DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

United States Earthquakes, 1958

By

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and

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ILLUSTRATIONS

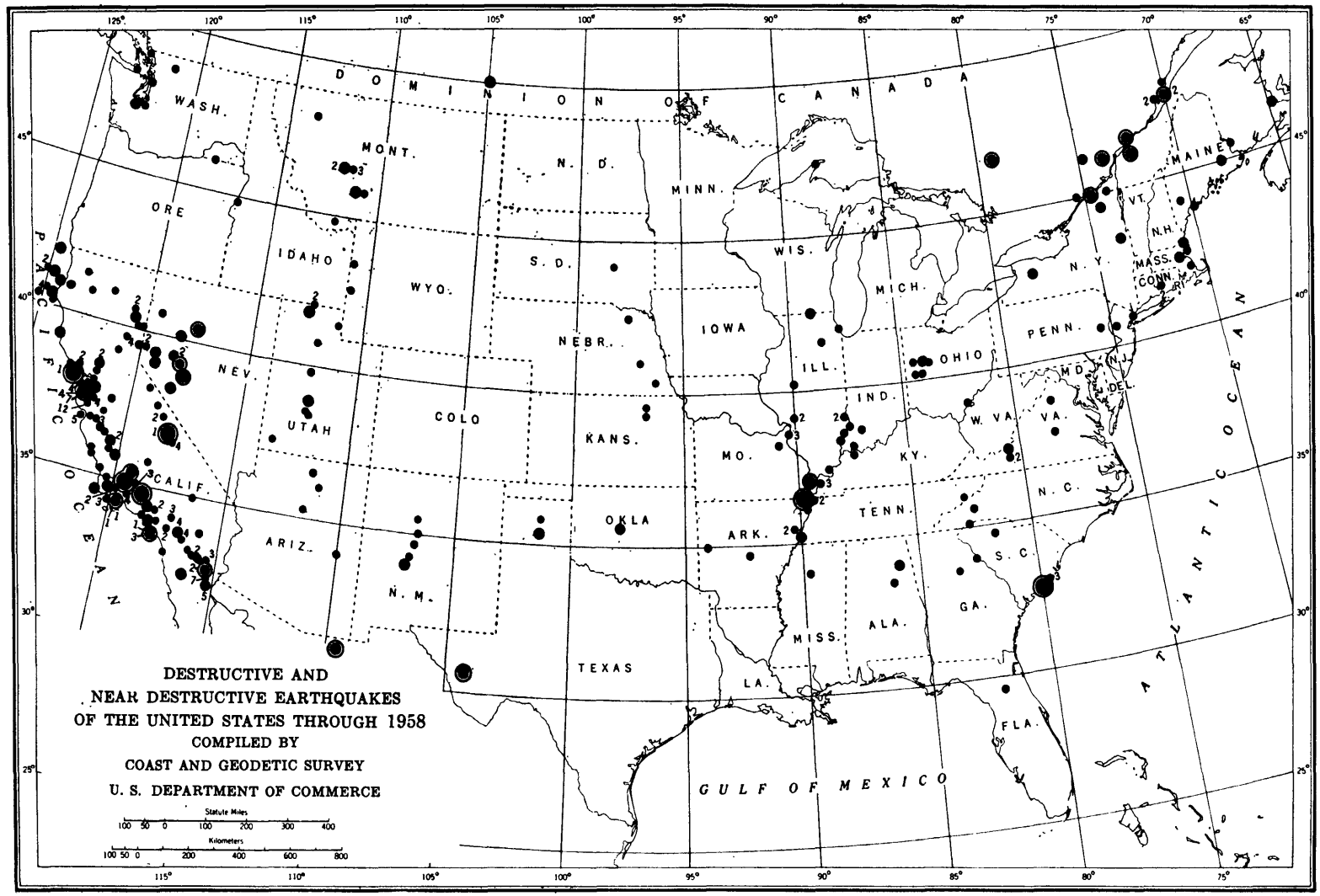

FIGURE 1.—Destructive and near destructive earthquakes in the United States through 1958.

UNITED STATES EARTHQUAKES, 1958

INTRODUCTION

This publication is a summary of earthquake activity in the United States and regions under its jurisdiction for the calendar year 1958. 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 46 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. Frank Press, 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 1958:

Arizona.—Dr. Eldred D. Wilson, University of Arizona, Tucson.
Colorado.—Prof. W. Warren Longley, University of Colorado, Boulder.
Idaho.—Dr. Earl F. Cook, College of Mines, University of Idaho, Moscow.
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. Additional information is furnished regularly by Mr. Berlen C. Moneymaker, Chief Geologist, Tennessee Valley Authority, Knoxville, Tenn., for earthquakes in the State of Tennessee, and Dr. Gerald R. MacCarthy, Department of Geology, University of North Carolina, Chapel Hill, N. C., for earthquakes in the State of North Carolina.

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 MERCALI 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. Disturbances 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 structures; **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 riverbanks 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. 12, 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 1958. 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 1958. 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. 3–9) 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 46 is a list of Survey and cooperating teleseismic stations for which the Survey publishes results. During the year the locations of 1285 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 1958, MSI–205 through 216 for the monthly bulletins of 1958 were published.

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 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 in 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 1958 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 1958. 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.

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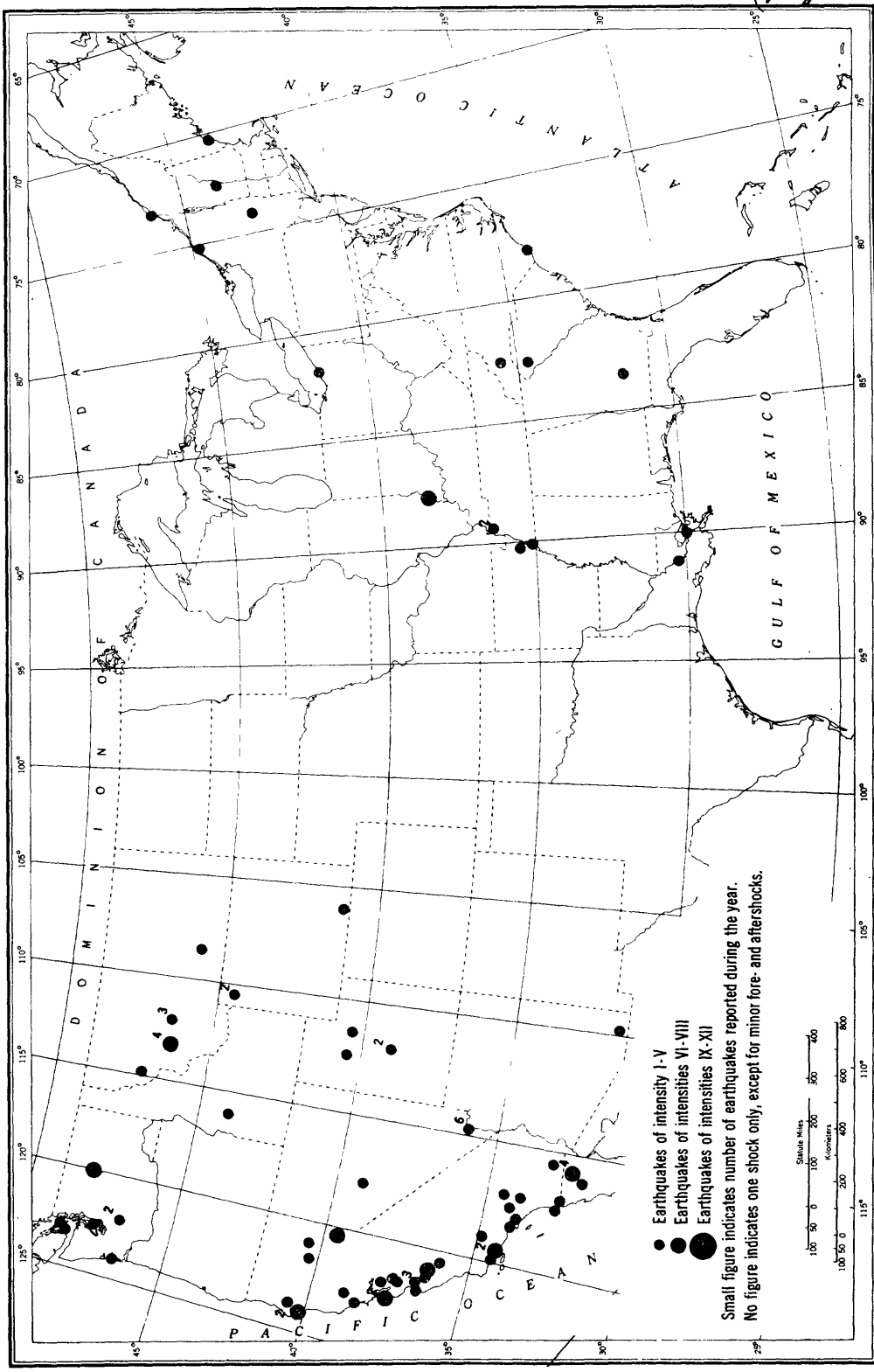

FIGURE 2.—United States earthquake epicenters, 1958.

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 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 earthquake for which no ratings are given range from I to IV.

Arizona: September 17, IV; November 30, III (2).

Arkansas: May 19, IV.

California: (Intensity V and above) May 24, VI; 27, V; 31, V; July 8, V; 13, VI; September 20, VI; October 1, VI; 10, V; 15, V; 16, V (3); 30, VI; November 16, V; 30, VI, V (3); December 2, V; 10, V; 11, VI; 23, V.

Georgia: April 8.

Idaho: May 22, IV.

Illinois: January 27, V; November 7, VI.

Indiana: November 7, V.

Kentucky: January 27, V; November 7, V.

Louisiana: November 6, IV; 19, V.

Maine: September 19, V.

Missouri: January 27, V; November 7, V.

Montana: February 7, IV; 24, IV; May 11, III; 28, VI; July 12, III; August 1, IV; October 27, IV; December 19, IV.

Nevada: January 18; April 19, VI; August 15, IV; 16, IV (2); 22, IV, 25, IV; October 1, V.

New Hampshire: November 21, IV.

New York: January 11, IV; May 6 IV; September 29, IV.

North Carolina: March 5, V; May 16, IV.

Ohio: May 1 V.

Oregon: November 18.

South Carolina: October 20, V.

Tennessee: January 26, V; April 8, V; 26, V.

Utah: February 13, VI; November 28, V; December 1, V (2), IV; 11, IV; 14.

Washington: January 5, IV; April 12 (2), VI; May 22, IV; July 9, V (2); 12, IV; August 22, V; September 21, IV; October 6, VI.

Wyoming: April 28 (4), V; July 12, IV; August 6, IV; 15; September 26, IV.

EARTHQUAKE ACTIVITY OUTSIDE THE UNITED STATES

NOTE.—The intensity of the earthquakes when completely defined are given.

Alaska: January 7, 10, 13, V; 19, 24, IV; February 5, 16, V; March 5, 31, V; April 7, VIII (2); 8, V; 11, V; 12 V; 17, 25; May 5 V; 10, V (5); 11, IV; 12 July 7, 9, XI; 12, 13 (2), 15, 17, 18, 31 (2); August 31, V (2); September 1, 7, 10; October 4, IV; 5, 6, 7, 19, 26 (2); November 5, 19, V; 23, 25, V; 29 (2); December 11, 21.

Hawaii: January 14, 20; February 11, 15, 20, 23; March 9, 10, 11, 12 (2), 13 (2), 29; April 21, 24; June 3 (2); July 2, 13, 16; August 11, 20 (2), 21; September 8, 9, 28; October 22 (2), 23; November 2, 14; December 27.

Panama Canal Zone: January 27, I; February 9, IV; May 19, II; July 14; September 11; November 13, I.

Puerto Rico: March 25.

NORTHEASTERN REGION

(75TH MERIDIAN OR EASTERN STANDARD TIME)

January 11: 11:36. Massena, N.Y. IV. Felt. Buildings shook; loose objects rattled; and subterranean sounds heard by one.

May 6: 14:00 (about). Albany, N.Y. IV. Felt by many. Buildings shook. (May have been of artificial origin.)

September 19: 12:45 (about). Cape Elizabeth, Maine. V. Felt by and alarmed many in the Cape Elizabeth area. Press reported some glass and dishes broken. Houses shook; small objects on furniture moved. Loud rumbling noises heard. Also felt at Halfway Rock 12 miles offshore.

September 29: 19:13:59*. Epicenter 45.8° north, 73.9° west, near Montreal, Canada (Dominion Observatory, Ottawa). Maximum intensity (damage) IV in the United States. Felt by many at Malone, New York, where buildings creaked; loose objects rattled. Rumbling subterranean sounds heard by several. Also felt at Constable, Fort Covington, Lawrenceville, and Whippleville, N.Y.

November 21: 18:30. Woodstock, N.H. IV. Felt by several. Buildings shook; loose objects rattled. Rumbling sounds heard by several.

EASTERN REGION

(75TH MERIDIAN OR EASTERN STANDARD TIME)

February 10–March 15: Wilmington, N.C. area. With the exception of the earthquake of March 5, 06:53:43*, the following disturbances were probably of artificial origin: Minor damage occurred consisting of cracked window, broken plaster, and dishes and cans shaken from shelves. See *EARTHQUAKE NOTES, Vol. XXIX, December 1958, "The Local Disturbances at Wilmington, N.C., 1958"* by Gerald R. MacCarthy, University of North Carolina.

February 10: 16:30. Felt at Wilmington.

February 14: 10:00. Felt at Burgaw and Rocky Point.

February 14: 16:15. Felt at Wilmington.

February 17: 9:49. Felt at Bolivia, Bolton (heard), Carolina Beach, Delco, Fort Fisher, Hallsboro, Long Beach, Longwood, Myrtle Grove Sound, Rocky Point, Shallotte, Southport, Supply, Wilmington, Winnabow, and Wrightsville Beach.

February 18: 9:25. Felt at Bolivia, Bolton (heard), Carolina Beach, Fort Fisher, Kure Beach, Lake Forest, Long Beach, Myrtle Grove, Rocky Point, Shallotte, Southport, Supply, Wilmington, Winnabow, Winter Park, and Wrightsville Beach.

February 19: 9:25. Felt at Bolivia, Bolton (heard), Carolina Beach, Kure Beach, Long Beach, Shallotte, Supply, Wilmington, and Winnabow. Also felt in New Hanover and Brunswick counties.

February 20: 9:55. Felt from Southport to Wrightsville, and up to 15 miles inland.

February 21: 9:26. Felt at Southport and Carolina Beach.

March 4: 8:50 (about). Felt at Carolina Beach.

March 5: 06:53:43*. Wilmington, N.C. and vicinity. V. Felt by and awakened many along the coast from Hampstead northward 35 miles to Kure Beach, and as far as 20 miles inland. Press reported shock lasted about a minute, shaking houses and rolling some sleepers out of bed. Felt many at Surf City, Topsail Island, where windows rattled and beds rocked. Recorded by the University of North Carolina seismograph.

March 5: 9:05. Felt at Bolton and Wilmington.

March 5: 9:22. Felt at Castle Hayne.

March 8: 13:50. Felt at Wilmington.

March 15: 9:11. Two small shocks at Wilmington rattled dishes, shook windows, and opened doors.

April 8: (about noon). Tift County, Ga. Slight earth tremors reported by several.

May 16: 17:30. Asheville, N.C. IV. Felt by many. Windows rattled.

October 20: 1:16. Anderson, S.C. V. Felt by, awakened, and frightened many. Houses shook; windows rattled. Many telephone calls to newspaper office from persons wanting to know "what blew up."

CENTRAL REGION

(90TH MERIDIAN OR CENTRAL STANDARD TIME)

January 26: 10:55:37*. Memphis, Tenn. V. Felt by many; several alarmed. Kitchen utensil and clock fell to floor; dishes clattered; windows rattled; floors shook. Intensity (damage) IV at Caruthersville, New Madrid, and Sikeston, Mo. Recorded by the Saint Louis seismograph.

January 27: 23:56:40*. Illinois-Kentucky-Missouri border. Felt over an area approximately 300 square miles of Illinois, Kentucky and Missouri. Maximum intensity (damage) V. Recorded by the Saint Louis seismograph.

INTENSITY (DAMAGE) V IN ILLINOIS:

Cairo.—Felt by and awakened many. Violent shaking. Faint rumble heard before shock.

Grand Tower.—Felt by and awakened many. Many thought their furnaces had exploded.

Mounds.—Felt by, awakened, and frightened many. Houses rocked.

INTENSITY (DAMAGE) V IN KENTUCKY:

Paducah.—Felt by and awakened many. Press reported two people thrown from beds. Houses rocked; windows rattled.

INTENSITY (DAMAGE) V IN MISSOURI:

Cape Girardeau.—Felt by, awakened, and frightened many. Police switchboards swamped with calls from anxious residents. Some thought their furnaces had exploded.

INTENSITY (DAMAGE) I TO IV IN KENTUCKY: Benton.

INTENSITY (DAMAGE) I TO IV IN MISSOURI: Caruthersville, Charleston, Saxton, and Sikeston.

April 8: 16:25:33*. Obion County, Tenn. V. A light earthquake centered in Obion County, was felt over an area of 400 square miles. Maximum intensity (damage) V occurred at Troy, where nearly all ran from homes; windows rattled; houses shook. Felt by nearly all at Obion, where the shock was accompanied by thunderlike noises. Also felt intensity (damage) IV at Elbridge (few alarmed), Hornbeak, Lane, Trimble, Union City and Woodland Mills. Recorded by the Saint Louis seismograph.

April 26: 1:30. Lake County, Tenn. V. Felt by and awakened many. Many reported a roaring noise resembling thunder then a sudden jar. The shock was also felt at Caruthersville, Mo.

May 1: 16:46:31*. Cleveland, Ohio. V. Felt by and alarmed many. Police and fireman switchboards swamped with calls from anxious residents. Houses rocked; dishes and windows rattled. Recorded by the John Carroll University seismograph.

May 19: 19:25. Marked Tree, Ark. IV. Felt by many. Buildings shook. One observer reported a sensation like truck striking building.

November 6: 17:08. New Orleans, La. IV. Felt by many. Windows shook; doors rattled. Recorded by the Loyola University seismograph.

November 7: 20:41:43*. Epicenter 38.4° north, 87.9° west, Illinois-Indiana border, JSA. Felt over an area of approximately 33,000 square miles of Illinois, Indiana, Kentucky, and Missouri. (See map, p. 10.) Maximum intensity (damage) VI. Recorded by the Saint Louis seismograph.

INTENSITY (DAMAGE) VI IN ILLINOIS:

Bartelso.—Felt. Cracked basement floor of new home. "Felt like building was getting a big push—lots of rattling."

Dale.—Felt. Plaster cracked and fell. Floor vibrated; sounded like the roaring of a train.

Mauni.—Felt by and alarmed many. Basement wall cracked; wall paper damaged. Dishes and windows rattled. Many thought their furnaces had exploded.

Mount Carmel.—Felt by nearly all; many alarmed. Can goods fell from shelves. Over 4,000 calls to the telephone company seeking cause of shock or noise. Buildings shook; loose objects rattled. Also felt by hundreds of football fans in stadium in the eastern section of Mount Carmel.

Sumner.—Felt by and alarmed many. Water heater displaced. Buildings shook; disturbed objects observed by many.

INTENSITY (DAMAGE) V IN ILLINOIS:

Albion.—Felt by many. Small amount of plaster fell from ceiling. Houses shook; dishes rattled.

Barnhill.—Felt by all. House cracked and popped as if settling. Swaying, rocking motion from east to west; gradual onset.

Bone Gap.—Felt by nearly all. Sounded like truck hit side of building.

Bridgeport.—Felt by all. Buildings creaked; loose objects rattled. Sounded like jet breaking the sound barrier or truck hitting side of building.

Cairo.—Felt by nearly all. Houses shook; dishes and windows rattled. Pendulum clock stopped.

Cave in Rock.—Felt. Shook towels off clothesline.

Cisne.—Felt by many; few alarmed. Mason jars displaced on shelf. Buildings shook; dishes rattled; venetian blinds, curtains, hanging lamps swayed violently. Rumbling sounds like approaching train heard before shock.

Clay City.—Felt by nearly all.

Crossville.—Felt by nearly all; many alarmed.

Ellery.—Felt by all. Houses shook; windows and dishes rattled.

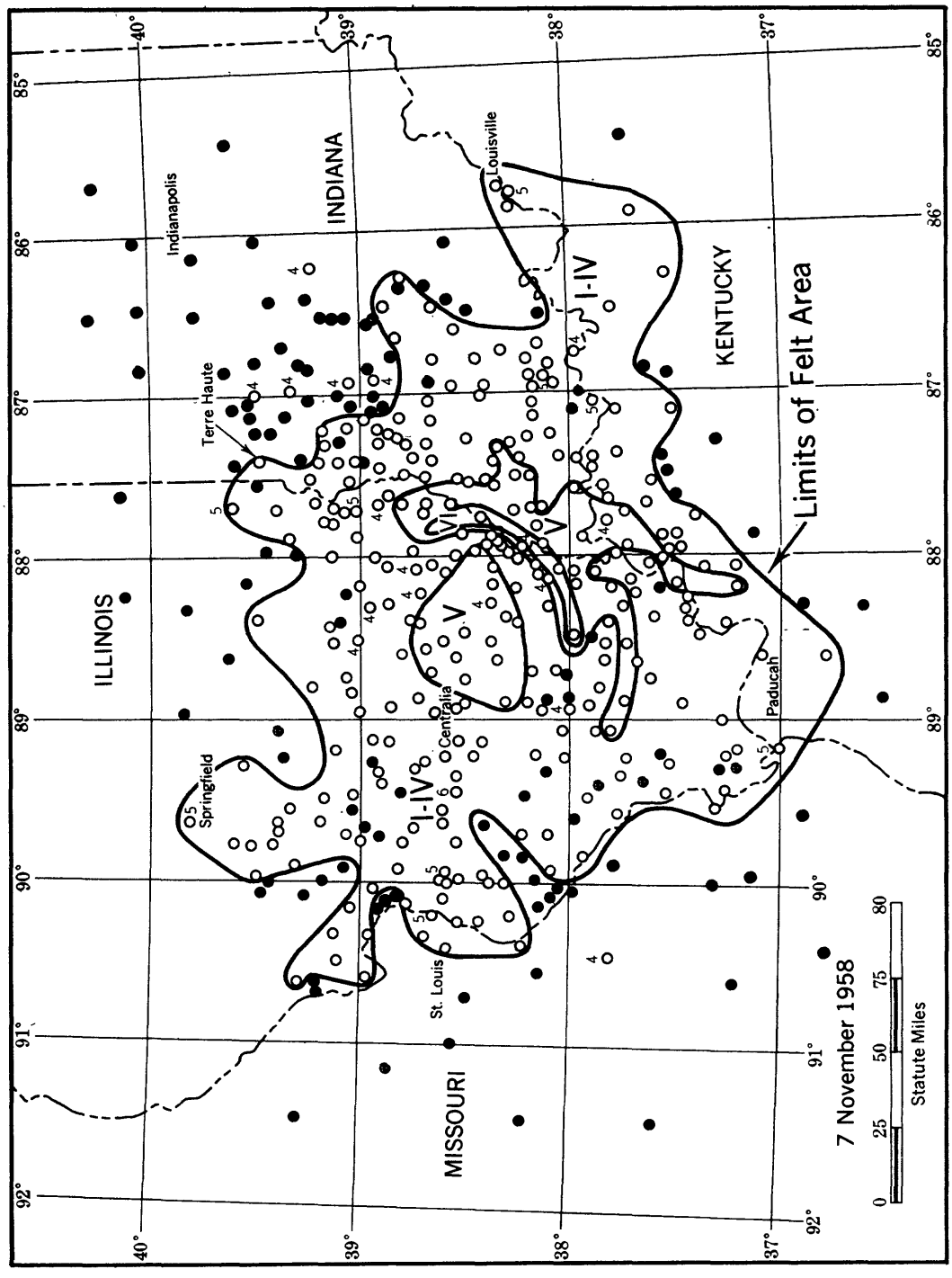

FIGURE 3.—Area affected by earthquake of November 7.

Emma.—Felt by nearly all. Heavy jolt. Some thought their furnaces had exploded.

Equality.—Felt by all; few alarmed. Buildings creaked; loose objects rattled. Abrupt onset; explosivelike sounds.

Harrisburg.—Felt by all. Buildings creaked; loose objects rattled. Rumbling sounds heard by many. Rapid onset; rocking north-south motion.

Herald.—Felt by nearly all.

Herrin.—Felt by many. Mayor of town reported he was knocked out of bed.

Johnsonville.—Felt by many; general alarm. Slight damage to ornaments. Buildings shook; loose objects rattled. Loud roaring sounds heard by many. Abrupt onset; bumping motion.

Keenes.—Felt by almost all. Buildings shook; loose objects rattled. Rumbling sounds heard. Abrupt onset; trembling motion.

Lawrenceville.—Felt by nearly all; few alarmed. Buildings shook; loose objects rattled. Thunderous sounds heard 1 second before shock. Gradual onset; trembling motion.

Marion.—Felt by and alarmed many. Buildings shook; loose objects rattled. Bumping, swaying motion.

Mill Shoals.—Felt by all. Buildings shook; dishes rattled.

Mount Vernon.—Felt by and alarmed many. Numerous calls to the city police. Houses shook; loose objects rattled; swaying motion.

O'Fallon.—Felt by all.

Orchardville.—Felt by all. Windows and doors rattled. Heavy vibration.

Paris.—Felt. Slight damage reported.

Pinkstaff.—Felt by and alarmed many. Bed rocked. Abrupt onset; bumping, rocking motion.

Ridgway.—Felt by all. Buildings shook; loose objects rattled. Sounded like a large truck—roaring and vibrating. Abrupt onset; trembling motion.

Rinard.—Felt by many. Lamps fell from tables and dishes from shelves. Sounded like gas furnace had exploded. Gradual onset; bumping motion.

Robinson.—Felt by all. Rumbling sounds heard by many.

St. Francisville.—Felt by and alarmed many. Windows rattled. Rumbling sounds followed shock.

Sims.—Felt by nearly all; few alarmed. Buildings shook; loose objects rattled. Rapid onset; trembling motion. Earth sounds heard by many.

Springfield.—Felt by many. Plaster shaken loose from ceilings; buildings shook; loose objects rattled. Moderate earth sounds heard by many. Abrupt onset; trembling motion.

Xenia.—Felt by nearly all.

INTENSITY (DAMAGE) V IN INDIANA:

Cynthiana.—Felt by all. Houses shook.

Evansville.—Felt by and alarmed many. Buildings creaked; loose objects rattled. Police and Weather Bureau switchboards swamped with calls from anxious residents. Dishes, tables, and chairs moved. Described as "everything from an explosion to a plane crash."

Fort Branch.—Felt by several. Plaster fell; windows rattled.

Haubstadt.—Felt by nearly all.

Hazleton.—Felt by nearly all; general alarm. Buildings creaked; loose objects rattled. Disturbed objects observed by several.

Mount Vernon.—Felt by nearly all; many alarmed. Police switchboards swamped with calls. Houses shook; dishes rattled in cabinet.

New Harmony.—Felt by nearly all. Stove and refrigerator "danced." Buildings creaked; loose objects rattled. Trembling motion.

Oakland City.—Felt by and alarmed many. Buildings shook; dishes and utensils rattled. Books in bookcase slipped but did not fall. Roaring and whistling sounds heard about 1 minute before earthquake.

Owensville.—Felt by nearly all. Loud, rumbling sounds heard by many.

Princeton.—Felt by all. Explosivelike sounds heard by many.

Rockport.—Felt by all; many alarmed. Numerous calls to newspaper office from anxious residents. Houses shook; chairs quivered; smoking stand "danced."

Santa Claus.—Felt by all. Steam pipes rattled.

Stewartsville.—Felt by all. Noticeable shaking. Rumbling sounds heard by many.

Terre Haute.—Felt by and alarmed several. Vibrations moved end of heavy sectional davenport 1 inch. Pillow on davenport fell. Dishes rattled; furniture and lights shook. Roaring sounds heard by many.

INTENSITY (DAMAGE) V IN KENTUCKY:

Corydon.—Felt by all. Dishes and windows rattled.

Dycusburg.—Felt by all. Windows rattled.

Louisville.—Felt by nearly all. Houses shook; windows rattled; furniture moved.

Morganfield.—Felt by many; few alarmed. Pictures and dishes displaced. Buildings creaked; loose objects rattled. Earth sounds heard by several at beginning of earthquake.

Sturgis.—Felt by nearly all.

INTENSITY (DAMAGE) V IN MISSOURI:

Saint Louis.—Felt by nearly all. "Some damage reported."

INTENSITY (DAMAGE) IV IN ILLINOIS:

Alma, Auburn, Ava, Belleville, Bellmont, Benton, Bogota, Brownstown, Brussels, Burnt Prairie Calhoun, Carbondale, Carmi, Caseyville, Centralia, Claremont, Cobden, Collinsville, Columbia, Cowling, Du Quoin, Eaton, Edwardsville, Eldorado, Elizabethtown, Enfield, Fairfield, Fieldon, Flat Rock, Flora, Freeburg, Glen Carbon, Greenville, Highland, Hillsboro, Jerseyville, Junction, Kenesburg, Lancaster, Litchfield, Macedonia, Marshall, Martinsville, Mattoon, McLeansboro, Mount Ena, Mount Olive, Mulkeytown, Murphysboro, New Baden, New Haven, Newton, Noble, Olney, Parkersburg, Raleigh, Rosiclare, Schell, Shawneetown, Springerton, South Standard, Tamalco, Teutopolis, Thompsonville, Tilden, Trenton, Trimble, Troy, Ullin, Vienna, Villa Ridge, Virden, Waggoner, Waterloo, Watson, West Frankfort, West Union, West Salem, and Yale.

INTENSITY (DAMAGE) IV IN INDIANA:

Boonville, Bowling Green, Buffaloville, Chandler, Dale, Decker, Edwardsport, Emison, Fairbanks, Fort Ritner, French Lick, Gentryville, Griffin, Holland, Hymera, Jacksonville, Kyana, Lamar, Linton, Lynville, Lyons, Mackey, Merom, Monroe City, Montgomery, Nashville, Patoka, Patricksburg, Paxton, Plainville, Poseyville, Richland, Saint Meinrad, Sullivan, Tell City, Vincennes, Washington, and Westphalia.

INTENSITY (DAMAGE) IV IN KENTUCKY:

Blackford, Geneva, Hardinsburg, Hebbardsville, Henderson, Henshaw, Leitchfield, Livermore, Marion, Owensboro, Providence, Reed, Sebree, Smith Mills, Tolu, Uniontown, and Wheatcroft.

INTENSITY (DAMAGE) IV IN MISSOURI:

Cape Girardeau, Clayton, and Festus.

INTENSITY (DAMAGE) I TO III IN ILLINOIS: Allendale, Altamont, Annapolis, Atwater, Bayle City, Beecher City, Belle Rive, Bethalto, Birds, Bonnie, Breese, Brighton, Browns, Calvin, Carlinville, Carriers Miles, Cartter, Chester, Coello, Coulterville, Cutler, Dahlgren, Donnellson, Dowell, Dundas, East Carondelet, Elsah, Evansville, Fillmore, Galatia, Giff, Gillespie, Grayville, Hecker, Hoyleton, Huey, Iola, Jacob, Kampsville, Karbers Ridge, Kell, Livingston, Loogootee, Marine, Marissa, Millstadt, Mitchell, Modesto, Montrose, Mound City, Nason, Norris City, Oblong, Omaha, Posey, Pulaski, Radom, Raymond, Royalton, Sailor Springs, Saint Elmo, Saint Jacob, Sainte Marie, Salem, Shobonier, Smithboro, Smithton, Sparta, Stonefort, Tamaroa, Taylorville, Thebes, Vandalia, Vernon, Wakefield, Walnut Hill, West York, and Wolf Lake.

INTENSITY (DAMAGE) I TO III IN INDIANA: Alfordsville, Bedford, Bloomfield, Bicknell, Bristow, Bruceville, Cannelburg, Dubois, Elberfeld, Folsomville, Francisco, Freelandville, Ireland, Jasper, Jeffersonville, Mariah Hill, New Albany, Newburgh, Oakton, Odon, Orleans, Petersburg, Wheatland, Williams, Scotland, Shelburn, Shoals, and Somerville.

INTENSITY (DAMAGE) I TO III IN KENTUCKY: Baskett, Clay, Elizabethtown, Fredonia, Mayfield, Paducah, Poole, Sheridan, and Sullivan.

INTENSITY (DAMAGE)I TO III IN MISSOURI: Farmington, Kirkwood, and South Saint Louis.

November 19: 12:15. Baton Rouge, La. V. Felt by and alarmed many. Scores of anxious residents telephoned the Weather Bureau, Civil Defense, police, newspaper and radio stations. Houses shook; windows rattled. Also felt at Baker and Denham.

WESTERN MOUNTAIN REGION

(105TH MERIDIAN OR MOUNTAIN STANDARD TIME)

February 7: 20:37. Helena, Mont. IV. Trembling motion, with rapid onset felt by several in community. Buildings creaked; loose objects rattled; homes shook slightly in west Helena. Rumbling earth noises heard by several.

February 13: 15:52:00*. Utah. Epicenter 40½° north, 111½° west, about 10 miles northwest of Wallsburg, W. Felt over an area of approximately 1,200 square miles of north-central Utah, principally in the region east of Utah Lake. Maximum intensity (damage) VI at Provo and Wallsburg. Felt by many and frightened few at Provo, where plaster cracked and fell; one wall cracked; furnishings moved; chandelier "swung like a pendulum." Faint to moderate earth noises heard by many a few seconds before shock. At Wallsburg, frightened all in community; small objects shifted. Rapid north-south motion; faint earth noises heard. Felt by several and frightened few at Pleasant Grove; windows and doors rattled; hanging objects

swung; trees, bushes shaken slightly. Reported as "very strong" about 12 miles south of Pleasant Grove. Felt by several at Springville, where windows and dishes rattled. Also felt at Elberta and Thistle.

February 24: 07:56:14*. Poulson, Mont. IV. Dishes rattled.

April 19: 02:01:02*. Boulder City, Nev. VI. Felt by many (some outdoors; active); awakened many or all; frightened many. Damage slight. Plaster cracked; dishes broken. Small objects shifted and overturned; books and pictures fell. Motion rapid; moderate earth noises heard by few.

April 28: 13:59:23*, 14:20:20*, 14:22:22*, 14:57:00*. Old Faithful, Yellowstone National Park, Wyo. V. Felt by many (some outdoors); small objects shifted; windows rattled; walls creaked. Five shocks, lasting about 10 seconds each were reported felt from 13:54 to 15:05, with frequent shaking between shocks. Four shocks recorded at Butte, Montana.

May 11: 16:40. Helena, Mont. (west section.) III. Slight, 2-second tremor, followed by moderate to severe jolt, felt by several.

May 22: 23:49:47*. Epicenter 44½° north, 116° west, W. Idaho. IV. Light shock felt by a number of persons in Boise. Reported felt as far north as Cascade, where vibration of house awakened observer and wife. Reported felt at Horseshoe Bend.

May 28: 05:00 or 06:00. Philipsburg, Mont. Shock reported felt by some around 05:00 or 06:00.

May 28: 09:45:54 (main shock). Georgetown Lake Area and Philipsburg, Mont. Epicenter 46½° north, 113° west, western Montana, W. The main shock was felt over an area of approximately 4,500 square miles. (See map, page 14.) Maximum intensity (damage) VI. Slight damage. At Philipsburg, windows broke, plaster cracked; bricks fell from several buildings. Professor Stephen W. Nile, who spent several days in the field investigating the earthquake, reported: "A rather long fault, concealed by superficial deposits, runs down the Philipsburg Valley to the Rock Creek divide, and past Philipsburg on the north by a distance of about 7 miles. The fault runs practically through the T Bar 3 Ranch, ½ mile west of Porters Corners, and ⅛ mile west of Phillipsburg. Its lower end extends almost to the Sanders Ranch (within 2 miles), and at the upper end it extends to within 3 miles of Maxville. Georgetown Lake, Anaconda, and Butte all lie on perpendiculars to the fault at its lower end, where field and seismograph data support an epicenter. In general, it may be said that the felt region, as usual in western Montana, had its long axis running southeast-northwest. Most energy seemed to have been sent east-southeast. Eleven aftershocks were recorded at Butte, the strongest occurring on May 28 at about 12:30. This aftershock was felt and heard over the central area from Philipsburg to Rock Creek."

INTENSITY (DAMAGE) VI:

Georgetown Lake Area.—Professor Nile reported the shock may have caused a rock slide in Flint Creek Canyon at the north end of Georgetown Lake, just below the Montana Power Company Dam. "I saw a pile of new slide rock down at the bottom, on the creek bed, and the creek was flowing underneath. it. The press reported a huge rock slide occurred at this place on June 9 and mentioned a smaller slide which occurred 'about two weeks ago,' which would be close to the time of the shock." At the Montana Power Company Dam, 54-inch pipeline, resting on trestle, vibrated at high frequency in west or northwest direction. Caretaker standing on pipeline very frightened. Sounds like heavy thunder heard. Heavy chest of drawers moved ½ inch towards southwest; large mirror moved back and forth along an east-west wall. "Seemed to pick the house up and shake it." Aftershock at 12:30 also felt. Generally felt around the Georgetown Lake area. On the east shore a woman ran from house; on the southern shore woman walking felt a sudden strong jerk which seemed to come from the west.

