DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

United States Earthquakes, 1971

By

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Introduction

United States Earthquakes, prepared annually since 1928, lists epicenters of all earthquakes and associated phenomena recorded in the United States and nearby territories during the year. It includes brief descriptions of earthquakes that were felt or caused damage in the United States, and summarizes all available data on tremors noted by residents of the Panama Canal Zone, Puerto Rico, and the Virgin Islands. In addition, a list of principal earthquakes of the world during the year is presented with brief accounts of their effects.

Sources of noninstrumental information used in this compilation include reports received from questionnaire canvasses, newspaper clippings, bulletins of the Seismological Society of America, special reports of other organizations, and data from the National Weather Service of NOAA whose observers prepare periodic reports on local seismic activity.

Instrumental data utilized in computing earthquake locations, depths, magnitude, and times of occurrence are obtained from NOAA and cooperating seismological observatories, both domestic and foreign.

NATIONAL GEOPHYSICAL AND SOLAR-TERRESTRIAL DATA CENTER

The National Geophysical and Solar-Terrestrial Data Center (NGSDC), previously the National Geophysical Data Center and the Aeronomy and Space Data Center, is one of the five major facilities of NOAA's Environmental Data Service. NGSDC's Solid Earth Data Services Division is responsible for data activities in the field of seismology.

NGSDC is a focal point for the dissemination of historical seismic information for both technical and general users. Its services include preparing local and regional seismic histories for engineers, actuaries, and other scientists; answering direct inquiries from the public on all aspects of historical earthquakes; publishing annual, quarterly, monthly, and revised historical earthquake reports; and making available at a nominal fee copies of seismograms, accelerograms, displacement meter records, digitized strong-motion seismograms, and epicenter lists (since January 1900). Information concerning services and products of NGSDC may be obtained from the National Geophysical and Solar-Terrestrial Data Center, Environmental Data Service, National Oceanic and Atmospheric Administration, Boulder, Colorado 80302. Some of the seismological services and products are described in the following paragraphs.

Earthquake Epicenter Data

The earthquake data files contain data on earthquakes, known or suspected explosions, associated collapse phenomena, coal bumps, rock bursts, quarry blasts, and other earth disturbances recorded by seismographs. The date, origin time, geographic location, focal depth, magnitude, and Modified Mercalli intensity are listed for each event when available. These data may be obtained on magnetic tape, punched cards, or microfilm.

Conventional Seismograms

Copies of seismograms from the Worldwide Network of Standard Seismographs (WWNSS) and other selected foreign

stations, as well as from the Canadian and NOAA networks of seismic stations, are available in 35-mm. or 70-mm. film format or as full-size paper copies.

High-Gain, Long-Period Seismograms

Seismograms from January 1971 recorded at Albuquerque, N. Mex., Ogdensburg, N.Y., Fairbanks, Alaska, Eilat, Israel, and Charters Towers, Australia, are now available. Additional stations have been installed recently in Toledo, Spain, Chieng-Mai, Thailand, Honolulu, Hawaii, Matsushiro, Japan, and Kongsberg, Norway. The records are on standard-size paper, and reproductions can be obtained in the same formats and costs as the WWNSS seismograms. Six components are recorded daily—three high- and three intermediate-gain values in the vertical, north-south, and east-west directions.

Earthquake Strong-Motion Data

All records from the NOAA strong-motion file, starting from the initial accelerograms and displacement meter records recorded in 1932, may be obtained in full-size paper copies, film chips, or 35-mm. roll film.

A set of accelerograms from 227 locations affected by the San Fernando, Calif., earthquake in February 1971 is also available. Records are generally from Los Angeles and surrounding areas and include (among others) recordings from Pacoima Dam, San Onofre, Vernon, and Santa Ana.

Additional conventional seismograms from the February 9, 1971, earthquake also can be purchased on 70-mm. film, 35-mm. film, or as full-size paper copies. These include most of the WWNSS seismograms, as well as records from many nonstandard stations.

Digitized accelerograms of strong earthquake ground motions, as processed from records of the Environmental Research Laboratories (previously Coast and Geodetic Survey records) accelerograph network, are available on magnetic tape or punched cards. These records are described in *Strong-Motion Earthquake Accelerograms, Digitized and Plotted Data, Volume 1, Parts A through M,* California Institute of Technology, Pasadena. The 114 records in the six series represent the recorded data for 22 earthquakes in California, Montana, and Washington.

Publications

Publications issued by NGSDC include the following:

1. *C&GS Special Publication 282, Earthquake Investigation in the United States* (Revised 1969 Edition). This semitechnical booklet explains important facts about earthquakes and discusses major historical shocks of the United States and nearby territories. It also contains sections on seismographs and the nature of earthquakes and seismic waves.

2. *C&GS Publication No. 41-1, Earthquake History of the United States* (Revised Edition Through 1970). This report describes prominent earthquakes (generally Modified Mercalli intensity V and above) in the United States from historical times through 1970. It contains regional tables that list earthquake epicenters or probable locations, intensity, and extent of felt area.

The preceding reports were prepared in collaboration with Environmental Research Laboratories (ERL) groups, especially the Seismological Field Survey and the National Earthquake Information Center.

EARTHQUAKE EARLY REPORTING SYSTEM

The ERL National Earthquake Information Center (NEIC) maintains an earthquake reporting system that provides accurate and rapid epicenter locations and magnitude values to the press and other interested groups. These results are available within 2 to 3 hours for earthquakes of magnitude 6½ or larger. Locations and magnitudes of smaller events are computed on request or on receipt of a press report. NEIC relies on NOAA and cooperating observatories worldwide to provide data for the earthquake reporting system.

Both NOAA and cooperating seismic ob-

servatories throughout the world furnish data for the epicenter program of the National Earthquake Information Center. During 1971, the locations of 4,747 epicenters were announced in the twice-weekly *Preliminary Determination of Epicenters* (PDE) list. Epicenters are published when sufficient information has accumulated to insure a reasonable degree of accuracy. The results are preliminary and do not always agree with later epicenters determined from additional seismic readings or from new data with critical azimuths and distances. For special studies, an inquiry should be made to the NEIC office for possible recomputations of epicenters of interest.

NEIC coordinates the collection of all types of earthquake information, with the special objective of correlating instrumentally determined earthquake locations with noninstrumental reports received from private and Government earthquake observers. This correlation is achieved through intensive regional investigations of earthquakes by local organizations and NEIC. Primary data are gathered by a canvass of the epicentral area using questionnaire cards. Cities receiving questionnaire cards are selected by a computer, based upon an analysis of the earthquake magnitude and projected felt area. When returned and analyzed, this information is used to map the seismic areas of the country in order to promote public safety through a better understanding of earthquake phenomena. Because the success of this data collection program depends largely on the cooperation of local officials and citizens, all who receive earthquake questionnaire cards are urged to complete and return them to the office indicated.

NEIC issues the following technical seismological reports. They are available at no cost (in limited numbers) to cooperating seismological groups, research institutions, universities, and libraries. Seismicity maps may be obtained at nominal prices.

1. *Preliminary Determination of Epicenters.* These twice-weekly reports list the approximate epicentral locations of all earthquakes recorded throughout the world. They contain origin time, geographic coordinates, region of occurrence, felt and damage data, depth, magnitude, and other related information on each earthquake. The *Preliminary Determination of Epicenters Monthly Listing,* a chronological listing of the twice-weekly data, is now available to the general public on subscription.

2. *Earthquake Data Report.* This twice-weekly report contains data used in the computation of the report above. It lists station arrival times, individual distances, azimuths, and traveltime residuals. Microfilm copies for some years are available.

3. *Antarctic Seismological Bulletin.* This quarterly report is a register of phase readings and epicenters from Antarctic seismograph stations.

4. *Regional Seismicity Maps.* These are 20- by 30-inch maps with buff-colored land areas that show patterns of regional seismicity of the earth for the period 1962-1969. The maps pinpoint earthquakes which have at least 10 observations employed in their locations from the year 1962. An index map also is available. The maps, by region, are as follows:

Southwest Pacific (NEIC 3008); Southeast Asia (NEIC 3009); Japan and Kuril Islands (NEIC 3010); Alaska (NEIC 3011); The United States (NEIC 3012); Middle America (NEIC 3013); South America (NEIC 3014); Europe and the Middle East (NEIC 3015); Central Asia (NEIC 3016); North Atlantic Ocean (NEIC 3017); South Atlantic Ocean (NEIC 3018); Indian Ocean (NEIC 3019); Arctic Region (NEIC 3020); and Antarctic Region (NEIC 3021).

5. *World Seismicity.* This is a five-color map, 49 by 32 inches, that depicts patterns of global earthquake activity for the period July 1, 1963, through December 1972. The map covers the earth on a Mercator projection. The three principal depth-of-focus classes (0 to 70 km., 71 to 300 km., and 301 to 700 km.) are shown in different colors (in press).

In addition to these publications, ERL

publishes a bimonthly *Earthquake Information Bulletin,* which contains information of past and continuing studies in seismology and describes techniques used in the investigation of earthquakes and related phenomena. This two-color magazine has regular departments for new publications, meetings, and earthquake descriptions.

SEISMOLOGY COLLABORATORS

Active cooperation in earthquake investigations in the Pacific Coast and Western Mountain States is provided by the University of California Seismographic Station at Berkeley, the California Institute of Technology Seismological Laboratory at Pasadena, and by several seismology collaborators. The following served as collaborators to NOAA during 1971:

Arizona.—Richard T. Moore, Arizona Bureau of Mines, University of Arizona, Tucson.

Colorado.—Warren L. Longley, University of Colorado, Boulder.

Idaho.—Melvin W. Jackson, Argonne National Laboratory, Idaho Falls.

Montana.—Stephen W. Nile, 320 Ranch, Gallatin Gateway.

Nevada.—David B. Slemmons, University of Nevada, Reno.

New Mexico.—Stuart A. Northrop, University of New Mexico, Albuquerque.

Utah.—J. Stewart Williams, Utah State University, Logan.

Washington.—Howard A. Coombs, University of Washington, Seattle.

Commercial agencies on the West Coast that provide valuable services to NOAA include telephone, power, oil, railroad, and insurance companies. Agencies interested in the manufacture of earthquake-resistive building materials also are active, as are several organizations of structural engineers and architects.

Earthquake information was collected in other parts of the country during 1971 by the following:

Northeastern Region.—Dae-Hyun Chung and Daniel J. Linehan, S.J., Weston College, Weston, Mass.

Eastern Region.—Gilbert A. Bollinger, Virginia Polytechnic Institute and State University, Blacksburg (for earthquakes in Virginia).

Central Region.—William J. Stauder, S.J., St. Louis University (for earthquakes in the central Mississippi Valley area); E.J. Walter, John Carroll University, Cleveland (for earthquakes in Ohio); and Berlen C. Moneymaker, Tennessee Valley Authority, Knoxville (for earthquakes in Tennessee).

Hawaii.—Hawaiian Volcano Observatory, Geological Survey, U.S. Department of the Interior, Hawaii National Park.

EPICENTER MAPS

Figure 1 shows the locations of damaging earthquakes (intensity VII and above) known to have occurred in the United States from historical times through 1971. Small numerals beside a plotted point indicate the number of shocks that have occurred at that point. Some of the more prominent of these earthquakes are listed on page 6.

Figure 2 is a plot of 1971 earthquakes by intensity. In some instances where instrumental control was not satisfactory or where results of investigations were inadequate, the plotted epicenters show the existence, rather than the precise locations, of the earthquakes. Earthquakes in the California and western Nevada areas are plotted on figure 2 when felt reports are received from several towns. Feeble earthquakes and minor aftershocks of large earthquakes usually are not shown on this map. A numeral beside a dot indicates the number of shocks reported at that location. Bulletins of the University of California Seismographic Station at Berkeley and the California Institute of Technology Seismological Laboratory at Pasadena should be consulted for additional details on epicenters.

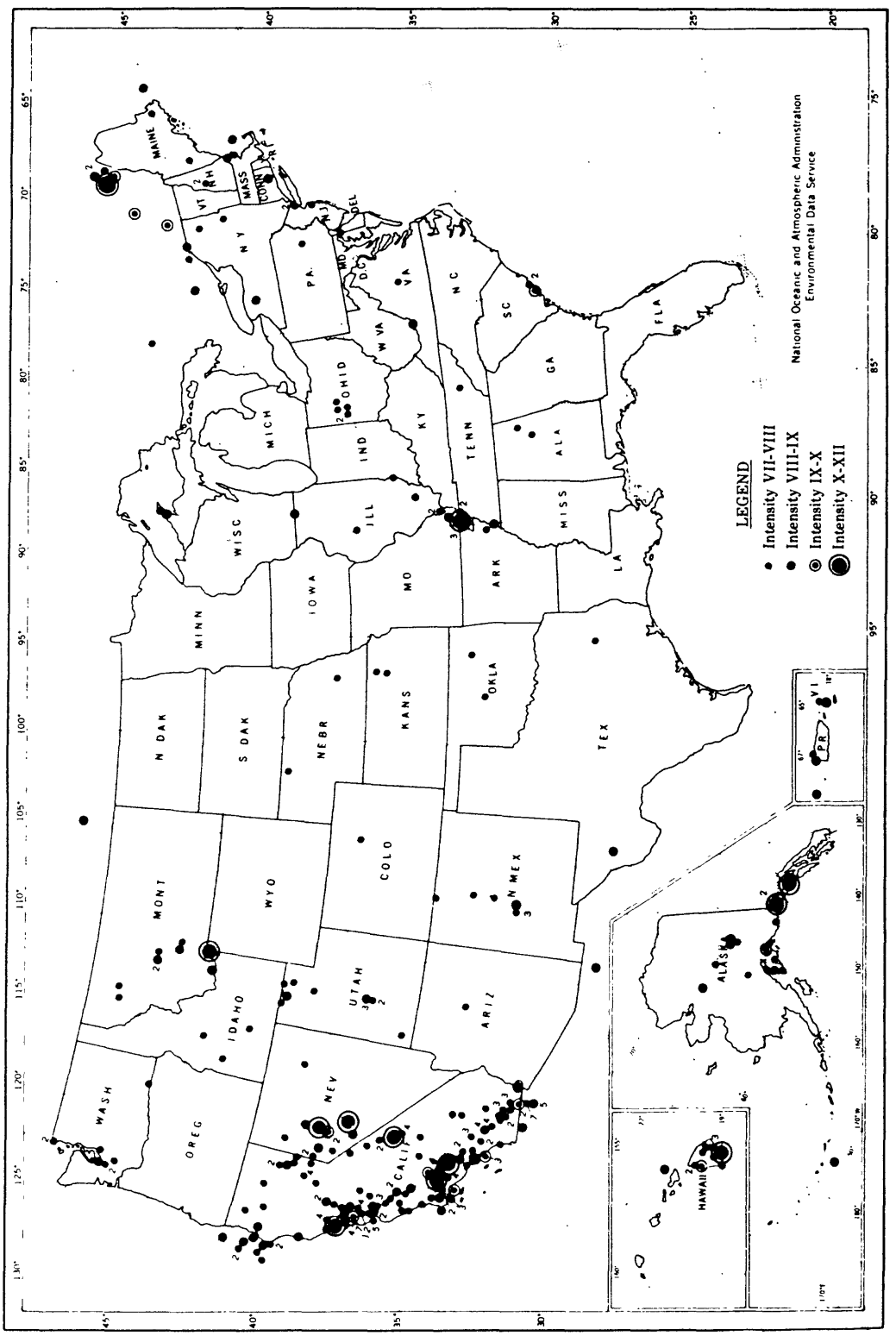

FIGURE 1.—Damaging earthquakes in the United States from earliest history through 1971.

List of Prominent Earthquakes of the United States through 1971 (see fig. 1)

Date	Locality	N. Lat.	W. Long.	Felt area	Modified Mercalli intensity
		degrees	*degrees*	*sq. mi.*	
1663 Feb. 5	St. Lawrence River region	47.6	70.1	750,000	X
1755 Nov. 18	East of Cape Ann, Mass	42.5	70.0	300,000	VIII
1811 Dec. 16 1812 Jan. 23 1812 Feb. 7	Near New Madrid, Mo	36.6	89.6	2,000,000	XII
1812 Dec. 21	Off coast of southern California	34	120	.....	X
1836 June 10	San Francisco Bay	38	122	.....	IX-X
1838 June	San Francisco region	37½	122½	.....	X
1852 Nov. 9	Near Fort Yuma, Ariz	33	114½	.....	VIII-IX
1857 Jan. 9	Near Fort Tejon, Calif	35	119	.....	X-XI
1865 Oct. 1	Fort Humboldt and Eureka, Calif	41	124½	.....	VIII-IX
1865 Oct. 8	Santa Cruz Mts., Calif	37	122	.....	VIII-IX
1868 Apr. 2	Near south coast of Hawaii	19	155½	.....	X
1868 Oct. 21	Hayward, Calif	37½	122	.....	IX-X
1872 Mar. 26	Owens Valley, Calif	36½	118	125,000	X-XI
1886 Aug. 31	Northwest of Charleston, S.C	32.9	80.0	2,000,000	IX-X
1892 Feb. 23	Northern Baja California	31½	116½	.....	VIII-IX (U.S.)
1892 Apr. 19	Vacaville, Calif	38½	122½	.....	IX
1892 Apr. 21	Winters, Calif	38½	122	.....	IX
1893 Apr. 4	Northwest of Los Angeles, Calif	34½	118½	.....	VIII-IX
1895 Oct. 31	Charleston, Mo	37.0	89.4	1,000,000	VIII
1898 Apr. 14	Mendocino County, Calif	39	124	.....	VIII-IX
1899 Sept. 3	Yakutat Bay, Alaska	60	142	.....	XI
1899 Sept. 10	. . . . do	60	140	.....	XI
1899 Dec. 25	San Jacinto and Hemet, Calif	33½	116½	100,000	IX
1906 Apr. 18	Northwest of San Francisco, Calif	38	123	375,000	XI
1915 Oct. 2	Pleasant Valley, Nev	40½	117½	500,000	X
1918 Apr. 21	Riverside County, Calif	33¾	117	150,000	IX
1921 Sept. 29 1921 Oct. 1	Elsinore, Utah	38.8	112.2	.....	VIII
1922 Mar. 10	Cholame Valley, Calif	35¾	120¼	100,000	IX
1925 Feb. 28	St. Lawrence River region	47.6	70.1	2,000,000	VIII
1925 June 27	Helena, Mont	46.0	111.2	310,000	VIII
1925 June 29	Santa Barbara, Calif	34.3	119.8	.....	VIII-IX
1927 Nov. 4	West of Point Arguello, Calif	34½	121½	.....	IX-X
1931 Aug. 16	Western Texas	30.6	104.1	450,000	VIII
1932 Dec. 20	Western Nevada	38.7	117.8	500,000	X
1933 Mar. 10	Long Beach, Calif	33.6	118.0	100,000	IX
1934 Jan. 30	Southeast of Hawthorne, Nev	38.3	118.4	110,000	VIII-IX
1934 Mar. 12	Near Kosmo, Utah	41.7	112.8	170,000	VIII
1935 Oct. 18	Northeast of Helena, Mont	46.6	112.0	230,000	VIII
1935 Oct. 31	. . . . do	46.6	112.0	140,000	VIII
1940 May 18	Southeast of El Centro, Calif	32.7	115.5	60,000	X
1949 Apr. 13	Western Washington	47.1	122.7	150,000	VIII
1952 July 21	Kern County, Calif	35.0	119.0	160,000	XI
1954 July 6	East of Fallon, Nev	39.4	118.5	130,000	IX
1954 Aug. 23	. . . . do	39.6	118.5	150,000	IX
1954 Dec. 16	Dixie Valley, Nev	39.3	118.2	200,000	X
1958 July 9	Southeastern Alaska	58.6	137.1	100,000	XI
1959 Aug. 17	Near Hebgen Lake, Mont	44.8	111.1	60,000	X
1964 Mar. 27	Southern Alaska	61.0	147.8	700,000	IX-X
1965 Apr. 29	Northwestern Washington	47.4	122.3	130,000	VIII
1971 Feb. 9	San Fernando, Calif	34.4	118.4	80,000	XI

The selection of isoseismal or "felt area" maps (figs. 3-6) is governed largely by the size of the area affected, the minimum radius generally being about 80 km (50 miles). This means that sharp, localized shocks of intensity VI (mostly in California) may not be shown on such maps, whereas others of intensity IV and V (largely in the Eastern and Central States) often will be shown. Felt reports from towns are designated on these maps by open circles, not felt reports by solid circles. Intensities higher, or lower, than those in the specific isoseismal zones are indicated by small numerals beside the open circles.

MAGNITUDE AND INTENSITY RATINGS

Magnitude, stated according to the Richter scale, is a measure of the energy release at the focus of an earthquake as determined by the amplitudes produced on a seismogram. Although the magnitude scale has neither "top" nor "bottom" values, the highest ever recorded was magnitude 8.9 and the lowest about −3. On this logarithmic scale, a magnitude 8 earthquake represents recorded amplitudes 10 times larger than those for a magnitude 7 earthquake, 100 times larger than a shock of magnitude 6, etc.

Intensity, expressed on the Modified Mercalli Intensity Scale of 1931 (see next section), is a measure of the effects of an earthquake on people and objects, as determined by experienced observers. It is a result of many factors, including magnitude of the earthquake, distance from its epicenter, local geological conditions, and structural properties of buildings. An earthquake in a populated area will have several intensities, depending on the local factors mentioned.

MODIFIED MERCALLI INTENSITY SCALE OF 1931

NOAA's National Geophysical and Solar-Terrestrial Data Center and National Earthquake Information Center report all intensities on the Modified Mercalli Intensity Scale of 1931.[1] The abridged version of this scale is given below. Values in parentheses are equivalent intensities in the Rossi-Forel Scale, still used by some countries to evaluate earthquake effects.

I. Not felt except by a very few under specially favorable circumstances. (I)

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

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)

IV. During the day, felt indoors by many, outdoors by a 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)

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)

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)

VII. Everybody runs outdoors. Damage *negligible* in buildings of good design and construction; *slight* to *moderate* in well-built ordinary structures; *con-*

[1]Harry O. Wood and Frank Neumann. *Bulletin of the Seismological Society of America*, Vol. 21, No. 4, pp. 277-283, December 1931

(page 10 follows)

siderable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motorcars. (VIII–)

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)

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+)

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

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.

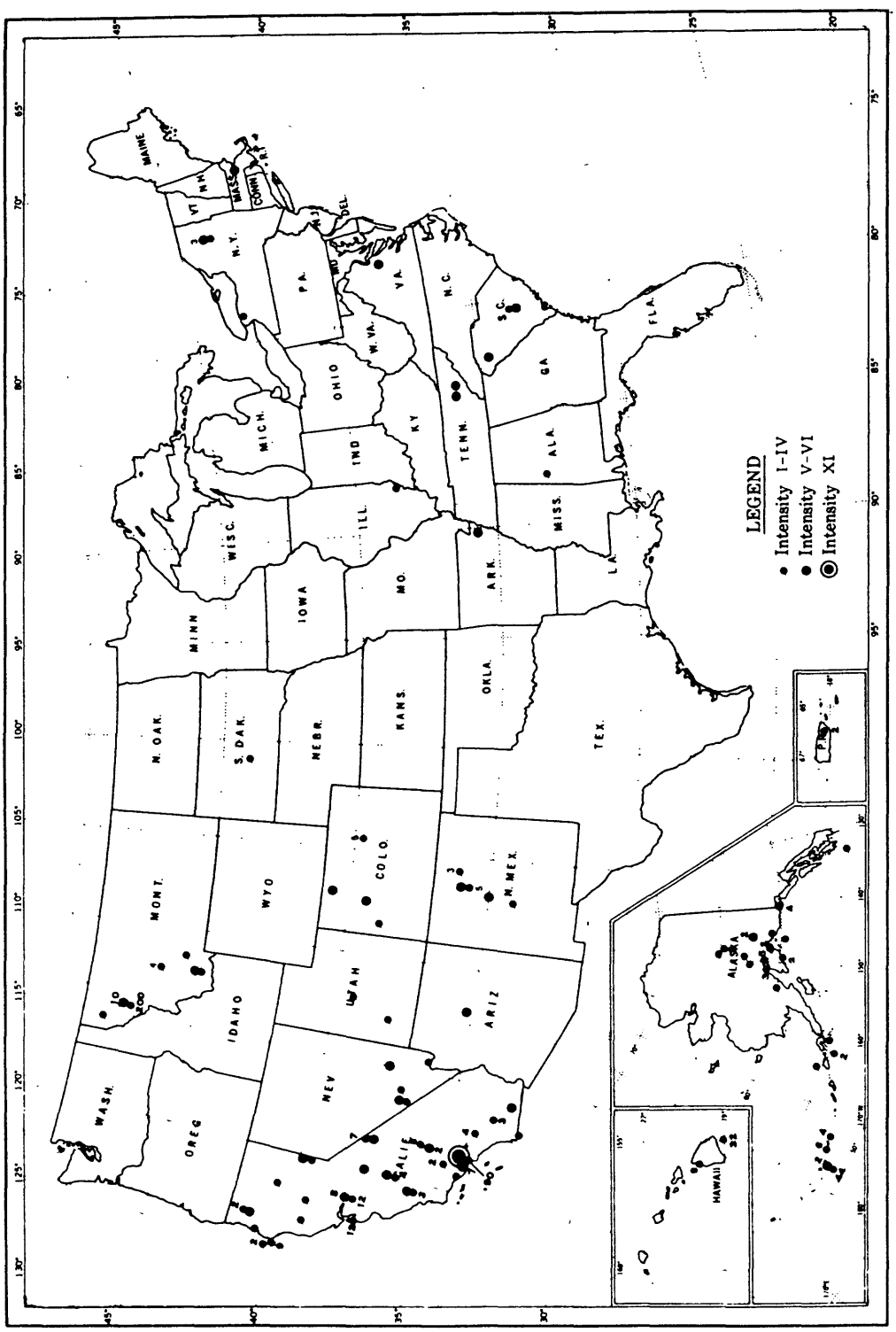

FIGURE 2.—Locations of earthquakes that were felt or caused damage in the United States during 1971.

