DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

United States Earthquakes, 1956

By

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and

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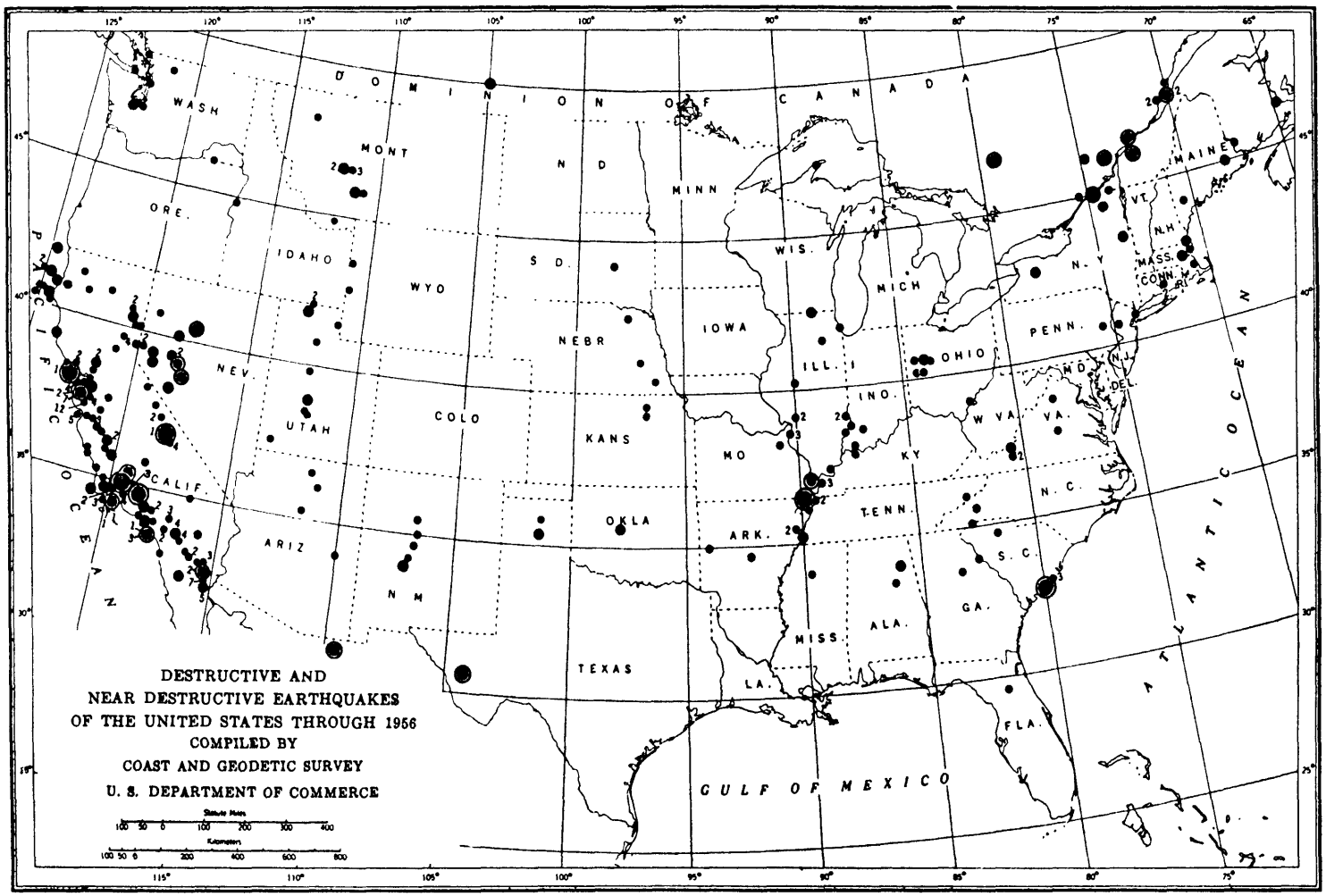

FIGURE 1.—Destructive and near destructive earthquakes in the United States through 1956.

UNITED STATES EARTHQUAKES, 1956

INTRODUCTION

This publication is a summary of earthquake activity in the United States and regions under its jurisdiction for the calendar year 1956. The sources of noninstrumental information used in the compilation include the United States Weather Bureau, whose observers prepare periodic reports on local seismic activity; telegraphic information collected by Science Service, Washington, D. C.; Bulletins of the Seismological Society of America; special reports of the Jesuit Seismological Association and the Northeastern Seismological Association; the *Hawaiian Volcano Observatory Summary;* newspaper clippings; and reports from interested individuals. Instrumental data used in locating earthquakes are obtained from the network of Coast and Geodetic Survey stations listed on page 44 and from other cooperating seismological stations in the United States and throughout the world.

The Coast and Geodetic Survey endeavors to coordinate efforts in collecting all types of earthquake information with the special object of correlating instrumental earthquake locations with noninstrumental reports received from the epicentral areas. This is done by local organizations making intensive regional investigations in California and elsewhere, and, when necessary, by the Coast and Geodetic Survey. This information serves to map the seismic areas of the country adequately and promote public safety through a better understanding of earthquake phenomena. Since the success of the general information service depends largely on the cooperation of local officials and citizens, all are urged to fill out and return earthquake questionnaires.

Earthquake information services.—The Coast and Geodetic Survey maintains a Seismological Field Survey in San Francisco to collect earthquake information and make field investigations of strong shocks in the Pacific coast and western mountain States. Details concerning damage, destruction, and other effects are enumerated in the quarterly *Abstracts of Earthquake Reports for the Pacific Coast and the Western Mountain Region.* This report is available on request from the Director of the Coast and Geodetic Survey, Washington 25, D. C. Active cooperation in this work is received from the University of California Seismographic Station, Berkeley (Dr. Perry Byerly, in charge); and the Seismological Laboratory, Pasadena (Dr. Beno Gutenberg, Director); as well as State Collaborators in Seismology. The following Collaborators served as agents of the Coast and Geodetic Survey in their respective States in 1956:

Arizona.—Dr. Eldred D. Wilson, University of Arizona, Tucson.
Colorado.—Prof. W. Warren Longley, University of Colorado, Boulder.
Montana.—Prof. Stephen W. Nile, Montana School of Mines, Butte.
Nevada.—Dr. David B. Slemmons, University of Nevada, Reno.
New Mexico.—Prof. Stuart A. Northrop, University of New Mexico, Albuquerque.
Oregon.—Dr. Ira S. Allison, Oregon State College, Corvallis.
Utah.—Prof. J. Stewart Williams, Utah State Agricultural College, Logan.
Washington.—Prof. Howard A. Coombs, University of Washington, Seattle.
Wyoming.—Prof. Horace D. Thomas, University of Wyoming, Laramie.

Among the commercial agencies on the west coast rendering valuable services are telephone, power, oil, railroad, and especially insurance companies. Certain concerns interested in the manufacture of earthquake-resistant building materials are also active together with various organizations of structural engineers and architects.

In other parts of the country the Jesuit Seismological Association with central office at St. Louis University collects information in the central Mississippi Valley area (Rev. Dr. Victor J. Blum, S. J., Dean of the Institute of Technology). The Northeastern Seismological Association with headquarters at Weston College, Weston, Mass. (Rev. Daniel J. Linehan, S. J., in charge), undertakes similar work in the northeastern States.

Modified Mercalli Intensity Scale of 1931.—All intensities used by the Coast and Geodetic Survey refer to the Modified Mercalli Intensity Scale of 1931.[1] The abridged version of this scale is given here with equivalent intensities according to the Rossi-Forel scale.

MODIFIED MERCALLI INTENSITY SCALE OF 1931

(ABRIDGED)

I. Not felt except by a very few under specially favorable circumstances. (I Rossi-Forel scale.)

II. Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing. (I to II Rossi-Forel scale.)

III. Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibration like passing of truck. Duration estimated. (III Rossi-Forel scale.)

IV. During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably. (IV to V Rossi-Forel scale.)

V. Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbance of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop. (V to VI Rossi-Forel scale.)

VI. Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight. (VI to VII Rossi-Forel scale.)

VII. Everybody runs outdoors. Damage **negligible** in buildings of good design and construction; **slight** to moderate in well-built ordinary structures; **considerable** in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motorcars. (VIII Rossi-Forel scale.)

VIII. Damage **slight** in specially designed structure; **considerable** in ordinary substantial buildings with partial collapse; **great** in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motorcars disturbed. (VIII+ to IX— Rossi-Forel scale.)

IX. Damage **considerable** in specially designed structures; well-designed frame structures thrown out of plumb; **great** in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken. (IX+ Rossi-Forel scale.)

X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river-banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks. (X Rossi-Forel scale.)

XI. Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.

XII. Damage total. Waves seen on ground surfaces. Lines of sight and level distorted. Objects thrown upward into air.

[1] Modified Mercalli Intensity Scale of 1931. Harry O. Wood and Frank Neumann, *Bulletin of the Seismological Society of America, vol. 21, No. 4, December* 1931.

Epicenter maps.—Figure 1 is designed to show the existence of destructive and near destructive earthquakes in the United States through 1956. The smallest dots indicate the shock was strong enough to overthrow chimneys or affect an area of more than 25,000 square miles (intensity VII to VIII); the largest solid dots may be associated with damage ranging from several thousand dollars to one hundred thousand dollars, or to shocks usually perceptible over more than 150,000 square miles (intensity VIII to IX); the smaller encircled dots represent damage ranging from approximately one hundred thousand to one million dollars, or an affected area greater than 500,000 square miles (intensity IX to X); the larger encircled dots represent damage of a million dollars or more, or an affected area usually greater than 1,000,000 square miles (intensity X to XII).

Figure 2 shows earthquake distribution in the United States during 1956. In a few cases where instrumental control is not satisfactory or where results of investigations are inadequate, the plotted epicenters should be considered as showing the existence of the earthquake rather than the precise location.

In figures 1 and 2, those earthquakes occurring in the California area are plotted when felt reports are received from several places. Earthquakes reported as feeble are not plotted on the epicenter map of the United States, nor are minor aftershocks plotted for heavy earthquakes in California or any other region. The number after a dot indicates the number of shocks which have occurred at or near the location, shown. Bulletins of the University of California Seismographic Station, Berkeley and the Seismological Laboratory, Pasadena, should be consulted for further details regarding epicenters and often for data on additional shocks.

The selection of isoseismal or "felt area" maps (figs. 3–10) is governed largely by the size of the area affected, the minimum radius generally being of the order of 50 miles. In the case of sharp localized shocks this means that some earthquakes of intensity VI (mostly in California) will not be shown on such maps whereas others of intensity IV and V (largely in the eastern and central areas) will be shown.

Teleseismic results.—On page 48 is a list of Survey and cooperating teleseismic stations for which the Survey publishes results. During the year the locations of 1136 epicenters were announced promptly on *Preliminary Determination of Epicenter* cards. Those desiring to receive these cards should request addition of their name to the PDE mailing list. All seismogram interpretations are published in the monthly Seismological Bulletin, MSI series, available on mailing list CGS–7 from the Director, Coast and Geodetic Survey, Washington 25, D. C. During the year 1956, MSI–145–c for the monthly bulletin for March 1951, and MSI–181 through 192 for the monthly bulletins of 1956 were issued.

Magnitude and Intensity (Damage) Ratings.—Magnitude Rating, stated according to the Gutenberg-Richter scale, is a measure of the energy-release at the focus of the earthquake, having therefore a fundamental relation to the shock. It is estimated by the analysis of seismograph records, as explained in the *Bulletin of the Seismological Society of America*, Vol. 32, No. 3, 1942. Intensity (Damage) Rating, usually expressed on the *Modified Mercalli Scale of 1931*, is a local measure of the effects on people and objects at any affected locality, being, therefore a result of many factors, including energy-release of the earthquake, distance, geological and topographic conditions, and structural properties of buildings. It varies from place to place. The two ratings are not simply comparable.

Strong-motion seismograph results.—The maintenance of a network of strong-motion seismographs and analysis of the records of destructive earthquake motions

thus obtained are functions of the Bureau in connection with a broad cooperative program of research being carried out on the Pacific Coast with a number of local organizations and institutions interested in the engineering aspects of the earthquake problem. The details of this program are described in S. P. 201, *Earthquake Investigations in California, 1934–35.*

The preliminary analyses of strong-motion records are published in the *quarterly Engineering Seismology Bulletin* which is available upon request from the Director, Coast and Geodetic Survey, Washington 25, D. C. The revised analyses are given in table 7.

Earthquake history.—A history of the more important shocks of the country appears in Serial 609, *Earthquake History of the United States.* Part I covers continental United States and Alaska, exclusive of California and western Nevada; Part II covers the stronger earthquakes of California and western Nevada. The first part was revised in 1947 and the latter in 1951.

A history of minor activity is covered largely in a series of references listed in Serial 609, in recent reports of the Coast and Geodetic Survey, and in the *Bulletin of the Seismological Society of America,* volume 29, No. 1, January 1939. The last two references give detailed information for all California earthquakes. The last one contains all information appearing in early catalogs published by the Smithsonian Institution.

A summary of the earthquake program as carried out in the United States is briefly outlined in S. P. 282, *Earthquake Investigation in the United States,* revised 1953. The major organizations and stations are listed together with a list of the independent and/or privately operated stations. This publication is available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 20 cents.

(page 7 follows)

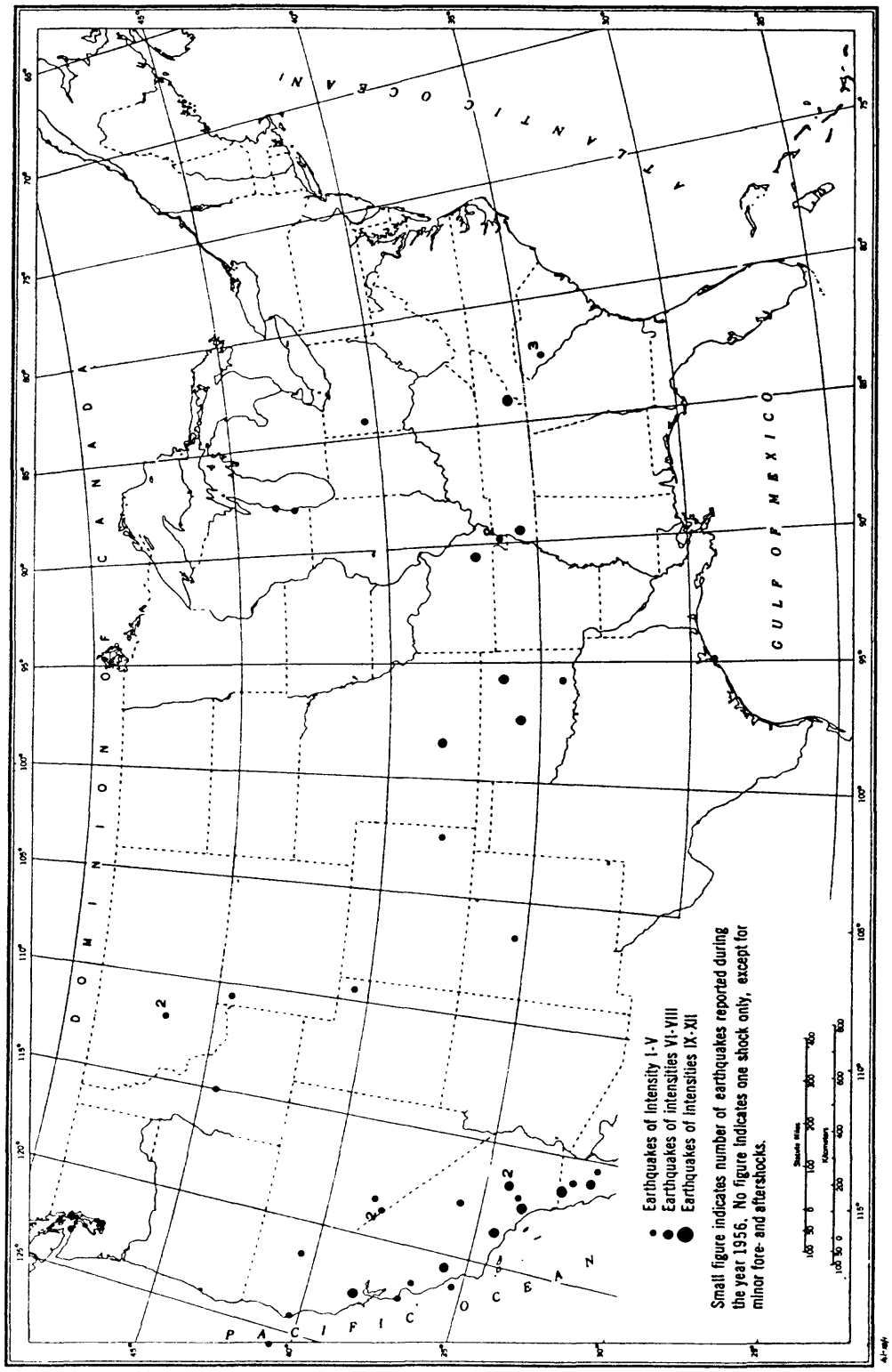

FIGURE 2.—United States earthquake epicenters, 1956.

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NONINSTRUMENTAL RESULTS

NOTE.—The following symbols are used to indicate authority for times or reported epicenters: P, reported by the Seismological Laboratory, California Institute of Technology, Pasadena; B, reported by the Seismographic Station, University of California, Berkeley; NESA, reported by the Northeastern Seismological Association, Weston, Mass.; JSA, reported by the Jesuit Seismological Association, St. Louis, Mo.; S, reported by the Seismograph Station, University of Washington, Seattle, Wash.; and W, reported by the Washington Office, Coast and Geodetic Survey.

An asterisk (*) indicates instrumental origin time of the earthquake when coordinates of the epicenter are given. Otherwise, instrumental times shown with asterisks are those of first motions.

When more than one degree of intensity is reported from a town, the town is listed under the highest intensity reported. More details will be found in the quarterly Abstracts of Earthquake Reports for the Pacific Coast and the Western Mountain Region, MSA series, issued on mailing list CGS-3 by the Coast and Geodetic Survey, Washington 25, D. C.

EARTHQUAKE ACTIVITY IN THE VARIOUS STATES

NOTE.—The intensities of the earthquakes for which no ratings are given range from I to IV.

Arizona: February 9, VI; 14, IV.

Arkansas: January 28, V; November 25, IV.

California: (Intensity V and above) January 2, VI; 3, V (2); February 6, VI; 9, VI; 14, V; 18, V; March 9, V; 18, VI (2); April 2, V; 4, VI; May 10, V; 11, V; June 4, V; July 18, V; 23, V; August 6, V; September 23, VI; October 11, V; November 10, V; 15, VI; 22, V; December 1, V.

Colorado: January 14, IV.

Idaho: August 6, V.

Illinois: March 13, IV; November 25, V.

Kansas: January 6, VI.

Kentucky: September 7, V (2); November 25, IV.

Massachusetts: September 21.

Missouri: January 23; 28, IV; October 29, V; November 25, VI.

Montana: February 2, III; March 3, IV; October 28, III; 29, III; November 18, IV; 25, IV; December 2, IV; 3, IV; 25, V.

Nevada: February 9, V; March 7, V; 19, IV; May 12, V; 27, IV; 29, IV; July 3; 5, IV; 26, V; December 31, VI.

New Mexico: April 25, V.

North Carolina: September 7, V (2).

Ohio: January 27, V.

Oklahoma: January 6, VI; February 16, VI; April 2, V; October 30, VII.

Oregon: October 11, III.

South Carolina: January 5, IV (2); May 19, IV; 27, IV.

Tennessee: January 28, VI; September 7, VI (2); November 25, IV.

Texas: October 30, IV.

Utah: February 11, IV (2).

Virginia: September 7, V (2).

Washington: January 6, V; February 8, V; 14; 24, V; April 8, IV; 26, III; December 15, IV.

Wisconsin: July 18, IV; October 13, IV.

Wyoming: March 23, IV; 30, IV; October 3, IV; November 25, III; December 12, IV; 21, V.

EARTHQUAKE ACTIVITY OUTSIDE THE UNITED STATES

Alaska: January 7 (2), 20; February 23; March 2, 25, 28 (2), 30, 31, V; April 26, 27, 28; May 7, 17, V; 18 (2), 19; June 8, IV, V; August 18; September 1, 27, 29; October 25; November 17 (2); December 6, 24 (4).

Hawaii: February 5, 18 (2); March 3, 9, 10, 29; April 15; May 13, 27; June 7, 14; July 26; August 7, 23; September 12, 26; October 11, 16 (2), 20 (2); November 13; December 14.

Panama Canal Zone: March 13; August 12, 20 (3); September 24, 25 (5); November 1, 19; December 12, 15.

Puerto Rico: February 13, V.

NORTHEASTERN REGION

(75TH MERIDIAN OR EASTERN STANDARD TIME)

September 21: Shortly before noon. Swansea, Mass. Two persons living 2 miles apart reported their houses shook.

EASTERN REGION

(75TH MERIDIAN OR EASTERN STANDARD TIME)

January 5: 03:00 and 03:30. Due West, S. C. IV. Felt by and awakened several. Buildings creaked; loose objects rattled. Disturbed objects observed by several. Trembling motion.

May 19: 14:00. Due West, S. C. IV. Felt by many. Buildings creaked; loose objects rattled. One bump, dull thud in ground, then mild creaking of building.

May 27: 18:25. Due West, S. C. IV. Felt by many. Buildings creaked; loose objects rattled. Bumping motion.

September 7: 08:36:01* and 08:49:29*. Epicenter 35½° north, 84° west, eastern Tennessee, W. VI. Moderate shocks felt over an area of approximately 8300 square miles of Kentucky, North Carolina, Tennessee, and Virginia. (See map, p. 8.) At Knoxville both shocks felt by nearly all; many alarmed. Window panes shattered; dishes broke; objects shaken from shelves; pictures fell;

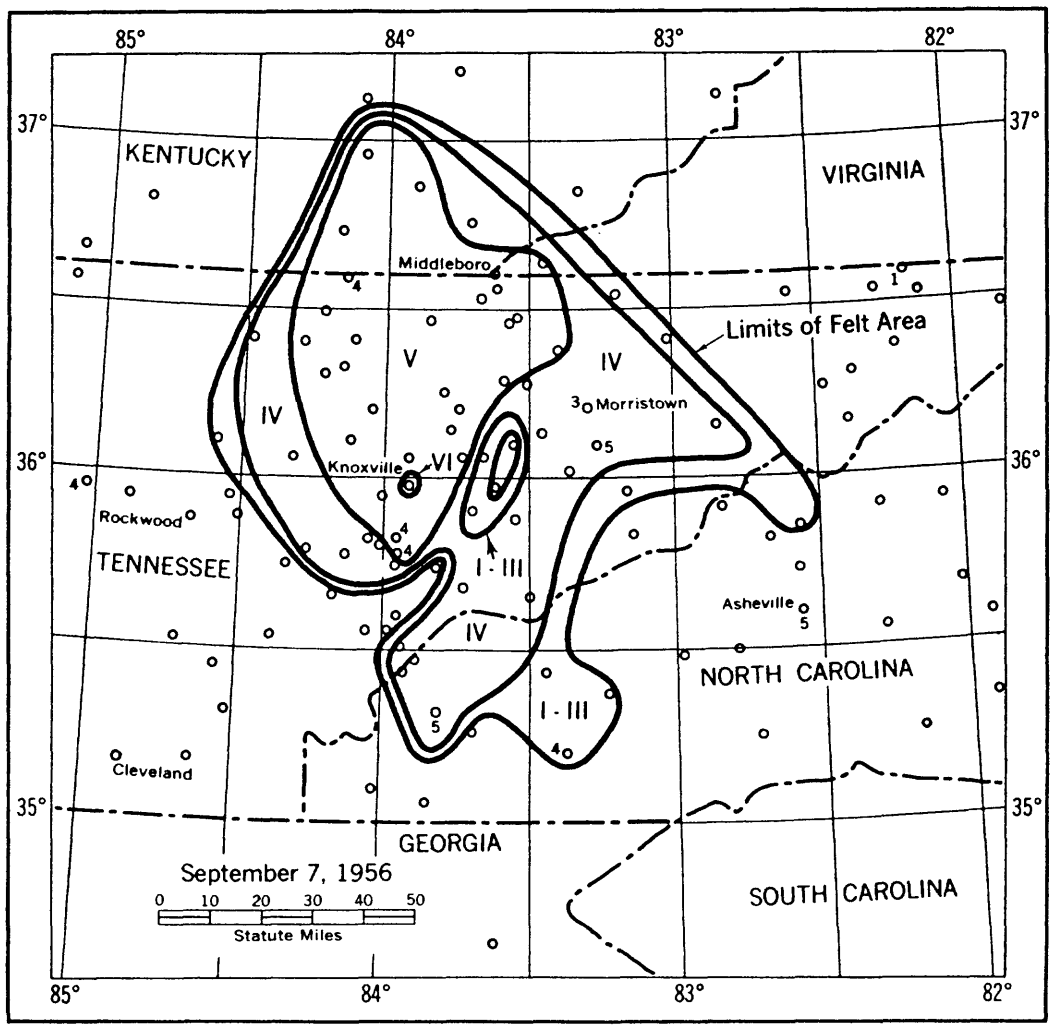

FIGURE 3.—Area affected by earthquake of September 7.

plaster knocked from walls. Radiator knocked out of place and left tilted on two legs. One report of chimney knocked down. Newspaper offices, police and radio stations, Weather Bureau, and TVA Geologic Branch were swamped with telephone calls. Many persons ran from homes fearing an explosion. "Shock felt as though the building was suddenly thrust upwards by a gas explosion or a compressed air blast." Questionnaire canvass conducted by Berlen C. Moneymaker, Chief Geologist, Tennessee Valley Authority, Knoxville, Tenn. Recorded by the seismograph at St. Louis University.

INTENSITY V IN KENTUCKY:

Barboursville.—First shock felt by nearly all; second shock by half the population. Buildings creaked; doors, windows, and dishes rattled.

Corbin.—Felt by many; few alarmed. Buildings creaked; loose objects rattled. One shock felt.

Middlesboro.—Felt by all; many alarmed. Both shocks felt. Newspaper and police switchboards swamped with calls. Houses shook; doors, windows, venetian blinds, and dishes rattled. Disturbed objects observed by many. A grandfather's clock which had not worked for some time was started by the shocks, and continued to run for several moments. No sound accompanied the first shock, but some reported a slight rumble with the second.

Williamsburg.—Felt by many; few alarmed. One shock felt. Buildings and windows shook; loose objects rattled.

INTENSITY V IN NORTH CAROLINA:

Asheville.—Both shocks felt by many; few alarmed. Weather Bureau, radio station, and newspaper switchboards flooded with calls. Vases knocked to floor and broken. Houses shook; windows and dishes rattled. Disturbed objects observed by several.

Robbinsville.—Both shocks felt. The first by nearly all; the second by few. Buildings creaked; loose objects rattled.

INTENSITY V IN TENNESSEE:

Alcoa.—Felt by nearly all indoors; many alarmed. Newspaper office flooded with calls from people seeking information about an explosion or earthquake. Two shocks, the first the strongest.

Andersonville.—First shock was felt by nearly all; second shock by several.

Arthur.—Both shocks felt by nearly all. Windows and dishes rattled. Low rumbling noise heard during earthquake.

Bearden.—Both shocks felt by nearly all. Housewife reported she was "knocked off her feet."

Caryville.—First shock felt by nearly all; second shock felt by only half the population. Windows, doors, and dishes rattled. First shock accompanied by noise like thunder.

Clinton.—Felt by many; alarmed few. Two shocks, the first the strongest. Buildings creaked; loose objects rattled. Many believed it to be an explosion.

Corryton.—Felt by all; many alarmed. Pictures on walls rattled and shook. Buildings creaked; loose objects rattled.

Cumberland Gap.—First shock felt by nearly all; second felt by several. Windows and doors rattled. On Highway 63 dishes and jars shaken from shelves.

Elk Valley.—Both shocks felt by nearly all. Windows and doors rattled. Sounds like "far off blasting" heard.

Fountain City.—Felt by and frightened many. Police station switchboard flooded with telephone calls. One observer reported the shock knocked a cup from her hand. People rushed out of the Huskey Trading Center fearing the building was about to fall. Windows and dishes rattled. Both shocks felt.

Jacksboro.—Both shocks felt by nearly all. People rushed from homes and buildings. Buildings shook; windows and dishes rattled. It was reported that a man standing on the street felt the pavement come up under his feet. A deep low rumble accompanied the first shock.

La Follette.—Both shocks felt by nearly all. Canned goods in grocery store shaken from shelves.

Lake City.—Felt by nearly all. Both shocks felt. The first the strongest.

Luttrell.—Both shocks felt by nearly all. Windows rattled. Sounded like "dynamite west of the town."

Mascot.—Both shocks felt by all; few alarmed. Buildings creaked; loose objects rattled. Thunderous sounds heard at beginning of shock.

Maynardville.—Both shocks felt by nearly all. Doors and windows rattled. Sensation like heavy objects striking building.

New Tazewell.—Both shocks felt by nearly all. Dishes shaken from shelves and broken. Floor moved; doors and windows rattled. One observer reported sounds of "falling things in apartment overhead." Many thought their furnaces had blown up. First shock was accompanied by a noise like a distant explosion.

Norris.—Both shocks felt by nearly all. The first was strong enough to cause some alarm.

Oak Ridge.—Both shocks felt by nearly all; many alarmed. Dishes shaken from shelves and broken. The first shock was the strongest. Houses shook; windows and doors rattled.

Pioneer.—Felt by nearly all. Dishes and windows rattled. One shock felt.

Speedwell.—Both shocks felt by nearly all.

Tazewell.—Both shocks felt by and alarmed many. Buildings shook; loose objects rattled. Disturbed objects observed by many. Many thought their furnaces had exploded. Low rumbling sounds heard following each shock.

Thorn Hill.—First shock felt by nearly all; second shock by few. Described as a hard jolt.

White Pines.—Felt by many. Two shocks. Groceries shaken from shelves. Disturbed objects observed by several. Buildings creaked; loose objects rattled.

INTENSITY V IN VIRGINIA:

Ewing.—Both shocks felt and heard by nearly all. Windows and doors rattled. A rumbling noise accompanied both shocks.

INTENSITY IV IN KENTUCKY: Pineville.

INTENSITY IV IN NORTH CAROLINA: Fontana Dam, Franklin, and Tapoco (Old Field Gap 2 miles from).

INTENSITY IV IN TENNESSEE: Burlington, Calderwood, Crossville, Dandridge, Friendsville, Gatlinburg, Greeneville, Huntsville, Jefferson City, Jellico, Lenoir City, Maryville, Mentor, Oliver Springs, Rockford, Rutledge, Sevierville, Strawberry Plains, Townsend, Wartburg, and Washburn.

INTENSITY I TO III IN NORTH CAROLINA: Andrews, Bryson City, Mars Hill, and Sylva.

INTENSITY I TO III IN TENNESSEE: Bristol (near Tri-City Airport), Morristown, Newport, Pumpkin Center, Rogersville, Seymour, and Sneedville.

INTENSITY I TO III IN VIRGINIA: Ewing (3 miles west of).

September 9: 16:45. College Grove, Tenn. IV. Felt by many. People rushed from homes thinking there had been an explosion. Windows rattled; houses shook. Deep rumbling underground noises heard by many.

CENTRAL REGION

(90TH MERIDIAN OR CENTRAL STANDARD TIME)

January 6: 05:57:59*. Epicenter 37¼° north, 98½° west, southern Kansas, W. Felt over an area of approximately 16,000 square miles of south central Kansas and northwestern Oklahoma. (See map, p. 11.) Maximum intensity VI. Minor damage at Coldwater and Medicine Lodge, Kansas, and at Alva, Oklahoma.

INTENSITY VI IN KANSAS:

Coldwater.—Felt by nearly all; many awakened; few alarmed. Minor cracking of walls in new motel. One chimney damaged. Baby buggy rolled across floor; shovels leaning against walls knocked down; and birdcage door shaken open.

Medicine Lodge.—Felt by all; awakened and alarmed many. Slight damage to chimney; bricks loosened in old building. Press reported many shaken from beds. Building swayed.

Wilmore.—Felt strongly. Old cracks in school building reopened and small amounts of plaster fell to floor.

INTENSITY VI IN OKLAHOMA:

Alva.—Felt by, awakened, and frightened many. Plaster shaken from wall. Book thrown off nightstand; bottle on shelf overturned. Furniture "jiggled" across floor. Houses shook; windows and dishes rattled.

Buffalo.—Felt by and awakened all. Houses shook.

INTENSITY V IN KANSAS:

Coates.—Felt by many. Cracks in east-west wall showed new movement and some extension. Paint cans knocked from shelves; tennis racket shook off wall. Wall plaques and pictures moved; dishes rattled violently. One observer reported he thought the north wall of his home was falling in. Several likened the motion to a truck or car striking the house.

Greensburg.—Felt by and frightened many. Disturbed objects observed by many.

Hardtner.—Felt by and awakened many. Houses shook; windows and dishes rattled. A filling station operator reported a distinct motion to the cement slab floor, and a cracking or popping noise in plate glass window.

Jetmore.—Felt by and awakened many. One report of crack in wall, not noticed before. Buildings shook; loose objects rattled.

Kiowa.—Felt by and awakened many. Police chief said it shook "half the people out of bed and the other half jumped out." Doors opened; dishes rattled. Some thought it was an explosion.

La Crosse.—Felt by several. Pendulum clock stopped; 11-inch pendulum swung south to north. Small clock dropped from wall. Beds swayed. Buildings creaked; loose objects rattled.

Larned.—Felt by and awakened many; few alarmed. Many calls to newspaper office. Buildings shook; windows and dishes rattled; beds rocked; and light fixtures swung.

Macksville.—Felt by nearly all; many awakened; few alarmed.

Pratt.—Felt by, awakened, and frightened many. Police, fire, and radio stations, and newspaper switchboards swamped with calls. Houses shook; beds and chairs moved; numerous parakeets reported thrown from perches; other pets reported uneasy. Chandeliers, curtains, pencils on desk, etc., moved east to west.

St. John.—Felt by and awakened many. Buildings creaked; loose objects rattled.

Stafford.—Felt strongly. Door flew open and floors shook.

INTENSITY V IN OKLAHOMA:

Alva (5 miles west and 4 miles north of).—Felt by several. Houses shook; pictures knocked askew; furniture moved across the floor. One observer reported he was knocked out of bed.

Fairview.—Felt by many. Plaster cracked. Buildings creaked; loose objects rattled.

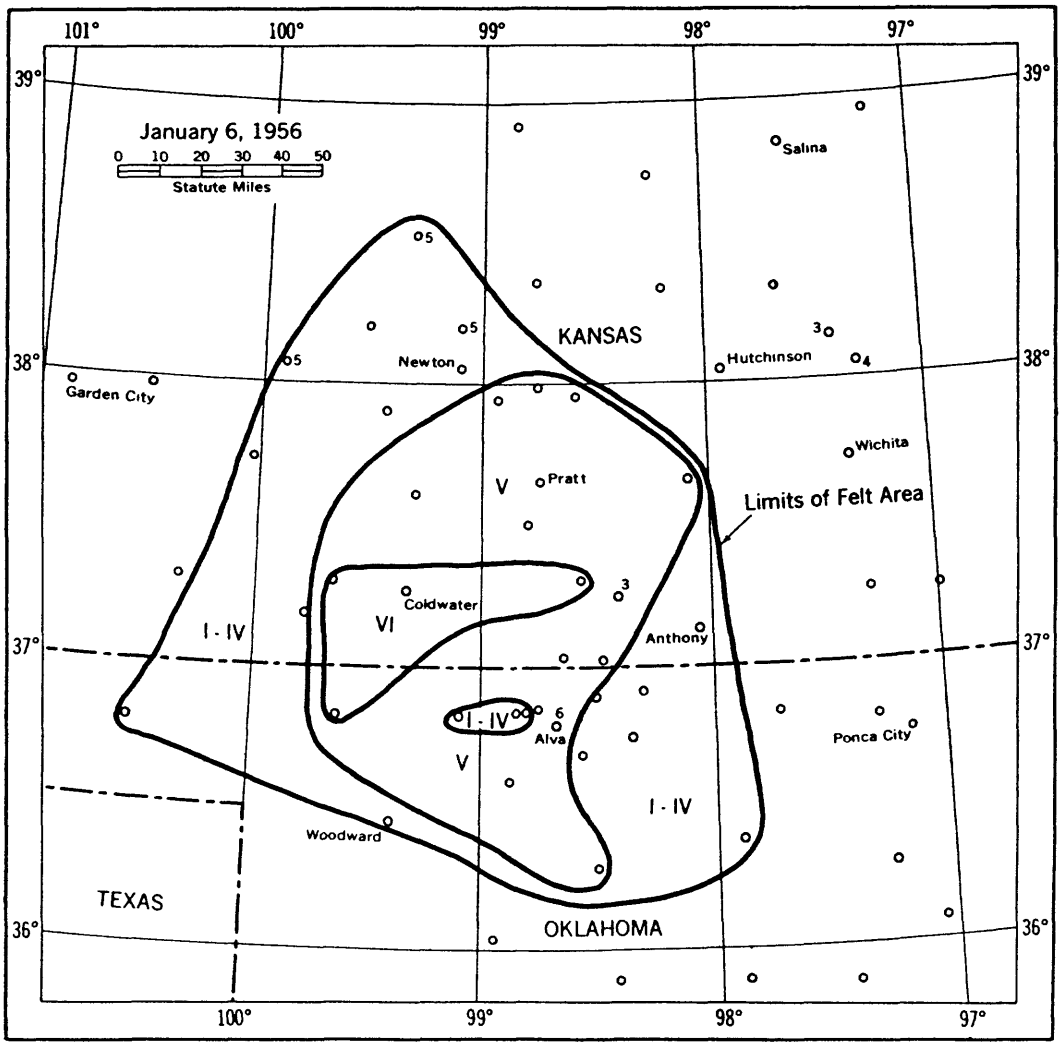

FIGURE 4.—Area affected by earthquake of January 6.

Waynoka.—Felt by majority of population. Buildings creaked; loose objects rattled. One observer reported she "thought all the windows would fall out."

INTENSITY IV IN KANSAS: Anthony, Ashland, Harper, Kingman, Kinsley, Larned (3 miles east of), Larned (9 miles south and 3 miles west of), Newton, and Zook.

INTENSITY IV IN OKLAHOMA: Alva (7 miles west and 4 miles north of), Alva (9 miles west and 4 miles north of), Burlington, Capron, Cherokee, Freedom, Perry, and Woodward.

INTENSITY I TO III IN KANSAS: Attica, Burdett, Dodge City, Hanston (11 miles east of Jetmore), and Sharon.

INTENSITY I TO III IN OKLAHOMA: Dacoma and Enid.

January 7: (no time given). Galveston Island, Tex. IV. Felt by many. Houses shook; windows and dishes rattled. Radio station switchboard flooded with inquiries.

January 23: 23:00. Caruthersville, Mo. Felt.

January 27: 06:03:26*. West central Ohio. V. Felt by, awakened, and frightened many at Anna, Botkins, Elmview (near Lima), Kettlersville, Lima, Port Jefferson, Quincy, and Sidney. Buildings shook; windows and dishes rattled. Disturbed objects observed by several. Felt by many at DeGraff, Middleburg, Saint Marys, Wapakoneta (few alarmed), and West Liberty where buildings creaked; loose objects rattled. Felt with intensity III at Bellefontaine and Fort Wayne, Ind. Recorded by the seismograph at John Carroll University and the amateur seismograph of Jacob E. Zint at Wapakoneta.

January 28: 22:14:15*. Epicenter 35°38′ north, 89°36′ west, Tennessee-Arkansas border, JSA. Covington, Tenn. VI. Felt by, awakened, and frightened many at Covington. Minor damage: few chimneys cracked and a few cracked walls. Buildings creaked; loose objects rattled. Intensity V at Henning, Tenn., where press reported some residents left homes. One report of cracked walls. Dishes and boxes on shelves displaced. Disturbed objects observed by many. Buildings creaked; loose objects rattled. Visible swaying of buildings and trees. The postmaster said it was the most frightening earthquake in the memory of the residents of the town. (See Earthquake Notes, Vol. XXVII, No. 4, December 1956, Tentative Velocities of Seismic Crustal Waves in the Central United States, by Otto W. Nuttli.)