Philipsburg.—Felt by and frightened many in community. Damage slight. Bricks fell from several buildings; some plaster cracked; windows broken in schoolhouse; some merchandise fell in stores. Small foundation crack widened; church bell jammed and out of service; top and bottom sashes of east-west window in bell tower considerably separated from glass; whole belfry appeared to have been twisted back and forth; felt like truck hit the building on east side; dust rose 6 inches from the floor. Poles and trees shaken strongly. "The trembling and thundering noise was really frightening—sounded like a huge airplane over the roof with motors wide open, then crashing. I listened for about 10 seconds then went outside. It stopped as I got outside. Children on lawn were scared too, and jumped up and down to show how the ground moved." In the Porters Corner area, near Philipsburg, a heavy candy case was displaced 4 inches toward the north. Philipsburg miners felt the shock at the 200-foot level. Mild aftershock at 12:30 heard and felt.

INTENSITY (DAMAGE) V: Anaconda, Drummond, Goldcreek (15 miles south of), Porters Corner area (T Bar 3 Ranch, John Munis Ranch), Rock Creek area (Carey Ranch, T. R. Hess Ranch, Walter Sanders Ranch).

INTENSITY (DAMAGE) IV: Butte, Divide, Hall, and Maxville.

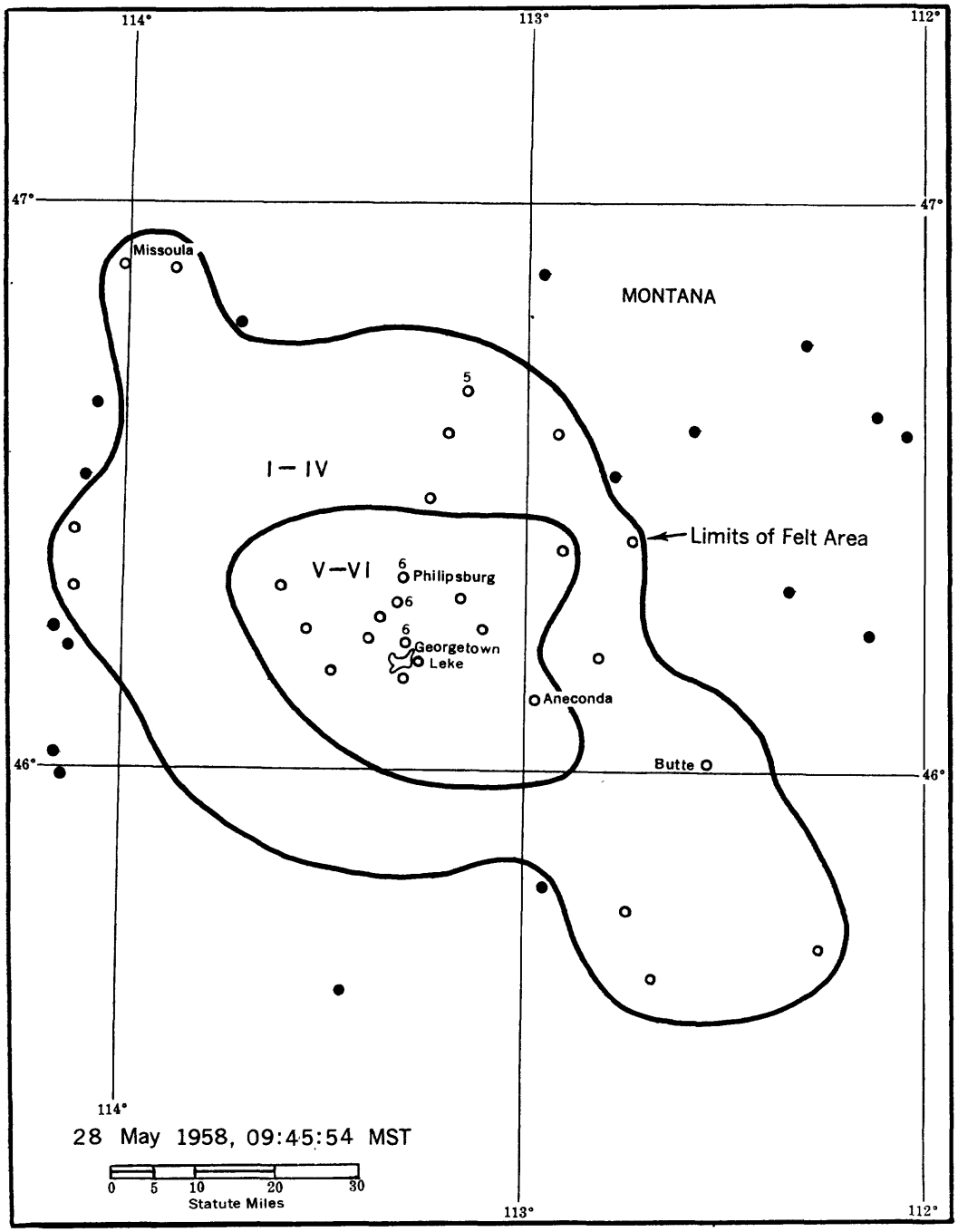

FIGURE 4.—Area affected by earthquake of May 28.

INTENSITY (DAMAGE) I TO III: Corvallis, Melrose, Silver Star, Victor, and Warm Springs. Also reported felt at Deer Lodge and Missoula (no details).

July 12: 18:45:32*. Billings, Mont. III. Decided movement of desk felt by observer sitting in hotel. Direction north-south; lasted about 2 seconds. Also felt very distinctly by woman at Laurel near Billings.

July 12: 22:35. Old Faithful, Yellowstone National Park, Wyo. IV. Felt by several. Windows, doors, dishes, and floor lamp rattled lightly. Motion slow; lasted 3 seconds.

August 1: 08:27. Philipsburg, Mont. IV. Felt by many in community. Motion rapid; lasted fraction of second.

August 6: 17:46:43*. Epicenter 41.1° north, 106.0° west, southeastern Wyoming, W. Foxpark. IV. Felt by several. Loose objects rattled. Light rumbling earth noises heard by several at time of shock. Two light tremors followed first shock. Also felt at Laramie.

August 15: 13:36. Foxpark, Wyo. Light tremor.

August 15: 22:44 (about). Boulder City and Hoover Dam, Nev. IV. Felt by and awakened observer at Boulder City; windows and doors rattled. Earth noises heard previous to shock. Motion slow; lasted 2–3 seconds. Felt in the control room at Hoover Dam, where windows and doors rattled. Motion rapid.

August 16: 01:30. Boulder City, Nev. IV. Felt by several in home and community; awakened and frightened all in home. Windows and doors rattled. Motion rapid, then slow; lasted 2–3 seconds.

August 16: 22:15. Boulder City, Nev. IV. Rapid motion, lasting 1 second, felt by observer lying down. Windows rattled.

August 22: 05:08:23*. Boulder City, Nev. IV. Felt by several in home and community. Windows and dishes rattled. Motion slow; lasted 1 second.

August 25: 11:33. Boulder City and Hoover Dam, Nev. IV. Felt by many and awakened few at Boulder City. Windows, doors, and dishes rattled; walls creaked. Motion rapid; lasted 2 seconds. Sharp, brief, rapid motion felt by all in the control room at Hoover Dam, where windows, doors, and dishes rattled.

September 17: 23:03. Southeast Arizona (Chochise County). IV. Blastlike trembling, followed by rumbling, felt by many near Bisbee at the Mule Mountain Ranch (2 miles west of top of divide.) Rock and concrete house shook. Felt by persons 10 miles distant; dishes rattled. Also felt by telephone operator in Bakersville (about 8 miles from Mule Mountain Ranch). At Paul Spur, deep shuddering, blastlike motion thoroughly frightened observer in stone house; house creaked slightly. Bumping, blastlike motion felt at Warren. Building creaked; loose objects rattled. Brief, bumping earth noises heard at time of shock.

September 26: 20:15, 20:17, 20:24. Old Faithful, Yellowstone National Park, Wyo. IV. Very abrupt, brief shocks felt by all sitting in log house. Windows and doors rattled; walls creaked; hanging objects swung. Motion slow.

October 27: 00:39:45*. Superior, Mont. IV. Strongly felt. People awakened. House rattled. Loud "whishing" sound heard. Also felt at St. Regis.

November 28: 06:30:39*. Nephi, Utah. V. Felt by many in community; awakened all in some homes. Felt like car hit building. Also felt at Levan (about 10 miles south of Nephi); thudding motion.

December 1: 13:50:48*. Epicenter 40½° north, 112½° west, northern Utah, W. The shock was reported felt over a small area, approximately 200 square miles, principally in the Nephi–Levan areas. Maximum intensity (damage) V. Damage very slight at Nephi: two reports of cracked plaster.

INTENSITY (DAMAGE) V:

Nephi.—Generally felt; severe shaking in some sections. Two reports of plaster cracking; mortar trickled down stove chimney. Telephone operators on second floor of building said the jolt felt like "we were rocking back and forth on a ball." Furnishings shook; bed rocked; chandeliers swung. To some persons it felt like heavy equipment passing through the streets. Roaring, rumbling earth noises, seemingly from the northwest, heard about 5 seconds before shock. Aftershock felt at 20:30.

INTENSITY (DAMAGE) IV:

Cedar Valley.—Felt by several (some outdoors). Dishes rattled in cupboards. Very distinct rumbles "as are felt from blasting at Bingham" reported by several persons.

Levan.—Noticeable shaking. Potted plants shook quite a bit; windows rattled.

December 1: 15:30:15*. Aftershock of 13:50:48*. Epicenter 40½° north, 112½° west, northern Utah, W. Nephi. IV. Dishes rattled. Slight to noticeable shaking in various sections of town. Roaring noises heard. Noticeable shaking at Levan.

December 1: 20:23:12*. Aftershock of 13:50:48*. Epicenter 40½° north, 112½° west, northern Utah, W. Nephi. V. Severe shaking, but not as strong as 13:50:48*. Plaster cracked. Shaking of building caused people on second floor to want to leave building. Beds, chairs, and potted plants shook; visible swaying of dishes. Rumble heard during shock. At Levan potted plants shook. Six miles south of Levan along Highway 91, doors shook. Also felt 4 miles south of Mona, where couch shook; bump heard like side of house bumped. Earlier shocks not felt.

December 11: (between 02:30 and 05:00). Wattis, Utah. IV. People awakened; windows rattled.

December 14: 14:00. Nephi, Utah. Man left cleaning shop to investigate disturbance. Heard rumble like that made by truck.

December 19: 08:30 and 08:35. Helena, Mont. (northeast section). IV. Slight shocks felt by several; by observer (active). Dishes rattled. Motion trembling; abrupt onset. Faint bumping earth noises heard at time of shock.

CALIFORNIA AND WESTERN NEVADA

(120TH MERIDAN 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: 13:43:27*. Epicenter 34°00′ north, 118°22′ west, near Inglewood, P. Inglewood. IV. Magnitude 1.6. Press reported numerous inquiries were received from residents of the area. Television program temporarily interrupted; vertical motion.

January 12: 18:45:01*. Epicenter 34°57′ north, 119°03′ west, near Wheeler Ridge, P. Taft. IV. Magnitude 3.9. Generally felt at and near Taft. Cups rattled.

January 14: 06:05:40*. Epicenter 32°34′ north, 117°09′ west, near Imperial Beach, P. San Diego. IV. Magnitude 3.7. Felt by many; awakened observer. Windows and dishes rattled; walls creaked. Sudden onset; lasting an instant. Felt like a subterranean explosion without any movement after initial shock which bumped the house.

January 18: 00:12. Paso Robles. "A sharp earthquake shook Paso Robles. No damage reported."—(*BSSA, July 1958.*)

January 18: 08:33:35*. Epicenter 39.1° north, 118.1° west, south of Fallon, Nev., B. Frenchman's Station. Magnitude 4.4. Two shocks reported felt, one "early Saturday" and one "late Saturday." Several additional shocks occurred on the 18th in the same region, the largest of magnitude about 3½.

January 22: 23:06:46*. Epicenter 34°23′ north, 119°35′ west, east of Santa Barbara, P. Santa Barbara. IV. Magnitude 2.6. Small shock, with rapid, jolting motion, felt by several. Windows rattled.

January 24: 19:39:54*. Epicenter 40°22′ north, 121°01′ west, north of Westwood, B. Caribou Powerhouse and Caribou Camp (northeast Plumas County). IV. Felt by several. Windows rattled; station meters swung very slightly. Sharply felt at Powerhouse. Also felt 35 miles distant at Hamilton Branch Camp near Hamilton Branch Powerhouse. Abrupt vibration, resembling large explosion, reported felt at both places.

January 31: 23:08:42*. Epicenter 38°52′ north, 122°48′ west, south of Kelseyville, B. IV. Magnitude 3.4. Felt by numerous persons at Calistoga; awakened and frightened few. Windows and dishes rattled. Moderate earth noises heard. At Hobergs, felt by, awakened and frightened all in home. Windows, doors, and dishes rattled as if shaken by a blast; house creaked. Loud rumbling earth noises from south heard. House creaked at Lower Lake. Faint earth noises heard; rapid motion lasting 10 seconds.

February 5: 16:30:33*. Epicenter 36°48′ north, 121°32′ west, southwest of Hollister, B. Hollister. IV. "A sharp earthquake rattled dishes and windows in the Hollister-San Juan Bautista area."—(*BSSA, July 1958.*)

February 6: 03:15:30*. Epicenter 32°03′ north, 116°10′ west, Sierra Juarez, Baja California, P. San Diego. IV. Magnitude 4.5. Minor shock awakened many.

February 6: 19:58:14*. Aftershock of March 22, 1957, B. Magnitude 2.1. Reported felt at San Francisco.

February 11: 18:25:44*. Epicenter 39°23′ north, 120°13′ west, northwest of Truckee, B. IV. Shock of 1-second duration felt by several in community at Donner Summit and Norden (some outdoors; active). Windows and doors rattled.

February 21: 05:31:28*. Epicenter 33°42′ north, 115°35′ west, near Hayfield, P. Magnitude 3.0. Hayfield Pumping Plant (Desert Center). IV. Felt by several; awakened observer. House creaked; loose objects rattled. Abrupt, trembling motion. Sharp rumbling earth noises lasting a fraction of a second.

February 21: 07:08:45*, 08:34:16*. Epicenter 33°42′ north, 115°35′ west, near Hayfield, P. Magnitudes 2.4 and 3.2, respectively. Slight tremors felt at Hayfield Pumping Plant (Desert Center).

February 23: 13:15:12*. Aftershock of March 22, 1957, B. Magnitude 1.7. Reported felt by several in the Ingleside District of San Francisco.

March 6: 06:58:38*. Epicenter 37°33′ north, 121°52′ west, east of Mission San Jose, B. Mission San Jose. IV. Magnitude 2.8. Felt by several (some outdoors); frightened few in community. Windows and doors rattled. Motion rapid, from south, lasting 3–4 seconds. Moderate earth noises heard.

March 6: 12:00 (about). "Residents of Brawley felt a small earthquake a few minutes after noon."—(*BSSA, July 1958.*)

March 12: 14:54:09*. Epicenter 37°55′ north, 122°09′ west, near Lafayette, B. Reported felt by two at Orinda standing still in market.

March 13: 15:15.0*. Epicenter 31.5° north, 115.5° west, Baja California, P. San Diego. III. Magnitude 4.3. Rapid motion felt by several in home and community. Hanging objects swung.

March 14: 06:01:36*. Epicenter 40°46′ north, 123°58′ west, east of Eureka, B. IV. Reported awakened many Humboldt County residents. Awakened few in home in east section of Eureka; to observer lying down motion seemed rapid, west-east swaying; to person standing and active, vertical. Felt by several in north section of Eureka; one thump.

March 19: 03:48:51*. Aftershock of March 22, 1957, B. San Francisco Peninsula area. IV. Magnitude 2.0 Small but sharp shock awakened some persons in the Outer Mission District of San Francisco. Redwood City, and the Sharp Park areas.

March 24: 18:58:23*. Epicenter 39.5° north, 122.3° west, west of Willows, B. Storrie. IV. Sharp motion felt by several in community. Windows rattled; walls creaked.

March 26: 20:55:39*. Epicenter 35°22′ north, 118°37′ west, north of Caliente, P. Magnitude 3.4. Kern Canyon PG&E Powerhouse (about 10 miles east of Bakersfield). IV. Rapid motion of 15-seconds' duration felt by several sitting; windows rattled.

March 28: 06:05:39*. Aftershock of March 22, 1957, B. Magnitude 2.5. Small shock felt in the Daly City area.

March 31: 06:33:43*. Epicenter 34°05′ north, 117°11′ west, near Redlands, P. IV. Magnitude 3.4. Shock, described as minor, felt in the San Bernardino–Riverside–Fontana area. Rapid motion, lasting 8 seconds, felt by several at Hemit, where windows rattled. Felt by several at San Bernardino; building creaked and loose objects disturbed and swung.

April 4: 09:05:48*. Epicenter 36°40′ north, 121°20′ west, southeast of Hollister, B. Hollister (7 miles south of). IV. Felt by several; house creaked; doors rattled. Motion northeast-southwest, lasting 30 seconds. Faint earth noises heard.

April 7: 04:01:15*. Epicenter 34°08′ north, 117°18′ west, near San Bernardino, P. Magnitude 2.5. Reported felt at San Bernardino.

April 15: 13:51:52*. Epicenter 34°06′ north, 117°10′ west, east of Redlands. Magnitude 3.2. Reported felt at San Bernardino.

April 20: 13:06:58* (main shock) and 13:16. Epicenter 38°37′ north, 122°16′ west, B. Magnitude of first shock 4.0. Both shocks reported felt at Monticello Dam, west of Winters.

April 29: 18:36:18*. Epicenter 32°47′ north, 118°06′ west, southeast of San Clemente Island, P. Magnitude 3.6. Felt by several at San Diego.

May 1: 11:31. "A slight earthquake was felt by Brawley residents."—(*BSSA, October 1958.*)

May 2: 05:10:47*. Aftershock of March 22, 1957, B. Magnitude 2.1. Daly City area. IV. Described as slight but strong enough to rattle dishes.

May 3: 23:52:44*. Aftershock of March 22, 1957, B. Magnitude 2.6. Daly City area. IV. Dishes rattled.

May 24: 15:04:46*. Epicenter 40°16′ north, 124°11′ west, near Petrolia, B. Magnitude 4.8. Felt over a land area of approximately 3,500 square miles of northwestern California, principally in Humboldt County. Maximum intensity (damage) VI. Sharp shock, but no damage reported.

INTENSITY (DAMAGE) VI:

Briceland.—Felt by many (some outdoors, active). Small objects shifted and overturned; knickknacks fell. Trees, bushes shaken slightly. Rapid motion; loud earth noises heard by many.

Carlotta.—Felt by and frightened all in community. Small objects shifted. Trees, bushes shaken moderately. Rapid, twisting motion; loud earth noises heard by many 4 seconds before shock.

Ferndale.—Frightened few in community. Small objects and furnishings shifted. Trees, bushes shaken strongly; hanging objects swung in circle. Slow motion.

Garberville.—Felt by all; frightened few. Small objects shifted and overturned. Trees, bushes shaken moderately. Rapid motion from northeast.

Honeydew.—Felt by and frightened all in community. Small objects overturned; knickknacks fell. Building seemed to drop an inch or two. Trees, bushes shaken moderately. Rapid motion from northwest; moderate earth noises from south heard by few three seconds before shock.

Miranda.—Felt by all; frightened many. Small objects and furnishings shifted. Trees, bushes shaken strongly. Slow motion; loud earth noises heard.

Petrolia.—Felt by all; frightened few. Small objects shifted and overturned; knickknacks and books fell. Rapid motion from south-north; moderate earth noises heard by many two seconds before shock.

INTENSITY (DAMAGE) V: Alderpoint, Alton, Cutten, Eel Rock, Fernbridge, Fields Landing, Fortuna, Holmes, Hoopa, Hydesville, Korbel, Laytonville, Loleta, Rio Dell, Shively, South Fork, and Westport.

INTENSITY (DAMAGE) IV: Arcata, Bayside, Crannell, Eureka, Fort Seward, Littleriver, Longvale, Phillipsville, Piercy, Rohnerville, Scotia, and Trinidad.

INTENSITY (DAMAGE) I TO III: Albion, Dos Rios, Ettersburg, Forest Glen, Fort Bragg, Mendocino, Orick, Potter Valley, and Zenia.

May 24: 21:06:33*. Epicenter 40°10′ north, 124°07′ west, near Ettersburg, B. Eureka. III. Trembling motion from west-east, lasting 3 seconds, felt by several in home (sitting and active); figurines rattled. Also felt at Hydesville and Scotia.

May 27: 15:09:32*. Epicenter 36.9° north, 121.6° west, east of Watsonville, B. Magnitude 3.8. Reported felt over about 150 square miles of the region east of Santa Cruz, from Aptos to San Martin. San Martin. V. Felt by several. Small objects shifted; windows and doors rattled; house creaked. Loud earth noises heard by few; motion rapid, lasting few seconds. Also felt at Aptos and 3.7 miles north of.

May 27: 23:48:18*. Epicenter 32.0° north, 115.0° west, Baja California, P. Magnitude 4.5. Rapid motion felt by several at San Diego.

May 31: 02:56:38*. Epicenter 34°00′ north, 118°10′ west, P. V. Magnitude 2.3. Awakened many and rattled windows at Lynwood and South Gate. At San Gabriel windows rattled; rapid motion, lasting 1 second.

May 31: 14:07:11* (main shock) and 14:21. Epicenter 37°52′ north, 122°00′ west, near Concord, B. Magnitude 4.1. Felt over an area of approximately 1,500 square miles of the San Francisco Bay region, principally in Contra Costa County. Maximum intensity (damage) V. Felt by all and frightened many at Danville; dishes rattled; trees, bushes shaken moderately; rapid north-northwest motion, lasting 30 seconds. Felt by all at Orinda; windows rattled; sharp jolt. At Port Costa, windows, doors, and dishes rattled; rapid motion, lasting about 1 minute. Felt by all in home at Rodeo, where small objects shifted; windows rattled; house creaked; motion rapid. At Walnut Creek, felt by several and frightened few; small objects shifted; dishes rattled; walls creaked; rapid motion, lasting 30 seconds; moderate earth noises heard by all 4 seconds before shock. Intensity (damage) IV at Alameda, Alamo, Berkeley, Canyon, Concord, Daly City and Colma, Diablo, Moraga, Pinole, Port Chicago, Saint Mary's College (Moraga), and Vallejo. Also felt at Antioch, Aptos (3.7 miles north of), Fairfield, Hayward, Marshall, Martinez, Oakland, Pleasanton, Point Reyes Station, San Francisco, and San Rafael.

May 31: 21:11:39*. Epicenter 37°59′ north, 122°01′ west, near Concord, aftershock of 14:07:11*, B. Slight shock felt by observer (sitting) at Canyon.

June 10: 13:09:42*. Epicenter 36°43′ north, 121°38′ west, near Salinas, B. Moss Landing. III. Slow, brief motion felt by observer in concrete building.

June 11: 08:25:36*. Epicenter 40°39′ north, 123°59′ west, southeast of Eureka, B. Eureka (north section). III. Brief, sharp jolt felt by several.

June 14: 04:17:54*. Epicenter 33°48′ north, 118°30′ west, off Point Vincente, P. Mild shock in the coastal area of Hermosa Beach.

June 18: 14:54:03*. Epicenter 38°43′ north, 122°30′ west, near Lake Merced, B. Reported felt in the Portola District of San Francisco.

June 21: 22:21:00*. Epicenter 38.6° north, 123.2° west, west of Healdsburg, B. Healdsburg. IV. Felt strongly; several awakened. Freight cars jolted so that some thought train had struck some object. Also felt at Rio Nido.

June 29: 13:14:01*. Epicenter 36°53′ north, 121°25′ west, near Hollister, B. Hollister. IV. Light shock rattled the Hollister area and neighboring communities.

July 6: 10:31:00*. Gulf of California shock. Rapid motion "just strong enough to be felt" reported at San Diego.

July 7: 01:00:49*. Epicenter 37°10′ north, 121°39′ west, near Morgan Hill, B. Moderate shock rocked the Morgan Hill area.

July 8: 20:37:43*. Epicenter 36.8° north, 121.5° west, southwest of Hollister, B. IV. Dishes rattled at Hollister and at San Juan Bautista. Felt weakly by several 7½ miles south of Hollister; windows rattled; slow motion, lasting about 20 seconds.

July 8: 21:23:40*. Epicenter 37°15′ north, 121°40′ west, near Morgan Hill, B. Magnitude 4.1. Felt over an area of approximately 3,000 square miles of the coastal region of west-central California, from San Rafael to Carmel and inland to a distance of about 30 miles. Maximum intensity (damage) V. No damage reported.

INTENSITY (DAMAGE) V:

Coyote.—Awakened many in home and community; frightened few. Windows, doors, and dishes rattled; house creaked. Sudden, rapid motion; moderate earth noises heard by many.

Holy City.—Felt by all in home. Furnishings shifted. Slow motion; faint earth noises heard.

Morgan Hill.—Felt by all; frightened few. Windows, doors, and dishes rattled; house creaked; hanging objects swung northwest; faint earth noises heard. Motion rapid—slow, rocking.

Milpitas.—Felt by all; awakened many in home and community; frightened few. Windows rattled. Rapid motion, lasting 3 seconds; faint earth noises heard.

Santa Cruz.—Felt by all; awakened and frightened many. Windows, doors, and dishes rattled; frame creaked. Hanging objects swung southwest. Rapid motion from southwest, lasting about 10 seconds.

INTENSITY (DAMAGE) IV: Aromas, Ben Lomond, Felton, Gilroy, Hollister and 7½ miles south of, Madrone, Mount Hermon, New Almaden, Port Chicago, San Francisco, San Jose, San Martin, San Rafael, Soquel, and South San Francisco.

INTENSITY (DAMAGE) I TO III: Aptos and 3.7 miles north of, Canyon, Carmel, Hayward, Oakland, Panoche, Pedro Valley, and Pescadero.

July 13: 21:25:55*. Epicenter 34°21 north, 119°29′ west, off Carpinteria, P. Magnitude 4.7. Felt over a land area of approximately 5,000 square miles of southern California. (See map, page 19.) Maximum intensity (damage) VI. Slight damage in Carpinteria: plaster cracked; slight loss from fallen merchandise.

INTENSITY (DAMAGE)VI:

Carpinteria.—Felt by and awakened all; frightened many in community. Damage slight. Plaster cracked. Stock oriented in line extending east-west through hardware store fell; loss about $20 to $30. Some loss (about $60.00) from fallen merchandise on north-south shelves in food market. Vases and small objects in home shifted and overturned. Rapid motion from south-north, lasting 5 seconds; loud earth noises heard by many.

INTENSITY (DAMAGE) V: Casitas Springs, Goleta, Maricopa, Meiners Oaks (Ojai), Montalvo, Ojai, Oxnard, Port Hueneme, Santa Barbara, Saticoy, Somis, Summerland, and Ventura.

INTENSITY (DAMAGE) IV: Fillmore, Gaviota, Guadalupe, Los Alamos, Los Prientos Ranger Station (about 10 miles north of Santa Barbara, at head of Santa Ynez Valley), McKittrick (6 miles west of, Temblo

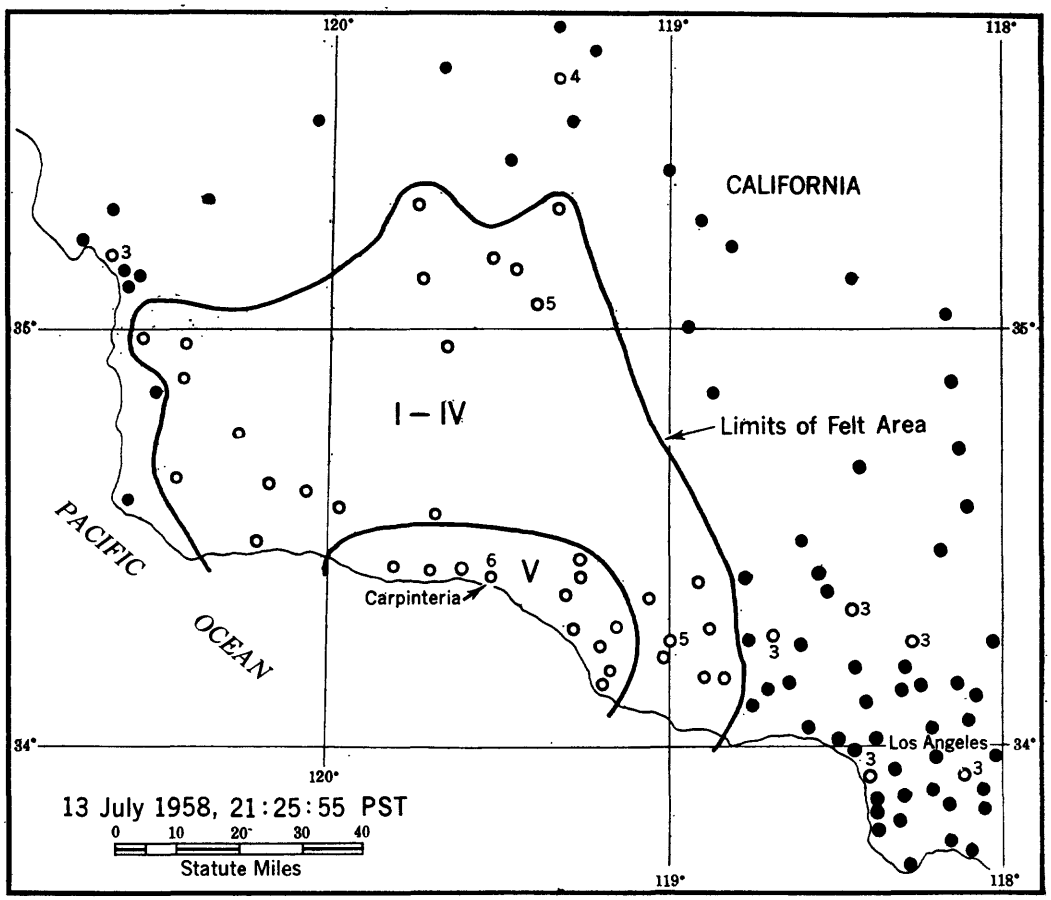

FIGURE 5.—Area affected by earthquake of July 13.

Mountains), Moorpark, Newbury Park, Orcutt, Santa Ynez, San Lucas Ranch (about 5 miles southeast of Santa Ynez), Thousand Oaks, and Wasco.

INTENSITY (DAMAGE) I TO III: Avila Beach, Buellton, Camarillo, Cuyama, El Segundo, Fellows, Lompoc, Manhattan Beach, Norwalk, Olive View, San Diego, Santa Maria, Santa Paula, Santa Susana, Santa Susana Canyon (7 miles from Agoura), Shell Beach (on coast about 10 miles south of San Luis Obispo), Tujunga, and Tupman.

July 14: 13:43:00*. Epicenter 40°17′ north, 124°23′ west, near Punta Gorda, B. IV. "A light earthquake rattled dishes in Humboldt County . . ."—(*BSSA, October 1958.*)

July 15: 23:46. Light shock reported felt in San Diego.

August 8: 05:43:15*. Epicenter 36.3° north, 121.2° west, northwest of King City, B. Big Sur. IV. Moderate southeast-northwest motion, lasting 2 seconds, felt by several lying down; frame creaked.

August 17: 21:55, 22:00:52*, 22:44:14*. Epicenter 30½° north, 114° west, Gulf of California, W. San Diego. III. Slight shocks felt by several at San Diego. House popped twice; slow motion, lasting a few seconds.

August 18: 04:28:29*. Epicenter 33°10′ north, 115°56′ west, west shore of Salton Sea, P. Magnitude 3.8. Brawley. IV. Light sleepers were awakened by a slight shock.

August 30: 08:43:55*. Epicenter 37°34′ north, 122°30′ west, near Montara. Magnitude 3.2. San Francisco Peninsula areas. IV. Sharply felt in San Mateo County and in parts of western San Francisco. Several small foreshocks and an aftershock were also reported.

August 31: 13:49:22*. Epicenter 40°18′ north, 121°24′ west, east of Mineral, B. Very light shock felt by observer at Storrie (PG&E); slow motion. "Felt only at Storrie."

September 5: 10:29:32*. Epicenter 36°36′ north, 121°13′ west, west of Llanada, B. Hollister (7½ miles south of). IV. Felt by several; windows rattled; walls creaked; door swung northwest. Northwest-southeast motion, lasting 15 seconds.

September 11: 06:00. Slight shock felt by few at Thermal.

September 18: 19:27:50*. Epicenter 36°51′ north, 121°28′ west, near Hollister, B. Hollister (7½ miles south of). IV. Moderate motion, lasting 30 seconds, felt by several; windows and doors rattled; house creaked.

September 20: 15:37:57*. Epicenter 37°18′ north, 121°37′ west, near Mount Hamilton, B. Magnitude 3.3. Reported felt at San Jose.

September 20: 23:24:55*. Epicenter 36°21′ north, 121°07′ west, southeast of Soledad, B. Magnitude 4.6. San Benito Area. VI. Fireplace cracked; dishes broken. Reported damaged two other homes and caused a landslide. Also felt at Soledad.

September 22: 19:50:15*. Epicenter 40°16′ north, 124°35′ west, off Punta Gorda, B. Magnitude 4.4. Eureka. III. Felt by several. One reported rapid, vertical motion, with downward motion the stronger, lasting 3–4 seconds; another short, slow jolt, with gradual onset. Also felt at Arcata, Ferndale, Fortuna, and Rio Dell.

October 1: 13:42:11*. Epicenter 39°34′ north, 120°18′ west, southeast of Sierraville, B. Magnitude 4.6. Felt over an area of approximately 5,000 square miles of northeastern California and western Nevada. Maximum intensity (damage) VI. Damage slight; chimneys cracked at Hallelujah Junction and few dishes broken at Reno, Nev.

INTENSITY (DAMAGE) VI:

Hallelujah Junction (Junction of U.S. Highway 395 and State Highway 24, about 20 miles northwest of Reno, Nev.).—Felt by all; frightened all in home. Damage slight. Chimneys cracked. Small objects shifted. Moderate earth noises heard about 5 seconds before shock. Minor shock felt about 15 seconds later.

INTENSITY (DAMAGE) V: Blue Canon, Chilcoot and vicinity, Grouse Ridge Lookout (about 10 miles north and east of Emigrant Gap), Sierraville and vicinity, and Vinton.

INTENSITY (DAMAGE) V IN NEVADA: Reno.

INTENSITY (DAMAGE) IV: Alleghany, Baxter, Beckwourth, Blairsden, Camptonville, Clio, Downieville, Emigrant Gap, Foresthill, Goodyears Bar, Graeagle, Granteville, Norden, Portola, Quincy (5 miles north of), Sattley, Sierra City, Sloat (5 miles east by south of), Soda Springs and 8 miles west of at Big Bend Ranger Station, Storrie, Tahoe Vista, Truckee, and Washington.

INTENSITY (DAMAGE) IV IN NEVADA: Flannigan and Sparks.

INTENSITY (DAMAGE) I TO III: Brockway, Doyle, Floriston, Oroville, and Pollock Pines.

INTENSITY (DAMAGE) I TO III IN NEVADA: Dayton, Genoa, and Verdi.

October 2: 20:25:51*. Epicenter 34°22′ north, 119°30′ west, off Carpinteria, P. Magnitude 3.7. Reported felt in the coastal area of Santa Barbara County from Carpinteria to Goleta. (*BSSA, January 1959.*)

October 10: 05:05:16*. Epicenter 35°56′ north, 120°30′ west, northwest of Parkfield, B. Magnitude

4.5. Felt over an area of approximately 3,500 square miles of southwestern California, principally in Monterey and San Luis Obispo counties. Maximum intensity (damage) V. No damage reported.

INTENSITY (DAMAGE) V:

Adelaida (15 miles west of Paso Robles).—Felt by all; awakened all in home. Windows, doors, and dishes rattled; house creaked. Moderate earth noises heard. Rapid east-west motion, lasting several seconds.

Camp Roberts (about 5 miles north of San Miguel).—Awakened many; frightened few. Windows rattled. Faint earth noises heard by many; rapid motion.

Coalinga.—Awakened many. Windows rattled. Slow, east-west motion.

Harmony.—Felt by all; awakened many in community. Rolling motion, lasting 30 seconds.

Lone Pine Inn (about 15 miles northwest of Coalinga).)—Awakened all in home. Windows and doors rattled. Slow, west-east motion.

Oilfields (10 miles northeast of Coalinga.—Awakened all in home. Windows and doors rattled. Slow motion, lasting about 8 seconds.

Parkfield.—Awakened all in community; frightened few. Few loose objects fell. Pendulum clock facing north stopped. Rapid motion, lasting about 30 seconds.

Paso Robles.—Awakened many; few alarmed. Few dishes fell from shelves. Buildings creaked; windows and loose objects rattled. Faint earth noises heard by many.

San Ardo.—Awakened many in community; felt by some outdoors. House creaked. Slow motion, lasting few seconds.

INTENSITY (DAMAGE) IV: Atascadero, Avenal, Bitterwater Pumping Station (about 20 miles southeast of Cholame), Cholame, Creston, Greenfield, King City, San Miguel, Shandon, and Templeton.

INTENSITY (DAMAGE) I TO III: Avila Beach, Lemoore, Lost Hills 2½ miles west of, Oceano, Pozo Guard Station (Pozo), and San Luis Obispo.

October 14: 19:43:39*. Epicenter 33°04′ north, 115°35′ west, west of Calipatria, P. Magnitude 2.7. Rapid motion and loud roar reported at Calipatria.

October 15: 02:36:58*. Epicenter 33°54′ north, 118°08′ west, west of Norwalk, P. Magnitude 3.2. Felt over an area of approximately 500 square miles of southwestern Los Angeles County. Sharp, jolting, explosivelike shock; loud earth noises heard by many. Intensity (damage) V at Bell, Bellflower, Downey, Huntington Park, Lakewood, Norwalk, and Santa Fe Springs, where many were awakened; few frightened; houses creaked; windows, doors, and dishes rattled; rapid motion, lasting 1–2 seconds. Intensity (damage) IV at Artesia, Compton, Hollydale, Long Beach, Lynwood, Maywood, North Long Beach, and Pico Rivera. Also felt at Buena Park, Los Amigos Station (Downey), and Sunset Beach.