Earthquake Descriptions

INTRODUCTION

The times of earthquake occurrences in the regions that follow are given in standard time. Times are expressed continuously from midnight to midnight, or 0 to 24 hours. Greenwich mean times are given in parentheses, following standard times, for earthquakes with quoted epicenters.

The following symbols are used to indicate authority for arrival or origin times, epicenters, and/or magnitudes. If no symbol is given, the authority is the National Earthquake Information Center of NOAA's Environmental Research Laboratories (ERL).

B—Seismographic Station, University of California, Berkeley.

P—Seismological Laboratory, California Institute of Technology, Pasadena.

JSA—Jesuit Seismological Association, St. Louis, Mo.

NESA—Northeastern Seismological Association, Weston, Mass.

BHP—Panama Canal Company, Balboa Heights, C.Z.

SLC—University of Utah, Salt Lake City.

Gol—Colorado School of Mines, Golden.

Pal—Columbia University, Lamont-Doherty Geological Observatory, Palisades, N.Y.

CSC—University of South Carolina, Columbia.

Butte—Montana School of Mines, Butte.

Adak—ERL Adak Observatory, Adak, Alaska.

College—ERL College Observatory, College, Alaska.

Palmer—ERL Palmer Observatory, Palmer, Alaska.

San Juan—ERL San Juan Observatory, San Juan, P.R.

Magnitude values in the descriptions that follow are either surface wave (M_S), body wave (m_b), or local (M_L). Each represents an average of individual station magnitudes determined from reported periods and amplitudes of representative seismic waves. All magnitudes in the regions which follow are M_L (local) unless otherwise noted. The local magnitude is determined using a formula developed by Charles F. Richter for southern California earthquakes. Surface wave magnitude is determined using a formula recommended by the International Committee on Magnitudes. Body wave magnitude is computed from *P* (primary) phases only, in the manner defined by Gutenberg and Richter. Magnitude values are preceded by the abbreviation mag. in the regional earthquake descriptions.

Roman numerals in the earthquake descriptions refer to the Modified Mercalli Intensity Scale of 1931 (see page 7), which gives about equal weight to the disturbance of inanimate objects and to personal reactions. When more than one degree of intensity is reported from a town, the town is assigned the highest intensity reported. Omission of an intensity rating indicates insufficient data. For brevity, intensity is abbreviated int. in the regions that follow.

Immediately following the Earthquake Descriptions section are tables 1 and 2. Table 1 is a 1971 listing of all earthquakes or related phenomena that were not reported felt in the regions in which they centered. Table 2 gives pertinent information on the principal earthquakes of the world in 1971. Perhaps incongruous in a report on U.S. earthquakes,

the latter list is included because of its unavailability in this format in other seismological publications.

SUMMARY OF EARTHQUAKE ACTIVITY

This is a summary of earthquake intensity data for the regions that follow. Where no intensity is given, data were insufficient to rate the effects on the Modified Mercalli Intensity Scale (see page 7).

Alaska: Intensity V and above. Apr. 14, V. Aug. 5, V. Oct. 12, V. Nov. 23, V.

Alabama: Mar. 14. Felt Arkansas earthquake of Oct. 1, IV.

Arizona: Felt California earthquakes of Feb. 9, IV, and Sept. 30, I—III. Nov. 3, V.

Arkansas: Oct. 1, V.

California: Intensity V and above. Jan. 4, V. Feb. 1, V; 9, XI; 9, V; 11, V; 18, V; 20, V; 26, V. Mar. 3, V; 8, V; 9, V; 25, V; 30, V; 31, VII. Apr. 15, V; 16, V; 25, V; 26, V. June 8, V; 19, V; 21, VI; 22, V. Aug. 1, V. Sept. 12, V; 30, VI. Oct. 21, V. Nov. 20, V; 24, V. Dec. 13, V; 28, V.

Colorado: Jan. 7, V. Mar. 11, III; 18, V Aug. 7, IV; 14, IV. Nov. 12. Dec. 8, IV.

Georgia: Felt South Carolina earthquakes of May 19, IV, and July 13, IV.

Hawaii: Numerous shocks were felt; none had intensity designations.

Idaho: July 16, V.

Illinois: Feb. 12, IV. Felt Arkansas earthquake of Oct. 1, IV.

Indiana: Felt Illinois earthquake of Feb. 12, IV. Felt Arkansas earthquake of Oct. 1, IV.

Kentucky: Felt Arkansas earthquake of Oct. 1, V.

Massachusetts: Oct. 20, V.

Mississippi: Felt Arkansas earthquake of Oct. 1, IV.

Missouri: Felt Arkansas earthquake of Oct. 1, V.

Montana: Intensity V and above. Jan. 10, V. Apr. 18, V; 21, V; 26, V. July 13, V; 16, V; 23, V; 27, V. Sept. 8, V; 11, V.

Nevada: Mar. 29. Felt California earthquakes of Feb. 9, IV, and Apr. 26, V. Aug. 5, IV. Felt Utah earthquake of Nov. 10. Dec. 8, V

New Hampshire: Felt Massachusetts earthquake of Oct. 20, IV.

New Mexico: Jan. 4, VI; 4; 6. Feb. 18. June 3. Dec. 5, V; 5; 6; 7; 9; 10.

New York: May 23, V (2). June 20, IV. July 10, V. Nov. 2 (probable blast).

North Carolina: Felt Tennessee earthquake of Oct. 9, V.

Oregon: July 13, IV.

Panama Canal Zone: June 5, III; 6, II.

Puerto Rico: Apr. 8. Felt June 11 earthquake in Dominican Republic.

South Carolina: May 19, V. July 13, VI; 13; 31, III.

South Dakota: Oct. 19, IV.

Tennessee: July 12, V. Felt Arkansas earthquake of Oct. 1, IV. Oct. 9, V.

Texas: Felt Arkansas earthquake of Oct. 1, I—III.

Utah: Felt California earthquake of Feb. 9, I—III. Apr. 22, III. Nov. 10. Felt Nevada earthquake of Dec. 8, IV.

Virginia: Sept. 11, V.

Washington: Jan. 14, IV. Oct. 25. Dec. 27, IV.

NORTHEASTERN REGION

[All times are eastern standard. If an epicenter is quoted, Greenwich mean time is given in parentheses.]

May 23: 01:24:26.0 (06:24). Epicenter 43.9° N., 74.5° W., New York, at a depth of 3 km., mag. 3.9, Pal. V. Felt by all at Blue Mountain Lake where a plastic water pipe broke (not definitely caused by earthquake). Int. IV at Gray (about 23 km. northeast of Utica), Raquette Lake, Speculator, and Tupper Lake. The following is an abstract of a paper[1] by Marc L. Sbar and others:

Microearthquake activity was monitored in the Blue Mountain Lake area of the southern Adirondacks from 25 May 1971 until early September. Among the thousands of earthquakes recorded, four were relatively large, ranging in

[1] "Preliminary Report on the Adirondack Earthquake Swarm of 1971," presented at the Eastern Section, Seismological Society of America, October 6-8, 1971, University Park, Pa

magnitude from 3.4 to 3.9. Two of the four shocks occurred on 23 May 1971, prior to the emplacement of six portable, high-gain, high-frequency seismographs. The other two occurred on 20 June and 10 July [see descriptions that follow]. In addition, six events were recorded, during the week preceding the 23 May earthquake, by the Middlebury College, Vermont, seismograph. The largest shocks were felt as far as 80 km. from their epicenters. Interestingly, a number of the earthquakes were heard as well as felt. Many more of the smaller events were only heard. The unusually large amount of audio frequencies associated with these shocks may be due to the shallow depth of the earthquakes and the proximity to the epicenters. The number of microearthquakes recorded per day at a site less than 2 km. from the hypocenters varied from a few tens to over 800 for an instrument with a magnification of about 6 million at 30 Hz. The depths ranged from near surface to about 2 km. All of the epicenters were distributed over a very small area, approximately 2 km. by 2 km. A preliminary composite fault-plane solution for the swarm indicates a thrusting mechanism.

May 23: 04:29:57.9 (09:29). Epicenter 43.9° N., 74.5° W., New York, mag. 3.4, Pal. No damage was noted, but int. **V** effects occurred at Blue Mountain Lake, Conifer, and Sabael. Int. IV at Newcomb and Tupper Lake. Also felt at Raquette Lake.

June 20: 21:48:29.7 (June 21, 02:48). Epicenter 43.9° N., 74.5° W., New York, at a depth of 1 km., mag. 3.6, Pal. Int. **IV** at Blue Mountain Lake, Newcomb, Raquette Lake, and Tupper Lake. Int. II at Inlet.

July 10: 03:14:58.9 (08:14). Epicenter 43.9° N., 74.5° W., New York, at a depth of 1 km., mag. 3.7, Pal. **V**. Slight damage was reported at Indian Lake. Small objects shifted. Int. V effects also were noted at Blue Mountain Lake and Sabael. Int. IV at Raquette Lake.

Oct. 20: 19:54:46.2 (NESA). Northeastern Massachusetts. The shock shifted objects and shook buildings at a few towns in northeastern Massachusetts. Int. **V** at Andover, Billerica, Methuen, Newburyport, and Tewksbury. Int. IV at Georgetown, Gloucester, Groveland, Ipswich, Lawrence, Merrimac, Middleton, North Andover, Reading, and Wakefield, Mass., and Salem, N.H. Int. II at Lowell and Wilmington, Mass.

Nov. 2: Between 06:00 and 07:00. Wilson, N.Y. Press reported a slight tremor shook houses, knocked a cup off table, and shook figurines off shelf. Also reported at Lockport and Ransomville. Not recorded on seismograph at Canisius College. Probably an explosion and not of seismic origin.

EASTERN REGION

[All times are eastern standard. If an epicenter is quoted, Greenwich mean time is given in parentheses.]

Mar. 14: 11:27:51.5 (16:27). Epicenter 33.1° N., 87.9° W., Alabama, at a depth of 1 km., JSA, mag. 3.9. Felt at Carrollton.

May 19: 07:54:03.4 (12:54). Epicenter 33.3° N., 80.6° W., South Carolina, at a depth of 25 km., mag. 3.4 (m_b).**V**. Felt from Gaston (about 24 km. southwest of Columbia) southeast to Harleyville (about 64 km. northwest of Charleston) and northwest to Augusta, Ga. Newspaper accounts reported several broken windows at Bowman (about 88 km. northwest of Charleston) and cracked windows and activated burglar alarm at Orangeburg. Int. IV effects occurred at Cordova and Harleyville, S.C., and Augusta, Ga. Int. I—III at Aiken and Gaston, S.C.

July 12: 21:03. Eastern Tennessee. **V**. Felt from Knoxville west to Oakdale, and from La Follette south to Philadelphia, an area covering approximately 5,200 sq. km. (2,000 sq. mi.) of eastern Tennessee. Strongest at Kingston, Knoxville, and Oakdale, but no damage was sustained. Int. IV at Concord (doubtful report), Emory Gap, Friendsville, Harriman, Louisville, Oliver Springs, and Philadelphia. Int. I—III at La Follette, Lenoir City, Loudon, Mooresburg, and Petros.

July 13: 03:15, 06:42:26.0 (CSC). Western South Carolina. **VI**. The main shock at 06:42 was felt over approximately 5,200 sq. km. (2,000 sq. mi.) of South Carolina and northeastern Georgia. A chimney cracked and furniture moved about at Newry, about 40 km. southwest of Greenville, S.C.

INTENSITY VI:

Newry.—Felt by and awakened all in community; frightened many. One chimney cracked (observer also reported no damage); furniture shifted. Entire house shook.

Hanging objects swung violently. Very loud earth noises. "This was the strongest quake ever felt at Newry. Several families are making plans to move and leave their homes. . . because we are directly below this 185-foot earth dam [Little River Dam]."

INTENSITY V:

Anderson, Clemson, Norris, Pendleton, Princeton, Salem, and Westminster.

INTENSITY IV:

Belton, Cateechee, Central, Fair Play, Fountain Inn, La France, Mountain Rest, Pickens, Sandy Springs, Sunset, Tamassee, Wahalla, and West Union.

INTENSITY IV IN GEORGIA:

Hartwell and Toccoa.

INTENSITY I—III:

Cleveland, Greer, Liberty, Longcreek, Richland, Seneca, Six Mile, and Starr.

July 31: 15:16:55.6 (20:16). Epicenter 33.4° N., 80.7° W., South Carolina, at a depth of 25 km. Int. **III** in the Orangeburg County area (south of Columbia) at Bowman, Cordova, and North.

Sept. 11: 19:06:27.1 (Sept. 12, 00:06). Epicenter 38.1 N., 77.4 W., Virginia, at a depth of 18 km. **V.** Felt over about 4,940 sq. km. (1,900 sq. mi.). A slight shock centered south of Fredericksburg in the Spotsylvania area. No damage occurred, but objects fell in an attic at Milford and furniture shifted. Int. V effects also were noted at Spotsylvania. Int. IV at Bowling Green, Brooke, Fredericksburg, Fredericks Hall, Ladysmith, Post Oak, and Woodford.

CENTRAL REGION

[All times are central standard. If an epicenter is quoted, Greenwich mean time is given in parentheses.]

Feb. 12: 06:44:27.7 (12:44). Epicenter 38.5° N., 87.9° W., southern Illinois, at a depth of 12 km, JSA. This slight shock was felt over 10,400 sq. km. (4,000 sq. mi.) of southern Illinois and Indiana. Int. **IV** in Illinois at Albion, Lawrenceville, Mount Carmel, Mount Erie, Noble, Olney, Sims, and West Union; in Indiana at Griffin, Mount Vernon, and Princeton. Int. I—III in Illinois at Allendale, Bellmont, Bone Gap, Bridgeport, Clay City, Crossville, Dundas, Fairfield, Flora, Louisville, Mill Shoals, Norris City, Parkersburg, Saint Francisville, Springerton, Sumner, and West Salem; in Indiana at Decker, Elberfeld, Fort Branch, Haubstadt, Hazelton, Oakland City, and Patoka.

Oct. 1: 12:49:39.4 (18:49). Epicenter 35.8° N., 90.4° W., northeastern Arkansas, at a depth of 19 km. **V.** Felt over about 143,000 sq. km. (55,000 sq. mi.) of Alabama, Arkansas, Indiana, Illinois, Kentucky, Mississippi, Missouri, Tennessee, and Texas (fig. 3). In Arkansas at Lake City, plaster and buildings cracked; at Sedgwick, concrete cracked; and at Delaplaine, slight damage was reported but not described.

INTENSITY V IN ARKANSAS:

Bay, Black Oak, Brookland, Delaplaine, Lake City, Lunsford, Roseland, Sedgwick and Trumann.

INTENSITY V IN KENTUCKY:

Cundiff and Moorman (damage slight).

INTENSITY V IN MISSOURI:

Tiff (cracked and bulging wall noted).

INTENSITY IV IN ALABAMA:

Chance, Double Springs, and Mount Vernon.

INTENSITY IV IN ARKANSAS:

Caraway, Casscoe, Dumas, Evening Shade, Fulton, Grubbs, Inboden, Jonesboro, Keiser, Landis, Lynn, Maynard, Monette, Montrose, Rivervale, Smithville, Stonewall, Tulot, Tyronza, Walnut Ridge, and West Ridge.

INTENSITY IV IN INDIANA:

Santa Claus.

INTENSITY IV IN ILLINOIS:
Waltonville.

INTENSITY IV IN KENTUCKY:
Center.

INTENSITY IV IN MISSISSIPPI:
Brooklyn and Hillhouse.

INTENSITY IV IN MISSOURI:
Arbyrd, Caledonia, Davisville, Farrar, Gatewood, Ironton, Puxico, and Thayer.

INTENSITY IV IN TENNESSEE:
Alamo, Cottontown, Fulton, Humboldt, Orme, Ridgely, and Samburg.

INTENSITY I–III IN ALABAMA:
Verbena.

INTENSITY I–III IN ARKANSAS:
Bigelow, Brickeys, Cash, Cave City, Dalton, Des Arc, Etowah, Lepanto, Marcella, Marianna, Moorefield, O'Kean, Pocahontas, Ravenden Springs, Saffell, Success, and Swifton.

INTENSITY I–III IN ILLINOIS:
Allendale, Du Quoin, Mascoutah, and Ozark.

INTENSITY I–III IN KENTUCKY:
Eminence and Leitchfield.

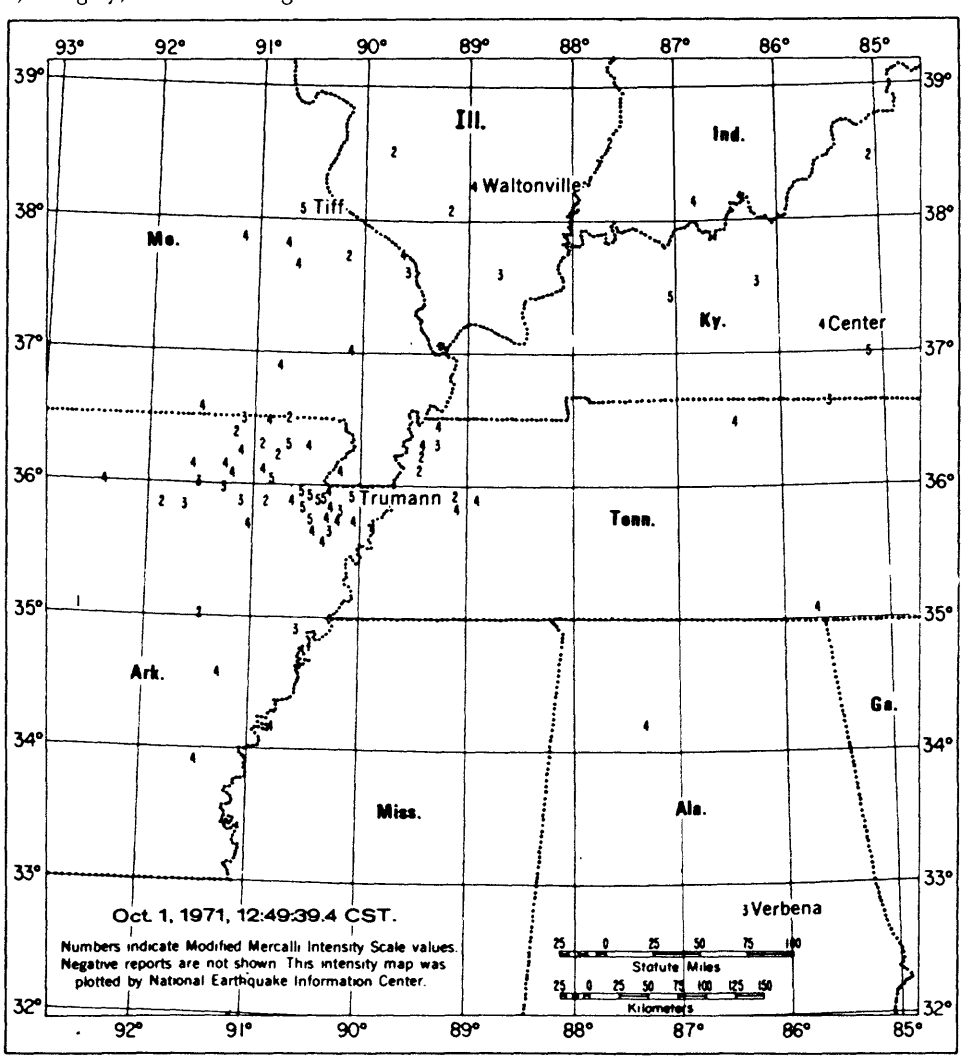

FIGURE 3.—Area affected by Arkansas earthquake of October 1.

INTENSITY I—III IN MISSOURI:

Eagle Rock, Harwood, New Wells, and Womack.

INTENSITY I—III IN TENNESSEE:

Crockett Mills, Elbridge, Finley, Miston, and Moss.

INTENSITY I—III IN TEXAS:

Nacogdoches.

Oct. 9: 11:43:33.8 (16:43). Epicenter 35.9° N., 83.5° W., Tennessee, at a depth of 18 km., mag. 3.4 (m_b) Int. V in Great Smokies National Forest at Greenbrier Ranger Station. near Cosby, where $100 worth of china broke; also at Cosby and Gatlinburg, Tenn., and Oconaluftee Ranger Station, N.C., where canned goods tumbled from shelves (press). Int. V effects also occurred at Newport and Sevierville, Tenn. Int. IV at Flat Rock, N.C. Int. I—III at Burnsville, Franklin, and Sylva, N.C., and Townsend, Tenn.

Oct. 19: 15:07:30.9 (Oct. 19, 21:07). Epicenter 44.0° N., 101.0° W., South Dakota, at a depth of 15 km. Int. **IV** at Cedar Bluff.

WESTERN MOUNTAIN REGION[1]

[All times are mountain standard. If an epicenter is quoted, Greenwich mean time is given in parentheses.]

Jan. 4: 00:39:06.7 (07:39), 06:15. Epicenter 35.0° N., 106.7° W., near Albuquerque, N. Mex., at a depth of about 9 km., mag. 4.7 (m_b). **VI**. Felt over about 1,600 sq. km. (600 sq. mi.) of the Albuquerque region. At the University of New Mexico, there was considerable minor damage that required extensive replastering, repainting, retiling, and replacement of supplies and office equipment. Press reported damage was estimated at $30,000 to $40,000, with much of it caused by breakage of chemicals that dissolved floor tile and molding. Steel shelves were damaged; thousands of books fell. Only the north-south shelves were overturned or had items fall off; east-west shelves were not damaged. At the West Mesa High School (reportedly built a few years ago), damage was generally slight, with one severe fracture of a beam connection. In other areas of Albuquerque, principally in the West section, there also were reports of cracked and fallen plaster. One old adobe building sustained both interior and exterior cracks. Plaster cracked and fell at the county jail. Windows cracked. One observer reported ground cracks. Merchandise fell in markets: objects fell in homes; dishes broke. Hanging objects swung violently. Many were awakened and frightened. The direction of motion was reported as north-south, east-west, and as a shuddering, jolting, up-and-down movement. Loud, explosivelike, roaring earth noises were heard. Calls were received at the Albuquerque Fire Department reporting later shocks, including a distinct aftershock at 06:15. Int. V (plaster cracked) at Alameda (about 11 km. north of Albuquerque) and Corrales (about 19 km. north of Albuquerque). Int. IV at Kirtland Air Force Base (adjoining southeast Albuquerque city limits).

Jan. 6: 03:56. Recorded at the New Mexico Institute of Mines and Technology, Seismology Center. The Institute reported the epicenter was about 18 km. north of Socorro, N. Mex., between San Acacia and Polvadera, mag. 3.4. The shock was generally felt in the Polvadera and Lemitar areas and to some extent at Socorro. It was the strongest in the area since January 1969.

Jan. 7: 13:39:52.1 (20:39). Epicenter 39.5° N., 107.3° W., Colorado, mag. 3.8. **V**. At Glenwood Springs, windows cracked and pictures fell from walls. The shock was felt over an area with about a 32-km. radius of Glenwood Springs.

Jan. 10: 19:08:53.9 (Jan. 11, 02:08). Epicenter 45.2° N., 112.0° W., Montana, mag. 3.6 (m_b). **V**. Felt over about 6,500 sq. km. (2,500 sq. mi.) of southwestern Montana, principally in the Virginia City-Ennis area of

[1] Prepared by N. H. Scott, Seismological Field Survey, Environmental Research Laboratories, National Oceanic and Atmospheric Administration, San Francisco, Calif. Scott also prepared California and Western Nevada Region, p. 22, and Washington and Oregon, p. 72

central Madison County. At Bozeman, a slight tremor was reported felt about 30 minutes later, and at Ennis, three shakes were reported felt during the evening. Small objects and furnishings shifted at Cameron. At Ennis, small objects and furniture shifted; plaster reportedly cracked at a hotel. At one location about 11 km. south of Ennis, a slight break in a basement waterpipe occurred. Small objects shifted at Jeffers. The tremor was quite severe at Virginia City where small objects shifted. Int. IV at Bozeman, Gallatin Canyon area (at two ranches about 50 km. and 60 km. south of Gallatin Gateway), Harrison, McAllister, and Norris. Int. I—III about 15 km. south of Gallatin Gateway.

Jan. 26: 03:52:52.7 (10:52). Epicenter 46.4° N., 112.2° W., Montana, at a depth of 15 km. Int. **IV** at Helena.

Feb. 8: 14:10. Int. **III** at Ennis, Mont.

Feb. 17: 00:48:17.0 (Butte). 00:54. Int. **IV** at Helena Mont.

Feb. 18: 04:28:13.7 (11:28). Epicenter 36.2° N., 105.7° W., New Mexico, at a depth of 5 km., mag. 3.7 (m_b). Felt at Dixon and San Juan Pueblo.

