sup>m</sup> . Epicenter, 12° S., 169° E. GEO, VIC, CAM, PAS, STL, MICH, MAN]					Honolulu.....				
Charlottesville.....	ePS	H.	m.	s.		S	H.	m.	s.
	e	10	48	44		eL	19	22	46
	e		55	18		F	20	30	27.0
	eL		59	00	Sitka.....	S	19	32	15
	F	12	40	00		L		45	17
Chicago.....	IPP	10	38	18		F	20	42	
	SKS		44	27	Tucson.....	e	19	33	57
	eS		45	31		e		37	34
	eS		46	01		eL		44.0	
	iPS		47	41		eL	20	10.0	
	eSS		53	35		F	21	48	
	L	11	09.6		November 25				
	F	12	58		[Origin, 19 <sup>h</sup> 03.0 <sup>m</sup> . Epicenter, 35.1° N., 138.8° E. Epicenter reported by Jesuit Seismological Association. STL, MAN, OTT, GEO, MICH, SJU]				
Honolulu.....	iP	10	27	56	Charlottesville.....	e	19	21	00
	PP		29	30		e		27	54
	iPPP		30	24		e		34	00
	iS		34	59		e		42	38
	SS		36.8			eL		45	00
	iSSS		39.0			F	21	35	
	L		40.8		Chicago.....	eP	19	16	11
	F	12	19			ePP		20	27
Sitka.....	P	10	32	05		SKS		26	31
	S		42	20		S		27	01
	eSS		47.6			ePS		28	08
	L		54.5			SS		33	15
	F	11	42			L		45	21
Tucson.....	eP	10	32	21		F	21	58	
	eSKS		42	49		S	19	20	30
	eS		43	48	Honolulu.....	SSS		25	40
	e		47	09		L		27	20
	eSS		49.3			F	21	04	
	eL		59.2			iS	19	21	06
	F	12	22		Sitka.....	eSSS		27	40
October 17						eL		31	40
[Origin, 8 <sup>h</sup> 46.6 <sup>m</sup> . Epicenter, 33° S., 72° W. La Paz reports it destructive in Aconcagna Valley, Chile. STL, PAS]						F	22	13	
Charlottesville.....	eP	8	57	48		e	19	15	36
	iS	9	06	58	Tucson <sup>24</sup> .....	e		19	06
	e		11	31		eS		26	04
	eL		14.3			e		35	25
	F		50			eL		38	20
Chicago <sup>23</sup> .....	P	8	58	35		F	21	28	
	iS	9	07	51	November 28				
	iS <sub>e</sub> S?		08	19	[Origin, 7 <sup>h</sup> 32.5 <sup>m</sup> . Epicenter, 18° N., 105° W. GEO, VIC, MICH, STL, CAM, PAS, SJU]				
	eL		16.9		Charlottesville.....	e	7	39	16
	F		50			eS		44	20
Honolulu.....	eL	9	31.6			SS		46	50
	F		58			L		48	00
Tucson.....	iP	8	58	19		F	8	42	
	e	9	03	10	Chicago.....	eP	7	38	55
	eS		07	43		ePP		39	32
	eSSS		16	16		S		43	33
	eL		21	25		SS		45	22
	F		45			iL		47	23
November 9						F	8	52	
[Origin, 19 <sup>h</sup> 03.3 <sup>m</sup> . Epicenter, 4° S., 125° E. Revised epicenter as reported by Wellington. MAN, GEO, CAM]					Honolulu.....	L	7	53	09
Charlottesville.....	e	19	31	20		F	8	38	
	e		54.6		Sitka.....	iS	7	47	40
	eL	20	09.0			iSS		51	10
	F	21	44			eL		55	30
Chicago.....	e	19	29	40		F	8	42	
	e		34	20	Tucson.....	iP	7	36	13
	e		37	20		e		38	50
	e		41	01		eS		39	07
	e		45	50		L		39	54
	eL		55.8			F	8	47	
	F	21	47						

See footnotes at end of table.