October 16: 09:59:22*, 10:02:30*, 11:11:15*. Epicenter 33°02′ north, 115°38′ west, near Brawley, P. Magnitudes 3.9, 3.5, 3.9, respectively. Reported felt over approximately 500 square miles of the Imperial Valley, from Niland south to Imperial. V. At Brawley, felt by all; frightened many; small objects overturned; some dishes fell from shelves; light fixtures swung. Loud earth noises from north heard by many 1 second before shock. Press reported the three shocks as definitely felt. Felt by and frightened many at Calipatria, where some dishes fell from shelves; walls creaked; light fixtures swayed. Loud earth noises heard. At Westmorland (09:59:22*), some dishes fell from shelves; light fixtures swayed. Faint earth noises heard. Only one shock felt. Intensity (damage) IV at Imperial and Niland.

October 23, 24, or 25: (about 00:10). El Nido. Shock with west-east motion distinctly felt.

October 30: 16:26:15*. Epicenter 37°30′ north, 121°48′ west, northeast of San Jose, B. Magnitude 4.2. Reported felt in scattered localities over a land area of approximately 1,500 square miles, principally in southwest Alameda County and along the east shore areas of the San Francisco Peninsula. Maximum intensity (damage) VI. Damage slight. At Milpitas a water main was reportedly cracked; window broke at Berkeley.

INTENSITY (DAMAGE) VI:

Milpitas.—Felt by all; frightened many. Water main cracked (BSSA, January 1959.). Rapid motion from west-east, lasting 15 seconds; moderate earth noises from west-east heard by many.

INTENSITY (DAMAGE) V: Berkeley, Brisbane, Moffett Field, Mount Eden, Niles, and San Carlos.

INTENSITY (DAMAGE) IV: Bolinas, Burlingame, Castro Valley, Colma, Daly City, El Granada, El Sobrante, Hayward, Livermore, Los Altos, Montara, Moss Beach, Mountain View, Palo Alto, Pleasanton, Redwood City, San Francisco, San Leandro, San Ramon, Sausalito, Stanford University (Palo Alto), and Stinson Beach.

INTENSITY (DAMAGE) I TO III: Alameda, Alviso, Canyon, Bodega Bay, (6 miles north of, Cormet), Fort Baker (just south of Sausalito), Inverness, Marshall, Mill Valley, Moraga, Oakland, Point Reyes Station, San Lorenzo, South San Francisco, Sunnyvale, and Sunol.

November 7: 13:33:24*. Epicenter 36°52′ north, 121°53′ west, in Monterey Bay, southwest of Watsonville, B. "The earthquake jolted San Francisco and sections of the central California coast from

San Rafael to Hollister."—(*BSSA, April 1959.*) Felt by many (IV) at Moss Landing, San Jose, and Santa Cruz PG&E substations.

November 13: 01:09:03*. Epicenter 32°44′ north, 117°23′ west, off San Diego, P. Magnitude 3.4. IV. Felt by many at La Jolla; rumblings heard. Felt by several and awakened few at San Diego; hanging objects swung; rapid motion, lasting 20 seconds. Felt by many at Point Loma (San Diego); rumblings heard.

November 16: 01:34:04*. Epicenter 34°30′ north, 119°50′ west, northwest of Santa Barbara, P. Magnitude 4.0. Reported felt over a land area of approximately 600 square miles along the coastal areas of Santa Barbara and Ventura counties from Santa Ynez to Ventura. Maximum intensity (damage) V. Damage very slight. Minor plaster cracking reported in two homes at Santa Barbara. Awakened many and frightened few in home and community at Carpinteria; windows, doors, and dishes rattled; house creaked; brief, rapid motion from north-south. At Goleta, awakened all in home; frightened few in home and community; windows, doors, and dishes rattled; rapid motion, lasting about 3 seconds. "Noise awakened us; we thought it was a sonic boom." Awakened many in community at Santa Barbara, where minor plaster cracking was reported in two homes (*BSSA, April 1959*); roar followed by single, hard bump. "Roared long enough to awaken us before shock." Intensity (damage) IV at Santa Ynez, Summerland, and Ventura (Foster Park).

November 16: 08:07:35*. Epicenter 39.1° north, 123.0° west, east of Ukiah, B. III. Felt by several in the Redwood Valley area. Rattled control panel at the PG&E Mendocino substation 6 miles north of Ukiah; rapid motion from north-south, lasting 2 seconds.

November 23: 13:04:02*. Epicenter 32°44′ north, 117°23′ west, off San Diego, P. Magnitude 3.4. IV. Felt by many in home and community at San Diego; object swung. Rapid motion, lasting 15 seconds. Operator of amateur seismograph station at San Diego reported many calls were received from Mt. Helix, Pacific Beach, and Point Loma, all in the San Diego area.

November 26: 22:04:26*. Epicenter 36°32′ north, 121°09′ west, northeast of Soledad, B. Felt slightly at Carmel.

November 30: 19:21:18* (main shock), 19:50:06*, 20:26:48*, 22:02:30* (second largest). Epicenter 32°15′ north, 115°45′ west, Sierra Juarez, west of southern part of Laguna Salada, Baja California, P. Magnitudes 5.8, 5.0, 4.8, 5.5, respectively. Recorded aftershocks very numerous. In the United States, the principal shock was reported felt over an area of approximately 15,000 square miles. (See map, page 23.) Maximum intensity (damage) VI. Minor damage in California. At Calexico, few buildings sustained minor interior and exterior plaster cracking, enlargement of old cracks, and loss from fallen merchandise. It was reported that no significant damage occurred at Mexcalli.

INTENSITY (DAMAGE) VI:

Calexico.—Felt by all and frightened many in community. Minor damage, principally plaster cracking and damage to fallen merchandise in stores. It was reported that probably the most damage in Calexico was sustained by a supermarket, where movement of ceiling loosened many of the staples holding the acoustic tile, causing the tile units to sag; plate glass window cracked; some plaster fell from interior wall cracks (appeared to be enlargement of existing settlement cracks). Damage to the building was estimated at about $300. Five shocks reported felt. Rapid motion, lasting 30 seconds.

Nestor (about 8 miles southeast of San Diego).—Felt by several. Damage slight. Plaster and walls cracked.

Potrero.—Felt by all; frightened few. Plaster cracked. Slow, east-west motion lasting about 1½ minutes; loud earth noises heard by many 2 seconds before shock.

Seeley.—(19:21:18*, 20:26:48*, 22:02:30*). Frightened many; all awakened at 22:02:30*. Chimneys and ground cracked. Rapid east-west motion, lasting 5 seconds. Loud earth noises from west heard by all.

INTENSITY (DAMAGE) V: Aguanga (19:21:18*, 22:02:30*), Alpine, Boulevard (three shocks felt), Brawley, Calipatria, Descanso, El Centro (five shocks felt), Guatay, Holtville, Imperial, Imperial Beach (also 22:02:30*), Jacumba, La Mesa (19:21:18*, 19:50:06*, 22:02:30*), Leucadia (19:21:18*, 19:50:06*), Lincoln Acres (19:21:18*, 19:31*), Mount Laguna, and Camp Ole near Mount Laguna (19:21:18*, 19:50:06*, 22:02:30*), National City, Pine Valley, Plaster City, Poway, San Diego (19:21:18*, 19:24, 19,50:06*, 22:02:30*), San Jacinto (light tremors followed main shock), San Marcos (also 19:10), Solana Beach, Sorrento, Tecate (sharp tremors), Temecula, Warner Springs (1 mile east of, in Los Tules area), and Wildomar.

INTENSITY (DAMAGE IV: Artesia, Balboa, Blythe (also 20:00, possibly 19:50:06*), Bonita (19:21:18*, 22:02:30*), Campo, Carlsbad, Del Mar, Dulzura, Escondido, Hemet (also 22:02:30*), Idyllwild, Irvine, Jamul (also slight shocks at 19:05, 22:02:30*, 22:03*), LaJolla, Lakeside, Lemon Grove, Mecca, Oceanside, Pala, Palomar Mountain, Palo Verde, Pauma Valley (19:21:18*, 22:02:30*), Ranchita (2 shocks), San Juan Capistrano, San Luis Rey, San Ysidro, Santa Ysabel, Spring Valley, Stanton, Tierra del Sol, Valley Center (Cole Grade Road), Vista, and Westmorland.

INTENSITY (DAMAGE) IV IN ARIZONA: Somerton (also 19:35, 20:26:48*, 22:02:30*).

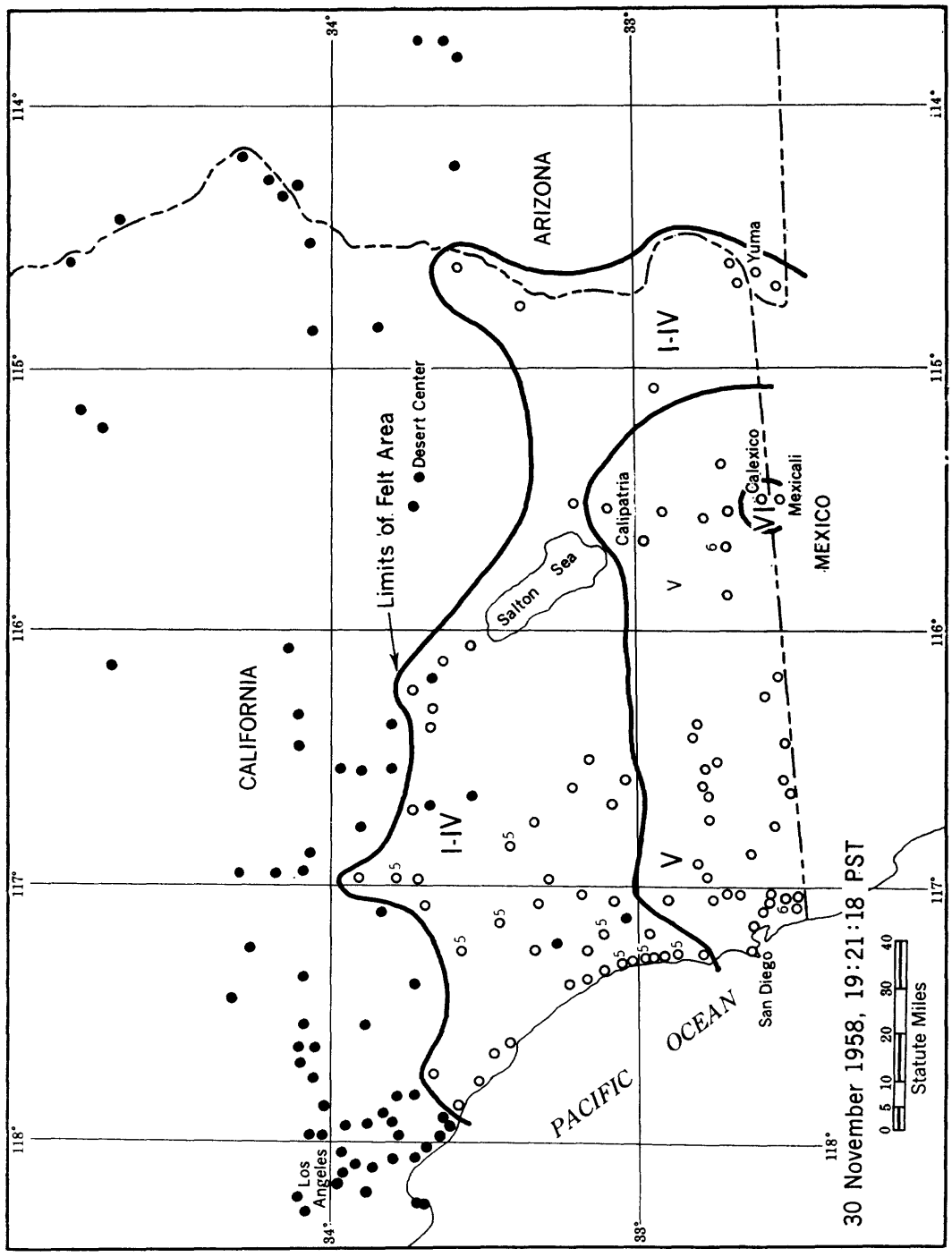

FIGURE 6.—Area affected by earthquake of November 30.

INTENSITY (DAMAGE) I TO III: Bard, Beaumont, Encinitas, Fallbrook, Indio, Julian, Laguna Beach, La Puente, La Quinta, Los Angeles (Echo Park–Silver Lake districts), Newport Beach, Niland, Rancho Mirage, Rancho Santa Fe, Riverside (20:26:48*, 22:02:30*), San Clemente, Santee, Seal Beach, Sunset Beach, Thermal, Trabuco Canyon (22:02:30*), Winchester, and Winterhaven.

INTENSITY (DAMAGE) I TO III IN ARIZONA: San Luis, Yuma (19:21:18*, 19:50:06*).

December 1: (early morning). Possibly the aftershock of 19:21:18* recorded at 00:43*, P. Magnitude 4.1. Two slight tremors felt at Warner Springs.

December 1: 12:20, 15:00, 16:54* (aftershock of 19:21:18*), P. Magnitude 4.7. Three shocks reported felt at San Diego.

December 2: 09:43:33. Epicenter 40°15′ north, 124°41′ west, west of Punta Gorda, B. Magnitude 4.3. Reported felt over a land area of approximately 2,000 square miles of Humboldt County. Maximum intensity (damage) V. No damage reported.

INTENSITY (DAMAGE) V:

Briceland.—Felt by all. Small objects shifted. Rapid motion, lasting about 30 seconds. Very loud and sharp.

Carlotta.—Felt by all; frightened few. Windows rattled; walls creaked; trees, bushes shaken slightly. Slow motion, lasting 2 seconds.

Ferndale.—Felt by all; frightened few. Windows and doors rattled; house creaked. Rapid motion, lasting 5 seconds. Loud earth noises heard.

Fields Landing.—Felt by all; frightened many. Frame creaked. Rapid motion from north-south.

Loleta.—Felt by all. Dishes rattled; hanging objects swung. Rapid, brief motion.

Pepperwood.—Felt by all. Windows, doors, and dishes rattled. Two shocks reported; first, slight; second heavy. Rapid north-south motion. Faint earth noises heard.

Petrolia.—Felt by all. Windows and doors rattled; house creaked. Slow, north-south motion, lasting 5 seconds. Faint earth noises heard by few.

INTENSITY (DAMAGE) IV: Bayside, Bridgeville, Eureka, Eel Rock, Fortuna, Harris, Holmes, Honeydew, Hydesville, Korbel, McCann, Miranda, Rio Dell, Rohnerville, Scotia, Shively, and South Fork.

INTENSITY (DAMAGE) I TO III: Alton, Alderpoint, Dows Prairie and Moonstone Beach areas, Ettersburg, Fernbridge, Garberville, Myers Flat, Phillipsville, Samoa, and Weott.

December 5: 19:24*, 19:31*. Aftershocks of November 30, 19:21:18*, P. Magnitudes 4.4 and 4.5, respectively. Reported felt at San Diego.

December 9: 05:55:31*. Foreshock of December 11, 01:52:27*, B. Small shock reported felt at San Francisco.

December 10: 04:41:03*. Epicenter 37°42′ north, 122°34′ west, foreshock of December 11, 01:52:27*, B. Slight shock reported felt in the Daly City area.

December 10: 05:37:43*. Epicenter 34°21′ north, 117°03′ west, northwest of Big Bear, P. Magnitude 3.6. V. Felt by and awakened many at Fawnskin, where windows, doors, and dishes rattled; house creaked. Rapid motion, lasting about 2 seconds. Sharp report heard. Awakened some at Redlands. Also felt at San Bernardino.

December 11: 01:52:27*. Epicenter 37°41′ north, 122°32′ west, southwest of San Francisco, B. Magnitude 4.7. Felt over a land area of approximately 6,500 square miles. (See map, page 25.) Maximum intensity (damage) VI. Damage slight. Slight plaster cracking, few broken dishes and windows, and slight loss from fallen merchandise. A minor slide was reported on State Highway No. 1 west of Daly City.

INTENSITY (DAMAGE) VI:

Colma-Daly City Areas.—Felt by all; awakened and frightened many. Walls cracked. Small objects overturned; dishes broken. Pendulum clock stopped. Trees, bushes shaken strongly. Loud, explosivelike earth noises heard before shock. Some reported it seemed as strong as the March 22, 1957 shock. Rapid, east-west motion, lasting 5-10 seconds.

Lafayette.—Felt by all; awakened many in community. Damage slight. Walls cracked. Rapid motion.

Moffett Field (Mountain View).—Felt by all; awakened all in home. Damage slight. Plaster cracked. Knickknacks fell. Rapid motion, lasting 1 minute; loud earth noises heard.

Rodeo.—Felt by all; awakened all in home; frightened many in community. Dishes broken. Hanging objects swung; trees, bushes shaken moderately. "I was nearly knocked out of bed." Slow motion from northeast, long duration. Loud earth noises heard from the northeast.

San Bruno.—Felt by all. Plaster and windows cracked; considerable canned goods fell from store shelves in the Rollingwood District; dishes broken in homes and stores. Motion rapid and slow; long duration.

San Francisco.—Generally felt. Damage very slight. Plaster cracked at 18th and Castro Streets; molding cracked in the Parkside District. Many awakened in downtown hotels, beds swayed. Venetian blinds clattered. Police on duty at the Hall of Justice said the building moved up and down; clock stopped. Burglar

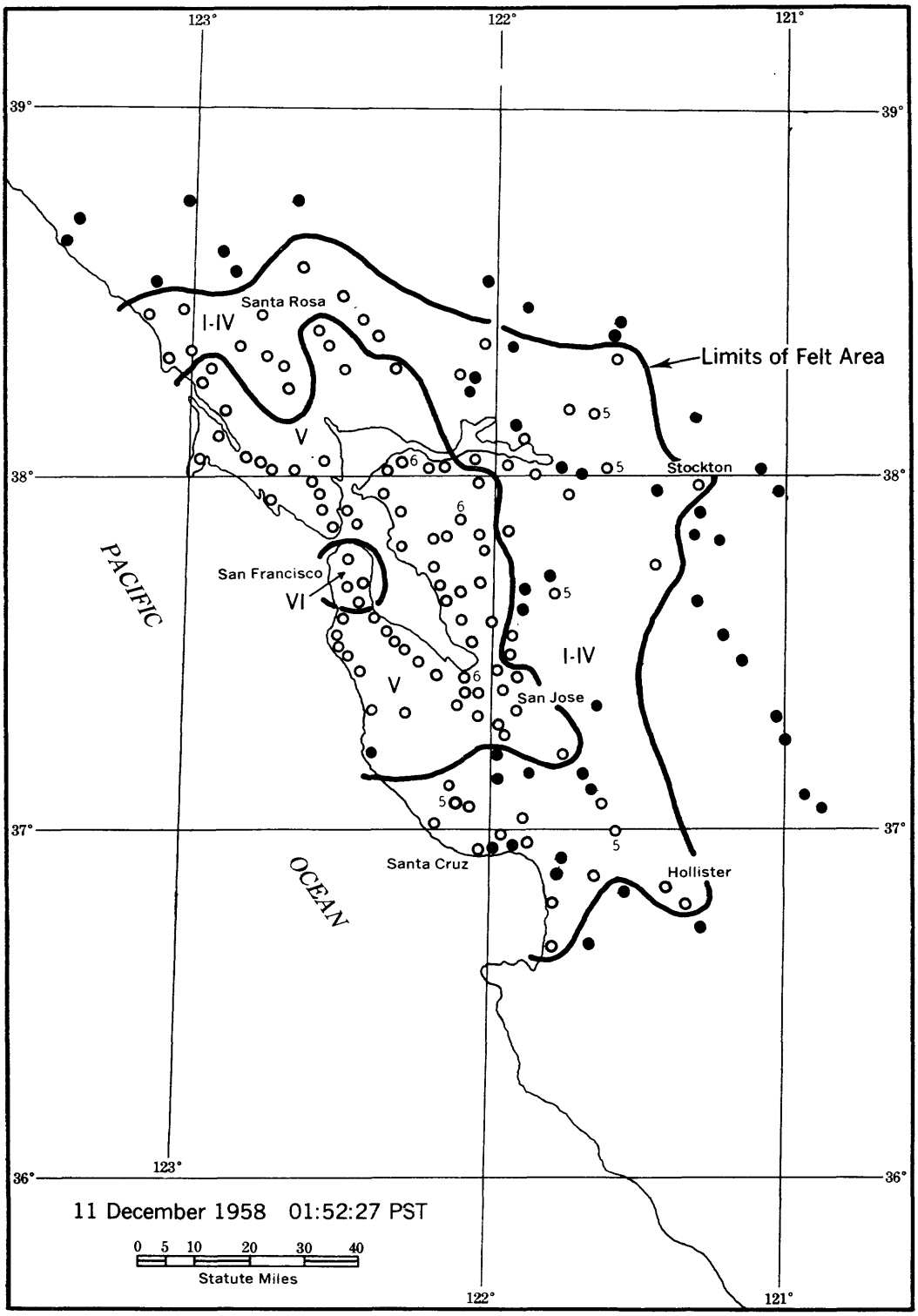

FIGURE 7.—Area affected by earthquake of December 11.

alarms were set off in the Taraval District. Small objects shifted and overturned in homes. Reported from west-central section: Estimated movement of floor at 2–3 inches. Sharp motion, seemed first north-south, then east-west.

INTENSITY (DAMAGE) V: Agnew, Alameda, Alamo, Albany, Alcatraz, Atherton, Belmont, Ben Lomond, Berkeley, Bethel Island (northeast corner of Contra Costa County), Brisbane, Castro Valley, Concord, Corte Madera, Coyote, Cupertino, Danville, Dillon Beach, El Granada, Fallon, Forest Knolls, Gilroy, Glen Ellen, Half Moon Bay, Hayward, Hercules, Isleton, Kenwood, Lagunitas, La Honda, Larkspur, Livermore (5 miles south of), Marin City (11 miles north of Santa Venetia), Marshall, Millbrae, Mill Valley, Milpitas, Montara, Monte Vista, Moraga, Moss Beach, Mountain View, Napa, Newark, Niles, Oakland, Palo Alto, Pedro Valley, Pinole, Point Reyes Station, Port Costa, Redwood City, Richmond, Ross, Saint Mary's College (Moraga), San Anselmo, San Jose, San Leandro, San Quentin, San Rafael, San Ramon, South San Francisco, Stinson Beach, Tomales, Vallejo, Vineburg, and Walnut Creek.

INTENSITY (DAMAGE) IV: Alvarado, Alviso, Antioch, Associated, Banta, Bodega, Bodega Bay, Bolinas, Boulder Creek, Boyes Hot Springs, Brentwood, Calistoga, Canyon, Collinsville, Cotati, Courtland, Crockett, Davenport, Diablo, El Cerrito, Fairfax, Hessel (village 5 miles south of Sebastopol), Hollister, Inverness, Jenner, Kentfield, Los Altos, Los Gatos, Marina, Menlo Park, Mission San Jose, Monte Rio, Moss Landing, Mount Hermon, Oakville, Penngrove, Petaluma, Pittsburg, Point Reyes Light Station, Port Chicago, Rio Vista, Saint Helena, San Carlos, San Lorenzo, San Martin, San Mateo, Santa Rosa, Sausalito, Soquel, Stockton, Suisan City, Sunnyvale, Tiburon, Tres Pinos, Vacaville, Valley Ford, Veterans Home (near Yountville), and Warm Springs.

INTENSITY (DAMAGE) I TO III: Aptos and 3.7 miles north of, Aromas, Martinez, Orinda, San Gregorio, and Santa Cruz.

December 11: 08:05:31*. Aftershock of 01:52:27*, B. Mount Hermon. IV. Light shock; house creaked.

December 11: 13:40:07*. Epicenter 37°38′ north, 122°34′ west; aftershock of 01:52:27*, B. IV. At San Francisco, felt by many on 10th floor of downtown office building; outdoors by others; motion rapid, rocking, vertical; felt by many at the West Portal School (southwest-central section). Also felt at Brentwood (eastern Contra Costa County).

December 13: 19:56:03*. Epicenter 37°32′ north, 122°34′ west; aftershock of 01:52:27*, B. San Francisco. III. Felt by several in the Stonestown area (southwest section).

December 15: 06:58:49*, 07:24:01*. Epicenter 36.2° north, 120.4° west, northwest of Coalinga, B. Coalinga. IV. Windows, doors, and dishes rattled. Rolling motion, lasting 5–10 seconds. (Observer reported time as 07:15. Report may refer to either shock since both were of the same magnitude and epicenter.)

December 20: 17:05:02*. Epicenter 33°53′ north, 118°29′ west, Santa Monica Bay, P. Magnitude 3.1. IV. Southwest Los Angeles County. Two jolts, which some thought were sonic booms, shook the coast area from Hermosa Beach to Venice. Hundreds telephoned police and newspaper offices. Buildings rocked slightly; furniture jiggled. Felt by many in homes at Manhattan Beach; windows rattled; felt table shake northeast-southwest. Noise and motion seemed from northeast-southwest; noise immediately preceded shaking, then jolt and shaking; rapid motion, lasting 3–4 seconds.

December 23: 03:16:17*. Epicenter 34°05′ north, 117°30′ west, east of Ontario, P. Magnitude 3.3. V. Felt by and awakened many in community at Etiwanda; windows rattled; rapid motion from east, lasting 2 seconds. Awakened observer and wife in Coldwater Canyon (4 miles up Coldwater Canyon and 8 miles from top of Mt. San Antonio Peak), where house shook; windows and loose objects rattled; abrupt, sharp jolt. preceded by distant rumbling sounds. Felt by many at Corona. Small shock jolted the Riverside area; reported as especially felt at Arlington (about 7 miles southwest of Riverside).

December 24: 17:27. Aftershock of November 30 at 19:21:18*, P. Magnitude 4.6. San Diego. III. Rapid, sharp jolting motion, lasting 7 seconds, felt by several in home and community.

WASHINGTON AND OREGON

(120TH MERIDIAN OR PACIFIC STANDARD TIME)

January 5: 16:00. Longmire, Wash. IV. Felt by many in home and community. Walls creaked. Slow motion. "Many thought the earthquake was snow sliding from roofs."

April 12: 14:37:11*. Epicenter 48° north, 120° west, north-central Washington, about 8 miles southwest of Pateros, W. Felt over an area of approximately 8,000 square miles. (See map, page 27.) Maximum intensity (damage) VI. Damage slight: few reports of plaster cracking; few windows and dishes broken. Rocks fell on roads near Chelan.

INTENSITY (DAMAGE) VI:

area two inches. Also felt at Cordova, Eklutna Lake, Eklutna Project (Power Station), and Palmer (4 miles southeast of).

February 5: 02:05:14*. Valdez. Slight shock. Duration 4 seconds.

February 16: 12:20. McGrath. V. Felt by several. Chandeliers swung in north-south direction; dishes fell from cupboard. Disturbed objects observed by one. Swaying motion. Faint rumbling sound heard before earthquake.

March 5: 09:26:35*. Felt at College and Fairbanks.

March 31: 05:50. Huslia. V. Felt by all.

April 7: 05:30:39.5* and 14:14:20*. Epicenter of first shock 66.1° north, 156.8° west (magnitude 7.3); of second shock 66½° north, 155½° west, central Alaska, W. Felt over an area of approximately 150,000 square miles of central Alaska. (See map, p. 29.) Maximum intensity (damage) VIII (severe breakage of lake and river ice and many ground cracks and mud flows) occurred within a 40 to 50 mile radius of Huslia. Evidence of pressure ridges, lakes thawing, numerous lakes filled with black slimy mud, and craters 20 feet across and 6 feet deep was reported. (See Transactions, American Geophysical Union, Vol. 39, No. 5,

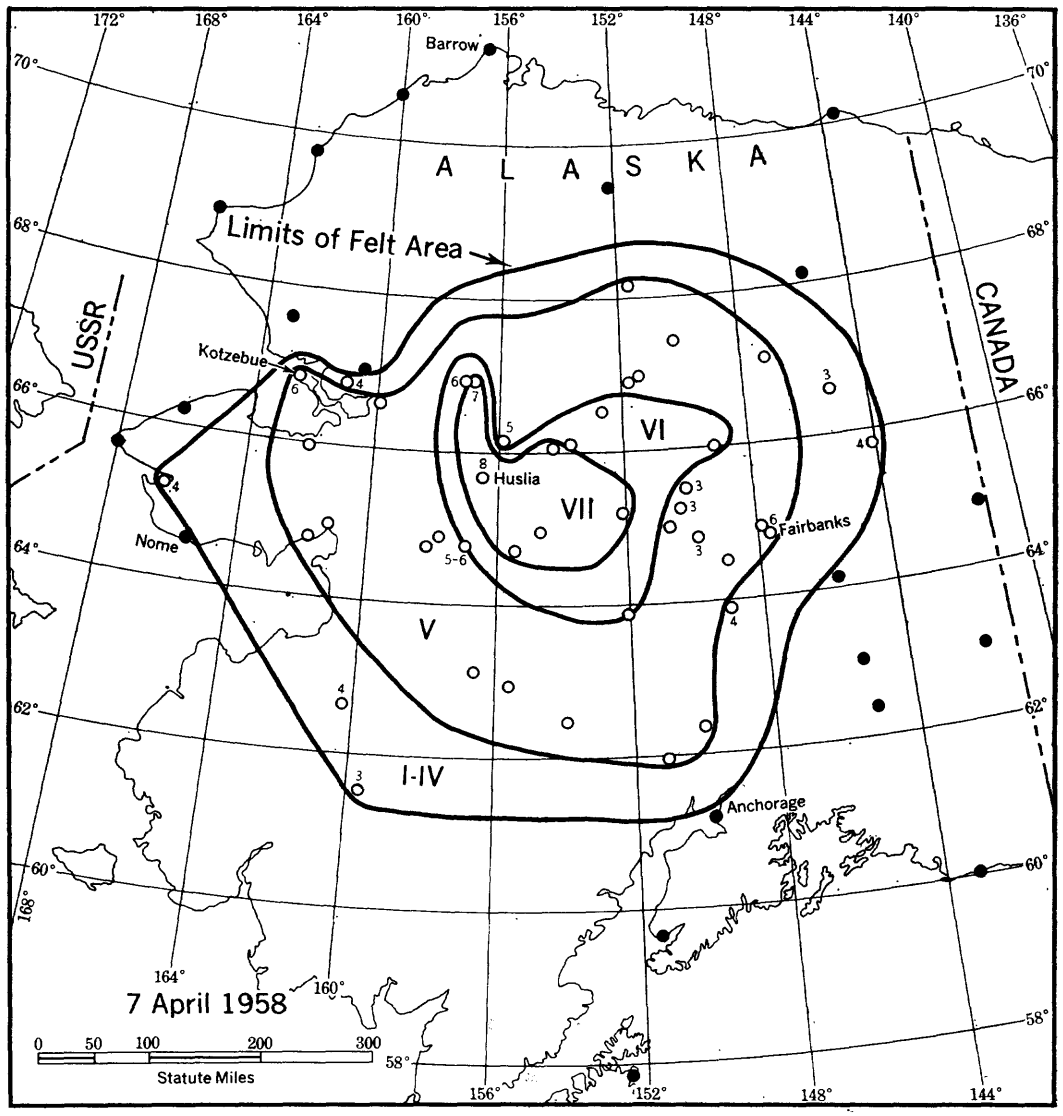

FIGURE 9.—Area affected by earthquake of April 7.

October 1958, *"Preliminary Report on the Alaskan Earthquake of April 7, 1958"* by T. Neil Davis, Geophysical Institute, University of Alaska, College, Alaska.)

INTENSITY (DAMAGE) VIII:

Huslia.—Felt by, awakened and frightened all. Sand and mud ejected; numerous earth lurches bordered small sloughs and ponds. Actual monetary damage was slight because most of the homes are of log construction and have no foundations. Concrete piers underneath a one-story plywood school building were chipped by the main shock and some boards around the foundation were knocked loose. Logs were shaken loose from window casings on two of the buildings, and many of the houses received minor damage to roof structure. Case goods and other heavy objects moved for a distance of 12 inches. Church bells rang; dishes and goods thrown to the floor; and wood piles shifted. Aftershock felt at 14:14:20*.

INTENSITY (DAMAGE) VII:

Hughes.—Felt by and awakened many. Lake and river ice beyond 8 miles south of Hughes cracked and pushed up in pressure ridges. Definite results of water agitation noted in lakes in the area. Clocks and coffee pots toppled from tables, stoves, and shelves. Heavy objects shifted; pictures on wall knocked askew.

Kobuk.—Felt by, awakened, and frightened all. Several sufficiently alarmed to run from their homes. Shore ice on Kobula River near village fell into the water. Dog team drivers travelling upstream reported many cracks to 10 inches wide in river ice, and water was flowing over the ice in some areas. The thickness of the river ice was four feet. Cabins on pilings shook violently; small objects fell. Electric lights swung. Aftershock felt at 14:14:20*.

Kokrines.—Felt by and awakened nearly all; few frightened. Cracks appeared in Yukon River ice near village. Heavy objects shifted; hanging objects swung in every direction. Water spilled from washtub on ground floor. One observer reported "the house shook so much that poles under it got out of place." Aftershock felt at 14:14:20*.

Ruby.—Felt by and awakened all; few alarmed. Shore ice fell from banks of Yukon River and river ice cracked and open water exposed. Cracks occurred in the walls of several log cabins. Books, tea kettles, and dishes fell from stoves and shelves. Aftershock felt at 14:14:20*.

Tanana.—Felt by and awakened all; many frightened. Ground cracks reported. Clock pendulum thrown sharply against case. Furniture shifted; hanging objects swung; doors thrown open. Guy wires and cables swayed. Aftershock felt at 14:14:20*.

INTENSITY (DAMAGE) VI:

Allakaket.—Felt by and awakened all; few frightened. Cracks appeared in lake ice near village. Water spilled from covered cans; light fixtures and gas lamps swayed from ceilings; windows, doors, dishes, and walls rattled. Aftershock felt at 14:14:20*.

Fairbanks.—Felt by, awakened, and alarmed many. Equipment tumbled from shelves in the Fairbanks News-Miner newspaper office. Pendulum clock stopped. Doors swung to and fro; light fixtures swayed.

Galena.—Felt by and awakened all; many frightened. Groceries overturned and dishes broken in commissary building; crack reported in wall but not confirmed. Hanging objects swung; windows, doors, dishes, and walls rattled; rumbling noises heard during earthquake. Aftershock felt at 14:14:20*.

Indian Mountain.—Felt by and awakened all. Doors failed to close properly; dishes fell from tables; hanging objects swung; doors, dishes, and walls rattled.

Kotzebue.—Felt by and awakened many; few alarmed. An auroral all-sky camera operated by the Geophysical Institute damaged. Ice blocks used for drinking water toppled at one building. Pictures and venetian blinds swayed. Rolling motion. Aftershock felt at 14:14:20*.

Shungnak.—Felt by and awakened all; many frightened. No damage to structure, but one observer reported "everything shifted inside our home." Water flowed over river ice where it had broken. Hanging objects swung NE-SW. Dishes, doors, and walls rattled. Earth noises heard just before earthquake.

Skivetna.—Felt by those awake; frightened one. Heavy objects shifted in attic. Light fixtures swung. Windows rattled; hanging objects swung north-south.

Stevens Village.—Felt by and awakened nearly all; many frightened. School building condemned (very old building—under pilings rotten—some fell and dirt wall caved in—poles supporting roof split and broken). Cracks observed along river banks (may not have been caused by earthquake). Water barrel shifted slightly; beds moved.

INTENSITY (DAMAGE) V:

Anaktuvuk Pass.—Felt by nearly all; even those in sod igloos. Small objects shifted and dishes fell from tables and shelves. Hanging objects swung in E-W direction.

Bettles Field (1 mile west of).—Felt by and frightened many; few awakened. Dishes and small objects shifted. Loud growling rumbling noises heard by many.

Bettles.—Felt by and awakened many; few alarmed. Hanging objects swung in E-W direction. Dishes and windows rattled.