Feb. 23: 11:45. Int. **III** at Polson, Mont.

Feb. 25: 07:40:45.4 (14:40). Epicenter 48.2° N., 115.2° W., Montana, at a depth of 17 km. Int. **IV** in the Crystal Lake-Lavonne Lake area about 48 km. southeast of Libby Dam.

Mar. 11: 07:08. Mag. 3.0 (Gol). Int. **III** at Commerce City, Colo. Also felt at Denver, Dupont, Eastlake, Henderson, Irondale, Thornton, and Westminster.

Mar. 11: 22:40. Int. **III** at Polson, Mont.

Mar. 13: 00:33:13.4 (07:33). Epicenter 44.9° N., 111.3° W., Hebgen Lake, Mont., region. Int. **IV** in the Gallatin Canyon area at 320 Ranch, about 60 km. south of Gallatin Gateway.

Mar. 18: 02:08:59.9 (09:08). Epicenter 40.7° N., 107.0° W., Colorado, at a depth of 10 km., mag. 4.4 (m_b). **V**. Felt over a small area of northern Colorado, principally in the Clark-Milner area. In a rural area of Clark, livestock were frightened; small objects shifted; loud earth noises; damage slight (no details). This observer reported two subsequent shocks of less intensity were felt. Observer at Clark reported the most noticeable effects (no details) were observed about 16 km. south of Clark. At Milner, some canned goods and cartons of 'pop' fell to the floor. Int. IV at Clark and Steamboat Springs. Also reported felt at the Colorado Ute Electric Plant about 5 km. east of Hayden and at a ranch about 5 km. northeast of Hayden.

Mar. 29: 06:22:35.6 (13:22). Epicenter 36.0° N., 114.7° W., southern Nevada, at a depth of 4 km., mag. 2.1. Felt at Boulder City.

Apr. 7: 12:05. Int. **III** at Polson, Mont.

Apr. 8: 01:15, 13:22. Montana. Int. **III** at Polson (01:15). Shock at 13:22 was felt at Kerr Dam (about 8 km. southwest of Polson).

Apr. 12: 02:10, 05:43:24.4 (12:43), 05:48, 05:50, 06:30, 07:20, 09:05, 11:55, 12:05, 17:42. Epicenter 47.8° N., 114.3° W., Montana, at a depth of 21 km., mag. 3.7. **V**. Window broke and dishes fell in an area about 13 km. from Polson on the west side of Indian Bay (Flathead Lake). Int. IV at Big Arm (light tremors also felt at 05:48, 05:50, 07:20, and 09:05). Int. III at Polson (09:05 and 12:05). Shocks were felt at Kerr Dam at 02:10, 06:30, and 17:42.

Apr. 13: 08:45, 09:37, 15:15. Montana. Heavy tremor at Big Arm (09:37). Int. **III** at Polson (08:45 and 15:15).

Apr. 14: 03:00. Int. **III** at Polson, Mont.

Apr. 15: 03:00, 03:02, 03:17. Felt at Big Arm, Mont. The third shock was a fairly strong tremor.

Apr. 16: 12:29:44.0 (19:29). Epicenter 47.6° N., 114.5° W., Montana, at a depth of 5 km., mag. 3.2. Int. **IV** at Big Arm; III at Polson. Also felt at Kerr Dam.

Apr. 17: 07:35. Montana. Int. **III** at Polson. Light tremor at Big Arm.

Apr. 18: 07:52:04.5 (14:52), 08:15, 08:20, 08:45. Epicenter 47.8° N., 114.4° W., Montana, at a depth of 5 km., mag. 3.7. **V**. Felt by all in community at Big Arm. Well water was cloudy for about 60 hours. Loud rumble. "We have felt about 26 shocks since April 12; also slight shocks at 08:20 and 08:45." Felt by all and awakened many at Elmo. "We have so

many small shocks that we do not pay much attention to them." Frightened many in community of Mahoney (west of Ronan). "Felt several shocks since this one." Awakened many at Pablo; loud rumble. Awakened many at Polson (slight shock also felt at 08:15). Felt strongly at Kerr Dam; direction southwest-northeast and whiplike. Int. I—III at Dixon and Ronan.

Apr. 19: 22:45, 23:04:12.0 (Apr. 20, 06:04). Epicenter 47.7° N., 114.6° W., Montana, at a depth of 5 km., mag. 3.3. Int. **III** at Big Arm and Polson (both shocks).

Apr. 20: 03:20, 13:00:36.3 (20:00). Epicenter 47.7° N., 114.4° W., Montana, at a depth of 5 km., mag. 3.2. Felt at Big Arm; loud tremor. Int. **III** at Polson (both shocks).

Apr. 21: 06:20:31.0 (13:20), 06:21, 06:22, 06:25, 06:42, 06:43:03.3 (13:43), 07:08:40.9 (14:08), 07:09, 10:56, 11:17, 11:40, 11:56, 11:58, 12:30. Epicenter (1) 47.9° N., 114.2° W; (2) 47.7° N., 114.3° W; (3) 47.7° N., 114.3° W., Montana, at depths of 5, 2, and 5 km., respectively, mag. 3.6, 3.4, and 3.0, respectively. **V**. Awakened and frightened many at Kerr Dam; new cracks in plaster; loud booming noise (shocks also felt at 06:21, 06:25, 06:42, 06:43, 07:08, 10:56, 11:17). Int. IV at Big Arm (shocks also felt at 06:22, 06:43, 07:08, 07:09, and 11:40). Int. III at Polson (shocks also felt at 06:22, 06:43, 07:08, 11:56, 11:58, and 12:30).

Apr. 22: 02:45, 03:05, 06:08, 06:12:13.6 (13:12), 06:16, 11:00. Epicenter 47.8° N., 114.3° W., Montana, at a depth of 5 km., mag. 3.1. Int. **IV** at Big Arm (slight tremor at 06:16). Int. III at Polson (shocks also felt at 02:45 and 03:05). Shocks at 06:08 and 11:00 felt at Kerr Dam.

Apr. 22: 16:01:03.2 (23:01). Epicenter 39.4° N., 112.0° W., Utah, at a depth of 5 km., mag. 3.4. Int. **III** at Mona and Scipio.

Apr. 23: 11:40:57.1 (18:40), 23:25. Epicenter 47.6° N., 114.3° W., Montana, at a depth of 5 km., mag. 3.1. Light tremor at Big Arm (also 23:25). Int. **III** at Polson.

Apr. 25: 05:35, 05:40, 12:48, 18:30, 18:41. Montana. At 18:30, int. **IV** at Dixon, Kerr Dam (shock also felt at 05:40), Mahoney, Rollins, and Polson (shock also felt at 05:40). Int. I—III at Big Arm (also light shocks felt at 05:35, 12:48, and 18:41), Charlo (about 8 km. north of), and Hot Springs.

Apr. 26: 02:02:26.1 (09:02), 05:00, 20:00. Epicenter 47.8° N., 114.3° W., Montana, at a depth of 5 km., mag. 4.2. **V**. Small earthslide at Kerr Dam (shock also felt about 20 minutes later). At Polson, items fell from several market shelves; some objects fell from shelves in homes. A few bricks fell from top of one chimney. Slight shock also felt at 05:00. Int. V effects (no damage) at Big Arm (also light tremor at 20:00), Dixon (also shock about 30 minutes later), Elmo, Mahoney (west of Ronan), Pablo, Proctor, and Rollins. Reported as rumbling heavily through the Valley View area. Int. IV at Hot Springs. Also felt at Hungry Horse Dam (slight bump), Ronan, and about 8 km. north of Saint Ignatius.

Apr. 27: 03:20, 04:30, 22:00. Montana. Int. **III** at Polson (03:20). Light tremors at Big Arm (04:30 and 22:00).

Apr. 29: 03:05, 03:10, 06:30, 06:52, 10:05, 21:37:39.1 (Apr. 30, 04:37), 21:59. Epicenter 47.9° N., 114.2° W., Montana, at a depth of 5 km., mag. 3.1. Int. **IV** at Big Arm (also slight shocks at 03:05, 06:30, and 10:05) and Kerr Dam (shocks also felt at 03:10, 06:52, and 21:59). Int. III at Polson (shock also felt at 06:52).

Apr. 30: 00:15, 15:30, 15:40, 16:01, 16:04. Montana. Int. **III** at Polson (00:15, 15:40, 16:04). Light tremors at Big Arm (15:30 and 16:01).

May 1: 02:05, 02:15, 09:05. Montana. Int. **III** at Polson (02:05 and 09:05). Light tremor at Big Arm (02:15).

May 2: 09:55. Int. **III** at Polson, Mont. Light tremor at Big Arm.

May 3: 05:50, 06:20, 06:33, 20:00. Montana. Int. **III** at Polson (05:50 and 06:20). At Big Arm very light at 06:33; moderate tremor at 20:00.

May 4: 22:27. Int. **III** at Polson, Mont.

May 5: 12:28, 12:29:36.6 (19:29). Epicenter 47.8° N., 114.1° W., Montana, at a depth of 5 km. Int. **IV** at Big Arm; III at Polson (shock

also felt at 12:28).

May 6: 20:18. Loud tremor felt at Big Arm, Mont.

May 7: 01:05, 05:40, 09:12. Montana. Int. **IV** at Big Arm (09:12); slight shocks at 01:05 and 05:40. Int. III at Polson (all shocks).

May 8: 03:45, 03:47, 03:50, 03:55, 23:40, 23:58. Int. **III** at Polson, Mont.

May 10: 10:17, 17:58. Int. **III** at Polson, Mont.

May 11: 07:40. Light shock felt at Big Arm, Mont.

May 12: 21:00, 21:17, 21:45. Int. **III** at Big Arm and Polson, Mont.

May 14: 14:05, 14:45, 21:06. Int. **III** at Big Arm and Polson, Mont.

May 17: 15:45. Int. **III** at Big Arm, Mont.

May 18: 21:45. Int. **III** at Big Arm, Mont.

May 21: 21:10. Int. **III** at Big Arm, Mont.

May 24: 07:30, 19:12, 23:08. Montana. Int. **III** at Big Arm (07:30) and Polson (all shocks).

May 27: 07:50, 12:36. Int. **III** at Polson, Mont.

May 30: 01:58:56.6 (08:58). Epicenter 47.7° N., 114.1° W., Montana, at a depth of 5 km., mag. 2.9. Int. **III** at Polson.

June 1: 12:02, 22:55. Int. **III** at Polson, Mont.

June 2: 16:12, 20:05. Int. **III** at Polson, Mont.

June 3: 01:15, 08:45, 15:30. Int. **III** at Polson, Mont.

June 3: 20:55:15.9 (June 4, 03:55). Epicenter 35.8° N., 105.6° W., New Mexico, at a depth of 5 km., mag. 3.8 (m_b). Felt at Albuquerque.

June 4: 03:00. Int. **III** at Polson, Mont.

June 9: 17:05, 22:45. Int. **III** at Polson, Mont.

June 11: 16:35, 17:52:17.3 (June 12, 00:52). Epicenter 47.7° N., 114.3° W., Montana, at a depth of 5 km., mag. 4.4 (m_b). Int. **IV** at Kerr Dam and Polson. Also felt in Valley View area.

June 12: 06:55:03.2 (13:55), 11:13, 14:40, 15:25, 15:33. Epicenter 47.7° N., 114.2° W., Montana, at a depth of 5 km. Int. **IV** at Kerr Dam. Int. III at Polson (also shocks at 11:13, 14:40, 15:25, and 15:33).

June 13: 11:51:21.5 (18:51). Epicenter 47.7° N., 114.3° W., Montana, at a depth of 5 km., mag. 4.4 (m_b). **V**. Plaster cracked at Kerr Dam. Int. IV at Elmo, Pablo, and Polson. Felt very slightly at Niarada.

June 14: 00:25. Int. **III** at Polson, Mont.

June 16: 01:00. Int. **III** at Polson, Mont.

June 18: 03:25, 22:48. Int. **III** at Polson, Mont.

June 19: 02:48. Int. **III** at Polson, Mont.

June 20: 14:25. Int. **III** at Polson, Mont.

June 21: 19:10. Int. **III** at Polson, Mont.

June 22: 03:02. Int. **III** at Polson, Mont.

June 22: 11:19:11.6 (Butte). Int. **IV** at Helena, Mont.

June 23: 03:55, 23:55. Int. **III** at Polson, Mont.

June 24: 08:10. Int. **III** at Polson, Mont.

June 25: 21:18, 22:54. Int. **III** at Polson, Mont.

June 29: 02:55. Int. **III** at Polson, Mont.

July 4: 19:36. Int. **III** at Polson, Mont.

July 10: 16:22. Int. **III** at Polson, Mont.

July 11: 11:34. Int. **III** at Polson, Mont.

July 12: 11:28, 13:10. Int. **III** at Polson, Mont.

July 13: 11:51:32.1 (18:51). Epicenter 47.8° N., 114.2° W., Montana, at a depth of 5 km., mag. 3.4. **V**. Plaster cracked at Kerr Dam. Int. IV at Big Arm, Elmo, and Mahoney (about 16 km. west of Ronan). Also reported felt at Kalispell and Polson.

July 14: 07:50. Int. **III** at Polson, Mont.

July 16: 03:54:19.7 (10:54). Epicenter 42.2° N., 111.4° W., eastern Idaho, at a depth of 5 km., mag. 3.6 (m_b). **V**. Awakened many in community at Bern and Ovid. Int. IV at Bennington, Dingle, Montpelier, and about 3 km. east of Montpelier.

July 23: 08:01:50.7 (15:01), 08:05:16.4 (15:05), 08:44:27.4 (15:44), 09:51:41.7 (16:51), 17:52:50.3 (July 24, 00:52), 19:55:24.9 (July 24, 02:55), 20:07:27.5 (July 24, 03:07). Epicenter (1) 47.8° N., 114.2° W.; (2) 47.8° N., 114.3° W.; (3) 47.8° N., 114.3° W.; (4) 47.8° N., 114.3° W.; (5) 47.8° N., 114.4° W.; (6) 47.9° N., 114.5° W.; (7) 47.8° N., 114.3° W., Montana, at a depth of 5 km., mag. of

first shock 4.0; of third, 3.5. Other shocks reported felt in the area: 08:30, 15:12, 17:00, 19:12, 19:13, 19:15, 19:35, 19:37, 20:45, and 21:45. Polson press reported approximately 15 aftershocks were felt. V(main shock at 08:01). The shock reportedly rumbled through the valley from Kalispell to Dixon. At Kerr Dam, light standards whipped back and forth during the shocks at 08:01 and 08:05. The shocks at 08:44 and 09:51 also were felt at the dam and many smaller shocks occurred. At Polson, a few items fell from shelves in markets and households; plaster cracked; plate glass window cracked; few bricks were "heard" tumbling from chimneys. Loud earth noises. No serious damage was reported. A man in a hayfield (south of Polson) observed a very wavy motion in the ground. At a location in the very end of the west side of Indian Bay on Flathead Lake (about 13 km. from Polson), a boat ramp shifted several centimeters; mounted deer heads and small objects fell; during the shock at 08:44, the pole corral shook very strongly. Int. IV at Dayton (shocks also felt at 08:05, 19:35, and two small ones later), Lake Mary Ronan (also 08:05), Proctor, and Rollins (08:01, 08:05, 08:44, "Hardest shocks we have felt").

July 24: 00:45, 04:01:03.9 (11:01), 04:38:26.0 (11:38), 04:43:02.6 (11:43), 05:30, 05:58, 17:25, 23:29. Epicenter (1) 47.8° N., 114.3° W.; (2) 47.9° N., 114.3° W.; (3) 47.8° N., 114.3° W., Montana, at a depth of 5 km., mag. of second shock 3.2; of third, 2.8. At Dayton, a "good" one at 04:01; two small ones before 05:00 and 08:00. At Kerr Dam, sharp shock at 04:38; many lesser shocks followed. At Rollins, five tremors were reported felt from 04:01 to 06:30. All of the shocks listed were reported felt at Polson.

July 25: 06:20, 23:05. Int. **III** at Polson, Mont.

July 27: 23:04:19.4 (July 28, 06:04). Epicenter 47.8° N., 114.3° W., Montana, at a depth of 5 km., mag. 4.4. **V**. Felt over approximately 12,480 sq. km. (4,800 sq. mi.), principally in the southwest Flathead Lake area. Felt by all at Big Arm; mail fell out of mailboxes; very loud jar. Awakened many at Elmo; small objects shifted. Awakened many at Hot Springs. At Kerr Dam, plaster cracked; awakened and frightened many; loud earth noises. "This is the hardest shock that I have ever felt here at Kerr Dam." Awakened many at Lonepine. Awakened many at Polson, and about 13 km. from Polson on Indian Bay. At Proctor, awakened many; quite violent shaking; loud earth noises. Awakened all at Rollins. Felt by and awakened all in home at Ronan. At Swan Lake, awakened many; small objects shifted. Int. IV at Dayton, Dixon, Kila, Plains, and Somers. Also felt at Lake Mary Ronan and very slightly about 8 km. north of Saint Ignatius.

July 28: 05:44, 07:55, 11:36, 11:47, 12:03. Int. **III** at Polson, Mont.

Aug. 1: 03:27. Int. **III** at Polson, Mont.

Aug. 3: 16:52. Int. **III** at Polson, Mont.

Aug. 5: 10:58:17.1 (17:58). Epicenter 36.9° N., 116.0° W., southern Nevada, at a depth of 4 km., mag. 4.3 (m_b). Reported as generally felt throughout the Nevada Test Site area with an intensity of **IV**. Int. III at Beatty and Mercury.

Aug. 7: 22:22:44.0 (Aug. 8, 05:22). Epicenter 39.9° N., 104.8° W., Colorado, at a depth of 5 km., mag. 4.4 (m_b). Int. **IV** at Commerce City. Reported felt to South Denver area, southwest to Evergreen, and north to Boulder and Brighton; also felt at Golden and in Coal Creek and Mount Vernon Canyons. Barely felt east of Highway 85.

Aug. 8: 12:34. Int. **III** at Polson, Mont.

Aug. 9: 08:53. Int. **III** at Polson, Mont.

Aug. 14: 01:35. Int. **IV** at Commerce City, Colo.

Aug. 14: 16:24. Int. **III** at Polson, Mont.

Aug. 23: 15:37. Int. **III** at Polson, Mont.

Aug. 24: 05:25. Int. **III** at Polson, Mont.

Aug. 26: 02:14. Int. **III** at Polson, Mont.

Aug. 27: 00:20, 09:50. Int. **III** at Polson, Mont.

Aug. 28: 09:42. Int. **III** at Polson, Mont.

Sept. 1: 17:06, 23:34. Int. **III** at Polson, Mont.

Sept. 2: 01:55. Int. **III** at Polson, Mont.

Sept. 5: 11:42. Int. **III** at Polson, Mont.

Sept. 8: 17:20:17.2 (Sept. 9, 00:20), 17:29, 17:32:28.3 (Sept. 9, 00:32), 17:45. Epicenter (1) 47.8° N., 114.2° W.; (2) 47.8° N., 114.3° W., Montana, at a depth of 5 km., mag. of first shock 3.9 (m_b). **V** (17:20). Felt by all at Big Arm (shocks also felt at 17:29 and 17:32). At Polson, few items fell from store and household shelves (shocks also felt at 17:32 and 17:45). In the Valley View area, felt by farmers in the fields; preceded by loud, explosivelike sound. Int. IV at Elmo, Pablo, Proctor, and Rollins.

Sept. 9: 05:57. Int. **III** at Polson, Mont.

Sept. 10: 20:10. Int. **III** at Polson, Mont.

Sept. 11: 01:38:03.9 (08:38), 01:44, 13:00. Epicenter 47.9° N., 114.3° W., Montana, at a depth of 5 km. **V**. At Proctor (01:38 and 01:44), loud, brief, violent shaking; awakened all in home and others in community; pictures displaced. All three shocks felt at Polson.

Sept. 13: 15:41. Int. **III** at Polson, Mont.

Sept. 17: 23:38. Int. **III** at Polson, Mont.

Oct. 1: 06:15. Int. **III** at Polson, Mont.

Oct. 21: 23:39. Int. **III** at Polson, Mont.

Oct. 22: 00:20:39.4 (07:20). Epicenter 47.7° N., 114.2° W., Montana, at a depth of 5 km. Int. **III** at Polson.

Oct. 24: 22:06. Int. **III** at Polson, Mont.

Oct. 25: 12:18. Int. **III** at Polson, Mont.

Oct. 26: 00:14. Int. **III** at Polson, Mont.

Oct. 27: 07:06. Int. **III** at Polson, Mont.

Nov. 3: 19:18:58.7 (Nov. 4, 02:18). Epicenter 35.2° N., 112.2° W., western Arizona, at a depth of 5 km., mag. 3.7. Int. **V** at Williams (no damage). Reported stronger about 6 and 14 km. north of Williams and about 29 km. south of Williams.

Nov. 6: 12:10. Int. **III** at Polson, Mont.

Nov. 8: 15:42. Int. **III** at Polson, Mont.

Nov. 10: 07:10:23.0 (14:10). Epicenter 37.8° N., 113.1° W., Utah, at a depth of 5 km., mag. 4.0. Felt in Cedar City-Summit area. Also reported felt at Panaca, Nev.

Nov. 12: 02:30:44.6 (09:30). Epicenter 38.9° N., 108.7° W., Colorado, at a depth of 5 km., mag. 4.0. Felt at Grand Junction.

Nov. 16: 11:48. Int. **III** at Polson, Mont.

Nov. 17: 09:54. Int. **III** at Polson, Mont.

Nov. 21: 01:02:49.5 (08:02). Epicenter 47.9° N., 114.3° W., Montana, at a depth of 5 km. Int. **III** at Polson.

Nov. 25: 23:18. Int. **III** at Polson, Mont.

Dec. 5 to 10. Dec. 5: 22:18:13.7 (Dec. 6, 05:18), 22:30. Epicenter 36.1° N., 106.3° W., New Mexico, at a depth of 5 km., mag. 3.2. **V**. At Mendales, felt by all and frightened many in community; adobe walls cracked slightly. "We felt five consecutive shocks between 22:30 and 23:10. The first shock was felt here at 22:30, and it was felt within a radius of about 16 km. that I know of. Earth noises were like 'angry' rumblings." It was also reported that in the Abiquiu-Mendales area four to seven tremors were felt, moving some furniture and frightening livestock. Int. IV at Abiquiu Dam (also 22:30). Rather strongly felt at Espanola. Int. I—III at Hernandez and Los Alamos. At Mendales, shocks reported as mild were felt on Dec. 6 at 04:20; Dec. 7, 15:40; Dec. 9, 22:45, and Dec. 10 (no time given).

Dec. 6: 00:55, 20:50. Int. **III** at Polson, Mont.

Dec. 8: 10:18:51.5 (17:18). Epicenter 37.7° N., 115.0° W., southern Nevada, at a depth of 5 km., mag. 4.8 (m_b). **V**. The "generally felt" area appeared to be about 33,800 sq. km. (13,000 sq. mi.). Beyond the limits of this area, the shock was reported felt at Beatty, Boulder City, and Las Vegas. All other reports from a very extensive questionnaire canvass were negative, as much of the epicentral area is very sparsely settled. At Caliente, felt by all in community. Int. IV at Alamo, Beatty, Boulder City, Bristol Silver Mines (about 40 km. northwest of Pioche), Hiko, Panaca, Pioche, and Ursine, and at Modena, Utah. Also reported felt in some high-rise buildings in Las Vegas.

Dec. 8: 22:28. Int. **IV** at Commerce City, Colo. Also felt at Adams City, Boulder, Denver (northeast area), Dupont, Eastlake, Henderson, Northglenn, and Thornton.

Dec. 20: 03:33. Int. **III** at Polson, Mont.

Dec. 23: 02:40:10.7 (09:40). Epicenter 47.8° N., 114.2° W., Montana, at a depth of 5 km. Int. **III** at Polson.

Dec. 24: 10:30. Int. **III** at Polson, Mont.

Dec. 27: 01:09:52.4 (08:09). Epicenter 47.7° N., 114.2° W., Montana, at a depth of 5 km., mag. 4.4 (m_b). Int. **IV** at Polson.

Dec. 30: 10:54. Int. **III** at Polson, Mont.

CALIFORNIA AND WESTERN NEVADA

[All times are Pacific standard. If an epicenter is quoted, Greenwich mean time is given in parentheses. All towns mentioned are in California unless otherwise stated.]

Jan. 4: 22:14:45.0 (Jan. 5, 06:14). Epicenter 34°02.2′ N., 117°56.2′ W., southern California, at a depth of 8 km., mag. 3.6, P. **V** Widely felt in Los Angeles County and in some areas of Orange County. In the San Gabriel Valley, tiny ceiling cracks were reported; many residents reported light household items were broken; most people reported the motion as a sharp, single jolt (press). Observer at South Pasadena reported a few plaster cracks were noted. Int. V at Covina, Glendora, Hacienda Heights, La Habra, Orange, and Temple City. Int. IV at Altadena, Artesia, Azusa, Baldwin Park, Brea, Compton, Glendale, Maywood, Monterey Park, Mount Wilson, North Hollywood, Norwalk, Pasadena, Rosemead, San Dimas, San Gabriel, and Whittier. Int. I—III at Arcadia, Buena Park, El Segundo, Inglewood, La Puente, South San Gabriel, Stanton, West Covina, and West Los Angeles area. Also reported felt at Alhambra, La Crescenta, Los Angeles (downtown area), and Monrovia.