INTENSITY V IN ARKANSAS:

Amorel.—Felt by nearly all; many awakened. House shook; rumbling noise like thunder.

INTENSITY V IN TENNESSEE:

Brighton.—Felt by nearly all. Houses trembled; beds swayed; pans and dishes rattled. Thunderous sounds heard.

Finley.—Felt by and alarmed several. Furniture and pictures displaced. Buildings creaked; loose objects rattled. Moderately loud bumping sounds heard.

Fort Pillow.—Felt by all; awakened few; few alarmed. Buildings shook; windows and dishes rattled.

Ripley.—Felt by nearly all; many awakened; few alarmed. Buildings shook; loose objects rattled. Roaring sounds like thunder heard before the earthquake. Rocking motion—north to south.

INTENSITY IV IN ARKANSAS: Blytheville, Hulbert, and Osceola.

INTENSITY IV IN MISSOURI: Braggadocio, Caruthersville, Deering, and Hayti.

INTENSITY IV IN TENNESSEE: Drummond, Jackson, Memphis, and Munford.

INTENSITY I TO III IN ARKANSAS: Driver, Lepanto, Luxora, Tomato, Victoria, West Memphis, and Wilson.

INTENSITY I TO III IN TENNESSEE: Ashport, Barr, Brownsville, Burlison, Cordova, Elbridge, Fulton, Gates, Mason, Millington, Miston, Tipton, and Whitehaven.

February 16: 17:30. Edmond, Okla. VI. Felt by and alarmed many. Few windows broken and plaster cracked. Pictures tilted; buildings creaked; and loose objects rattled.

INTENSITY V:

Guthrie.—Felt by and alarmed many. Sounds similar to distant explosion heard by many.

Oklahoma City.—Felt by and alarmed all. Police, newspaper, radio, and television switchboards swamped with calls of inquiry. Houses shook; pictures moved; windows rattled. Described as a "crackling noise followed by two loud booms," or "an airplane exploding in the air."

Pawnee.—Felt by many. Cracks enlarged in high school building. Doors swung open to the south. Buildings creaked; loose objects rattled. Sounded like distant jet at beginning of earthquake.

INTENSITY I TO IV: Big Cabin, Chickasha, Cushing, Duncan, Shawnee, and Stillwater.

March 13: 09:05. Fulton County, Ill. IV. Felt by many at Abingdon, Adair, Canton, Ellisville, Industry, Ipava, Table Grove (few alarmed), and Vermont, where buildings shook; windows,

doors, and loose objects rattled. Thunderous roaring sounds heard. Trembling motion. Also felt at Dunfermline.

April 2: 10:03:18*. Southeastern Oklahoma. V. Felt by and alarmed many at Antlers. Objects fell from kitchen wall. Buildings shook; windows and loose objects rattled. Thunderous, rattling, and bumping noises heard by many. Felt at Broken Bow, Idabel (pictures moved on walls), Hugo (telephone service temporarily interrupted), Sawyer, Sobol, and Valliant, where buildings creaked; dishes, windows, and loose objects rattled. Also felt at Corinne and Farris. Recorded by the seismograph at the University of Arkansas.

July 18: 15:30–17:00. Oostburg, Wis. IV. Series of earth tremors shook the lake shore area of Lake Michigan east of Oostburg. Scores of persons in the vicinity were apprehensive as windows and dishes rattled, and houses shook. Recorded by the seismograph at the Nunn Bush Shoe Co., Milwaukee, Wis.

October 13: (no time given). Milwaukee, Wis. IV. Felt by many in an area extending from Milwaukee to Racine. Loud rumbling sounds heard by many.

October 29: 03:23:44*. Caruthersville, Mo. V. Felt by and awakened many. Houses shook. Sounded like an explosion. Recorded by the seismograph at Saint Louis University.

October 30: 04:36:21*. Northeastern Oklahoma. Felt over an area of approximately 3700 square miles. (See map, p. 13.) Maximum intensity VII at Foster Ranch, just west of Catoosa, where oil well Coshow's No. 2 was shut down by a slippage of the formation and sticking of tools. Recorded by seismograph at St. Louis University, Southern Methodist University, University of Arkansas, and South Dakota State School of Mines.

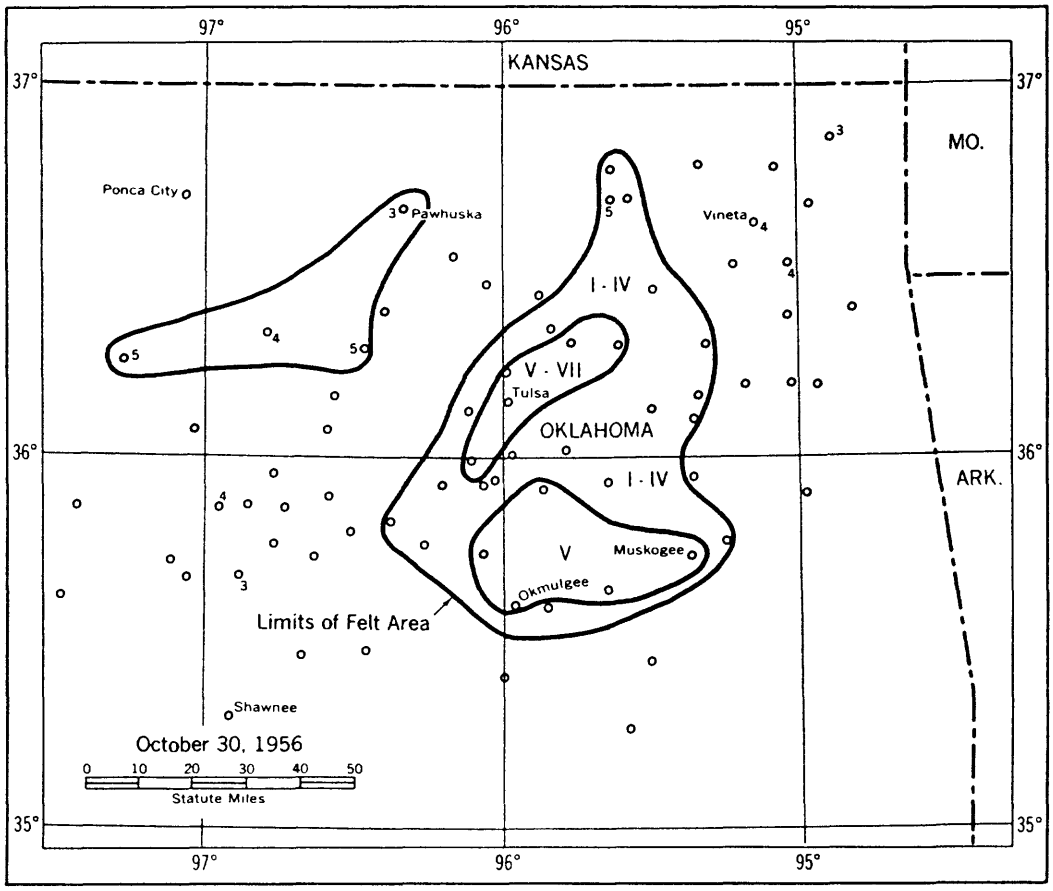

FIGURE 5.—Area affected by earthquake of October 30.

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INTENSITY VI IN OKLAHOMA:

Tulsa.—Felt by, awakened, and alarmed many. Minor damage: one cracked foundation, plaster cracks in one home, and chipped cups and saucers in a few cafes were reported. Police, fire department, radio stations, and newspaper offices flooded with calls of inquiry. Attendants at St. Johns and Hillcrest hospitals reported articles on tables and desks moved; lights and ceiling fans swayed; beds rocked; and tables "danced." Buildings trembled violently.

INTENSITY V IN OKLAHOMA:

Beggs.—Felt by and awakened many. One report of cracked plaster. Buildings creaked; loose objects rattled. Thunderous sounds, as if distant thunder or explosion, heard 1 or 2 seconds before earthquake.

Bixby.—Felt by and awakened many. Buildings creaked; loose objects rattled. Thunderous sounds heard by many.

Boynton.—Felt by and awakened many. Windows rattled. Moderate bumping sounds heard by many.

Claremore.—Felt by and awakened many. Houses shook; windows rattled. Jarring motion. Roaring sounds heard at beginning of earthquake.

Cleveland.—Felt by several. Beds and child's crib displaced. Buildings creaked; loose objects rattled. Trembling motion. Rattling sounds heard.

Muskogee.—Felt by and awakened many. Clock on table moved visibly. Buildings shook.

Nowata.—Felt by and awakened many. Houses shook; door jarred open. Muffled roar like "popping noise." Many reported it felt like something hit the house.

Oakhurst.—Felt by all. Houses rocked. Thunderous sounds heard by many at beginning of earthquake. Many thought it was an explosion at one of the refining furnaces.

Okmulgee.—Felt by and awakened many. Overhead garage door shaken loose by the earthquake came crashing down. Thunderous sounds heard by many.

Perry.—Felt by and awakened many.

Sapulpa.—Felt by and awakened many. Houses shook; windows and loose objects rattled. The press reported sounds like thunder; a blast like an explosion; a dull thud like some of the children falling out of bed; and something heavy striking the house. Trembling motion.

Turley.—Felt by and awakened many. Buildings creaked; windows and loose objects rattled. Sound like thunder heard.

INTENSITY IV IN OKLAHOMA: Bristow, Broken Arrow, Chouteau, Collinsville, Coweta, Delaware, Glenpool, Inola, Jenks, Ketchum, Miami, Morris, Mounds Creek, Nowata (1½ miles east of), Pawhuska, Pawnee, Pryor, Sand Springs, Skiatook, Slick, Tryon, and Vinita.

INTENSITY IV IN TEXAS: Electra.

INTENSITY I TO III IN OKLAHOMA: Avant, Chandler, Fort Gibson, Foyil, Kiefer, Mazie, and Sparks.

November 25: 22:12:44*. Epicenter 37.1° north, 90.6° west, Wayne County, Mo., JSA. VI. Felt over an area of approximately 21,500 square miles of Arkansas, Illinois, Kentucky, Missouri, and Tennessee. (See map, p. 15.) Minor damage occurred at Grubville, Richmond Heights (suburb of St. Louis), St. Louis, Mo., where windows were shattered and walls cracked, and at Sturdivant, Mo., where concrete porch was cracked. Police and newspaper switchboards swamped with calls of inquiry. Many persons thought there had been an explosion.

INTENSITY V IN ILLINOIS:

Wood River.—Felt by all. Houses shook. Sounded like a heavy truck had crashed in front of house.

INTENSITY V IN MISSOURI:

Coldwater.—Felt by nearly all. Houses and floors shook; rumbling noises heard by many.

Frohna.—Felt by nearly all. Houses shook. Rocking motion.

Fruitland.—Felt by all. Windows rattled. Swaying motion.

Hendrickson.—Felt by all. Felt like small explosion followed by what seemed to be a tremendous blast. Some thought the gas plant had blown up.

Lowndes.—Felt by nearly all. Houses quivered. Sounded like a gun blast.

Mill Spring.—Felt by nearly all. Houses shook. Loud rumbling sounds heard by many.

Poplar Bluff.—Felt by nearly all. Police switchboards swamped with calls. Slight rumble accompanied the tremor.

Scopus.—Felt by all who were awake. Houses shook. Sounded like heavy thunder.

Vulcan.—Felt by all. Windows and doors rattled. Roaring sounds heard by many.

INTENSITY IV IN ARKANSAS: Pocahontas.

INTENSITY IV IN ILLINOIS: Alton, Ava, Cairo, Coello, Creal Springs, Du Quoin, Ellis Grove, Hecker, Hurst, Makanda, Marine, Marion, Millstadt, Mitchell, Mounds, Mulkeytown, Murphysboro, Nashville, Percy, Pomona, Sandoval, Tamms, Tilden, Villa Ridge, Whittington, Willisville, and Wolf Lake.

INTENSITY IV IN KENTUCKY: Arlington, Bardwell, and Hickman.

INTENSITY IV IN MISSOURI: Affton, Ballwin, Bell City, Bernie, Bonne Terre, Brunot, Buckhorn, Cape Girardeau, Cascade, Centerville, Clayton, Clubb, Davisville, Doe Run, Doniphan, Dudley, Eunice, Fenton, Festus, Fisk, Fredericktown, Friedheim, Gideon, Gipsy, Grandin, Greenville, Herculaneum, Houston, Irondale, Ironton, Jackson, Jaywye, Ladue, Leasburg, Leadwood, Leeper, Lesterville, Longtown, McGee, Millcreek, Moselle, Morely, New Haven, Oak Ridge, Old Appleton, Pacific, Patterson, Perkins, Piedmont, Pocahontas, Redford, Reynolds, Rich Fountain, Risco, Rock Hill, Saint Charles, Saint Charles (3 miles west of), Saint Marys, Sikeston, Silva, Sligo, Ste. Genevieve, University City, Wappapello, Wardell, Webster Grove, Williamsville, Wittenberg, Womack, and Zion.

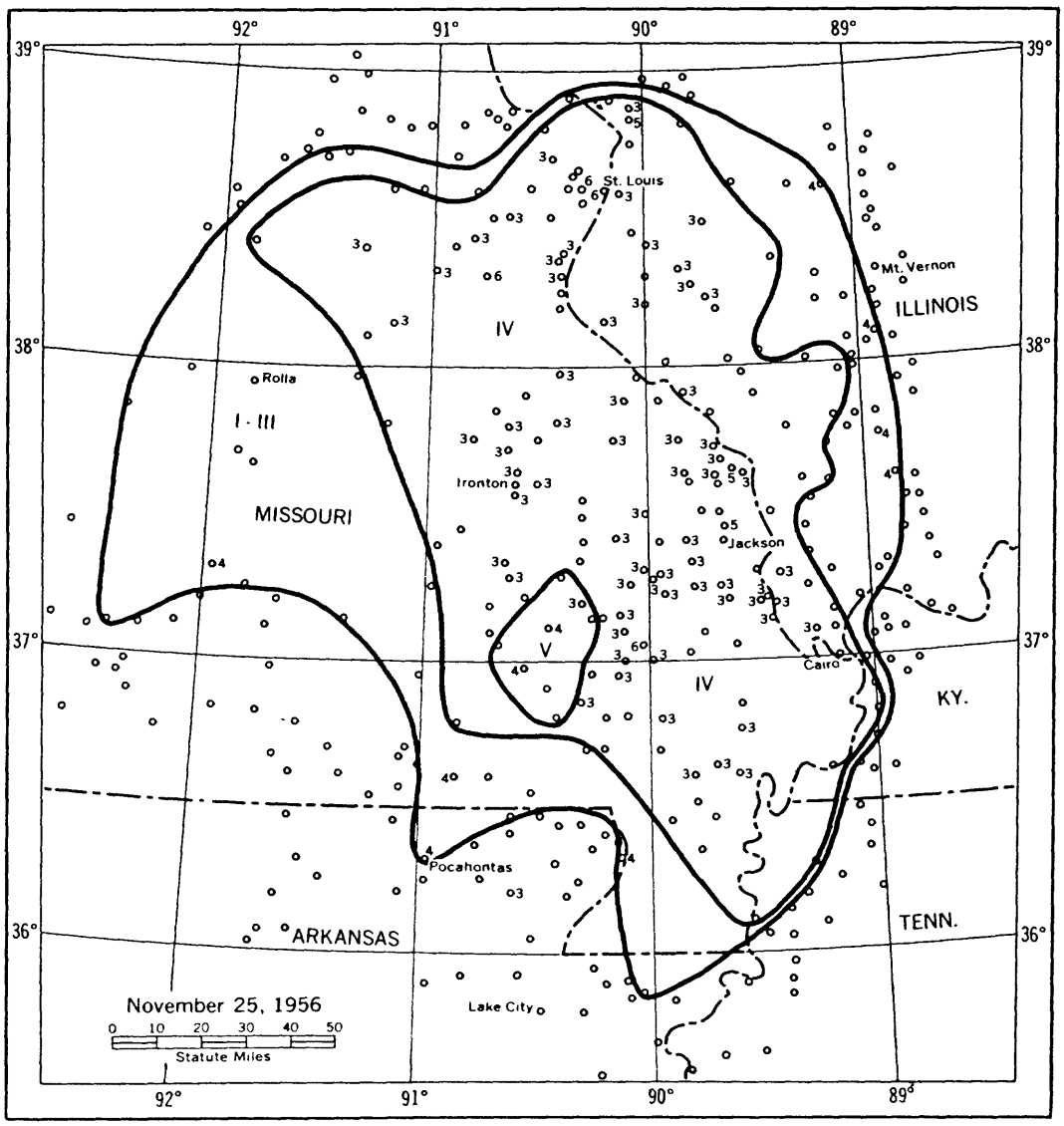

FIGURE 6.—Area affected by earthquake of November 25.

INTENSITY IV IN TENNESSEE: Boothspoint and Hornbeck.

INTENSITY I TO III IN ARKANSAS: Beech Grove, Dell, Nimmons, Success, and Twist.

INTENSITY I TO III IN ILLINOIS: Aviston, Belknap, Cache, Carbondale, Carterville, Chester, Christopher, Cobden, Cutler, Dubois, East Alton, East Saint Louis, Fults, Herrin, Huey, Johnston City, Jonesboro, Karnak, Lenzburg, McClure, Marissa, Mascoutah, Millcreek, New Athens, Olmsted, Radom, Red Bud, Rockwood, Sesser, Smithton, Thebes, Ullin, Valier, and Waltonville.

INTENSITY I TO III IN KENTUCKY: Clinton and Wickliffe.

INTENSITY I TO III IN MISSOURI: Allenville, Altenburg, Annapolis, Arab, Arcadia, Banner, Barnhart, Biehle, Bismarck, Brazeau, Brogg City, Broseley, Burfordville, Caledonia, Catawissa, Catron, Chaffee, Clearwater, Commerce, Cooper Hill, Des Arc, Dexter, Dixon, Dutchtown, Edgar Springs, Ellington, Eminence, Eureka, Farmington, Farrar, Fornfelt, French Village, Gerald, Glenallen, Gordonville, Grassey, Hiram, Illmo, Imperial, Iron Mountain, Kinder, Lenox, Leopold, Leora, Lilbourn, Lodi, Lutesville, McKittrick, Marble Hill, Marquand, Marthasville, Maryland Heights, Matthews, Menfro, Millersville, Neelyville, New Wells, Norwood, Oxly, Parma, Patton, Perryville, Pevely, Pilot Knob, Ponder, Portage des Sioux, Puxico, Rhineland, Richland, River aux Vases, Rombauer, Roselle, Saint Albans, Saint Clair, Sherman, Steelville, Sullivan, Uniontown, Van Buren, Whitewater, Yukon, and Zalma.

WESTERN MOUNTAIN REGION

(105TH MERIDIAN OR MOUNTAIN STANDARD TIME)

January 14: 11:49. Southeastern Colorado. IV. Felt by many at Lamar, described as fairly sharp, causing considerable excitement and some alarm. Disturbed objects observed by several. Two shocks; motion bumping and trembling; abrupt onset. Faint rumbling earth noises heard by many. Slight tremble, accompanied by roaring earth noises, felt by a number of persons at Springfield. Creaking of buildings and rattling of loose objects heard by few; disturbed objects observed by few. Shock at 11:40 also felt.

February 2: 08:02. Helena, Mont. (southeast section). III. Rapid vibration felt by several. Loud roaring heard.

February 11: 20:00, 21:15 (about). Vernal, Utah (southeast section). IV. Generally felt. Pictures on north-south walls knocked askew. Rattling of loose objects heard by several. Two tremors about 1 minute apart at 21:15; motion trembling, lasting few seconds.

March 3: 07:04. Helena, Mont. (west section). IV. Felt by many; awakened few. Creaking of buildings and rattling of loose objects heard by several. Vibration only, lasting 3–4 seconds, gradual onset.

March 23: 20:30. Yellowstone National Park, Wyo. (Yellowstone Lake). IV. Felt by several sitting and active in home; awakened all in home.

March 30: 00:16:10*. Epicenter near Yellowstone National Park, Wyo., W. Yellowstone National Park (Mammoth). IV. One rapid jar, causing lamps to shift, felt by several and awakened few in community.

April 25: 20:30. New Mexico. Sandia Mountains, east of Albuquerque. V. Felt by at least three families at Placitas, about 17 miles north of Tres Pistolas-Tijeras area. Muffled, explosivelike noise heard, followed immediately by a distinct jolt. Floor and couch on which observer was sitting seemed to fall about an inch then bounce back. Pictures knocked askew. Dogs barked. "Some new cracks in outside plaster may have occurred." Awakened many and frightened few in Tijeras Canyon (east of Albuquerque) where windows, doors, and dishes rattled. Felt by several sitting and active in home in Tres Pistolas Canyon. Doors rattled; windows and walls shook; roof creaked.

May 27: 07:45. Boulder City, Nev. (Hoover Dam Power Plant). IV. Felt by many. Motion rapid.

May 29: 08:02. Boulder City, Nev. (Hoover Dam Power Plant). IV. Felt by many. Motion rapid.

August 6: 21:05:52*. Epicenter 44½° north, 115° west, western Idaho, W. Felt over an area of approximately 1,200 square miles of southwest-central Idaho. Maximum intensity V. Slight damage at Stanley; windows cracked.

INTENSITY V:

Cape Horn Guard Station.—Described as severe shock. Shock also felt at 20:20.

Redfish Lake Lodge (at base of Sawtooth Range).—Very strong shock. Felt by and frightened all; everyone left cabins and main lodge. Rapid motion from north-south. Faint earth noises from north-south heard by many 10 seconds before shock.

Sawtooth Lodge.—Felt by all. Windows and dishes rattled. Motion rapid. Also felt at Guard Station, 10 miles west of Sawtooth Lodge.

Stanley.—Felt by several; awakened and frightened few in community. Damage slight. Windows cracked; small objects shifted. Motion slow. Shock also felt about 20:30, and one during night which awakened some persons.

INTENSITY IV: Atlanta.

INTENSITY I TO III: Alturas Lake area, Challis (two shocks).

October 3: 13:21:40*. Epicenter 41.5° north, 110.1° west, southwestern Wyo., W. Opal. IV. Felt by many; frightened few. Windows, doors, and dishes rattled; walls creaked. Trees, bushes shaken slightly. Hanging objects swung. Loud earth noises from west heard 1 second before shock. Motion rapid.

October 28: 14:21. Helena, Mont. (Kenwood area). III. Felt by several in community. Motion slow, lasting 1½ seconds.

October 29: 08:11. Helena, Mont. (Kenwood area). III. Shock described as "stronger than yesterday's tremor" felt by several in community. Motion slow, lasted 3 seconds.

November 18: 23:18:23*. Helena, Mont. IV. Double jolt, lasting about 3 seconds, accompanied by heavy rumble and some vibration, awakened some in Helena. At the Weather Bureau Airport Station, felt by many; awakened and frightened few in community. Windows rattled; walls creaked. Vibration also felt by few at 23:23. Recorded on Butte, Mont., seismograph.

November 25: 18:02. Helena, Mont. (Kenwood area). IV. Light vibration, lasting 2 seconds, felt by observer. Building creaked; loose objects rattled. Loud rumble heard.

November 25: 20:12. Yellowstone National Park, Wyo. (Lake Ranger Station). III. Felt by three persons. Building moved; hanging objects swung. Motion rapid, lasting less than 1 second.

December 2: 14:30. Vandalia, Mont. (3 miles north of, Milk River Valley). IV. Cattle stopped grazing and stampeded about pasture.

December 3: 20:37. Swan Lake, Mont. IV. Rapid motion from south-southeast, lasting fraction of second, felt by several in community and awakened few in home. Windows rattled. Electric lights flickered at one place.

December 12: 04:35. Yellowstone National Park, Wyo. (Lake Hotel). IV. Rapid motion felt by observer lying down in home. Frame creaked.

December 21: 09:33 and 09:48. Yellowstone National Park, Wyo. (Lake Hotel). V. Rapid motion from north felt by several in home and by observer outdoors active; frightened few. Small objects shifted. Trees, bushes shaken moderately. Rumbling earth noises.

December 25: 06:57:55*. Helena, Mont. V. Described as a strong, sharp, double jolt. Felt by and awakened many in community; frightened few. Windows, doors, dishes, and loose objects rattled; buildings creaked. Rumbling earth noises heard by several at time of shock. Recorded on Hungry Horse, Mont., seismograph.

CALIFORNIA AND WESTERN NEVADA

(120TH MERIDIAN OR PACIFIC STANDARD TIME)

NOTE.—All places are in California unless otherwise stated. The *Bulletin of the Seismological Society of America* is referred to as the BSSA.

January 2: 16:25:49*. Epicenter 33°45′ north, 117°30′ west, near Glen Ivy, Temescal Canyon, P. Felt over land area of approximately 9,000 square miles of southern California. (See map, p. 18.) Magnitude 4.7. Maximum intensity VI. Rock slides reported in the vicinity of Glen Ivy. Slight damage, consisting of cracked plaster, broken windows and dishes, reported from several places.

INTENSITY VI:

Alberhill.—Felt by many or all; frightened few. Small objects shifted and overturned; knick-knacks fell.

Glen Ivy.—Rock slides reported.

Hemet.—Felt by all and frightened many in community. Damage slight. Plaster cracked and fell. Trees, bushes shaken moderately. Loud earth noises from east heard.

Mira Loma.—Felt by several. Plaster cracked; dishes broke. Small objects and furnishings shifted. Pendulum clock stopped. Trees, bushes shaken slightly. Moderate earth noises from northwest heard.

Riverside.—Felt by all and frightened many in community. Plaster cracked; dishes broke. Trees, bushes shaken moderately. Loud earth noises heard.

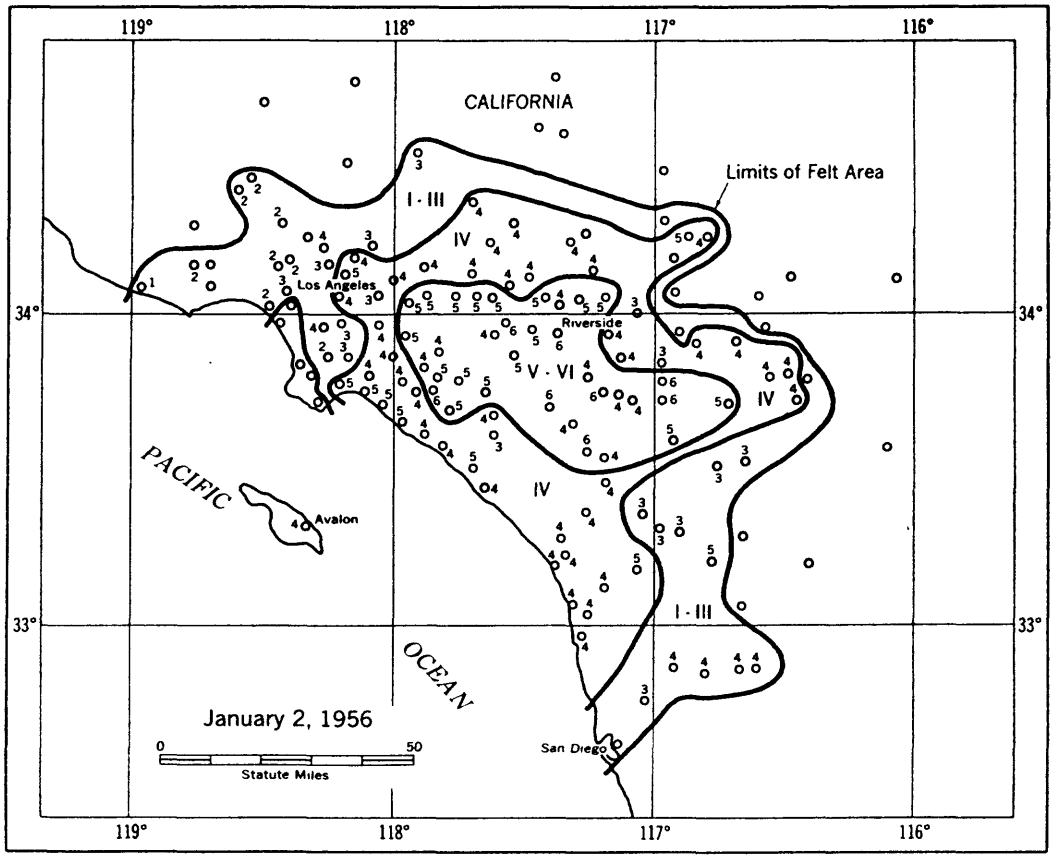

FIGURE 7.—Area affected by earthquake of January 2.

Romoland.—Felt by all and frightened many in community. Plaster cracked. Trees, bushes shaken moderately. Loud earth noises heard by many ½ second before shock.

San Jacinto.—Felt by all and frightened few in community. Plaster cracked. Small objects and furnishings shifted. Trees, bushes shaken slightly. Faint earth noises from northeast heard.

Santa Ana.—Plaster cracked; dishes broke.

Wildomar.—Felt by and frightened many in community. Windows reported broken. Small objects and furnishings shifted; knickknacks fell. Trees, bushes shaken strongly. One slight shock, pause of about 1 second, then a strong shock. Sinking and churning sensation.

INTENSITY V: Arlington, Big Bear City, Bloomington, Button Ranch (about 12 miles southeast of Winchester), Corona, Covina, El Toro, Guasti, Huntington Beach, Idyllwild, Irvine, La Habra, Loma Linda, Long Beach, Mesa Grande, Ontario, Orange, Pasadena, Pomona, Puente, Redlands, San Dimas, San Juan Capistrano, Silverado, and Valley Center.

INTENSITY IV: Alpine, Altadena, Anaheim, Avalon (Santa Catalina Island), Balboa, Buena Park, Cabazon, Camp Pendleton, Cathedral City, Corona del Mar, Crestline, Del Mar, Descanso, Elsinore, Etiwanda, Fallbrook, Fontana, Fullerton, Garden Grove, Glendora, Guatay, Highgrove, Highland, Homeland, Huntington Park, La Crescenta, Lakeside, Lakeview, Leucadia, Los Alamitos, Los Angeles, Lytle Creek, Montebello, Moreno, Mount Baldy, Murrieta, Norco, Oceanside, Palm Springs, Perris, Rancho Mirage, Rancho Santa Fe, San Clemente, San Luis Rey, San Marcos, Sugarloaf, Temecula, Trabuco Canyon, Tustin, Upland, Walnut, White Water, Whittier, Winchester, Wrightwood, and Yorba Linda.

INTENSITY I TO III: Agoura, Anza, Bellflower, Beverly Hills, Calimesa, Colton, Compton, Costa Mesa, El Monte, Gilman Hot Springs, Hawthorne, Laguna Beach, La Mesa, Maywood, Monrovia, Monterey Park, Montrose, Mountain Center, Mount Wilson, Newhall, North Hollywood, Olive,

Pala, Palomar Mountain, Pauma Valley, Pearblossom, San Diego, San Fernando Power Plant (San Fernando), Santa Monica, Saugus, Solromar, South Pasadena, Sun Valley, and Sylmar (San Fernando).

January 3: 06:24:01*. Epicenter 32°23′ north, 116°00′ west, Baja California, southeast of Tecata, P. Felt over an area of approximately 3,500 square miles of southern California. Magnitude 4.7. Maximum intensity in California V. No damage reported.

INTENSITY V:

Alpine.—Awakened many in community. Walls creaked. Loud earth noises from east heard by many. Motion rapid.

Casa de Oro (Spring Valley).—Furniture rolled in home.

Hauser Canyon (Campo).—Felt by and awakened all. Windows, doors, and dishes rattled. Loud earth noises from east heard by many. Motion rapid.

Hipass.—Felt by all. Felt like a small nearby dynamite explosion. Faint earth noises heard by many. Motion slow.

INTENSITY IV: Boulevard, Del Mar, Descanso, Dulzura, El Centro, Escondido, Jacumba, Julian, Lakeside, Mount Laguna, Pine Valley, Potrero, San Marcos, Santa Ysabel, Santee, and Sorrento.

INTENSITY I TO III: El Cajon, Heber, La Mesa, and San Diego.

January 3: 21:23. Ukiah (3 miles west and 5 miles south of). V. A rancher reported shock caused roof to leak. In Ukiah many calls received by radio station, police and fire departments; few alarmed. Buildings creaked; loose objects rattled. Rumbling earth noises heard by many. Felt by several 3 miles west of Ukiah.

January 9: 03:11:56*. Epicenter 37°40′ north, 122°32′ west, southwest of San Francisco, B. IV. Felt principally in the Colma, Daly City, and Westlake areas. Woman in Ingleside district reported that it seemed like the "whole house was coming down."

January 12: 11:15. Guatay. III. Brief shock preceded by a faint rumble felt by several outdoors. Motion from east.

January 15: 09:20. Kaiser Mine, Nev. IV. Felt by many. Doors rattled; walls creaked. Felt like sudden drop to woman in trailer.

February 6: 18:17:56* and 19:16:39* (main shock). Epicenters 34°35′ north, 118°36′ west, north of Castaic, P. Main shock felt over an area of approximately 3,000 square miles. Maximum intensity VI. Magnitude 4.2 and 4.6, respectively.

INTENSITY VI:

Elizabeth Lake Canyon Road and Newhall.—Landslide on the Elizabeth Lake Canyon Road. Telephone lines temporarily disrupted in Newhall area.

INTENSITY V: Castaic, Chatsworth, La Crescenta, Lake Hughes, Montrose, Olive View, Ontario, Pacoima, Piru, and Sandberg.

INTENSITY IV: Agoura, Alhambra, Altadena, Fillmore, Glendale, Lebec, Mojave, Monterey Park, Mount Baldy, Mount Wilson, Santa Monica, Saugus and vicinity, Tehachapi, Tujunga, Van Nuys, Whittier, and Yorba Linda.

INTENSITY I TO III: Acton, Burbank, Desert Springs, Hawthorne, Los Angeles, Maricopa, Manhattan Beach, Redondo Beach, Santa Susana, and San Fernando Power Plant (San Fernando).

February 8: 23:45. Cantil (1 mile southeast of Garlock Fault). IV. Slight shock. House creaked.

February 9: 05:40. Cantil. IV. Felt by several in home; awakened few. Windows, doors, and dishes rattled; house creaked. Hanging objects swung. Trees, bushes shaken slightly. Motion slow.

February 9: 06:32:38*. Main shock of a series originating in Baja California. Epicenter 31°45′ north, 115°55′ west, Baja California, near El Alamo, P. Magnitude 6.8. Foreshock of magnitude 4.7 at 06:16:24*. The main shock was felt over an area of approximately 30,000 square miles in the United States. (See map, p. 20.) In Baja California, near El Alamo, a new fault line 18 miles long was observed. New springs, from deep underground sources and with water temperatures of 81°, were formed along the fault line. Damage occurred at El Alamo and there was serious damage in San Miguel, which was unoccupied at the time. At Rancho Viejo, about 80 miles southwest of Mexicalli, 18-inch-thick walls of adobe ranch house split apart. Maximum intensity in United States was VI. Minor damage, consisting mainly of broken windows, cracked plaster, and damaged merchandise, reported from a number of towns in California, and from Yuma, Arizona. Aftershocks numerous, with epicenters extending eastward toward that given for February 14. Totals from all these epicenters for January-March: Magnitude 6 and over, 4; 5.0–5.9, 21; 4.5–4.9, 79; 4.0–4.4, about 170.

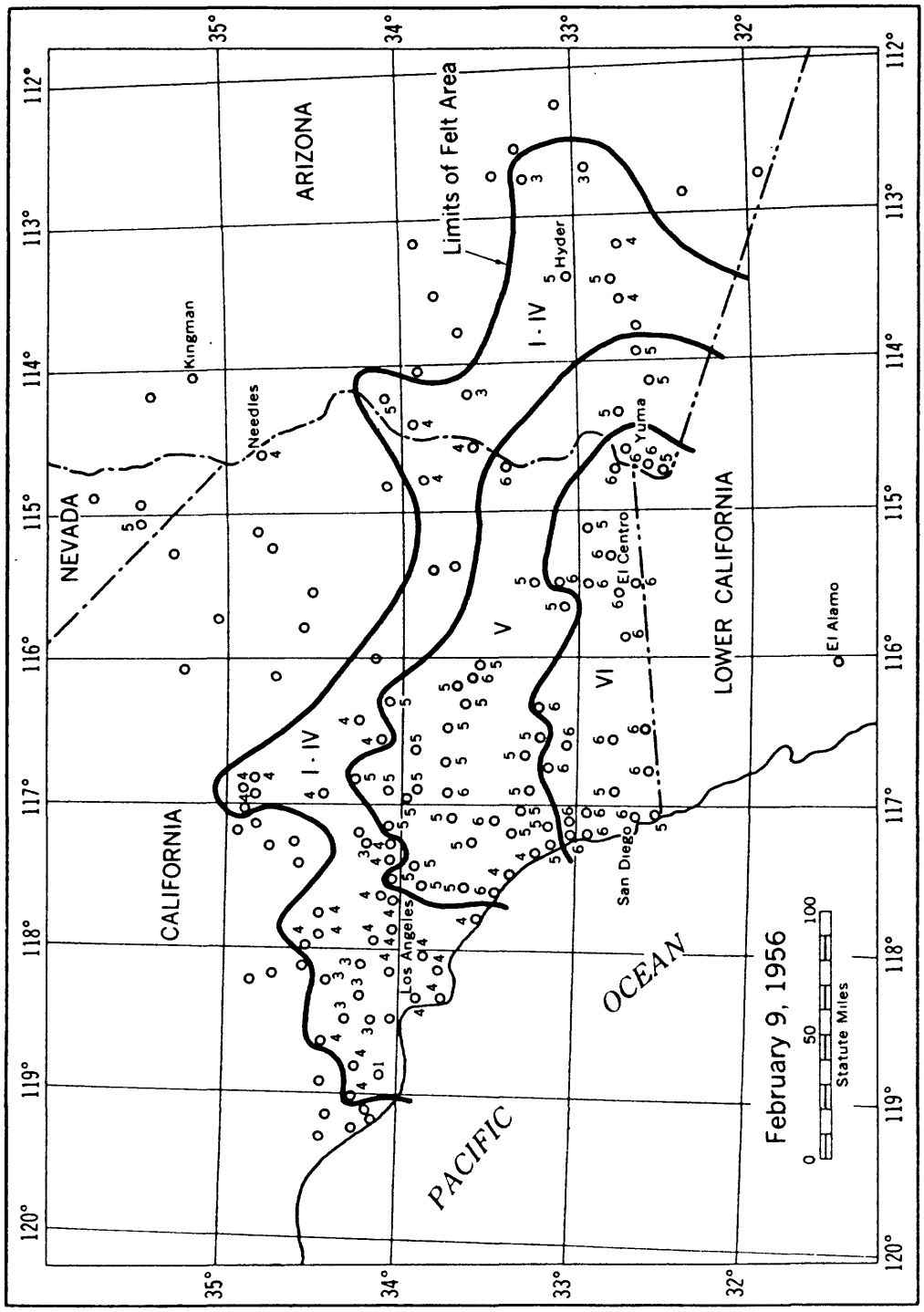

FIGURE 8.—Area affected by earthquake of February 9.

INTENSITY VI:

Alpine.—Felt by and awakened all; frightened many in community. Windows, doors, and dishes rattled; walls creaked.

Anza (Sec. 12, T8S, R3E).—Felt by several; awakened all in home; frightened few. Cement floor cracked. Loud earth noises from south heard.

Bonita.—Broken walls reported. Moderate earth noises heard 2 seconds before shock.

Borrego Springs.—Felt by and awakened all in community; frightened few. Small objects shifted. Moderate earth noises from northeast heard by many. Trees, bushes shaken slightly. Slight shocks felt at 07:24:26* and 10:48:45*.

Boulevard.—Felt by all; awakened all in home; frightened many. Bed collapsed. Groceries fell from shelves. Other shocks felt at 07:01:33*, 07:24:26*, 08:29:53*, 09:06:21*, and 10:48:45*. Shock at 10:48:45* had slight east-west motion then strong north-south motion. At the school seven shocks were reported felt, from 08:29:53* to 14:00.