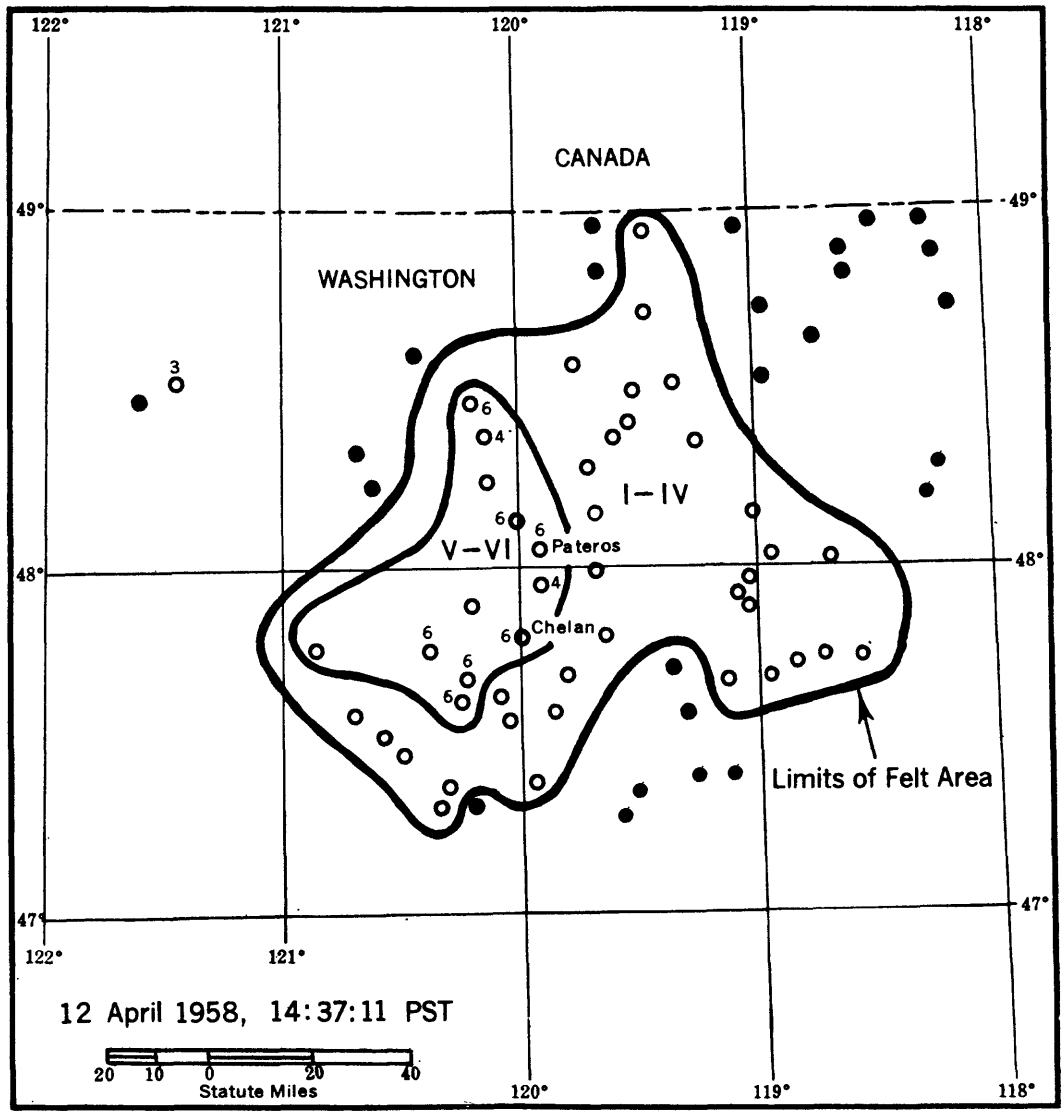

FIGURE 8.—Area affected by earthquake of April 12.

Ardenvoir.—Felt by all. Cans fell. Rapid motion, lasting about 5 seconds.

Chelan and Pateros areas.—Felt by all. Windows and dishes broken in some homes; lights swayed in wide arc. State Highway Patrol reported rocks fell on U.S. Highway No. 97 and a considerable amount fell along one section south of a tunnel which spans the road near Chelan. Rapid motion from east, lasting 15 seconds; moderate earth noises from east heard 3 seconds before shock; at Pateros, noise sounded like furniture being pushed across bare boards.

Chelan Falls.—Felt by all; frightened many; awakened observer. Rapid motion, lasting several seconds; loud earth noises heard by many. One observer reported it seemed as if the whole house was going to fold up.

Entiat.—Felt by all. Small objects shifted. Trees, bushes shaken moderately. Rapid motion, lasting 10 seconds; moderate earth noises heard by few.

Methow.—Felt by many. Plaster cracked. Entire building rattled. Rapid motion from north-south, lasting 30 seconds; loud earth noises heard by many.

Orondo.—Felt by all; frightened few. Plaster cracked. Small objects shifted. Two distinct shocks; rapid motion from east, lasting 30 seconds; loud earth noises heard by many 2 seconds before shock.

Winthrop.—Felt by many; frightened few. Damage slight. Dishes broken. Small objects and furnishings shifted; vases and small objects overturned; knickknacks fell. Some said rapid motion; others, slow; duration from few seconds to 30 seconds; faint to moderate earth noises from east 2–3 seconds before shock.

INTENSITY (DAMAGE) V: Carlton, Manson, Stevens Pass (Merritt Cafe on Highway 2).

INTENSITY (DAMAGE) IV: Almira, Azwell, Brewster, Bridgeport, Cashmere, Creston, Conconully, Coulee Dam, Douglas, Electric City, Farmer, Govan, Grand Coulee, Hartline, Keller, Leavenworth, Malott, Monse, Nespelem, Omak (1 mile northeast of), Synarop, Tonasket, Twisp, Waterville, Wenatchee, and Withrow.

INTENSITY (DAMAGE) I TO III: Disautel, Dryden, East Wenatchee, Mansfield, Marblemount, Monitor, Oroville, Palisades (1½ miles from, in Moses Coulee), and South Wenatchee.

April 12: 17:00 or 18:00 (about). Electric City. Some reported a shock was felt with about the same effects as the shock at 14:37:11*.

May 22: 12:13. Skagit River area, Wash. IV. Reported as strongest at Diablo Dam and Newhalem. Houses creaked; tools swayed against boards. Felt at Ross Dam Powerhouse. Also felt at Victoria, B.C., where seismographic station reported the epicenter of this shock was in Canada.

July 12: 17:42. Western Washington. Felt over an area of approximately 300 square miles of the Puget Sound region. IV. At Battle Point on Bainbridge Island, felt like a heavy object hit house; whole house shook; frame creaked. Rapid motion from east, lasting 1 second. Felt by all in home at Bremerton, where windows, doors, and dishes rattled; vases and small objects shook east-west; rapid motion, lasting 10–15 seconds; loud roaring earth noises from east heard 2–3 seconds before shock. Also felt by several at Post Office. Felt by all one mile east of Port Orchard; frame creaked. Distant rumbling noise, 2–3 seconds before shock, increasing in volume, until a sudden lurch was felt in the house; ended with sensation of house being picked up and dropped; rapid motion, lasting about 3 seconds. At Retsil, felt by all. At Veterans Home (Retsil), three very sudden and strong shocks from northwest-southwast, with light upward lift. Also felt at Annapolis, Hansville, Kingston, Kitsap Lake (west of Bremerton), and Tracyton.

August 22: 21:00 (about). Eastsound, Wash. (Orcas Island). V. Felt by several (some outdoors; active). Small objects and furnishings shifted; windows, doors, and dishes rattled; house creaked. Brief duration; moderate earth noises heard 5 seconds before shock.

September 21: 23:35. Ashford, Wash. IV. Felt by and awakened several in community. Doors rattled. Rapid motion.

October 6: 21:07:52*. Epicenter 46°43′ north, 124°02′ west, north end of Willapa Bay, Washington, S. Felt over a land area of approximately 1,800 square miles of Grays Harbor and Pacific counties in western Washington. Maximum intensity (damage) VI at Tokeland, where patio around motel was cracked in several places.

INTENSITY (DAMAGE) VI:

Tokeland (north end of Willapa Bay).—Felt by all; awakened many and frightened few in community. Patio around motel cracked in several places. Rapid motion from west-east, lasting several seconds; moderate earth noises heard by several.

INTENSITY (DAMAGE) V: Aberdeen, Bay Center, Grayland, Menlo, Nahcotta, North Cove, and South Bend.

INTENSITY (DAMAGE) IV: Hoquiam, Ocean Park, Oysterville, Porter, Raymond, and Westport.

INTENSITY (DAMAGE) I TO III: Cosmopolis, Frances, Ocean City, and Satsop (1 mile northeast of).

November 18: 14:15. Gresham, Oreg. Shock reported felt only at Gresham.

ALASKA

(150TH MERIDIAN OR ALASKA STANDARD TIME)

January 7: 13:07:44*. Valdez. Slight shock. Duration 3 seconds.

January 10: 12:33:37*. Bear Cove. Sharp shock. Felt slightly at Homer (5 miles northwest of) and Kasilof (5 seconds duration).

January 13: 00:28:34*. College. V. Felt by many; awakened several. One report of broken dishes. Buildings shaken moderately in the Fairbanks area.

January 19: 16:37:14*. Homer (5 miles northwest of). Slight shock.

January 24: 13:17:29*. Epicenter 60° north, 152° west, Kenai Peninsula, W. Magnitude 6¼–6½. Anchorage. IV. Felt by many. Buildings shook; dishes rattled. Rumbling sounds heard. At the Weather Bureau Airport Station, suspended light fixtures, wall maps, pictures, curtains and venetian blinds swayed. Contents of cabinets rattled. Felt strongly at Eklutna, Girdwood, and Kasilof. The Weather Bureau observer at Kasilof reported shock was sufficiently intense enough to settle the snow cover in the

Candle.—Felt by and awakened many. Bed and curtains swayed.

College.—Felt by and awakened many. Windows, doors, and walls rattled. Hanging objects swung in NE-SW direction.

Farewell.—Felt by many; few awakened. Large wire antenna broken loose; hanging objects swayed; windows rattled.

Hogates.—Felt by all; many awakened. Hanging objects swung NW-SE. Windows, doors, and walls rattled.

Koyukuk.—Felt by, awakened, and frightened many.

Lake Minchumina.—Felt by and awakened nearly all; few frightened. Cracks seen in lake ice. Chair on casters moved several inches. Hanging objects swung in NE-SE direction. Windows rattled.

Manley Hot Springs.—Felt by and awakened many. Small objects shifted. Windows, dishes, and walls rattled. Hanging objects swung. Earth noises heard following heaviest shock.

McGrath.—Felt by and awakened all; many frightened. Trees, antenna poles swayed; bird cage, floor lamps, pictures swung. Windows, doors, and dishes rattled. Aftershock felt at 14:14:20*.

Moses Point.—Felt by and awakened many; few frightened. Hanging objects swung in N-S direction. Buildings rattled.

Nenana.—Felt by many; awakened and frightened few. All radio antennas swung violently; windows and doors rattled; dogs awakened. Hanging objects swung N-S.

Nulato.—Felt by and awakened all; many frightened. Walls and beds shook; windows, dishes rattled. Radio aerials swung. Hanging objects swung in N-S direction. Aftershock felt at 14:14:20*.

Selawik.—Felt by nearly all; many awakened. Buildings rattled; door swung open. Noise of cracking ice heard, but no cracks observed. Hanging objects swung SE-NW.

Talkeetna.—Felt by nearly all; many awakened. Pendulum clock stopped and heavy teletype machine shifted slightly. Hanging objects swung. Windows, doors, dishes and walls rattled. Aftershock felt at 14:14:20*.

Unalakleet.—Felt by and awakened nearly all; few frightened. Hanging objects swung N-S; doors, windows, dishes, and walls rattled.

Venetie.—Felt by and awakened one. River ice noticeably broken in main channel of river. Bed shook.

Wiseman.—Felt by all. Lamps swayed. Hanging objects swing in S-SE direction.

INTENSITY (DAMAGE) I TO IV: Aniak, Anvik, Circle, Eureka, Fort Yukon, Healy, Noorvik, Point Barrow, Rampart, Summit, Teller, Tolovana, and Umiat.

April 8: 20:15:12*. Epicenter 56½° north, 139° west, Gulf of Alaska, W. V. Felt by many; awakened and frightened few at Yakutat. Windows, doors, and dishes rattled; hanging objects swung. Walls and windows of large hangar at airport bulged outward. Disturbed objects observed by many. Felt by many at Sitka where dishes and glassware were dislodged from their positions on shelves; hanging mirror set in motion. Gentle rocking motion reported by many.

April 11: 02:17:57*. Kobuk and Kotzebue. V. Felt by and awakened many; few alarmed at Kotzebue. Windows, doors, dishes and walls rattled. Hanging objects swung north to south. At Kobuk, felt by all. Buildings shook; duration few seconds.

April 12: 23:07:24*. Epicenter 66° north, 156° west, central Alaska, W. Magnitude 6¾. V. Felt by and awakened many at Nulato and Kobuk. Moved cans on shelves at Hughes. Buildings shook; loose objects rattled; lights and fixtures swayed at Galena, Manley Hot Springs, Tanana, and Tolovana. Also felt at College, Fairbanks, Lake Minchumina, and Shungnak.

April 17: 21:39:07*. Anchorage. Felt. Slight tremor.

April 25: 05:39:46*. Homer (5 miles northwest of). Felt. Slight tremor.

May 5: 13:53:29*. Epicenter 57½° north, 136½° west, near coast of southern Alaska, W. V. Felt by nearly all at Chicago and Sitka. Houses shook; dishes rattled. Numerous calls to the Sitka Magnetic Observatory from alarmed residents. Also felt at Haines, Hoonah, Juneau, and Petersburg.

May 10: 12:54:40*. Epicenter 65° north, 152½° west, central Alaska, W. Magnitude 6¼–6½. Manley Hot Springs and Tanana. V. Felt by and frightened many at Manley Hot Springs. Houses shook; hanging objects swung; dishes and doors rattled. Felt by all at Tanana. Pendulum clock stopped; mirror knocked from wall. Also felt at College, Fairbanks, and Hughes.

May 10: 13:13:19*. Epicenter 64½° north, 152½° west, central Alaska, W. V. Felt by all at Manley Hot Springs and Tanana. Also felt at College, Fairbanks, and Hughes.

May 10: 19:23:54*. Epicenter 65° north, 152½° west, central Alaska, W. Magnitude 6¼–6½. Manley Hot Springs. V. Felt by all and frightened many. Canned goods shaken from shelves; windows, doors and dishes rattled. Also felt at College, Fairbanks, and Hughes.

May 10: 19:37:01*. Epicenter 65° north, 151½° west, central Alaska, W. Felt at College.

May 10: 23:08:43*. Epicenter 65° north, 152½° west, central Alaska, W. Felt at College, Fairbanks, Hughes, Manley Hot Springs, and Tanana.

May 11: 02:11:22*. Epicenter 65° north, 153½° west, central Alaska, W. Fairbanks and Tanana. IV. Felt by many; light fixtures swayed; buildings shook.

May 12: 22:15:11* and 22:19. Palmer (4 miles southeast of). Felt. Slight shocks.

July 7: 19:48:58*. Homer (5 miles northwest of). Felt. Slight shock.

July 9: 20:15:51*. Epicenter 58.6° north, 137.1° west, southeastern Alaska, W. Magnitude 7.9. Maximum intensity (damage) XI. A major earthquake, the strongest in this region since the Yakutat shock of September 10, 1899, was felt over an area of 400,000 square miles of southeastern Alaska, as far south as Seattle, Wash., and eastward to Whitehorse, Y.T., Canada. Three people were killed on Khantaak Island, near Yakutat, and a fishing boat with two persons aboard was missing after being caught by a huge wave in Lituya Bay. Effects on works of man relatively slight, as the epicentral region had no permanent settlements other than the village of Yakutat.

INTENSITY (DAMAGE) XI:

Dry Bay (Akwe River).—Numerous cracks, ground heaves and sand blows. One near-shore fissure was so large a truck was reported lost in it. Numerous fumaroles—sulphur odors very strong.

Dry Bay (East River).—Threw people to floor. Cabin collapsed just after inhabitants escaped from it. Land fissured with one hundred 20–30 ft. water spouts.

Lituya Bay.—Precipitation of avalanche material and large scale breakup along the Lituya Glacier face combined to generate a series of waves which must have reached a maximum height of at least 200 feet. A 40-foot fishing boat anchored in Anchorage Cove was carried just in front of the largest wave crest and two persons aboard estimated they cleared La Chaussee Spit (mouth of Lituya Bay) at an altitude of 100 feet or more. Another fishing boat with two persons aboard was missing after the wave passed. No trace of the vessel or its passengers has been found. Across the bay and slightly inland a 3200-foot cliff was denuded to a height of 1,800 feet, either by avalanche, wave action, or by a combination of the two.

Yakutat.—Felt by and alarmed all. Some damage to several bridges, docks, oil lines; one water tower destroyed (fell toward the east). A few cabins destroyed. Windows cracked and frames buckled; furniture and dishes broken. Eleven hundred closely stacked helium cylinders fell with a dominant south direction. Surface fissures noted in village with an ESE and WNW elongation. At the airport area, about 10 miles to the south, numerous small cracks were noted running WNW. Large concrete blocks forming the runways were buckled in the same direction. The "Millpond" about 300 yards northeast of the runway evidenced "seiching." Large logs were thrown up on the banks four feet above water level. Water in ditches flattened the grass and brush as much as two feet above water level. Many large trees (majority of them dead) were snapped off or up-rooted. Ramp at airport undulated with individual slabs rising and falling in a wavelike motion.

Yakutat Bay (Khantaak Island).—According to eyewitnesses, about 500 yards of the south end of Khantaak Island "heaved 20 feet into the air and then fell into the bay," carrying three persons with it. Rescue efforts were hampered by the general turbulence and an estimated wave of four feet in height. Across the bay a two mile section of beach between Points Manby and Blizhi slumped into the water.

INTENSITY (DAMAGE) IX:

Haines.—Felt by and alarmed all. Submarine cables broken in the Haines–Skagway area.

Icy Point (12½ miles out of).—Violent shock. Observer reported it "felt like they were riding on top of a big explosion; rumblings under the water. Loud roars from mountainside breaking away—ice and rocks falling into sea with roll throwing up a wall of water."

Lena Point (north of Juneau).—Submarine cables of the Alaska Communication System were severed and telephone communications cut between Juneau and Alaska cities to the north.

Skagway.—Cable broken. Many landslides.

INTENSITY (DAMAGE) VII:

Baranof.—Felt by and alarmed all. Landslides and tidal disturbances noted in Warm Springs Bay and Baranof Lake. Buildings and trees swayed in N-S direction. Bells rung in house.

Juneau.—Felt by and alarmed all. Serious panic in theatre. Rock slides in high areas. Merchandise thrown from shelves; windows and dishes broken. Pendulum clock stopped; radio tower swayed violently. At Auk Bay, 3 miles west of airport, chimney toppled and some damage to dock was reported.

Pelican.—Felt by and alarmed all. Several people reported injured. "Great loss of equipment and materials."

Sitka.—Felt by and alarmed many. Minor seismic sea wave reported. Maximum rise and fall of tide was approximately ½ foot. Numerous reports of broken dishes, bottles and store merchandise; one

chimney toppled; and concrete basement cracked. Chandeliers and light fixtures swung; water splashed from goldfish bowls.

INTENSITY (DAMAGE) VI:

Excursion Inlet.—"Very little destruction noted by residents."

INTENSITY (DAMAGE) V:

Annex Creek.—Felt by all.

Cape Decision.—Felt by all.

Cape Saint Elias.—Felt by all.

Cordova.—Felt by many. Trees swayed.

Girdwood.—Felt by all.

Little Port Walter.—Felt by all.

Petersburg.—Felt by and alarmed many. People fled to the streets.

Point Retreat L/S.—Felt by all.

Sterling.—Felt by all.

Valdez.—Felt by all.

Wrangell.—Felt by all.

INTENSITY (DAMAGE) V IN WASHINGTON:

Orcas Island.—Two severe shocks reported, one lasting 6 seconds; the other, 10 seconds. The second shock almost knocked vase from table. Five-foot-deep spring well riled.

INTENSITY (DAMAGE) IV IN WASHINGTON:

Seattle.—Twenty musicians in floating concrete orchestra pit at the Agua Theater were noticeably disturbed by undulation of the pit, which lasted for about 5 minutes. (Stage built on piling but not the pit.)

INTENSITY (DAMAGE) I TO IV: Angoon, Anchorage, and Ketchikan.

July 12: 22:10:02*. Epicenter 58.3° north, 136.9° west, southeastern Alaska, W. Magnitude 5½–5¾ (Berk). Felt at Sitka.

July 13: 10:10 and 10:20. Annex Creek. Mild tremor.

July 15: 20:17:18*. Eklutna Project. Sharp shock. Felt at Girdwood (mild tremor) and 4 miles southeast of Palmer (15 seconds duration).

July 17: 03:48:45*. Epicenter 57½° north, 137° west, southeastern Alaska, W. Felt at Juneau and Sitka.

July 18: 07:03:58*. Epicenter 58½° north, 138½° west, southeastern Alaska, W. Felt at Juneau.

July 31: 05:48:32*. Epicenter 61½° north, 151° west, southern Alaska, W. Felt at Anchorage, Eklutna Project, and 4 miles southeast of Palmer (two sharp shocks).

August 31: 13:00:16*. Epicenter 63° north, 144½° west, central Alaska, W. Magnitude 5¾–6 (Berk). Tanacross. V. Felt by and alarmed many. Buildings creaked; loose objects rattled. Moderately loud subterranean sounds occurred before the earthquake.

August 31: 16:30. Tanacross. V. Felt by and alarmed many. Buildings shook; windows rattled. Trembling motion; gradual onset.

September 1: 23:42 (BST). Felt on Adak. Slight tremor.

September 7: 02:40. Eklutna Project. Felt. Slight shock.

September 10: 18:30. Valdez. Felt. Series of slight tremors—duration 30 seconds.

October 4: 02:58:24*. Epicenter central Alaska, W. Anchorage. IV. Felt by many; abrupt onset; trembling motion. Felt by several at College.

October 5: 05:32:08*. Felt by several at College.

October 6: 22:46:31*. Felt at College.

October 7: 13:17 (BST). Felt on Adak. Slight tremor.

October 19: 14:55:34*. Epicenter 52° north, 175° west, Andreanof Islands, Aleutian Islands, W. Felt on Adak.

October 26: 11:55. Palmer (4 miles southeast of). Felt. Slight tremor.

October 26: 20:35 (BST). Felt on Adak. Slight tremor.

November 5: 05:00. Valdez. Slight tremor. Duration 5 seconds.

November 19: 05:02:15*. Epicenter 60½° north, 150½° west, Kenai Peninsula, W. Depth about 60 km. Venta. V. Felt by and awakened many. Bottles on shelves moved but did not fall; bunks shaken severely; hanging objects swayed. Felt at Girdwood, Homer (5 miles northwest of), Kasilof, Seward, and Sterling.

November 23: 12:15. Venta. Felt. Two slight shocks.

November 25: 19:15 (YST). Yakutat. V. Felt by many; few alarmed. Buildings shook; loose objects rattled.

November 29: 03:52:43*. Felt at Haines, Haines Terminal, and Skagway.

November 29: 04:34. Felt on Adak. Slight shock.

December 11: 11:00:24*. Felt on Adak. Slight shock.

December 21: 16:41:29*. Epicenter 66° north, 147° west, central Alaska, W. Felt by few at Fairbanks.

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 U. S. Geological Survey. For additional information, see the Hawaiian Volcano Observatory Summary 9 through 12.

January 14: 02:26:59*. Felt near Hawaii National Park Headquarters. Origin north rim of Kilauea caldera.

January 20: 04:54:17*. Felt at Hakalau. Origin near Laupahoehoe.

February 11: 14:10:39*. Felt at Hawaii National Park Headquarters and Kilauea Military Camp. Origin northeast rim of Kilauea caldera.

February 15: 16:48:38*. Felt at Naalehu and Pahoa. Origin southeast of Naalehu.

February 20: 07:19:23*. Felt at Kamuela. Origin northwest of Honokaa.

February 23: 04:00:35*. Awakened many on Oahu. Origin northeast of Ulupau Head, Oahu.

March 9: 09:43:52*. Felt in Hilo. Origin southwest of Kalapana.

March 10: 03:09:04*. Felt at Honokaa. Origin west of Keanakolu.

March 11: 22:13:01*. Felt at Honokaa. Origin west of Keanakolu.

March 12: 21:05:46*. Felt at Honokaa. Origin west of Keanakolu.

March 12: 23:19:20*. Felt at Honokaa. Origin west of Keanakolu.

March 13: 08:10:21*. Felt at Honokaa. Origin west of Keanakolu.

March 13: 15:08:33*. Felt east of Kilauea caldera. Origin near Puu Kulani.

March 29: 13:29:46*. Felt in Hilo. Origin northeast of Apua Point.

April 21: 06:06:36*. Felt in Hilo. Origin northwest of Apua Point.

April 24: 03:06:33*. Felt over most of the island of Hawaii. Origin north of Laupahoehoe.

June 3: 22:51:49*. Felt on the north rim of Kilauea caldera. Origin north rim of Kilauea caldera.

June 3: 22:55:10*. Felt on the north rim of Kilauea caldera. Origin north rim of Kilauea caldera.

July 2: 14:11:48*. Epicenter 19°25′ north, 154°48′ west. Felt in Hilo, Pahoa, and the Volcano District. Origin south of Cape Kumukahi.

July 13: 04:20:52*. Felt in Kealakekua. Origin west of Kailua. Kona.

July 16: 19:17:58*. Felt in Captain Cook. Origin north of Naalehu.

August 11: 09:01:28*. Felt near Kilaueu. Origin southwest of the Outlet seismograph station.

August 20: 09:46:07*. Felt near the east rim of Kilauea caldera and in Hilo. Origin beneath Kilauea caldera.

August 20: 13:13:55*. Felt near the east rim of Kilauea caldera. Origin beneath Kilauea caldera.

August 21: 00:42:57*. Felt in Kealakekua and Captain Cook. Origin near Hookena.

September 8: 16:06:10*. Felt south of Hawaii National Park Headquarters. Origin near the northeast rim of Kilauea caldera.

September 9: 11:07:39*. Felt at Hawaii National Park Headquarters. Origin near the northeast rim of Kilauea caldera.

September 28: 20:48:06*. Felt from Hilo to Kealakekua. Origin north of Naalehu.

October 22: 22:14:47*. Felt in Kealakekua. Origin west of Hookena.

October 22: 23:43:28*. Epicenter 19°12.5′ north, 155°19′ west. Felt from Hawaii National Park to Kealakekua. Origin south of Kilauea.

October 23: 12:23:23*. Epicenter 19°12.5′ north, 155°19′ west. Felt at Pahala.

November 2: 05:55:44*. Felt from Hawaii National Park to Hilo. Origin southeast of Uwekahuna.

November 14: 20:47:47*. Felt at Kealakekua. Origin southwest of Kealakekua.

December 27: 09:17:24*. Felt from Hilo to Kealakekua. Origin northwest of Hilo.

PANAMA CANAL ZONE

(60TH MERIDIAN TIME)

January 27: 04:31:37*. Intensity (damage) I at Balboa Heights.

February 9: 00:15:05*. Epicenter 8° north, 79½° west, south of Panama, W. Intensity (damage) IV at all Canal Zone towns, Santa Clara and Rio Hato, and the southwest coast of Panama.

May 19: 09:28:14*. Intensity (damage) II at Balboa Heights.
July 14: 21:21:28*. Felt at Boquet and El Volcan, Panama.
September 11: 21:16:17*. Felt at El Volcan, Panama.
November 13: 17:47:17*. Intensity (damage) I at Balboa Heights.

PUERTO RICO

(60TH MERIDIAN TIME)

March 25: 14:42:27*. Epicenter 18° north, 64½° west, Virgin Islands, W. Felt at San Juan.

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 1958.

Resurveys were made over the closely spaced monuments in the vicinity of Palmdale, Calif. This operation included triangulation, traverse and leveling. A comparison of the 1958 traverse measurements with those made in 1947 does not disclose any significant movement. These two sets of observations were also compared with the original measurements made in 1938. In a few instances there is indication of systematic movement during the 20 year period. However, if any conclusive results are to be obtained, the survey data with the small changes should be correlated with the fault structures in that locality. Such studies have not been made.

Releveling was started in October 1958 and continued into 1959 on a net of precise level lines in the Galveston-Houston, Texas region. This releveling was of first-order accuracy and totaled 1,280 miles of lines. This is an area scheduled for releveling at 5-year intervals, the previous releveling was in 1953–54. The maximum settlement, as noted through previous leveling, was near Texas City, Texas, and amounted to 3.0 ft. from 1943 to 1954. The releveling of 1958–59 shows a maximum settlement since 1954 of 1.5 ft. in the vicinity of Pasadena, Texas.

Releveling was continued in 1958 in the Delta area and the San Joaquin Valley of California from Fairfield to Kettleman City in connection with settlement studies. The total releveling undertaken in California in 1958 was 972 miles of first-order and 385 second-order. The maximum settlement was 14.00 ft. from 1943 to 1958. The earthquake cross line in the vicinity of Palmdale, Calif., was also releveled in 1958 with very small changes noted.

TIDAL DISTURBANCES OF SEISMIC ORIGIN

Following a large earthquake in southeastern Alaska on July 10 (06:15:51 GCT), Lituya Bay was overrun by a huge wave that covered La Chaussee Spit. (See p. 32.) There was a seismic sea wave with an amplitude of about 1 ft. recorded on the tide gage at Yakutat and a wave with a smaller amplitude recorded at Sitka.

Earthquakes on November 6 (22:58:06 GCT) and November 12 (20:23:26 GCT) in the Kurile Islands caused weak seismic sea waves in the Aleutians, on the Pacific coasts of North and South America and on various Pacific islands.

An earthquake on November 4 (22:54:46 GCT) in the South Pacific, 50° south, 115° west, set up weak seismic sea waves that were recorded on several tide gages.

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 U.S. 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 1944 through 1949 appeared in United States Earthquakes, 1949. Data for the years subsequent to 1950 were published annually in United States Earthquakes, 1950 through 1957.

WELL DESCRIPTIONS

ALABAMA

Well No. Tal–2, artesian, Sylacauga, NE¼SW¼ Sec. 29, T. 21 S., R. 4 E. Owner, City of Sylacauga. Depth, 202 feet; diameter, 6 to 3 inches; depth of casing, 69 feet; finish, open hole. Aquifer, Sylacauga marble member of Talladega slate; Cambrian or Ordovician.

Well No. Tus–2, nonartesian, Tuscaloosa, NE¼SW¼ Sec. 29, T. 21 S., R. 10 W. Owner, B. F. Goodrich Tire and Rubber Co. Depth, 90 feet; diameter, 6 inches; depth of casing, 72 feet; finish, 5 inch screen from 58 to 71 feet. Aquifer, standard gravel; Quaternary.

CALIFORNIA

Well No. 5/28–3362, water table, 2.35 miles NNE of Goleta, 34°28′13″N, 119°40′15″W. Owner, Rancho del Cierro. Depth, 132.8 feet; diameter, 12 inches; depth of casing, 132.8 feet; finish unknown. Aquifer, sand, gravel and sandstone; Quaternary alluvium and Miocene Vaqueros sandstone.

Well No. 8/10–8R3, semiconfined, Edwards, SE¼SE¼ Sec. 8, T. 8 N., R. 10 W., SBB and M. Owner, Edwards Air Force Base. Depth, 230 feet; diameter, 14 inches; depth of casing, 230 feet; finish, open bottom. Aquifer, sand, silt, and clay; Quaternary alluvium and lacustrine deposits.

Well No. 9/10–12R1, semiconfined, Edwards, SE¼SE¼ sec. 12, T. 9 N., R. 10 W., SBB and M. Owner, Edwards Air Force Base. Depth, originally 252 feet, measured, 186.6 feet; diameter, 16 inches; depth of casing, 252 feet; finish, gravel pack. Aquifer, sand and gravel; Pleistocene.

Well No. 9/10–24N1, semiconfined, Edwards, SW¼SW¼ Sec. 24, T. 9 N., R. 10 W., SBB and M. Owner, Edwards Air Force Base. Depth, 127.4 feet; diameter, 7 inches; depth of casing, 150 feet; finish, open bottom, now filled with sand. Aquifer, sand, silt, and clay; Quaternary alluvium and playa or lacustrine deposits.

Well No. 14/13–26N1, Fresno County, SW¼SW¼ Sec. 26, T. 14 S., R. 13 E., MDB and M. Owner, Pilibos Bros. Depth, 1410 feet; diameter, 16 inches; finish, perforated casing, gravel packed. Aquifer, undifferentiated alluvium; Recent and Pleistocene (?).

Well No. 23/25–17Q1, Tulare County, SW¼SE¼ Sec. 17, T. 23 S., R. 25 E., MDB and M. Owner, E. K. Tompson Estate. Depth, 615 feet; diameter, 16 inches; finish, open bottom. Aquifer, undifferentiated alluvium; Recent and Pleistocene (?).

Well No. 23/25–17Q3, Tulare County, SW¼SE¼ Sec. 17, T. 23 S., R. 25 E., MDB and M. Owner, E. K. Tompson Estate. Depth, 355 feet, diameter, 16 inches; finish, open bottom. Aquifer, undifferentiated alluvium; Recent and Pleistocene (?).

Well No. 24/26–34F1, Tulare County, NE¼SW¼ Sec. 34, T. 24 S., R. 26 E., MDB and M. Owner, Lanza Vineyards. Depth, 1510 feet; diameter, 16 inches; finish, perforated casing, 400 to 1510 feet. Aquifer, undifferentiated alluvium; Recent and Pleistocene (?).

Well No. 25/26–1A2, Tulare County, NE¼NE¼ Sec 1, T. 25 S., R. 26 E., MDB and M. Owner,

Midstate Horticultural. Depth, 892 feet; diameter, 16 inches; finish, unknown. Aquifer, undifferentiated alluvium; Recent and Pleistocene (?).

IDAHO

Well No. 7N–36E–22ac2, nonartesian, Jefferson County near Hamer, 43°55′N, 112°13′W. Owner, J. L. Sanders. Depth, 35 feet; diameter, 8 inches; depth of casing, 18 feet; finish, open end. Aquifer, basalt with interbedded sand, clay and gravel; Snake River basalt; Quaternary.

Well No. 4S–24E–6bb1, nonartesian, Minidoka County, 43°06′N, 113°39′W. Owner, U.S. Government. Depth, 445.1 feet; diameter, 6 inches; depth of casing, 444.3 feet; finish, perforations, 420 to 444 feet. Aquifer, lava and cinders; Snake River basalt; Quaternary.

Well No. 5S–23E–17ca1, nonartesian, Lincoln County, 42°59′N, 113°45′W. Owner, U.S. Government. Depth, 332.7 feet; diameter, 6 inches; depth of casing, 332.7 feet; finish, perforations, 312 to 332 feet. Aquifer, lava with interbedded clay; Snake River basalt; Quaternary.

Well No. 8S–14E–16bc1, nonartesian, Gooding County, 42°44′N, 120°50′W. Owner, Sand Springs Ranch. Depth, 53 feet; diameter, 5 inches; depth of casing, 49.7 feet; finish, open end aluminum. Aquifer, Snake River basalt; Quaternary.

Well No. 10S–20E–5ba1, nonartesian, Jerome County near Hazelton, 42°35′N. 114°09′W. Owner, Kenneth Fine. Depth, 325 feet; diameter, 6 inches; depth of casing, 300 feet; finish, open hole. Aquifer, Snake River basalt; Quaternary.

NEW JERSEY

Well No. 25.14.8.2.2, artesian, Loveland and East Street, Madison, 40°45′55″N., 74°25′00″W. Owner, Borough of Madison. Depth, 181 feet; diameter, 12 inches; finish, unknown. Aquifer, Wisconsin terminal moraine.

Well No. 25.14.9.4.1, artesian, John Avenue, Madison, 40°45′03″N., 70°23′03″W. Owner, Borough of Madison. Depth, unknown; diameter, 5 inches, finish, unknown. Aquifer, Wisconsin terminal moraine.

Well No. 29.1.4.4.2, nonartesian, near Runyon Pond, Middlesex County, 40°25′14″N., 74°19′40″W. Owner, Perth Amboy Water Works. Depth, 24 feet; diameter, 6 inches; finish ,unknown. Aquifer, Old Bridge sand; Raritan formation.

Well No. 36.13.2.9.1, Pleasantville, 39°24′39″N., 74°30′44″W. Owner, Atlantic City Water Department. Depth, 680 feet; diameter, 10 inches; finish, unknown. Aquifer, Atlantic City 800 feet sand; Kirkwood formation; Tertiary.

Well No. 37.22.3.9.7, artesian, Middle Township, Cape May County, 39°06′08″N., 74°48′37″W. Owner, U.S. Geological Survey. Depth, 232 feet; diameter, 6 inches; depth of casing, 217 feet; finish, screen from 217 to 232 feet. Aquifer, Cohansey sand; Miocene (?).

Well No. 37.31.3.5.5, artesian, Lower Township, Cape May County, 39°01′00″N., 74°53′00″W. Owner, U.S. Geological Survey. Depth, 255 feet; diameter, 6 inches; depth of casing, 240 feet; finish, screen from 240 to 255 feet. Aquifer, Cohansey sand; Miocene (?).

Well No. 37.31.8.1.2, West end of Cape May Canal, Cape May, 38°57′57″N., 74°57′40″W. Owner, U.S. Geological Survey. Depth, 252 feet; diameter, 6 inches; depth of casing, 242 feet; finish, screen from 242 to 252 feet. Aquifer, Cohansey sand; Miocene (?).

Well No. 37.31.8.7.2, artesian, Sunset Blvd., Cape May Point, 38°56′29″N., 74°57′40″W. Owner, Borough of Cape May Point. Depth, 277 feet; diameter, 6 inches; depth of casing, 247 feet; finish, screen 247 to 277 feet. Aquifer, Cohansey sand; Miocene (?).

Well No. 37.31.9.7.7, artesian, Sunset Blvd., West Cape May, 38°56′07″N., 74°55′56″W. Owner, U.S. Geological Survey. Depth, 293 feet; diameter, 6 inches; depth of casing, 283 feet; finish, screen from 283 to 293 feet. Aquifer, Cohansey sand; Miocene (?).

WISCONSIN

Well No. Lf–183, semiartesian; New Diggings, SE¼SE¼, Sec. 27, T. 1 N., R. 1 E. Owner, New Jersey Zinc, Lead, and Smelting Company. Depth, 130 feet; diameter, 6 inches; finish, open. Aquifer, Galena limestone and dolomite; Decorah and Platteville formations; Ordovician.

TABLE 1.—*Fluctuations in well-water levels, January 1 through December 31, 1958*

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.