Jan. 15: 16:53:53.8 (Jan. 16, 00:53), 21:13:29.2 (Jan. 16, 05:13). Epicenter (1) 35°29.0′ N., 118°20.3′ W.; (2) 35°30.4′ N., 118°20.0′ W., central California, at a depth of 8 km., mag. 3.6 and 2.8, respectively, P. Int. **IV** in the Piute Mountains area (Piute Peak, near Claraville). Shock also felt at 21:13.

Jan. 18: 15:31:19.4 (23:31). Epicenter 36°57.4′ N., 121°37.2′ W., central California, at a depth of 1 km., mag. 2.7, B. Int. **IV** at Gilroy.

Jan. 21: 01:31:24.0 (09:31). Epicenter 33°53.1′ N., 118°27.7′ W., near coast of southern California, at a depth of 8 km., mag. 2.8, P. Felt at Manhattan Beach.

Jan. 21: 23:35:53.0 (Jan. 22, 07:35). Epicenter 34°05.0′ N., 118°15.0′ W., southern California, at a depth of 8 km., mag. 1.9, P. Felt in central Los Angeles area.

Jan. 31: 04:22:49.5 (12:22). Epicenter 35°55.6′ N., 120°30.6′ W., central California, at a depth of 10 km., mag. 3.8, B. Int. **IV** at Shandon.

Feb. 1: 14:16:05.9 (22:16), 23:00. Epicenter 37°22′ N., 120°01′ W., central California, at a depth of 6 km., mag. 3.2, B. **V**. About 4 km. due north of Mariposa, on Whitlock Road, walks separated and previous cracks enlarged. Cracks in ceiling moved back together. Loud earth noises. Shock at 23:00 awakened observer.

Feb. 3: Int. **IV** at Imperial Beach.

Feb. 4: 00:45:16 (08:45). Epicenter 41.4° N., 123.5° W., northern California (location uncertain), at a depth of 2 km., mag. 3.6, B Int. **II** at Crescent City.

Feb. 4 or 5: No time given. Int. **IV** in the Kelso Valley area (east of Piute Mountains in Kern County). Observer in Piute Peak area, near Claraville, reported many heavy jars and shakes also had been felt in the mountain range to the west.

Feb. 8: 18:00, 18:07:01.4 (Feb. 9, 02:07). Epicenter 36°37.2′ N., 121°18.0′ W., central California, at a depth of 0 to 5 km., mag. 2.8, B. Int. **III** about 10 km. south of Paicines.

Feb. 9: 06:00:41.6 (14:00). Main shock of the disastrous San Fernando earthquake. Epicenter 34°24.7′ N., 118°24.0′ W., southern California, at a depth of about 8 km., mag. 6.4, P. The epicenter is about 14 km. north of San Fernando in a sparsely populated area of the San Gabriel Mountains. **XI**. The earthquake was "generally" felt over approximately 208,000 sq. km. (80,000 sq. mi.) of California, Nevada, and Arizona (fig. 4). There were a few instances of the shock being reported felt beyond this area at Bridgeport, Stockton, and Yosemite National Park, Calif., Tonopah, Nev., and Beryl, Utah. Intensities ranging from VIII—XI (fig. 5)

were indicated in an area of about 494 sq. km. (190 sq. mi.), with the one int. XI assigned to the Olive View Hospital.

It was reported that 58 persons died as a direct consequence of the earthquake—three at the Olive View Hospital, 49 at the Veterans Administration Hospital, 2 by collapse of freeway overpass, and 4 at other locations, including one person killed by the collapse of an old building in downtown Los Angeles. Over 2,000 injuries were reported many requiring hospital treatment.

Damage to public and private property was estimated at over $500 million. It was reported that approximately 850 homes, 65 apartment buildings, and 574 commercial-industrial buildings were so damaged that they were vacated; some 4,800 homes, 265 apartment buildings, and 1,125 commercial buildings had appreciable damage; and about 30,000 structures had lesser damage. About 1,700 mobile homes were substantially damaged. The most spectacular damage was the collapse of major structures at the Olive View Hospital and the Veterans Administration Hospital, and the collapse of freeway overpasses. Public utilities and facilities of all kinds were greatly damaged—water, gas, sewer, and electric—both above and below ground. The near failure of the Lower Van Norman Dam caused authorities to evacuate thousands of

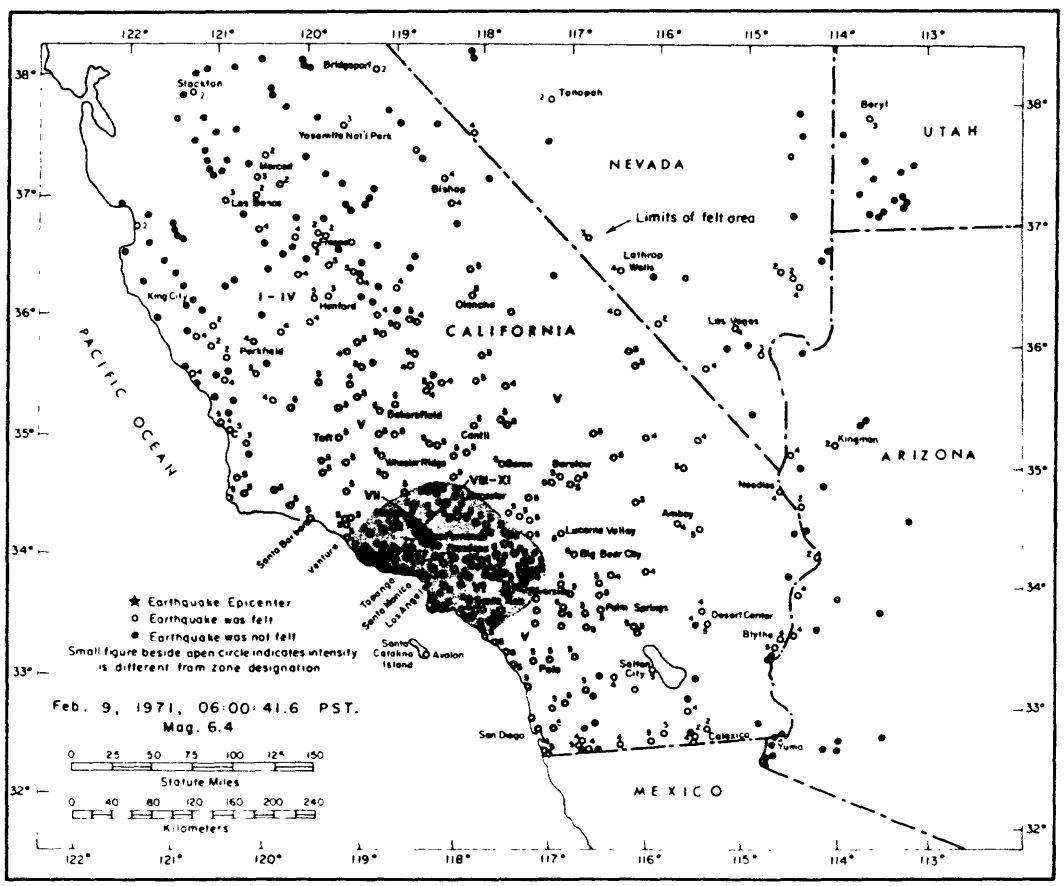

FIGURE 4.—Area affected by San Fernando, Calif., earthquake of February 9.

people from areas below the dam until the water in the reservoir could be lowered and the extent of damage and danger determined.

The following estimates of damage are from a report by the Los Angeles County Earthquake Commission.[1]

Jurisdiction or agency	*Public property*	*Private property*
City of Los Angeles	$ 92,000,000	$210,000,000
County of Los Angeles	100,000,000	6,800,000
Other local jurisdictions	5,200,000	30,000,000
State of California	15,000,000	.....
Federal Government	10,000,000	.....
Metropolitan Water District	6,000,000	.....
General Telephone	.....	4,700,000
Los Angeles School District	22,500,000	.....
Southern California Gas Company	.....	2,000,000
Southern California Edison Company	.....	750,000
Total	$250,700,000	$254,250,000

Total (public and private) $504,950,000

Considerable damage, mainly to older buildings and dwellings, occurred in the Int. VII zone. Some were posted as "unsafe" and others, notably in the Alhambra, Beverly Hills, Burbank, and Glendale areas, were to be demolished. A few large buildings sustained some structural damage, but damage to large or high-rise buildings was chiefly in the form of cracked partitions, fallen plaster, and broken windows. Thousands of chimneys were damaged. There were numerous reports of inoperative elevators, principally owing to counterweights being out of guide rails.

The earthquake created a zone of discontinuous surface faulting, named the San Fernando Fault zone, which extended from the Bee Canyon area (west of Upper Van Norman Lake) roughly eastward across the Sylmar-San Fernando area to the Big Tujunga Canyon area north of Sunland, a distance of about 20 km. The main rupture segment, designated the Sylmar segment, extended eastward from the intersection of Hubbard Street and Glenoaks Boulevard (in southern Sylmar-northern San Fernando area) across Foothill Boulevard to the Foothill Nursing Home. Although it was in this segment of the fault zone that the greatest concentration of ground distortion occurred, prominent ground displacements, fractures, and scarps were observed in other segments of the fault zone, notably in Tujunga segment, extending from the vicinity of the Foothill Nursing Home eastward into Big Tujunga Canyon, and in areas north and northwest of Upper Van Norman Lake. Surface faulting also occurred in areas away from the main segments of faulting, including an area just east of the Veterans Administration Hospital, Lopez and Kagel Canyon areas, in Kagel Mountain (just east of Pacoima Reservoir), and in areas east of Lower Van Norman Lake along the Golden State Freeway.

Severe ground fracturing and landsliding were responsible for extensive damage in areas not associated with faulting. There was severe ground cracking in the Olive View Hospital area, in the southwestern Sylmar and San Fernando areas, in the upper Granada Hills area west of Van Norman Lakes, and in many areas north and east of the Sylmar-San Fernando area. There was extensive landsliding and slumping, along with numerous fissures and sand boils, in the Van Norman Lakes area. It was reported that the appearance of the sand boils indicated liquefaction of soil in this area. The most damaging slide, called the Juvenile Hall Slide, occurred in the Upper Lake area, where practically all structures and facilities located in or crossing this slide were severely damaged—highway overpasses and bridges, railroads, pipelines and canals, Sylmar Converter Station, San Fernando Valley Juvenile Hall, Joseph Jensen Filtration Plant, and other structures and facilities. Landslides and rockfalls were widespread and very numerous (over 1,000 were mapped from an aerial reconnaissance), with high concentrations in the foothills and mountainous areas of the San Gabriel Moun-

[1]Los Angeles County Earthquake Commission, *San Fernando Earthquake, February 9, 1971*, County Board of Supervisors, Los Angeles, November 1971, 45 pp

tains. One of the largest slides occurred on the east side of Schwartz Canyon and was approximately 183 m. wide. Many roads were blocked by landslides and rockfalls in the area of severe shaking. Another type of ground rupture which displayed the violence of this earthquake was the numerous shattered ridge tops, with the soil of previously smooth surfaces upthrown, overturned, and pulverized. This type of ground disturbance was especially exemplified west of Grapevine Canyon, in the hills north of the Olive View Hospital, near Wallaby and Rajah Streets in the northeasternmost corner of Sylmar, west of Balboa Boulevard, east of Bartholomaus Canyon, and on the ridges above Oliver and Schwartz Canyons.

No foreshocks were recorded. Numerous strong aftershocks were recorded. One hundred and seventy-four aftershocks of magnitude 3.0 or greater were recorded up to 23:36:06.5 on February 9, with two of magnitude 5.8 occurring at 06:01:08.0 and 06:02:44.0. Thirty-one clear aftershocks were recorded on the Pacoima Dam strong-motion accelerograph, located about 8 km. south of the epicenter, from 06:01:08.0 to 06:05:58.0. The main shock record from the Pacoima Dam accelerograph revealed the highest accelerations ever measured, 1.25*g* horizontally and 0.72*g* vertically. A very large number of aftershocks were felt, keeping people in a state of apprehension for weeks. An observer at Burbank reported over 120 aftershocks were felt up to June 21.

INTENSITY IX–XI:

San Fernando, Sylmar, and Adjacent Areas

The one instance of intensity **XI** was assigned to Olive View Hospital in the northern Sylmar area, north of Foothill Boulevard, where collapses of newly built, reinforced concrete, earthquake-resistive buildings reduced this $23.5 million complex to a total loss. Four five-story wings pulled away from the main building, three toppled. The second story of a two-story building dropped to the ground level. All other buildings were seriously damaged. This damage was reported to have been the result of severe ground shaking, not of ground faulting. The following is from a report by the Los Angeles County Earthquake Commission.[2]

> Of particular interest is the new main Medical Center, which was dedicated just 30 days before the earthquake. Within this group are the six-story medical center building, a two-story psychiatric unit, a central heating plant, a one-story assembly building, and an ambulance shelter canopy. All of these buildings suffered major structural damage. Three lives were lost in the medical-center building—one from falling debris and two allegedly as a result of electric-power failure. The six-story building had four stair towers that were isolated structurally from the upper five stories of the building. The supporting columns of three of these towers failed, permitting the towers to collapse onto the first-floor construction. The upper stories of the main buildings, though damaged, retained their configurations. The lower two stories had column failures and some local floor areas collapsed. However, even though offset more than 2 feet, the structure as a whole remained standing, permitting the evacuation of the building through the two remaining interior stairs. Utilities in the building, including emergency facilities, were inoperative after the earthquake. The first story of the psychiatric building collapsed completely with the second floor settling down to ground level. No lives were lost in this building because no persons were present on the lower floor at the time of the earthquake. The twelve columns of the ambulance-shelter canopy all were shattered, permitting the roof to collapse on the ambulances beneath. The failure of cross-bracing members in one end wall was the main structural damage to the central heating building. Equipment within the building that was not anchored to the floor became displaced and one of the boilers shifted 52 inches relative to the building. The assembly building did not collapse, but the columns were severely distorted.

INTENSITY IX–X:

Most of the major and spectacular damage to highway structures and bridges occurred in the area along U.S. Highway 5 at the interchanges of 5/210 and 5/14, located about 1½ km. apart. At the Route 5/210 interchange (Foothill Boulevard and Golden State Freeway), three highway overpasses totally collapsed and two required rebuilding. Two men were killed at this location when one of the overpasses collapsed onto their truck. Bridge columns failed. Pavement cracked and buckled. At the Route 5/14 interchange (Golden State and Antelope Valley Freeways), two spans of a nine-span bridge

[2] See footnote 1 on p. 24

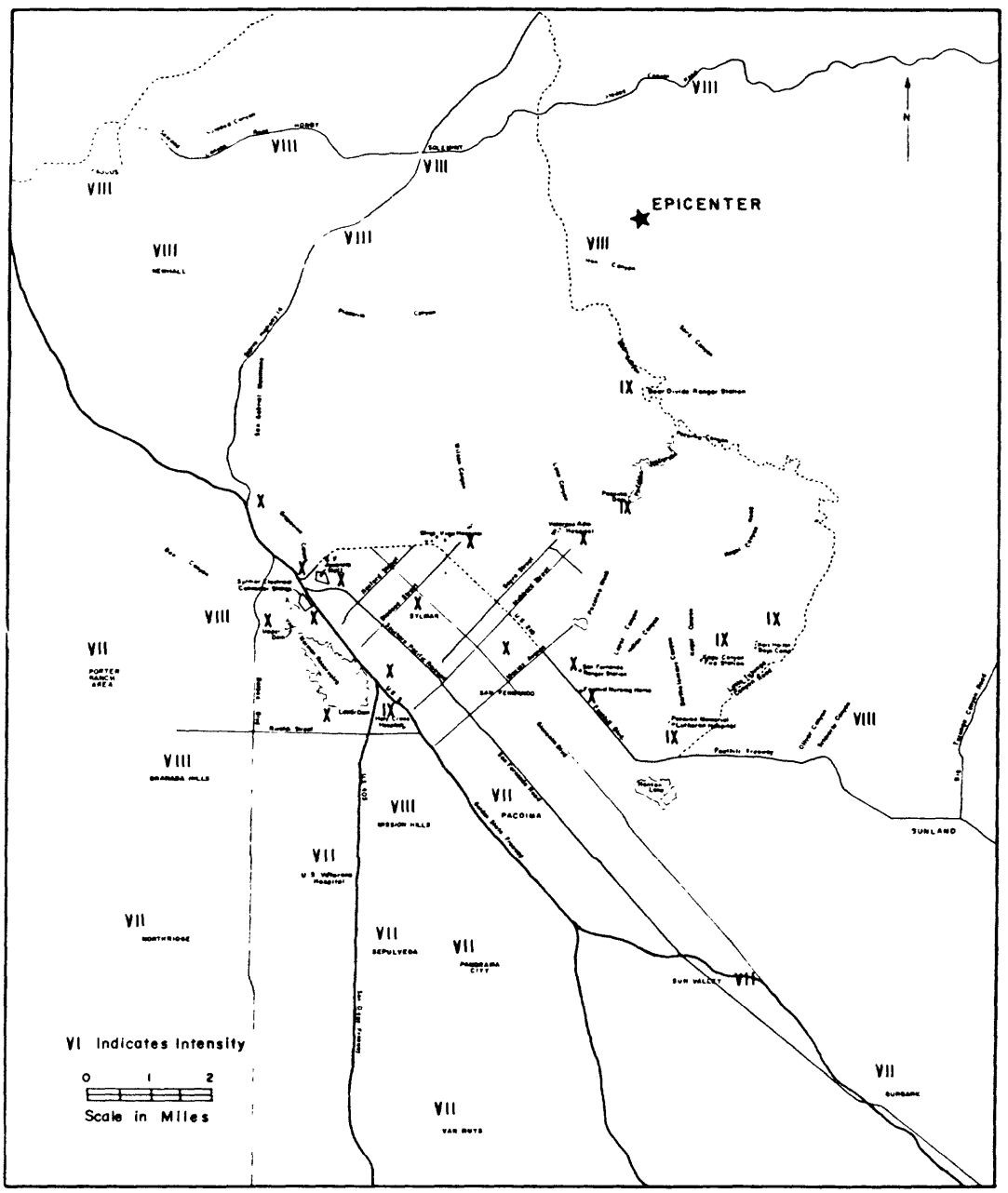

FIGURE 5.—Epicentral area of San Fernando, Calif., earthquake of February 9.

collapsed. A bridge also collapsed at the interchange between the Golden State Freeway and San Diego Freeway. It was reported that almost all remaining structures in the general vicinity of the interchanges (possibly as many as 70) were damaged to some extent, many requiring extensive repair. Numerous roads and city streets in the Sylmar-San Fernando area were made dangerous or impassable by ruptures.

Railroad traffic also was disrupted owing to displacement and distortion of rails and to a

collapsed overpass which fell onto the track. In front of the San Fernando Valley Juvenile Hall facilities, railroad tracks were twisted and broken and displaced as much as 1.2 m.

The old Upper and Lower Van Norman earthfill dams were damaged to the extent that rebuilding is required. The reservoir keeper of Lower Van Norman Dam reported: "We live on the reservoir grounds at the bottom of the dam on the west end (11729 Strandwood Ave.). No ground cracks around the house. Chimney badly damaged. One crack in foundation. Stove, refrigerator, and dresser shifted. No broken plaster; no broken windows. Damage was slight. My wife and child were up, getting ready for school. She heard the shock coming. I was asleep. I tried to get out of bed but couldn't, until the worst of it was over. I made a quick check of the family and a quick check of the house, then dressed and went to check the dam. When I got to the main road going to the top of the dam, I could see, through the dust, an irregularity of the crest of the structure below, looking to the top. I drove to the top of the dam and around the west abutment and saw the damage to the face. It was hard to believe what I saw."

Pacoima Dam, located about 2 km. northeast of the San Fernando Veterans Administration Hospital, reportedly sustained $1.5 million damage to its abutments. Massive rockslides blocked the access road to the dam, preventing immediate inspection of the accelerograph located there. Waterlines were damaged. In view of the apparent high intensity in this area, the following, as reported by the caretaker of the dam, is of interest: "Caretaker's house is a one-story wood frame building (built in 1953), situated on loose fill (fill done in 1938). It is approximately 12 by 12 m. and rests 0.6 m. off the ground on a concrete perimeter foundation with wood plate around the foundation. There was no damage to the concrete foundation and only minor damage to the wood support. The brick chimney was undamaged. There were hairline cracks in ceiling plaster and above doors; no doors were out of plumb. Doors on a 1.8-m.-high hutch opened and the first row of glasses was thrown out; then the doors closed and rest of glasses did not break. Some objects fell in the house. Huge rock rolled down and broke outside stucco but the rock did not come through into the house. An old nearby house (built in 1937) had outside brick chimney separate from frame but the chimney did not fall. At the dam, an empty tank (under construction) shifted about 15 cm. off foundation." It was reported that Lopez and Hansen Dams sustained only minor damage.

There was extensive and severe damage to underground waterlines, gaslines, sewers, tunnels, flood control facilities, and electrical facilities and structures. It was reported that it will be necessary to completely rebuild the sewer system in the area bounded by Hubbard Street, Glenoaks Boulevard, Harding Street, and Eighth Street. In the Upper Van Norman Lake area, sections of several canals were damaged badly; several flood control dikes suffered slumping.

Approximately $2.5 million damage was reported to the Los Angeles flood control facilities, and about half of this loss was caused by breakage of reinforced concrete open channel and underground box channels. In one case, breakage extended for the length of a city block. Substantial damage occurred to Wilson Canyon Channel, Mansfield Avenue Storm Drain, Pacoima Wash, Lopez Canyon Channel, and Glenoaks Boulevard Drain, all in the San Fernando-Sylmar area, Lopez Debris Basin, north of Hansen Dam, was seriously damaged. Damage was estimated at $6 million to Metropolitan Water District of Southern California facilities. At Joseph Jensen Filtration Plant (about 0.4 km. northwest of Upper Van Norman Lake), there was extensive ground cracking in the plant area with lateral movement of 0.3 m. or more, and extensive damage to above- and below-ground structures. A huge steel water storage tank buckled and anchor bolts pulled out. The Balboa Inlet Tunnel (4.3 m. in diameter) had about 90 m. of lining badly damaged at a point about 457 m. from its downstream portal. It was reported the San

Fernando Tunnel (5.4 m. in diameter and about 9 km. long), which extends from Magazine Canyon to Pacoima Wash, experienced about 1.9-m. vertical displacement between its portal and a point 7.2 km. into the tunnel. The First and Second Owens River Aqueducts were damaged. The Second Aqueduct was damaged in its Saugus pipeline portion (pipes buckled and supports moved) between Terminal Hill and Magazine Canyon. Water service to the Granada Hills, Porter Ranch, Sylmar, and other high-elevation areas in the San Fernando Valley was disrupted by the many trunkline breaks on the Susana, Granada, and Maclay trunklines. On the Granada line, most of the 10 or 12 breaks were in the Joseph Jensen Filtration Plant area.

The wood roof collapsed at the small Maclay Reservoir on the Maclay High Line, and cracking occurred at the sides and corners of the basin. Damage at the Sylmar Converter Station (Pacific Intertie), west of Upper Van Norman Lake, was estimated at approximately $22 million. It was reported the most severe damage to this plant involved electrical equipment and underground conduit. There was extensive damage to converters, transformers, and circuit breakers. Heavy outdoor electrical equipment, some weighing many tons, was overturned. Building damage included many cracks and separations of concrete walls. It was estimated that this facility would be out of operation for about a year. A power-generating plant north of the station also was damaged seriously. There was severe damage to electrical equipment at the Olive Switching Station, about 0.8 km. west of the Sylmar Converter Station, where insulator-supported equipment collapsed and several large transformers overturned. Severe damage was sustained at the Olive View Powerplant, where large boilers were shifted as much as 1.2 m. and where tanks and motors were torn loose from anchorages. Many elevated water tanks were damaged; some were shifted, overturned, and destroyed. A large steel tank just north of Olive View Hospital was ruptured. An elevated water tank east of San Fernando Ranger Station (in Lopez Canyon) was shifted from its pad and destroyed. A Fiberglas tank near the northwest shore of Lower Van Norman Lake was overturned. A large tank at Granada Hills was damaged. Many water wells were damaged. In general, all utility facilities—gas, electric, and water—in the severely damaged areas of San Fernando and Sylmar were out of service.

The water distribution system for the city of San Fernando was almost completely destroyed by ground cracking and violent shaking. All reservoirs leaked; two could not be repaired. Many underground gas and waterlines were separated, buckled, or fractured. Nearly every pipeline in the major ground rupture zone was damaged. All telephone equipment in the Sylmar Central Office of the General Telephone Company (Polk St. and Borden Ave.) was totally destroyed. Damage to the building and equipment was estimated at $4.5 million. In the Sylmar area, many pole transformers were thrown down; insulators and crossarms were broken; wires and poles were knocked down; and cable was sheared off in underground ducts. Four gas transmission lines, ranging in diameter from 30.4 to 66.0 cm., were damaged between Newhall and San Fernando, resulting in loss of gas supply to the San Fernando-Sylmar area. A main feeder gasline (40.6 cm. in diameter) broke and erupted in flames on Glenoaks Boulevard between Hubbard and Bledsoe Streets, shutting off service to 20,000 homes. Oil field facilities and related structures sustained minor damage to tanks, roads, pipelines, and a few wells in Aliso Canyon, Cascade, Castaic, Newhall, Newhall-Potrero, Oak Canyon, Placerita, and Ramona Oil Fields.