Brawley.—Felt by and frightened all in community. Few dishes broke and some canned goods toppled in market.

Calexico.—Felt by and awakened all; frightened many in community. Twelve windows broke on lower floor of hotel, and an arcade cracked. Plaster cracked and fell; dishes broke. Merchandise fell from shelves and broke.

Calipatria.—Felt by and awakened all in community; frightened many. Doors swung. Some complained of nausea.

Campo (Hauser Canyon).—Felt by and awakened all in community; frightened few in home. Small objects shifted and overturned; knickknacks fell. Moderate earth noises from northeast heard.

Chula Vista.—Felt by all; awakened all in home. Windows cracked and broke. Cans toppled from shelf in market. Small objects shifted and overturned; books fell. Cuckoo clock stopped. Trees, bushes shaken moderately. Sounded like a big truck coming up steep driveway.

Coachella.—Felt by all in community; awakened and frightened many. Small objects and furnishings shifted. Pendulum clock stopped. Trees, bushes shaken moderately.

Descanso.—Felt by and awakened all in community. Windows, doors, and dishes rattled; house creaked. Hanging objects swung. Trees and bushes shaken. Shocks also felt at 06:16:24*, 07:01:33*, and 07:24:26*.

El Cajon.—Felt by and frightened all. Knickknacks fell. Trees, bushes shaken moderately. Moderate earth noises from east heard 5 seconds before shock.

El Centro.—Heavy shock. Some persons left homes. Some objects fell. Rocking chair rocked strongly. Other shocks felt at 10:48:45*, 20:00, and 20:18:15*. Windows rattled during last two shocks.

Encinitas.—Felt by and awakened many in community; frightened few; felt outdoors by some (active). Wood paneling on walls separated. Walls creaked. Trees, bushes shaken moderately. Clothing on hangers swung definitely north-south. Other shocks felt at 07:24:26* and 08:29:53*.

Guatay.—Felt by many; awakened all in home; frightened few. Damage slight. Plaster cracked. Knickknacks fell; small objects and furnishings shifted. Loud rumbling earth noises heard by many. "Five other shocks of lesser intensity felt."

Heber.—Felt by and awakened all in community; frightened few. Trees, bushes shaken strongly. Windows, doors, and dishes rattled; house creaked. Hanging objects swung.

Hipass.—Felt by many. Plaster fell. Small objects shifted and overturned; knickknacks, books, and pictures fell. Two other heavy shocks felt same morning and several light shocks felt during next two days.

Holtville.—Felt by, awakened, and frightened many in community (some outdoors; active). Damage slight. Water main and windows broke. Fire in food market and residence was attributed to shock. Small objects shifted, few overturned. Trees, bushes shaken moderately. Moderate earth noises from northwest-southeast heard by many.

Imperial.—Felt by all; awakened all in home; frightened many. Damage slight. Plaster cracked. Dishes and windows broke. Small objects shifted and overturned; knickknacks, books, and pictures fell. Pendulum clock stopped. Trees, bushes shaken strongly. Faint earth noises from north-south heard by many.

Imperial Beach.—Felt by, awakened, and frightened all. Trees, bushes shaken moderately. Windows, doors, and dishes rattled; house creaked.

Jacumba.—Felt by, awakened, and frightened all in community. Damage slight. Dishes and other objects fell from shelves; books and pictures fell. Dishes, lamps broke.

Jamul.—Felt by all in community. Hairline plaster cracks in every room of 10-year-old house. Other shocks felt at 06:16:24*, 06:46:23*, 07:45:04*, and 08:59:53*.

Julian.—Felt by all; awakened all in home; frightened few in community. Pendulum clock facing west stopped. Trees, bushes shaken slightly. Faint earth noises heard.

La Jolla.—Felt by many (some outdoors) and awakened many in community; frightened few. Block-long pavement crack, ¼ inch wide, in the 700 block of Fernglen Street. House creaked loudly.

La Mesa.—Felt by all; awakened many; frightened few in community. Hairline plaster cracks. Faint earth noises from northeast heard by few.

Lincoln Acres.—Felt by all; awakened and frightened many. Small objects and furnishings shifted; knickknacks, books, and pictures fell. Trees, bushes shaken strongly. "Strongest shock felt in 10 years."

Mesa Grande.—Felt by all; awakened all; frightened many in community. Windows cracked. Small objects and furnishings shifted and overturned; knickknacks, books, and pictures fell. Trees, bushes shaken moderately.

National City.—Felt by all; awakened all; frightened few in home. Damage slight. Plaster cracked.

Nestor.—Felt by many. Damage slight. Plaster cracked. Trees, bushes shaken slightly.

Palm City.—Awakened all in community; frightened few. Few objects in store overturned. Trees, bushes shaken strongly. Other shocks felt at 07:48* and 10:48:45*.

Palo Verde.—Felt by all in community (some outdoors; quiet); awakened many. Damage slight. Small objects shifted.

Pine Valley.—Felt by all; awakened all; frightened few. Small objects and furnishings shifted; knickknacks fell. Many minor shocks felt on February 9.

Plaster City.—Felt by, awakened all; and frightened many in community. Small objects shifted.

Rancho Santa Fe.—Felt by all in community; frightened few. Plaster and walls cracked. Damage slight to masonry. Small objects shifted.

San Diego.—Generally felt; many frightened and ran outdoors. Minor damage reported. An overhead 5-inch pipe on Broadway Pier broke; one water pipe broke on 6th floor of downtown building; one plate glass window broke at 646 12th Street. Plaster cracked. Unstable objects overturned. Mannequins toppled in store window. Burglar and fire alarms set off. Pendulum clocks stopped. Many shocks were reported felt, some timed at 06:16:24*, 06:34*, 06:46:23*, 07:01:33*, 07:24:26*, 07:40*, 07:45:04*, 07:48*, 08:11*, 08:29:53*, 09:06:21*, 20:18:15*, and 20:23*. It was reported 35 shocks were felt in 24 hours.

San Jacinto.—Felt by and awakened all in community; frightened few. Small objects and furnishings shifted. Trees, bushes shaken moderately. Slight, rolling shocks felt at 06:34* and 07:45:04*.

San Juan Capistrano.—Felt by and awakened all in community. Windows, doors, and dishes rattled.

Santee.—Felt by and awakened all in community; frightened few. Windows and doors rattled; walls creaked. Hanging objects swung.

Seeley.—Awakened all; frightened all. Plaster cracked. Small objects shifted. Trees, bushes shaken strongly.

Solana Beach.—Felt by and awakened all in community. Damage slight. Plaster cracked. Trees, bushes shaken strongly.

Tecate.—Awakened all in community; frightened few. Plaster, windows, and walls cracked. Small objects shifted and overturned. Trees, bushes shaken strongly.

Temecula.—Felt by and frightened all in community. Damage slight. Chimneys twisted.

Winterhaven.—Felt by and awakened all; frightened few. Plaster and adobe walls cracked.

INTENSITY VI IN ARIZONA:

Somerton.—Felt by all and frightened many in community; awakened all in home. Small objects overturned; furnishings shifted. Trees, bushes shaken moderately. Other shocks felt at 07:01:22*, 07:24:26*, and several during the rest of the day.

Yuma.—Felt by all or nearly all; many alarmed. Plaster cracked; windows broke. Merchandise fell from store shelves. Pendulum clock stopped.

INTENSITY V: Altadena, Arlington, Balboa, Banning (also very light shock at 07:24:26*), Beaumont, Bonsall, Canoga Park, Cardiff-by-the-Sea, Carlsbad, Cathedral City, Chino, Corona, Del Mar, Escondido, Etiwanda, Fallbrook (4½ miles south of), Fallsvale, Fawnskin, Forest Home, Glamis, Glendale, Hodges Dam (Rancho Santa Fe), Huntington Park, Idyllwild, Indio, Joshua Tree, La Habra, Lakeside, Lemon Grove, Leucadia, March Air Force Base, Mecca (also felt shock at 11:15)

and 3 miles southeast of, Moreno, Newport Beach, Niland, Pala and surrounding area, Palm Desert, Palomar Mountain, Pauma Valley (several aftershocks felt), Phelan, Pomona, Potrero, Poway, Ranchita, Rancho Mirage, Redlands, Rialto, Romoland, San Luis Rey, San Marcos (shocks at 06:16:24*, 06:34*, and 10:48:45* also felt), San Ysidro, Sorrento, Spring Valley (shock at 21:07* also felt), Sunnyside, Temple City, Thermal, Trabuco Canyon, Valley Center (shock at 07:24:26* also felt and several shocks felt until 10:48:45*), Walnut, Warner Springs (also mild shocks felt at 06:16:24*, 08:59:53*, and 10:48:45*), Westmorland, White Water, and Wildomar (several small shocks felt after main shock; small shock at 10:48:45*).

INTENSITY V IN ARIZONA: Aztec, Dome (few lesser shocks also felt), Gadsden (small shocks continued), Hyder, Parker, Tacna (strongest of shocks felt), and Wellton (about 6 miles northeast of).

INTENSITY V IN NEVADA: Searchlight (7 miles west of, YKL Ranch).

INTENSITY IV: Azusa, Baldwin Park, Bard Valley (Bard), Barstow, Blythe, Cabazon, Castaic, Colton, Corona del Mar, Downey, El Monte, El Segundo, Fallbrook, Fontana, Gilman Hot Springs, Grossmont, Hawthorne, Hemet (also felt slight shock at 07:24:26* and later in the morning), Laguna Beach, La Mirada, Long Beach, Los Alamitos, Los Angeles (also felt slight shocks at 08:29:53*, 08:59:53*), Lucerne Valley, Montebello, Monterey Park, Morongo Valley, Mountain Center, Needles, Newberry, Oceanside, Ontario, Palmdale, Palm Springs, Palos Verdes Estates, Pearblossom, Perris, Puente, Riverside, San Clemente, San Dimas, Santa Ysabel, Simi, Somis, Thousand Palms, Universal City, Upland, Valyermo, Winchester, Yermo, and Yucca Valley.

INTENSITY IV IN ARIZONA: Dateland, Poston, and Sentinel.

INTENSITY I TO III: Acton, Agoura, Calimesa, Crestline, Midland, Mount Wilson, Port Hueneme, San Fernando, Tujunga, Venice, and Wrightwood.

INTENSITY I TO III IN ARIZONA: Arlington, Gila Bend, and Quartzsite.

February 9: 21:30 (about). Bakersfield. "Thought there was a light shock."

February 10: 05:42*, 06:30:12*, 10:12:54*. Epicenter 31°45′ north, 115°55′ west, aftershocks of February 9, Baja California, P. Magnitude of second and third shock 4.9 and 5.5 respectively. Boulevard. First shock lasted 8 seconds; second, slight shock; third, slight but long, lasting 45 seconds. Motion south-north, then west-east. Other slight shocks felt through Friday night (10th) and Saturday (11th).

February 10: 18:57:46*. Epicenter 31°45′ north, 115°55′ west, aftershock of February 9, Baja California, P. Magnitude 5.1. San Diego. III. Felt by several in home and community. Hanging objects swung. Direction east-west.

February 11: (no time given). Encinitas. Observer reported several tremors felt. Aftershock of February 9, Baja California, with magnitude of 4.6 recorded at 08:59*.

February 14: 10:00. San Diego. Felt strongly on third floor.

February 14: 10:33:34* and 17:20:38*. Epicenter 31°30′ north, 115°30′ west, Baja California, P. Aftershocks of February 9. Felt over large area of southern California and Arizona. Magnitudes 6.3 and 6.4 respectively. Maximum intensity in the United States V. No damage reported.

INTENSITY V:

Descanso.—(10:33:34*, 17:20:38*). Felt by all and frightened many in community. Windows, doors, and dishes rattled; walls creaked. Trees, bushes shaken slightly. Motion slow.

Jamul.—(10:33:34*). Felt by all in community. Windows, doors, and dishes rattled strongly. Hanging objects swung west-east. Trees, bushes shaken slightly. "Strongest felt so far." Motion rapid.

San Diego.—Both shocks generally felt; frightened few. Fire alarms set off during shock at 10:33:34*. Trees, bushes, and poles shaken moderately. Motion slow, swaying.

INTENSITY IV: Bonita (10:33:34*), El Centro (10:33:34*, 17:20:38*), Hemet (10:33:34*, shock at 17:20:38* also felt), Hodges Dam (10:33:34*, 17:20:38*), La Jolla (17:20:38*), Long Beach (10:33:34*), Los Angeles (10:33:34*, 17:20:38*), San Jacinto (several other tremors felt during day and night of the 14th).

INTENSITY IV IN ARIZONA: Wellton (10:33:34*), Yuma (10:33:34*).

INTENSITY I TO III: Trabuco Canyon (10:33:34*).

INTENSITY I TO III IN ARIZONA: Dome (10:33:34*).

February 15: 00:35:54*. Aftershock of February 9, Baja California. Hemet. IV. Awakened few.

February 18: 15:58:30*, 16:06:42*, and 19:23:27*. Epicenter 36°40′ north, 121°19′ west, near Paicines, B. Felt over land area of approximately 1,300 square miles of San Benito and Monterey counties. Maximum intensity V. Shock at 15:58:30* frightened few at Paicines where slight plaster cracks were reported; few knickknacks fell; small objects and furnishings shifted. Intensity IV re-

ported from Big Sur (19:23:27*), Chualar Canyon (about 10 shocks felt; shock at 15:58:30* was only shock felt 9 miles from observer's home), Hollister (7½ miles south of; all three shocks felt, last two weak), Idria (15:58:30*), Paloma Station (all three shocks felt), San Benito (15:58:30*). Shock at 15:58:30* felt very slightly at Mount Hermon.

February 29: 18:53. Aftershock of February 9, Baja California. San Diego. III. Felt by several in community.

March 7: 23:26:19*. Epicenter 39°02′ north, 118°04′ west, 45 miles southeast of Fallon, Nev., B. Kaiser Mine (about 13 miles northwest of Gabbs, Nev.). V. Felt by and awakened many; frightened few. Few small objects shifted. Motion rapid.

March 9: 21:56:14*. Epicenter 40°18′ north, 124°14′ west, near Petrolia, B. Felt over an area of approximately 2,500 square miles of Humboldt and Mendocino counties. Maximum intensity V. No damage reported. Aftershocks felt at 22:03:21* and 22:05:42*.

INTENSITY V:

Alderpoint.—Felt by all; awakened and frightened few. Two shocks felt. Motion slow, rolling.

Arcata.—Felt by all and frightened all in home. Windows rattled; walls creaked. Motion slow.

Carlotta.—Felt by all; awakened many and frightened few in community. Windows, doors, and dishes rattled; walls creaked. Hanging objects swung. Moderate earth noises heard by few. Shock at 22:03:21* also felt.

Ettersburg.—Felt by all. Small objects shifted. Windows rattled. Motion slow.

Ferndale.—Felt by all; awakened many. Windows rattled; walls creaked. Hanging objects swung. Faint earth noises heard. Motion rapid.

Fields Landing.—Felt by and awakened many in homes; frightened few. Small objects shifted. Windows, doors, and dishes rattled; walls creaked. Hanging objects swung. Motion rapid.

Fortuna.—Felt by all and awakened all in home. Windows, doors, and dishes rattled; house creaked. Hanging objects swung. Faint earth noises heard. Motion rapid.

Holmes.—Felt by all. Moderate earth noises heard.

Petrolia.—Felt by all; awakened all in home; frightened many in community. Windows, doors, and dishes rattled; house creaked. Moderate earth noises heard. Motion rapid. Three light shocks felt after the first heavy one.

Rio Dell.—Felt by all; awakened and frightened few in community. Motion slow.

Weott.—Felt by and awakened many in community. Walls creaked. Motion slow.

INTENSITY IV: Alton, Bridgeville, Eureka (shock at 22:03:21* also felt), Garberville, Honeydew (sharp jolt felt 8 minutes after first shock), Korbel (slight shock few minutes after first one), Loleta, Miranda, Phillipsville, Rockport, Scotia, and Westport.

INTENSITY I TO III: Briceland, Hoopa, Piercy, Trinidad, and Willits.

March 10: 06:07:56*. Epicenter 39°19′ north, 118°28′ west, south end of Stillwater Mountains, Nev., B. IV. Awakened a number of persons in Fallon.

March 10: 06:12:54*. Epicenter 31°30′ north, 115°30′ west, Baja California, P. Magnitude 5.0. Aftershock of February 9, Baja California. Reported felt in San Diego.

March 10: 23:49:18*. Epicenter 40°28′ north, 121°33′ west, near Lassen Peak. Main shock of a series of about 70 small shocks, B. IV. Felt by and awakened observer at Mineral where house creaked. Motion rapid.

March 11: 09:43:00*. Epicenter 40°18′ north, 124°17′ west, near Petrolia, B. II. Bumping motion, lasting 2 seconds, felt at Scotia.

March 11: 11:05:43*. Epicenter 36°33′ north, 121°11′ west, near San Benito, B. Paloma (Jamesburg route, Carmel Valley). IV. Felt by several. Building creaked; loose objects rattled. Slight east-west jerk.

March 16: 06:35:04*, 11:43:53*, 12:29:34* (main shock), 15:34:57* (second largest). Epicenter of first shock 34°17′ north, 116°46′ west; of following shocks, 34°15′ north, 116°45′ west, near Baldwin Lake. Magnitudes 3.4, 3.5, 4.8, 4.4, respectively. Sixteen shocks of magnitude 3.0 and over on March 16 and 17, P. Main shock felt over area of approximately 8,000 square miles of Southern California. Maximum intensity VI. No damage reported.

INTENSITY VI:

Sugarloaf (about 4 miles southwest of Baldwin Lake).—Felt by and frightened all in community. Knickknacks and top row of canned goods fell in two homes. Trees, bushes shaken strongly. Nine distinct, sharp jolts reported felt, beginning at 06:35:04* and ending at 21:50.

INTENSITY V: Big Bear City (12 shocks reported felt between 06:35:04* and 23:00), Fawnskin (series of shocks all morning, one at 09:30), Lucerne Valley, Oro Grande, and Seven Oaks.

INTENSITY IV: Banning, Cedarpines Park, East Highlands, Fallsvale, Forest Home, Idyllwild, Indio, Joshua Tree, Moreno, Morongo Valley, Mountain Center, Norco, Palm Springs, Patton, Pioneertown, Temecula, Thermal, and Victorville.

INTENSITY I TO III: Adelanto, Cabazon, Colton, Crestline, Desert Hot Springs, Etiwanda, Fullerton, Hemet (and shock also felt at 16:40:13* or 16:44:03*), Lakeview, Ludlow, Lytle Creek, Perris, Rancho Mirage, San Jacinto, Santa Ysabel, Summit, Thousand Palms, Walnut, and White Water.

March 17: 02:00 to 22:15. Aftershocks of March 16. Sugarloaf. Six moderate shocks reported felt. (Shock of magnitude 4.0 recorded at 18:42:18* and one of magnitude 3.0 recorded at 22:58:02*.)

March 18: 02:17:41* and 02:22:03*. Epicenter 40°31′ north, 121°36′ west, near Manzanita Lake, B. VI. Felt by, awakened, and frightened all in home at Manzanita Lake. Damage slight. Plaster cracked and a small amount fell. Small objects overturned. Doors swung. "Strongest shock felt here in 8 years." Felt by and awakened many at Mineral. Windows, doors, and dishes rattled; house creaked. All awakened in Snow Survey cabin southeast of Lassen Peak. Two already awake heard rumbling earth noises before shock.

March 18: 04:00 to 21:30. Three rolling shocks felt at Sugarloaf, the first at 04:00 and the last at 21:30.

March 19: 07:09:23*. Epicenter 40°08′ north, 119°40′ west, in Pyramid Lake, Nev., B. Flannigan. IV. Quick, jolting tremor felt by several in community. Walls creaked. Very slight tremor felt at Empire.

March 19: 22:00. Shock described as "humming" felt at Sugarloaf.

March 23: 13:23:25*. Epicenter 35°05′ north, 119°10′ west, north of Wheeler Ridge, P. IV. A sharp, rolling shock felt in west Bakersfield and in farming areas to the southwest as far as Taft and Maricopa. Distinctly felt in City Hall at Bakersfield. Many calls received by Sheriff's office and other agencies, but no damage was reported.

March 30: 22:00:19*. Epicenter 35°19′ north, 118°29′ west, east of Caliente, P. Tehachapi. IV. Felt by all or nearly all. Light jar followed immediately by very heavy jar that shook whole house. Sounded like very large object struck house.

April 2: 00:49:35*. Epicenter 37°57′ north, 122°18′ west, El Cerrito Hills, B. Berkeley. V. Fire, caused by a gas leak into telephone cable tunnel, attributed to earthquake. Scores of persons awakened. Felt by many in Albany and El Cerrito. Described as sharp, short, explosivelike jolt. Awakened observer at Canyon where house creaked. Motion rapid, sharp.

April 2: 11:47:36*. Aftershock of February 9, Baja California. Epicenter 31°30′ north, 115° 30′ west, Baja California, P. San Diego. III. Felt by several in community. Motion rapid.

April 3: 16:53:28*. Epicenter 38°03′ north, 122°20′ west, San Pablo Bay, B. Residents of Richmond reported feeling slight shock.

April 4: 17:15:14*. Epicenter 40.5° north, 121.5° west, near Mount Lassen, B. Manzanita Lake (Lassen Volcanic National Park). IV. Sharp tremor felt by observer sitting in office. Windows rattled. Trees, bushes shaken slightly. Motion rapid.

April 4: 20:29:13* and 20:29:32*. Epicenter 38°32′ north, 122°31′ west, near Saint Helena, B. Felt area approximately 4,500 square miles of north-central California. (See map, p. 26.) Magnitude 4¾. Maximum intensity VI. Minor damage occurred.

INTENSITY VI:

Angwin-Saint Helena Sanatorium area.—Principal damage appeared to be there. Residents reported numerous instances of cracked plaster and cracked concrete house foundations. At the Saint Helena Sanatorium tile flooring connecting older frame building with new wing cracked (sections abut but not joined except the flooring of a corridor). Several patients were reportedly thrown from beds. Girls in near-panic at the Pacific Union College. Reported as the strongest shock felt in 20 years. Two shocks felt about 15 seconds apart.

Calistoga.—Felt by all; many alarmed. Canned goods fell from grocery store shelves. Visible rocking of buildings. Two shocks felt.

Napa.—Frightened few in community. Damage slight. Plaster cracked. Canned goods fell from grocery store shelves.

Saint Helena.—Felt by and frightened all in community; many rushed to streets. Damage reported as minor despite twisting, wrenching motion. Pine walls cracked in house on Silverado Trail. In downtown Saint Helena some plaster fell from ceiling; heavy stone walls creaked; linotypes rocked; light fixtures swayed. Pedestrian on Main Street saw building walls sway. Canned goods fell from store shelves. Trees, bushes shaken strongly. Most persons reported feeling three shocks.

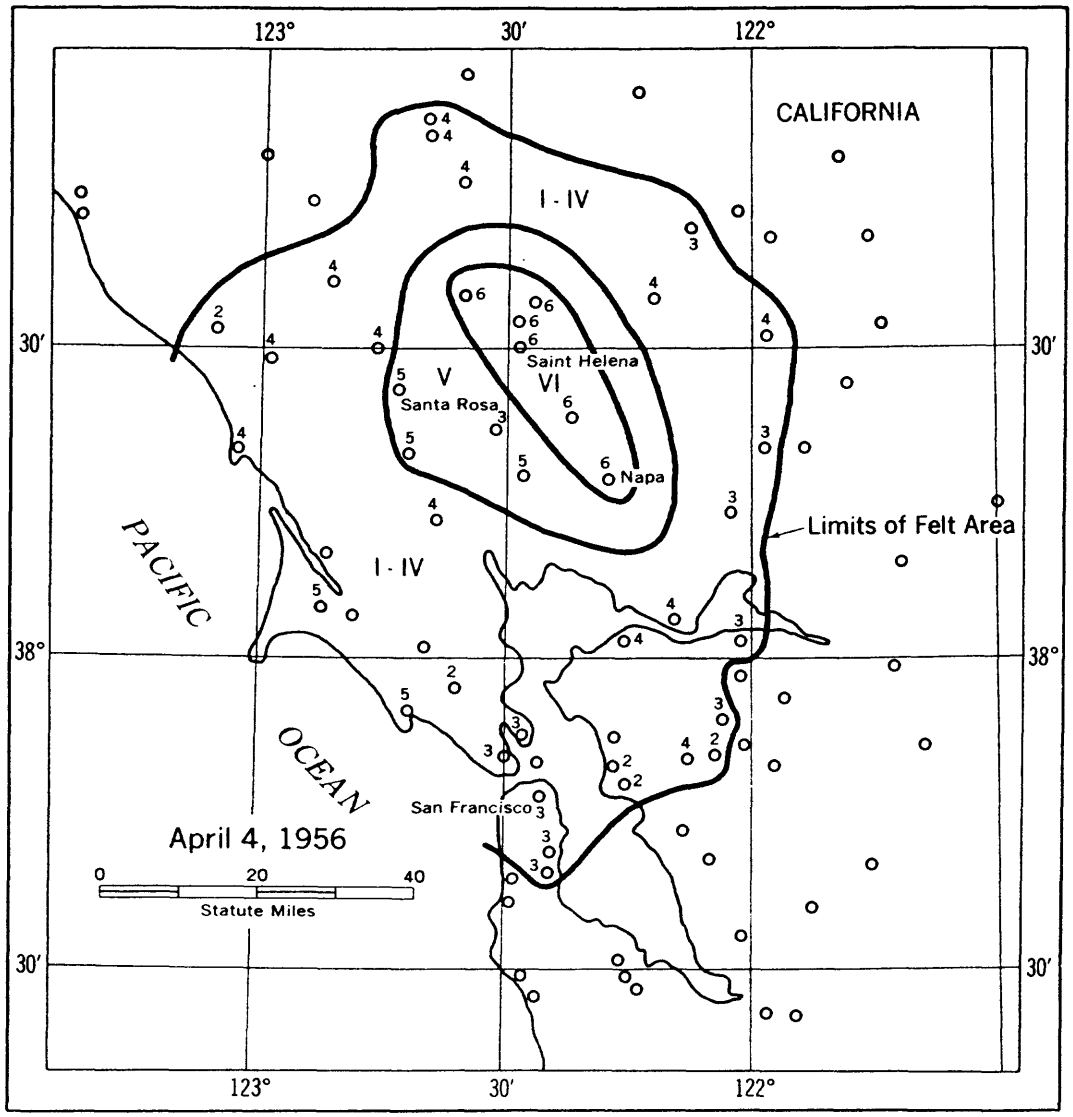

FIGURE 9.—Area affected by earthquake of April 4.

First movement violent, followed within few seconds by shorter and less severe shock, then about 15 minutes later a slight, rolling shock.

Yountville.—Felt by and frightened all in community. Small objects shifted. Everything swayed, jumped, and rattled. Trees, bushes shaken slightly.

INTENSITY V: Bolinas, Cotati, Inverness, Santa Rosa, and Sonoma.

INTENSITY IV: Bodega Bay, Canyon, Cobb, Crockett, Fulton, Guerneville, Healdsburg, Hobergs, Middletown, Monticello, Petaluma, Pinole, and Winters.

INTENSITY I TO III: Alameda, Brisbane, Brooks, Cazadero, Fairfield, Glen Ellen, Lafayette, Livermore, Marshall, Moraga, Oakland, Port Chicago, Redwood City, San Anselmo, San Bruno, San Francisco, San Mateo County, San Quentin, Sausalito, South San Francisco, and Vacaville.

April 10: 06:09:20*. Epicenter 37°50′ north, 121°53′ west, northwest of Livermore, B. Reported felt at Berkeley and Walnut Creek.

April 11: 05:12:17*. Aftershock of April 4. Epicenter 38°28′ north, 122°29′ west, near Saint Helena, B. IV. Angwin-Saint Helena area. Slight, brief shock, followed by loud rumbling, awakened some persons.

April 15: 21:11:20*. Epicenter 35°20′ north, 118°59′ west, near Bakersfield, P. Bakersfield (east section). IV. Felt by several in community. Three distinct jolts, weak, strong, weak, like a sonic blast. Pictures askew. "A loud rumble was heard by some residents immediately preceding the earthquake. There were no reports of damage."—*BSSA, July 1956.*)

April 25: 01:08:29*. Aftershock of February 9, Baja California. Epicenter 31°30′ north, 115°30′ west, Baja California, P. Magnitude 5.7. Reported felt at San Diego. Motion rapid.

April 27: 14:28:59*. Epicenter 37°30′ north, 121°42′ west, northeast of San Jose, B. III. Slight shock felt. Felt by many in reinforced-concrete building at 86 South Third St. Motion rapid.

May 10: 01:07:56*. Epicenter 40°30′ north, 121°38′ west, north of Mineral, B. Mineral. V. Felt by and awakened many in community. Small objects shifted. Motion rapid.

May 10: 03:48:54*. Aftershock of February 9, Baja California. Epicenter 31°50′ north, 116°00′ west, Baja California, P. Magnitude 5.0. III. Felt by several in home at San Diego. Motion rapid.

May 10: 09:51:05*. Epicenter 40.5° north, 121.8° west, northwest of Mineral, B. Mineral. IV. Felt by many in community. Frame creaked. Motion rapid.

May 11: 08:30:50*. Epicenter 34°16′ north, 116°45′ west, near Baldwin Lake, P. Felt area approximately 9,000 square miles of southern California, principally in Riverside and San Bernardino counties. (See map, p. 27.) Magnitude 4.7. Maximum intensity V.

INTENSITY V:

Banning.—Felt by all; frightened many. Windows rattled; frame creaked. Hanging objects swung southwest. Moderate earth noises heard 2 seconds before shock. Motion rapid.

Big Bear Lake.—Reported as strongest shock felt for some time. Probably felt by all. Motion swaying east-west.

Cathedral City.—Felt by all; awakened and frightened few. Windows and dishes rattled. Hanging objects swung. Motion rapid.

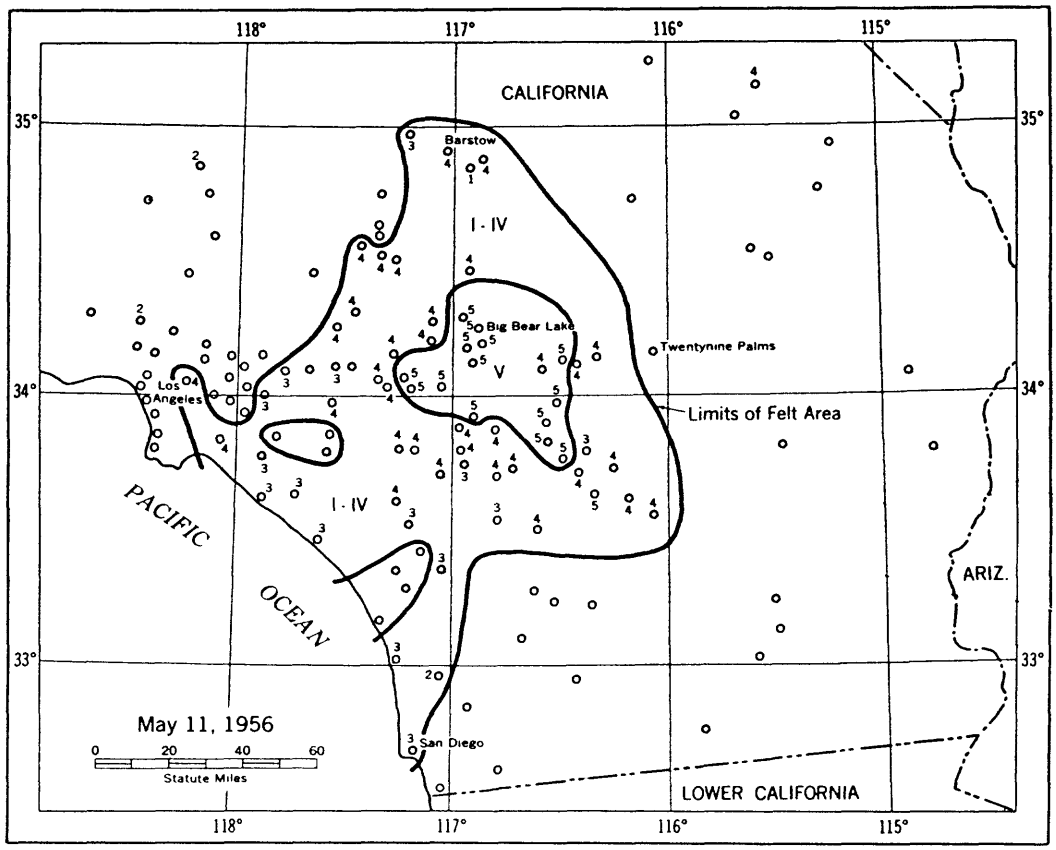

FIGURE 10.—Area affected by earthquake of May 11.

Desert Hot Springs.—Felt by all. Windows, doors, and dishes rattled. Hanging objects swung. Faint earth noises heard.

Fallsvale.—Felt by several; by observer outdoors leaning against house; frightened few. Windows, doors, and dishes rattled; walls creaked. Light fixtures and hanging vases swung, Trees, bushes shaken moderately. Motion rapid. Loud rumbling earth noises from northeast, like heavy blast, heard about 2 seconds before shock.

Fawnskin.—Felt by all in home; frightened few. Small objects shifted; knickknacks, books, and pictures fell. Motion rapid.

Forest Home.—Felt by all; frightened few. Windows and doors rattled; frame creaked. Trees, bushes shaken slightly. Faint earth noises heard. Motion rapid.

La Quinta.—Felt by many; frightened few. Plaster cracks widened. Windows and doors rattled; safe shook. Faint rumbling earth noises from southeast or south heard by few 5 seconds before shock. Motion slow.

North Palm Springs.—Felt by all; awakened and frightened all in home. Windows and doors rattled. Faint rumbling earth noises heard by few before shock. Motion rapid.

Palm Springs.—Felt by all; frightened few. Windows and doors rattled; frame creaked. Man living on south edge of town said he was almost shaken out of bed. Moderate earth noises heard by many 5 seconds before shock. Motion slow.

Pioneertown.—Felt by many. Small objects shifted. Windows and scales rattled. Trees, bushes shaken slightly. Hanging objects swung north-south. Motion slow.

Redlands.—Felt by all. Windows, doors, and dishes rattled; post office building creaked. Trees, bushes shaken moderately. Faint earth noises heard by many. Motion rapid, vertical.

San Bernardino.—Two strong jolts. Dishes rattled and chandeliers swung. Woman reported pen moved up and down while writing.

Seven Oaks.—Felt by all. Windows and doors rattled. Faint earth noises heard. Motion rapid.

Sugarloaf.—Felt by all. Windows, doors, and dishes rattled; house creaked. Loud earth noises heard at time of shock. Motion slow.

Yucaipa.—Very sharp; considerable excitement. Felt by several in strongly built cement-block post office building. Moderate earth noises heard by many. Motion slow.

INTENSITY IV: Adelanto, Apple Valley, Arrowbear Lake, Barstow, Beaumont, Cabazon, Cima, Colton, Gilman Hot Springs, Highland, Idyllwild, Indio, Joshua Tree, Lakeview, Loma Linda, Los Alamitos, Los Angeles, Lucerne Valley, Lytle Creek, Mecca, Mira Loma, Morongo Valley, Mountain Center, Perris, Rancho Mirage, San Jacinto, Summit, Terwilliger Valley, Thermal, Victorville, Wildomar, Winchester, Yermo, and Yucca Valley.

INTENSITY I TO III: Anza, Balboa, Daggett, El Toro, Encinitas, Etiwanda, Hemet, Hinkley, Murrieta, Pala, Pomona, Poway, Rosamond, San Clemente, San Diego, Santa Ana, Thousand Palms, Van Nuys, Walnut, and White Water.

May 12: 20:10:03*. Epicenter 39°16′ north, 119°35′ west, southeast of Fallon, Nev., B. V. Generally felt at Fallon. Felt by observer sitting on first floor of strongly built stucco house 5½ miles west of Fallon. Felt by few at Austin. Also felt at the Nevada Scheelite Mine about 40 miles southeast of Fallon.

May 14: 06:52:22*. Aftershock of February 9, Baja California. Epicenter 31°35′ north, 115°40′ west, Baja California, P. III. Felt by few in community at Balboa; by observer lying down on first floor of wood-frame house. Motion slow, very light. Felt by several in home at San Diego where hanging objects swung north. Motion rapid.

May 15: 02:45. Santa Maria. "A sharp jolt, presumed to be an earthquake, was felt by several residents . . ."—(*BSSA, July 1956.*)

May 15: 10:36:48* (main shock), 11:37:53*, 11:42:44*. Epicenter 40°32′ north, 121°29′ west, near Mount Lassen, B. Mineral. IV. Three shocks felt with about the same intensity. Felt by many in community, some outdoors. Windows and doors rattled; walls creaked. Motion rapid.

May 17: 10:57. Los Gatos. III. Felt by few on second floor of Los Gatos Union High School. Faint rumbling earth noises like thunder heard at beginning of shock. Motion rolling, northwest-southeast.

May 18: 02:30. Manzanita Lake (Lassen Volcanic National Park). IV. Awakened all in home. Motion slow. (Nothing recorded at this time on the Mineral seismograph, although there were several small Lassen Peak shocks during the night, B.)

May 18: 10:07:03*. Epicenter 35°00′ north, 118°52′ west, Tejon Ranch, P. Felt at Fort Tejon.

May 26: 01:27. Hollister (7½ miles south of). IV. Felt by several in home; awakened and frightened few. Windows and doors rattled; house creaked. Motion rapid.

May 28: 23:08*. Epicenter 41.1° north, 124.0° west, B. Very light shock felt in Eureka.

May 31: 12:00. Eureka (½ mile south of). III. Felt by observer active on first floor of weakly built wooden house. Direction west-east. Motion rapid.

June 1: 10:44, 10:56, 13:00, 14:30, 14:41, and 15:30. Eureka. III. Light shocks. Direction south-north. Two lasted 3–4 seconds.

June 4: 00:33:19*. Epicenter 35°10′ north, 119°10′ west, east of Buena Vista Lake, P. V. Pictures moved on walls at Bakersfield. Felt sharply at Taft, especially in the western section. Also felt at the PG&E Steam Plant, 15 miles west of Bakersfield.

June 8: 14:25. Canyon. IV. Rapid motion, lasting 1–2 seconds. Felt by observer in home. Windows rattled sharply.

June 21: 22:17:58*. Epicenter 33°54′ north, 118°32′ west, Santa Monica Bay, P. Reported felt in Beverly Hills, Inglewood, and southwest Los Angeles.

July 3: 20:35:36*. Epicenter 39°20′ north, 118°30′ west, southeast of Fallon, Nev., B. Felt slightly at Fallon.

July 3: 21:52:56*. Epicenter 34°14′ north, 117°06′ west, east of Lake Arrowhead, P. IV. Sharp shock, followed by lesser jolts, awakened residents and vacationers in Lake Arrowhead area. Shock at 21:52:56* felt at Lake Arrowhead Lodge, with others reported shortly after 00:00 and before 03:00 on July 4.

July 3: 21:57:28*. Epicenter 37.7° north, 119.3° west, southeast of Yosemite, B. IV. Windows rattled at Balch Powerhouse, near Trimmer. Motion rapid. Foreshock was reported felt at 21:15. At June Lake, felt by several and awakened few. Windows rattled; walls creaked. Motion rapid. Very noticeable in central section of Yosemite National Park, especially loud rumbling earth noises. Felt by many. Motion trembling. Also felt at Silver Lake.

July 4: 02:43:38*. Epicenter 34°14′ north, 117°06′ west, east of Lake Arrowhead, P. Felt at Lake Arrowhead Lodge.

July 4: 13:42. San Diego. Mild bumps, lasting 15 seconds, felt by observer while cruising on San Diego Bay, off Civic Center. Reported by press as an earthquake.

July 5: 13:18. Slight shock reported felt at Electra Powerhouse (NW¼, Sec. 33, T6N, R12E) near Jackson.