Date and station	Phase	Greenwich civil time			Date and station	Phase	Greenwich civil time		
November 30					December 3—Continued				
[Origin, 21 <sup>h</sup> 30.5 <sup>m</sup> . Epicenter, 18° N., 106° W. MICH, NYF, BER, STL]					Chicago.....				
Charlottesville.....	eS	H.	m.	s.		eS	H.	m.	s.
	eSS	21	42	16		iPS	19	19	26
	eL		43	40		ePPS		21	51
	F	22	47	35		SS		23	30
Chicago.....	eS	21	10			eSSS		28	23
	eSS	21	41	41		L		31	40
	eL		43	28		F	21	51	40
	F	22	45	24	Honolulu.....	eS	19	30	
Honolulu.....	eL	21	33			ePS		16	50
	F	22	51	10		eL		18	14
Sitka.....	L	21	20			F	20	30.0	
	F	23	21		Sitka.....	eSKS	19	45	
Tucson.....	iP	21	34	08		ePS		15	20
	e		36	44		eSS		17	52
	eL		37	40		i		22	50
	iL		37	33		eL		29	42
	F	22	23			F	21	39	00
December 3					Tucson.....	eSKS	19	48	
[Origin, 18 <sup>h</sup> 51.8 <sup>m</sup> . Epicenter, 19° N., 96° E. BROM, NYF, STL, MAN, SJU]						ePS		17	54
Charlottesville.....	eSKS	19	17	58		e		22	31
	eS		20	28		eSS		24	44
	ePS		22	22		eL		29	18
	eSS		28	44		F	21	36	06
	eL		41	08				27	
	F	21	30						

<sup>1</sup> Nothing on N-S.<sup>2</sup> Beginning lost while changing paper.<sup>3</sup> About 6 activities appear between PS and L.<sup>4</sup> F lost during adjustment of instrument.<sup>5</sup> PS exceptionally active.<sup>6</sup> N-S record lost; short period; small amplitude.<sup>7</sup> N-S record lost. Minute marker not operating; times questionable.<sup>8</sup> STL.<sup>9</sup> Reported felt at Grover, Wyo., and near-by towns.<sup>10</sup> P extremely weak; 2 L waves sharply defined. End-on record.<sup>11</sup> End-on type.<sup>12</sup> Traces overlapping.<sup>13</sup> OTT, NYF, GEO.<sup>14</sup> Felt in Montana.<sup>15</sup> Finish lost by overlap. Time uncertain.<sup>16</sup> LN06 42, LN 08.1. End-on record.<sup>17</sup> N-S record lost.<sup>18</sup> E-W obscured by microseisms.<sup>19</sup> Slight.<sup>20</sup> Slight near-by shock.<sup>21</sup> Weak record.<sup>22</sup> Finish lost in next shock.<sup>23</sup> Last part of N-S record lost.<sup>24</sup> Several local shocks superimposed on this record.



## SUMMARY OF INSTRUMENTAL RESULTS



Date, 1930	G. C. time of origin		Region	Provisional epicenter (degrees)
	<i>h.</i>	<i>m.</i>		
Mar. 23.....	7	12.1	Sunda Islands.....	7.6 S., 124.8 E.
Apr. 16.....	14	30.2	Off Pacific coast of Canada.....	50 N., 132 W.
Apr. 26.....	16	18.2	Aleutian Islands.....	50.5 N., 179.5 E.
May 5.....	13	45.5	India.....	17 N., 95 E.
May 6.....	22	34.4	North Persia <sup>1</sup> .....	
May 20.....	11	15.0	Aleutian Islands.....	51 N., 180 W.
May 31.....	10	21.4	Off Oregon coast.....	46 N., 132 W.
June 11.....	0	48.7	New Guinea.....	6 S., 144 E.
June 12.....	9	47	Wyoming <sup>2</sup> .....	
June 13.....	0	53.9	Aleutian Islands.....	52 N., 172 W.
June 25.....	10	17.6	Chile coast.....	16 S., 75 W.
Do.....	12	05.8	Caribbean Sea.....	17 N., 63 W.
July 2.....	21	03.6	South Tibet.....	27.5 N., 90 E.
July 13.....	1	00	Montana <sup>3</sup> .....	
July 14.....	22	40.2	Central America.....	13 N., 89 W.
July 22.....	19	26.1	Tisima Islands, Japan.....	44 N., 148 E.
July 23.....	0	09.1	Italy.....	41 N., 14 E.
July 27.....	18	58.2	Off Pacific coast of Central America.....	12 N., 91 W.
July 29.....	6	23.7	do.....	12 N., 89 W.
Aug. 18.....	9	53.7	South Atlantic Ocean.....	54 S., 31 W.
Aug. 29.....	8	27.2	Off Pacific coast of Central America.....	8 N., 83 W.
Oct. 8.....	10	19.5	South Pacific Ocean.....	12 S., 169 E.
Oct. 17.....	8	46.6	Chile.....	33 S., 72 W.
Nov. 9.....	19	08.3	Near Celebes Islands.....	4 S., 125 E.
Nov. 25.....	19	03.0	Japan.....	35.1 N., 138.8 E.
Nov. 28.....	7	32.5	Mexico, west coast.....	18 N., 105 W.
Nov. 30.....	21	30.5	do.....	18 N., 106 W.
Dec. 3.....	18	51.8	India.....	19 N., 96 E.