Damages to Other Structures

San Fernando Veterans Administration Hospital: Major collapses of older unreinforced masonry buildings occurred at this complex facility. Forty-nine were killed; many were injured.

San Fernando Valley Juvenile Hall Facilities: Severe and extensive damage oc-

curred to practically all buildings; one collapsed. Buildings were evacuated. Fissures about 45 to 60 cm. wide and about 1.2 to 1.5 m. deep were observed at this site.

San Fernando Industrial Tract (east of intersection of Foothill Blvd. and Arroyo St.): Most structures were posted as unsafe. Severe ground cracking, lurching, and compression-ridging occurred at this site. Sidewalks were torn up and buckled.

Sylmar Industrial Tract (east of San Fernando Road in Bledsoe and Bradley areas): Most buildings were posted as unsafe. Many roofs and walls collapsed. Considerable ground cracking and compression-ridging occurred.

Foothill Nursing Home (just east of Foothill Blvd. and about 0.5 km. south of San Fernando Ranger Station): The building, a one-story concrete block structure, was damaged severely. The curb and sidewalk in front of the building were raised about 0.9 m. by surface faulting that also passed under the building.

Holy Cross Hospital (southeast of Lower Van Norman Lake): Major structural damage occurred to this seven-story reinforced concrete building. Extensive and severe cracking was observed. Also, the nearby Indian Hills Medical Building was damaged badly.

Pacoima Memorial Lutheran Hospital (about 2.8 km. southeast of Foothill Nursing Home): Major structural damage was sustained to this four-story reinforced concrete building.

Damage to Private Dwellings

Severe and extensive residential damage occurred in the area of permanent ground displacement, beginning in the area of Glenoaks Boulevard and Hubbard Street and extending east across northern San Fernando (north of Maclay Ave.) and on into the foothills to the east. Many houses, including mobile homes, were cracked very badly and shifted from foundations. Many one- and two-story apartment buildings also were damaged extensively. Another area of severe and extensive damage to residential houses was between the Olive View Hospital and the Veterans Administration Hospital where some residences were damaged beyone repair and some were in a state of collapse; many shifted off foundations. Practically all concrete block walls and chimneys fell. Also, many dwellings in various states of construction in the area east of the Veterans Administration Hospital were damaged heavily and some collapsed.

The following is from a report by California Institute of Technology.[3]

> Most schools in the San Fernando Valley were post-1933, and these experienced little damage from shaking. Some wood frame buildings were shifted on their foundations, and some cracking was experienced. The foundations of several school buildings, such as Van Gogh School and Sylmar High School, were disrupted by permanent ground displacements, but structural damage was not such as to constitute any undue hazard to occupants. However, in some cases, light fixtures and ceilings, supposedly designed to withstand earthquake shaking, fell and these would have been hazardous. The generally good behavior of the school buildings in the San Fernando Valley is due mainly to the fact that they were well constructed one- and two-story structures, mostly wood frame and plaster, that were significantly stronger than the minimum requirements of the building code. Of the pre-1933 schools, Morningside School at Maclay Avenue and Fifth Street in San Fernando was closest to the center of the earthquake. One of the two structures at this site was a good quality, two-story brick bearing wall building (1928), which was cracked very badly by the ground shaking. Although it would not have injured occupants during the earthquake, it did appear afterwards to be in a most dangerous condition, and it has been demolished. Since the earthquake, most of the old buildings have been closed. A few were judged to be in a good condition and not unduly hazardous to the occupants, and these will be used for a limited period of time.

An observer at 13597 Simshaw Avenue (about six blocks south of the southeast boundary of Veterans Administration Hospital grounds) reported the following in a letter to

[3] California Institute of Technology, *Engineering Features of the San Fernando Earthquake, February 9, 1971, Earthquake Engineering Research Laboratory Report*, EERL 71-02, Pasadena, June 1971, 512 pp

Robert D. Nason, Earthquake Mechanism Laboratory, ERL, NOAA:

"The first shock was sudden; no warning rumble. I thought it was an explosion. We went up and down, with the noise and jolts accelerating. My husband, a large, strong man, tried to force himself up from the bed but was slapped down each time. I had trouble hanging onto the bed. The slapping motion of the earth seemed to be in an east-west direction, with the last slap ending in a hard motion to the west, toward Olive View Hospital. We were shaking between the up-and-down motions. Now we started to roll. It was when we were in the rolls, north-south direction, that I could hear everything falling and breaking. The 'slaps' felt as if one were being blown around and up in the air, then coming down hard, like being in the center of a big explosion. The concussion was unbearable. When we got to the bedroom door we found it was jammed with furniture, including the heavy dresser and the sewing machine, which was upside down. My husband had the door cleared in seconds. My four children were huddled in the hall. We were now in the aftershocks. The hall was leaning in first one way, then another. We were thrown against each side of the wall all the way to the front door. We were the first ones out on our street. I saw people who looked simply frightened 'out of their lives' and some who looked absolutely blank. At daylight, we were amazed to find the house structurally intact, as we had been thinking it would be totally ruined. Inside, however, it was a mess, taking over 3 weeks to straighten it up. We had about $181 in structural glass damage; even the shower doors were broken. Our neighbors on both sides of us were not so lucky."

At 22117 Sierra Highway (about 5 km. northwest of Sylmar) an observer reported:

"All other earthquakes that I have experienced were of a rolling motion, but this one felt as if the bottom fell out of everything. I felt a falling sensation, and jumped up to try to get out, but I was knocked down to my knees. I was sitting at the kitchen table when it struck. Everything began to fall; all dishes and glassware crashed to the floor; then in about 5 seconds the light went out. I finally got to my feet, after about 30 seconds, and yelled to my wife to hurry down so we could get outside. If we had been sitting on a big vibrator, it couldn't have shaken us any harder. There was no rolling or horizontal motion. It was a straight-up-and-down motion. A big bookcase and a large commode upstairs fell toward the east. There was no noise as in other earthquakes I have experienced. This one hit without warning. This old house was built in 1915 and is on pretty solid ground. My service station across the street from me was not damaged. About 0.8 km. south of me, near that new freeway that was being built and where so many bridges were lost, there is a mountain that is torn all to pieces—looks as if it went through a grinder. The north side of my house didn't seem to get hit as hard as the south side."

Kagel Canyon Area

12587 N. Dexter Park Road (Los Angeles Fire Station No. 74, about 5 km. southeast of Veterans Administration Hospital, in sec. 32, T. 3N., R. 14W.).—Felt by, awakened, and frightened all in community. Ground cracks; landslides; disturbed water. Chimneys, tombstones, and elevated water tanks cracked, twisted, and overturned. Gas mains broke. Power off. Furniture overturned and broke. Violent motion in all directions; also strong vertical motion. Damage great. "This building was moved off foundation approximately 0.3 m. and had to rise over sill at least 11 cm. to settle down without damage to shingles." The following is an excerpt from a report by B. J. Morrill.[4]

"Firemen were resting in the wood frame quarters building . . . . Mr. J. White, duty fireman, stated that he was tossed out of bed onto the floor, and the bed landed on top of

[4] Morrill, B J., "Evidence of Record Vertical Acceleration at Kagel Canyon During the Earthquake," *The San Fernando, California, Earthquake of Feburary 9, 1971, Geological Survey Professional Paper 733*, U S Department of the Interior and U S Department of Commerce, Washington, D C., 1971, pp 177-181.

him. Every object in the building was upset. Even the handset of a standard wall phone came off its hook. Loud cracking and thunderlike noises added to the general confusion. The building was shifted off its foundation. Outside, rocks were thrown off the ground, and large cracks appeared in both soil and rock . . . many ground cracks appeared throughout the area. The surface of a hill adjacent to the building exhibited the 'shattered earth' effect reported . . . a few miles to the west. A nearby rock roadcut appeared to have exploded, and the adjacent road was offset in many places . . . .

"A 20-ton fire truck in the garage . . . moved 6 to 8 feet fore and aft, 2 to 3 feet sideways without leaving visible skid marks on the garage floor. The truck was in gear, and the brakes were set. Damage to the truck was a bent rear step, broken windshield, shattered red light, and siren broken off. Also, a ladder and a hook were broken. Marks which appear to have been made by the right rear tire were found on the door frame . . . 3 feet above the floor, while the metal fender was not damaged. The fender extends several inches out beyond the upper portion of the tire. Four feet above the floor the hose rack was broken by the rear step of the truck. The step was bent up while the hose rack was broken downward. The rear of the garage was pushed outward 6 to 8 inches, and the final position of the truck was about 4 feet out the front of the garage, with the garage door resting on the cab."Morrill also suggests that the building accelerated upward, with respect to the ground, at a rate of at least 1*g* for about 0.1 second.

12557 Kagel Canyon Road.—Felt by, awakened, and frightened all; general panic. Ground cracks; landslides; disturbed water. Chimneys, tombstones, and elevated water tanks cracked and twisted. Masonry shattered; wood twisted. Hanging objects swung violently in all directions. Furniture overturned and broke. Plaster cracked and broke; windows cracked. Damage moderate to great. Explosivelike, loud earth noises. Many aftershocks.

11825 West Trail (southern Kagel Canyon).—Felt by, awakened, and frightened all in community. Four ground cracks around house, three about 2.5 cm. wide and one about 10 cm. wide; ground raised in several places. Ten-cm.-wide cracks in 0.3-m.-thick walls. Retaining walls fell. House full of plaster cracks. Stucco walls cracked. Foundation broke in 2 places. Hanging objects swung violently northeast-southwest and up and down. All items fell from cabinets. Most small objects fell and broke or were ruined by fluid. Furniture shifted, overturned, and broke; refrigerator on rollers moved; one old refrigerator overturned. Damage moderate. House moved northeast-southwest in bucking motion. Loud earth noises, like noise of low-flying jet. "Husband heard the shock coming. Hard rattle at first, then in 1 to 2 seconds I was thrown from chair and my husband was dumped into the tub; then back-and-forth motion. I was able to reach the hall and get the children under a doorway until things slowed down, then we went outside. Lights went out in the first movement. Water out but gas and telephone OK. Ground seemed to keep moving. We have 3 acres (San Gabriel Range, first mountain by valley) with three houses. Lower house had little damage; no landslides or broken pipes. The second house about 38 m. or so higher up, had cracked foundation; 0.3-m.-thick walls cracked 2.5 to 10 cm; four deep ground cracks, two under the house. Third house, about another 30 m. higher up than the second house, had cement floors buckled and cracked; deep ground cracks; pipes separated; new garage (side room) separated from house and slightly askew; 1.9-cm. floor crack in cement; door wedged closed; everything dumped from cabinets, and lots of stored glass windows broke. Water main in front of this third house was broken in five places."

13706 N. Kagel Canyon Road.—Felt by and awakened all. Ground cracked. Chimneys and plaster cracked. Water tank off foundation. Fifteen m. of natural stone wall, running west-east, fell. Hanging objects swung violently east-west. Small objects fell and

broke. Furniture shifted and overturned in all directions and broke. Damage moderate. "My husband was awake and was thrown from north to south. Furniture was overturned from north-south, east-west, and west-east. Refrigerator was out of position from south to north about 46 cm. Kitchen cabinets, from both north and south shelves, were almost emptied. In living room, articles on north end of room slid off tables toward north, and on south end of room all books were dumped onto the floor from west to east. Most violent action seemed to be from east to west, from final position of furniture."

The following was excerpted from a letter by Doreen Russell, Secretary, Kagel Canyon Civic Association: "Many of our homes have been totally destroyed, while others just next door had no real structural damage. For example, our home had very slight damage, but two of our immediate neighbors, one who owns a very new house and the other a much older structure lost their homes. Severe ground scarp at Glen Haven Cemetery."

Karl Holton Boys Camp (about 5.6 km. southeast of the Veterans Administration Hospital, in Little Tujunga Canyon, east of Kagel Canyon).—Extensive damage to buildings. Forty-six m. of 4.3-m.-high concrete block wall collapsed. Extensive landsliding and ground fracturing. Severe structural damage where ground cracks passed through or adjacent to the buildings. The camp was evacuated.

Little Tujunga Ranger Station (12371 N. Little Tujunga Road, about 0.8 km. south of Karl Holton Boys Camp).—(Report from Hugh E. Masterson, District Fire Control Officer). Felt by, awakened, and frightened all in community; general panic. Ground heavily fractured. Water tank twisted. Concrete cesspool, waterlines, and pavement damaged. Plaster cracked in several rooms. All crockery, china, bric-a-brac, pictures, etc., broken; everything upside down. "My station building is No. A-3, one of six buildings plus two occupied mobile homes. Very heavy damage to all the buildings at the station. Many inspectors have been at the station but no final estimate made of the damage; however, it will probably exceed $1 million." Hanging objects swung violently north-south. Loud earth noises.

Little Tujunga Road—Bear Canyon area (Bear Divide Ranger Station, NW 1/4 sec. 7, T. 3N., R.14W., about 2.7 km. north-northeast of Pacoima Dam).—Felt by and awakened all in community; frightened many. Landslides. Rockslides on road up to 382,500 cu. m. Many cracks in fill ground and in solid ground. Block wall broke. "A giant up-and-down motion, changing to north-south side motion. Mobile home dead-manned from concrete to 1.27-cm. cable to 0.96-cm. eyebolts—eyebolts straightened out." Very loud earth noises.

INTENSITY VIII.

Granada Hills.—The following report on Van Gogh Street School is from a report by Lew and others:[5]

"Constructed in 1968. The school is in an area of ground rupture directly west of the Upper Van Norman Reservoir. The construction is single-story wood frame and stucco. Although there was no collapse, there was major structural damage which consisted of buckling of slabs on grade, fracturing of concrete foundation walls, and displacement of bearing walls in the zone of cracked foundations. The lunch shelter columns were permanently bent approximately 15° at the base at the point of weakness created by openings for electrical outlet boxes. A cantilever concrete block garden wall leaned approximately 10° but remained standing. The underground utilities were severely damaged. The school has been repaired and is fully occupied." Patrick Henry Junior High School: "Constructed in 1959. The buildings are primarily one- and two-story reinforced grouted brick and concrete bearing wall structures. The major structural damage consisted of fracturing of four second-story columns of a two-story covered arcade. The concrete roof of

[5]Lew, H. S. and others, *Engineering Aspects of the 1971 San Fernando Earthquake, Building Science Series 40*, U.S. Department of Commerce, National Bureau of Standards, Washington, D. C., December 1971, 419 pp.

the arcade was shored to prevent collapse. The longitudinal concrete wall in the classroom buildings, extending the full length of the buildings, sustained some hairline diagonal cracks near both ends of the building. The cracking can be attributed to shrinkage stresses that existed prior to the earthquake. A concrete curb at the corner of the mechanical penthouse fractured under the steel column at the brace connection. Structural damage was minimal; however, a major loss of lighting fixtures constituted a real hazard. There was nominal damage to acoustical ceiling tile. Electrical conduits were damaged. The damaged arcade has been removed. The entire school is in use."

Structural damage at the Van Gogh Street School was reportedly caused by ground surface movement, and damage at the Patrick Henry Junior High School resulted from vibrational movement. There was also considerable damage to dwellings and business establishments in the Granada Hills area. An observer at 16834 Bircher Street (southwest of Lower Van Norman Reservoir) reported: "Our tract (wood floors, lath, plaster, and stucco; one- and two-story homes) suffered minimal damage. However, newer dwellings to north and northwest (slab, wallboard construction) sustained major damage, many condemned. Many commercial markets had major to minor damage; many business buildings marked 'unsafe.' Minor ground cracks north of our tract. Block fences fell. China cabinet overturned. Damage slight at my home." Other observers reported: Ground cracks; landslides; disturbed water. Chimneys, tombstones and elevated water tanks cracked, twisted, and overturned. Electricity and water off. Concrete block fences, running both north-south and east-west, fell. Plaster, windows, walls, and chimneys cracked; plaster and chimneys fell. Plumbing broke. Water splashed from swimming pools. Furniture overturned and broke; heavy furniture and other heavy items moved. Shelves and cupboards emptied. Hanging objects swung violently in various directions, principally north-south and east-west. Loud earth noises. "There was quite a lot of vertical movement during the first part of the shock. It was almost impossible to walk for the first few seconds."

Mission Hills.—Felt by and awakened all; frightened many. At Mission San Fernando Rey, about 0.8 km. south of Holy Cross Hospital, adobe walls were cracked severely. Ground cracks; landslides; disturbed water. Chimneys, tombstones, and elevated water tanks cracked and overturned. Plaster cracked, broke, and fell; windows cracked. Furniture shifted, overturned, and broke; other heavy objects were thrown and overturned. A six-year-old boy was thrown out of bed. Hanging objects swung violently in various directions. Loud earth noises. "Noticed high-frequency, low-amplitude vertical motion at beginning of shock; low-frequency, high-amplitude lateral motion at end." One observer reported damage as great.

Newhall-Valencia area.—Felt by, awakened, and frightened all in community. The National Earthquake Information Center[6] reported:

"Four old buildings in downtown Newhall were condemned by the City Engineer, who also estimated 90 percent of the fireplaces and chimneys on two-story houses were damaged in the area. One concrete wall was knocked down; most homes sustained only superficial damage."

Gasline broke on Lyons Avenue. Newhall phone plant was flooded by a broken water main. The California Institute of Technology[7] reported that a glass manufacturing company (between Newhall and Saugus) sustained $10 million damage to buildings, storage bins, and furnaces. There was damage to oil refinery storage tanks and pipelines at the Newhall refinery located about 3.2 km. southeast of Newhall. The bottom of one jet-fuel storage tank buckled, and there were scattered leaks elsewhere in the plant. The chief problem for the refinery was

[6] National Earthquake Information Center, *Earthquake Information Bulletin*, Vol 3, No 2, National Ocean Survey, National Oceanic and Atmospheric Administration, Rockville, Md., March-April, 1971, p 4

[7] See footnote 3 on p 29

lack of water. Both sides of a booster pump on the waterline leading to the refinery were ruptured. Minor damage was done to testing equipment in the laboratory *(Oil and Gas Journal,* Feb. 15, 1971). The USGS-NOAA report[8] stated that at a building in the Valencia shopping center (24200 Lyons Ave.), large sections of the suspended ceiling collapsed; almost all the glass in the front wall broke; brick walls spalled. Other observers reported: Ground cracks; landslides; disturbed water. Chimneys, tombstones, and elevated water tanks cracked, twisted, and overturned. Block fences fell. Plaster cracked and fell. Windows broke. Furniture shifted, overturned, and broke; TV overturned; piano and refrigerator moved; many items fell in homes. Hanging objects swung violently in all directions. At the Newhall Ranger Station, about 2.6 km. south of Newhall, an observer reported electricity, phone, and water services were knocked out at impact of the shock. Loud, explosivelike earth noises occurred a split second before the shock; direction of thrust seemed to be to the south. An observer at Valencia reported a sensation of violent rotary motion. About 8 km. northeast of Newhall Post Office, observers reported: Water supply cut off. Some chimneys loosened; cracks in walls, concrete slabs, etc. Many windows broke in stores. Ground cracks; disturbed water. Retaining walls tilted. Vehicles shifted. China closet overturned; large TV thrown off stand; bookshelves and books on floor; kitchen cupboards emptied of all contents. "Shock was like a dropping motion, then a shift from northeast-southwest. Had to leave premises due to my wife being disturbed." One observer reported damage as great.

Saugus, Honby, and Soledad Canyon Road areas east of Saugus.—Felt by, awakened, and frightened all in community. Postmaster at Saugus reported: Ground and trailer foundations cracked. Most light fixtures fell. Plaster cracked, broke, and fell. Furniture shifted, overturned, and broke. Windows broke. "Everyone got out of post office just in time to avoid falling light fixture." The USGS-NOAA report[8] noted the following in the Honby area (about 6 km. east by north of Saugus) at North Oaks Shopping Center (department store at 19419 Soledad Canyon Road):

"The building is one-story with brick exterior walls, glued-laminated beams, and panelized wood roof. The rear wall of the building separated from the roof by about 9 inches in one area, and the adjacent roof section collapsed. Other sections of roof along the sidewalls also collapsed, and purlins were pulled out of their supports." Building material store at 19407 Soledad Canyon Road: "The building is one story with brick exterior walls, interior columns, and wood roof construction. Brick piers spalled at connection to wood beams along front wall. Interior partitions cracked. Several main beams were pulled out from the masonry at their support along the front wall. Ledgers along masonry walls were pulled out, and parts of the roof structure collapsed. Cracks occurred in the paving of a nearby parking lot. . . ." The report also stated that at the Honby School, ground surface cracking occurred throughout the site. One crack passed through one of the school buildings. An observer reported: "I teach at the Honby School (one-story building; six classrooms). Over 2.5-cm.-wide floor crack across center of slab; section dropped about 4 cm.; some doors will not open and some will not close; new blacktop cracked and broken. Many people have asked for transfers for their children and are leaving the community." It was reported there was some bridge damage along the Soledad Canyon Road areas east of Saugus. Other observers at Honby reported: Streets cracked and curbs broken. Many buildings condemned. Chimneys cracked and twisted. Block walls fell. Tombstones and elevated water tanks cracked, twisted, and overturned. Many cracks in swimming pool. Water disturbed. Plaster cracked, broke, and fell.

[8]U. S. Geological Survey and National Oceanic and Atmospheric Administration (Publishers), *The San Fernando, California, Earthquake of February 9, 1971, Geological Survey Professional Paper 733,* U. S. Department of the Interior and U. S. Department of Commerce, Washington, D. C., 1971, 254 pp.

Fifty to 70 percent of store windows broke. Furniture shifted, overturned, and broke; 600-pound transmitter overturned to south. Locked doors swung open and closed. Electricity off instantly but came on again in about 20 minutes. Hanging objects swung violently in all directions. Loud earth noises, like multiple sonic booms. Aftershocks for first 2 days were sharp, like sonic booms; later aftershocks were quiet shakes preceded by rumble. Near Soledad (10511 Soledad Canyon Road, about 11 km. east by north of Honby), one observer reported: Ground cracks; landslides; disturbed water. Chimneys cracked, twisted, and overturned. Roof split. Water heater tore loose. Furniture shifted, overturned, and broke. Miscellaneous articles scattered and broke. Hanging objects swung violently east-west. Loud earth noises. Damage slight to house.

The USGS-NOAA report[9] noted that at Solemint (east of Honby), the Soledad Canyon School was damaged by ground surface movement. Diagonal cracking was observed throughout the school site. The press reported that southeast of Solemint, in Iron Canyon, a house and land "slipped" more than 9 m. and that Head Road in Iron Canyon "dropped" 4.5 m.

INTENSITY VII:

Alhambra.—Felt by, awakened, and frightened all in community. The following, from Steinbrugge and others,[10] does not include publicly owned structures: "55 buildings damaged; 15 posted unsafe; 5 commercial buildings demolished or to be demolished; 400 chimneys damaged; estimated total dollar loss, $2 million." Other observers reported: Chimneys overturned. Damage was light, except to old buildings in business district where some (very few) plate glass windows were broken; one old brick building lost parapet walls and front. In wood frame buildings, damage was limited to cracked plaster and windows, broken dishes and knickknacks. Store buildings suffered broken plate glass windows. Chimneys pulled away from some buildings. Several unreinforced brick parapets fell. Press reported powerlines down. Water sloshed from swimming pools. Electrical transformer explosions; power out for nearly 1 hour. Furniture shifted. Hanging objects swung violently east-west. Loud earth noises. Earthquake appeared to have a long duration, 10 to 15 minutes, because of aftershocks. Noticeable up-and-down motion.

Altadena.—Felt by and awakened all in community; frightened many. Ground cracked. Chimneys cracked, twisted, and fell. Plaster and walls cracked; plaster fell. Press reported powerlines down. Water splashed from swimming pools. Furniture overturned; piano escaped caster cups. Objects, dishes, pictures, and books fell. Hanging objects swung violently north-south and east-west. Loud earth noises. "Almost solid aftershocks for half an hour. Couldn't distinguish other noises due to general falling and crashing of objects. Power failure in a few minutes was worse than aftershocks. Everything tall fell. Left for work at 6:58 a.m. No evidence of shock as I drove south on Lake Avenue. However, in Board of Education Building (in Pasadena), library shelves had fallen west from against east wall. Books from shelves were also tossed every which way. Things in hall cupboards fell. General problem. Big window at Bullocks, Pasadena, shattered. Aftershocks came with regularity every few minutes after the initial bump which definitely preceded the sway in Altadena. I would say we had between 10 and 20 small aftershocks—sometimes no more than a queasy vertigo—after the initial shock. At least four were of fair violence."

Beverly Hills.—Felt by, awakened, and frightened all in community. The following, from Steinbrugge and others,[10] does not include publicly owned structures: "135 buildings damaged; 2 commercial buildings demolished or to be demolished; 1,000 chim-

[9] See footnote 8, p. 34.

[10] Steinbrugge, Karl V. and others, *San Fernando Earthquake, February 9, 1971*, Pacific Fire Rating Bureau, San Francisco, 1971, 93 pp.

neys damaged; estimated total dollar loss, $80,000." Observers reported: Power off. Plaster and windows cracked. Bookshelf fell; books fell from both north-south and east-west walls. Other small objects shifted, overturned, and fell; some broke. Water sloshed from many swimming pools. Trees and bushes shook; vehicles rocked. Hanging objects swung violently; at other places, moderately north-south. Loud earth noises.