July 5: 19:31:35*. Epicenter 38°27′ north, 118°37′ west, near Hawthorne, Nev., B. Felt area approximately 1,000 square miles of western Nevada. Maximum intensity IV. Shock felt by observer (sitting) at Dead Horse Well (9 miles southeast of Rawhide) where windows, doors, and dishes rattled; house creaked; light swung. Felt by many (some outdoors); awakened and frightened few in community at Hawthorne. Described as two sharp jolts, rattling windows, dishes, and bottles. Reported rather strong at Luning where it was felt by many. One sharp shock felt by many at Schurz (some outdoors; quiet).

July 8: 03:22:18*. Epicenter 34°14′ north, 117°06′ west, east of Lake Arrowhead, P. Felt at Lake Arrowhead.

July 9: 15:15. Huasna (about 12 miles southeast of Arroyo Grande). III. Slight shock felt by several. Windows rattled slightly. Motion swaying.

July 11: 11:22:06*. Epicenter 35°46′ north, 117°56′ west, southwest of Brown, P. IV. Felt by many at China Lake. At Kernville, felt by many; direction north-south; motion slow. At Oak Flat Lookout (about 12 miles northwest of Kernville) and Tobias Peak Lookout (about 20 miles southwest of Kernville), felt by several; windows, doors, and dishes rattled; house creaked; direction north-south; motion slow. Also felt at the Kern River Powerhouse No. 3, near Kernville.

July 12: 21:32:52*. Epicenter 40.8° north, 123.6° west, east of Arcata, B. Minor shock jarred small communities of Blue Lake and Korbel.

July 13: 15:02:01*. Epicenter 40.7° north, 121.4° west, southeast of Burney, B. Felt at Hat Creek. Aftershocks also felt at 15:08 and 15:15.

July 15: 03:06:53*. Epicenter 33.9° north, 118.2° west, Los Angeles, P. Reported felt at Los Angeles.

July 15: 16:39*. Baja California, P. Chandeliers swayed at San Diego.

July 18: 10:43:42*. Epicenter 34°12′ north, 116°55′ west, near Big Bear Lake, P. Fawnskin. IV. Felt by many in community; windows rattled; walls creaked. Motion rapid.

July 18: 15:03:07*. Epicenter 38°39′ north, 122°44′ west, north of Santa Rosa, B. V. Windows cracked at Windsor. Felt sharply at Santa Rosa.

July 20: 17:52:00*. Epicenter 40°16′ north, 124°22′ west, near Petrolia, B. Several sharp jerks felt at Ferndale seismograph station.

July 23: 00:03:48*. Epicenter 36.3° north, 121.3° west, northwest of King City, B. Felt area approximately 4,000 square miles of coastal areas of central California. Maximum intensity V.

INTENSITY V:

Big Sur.—Felt by several in home; outdoors by observer (quiet); awakened many in community. Doors rattled; frame creaked. Hanging objects swung. Motion rolling.

Chualar Canyon.—Felt by, awakened, and frightened all. Windows, doors, and dishes rattled. Loud earth noises heard. Motion rapid.

Gonzales.—Windows, doors, and dishes rattled; walls creaked. Hanging objects swung. Loud earth noises heard by few 10 seconds before shock. Motion rapid.

Greenfield.—Felt by all; awakened many. Windows, doors, and dishes rattled. Hanging objects swung. Moderate earth noises from east heard about 30 seconds before shock. Motion rapid.

Hollister (7 miles south of).—Felt by and awakened many; frightened few. Windows, doors, and dishes rattled; house creaked.

King City.—Felt by and awakened many; frightened few. Windows, doors, and dishes rattled. Hanging objects swung. Moderate earth noises heard. Motion slow.

Paso Robles.—Felt by many and awakened few in community. Reportedly felt stronger east of Paso Robles. Homes shaken and wall pictures tilted, but no damage reported. Motion rapid.

San Benito.—Felt by all; awakened all in home. Doors rattled; house creaked. Earth noises from northeast heard by many. Motion slow.

San Juan Bautista.—Awakened many.

INTENSITY IV: Adelaida Ranch (about 14 miles west of Paso Robles), Aptos, Carmel Valley, Peachtree Valley (about 20 miles east of King City), and Pinnacles National Monument (Sec. 2, T17S, R7E, MDBM).

INTENSITY I TO III: Monterey, Moss Landing (PG&E Steam Plant), and Volta.

July 24: 20:52. Merced (3½ miles east of). Shock of slow motion and momentary duration reported felt at the PG&E Wilson Substation, 3½ miles east of Merced.

July 24: 22:52:16*. Epicenter 38°13′ north, 122°06′ west, near Fairfield, B. Cordelia PG&E Substation (about 5 miles southwest of Fairfield). III. Brief shock. Building shook north-south. Also felt at Fairfield, Napa, Solano, and Vallejo.

July 26: 01:53:17*. Epicenter 39°33′ north, 118°27′ west, east of Fallon, Nev., B. Magnitude 5.1. Stillwater. V. Knocked clock off mantel at Kent Ranch. Also felt at Fallon.

July 31: 09:25. Huasna (about 12 miles southeast of Arroyo Grande). IV. Slight shock felt by observer sitting. Windows rattled.

August 1, 2, 3: 08:03, 14:05, 07:55, respectively. San Francisco. East-west rolling motion felt in home in Sunset District and by others in home in Haight-Ashbury District.

August 2: 19:39:41*. Epicenter 40°34′ north, 121°21′ west, northeast of Mount Lassen, B. Manzanita Lake (Mineral). IV. Felt by many. Earth noises heard by few. Motion rapid, brief.

August 3: 10:21:25*. Epicenter 40°29′ north, 121°28′ west, near Mount Lassen, B. Mount Harkness (Lassen Volcanic National Park). IV. Windows, doors, and dishes rattled. Faint rumbling earth noises heard. Motion rapid.

August 5: 21:31:09*. Epicenter 33°32′ north, 116°44′ west, near Anza, P. Hemet. III. Barely noticeable shock, lasting 1 second, felt by observer in home. Hanging shelf rattled. Motion rapid.

August 6: 23:03:29*. Epicenter 40.5° north, 121.5° west, near Lassen Peak, B. Manzanita Lake (Mineral). V. Felt by and awakened all in community. Both components of seismograph dismantled. Windows, doors, and dishes rattled; walls creaked. Hanging objects swung. Motion slow. Aftershocks felt.

August 8: 16:08:49*. Epicenter 34°22′ north, 119°48′ west, off Santa Barbara, P. IV. At Santa Barbara described as a slight rolling earthquake. Few persons calling Sheriff's office thought disturbance was sonic blast. Felt by many at Los Priestos Ranger Station (20 miles north of Santa Barbara at head of Santa Inez Valley) where buildings creaked. Motion rocking.

August 10: 11:26:00*. Epicenter 38°02′ north, 122°27′ west, San Pablo Bay, B. Felt in some sections of Richmond.

August 19: 21:10:33*. Epicenter 36°29′ north, 121°29′ west, near Gonzales, B. Pinnacles National Monument (Paicines). IV. Trembling motion felt accompanied by rumbling earth noises. Buildings creaked; loose objects rattled.

August 25: 07:57:43*. Epicenter 31°30′ north, 115°30′ west, Baja California, P. San Diego. IV. Reported as fairly strong, shaking buildings and houses.

September 2: 06:17:11*. Epicenter 37°25′ north, 121°42′ west, northwest of Mount Hamilton, B. IV. "A minor earthquake rattled windows in the San Jose area. No damage was reported."—(*BSSA, January 1957.*)

September 8: 02:12. "Five separate earthquakes, between 02:12 and 03:00, were felt by Brawley residents. No damage was reported."—(*BSSA, January 1957.*)

September 10: 05:12:35*. Epicenter 35°23′ north, 119°05′ west, P. Felt at Bakersfield.

September 20: 12:15:13*. Epicenter 33°48′ north, 118°37′ west, Santa Monica Bay, P. Felt at Inglewood.

September 21: 21:06. Slight tremor and noise reported at Descanso.

September 22: 23:15. Long Valley Dam (about 20 miles northwest of Bishop). IV. Felt by many in community. Windows and doors rattled; walls creaked. Motion rapid.

September 23: 00:51:55*. Epicenter 31°35′ north, 115°40′ west, Baja California, P. San Diego. II. Shock with rapid motion and lasting 45 seconds felt by observer in home. "Series of deflections from 08:06 and during day. Had calls from El Cajon Valley of rumblings during the day."

September 23: 03:24:42*. Epicenter 33°32′ north, 116°33′ west, southwest of Santa Rosa Mountain, P. Felt area approximately 1,500 square miles of southwest Riverside County. Maximum intensity of VI reported from Palm Springs where many awakened; few frightened. Plaster cracked in several homes and small objects shifted. Motion rapid. Awakened many at Banning, Hemet, Mountain Center, Rancho Mirage, and San Jacinto. Felt by many and awakened few at Anza. At North Palm Springs, some awakened. Also felt at Indio and Riverside.

September 29: 10:03:06*. Epicenter 35°39′ north, 118°26′ west, near Isabella, P. Kernville. IV. Felt by several; windows and doors rattled; walls creaked. Motion rapid. Felt sharply at Isabella.

September 30: 11:29:36*, 11:30:02*. Epicenter 35°08′ north, 118°24′ west, near Monolith, P. Tehachapi. IV. Buildings creaked by rapid, west-east jar of 2 seconds' duration.

October 2: 12:44:35*. Epicenter 33°50′ north, 117°01′ west, southeast of Riverside, P. IV. Felt by many in community and frightened few at Hemet; windows and doors rattled; motion rapid. Brief, northeast jar felt by all in home (sitting) at Redlands where house creaked. Rattled windows and dishes in the Riverside area. Light shock, sensation of ground settling straight down, felt at Wildomar. Also felt at Banning, Cabazon, Palm Springs, San Jacinto, and Santa Ana. Shocks at 06:36 and 08:14 were reported felt at Hemet.

October 2: 17:34:36*. Epicenter 33°50′ north, 117°01′ west, southeast of Riverside, P. Hemet. IV. Felt by many and frightened few in community. Windows and doors rattled. Rapid, east-west jarring motion.

October 4: 12:06:35*. Epicenter 35°32′ north, 118°21′ west, southeast of Isabella, P. At Bakersfield shock went almost unnoticed, due to heavy rain and thunder storm. Abrupt, trembling motion, lasting 2 seconds, felt at Tehachapi.

October 6: 04:30:42*. Epicenter 40°25′ north, 124°00′ west, southeast of Scotia, B. Phillipsville (1 mile south of). IV. One bump. Felt by several; buildings creaked; loose objects rattled; objects disturbed.

October 6: 18:38:19*. Epicenter 37°49′ north, 121°50′ west, north of Livermore, B. San Ramon area. IV. Felt by many. Felt slightly at Berkeley and Oakland. Also felt at Stockton.

October 9: 22:00. Oxnard. IV. "A light earthquake was thought to have rattled windows in Camarillo, Oxnard, and Port Hueneme about 10 p. m., PST."—(*BSSA, January 1957.*)

October 11: 08:48:50*. Epicenter 40°40′ north, 125°46′ west, 100 miles west of Ferndale, B. Felt over land area of approximately 3,500 square miles of Humboldt County. Also felt with slight intensity at Bucks Creek Powerhouse (Plumas County) and at Medford and Shady Cove, Oreg. Maximum Intensity V. Few dishes broken. Aftershocks were reported felt at 09:18:17* and 09:22:32*.

INTENSITY V:

Bayside.—Felt by all. Small objects shifted. Moderate earth noises heard by few. Motion slow.

Blue Lake.—Felt by all; frightened few. Windows, doors, and dishes rattled; house creaked. Moderate earth noises heard.

Crannell.—Felt by several; frightened few. Small objects shifted. Flower pot almost fell from shelf on northeast side of kitchen. Telephones gave a short ting just before the rocking started. Trees, bushes shaken slightly. Motion slow.

Eureka.—Two rolling shocks, very close together. Felt by many; awakened and frightened few. Dishes broke in some homes. Small objects shifted; knickknacks fell; sawhorse with few empty cartons on it overturned in west direction.

Ferndale.—Felt by all; frightened many in community. Windows rattled. Hanging objects swung east-west. Loud earth noises heard by many 5 seconds before shock. Motion slow.

Fields Landing.—Felt by all; frightened many in community. Windows rattled; walls creaked. Motion slow.

Fortuna.—Felt by all; frightened all in office, except observer. Leaves of flowers and shrubs in planters shook. Windows and doors rattled; hanging objects swung. Motion rocking, rolling.

Korbel.—Felt by and frightened many. Windows rattled; walls creaked. Moderate earth noises heard by few. Rolling motion.

Loleta.—Felt by all. Windows rattled; frame creaked. Hanging objects swung. Motion slow.

Petrolia.—Felt by all; frightened few in community. Windows, doors, and dishes rattled; house creaked. Hanging objects swung. Motion slow.

Rio Dell.—Felt by all; frightened few. Knickknacks fell in store. Windows, doors, and dishes rattled. Hanging objects swung northeast. Faint earth noises from northeast heard by few. Motion slow.

INTENSITY IV: Alton, Blocksburg, Bridgeville, Denny, Forest Glen, Fort Bragg, Freshwater, Garberville, Holmes, Honeydew, Kneeland, Piercy, Scotia, and Trinidad.

INTENSITY I TO III: Alderpoint, Arcata, Bell Springs, Bucks Creek Powerhouse (NE ¼, Sec. 29, T24E, R6E), Cape Mendocino (1 mile south of), Carlotta, Crescent City, Ettersburg, Phillipsville, Weitchpec, and Willow Creek.

INTENSITY I TO III IN OREGON: Medford and Shady Cove.

October 12: 01:25. Carlotta. III. Slight shock felt by several. Bed shook.

October 13: 11:43. Eureka. IV. Heavy, sharp, west-east settling motion felt by several. Garage trembled. Motion rapid.

October 18: 15:23:22*. Epicenter 33°54′ north, 117°57′ west, east of Los Angeles, P. Felt at Anaheim and Fullerton.

October 19: 04:32:03*. Epicenter 36°39′ north, 121°14′ west, southeast of Paicines, B. IV. Monterey Peninsula. "Several Monterey Peninsula residents were awakened. The tremor rattled windows, but there were no reports of damage."—(*BSSA, January 1957.*)

October 21: 06:02:30*. Epicenter 36°59′ north, 122°16′ west, west of Santa Cruz, B. Felt over land area of approximately 150 square miles of Santa Cruz County. Maximum intensity V. Felt by many; awakened many in home at Ben Lomond; windows and doors rattled; walls creaked. Motion slow. At Boulder Creek, felt by several; awakened few in community. Trees, bushes shaken slightly. Motion slow; slight shock. Awakened two in home at Davenport. Motion rapid. Frightened few in home at Mount Hermon; windows rattled. Slight shock. Motion slow. Felt by many and awakened few at Santa Cruz where buildings creaked; loose objects rattled; parakeets disturbed.

October 25: 14:43. Probably not an earthquake, P. San Diego. II. Rapid motion felt by several in home.

November 3: 20:37. Hollister (7½ miles south of). II. Weak shock felt by several in home (sitting). Motion slow.

November 7: 19:41:02*. Epicenter 36°47′ north, 121°40′ west, between San Juan Bautista and Castroville, B. Hollister. "A light earthquake shook the Hollister area."—(*BSSA, January 1957.*)

November 9: 13:17. Tehachapi. IV. One sharp jar felt by observer. Moderately loud bumping earth noises heard.

November 10: 01:06:34*. Epicenter 40°13′ north, 123°48′ west, near Miranda, B. V. "Humboldt County residents from Rio Dell to Blue Lake were awakened by a sharp, jolting earthquake. Windows rattled, but no damage was reported."—(*BSSA, January 1957.*) Awakened all from sound sleep in home at Eureka where dishes, lamps, and utensils rattled. One mile south of Phillipsville, awakened two; building creaked and loose objects rattled. Steady rumbling heard for about 20 seconds.

November 14: 05:49:23*. Epicenter 37°28′ north, 118°49′ west, west of Bishop, P. Long Valley Dam (about 20 miles northwest of Bishop). V. Rapid motion, lasting 2 seconds, awakened many in community.

November 15: 19:23:09*. Epicenter 35°57′ north, 120°28′ west, northwest of Parkfield, B. Felt over land area of approximately 8,000 square miles, extending from Holy City (Santa Cruz Coun-

ty) south to Betteravia (Santa Barbara County) and inland as far as Firebaugh (Fresno County). Magnitude 5.0. Maximum intensity VI was reported from Mee Ranch, near Lonoak, where plaster cracked.

INTENSITY VI:

Mee Ranch (Lonoak).—Felt by all in home. Plaster cracked. Trees, bushes shaken moderately. Moderate earth noises from southeast heard by many 2 seconds before shock.

INTENSITY V: Adelaida (15 miles west of Paso Robles), Arroyo Grande, Avenal, Bitterwater Pumping Station, Creston, Harmony, Huron, Keys Valley Ranch (15 miles northeast of Paso Robles), King City, San Ardo, San Lucas, San Miguel, Soledad, Templeton, and Westhaven.

INTENSITY IV: Aptos, Atascadero, Betteravia, Big Sur, Bryson (Ernest Weferling Ranch), Buellton, Burrel, Cayucos, Coalinga (14 miles northwest of, in Los Gatos Canyon), Coalinga Mineral Springs, Greenfield and vicinity, Jolon, Lemoore, Mendota, Morro Bay, Nipomo, Paloma Station (Jamesburg route), Paso Robles, Pozo Guard Station, Salinas, San Joaquin (3 miles south of), San Luis Obispo, San Simeon, Santa Margarita, Seaside, Shandon, and Stratford.

INTENSITY I TO III: Avila Beach, Caruthers, Cholame, Chualar, Corcoran, Firebaugh, Hanford, Hollister, Holy City (1 mile north of, Chemeketa Park), Idria, Laton, Kettleman Compressor Station, Moss Landing, Mount Hermon, San Benito, and Santa Cruz.

November 19: 05:53:53*. Epicenter 35°59′ north, 120°34′ west, northwest of Parkfield, B. Adelaida (15 miles west of Paso Robles). III. One jolt. Window rattled once.

November 19: 19:42:44*. Epicenter 34.7° north, 120.5° west, north of Lompoc, P. Los Alamos (west section). IV. Felt by many. Buildings creaked; loose objects rattled. Objects disturbed in many homes, some swung and were displaced in northeast-southwest direction.

November 19: 23:42. Los Alamos (west section). III. Bumping motion felt by several.

November 22: 08:43:58*. Epicenter 36.6° north, 121.3° west, northeast of Soledad, B. Hollister. V. "A rolling earthquake sent residents of the Hollister area into the streets. No damage reported."—(*BSSA, January 1957.*) Awakened and frightened few 7½ miles south of Hollister. Windows, doors, and dishes rattled; house creaked; trees, bushes shaken moderately. Motion slow. At Big Sur, felt by several in community; doors rattled and frame creaked. Motion slow.

November 30: 04:55:17*. Epicenter 37°59′ north, 122°01′ west, near Concord, B. Concord. IV. "A light earthquake awakened a few light sleepers in the Concord area."—(*BSSA, January 1957.*)

December 1: 06:11:25*. Epicenter 36°52′ north, 121°36′ west, west of Hollister, B. Felt over land area of approximately 3,200 square miles of the coastal area of west-central California. Maximum intensity V. No damage reported.

INTENSITY V:

Aromas.—Felt by some outdoors; awakened many in community; frightened few. Windows, doors, and dishes rattled. Motion jolting.

Gilroy.—Felt by all; awakened many; frightened few. Hanging objects swung. Motion slow.

Holy City (1 mile north of, Chemeketa Park).—Awakened and frightened few. Small objects shifted.

Morgan Hill.—Felt by and awakened all. Windows, doors, and dishes rattled. Moderate earth noises from south heard. Motion slow.

San Jose.—Felt by many; some alarmed; awakened many in home. Small objects shifted. Motion rapid; one strong bump and lesser ones.

Santa Clara.—Felt by all; awakened all in home; frightened many in community. Windows, doors, and dishes rattled. Motion rapid.

Watsonville.—Felt by and awakened many in community; frightened few. Trees, bushes shaken moderately. Windows rattled; walls creaked. Moderate earth noises from east heard by many 3 seconds before shock. Motion slow.

INTENSITY IV: Alvarado, Aptos, Capitola, Coyote, Felton, Hollister, Los Gatos, Madrone, Mission San Jose, Moffett Field, Niles, Palo Alto, Redwood City, San Francisco, San Martin, South San Francisco, and Sunol.

INTENSITY I TO III: Ben Lomond, Bolinas, El Sobrante, Freemont, Hayward, Moraga, Moss Beach, Moss Landing, Mount Hamilton, Mount Hermon, Newark PG&E Substation, Oakland (Peralta Hospital), San Gregorio, and Santa Cruz.

December 12: 18:35:16*. Epicenter 37°38′ north, 122°03′ west, near Hayward, B. Hayward (corner Castro and Hillary Sts.). IV. Felt as a distinct explosion.

December 13: 05:15:37*. Epicenter 31° north, 115° west, Baja California, W. Awakened people in San Diego.

December 15: 04:30 or 05:00. Coleville. Felt by about half the community.

December 18: 21:10:44*. Epicenter 40°42′ north, 122°05′ west, near Ingot, B. IV. Felt by many in home and frightened few at Whitmore where furnishings shifted. Motion jolting. Cottonwood and Kilare powerhouses and camps at Pit River powerhouses Nos. 3, 4, and 5 reported sharp shock, lasting about 3 seconds. Also felt at McCloud, Mineral (Lassen Volcanic National Park Headquarters), Ono and 17 miles east and 3 miles northwest of, Red Bluff (3 miles east of), and Redding.

December 19: 16:27:35*. Epicenter 37°55′ north, 122°17′ west, near Berkeley, B. Felt slightly by one person on second floor of Bacon Hall, University of California.

December 31: 09:36:16*, 09:37:45*, 09:39:24* (main shock). Epicenter 38°17′ north, 118°58′ west, near Hawthorne, Nev., B. Felt area of principal shock approximately 6,000 square miles of western Nevada and eastern California. Magnitudes for the three shocks were 3.8, 5.0, and 5.1, respectively. Maximum intensity VI south of Hawthorne where two cracks were reported in U. S. Highway 95.

INTENSITY V:

Hawthorne.—Felt by many (some outdoors; active); frightened few. Three sharp shocks felt. The county courthouse was evacuated when the first shock was felt at 09:36:16*. Windows and dishes rattled; walls creaked.

Thorne.—Felt by all. Windows rattled. Hanging objects swung north. Motion rapid.

INTENSITY IV IN NEVADA: Carson City, Genoa, Mina, Stillwater, and Wellington.

INTENSITY IV: Bridgeport, Stanislaus Powerhouse, Vade, White Pines, and Yosemite National Park.

INTENSITY I TO III IN NEVADA: Frenchman's Station, Gabbs, Gardnerville, Luning, Mason, Schurz, Tonopah, and Yerington.

INTENSITY I TO III: El Portal.

(No date given): 13:30. IV. Felt by two 1 mile south of Phillipsville. Telephone wires bobbed up and down like someone was working on them. Motion rocking.

WASHINGTON AND OREGON

(120TH MERIDIAN OR PACIFIC STANDARD TIME)

January 6: 20:29:35*. Epicenter 47°19′ north, 122°25′ west, S. Felt area approximately 2,500 square miles of Puget Sound, Washington. Maximum intensity V.

INTENSITY V:

Burley.—Felt by all. Windows rattled. Faint earth noises heard.

Dash Point.—Felt by observer outdoors. Small objects shifted. Dishes rattled. Hanging objects swung. Motion rapid.

Dieringer.—Felt by several. Small objects shifted. Windows rattled.

Retsil.—Felt by all. Moderate earth noises heard. Motion rapid.

INTENSITY IV: Cove, Dockton, Fox Island, Gorst, Lakebay, Olympia (4 miles south of), Port Orchard, Seattle, Vashon, and Wauna.

INTENSITY I TO III: Black Diamond, Bremerton, Kent, Olalla, Orillia, Pacific, Portage, Steilacoom, and Tacoma.

February 8: 16:57:12* and 17:29. Epicenter 48°21′ north, 122°39′ west, northwest corner of Whidbey Island, few miles south of Deception Pass, S. Felt area approximately 4,000 square miles of northwestern Washington. Maximum intensity V. It was reported some objects fell from store shelves (no location given). Aftershock at 17:29 reported as considerably weaker.

INTENSITY V:

Anacortes.—Felt by all. Doors rattled and swung north. Trees, bushes shaken slightly. Motion rapid.

Bay View.—Felt by all and frightened few. Trees, bushes shaken moderately. Hanging objects swung. Windows and doors rattled. Loud earth noises from east heard. Motion rapid. Two moderate shocks, close together, felt about 25 minutes after first shock.

Burlington.—Felt by many and frightened few in community. Small objects shifted. Trees, bushes shaken slightly. Windows, doors, and dishes rattled for about 30 seconds. Loud earth noises heard by many at time of shock. Motion rapid.

La Connor.—Felt by all and frightened few in community. Windows, doors, and dishes rattled; house creaked. Loud earth noises heard by many at time of shock. Motion rapid.

Mount Vernon.—Felt by all. Small objects and furnishings shifted. Hanging objects swung. Loud earth noises heard by many. Motion rapid.

Oak Harbor.—Felt by all. Windows, doors, and dishes rattled. Motion rapid, jarring, felt like truck hit building.

INTENSITY IV: Arlington, Coupeville, Doebay vicinity, East Stanwood, Fortson, Friday Harbor, Granite Falls, Lopez, Marysville, Orcas, Sedro Woolley, and Stanwood.

INTENSITY I TO III: Acme, Bellingham, Bothell, Gold Bar, Index, Oso, Port Townsend, Shaw Island, Silvana, and Startup.

February 14: 05:55. Aftershock of February 8. Felt at Coupeville and Port Townsend.

February 24: 14:00 (about). Washington. Electric City (about 2 miles southwest of Grand Coulee). V. Felt by many (some outdoors); awakened few in community. Small objects shifted. Pictures swung. Moderate earth noises heard by few at time of shock. Motion rapid. Described by some as similar to concussion and movement caused by blasting but of different sound. At Grand Coulee quite a vibration was noticed which observer thought was a sonic boom, due to jet activity at the time.

April 8: 14:28:12*. Northwestern Washington. Epicenter 48°26′ north, 123°08′ west, S. Felt area approximately 1,200 square miles in the United States. IV. Felt by several at Anacortes where windows, doors, and dishes rattled; hanging objects swung northeast; trees, bushes shaken slightly. Frightened few at Decatur Island; windows, doors, and dishes rattled; house creaked. At Eastbound, felt by many and frightened few; windows rattled slightly; house creaked. Felt by many at Oak Harbor. House creaked at Olga. Felt at Orcas. Windows and oil burner stove rattled; house creaked. Felt at Sequim. Windows rattled; chains shook. Loud blastlike noises from north. At Shaw Island, felt by several. Chimney creaked. Second shock felt about 15 seconds later. Also felt at Coupeville, Friday Harbor, Hadlock, and Lopez.

April 26: 08:48:22*. Puget Sound area, Washington. Epicenter about 10 miles south of the University of Washington, Seattle, S. III. Sudden jolt then slow rolling motion, lasting 5–10 seconds felt by observer in home at Renton. At Seattle, felt by observer and at least one other person. Floor (on wooden beams) vibrated vertically. Motion similar to heavy truck passing but of longer duration. Also felt at Issaquah.

December 15: 01:50. Washington. IV. Minor explosivelike disturbance. Felt by many and frightened few at Kelso and Longview. In southwestern Longview insecure shelf tilted, causing several dishes to fall. Windows and dishes rattled. Motion brief, rolling, seemed from all directions. Also felt at Lexington, 2 miles north of Longview.

ALASKA

(150TH MERIDIAN OR ALASKA STANDARD TIME)

January 7: 00:00. Sterling. Felt.

January 7: 00:43:20*. Anchorage. IV. Felt. Windows rattled.

January 20: 05:23:28*. Caswell. Felt.

February 23: 23:15. Kasilof. Slight shock.

March 2: 01:56:20*. Epicenter 63½° north, 149½° west, central Alaska, W. Fairbanks. IV. Felt by many. Houses shook; windows and dishes rattled. One observer reported he heard articles dropping to the floor in the apartment above him. Motion rolling. Also felt at College, McKinley Park, Summit, and Talkeetna.

March 25: 22:17:24*. Epicenter 61½° north, 151° west, southern Alaska, W. Anchorage. IV. Felt by several. Windows rattled.

March 28: 19:53:42*. Seward. Slight shock.

March 28: 20:00:00*. Fairbanks. IV. Felt by many. Abrupt onset; motion bumping.

March 30: 07:50:45*. Epicenter in central Alaska, W. Felt at College.

March 31: 01:54:17*. McGrath. V. Felt by and awakened nearly all. Buildings shook; windows and loose objects rattled. Lights on chains swung an estimated 2 inches from normal position. Floors of buildings swayed; disturbed objects observed by many. Rapid onset. Two shocks felt.

April 26: 19:20. Chichagof. IV. Sharp jolt of about 3 seconds. Rattled guy wires on chimney.

April 27: 19:55. Valdez. Slight shock. Duration 3 seconds.

April 28: 14:08:28*. Epicenter in Fox Islands, Aleutian Islands. Felt on Unalaska.

May 7: 10:58:02*. Unalaska. Felt by several.

May 17: 18:19:16*. Fairbanks. V. Felt by many. Windows shook; upper floors of taller buildings jiggled noticeably. Police switchboards swamped with calls of inquiry. Bumping motion; abrupt onset. Duration 2 seconds. Felt at College.

May 18: 22:19:01*. Valdez. Felt. Duration 2 seconds.

May 18: 22:35. Homer (5 miles northwest of). Slight shock.

May 19: 11:55. Valdez. Felt. Duration 3 seconds.

June 8: 16:24:53*. Hot Springs. IV. Felt by and awakened several. Dishes rattled. Moderate earth noises heard before shock.

June 8: 16:26:57*. Epicenter 64° north, 148° west, central Alaska, W. Hot Springs. V. Felt by and awakened several. Objects toppled from shelf. Walls creaked; windows, doors, and dishes rattled. Hanging objects swung. Loud earth noises heard before shock. Felt at College.

August 18: 13:36:45*. Valdez. Felt. Duration 2 seconds.

September 1: 05:30 and 05:32. Nyac. Felt.

September 27: 18:55:50*. Caswell. Felt.

September 29: 11:49. Caswell. Felt.

October 25: 21:26. Matanuska Agriculture Experiment Station. IV. Felt. Lampshade swayed. Direction southeast-northwest.

November 17: 07:23:05*. Caswell. Felt.

November 17: 10:27:15*. Epicenter 54½° north, 134° west, Queen Charlotte Islands region, W. Magnitude 6¼. Intensity IV at Ketchikan and Petersburg, Alaska, where buildings shook; windows and dishes rattled; pictures swayed.

December 6: 21:24. Girdwood. Felt.

December 24: 19:26. Girdwood. Felt.

December 24: 19:30. Anchorage and Kasilof. Felt. Duration 5 seconds, and movement in E–W direction at Anchorage. Duration about 3 seconds at Kasilof.

December 24: 19:50. Girdwood. Felt.

December 24: 19:52. Anchorage. Felt. Duration 2 seconds.

HAWAIIAN ISLANDS

(150TH MERIDIAN OR HAWAIIAN STANDARD TIME)

NOTE.—Data on the following local disturbances were determined from seismograph stations operated on the islands of Hawaii and Maui by the Hawaiian Volcano Observatory of the Geological Survey. "Felt locally" appearing in the summary means in the vicinity of the observatory. For additional information, see the Hawaiian Volcano Observatory Summary 1 through 4.

February 5: 07:21:03*. Slight. Felt at Hawaii National Park and Pahala. Origin Kaoiki fault near Halfway House.

February 18: 17:02:50*. Moderate. Felt at Hawaii National Park. Origin Kaoiki fault west of Kilauea caldera.

February 18: 17:04:06*. Waikiki, W. Felt.

March 3: 21:49:35*. Moderate. Felt at Hawaii National Park, Hilo, and Olaa. Origin south of Kilauea caldera.

March 9: 13:35:00*. Slight. Felt at the Volcano House. Origin northeast rim of Kilauea caldera.

March 10: 01:58:07*. Slight. Felt at Glenwood and Hilo. Origin east coast of Hawaii east northeast of Hilo.

March 29: 15:53:27*. Moderate. Felt at Pahoa. Origin east rift of Kilauea south of Pahoa.

April 15: 19:09:20*. Moderate. Felt at Honokaa. Origin north-northwest of Keahole Point.

May 13: 21:53:36*. Moderate. Epicenter 20°17′ north, 155°17′ west, off north coast of Hawaii. Felt from Hawaii National Park on Hawaii to Honolulu on Oahu.

May 27: 15:41:00*. Strong. Felt from Kealakekua to Hilo; strongly at Kapapala. Origin north of Ainapo.

June 7: 00:35:58*. Moderate. Felt at Kealakekua. Origin near Kealakekua.

June 14: 15:09:55*. Strong. Felt throughout Kona and as far as the Hawaiian Volcano Observatory. Origin north of Kealakekua.

July 26: 01:40:45*. Moderate. Felt in central Kona. Origin southwest rift of Mauna Loa.

August 7: 07:04:39*. Oahu, W. IV. Felt over most of Oahu and parts of Maui and Molokai.

August 23: 23:21. Kona. Felt by few.

September 12: 19:09. Felt in the Volcano area. Origin east rift of Kilauea near Kalalua crater.

September 26: 00:43:37*. Slight. Felt at Hilo. Origin west-southwest of Kalapana along the south shore of Kilauea.

October 11: 12:53:34*. Slight. Felt at Kamuela. Origin northwest of Kamuela.

October 16: 00:44:43*. Epicenter 20° north, 157° west, Hawaiian Islands, W. Felt over the entire island of Hawaii and as far north as Honolulu on Oahu. Aftershock at 17:31:24 felt slightly at Kona.

October 20: 20:23:04*. Feeble. Felt at Hilo. Origin near the south shore of Kilauea southwest of Kalapana.

October 20: 22:05:14*. Feeble. Felt at Hilo. Origin near the south shore of Kilauea southwest of Kalapana.

November 13: 00:11:25*. Slight. Felt at the north rim of Kilauea caldera. Origin Kaoiki fault near Kilauea caldera.

December 14: 19:13:21*. Feeble. Felt at Kona. Origin near the Kona seismograph station.

PANAMA CANAL ZONE

(60TH MERIDIAN TIME)

March 13: 09:13:10*. Epicenter 7° north, 82° west, off south coast of Panama, W. Magnitude 6¾. Intensity IV at Balboa Heights, C. Z., and San Salvador, El Salvador. Also felt at Panama City, Panama.

August 12: 20:42:23*. Intensity II at Balboa Heights.

August 20: 01:33:47*. Epicenter 7½° north, 80° west, near south coast of Panama, W. Intensity IV at Balboa Heights.

August 20: 03:06:20*. Epicenter 7½° north, 80° west, near south coast of Panama, W. Intensity III at Balboa Heights.

August 20: 03:19:59*. Epicenter 7½° north, 80° west, near south coast of Panama, W. Intensity III at Balboa Heights.

September 24: 11:38:08*. Epicenter near Costa Rica-Panama border, W. Felt at Puerto Armuelles, Panama.

September 25: 01:19:23*. Felt at Puerto Armuelles, Panama.

September 25: 02:01:58*. Felt at Puerto Armuelles, Panama.

September 25: 02:56:55*. Epicenter near Costa Rica-Panama border, W. Felt at Puerto Armuelles, Panama.

September 25: 14:27:25*. Epicenter 8° north, 83° west, Costa Rica-Panama border, W. Felt at Puerto Armuelles, Panama.

September 25: 17:31:15*. Epicenter 8° north, 83° west, Costa Rica-Panama border, W. Felt at Puerto Armuelles, Panama.

November 1: 11:42:12*. Epicenter 10° north, 80° west, near north coast of Panama, W. Intensity IV at Balboa Heights.

November 19: 22:44:54*. Intensity III at Balboa Heights.

December 12: 06:16:45*. Intensity III at Balboa Heights. Felt strongly at Canazas, Divisa, and Sta. Maria, Panama.

December 15: 21:41:52*. Epicenter 6½° north, 78° west, near west coast of Colombia, W. Magnitude 6½. Intensity III at Balboa Heights.

PUERTO RICO

(60TH MERIDIAN TIME)

February 13: 11:33:14*. Epicenter 19° north, 66½° west, off north coast of Puerto Rico, W. V. Felt over the entire island of Puerto Rico. Frightened many at Aguadilla, Caguas, and Mayagues, where houses shook and furniture moved. Students at the University of Puerto Rico left their classrooms.

461132—58——6

MISCELLANEOUS ACTIVITIES

GEODETIC WORK OF SEISMOLOGICAL INTEREST

The program of repeating geodetic control surveys for the purpose of detecting horizontal and vertical movement in the earth's crust was continued in 1956.

A triangulation party was assigned to the project of reobserving a primary scheme of triangulation along the coast from the Mexican boundary, northward towards San Francisco. This work could not be completed because of adverse atmospheric conditions. A partial network of observations was obtained extending as far as Santa Barbara.

This party was then assigned to the project of reobserving the triangulation in Owens Valley. This scheme extended from the general vicinity of Mono Lake, south to Inyokern. This net had been originally observed in 1934. A simultaneous adjustment of the two networks indicated that there has been no shift of position of one side of the valley relative to the other during the time between the two surveys. Differences of adjusted azimuths crossing the valley was generally less than one second. This is well within the limit of error of first-order triangulation.

Releveling was undertaken in 1956 from Colton to Barstow, Calif., which included leveling over bench marks in the vicinity of Cajon which were originally established in 1935 for seismic studies. This is the second releveling over these bench marks. Releveling was also undertaken from Colton via Bryn Mawr to Big Bear City, Calif., which crosses the San Andreas fault.

TIDAL DISTURBANCES OF SEISMIC ORIGIN

An earthquake near Kamchatka on March 30 caused a seismic sea wave that was recorded on tide gages in the Aleutian Islands, various Pacific Ocean islands, and the west coast of the United States. The maximum recorded height was at Attu where the height was about 2 feet.

A small sea wave was caused in the sea of Okhotsk by an earthquake near the north coast of Hokkaido, Japan, on March 5.

A seismic sea wave was set up in the Aegean Sea on July 9. A visual account of the wave at Ios Island is available but there are no tide gage records. The maximum reported waves were about 10 feet from crest to trough.

FLUCTUATIONS IN WELL WATER LEVELS

INTRODUCTION

The following data are tabulated for the purpose of associating fluctuations in well-water levels with earthquakes. The data are made available by the Ground Water Branch of the United States Geological Survey. Complete information on earthquakes may be obtained from the Preliminary Determination of Epicenter cards issued by the Coast and Geodetic Survey or from registers of seismographic stations nearest the locality.

Similar data for 1943 were published by the Coast and Geodetic Survey in United States Earthquakes, 1943, and those for subsequent years through 1949 appeared in United States Earthquakes, 1949, and United States Earthquakes, 1950, 1951, 1952, 1953, 1954, and 1955, respectively. Descriptions of wells given here include only those that have not appeared in previous editions.

WELL DESCRIPTIONS

CALIFORNIA

Well No. 1/5–16C1, semi-confined, San Bernardino County. Owner, Fontana Union Water Co. Depth, 531 feet; diameter, 20 inches; finish, perforated at intervals from 354 to 490 feet. Aquifer, Pleistocene alluvium.

Well No. 1/5–22E1, semi-confined, San Bernardino County. Owner, formerly Citizens Land & Water Co. Depth, 620 feet; diameter, 14 inches. Aquifer, Pleistocene alluvium.

Well No. 3/15–4G1, semi-confined, Riverside County. Owner, National Park Service. Depth, 445 feet; diameter, 16 inches. Aquifer, Pleistocene alluvium, possibly pinto formation.

Well No. 4/28–5K3, water table, 34°27′ N., 119°50′ W., Santa Barbara County. Owner, L. Mostachetti. Depth, 25 feet; diameter, 6 feet; finish, open bottom. Aquifer, Recent alluvium.