ALABAMA

Well No.	Date	Time G. C. T.	Depth to water				
			Before disturbance	After disturbance	At highest point	At lowest point	Amplitude of fluctuation
Mon-3	Jan. 23, 1958	08:00	59.54	59.54	59.50	59.61	0.11
Tus-2	Feb. 26, 1958	17:00	24.40	24.40	24.37	24.42	.05
Tus-1	Feb. 26, 1958	19:00	17.44	17.44	17.42	17.47	.05
Col-1	April 7, 1958	15:00	10.88	10.88	10.59	11.18	.59
Elm-1	do	15:00	6.84	6.84	6.79	6.89	.10
Mar-1	do	15:00	6.70	6.70	6.69	6.71	.02
Mon-1	do	15:00	59.20	59.20	59.17	59.23	.06
Col-1	July 10, 1958	06:20	16.25	16.25	15.29	17.09	1.80
Elm-1	do	06:20	8.67	8.67	8.57	8.77	.20
Mar-1	do	06:20	7.27	7.27	7.21	7.32	.11
Mon-1	do	06:20	59.50	59.50	59.39	59.60	.21
Tal-2	do	06:20	19.08	19.08	18.95	19.20	.25

CALIFORNIA

15/16-34E1	Jan. 15, 1958	03:00	160.31	160.33	160.30	160.36	0.06
15/16-34E1	Jan. 17, 1958	04:00	160.39	160.42	160.39	160.43	.04
14/13-28P1	do	10:00	392.40	392.42	392.37	392.45	.08
14/13-28P1	Jan. 24, 1958	07:00	393.48	393.49	393.47	393.52	.05
18/18-31P1	Jan. 27, 1958	05:00	172.72	172.74	172.68	172.76	.08
18/18-31P1	Feb. 1, 1958	02:00	172.71	172.72	172.70	172.73	.03
14/13-28P1	do	05:00	393.65	393.80	393.56	393.80	.24
14/13-26N1	Feb. 9, 1958	02:00	396.44	396.42	396.28	396.44	.16
14/13-28P1	do	09:00	393.33	393.39	393.35	393.43	.08
15/16-34E1	Feb. 11, 1958	13:00	160.30	160.28	160.25	160.33	.08
15/16-20R1	Feb. 19, 1958	22:00	52.92	52.90	52.90	52.98	.08
15/16-34E1	Feb. 26, 1958	10:00	159.86	159.87	159.84	159.89	.05
14/13-28P1	Mar. 10, 1958	08:00	390.55	390.52	390.50	390.59	.09
14/13-28P1	Mar. 11, 1958	05:00	390.24	390.22	390.20	390.29	.09
14/13-28P1	Mar. 16, 1958	04:00	389.20	388.90	388.90	389.25	.35
15/16-34E1	Mar. 20, 1958	15:00	158.50	158.74	158.39	158.74	.35
14/13-28P1	Mar. 21, 1958	16:00	386.78	386.63	385.65	388.19	2.54
2/7-2C1	Apr. 7, 1958	19:00	36.78	36.78	36.75	36.80	.05
24/26-34F1	Apr. 14, 1958	15:00	252.84	252.84	252.57	254.26	1.69
18/18-31P1	Apr. 21, 1958	23:00	163.00	162.98	162.85	164.87	2.02
15/16-20R1	May 7, 1958	15:00	52.56	52.54	52.51	52.59	.08
23/25-17Q1	May 8, 1958	24:00	123.44	123.52	123.44	123.60	.16
15/16-34E1	May 18, 1958	10:00	155.47	155.45	155.40	155.50	.10
14/13-28P1	May 26, 1958	07:00	384.60	384.60	384.60	384.83	.23
8/10-8R3	do	11:00	51.38	51.38	51.37	51.38	.01
9/10-24N1	May 30, 1958	24:00	33.58	33.58	33.54	33.62	.08
23/25-17Q3	May 31, 1958	23:00	117.29	117.28	116.44	117.43	.99
24/26-34F1	June 1, 1958	11:00	263.20	262.40	262.30	263.20	.90
24/26-34F1	June 8, 1958	01:00	263.48	263.49	263.25	263.82	.57
24/26-34F1	June 20, 1958	15:00	266.05	266.00	265.92	266.82	.90
14/13-28P1	June 23, 1958	19:00	396.77	396.64	396.64	396.81	.17
11/5-2B1	July 4, 1958	20:00	9.60	9.60	9.58	9.69	.11
15/16-20R1	July 10, 1958	04:00	57.72	57.73	57.67	57.81	.14
23/25-17Q3	do	05:00	121.33	121.35	121.29	121.42	.13
2/7-2C1	do	06:00	38.18	38.18	38.10	38.27	.17
18/18-31P1	do	14:00	167.99	168.01	167.98	168.02	.04
5/28-34N1	do	20:00	8.81	8.79	8.77	8.85	.08
11/5-2B1	July 19, 1958	06:00	8.55	8.55	8.48	8.76	.28
14/13-28P1	Aug. 28, 1958	10:00	411.77	411.77	411.75	411.82	.07
15/16-34E1	do	11:00	161.03	161.03	161.01	161.07	.06

Footnotes at end of table.

TABLE 1.—*Fluctuations in well-water levels, January 1 through December 31, 1958*—Continued

CALIFORNIA—Continued

Well No.	Date	Time G. C. T.	Depth to water				
			Before disturbance	After disturbance	At highest point	At lowest point	Amplitude of fluctuation
15/16-34E1	Sept. 7, 1958	10:00	162.18	162.18	162.13	162.22	.09
18/18-31P1	Sept. 8, 1958	24:00	176.38	176.39	176.36	176.41	.05
14/13-26N1	Oct. 2, 1958	07:00	363.73	363.72	363.71	363.76	.05
14/13-26N1	Oct. 4, 1958	06:00	362.85	362.83	362.82	362.91	.09
18/18-31P1	Oct. 7, 1958	15:00	176.72	176.71	176.69	176.73	.04
11/5-2B1	Oct. 9, 1958	16:00	12.89	12.89	12.84	13.05	.21
24/26-34F1	Oct. 14, 1958	12:00	265.75	265.75	263.50	270.00	6.50
24/26-34F1	Oct. 27, 1958	10:00	261.72	261.62	261.56	263.71	2.15
5/28-33L2	Nov. 6, 1958	22:00	7.09	7.10	7.08	7.12	.04
15/16-20R1	.....do.....	23:00	58.17	58.16	58.10	58.21	.11
5/28-34N1	.....do.....	24:00	10.34	10.36	10.32	10.38	.06
14/13-26N1	Nov. 19, 1958	02:00	373.12	373.11	373.09	373.18	.09
18/18-31P1	.....do.....	19:00	177.04	177.03	177.02	177.05	.03
11/5-2B1	Nov. 20, 1958	16:00	13.50	13.50	13.36	13.65	.29
18/18-31P1	Nov. 21, 1958	02:00	177.03	177.03	177.02	177.05	.03
9/10-12R1	.....do.....	24:00	36.28	36.28	36.24	36.34	.10
18/18-31P1	Nov. 23, 1958	02:00	174.34	174.38	174.33	174.38	.05
18/18-31P1	Nov. 24, 1958	03:00	174.24	174.25	174.23	174.27	.04
18/18-31P1	.....do.....	22:00	174.11	174.09	174.08	174.16	.08
18/18-31P1	Dec. 31, 1958	04:00	170.82	170.81	170.80	170.84	.04
NORTHERN FLORIDA							
D206	Jan. 15, 1958	19:40	12.20	12.19	12.14	12.26	0.12
P45	.....do.....	17:45	65.80	65.80	65.76	65.84	.08
L7	Jan. 18, 1958	16:00	159.67	159.72	159.48	159.94	.46
D206	Jan. 19, 1958	13:30	12.49	12.51	12.42	12.59	.17
H30	.....do.....	15:00	+7.48	+7.45	+7.50	+7.40	.10
H500	.....do.....	14:15	51.67	51.69	51.63	51.73	.10
M92	.....do.....	14:40	42.45	42.47	42.43	42.53	.10
O47	.....do.....	14:20	5.94	5.96	5:94	5.97	.03
P246	.....do.....	14:50	26.26	26.23	26.21	26.28	.07
P45	.....do.....	14:30	66.04	66.06	65.94	66.14	.20
S9	.....do.....	14:40	2.00	2.04	2.00	2.05	.05
T35	.....do.....	14:10	18.86	18.90	18.56	19.20	.64
T36	.....do.....	14:45	14.62	14.63	14.60	14.66	.06
V31	.....do.....	14:00	5.10	5.11	5.08	5.12	.04
D206	.....do.....	13:50	12.51	12.52	12.50	12.54	.04
H500	.....do.....	14:30	51.69	51.69	51.68	51.70	.02
P45	.....do.....	15:00	66.07	66.08	66.06	66.09	.03
T35	.....do.....	14:30	18.90	18.90	18.80	18.95	.15
D206	Apr. 7, 1958	15:30	11.46	11.48	11.38	11.55	.17
G30	.....do.....	16:30	7.43	7.49	7.41	7.53	.12
H30	.....do.....	16:00	+9.48	+9.46	+9.54	+9.40	.14
H500	.....do.....	15:00	49.90	49.90	49.77	50.00	.23
M92	.....do.....	16:30	40.95	40.96	40.88	41.07	.19
O47	.....do.....	14:30	3.12	3.13	3.10	3.15	.05
P16	.....do.....	15:30	64.50	64.51	64.40	64.60	.20
P13	.....do.....	15:45	8.82	8.80	8.71	8.92	.21
P246	.....do.....	16:45	25.01	24.98	24.91	25.09	.18
P45	.....do.....	16:30	64.91	64.92	64.73	64.92	.19
S9	.....do.....	16:00	1.03	1.05	0.99	1.08	.09
T35	.....do.....	16:00	18.00	17.95	17.46	18.45	.99
T36	.....do.....	16:00	14.50	14.49	14.44	14.56	.12
V31	.....do.....	16:00	4.73	4.74	4.70	4.78	.08
P45	Apr. 14, 1958	21:00	65.13	65.13	65.12	65.15	.03
D206	July 10, 1958	06:00	12.65	12.64	12.48	12.89	.41
E74	.....do.....	06:50	89.07	89.11	89.07	89.12	.05
G30	.....do.....	06:30	10.40	10.45	10.16	10.72	.56

Footnotes at end of table.

TABLE 1.—*Fluctuations in well-water levels, January 1 through December 31, 1958*—Continued

NORTHERN FLORIDA—Continued

Well No.	Date	Time G. C. T.	Depth to water				
			Before disturbance	After disturbance	At highest point	At lowest point	Amplitude of fluctuation
H30	July 10, 1958	06:50	+6.58	+6.60	+6.92	+6.25	.67
H500	do	06:50	52.75	52.75	52.12	53.25	1.13
M92	do	07:00	43.88	43.87	43.37	44.21	.84
O47	do	06:30	5.20	5.21	5.11	5.31	.20
P16	do	07:00	65.28	65.26	64.92	65.46	.54
P13	do	07:00	9.38	9.38	9.08	9.71	.63
P45	do	06:30	66.78	66.77	66.49	67.00	.51
T35	do	06:30	5.25	5.21	4.10	7.30	3.20
T36	do	07:00	12.79	12.75	12.50	13.05	.55
V31	do	06:30	5.20	5.21	5.05	5.39	.34
D206	Nov. 6, 1958	23:30	12.68	12.70	12.50	12.88	.38
H30	do	23:10	+8.93	+8.91	+9.02	+8.84	.18
H500	do	23:50	51.18	51.21	51.14	51.57	.43
M92	do	23:40	42.09	42.11	42.05	42.18	.13
O47	do	24:00	5.35	5.34	5.29	5.41	.12
P45	do	23:40	67.38	67.40	67.18	67.61	.43
S9	do	23:45	1.98	1.99	1.95	2.01	.06
T35	do	23:30	19.40	19.30	19.20	19.54	.34
T36	do	23:30	12.12	12.15	12.09	12.15	.06
V31	do	23:45	4.85	4.85	4.82	4.91	.09
SOUTHERN FLORIDA [1]							
F210	Jan. 19, 1958	14:30	1.70	1.70	1.75	1.65	0.10
F291	do	14:30	2.40	2.40	2.46	2.34	.12
G518	do	14:30	2.03	2.03	2.04	2.01	.03
G553	do	14:30	5.73	5.73	5.75	5.70	.05
S19	do	14:30	1.42	1.42	1.46	1.36	.10
C130	Apr. 7, 1958	15:45	3.56	3.56	3.58	3.54	.04
F210	do	15:45	1.62	1.62	1.93	1.32	.61
F291	do	15:45	2.02	2.02	2.27	1.76	.51
G518	do	15:45	1.88	1.88	2.00	1.75	.25
G553	do	15:45	4.81	4.81	4.94	4.72	.22
G580	do	15:45	2.81	2.81	3.12	2.46	.66
S19	do	15:45	1.37	1.37	1.82	0.84	.98
S329	do	15:45	2.41	2.41	2.57	2.24	.33
F210	July 10, 1958	06:45	2.10	2.10	2.97	1.29	1.68
F291	do	06:45	2.18	2.18	2.74	1.57	1.17
G553	do	06:45	7.33	7.33	7.64	7.06	.58
G580	do	06:45	4.19	4.19	4.76	3.26	1.50
L414	do	06:45	18.44	18.44	18.74	18.32	.15
S19	do	06:45	1.88	1.88	2.53	1.23	1.30
S68	do	06:45	1.49	1.49	1.91	1.12	.79
S329	do	06:45	2.89	2.89	3.29	2.47	.82
F210	Nov. 6, 1958	23:30	1.94	1.94	1.99	1.89	.10
F291	do	23:30	2.00	2.00	2.02	1.96	.06
G553	do	23:30	4.53	4.53	4.54	4.52	.02
S19	do	23:30	0.93	0.93	0.97	0.87	.10
S68	do	23:30	−0.13	−0.13	−0.10	−0.15	.05
S329	do	23:30	1.27	1.27	1.29	1.23	.06
F291	Dec. 11, 1958	17:30	1.93	1.93	1.94	1.91	.03
S19	do	17:30	1.63	1.63	1.64	1.62	.02
GEORGIA							
119	Jan. 19, 1958	14:00	41.19	41.19	41.08	41.32	0.24
120	do	14:00	38.78	38.78	38.68	38.89	.20
291	do	14:00	30.74	30.75	30.63	30.83	.20

Footnotes at end of table.

TABLE 1.—*Fluctuations in well-water levels, January 1 through December 31, 1958*—Continued

GEORGIA—Continued

Well No.	Date	Time G. C. T.	Depth to water				
			Before disturbance	After disturbance	At highest point	At lowest point	Amplitude of fluctuation
119	Jan. 19, 1958	14:30	41.19	41.19	41.17	41.20	.03
120	do	14:30	38.78	38.78	38.75	38.82	.07
291	do	14:30	30.74	30.74	30.69	30.78	.09
119	Apr. 7, 1958	16:00	37.41	37.45	37.19	37.66	.47
120	do	16:00	30.63	30.63	30.46	30.80	.34
291	do	16:00	26.42	26.47	26.17	26.65	.48
119	Apr. 14, 1958	22:00	29.89	29.88	29.85	29.93	.08
120	Apr. 15, 1958	04:00	29.52	29.51	29.50	29.54	.04
291	July 8, 1958	08:00	47.98	47.98	47.92	48.07	.15
119	July 10, 1958	06:00	40.55	40.54	40.05	41.05	(1.00)
291	do	07:00	48.12	48.12	48.09	48.15	.06
119	July 27, 1958	05:00	40.75	40.75	40.74	40.77	.03
IDAHO							
8S-27E-31dd1	Jan. 19, 1958	14:00 16:00	23.84	23.84	23.78	23.87	0.09
8S-26E-33be1	do	16:30	103.95	103.95	103.93	103.96	.30
4S-32E-12dd1	Apr. 7, 1958	13:00 15:00	21.35	21.35	21.33	21.38	.05
6S-33E-20ab1	do	14:00 16:00	34.11	34.11	34.01	34.19	.18
8S-26E-33bc1	do	14:30	104.72	104.72	104.62	104.90	.28
9S-25E-23db1	do	15:30	128.40	128.40	128.36	128.42	.06
3N-29E-14ad1	do	16:00 18:00	451.39	451.39	451.24	451.58	.34
7N-34E-4cd1	do	16:00	6.67	6.67	6.55	6.80	.25
7N-36E-22ac2	do	16:00	6.77	6.76	6.72	6.80	.08
9S-26E-7bc1	Apr. 9, 1958	12:00 14:00	70.14	70.14	70.12	70.17	.05
4S-24E-6bb1	do	18:00	411.27	411.27	411.17	411.28	.11
5S-23E-17ca1	Apr. 28, 1958	19:00	303.38	303.38	303.32	303.43	.11
3N-29E-14ad1	July 10, 1958	02:00 04:00	450.96	450.96	450.70	451.38	.68
4S-32E-12dd1	do	03:00 05:00	15.91	15.93	15.79	16:08	.29
7S-24E-2ad1	do	04:00 06:00	209.70	209.74	209.66	209.83	.17
53N-2W-9aa1	do	05:30	231.93	231.92	231.85	232.00	.15
5N-34E-9bd1	do	06:30	259.16	259.17	259.07	259.24	.17
7N-34E-4cd1	do	06:30	20.58	20.59	20.25	20.95	.70
7N-36E-22ac2	do	06:30	7.00	7.01	6.91	7.08	.17
9S-25E-23db1	do	06:30	125.13	125.13	124.97	125.31	.34
8S-26E-33bc1	July 21, 1958	12:00	103.58	103.59	103.53	103.64	.11
8S-26E-33bc1	July 23, 1958	11:00	103.49	103.51	103.45	103.60	.15
8S-14E-16bc1	July 26, 1958	21:30	37.79	37.79	37.70	37.81	.11
10S-20E-5ba1	Aug. 15, 1958	19:00 21:00	246.62	246.62	246.56	246.76	.20
9S-25E-23db1	Oct. 6, 1958	20:00	122.11	122.11	122.09	122.13	.04
1S-19E-3ccd	Nov. 6, 1958	19:00 21:00	9.61	9.61	9.60	9.63	.03
6S-33E-20ab1	do	20:00 22:00	33.90	33.90	33.87	33.93	.06
ILLINOIS							
ANL-20	July 10, 1958	06:00	41.24	41.23	41.13	41.38	0.25
ANL-10	Nov. 6, 1958	23:00	78.32	78.35	78.28	78.40	.12
ANL-20	do	23:00	41.34	41.35	41.33	41.36	.03

Footnotes at end of table.

TABLE 1.—*Fluctuations in well-water levels, January 1 through December 31, 1958*—Continued

INDIANA

Well No.	Date	Time G. C. T.	Depth to water				
			Before disturbance	After disturbance	At highest point	At lowest point	Amplitude of fluctuation
Pu6(29/4W–4L1)	Jan. 19, 1958	14:15	10.39	10.40	10.31	10.46	0.15
Pu6(29/4W–4L1)	do	14:45	10.41	10.41	10.39	10.42	.03
Ma 31	Apr. 7, 1958	15:00	101.00	101.10	100.88	101.32	.44
Pu6(29/4W–4L1)	do	15:50	10.96	.....	10.83	11.09	.26
Pu6(29/4W–4L1)	Apr. 12, 1958	12:00	10.82	10.82	10.81	10.83	.02
Ma 31	July 10, 1958	06:00	100.00	99.90	99.33	100.40	1.07
Ma 32	do	06:00	11.65	11.50	10.63	12.15	1.52
Md 8	do	06:30	26.17	26.18	26.15	26.22	.07
Pu6(29/4W–4L1)	do	06:45	10.33	10.28	10.02	10.59	.57
Pu6(29/4W–4L1)	Nov. 6, 1958	23:15	14.27	14.33	14.19	14.38	.19
Ma 32	do	23:30	10.69	10.71	10.52	10.87	.35

MICHIGAN

7N.7E.17–1	Jan. 19, 1958	15:00	27.41	27.41	27.28	27.55	0.27
7N.7E.17–1	do	15:30	27.42	27.42	27.38	27.46	.08
7N.7E.17–1	Apr. 7, 1958	17:00	27.22	27.23	26.92	27.56	.64
7N.7E.17–1	Apr. 12, 1958	12:30	27.37	27.37	27.35	27.38	.03
7N.7E.17–1	Apr. 13, 1958	10:00	27.45	27.45	27.44	27.45	.01
7N.7E.17–1	Apr. 14, 1958	22:30	27.42	27.42	27.38	27.44	.06
7N.7E.17–1	Apr. 15, 1958	04:30	27.44	27.44	27.43	27.45	.02
7N.7E.17–1	June 6, 1958	10:00	29.29	29.29	29.27	29.30	.03
42N.2W.7–1	July 10, 1958	07:00	4.10	4.10	3.50	4.70	1.20
2S.8W.2–1	do	07:00	11.38	11.38	11.28	11.48	.20
9N.12W.23–1	do	07:00	+0.10	+0.10	+0.22	−0.03	.25
6N.7E.9–1	do	07:00	48.58	48.58	48.51	48.62	.11
7N.7E.17–1	do	07:00	30.18	30.18	29.81	30.50	.69
4N.2W.24–1	do	07:00	64.48	64.48	64.36	64.62	.26
39N.25W.28–3	do	07:00	2.10	2.10	2.04	2.25	.21
41N.5W.23–1	do	07:00	11.80	11.80	11.73	11.87	.14
7N.7E.17–1	Oct. 11, 1958	13:30	29.46	29.46	29.44	29.48	.04
7N.7E.17–1	Oct. 29, 1958	08:45	28.80	28.80	28.79	28.81	.02
7N.7E.17–1	Nov. 6, 1958	23:30	28.66	28.66	28.56	28.76	.20
7N.7E.17–1	Nov. 7, 1958	00:30	28.66	28.66	28.61	28.71	.10
39N.23W.28–3	do	00:30	3.17	3.17	3.13	3.22	.09
7N.7E.17–1	Nov. 12, 1958	21:30	28.55	28.55	28.53	28.56	.03
7N.7E.17–1	Nov. 18, 1958	14:30	28.15	28.15	28.13	28.16	.03
7N.7E.17–1	Nov. 26, 1958	10:30	27.85	27.85	27.83	27.87	.04

NEVADA

S19/60–9bcc1	Jan. 19, 1958	15:00	91.10	91.10	91.06	91.14	0.08
S19/60–9bcc1	Apr. 7, 1958	16:00	90.81	90.81	90.66	90.94	.28
S19/60–33baa1	do	16:00	15.08	15.08	15.04	15.10	.06
S19/60–9bcc1	Apr. 12, 1958	11:40	90.81	90.81	90.79	90.83	.04
S19/60–9bcc1	June 10, 1958	04:30	94.48	94.48	94.40	94.66	.26
S21/61–29dda1	June 18, 1958	00:20	23.70	23.70	23.68	23.74	.06
S19/60–3baa1	July 10, 1958	05:50	20.14	20.18	20.10	20.27	.07
S20/60–25adb1	do	07:00	71.85	71.82	71.53	72.10	.57
S19/60–25bcc1	Aug. 30, 1958	18:40	97.76	97.76	97.73	97.78	.05
S19/60–3baa1	Nov. 16, 1958	22:30	18.76	18.76	18.72	18.80	.08
S19/60–9bcc1	do	22:30	95.22	95.22	94.96	95.44	.48

Footnotes at end of table.

TABLE 1.—*Fluctuations in well-water levels, January 1 through December 31, 1958*—Continued

NEW JERSEY [1]

Well No.	Date	Time G. C. T.	Depth to water				
			Before disturbance	After disturbance	At highest point	At lowest point	Amplitude of fluctuation
26.22.4.4.4	Jan. 19, 1958	14:15	+29.10	+29.12	+29.18	+29.02	0.16
26.22.4.4.4	.....do.....	14:45	+29.12	+29.13	+29.15	+29.10	.05
25.14.8.2.2	Apr. 7, 1958	15:50	+192.39	+192.39	+192.41	+192.36	.05
25.14.9.4.1	.....do.....	15:50	+178.60	+178.60	+178.63	+178.58	.05
26.22.4.5.8	.....do.....	16:00	+25.21	+25.21	+25.22	+25.20	.02
29.1.4.4.2	.....do.....	16:00	+17.36	+17.36	+17.42	+17.10	.32
31.1.6.4.8	.....do.....	16:00	−6.24	−6.26	−6.22	−6.29	.07
31.11.5.2.1	.....do.....	16:00	−28.20	−28.20	−28.19	−28.20	.01
37.22.3.9.7	.....do.....	16:00	+7.24	+7.24	+7.26	+7.23	.03
37.31.3.5.5	.....do.....	16:00	−1.67	−1.67	−1.65	−1.68	.03
37.31.8.7.2	.....do.....	16:00	−6.22	−6.22	−6.17	−6.27	.10
36.13.2.9.1	June 26, 1958	22:45	−18.35	−18.38	−18.31	−18.40	.09
37.31.8.1.2	.....do.....	22:45	−7.99	−7.98	−7.98	−8.00	.02
37.31.9.7.7	.....do.....	22:45	−17.91	−17.91	−17.89	−17.92	.03
37.32.7.5.7	.....do.....	22:45	−11.28	−11.28	−11.25	−11.29	.04
37.31.3.5.5	.....do.....	23:00	−9.37	−9.37	−9.38	−9.37	.01
26.22.4.4.4	July 10, 1958	06:30	+27.12	+27.15	+27.42	+26.85	.57
26.21.5.9.2	.....do.....	06:45	+52.15	+52.17	+52.30	+52.06	.24
26.22.4.4.4	.....do.....	06:45	+27.15	+27.15	+27.23	+27.11	.12
31.1.6.4.8	.....do.....	06:45	−7.85	−7.85	−7.80	−7.91	.11
25.14.8.2.2	.....do.....	06:50	+191.80	+191.80	+191.82	+191.77	.05
26.22.4.5.8	.....do.....	06:50	+24.45	+24.45	+24.47	+24.43	.04
37.22.3.9.7	.....do.....	07:00	+6.13	+6.13	+6.15	+6.12	.03
37.31.3.5.5	.....do.....	07:00	−15.78	−15.77	−15.80	−15.75	.05
37.31.9.7.7	.....do.....	07:00	−21.58	−21.57	−21.53	−21.61	.08
26.22.4.4.4	July 26, 1958	17:50	+29.59	+29.59	+29.63	+29.57	.06
31.1.6.4.8	Nov. 6, 1958	16:00	−7.12	−7.11	−7.09	−7.13	.04
26.22.4.5.8	.....do.....	23:15	+23.56	+23.56	+23.57	+23.55	.02
25.14.8.2.2	.....do.....	23:30	+191.50	+191.50	+191.52	+191.49	.03
26.21.5.9.2	.....do.....	23:30	+48.29	+48.29	+48.35	+48.22	.13
26.22.4.4.4	.....do.....	23:30	+27.90	+27.90	+28.18	+27.61	.57
31.1.6.4.8	.....do.....	23:30	−7.20	−7.21	−7.16	−7.25	.09
26.22.4.4.4	Nov. 7, 1958	01:00	+27.91	+27.92	+27.93	+27.88	.05
NEW YORK							
Sa 529	Jan. 19, 1958	14:15	43.75	43.77	43.73	43.79	0.06
Sa 529	Mar. 11, 1958	01:00	43.10	43.10	43.09	43.10	.01
Sa 529	Apr. 7, 1958	15:45	44.24	44.28	44.11	44.40	.29
Sa 529	July 10, 1958	06:30	47.69	47.64	47.52	47.79	.27
Sa 529	July 26, 1958	17:45	50.26	50.27	50.25	50.27	.02
Sa 529	Nov. 6, 1958	23:00	45.48	45.46	45.36	45.63	.27
WASHINGTON							
20/3-18c1	Apr. 7, 1958	16:05	96.37	96.37	96.01	96.82	0.81
20/3-18c1	July 10, 1958	06:00	95.87	95.89	94.86	96.83	1.97
WISCONSIN							
Lf-121	Jan. 19, 1958	14:00	75.49	75.49	75.40	75.55	0.15
Lf-57	Apr. 14, 1958	21:00	14.06	14.05	14.04	14.07	.03
Lf-148	Apr. 17, 1958	14:00	64.17	64.19	64.13	64.37	.24
Lf-183	May 22, 1958	13:00	94.55	94.55	94.55	94.57	.02
Lf-183	May 31, 1958	20:00	94.41	94.40	94.36	94.47	.11

Footnotes at end of table.

TABLE 1.—*Fluctuations in well-water levels, January 1 through December 31, 1958*—Continued

WISCONSIN—Continued

Well No.	Date	Time G. C. T.	Depth to water				
			Before disturbance	After disturbance	At highest point	At lowest point	Amplitude of fluctuation
Lf-60	June 28, 1958	21:00	13.05	13.05	13.00	13.17	.17
Lf-148	.....do.....	21:00	64.10	64.10	63.87	64.21	.34
Lf-183	July 5, 1958	22:00	94.14	94.14	94.11	94.16	.05
Lf-183	July 10, 1958	04:00	94.18	94.18	94.11	94.25	.14
Lf-95	.....do.....	05:00	84.27	84.27	84.24	84.30	.06
Lf-60	.....do.....	06:00	14.73	14.74	14.71	14.75	.04
Lf-183	Aug. 15, 1958	07:00	94.15	94.16	94.14	94.19	.05
Lf-148	Sept. 15, 1958	06:00	63.75	63.75	63.59	63.89	.30
Lf-148	Sept. 21, 1958	09:00	63.73	63.73	63.55	63.85	.30
Lf-57	Nov. 6, 1958	21:00	126.97	126.99	126.49	127.48	.99
Lf-121	Nov. 7, 1958	01:00	75.56	75.60	75.35	75.76	.41
Lf-57	Nov. 12, 1958	21:00	127.12	127.12	127.10	127.15	.05
HAWAIIAN ISLANDS							
132	Jan. 19, 1958	13:00	16.01	16.00	15.97	16.02	0.05
132	Apr. 7, 1958	13:10	15.17	15.17	15.13	15.21	.08
T-52	.....do.....	16:10	145.33	145.34	145.30	145.36	.06
132	May 31, 1958	18:20	15.96	15.98	15.93	16.00	.07
T-52	.....do.....	19:45	145.31	145.31	145.30	145.32	.02
83*	July 10, 1958	03:30	+0.65	+0.65	+0.66	+0.64	.02
T-24	.....do.....	05:40	34.84	34.84	34.84	34.85	.01
132	.....do.....	06:00	17.56	17.53	17.28	17.84	.56
T-41	.....do.....	06:20	65.81	65.82	65.80	65.84	.04
T-52	.....do.....	06:30	147.69	147.70	147.51	147.85	.34
132	Nov. 6, 1958	22:30	16.25	16.25	15.77	16.73	.96
T-24	.....do.....	22:30	33.99	33.98	33.95	34.01	.06
2	.....do.....	23:00	10.50	10.51	10.32	10.64	.32
132	.....do.....	23:00	16.25	16.25	15.62	16.88	1.26
T-52	....do.....	23:00	146.45	146.44	146.12	146.76	.64
T-41	.....do.....	23:30	63.56	63.56	63.53	63.60	.07

* Hawaiian Islands Well No. 83 formerly No. 36A.
\+ Water surface above mean sea level or land surface datum.
− Water surface below mean sea level.
[1] Values refer to mean sea level datum.

SEISMOLOGICAL OBSERVATORY RESULTS

The Coast and Geodetic Survey publishes the results of its teleseismic stations and co-operating 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:

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Balboa Heights 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, which may be obtained on loan by addressing the Seismograph Station Director, Meteorological and Hydrographic Office, Panama Canal Company, Balboa Heights, C.Z.

For detailed instrumental data regarding these stations, including instrumentation, constants, and other information, see *Seismological Bulletin, MSI—217*, January 1959. 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.

TABLE 2.—*Summary of instrumental epicenters for 1958.*

1958	Origin rime G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Jan. 1	03	06	16**	Unimak Island				
1	15	06	08*	Fox Islands, Aleutian Islands	52	N.	171½	W.
1	23	02	33*	Tonga Islands region. Depth about 100 km	16	S.	174	W.
2	00	21	22*	New Britain. Felt at Kokopo, Rabaul and Wonakgoi	5	S.	152	E.
2	02	08	15*	Off south coast of Greece	36½	N.	22	E.
2	15	45	22*	Iran	34½	N.	48	E.
2	21	12	07*	Kurile Islands. Depth about 60 km	45	N.	151	E.
2	22	35	29*	Northeast of Trinidad. Felt at Tobago	11½	N.	60½	W.
3	01	55	10*	South of Honshu, Japan	29½	N.	141	E.
3	06	24	31*	North Atlantic Ocean	32	N.	41½	W.
3	06	49	56*	.....do	31	N.	40½	W.
3	07	02	07*	.....do	31	N.	40½	W.
3	07	55	40*	.....do	31½	N.	41	W.
3	08	33	31*	.....do	32½	N.	41	W.
3	09	25	47*	.....do	31½	N.	40½	W.
3	10	12	33*	.....do	31½	N.	41	W.
3	17	47	12*	Mascarene Islands region	22	S.	65	E.
4	06	39	45*	North Atlantic Ocean	31½	N.	40½	W.
4	08	02	20*	Guerrero, Mexico. Felt. Mag. 5¾	17	N.	99½	W.
4	08	27	53*	India–Tibet border	27	N.	92	E.
4	13	05	24*	Banda Sea	6	S.	133	E.
4	15	33	54*	North Atlantic Ocean	32	N.	41	W.
4	17	27	33*	Nevada. Mag. 4½–4¾ (Berk)	40	N.	116	W.
4	23	21	38*	Off south coast of Java. Felt south of Sourakarta. Depth about 200 km.	8½	S.	112	E.
5	08	05	11*	Celebes Sea. Depth about 550 km	2	N.	122½	E.
5	11	30	44*	Stanovoi Mountains region, Siberia	56½	N.	121	E.
5	12	28	20*	Solomon Islands. Felt at Karoola and Rabaul. Depth about 100 km.	6	S.	155	E.
5	17	00	04*	Great Salt Lake, Utah	41	N.	112½	W.
6	01	54	30*	Hindu Kush	37½	N.	71	E.
6	09	07	40*	Unimak Island region	54½	N.	161	W.
6	09	51	40*	Near south coast of Java	7	S.	107	E.
6	09	54	13**	West-Central Iran				
6	11	24	11*	Burma	26	N.	96½	E.
7	02	56	19*	Peru–Bolivia–Chile border. Depth about 150 km	18½	S.	69	W.
7	06	05	08*	Tadzhik S.S.R.	39	N.	70	E.
7	08	20	54**	Tonga Islands region				
8	03	12	55**	New Hebrides Islands				
9	11	13	56*	Near north coast of New Guinea. Felt at Lae, Port Moresby and Wau. Depth about 150 km.	5½	S.	147	E.
9	17	39	24*	Sinkiang Province, China	44½	N.	85	E.
10	13	37	14*	Fox Islands, Aleutian Islands	52	N.	171	W.
10	22	57	20*	Kurile Islands. Felt. Depth about 100 km	45	N.	148	E.
11	04	47	35*	Kamchatka	55	N.	161	E.
11	08	36	01**	Fox Islands, Aleutian Islands				
11	13	18	47*	Tonga Islands region	23½	S.	177	W.
11	23	21	37*	Near north coast of Hokkaido, Japan. Depth about 350 km	46	N.	142½	E.
12	14	55	09*	Atlantic Ocean	31½	N.	41	W.
13	00	02	24*	Rat Islands, Aleutian Islands. Depth about 100 km	52½	N.	177	E.
13	02	52	40*	Off south coast of Panama	7	N.	83	W.
13	02	54	37*	Santa Cruz Islands. Depth about 100 km	11	S.	166	E.
13	07	10	30**	Fiji Islands				
13	09	39	58*	Northern Chile	20	S.	69½	W.
13	13	09	40*	.....do	20	S.	69½	W.
13	13	19	49*	Ryukyu Islands	27½	N.	130	E.
13	20	14	27*	Andaman Islands	11½	N.	92½	E.
14	01	33	55*	Rat Islands, Aleutian Islands. Depth about 100 km	51½	N.	178½	E.
14	05	54	48*	Tonga Islands	22	S.	175	W.
14	07	20	25*	Kermadec Islands. Depth about 350 km	29	S.	179	W.
14	13	34	40*	Eastern Turkey	39½	N.	41	E.
14	15	00	14*	Santa Cruz Islands	12½	S.	167	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Jan. 15	04	10	45*	Near coast of Siberia	43	N.	136	E.
15	07	37	40**	Near coast of El Salvador. Felt at San Salvador and in western El Salvador.				
15	13	15	31*	Caspian Sea	40	N.	51½	E.
15	19	14	29*	Southern Peru. 28 killed, many injured and extensive property damage in Mejia. Depth about 60 km. Mag. 7.3.	16½	S.	72	W.
15	22	15	44*	New Hebrides Islands	13½	S.	167	E.
16	02	04	24*	Northern Iran. Many killed and moderate property damage.	36½	N.	53	E.
16	04	16	46*	Tonga Islands region. Depth about 250 km	16	S.	175	W.
16	04	18	10*	Aegean Sea	39½	N.	25	E.
16	11	03	32*	New Hebrides Islands	14	S.	167	E.
17	04	14	02*	Spice Islands	1	S.	127	E.
17	05	23	08**	Tucuman Province, Argentina. Depth about 150 km				
17	07	15	38*	Antarctic Ocean	52	S.	139½	E.
18	15	14	26*	North of Tristan da Cunha	29	S.	13	W.
18	16	33	35	South of Fallon, Nevada. Felt	39.1	N.	118.1	W.
18	19	24	30*	Solomon Islands. Depth about 100 km	6	S.	155	E.
19	09	10	55*	Off northeast coast of Formosa	25	N.	122½	E.
19	14	07	27*	Near coast of Ecuador. 20 killed, many injured, and extensive property damage at Esmeraldas, Palmas and Guayaquil. Large water waves caused damage at Esmeraldas and Guayaquil. Depth about 40 km. Mag. 7.8.	1½	N.	79½	W.
19	14	43	24*	Ecuador aftershock. Slight damage in northern Ecuador. Depth about 60 km. Mag. 6¾.	1½	N.	79	W.
19	16	50	13*	Near coast of Sumatra	5½	N.	95	E.
20	02	19	53*	Northern Chile	30½	S.	71½	W.
20	07	13	02*	Near coast of Luzon, Philippine Islands. Felt at Ambulong, Calapan, Manila and Quezon City. Depth about 100 km.	14½	N.	120	E.
20	09	55	44*	Northern Chile	30½	S.	71½	W.
21	08	06	56*	Near coast of Chile	29	S.	73	W.
22	18	29	11*	Near east coast of Formosa. Felt at Taipei. Depth about 200 km.	23	N.	121½	E.
22	23	31	43*	Komandorskie Islands	54	N.	170	E.
23	02	34	09*	Kurile Islands. Depth about 150 km	44½	N.	146½	E.
23	05	30	10*	Southern Tibet	30½	N.	84	E.
23	08	52	23*	New Hebrides Islands. Depth about 150 km	18½	S.	170	E.
23	13	35	03*	Off west coast of Norway. Felt in central Norway	65	N.	6½	E.
24	04	35	55*	Northeast of Lake Baikal, USSR	56½	N.	115½	E.
24	05	53	58*	Near east coast of Kamchatka. Mag. 6½	56½	N.	163	E.
24	06	11	03*	Near east coast of Kamchatka	56½	N.	163	E.
24	06	48	06*	About 300 miles southwest of Prince Edward Islands	49	S.	32	E.
24	18	03	32*	Komandorskie Islands region	54	N.	170	E.
24	22	58	57**	Near Islands, Aleutian Islands				
24	23	17	29*	Kenai Peninsula, Alaska. Felt at Anchorage. Depth about 60 km. Mag. 6¼–6½.	60	N.	152	W.
24	23	53	29	Fiji Islands. Depth about 550 km	17½	S	178½	W.
26	03	35	17*	South Pacific Ocean	54½	S.	133	W.
26	06	42	13*	Kurile Islands	47½	N.	154½	E.
26	07	28	33*	....do	49½	N.	155	E.
27	07	43	58*	Samoa Islands. Mag. 6¾	15	S.	174	W.
27	08	52	42*	Solomon Islands. Depth about 200 km	8	S.	155	E.
28	17	15	00*	Iran	36	N.	58½	E.
28	19	41	54*	Molucca Passage	3½	N.	127	E.
29	00	16	30*	Off east coast of Hokkaido, Japan	37	N.	142	E.
29	10	14	55*	Near coast of Guerrero, Mexico	16	N.	99	W.
30	02	08	44*	Fiji Islands. Depth about 250 km	21	S.	179½	W.
30	04	58	01*	Tonga Islands	19	S.	172½	W.
30	06	13	24*	Solomon Islands. Mag. 6½	7½	S.	155½	E.
30	19	13	30**	Dodecanese Islands				
30	22	41	27**	Tonga Islands region. Depth 600 km				