Burbank.—Felt by, awakened, and frightened all in community. The following, from Steinbrugge and others,[11] does not include publicly owned structures: "445 buildings damaged; 25 posted unsafe; demolished or to be demolished—residential, 3; commercial, 3; churches and schools, 1; 500 chimneys damaged; estimated total dollar loss, $4 million." Observers reported: Chimneys cracked, twisted, and overturned. Damage great to unreinforced brick. Plaster cracked and fell. Windows broke. Garden walls cracked. Heavy furniture and other heavy objects moved; furniture overturned. Water splashed from swimming pools. Observer in southwestern Burbank (209 N. Naomi St.) reported: "Motion in this area was an increasingly rapid, complex shaking for roughly 10 to 15 seconds, after being awakened. After the motion had reached a peak, it began slowly to decrease in intensity; however, ground motion did not stop completely until after a considerable length of time; there was a short interval before the next shock. A number of people left their houses during the shock; people walked unsteadily. Two roars (very prominently heard in this neighborhood) were emitted from a power plant about 3 km. from here as the quake caused valves to close as steam shot out. Power was knocked out in this neighborhood and remained out for slightly more than 2 hours. Many plate glass windows at nearby business establishments were broken. A substantial number (about 10 percent) of chimneys in this neighborhood were cracked, several so severely that their upper portions had to be removed. A few chimneys were slightly separated from houses, and the upper portions of a few were slightly twisted. One straight crack, clearly visible from the street, extended from the base to the roof of a single-story library about 0.4 km. to the north, and several long, conspicuous cracks formed in plaster interior walls of a church about 0.8 km. north of here. Damage in other parts of Burbank: "Instances of cracked walls, badly cracked chimneys, shattered windows, and other damage were common in much of Burbank. Some old buildings had extensively damaged walls and ceilings and were considered unsafe. Some of the severe damage included the fall of portions of the exterior walls just below the roofs of a church and a rest home, both relatively old buildings near downtown Burbank; walls of both were predominantly of brick. Although the worst damage was typically to older buildings, minor damage was common in newer ones. In spite of much costly damage in places, at many other places damage was virtually nil." Motion east-west. Loud earth noises.

Canoga Park.—Felt by, awakened, and frightened all in community. Water escaped from street hydrants. Interior and exterior wall cracks. Plaster cracked. Windows broke. Extensive damage to merchandise in stores. At a building in one shopping center, ceiling tiles and complete light casings fell; on the roof, four 4-ton fans were sheared from bolts and fans shifted 5 to 23 cm.; water pipes were damaged in adjacent buildings. At another shopping center, exterior walls of a building cracked and separated about 1.9 cm. in some places; 40 percent of bottles fell from shelves, even though the shelves were wired to prevent falling. Furniture shifted in homes and many objects fell. Water splashed from swimming pools. Electricity out. Motion reported as both north-south and east-west. Hanging objects swung violently in all directions. "Our home was shaking so violently that it was difficult to walk." Loud, roaring and rumbling earth noises.

Encino.—Felt by, awakened, and frightened all in community. Waterlines

[11] See footnote 10 on p. 35

broke. Plaster cracked. Block garden walls broke. Yard swamped with water from swimming pool. Electricity out. Two palm trees knocked over. Flagstone and concrete driveway cracked; concrete and flagstone pool deck raised 1.27 cm. above pool tile; steel support column of porch shifted about 3.8 cm. out of concrete base; garage roof support timber shifted about 2.5 cm. on north end. Damage about $4,000.

Fillmore.—Felt by, awakened, and frightened all in community. Chimneys and plaster cracked. Windows cracked. "We lost one building in town—a dress shop—when the roof caved in. Two other business buildings were damaged: One furniture store lost part of the roof in the rear of the building and a hardware store lost part of the brick firewall on the north side of the building. All of the grocery and liquor stores in town suffered losses when canned and bottled goods fell off the shelves and display counters. Electrical service was out in the surrounding rural areas for a short time, about 5 to 15 minutes. "I was awakened by a terrific shaking of the bed and a terrible noise. Seemed as if the house would fall to pieces, but the only damage to the structure was to an outside brick chimney which was separated from the house by about 1.9 cm. About 1.5 city blocks away, the side of a two-story brick building fell on a one-story frame roof and demolished the smaller building. There was some damage to an orange-packing house. The lights were out for a few minutes."

Flintridge (southwest of La Canada; 34°11′ N., 118°10′ W.).—Felt by all in community; awakened all in home. Heavy chimney sheared off at roofline. Plaster cracked throughout interior. Minimum cracking of exterior stucco. Roof tiles shifted and broke. Torsion of building visually observed. Interior wood and lath and plaster failed (both horizontally and diagonally) in shear, and vertically in tension. Also some compression parallel to wave travel. Wall damage was extensive; ceiling damage was moderate. Water sloshed from swimming pool. Small objects and books fell.

Glendale.—Felt by, awakened, and frightened all in community. The following, from Steinbrugge and others,[12] does not include publicly owned structures: "31 buildings posted unsafe; buildings demolished or to be demolished—residential, 13; commercial, 23; churches and schools, 5; 3,250 chimneys damaged; estimated total dollar loss, $2 million." Press reported the Glendale Presbyterian Church (built in 1923) was severely damaged. The First Methodist Church was not damaged, but in the 54-year-old former sanctuary behind it, towers fell through the roof. A Glendale press report (dated Apr. 7, 1971) stated earthquake damage to Glendale schools reached an estimated $272,561. Repairs and damage ranged from a low of $18 at Daily High School to a high of $57,400 at Crescenta Valley High School. Damage at Clark Junior High School was set at $56,250. Students probably will not be allowed to use the Hoover High School auditorium this year as the structure apparently has to be beefed up, brick facing removed, etc. Another press report (dated Apr. 22, 1971) stated demolition occurred at 40 separate general locations and included 400 chimney projects. Major demolitions were the Glendale Presbyterian Church sanctuary at 219 E. Harvard Street ($70,283) and the First United Methodist Church at Jackson Street and Wilson Avenue ($47,317). Repair of public buildings, utilities, and related costs amounted to $342,589. The Public Service Building, costing $257,000 in restoration from quake damage, was hit the worst. Observers reported: Ground cracked. Block wall fence damage. Plaster cracked and fell. Many windows cracked. Furniture overturned and broke; heavy furniture moved. Many items fell in homes. Electricity out. Water brownish color. Water splashed from swimming pools. Some elevators out of commission due to counterbalances being knocked out of guide rails. Hanging objects swung violently north-

[12] See footnote 10 on p. 35

south and east-west. Loud earth noises.

La Canada.—Felt by, awakened, and frightened all in community. Chimneys cracked and overturned. Low, false ceiling bent and fell. Plaster, windows, and walls cracked; plaster fell. Slab in patio raised and cracked. Heavy objects moved; furniture overturned. Door slammed and hinges pulled loose. Hanging objects swung violently north-south; pictures fell east-west. Pool water sloshed violently. Press reported powerlines down. "There was a distinct feeling of significant vertical acceleration during the early moments of the shock." Loud earth noises from the north.

La Crescenta.—Felt by, awakened, and frightened all in community. Many false fronts of buildings were damaged badly. Unreinforced parapet failed. Some old stone walls cracked. Chimneys cracked and overturned. Many windows cracked in old and new buildings. Water and furnace pipes broke. Concrete pool deck cracked and concrete and stone supporting wall dislocated. One observer estimated damage to house and contents at $3,000. Much merchandise loss in stores. Furniture shifted and many objects fell in homes. Water splashed from swimming pools. Violent up-and-down motion, also north-south and east-west. Hanging objects swung violently in all directions. Loud earth noises.

Los Angeles.—Moderate damage occurred in downtown Los Angeles, especially to older-type buildings with brick and masonry facings. Portions of an old building, the Mission Inn, collapsed, killing one person. Extensive damage occurred to some of the old historic buildings on Olvera Street. Press reported "unsafe" and "potentially unsafe" signs were posted at some buildings in "Little Tokyo" and along Main and Los Angeles Streets. Considerable nonstructural damage occurred to some of the larger buildings and to some high-rise buildings—plaster partitions cracked; fall of plaster and tile; broken windows. Many elevators were knocked out of service. Press reported the City Hall (27 stories; built in 1927) was a shambles from fallen plaster and cracked walls from the 15th floor up; extensive damage was reported in the Hall of Justice (15 stories; built in 1925) where windows were broken and plaster and tile fell to the floor; an 8-cm. crack was reported in the jail section. At the Hall of Administration (eight stories), the roof cracked and seismic joints cracked throughout. At the Occidental Tower (built in 1965), ceiling tile fell and there were a number of broken windows. There was some damage, largely cracked plaster, at the 42-story Union Bank Square Building where elevators were knocked out of commission. At the Roosevelt Building, marble was shaken loose in the lobbies and walls cracked. It was reported that the 32-story Bunker Hill Tower, with its two 19-story buildings, sustained only minor damage to ceilings and walls. The old Los Angeles High School (a four-story, 92-classroom building built in 1917 and rebuilt after the 1933 earthquake) was ordered razed because of damage. The May Company store was closed to customers because of extensive interior damage. Stairwells, escalators, and elevator wells were damaged. Plaster cracked and fell. Over 60 percent of the plate glass windows broke. Slight damage occurred to cornices and ornamental trim (from *Headlines,* a May Company publication, undated).

The California Institute of Technology[13] reported ruptured gaslines in Highland Park, and it was reported that a ruptured gasline blew a crater in a freeway overpass bridge in Eagle Rock. Chimneys fell, plaster cracked and fell, and windows broke in many other areas of Los Angeles city. The following reports were received from private observers: Olympic and Alameda (about 3 km. south by east of the Civic Center): "The building in which I work (Olympic and Alameda) sustained about 400 broken windowpanes, about 35 by 51 cm. (14 by 20 in.), all steel sash. Almost 100 percent of these were on the north and south sides of the building. One or two freight-type elevators were inoperative

[13] See footnote 3 on p. 29.

owing to guide tracks warping and permitting counterbalance weights to swing free."

127 S. Serrano Avenue (in area about 2 km. southwest of Los Angeles City College): Almost all nearby chimneys fractured. Many new plaster cracks appeared in all eight rooms. Bookcase fell; dresser moved. Small objects shifted, overturned, and fell; dishes and glasses broke. Pool water splashed about 6 m. horizontally. Damage slight to observer's residence.

3812 Terry Street (in area about 1.2 km. northwest of Silver Lake): Plaster cracked, broke, and fell; ceramic tile fell. Furniture shifted; heavy chest moved about 30 to 38 cm. away from wall. Hanging objects swung violently north-south. Small objects overturned, fell, and flew through the air. "Everything in front apartment that was movable shifted. I attempted to walk across the room but was unable to do so. Damage moderate."

932 Maltman Avenue (Silver Lake area, about 0.8 km. from southwest shore): Chimneys cracked and overturned. Some plaster cracked, broke, and fell; one window cracked. Water splashed from swimming pools in the area. Small objects shifted. Damage slight to observer's residence.

4411 Los Feliz Boulevard (south of Griffith Park): Chimneys cracked, twisted, and overturned. "Older masonry buildings generally damaged." Plaster cracked. Small objects and furniture shifted. Hanging objects swung violently east-west. Damage moderate.

2835 Sunset Place (about 4 km. west by north of Civic Center, near Lafayette Park): "Chimneys in our block fell; some cracked and will be removed. There were reports of broken dishes in this area. We had nothing broken; one small mirror fell. Powerlines in rear of building flashed."

5238 College View Avenue (south of Ventura Freeway and just southeast of southeast corner of Glendale city limits): Observer reported there was no damage to his home, but that most neighbors' chimneys were cracked, twisted, and overturned. Small objects shifted, overturned, and fell. Furniture shifted slightly. Trees and bushes shook; vehicles rocked.

5415 Wameda Avenue (Eagle Rock area): Plaster cracked and fell; window broke. Books and pictures fell; everything askew. Dishes fell out of cupboards and shattered. Furniture moved. Whole house shook violently—had to "hold on." Air raid siren short-circuited. Car fell off jack stands in garage.

5151 State College Drive (California State College), just northeast of Monterey Park city limits: "On the California State College Campus the new eight-story Administration Building is built on about seven pairs of reinforced concrete columns (no first floor). Column pairs 1 and 7 exhibit tension cracks. No other columns show any damage. Plaster cracks, 45° diagonal, only in east-west walls. Corners of rooms and steel door frames show separation cracks. Bookcases fell if facing east-west; generally did not fall if facing north-south."

3566 Lowry Road (in area about 0.8 km. southeast of Griffith Park, west of Golden State Freeway): Chimneys cracked, twisted, and overturned on older homes. Considerable ceiling and glass damage in vicinity. "Many pre-1933 masonry buildings severely damaged, some beyond repair, within about a 3-km. radius of my house." Small objects shifted, overturned, and fell.

Hollywood area: Sidewalks buckled. Windows broke. Chimneys cracked and fell. Buildings were damaged, especially brick buildings. "After the earthquake, people were outside on sidewalks and would not go back inside because of the aftershocks. I thought the building would disintegrate. Part of a brick wall on roof fell. Arch over building entrance cracked, creating danger. Brick buildings seemed to be more damaged than single-structure cement buildings. Lights out almost immediately and things overturned. Saw flashes of light from shorted telephone pole transformers—thought the whole city was ablaze. Got dressed and went outside; sat in car, as I thought there would be aftershocks, and there were. Noted some traffic lights were inoperative. People went outside

after the shock, then attempted to go back inside, but aftershocks kept them outside for about 25 minutes." Observer at 1627 N. Normandie Avenue reported: "Older brick buildings received the most damage. Chimneys cracked. Heavy objects moved. Water sloshed from toilet bowls. This area where I live was apparently jolted heavier than other sections of Hollywood. Perhaps adobe soil is responsible. Chimneys fell at Hollywood-Wilshire area."

Montrose.—Felt by, awakened, and frightened many in community. Chimneys and water tanks cracked, twisted, and overturned. Plaster cracked and broke. Windows cracked. Damage moderate. Ground cracked. Water disturbed. Furniture shifted, overturned, and fell. Twisting motion of building. Moderate earth noises. Press reported powerlines down.

North Hollywood.—Felt by, awakened, and frightened all in community. Water mains broke. Outdoor block walls cracked and dislocated. Chimneys fell and others separated from houses. Exterior bricks cracked. Large plate glass windows broke. Plaster cracked, broke, and fell. Heavy furniture and other heavy objects moved; some furniture overturned and broke; file cabinet and bookcase overturned; bookshelves collapsed. Numerous reports of small objects falling; extensive damage to dishes and glassware in some homes. Much water sloshed from swimming pools. One observer reported water from swimming pools was in the streets. Elliptical holes in ground around pipe risers for lawn sprinklers. Hanging objects swung violently in all directions, some reported north-south, east-west, and northeast-southwest. One observer reported strong vertical motion was felt. Loud earth noises. Observer at 7262 Farmdale Avenue (about five blocks northwest of Burbank Airport) reported: "I was awakened at 6:00 a.m. The house shook and rolled, and there were rumbling noises but not extremely loud. Oven and refrigerator displaced about 10 cm. General disruption in all rooms. Immediately after the shock subsided (lasted about 20 to 30 seconds), I checked lights and phone—they still worked. Water OK. I felt five or six aftershocks between about 6:09 and 6:19 a.m.; then I sat down to record more aftershocks." This observer reported he felt 34 shocks to 1:30 p.m., with the strongest at 6:35, 6:44, 8:00, 8:30, 10:57 and 10:59 a.m., and at 12:57 p.m. Stopped keeping record after 1:45 p.m.

Northridge and Porter Ranch District.—Felt by, awakened, and frightened all in community. Lew and others[14] reported the following at Northridge Hospital (Roscoe Blvd. near Reseda Blvd.):

"Five-story steel frame structure with reinforced brick masonry shear walls. The exterior cladding was of brick veneer. Damage to the veneer was extensive on the east and west elevations. The shear walls in the first story were badly cracked at many places. All mechanical and electrical equipment was functioning after the earthquake, including the elevators." San Fernando Valley State College (1811 Nordhoff St.): It was reported that $245,000 in damage was caused principally by collapsing bookshelves, toppling furniture, and falling glass from broken light fixtures and windows. A California Institute of Technology report[15] noted that only very minor cracking of structural members was found in the various buildings on this campus, which included an eight-story dormitory and an eight-story office tower. Other observers reported: Walls cracked. Chimneys cracked, twisted, and overturned. Plaster cracked, broke, and fell. An observer at 9723 Rathburn Avenue reported: "The severe shaking seemed to last for 2 to 3 minutes. Multistory wood frame stucco buildings in neighborhood suffered extreme damage in shear walls but little damage in horizontal elements such as floors and ceilings. Modern reinforced masonry buildings all seem damaged around corners at roof level." Block garden walls, running in both north-south and east-west directions, fell. Patio cement cracked; driveway cracked and old cracks enlarged. Water was disturbed

[14] See footnote 5 on p. 32
[15] See footnote 3 on p. 29

and dirty. Electricity and power out. Street lights swayed. Much water sloshed from swimming pools. Heavy furniture shifted, including piano, refrigerator, bed, and file cabinet. Furniture overturned and broke. Other objects fell and broke in numerous houses; cabinets emptied; many dishes broke. Water sloshed from toilet bowls. Movement of people was difficult. Loud earth noises preceded earthquake. Numerous aftershocks were felt. "Aftershocks have caused cracks in plaster, and small partial roof and garage roof to sag. For the first several hours we felt seasick."

Pacoima (excluding the more strongly shaken areas of northern Pacoima) and Arleta District south of Pacoima.—Felt by, awakened, and frightened all in community. Postmaster at Pacoima reported: Ground cracked. Gaslines broke. Chimneys overturned. Outside block walls were knocked down. Crack in floor the length of the building (post office). Furniture overturned. Small objects and dishes fell. Hanging objects swung violently. Building shook rapidly back and forth for 1 minute. In the Arleta District, plaster, windows, outside walls, and block fences cracked. Water disturbed; swimming pool overflowed. Furniture shifted, overturned, and broke; heavy furniture shifted. Water sloshed from toilets. Hanging objects swung violently east-west. "Our next door neighbor's cupboards face the same direction as ours but she lost only one bottle of catsup. Our kitchen had to be cleaned out with a shovel. Most of the furniture in the family room moved at least 15 to 20 cm. from walls, including a large player piano. We couldn't tell in which direction it was shaking—seemed to be both bouncing and swaying. We tried to walk through the house to get the children and had to hold on to the walls to keep from falling. Our block fences are all cracked but still standing. We have many cracks outside, but few cracks inside." Damage slight. Loud, roaring earth noises.

Panorama City.—Lew and others[16] reported the following at the Kaiser Foundation Hospital (13652 Cantara St.):

"Ten-story reinforced lightweight concrete shear wall structure. There was severe cracking of the shear walls in the first, second, and third stories. The doors to the interior stairwell on the second and third floors were rendered inoperative due to the crushing of the spandrel beam in the shear wall. The fourth-floor slab, which is the transfer slab between the circular tower shear walls and the walls below, cracked and displaced vertically. There was no apparent sign of structural damage above the fourth-floor level. About 50 glass panels fell from the building. All the elevators were out of service after the earthquake. The entire hospital remained in operation."

The building at 14545 Lanark Street was reportedly damaged very badly; also damaged was a structure at 8155 Van Nuys Avenue (letter from Superintendent of Buildings, Department of County Engineer, Los Angeles). Other observers reported: Electricity off over entire area. Plaster and stucco cracked. Waterline broke between meter and house. Furniture shifted; small objects fell; lamp and books fell to south. Hanging objects swung violently east-west. Loud earth noise.

Pasadena.—Felt by, awakened, and frightened all in community. The following from Steinbrugge and others[17] does not include publicly owned structures: "10 buildings damaged; posted unsafe, 4; demolished or to be demolished—churches and schools, 1; 2000 chimneys damaged; estimated total dollar loss $2½ million." A press report of February 19, 1971, stated Pasadena city officials roughly estimated damage at $200,000 to public property, with the majority of the loss attributed to road damage. The largest single item occurred on Park View Avenue, which runs parallel and east of Linda Vista Avenue. There, approximately 246 m. of retaining wall standing 3½ m. high was affected, with approximately 92 m. of the wall reduced to rubble. Estimates

[16] See footnote 5 on p. 32

[17] See footnote 10 on p. 35

for repair of the wall make up the major portion of the $200,000 figure. Jet Propulsion Laboratory (4800 N. Oakgrove Ave.): One engineer at the laboratory estimated minor damage to the laboratory at about $200,000. Another engineer reported: "I arrived at work about 7:50 a.m., and made numerous surveys of buildings on the laboratory grounds to assess structural damage. Structural damage was superficial. Some spalling of concrete columns and concrete block walls. Some cracking of concrete walls. Considerable damage to architectural finishes (plaster, suspended ceilings, lighting fixtures). Expansion joints and seismic joints had worked and caused buckling of threshold strips and buckling and displacement of metal water stops at joints. Some waterlines broke." The California Institute of Technology[18] reported the following damage at Millikan Library (1201 E. California Blvd.):

"Nine-story reinforced concrete building. Many bookshelves collapsed on the upper floors and books fell to the floor. With the exception of hairline cracking in the plaster around some window panels, no damage to the building itself was observed." Other observers reported: Ground cracked (northeast area of Pasadena). Chimneys cracked, twisted, and overturned. Walls cracked; plaster cracked, broke, and fell. Windows cracked; many windows broke in business district. Furniture shifted, overturned, and broke. Small objects shifted, overturned, and fell; many items fell in homes; dishes broke. Hanging objects swung violently north-south and east-west. Heavy sloshing of water from swimming pools; water out of one pool indicated east-west direction of motion. Loud earth noises, some about 5 seconds before shock.

Reseda.—Felt by, awakened, and frightened all in community. Some roofs buckled. Plaster cracked and fell. Block garden walls fell. Asphalt driveways and some new sidewalk around power poles cracked. Waterline in air-conditioning system broke. Water sloshed from swimming pools. Heavy furniture and other objects shifted and overturned. Small objects shifted, overturned, fell, and broke. Doors flew open on cupboards and furniture facing north or south; on shelves running north-south nothing fell. Hanging objects swung violently north-south and east-west. Loud, rumbling earth noises. Stucco cracks were widened by aftershocks.

Sepulveda.—Felt by, awakened, and frightened all in community. The California Institute of Technology[18] reported the following at Holiday Inn (corner of Roscoe Blvd. and Orion St.):

"Seven-story reinforced concrete building. Extensive damage to interior plasterwalls, to the plumbing fixtures, etc., on the second, third, and fourth floors. The upper three floors were not damaged severely. The nonstructural damage has been estimated at approximately $250,000." Lew and others[19] reported the following at the Veterans Administration Hospital (about 4 km. south of the Lower Van Norman Reservoir):

"Buildings range from one to six stories and are designed to resist earthquake forces. Overall, there was only minimal structural damage to the hospital. The operation of the hospital was not interrupted. However, extensive elevator and plaster repairs were required and a number of seismic joints required replacement."

Other observers reported: Water and gas service disrupted; lights out. Ground cracks; landslides. Block garden walls cracked and fell. Chimneys cracked. Many windows cracked. Plaster and stucco cracked; plaster fell. Cement floors cracked. Telephone pole tilted east-west; small chicken shed tilted south. Heavy sloshing of water from swimming pools; slight spalling of sidewalk at pool joints. Heavy articles of furniture and other objects shifted considerably; some overturned. Hot water tank connections loosened; water leaked. Objects fell from both north-south and east-west walls; dishes and lamps broke. Hanging objects swung violently in all direc-

[18]See footnote 3 on p. 29

[19]See footnote 5 on p. 32.

tions. Very loud, rumbling earth noises. One observer reported that since the aftershocks, many very thin exterior cracks were found on garage and house and that cement porches shifted about 2 cm. from the house.

Sherman Oaks.—Felt by, awakened, and frightened all in community. The USGS-NOAA[20] reported the following at Union Bank building (northeast corner of Sepulveda and Ventura Blvds.):

"The structure is 13 stories high over a two-level subterranean garage. Structural damage was limited principally to the four corner columns."

Nonstructural damage was reported as:

"Elevators out of commission; doors in the second, third, fourth, and fifth floors were slightly jammed, indicating some partition movement; considerable areas of ceiling tile over the second floor fell; one dry-wall partition at the east of the building buckled and showed horizontal movement; some steel stairlandings pulled away from their supports but were still functional; five large panes of glass in the first floor cracked or broke; marble veneer in the first-floor lobby cracked and fell away from the walls and had to be replaced. The upper floors showed the least damage, and the penthouse showed no damage. The mechanical equipment in the penthouse was intact and securely mounted." According to Lew and others,[19] the Bank of California Building (across the street from the Union Bank Square), a 12-story reinforced concrete building, sustained cracks in the building frame over most of its height. These were especially pronounced in the connection of the lightweight concrete beams to the normal weight concrete columns. This damage was being repaired with epoxy. Other observers reported: Power out; telephones out; water unfit for drinking. Ground cracked slightly. Unreinforced chimneys cracked, twisted, and overturned. Sidewalk slab cracked. Plaster cracked (both north-south and east-west walls) broke, and fell. Water pressure regulator broke; heater gas valve cracked. Small objects shifted and overturned. TV set fell off shelf. Hanging objects swung violently north-south and east-west; house jerked violently north-south. Water sloshed from swimming pools. All observers reported damage as slight to none. "Major ground motion appeared to be east-west; lasted about 1 minute. Very little damage to houses (hillside houses on rock) in general vicinity (3817 Cody Rd.). Houses at lower elevations on softer substrata appeared to sustain larger accelerations and damage."