Well No. 4/28–34N1, water table, 34°28′ N., 119°48′ W., Santa Barbara County. Owner, A. Bosio. Depth, 170 feet; diameter, 8 inches; open bottom. Aquifer, Recent alluvium.

Well No. 5/28–34N1, water table, 34°28′ N., 119°48′ W., Santa Barbara County. Owner, A. Bosio. Depth, 170 feet; diameter, 8 inches; open bottom. Aquifer, Recent alluvium.

Well No. 11/5–2N4, water table, San Diego County. Owner, U. S. Marine Corps. Depth, 200 feet; diameter, 6 inches. Aquifer, Recent alluvium.

IDAHO

Well No. 7N–36E–8bbl, nonartesian, 43°57′ N., 112°16′ W., Jefferson County. Owner, U. S. Fish and Wildlife Service. Depth, 200 feet; diameter, 10 inches. Aquifer, Snake River basalt, Pleistocene(?).

Well No. 2S–20E–1ac2, nonartesian, 43°18′ N., 114°02′ W., Blaine County. Owner, R. N. Leazenby. Depth, 2009 feet; diameter, 10 inches; finish, perforated iron casing. Aquifer, Snake River basalt, and alluvium, Quaternary.

TABLE 1.—*Fluctuations in well-water levels, January 1 through December 31, 1956.*

NOTE.—Complete information on earthquakes possibly associated with the following tabulations may be obtained from the *Preliminary Determination of Epicenter* cards issued by the Coast and Geodetic Survey, or from registers of seismographic stations nearest the locality.

Well No.	Date	Time G. C. T.	Depth of water				
			Before disturbance	After disturbance	At highest point	At lowest point	Amplitude of fluctuation
ALABAMA							
Elm-1	10-13-56	23:00	9.13	9.13	8.98	9.20	0.22
Elm-1	11-19-56	24:00	9.11	9.09	8.93	9.20	.27
ARIZONA							
(D-13-24)16bbb	2- 9-56	(1) 14:30	78.29	78.27	78.27	78.30	0.03
(D-13-29)18bac	2- 9-56	(1) 14:30	100.49	100.51	100.44	100.53	.09
(D-24-27)10ddb	2- 9-56	(1) 14:30	15.67	15.67	15.67	15.67	.00
(D-23-22)33dcb	2- 9-56	(1) 14:30	16.76	16.77	16.75	16.78	.03
(A-18-19)16dac	2- 9-56	(1) 14:30	32.45	32.45	32.36	32.56	.20
(D-13-24)16bbb	3-20-56	05:00	74.39	74.39	74.38	74.41	.03
CALIFORNIA							
2/7-2C1	2- 9-56	24:00	35.00	35.00	34.92	35.05	0.13
3/8-29C1	2- 9-56	09:00	87.99	88.00	87.96	88.03	.07
4/28-34N1	2-15-56	01:00	7.78	7.78	7.75	7.80	.05
3/15-4G1	2-15-56	01:00	154.22	154.21	154.19	154.22	.03
15/16-34E1	3-16-56	15:00	147.65	147.65	147.62	147.68	.06
20/15-32A1	4-20-56	15:00	187.51	187.50	----------	----------	1.00
18/18-31P1	4-21-56	03:00	174.47	174.35	174.35	174.50	.15
20/15-32A1	7- 8-56	21:00	188.78	188.81	----------	----------	1.00
20/15-32A1	7-15-56	20:00	188.92	188.92	188.89	189.09	.20
4/28-5K3	8- 9-56	00:08	9.60	9.61	9.60	9.61	.01
5/28-34N1	8- 9-56	00:08	9.64	9.64	9.63	9.65	.02
NORTHERN FLORIDA							
D206	2- 9-56	15:00	12.60	12.62	12.59	12.64	0.05
H500	2- 9-56	15:00	54.26	54.27	54.23	54.30	.07
M92	2- 9-56	15:00	44.87	44.89	44.86	44.90	.04
P16	2- 9-56	15:00	71.62	71.62	71.60	71.65	.05
L7	2- 9-56	15:00	168.89	168.90	168.86	168.93	.07
P13	2- 9-56	15:00	9.72	9.70	9.69	9.73	.04
P246	2- 9-56	15:00	27.02	27.01	26.99	27.04	.05
P45	2- 9-56	15:00	73.95	73.96	73.94	73 97	.03
T35	2- 9-56	15:00	24.42	24.44	24.38	24.58	.20
V24	2- 9-56	15:00	8.30	8.34	8.28	8.38	.10
D206	7- 9-56	03:30	14.58	14.59	14.57	14.60	.03
H500	7- 9-56	03:30	55.66	55.66	(2)	(2)	(2)
L7	7- 9-56	03:30	168.10	168.09	168.07	168.12	.05
M92	7- 9-56	03:30	45.33	45.33	(2)	(2)	(2)
M450	7- 9-56	03:30	3.14	3.14	3.12	3.16	.04
O47	7- 9-56	03:30	10.76	10.76	(2)	(2)	(2)
T35	7- 9-56	10:00	24.00	24.00	23.95	24.05	.10
H30	10-24-56	15:00	+8.74	+8.73	+8.78	+8.65	.13
H500	10-24-56	15:00	51.59	51.59	51.55	51.65	.10
M92	10-24-56	15:00	41.75	41.66	41.66	41.83	.17
M450	10-24-56	15:00	1.72	1.74	1.57	1.90	.33
O47	10-24-56	15:00	1.06	1.08	1.06	1.10	.04
L7	10-24-56	15:00	166.92	166.92	166.84	167.00	.16
P246	10-24-56	15:00	26.02	26.00	26.00	26.06	.06
P45	10-24-56	15:00	68.45	68.46	68.33	68.58	.25
S9	10-24-56	15:00	63.83	63.85	63.81	63.87	.06

Footnotes at end of table.

TABLE 1.—*Fluctuations in well-water levels, January 1 through December 31, 1956*—Con.

SOUTHERN FLORIDA

Well No.	Date	Time G. C. T.	Depth of water				
			Before disturbance	After disturbance	At highest point	At lowest point	Amplitude of fluctuation
F210	2- 9-56	15:00	0.97	0.97	1.02	0.91	0.11
F291	2- 9-56	15:00	1.58	1.58	1.69	1.46	.23
G553	2- 9-56	15:00	3.30	3.30	3.34	3.25	.09
G580	2- 9-56	15:00	1.94	1.94	2.02	1.83	.19
S19	2- 9-56	15:00	0.95	0.95	1.07	0.77	.30
S68	2- 9-56	15:00	−0.09	−0.09	−0.04	−0.13	.09
S329	2- 9-56	15:00	1.37	1.37	1.37	1.33	.04
F210	7- 9-56	10:30	1.05	1.05	1.07	1.04	.03
F291	7- 9-56	11:00	1.36	1.36	1.41	1.32	.09
G553	7- 9-56	11:15	1.72	1.72	1.73	1.70	.03
G580	7- 9-56	10:00	1.66	1.66	1.70	1.61	.09
S19	7- 9-56	11:00	1.21	1.21	1.26	1.15	.11
S68	7- 9-56	(1) 10:30	0.13	0.13	0.18	0.09	.09
F210	10-24-56	15:00	2.57	2.57	2.62	2.48	.14
G553	10-24-56	13:30	5.05	5.05	5.10	5.03	.07
S68	10-24-56	14:30	1.04	1.04	1.06	1.00	.06
S329	10-24-56	15:00	3.35	3.35	3.37	3.29	.08
F210	12-21-56	10:00	0.92	0.92	0.94	0.91	.03
F291	12-21-56	09:00	1.28	1.28	1.31	1.26	.05
S19	12-21-56	09:00	1.03	1.03	1.07	1.02	.05

IDAHO

8S-26E-33bc1	2- 9-56	15:00	101.71	101.71	101.64	101.76	0.12
6N-31E-13db1	2- 9-56	14:16	214.79	214.79	214.69	214.88	.19
6N-31E-27ba1	2- 9-56	14:16	210.90	210.90	210.85	210.97	.12
4N-30E-71ad1	2- 9-56	14:16	325.82	325.83	325.68	325.90	.22
9S-25E-23db1	2- 9-56	14:30	124.21	124.21	124.18	124.24	.06
5N-34E-9bd1	2- 9-56	14:16	255.81	255.82	255.80	255.82	.02
7S-24E-2ad1	2- 9-56	14:16	204.39	204.39	204.37	204.40	.03
8S-25E-24bd1	2- 9-56	14:30	135.89	135.90	135.89	135.91	.02
8S-25E-36da1	2- 9-56	15:00	101.74	101.74	101.68	101.80	.12
8S-26E-33bc1	2-14-56	18:30	101.61	101.61	101.60	101.62	.02
8S-27E-31dd1	2-14-56	22:00 24:00	22.05	22.05	22.00	22.08	.08
8S-26E-33bc1	2-15-56	01:00	101.57	101.56	101.55	101.57	.02
8S-27E-31dd1	2-18-56	24:00 02:00	22.02	22.02	21.93	22.10	.17
8S-26E-33bc1	2-19-56	02:30	101.73	101.74	101.71	101.76	.05
4N-30E-71ad1	2-19-56	02:00 04:00	325.67	325.67	325.62	325.71	.09
9S-25E-23db1	2-21-56	22:30	124.54	124.56	124.52	124.60	.08
9S-25E-23db1	2-29-56	09:00	124.87	124.87	124.87	124.89	.02
5N-34E-9bd1	6-21-56	12:00 14:00	260.38	260.38	260.35	260.41	.06
4N-30E-7ad1	7- 9-56	05:00 07:00	325.87	325.87	325.83	325.91	.08
8S-26E-33bc1	10-11-56	16:30	100.02	100.02	100.00	100.04	.04
3N-29E-14ad1	12-21-56	02:00 04:00	453.93	453.93	453.88	453.98	.10
8S-27E-31dd1	12-21-56	07:00 09:00	22.09	22.09	21.94	22.23	.29
8S-26E-33bc1	12-21-56	09:00	101.33	101.33	101.30	101.35	.05

Footnotes at end of table.

TABLE 1.—*Fluctuations in well-water levels, January 1 through December 31, 1956*—Con.

Well No.	Date	Time G. C. T.	Depth of water				
			Before disturbance	After disturbance	At highest point	At lowest point	Amplitude of fluctuation
ILLINOIS							
ANL-11	2- 9-56	14:30	78.61	78.61	78.58	78.69	0.11
ANL-10	2-19-56	01:30	73.27	73.26	73.23	73.34	.11
ANL-9	2-19-56	02:00	93.15	93.15	93.06	92.20	.04
ANL-11	10-13-56	09:00	78.58	78.57	78.55	78.61	.06
ANL-11	10-16-56	12:00	78.85	78.84	78.83	78.88	.05
MICHIGAN							
GeFL491	1-16-56	(1) 24:00	29.48	29.48	29.46	29.51	0.05
GeFL491	2-19-56	(1) 02:45	28.95	28.95	28.92	28.97	.05
GeFL491	3-13-56	14:30	28.20	28.20	28.19	28.21	.02
GeFL491	6-10-56	00:30	31.28	31.28	31.26	31.30	.04
GeFL491	6-23-56	03:00	33.39	33.39	33.39	33.40	.01
GeFL491	6-24-56	21:30	33.43	33.43	33.40	33.46	.06
GeFL491	6-28-56	(1) 23:00	33.52	33.52	33.51	33.53	.02
GeFL491	7- 9-56	03:30	33.29	33.29	33.25	33.33	.08
GeFL491	7- 9-56	03:45	33.29	33.29	33.28	33.30	.02
GeFL491	7-16-56	16:00	33.15	33.15	33.14	33.17	.03
GeFL491	9-20-56	20:30	30.89	30.89	30.87	30.90	.03
GeFL491	10-10-56	(1) 17:00	29.95	29.95	29.92	29.98	.06
GeFL491	10-24-56	(1) 15:00	29.60	29.61	29.56	29.65	.09
GeFL491	11- 8-56	08:30	28.97	28.97	28.96	28.99	.03
GeFL491	11-17-56	(1) 21:00	28.82	28.82	28.81	28.83	.02
GeFL491	12-21-56	09:30	28.45	28.45	28.40	28.50	.10
NEVADA							
11/24-22dc1	1- 7-56	17:00	60.40	60.37	60.36	60.43	0.07
S19/60-9bcc1	2- 9-56	14:35	87.26	87.26	89.06	89.53	.47
S19/60-33baa1	2- 9-56	14:35	17.74	17.74	17.69	17.80	.11
S20/60-25adb1	2- 9-56	14:35	50.95	51.04	50.84	51.12	.28
S19/60-9bcc1	2-14-56	14:45	89.25	89.25	89.21	89.29	.08
S19/60-9bcc1	2-15-56	01:20	89.27	89.27	89.24	89.30	.06
S19/60-9bcc1	7- 9-56	03:50	92.61	92.61	92.58	92.64	.06
S11/24-22dc1	9-11-56	01:00	57.62	57.62	----------	57.97	----------
S11/24-22dc1	9-15-56	16:00	57.81	57.81	57.74	57.88	.14
S19/60-9bcc1	10-11-56	17:00	95.34	95.34	95.28	95.40	.12
S19/60-9bcc1	12-21-56	09:15	91.75	91.75	91.71	91.81	.10
NEW JERSEY							
26.22.4.4.4	1-16-56	24:15	26.76	26.77	26.78	26.74	0.04
26.22.4.4.4	2- 9-56	14:45	28.21	28.21	28.29	28.13	.16
26.22.4.4.4	2-15-56	01:30	27.77	27.77	27.78	27.76	.02
26.21.5.9.2	2- 9-56	14:45	54.64	54.64	54.71	54.62	.09
26.22.4.4.4	6-10-56	00:15	27.90	27.90	27.92	27.89	.03
31.1.6.4.8	7- 9-56	03:30	−8.20	−8.20	−8.19	−8.21	.02
26.22.4.4.4	7- 9-56	03:40	24.27	24.27	24.29	24.25	.04
30.22.9.7.3	7- 9-56	(1) 03:30	−3.22	−3.22	−3.21	−3.23	.02
31.1.6.4.8	10-24-56	14:45	−7.79	−7.79	−7.78	−7.81	.03
26.22.4.4.4	10-24-56	15:00	24.05	24.05	24.20	23.96	.24

Footnotes at end of table.

TABLE 1.—*Fluctuations in well-water levels, January 1 through December 31, 1956*—Con.

NEW YORK

Well No.	Date	Time G. C. T.	Depth of water				
			Before disturbance	After disturbance	At highest point	At lowest point	Amplitude of fluctuation
Sa529	1- 8-56	21:15	44.24	44.24	44.23	44.24	0.01
Sa529	1-10-56	09:45	44.15	44.15	44.14	44.15	.01
Sa529	1-16-56	23:45	44.08	44.08	44.07	44.09	.02
Sa529	2- 9-56	15:45	44.32	44.32	44.30	44.34	.04
Q64	2- 9-56	14:45	2.10	2.10	2.23	2.00	.23
Sa529	6- 9-56	23:30	45.18	45.17	45.17	45.19	.02
Sa529	6-28-56	(1) 22:30	45.79	45.79	45.77	45.80	.03
Q64	10- 9-56	14:46	−1.62	−1.62	−1.61	−1.66	.05
Q64	10-24-56	10:59	−1.14	−1.14	−0.95	−1.33	.38
Q64	12-13-56	13:15	−0.60	−0.60	−0.59	−9.62	.03
Q64	12-25-56	09:33	−0.50	−0.50	−0.49	−0.51	.02

TENNESSEE

79:148-18	1-29-56	22:21	47.55	47.56	47.53	47.57	0.04
7:1-6	2-14-56	21:00	77.22	77.22	77.21	77.23	.02
7:1-6	5-11-56	16:30	77.90	77.90	77.90	77.91	.01
7:1-6	6- 9-56	23:30	78.40	78.40	78.40	78.40	.01
7:1-6	6-28-56	22:50	78.77	78.77	78.77	78.78	.01
7:1-6	7- 9-56	03:19	78.90	78.91	78.90	78.92	.02
79:7-26	8-23-56	13:49	95.31	95.54	95.28	95.78	.50
7:1-6	9-16-56	20:26	99.60	99.60	99.60	99.61	.01
7:1-6	10-24-56	14:40	77.33	77.33	77.32	77.34	.02
7:1-6	11-17-56	19:00	77.15	77.15	77.15	77.16	.01
79:5-193	12-15-56	13:50	116.62	116.63	116.60	116.63	.03
7:1-6	12-21-56	09:20	74.77	74.77	74.75	74.78	.03
7:1-6	12-28-56	14:30	74.52	74.52	74.52	74.53	.01

WISCONSIN

Lf-57	1-10-56	09:50	88.27	88.29	88.25	88.30	0.05
Lf-57	1-16-56	23:40	88.39	88.39	88.34	88.43	.09
Lf-57	6- 9-56	23:00	89.06	89.06	89.04	89 09	.05
Lf-148	6-10-56	15:00	65.80	65.76	65.56	65.85	.29

HAWAIIAN ISLANDS

36A	7- 9-56	(1) 03:00	13.68	13.69	13.67	13.70	0.03
132	7- 9-56	(1) 02:50	15.69	15.69	15.68	15.71	.03
36A	7-10-56	(1) 02:40	13.69	13.69	13.67	13.70	.03
132	12-26-56	(1) 23:40	14.06	14.06	14.05	14.07	.02
36A	12-27-56	00:40	12.22	12.23	12.22	12.24	.02

[1] Time approximate.
[2] Less than 0.02 ft. fluctuation.
+Water surface above mean sea level or land surface datum;
−Water surface below mean sea level.

SEISMOLOGICAL OBSERVATORY RESULTS

The Coast and Geodetic Survey publishes the results of its teleseismic stations and cooperating stations in the monthly *Seismological Bulletin.* All seismogram interpretations are tabulated together with epicenters based on the published data and instrumental results received from seismological stations in all parts of the world. Instrumental results are published for the following stations:

Balboa Heights
(The Panama Canal Co.)
Boulder City, Nev.
Bozeman, Mont.
(Montana State College)
Burlington, Vt.
(University of Vermont)
Butte, Mont.
(Montana School of Mines)
Chicago, Ill.
(University of Chicago and U. S. Weather Bureau)
College, Alaska
Columbia, S. C.
(University of South Carolina)
Eureka, Nev.
(Eureka Corporation Limited)
Honolulu, T. H.
Hungry Horse, Mont.
Lincoln, Nebr.
(Nebraska Wesleyan University)
Philadelphia, Pa.
(The Franklin Institute)
Rapid City, S. Dak.
(South Dakota State School of Mines and Technology)
Salt Lake City, Utah
(University of Utah)
San Juan, Puerto Rico
Sitka, Alaska
Tucson, Ariz.
Ukiah, Calif.
(International Latitude Observatory)
Washington, D. C.

College, Honolulu, San Juan, Sitka, Tucson, Ukiah, and Washington are Coast and Geodetic Survey stations.

Boulder City and Hungry Horse are cooperating stations of the Bureau of Reclamation. Eureka is operated by personnel of the Eureka Corporation Limited.

Bozeman, Butte, Chicago, Columbia, Lincoln, Rapid City, and Salt Lake City are cooperating university stations.

Balboa Heights, Burlington, and Philadelphia are independent stations.

All readings were made or revised at the Washington Office except those for Balboa Heights. All seismograms are on file in the Coast and Geodetic Survey, except those for Balboa Heights and Burlington, which may be obtained on loan by addressing the Seismograph Station Director: Meteorological and Hydrographic Office, Panama Canal Company, Balboa Heights, C. Z.; University of Vermont, Burlington, Vt.

For detailed instrumental data regarding these stations, including instrumentation, constants, and other information, see *Seismological Bulletin,* MSI–181, January 1956. Those desiring to receive this publication as issued should request addition of their name to the *CGS–7* mailing list. All requests should be made to the Director, Coast and Geodetic Survey, Washington 25, D. C.

SUMMARY OF INSTRUMENTAL EPICENTERS FOR 1951

The summary of instrumental epicenters for 1951 is not available for publication at this time. However, the summary will be published as soon as the data become available. The last Seismological Bulletin issued covers March 1951.

TABLE 2.—*Summary of instrumental epicenters for 1956*

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	m	s		°	′	°	′
Jan. 1	09	03	50**	Sinkiang Province, China				
1	23	08	28*	Timor Island region. Felt in Northern Territory, Australia. Depth about 150 km. Mag. 6–6¼.	7	S.	129	E.
2	01	30	15*	Nicobar Islands region	8	N.	95	E.
2	09	28	06*	Fiji Islands. Depth about 600 km	19	S.	180	
3	00	25	49	Temescal Canyon, California. Slight damage. Mag. 4.7	33	45 N.	117	30 W.
3	10	41	08*	Southern Kurile Islands	43½	N.	147	E.
3	13	03	41*	Andreanof Islands, Aleutian Islands	51	N.	180	
3	14	24	01	Baja California. Felt in southern California. Mag. 4.7	32	23 N.	116	00 W.
3	15	40	55*	Kurile Islands	48½	N.	155	E.
3	21	33	35**	Near east coast of Kamchatka				
3	23	24	52*	Unimak Island, Alaska	54½	N.	163	W.
4	05	07	53*	Southern Hokkaido, Japan	42½	N.	143	E.
4	06	42	37*	Fox Islands, Aleutian Islands	52½	N.	171	W.
4	11	56	38*	Mindanao Island, Philippine Islands. Felt at Mambajao and Surigao.	9½	N.	126	E.
4	14	15	39*	New Britain region	6½	S.	153	E.
5	20	27	04*	Arctic Ocean	72	N.	1½	E.
5	22	31	37**	Southern Kurile Islands aftershock. Felt				
6	05	43	38*	Off coast of Portugal. Felt at Lisbon	36½	N.	11	W.
6	06	59	17*	Andreanof Islands, Aleutian Islands	51½	N.	179½	W.
6	11	57	59	Southern Kansas. Minor damage at Coldwater, Medicine Lodge, Kans., and Alva, Okla.	37¼	N.	98½	W.
6	12	15	40*	Greece-Turkey border. Slight damage in the Dardanelles region	40½	N.	26	E.
6	14	53	03**	Near north coast of Turkey				
6	17	51	32*	Andreanof Islands, Aleutian Islands	51	N.	179½	W.
6	22	25	02*	Near east coast of Honshu, Japan. Felt	39	N.	142	E.
6	23	32	50**	Guerrero, Mexico. Felt				
7	09	16	53*	Off east coast of Kamchatka	52½	N.	160½	E.
7	10	15	59*	Andreanof Islands, Aleutian Islands	51	N.	179½	W.
7	10	25	08*	Bismarck Sea	5	S.	148	E.
7	10	32	15*	Andreanof Islands aftershock	51½	N.	179½	W.
7	10	51	40*	----do----	51½	N.	179½	W.
7	11	11	30**	----do----				
7	16	41	04*	Yukon, Canada	65½	N.	133½	W.
7	19	29	00*	Near north coast of Celebes	1½	N.	122½	E.
8	03	26	12**	New Hebrides Islands region				
8	07	11	26*	Guerrero, Mexico. Many injured and heavy damage at Acapulco. Mag. 6½.	17	N.	99½	W.
8	18	46	29*	New Britain region	4½	S.	153	E.
8	20	54	13*	Northern Chile. Slight damage at Arica. Mag. 7.1	19	S.	70	W.
8	22	58	22**	Northern Chile aftershock				
9	03	15	40**	----do----				
9	07	52	48**	----do----				
9	08	01	36*	Near north coast of Hokkaido, Japan. Felt. Depth about 150 km.	43½	N.	145½	E.
9	12	05	53*	Fiji Islands region. Depth about 650 km. Mag. 6½	23	S.	179	E.
9	17	01	23*	Chiapas, Mexico. Felt. Depth about 200 km	16	N.	92	W.
10	08	52	36*	Tonga Islands region. Mag. 7.3	25	S.	176	W.
10	10	18	25*	Tonga Islands region aftershock	25	S.	176	W.
10	12	32	15*	Off coast of Oregon	43½	N.	127	W.
10	21	54	05*	Tonga Islands region aftershock	25	S.	175½	W.
11	06	10	03*	Nicobar Islands	7½	N.	94	E.
11	06	38	05*	Off south coast of Honshu, Japan. Felt in Honshu. Depth about 200 km.	33	N.	139	E.
11	07	10	49**	Nicobar Islands aftershock				
11	10	45	30**	Kermadec Islands region				
11	11	54	59**	Solomon Islands. Depth about 100 km				
11	12	43	10**	Chile-Argentine border. Felt in Chile				
11	20	31	16*	New Hebrides Islands	16½	S.	168	E.
11	21	11	04*	Solomon Islands	8½	S.	157½	E.
11	22	16	18**	Central Pakistan				
12	04	38	00*	Northern Chile	19	S.	70	W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	m	s		°	′	°	′
Jan. 12	05	46	05*	Northern Hungary. Two killed, many injured, and extensive property damage at Taksony, Soroksar, and Dunaharaszti.	47½	N.	19½	E.
12	06	10	25*	Tonga Islands region	22½	S.	177½	W.
12	07	45	27*	Western Colombia. Felt in Caldas. Depth about 200 km	5	N.	75½	W.
13	03	02	50**	Tonga Islands region				
13	03	04	50**	do				
13	03	27	13*	Near east coast of Kamchatka	57½	N.	163	E.
13	03	27	43**	do				
13	06	16	14*	Norfolk Island region. Mag. 6–6¼	29	S.	167½	E.
13	12	12	41*	Tonga Islands region	24	S.	177	W.
14	14	08	41*	Fox Islands, Aleutian Islands. Mag. 6	51½	N.	173	W.
14	14	24	40*	Near east coast of Hokkaido, Japan. Felt	43	N.	145	E.
14	18	32	54*	Mid-Atlantic Ocean	8	N.	38½	W.
14	22	10	42*	Tonga Islands region. Depth about 200 km	18	S.	173	W.
15	01	23	10**	About 50 miles south of Guam				
15	10	16	45*	Tonga Islands region	25	S.	176	W.
15	13	49	39**	Queen Charlotte Islands region				
15	18	42	03**	Tonga Islands				
15	21	04	20*	Kurile Islands	44	N.	147½	E.
16	02	00	17*	New Ireland region. Depth about 150 km	5	S.	153	E.
16	12	40	00*	South of Unimak Island, Alaska	54	N.	163	W.
16	23	37	37*	Near coast of Ecuador. Heavy property damage at Portoviejo and Bahia de Caraquez. Felt on board M/S *Equateur* at 1.06S, 81.08W. Mag. 7.3.	½	S.	80½	W.
17	08	00	45**	Pacific Ocean, about 1,000 miles southwest of Galapagos Islands				
17	19	00	08**	Solomon Islands region				
18	05	45	06**	Mendoza Province, Argentina				
18	08	07	17*	Northern Chile. Felt in Atacama and Antofagasta Provinces	24	S.	70	W.
18	09	34	52*	New Hebrides Islands	14½	S.	167	E.
19	03	51	56**	Off west coast of Colombia				
19	08	38	52*	South of Honshu, Japan. Depth about 500 km	29	N.	139	E.
19	18	07	05*	Solomon Islands	6	S.	155	E.
19	19	50	34*	Nepal-Tibet border	30	N.	81	E.
20	04	33	30*	Kurile Islands	47	N.	154	E.
20	05	03	10*	Fox Islands, Aleutian Islands	52½	N.	170	W.
20	23	23	40*	Solomon Islands. Depth about 150 km	5	S.	155	E.
21	08	09	33*	Near coast of Guatemala. Depth about 150 km	15	N.	93	W.
21	12	22	42*	Tonga Islands region	23	S.	176	W.
21	13	38	44*	Ceram Sea. Depth about 700 km	1½	S.	129½	E.
21	17	35	34*	Burma	23	N.	94	E.
21	17	54	15*	Southern Bolivia. Depth about 100 km	21	S.	67½	W.
21	18	47	33**	Ecuador aftershock				
22	00	50	46**	Kodiak Island foreshock				
22	00	57	50**	do				
23	00	46	35*	Kodiak Island region, Alaska	58	N.	154½	W.
23	03	47	27*	Near east coast of Kamchatka. Depth about 60 km. Mag. 6½	55½	N.	162	E.
23	07	36	14*	Mindanao, Philippine Islands. Depth about 650 km	7	N.	123½	E.
24	08	49	07*	New Hebrides Islands	16½	S.	167	E.
24	12	15	04*	Kurile Islands	45	N.	150	E.
25	06	29	58**	About 300 miles off coast of Ecuador				
25	10	47	53**	Tonga Islands region				
26	15	33	30**	Near north coast of Mindanao, Philippine Islands. Felt at Mambajao				
27	01	13	22*	Aegean Sea. Felt on the Island of Kythera	37	N.	24	E.
27	10	06	53*	Sinkiang Province, China	41½	N.	83½	E.
27	13	38	45*	Tonga Islands region	26	S.	176	W.
28	04	52	29*	Mid-Atlantic Ocean	1	N.	27	W.
28	07	42	52*	New Britain. Depth about 100 km. Mag. 6½	4½	S.	151½	E.
28	22	55	30*	Western Nevada. Mag. 4½ (Berk)	39	N.	118	W.
29	03	29	12**	Near south coast of Arabia				
29	04	44	15	Tennessee-Arkansas border. Minor damage at Covington, Tennessee.	35	38 N.	89	36 W.
29	16	32	53**	Off southeast coast of Kamchatka				
29	18	49	12**	Northeastern New Guinea				

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.	Region, focal depth, and remarks	Coordinates of provisional epicenter	
			Latitude	Longitude
	h m s		° ′	° ′
Jan. 29	22 20 53*	South of Formosa	21 N.	121 E.
30	08 34 32**	Fiji Islands. Depth about 600 km		
30	08 43 01*	Near north coast of North Island, New Zealand. Felt in Auckland Province. Mag. 6¼.	38½ S.	177½ E.
30	10 01 49**	New Zealand aftershock		
30	14 55 51**	Andreanof Islands, Aleutian Islands		
30	19 09 12**	About 400 miles south of Fiji Islands. Depth about 500 km		
31	00 39 05*	New Hebrides Islands. Depth about 150 km	14½ S.	167 E.
31	05 24 14**	Volcano Islands region		
31	09 17 11*	New Ireland. Depth about 400 km. Mag. 6½	4 S.	152 E.
Feb. 1	01 32 55*	Loyalty Islands	20 S.	169 E.
1	08 27 41*	Fiji Islands region. Depth about 600 km	21 S.	179½ W.
1	13 41 44*	Mariana Islands. Depth about 370 km. Mag. 7.0	19 N.	145½ E.
1	15 10 46*	Near west coast of Italy. Felt at Diamanta. Depth about 200 km	39½ N.	16 E.
1	16 25 28**	Northern Chile		
2	03 21 45*	Atlantic Ocean	17½ N.	46½ W.
2	10 42 37*	Windward Islands. Depth about 200 km	12 N.	62 W.
2	14 54 18*	Off coast of Guerrero, Mexico	16 N.	98½ W.
2	16 54 32*	Off coast of Guerrero, Mexico. Felt	16 N.	98½ W.
3	13 16 02**	Eastern Iraq		
4	02 55 02*	Near coast of Ecuador	0	81 W.
4	18 38 22**	New Ireland region		
5	04 50 42*	Halmahera region	3 N.	128½ E.
5	20 35 55*	Molucca Passage	3½ N.	128 E.
7	03 16 39	Los Angeles County, Calif. Felt at Newhall. Mag. 4.6	34 35 N.	118 36 W.
7	07 03 29**	Northwestern Colombia		
7	16 59 25**	Queen Charlotte Islands		
9	00 57 12	Northwestern Washington. Felt from Everett to Bellingham	48 21 N.	122 39 W.
9	07 32 18*	South of Panama	5½ N.	83 W.
9	08 31 20**	Queen Charlotte Islands region		
9	14 32 38	Baja California. Minor damage in Imperial Valley, Calif., and Yuma, Ariz. Mag. 6.8.	31 45 N.	115 55 W.
9	15 24 26	Baja California aftershock. Felt. Mag. 6.1	31 45 N.	115 55 W.
9	16 29 53	Baja California aftershock. Felt. Mag. 5.8	31.6 N.	115.7 W.
9	16 59 53	Baja California aftershock. Felt. Mag. 5.7	31 45 N.	115 55 W.
9	18 48 45	....do	31 45 N.	115 55 W.
9	21 55 33*	Central Honshu, Japan. Felt at Tokyo	36½ N.	139 E.
9	23 51 20**	About 150 miles off coast of Guerrero, Mexico		
10	00 02 40*	Off coast of Honshu, Japan. Felt. Depth about 60 km	37 N.	142 E.
10	00 05 27*	Baja California aftershock. Mag. 4.6	31½ N.	116 W.
10	04 18 15	Baja California aftershock. Mag. 5.0	31 35 N.	115 40 W.
10	12 38 35*	Off coast of Peru. Felt at Lima	11½ S.	79 W.
10	13 43 20**	About 100 miles off coast of Peru		
10	14 30 12	Baja California aftershock. Felt. Mag. 4.9	31 45 N.	115 55 W.
10	15 09 29	Baja California aftershock. Felt. Mag. 5.0	31 45 N.	115 55 W.
10	18 12 54	Baja California aftershock. Mag. 5.5	31 45 N.	115 55 W.
10	18 40 07**	Southeastern Luzon, Philippine Islands. Felt at Catarman, Legaspi, and Virac.		
11	02 57 46	Baja California aftershock. Felt. Mag. 5.1	31 45 N.	115 55 W.
11	05 38 38*	Off north coast of Sumatra	5 N.	94½ E.
11	06 11 24	Baja California aftershock. Mag. 5.0	31 45 N.	115 55 W.
11	06 24 25	Baja California aftershock. Mag. 5.4	31 35 N.	116 40 W.
11	06 45 38*	Atlantic Ocean	5 S.	13½ W.
12	11 49 20*	Off northwest coast of Luzon, Philippine Islands. Felt in northern Luzon. Mag. 6½.	19 N.	119½ E.
12	12 08 45*	Luzon aftershock	18 N.	120 E.
12	12 17 33**	....do		
12	17 31 18**	Hindu Kush. Depth about 200 km		
12	19 40 20*	Luzon aftershock	19 N.	120 E.
13	02 12 00**	....do		
13	03 44 45*	....do	19 N.	120 E.
13	14 20 48**	....do		
13	14 29 44*	Sea of Okhotsk. Depth about 500 km	51 N.	150 E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	m	s		°	′	°	′
Feb. 13	15	33	14*	Off north coast of Puerto Rico. Felt at San Juan. Depth about 60 km.	19	N.	66½	W.
13	20	49	10**	Off coast of Peru				
13	22	39	50*	Luzon aftershock	18½	N.	119½	E.
14	00	52	50*	Near east coast of Honshu, Japan. Several injured and minor property damage at Tokyo. Depth about 60 km. Mag. 5¾–6.	35½	N.	139½	E.
14	07	38	10**	Luzon aftershock				
14	08	21	03*	----do----	19	N.	119½	E.
14	09	53	26*	Near coast of Algeria. Felt at Cavaignac, Francis Garnier, Montenotte, and Tenes.	37	N.	1½	E.
14	12	33	48*	Luzon aftershock	18½	N.	119½	E.
14	14	45	32	Baja California aftershock. Mag. 5.0	31	30 N.	115	30 W.
14	18	33	34	Baja California aftershock. Felt. Mag. 6.3	31	30 N.	115	30 W.
14	18	55	12**	Luzon aftershock				
14	21	08	36*	Hokkaido, Japan. Felt	42½	N.	143	E.
14	21	50	08*	Andreanof Islands, Aleutian Islands. Depth about 60 km	52	N.	180	
15	01	20	38	Baja California aftershock. Felt. Mag. 6.4	31	30 N.	115	30 W.
15	02	28	39	Baja California aftershock. Mag. 5.3	31	30 N.	115	30 W.
15	07	07	47	Baja California aftershock. Mag. 5.2	31	30 N.	115	30 W.
15	08	35	54	Baja California aftershock. Felt. Mag. 5.0	31	30 N.	115	30 W.
15	11	57	39**	Kurile Islands region				
15	12	50	12*	Peru. Two killed in Callejon-Huaylas region. Depth about 150 km.	8½	S.	74½	W.
15	15	49	27*	Southern Iran	28	N.	53	E.
15	18	54	44	Baja California aftershock. Mag. 4.9	31	30 N.	115	30 W.
15	20	36	03*	Pacific Ocean	13½	S.	111½	W.
16	00	17	53*	Mariana Islands region. Depth about 100 km	22½	N.	143	E.
16	03	05	40**	Guerrero, Mexico. Felt				
16	05	53	02	Baja California aftershock. Mag. 5.0	31	30 N.	115	30 W.
16	08	12	28	----do----	31	30 N.	115	30 W.
17	09	25	00	Baja California aftershock. Mag. 4.9	31	30 N.	115	30 W.
17	09	53	55*	South Atlantic Ocean	47	S.	15	W.
17	10	40	00**	Baja California aftershock. Mag. 4.7				
18	01	37	16*	Near coast of Peru	10	S.	79	W.
18	07	34	20*	South of Honshu, Japan. Felt on Honshu. Depth about 480 km. Mag. 7.3.	30	N.	137½	E.
18	10	24	20*	Northern Peru	5	S.	79½	W.
18	17	48	40*	Near coast of Peru	8½	S.	79½	W.
18	23	58	30	San Benito and Monterey Counties, Calif. Felt. Mag. 4.2 (Berk)	36	40 N.	121	19 W.
19	02	18	00*	Queen Charlotte Islands. Mag. 6¾	52	N.	131½	W.
19	02	39	35*	Queen Charlotte Islands aftershock	52	N.	131½	W.
19	04	13	16*	Alaska Peninsula	58½	N.	154	W.
19	05	15	12**	New Hebrides Islands. Depth about 200 km				
19	05	40	22*	Tonga Islands	23	S.	176	W.
19	14	48	45*	Fiji Islands region. Depth about 600 km	22½	S.	180	
20	07	00	10**	Off south coast of Kamchatka				
20	07	57	38*	Ryukyu Islands	24	N.	124	E.
20	13	06	40**	Near coast of Oaxaca, Mexico				
20	20	31	35*	Turkey. Four killed and several injured at Istanbul. Extensive damage at Eskisehir.	40	N.	30½	E.
21	03	00	54**	Fiji Islands region				
21	05	09	13**	Fiji Islands				
21	20	32	55*	Fiji Islands region. Depth about 650 km	22	S.	179	W.
21	22	59	24*	Arctic Ocean foreshock	73½	N.	8	E.
22	00	07	37*	Arctic Ocean, southwest of Spitsbergen	73½	N.	8	E.
22	05	21	18*	Near Unimak Island, Alaska	54	N.	163	W.
22	09	59	24*	Chagos Islands region	5	S.	67	E.
23	01	21	03*	North Atlantic Ocean	31	N.	42	W.
23	17	31	30**	Southern Iran				
24	09	19	01*	Kermadec Islands region	32	S.	179½	E.
24	09	45	45**	About 150 miles east of Trinidad				
26	05	15	26*	Northern Honshu, Japan	39½	N.	140	E.
26	11	33	44**	Santa Cruz Islands region				

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	m	s		°	′	°	′
Feb. 27	03	23	20**	Central Kamchatka				
27	08	37	58*	Andreanof Islands, Aleutian Islands. Depth about 100 km	52	N.	174	W.
28	11	13	20*	Northern Chile. Felt strongly at Antofagasta and Portozuelo	23	S.	70	W.
29	06	57	52*	South of Honshu, Japan	29½	N.	141	E.
29	09	01	08**	Baja California aftershock. Mag. 4.7				
29	20	51	18*	Burma-India border. Depth about 60 km	23½	N.	94½	E.
29	21	25	58*	Burma-India border aftershock. Depth about 60 km	23½	N.	94½	E.
29	23	46	18*	Near southeast coast of Kamchatka	52	N.	159	E.
Mar. 1	02	52	54**	Baja California aftershock. Mag. 4.8				
1	06	26	40**	Northern Kurile Islands				
1	12	47	56**	Southern Iran				
1	14	01	56*	Near southeast coast of Kamchatka	52	N.	159	E.
1	14	26	44*	do	52	N.	159	E.
1	23	11	50*	Off coast of Costa Rica	9½	N.	85½	W.
2	11	56	20*	Alaska. Felt at College, McKinley Park, and Talkeenta	63½	N.	149½	W.
2	14	49	18*	Kurile Islands. Felt. Depth about 100 km	45½	N.	149½	E.
3	00	05	25*	Samoa Islands region. Felt at Apia. Mag. 6¾	15	S.	173½	W.
3	10	13	44*	Burma-India border aftershock. Depth about 60 km	23½	N.	94½	E.
3	18	23	11**	Baja California aftershock. Felt. Mag. 5.1				
4	03	18	10*	North Polar region	83½	N.	112	E.
4	16	16	54*	Near southeast coast of Kamchatka	52½	N.	158½	E.
5	03	42	25*	do	52	N.	159½	E.
5	07	12	21*	Southern Sinkiang Province, China	38½	N.	77½	E.
5	23	29	41*	Near north coast of Hokkaido, Japan. Minor damage; slight seismic sea wave. Mag. 6½–6¾.	44½	N.	144	E.
5	23	42	53**	Sinkiang Province, China				
6	01	53	43**	About 150 miles off south coast of Honshu, Japan. Depth about 150 km.				
6	08	55	28*	Southern Iran	28	N.	52½	E.
6	09	09	40**	Iran aftershock				
6	13	40	02**	About 100 miles off southeast coast of Kamchatka				
6	20	53	12**	Iran aftershock				
7	21	51	48*	Near coast of Costa Rica	9½	N.	85	W.
8	07	26	20	Near Gabbs, Nevada. Felt. Mag. 4.6	39	02 N.	118	04 W.
8	11	05	26*	Fox Islands, Aleutian Islands	53½	N.	168½	W.
9	00	32	40	Baja California aftershock. Mag. 5.0	31	45 N.	115	55 W.
9	04	25	01	Baja California aftershock. Mag. 4.9	31	30 N.	115	30 W.
9	07	48	30**	About 100 miles off east coast of Trinidad. Felt				
9	11	37	56**	Banda Sea				
9	15	33	26**	Southern Iran				
9	16	44	50**	Iran aftershock				
9	17	31	07*	Near coast of Ecuador	1	N.	80	W.
10	03	42	10*	Tonga Islands	17½	S.	173	W.
10	05	56	14	Humboldt and Medocino Counties, Calif. Felt. Mag. 4.5	40	18 N.	124	14 W.
10	14	12	54	Baja California aftershock. Felt. Mag. 5.0	31	30 N.	115	30 W.
10	16	26	33*	Near south coast of Mindanao, Philippine Islands	5	N.	126	E.
10	19	33	40*	Tonga Islands. Depth about 200 km	22½	S.	176	W.
10	21	37	01*	Molucca Passage	½	N.	125½	E.
12	02	15	57*	Central Peru	11	S.	76½	W.
12	11	22	51*	Near Panay Islands, Philippine Islands. Felt at Iloilo	10	N.	122	E.
12	19	50	37*	Samoa Islands region	15	S.	175	W.
13	01	40	29**	Dominican Republic				
13	09	26	13*	Near east coast of Honshu, Japan	36	N.	142	E.
13	13	13	10*	Off south coast of Panama. Felt in El Salvador and Canal Zone. Mag. 6¾.	7	N.	82	W.
13	19	22	15*	Komandorskie Islands region	54	N.	169	E.
13	23	31	50*	New Ireland	4	S.	153	E.
14	05	29	34	Baja California aftershock. Mag. 4.9	31	30 N.	115	30 W.
14	11	00	38**	Andaman Islands				
14	15	38	38*	Off coast of North Island, New Zealand. Felt at Auckland and Ineroa.	37	S.	178	E.
14	15	43	20**	New Zealand aftershock. Felt at Auckland, Ineroa, Tairua and Thames.				