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Jan. 31	06	22	35*	Kurile Islands region	44½	N.	153	E.
31	06	32	39*	North Island, New Zealand. Slight damage at Dannevirke. Felt in southern part of North Island.	40	S.	176½	E.
31	23	20	15**	Sikang Province, China				
Feb. 1	02	42	07*	Southern Alaska	60½	N.	140½	W.
1	16	10	15*	Near coast of Ecuador. Felt at Esmeraldas. Mag. 6¾–7	2	N.	79	W.
1	18	02	39*	....do	2	N.	79	W.
1	20	45	45*	Ecuador aftershock. Mag. 6¾	1½	N,	79	W.
1	22	00	15*	Solomon Islands	7	S.	156	E.
2	02	34	59*	Ecuador aftershock	1½	N.	79½	W.
2	03	15	10**	Near coast of Guerrero, Mexico				
2	08	11	53*	Kurile Islands. Mag. 6½–6¾	48½	N.	154½	E.
2	08	16	20*	Ecuador aftershock	2	N.	80	W.
2	08	49	13*	....do	2	N.	79	W.
2	20	53	08*	Ryukyu Islands region. Depth about 200 km	27½	N.	127	E.
3	08	25	19*	Tonga Islands	21	S.	174	W.
3	14	02	16*	Panama–Colombia border	7	N.	77½	W.
3	19	27	12*	Central Iran	32½	N.	56	E.
4	00	02	16*	Solomon Islands. Felt at Karoola	6½	S.	155	E.
4	02	16	00*	Banda Sea	6	S.	131½	E.
4	08	06	25*	Off south coast of Greenland	58	N.	52	W.
4	12	40	27*	Solomon Islands	7	S.	156	E.
4	19	45	27*	Unimak Island	54	N.	164	W.
4	23	37	50**	Near east coast of Honshu, Japan				
5	03	15	17*	Turkman S.S.R.	40½	N.	53	E.
5	08	08	15*	Kurile Islands. Depth about 60 km	46½	N.	152½	E.
5	15	46	25*	Fox Islands, Aleutian Islands	52½	N.	170½	W.
6	01	42	09*	Near northeast coast of Formosa	24½	N.	122½	E.
6	16	00	12*	Kermadec Islands region. Depth about 250 km	27½	S.	178	W.
7	00	32	25*	Near northeast coast of Sumatra	3½	N.	96½	E.
7	01	10	31*	Kermadec Islands	31	S.	179	W.
7	04	37	33*	Komandorskie Islands	55	N.	167	E.
7	06	59	53*	Ryukyu Islands	27½	N.	128½	E.
7	23	23	30*	Szechwan Province, China	31½	N.	104	E.
9	04	15	05*	South of Panama. Felt at Balboa Heights	8	N.	79½	W
9	09	31	03*	East Pakistan–India border. Felt at Mymensingh, East Pakistan and Sylhet, India.	25	N.	90½	E.
9	22	29	23*	Mindoro, Philippine Islands	12½	N.	121	
10	14	42	30*	Volcano Islands	26	N.	142½	
11	00	46	02*	Off south coast of Java	9	S.	107½	
11	11	38	14*	Near west coast of Luzon, Philippine Islands. Felt at Iba. Depth about 100 km.	15	N.	119½	
11	12	46	20**	Near coast of Guatemala				
11	20	00	09*	Celebes	1	S.	121½	
12	02	34	14*	Mariana Islands. Felt at Guam. Depth about 150 km	13½	N.	144	
12	06	34	59*	New Britain. Felt at Rabaul. Depth about 60 km	5½	S.	151	E.
12	07	21	37*	....do	5½	S.	151½	E.
12	18	17	09*	Nicobar Islands region	6½	N.	95½	E.
12	23	31	21*	Near east coast of Hokkaido, Japan. Felt at Kushiro and Nemuro.	43½	N.	145½	E.
12	23	43	45*	Andreanof Islands, Aleutian Islands. Mag. 6	52	N.	175	W.
13	00	11	36*	Northern Assam	27½	N.	92	E.
13	04	18	19*	Andreanof Islands, Aleutian Islands	50	N.	178	W.
13	09	32	24*	Near coast of Siberia. Depth about 350 km	44	N.	135½	E.
13	22	52	00*	North-Central Utah. Slight damage at Provo	40½	N.	111½	W.
15	01	46	40*	Kurile Islands. Felt at Kushiro and Nemuro. Mag. 6–6¼	44	N.	147	E.
16	06	04	05*	Near coast of Honshu, Japan. Felt at Tokyo. Mag. 6–6¼	39	N.	142	E.
16	07	42	11*	Mariana Islands. Depth about 200 km	17	N.	146	E.
16	09	44	55*	Montana–Idaho border region	45	N.	113	W.
16	23	01	59*	Off north coast of Iceland	67½	N.	19	W.
16	23	54	45*	Solomon Islands	6	S.	155	E.
17	02	25	46*	Near east coast of Kamchatka	52	N.	159½	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Feb. 17	05	18	35*	Hindu Kush. Felt in northern Afghanistan and Tadzhik S.S.R. Depth about 200 km.	35½	N.	70	E.
18	07	34	07*	Tonga Islands	21	S.	173½	W.
18	13	21	20*	Kermadec Islands	31	S.	178½	W.
18	18	52	41*	Batan Islands region	20½	N.	120½	E.
18	19	08	05*	do	21	N.	120	E.
18	19	48	43*	do	20½	N.	120½	E.
18	20	08	44*	Bismarck Sea	3	S.	147½	E.
19	01	20	20*	South Pacific Ocean	37½	S.	111	W.
19	03	39	57*	Western Sinkiang Province, China	39½	N.	75	E.
19	10	32	58*	do	39½	N.	75½	E.
19	19	25	21*	Near south coast of Java. Moderate damage in Priangan	8	S.	108	E.
20	03	57	42*	Batan Islands aftershock	20½	N.	120½	E.
20	04	05	07*	do	20½	N.	120	E.
20	04	38	34*	do	20½	N.	120½	E.
20	09	04	44*	do	21	N.	120	E.
21	03	18	25*	Off coast of Peru	16	S.	74½	W.
21	11	52	50*	Near east coast of Honshu, Japan. Felt at Tokyo. Depth about 100 km.	36	N.	140½	E.
21	13	47	10*	Off coast of Ecuador	1½	N.	80	W.
22	08	11	50*	Near north coast of New Guinea. Felt at Mumeng and Saidor. Depth about 200 km.	6	S.	147	E.
22	10	50	23*	Andreanof Islands, Aleutian Islands. Mag. 6¾	50½	N.	175	W.
22	13	21	48*	Andreanof Islands, Aleutian Islands	50½	N.	175	W.
22	17	05	00*	do	51½	N.	174½	W.
23	00	24	34*	New Britain–Solomon Islands region. Felt at Ulamona	6	S.	153	E.
23	01	22	49*	Andreanof Islands, Aleutian Islands	52	N.	175	W.
23	08	14	48*	Santiago del Estero Province, Argentina. Depth about 600 km.	27½	S.	63	W.
23	09	12	20*	Bonin Islands region. Felt. Depth about 400 km	28½	N.	139½	E.
23	10	06	23*	Batan Islands aftershock	20½	N.	120½	E.
23	10	47	40*	Volcano Islands	24	N.	141½	E.
23	14	15	42*	Near south coast of Honshu, Japan. Felt at Tokyo. Depth about 300 km.	34½	N.	137½	E.
24	07	58	59*	Andreanof Islands, Aleutian Islands	51½	N.	173	W.
24	12	27	06*	Outer Mongolia	45	N.	99	E.
24	21	25	25*	Tonga Islands region	15½	S.	172½	W.
25	01	56	40*	Rat Islands, Aleutian Islands	51½	N.	179½	E.
[illegible]5	07	27	18*	Fox Islands, Aleutian Islands	52½	N.	170½	W.
[illegible]5	14	56	20**	Northern Sumatra				
[illegible]	15	02	08*	New Britain	6	S.	151½	E.
[illegible]	00	17	56*	New Ireland. Depth about 300 km	3	S.	152½	E.
[illegible]	11	35	29*	South of Honshu, Japan	31½	N.	141½	E.
[illegible]	16	50	46*	Kurile Islands	50	N.	155½	E.
26	17	18	56*	Off south coast of Hokkaido, Japan	41	N.	143½	E.
27	23	27	49*	Batan Islands aftershock	21	N.	120	E.
28	09	54	53*	Mid-Atlantic Ocean	27	N.	44	W.
28	16	41	57*	Panay, Philippine Islands	11	N.	122½	E.
Mar. 1	00	13	23*	Atlantic Ocean, southwest of St. Helena Island	20	S.	12	W.
1	06	23	58*	Tonga Islands region	17	S.	172½	W.
1	09	05	40*	Near coast of Peru. Felt at Lima	13½	S.	76½	W.
1	09	26	46*	Southern Iran	28	N.	54½	E.
1	16	16	01*	Tonga Islands region. Felt at Apia	17	S.	173	W.
1	17	21	33*	El Salvador. Felt. Depth about 60 km	14	N.	89½	W.
2	02	33	40*	Batan Islands	21	N.	121	E.
3	00	44	47*	Guatemala. Depth about 100 km	15	N.	91½	W.
3	04	06	16*	New Hebrides Islands	14½	S.	168½	E.
3	04	50	44**	Fiji Islands region				
3	07	22	42*	Near east coast of Formosa	23½	N.	122	E.
3	11	04	49*	Tonga Islands	20	S.	174½	W.
3	16	18	17*	Komandorskie Islands. Mag. 6¼–6½	55½	N.	166½	E.
3	16	55	38*	Hindu Kush	35½	N.	70	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Mar. 3	17	10	55*	Komandorskie Islands	55½	N.	166½	E.
3	17	13	14*	Colombia. Depth about 150 km	6	N.	73½	W.
3	17	32	47*	Komandorskie Islands	55½	N.	166	E.
4	01	50	09*	Near coast of Ecuador	½	S.	81	W.
4	11	32	04**	Dodecanese Islands				
4	17	48	35*	Ryukyu Islands	27	N.	130	E.
5	19	53	28*	Fox Islands, Aleutian Islands	52	N.	170½	W.
6	03	21	49*	Fiji Islands region. Depth about 250 km	15	S.	175	W.
6	05	41	06*	Near south coast of Greece	36	N.	23	E.
6	11	56	33*	Near north coast of Mindanao, Philippine Islands	9	N.	126	E.
7	06	55	30*	Hindu Kush. Felt at Warsak. Depth about 200 km	37	N.	71	E.
7	08	21	23*	Near northeast coast of Mindanao, Philippine Islands. Felt at Surigao.	9½	N.	126	E.
7	11	29	56*	Shikoku, Japan	34½	N.	134	E.
7	17	30	38*	Tonga Islands	20	S.	176	W.
8	20	10	23*	Central Chile. Felt at Santiago. Depth about 100 km	33½	S.	70	W.
9	07	23	51*	Near north coast of New Guinea	6½	S.	148	E.
9	08	07	30*	Andreanof Islands, Aleutian Islands	51½	N.	178½	W.
9	10	22	25*	Kermadec Islands region. Depth about 60 km. Mag. 6½–6¾.	34	S.	178½	W.
9	11	23	19*	Halmahera Island region	2	N.	129	E.
10	07	58	04*	Fox Islands, Aleutian Islands	52½	N.	171½	W.
10	17	27	20**	Central Ryukyu Islands				
10	21	31	48*	Tonga Islands. Depth about 200 km	20	S.	176	W.
11	00	25	56*	Ryukyu Islands. Several killed, many injured on Okinawa. Felt strongly; and fissuring on Ishigaki and Miyako; also felt at Aparri, Basco, and Calayan. Depth about 70 km. Mag. 7.5.	25	N.	125	E.
11	08	47	23*	Guatemala. Depth about 200 km	14½	N.	90½	W.
11	13	59	00*	New Hebrides Islands	13	S.	167	E.
11	14	56	46**	New Britain region				
11	21	38	56*	Southern Peru	16	S.	72	W.
11	23	53	00*	Guerrero, Mexico	17	N.	98½	W.
12	00	08	20**	About 150 miles off coast of southern Mexico				
12	12	09	19*	Nevada–Oregon–California border region	42	N.	119½	W.
12	14	36	33*	Mariana Islands	20½	N.	146	E.
12	18	16	50*	Bonin Islands region. Depth about 500 km	27	N.	139½	E.
13	21	28	40**	New Hebrides Islands				
13	23	49	23*	Masbate Island, Philippine Islands. Felt in central Philippines.	12½	N.	123½	E.
14	00	09	41*	Northern Burma	25½	N.	96	E.
15	00	24	01*	Near east coast of Formosa	23	N.	121½	E.
15	06	27	02*	Albania–Greece border. Felt strongly at Castoria and Florina.	40½	N.	21	E.
15	08	34	04*	Arizona. Mag. 5	32½	N.	113½	W.
15	15	33	57*	New Hebrides Islands	17½	S.	169	E.
15	19	06	10*	New Britain. Felt at Rabaul	5	S.	152	E.
15	20	46	23*	Lesser Antilles	18	N.	64	W.
16	02	01	54**	Near south coast of Hokkaido, Japan				
17	21	07	24*	Nicobar Islands region	8	N.	93½	E.
17	21	40	23*	Near northeast coast of New Guinea	6½	S.	147½	E.
18	22	20	02*	Fox Islands foreshock	50½	N.	173	W.
19	16	04	03*	Austria-Yugoslavia border. Felt in southern Austria. Depth about 100 km.	47	N.	14½	E.
20	01	38	04*	Fox Islands, Aleutian Islands region. Mag. 6½	51	N.	173	W.
20	14	47	05*	Solomon Islands	10	S.	161	E.
21	14	15	02*	Mexico–Guatemala border. Depth about 150 km	15	N.	92½	W.
21	15	29	52*	Northern New Guinea	4½	S.	143	E.
21	18	32	54*	Andaman Islands	13½	N.	92½	E.
22	06	18	54**	Kermadec Islands region				
22	10	11	34*	Burma. Depth about 100 km	23½	N.	94	E.
22	11	07	47*	Afghanistan	35½	N.	67	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Mar. 23	10	14	42*	Near northwest coast of Luzon, Philippine Islands	18	N.	120	E.
23	20	13	07**	Andreanof Islands, Aleutian Islands				
24	00	55	55*	Loyalty Islands region	21	S.	170½	E.
24	11	55	40*	Near north coast of Luzon, Philippine Islands	18½	N.	120	E.
24	14	53	51*	Near north coast of Hokkaido, Japan. Felt at Nemuro	43	N.	146	E.
24	21	46	31*	Loyalty Islands region	21½	S.	170½	E.
25	08	25	13**	Fiji Islands region				
25	08	59	58**	Blast at Pokrovsk, northern Ural Mountains, USSR				
25	15	56	49*	Batan Islands region	21	N.	120	E.
25	18	42	27*	Virgin Islands. Felt	18	N.	64½	W.
25	19	01	52*	New Hebrides Islands	17½	S.	167½	E.
25	22	33	45*	Maldive Islands region	3	N.	67	E.
25	23	51	21**	Strait of Malacca				
26	00	25	49*	Samar Island, Philippine Islands. Felt at Hinatuan and Surigao. Depth about 100 km.	11	N.	126	E.
27	06	05	51*	Near coast of Chiapas, Mexico. Depth about 150 km	14½	N.	93	W.
27	06	35	07*	Near southeast coast of Kamchatka	53	N.	160	E.
28	00	23	30*	New Britain region. Felt at Rabaul	6	S.	153	E.
28	04	09	30*	Hindu Kush. Felt. Depth about 200 km	36½	N.	71	E.
28	12	06	24*	do	37	N.	71	E.
28	14	45	22*	Tonga Islands	20½	S.	174	W.
30	14	23	20*	Near coast of Colombia. Felt at Cali. Depth about 60 km.	4	N.	77	W.
30	17	33	01*	Fiji Islands region. Depth about 550 km	23	S.	179½	E.
30	22	36	53*	Tonga Islands	22	S.	176	W.
31	10	30	56*	Chiapas, Mexico. Depth about 100 km	17	N.	93½	W.
31	15	01	30*	Fox Islands, Aleutian Islands	52	N.	167½	W.
31	16	46	15**	Ionian Sea				
31	17	49	38*	Near west coast of Hokkaido, Japan. Felt	44½	N.	141	E.
31	19	50	37**	Catamarca Province, Argentina				
31	21	09	01*	Leeward Islands	17½	N.	60	W.
Apr. 1	14	07	12*	Northern Honshu, Japan	39½	N.	141½	E.
1	16	44	34*	Andreanof Islands, Aleutian Islands	51½	N.	179½	W.
2	10	50	42*	Solomon Islands. Felt at Rabaul	5½	S.	154½	E.
2	20	55	30*	Southeast Pacific Ocean	35½	S.	105½	W.
3	02	23	43*	Albania. Felt in Albania and on Corfu Island	41	N.	20½	E.
3	07	18	34*	Near Crete	35	N.	27½	E.
3	08	25	43*	Near coast of Ecuador	1½	N.	79	W.
4	01	55	41*	South of Fiji Islands. Depth about 550 km	24	S.	179½	E.
4	02	23	20*	New Britain Island region. Felt at Ulamona	5½	S.	152	E.
4	07	16	55*	New Britain. Felt at Rabaul and Warangoi	5½	S.	152	E.
4	07	29	55*	New Britain. Felt at Rabaul and Ulamona	5½	S.	152	E.
4	09	18	49**	Albania aftershock				
4	15	38	03*	New Britain. Felt at Rabaul	5½	S.	152	E.
5	05	10	59*	Andreanof Islands, Aleutian Islands	51½	N.	180	
6	10	36	30*	Mariana Islands	13	N.	144½	E.
6	16	57	31*	Bolivia–Argentina border. Depth about 200 km	22	S.	67	W.
7	03	28	52**	Sandwich Islands				
7	07	09	08*	Fiji Islands. Depth about 650 km	17½	S.	178½	W.
7	15	30	39.5	Alaska. Felt throughout central Alaska. Mag. 7.3	66.1	N.	156.8	W.
7	18	05	02*	Near east coast of Honshu, Japan. Felt. Mag. 6.7	38½	N.	143	E.
7	18	30	12*	Honshu aftershock. Felt	38½	N.	142½	E.
7	18	36	37*	do	38	N.	142½	E.
7	18	38	18*	do	38	N.	143	E.
7	18	47	11*	do	38	N.	143	E.
7	19	13	20*	Outer Mongolia. Mag. 6.7	45	N.	98	E.
8	00	14	20*	Alaska. Felt in central Alaska	66½	N.	155½	W.
8	04	35	21*	Colombia	7	N.	73	W.
8	07	10	45*	Off coast of Honshu, Japan	38	N.	142½	E.
8	09	59	15*	Afghanistan	33	N.	67½	E.
8	13	21	33*	Tonga Islands. Depth about 250 km	19	S.	176	W.
8	14	05	28**	Fox Islands, Aleutian Islands				
8	17	17	05**	El Salvador. Felt at San Salvador				