"All remarked that vertical motion definitely occurred as well as horizontal motion like a boat on the waves." Duration was also very long and constant, about 30 seconds. Loud, roaring, thunderlike earth noises.

South Pasadena.—Felt by, awakened, and frightened all in community. The following, from Steinbrugge and others,[21] does not include publicly owned structures: "Buildings damaged, 20; posted unsafe, 1; 300 chimneys damaged; estimated total dollar loss, $275,000." Other observers reported: Ground crack on Monterey Road. Plaster cracked and fell. Large plate glass windows cracked in several stores. Community water tank leaked. In old section of town many unreinforced brick chimneys cracked or fell. Some old brick parapets fell in commercial area. One or two buildings of unreinforced masonry construction showed severe cracking. Heavy sloshing of water from swimming pools. Heavy articles of furniture shifted, some overturned; refrigerator shifted 0.3 m. in northwest direction. Small objects shifted, overturned, fell, and broke; dishes broke. Hanging objects swung violently north-south and east-west. Loud earth noises.

Sunland.—Felt by, awakened, and frightened all in community. Ground cracked. Block walls fell. Rocks in garden rolled. Chimneys cracked. Plaster cracked, broke, and fell. Windows broke. Furniture shifted, overturned, and broke. Built-in oven sprung from cabinet. Small objects fell; pictures and

[20]See footnote 8 on p 34

[21]See footnote 10 on p 35

mirror fell. "Damage to furniture and dishes was in excess of $900." Hanging objects swung north-south and east-west. "Shock was violent enough to knock one off his feet if not holding on to something solid." Loud earth noises.

Sun Valley.—Felt by, awakened, and frightened all in community. Chimneys cracked, twisted, and overturned. Plaster cracked. Water disturbed. Heavy sloshing of water from swimming pools. Furniture shifted and overturned. Piano, refrigerator, etc., moved east-west. "Chinaware fell from every china closet in neighborhood." Hanging objects swung violently northwest-southeast; dining room fixture (1.2-m. chain) swung to the ceiling. Outdoor reinforced concrete block wall cracked. Damage reported as moderate and slight. Direction of motion north-south and east-west. Loud, rumbling and explosivelike earth noises. Many aftershocks felt.

Tarzana.—Felt by, awakened, and frightened all in community.Cracks widened in pavement and asphalt driveways. House foundations cracked. Plaster and windows cracked; plaster fell. Slight damage to brick. Water pipe broke. Toilet and bathtub line damaged. Water disturbed. Pool water sloshed. Furniture shifted; bed moved up and down and across the floor. Small objects shifted, overturned, and fell. Damage reported as moderate and slight. Hanging objects swung violently north-south. Vibration quite violent in north-south direction. Loud earth noises.

"The initial shock was like a sledgehammer blow; then a creaking, chattering, shaking and rocking motion lasting about 20 to 30 seconds. Aftershocks were also hammerlike blows, with shaking. There are still (Mar. 9) numerous strong aftershocks."

Tujunga.—Felt by, awakened, and frightened all in community. Ground cracked. Minor cracking of pavement. Chimneys cracked, twisted, and overturned. Plaster and windows cracked. Electrical wires down. Water pipe broke. Fixture fell. Furniture shifted. Small objects shifted, overturned, and fell. Building bounced up and down at least 15 cm. Hanging objects swung violently. "Most of the dwellings in the area suffered only minor damage. Some older dwellings suffered moderate-to-major damage, but these were very few. Many commercial buildings had broken plate glass. Few commercial buildings suffered moderate damage. From February 9 through February 13 we experienced an average of 12 aftershocks; on February 14, four; February 15, three. Some came with no warning and just caused a rolling sensation; others would give a warning that sounded like a freight train in the distance, becoming slightly louder, then the jolt. Some jolts shook the house back and forth; others hit with one explosivelike sound and shaking like a sonic boom.

Van Nuys.—Felt by, awakened, and frightened all in community. Ground cracked. Water was disturbed and muddy. Electricity off. Chimneys cracked, twisted, and overturned. Block garden walls cracked; portions fell. Plaster cracked; exterior stucco cracked; windows broke. Slab floor cracked. Heavy sloshing of water from swimming pools. Cars rolled out of driveways and garages. Furniture shifted, overturned, and broke. Water heaters moved, some off their stands. Pipes were torn from water heater in basement. Small objects shifted, overturned, and fell; many items broke. People were thrown from their beds; walking was difficult. Hanging objects swung in various directions, violently east-west. Heavy shaking for about 1 minute. Loud rumbling and roaring earth noises.

Verdugo City (just west of La Crescenta and Montrose).—Felt by, awakened, and frightened all in community. "Major damage to buildings in area. Many windows and dishes broke. Without lights until 10:20 and limited telephone service for most of the day." Plaster cracked. Small objects fell. Furniture shifted. Water sloshed from toilet.

Vernon.—Felt by all; frightened many. The following, from Steinbrugge and others,[22] does not include publicly owned structures: "Buildings damaged, 30; posted unsafe, 5;

[22]See footnote 10 on p. 35

estimated total dollar loss, $100,000." At the post office, floor had rolling motion; light fixtures swung violently; cases shifted.

Woodland Hills.—Felt by, awakened, and frightened all in community; general panic. Electricity off. Cement work, especially pool decking, severely cracked. Plaster and wallboard cracked; interior and exterior floors cracked. Tree leaned; few branches broke off. Cement blocks in fence loosened. Heavy sloshing of water from swimming pools. Heavy furniture shifted; furniture overturned. Small objects shifted, overturned, and fell; dishes broke. Hanging objects swung in various directions, violently east-west. Damage reported as moderate and slight. Loud earth noises. "Ground motion appeared to be fairly uniform in the shaking for about 1 minute. My house seemed to move most in an east-west direction. The frequency of vibration of my house was somewhere between 1/5 and 1/10 second. The aftershocks were very short in length and appeared of small magnitude." "No electricity for 1 hour and 15 minutes. Electric power went out within seconds after start of shock. Gas and water supply remained OK. No telephone communication for 7 hours. Aftershocks seemed to be, in general, a rolling, wavy motion, causing a good shake. However, about one of four aftershocks seemed like a roll at first, then a big thud and dropping sensation."

INTENSITY VI:

Agoura.—Felt by, awakened, and frightened all in community. Plaster cracked. Damage slight. Small objects shifted, overturned, and fell.

Agua Dulce (about 22 km. northeast of Saugus).—Felt by and awakened all; frightened many or all. Ground cracked. Some jacks under trailer fell over and skirting buckled. Small objects overturned and fell. Furniture shifted; some overturned. Hanging objects swung violently. Damage slight to moderate. USGS-NOAA[23] reported that at the Agua Dulce Elementary School, several plastic light diffusers fell from fluorescent light tube fixtures and there was some light "cosmetic" damage.

Anaheim.—Felt by, awakened, and frightened all in community. Cement and wall cracked; plaster cracked. Leak in hot water tank inlet. Damage slight. Water disturbed. Small objects shifted, overturned, and fell. Hanging objects swung violently north-south.

Arcadia.—Felt by, awakened, and frightened all in community. Chimneys cracked. Plaster cracked; acoustic plaster fell; minor exterior plaster cracking. Powerlines down. Damage reported as slight by all observers. Furniture shifted and overturned. Small objects shifted, overturned, and fell. Trees and bushes shook; vehicles rocked. Hanging objects swung violently both east-west and north-south. Water splashed out of swimming pools. Lights flashed outside; lights went out. "Held on to door frame to stand up."

Baldwin Park.—Felt by all and frightened many in community; awakened all in home. Plaster cracked. Small cracks in patio. Swimming pool water sloshed over. Trees and bushes shook; vehicles rocked. Hanging objects swung violently north-south. Small objects shifted and overturned. "Earthquake seemed to build up in intensity—from violent up-and-down motion to heavy roll. Felt strong aftershock at 8:00 a.m. on 9th while at work in City Of Industry. All felt it. Have felt several aftershocks with rolling motion."

Camarillo.—Felt by, awakened, and frightened all. "St. Mary Magdalene Church suffered structural damage." Powerlines arced, causing blue flashes. Water disturbed. Hanging lamps swung about 0.9 m. northeast-southwest. Small objects shifted and fell. Pendulum fell off clock.

Carson.—Felt by all in community; awakened and frightened all in home. "One chimney dislocated. Slight separation between exposed beam and plaster." Swimming pool lost about 15 cm. of water. Hanging objects swung violently east-west. Small objects fell.

Castaic and vicinity.—Felt by and

[23]See footnote 8 on p. 34

awakened all in community; frightened many. Waterline broke. Plaster cracked. Minor cement cracks in stairs. All observers reported damage as slight. Small objects fell; furniture shifted. Trees and bushes shook; vehicles rocked. Horse panicked and jumped fence. Field investigator from Seismological Field Survey reported observed damage at Castaic Junction (about 6 km. south of Castaic) was slight—plate glass window broke; some objects fell from shelves.

Cerritos.—Felt by, awakened, and frightened all in home. "Other wood frame, one-story houses in community sustained some plaster and stucco cracking. There were also incidents of objects falling off shelves, etc."

Chatsworth.—Felt by, awakened, and frightened all in community. Plaster cracked. Block wall, 0.9 m. high, overturned. Damage slight. Swimming pool lost about 8 cm. of water. Trees and bushes shook. Small objects shifted, overturned, and fell. Hanging objects swung violently—seemed east-west.

Compton.—Felt by and awakened all in community; frightened many. Plaster cracked, broke, and fell. One window cracked. Powerline down. Steinbrugge and others[24] estimated total dollar loss at Compton, excluding publicly owned structures, at $10,000. Hanging objects swung violently north-south.

Costa Mesa.—Felt by most in community; awakened and frightened many. Plaster fell and some old plasterboard cracks reopened. Water sloshed from swimming pools. Hanging objects swung violently east-west. Vault door closed. Heavy shaking. "Aftershocks were not strong enough to slosh water from pool, but hanging objects swayed."

Covina.—Felt by and frightened all in community; awakened many. Plaster cracked and old cracks widened. Hanging objects swung violently east-west and northwest-southeast. Small objects shifted, overturned, and fell. Trees and bushes shook; vehicles rocked. Cupboard doors popped open. "Appeared to be high-frequency vibration—not the slow rolling motion as felt with previous earthquakes in this area. The aftershocks have been more frightening than the initial shock. Several times we have felt dizzy. On the evening of February 20 at about 10:00 and 11:00 there were two shocks that caused lamps to swing and windows to rattle."

Crestline.—Felt by and awakened all in community; frightened many. Chimney cracked. Masonry cracked; some broke loose. Damage slight. "To date (Feb. 23), one delayed earthquake effect (happened on Feb. 16), first time fireplace was used after earthquake occurred: Due to cracked flue liner a residence was damaged to the extent of $8,000 by fire in brick fireplace." Small objects shifted, overturned, and fell; bottles, etc., broke.

Cucamonga.—Felt by, awakened, and frightened many in community. Some plaster cracking in community. Hanging objects swung moderately to violently north-south.

Culver City.—Felt by and awakened all in community; frightened many. Plaster and windows cracked. Damage slight. Ground cracked (one report). Water disturbed. Small objects fell; furniture shifted. Hanging objects swung violently in all directions. Basketball pole swayed. Trees and bushes shook; vehicles rocked. Lights flashed. Phone out of order.

Downey.—Felt by, awakened, and frightened all in community. Plaster cracked, broke, and fell. Slight cracks in chimney. Driveway crack widened. Damage slight. About 0.3 m. of water sloshed from swimming pool. Small objects shifted, overturned, and fell; furniture shifted; Hanging objects swung violently northeast-southwest. Street lights went off and on. Telephone pole crooked. Trees and bushes shook; vehicles rocked.

Elizabeth Lake area (about 5 km. southeast of Lake Hughes; about 0.4 km. north of east shore).—Felt by all in home and community. Plaster cracked. Lamps fell and broke. Small objects shifted southwest. Trees shook. Hanging objects swung violently northeast-southwest. Chickens were knocked from

[24]See footnote 10 on p. 35

roosts. "Twelve heavy aftershocks felt within the next 2 hours."

El Monte.—Felt by all in home; awakened all and frightened many. Power failure—broken wires. Small objects shifted, overturned, and fell; slight breakage of dishes. Furniture shifted some. "Continued tremors on successive days."

Fairmont Reservoir (about 3.2 km. north by east of Lake Hughes).—Felt by and frightened all in community. Hanging objects swung violently in every direction. Small objects fell. Furniture shifted. "Our power went off at the first shock but came on again in about 10 minutes. Telephone communications were knocked out; restored 5 days later. Aftershocks were felt during the following 24 hours but they were very moderate."

Florence.—Felt by all in community; awakened and frightened many. Plaster cracked; few windows cracked. Damage slight. Trees and bushes shook; vehicles rocked. Hanging objects swung violently. Small objects overturned; furniture shifted.

Fullerton.—Felt by and awakened all in community; frightened many. Acoustical tile fell in bank building. Plaster cracked. New cracks in patio. Damage slight. Water sloshed from swimming pools. Small objects shifted, overturned, and fell. Hanging objects swung violently north-south. Trees and bushes shook; vehicles rocked.

Gardena.—Felt by all in community; awakened and frightened many. Plaster cracked. Swimming pool water splashed "like ocean waves." Trees shook; vehicles rocked. Hanging objects swung violently east-west. Small objects shifted. "Initial strong jolt; then gentle rolling motion for about 1 minute."

Glendora.—Felt by and awakened all in community; frightened many. Plaster cracked. Some small cracks enlarged (very few). Damage slight. Water sloshed from swimming pools. Small objects shifted and overturned. Hanging objects swung violently. Cabinet doors opened. Many aftershocks.

Hacienda Heights.—Felt by all in community; awakened and frightened many. Plaster cracked. Damage slight. Flashes from shorted powerlines. Water sloshed from swimming pool. Small objects shifted; all pictures shifted. Hanging objects swung violently. Trees and bushes shook; vehicles rocked. "Motion started as violent high-frequency shaking, then after about 15 seconds changed to long period."

Hawthorne.—Felt by all and awakened many in community; frightened few. Exterior cracks in plaster where apartment is cantilevered over driveway. Hanging objects swung violently east-west. "Lack of balance when standing. Short-period shaking for about 20 seconds, followed by long-period shaking."

Highland.—Felt by, awakened, and frightened all in community. Plaster cracked. Damage slight. Small objects fell; furniture shifted. Trees and bushes shook; vehicles rocked. Hanging objects swung violently with a twisting motion.

Huntington Beach.—Felt by and awakened all in community; frightened many. Plaster cracked. Drywall cracked and some ceiling panels fell. Some cracks in cement. Damage slight. "Very strong, sharp jolts, but very little damage." Small objects fell; furniture shifted slightly. Trees and bushes shook. Hanging objects swung moderately north-south.

Huntington Park.—Felt by, awakened, and frightened all in home. Driveway cracked (transverse and diagonal cracks). Hanging objects swung violently east-west.

La Habra.—Felt by, awakened, and frightened many in community. Plaster cracked. Plastic water connection cracked. Ground cracked. Damage slight. Pool water sloshed. Small objects shifted, overturned, and fell; furniture shifted. Hanging objects swung violently east-west. Trees and bushes shook; vehicles rocked.

Lake Hughes.—Felt by, awakened, and frightened all in community. "Whipping action of pump shaft snapped pump pipe where it threads into submersible pump, causing a break in pipe which made pump burn up. Damage slight, except to pump." High wires swayed. Hanging objects swung violently east-west. Trees and bushes shook; vehicles

rocked. Water disturbed. Small objects shifted, overturned, and fell; beds moved about 15 to 30 cm.

Lakewood.—Felt by all in community; awakened and frightened many. Plaster cracked. Pool lost about 20 cm. of water. Electrical wires swayed. Hanging objects swung violently north-south. Small objects and furniture shifted. "Rolling motion; no extreme acceleration changes."

La Mirada.—Felt by and awakened all in community; frightened many. Small cracks in plaster and foundation. Damage slight. Small objects shifted, overturned, and fell; furniture shifted. Pendulum clock stopped. Trees and bushes shook; vehicles rocked. "Initial shock lasted over 2 minutes. The vertical and horizontal motion was easily felt and seen. Two moderately severe aftershocks were felt at about 6:20 and 8:20 a.m., but the remainder (about four) were scarcely noticeable."

Lancaster.—Felt by and awakened all in community; frightened many. Chimneys and plaster cracked. Damage slight. Many small objects shifted, overturned, and fell; furniture shifted. "Many aftershocks felt, but none that would cause heavy damage. The largest one was felt at about 9:00 p.m. on the 9th."

La Puente.—Felt by and awakened all in community; frightened many. Plaster cracked in some homes. Damage slight. Hanging objects swung violently. Small objects shifted, overturned, and fell. Vehicle rocked. "Shock frightened all in our home. Noticed up-and-down and horizontal motion. House continued to sway back and forth considerably after shock had stopped."

Lenwood (small community about 11 km. southwest of Barstow).—Felt by, awakened, and frightened all in community. Plaster cracked. Trees and bushes shook; vehicles rocked. Small objects and furniture shifted.

Littlerock.—Felt by and awakened all in community; frightened many. Few reports of plaster cracking. One plate glass window broke. Bottles and cans fell off shelves at two stores. Damage very slight.

Lomita.—Felt by and awakened all in community; frightened many. Plaster cracked in some buildings. Windows cracked in several stores in town. Damage slight. Small objects shifted. North-south swaying motion.

Long Beach.—Felt by, awakened, and frightened all in community. Plaster cracked. "Minor damage at Long Beach." Elevator knocked off track. Water in swimming pools sloshed violently. Small objects shifted, overturned, and fell; furniture shifted. Hanging objects swung violently north-south, east-west, and northeast-southwest. Trees and bushes shook; vehicles rocked. "Shock lasted for 35 seconds. Started slowly, reaching a peak in about 10 seconds which lasted about 15 seconds; then tapered off."

Lytle Creek.—Felt by and awakened all in community; frightened many. Cracks in walls and foundation. Small objects fell. Trees and bushes shook; vehicles rocked. Hanging objects swung moderately west-east. "We have not felt many of the aftershocks."

Malibu.—Felt by, awakened, and frightened all. Plaster cracked. Landslides. Damage slight. Trees and bushes shook; vehicles rocked. Hanging objects swung violently, seemed east-west. Small objects shifted, overturned, and fell. Bubbles caused by gas seepage were observed emanating from the ocean floor off Malibu Point. The occurrence was investigated by scuba divers. USGS-NOAA[25] reported that gas emanated from small holes and craters in the ocean floor. No ruptures or dislocations of the sea floor were observed during the dive.

Manhattan Beach.—Felt by and awakened all in community; frightened many. Hairline cracks in plaster; old cracks slightly enlarged; old hairline cracks in patio slightly widened. Windows cracked. "Cement walls without adequate foundation were slightly tilted." Pool water sloshed. Elevated water tank made loud noises. Hanging objects swung violently. Two people ran outside and had to hang on to windowsill to keep balance. Tree, about 3.6 m. high, whipped violently. Press reported: "Facade and parapets on the old City Hall (built in 1916) have cracked to the point of

[25]See footnote 8 on p. 34

collapse. Those cracks were brought out by the earthquake, but it is an old building and there will be more cracks." Aftershocks felt at 09:00 and 21:00.

Marina Del Rey.—Felt by all in community; awakened many; frightened few. Ground cracked. Trees shook; vehicles rocked on roadways. Hanging objects swung violently. Small objects overturned and fell; furniture shifted. "Floor shook up and down fairly violently for over 1 minute, but no damage."

Maywood.—Felt by, awakened, and frightened all in community. Transformers and high-tension lines arced and "sputtered." Damage slight. Small objects shifted, overturned, and fell. Trees and bushes shook; vehicles rocked. Hanging objects swung violently north-south. "Very difficult to walk—had to hold on to walls and doorways. Seemed as if one were riding on waves during the major aftershocks felt within the house. Felt many aftershocks as slight vibrations."

Mission Viejo (about 3 km. southeast of El Toro).—Felt by and awakened all in community; frightened many. Plaster cracked and fell; exterior stucco cracked at corners of openings; concrete slab separated at cold joint. Swimming pool water sloshed about north-south, and did not calm down for 2 hours. Trees and bushes shook strongly. "Rolling motion felt by husband in bed—almost enough to roll him out of bed. Aftershocks very slight—hardly noticeable—but continuous during evening of the 9th."

Monrovia.—Felt by, awakened, and frightened all in community. Plaster cracked. Inside partitions cracked at joints. Damage slight. Pool water sloshed over pool. Hanging objects swung violently east-west; objects also swung north-south. Small objects shifted, overturned, and fell. "Felt as a rocking motion rather than sharp jolts, also some aftershocks; later aftershocks were jolts."

Monterey Park.—Felt by, awakened, and frightened all in community. Chimneys and plaster cracked. About a 1.8-m.-long section of about 0.9-m.-high retaining wall pushed out and cracked but did not collapse. Old cracks reopened in cement block walls. Damage slight. Swimming pools lost about 15 to 20 cm. of water; very heavy wave action. Small objects shifted, overturned, and fell; some broke. Hanging objects swung violently north-south and northwest-southeast. Furniture shifted few centimeters. Trees and bushes shook; vehicles rocked. "Watched brilliant flare of electrical transformers (at about five locations) being shorted and burn out as quake shook." "Noticeable and disorienting ground motion, mostly lateral and fairly rapid, felt while jogging. Very noisy rattling of houses around me. No one came outside."

Moorpark.—Felt by and awakened all in community; frightened many. Plaster cracked. Damage slight. Trees and bushes shook; vehicles rocked. Hanging objects swung violently. Small objects fell; furniture shifted, overturned, and broke.

Mount Baldy area.—The Mount Baldy Ranger Station reported rocks fell on Mount Baldy Road, but the road was not closed (press).

Newbury Park (about 6.4 km. southwest of, at Rancho Sierra Vista).—Felt by and awakened all in home; frightened few. Chimneys and plaster cracked. Aluminum patio roof buckled. Damage slight. Trees and bushes shook; vehicles rocked. Small objects and furniture shifted.

Ontario.—Felt by, awakened, and frightened many in community. Reports of cracked plaster. Press reported some ceiling tile was shaken loose at the Ontario International Airport, but that there was little other damage. Alarms were set off at two banks. Small objects shifted, overturned, and fell (in moderate amount). Trees and bushes shook; vehicles rocked.

Oxnard.—Felt by and awakened all in community; frightened many. Plaster cracked. "Five or six chimneys in town were cracked." Some shaking of trees and bushes. Small objects shifted, overturned, and fell; furniture shifted. Hanging objects swung moderately north-south and east-west.

"Lasted longer than any shock I've ever felt. Long, slow rolls, changing from north-south to east-west direction."

Palmdale.—Felt by all in community; awakened and frightened all in home. Some cracks. Hanging objects swung violently east-west. Small objects shifted, overturned, and fell.

Palos Verdes Peninsula.—Felt by all in community; awakened and frightened many. Plaster cracked. Two cracks in block retaining wall on east side of house; crack in porch now about 1.27-cm. difference between levels; two large windows cracked. Ground cracked; landslides; water disturbed. Trees and bushes shook; vehicles rocked. All pictures askew. Hanging objects swung north-south; moderately southeast-northwest.

Piru and vicinity.—Felt by all and frightened many in community. Chimneys overturned. "Plaster cracked in several buildings in town." Damage slight. Trees and bushes shook; vehicles rocked. Hanging objects swung violently north-south. Small objects fell. California Institute of Technology[26] reported that the Santa Felicia Dam (about 4.8 km. northeast of Piru) was undamaged except for a narrow meandering crack across the crest at the east abutment, apparently shallow.

Placentia.—Felt by, awakened, and frightened all in community. Plaster cracked. Damage slight. Hanging objects swung violently in every direction. Swimming pool water rose about 0.4 m. and sloshed for about 20 minutes after initial shock. Trees and bushes shook; vehicles rocked. Small objects fell. "The worst aftershock was about 8:05 a.m., when things swayed again."

Pt. Mugu.—Felt by and awakened most in community; frightened many. Vehicles rocked; water disturbed. "Only minor damage was reported here. The Station Bowling Alley had all pins shaken from the automatic pin-setters and scattered about the lanes, while at the Commissary store, cake mix and cereals fell and a few jars of baby food fell and broke. A few bottles and cans fell from shelves in the Navy Exchange Mini-Mart, but nothing was broken. Several residents reported losing water from fish tanks."

Port Hueneme.—Felt by all in building; frightened few. Several new cracks in building. Damage slight. Water tower swayed. Hanging objects swung violently east-west.

Quartz Hill.—Felt by all in community; awakened and frightened many. Observer at fire station reported: "There are some new cracks, small and not long, in exterior stucco, mostly around doors and windows. There was no fall of chimneys in the area, and the only damage I have observed locally is one plate glass window broken in store. The original motion varied in intensity during the initial time, then there was a short pause of a few seconds and a second, shorter motion was felt. Motion was rapid, lasting about 40 to 50 seconds." Second shock (believed to be the first strong aftershock) also was felt. Other observers reported: Hairline stucco cracks. Knickknacks fell. House trailer swayed west-east. Damage negligible. Trees and bushes shook; vehicles rocked. Hanging objects swung moderately west-east.