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	m	s		°	′	°	′
Mar. 14	16	39	43**	East Pakistan. Felt at Bogra				
15	15	28	33*	South of Panama	7½	N.	82½	W.
15	15	44	55*	....do	7½	N.	82½	W.
15	20	16	30*	Northern Chile	20	S.	69½	W.
16	14	12	11*	Tonga Islands region	23	S.	176	W.
16	18	21	25*	Near south coast of Hokkaido, Japan	42	N.	141½	E.
16	19	02	40**	Tonga Islands region				
16	19	32	39*	Lebanon. 136 killed, 6,000 houses destroyed and 17,000 damaged in	33½	N.	35½	E.
16	19	43	28*	400 villages in the Chouf region.	33½	N.	35½	E.
16	20	29	34	Near Baldwin Lake, Calif. Felt. Mag. 4.8	34	15 N.	116	45 W.
16	23	34	57	Near Baldwin Lake, Calif. Felt. Mag. 4.4	34	15 N.	116	45 W.
17	11	42	31*	Northern Honshu, Japan. Felt. Depth about 150 km	40	N.	141	E.
17	15	41	18*	Near east coast of Hokkaido, Japan. Felt	43	N.	145	E.
17	16	40	55**	Northern Kurile Islands				
17	19	54	56*	Solomon Sea foreshock	10	S.	154	E.
17	23	41	42*	Solomon Sea	10	S.	154	E.
18	08	17	57*	Nicobar Islands	6	N.	93	E.
19	15	09	23	Pyramid Lake, Nev. Felt at Flanigan. Mag. 4.1 (Berk)	40	08 N.	119	40 W.
19	17	35	57*	New Britain	6	S.	150	E.
20	02	23	29*	Hokkaido, Japan. Felt	43	N.	143	E.
20	04	15	00*	Off southeast coast of Kamchatka	51½	N.	159½	E.
20	09	41	36*	Near coast of New Britain. Depth about 60 km	5	S.	152½	E.
20	10	23	39*	Off northwest coast of Luzon, Philippine Islands	19½	N.	120	E.
20	11	26	54**	Southern Kurile Islands				
20	17	12	15*	Fiji Islands. Depth about 500 km	19	S.	178½	W.
21	04	54	46*	Azerbaijan S. S. R	41	N.	48½	E.
21	07	43	50*	Northeast of Puerto Rico	20	N.	64½	W
22	06	33	55*	Ecuador. Felt at Guayaquil. Depth about 100 km. Mag. 6½	3½	S.	79	W.
23	04	03	08*	Northeast of Puerto Rico	20	N.	64½	W.
23	05	10	48*	New Britain	5	S.	151	E.
23	05	50	08**	Southeastern Tibet				
23	14	56	52**	Tonga Islands				
23	20	00	44*	Solomon Islands	6	S.	155	E.
23	21	23	25	North of Wheeler Ridge, Calif. Felt at Bakersfield, Maricopa, and Taft. Mag. 4.3.	35	05 N.	119	10 W.
24	21	08	25**	Tonga Islands region. Felt at Apia				
25	05	44	20**	Near coast of Guatemala and El Salvador				
25	23	27	31*	Near southeast coast of Kamchatka	52	N.	159	E.
26	00	01	55*	Fiji Islands. Depth about 350 km	18	S.	178½	W.
26	03	20	45*	Near southeast coast of Kamchatka	52	N.	159	E.
26	03	24	35*	Kamchatka aftershock	52	N.	159	E
26	03	59	02*	Northeast of Puerto Rico	20	N.	64½	W.
26	03	59	25*	Near southeast coast of Kamchatka	52	N.	159	E.
26	05	21	20*	Northern Chile-Argentina border. Felt at Antofagasta, Chile. Depth about 150 km.	24½	S.	68	W.
26	08	17	24*	Southern Alaska. Felt at Anchorage	61½	N.	151	W.
26	17	02	12**	Near southeast coast of Kamchatka				
27	16	51	38**	Banda Sea				
28	03	21	24**	Andreanof Islands, Aleutian Islands				
28	08	14	05*	Tonga Islands. Depth about 60 km	22	S.	175	W.
28	11	39	13**	Thessalie, Greece. Felt				
28	22	05	18*	Off south coast of Honshu, Japan. Depth about 500 km	30	N.	137	E.
30	07	16	10**	Near Yellowstone National Park, Wyo. Felt				
30	17	50	45**	Central Alaska. Felt at College				
30	18	43	45*	Off coast of Northern Honshu, Japan. Felt	40	N.	144	E.
30	22	15	31*	Tonga Islands region	22	S.	176	W.
31	01	34	00*	Northeast of Puerto Rico	20	N.	64	W.
31	07	31	12**	Near coast of northern Chile. Felt at Antofagasta				
31	08	19	30*	Near coast of Colombia. Felt in Narino District. Depth about 100 km.	3½	N.	78½	W
Apr. 1	06	37	08**	Near west coast of Sumatra				
1	12	16	33*	Near east coast of Kamchatka	52	N.	159	E.
1	12	37	52*	Kurile Islands. Depth about 150 km	48½	N.	153½	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	m	s		°	′	°	′
Apr. 2	10	49	56*	Off coast of Sumatra. Felt in Tapanuli Province	2	N.	97	E.
2	11	04	22**	Southern Tibet. Depth about 100 km				
4	00	23	25**	Near west coast of Southern Honshu, Japan				
5	04	02	00*	Near east coast of Kamchatka	53	N.	158	E.
5	04	29	13	North Central California. Felt in Napa Valley, and San Francisco Bay region. Mag. 4.4 (Berk).	38	32 N.	122	31 W.
5	07	47	39*	Near northeast coast of New Guinea. Depth about 100 km	6	S.	146½	E.
5	17	20	27*	Rat Islands, Aleutian Islands	51	N.	179	E.
6	07	11	34*	Hindu Kush. Depth about 200 km	36½	N.	71	E.
6	16	27	51*	New Hebrides Islands. Depth about 200 km	13	S.	167	E.
6	23	58	40*	Revilla Gigedo Islands	19½	N.	109½	W.
7	04	30	10**	Western Pakistan-India border				
7	18	00	57*	Kermadec Islands. Depth about 350 km	32	S.	180	
8	07	48	40**	Tonga Islands region				
8	10	32	47*	do	23	S.	178	W.
8	22	28	12	Northwestern Washington. Felt in northern Puget Sound	48	26 N.	123	08 W.
9	04	42	25	Fairview Peak, Nev. Mag. 4.3 (Berk)	39	11 N.	118	07 W.
9	18	06	25*	Fiji Islands	16	S.	179	W.
9	22	16	23*	Solomon Islands	10	S.	162	E.
10	13	16	04*	Near south coast of Sumatra. Depth about 150 km. Mag. 6½	3	S.	102	E.
11	01	45	10*	Tadzhik S. S. R	39	N.	70	E.
11	17	34	15*	Indian Ocean, about 800 miles southeast of Madagascar	35½	S.	54½	E.
12	04	59	37**	Central New Guinea				
12	05	05	05*	Northern Chile. Felt at Antofagasta, Chanaral, and Taltal	26	S.	70	W.
12	22	34	44*	Northern Iran	37	N.	50	E.
13	04	38	53*	Chile-Argentina-Bolivia border. Felt at Antofagasta, Chile. Depth about 250 km.	23	S.	67	W.
13	07	55	00*	Near south coast of Kamchatka	50½	N.	156	E
16	01	42	29*	Near east coast of Kamchatka	55	N.	162	E.
16	10	46	42*	Near south coast of Sumatra. Felt at Benkoulen	3½	S.	102	E
16	20	32	57**	Solomon Islands				
16	20	49	00**	500 miles west of Galapagos Islands				
17	12	16	16*	Off south coast of Honshu, Japan. Depth about 450 km	30½	N.	138½	E.
18	01	56	49**	Southeastern Tibet				
18	11	00	13*	Adreanof Islands, Aleutian Islands. Mag. 6½	52	N.	178	W.
18	15	59	00**	Northern Chile. Felt at Copiapo and La Serena. Depth about 60 km.				
18	17	55	11*	Adreanof Islands aftershock	52	N.	178	W.
19	18	38	52*	Southern Spain. Seven killed, 60 injured, and extensive property damage at Albolote, Atarfe, and Granada.	37	N.	4	W.
20	15	15	56*	Banda Sea. Depth about 150 km	7½	S.	129	E.
20	16	37	01**	About 500 miles southwest of Chagos Islands				
21	00	03	23*	Solomon Islands	6	S.	155	E.
21	01	25	12**	About 100 miles south of Formosa				
21	07	51	09**	Andreanof Islands, Aleutian Islands				
21	13	53	49**	Off south coast of El Salvador. Felt at San Salvador				
21	17	12	30*	Fiji Islands. Depth about 600 km	17½	S.	179	W.
22	03	47	50**	Kermadec Islands region				
22	04	40	53*	New Britain. Mag. 6¼–6½	6	S.	151½	E.
22	17	21	53*	South of Alaska Peninsula. Mag. 6	54	N.	162	W.
23	03	31	40*	Off east coast of Hokkaido, Japan. Felt. Mag. 6½–6¾	42½	N.	144½	E.
24	00	22	30*	Off coast of Colombia	3½	N.	79	W.
24	23	24	37*	Off southeast coast of Kamchatka	51½	N.	160	E.
25	08	29	58*	Fiji Islands. Mag. 6–6¼	17	S.	175	E.
25	08	38	56*	Fiji Islands aftershock	17	S.	175	E.
25	09	08	29	Baja California. Felt at San Diego, Calif. Mag. 5.7	31	30 N.	115	30 W.
25	17	02	15**	About 300 miles off coast of Guerrero, Mexico				
26	03	00	03**	Northern Italy. Felt at Borgo S. Lorenzo, Firenzuola, and Pietramola.				
26	05	43	17*	Off coast of Northern Chile. Depth about 100 km	21½	S.	71	W.
26	07	41	52*	Fiji Islands aftershock. Mag. 6	16½	S.	174	E.
26	11	38	42*	Central Honshu, Japan. Felt. Depth about 100 km	37	N.	140	E.
26	14	52	19*	Northern Sakhalin	51	N.	143	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Apr. 26	16	59	05**	Northern Kurile Islands				
28	06	35	34*	Mariana Islands. Depth about 60 km	13½	N.	145	E.
28	14	45	30**	Kermadec Islands				
29	00	08	28**	Fox Islands, Aleutian Islands. Felt on Unalaska				
29	21	52	31*	Amirante Islands, Indian Ocean	6½	S.	51½	E.
May 1	02	42	03*	Near coast of southern Sumatra. Felt at Benkoulen	4½	S.	103	E.
1	12	57	48**	Tonga Islands				
2	02	45	16**	Banda Sea, about 150 miles north east of Timor Island				
2	06	34	22*	Bonin Islands region. Depth about 550 km	28	N.	139½	E.
3	02	11	17*	Southern Peru	16	S.	74	W.
3	02	59	20**	Gulf of Alaska, about 200 miles northwest of Sitka				
4	13	50	00**	Near coast of Guerrero, Mexico. Felt at Acapulco				
4	14	14	20*	Tonga Islands	19	S.	175	W.
4	18	45	21*	Near east coast of Luzon, Philippine Islands. Felt at Baler	16	N.	122	E.
5	03	22	27*	Samoa Islands region. Depth about 100 km. Mag. 6	15½	S.	173	W.
5	12	39	15*	Argentina-Chile border. Depth about 150 km	28½	S.	69	W.
6	20	57	16*	Unimak Island region, Alaska. Mag. 5¾	54½	N.	162½	W.
6	22	02	27*	Kurile Islands	45½	N.	150½	E.
7	08	17	03*	Guatemala. Felt in Guatemala and El Salvador. Depth about 200 km.	14½	N.	90½	W.
7	10	58	12*	South Indian Ocean. Mag. 6¼	46½	S.	96	E.
7	18	38	47*	Caroline Islands	10	N.	141½	E.
8	03	07	34*	Near north coast of Luzon, Philippine Islands. Felt at Aparri	19	N.	121½	E.
8	10	46	22*	Arctic Ocean	75	N.	1½	E.
8	12	47	18**	Fiji Islands region. Depth about 400 km				
8	19	50	05*	Hindu Kush	38½	N.	74½	E.
8	20	50	00**	Iran, near north coast of Persian Gulf				
10	05	44	48*	Mariana Islands. Depth about 100 km	12	N.	143	E.
10	11	48	54	Baja California. Felt at San Diego, California. Mag. 5.0	31	50 N.	116	00 W.
10	16	36	32*	Near Unimak Island, Alaska	53½	N.	164	W.
10	18	12	00*	Off west coast of Spitsbergen	79	N.	3	E.
10	23	04	05*	Molucca Passage	4½	N.	127½	E.
11	16	30	50	Riverside and San Bernardino Counties, Calif. Felt from Los Angeles to San Diego. Mag. 4.7.	34	16 N.	116	45 W.
12	09	44	49*	Near south coast of Honshu, Japan, Depth about 250 km	34½	N.	139	E.
12	21	40	23*	Off east coast of Hokkaido, Japan	43½	N.	146½	E.
13	04	10	03	Western Nevada. Felt at Fallon. Mag. 4.3 (Berk)	39	16 N.	119	35 W.
13	04	27	14**	North Polar region, north of Severnaya Zemlya, Siberia				
13	07	50	33*	Central Pakistan. Felt at Barkbam, Munro, and Rakhni	30	N.	70	E.
13	08	56	36**	North Polar region, north of Severnaya Zemlya, Siberia				
13	14	34	00*	North Polar region	85½	N.	82	E.
15	08	13	02*	Near coast of Peru. Depth about 100 km	13½	S.	77	W.
15	12	33	19*	Near coast of Peru	6	S.	82	W.
15	18	34	15*	Near west coast of Greece. Felt in Ilia and on Zante Island	37½	N.	21	E.
15	22	56	55*	Near west coast of Greece. Felt in Ilia, Messinia, and on Zante Island.	38	N.	22	E.
16	22	09	50*	South of Fiji Islands. Depth about 600 km	24	S.	178½	E.
17	00	07	24**	Hindu Kush. Depth about 200 km				
17	05	59	57*	Near coast of southern Peru. Depth about 60 km	16½	S.	72	W.
17	21	08	46*	Near Islands, Aleutian Islands	52½	N.	174	E.
18	08	19	35*	Fiji Islands. Depth about 600 km	17	S.	179	W.
18	09	55	09*	Southern Alaska. Depth about 100 km	62	N.	145½	W.
18	22	08	25**	Near east coast of Greece. Felt in Larissa				
19	00	21	12*	Santa Cruz Islands	11½	S.	166½	E.
19	01	30	36*	Solomon Islands. Felt at Karoola. Mag. 6¼	7	S.	156	E.
19	06	27	50**	About 150 miles off coast of Guatemala				
19	20	02	15*	Indian Ocean. Mag. 6¼	40	S.	43	E.
20	15	41	56*	Sinkiang Province, China	37½	N.	76	E.
20	17	50	37**	Marshall Islands				
21	00	29	47**	Northern Chile. Depth about 100 km				
21	09	15	47*	Kenai Peninsula, Alaska. Depth about 150 km	60	N.	150½	W.
22	02	05	06*	South of Mindanao, Philippine Islands	4½	N.	126½	E.
22	03	01	03*	Samoa Islands. Felt at Apia. Mag. 6½	15½	S.	173	W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	m	s		°	′	°	′
May 22	05	10	40**	Near east coast of Celebes				
22	13	36	12*	New Ireland. Felt at Rabaul, New Britain. Depth about 550 km. Mag. 6¼.	4	S.	152½	E.
22	20	55	27**	Assam-China border region				
23	10	15	33*	Chagos Islands region	9	S.	67	E.
23	16	41	15**	Fiji Islands				
23	20	48	30*	Fiji Islands. Depth about 430 km. Mag. 7½	15½	S.	179	W.
23	21	52	26**	Fiji Islands. Depth about 550 km				
24	02	27	29**	Gulf of California				
24	19	59	42*	Banda Sea	5	S.	131	E.
25	00	50	33*	Near coast of Sumatra	1	N.	97½	E.
25	02	19	06**	About 700 miles northeast of Mascarene Islands				
26	08	30	18*	Boeroe Island, Banda Sea	4	S.	126½	E.
26	17	46	34*	Northern Chile-Argentina border. Felt at Antofagasta, Chile. Depth about 200 km.	24	S.	67	W.
26	20	21	14*	Fiji Islands. Depth about 500. Mag. 6½	19	S.	178½	W.
27	13	09	42**	Near coast of northern Sumatra				
27	16	50	05**	Guerrero, Mexico				
27	16	56	49*	Banda Sea. Depth about 200 km	6½	S.	129½	E.
27	17	55	56**	Marshall Islands				
28	01	44	26*	North Atlantic Ocean	27½	N.	44½	W.
28	03	38	37**	Near coast of northern Chile. Felt at Antofagasta				
28	09	14	59*	North of Samar Island, Philippine Islands. Felt at Virac	13	N.	124½	E.
28	13	23	17*	Northern Celebes. Felt at Jolo. Depth about 100 km	1	N.	122	E.
29	06	29	21*	Near south coast of Sumatra. Depth about 100 km	4½	S.	103	E.
29	14	45	09*	Near coast of northern Chile	22½	S.	71	W.
29	17	48	26*	Southern Peru. Depth about 100 km	14½	S.	72½	W.
30	15	41	57*	Tonga Islands region. Depth about 350 km	23	S.	178½	W.
30	18	37	10**	About 100 miles off north coast of New Guinea				
31	08	55	45**	Salta Province, Argentina. Minor damage at Salta				
31	14	50	13*	Kurile Islands	45½	N.	151	E.
31	21	00	50**	Fiji Islands. Depth about 60 km				
June 1	10	46	20*	Iceland. Felt at Reykjavik	64	N.	22	W.
2	22	53	59*	Rat Islands, Aleutian Islands. Depth about 100 km	52½	N.	178	E.
3	05	19	23*	Arctic Ocean	79½	N.	118½	W.
3	13	28	53*	Bonin Islands	27	N.	141½	E.
3	18	52	20*	Kermadec Islands	31	S.	178½	W.
4	02	04	10**	Kamchatka foreshock				
4	02	07	09*	....do	52	N.	159½	E.
4	02	19	55*	Near south coast of Kamchatka	52	N.	159½	E.
4	07	07	13**	Aleutian Islands foreshock				
4	07	09	18*	Fox Islands, Aleutian Islands. Mag. 6¼	52	N.	170½	W.
4	12	05	49*	Kermadec Islands	32½	S.	178	W.
5	05	29	47*	Java. Felt	8	S.	112	E.
5	05	32	23*	Costa Rica	10	N.	84	W.
5	05	59	41*	Pacific Ocean. Mag. 6¼	51	S.	112½	W.
5	16	13	55**	Fox Islands, Aleutian Islands				
5	19	01	02*	Kamchatka	52	N.	159	E.
5	20	17	04*	Fox Islands, Aleutian Islands. Depth about 60 km	52	N.	171	W.
8	01	54	35*	Santa Cruz Islands. Depth about 300 km	12	S.	167½	E.
8	04	07	26*	Afghanistan foreshock	35	N.	67½	E.
8	12	29	47*	Solomon Islands. Felt at Rabaul and Karoola	6	S.	154½	E.
8	13	53	09*	Argentian-Chile border region. Felt strongly at Coquimbo and La Serena, Chile. Depth about 150 km.	30	S.	70	W.
8	20	58	30**	Kermadec Islands				
9	02	26	57*	Central Alaska. Felt at College	64	N.	148	W.
9	05	37	04**	New Britain. Felt at Rabaul				
9	10	08	32*	Central Chile. Felt at Coquimbo, Illapel, La Serena, Santiago, and Valparaiso, Chile, and San Juan, Argentina. Depth about 150 km. Mag. 6¾.	30½	S.	70½	W.
9	23	13	51*	Afghanistan. Many killed and extensive property damage in Bamian and Kamard districts. Mag. 7.6.	35½	N.	67½	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
June 9	23	53	41*	Afghanistan aftershock. Felt	35	N.	68	E.
10	01	01	35*	....do	35	N.	68	E.
10	03	33	05**	....do				
10	04	22	08*	Celebes	½	N.	123½	E.
10	15	19	40*	Off south coast of Peru	18	S.	74½	W.
11	01	11	24*	Near south coast of Crete	34½	N.	26½	E.
11	02	57	15*	Afghanistan aftershock	35	N.	67½	E.
11	08	22	09*	North Atlantic Ocean	52	N.	31½	W.
11	09	56	10*	Northern Chile-Argentina border. Mag. 5¾–6	27½	S.	69	W.
11	16	49	45**	Near coast of Guerrero, Mexico				
11	22	33	51**	Near coast of northern Peru				
11	22	54	45*	Southern Siberia	51	N.	88	E.
12	03	12	28**	Assam. Felt at Sylhet and Mymensingh				
12	08	54	02*	Eastern Pacific Ocean. Mag. 6¼–6½	9	S.	110	W.
12	21	04	52*	Sumbawa	9	S.	117½	E.
13	12	07	41*	Near coast of Celebes. Felt at Minahasa. Depth about 200 km	½	S.	124½	E.
13	17	10	34*	Near coast of New Guinea. Felt at Lae. Depth about 300 km	6	S.	147½	E.
13	20	47	16**	New Britain region				
14	12	12	19*	Kurile Islands. Felt	45	N.	150½	E.
15	13	53	22**	Northern Kurile Islands				
15	15	35	47**	About 300 miles south of Tonga Islands. Depth about 200 km				
16	06	19	22*	Ryukyu Islands. Felt	28½	N.	131½	E.
16	16	57	37**	Chiapas, Mexico. Depth about 200 km				
16	18	12	27**	Kermadec Islands. Felt at Dannevirke				
16	18	31	03**	....do				
16	18	32	12**	....do				
16	19	36	01**	About 300 miles south of Tonga Islands				
17	03	01	34**	Kermadec Islands. Depth about 200 km				
19	00	19	08**	Southern Sumatra				
20	02	03	58**	Pacific Ocean, about 650 miles northwest of Easter Island				
20	16	29	42**	Tonga Islands				
21	11	06	36**	Western New Guinea				
21	19	40	12*	Celebes	5	S.	120	E.
21	20	32	03**	Sumbawa				
22	23	35	56**	Southern Peru. Depth about 100 km				
23	02	18	02*	Near east coast of Kamchatka. Mag. 6½	56½	N.	163½	E.
23	13	44	19*	Solomon Islands	7	S.	155	E.
23	17	59	23*	South of Panama	6	N.	83	W.
23	23	18	57*	Loyalty Islands region	21	S.	174	E.
24	12	55	02**	Indian Ocean, about 400 miles north of Prince Edward Islands. Mag. 6.				
24	20	58	36*	Solomon Islands. Mag. 6	7	S.	155	E.
25	01	02	30*	Mascarene Islands region	21½	S.	67	E.
25	12	52	07**	Eastern Iran				
26	00	00	13*	New Hebrides Islands	17	S.	169½	E.
26	11	23	09*	Tokelau Islands region	10	S.	173½	W.
27	18	57	30*	Southern Formosa. Felt	23	N.	121	E.
27	20	40	56*	New Britain	3½	S.	151½	E.
28	03	54	20*	Fiji Islands	15½	S.	178	W.
28	17	42	30**	Central Yugoslavia				
28	22	28	50*	Kurile Islands	49½	N.	158	E.
28	22	58	50	Off coast of Vancouver Island, British Columbia. Mag. 6¼–6½	48¾	N,	129¼	W.
28	23	16	50*	Vancouver Island aftershock	49	N.	129½	W.
29	02	18	28*	Southern Iran	28	N.	57	E.
29	02	21	52*	Off north coast of Formosa. Felt	24	N.	122½	E.
29	04	09	54*	Central Honshu, Japan. Felt	37	N.	139½	E.
29	17	43	26*	Near southwest coast of Luzon. Philippine Islands	14	N.	121	E.
29	22	36	17*	Off coast of Oaxaca, Mexico	13½	N.	97	W.
30	01	50	20*	Black Sea, near coast of Romania	44	N.	29	E.
30	03	08	18*	Tadzhik S. S. R.	39½	N.	70	E.
30	11	37	06**	Northeastern Iran				
30	13	09	47*	Easter Island region	33½	S.	103	W.
30	14	17	09*	Northern Chile. Felt. Depth about 200 km	22½	S.	69	W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	m	s		°	′	°	
July 2	14	26	35*	Sawoe Sea	8	S.	124	E.
3	00	31	29**	Colombia-Venezuela border				
3	10	17	57*	Nepal	28	N.	84½	E.
3	15	46	41*	Near coast of Guatemala	13½	N.	91	W.
3	23	26	17*	Hindu Kush. Depth about 250 km	36½	N.	71	E.
4	00	39	55*	Fiji Islands. Depth about 450 km	18	S.	178½	W.
4	03	04	14*	Solomon Islands. Felt at Aropa	7	S.	155½	E.
4	03	42	50*	Solomon Islands aftershock	7	S.	155½	E.
4	07	19	09*	....do	7	S.	155½	E.
4	11	08	28*	Central Chile. Felt at Coquimbo and Curcio	31	S.	71	W.
4	16	10	48*	Tonga Islands region. Depth about 450 km	23½	S.	180	
4	23	39	14**	Loyalty Islands				
5	05	54	35**	Near east coast of Kamchatka				
5	08	16	47*	Off coast of Hokkaido, Japan. Felt. Depth about 100 km	43½	N.	140	E.
5	13	01	05*	Alaska	63½	N.	151½	W.
6	02	22	00*	Off coast of Oregon. Mag. 5 (Berk)	42½	N.	126	W.
6	03	31	35	Near Hawthorne, Nev. Felt at Fallon, Hawthorne, and Luning. Mag. 4.9.	38	27 N.	118	37 W.
6	13	32	25*	Northern Chile. Felt at Antofagasta. Depth about 60 km	23	S.	70	W.
8	02	01	30**	About 100 miles off coast of Oregon. Mag. 4.2 (Berk)				
8	04	33	00**	Halmahera Island region				
8	06	01	56*	Molucca Passage. Depth about 60 km	0		126½	E.
8	20	29	52**	New Hebrides region				
9	03	11	39*	Aegean Sea. Forty-eight killed many injured. Several towns destroyed in the Cyclades. 10 ft. seismic sea wave reported on Aegean Islands. Also felt in Crete and southern Greece. Mag. 7.8.	37	N.	26	E.
9	03	18	47**	Near Kodiak Island, Alaska				
9	03	24	05**	Aegean Sea aftershock. Felt in the Cyclades, Crete, and southern Greece. Mag. 6¼.				
9	04	33	22**	....do				
9	06	19	07**	....do				
9	06	22	49*	Aegean Sea aftershock. Felt on Crete	37	N.	25½	E.
9	09	56	13*	Near coast of Haiti. Moderate property damage at Port de Paix. Depth about 100 km. Mag. 6¼.	20	N.	73	W.
9	20	10	25**	Aegean Sea aftershock				
9	20	13	56**	....do				
9	20	34	38**	Off coast of southern Sumatra				
9	21	28	42*	Aegean Sea aftershock. Felt on the island of Pholegandros	37	N.	26	E.
10	03	01	27*	Aegean Sea aftershock. Felt on the islands of Kos and Samos	37	N.	26	E.
10	17	56	03**	Marshall Islands				
10	22	08	23*	Hindu Kush. Felt at Peshawar and Rawalpindi. Depth about 100 km.	36½	N.	71½	E.
11	19	22	06	Kern County, Calif. Felt at China Lake and Kernville. Mag. 4.2	35	46 N.	117	56 W.
12	15	01	26*	Central Burma. Depth about 100 km	23	N.	94½	E.
13	13	36	03*	Northern Chile. Felt at Copiapo, La Serena, and Vallenar. Depth about 100 km.	27	S.	70	W.
14	03	29	21**	Ryukyu Islands				
14	03	38	27**	Near coast of Guerrero, Mexico				
14	17	09	30*	North Atlantic Ocean	17	N.	45½	W.
14	22	05	41*	Off north coast of Luzon, Philippine Islands. Felt at Basco and Calayan.	20	N.	121½	E.
15	01	55	09*	Off coast of Oregon	44	N.	127½	W.
15	12	52	16*	Bonin Islands region. Depth about 500 km	28	N.	139	E.
15	18	39	33*	Off coast of northern Honshu, Japan. Felt. Depth about 100 km.	42	N.	142	E.
16	06	27	43**	Near east coast of Honshu, Japan. Felt				
16	09	24	38*	Near east coast of Kamchatka	55½	N.	161½	E.
16	15	07	10*	Central Burma. Thirty killed and major property damage at Mandalay and Sagaing. Depth about 100 km. Mag. 7.0.	22	N.	95½	E.
16	20	40	25*	Burma aftershock. Depth about 100 km	22½	N.	96½	E.
16	21	34	03*	Andreanof Islands, Aleutian Islands	52	N.	178½	W.
17	04	36	02**	Mariana Islands, about 200 miles northeast of Guam				
17	07	34	07*	Banda Sea. Felt at Tual. Depth about 450 km. Mag. 6¾	7	S.	126½	E.
17	15	19	38*	Azores Islands region	41	N.	27	W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
July 17	17	05	07**	Mariana Islands aftershock				
17	22	32	40**	About 300 miles off coast of Guerrero, Mexico				
18	00	27	27*	New Britain. Felt	5	S.	151	E.
18	05	18	23*	Loyalty Islands	21½	S.	170	E.
18	06	19	35*	Banda Sea. Depth about 190 km. Mag. 7.5	5	S.	130½	E.
18	10	58	18**	Near east coast of Kamchatka				
19	20	40	54*	Near west coast of Luzon, Philippine Islands. Felt at Baguio, Dagupan, Iba, and Manila.	15	N.	120½	E.
19	23	26	25*	Near coast of Costa Rica. Felt at San Jose. Mag. 6 (Berk)	9½	N.	84½	W.
19	23	38	04*	Costa Rica aftershock	9½	N.	85	W.
20	07	39	10*	Northern Chile. Felt at Antofagasta	20	S.	70	W.
20	17	45	59**	Marshall Islands				
20	23	19	40**	Mariana Islands foreshock				
21	00	08	31*	Mid-Atlantic Ocean	1	N.	26	W.
21	14	51	06*	Sea of Okhotsk. Depth about 600 km	50½	N.	147½	E.
21	15	21	20*	Loyalty Islands region	22½	S.	172½	E.
21	15	32	25*	Western India. 111 killed, 300 injured, and major property damage in the State of Kutch. Mag. 6—6¼.	23	N.	70	E.
21	20	55	57*	Mariana Islands region	15½	N.	147	E.
22	03	28	59**	Aegean Sea aftershock. Felt on the Cyclades and Dodecanese Islands				
22	09	25	08*	Northern Chile. Felt at Arica. Depth about 100 km. Mag. 6—6¼	19	S.	69	W.
23	08	03	48	Northwest of King City, Calif. Felt in Monterey, San Luis Obispo, and San Benito Counties. Mag. 4.7.	36.3	N.	121.3	W.
23	14	25	46*	Solomon Islands region. Felt at Kokopo, Namatanai, and Rabaul, New Britain.	4½	S.	154	E.
23	19	25	58*	Easter Islands region. Mag. 6¾	24	S.	112	W.
23	21	56	56*	Near north coast of New Guinea. Felt at Wau	6	S.	148	E.
24	07	03	44**	Tonga Islands foreshock				
24	07	04	35**	Tonga Islands				
24	13	00	18*	South of Honshu, Japan. Depth about 500 km	30½	N.	139	E.
24	14	01	07*	Honshu, Japan. Felt	38½	N.	138½	E.
24	18	56	32*	Molucca Passage	1	N.	126½	E.
26	06	13	29**	Near east coast of Hokkaido, Japan. Felt				
26	08	30	24*	Northern Chile. Felt at Antofagasta	23	S.	69	W.
26	09	53	17	East of Fallon, Nevada. Felt at Fallon and Stillwater. Mag. 5.1 (Berk).	39	33 N.	118	27 W.
26	17	49	12*	Kermadec Islands region. Depth about 650 km	27	S.	178	E.
27	13	50	43*	Kamchatka	54	N.	161	E.
27	21	36	52*	Mariana Islands	15	N.	147½	E.
27	23	23	54*	Mariana Islands aftershock	15½	N.	147½	E.
28	02	01	58*	New Britain. Felt at Karoola, Kokopo, Namatanai, and Rabaul. Depth about 150 km.	6	S.	154	E.
28	11	09	05*	Mariana Islands aftershock	15½	N.	147½	E.
28	11	21	43*	Off coast of Ecuador	0		80½	W.
29	07	13	44*	Eastern Indian Ocean	9	S.	85½	E.
29	13	28	56*	Guatemala. Felt at San Salvador, El Salvador. Depth about 100 km.	14½	N.	90½	W.
29	13	44	11**	Guatemala aftershock. Depth about 100 km				
30	05	41	01**	Aegean Sea aftershock. Felt on Crete and Thira				
30	09	15	00*	Aegean Sea aftershock. Felt on Crete, in southern Greece, and on the Cyclades and Dodecanese Islands.	36½	N.	26	E.
30	10	39	56*	do	36½	N.	26	E.
30	11	23	54**	Ryukyu Islands region				
30	14	43	33*	Near north coast of Luzon, Philippine Islands. Felt at Aparri, Baguio, and Tuguegarao.	19	N.	121	E.
31	16	38	24*	Halmahera Island	2½	N.	128½	E.
Aug. 1	01	48	20*	Yukon, Canada	66	N.	133½	W.
1	06	44	00*	Central Chile foreshock	28½	S.	71½	W.
1	06	57	09*	Central Chile	28½	S.	71½	W.
1	17	32	57*	Samoa Islands. Felt at Apia	14½	S.	173½	W.
1	20	28	26*	Dominican Republic	18½	N.	71	W.
2	07	11	20*	Central Colombia. Felt at Chinchina and Pereira. Depth about 200 km.	5	N.	75½	W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	m	s		°	′	°	′
Aug. 2	07	18	15*	Off coast of Hokkaido, Japan. Felt. Depth about 60 km	43½	N.	146	E.
4	06	10	05*	Near coast of northern Chile. Felt at Antofagasta	21	S.	71	W.
4	09	48	45*	New Britain. Felt at Rabaul. Depth about 60 km. Mag. 6¼–6½	5	S.	153	E.
4	10	00	25*	New Britain. Felt at Rabaul	5	S.	152	E.
4	11	22	30**	100 miles off north coast of Puerto Rico				
5	09	09	12*	Off east coast of Hokkaido, Japan	41	N.	144	E.
6	17	22	45*	Ryukyu Islands	26½	N.	127	E.
7	00	29	53*	Burma. Depth about 150 km	22½	N.	93½	E.
7	04	05	52*	Western Idaho. Slight damage at Stanley	44½	N.	115	W.
8	23	02	10*	Southern Afghanistan	32	N.	67	E.
9	03	04	16*	Fiji Islands. Depth about 500 km	18½	S.	179	E.
9	07	19	15**	Central Chile				
9	09	35	38*	Loyalty Islands region	20	S.	168	E.
9	17	00	57*	Near coast of Nicaragua	12	N.	86	W.
9	21	45	42*	Kermadec Islands	31½	S.	178	W.
9	23	00	42*	Samoa Islands region. Felt at Apia. Depth about 250 km. Mag. 6¾	15	S.	176	W.
10	02	17	11*	Costa Rica	10	N.	84½	W.
10	15	24	37**	Fiji Islands region				
11	23	54	16*	Rat Islands, Aleutian Islands. Depth about 100 km	51½	N.	175½	E.
12	00	25	42*	Tonga Islands. Depth about 200 km	19	S.	176	W.
12	05	40	07**	Northern New Britain. Felt at Rabaul. Depth about 150 km				
12	16	59	33*	Near south coast of Honshu, Japan. Felt. Mag. 6½–6¾	34	N.	138	E.
13	09	07	38*	Kermadec Islands region	28½	S.	176	W.
14	02	50	30**	Prince Edward Islands region, South Indian Ocean				
14	11	47	53**	Kermadec Islands region				
14	23	34	33*	Fiji Islands. Depth about 550 km	19½	S.	179	W.
15	05	20	37*	Sumatra. Felt in Benkoulen and Tapanouli. Depth about 300 km. Mag. 6–6¼.	0		101½	E.
15	10	51	19*	Northern Celebes. Depth about 150 km	0		123	E.
15	12	02	54*	Near coast of Yugoslavia. Felt at Knin, Snij, Split, Zadar, and Zagreb.	43½	N.	16½	E.
15	13	11	45*	Kurile Islands foreshock	45	N.	151	E.
15	13	12	10*	Kurile Islands. Mag. 6¼	46	N.	151	E.
15	21	28	50*	Kurile Islands aftershock	45½	N.	151	E.
16	00	38	30**	About 100 miles off south coast of Greece				
16	02	09	39*	Near southwest coast of Portugal. Slight damage at Sagres. Felt at Ayamonte, Spain.	37	N.	8½	W.
16	08	10	25*	Andreanof Islands, Aleutian Islands	51	N.	176	W.
17	01	23	10*	North Atlantic Ocean	54	N.	35	W.
17	01	59	37*	North Atlantic aftershock	54½	N.	36	W.
17	05	53	25*	Near coast of Peru	7	S.	80	W.
17	09	15	06**	About 300 miles off coast of Oregon				
17	14	15	53*	New Britain region. Felt at Rabaul	4	S.	151½	E.
17	15	10	13*	New Britain aftershock	4	S.	151½	E.
18	00	52	16*	Idaho	44	N.	115½	W.
19	05	17	43*	Fiji Islands region. Depth about 150 km	21½	S.	179	W.
19	08	48	57*	Tonga Islands. Depth about 100 km	20	S.	176	W.
20	05	33	47*	Near south coast of Panama. Felt at Balboa Heights	7½	N.	80	W.
20	07	06	20*	Panama aftershock. Felt at Balboa Heights	7½	N.	80	W.
20	07	19	59*	....do	7½	N.	80	W.
20	09	43	50*	Off coast of Guatemala. Depth about 100 km	13½	N.	91½	W.
21	11	26	01*	Kurile Islands	49½	N.	156	E.
22	11	26	06**	New Hebrides Islands				
22	17	12	54**	Molucca Passage				
22	19	40	15**	Northern Assam				
23	13	04	06*	Unimak Island region	54	N.	162½	W.
23	13	48	30*	Bolivia. Felt at La Paz. Depth about 100 km. Mag. 6¼	15	S.	68	W.
23	22	05	08**	Near east coast of Honshu, Japan. Felt				
23	23	20	20*	Szechwan Province, China	27	N.	101½	E.
23	23	59	31*	Timor Island	10	S.	124	E.
24	00	03	10*	Near east coast of Kamchatka	57	N.	163	E.
24	03	50	54*	Kurile Islands	45½	N.	152	E.
24	04	27	33*	Near Islands, Aleutian Islands. Mag. 6½	53	N.	172½	E.