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin rime G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Apr. 9	04	36	29*	Southwestern Iran	29	N.	52	E.
9	06	15	12*	Gulf of Alaska. Felt at Sitka and Yakutat	56½	N.	139	W.
9	17	58	02*	Molucca Passage	2	N.	126½	E.
10	01	03	45*	Ryukyu Islands	27½	N.	128½	E.
10	01	44	34*	Near east coast of Kamchatka	53	N.	160½	E.
10	10	55	31*	Outer Mongolia	51½	N.	99	E.
10	11	50	05	Off east coast of Honshu, Japan. Felt	38½	N.	143	E.
10	13	18	47*	Northern Chile. Depth about 150 km	24	S.	69	W.
10	19	10	13*	Tonga Islands. Depth about 200 km	18	S.	174½	W.
10	23	12	47*	About 1000 miles west of Galapagos Islands. Mag. 6	4½	S.	107	W.
11	00	58	13*	Off east coast of Honshu, Japan. Felt	38½	N.	142½	E.
11	03	58	28*	Mexico	17	N.	94	W.
11	09	12	42**	Panama-Costa Rica border				
11	17	27	00*	Andreanof Islands, Aleutian Islands	52	N.	174	W.
11	17	54	43*	Andreanof Islands, Aleutian Islands	52	N.	174	W.
11	23	11	26*	Kurile Islands. Depth about 100 km. Mag. 6½	47½	N.	153½	E.
11	23	24	11*	Molucca Passage	0		125	E.
12	10	24	55**	Gulf of California foreshock. Mag. 5½				
12	11	46	58*	Gulf of California. Mag. 6½	26½	N.	111	W.
12	13	25	22*	Ryukyu Islands	25	N.	126	E.
12	22	37	11*	North-central Washington. Slight damage	48	N.	120	W.
13	01	48	43*	Alaska	66½	N.	155½	W.
13	04	08	56*	Outer Mongolia	46	N.	98	E.
13	08	25	37*	Fiji Islands. Depth about 450 km	17	S.	177½	W.
13	09	07	24*	Alaska. Felt in central Alaska. Mag. 6¾	66	N.	156	W.
13	12	29	07*	Near east coast of Kamchatka. Mag. 6½	53	N.	161	E.
14	02	49	41*	Kurile Islands	47	N.	152	E.
14	03	12	25*	Alaska	66	N.	155	W.
14	03	47	16*	Ryukyu Islands	26½	N.	128	E.
14	16	26	55*	Outer Mongolia	45	N.	98	E.
14	18	08	40*	Near east coast of Kamchatka	53	N.	161	E.
14	19	21	54*	New Hebrides Islands	14½	S.	168	E.
14	21	32	28*	Near coast of Ecuador. 3 killed, 12 injured and minor property damage at Esmeraldes. Also felt at Quito and Ibarra. Mag. 6.8.	1	N.	79½	W.
14	22	48	33*	Ecuador aftershock. Mag. 6½–6¾	1	N.	79½	W.
15	01	30	43*	.....do	1	N.	79½	W.
15	03	52	39*	Off west coast of Costa Rica. Mag. 6¾	9	N.	84	W.
15	09	59	55*	Near south coast of Luzon, P.I. Felt at Manila. Depth about 100 km.	15	N.	120	E.
15	10	59	59*	Fox Islands, Aleutian Islands	53	N.	167½	W.
16	12	36	24*	Philippine Islands. Depth about 150 km	14	N.	120½	E.
17	02	01	26*	Solomon Islands region	6	S.	154	E.
17	02	15	16*	Solomon Sea. Felt at Buin	10	S.	152½	E.
17	02	46	17*	South of Honshu, Japan. Depth about 150 km	32	N.	139½	E.
17	06	21	43*	Solomon Islands. Felt at Aropa	6	S.	155	E.
17	10	04	46*	New Britain. Felt at Rabaul	5½	S.	152	E.
17	11	32	48*	Near east coast of Honshu, Japan. Felt on Honshu	37	N.	140½	E.
17	14	06	06*	Off coast of Costa Rica	8	N.	85	W.
17	16	42	21*	Solomon Islands	6½	S.	154½	E.
18	03	11	55*	Kurile Islands	48½	N.	154½	E.
18	05	10	16*	Off east coast of Honshu, Japan	39	N.	143	E.
18	07	32	06*	Fiji Islands. Depth about 600 km	20	S.	178	W.
18	09	03	27*	New Guinea	5	S.	143½	E.
18	14	20	44*	Off east coast of Kamchatka	53½	N.	162	E.
18	17	51	44*	Near south coast of Kamchatka	49½	N.	156½	E.
18	19	07	19*	Kurile Islands	47½	N.	153	E.
19	00	10	50*	South of Honshu, Japan	30½	N.	141½	E.
19	04	03	26*	Gulf of California. Mag. about 6	26½	N.	110½	W.
19	10	49	50*	Solomon Islands	10½	S.	161½	E.
19	14	14	38*	Volcano-Mariana Islands region. Depth about 200 km	22½	N.	143	E.
19	22	42	20*	Off east coast of Kamchatka	52½	N.	161	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter	
					Latitude	Longitude
	h	*m*	*s*		° ′	° ′
Apr. 20	12	56	30*	Off north coast of Luzon, P.I. Felt at Aparri and Calayan	19 N.	121½ E.
20	21	06	58	California. Felt in Napa County. Mag. 4.0 (Berk)	38 37 N.	122 16 W.
20	21	15	00**	Sandwich Islands		
21	05	32	00*	Near east coast of Formosa	24½ N.	122 E.
21	12	15	28*	Peru. Depth about 150 km	8 S.	74 W.
21	20	14	47*	Samoa Islands region. Mag. 6½	15 S.	174½ W.
21	22	37	18*	Sumatra. Mag. 6½	4½ S.	104 E.
21	23	57	05*	Banda Sea	6½ S.	131½ E.
22	05	39	07*	Fiji Islands region	15 S.	174½ W.
22	09	08	13*	Celebes	½ S.	120½ E.
22	10	02	43*	Southern Turkey	37 N.	31 E.
22	21	12	45**	Solomon Islands region		
23	02	57	40*	Kurile Islands	45 N.	152 E.
23	05	53	06*	Ryukyu Islands	30½ N.	130 E.
23	04	52	47*	Kurile Islands. Depth about 100 km	45½ N.	152 E.
23	10	58	35*	New Britain region. Felt at Rabaul and Warangoi	5½ S.	153 E.
23	15	11	39*	Fiji Islands region	15½ S.	176 W.
23	19	12	36*	New Britain. Felt at Rabaul and Warangoi. Depth about 100 km.	4½ S.	153 E.
24	13	09	41*	Loyalty Islands	22 S.	170½ E.
24	17	21	10*	Loyalty Islands aftershock	22 S.	170½ E.
24	17	38	35**	New Hebrides Islands		
24	18	09	14*	Pacific Ocean	5 N.	83 W.
25	08	35	06*	Fox Islands, Aleutian Islands	51½ N.	171½ W.
25	19	03	18*	Fox Islands, Aleutian Islands	52 N.	171 W.
26	01	09	30*	Kurile Islands region. Depth about 100 km	44½ N.	152½ E.
26	01	13	34*	Loyalty Islands aftershock	22 S.	170 E.
26	09	25	54*	New Hebrides Islands	15 S.	168 E.
27	08	12	58*	Tonga Islands region. Depth about 100 km	22 S.	176 W.
27	14	58	58*	Off northwest coast of Luzon, Philippine Islands	18 N.	120 E.
27	17	17	39*	Near east coast of Hokkaido, Japan. Depth about 100 km	42½ N.	143½ E.
27	18	38	10*	Jujuy Province, Argentina. Felt at Antofagasta. Depth about 200 km.	23 S.	66 W.
27	19	03	50*	Fox Islands, Aleutian Islands	52½ N.	169 W.
28	08	00	09*	Northern Gulf of California	29½ N.	114 W.
28	11	28	14*	Solomon Islands–New Britain region. Felt at Karoola, Rabaul and Warangoi.	5 S.	153½ E.
28	11	47	40*	Peru. Mag. 6½	11 S.	74 W.
28	16	00	50*	Mariana Islands region	13 N.	141½ E.
29	05	07	35*	Outer Mongolia	45 N.	100 E.
29	13	35	00*	Southeastern Alaska	60 N.	141 W.
30	08	16	48*	Hindu Kush	36 N.	71 E.
30	13	54	44*	Kansu Province, China	38 N.	103½ E.
30	14	08	00*	Off coast of Portugal. Felt at Lisbon	37½ N.	14 W.
30	19	27	32*	Southern Bolivia. Depth about 150 km. Mag. 6	21 S.	67½ W.
May 1	00	29	15*	New Hebrides Islands. Depth about 200 km. Mag. 6¼	13½ S.	167½ E.
1	06	10	15**	Banda Sea		
1	07	12	07*	Near west coast of Luzon, Philippine Islands. Felt at Laoag.	18½ N.	120½ E.
1	09	31	43*	Celebes	½ S.	120 E.
1	12	33	35*	Volcano Islands region. Depth about 400 km	26½ N.	140½ E.
2	20	29	18*	Near coast of Guerrero, Mexico. Mag. 6¼–6½	16½ N.	99 W.
2	21	20	13*	Southern Iran	28½ N.	55 E.
3	06	37	55*	Molucca Passage	4 N.	128½ E.
3	20	18	16*	Near south coast of Greece	36½ N.	22 E.
5	05	21	33*	Iran–Iraq border	36½ N.	45½ E.
5	06	31	39*	Belgian Congo	9½ S.	27½ E.
5	13	32	53*	Andreanof Islands, Aleutian Islands. Depth about 60 km.	52 N.	172½ W.
5	23	53	29*	Near coast of southern Alaska. Felt at Juneau and Sitka	57½ N.	136½ W.
6	01	14	20*	Andreanof Islands, Aleutian Islands	52 N.	173½ W.
7	14	47	35*	Afghanistan–Pakistan border	35½ N.	71 E.
7	21	57	03*	Kamchatka region	50 N.	158½ E.
8	02	47	14*	North Atlantic Ocean	45½ N.	28 W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	
May 8	12	40	46*	Salta Province, Argentina. Felt at Antofagasta, Chile. Depth about 200 km. Mag. 6¼–6½.	24	S.	67	W.
9	00	44	12*	Galapagos Islands region. Mag. 6	1½	N.	94½	W.
9	02	40	46*	Dodecanese Islands. Slight damage on Rhodes	36½	N.	27½	E.
9	04	20	31*	Cordoba Province, Argentina. Depth about 200 km. Mag. 6¾.	30½	S.	65	W.
10	22	54	40*	Central Alaska. Felt at College and Tanana. Mag. 6¼–6½.	65	N.	152½	W.
10	23	13	19*	Alaska aftershock. Felt at College	64½	N.	152½	W.
11	00	36	02**	Celebes				
11	05	23	54*	Central Alaska. Felt at College. Mag. 6¼–6½	65	N.	152½	W.
11	05	37	01*	Alaska aftershock. Felt at College	65	N.	151½	W.
11	09	08	43*	Alaska aftershock. Felt at Tanana	65	N.	152½	W.
11	12	11	22*	Alaska aftershock. Felt at Fairbanks and Tanana	65	N.	153½	W.
11	17	50	00**	Marshall Islands region				
12	05	38	16*	Fox Islands, Aleutian Islands	52	N.	169½	W.
12	16	50	05*	South of Honshu, Japan. Depth about 150 km	31	N.	140½	E.
12	17	48	51*	New Hebrides Islands	13	S.	167½	E.
12	18	29	58*	Marshall Islands region	12	N.	162	E.
12	21	12	16*	Peru. Depth about 150 km	6½	S.	75½	W.
12	22	16	00*	Fox Islands, Aleutian Islands	53½	N.	168	W.
14	03	35	09*	New Ireland. Felt at Londolovit, Namatana, and Rabaul	4½	S.	153	E.
14	12	35	42*	Andaman Islands region	12½	N.	95	E.
14	17	41	18*	Quebec Province, Cañada. Felt at Lac des Loups	47	N.	77	W.
15	04	24	50*	Andreanof Islands, Aleutian Islands	51½	N.	173½	W.
15	04	40	54**	Tonga Islands region				
15	07	01	56*	Santa Cruz Islands	11½	S.	165	E.
15	09	43	46*	New Hebrides Islands	13	S.	166½	E.
15	13	45	53*	do	13	S.	166½	E.
15	18	41	23**	Fiji Islands				
16	01	30	00*	Marshall Islands region	12½	N.	161	E.
16	02	04	06*	Andreanof Islands, Aleutian Islands	52	N.	173½	W.
16	21	21	09*	Mona Passage. Felt at Ciudad Trujillo, Dominican Republic.	18	N.	68½	W.
17	05	25	34*	Libya	32	N.	11½	E.
17	07	02	25*	Bismarck Sea	3	S.	147½	E.
17	15	38	20*	Andreanof Islands, Aleutian Islands	51	N.	179	W.
17	17	43	45*	Tonga Islands	18½	S.	174½	W.
18	02	32	52*	New Hebrides Islands. Mag. 6¼–6½	13	S.	167	E.
18	03	31	18*	New Hebrides aftershock	13	S.	167	E.
18	05	26	44*	New Hebrides Islands. Depth about 60 km	13	S.	167	E.
18	12	21	18*	New Hebrides aftershock. Mag. 6–6¼	13	S.	167	E.
19	00	06	00*	New Hebrides aftershock	13	S.	167	E.
20	05	44	47*	South of Fiji Islands. Depth about 550 km	25	S.	180	
21	04	45	24*	Near south coast of Formosa. Depth about 100 km	22	N.	121	E.
21	14	08	18*	Leeward Islands. Depth about 150 km	17½	N.	63	W.
22	02	27	45*	Kenai Peninsula, Alaska	59½	N.	151	W.
22	11	32	50*	Andreanof Islands, Aleutian Islands	50½	N.	175	W.
22	15	08	00*	Bismarck Sea	3	S.	146	E.
22	22	09	56*	Fox Islands, Aleutian Islands	52½	N.	167	W.
23	06	49	47*	Idaho. Felt at Boise, Cascade, and Horseshoe Bend	44½	N.	116	W.
24	16	33	01*	New Guinea	6	S.	146	E.
24	23	04	46	Humboldt County, California. Felt. Mag. 4.8 (Berk.)	40 16	N.	124 11	W.
25	00	35	23*	Andreanof Islands, Aleutian Islands. Mag. 5½–5¾	51½	N.	177	W.
25	14	54	30*	do	51½	N.	177	W.
25	16	54	26*	Samoa Islands region	14½	S.	174	W.
25	17	40	47*	Near west coast of Kyushu, Japan	31	N.	129½	E.
25	21	11	45*	Ecuador–Peru border region. Felt in Ecuador. Depth about 100 km. Mag. 6½.	3	S.	77	W.
26	08	49	47*	Ecuador–Peru aftershock. Depth about 100 km	3	S.	77	W.
26	09	06	51*	Ecuador–Peru border	3½	S.	78½	W.
26	10	56	30*	Fox Islands, Aleutian Islands. Mag. 6–6¼	53	N.	169½	W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
May 26	16	18	10*	Fiji Islands. Depth about 600 km	17½	S.	178½	W.
27	18	27	40*	Dodecanese Islands. Depth about 150 km. Felt on Crete	37	N.	27	E.
27	23	32	43*	Near north coast of New Guinea	5½	S.	146	E.
28	02	14	11**	New Ireland region				
28	16	45	54*	Western Montana. Felt. Slight damage at Philipsburg	46½	N.	113	W.
29	03	15	50*	Tadzhik S. S. R.	38	N.	72½	E.
29	03	39	36*	Fiji Islands region. Depth about 350 km	20	S.	177	W.
29	05	21	29*	Bonin Islands region. Depth about 450 km.	27½	N.	139½	E.
29	06	59	11*	Oaxaca, Mexico	16½	N.	97½	W.
30	05	16	15*	Georgia, S. S. R.	41½	N.	44	E.
30	05	50	26*	Solomon Islands	7	S.	154½	E.
30	16	11	40*	Near north coast of Formosa. Depth about 100 km. Felt in northern Formosa.	25	N.	122	E.
30	18	04	50*	Fox Islands, Aleutian Islands. Mag. 6–6¼	52½	N.	169	W.
30	19	09	09*	Fox Islands, Aleutian Islands	52½	N.	168½	W.
30	21	14	17**	Southern Bolivia				
30	21	20	05**	Fiji Islands region				
31	08	01	27*	Southern Bolivia	21½	S.	64	W.
34	09	31	18*	Georgia, S. S. R.	41½	N.	44½	E.
31	19	32	30*	New Hebrides Islands. Mag. 7.2	15	S.	169	E.
June 1	04	00	06*	Near east coast of Kamchatka	52½	N.	160	E.
1	10	40	17*	Bolivia–Chile border region. Depth about 150 km	1[illegible]	S.	69	W.
1	12	34	56*	Near north coast of New Guinea. Felt at Goroka	5½	S.	146	E.
1	18	21	17*	Alaska	60½	N.	143½	W.
1	19	47	05*	Southern Bolivia	19	S.	64½	W.
3	01	49	36*	Andreanof Islands, Aleutian Islands	51½	N.	178½	W.
3	19	31	52*	New Hebrides Islands. Mag. 6½	15	S.	168	E.
4	09	47	39*	New Guinea. Depth about 150 km	7	S.	145	E.
4	14	29	50*	Fox Islands, Aleutian Islands. Mag. 6–6¼	52½	N.	167	W.
5	02	14	16*	New Britain	5½	S	151½	E.
5	08	21	07*	Santa Cruz Islands	10½	S.	16[illegible]	E.
5	13	23	57*	Near coast of Nicaragua	12½	N.	86½	W.
5	13	29	42*	Off coast of Greece. Felt in southwestern Greece. Depth about 100 km.	36½	N.	20	E
6	09	11	14*	Off coast of Costa Rica. Mag. 6½–6¾	8	N.	84½	W.
6	12	23	54*	Northern Chile. Depth about 150 km	21	S.	69	W.
6	14	38	50*	Costa Rica aftershock	7	N.	84½	W.
6	15	52	10**	do				
6	19	15	28*	South of Costa Rica. Mag. 6	5½	N.	82½	W.
6	22	44	05*	Off coast of Costa Rica	8	N.	84½	W.
6	22	46	20**	Revilla Gigedo Islands				
7	00	28	45*	South of Panama	½	N.	82½	W.
7	03	23	42*	New Britain. Depth about 150 km	5	S.	150½	E.
7	12	55	01*	South of Tasmania	53	S.	140	E.
8	00	38	52*	Fox Islands, Aleutian Islands. Mag. 6½–6¾	53	N.	167	W.
8	15	52	23*	Near coast of southern Peru	16	S.	75	W.
8	21	09	23*	Atlantic Ocean	7	N.	34½	W.
9	15	59	00*	Fox Islands, Aleutian Islands	52½	N.	168	W.
9	21	16	58*	Near east coast of Kamchatka	54½	N.	160½	E.
10	00	10	30*	Fox Islands, Aleutian Islands	53	N.	167	W.
10	04	00	04*	Kermadec Islands	30½	S.	177	W.
10	04	53	35*	Bonin Islands region. Depth about 500 km	27½	N.	140	E.
10	07	04	02*	Western Iran	30½	N.	51½	E.
10	20	21	26**	Panama–Colombia border				
12	11	54	04*	Off coast of Costa Rica. Mag. 6–6¼	7½	N.	84½	W.
12	20	52	57*	Fox Islands, Aleutian Islands. Mag. 6½	53	N.	167	W.
12	21	33	25*	Fox Islands, Aleutian Islands	53	N.	167	W.
13	08	54	51*	Samoa Islands region	15	S.	173½	W.
13	10	58	44*	South of Australia	50	S.	126	E.
14	18	29	59*	Marshall Islands	12	N.	161½	E.
15	02	41	10*	Fiji Islands. Depth about 550 km	20	S.	178	W.
15	07	17	29*	Fiji Islands region	22	S.	178	W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.	Region, focal depth, and remarks	Coordinates of provisional epicenter	
			Latitude	Longitude
	h m s		° ′	° ′
June 15.....	11 32 38*	Near coast of New Guinea	9 S.	150 E.
15.....	14 54 37*	Fiji Islands. Depth about 600 km. Mag 6¼	18 S.	178½ W.
15.....	17 20 56*	Near coast of New Guinea	9½ S.	150 E.
16.....	01 10 12*	New Hebrides Islands. Depth about 100 km	14½ S.	167½ E.
16.....	07 13 39*	New Hebrides Islands	15 S.	169 E.
16.....	08 13 07*	Fiji Islands region	14½ S.	177½ W.
16.....	14 31 59*	Near coast of El Salvador. Felt in southern El Salvador. Depth about 100 km.	13 N.	88½ W.
16.....	14 56 58*	Near coast of Peru	7½ S.	80 W.
17.....	00 27 08*	Hokkaido, Japan. Felt. Depth about 100 km	42½ N.	141 E.
17.....	15 07 30*	Bonin Islands region	27 N.	141 E.
17.....	19 06 43*	Volcano Islands. Depth about 60 km	25 N.	142½ E.
18.....	01 15 02*	Off north coast of Iceland	68½ N.	16 W.
18.....	02 23 27*	Iceland aftershock	69 N.	16 W.
18.....	04 34 04*	.....do	69 N.	16 W.
18.....	06 40 40*	Off south coast of Mexico	14½ N.	94 W.
19.....	03 21 56*	Alaska–Yukon, Canada border	59 N.	136 W.
19.....	04 01 08*	Mexico–Guatemala border. Depth about 100 km	15½ N.	92 W.
19.....	05 18 00*	Kurile Islands. Mag. 6½	49½ N.	156 E.
19.....	09 48 50**	Near coast of Guerrero, Mexico	.....	.....
19.....	11 11 20*	New Hebrides Islands	15½ S.	168½ E.
19.....	18 02 15*	South of Tasmania	52½ S.	140 E.
20.....	00 47 58*	Samoa Islands region	16 S.	173 W.
20.....	17 32 36*	Fiji Islands. Depth about 600 km	20½ S.	179 W.
20.....	19 17 10*	Off coast of Kyushu, Japan	31½ N.	129½ E.
21.....	03 25 09*	North Atlantic Ocean	33 N.	42 W.
21.....	08 23 43**	Andreanof Islands, Aleutian Islands	.....	.....
21.....	23 39 30**	Near southeast coast of Kamchatka	.....	.....
22.....	04 57 38*	Southern Kurile Islands	44 N.	147 E.
22.....	05 29 29*	Sea of Japan. Depth about 350 km	37 N.	135 E.
23.....	05 10 03*	Outer Mongolia	49 N.	102 E.
23.....	07 19 02	New Hebrides Islands	15½ S.	168½ E.
23.....	18 53 23*	Fiji Islands foreshock. Depth about 650 km	18 S.	178 W.
23.....	19 17 43*	Fiji Islands. Depth about 650 km	18 S.	178 W.
24.....	00 09 18*	Near south coast of Java. Depth about 200 km	8½ S.	112 E.
24.....	04 48 15*	Western Sinkiang Province, China	40½ N.	78½ E.
25.....	09 36 30*	Near north coast of New Guinea. Mag. 6.5	3 S.	144½ E.
25.....	12 43 55*	New Britain. Felt at Rabaul	5 S.	152 E.
25.....	23 24 03*	Sea of Okhotsk. Depth about 450 km	52 N.	152½ E.
26.....	04 38 25*	Kamchatka. Depth about 150 km. Mag. 6½–6¾	54 N.	159½ E.
26.....	07 39 21*	Ryukyu Islands	24 N.	125½ E.
26.....	23 29 32*	South of Honshu, Japan	31 N.	141½ E.
27.....	05 44 28*	Near coast of El Salvador. Slight damage in southern El Salvador. Depth about 60 km. Mag. 6.	13 N.	88½ W.
28.....	19 29 58*	Marshall Islands	12 N.	162 E.
29.....	03 25 42*	Southern Peru. Depth about 150 km. Mag. 6½ (Berk)	15½ S.	70½ W.
29.....	09 14 37*	Tonga Islands	16½ S.	172 W.
29.....	12 40 48*	Samoa Islands region	15½ S.	173 W.
29.....	23 14 59*	Molucca Passage	3½ N.	127 E.
30.....	08 42 33*	Dodecanese Islands. Felt	36½ N.	27½ E.
30.....	14 02 08*	Baffin Bay	73 N.	69½ W.
30.....	18 26 20*	South of Honshu, Japan. Mag. 6¾	31 N.	141½ E.
July 1.....	05 53 07*	Andreanof Islands, Aleutian Islands. Mag. 6	51½ N.	176½ W
2.....	00 44 38*	Near east coast of Kamchatka. Depth about 60 km	52½ N.	158 E.
2.....	04 48 03*	Fiji Islands. Depth about 350 km	18 S.	177 W.
2.....	16 41 07*	Samoa Islands region	15 S.	174 W.
3.....	05 45 07*	Mascarene Islands region	18 S.	66 E.
3.....	06 27 44*	Kermadec Islands region. Depth about 400 km. Mag. 6.	29 S.	179 W.
3.....	10 23 02*	Pacific Ocean	55 S.	126 W.
3.....	12 48 00*	Sea of Okhotsk. Depth about 400 km	48 N.	147 E.
3.....	19 00 36*	Off coast of El Salvador. Felt in western El Salvador. Depth about 100 km.	12 N.	89½ W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
July 4	00	19	28*	Tonga Islands	19	S.	173½	W.
4	00	53	10*	Atlantic Ocean	9	N.	40	W.
4	13	05	37**	About 250 miles north of Balleny Islands				
4	18	34	03*	Near south coast of Mindanao, Philippine Islands. Felt at Cotabato, Davao, and Zamboanga.	6	N.	125	E.
5	23	21	50**	About 150 miles off coast of Honshu, Japan				
6	04	40	59*	Alaska Peninsula	55	N.	160½	W.
6	16	03	14*	Central Alaska	66	N.	155	W.
6	18	31	00**	Gulf of California. Mag. 4¾				
6	23	34	11*	South of Honshu, Japan	31	N.	142	E.
7	05	16	04*	Andreanof Islands, Aleutian Islands	50½	N.	180	
7	13	38	00*	do	50½	N.	179½	E.
8	05	02	14**	Near Czechoslovakia–Germany border				
8	06	06	28*	Tonga Islands	21½	S.	174	W.
8	22	48	36*	Indian Ocean, northeast of Prince Edward Islands. Mag. 6.	43	S.	41½	E.
9	13	54	27*	Fiji Islands. Depth about 600 km	20½	S.	178½	W.
9	14	16	59*	New Britain	5½	S.	151½	E.
9	15	18	20*	Guatemala. Depth about 100 km	14½	N.	91½	W.
10	06	15	51	Southeastern Alaska. 5 killed and moderate property damage. Extensive fissuring and avalanche activity. Portions of Khantaak Island submerged in Yakutat Bay. Waves estimated as greater than several hundred feet in Lituya Bay. Mag. 7.9.	58.6	N.	137.1	W.
10	07	44	52*	Alaska aftershock	59½	N.	140½	W.
10	07	58	12*	do	60	N.	140	W.
10	08	56	06*	do	59½	N.	141	W.
10	10	05	20**	do				
10	10	13	33**	do				
10	10	16	35*	do	60½	N.	140	W.
10	11	36	59**	do				
10	12	26	37*	do	59½	N.	141½	W.
10	13	16	20*	do	57½	N.	139	W.
10	15	02	02*	Southeastern Alaska	60	N.	141	W.
10	18	34	22**	Alaska aftershock				
11	07	43	05*	Andreanof Islands, Aleutian Islands	51	N.	175	W.
11	19	10	20*	Northern Chile. Mag. 6½	21	S.	69	W.
11	19	50	08*	Alaska aftershock	57½	N.	137½	W.
12	00	48	30*	Pacific Ocean. Mag. 6	5	S.	106½	W.
12	02	31	55*	Pacific Ocean	4½	S.	105½	W.
12	03	29	58*	Marshall Islands	12	N.	165	E.
13	08	10	02	Alaska aftershock. Felt at Sitka. Mag. 5½–5¾ (Berk)	58.3	N.	136.9	W.
13	11	23	48**	Alaska aftershock				
13	12	03	50*	Solomon Islands. Depth about 100 km	10	S.	161½	E.
13	15	28	00*	India–Burma border	24½	N.	94	E.
13	23	04	28*	Komandorskie Islands	55	N.	168	E.
14	02	54	18*	Southeastern Alaska	61	N.	143	W.
14	05	25	55	Near coast of California. Slight damage at Carpinteria. Mag. 4.7.	34 21	N.	119 29	W.
15	05	59	34*	Southeastern Alaska	60	N.	140½	W.
15	07	59	18*	Near west coast of Crete	35½	N.	23½	E.
16	01	47	20*	Andreanof Islands, Aleutian Islands	51½	N.	176½	W.
16	03	52	39*	do	51½	N.	176½	W.
16	12	54	18*	South Pacific Ocean. Mag. 6 (Berk)	29½	S.	113	W.
16	16	54	17*	Santa Cruz Islands	12	S.	166½	E.
16	18	40	21*	do	12	S.	166½	E.
16	21	58	20**	Belgian Congo–Northern Rhodesia border				
17	05	37	06*	Northern Greece. Minor damage at Salonika	40½	N.	23	E.
17	13	48	45*	Southeastern Alaska. Felt at Juneau and Sitka	57½	N.	137	W.
17	19	02	10*	Andreanof Islands, Aleutian Islands. Mag. 5¾ (Berk)	51	N.	176	W.
17	19	29	36*	Andreanof Islands, Aleutian Islands	51	N.	177	W.
17	20	59	17*	Andreanof Islands, Aleutian Islands. Mag. 6 (Berk)	51	N.	177½	W.
18	00	39	18*	Andreanof Islands, Aleutian Islands. Mag. 5¾ (Berk)	51	N.	176½	W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
July 18	01	47	21*	Ecuador–Peru border. Depth about 100 km	4	S.	78	W.
18	17	03	58*	Southeastern Alaska. Felt at Juneau	58½	N.	138½	W.
18	21	38	05*	Ryukyu Islands region	25½	N.	124	E.
19	06	30	19*	New Guinea. Depth about 150 km	4	S.	138½	E.
19	14	57	24*	Near south coast of Hokkaido, Japan	41	N.	143½	E.
19	17	23	20*	Andreanof Islands, Aleutian Islands	51½	N.	176	W.
19	18	16	52*	Spice Islands	0		129½	E.
19	22	14	01*	Spice Islands aftershock	½	S.	129	E.
20	11	43	47*	Central Chile. Felt at Santiago, Valparaiso, San Antonio, and La Serena.	31½	S.	71	W.
21	07	24	58*	Kurile Islands. Mag. 6–6¼ (Berk). Felt in Japan	44½	N.	147½	E.
21	09	39	06*	Near coast of El Salvador	12	N.	89	W.
21	14	37	18*	Andreanof Islands, Aleutian Islands, Mag. 6¼ (Berk)	51½	N.	178	W.
21	18	32	58*	New Hebrides Islands	14	S.	167½	E.
22	03	55	35*	Southeastern Alaska	58½	N.	138	W.
22	05	08	40*	Andreanof Islands, Aleutian Islands	51	N.	176	W.
22	10	37	57*	Southeastern Alaska	59	N.	138	W.
22	14	54	00*	Fiji Islands region. Depth about 600 km	22	S.	180	
22	20	30	00**	Marshall Islands region	.....		.....	
22	22	45	51*	Gulf of Alaska. Depth about 100 km	53	N.	160	W.
23	10	27	19*	South of Honshu, Japan	31	N.	142	E.
23	11	44	00**	Solomon Islands region	.....		.....	
23	14	15	34*	Off coast of Chile	26½	S.	73½	W.
23	18	03	56*	Off coast of Nicaragua	10	N.	89½	W.
24	13	08	05*	Fox Islands, Aleutian Islands	52½	N.	170	W.
25	01	43	43*	Southeastern Alaska	58½	N.	137	W.
25	17	50	15*	Molucca Passage	3½	N.	128½	E.
26	06	13	50*	South Indian Ocean	40	S.	45½	E.
26	08	35	10*	South Pacific Ocean	60½	S.	168½	W.
26	17	37	09*	Peru–Bolivia border. Depth about 620 km. Mag. 7.5	13½	S.	69	W.
26	20	29	59*	Marshall Islands	12	N.	161½	E.
27	00	22	32*	Fiji Islands region. Depth about 600 km	20½	S.	178½	W.
27	00	56	00*	Southeastern Alaska	58½	N.	137	W.
27	02	14	22	Andreanof Islands, Aleutian Islands	51	N.	179	W.
27	03	21	56*	Kurile Islands	45½	N.	148	E.
27	17	01	29*	New Hebrides Islands	15½	S.	169	E.
27	17	19	03*	South Indian Ocean	28½	S.	62	E.
27	18	30	33*	North Atlantic Ocean	55	N.	34½	W.
28	01	23	05*	New Britain. Depth about 200 km	5	S.	151½	E.
28	17	24	40*	Fiji Islands region. Depth about 500 km	20	S.	177½	W.
28	18	33	45*	South Pacific Ocean, west of Easter Island	26½	S.	115½	W.
28	21	23	25*	Fiji Islands. Depth about 650 km	20	S.	178½	W.
29	10	49	27*	Tonga Islands	20½	S.	175½	W.
29	21	37	25*	Atlantic Ocean	4	N.	26½	W.
30	02	47	17*	Kurile Islands. Felt at Kushiro, Japan	44½	N.	148½	E.
30	04	44	53*	New Guinea	2½	S.	140	E.
30	07	32	28*	South of Honshu, Japan	30	N.	141	E.
30	15	10	18**	South Pacific Ocean, about 1800 miles southwest of Easter Island.	.....		.....	
31	02	03	45*	Andreanof Islands, Aleutian Islands	51½	N.	174½	W.
31	02	26	23*	.....do	51½	N.	174½	W.
31	12	00	57**	San Juan Province, Argentina. Depth about 150 km	.....		.....	
31	15	48	32*	Southern Alaska. Felt at Anchorage	61½	N.	151	W.
Aug. 1	05	37	50*	Fiji Islands region. Depth about 450 km	16	S.	176½	W.
1	12	28	28*	Near south coast of Luzon, Philippine Islands. Felt at Calapan, Manila, and Romblon. Depth about 150 km.	13½	N.	120½	E.
1	14	27	31*	Fiji Islands. Depth about 500 km	19	S.	177½	W.
2	04	45	25**	Off coast of Oaxaca, Mexico	.....		.....	
3	01	06	24*	Fiji Islands region. Depth about 550 km. Mag. 6¼–6½	21½	S.	179	W.
4	04	13	19*	Banda Sea. Depth about 150 km	6	S.	130	E.
4	06	27	20*	Samoa Islands	15	S.	172	W.
4	08	44	27**	Fiji Islands region	.....		.....	

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Aug. 4	13	33	55*	New Britain region	5½	S.	152½	E.
4	17	29	43*	Samoa Islands region. Depth about 250 km	15½	S.	175	W.
4	17	48	20*	Kurile Islands. Felt at Kushiro, Japan. Depth about 200 km.	43½	N.	147	E.
5	17	21	47*	Tonga Islands region	24½	S.	175	W.
6	02	49	10**	Near coast of northern Chile				
6	09	51	24*	Salta Province, Argentina. Depth about 550 km	24½	S.	63	W.
6	14	23	25**	Solomon Islands				
6	17	16	05*	Near coast of Norway. Felt in western Norway	59½	N.	5½	E.
6	21	09	09*	Tonga Islands. Mag. 6¾	17	S.	173	W.
6	21	51	00*	Santa Cruz Islands. Depth about 150 km	12	S.	167	E.
7	00	46	43	Southeastern Wyoming. Felt	41.1	N.	106.0	W.
8	00	36	13*	Komandorskie Islands	55	N.	166	E.
8	05	29	40*	France–Spain border region. Felt at Barcelona and Gerona.	42	N.	2½	E.
8	12	52	06*	Hindu Kush. Depth about 200 km	37	N.	71½	E.
8	14	40	55*	Southeastern Alaska	59½	N.	139	W.
8	20	37	30*	France–Spain border region. Felt at Barcelona and Gerona.	42	N.	2½	E.
9	12	47	55**	South Atlantic Ocean, about 750 miles northeast of Sandwich Islands.				
10	18	05	54*	New Britain region. Felt at Rabaul	3½	S.	151½	E.
10	23	41	37*	Mariana Islands region. Depth about 150 km	21½	N.	144	E.
11	07	53	12*	New Hebrides Islands	18	S.	168½	E.
11	20	26	22*	Off coast of Sumatra	3	S.	100½	E.
12	08	15	59*	Andreanof Islands, Aleutian Islands	51½	N.	175	W.
12	15	10	57*	Southeastern Alaska	59½	N.	139	W.
12	15	35	40**	Off coast of Oaxaca, Mexico. Depth about 100 km				
12	16	23	42*	Gulf of California	27	N.	110½	W.
12	16	53	13*	Molucca Passage foreshock	½	N.	126	E.
12	19	04	20*	Timor Island	9½	S.	123½	E.
12	19	25	05*	Molucca Passage	0		126½	E.
12	23	12	17*	Near coast of New Britain. Felt at Rabaul. Depth about 100 km.	6	S.	152	E.
13	00	11	28*	Near coast of New Britain	6	S.	152½	E.
13	03	50	35*	Molucca Passage aftershock	½	N.	126	E.
13	07	33	29*	Northern Afghanistan	36½	N.	66½	E.
13	10	02	49*	Off coast of New Britain	6	S.	153	E.
13	10	46	47**	Andreanof Islands, Aleutian Islands				
13	14	49	17*	Fiji Islands region. Depth about 550 km	17½	S.	178	W.
13	19	21	21**	Solomon Islands				
13	20	13	00*	Andreanof Islands, Aleutian Islands	51	N.	177½	W.
13	21	56	31*	Solomon Islands region. Felt at Rabaul. Depth about 200 km.	4½	S.	154	E.
14	02	28	25*	Mariana Islands	19½	N.	146½	E.
14	09	45	14*	Tonga Islands region	23½	S.	175½	W.
14	11	27	00*	Iran	34½	N.	48	E.
14	12	43	28*	New Hebrides Islands	14	S.	167½	E.
14	14	55	10*	Andreanof Islands, Aleutian Islands. Mag. 6½	52	N.	175	W.
14	15	18	05*	Andreanof Islands, Aleutian Islands	51	N.	175½	W.
14	15	26	19*	Iran	34	N.	47½	E.
15	02	26	51*	New Britain	6	S.	150½	E.
15	06	20	53*	Northern Colombia. Felt. Depth about 200 km	7	N.	73	W.
15	19	55	39*	Near east coast of Kamchatka. Depth about 60 km. Mag. 6¾.	53	N.	160½	E.
15	22	29	17*	Celebes. Depth about 170 km. Mag. 7.0	1½	N.	125	E.
16	13	17	52*	Andreanof Islands, Aleutian Islands. Mag. 6–6¼	51½	N.	176	W.
16	19	13	45*	Iran. 200 killed and extensive property damage in western Iran.	34½	N.	48	E.
17	09	08	35*	Andreanof Islands, Aleutian Islands. Felt on Adak	51½	N.	176	W.
17	10	50	40*	Andreanof Islands, Aleutian Islands	51	N.	176	W.
17	11	16	13*	....do	51½	N.	176	W.
17	18	01	05*	Bismarck Sea	3	S.	145½	E.
17	21	11	09*	Kermadec Islands region	35½	S.	179½	W.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Aug. 18	06	00	52*	Gulf of California. Felt at San Diego. Mag. 5¼	30½	N.	114	W.
18	06	44	14*	Gulf of California. Felt at San Diego. Mag. 5½	30½	N.	114	W.
18	10	16	40*	Panama–Colombia border	7½	N.	78	W.
18	15	19	20*	Kurile Islands	48	N.	155	E.
19	04	45	45*	Fiji Islands region	19	S.	175	E.
19	16	06	18*	Andreanof Islands, Aleutian Islands	51½	N.	175½	W.
19	16	29	44*	Near east coast of Kamchatka. Depth about 100 km	53	N.	160	E.
19	21	48	07*	New Ireland	1	S.	149½	E.
19	22	55	18*	New Ireland region	1	S.	149	E.
20	03	40	07*	New Hebrides Islands. Mag. 6¼–6½	14	S.	167	E.
20	05	00	59*	New Ireland aftershock	1	S.	149	E.
20	06	22	23*	Outer Mongolia	45	N.	99½	E.
20	08	46	04*	Near east coast of Formosa	24	N.	122	E.
20	09	20	10*	Kamchatka	53½	N.	159½	E.
20	09	48	38**	New Hebrides Islands				
20	17	39	38*	....do	19	S.	170	E.
20	21	42	21*	Kamchatka	52	N.	158	E.
20	22	25	47**	Hindu Kush. Depth about 250 km				
20	22	48	05*	New Britain foreshock. Depth about 250 km	5	S.	149	E.
21	00	12	53*	Southern Bolivia. Depth about 300 km	20	S.	65	W.
21	01	09	00*	Tonga Islands region	24	S.	176	W.
21	04	03	26*	....do	24	S.	176	W.
21	08	27	35*	Santiago del Estero Province, Argentina. Depth about 550 km.	26½	S.	62	W.
21	11	54	40*	Bonin Islands region. Depth about 450 km	28	N.	139½	E.
21	12	19	00*	Fox Islands, Aleutian Islands	53	N.	163	W.
21	20	59	10*	Fiji Islands region. Depth about 250 km	18	S.	176	W.
22	00	01	21*	South Indian Ocean	49½	S.	117	E.
22	09	56	40*	New Hebrides Islands. Depth about 100 km	15	S.	167	E.
22	12	18	53*	Pacific Ocean	11½	S.	97	W.
22	20	33	40*	Andreanof Islands, Aleutian Islands	51	N.	179½	W.
22	22	16	48*	New Britain. Felt at Port Moresby	5½	S.	150	E.
22	23	18	33*	Pacific Ocean	26½	S.	115	W.
23	07	59	09*	Santa Cruz Islands	12	S.	167	E.
23	21	56	53*	Andreanof Islands, Aleutian Islands	52	N.	173	W.
24	08	02	30*	Iran	34	N.	48½	E.
24	16	54	25*	Near coast of Luzon, Philippine Islands. Felt at Manila. Depth about 150 km.	14	N.	121	E.
25	06	27	12*	Tonga Islands region	24	S.	175½	W.
25	08	26	35*	Loyalty Islands region	23	S.	173	E.
26	05	00	29*	Near east coast of Honshu, Japan	37½	N.	142	E.
26	12	20	43*	New Hebrides Islands foreshock	14	S.	167	E.
26	12	45	02*	....do	14	S.	167	E.
26	14	40	24**	Near west coast of Java				
26	15	57	57*	Santa Cruz Islands. Depth about 150 km	12	S.	167	E.
26	17	55	34*	New Hebrides Islands	14	S.	167	E.
26	23	23	20*	New Hebrides Islands aftershock	14	S.	167	E.
26	23	31	38*	....do	14	S.	167	E.
26	23	45	07*	....do	14	S.	167½	E.
27	02	25	32*	About 1000 miles southwest of Galapagos Islands	4½	S.	104½	W.
27	13	09	03*	Kamchatka	53½	N.	159½	E.
27	15	16	35*	Near west coast of Greece. Felt	38	N.	20½	E.
28	09	36	06*	Chile–Argentina border. Minor damage at Las Melosas, Chile.	33½	S.	69½	W.
28	18	15	49*	Fox Islands, Aleutian Islands	53	N.	170½	W.
29	12	24	23*	New Hebrides Islands. Mag. 5¾–6	14½	S.	167	E.
29	12	51	57*	New Hebrides Islands aftershock	14	S.	167	E.
30	18	38	18*	Gulf of California	27½	N.	112	W.
31	06	37	39**	Off southeast coast of Kamchatka				
31	09	18	15*	Iran–Pakistan border	28½	N.	62	E.
31	15	24	45*	Central Alaska	63½	N.	148	W.
31	16	19	57*	Santa Cruz Islands	11	S.	166½	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Aug. 31	23	00	16*	Central Alaska. Felt at Tanacross. Mag. 5¾–6 (Berk)	63	N.	144½	W.
Sept. 1	00	57	10*	Tonga Islands region	24	S.	175½	W.
1	14	30	46*	Bolivia. Many injured and extensive property damage at Aiquile.	18	S.	65	W.
1	15	29	31*	Sea of Japan. Felt at Kushiro and Utsunomiya. Depth about 400 km.	38	N.	134½	E.
2	01	13	26*	Ionian Islands. Felt	38	N.	21	E.
2	02	27	41*	Santa Cruz Islands region	10½	S.	164½	E.
2	02	56	34*	Solomon Islands. Depth about 100 km	6½	S.	155	E.
2	14	25	37*	Near north coast of New Guinea. Felt	5½	S.	145½	E.
2	19	41	10**	Near coast of El Salvador. Felt. Depth about 100 km				
2	20	07	04*	Near coast of Oaxaca, Mexico	15	N.	92½	W.
3	01	34	06*	Iran	34	N.	47	E.
3	03	44	24*	Atlantic Ocean	0		18	W.
3	04	17	50**	Off coast of Guatemala				
3	08	10	26*	Off northeast coast of Honshu, Japan. Depth about 60 km	40½	N.	143	E.
4	00	03	00*	Dodecanese Islands. Felt. Depth about 60 km	37	N.	26½	E.
4	06	58	52*	Rat Islands, Aleutian Islands	51½	N.	177½	E.
4	21	51	08*	Chile–Argentina border. 4 killed and major property damage at San Jose and Volcan. Felt at Rancaqua and Santiago. Mag. 6.7.	33½	S.	69½	W.
4	23	10	22*	Fiji Islands. Depth about 500 km	18½	S.	178	W.
5	03	41	22**	Chile–Argentina border				
5	06	12	58*	....do	34	S.	70	W.
5	10	59	03**	Kurile Islands				
5	13	01	55*	Near coast of Sumatra	5	S.	102	E.
5	13	08	04*	Sumatra aftershock	5	S.	102	E.
5	14	14	17*	....do	5	S.	101½	E.
7	02	48	14*	Northern Colombia. Depth about 150 km	7	N.	73	W.
7	04	40	57*	Solomon Sea. Felt at Losnia	10	S.	153	E.
7	04	43	37*	....do	9½	S.	152½	E.
7	10	07	05*	Ryukyu Islands	27	N.	127½	E.
8	05	25	37*	Near east coast of Kamchatka. Depth slightly greater than normal.	53½	N.	159	E.
8	13	58	19**	Santa Cruz Islands region				
8	14	53	13*	Northern Kyushu, Japan. Felt. Depth about 60 km	33½	N.	131½	E.
8	22	24	55*	Chile–Argentina border	34	S.	70	W.
9	04	09	38**	Java Sea				
9	11	32	10*	Kurile Islands. Depth about 60 km	46	N.	151	E.
9	22	23	37*	Near Islands region, Aleutian Islands	54	N.	171	E.
11	18	01	44*	Near east coast of Mindanao, Philippine Islands. Felt on Davao and Surigao.	7½	N.	126½	E.
11	23	37	33*	Loyalty Islands	21	S.	170½	E.
12	05	37	46*	Indian Ocean	41	S.	78½	E.
12	13	45	46*	Java	6	S.	106	E.
12	22	08	06*	Banda Sea	6½	S.	129½	E.
14	14	21	37*	Stanavoi Mountains region, Siberia. Mag. 6¼–6½	57	N.	121	E.
14	17	57	28**	New Hebrides Islands				
14	19	42	13*	Off east coast of Kyushu, Japan	31	N.	133	E.
14	21	31	55*	Chagos Archipelago region	7	S.	68	E.
15	05	36	18*	Pacific Ocean. Depth about 100 km	8½	N.	103½	W.
15	16	48	10*	Kermadec Islands region	33	S.	179	W.
15	19	01	38*	Near west coast of Kamchatka	52	N.	156½	E.
15	19	45	40*	Celebes Sea. Depth about 600 km. Mag. 6–6¼	2½	N.	120½	E.
16	03	52	52*	Eastern Siberia	61	N.	136½	E.
16	07	22	20*	Panay Island, Philippine Islands. Felt at Iloilo and Roxas City.	11½	N.	123	E.
16	12	45	23*	Tonga Islands	22	S.	175	W.
16	14	22	30*	Eastern Iran	34½	N.	59½	E.
17	12	23	50*	Kurile Islands	48½	N.	155	E.
18	03	35	32**	Sandwich Islands				
18	06	51	09*	Near north coast of New Guinea. Felt	2½	S.	141	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Sept. 18	14	41	40*	Mid-Atlantic Ocean	½	N.	30	W.
18	20	53	02*	Hindu Kush. Depth about 150 km	36½	N.	71	E.
18	21	24	42*	Off coast of Peru	9½	S.	80	W.
19	08	12	33*	Molucca Passage	2½	N.	127	E.
19	17	18	40*	Fox Islands, Aleutian Islands	53	N.	168½	W.
20	05	17	23*	North Viet Nam	20½	N.	105	E.
20	10	34	00*	Atlantic Ocean	15½	N.	46	W.
20	17	09	24*	Solomon Islands	6½	S.	154½	E.
20	17	18	43**	About 400 miles south of Fiji Islands				
21	05	45	10*	Honshu, Japan. Felt	38	N.	142	E.
21	07	24	55	Southeast of Soledad, California. Slight damage in the San Benito area.	36 21	N.	121 07	W.
21	13	29	03*	Samoa Islands region. Felt at Apia. Depth about 150 km.	15	S.	174	W.
21	16	18	30*	Iran. Many casualties and heavy damage at Karksar	36	N.	49	E.
22	07	00	14*	Off north coast of Java. Depth about 600 km	6	S.	110	E.
22	08	37	27*	Bonin Islands. Depth about 500 km	27½	N.	140	E.
22	11	32	54*	Ecuador. Depth about 200 km	1½	S.	77	W.
22	19	05	44*	Kermadec Islands region. Mag. 6¾	33½	S.	177½	W.
22	20	08	40*	Hokkaido, Japan. Felt	42	N.	142	E.
22	22	51	44*	New Hebrides Islands	16½	S.	168½	E.
23	03	50	15	Northern California. Felt in Humboldt County. Mag. 4.4 (Berk).	40 16	N.	124 35	W.
24	03	44	14*	Gulf of Alaska. Mag. 6¼	59½	N.	143½	W.
24	13	53	05**	Central Chile. Felt at Santiago				
25	06	54	00*	Hindu Kush. Depth about 200 km	36½	N.	70	E.
25	07	20	01*	Atlantic Ocean. Mag. 6½	9	N.	39½	W.
25	07	55	25*	Off north coast of Puerto Rico	19½	N.	66	W.
25	15	15	37*	Kermadec Islands region	32½	S.	178	W.
25	20	24	44*	Pacific Ocean. Southeast of Easter Island	36	S.	98	W.
25	20	55	53*	Kermadec Islands region	33	S.	178½	W.
26	11	34	24**	Banda Sea				
26	18	10	28*	Andreanof Islands, Aleutian Islands	50½	N.	175	W.
27	07	36	07*	Off south coast of Java	9	S.	106	E.
27	10	41	28*	Near north coast of Iceland	66	N.	17	W.
27	12	37	07*	Near coast of Honshu, Japan. Felt	37	N.	141½	E.
27	13	55	02*	Samoa Islands region. Depth about 150 km	15	S.	174	W.
28	12	50	25*	New Britain–Solomon Islands region. Felt	5	S.	153½	E.
28	20	53	40*	Honshu, Japan. Felt	36½	N.	139½	E.
29	00	03	46*	Tonga Islands region	16½	S.	173	W.
29	09	53	20*	Banda Sea	4½	S.	130	E.
29	14	17	11*	Off northeast coast of Honshu, Japan	39½	N.	143½	E.
29	15	15	44*	Honshu aftershock. Felt	39	N.	143	E.
30	07	08	37*	Molucca Passage	3½	N.	128	E.
30	08	45	28*	Switzerland–Austria border. Slight damage at Landeck	47	N.	10	E.
30	08	47	06*	Loyalty Islands region	23	S.	172½	E.
30	09	18	10*	Molucca Passage	3	N.	128	E.
Oct. 1	05	21	01*	Off north coast of Luzon, Philippine Islands	19½	N.	121	E.
1	06	31	33*	Santa Cruz Islands	11	S.	166	E.
1	09	29	43*	Antarctic Ocean, southwest of Macquarie Island. Mag. 6¼	57	S.	147	E.
1	11	59	55*	Celebes Sea	3	N.	125	E.
1	16	43	36*	Jan Mayen Island region	71½	N.	3½	W.
1	17	47	15*	Fox Islands, Aleutian Islands. Mag. 6¼	53	N.	165½	W.
1	21	42	11	Southeast of Sierraville, California. Felt in northeastern California and western Nevada. Slight damage.	39 34	N.	120 18	W.
2	04	25	27*	Sandwich Islands region	58	S.	9½	W.
2	15	00	50*	Off east coast of Mindanao, Philippine Islands	7½	N.	127	E.
3	00	33	07*	Philippine Islands region	13½	N.	120	E.
3	02	40	19*	Jujuy–Salta provinces border, Argentina. Depth about 20 km.	24½	S.	67	W.
3	11	26	38*	Southern Indian Ocean	33½	S.	56½	E.
4	00	49	36*	New Guinea. Depth about 100 km	4½	S.	143½	E.
4	04	04	10*	New Hebrides Islands	14	S.	167	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Oct. 4	09	51	26*	Mariana Islands region	22½	N.	144½	E.
4	11	33	07*	....do	22½	N.	144½	E.
4	12	58	24**	Central Alaska. Felt at Anchorage and College				
4	14	18	47*	Jujuy Province, Argentina. Depth about 100 km	22½	S.	67	W.
4	15	08	27*	Mariana Islands region	22½	N.	145	E.
4	18	09	33*	New Hebrides Islands	13½	S.	168	E.
5	06	07	19*	Mariana Islands. Depth about 200 km	18½	N.	145½	E.
6	00	47	20*	Kermadec Islands. Depth about 250 km	32	S.	179½	E.
6	02	08	41*	South of Fiji Islands. Depth about 550 km	24	S.	179½	W.
6	09	29	22*	Iran–Turkmen S.S.R. border	37½	N.	54½	E.
6	18	52	43*	Near east coast of Kamchatka	56	N.	163	E.
7	12	32	40*	New Britain. Felt at Karoola, Pomio, and Rabaul. Mag. 6¼–6½ (Berk).	5	S.	151½	E.
7	15	24	27*	Bolivia–Peru border. Depth about 200 km	16	S.	69	W.
8	11	12	50*	Kermadec Islands. Felt on Raoul Island	29	S.	177½	W.
8	14	00	47*	Solomon Islands	7	S.	155½	E.
8	14	24	27*	....do	7	S.	156½	E.
8	15	38	17*	Kermadec Islands	29	S.	178	W.
9	10	22	08*	Mariana Islands	14	N.	145½	E.
9	11	20	17*	Sandwich Islands region	55½	S.	27½	W.
9	13	31	42*	Crete. Felt	35	N.	25	E.
10	08	30	26*	Near east coast of Kamchatka. Depth about 100 km	53½	N.	160½	E.
10	09	16	40**	Tibet–India border				
10	11	35	24*	Off south coast of Mindanao, Philippine Islands	5½	N.	127	E.
10	13	05	16	Monterey and San Luis Obispo counties, California. Felt	35	56 N.	120	30 W.
10	21	05	51**	Near Islands, Aleutian Islands region				
11	00	41	35*	Yukon Territory, Canada	65½	N.	132½	W.
11	02	00	40*	Near east coast of Kamchatka	53	N.	159½	E.
11	09	06	53*	Near east coast of Hokkaido, Japan	42½	N.	144½	E.
11	14	37	42*	Jujuy Province, Argentina. Depth about 200 km. Mag. 6.	23½	S.	65	W.
12	01	35	27*	Peru. Depth about 150 km	6	S.	74½	W.
12	09	44	50*	Tonga Islands region. Depth about 250 km	17	S.	175½	W.
12	11	15	46*	Rat Islands, Aleutian Islands	51½	N.	178½	E.
12	12	47	42*	Near north coast of New Guinea	4½	S.	144	E.
12	15	18	42*	East China Sea. Depth about 250 km. Mag. 6¾. Felt in Japan.	27½	N.	125½	E.
12	17	27	00*	New Hebrides Islands	14	S.	167	E.
13	05	26	56*	Northwest of Fiji Islands	14	S.	173½	E.
13	08	58	10*	Kirghiz S.S.R.	41½	N.	75	E.
13	09	00	22*	Montana	47	N.	112½	W.
14	09	06	24*	Near east coast of Kamchatka	52½	N.	159	E.
14	21	05	10*	South of Honshu, Japan. Depth about 350 km	33	N.	136½	E.
14	23	22	54*	Chile–Bolivia border. Depth about 300 km	20	S.	68½	W.
15	11	31	30*	Kermadec Islands	31	S.	178½	W.
15	17	03	10*	New Hebrides Islands	17	S.	169	E.
16	11	52	30*	Burma	23	N.	94½	E.
16	18	02	01*	Santa Cruz Islands. Depth about 100 km	11	S.	167	E.
17	10	23	56*	Fiji Islands. Depth about 400 km	19½	S.	177½	W.
18	06	34	17*	Colombia–Venezuela border. Depth about 100 km	7	N.	71½	W.
18	19	01	00*	Antarctic Ocean	53	S.	26	W.
19	01	53	54*	Tonga Islands	19	S.	172½	W.
19	11	42	42*	Kermadec Islands region	34½	S.	178	W.
19	21	22	10**	Near coast of Oaxaca, Mexico				
20	00	55	34*	Andreanof Islands, Aleutian Islands	52	N.	175	W.
20	01	12	37*	Off south coast of Java. 7 killed at Blitar, 1856 injured. 95 houses destroyed, 206 heavily damaged. Felt at Jogjakarta, Malang and Surabaja. Depth about 100 km.	9½	S.	112½	E.
21	06	14	50*	Near northeast coast of New Guinea	5½	S.	147	E.
21	15	40	40*	South of Java	11	S.	111	E.
21	17	32	45*	Kermadec Islands	29	S.	179	W.
21	18	48	38*	Solomon Islands	6	S.	154½	E.
22	23	42	47*	New Hebrides Islands	14½	S.	168	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Oct. 23	02	29	47*	Kentucky–Virginia border	37½	N.	82½	W.
23	06	41	58*	Greece. Felt at Achie, Arcadie and Argolide	38	N.	22	E.
23	15	43	00	Iran	34½	N.	47	E.
23	16	45	12*	Samoa Islands region. Felt at Apia	15	S.	173	W.
24	08	57	33*	New Hebrides Islands	15½	S.	168	E.
24	21	13	06*	Molucca Passage	0		125	E.
25	06	25	04*	South Atlantic Ocean	22½	S.	11	W.
26	02	17	32*	Northern Borneo	5½	N.	117	E.
26	12	40	30*	Iraq–Turkey border	37½	N.	44½	E.
26	15	24	13*	Yukon Territory, Canada	65½	N.	133	W.
26	18	47	35*	Molucca Passage	3	N.	127	E.
27	09	51	40*	Central Alaska	62½	N.	147½	W.
27	15	04	44*	Tonga Islands region	23½	S.	175½	W.
27	18	16	53*	Kurile Islands	44½	N.	147½	E.
28	04	14	55*	Antarctic Ocean	62½	S.	157	W.
28	05	22	48*	Burma	25½	N.	96	E.
28	10	46	27*	Southern Tibet	30½	N.	85	E.
28	18	18	03*	New Britain–Solomon Islands region	4½	S.	153½	E.
28	23	50	08*	Andreanof Islands, Aleutian Islands	52	N.	179½	E.
29	06	07	34*	....do	51	N.	179	E.
29	07	44	10*	Andreanof Islands, Aleutian Islands. Mag. 6¼	51½	N.	179½	E.
29	07	55	14*	Andreanof Islands, Aleutian Islands	51½	N.	179	E.
29	08	06	15*	....do	51	N.	179	E.
29	15	17	00*	Near east coast of Kamchatka	55	N.	161	E.
29	19	25	30*	Andreanof Islands, Aleutian Islands	51	N.	179½	E.
30	03	44	32*	....do	51½	N.	179	E.
30	10	05	00*	Tonga Islands	20½	S.	176	W.
30	23	04	39*	Solomon Islands	10	S.	160½	E.
31	00	26	15	Northeast of San Jose, California. Slight damage. Mag. 4.2 (Berk).	37 30	N.	121 48	W.
31	07	10	00*	Gulf of California	22	N.	109	W.
31	19	02	54*	New Guinea	3½	S.	143½	E.
31	23	39	27*	Near north coast of Formosa. Depth about 100 km	25	N.	122½	E.
Nov. 1	03	38	35*	Bismarck Sea. Felt at Kavieng, New Ireland. Mag. 6¼–6½.	3	S.	150	E.
1	06	06	47*	Off north coast of New Guinea	3½	S.	145½	E.
1	06	15	54**	New Guinea aftershock				
1	12	08	21*	New Hebrides Islands foreshock	17½	S.	168	E.
1	12	15	43*	....do	17½	S.	169	E.
1	12	16	36*	New Hebrides Islands. Mag. 6–6¼	17½	S.	168	E.
1	15	50	10*	New Hebrides Islands aftershock	17½	S.	168	E.
1	17	25	45*	New Hebrides Islands	15½	S.	169	E.
1	19	26	09*	New Hebrides Islands aftershock	18	S.	168½	E.
2	10	44	47*	Andreanof Islands, Aleutian Islands	51½	N.	175	W.
2	18	59	49*	Near coast of Guerrero, Mexico	16	N.	99	W.
3	04	00	30*	Kermadec Islands	31	S.	177½	W.
3	14	31	35*	Tibet	30	N.	84½	E.
4	00	24	24*	Near north coast of New Guinea	6	S.	147½	E.
4	08	28	28*	Bonin Islands region	28	N.	140½	E.
4	08	31	00*	....do	28	N.	141	E.
4	09	16	44*	Colombia. Depth about 150 km	7	N.	73	W.
4	19	55	11*	Santa Cruz Islands	11	S.	166	E.
4	22	54	46*	South Pacific Ocean. Minor seismic sea wave. Mag. 6	50	S.	115	W.
4	23	34	50*	New Hebrides Islands aftershock	17½	S.	168	E.
5	04	27	50*	....do	17	S.	168	E.
5	08	00	11*	Northern Chile. Depth about 150 km	19½	S.	69	W.
5	12	59	39*	Samoa Islands region	14½	S.	175½	W.
5	15	47	25*	Kodiak Island, Alaska. Depth about 60 km	58	N.	154	W.
6	15	30	06*	Banda Sea. Depth about 250 km	6	S.	128	E.
6	22	58	06*	Kurile Islands. Minor seismic sea wave. Slight damage in northern Hokkaido. Depth about 75 km. Mag. 8.7.	44½	N.	148½	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Nov. 7	00	36	12*	Kurile Islands aftershock	44	N.	149	E.
7	01	01	58*	do	44	N.	148½	E.
7	01	13	52*	Kurile Islands aftershock. Depth about 60 km	45	N.	149	E.
7	01	42	56*	Kurile Islands aftershock	44½	N.	149½	E.
7	01	55	33*	do	44½	N.	149	E.
7	02	50	54*	Kurile Islands aftershock. Depth about 60 km	44½	N.	149½	E.
7	04	59	56*	do	44½	N.	149	E.
7	07	40	36*	Kurile Islands aftershock	44½	N.	149	E.
7	10	29	17*	do	44	N.	148	E.
7	11	24	25*	Kurile Islands aftershock. Depth about 60 km	44½	N.	149½	E.
7	17	32	48*	Kurile Islands aftershock. Felt in Japan	44	N.	148½	E.
7	19	14	31*	Kurile Islands aftershock	44½	N.	149½	E.
7	21	33	24	Southwest of Watsonville, California. Felt. Mag. 4¼ (Berk).	36 52	N.	121 53	W.
8	02	41	43	Illinois–Indiana border. Felt in Illinois, Indiana, Kentucky, and Missouri.	38.4	N.	87.9	W.
8	09	22	53*	Off southeast coast of Kamchatka	52	N.	159½	E.
8	12	08	30*	Kurile Islands. Felt in Japan	44½	N.	149	E.
8	19	36	48*	Andaman Islands	11½	N.	93	E.
9	03	14	47*	Kurile Islands aftershock	44	N.	148½	E.
9	10	17	30*	do	44½	N.	150	E.
9	14	33	17*	do	44	N.	148	E.
9	17	52	52*	do	44	N.	148	E.
9	21	04	46*	Kurile Islands aftershock. Felt in Japan	44	N.	148	E.
10	06	58	00**	Pacific Ocean foreshock				
10	11	13	05*	Pacific Ocean	9	S.	110	W.
11	22	37	46*	Near coast of northern Chile	22	S.	69	W.
12	03	58	21*	Off north coast of Luzon, Philippine Islands. Felt at Aparri and Calayan.	19½	N.	122	E.
12	06	09	10*	Venezuela	9½	N.	70	W.
12	10	39	47*	Solomon Islands. Felt lightly at Rabaul. Depth about 100 km.	7	S.	156	E.
12	17	44	11*	Kurile Islands aftershock	44	N.	148½	E.
12	18	36	49*	do	44	N.	149	E.
12	20	23	26*	Kurile Islands aftershock. Felt on Hokkaido and northern Honshu, Japan. Minor seismic sea wave. Mag. 7.3.	44½	N.	148½	E.
12	21	23	20*	Kurile Islands aftershock	44	N.	148½	E.
12	22	59	36*	do	45	N.	149½	E.
12	23	32	00*	do	44	N.	149	E.
13	02	56	26*	Kurile Islands aftershock. Felt in Japan	44	N.	148½	E.
13	04	04	37*	Kurile Islands, aftershock	44½	N.	148	E.
13	05	09	35**	do				
13	05	59	53*	Off west coast of Hokkaido, Japan. Felt in Japan	43½	N.	139	E.
13	08	31	40*	New Hebrides Islands	15	S.	167½	E.
13	09	06	18*	Venezuela	9½	N.	70	W.
13	10	55	56**	Kurile Islands aftershock				
13	16	16	25*	Nicobar Islands	9	N.	93½	E.
13	18	34	22*	Kurile Islands aftershock	44	N.	148	E.
13	23	08	50**	do				
14	05	04	25*	South Pacific Ocean	36	S.	102	W.
14	05	34	53*	Kurile Islands aftershock. Felt in Japan	44	N.	149	E.
14	05	46	34*	Guatemala. Felt at San Salvador, El Salvador. Depth about 150 km.	14½	N.	91½	W.
14	13	48	20*	Banda Sea	6	S.	131	E.
14	15	22	16*	Nicaragua. Felt at Managua. Depth about 100 km	13	N.	86	W.
15	05	42	42*	Southern Greece. Felt	38	N.	22½	E.
15	09	00	45*	Kurile Islands aftershock. Mag. 6½–6¾	44	N.	149	E.
15	09	53	55*	Kurile Islands aftershock	44½	N.	148½	E.
15	19	15	03*	Samoa Islands region	15½	S.	172½	W.
15	22	18	57*	Wyoming	44½	N.	110½	W.
15	23	20	18*	Kurile Islands aftershock	44	N.	148	E.
16	04	47	31*	Kurile Islands aftershock. Felt in Japan	44½	N.	149	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Nov. 16	05	40	46*	Kurile Islands aftershock	44½	N.	149	E.
16	06	15	36*	Kurile Islands aftershock. Depth about 60 km	44	N.	148½	E.
16	10	20	21**	Kurile Islands aftershock	.....		.....	
16	17	44	48*	Samoa Islands region. Felt at Apia. Mag. 6¼	16	S.	172	W.
16	18	02	25*	Loyalty Islands	20	S.	169	E.
16	20	23	56*	Outer Mongolia–China border	42	N.	106	E.
16	21	12	24*	Kurile Islands aftershock. Felt in Japan	44½	N.	147½	E.
16	21	46	00*	Bonin Islands. Depth about 500 km	28	N.	139½	E.
16	22	41	15*	Pacific Ocean, south of Panama	5	N.	83	W.
17	09	46	30*	Solomon Islands	10½	S.	162½	E.
17	15	34	23*	Kurile Islands aftershock	44½	N.	148½	E.
17	18	44	49*	Loyalty Islands	20½	S.	169	E.
18	07	45	30*	Andreanof Islands, Aleutian Islands	50½	N.	179	E.
18	07	56	31*	Aleutian Islands aftershock	51½	N.	178½	E.
18	07	59	48**	....do	.....		.....	
18	18	33	00*	Kurile Islands aftershock	44	N.	149	E.
19	01	35	06*	Santiago del Estero Province, Argentina. Depth about 600 km.	27½	S.	63½	W.
19	03	08	54*	Kurile Islands aftershock	44	N.	149	E.
19	03	53	56*	Kermadec Islands	31	S.	179	W.
19	05	18	52*	Kurile Islands aftershock. Felt in Japan	43½	N.	148½	E.
19	09	23	51*	Kurile Islands aftershock. Depth about 60 km	44	N.	149	E.
19	15	02	15*	Kenai Peninsula, Alaska. Felt. Depth about 60 km	60½	N.	150½	W.
19	19	30	18**	Fiji Islands	.....		.....	
20	05	36	33*	Off east coast of Kamchatka	52	N.	159½	E.
20	06	31	20*	Kurile Islands aftershock	44	N.	149	E.
20	14	18	04*	Kurile Islands aftershock. Depth about 60 km	45	N.	149½	E.
20	23	03	40*	Andreanof Islands, Aleutian Islands	52	N.	177	W.
21	01	41	43*	Off coast of Sakhalin. Depth about 400 km	48½	N.	146½	E.
21	23	33	36*	New Britain. Depth about 60 km	6	S.	151½	E.
22	00	04	20*	South of Java	10½	S.	112½	E.
22	01	56	56*	Ceram Island region	4	S.	131½	E.
23	03	20	52*	Ecuador	2½	S.	79	W.
23	20	15	48*	Southern Tibet	29	N.	87	E.
23	22	19	23*	Andreanof Islands, Aleutian Islands	51	N.	175½	W.
23	23	37	30*	....do	51½	N.	174½	W.
24	06	48	57*	Drake Passage	57½	S.	65½	W.
24	17	42	20*	Near east coast of Mindanao, Philippine Islands	8	N.	127	E.
24	22	26	56*	Leeward Islands. Felt on Antigua and St. John's	17½	N.	61	W.
25	02	23	57*	Southwestern France. Slight damage in Pyrenees region	43	N.	½	W.
25	09	12	54*	Near east coast of Honshu, Japan. Felt in Japan	36½	N.	141½	E.
25	13	14	10*	Tonga Island region	16½	S.	173	W.
25	13	14	40*	South of Java	10½	S.	113	E.
26	00	17	09	....do	10½	S.	112½	E.
26	09	13	37*	Kurile Islands aftershock	45	N.	149	E.
27	13	41	47**	About 300 miles northeast of Balleny Islands	.....		.....	
29	03	34	47*	Kurile Islands aftershock	44½	N.	149	E.
29	04	46	36*	Kermadec Islands region	28	S.	177½	W.
30	01	32	41*	South of Honshu, Japan. Felt in Japan. Mag. 6	32	N.	137½	E.
30	01	55	28*	Honshu aftershock	32	N.	137½	E.
Dec. 1	03	21	18	California–Mexico border. Mirror damage at Calexico, El Centro and San Diego. Felt throughout southern California and western Arizona. Mag. 5.8.	32	15 N.	115	34 W.
1	03	50	06*	California–Mexico border aftershock. Felt. Mag. 5.0	32½	N.	115½	W.
1	04	26	48*	California–Mexico border aftershock. Felt. Mag. 4.8	32½	N.	115½	W.
1	04	45	28**	Pacific Ocean, about 700 miles southeast of Easter Island	.....		.....	
1	06	02	30*	California–Mexico border aftershock. Felt. Mag. 5.5	32½	N.	115½	W.
1	07	21	53*	North Atlantic Ocean	30½	N.	41	W.
1	14	15	37*	Kurile Islands	44½	N.	150	E.
1	20	50	48*	Northern Utah. Felt at Nephi	40½	N.	112½	W.
1	22	30	15*	....do	40½	N.	112½	W.
2	01	12	22*	Kurile Islands	44	N.	149	E