<sup>1</sup> Felt in northwestern Persia.<sup>2</sup> Felt at Grover, Wyo.<sup>3</sup> Felt in Montana.

## MISCELLANEOUS SEISMOLOGICAL ACTIVITY

## GEODETIC WORK

During the year 1930 first-order leveling was rerun in southern California from Niland south to El Centro, from El Centro to Jacumba, and from El Centro eastward to Yuma, Ariz. The new leveling showed remarkably close agreement with the old except in three or four separate localities where divergences between the old and new leveling were larger than could reasonably be accounted for by errors in the leveling itself.

A new line of first-order levels was run from Lathrop, Calif., along the railroad to Bakersfield, Calif.

During the months April to July, 1930, observations were completed on the arc of first-order triangulation in the vicinity of Point Reyes, Calif. This triangulation extends from the coast in the vicinity of Point Reyes northeastward to the vicinity of Napa, Calif., and consists of a first-order arc with many second-order stations located in the vicinity of the fault lines.

Another arc of first-order triangulation was extended from the coast of California in the vicinity of Point Pinos northeastward to Mariposa Peak during the months August to November, 1930. Numerous stations were established with second-order accuracy along the various fault lines crossed by this arc of triangulation.





### HYDROGRAPHIC WORK

Vessels of the Coast and Geodetic Survey are directed to make reports of visible or felt effects of earthquakes. Except for two slight shocks felt in the region of San Francisco no reports were received for the period covered by this report.

### TIDAL OBSERVATIONS

Tidal records from the numerous gages on the Atlantic and Pacific coasts were examined. No records due to so-called tidal waves were found.



## PUBLICATION NOTICES

To make immediately available the results of its various activities to those interested, the Coast and Geodetic Survey maintains mailing lists of persons and firms desiring to receive notice of the issuance of charts, Coast Pilots, maps, and other publications.

Should you desire to receive such notices, you may use the form given below, checking the lists covering the subjects in which you are interested.

(Date) -----

DIRECTOR, U. S. COAST AND GEODETIC SURVEY,  
*Washington, D. C.*

DEAR SIR: I desire that my name be placed on the mailing lists indicated by check below, to receive notification of the issuance of publications referring to the subjects indicated:

- ☐ 109. Astronomic work.
- ☐ 109-A. Base lines.
- ☐ 109-B. Coast Pilots.
- ☐ 109-C. Currents.
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- ☐ 109-M. Tides.
- ☐ 109-N. Topography.
- ☐ 109-O. Triangulation.
- ☐ 109-P. Cartography.
- ☐ 109-R. Airway maps.

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A catalogue of the publications issued by all bureaus of the Department of Commerce may be had upon application to the Chief, Division of Publications, Department of Commerce, Washington, D. C. It also contains a list of libraries located in various cities throughout the United States, designated by Congress as public depositories, where all publications printed by the Government for public distribution may be consulted.