Footnotes at end of table

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter					
					Latitude			Longitude		
	h	m	s		°	′		°	′	
Aug. 24	04	50	00*	Near Islands aftershock	53½		N.	172½		E.
24	04	59	16*	Kurile Islands	48½		N.	157		E.
24	08	27	42*	Loyalty Islands	21		S.	169		E.
24	08	41	30*	Kamchatka	54		N.	162		E.
24	19	14	55*	Fox Islands, Aleutian Islands	52		N.	170½		W.
25	00	22	44*	Halmahera Island region	2		N.	129		E.
25	15	57	43	Baja California. Felt at San Diego, Calif. Mag. 5.0	31	30	N.	115	30	W.
25	19	33	45*	Near Islands aftershock	52½		N.	172½		E.
25	22	03	28*	Santa Cruz Islands. Depth about 200 km	12		S.	166½		E.
26	16	48	20*	Near Islands aftershock	52½		N.	172½		E.
27	15	37	23**	Near Dagestan A. S. S. R						
27	18	01	01*	Central Alaska. Depth about 60 km	64		N.	150		W.
28	01	29	43*	Near northwest coast of Turkey	41½		N.	30½		E.
28	09	49	13*	Tonga Islands region. Depth about 600 km	23½		S.	180		
29	03	04	32*	Near east coast of Kamchatka	54		N.	160		E.
30	04	24	24*	Unimak Islands, Aleutian Islands. Mag. 6	54		N.	164		W.
30	05	24	53	Off coast of northern California. Mag. 5.3 (Berk)	40.7		N.	126.4		W.
31	00	11	46**	Solomon Islands. Felt at Buin. Depth about 100 km						
31	18	22	53*	Near coast of Peru. Depth about 60 km	13		S.	77		W.
31	22	03	23*	Mariana Islands foreshock	15½		N.	147½		E.
31	23	06	38*	Mariana Islands region	15½		N.	147½		E.
Sept. 1	00	21	36*	Mariana Islands aftershock	15½		N.	147½		E.
1	11	01	22*	....do	15½		N.	147½		E.
1	17	56	36*	Unimak Island region, Alaska	54		N.	163½		W.
2	14	24	47*	Tonga Islands region. Depth about 300 km	22½		S.	178½		W.
3	14	56	52*	Southern Formosa	23		N.	120½		E.
3	18	05	11*	New Hebrides Islands. Felt at Vila	17½		S.	168½		E.
3	18	41	00**	Near south coast of Greece. Felt in Laconie						
4	07	31	30**	Guatemala-El Salvador border. Depth about 100 km						
4	08	34	32**	Central Idaho						
4	11	55	31**	Fiji Islands. Depth about 100 km						
4	14	11	57**	Fiji Islands region						
6	01	30	43*	Northwestern Colombia	7½		N.	77		W.
6	08	47	10**	Tonga Islands region						
6	10	40	06*	Near Islands, Aleutian Islands	52		N.	174		E.
6	11	46	35**	Dodecanese Islands region. Felt on Patmos, Santorin, and Crete						
6	12	58	41*	....do	36		N.	26		E.
7	03	54	18*	Fiji Islands region. Depth about 250 km	18		S.	176½		W.
7	09	10	30**	Near coast of northern Chile						
7	13	36	01	Eastern Tennessee. Felt in Kentucky-North Carolina-Tennessee-Virginia border region. Minor damage at Knoxville, Tenn.	35½		N.	84		W.
8	18	08	10*	Arctic Ocean, west of Spitsbergen	76½		N.	7		E.
9	15	19	44**	Fiji Islands region. Depth about 550 km						
9	17	35	13*	Halmahera Island. Depth about 150 km	3		N.	129		E.
10	04	30	16	Near coast of northern California. Mag. 4.5 (Berk)	40.5		N.	127.2		W.
10	11	25	28*	El Salvador. Felt at San Salvador	14½		N.	89½		W.
10	12	31	54*	Central Sumatra. Depth about 250 km	0			101½		E.
10	14	04	45*	Pacific Ocean, south of Mexico	11½		N.	103½		W.
10	23	51	44*	Tonga Islands region	25½		S.	175½		W.
10	23	59	26*	Costa Rica-Panama border	8½		N.	83		W.
11	02	32	28*	Fiji Islands. Mag. 6	16½		S.	178		E.
11	08	36	57**	Fiji Islands aftershock						
11	09	54	40*	Guatemala. Depth about 100 km. Mag. 6–6¼	14		N.	91		W.
11	15	44	04*	New Hebrides Islands. Mag. 6	17		S.	169		E.
11	21	03	56*	Northern Kurile Islands. Mag. 6¼	49½		N.	155		E.
12	13	25	45*	Mariana Islands region	23		N.	146		E.
12	19	59	54*	Kurile Islands aftershock	49½		N.	156		E.
13	13	53	49*	Near Halmahera Island. Depth about 300 km	3		N.	128½		E.
13	14	30	20**	About 500 miles south of Tasmania						
13	18	43	49**	New Hebrides Islands						
14	06	16	54*	Off coast of Chiapas, Mexico	15		N.	94		W.
14	09	22	12	Near coast of northern California. Mag. 4.2 (Berk)	40	28	N.	126	05	W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	m	s		°	′	°	′
Sept. 15	07	39	04*	Northern Chile. Felt at Antofagasta. Depth about 100 km. Mag. 6¾.	20	S.	69	W.
15	10	33	09*	New Britain. Depth about 400 km	4	S.	151	E.
15	16	26	30**	New Hebrides Islands				
16	08	37	22*	Pakistan-Afghanistan border. Felt at Kohat, Parachinar, and Rawalpindi. Mag. 6¼–6½.	34	N.	69½	E.
16	13	26	30*	Tonga Islands. Depth about 200 km	19	S.	174½	W.
16	14	23	22*	Afghanistan aftershock	34	N.	69½	E.
16	18	07	38*	Aegean Sea. Felt on Santorin and Crete	36½	N.	26	E.
16	20	25	47*	Near south coast of Kamchatka. Depth about 60 km	51	N.	157	E.
17	20	19	07*	Near south coast of Sumatra. Depth about 150 km	5½	N.	95	E.
18	09	48	56*	Azores Islands	37	N.	24	W.
18	16	02	14*	Off south coast of Honshu, Japan	30½	N.	142	E.
19	23	47	44*	Western Burma. Felt at Chittagong and Dacca, East Pakistan. Depth about 150 km.	23½	N.	94½	E.
20	03	02	32*	Near coast of northern Chile. Felt at Antofagasta	23	S.	69½	W.
20	13	55	00*	Kodiak Island, Alaska	57½	N.	152	W.
20	20	06	09*	Kamchatka foreshock	51	N.	159	E.
20	21	52	01*	Near south coast of Kamchatka. Mag. 6¼	51½	N.	159½	E.
21	03	34	46**	Kamchatka aftershock				
21	09	16	20*	Central Mexico	20	N.	100½	W.
21	19	11	59*	Santiago del Estero Province, Argentina. Depth about 600 km	26½	S.	63	W.
21	22	55	46*	Kurile Islands	46	N.	151½	E.
22	06	53	20*	Fiji Islands region. Depth about 650 km	22½	S.	179½	W.
22	14	02	24*	Tadzhik S. S. R	39	N.	71	E.
22	15	54	21*	do	38	N.	69	E.
22	18	18	19*	Kurile Islands	45½	N.	151	E.
23	03	02	10*	Kurile Islands aftershock	45½	N.	151	E.
23	08	51	55	Baja California. Felt at San Diego, Calif. Mag. 4.9.	31	35 N.	115	40 W.
24	06	04	37*	Samoa Islands. Felt at Apia. Mag. 6	15½	S.	173½	W.
24	07	02	13*	Fiji Islands region	22	S.	175	E.
24	10	20	38*	Pakistan-Afghanistan border aftershock. Felt at Parachinar, Pakistan.	34	N.	69½	E.
24	11	23	54**	Near coast of central Chile. Felt at Santiago				
24	15	38	08**	Costa Rica-Panama foreshock. Felt at Puerto Armuelles, Panama				
25	06	56	55**	do				
25	18	27	25*	Near Costa Rica-Panama border. Felt at Puerto Armuelles, Panama.	8	N.	83	W.
25	21	31	15*	Costa Rica-Panama aftershock. Felt at Puerto Armuelles, Panama	8	N.	83	W.
26	05	04	01*	Off south coast of Honshu, Japan	30½	N.	142	E.
26	13	46	52*	Rat Islands, Aleutian Islands. Depth about 100 km	52	N.	176	E.
28	15	01	36*	Off west coast of Spitsbergen	77½	N.	7	E.
29	03	55	27*	Northern Celebes. Depth about 300 km	0		123	E.
29	09	03	37*	Nicobar Islands	7½	N.	94½	E.
29	11	31	40*	Off coast of Peru. Felt at Lima	12	S.	78	W.
29	21	20	52*	Central Honshu, Japan. 1 killed, 1 injured, and minor damage in Fukushima.	38	N.	141	E.
29	22	22	48*	Off north coast of Halmahera Island. Depth about 60 km	3	N.	128	E.
29	23	01	00*	Arctic Ocean, northwest of Norway	70½	N.	9	E.
29	23	20	52*	Central Honshu, Japan. 4 killed, several injured, and minor property damage at Tokyo. Depth about 60 km. Mag. 6¾–7.	35½	N.	140	E.
30	14	41	44*	Mariana Islands. Felt on Guam. Depth about 100 km	14	N.	144	E.
Oct. 1	15	14	20*	Fiji Islands. Depth about 500 km	15½	S.	179½	W.
1	18	04	40*	Jamaica. Minor damage at Moneague, Port Maria, and St. Ann's Bay.	18½	N.	77	W.
2	07	51	30*	Off coast of Jalisco, Mexico. Felt	21	N.	108	W.
2	14	56	26*	Near southeast coast of Kamchatka. Depth about 60 km. Mag. 6¼–6½.	53	N.	159	E.
2	15	53	30*	Southern Gulf of California	24	N.	109½	W.
3	01	09	03**	Off coast of Oaxaca, Mexico				
3	08	18	49*	Northern Chile. Depth about 150 km. Mag. 6½	20	S.	69½	W.
3	20	21	40	Southwestern Wyoming. Felt at Opal	41.5	N.	110.1	W.
4	17	15	14**	About 200 miles off coast of Chiapas, Mexico				

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Oct. 5	08	14	44**	About 100 miles off east coast of Kamchatka				
5	21	43	16*	New Hebrides Islands. Depth about 100 km	14	S.	167½	E.
6	06	15	57*	Molucca Passage	2½	N.	126½	E.
6	07	29	11*	Arctic Ocean	73	N.	4½	E.
6	17	00	14*	Fiji Islands. Depth about 100 km	16	S.	179	W.
7	06	52	00*	Off coast of Panama	5	N.	82	W.
7	19	34	34*	Fiji Islands region. Depth about 200 km	19	S.	177	W.
7	21	27	50*	New Hebrides Islands. Depth about 100 km	13	S.	167	E.
8	00	19	47*	Near north coast of New Guinea. Felt at Angoram and Rabaul. Depth about 100 km.	4	S.	144½	E.
8	01	49	09**	About 200 miles off coast of Vancouver Island, B. C.				
8	04	29	04*	Mariana Islands region	12	N.	141	E.
8	14	55	49*	Tonga Islands	20	S.	174	W.
8	17	22	10**	Near east coast of Formosa				
9	06	19	37*	Tonga Islands	19½	S.	174	W.
9	10	53	41*	Atlantic Ocean	25	N.	46	W.
9	14	46	18*	....do	24½	N.	45½	W.
9	16	50	56*	Mariana Islands	15½	N.	147½	E.
10	15	31	34*	Northern India	28½	N.	78	E.
11	02	24	33*	Kurile Islands. Felt on Hokkaido, Japan. Depth about 110 km. Mag. 7.6.	46	N.	150½	E.
11	16	48	50	West of Ferndale, Calif. Felt in the coastal areas of northern California and at Medford and Shady Cove, Oreg. Mag. 6.0 (Berk).	40	40 N.	125	46 W.
11	17	18	19	Northern California aftershock. Felt. Mag. 4.8 (Berk)	40	45 N.	125	48 W.
11	17	22	30	....do	40.7	N.	125.8	W.
12	02	37	45*	Near coast of central Peru. Depth about 60 km. Mag. 6½	15½	S.	75	W.
12	12	22	46*	Near east coast of Hokkaido, Japan. Felt. Mag. 6¼–6½	42½	N.	144½	E.
12	13	21	52*	Hokkaido aftershock	42½	N.	144½	E.
12	18	40	34**	New Hebrides Islands. Depth about 200 km				
13	04	47	32*	Off north coast of South America	13	N.	56½	W.
13	05	04	40*	Western Venezuela	9½	N.	70	W.
13	08	21	12*	Hindu Kush. Felt at Faizabad, Afghanistan. Depth about 150 km	36½	N.	71½	E.
13	15	12	24*	Northern Kurile Islands	49½	N.	155½	E.
13	18	54	06*	New Britain. Felt at Numundo and Popondetta. Depth about 150 km.	5	S.	149½	E.
13	22	55	23	Near coast of northern California. Mag. 4.3 (Berk)	40	45 N.	125	48 W.
14	03	59	27*	Near north coast of New Guinea	4	S.	146	E.
14	09	34	17**	Near east coast of Kamchatka				
14	10	43	28*	Mariana Islands. Depth about 400 km	18½	N.	145	E.
14	21	05	36*	Off east coast of Honshu, Japan. Felt at Tokyo and in northeastern Honshu. Depth about 60 km.	38	N.	141½	E.
15	07	46	00*	Near east coast of Samar, Philippine Islands. Felt at Mambajao. Depth about 200 km.	11½	N.	126½	E.
15	23	07	20*	Tadzhik S. S. R.	37½	N.	68½	E.
16	10	44	43	Hawaiian Islands. Felt on Hawaii and Oahu	20	N.	157	W.
18	03	27	18**	Near north coast of Mindanao, Philippine Islands				
18	07	15	25**	150 miles off coast of Oregon				
19	01	28	53*	Central Peru. Depth about 100 km	11½	S.	76	W.
19	10	50	42*	Solomon Islands. Felt at Karoola and Rabaul. Depth about 150 km.	5	S.	154½	E.
19	12	00	38*	Fiji Islands. Depth about 650 km. Mag. 6	21	S.	179	W.
19	14	05	34*	South Pacific Ocean. Mag. 6½	56½	S.	122	W.
19	20	47	33*	Rat Islands, Aleutian Islands. Mag. 6¾	52	N.	177	E.
19	21	27	47*	Rat Islands aftershock	52	N.	177	E.
19	21	37	45**	....do				
19	23	58	30*	Off coast of Oregon	42½	N.	127	W.
20	03	31	24*	Fox Islands, Aleutian Islands	51½	N.	170	W.
21	08	39	45*	Southern Gulf of California	25	N.	109	W.
22	07	26	15*	Rat Islands, Aleutian Islands	52	N.	177	E.
22	12	35	10*	Near southeast coast of New Guinea. Felt at Baniara, Esa'Ala, Losuia, and Sagarai.	9½	S.	150	E.
22	15	18	13*	Near southeast coast of New Guinia. Depth about 100 km	9½	S.	150	E.
23	04	24	52**	Off coast of El Salvador. Felt				

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	m	s		°	′	°	′
Oct. 23	08	07	35*	Northwest of Galapagos Islands. Mag. 5¾	3	N.	95	W.
23	08	41	22*	Mindora Island, Philippine Islands. Felt at Manila, Calapan, and Ramblon. Depth about 100 km.	13½	N.	120½	E.
23	10	01	48*	Tonga Islands	19	S.	174	W.
23	10	32	03**	Off southeast coast of Formosa				
24	10	59	26*	North Atlantic Ocean	47	N.	27	W.
24	14	42	10*	Near coast of Nicaragua. Minor damage at Managua. Felt in southern El Salvador. Mag. 7.3.	12	N.	86½	W.
25	05	21	40*	Nicaragua aftershock. Felt in Nicaragua and El Salvador. Mag. 6¼–6½.	12	N.	87	W.
25	19	04	04*	Tonga Islands region	17½	S.	175	W.
26	02	47	00*	Fiji Islands	17½	S.	176	E.
26	08	54	46*	Banda Sea. Depth about 200 km	6½	S.	130	E.
26	08	56	30*	Fiji Islands region. Depth about 350 km	21	S.	178	W.
26	22	50	24*	New Hebrides Islands. Mag. 6½	14	S.	167	E.
27	00	45	21*	Kansu Province, China	39½	N.	99	E.
27	15	33	08*	Near coast of Nicaragua. Depth about 200 km. Mag. 5¾–6	12	N.	86	W.
28	02	55	03**	Fiji Islands				
28	03	28	41*	Kermadec Islands. Mag. 6¾	32	S.	179	W.
28	06	42	52*	Tonga Islands	17	S.	173	W.
28	10	45	06*	Luzon, Philippine Islands. Felt at Auroro, Daet, Infanta, and Legaspi.	14	N.	123½	E.
28	18	18	50**	Off east coast of New Britain				
29	07	34	57**	Dodecanese Islands. Felt on Santorin and Crete				
29	15	42	08*	Central Peru. Depth about 60 km	8½	S.	77	W.
29	16	21	00**	Northern Iceland foreshock. Felt				
29	22	33	49*	Tonga Islands region. Depth about 200 km	22	S.	177	W.
30	00	11	03*	Near coast of northern Iceland. Felt	66½	N.	17½	W.
30	22	52	27*	Off coast of Colombia	5	N.	79	W.
31	00	03	04*	——do.	5	N.	79	W.
31	02	34	40**	Fiji Islands. Depth about 500 km				
31	14	03	38*	Southern Iran. 350 killed, many injured, and extensive property damage in Laristan. Mag. 6¾.	27	N.	54½	E.
31	14	22	19*	Iran aftershock	27	N.	54½	E.
31	22	21	15**	Northeast India				
Nov. 1	05	52	34*	Southern Iran aftershock	27½	N.	54	E.
1	15	42	12*	Near north coast of Panama. Felt at Balboa Heights, Canal Zone	10	N.	80	W.
1	17	31	05**	Kamchatka				
2	10	38	55*	Southern Arizona	32	N.	112	W.
2	16	04	30*	Near east coast of Greece. Several injured and extensive property damage at Volos.	39	N.	23	E.
3	05	26	02*	Southern Yukon, Canada	61	N.	139	W.
3	10	04	02*	Near south coast of Kamchatka	52	N.	159	E.
3	18	02	04*	South of Fiji Islands. Depth about 500 km	24	S.	180	
4	05	37	15*	Near east coast of Honshu, Japan. Felt. Depth about 100 km	35½	N.	140½	E.
4	07	05	43*	Tonga Islands. Depth about 60 km. Mag. 6½–6¾	22	S.	175	W.
4	08	35	20*	Mendoza Province, Argentina	34	S.	68	W.
4	11	53	30**	Southern Quebec, Canada. Felt at Gatineau, Ontario, Canada				
4	21	40	55*	Yukon, Canada	61	N.	139	W.
6	00	03	15**	Tonga Islands				
6	14	12	35*	Aru Islands	5½	S.	134	E.
6	23	14	20*	Andreanof Islands, Aleutian Islands	52	N.	176	W.
7	03	06	51*	Fiji Islands. Depth about 600 km	17½	S.	178½	W.
7	17	07	55**	Northeastern Iran				
8	03	45	51*	Fiji Islands region. Depth about 550 km	24	S.	179	E.
8	06	50	24*	Fiji Islands. Depth about 500 km	18	S.	178	W.
8	15	44	50*	Mindanao, Philippine Islands. Felt at Hinatuan, Mambajao, and Surigao.	9	N.	126	E.
9	06	01	51*	North Atlantic Ocean	36	N.	34½	W.
9	11	55	16**	Near south coast of Java. Felt in Central Java				
9	13	06	10*	Southern Mexico. Slight damage in Oaxaca Province. Also felt in Chiapas and the Isthmus of Tehuantepec. Depth about 150 km. Mag. 6¼–6½.	17	N.	94	W.
9	17	56	26*	Kermadec Islands. Depth about 350 km	17½	S.	178	W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Nov. 10	00	08	27*	Near coast of Costa Rica. Depth about 100 km. Mag. 6	10½	N.	86	W.
10	09	06	34	Near coast of northern California. Felt in Humboldt County. Mag. 4.1 (Berk).	40	13 N.	123	48 W.
10	11	53	30**	Near coast of Kodiak Island, Alaska				
10	14	39	56*	Luzon, Philippine Islands. Felt at Baguio, Baler, Dagupan, and Manila.	16	N.	121	E.
10	15	41	02*	India-Burma border. Depth about 150 km	25	N.	94½	E.
11	03	13	48*	Fiji Islands. Depth about 650 km	16½	S.	179	W.
11	19	15	20*	Kurile Islands. Felt	44	N.	149	E.
12	08	33	20*	Molucca Passage	1	N.	126	E.
12	20	57	35*	Spitsbergen foreshock	73	N.	7	E.
13	02	58	37*	Spitsbergen region	73	N.	7	E.
13	07	40	58*	Loyalty Islands region	21½	S.	174	E.
13	08	36	17**	....do				
13	09	55	29*	Indian Ocean, about 1,000 miles south of Australia. Mag. 6–6¼	48½	S.	124	E.
13	14	38	51*	Near east coast of Luzon, Philippine Islands. Felt at Daet and Manila.	15	N.	123	E.
14	00	51	27*	Hindu Kush. Felt at Kabul, Afghanistan; and Lahore and Parachinar, Pakistan. Depth about 150 km.	36½	N.	71	E.
14	05	10	24*	New Britain region. Felt at Karoola. Depth about 100 km	6	S.	153½	E.
15	14	17	09*	Galapagos Islands foreshock	5	S.	104½	W.
15	17	27	55*	Pacific Ocean, about 900 miles west of Galapagos Islands	3	S.	103½	W.
16	03	23	09	Near coast of California. Felt in Santa Cruz, Santa Barbara, and Fresno Counties. Mag. 5.0 (Berk).	35	57 N.	120	28 W.
16	06	23	10**	Rat Islands, Aleutian Islands				
16	08	26	11*	Northeastern Nevada	41	N.	116	W.
16	08	48	14*	Central New Guinea. Depth about 150 km. Mag. 5¾–6	4	S.	139	E.
16	11	43	35*	Southern Luzon, Philippine Islands. Felt at Daet	14	N.	123	E.
16	11	53	54*	Northwestern Venezuela	8½	N.	71	W.
16	16	16	19*	New Hebrides Islands region	20	S.	170½	E.
16	22	02	19*	Peru-Bolivia-Chile border region. Depth about 150 km	18	S.	69	W.
17	19	15	06*	Ryukyu Islands region. Depth about 150 km	27½	N.	126	E.
17	20	27	15*	Queen Charlotte Islands region. Felt at Ketchikan and Petersburg, Alaska. Mag. 6½.	54½	N.	134	W.
18	05	19	26*	Western Sinkiang Province, China	40	N.	76½	E.
18	09	46	49*	Kermadec Islands foreshock	27	S.	176	W.
18	18	16	25*	Kermadec Islands region	27	S.	176	W.
18	21	22	38*	Ryukyu Islands. Felt	28½	N.	129½	E.
19	02	50	31*	New Guinea	3	S.	139½	E.
19	12	02	26*	Mariana Islands. Depth about 150 km	14	N.	144	E.
20	11	03	30*	Banda Sea	7	S.	129	E.
20	11	58	55*	Near east coast of Celebes. Depth about 200 km	½	S.	123½	E.
20	23	20	52*	Aegean Sea. Felt on Chios, Lemnos, Lesbos, and Samos	39½	N.	25½	E.
21	06	22	10*	Off west coast of Sakhalin	49	N.	141½	E.
21	07	33	28*	Near coast of northern Honshu, Japan. Felt. Depth about 60 km	38	N.	142	E.
21	07	49	47*	Solomon Islands. Felt at Namatanai and Rabaul. Depth about 100 km.	4	S.	152½	E.
21	22	06	55*	Near coast of Guerrero, Mexico. Felt at Acapulco	15½	N.	99½	W.
22	08	32	45*	Panama-Costa Rica border	8½	N.	82½	W.
22	15	37	49*	Fiji Islands	15	S.	178	W.
22	23	29	07*	Near west coast of New Guinea	3	S.	132	E.
23	02	51	40**	Off coast of Oregon				
23	10	00	50*	Fox Islands, Aleutian Islands	52½	N.	169½	W.
24	01	56	06*	Argentina-Bolivia border. Felt at Antofagasta, Chile. Depth about 150 km.	22½	S.	67	W.
24	20	41	58*	Kermadec Islands region	27	S.	175	W.
25	07	21	36**	Tonga Islands				
25	11	24	59*	Unimak Island region, Aleutian Islands	54	N.	164	W.
25	14	15	10*	Near coast of southern Peru. Depth about 100 km	17	S.	71½	W.
25	18	07	40*	New Hebrides Islands. Depth about 100 km	15	S.	168	E.
26	02	59	34**	Bonin Islands				
26	04	12	44	Wayne County, Mo. Felt in Arkansas, Illinois, Kentucky, Missouri, and Tennessee. Minor damage in Missouri.	37.1	N.	90.6	W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	m	s		°	′	°	′
Nov. 26	05	07	55*	Celebes	½	N.	122½	E.
26	18	49	56*	Northern Chile. Felt at Antofagasta. Depth about 100 km	26	S.	70½	W.
26	23	29	41*	Loyalty Islands. Mag. 6½	22	S.	169	E.
27	00	51	46*	Loyalty Islands aftershock	21	S.	168½	E.
27	02	19	34**	....do				
27	06	17	29**	....do				
27	06	59	34*	Solomon Islands	5	S.	154	E.
27	08	00	06**	Off north coast of Hokkaido, Japan				
27	09	44	06**	Loyalty Islands aftershock				
27	13	19	05*	....do	21	S.	169	E.
27	15	52	20**	....do				
28	06	59	18**	....do				
28	15	11	33*	Kermadec Islands	30	S.	176	W.
28	19	27	11*	Northern Kurile Islands. Mag. 6¾	49½	N.	155	E.
29	04	13	35*	South Orkney Islands region	58	S.	46½	W.
29	07	16	07*	Bonin Islands foreshock	27	N.	141	E.
29	09	15	20*	Bonin Islands. Mag. 6¾	27	N.	141	E.
29	14	36	20*	Bonin Islands aftershock	27½	N.	141½	E.
30	16	42	03**	Near north coast of Vancouver Island, British Columbia, Canada				
30	16	51	28*	Tonga Islands	20½	S.	174½	W.
30	19	30	34*	San Juan Province, Argentina. Depth about 150 km	31½	S.	70	W.
Dec. 1	07	43	51*	Loyalty Islands	22	S.	169	E.
1	21	24	54*	Off coast of southern Peru	17½	S.	72½	W.
2	01	45	48*	Near east coast of Dominican Republic	18½	N.	69	W.
2	02	59	56*	Fox Islands foreshock	52½	N.	169	W.
2	05	53	45*	Bonin Islands region. Depth about 300 km	27½	N.	137½	E.
2	16	33	36*	Tonga Islands	17	S.	173½	W.
3	07	12	44*	Fox Islands foreshock	53	N.	169	W.
3	07	20	08*	Fox Islands, Aleutian Islands. Mag. 6½–6¾	53	N.	169	W.
3	07	44	55*	Fox Islands aftershock	52½	N.	169	W.
3	20	56	40**	....do				
4	08	44	28*	Kurile Islands	50	N.	156	E.
4	08	50	25**	Kurile Islands aftershock				
4	10	07	54*	South Pacific Ocean. Mag. 6–6¼	45½	S.	106	W.
4	10	42	10*	Fox Islands aftershock	53	N.	169	W.
4	13	21	07**	Samoa Islands. Felt at Apia				
4	20	59	52*	Ryukyu Islands. Depth about 100 km	26	N.	127	E.
4	23	01	35*	Guatemala. Felt in western El Salvador and Chiapas, Mexico. Depth about 150 km. Mag. 6.	15	N.	92	W.
5	01	47	56**	Near coast of southern Peru				
5	05	24	27**	Near coast of Colima, Mexico				
7	11	21	37**	Near west coast of Luzon, Philippine Islands. Felt at Manila and Olongapo.				
7	14	30	33**	Southeastern Sumatra. Felt at Benkoulen and Palembang. Depth about 100 km.				
8	16	10	27*	Andreanof Islands, Aleutian Islands. Mag. 6½	51	N.	179½	W.
9	00	10	45*	Molucca Passage	0		125½	E.
9	05	19	06*	Fox Islands aftershock	53	N.	169	W.
9	11	28	29*	New Britain. Depth about 100 km	6	S.	152	E.
9	17	00	45**	Off east coast of Kamchatka				
10	08	13	30**	Bonin Islands				
10	08	30	45*	Andreanof Islands aftershock	51	N.	179½	W.
10	16	48	21*	New Britain. Felt at Rabaul. Depth about 60 km	5	S.	152	E.
10	23	15	00**	Argentina-Chile border				
11	06	30	58*	Northern Kurile Islands	50	N.	156	E.
12	10	20	26*	Mariana Islands. Depth about 200 km	13½	N.	144½	E.
12	20	53	15**	Formosa. Depth about 150 km				
13	13	15	37*	Baja California. Felt at San Diego, Calif. Mag. 5¾–6	31	N.	115	W.
13	14	52	02*	Molucca Passage	2	N.	126½	E.
13	19	34	24*	Mariana Islands	12	N.	143	E.
15	09	03	30**	About 300 miles north of Galapagos Islands				
15	13	50	56*	Halmahera Island. Depth about 150 km	2½	N.	128½	E.
15	17	24	24*	New Hebrides Islands. Depth about 150 km. Mag. 6–6¼	13	S.	167½	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1956*—Continued

1956	Origin Time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	m	s		°	′	°	′
Dec. 15	23	13	55*	Colombia foreshock	6½	N.	78	W.
15	23	41	28**	....do				
16	01	41	52*	Near west coast of Colombia. Felt at Balboa Heights, Canal Zone. Mag. 6½.	6½	N.	78	W.
16	22	06	45**	Kermadec Islands				
18	02	14	12**	Bonin Islands				
18	02	31	00*	Chile-Argentina border. Felt at Antofagasta and Copiapo, Chile. Mag. 7.0.	25½	S.	68½	W.
18	12	14	13*	Unimak Island region	53½	N.	164	W.
18	17	53	00*	Israel-Jordan border region. Minor damage at Haifa, Israel. Felt at Jerusalem and Tel Aviv, Israel; and Ksara, Lebanon. Mag. 6.	30½	N.	35½	E.
18	19	20	06*	South Indian Ocean	36	S.	77	E.
18	21	12	49*	Near south coast of Honshu, Japan. Felt at Tokyo. Depth about 100 km.	34½	N.	139	E.
19	01	18	10*	Southern Kamchatka	51½	N.	157	E.
19	04	36	20*	Bonin Islands region. Depth about 450 km	29	N.	139½	E.
20	10	59	56*	Kermadec Islands. Mag. 6½	27	S.	176	W.
20	19	47	51*	Kurile Islands. Felt	46	N.	150	E.
20	21	13	40*	Near west coast of Sumatra	4½	S.	101½	E.
20	23	57	36*	Kamchatka	54	N.	161½	E.
21	03	27	41*	Burma-India border	27	N.	96½	E.
21	08	58	53*	Queen Charlotte Islands. Mag. 6¾	51	N.	131	W.
21	10	31	34*	Honshu foreshock. Felt	34	N.	139½	E.
21	18	11	07*	....do	34	N.	140	E.
21	20	10	06*	Near south coast of Honshu, Japan. Felt	34	N.	139	E.
22	22	38	12*	Kermadec Islands	29½	S.	177	W.
22	23	12	35*	Honshu aftershock. Felt	33½	N.	139	E.
23	08	37	26*	Mariana Islands region. Depth about 100 km. Mag. 6½	22	N.	144½	E.
24	04	34	20**	Costa Rica-Nicaragua border region				
24	18	38	53*	Near east coast of Mindanao, Philippine Islands. Felt at Hinatuan, Mambajao, and Surigao.	10	N.	127	E.
25	02	58	48*	North Atlantic Ocean	48½	N.	28	W.
25	04	29	49*	Tonga Islands. Depth about 200 km	20	S.	176	W.
25	09	33	37*	North Atlantic Ocean. Mag. 6½	48½	N.	28	W.
26	07	34	18*	Off south coast of Java	9½	S.	112	E.
26	07	46	24*	Santa Cruz Islands. Mag. 6	10	S.	166	E.
27	00	14	11*	Tonga Islands region. Depth about 240 km. Mag. 7.1	23½	S.	177	W.
27	10	08	10*	Dodecanese Islands	36	N.	27½	E.
27	21	31	28*	Mindanao, Philippine Islands. Felt at Davao, Hinatuan, Mambajao, and Surigao.	7½	N.	126	E.
28	02	23	51*	Northern Afghanistan	37½	N.	70½	E.
28	13	41	08*	Near south coast of Mindanao, Philippine Islands	5½	N.	126	E.
28	14	24	40*	Near coast of North Island, New Zealand. Moderate damage in Gisborne and vicinity. Depth about 150 km. Mag. 6¼–6½.	39	S.	177½	E.
28	19	21	30*	Off south coast of Baja California	21	N.	109	W.
28	21	12	02*	Fiji Islands region	15½	S.	176	W.
29	03	40	21*	New Britain. Felt at Rabaul. Depth about 60 km	5½	S.	151½	E.
29	06	51	08*	....do	5½	S.	151½	E.
29	09	37	13**	Near south coast of Kamchatka				
29	19	27	16*	Fiji Islands. Depth about 600 km	21	S.	180	
29	19	51	49**	Near south coast of Java. Depth about 150 km				
29	20	22	12*	Tonga Islands. Mag. 6¼–6½	21	S.	175½	W.
30	18	24	30**	Greece. Felt in Aetolie, Elide, and on Leneade				
30	21	59	06*	India-Burma border	24	N.	94½	E.
31	04	42	29*	Off north coast of Norway	72	N.	16½	E.
31	09	03	40*	Northern Gulf of California	31	N.	114	W.
31	17	36	16	Nevada foreshock. Felt at Hawthorne. Mag. 3.8 (Berk)	38	17 N.	118	58 W.
31	17	37	45	Nevada foreshock. Felt at Hawthorne. Mag. 5.0 (Berk)	38	17 N.	118	58 W.
31	17	39	24	Near Hawthorne, Nevada. Minor damage. Mag. 5.1 (Berk)	38	17 N.	118	58 W.

*Indicates probable error of $\frac{1}{10}$ minute.
**Indicates probable error of $\frac{1}{4}$ minute.

TABLE 3.—*Principal earthquakes of the world from January through December 1956*

NOTE.—This table lists (1) the strongest shocks of the period as revealed by seismographic records, particularly those of the Western Hemisphere stations; (2) important destructive and near-destructive earthquakes; (3) earthquakes of unusual interest outside the two preceding categories; and (4) magnitude as determined by Pasadena.

1956	Origin Time G. C. T.	Region	Coordinates of provisional epicenter		Remarks
			Latitude	Longitude	
	h *m* *s*		° ′	° ′	
Jan. 8	07 11 26*	Guerrero, Mexico	17 N.	99½ W.	Many injured and heavy property damage at Acapulco. Mag. 6½.
8	20 54 13*	Northern Chile	19 S.	70 W.	Slight damage at Arica. Mag. 7.1.
10	08 52 36*	Tonga Islands region	25 S.	176 W.	Mag. 7.3.
12	05 46 05*	Northern Hungary	47½ N.	19½ E.	2 killed, many injured, and extensive property damage at Dunaharaszti, Soroksar, and Taksony.
16	23 37 37*	Near coast of Ecuador	½ S.	80½ W.	Heavy property damage at Bahia de Caraquez and Portoviejo. Felt on board M/S *Equateur* at 1.06°S., 81.08°W. Mag. 7.3.
Feb. 1	13 41 44*	Mariana Islands	19 N.	145½ E.	Depth about 370 km. Mag. 7.0.
9	14 32 38	Baja California	31 45 N.	115 55 W.	Minor damage in Imperial Valley, Calif., and Yuma, Ariz. Mag. 6.8.
15	12 50 12*	Peru	8½ S.	74½ W.	2 killed in Callejon-Huaylas region. Depth about 150 km.
18	07 34 20*	South of Honshu, Japan	30 N.	137½ E.	Felt on Honshu. Depth about 480 km. Mag. 7.3.
20	20 31 35*	Turkey	40 N.	30½ E.	4 killed and several injured at Istanbul. 2,000 houses damaged at Eskisehir.
Mar. 16	19 32 39*	Lebanon	33½ N.	35½ E.	136 killed, 6,000 houses destroyed and 17,000 damaged in 400 villages in the Chouf region.
16	19 43 28*	do	33½ N.	35½ E.	
Apr. 19	18 38 52*	Southern Spain	37 N.	4 W.	7 killed, 60 injured, and extensive property damage at Albolote, Atarfe, and Granada.
May 23	20 48 30*	Fiji Islands	15½ S.	179 W.	Depth about 430 km. Mag. 7½.
June 9	23 13 51*	Afghanistan	35½ N.	67½ E.	350–400 killed; extensive property damage in Bamian and Kamard District. Avalanche in the Kamard Valley formed a dam, the rupture of which on June 14 caused floods, most casualties due to inundation. Mag. 7.6.
July 9	03 11 39*	Aegean Sea	37 N.	26 E.	48 killed, many injured, and several towns destroyed in the Cyclades. 10-ft. seismic sea wave caused extensive damage on various Aegean Islands. Also felt in southern Greece and Crete. Mag. 7.8.
16	15 07 10*	Central Burma	22 N.	95½ E.	30 killed and major property damage at Mandalay and Sagaing. Depth about 100 km. Mag. 7.0.
18	06 19 35*	Banda Sea	5 S.	130½ E.	Depth about 190 km. Mag. 7.5.
21	15 32 25*	Western India	23 N.	70 E.	111 killed, 300 injured, and major property damage in the State of Kutch. Mag. 6–6¼.
Sept. 29	21 20 52*	Central Honshu, Japan	38 N.	141 E.	1 killed, 1 injured, and minor property damage in Fukushima.
29	23 20 52*	do	35½ N.	140 E.	4 killed, several injured, and minor property damage at Tokyo. Depth about 60 km. Mag. 6¾–7.
Oct. 11	02 24 33*	Kurile Islands	46 N.	150½ E.	Felt in Hokkaido, Japan. Depth about 110 km. Mag. 7.6.
24	14 42 10*	Near coast of Nicaragua	12 N.	86½ W.	Minor damage at Managua. Felt in southern El Salvador. Mag. 7.3
31	14 03 38*	Southern Iran	27 N.	54½ E.	350 killed, many injured, and extensive damage in Bastak, Laristan. Mag. 6¾.
Dec. 18	02 31 00*	Chile-Argentina border	25½ S.	68½ W.	Felt at Antofagasta and Copiapo, Chile. Mag. 7.0.
27	00 14 11*	Tonga Islands region	23½ S.	177 W.	Depth about 240 km. Mag. 7.1.