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Dec. 2	17	43	33	Off coast of northern California. Felt in Humboldt County Mag. 4.3 (Berk).	40	15 N.	124	41 W.
3	02	23	40*	Nepal. Felt at Chatra, Kathmanou and Patna	27	N.	86	E.
3	09	48	26*	Near north coast of Luzon, Philippine Islands. Felt at Aparri and Tuguegarao.	19	N.	121½	E.
3	16	00	58*	South of Honshu, Japan. Depth about 550 km	29	N.	138½	E.
4	12	34	34*	Near coast of Guatemala. Felt in western El Salvador. Depth about 100 km.	14	N.	91½	W.
4	19	19	23*	Near coast of Nicaragua. Depth about 100 km	11½	N.	86½	W.
6	09	33	45*	South of Panama. Mag. 6-6¼	6½	N.	83	W.
6	15	31	30**	Near north coast of Iceland. Felt at Reykjavik				
6	22	35	43*	South of Honshu, Japan	33	N.	141	E.
7	00	06	07*	Komandorskie Islands region	54	N.	169	E.
7	01	09	18*	Off south coast of Formosa	21½	N.	121	E.
7	01	43	51*	do	21½	N.	121½	E.
7	02	46	38**	Hindu Kush				
7	02	45	49*	Talaud Islands	4	N.	127	E.
7	06	21	46**	Bismarck Sea				
7	17	42	00*	Off coast of Mexico	18½	N.	105½	W.
7	17	58	08*	Off coast of Mexico. Mag. 6 (Berk)	18	N.	105	W.
8	03	10	17*	New Hebrides Islands. Depth about 200 km	13	S.	167	E.
8	07	17	19*	Tsaidam Basin, China	38	N.	97½	E.
8	11	42	10*	Kurile Islands	44	N.	149	E.
8	12	08	23*	Kurile Islands. Felt in Japan	44	N.	149½	E.
9	00	40	05**	Sumba Island region				
9	08	00	30*	Flores Sea	8	S.	118	E.
9	12	17	47*	New Hebrides Islands. Felt at Luganville	14½	S.	167	E.
9	19	03	05*	Costa Rica–Panama border	8½	N.	83	W.
9	20	41	31*	Dodecanese Islands region	35	N.	28	E.
10	03	43	43*	Hindu Kush. Depth about 150 km	36½	N.	71½	E.
10	07	02	59*	Off North Island, New Zealand. Felt. Depth about 300 km. Mag. 6¾.	37	S.	176½	E.
10	07	21	56*	South of Honshu, Japan. Felt in Japan. Depth about 300 km.	33	N.	139	E.
10	14	39	00*	Off south coast of Mindanao, Philippine Islands. Depth about 200 km.	5	N.	126	E.
10	16	11	02*	Off west coast of Colombia	3	N.	8	W.
10	21	49	20*	Gulf of California. Mag. 5¾	24½	N.	10	W.
11	08	22	20*	Gulf of California	23½	N.	10	W.
11	09	52	27	Southwest of San Francisco, California. Minor damage. Mag. 4.7 (Berk).	37	41 N.	122	32 W.
11	15	33	25*	South of Honshu, Japan. Felt in Japan	30½	N.	140	E.
11	18	38	12*	do	30	N.	140	E.
13	09	06	09*	New Britain region. Felt at Rabaul	4½	S.	153½	E.
13	09	07	30*	Sandwich Islands region	55½	S.	22	W.
13	14	28	33*	Kurile Islands	44½	N.	149	E.
14	07	11	28*	South Pacific Ocean. Mag. 6	35	S.	108½	W.
14	13	26	51*	Gulf of California	23	N.	108	W.
14	15	35	35*	South of Panama	3½	N.	83	W.
15	07	50	48*	do	5½	N.	82½	W.
15	11	46	25*	Kurile Islands. Depth about 60 km	44½	N.	149	E.
15	12	40	27*	Kermadec Islands	31	S.	177½	W.
16	02	32	24*	Kurile Islands	44½	N.	148½	E.
16	03	18	38**	About 450 miles south of Fiji Islands				
17	02	25	55*	Off coast of Alaska Peninsula. Depth slightly greater than normal.	55	N.	162	W.
17	08	57	10*	South of Honshu, Japan. Felt at Tokyo. Depth about 400 km.	33	N.	137	E.
17	15	34	15*	Ryukyu Islands region	28½	N.	127½	E.
17	20	33	58*	New Ireland region. Felt at Rabaul. Depth about 150 km	4½	S.	153½	E.
18	01	39	26**	Loyalty Islands region. Depth about 100 km				
18	07	18	05*	South of Sumbawa Island	11	S.	117½	E.

Footnotes at end of table.

TABLE 2.—*Summary of instrumental epicenters for 1958*—Continued

1958	Origin time G. C. T.			Region, focal depth, and remarks	Coordinates of provisional epicenter			
					Latitude		Longitude	
	h	*m*	*s*		°	′	°	′
Dec. 18	07	26	16*	Near north coast of Luzon, Philippine Islands. Felt at Laoag and Baguio.	18	N.	120½	E.
18	19	23	53*	Tonga Islands region	16	S.	173	W.
19	03	27	26*	Western Turkey	38	N.	30	E.
19	11	14	40*	Southern Peru. Depth about 100 km	16	S.	72	W.
19	14	36	46*	South of Panama	5	N.	83	W.
19	18	36	23*	Andreanof Islands, Aleutian Islands	51½	N.	177½	W.
20	19	20	43*	Ryukyu Islands region	28½	N.	127½	E.
20	21	12	50**	Sumbawa Island				
21	05	46	26*	Western Sinkiang Province, China	44½	N.	81	E.
21	13	03	30**	Fiji Islands region				
22	02	17	14*	Solomon Islands	6	S.	155	E.
22	02	41	29*	Central Alaska. Felt at Fairbanks	66	N.	147	W.
22	07	56	06**	Tonga Islands region				
23	03	30	18**	do				
23	06	27	15*	Near west coast of Colombia	2	N.	79	W.
24	01	13	17*	Near south coast of New Britain. Depth about 100 km	6½	S.	150½	E.
24	07	17	08*	Off south coast of Turkey	35½	N.	29	E.
24	20	35	20*	New Hebrides Islands. Slight damage at Port-Villa. Felt at Epi, Nguna, and Vate.	18	S.	169	E.
24	22	10	56*	New Hebrides Islands. Felt at Port-Villa, Nguna, and Vate.	18	S.	169	E.
25	08	05	38*	New Britain. Felt at Rabaul and Pomio. Depth about 60 km. Mag. 6¾.	5½	S.	151	E.
25	09	11	46*	Andreanof Islands, Aleutian Islands	51½	N.	175	W.
26	05	51	04**	South of Fiji Islands. Depth about 600 km				
28	05	13	15*	Northwestern Venezuela	9½	N.	70	W.
28	05	34	36*	Western Nepal-India border	29½	N.	80	E.
28	06	44	55*	Fiji Islands. Depth about 550 km	18½	S.	178	W.
28	11	46	56*	Jan Mayen Island	71½	N.	7½	W.
29	10	44	50**	Off coast of Jalisco, Mexico				
29	22	38	22*	Northern Sumatra	2½	N.	99	E.
30	08	37	56*	South Pacific Ocean. Mag. 6	35½	S.	105½	W.
30	16	06	40*	New Hebrides Islands region	15	S.	173	E.
31	01	34	15*	Samoa Islands region	15½	S.	172½	W.
31	01	45	52*	Tonga Islands region. Depth about 400 km	23	S.	178½	W.
31	03	45	18*	Northern India	30½	N.	79½	E.
31	10	30	49*	Kurile Islands. Depth about 100 km	46½	N.	154	E.

* Indicates probable error of 1/10 minute.
** Indicates probable error of 1/4 minute.

TABLE 3.—*Principal earthquakes of the world from January through December 1958.*

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.

1958	Origin time G. C. T.			Region	Coordinates of provisional epicenter				Remarks
					Latitude		Longitude		
	h	*m*	*s*		°	′	°	′	
Jan. 15....	19	14	29*	Southern Peru.....	16½	S.	72	W.	28 killed, many injured and extensive property damage in Mejia. Depth about 60 km. Mag. 7.3.
16....	02	04	24*	Northern Iran.....	36½	N.	53	E.	Many killed and moderate property damage.
19....	14	07	27*	Near coast of Ecuador...	1½	N.	79½	W.	20 killed, many injured and extensive property damage at Las Esmeraldas, Las Palmas, Guayaquil. Large water waves caused damage at Las Esmeraldas and Guayaquil. Depth about 40 km. Mag. 7.8.
Mar. 11....	00	25	56*	Ryukyu Islands.....	25	N.	125	E.	Several killed and many injured on Okinawa; fissuring on Miyako and Ishigaki. Felt on Batan Islands. Depth about 70 km. Mag. 7.5.
Apr. 7....	15	30	39.5	Alaska.....	66.1	N.	156.8	W.	Felt throughout central Alaska. Mag. 7.3.
14....	21	32	28*	Near coast of Ecuador...	1	N.	79½	W.	3 killed, 12 injured and minor damage at Las Esmeraldas. Also felt at Quito and Ibarra. Mag. 6.8.
May 31....	19	32	30*	New Hebrides Islands....	15	S.	169	E.	Mag. 7.2.
July 10....	06	15	51	Southeastern Alaska.....	58.6	N.	137.1	W.	5 killed and minor property damage. Extensive fissuring and avalanche activity. Great water waves in Lituya Bay. Mag. 7.9.
26....	17	37	09*	Peru–Bolivia border.....	13½	S.	69	W.	Depth about 620 km. Mag. 7.5.
Aug. 15....	22	29	17*	Celebes.....	1½	N.	125	E.	Depth about 170 km. Mag. 7.0.
16....	19	13	45*	Iran.....	34½	N.	48	E.	200 killed and extensive property damage in western Iran.
Sept. 1....	14	30	46*	Bolivia.....	18	S.	65	W.	Many injured and extensive property damage at Aiquile.
4....	21	51	08*	Chile–Argentina border...	33½	S.	69½	W.	4 killed, major property damage at San Jose and Volcan. Mag. 6.7.
21....	16	18	30*	Iran.....	36	N.	49	E.	Many casualties and heavy damage at Karksar.
Oct. 20....	01	12	37*	Off south coast of Java...	9½	S.	112½	E.	7 killed, many injured and extensive property damage at Blitar. Depth about 100 km.
Nov. 6....	22	58	06*	Kurile Islands.....	44½	N.	148½	E.	Slight damage in northern Hokkaido. Minor seismic sea wave. Depth about 75 km. Mag. 8.7.
12....	20	23	26*	Kurile Islands aftershock.	44½	N.	148½	E.	Felt on Hokkaido and northern Honshu, Japan. Minor seismic sea wave. Depth about 40 km. Mag. 7.3.

* Indicates probable error of 1/10 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 Earthquake* 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 0.1g.

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 period 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, 1958.*

NORTHERN CALIFORNIA

Station	Accelerograph	Displacement 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	2	
San Jose, Bank of America, basement	1	1	
San Jose, Bank of America, 13th floor	1		
Suisun Bay Bridge	1		

SOUTHERN CALIFORNIA

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	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, 1958*—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., Federal Office Building	1	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	62	19	11

TABLE 5—*List of shocks recorded and records obtained on strong-motion seismographs in 1958*

Date	Region and Recording Station	Records			
		Accelero-graph	Survey displace-ment meter	Carder displace-ment meter	Weed
Apr. 23	Peru, South America, Lima	1			
May 24	Northern California, Eureka	1			
	Ferndale	1	1		
May 31	Central California, San Francisco, Southern Pacific Building	1			
July 9	Alaska, Seattle	1		1	
Dec. 11	Central California, Oakland, Chabot Observatory				1
	San Francisco, Shell Building				2
	Total	5	1	1	3

TABLE 6.—*Summary of outstanding instrumental and noninstrumental data for 1958.*

Epicenter	Recording Station and Distance	Location of Instrument	Intensity[1]	Acceleration	Displacement[2]
				cm/sec.^{2}	*cm.*
PERU EARTHQUAKE OF APRIL 23					
Peru	Lima	1st floor		38	0.003
NORTHERN CALIFORNIA EARTHQUAKE OF MAY 24					
40°16′ N., 124°11′ W., near Petrolia, VI.* Mag. 4.8.	Ferndale, 22 miles	1st floor	VI	44	0.30
NORTHERN CALIFORNIA EARTHQUAKE OF MAY 31					
37°52′ N., 122°00′ W., Concord, Calif., V.* Mag. 4.1.	San Francisco, 23 miles	14th floor	I–III	3	0.08
SOUTHERN ALASKA EARTHQUAKE OF JULY 9					
58.6° N., 137.1° W., Lituya Bay, XI.* Mag. 7.9.	Seattle, 950 miles		I–III	1	0.1
NORTHERN CALIFORNIA EARTHQUAKE OF DECEMBER 11					
37°41′ N., 122°32′ W., southwest of San Francisco, VI.* Mag. 4.7.	San Francisco, 10 miles	21st floor	VI	14	0.2

[1] Reported intensity of earthquake at recording station.

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 1958.*

Station and component	Instrument No.	T_0	V	Sensitivity	ϵ	Acceleration		Displacement		Remarks
						Period	Amplitude	Period	Amplitude	
		sec.		*cm./g*		*sec.*	*cm/sec.*^{2}	*sec.*	*cm.*	
PERU EARTHQUAKE OF APRIL 23										
Lima:										
Vertical	286	0.064	123	12.8	8	0.05	34		0.002	
N. 82° W	287	.064	125	12.6	8	.06	38		.003	
N. 8° E	288	.064	122	12.4	9	.06	20		.002	
NORTHERN CALIFORNIA EARTHQUAKE OF MAY 24										
Eureka:										
Vertical	250	0.066	116	12.4	8	0.1	5		0.001	
N. 79° E	251	.066	121	13.2	11	.1	7		.002	
N. 11° W	252	.066	121	13.1	11	.1	7		.002	
Ferndale:										
Vertical	247	.066	124	13.5	13	.4	15		.06	
N. 44° E	248	.066	125	13.7	10	.1	44	0.9	.30	
N. 46° W	249	.065	123	13.0	11	.1	40	.8	.19	

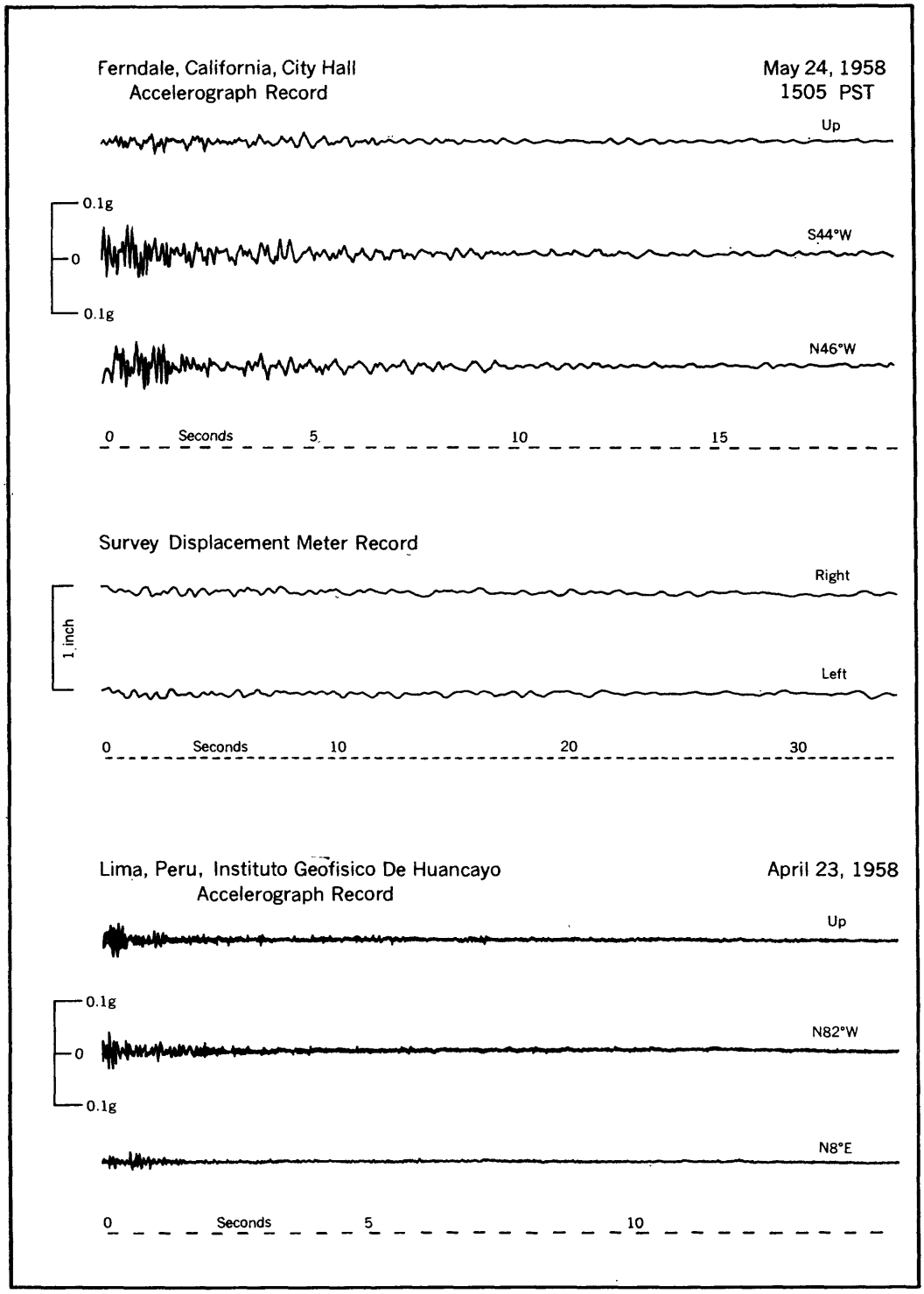

FIGURE 10.—Tracings of accelerograph and Survey displacement meter records obtained at Ferndale, City Hall, on May 24; and accelerograph record at Lima, Peru, on April 23.

TABLE 7.—*Composite of strong-motion instrumental data for 1958.*—Continued

NORTHERN CALIFORNIA EARTHQUAKE OF MAY 31

Station and component	Instrument No.	T_0	V	Sensitivity	ϵ	Acceleration		Displacement		Remarks
						Period	Amplitude	Period	Amplitude	
San Francisco, Southern Pacific Bldg., 14th floor:										
Vertical	184	0.046	119	6.3	10	0.2	1	.....	0.001	
N. 45° E	183	.046	120	6.4	10	1.0	2	.....	.05	
N. 45° W	182	.046	122	6.4	10	1.0	3	.....	.08	
SOUTHERN ALASKA EARTHQUAKE OF JULY 9										
Seattle:										
N. 58° E	CDM-13	2.5	0.8	.....	10	.....	.....	10	0.11	Negligible trace motion.
N. 32° W	CDM-12	2.5	.8	.....	10	.....	.....	6	.09	Do.
CENTRAL CALIFORNIA EARTHQUAKE OF DECEMBER 11										
Oakland, Chabot Observatory (Weed):										
N. 56° E	8	0.19	7	7	2	0.4	4	.....	0.02	
N. 34° W	8	.19	7	7	2	.3	6	.....	.01	
San Francisco, Shell Bldg., 21st floor (Weed):										
N. 81° E	3	.20	7	7	2	.2	11	.....	.01	
N. 9° W	3	.20	7	7	2	.7	14	.....	.2	
San Francisco, Shell Bldg., Sub-basement (Weed):										
N. 81° E	4	.19	7	.....	3	.9	4	.....	.08	
N. 9° W	4	.19	7	.....	3	.9	4	.....	.08	

* Estimated from acceleration if no entry in displacement column.

TILT OBSERVATIONS

Three Merritt tiltmeter stations, Table Mountain, Santiago Peak, and University of California (library), continued in routine operation.

PUBLICATION NOTICES

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

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