*Indicates probable error of ⅒ minute.

STRONG-MOTION SEISMOGRAPH RESULTS

INTRODUCTION

During 1932, the Coast and Geodetic Survey inaugurated a program of recording strong ground movements in the seismically active regions of the country to obtain basic data needed in the design of earthquake-resistant structures. Notes pertinent to this program will be found in the preceding issues of the *United States Earthquakes* series and in S. P. 201, *Earthquake Investigations in California, 1934–35*. The latter is much broader in scope than the former, and contains data on structural and ground vibrations with detailed descriptions of the various activities which comprise the seismological program as a whole.

Interpretation of records.—The analyses appearing in tables 6 and 7 are based on the assumption of simple harmonic motion. This refers especially to the computation of displacement from accelerograph records. As most accelerograph records are of irregular character, and the character of the longer period waves is often obscured by the superposition of shorter period waves of relatively large amplitude, the estimates of displacement must be considered only rough approximations. These analyses are essentially condensations of material appearing in the *Quarterly Engineering Seismology Bulletin* available through mailing list CGS–5 from the Director, Coast and Geodetic Survey, Washington 25, D. C.

Units and instrumental constants.—Quantitative results are expressed in c.g.s. units; centimeters or millimeters for displacement; and centimeters per second per second for acceleration. It is sometimes desirable to express acceleration in terms of the acceleration of gravity, indicated by "g" which is equal to 980 cm/sec.^{2} For practical purposes it is only necessary to point off three decimal places to convert cm/sec.^{2} to "g."

Most of the instruments have been adjusted so that each will register the maximum acceleration to be expected on the particular type of geological formation beneath the instrument. The following expectable earthquake accelerations were used in determining the accelerograph sensitivities: (a) rock foundation, 25 percent of gravity; (b) residual clay and shale, 40 percent of gravity; (c) alluvium, 70 percent of gravity; and (d) top floors of tall buildings, 100 to 200 percent of gravity. The four sensitivities may be roughly listed as 26, 19.5, 13, and 6.5 mm. per 0.1 g., respectively.

Sensitivity of the seismographs is expressed as the deflection of the trace, or light spot, in centimeters, for a constant acceleration of 0.1 g.

Damping ratio of the pendulum is the ratio between successive amplitudes when the pendulum oscillates.

Seismogram illustrations.—Reproductions of records in this publication are tracings of the original records and must not be accepted as genuine copies. The tabulated instrumental constants refer to the original records. The tracings are intended to show the nature of the data rather than furnish a means through which the reader can make his own measurements. Those who desire true copies for critical study should make request to the Director, Coast and Geodetic Survey, Washington 25, D. C.

Acceleration and displacement scales representing the equivalent of 0.1 g. and 1 inch are indicated on the tracings of the acceleration and displacement curves. The scales provide the investigator with a quick means for making rough measurements on the published curves. The measurements of periods on records of this nature are dependent largely on the judgment of the person reading them and considerable latitude must be allowed in appraising their accuracy. The aim of such analyses is primarily to give a fair picture of the magnitudes of the various elements involved, and the figures tabulated should therefore not be used for important studies without first referring to the illustrations for some idea of the nature of the original records.

TABLE 4.—*Coast and Geodetic Survey strong-motion stations in operation as of Dec. 31, 1956*

NORTHERN CALIFORNIA

Station	Accelero-graph	Displace-ment meter	Weed
Berkeley, University of California	1		
Eureka	1		
Ferndale	1	1	
Hollister, Library	1	1	
Monterey, City Hall			1
Oakland, City Hall, Basement	1		
Oakland, City Hall, 16th floor	1		
Oakland, Chabot Observatory			1
Sacramento, Federal Building			1
San Francisco, Alexander Bldg., basement	1		
San Francisco, Alexander Bldg., 11th floor	1		
San Francisco, Alexander Bldg., 16th floor	1		
San Francisco, 450 Sutter St., basement			1
San Francisco, 450 Sutter St., 29th floor			1
San Francisco, Golden Gate Park	1		
San Francisco, Shell Bldg., subbasement			1
San Francisco, Shell Bldg., 21st floor			1
San Francisco, Shell Bldg., 29th floor			1
San Francisco, Southern Pacific Bldg., basement	1		
San Francisco, Southern Pacific Bldg., 14th floor	1		
San Francisco, State Bldg., basement	1	1	
San Jose, Bank of America, basement	1	1	
San Jose, Bank of America, 13th floor	1		
Suisun Bay Bridge	1		

SOUTHERN CALIFORNIA

Arvin	1	1	
Bakersfield	1	1	
Bishop	1		
Cachuma Dam, Crest	1	1	
Cachuma Dam, Valve House	1	1	
Colton	1	1	
El Centro	1	2	
Hollywood Storage Co., basement	1		
Hollywood Storage Co., penthouse	1		
Hollywood Storage Co., adjoining P. E. Lot	1		
Long Beach, Public Utilities Building	1	1	
Long Beach, Terminal Island	1		
Los Angeles, Edison Bldg., basement	1		
Los Angeles, Occidental Life Bldg., basement	1		
Los Angeles, Occidental Life Bldg., 11th floor	1		
Los Angeles, Subway Terminal, subbasement	1	1	
Los Angeles, Subway Terminal, 13th floor	1		
Los Angeles, Vernon, C. M. D	1		
Pasadena, California Institute of Technology	1		1
Port Hueneme	1		
San Bernardino			1
San Diego	1		
San Luis Obispo	1		
Santa Ana			1
Santa Barbara	1		
Taft	1		
Westwood, University of California, Los Angeles	1	1	

TABLE 4.—*Coast and Geodetic Survey strong-motion stations in operation as of Dec. 31, 1956*—Continued

OUTSIDE CALIFORNIA

Station	Accelero-graph	Displace-ment meter	Weed
Bozeman, Mont., Montana State College	1		
Butte, Mont., Montana School of Mines	1		
Columbia Falls, Mont., Hungry Horse Dam, Bureau of Reclamation	1		
Hawthorne, Nev., U. S. Naval Ammunition Depot	1		
Helena, Mont., Carroll College	1		
Hoover Dam, Nev., 1215 Gallery	1	1	
Hoover Dam, Nev., intake tower	1	1	
Hoover Dam, Nev., oilhouse	1	1	
Logan, Utah, Utah State Agricultural College	1		
Olympia, Wash., Highway Test Laboratory	1		
Portland, Oreg., State Office Bldg	1		
Ross Dam, Wash., Block 16	1		
Ross Dam, Wash., Right Bank	1		
Seattle, Wash., Army Base	1		
Tacoma, Wash., College of Puget Sound	1		
OUTSIDE UNITED STATES			
Balboa Heights, C. Z	1		
Bogota, Colombia, South America	1		
Guatemala City, Guatemala, Central America	1		
Lima, Peru, South America	1		
Quito, Ecuador, South America	1		
San Jose, Costa Rica, Central America	1		
Santiago, Chile, South America	1		
Total	63	17	11

TABLE 5.—*List of shocks recorded and records obtained on strong-motion seismographs in 1956*

Date	Region and recording station	Records			
		Accelero-graph	Survey dis-placement meter	Carder dis-placement meter	Weed
Feb. 9	Baja California, Colton	1		1	
	El Centro	2	4	2	
	Hollywood	3			
	Los Angeles, Edison Building	1			
	Los Angeles, Occidental Building	2			
	Los Angeles, Subway Terminal Building	2	1		
	Pasadena	1			1
	San Bernardino				1
	San Diego	1			
	Santa Ana				1
	Vernon	1			
	Westwood	1	1		
14	Baja California, Hollywood	5			
	Los Angeles, Occidental Building	4			
	Los Angeles, Subway Terminal Building	4	2		
	Pasadena	1			
	San Diego	1			
	Vernon	2			
	Westwood	1		1	
18	Central California, Hollister	1		1	
Mar. 9	Northern California, Ferndale	1	1		
July 5	Southwestern Nevada, Hawthorne	1			
23	Central California, Hollister	1		1	
Aug. 8	Southern California, Santa Barbara	1			
Sept. 9	Peru, South America, Lima	1			
29	Peru, South America, Lima	1			
Oct. 11	Northern California, Eureka	1			
	Ferndale	1	1		
	San Francisco, Southern Pacific Building	2	1		
Dec. 31	West Central California, Hawthorne	1			
	Total	45	11	6	3

TABLE 6.—*Summary of outstanding instrumental and noninstrumental data for 1956*

Epicenter	Recording station and distance	Location of instrument	Intensity [1]	Acceleration	Displacement [2]
				cm./sec.[2]	*cm.*
BAJA CALIFORNIA EARTHQUAKE OF FEBRUARY 9					
31°45′ N., 115°55′ W., Baja California Mag. 6.8	El Centro, 74 miles	Subbasement	VI	46	3.56
NORTHERN CALIFORNIA EARTHQUAKE OF MARCH 9					
40°18′ N., 124°14′ W., near Petrolia, California, V.*	Ferndale, 20 miles	1st floor	V	18	0.10
SOUTHWESTERN NEVADA EARTHQUAKE OF JULY 5					
38°27′ N., 118°37′ W., near Hawthorne, Nevada, IV.*	Hawthorne, 5 miles	Basement	IV	20	0.005
SOUTHERN CALIFORNIA EARTHQUAKE OF AUGUST 8					
34°22′ N., 119°48′ W., off Santa Barbara, IV.*	Santa Barbara, 6 miles	Courthouse	IV	20	0.005
NORTHERN CALIFORNIA EARTHQUAKE OF OCTOBER 11					
40°40′ N., 125°46′ W., 100 miles west of Ferndale, V.*	Ferndale, 80 miles	1st floor	V	19	0.51
SOUTHWESTERN NEVADA EARTHQUAKE OF DECEMBER 31					
38°17′ N., 118°58′ W., near Hawthorne, Nevada, VI.* Mag. 5.1.	Hawthorne, 27 miles	Basement	VI	15	0.03

[1] Reported intensity of earthquake at recording station.

[2] Displacement is the maximum recorded at the station reporting the maximum acceleration of the earthquake. If displacement is much greater at another location it is given along with the maximum acceleration at the same location.

*Following intensity designation in epicenter column, indicates maximum reported intensity of earthquake.

TABLE 7.—*Composite of strong-motion instrumental data for 1956*

BAJA CALIFORNIA EARTHQUAKE OF FEBRUARY 9, 06:33

Station and component	Instrument No.	T_s	V	Sensitivity	ϵ	Acceleration		Displacement		Remarks
						Period	Amplitude	Period	Amplitude*	
El Centro:		*sec.*		*cm./0.1 g*		*sec.*	*cm./sec.²*	*sec.*	*cm.*	
Vertical	V-208	0.0646	121	12.52	10	0.2	10		0.01	
N.-S.	L-206	.0661	125	13.55	12	.4	27			
E.-W.	T-207	.0655	121	12.88	12	.7	46			
N.-S.	CDM-28	5.76	1.0		10					
E.-W.	CDM-29	5.52	1.0		10					
N.-S.	DM-17	9.54	1.0		12			7	1.95	
E.-W.	DM-17	10.12	1.0		10			6	3.56	
Hollywood Storage Building, Penthouse:										
Vertical	V-193	.0454	121	6.18	10	.5	2		.01	
N.-S.	L-192	.0468	123	6.68	11	1.5	15		.90	
E.-W.	T-191	.0466	124	6.68	11	.6	7		.06	
Basement:										
Vertical	V-217	.0647	124	12.87	10	.4	2		.008	
N.-S.	L-216	.0661	122	13.20	11	.5	2		.01	
E.-W.	T-215	.0638	122	12.32	8	.8	2		.03	
Los Angeles, Occidental Life Building, 11th floor:										
Vertical	V-187	.0465	120	6.56	9					Trace motion barely discernible.
N. 38° E.	L-186	.0456	122	6.29	11	1.6	20		1.3	
N. 52° W.	T-185	.0458	122	6.34	7	1.5	18		1.0	
Basement:										
Vertical	V-205	.0643	122	12.51	11					Negligible trace motion. [j]
N. 38° E.	V-204	.0642	122	12.47	13	1.6	3		.2	
N. 52° W.	T-203	.0654	123	13.05	12	.9	3		.06	
San Diego:										
Vertical	V-322	.0808	124	20.08	10	1.3	7		.3	
N.-S.	L-323	.0800	122	19.38	14	.8	8		.13	
E.-W.	T-324	.0804	124	19.75	9	1.7	13		1.0	

BAJA CALIFORNIA EARTHQUAKE OF FEBRUARY 9, 07:25

El Centro:										
Vertical	V-208	.0646	121	12.52	10	0.2	3		0.003	
N.-S.	L-206	.0661	125	13.55	12	.6	12	2.1	.46	
E.-W.	T-207	.0655	121	12.88	12	.9	9	2.4	.86	
N.-S.	CDM-28	5.76	1.0		10					
E.-W.	CDM-29	5.52	1.0		10					
N.-S.	DM-17	9.54	1.0		12					
E.-W.	DM-17	10.12	1.0		10					

NORTHERN CALIFORNIA EARTHQUAKE OF MARCH 9

Ferndale:										
Vertical	V-247	0.0663	124	13.51	12	0.3	8		0.02	
N. 44° E.	L-248	.0664	125	13.61	10	.2	15			
N. 46° W.	T-249	.0647	123	12.72	11	.2	18			
N. 46° W.	DM-13	9.81	1		10			0.9	.10	
N. 44° E.	DM-13	9.78	1		12			.7	.07	

Footnote at end of table.

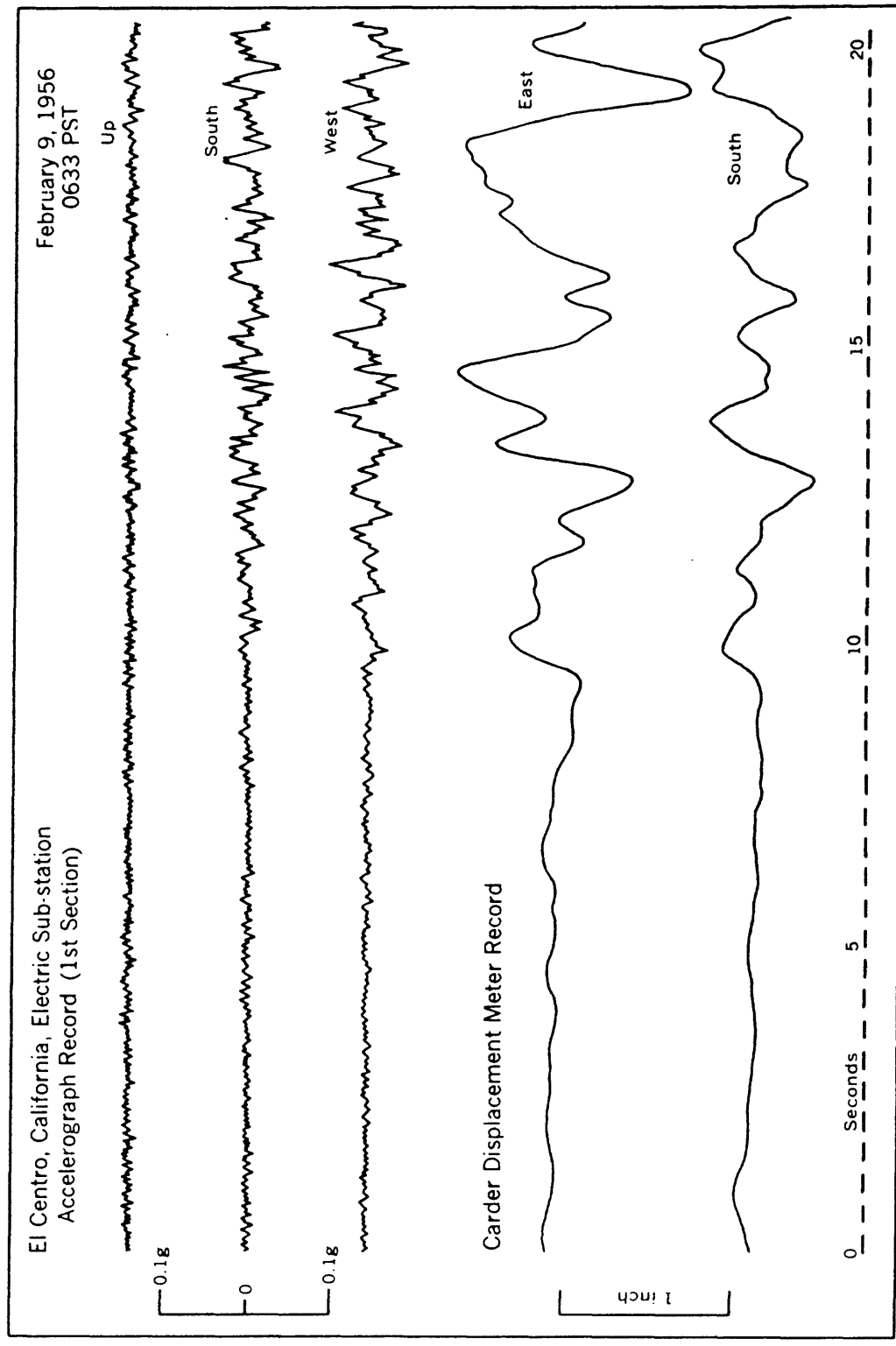

FIGURE 11.—Tracings of accelerograph and displacement meter records obtained at El Centro on February 9. (1st Section)

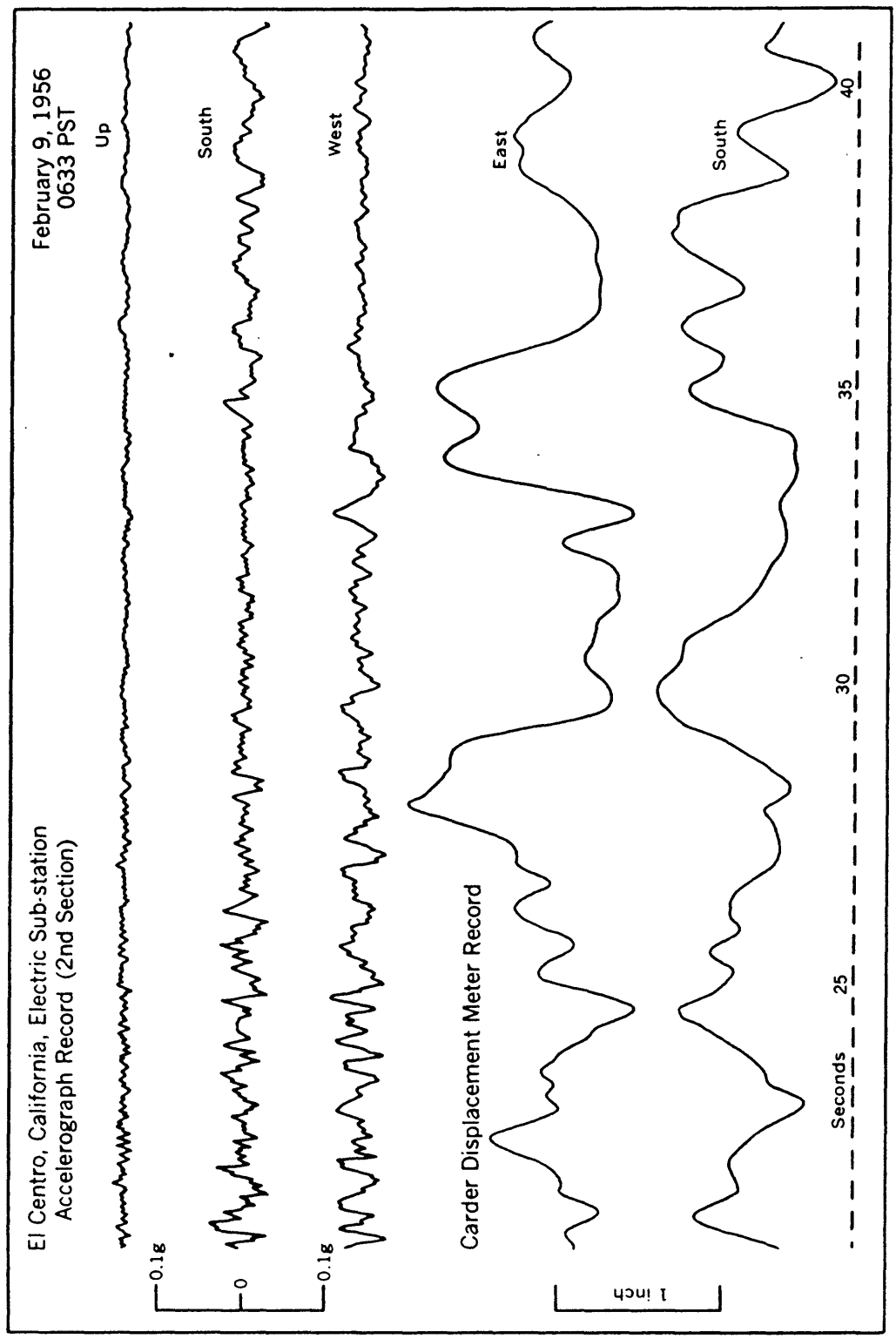

FIGURE 12.—Tracings of accelerograph and displacement meter records obtained at El Centro on February 9. (2d Section)

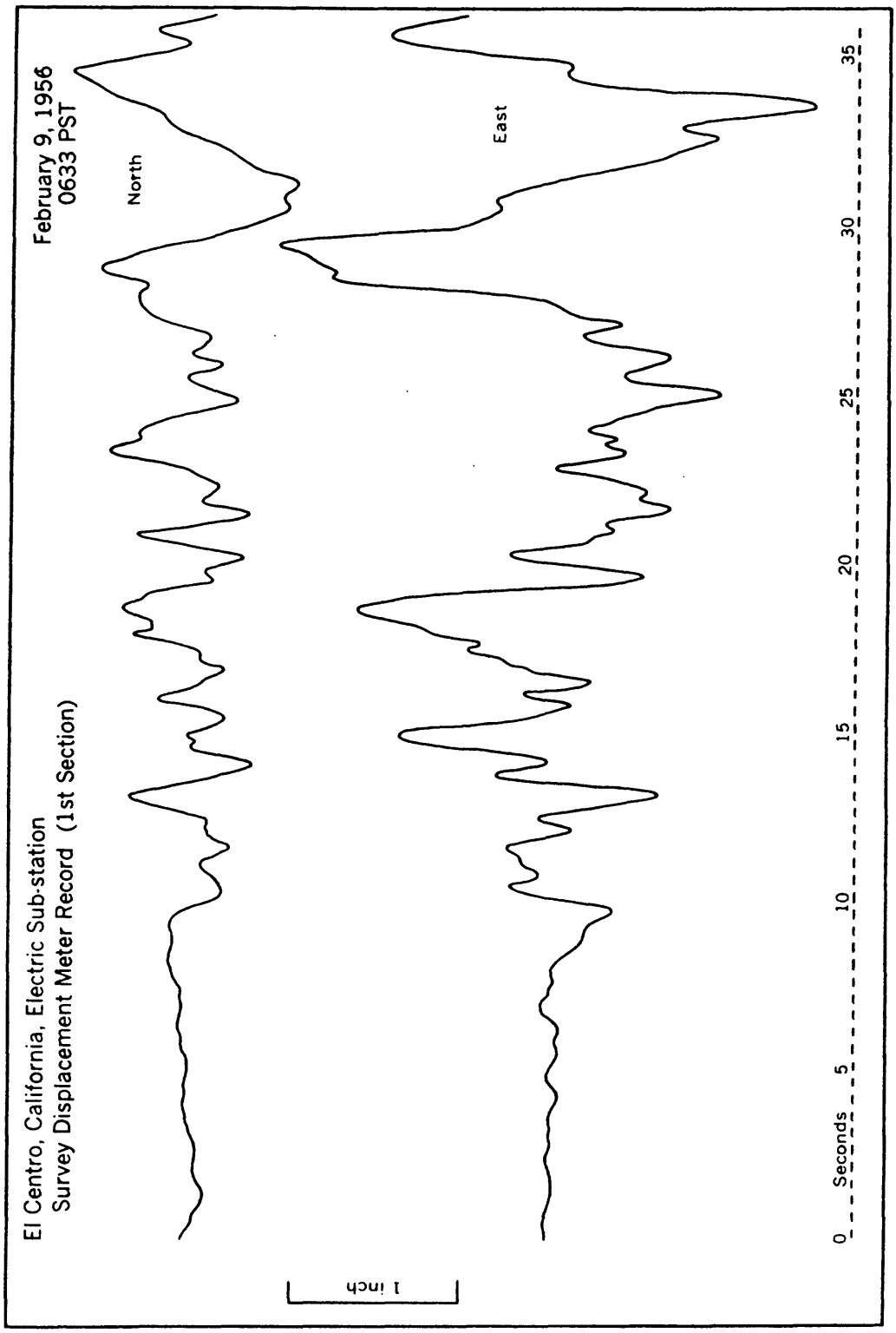

FIGURE 13.—Tracings of displacement meter records obtained at El Centro on February 9. (1st Section)

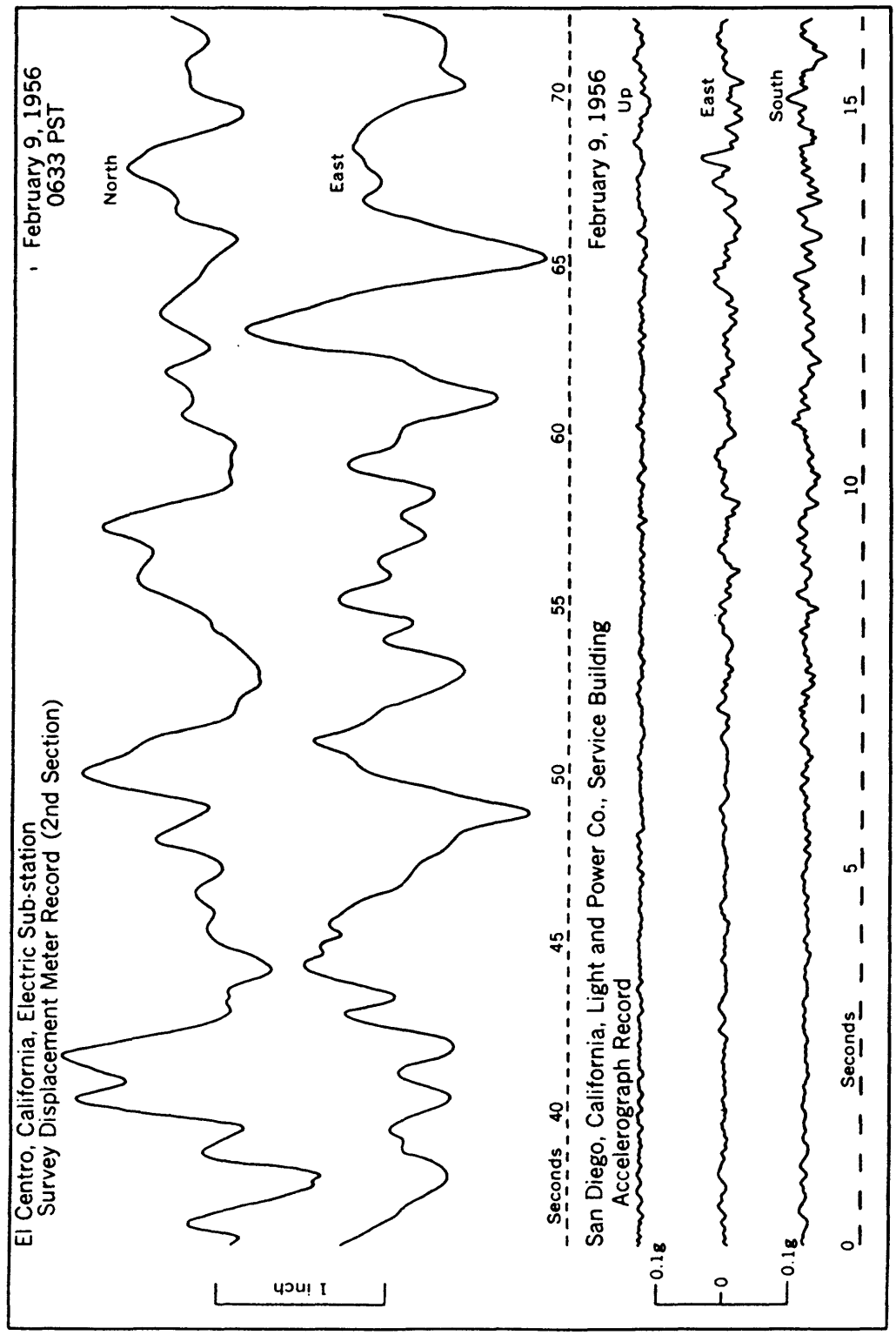

FIGURE 14.—Tracings of displacement meter records obtained at El Centro (2d Section); and accelerograph records at San Diego on February 9.

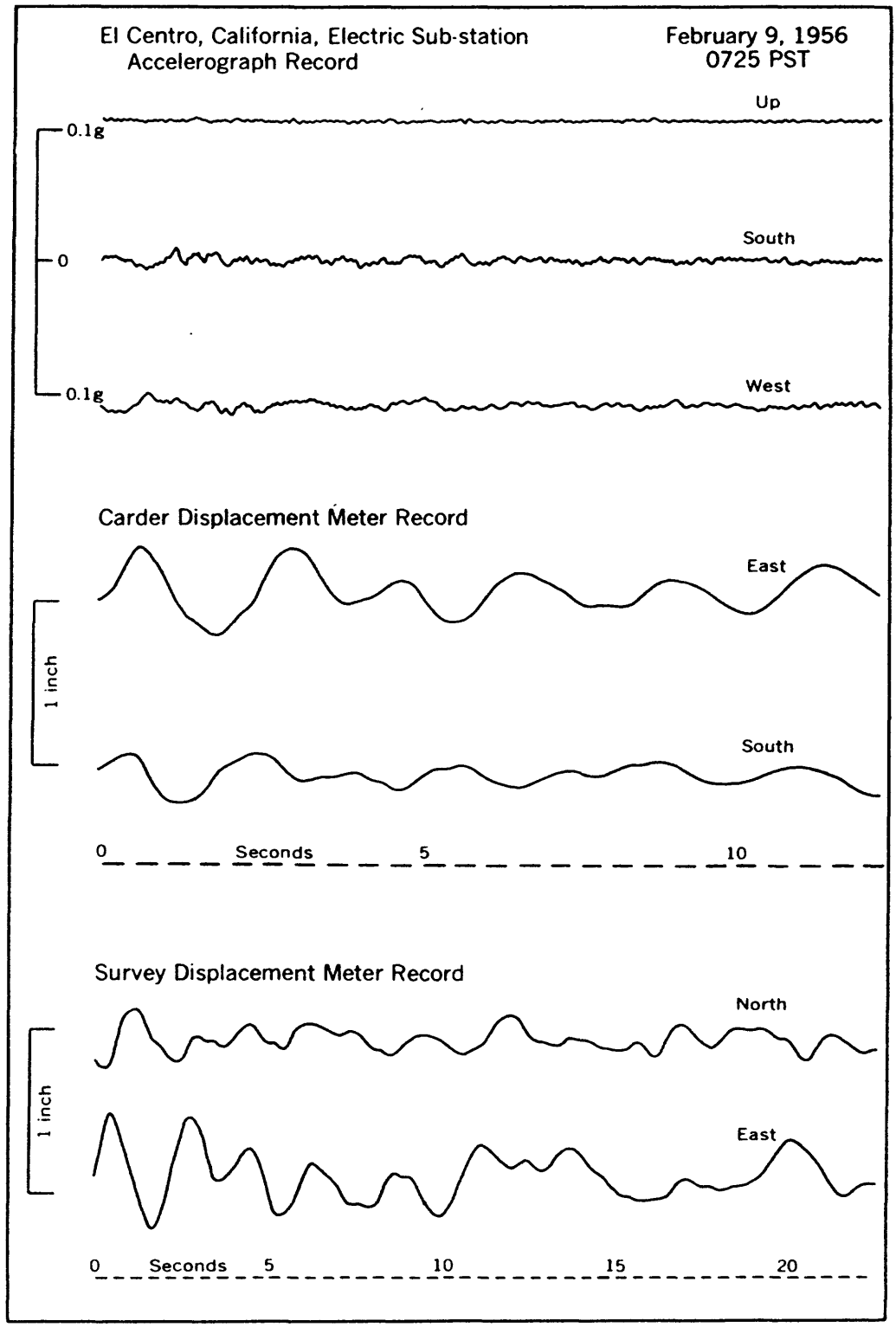

FIGURE 15.—Tracings of accelerograph and displacement meter records obtained at El Centro on February 9.

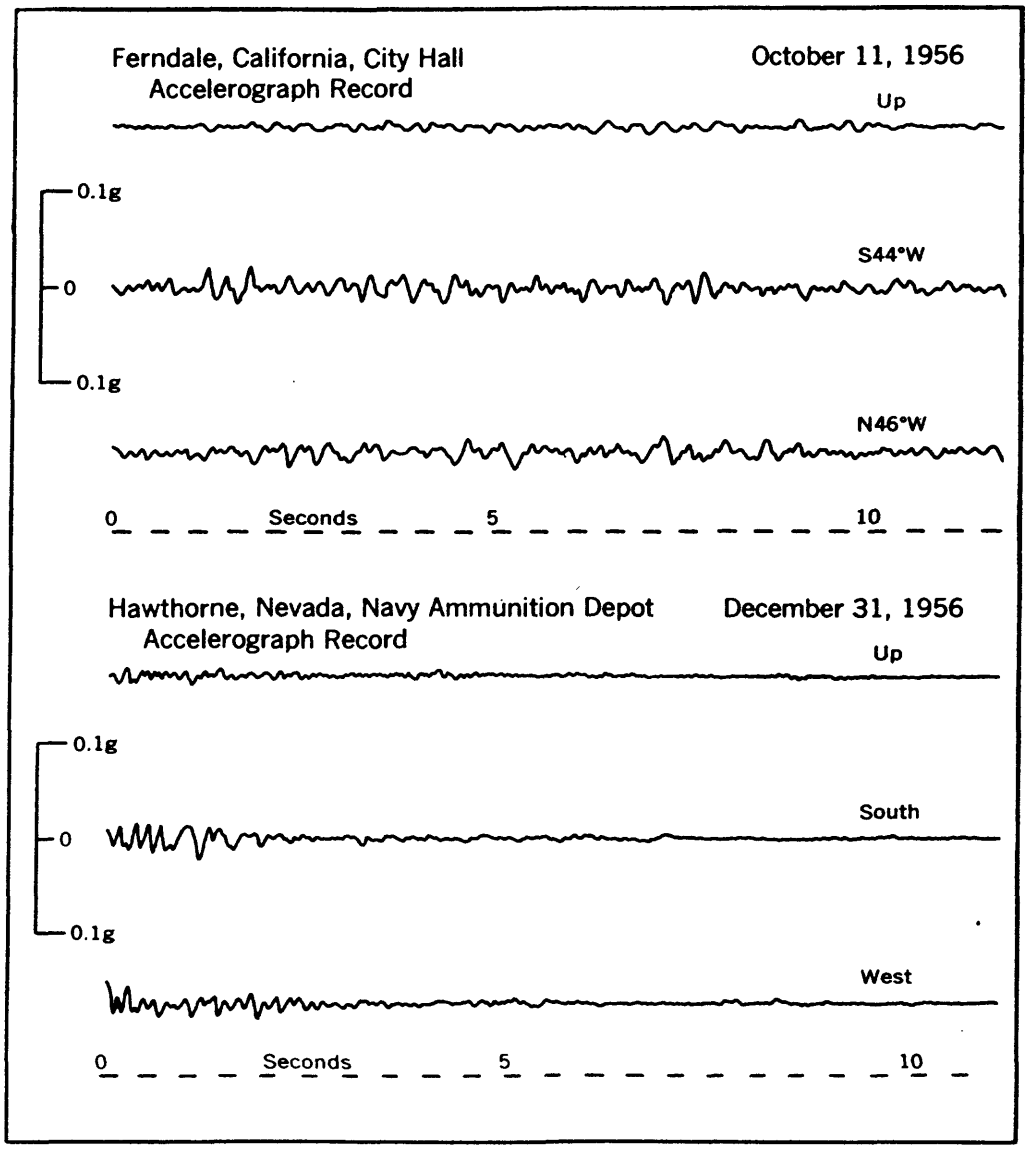

FIGURE 16.—Tracings of accelerograph records at Ferndale on October 11; and accelerograph records at Hawthorne, Nev., on December 31.

TABLE 7.—*Composite of strong-motion instrumental data for 1956*—Continued

SOUTHWESTERN NEVADA EARTHQUAKE OF JULY 5

Station and component	Instrument No.	T_o	V	Sensitivity	ϵ	Acceleration		Displacement		Remarks
						Period	Amplitude	Period	Amplitude*	
Hawthorne:		sec.		cm./0.1 g		sec.	cm./sec.²	sec.	cm.	
Vertical	V-244	0.0653	125	13.20	9	0.1	6		0.002	
N.-S.	L-245	.0683	124	14.29	8	.1	20		.005	
E.-W.	T-246	.0661	125	13.55	8	.1	12		.003	
SOUTHERN CALIFORNIA EARTHQUAKE OF AUGUST 8										
Santa Barbara:										
Vertical	V-259	0.0656	125	13.35	9	0.1	9		0.002	
N. 42° E.	L-260	.0644	126	12.95	11	.1	20		.005	
N. 48° W.	T-261	.0654	126	13.36	8	.1	19		.005	
NORTHERN CALIFORNIA EARTHQUAKE OF OCTOBER 11										
Ferndale:										
Vertical	V-247	0.0662	124	13.49	14	0.4	7		0.03	
N. 44° E.	L-248	.0664	125	13.66	9	.3	19			
N. 46° W.	T-249	.0648	124	12.90	10	.4	18			
N. 46° W.	DM-13	9.92	1		10			11	.51	
N. 44° E.	DM-13	9.85	1		11			11	.39	
SOUTHWESTERN NEVADA EARTHQUAKE OF DECEMBER 31										
Hawthorne:										
Vertical	V-244	0.0648	124	12.91	12	0.2	7		0.007	
N.-S.	L-245	.0677	124	14.10	9	.3	15		.03	
E.-W.	T-246	.0658	126	13.52	10	.1	15		.004	

*Estimated from acceleration if no entry in displacement period column.

TILT OBSERVATIONS

Four Merritt tiltmeter stations continued in routine operation.

CORRECTIONS TO PREVIOUS EDITIONS

United States Earthquakes, 1955. Page 39. Tidal Disturbances of Seismic Origin. Insert on April 19 after Tongoy.

PUBLICATION NOTICES

The Coast and Geodetic Survey maintains mailing lists for notices of the issuance of its publications. Should you desire to receive notices of seismological publications, address your request to: Director, Coast and Geodetic Survey, Washington 25, D. C.

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