Redondo Beach.—Felt by, awakened, and frightened all in community. Plaster cracked, broke, and fell. Block fence cracked. Water heater damaged. Merchandise fell and broke in store. "Bathroom cabinets appear to have pulled slightly away from walls in both bathrooms. Many new fine cracks in exterior of building and around upper end of supporting parts; cracking of plaster exterior noticeable. Overall damage was surprisingly slight." "I work at the South Bay Center (May Company). We had a lot of breakage and items spilled in the aisles." Water disturbed in swimming pool. "Motion of building was an easy rolling, not sharp, lasting about 1 to 2 minutes." Mild aftershocks were reported felt at about 06:15, 07:37, 09:05, 21:00, and 21:19.

Rubidoux (about 3 km. northwest of Riverside).—Felt by all; frightened few. Plaster cracked. Hairline cracks inside and outside of building. Damage slight. Hanging objects

[26]See footnote 3 on p. 29.

swung violently east-west.

Riverside.—Felt by and awakened all in community; frightened many. Plaster cracked. Slight damage to facing slumpstone. Observer at Colton reported plaster was cracked at the University of California in the Geology Building. Small objects shifted, overturned, and fell. Trees and bushes shook; vehicles rocked. Hanging objects swung moderately northeast-southwest. Mild aftershocks were reported felt at about 06:20, 07:30, 08:00, 21:00, and 21:15.

Rosemead.—Felt by, awakened, and frightened all in community. Plaster cracked. Damage slight. "Moderate breakage in area." Power failure for 1½ hours. Small objects shifted, overturned, fell, and broke; furniture shifted. Hanging objects swung violently in all directions. Trees and bushes shook; vehicles rocked. "I noticed lots of light flashes after the worst was over, about 20 seconds."

San Gabriel.—Felt by, awakened, and frightened all in community. Chimneys and plaster cracked. Store windows cracked. Hairline cracks in exterior concrete walls. Block wall cracked. Damage reported as slight. The following, from Steinbrugge and others,[27] does not include publicly owned structures: "30 chimneys damaged; estimated total dollar loss, $9,500." Small objects shifted, overturned, and fell. Hanging objects swung violently east-west, northwest-southeast. Electric wires twisted together. "Saw many transformers explode; thought it was lightning." At a restaurant, a heavy oven (on pedestal) moved west about 2.5 cm. Bed appeared to move in all directions but mainly north-south. "Rolling north-south sway, then, after a few seconds, the floor started to pitch up and down with an east-west movement; as the shock slowed down, it became a north-south sway again." "Motion of house was up and down with sudden drop." "Two distinct jolts; violent shaking, lasting about 40 seconds." "Aftershocks were mostly of a rolling motion."

San Jacinto.—Felt by and awakened all in community; frightened many. Chimneys cracked. Plaster cracked in some buildings. Damage slight. Hanging objects swung violently north-south, then circular. Small objects shifted. Trees and bushes shook; vehicles rocked. Pendulum clock stopped.

San Marino.—Felt by, awakened, and frightened all in community. Plaster cracked; small pieces fell. Chimney cracked. Plate glass broke. Damage slight. File cabinets moved north-south. Hanging objects swung violently east-west. Small objects shifted, overturned, and fell; furniture overturned. Water sloshed from swimming pools. "Chandelier, about 1.2 m. long, swung about 10 cm. from plumb in north-south direction. Shower doors bounced in floor tracks about three times per second. Vertical movement was a prominent component."

Santa Ana.—Felt by and awakened all in community; frightened many. Plaster cracked. "Inspected two-story precast beams, block exterior walls, precast floor sections, interior nonbearing steel and plaster walls. Plaster on most interior nonbearing walls showed rather severe deflection of structure at first floor only. No structural damage of any consequence noticeable. The shock in our area seemed well dampened, not sharp." Shook 6.7-m. trailer off jacks. Hanging objects swung moderately north-south and east-west.

Sante Fe Springs (Post Office).—Felt by all; frightened many. Exterior building cracks slightly enlarged. Trees and bushes shook; vehicles rocked. Small objects and furniture shifted. Hanging objects swung moderately north-south.

Santa Monica.—Felt by and awakened all in community; frightened many. Chimneys and plaster cracked. The following, from Steinbrugge and others,[27] does not include publicly owned structures: "20 buildings damaged; posted unsafe, 1; 30 chimneys damaged; estimated total dollar loss, $50,000." Nonstructural partitions cracked in 13-story building. Small objects shifted and

[27]See footnote 10 on p. 35

fell; lamps overturned; furniture shifted. Hanging objects swung violently east-west. Trees and bushes shook; vehicles rocked. "It was a hard and comparatively long shake, lasting about 1 minute. Little, if any, structural damage to wood frame stucco houses."

Santa Susana.—Felt by, awakened, and frightened all in community. "Some damage in area, especially in retail stores where merchandise was strewn on floors and broken." Mortar line on block wall cracked. Crack appeared at interface of foundation and wood structure in the stucco covering the external walls. Hanging objects swung violently; also moderately northeast-southwest.

Sierra Madre.—Felt by, awakened, and frightened all in community. "Most of the damage was in grocery and liquor stores due to merchandise falling from shelves. One plate glass window in store broke. No structural damage in the city." Trees and bushes shook; vehicles rocked. Hanging objects swung moderately east-west, north-south, and northwest-southeast. Furniture shifted. Water sloshed over swimming pool. Electricity was interrupted for a few minutes. "Continuous rolling motion; seemed maximum at beginning."

South Gate.—Felt by all in community; awakened all; frightened many. One light fixture loosened but did not fall. Damage slight. Lights failed for about 1 minute. "Saw flash from transformers blowing about 0.4 km. away." Bookcase shifted about 2.5 cm. Small objects shifted, overturned, and fell. Water disturbed. Hanging objects swung violently east-west. Trees and bushes shook.

Studio City.—Felt by, awakened, and frightened all in community. Ground cracked. Plaster cracked. Damage slight. Water in swimming pool sloshed out. Small objects and furniture shifted. Trees and bushes shook; vehicles rocked: Hanging objects swung violently.

Thousand Oaks.—Felt by and awakened all in community; frightened many. Slight plaster cracking above several doors in one home. "Only damage to my house was that the house apparently wracked just enough so that one door would not latch." Cracks in sidewalk. Water disturbed. Trees and bushes shook; vehicles rocked. Small objects shifted; furniture shifted some. Hanging objects swung moderately east-west.

Topanga.—Felt by and awakened all in community; frightened many. Rockslides. Plaster cracked. One chimney reported broken. Dry rock walls dislodged (minor). Damage slight. Some settlement of foundation, perhaps 1.2 cm. Planter box on casters, weight about 114 kg., moved about 10 cm. north. Small objects shifted, overturned, and fell; furniture shifted. Trees and bushes shook; vehicles rocked. Hanging objects swung violently; moderately north-south and east-west.

Torrance.—Felt by and awakened all in community; frightened many. Minor plaster cracking. Crack in patio slab. Window cracked. Damage slight. Water sloshed from swimming pools. Vehicles rocked. Hanging objects swung violently north-south. "Doors on east-west axis swung open and closed many times; north-south doors only vibrated. Shock at 8:00 a.m. strong jolt, seemed almost as strong as the first one. Did not feel any of the earlier or later aftershocks."

Tustin.—Felt by many in community; awakened and frightened all in home. Plaster cracked. Swimming pool water sloshed out in large waves. Furniture shifted. Hanging objects swung moderately north-south.

Twin Peaks.—Felt by many and awakened all in community; frightened all. Some chimneys cracked.

Upland.—Felt by, awakened, and frightened all in community. Press reported a false ceiling, with a 2.4-m. neon light, fell to the floor; some cans fell from shelves at a market. Trees and bushes shook. Hanging objects swung violently in all directions. Furniture shifted. Pendulum clocks stopped. "Pool water disturbed but did not slosh over sides."

Valinda.—Felt by all in community; awakened and frightened all in home. Movement of exterior timber patio. Separation of mortar joints in block wall.

Valyermo and vicinity.—Felt by and awakened all in community; frightened many. At Ranger Station (about 2.4 km. northwest of Valyermo): One block building cracked. Damage slight. Trees and bushes shook; vehicles rocked. Hanging objects swung violently southwest-northeast. Small objects shifted, overturned, and fell. About 6.4 km. southeast of Valyermo (sec. 24 and 25, T. 4N., R.9W.): Ground cracked. Trees and bushes shook. Damage slight. In Juniper Hills area: Water disturbed. Hanging objects swung violently east-west. Small objects shifted, overturned, and fell. Trees and bushes shook; vehicles rocked.

Venice.—Felt by and awakened all in community; frightened many. Plaster and windows cracked. Damage slight. Pool emptied. "Transmission" moved about 0.46 m. Small objects fell. Furniture shifted. Hanging objects swung violently east-west. Bushes shook. Water dirty.

Vincent.—(about 8 km. south of Palmdale).—USGS-NOAA[28] reported that the Vincent Intertie Station had some electrical equipment similar to that at the Sylmar Converter Station, but only minor damage occurred.

Walnut.—Felt by and awakened all in community; frightened many. Plaster cracked (observer heard of this). Ground cracked; water disturbed (observer heard of this on radio). Vehicle moved about 15 cm. Small objects shifted, overturned, and fell. Trees shook. Hanging objects swung violently east-west; also moderately north-south. Aftershocks felt at about 06:32 and 07:59.

West Covina.—Felt by, awakened, and frightened all in community. Plaster cracked. "All plaster and paint cracked over door and window frames; cabinets slightly separated from ceiling. A heavy brass hanging lamp swung violently and continued swinging for 10 minutes." Driveway paving cracked. Damage slight. Small objects shifted, overturned, and fell, including canned goods. Furniture shifted. Water splashed from swimming pools. Hanging objects swung violently east-west, north-south, and northwest-southeast. Trees and bushes shook; vehicles rocked. Aftershocks felt at 08:00 and 21:30.

Whittier.—Felt by and awakened all in community; frightened many. Plaster cracked and old cracks reopened. "Slight cracking at 45 percent of door openings; metal vents projecting above roof slightly out of plumb; lost about 20 cm. of pool water—waves in east-west direction. Stucco house and garage has lots of hairline cracks 'all over,' and fireplace chimney has two large cracks near base. Concrete at roadways cracked." Damage slight. Telephone poles swayed. Small objects shifted, overturned, and fell; furniture shifted. Hanging objects swung violently east-west and north-south. Trees and bushes shook; vehicles rocked.

INTENSITY V:

Acton and about 6.4 km. northwest of, Adelanto (plaster cracked), Alta Loma, Apple Valley (plaster cracked), Arroyo Grande, Artesia, Arvin, Avalon, Avila Beach, Azusa, Bakersfield and vicinity, Banning (small plaster cracks), Barstow, Beaumont (plaster cracked), Bell (some cracks), Bellflower (some old cracks reopened), Bell Gardens, Big Bear City (aftershocks at 06:08, 08:10; very slight aftershocks during rest of day), Big Bear Lake, Bloomington, Bonsall, Boron, Brea (plaster cracked in one room), Bryn Mawr, Buellton, Buena Park, Buttonwillow, Cachuma Village and Cachuma Dam, Cadiz (plaster cracked), Calabasas (windows cracked), Caliente, California City (plaster cracked), California Hot Springs, California Valley (formerly Simmler; cracks widened in cement floor), Calimesa, Camp Pendleton, Cantil, Capistrano Beach, Carlsbad, Carpinteria, Cartago, Casmalia, Cathedral City, Cedar Glen, Cedarpines Park, Charter Oak, Cherry Valley, China Lake, Chino, City Of Industry, City Terrace, Claremont (three aftershocks), Coachella, Colton (rapid succession of aftershocks and large cluster of minor aftershocks around 21:30 and 22:30), Corona, Corona Del Mar (plaster cracked;

[28]See footnote 8 on p. 34

several brief aftershocks for 1 hour after main shock), Coronado, Crest Park, Cuyama, Daggett, Dana Point, Death Valley Junction, Delano, Delkern (plaster cracked), Del Mar, Desert center, Desert Hot Springs, Diamond Bar (one small plaster crack), Di Giorgio (moderately strong aftershock within 15 minutes of the first shock), Duarte, Ducor, Dunn Siding (about 48 km. northeast of Yermo), East Los Angeles, Edison, Edwards Air Force Base (windows cracked), El Cajon, El Mirage area (west of Adelanto), El Segundo (old plaster cracks reopened), El Toro and Marine Corps Air Station (aftershock at 07:58), Encinitas, Escondido, Essex (plasterboard cracked), Etiwanda, Fallbrook and vicinity, Farmersville, Fawnskin, Fellows, Fontana and 8 km. north of, Forest Falls, Fort Irwin, Fort Tejon State Historical Park (near Lebec), Fountain Valley, Frazier Park and Chuchupate Ranger Station (near Frazier Park), Garden Grove, Gaviota, George Air Force Base, Gilman Hot Springs (windows cracked), Glennville, Goleta (small aftershock about 1 hour later), Gorman, Grover City, Halcyon, Harbor City (plaster cracked slightly), Havilah (about 8 km. south by west of Bodfish; hairline plaster cracks), Helendale, Hemet (some cracks) and 8 km. east of, Hermosa Beach, Hesperia, Highgrove (window cracked), Hinkley, Homeland, Homestead (about 6.4 km. northwest of Inyokern on Highway 6), Huron (some plaster cracked), Idyllwild, Imperial, Indio, Inglewood (windows cracked), Irvine, Irwindale (three cracks), Johannesburg, Johnsondale, Keene, Kelso, Kettleman City, Kern River Powerhouse No. 1 (Southern California Edison, about 16 km. east-northeast of Bakersfield), Kern Canyon Powerplant (Pacific Gas and Electric, mouth of Kern Canyon), Kernville, Laguna Beach, Laguna Hills (plaster cracked), La Jolla (small plaster cracks), Lake Arrowhead, Lake Isabella, Lakeview, La Mesa, Lamont, La Quinta, Laton, La Verne, Lawndale, Lebec and vicinity, Lemoore, Leucadia, Lincoln Acres, Little Lake, Llano, Loma Linda, Lompoc, Lone Pine, Loraine (about 16 km. east of Caliente), Los Alamitos, Los Olivos, Los Prietos Ranger Station (about 16 km. northwest of Santa Barbara), Los Serranos (Chino area), Lost Hills (hairline plaster cracks), Lucerne Valley, Ludlow, Lynwood, McFarland, McKittrick, March Air Force Base, Maricopa, Mecca (plaster cracked and slight cracks in brick seams), Meiners Oaks, Midway City, Mira Loma, Mojave (very slight plaster cracks), Monolith, Montclair, Montebello (small plaster cracks), Moreno, Morongo Valley, Mount Baldy, Mount Wilson, Murrieta, National City, Newberry Springs, Newbury Park, New Cuyama, Newport Beach, Norco, North Palm Springs, Norton Air Force Base, Norwalk (plaster cracked; damage very slight), Nuevo, Oak Grove Ranger Station (about 16 km. southeast of Aguanga), Oak View, Oceano, Oceanside, Ocotillo, Ocotillo Wells (Desert Ironwoods Motel, about 4.8 km. west of Ocotillo Wells), Ojai, Olancha, Orange (one crack in chimney), Oro Grande, Ozena Guard Station (near junction of Highway 33 and Lockwood-Ozena Road), Pacific Palisades, Pala, Palm Desert, Palm Springs, Palos Verdes Estates, Paramount, Pattiway (Hudson Ranch), Pearblossom and about 8 km. south of (most aftershocks felt), Pedley, Perris, Phelan, Pico Rivera (aftershock at 08:00), Pinon Hills, Pioneertown (small plaster cracks), Pixley, Pomona, Porterville, Poway, Pumpkin Center (about 25.7 km. south of Bakersfield), Romona, Rancho Mirage (minor plaster cracks), Rancho Santa Fe, Randsburg, Redlands, Red Mountain, Rialto, Ridgecrest, Rimforest, Ripley, Rolling Hills Estates, Rosamond, Running Springs, Sage Fire Control Station (about 19.3 km. southeast of Hemet), Salton City (west shore of Salton Sea), San Bernardino (heavy aftershock at about 08:00), San Clemente, Sandberg (Sandberg Ranch), San Diego, San Dimas, San Juan Capistrano, San Luis Rey, San Pedro, Santa Barbara (aftershock at about 06:30), Santa Maria, Santa Paula, Santa Ynez and about 6.4 km. southeast of Santa Ysabel, Santee, San Ysidro (slight cracks in brick wall), Seal Beach (plaster cracked; negligible

damage), Seeley, Shandon, Shafter, Shoshone, Signal Hill, Silverado, Simi, Solana Beach (two aftershocks felt), Solvang, South Laguna, South San Gabriel, Springville, Stanton, Sugarloaf, Sultana, Summerland, Sun City, Sunnymead, Sunnyside, Sunset Beach (plaster cracked), Surfside, Taft, Tecate, Tecopa, Tehachapi and Cummings Ranch (near Tehachapi), Temecula, Temple City, Terra Bella, Thermal, Thousand Palms, Tipton, Trabuco Canyon (about 9.7 km. northeast of El Toro), Traver, Trona, Ventucopa area (Reyes-Wegis Cattle Ranch, about 9.7 km. west of Ventucopa in Santa Barbara Canyon), Ventura (aftershock at about 06:30 barely felt), Victorville (slight tremor at about 06:00 on Feb. 10), Vista, Warm Springs (about 14.5 km. north by east of Castaic), Westend, Westlake Village (west of Malibu Junction), Westminster (plaster cracked), Wheeler Ridge, White Water, Wild (about 8 km. northeast of Helendale), Wildomar, Wilmington (plaster cracked), Winchester, Wrightwood, Yermo, Yorba Linda (drywall cracked some), and Yucaipa.

INTENSITY IV:

Alpaugh, Amboy, Armona, Atascadero, Avenal and about 9.7 km. northeast of, Baker, Big Pine, Bishop, Blythe, Bodfish, Borel Powerhouse (21.6 km. south by southwest of Kernville Powerhouse No. 3, 35°47′ N., 118°26′ W.), Borrego Springs, Boulevard, Brawley (Wieman Ranch, about 11.3 km. west of Brawley), Burrel, Cabazon and about 16.1 km. east of, in San Gorgonio Pass, Calexico, Cambria, Camp Nelson, Cardiff By The Sea, Cholame and Bitterwater Pumping Station, about 29 km. southeast of Cholame, Chula Vista, Cima, Corcoran, Creston, Darwin, Death Valley (Furnace Creek Inn and Furnace Creek Ranch), Del Rey, Dinuba, Dulzura area (Barrett Dam), Eagle Mountain, Earlimart, East Highlands, Exeter, Firebaugh, Five Points, Fowler, Guadalupe, Guatay, Helm, Herndon, Imperial Beach, Independence, Inyoken, (about 7 km. west of at Beckman Ranch), Ivanhoe, Jacumba, Jamul, Joshua Tree, Keeler, Kern River Powerhouse No. 3 (near Kernville, 35°47′ N., 118°26′ W.), Kingsburg, Kings Canyon National Park, Lakeside, La Panza (about 40.2 km. east of Santa Margarita, on Highway 58), Lemongrove, Lindsay, Long Valley Dam (about 40.2 km. northwest of Bishop at Lake Crowley), Los Alamos, Miracle Hot Springs, Miramar Naval Air Station (Miramar), Miramonte, Mountain Center, Mount Laguna, Needles, Nestor, Nipomo, Nipton, Oildale, Orosi, Parkfield, Paso Robles, Pauma Valley, Peidra and about 11.3 km. south of, Pine Valley, Pismo Beach, Poplar, Posey, Potrero, San Marcos, San Onofre Nuclear Generating Plant (near San Clemente), Selma, Spring Valley, Stratford, Strathmore, Surf, Templeton, Three Rivers and Ash Mountain (near Three Rivers), Tulare, Twentynine Palms, Valley Center, Vandenberg Air Force Base (about 16.1 km. northwest of Lompoc), Warner Springs, Wasco, Weldon, Woodville, Woody, Yettem, and Yucca Valley.

INTENSITY IV IN ARIZONA:

Bullhead City, Ehrenberg, and Poston.

INTENSITY IV IN NEVADA:

Dyer, East Las Vegas, Goodsprings, Las Vegas, Lathrop Wells, and Overton.

INTENSITY I–III:

Biola, Bridgeport, Bryson area (Weferling Ranch), Caruthers, Clovis, Control Gorge Powerplant (about 20.9 km. northwest of Bishop), Earp, El Nido, Fresno, Hanford, Heber, Holtville, Hornitos (near), June Lake, Kaweah, Le Grand, Lockwood, London (Dinuba area), Los Banos, Los Osos, Merced, Milo (about 8 km. northeast of, near Springville), Moss Landing (Pacific Gas and Electric Steamplant; no motion actually felt, but considerable float movement in water tank), Palomar Mountain, Palo Verde, Parker Dam, Pinedale, Piute Mountain area (about 21 km. southeast of Bodfish), Plaster City, Point Arguello, Red Top, Riverdale, San Ardo, San Miguel, Snelling, Stockton, Strawberry, Wofford Heights, and Yosemite National Park.

INTENSITY I–III IN ARIZONA:
Kingman and Topock.

INTENSITY I–III IN NEVADA:
Beatty, Boulder City, Logandale, Moapa, Pahrump, and Tonopah.

INTENSITY I–III IN UTAH:
Beryl.

Feb. 9: 06:10:28.0 (14:10). Epicenter 34°24.7′ N., 118°24.0′ W., southern California, at a depth of about 8 km., mag. 5.3, P. Aftershock of San Fernando earthquake. Int. V at La Canada. Pool water splashed violently. At 07:00, pool water was still swaying about 4 cm. from end to end. Also felt at Big Bear City (shocks felt for balance of the day), Burbank (strong shock; about 12 shocks during the next hour, and approximately 42 aftershocks reported felt throughout the day of Feb. 9), Di Giorgio (moderately strong aftershock within 15 minutes of the first shock), and in the Windsor Hills area north of Inglewood.

Feb. 9: 06:16:12.9 (14:16). Epicenter 34°20.3′ N., 118°19.9′ W., southern California, at a depth of about 11 km., mag. 4.1, P. Aftershock of San Fernando earthquake. Felt at Redondo Beach.

Feb. 9: 06:19:50.2 (14:19). Epicenter 34°21.4′ N., 118°24.0′ W., southern California, at a depth of about 12 km., mag. 4.0, P. Aftershock of San Fernando earthquake. Felt at La Canada (moderately severe) and Riverside (mild shock).

Feb. 9: 06:43:46.7 (14:43). Epicenter 34°18.5′ N., 118°27.2′ W., southern California, at a depth of about 6 km., mag. 5.2, P. Felt at Goleta (probably the shock reported felt about an hour after the main shock), North Hollywood, and in the Windsor Hills area north of Inglewood.

Feb. 9: 07:38:29.7 (15:38). Epicenter 34°21.0′ N., 118°28.1′ W., southern California, at a depth of about 7 km., mag. 3.9, P. Aftershock of San Fernando earthquake. Felt at Redondo Beach.

Feb. 9: 07:58:20.7 (15:58). Epicenter 34°20.1′ N., 118°19.8′ W., southern California, at a depth of about 14 km., mag. 4.8, P. Aftershock of San Fernando earthquake. **IV.** Reported felt at Burbank (strong shock), City Of Industry (strongly felt), El Toro (Marine Corps Air Station), La Canada, Los Angeles (IV), Norton Air Force Base (III), North Hollywood, Pasadena (IV), Pico Rivera, Placentia, Riverside, San Bernardino (heavy shock), South Pasadena, Torrance (strong jolt), West Covina, and Walnut.

Feb. 9: 08:14:00.0 (16:14). Epicenter 34°24.7′ N., 118°24.0′ W., southern California, at a depth of about 8 km., mag. 3.8, P. Aftershock of San Fernando earthquake. Felt at Big Bear City. Time was given as 08:10.

Feb. 9: 08:19:26.5 (16:19). Epicenter 34°27.4′ N., 118°25.6′ W., southern California, at a depth of about 1 km., mag. 4.2, P. Aftershock of San Fernando earthquake. Felt at La Mirada (moderately severe). "About four other shocks were felt but were scarcely noticeable." Also felt at Burbank.

Feb. 9: 09:03:47.5 (17:03). Epicenter 34°18.0′ N., 118°29.4′ W., southern California, at a depth of about 7 km., mag. 3.9, P. Aftershock of San Fernando earthquake. Felt at Burbank, Manhattan Beach, and Riverside.

Feb. 9: 09:05:00.0 (17:05). Epicenter 34°24.7′ N., 118°24.0′ W., southern California, at a depth of about 8 km., mag. 3.5, P. Aftershock of San Fernando earthquake. Felt at Redondo Beach.

Feb. 9: 19:12:12.0 (Feb. 10, 03:12). Epicenter 34°22.2′ N., 118°18.1′ W., southern California, at a depth of about 1 km., mag. 4.0, P. Aftershock of San Fernando earthquake. Felt strongly at Burbank.

Feb. 9: 21:06:36.0 (Feb. 10, 05:06). Epicenter 34°24.7′ N., 118°19.8′ W., southern California, at a depth of about 5 km., mag. 4.3, P. Aftershock of San Fernando earthquake. Felt at Burbank (strong), Lancaster ("Many aftershocks were felt but none that would cause heavy damage. The largest at about 9 p.m."), Manhattan Beach, Redondo Beach, and Riverside.

Feb. 9: 21:18:07.2 (Feb. 10, 05:18). Epicenter 34°25.5′ N., 118°24.8′ W., southern

California, at a depth of about 6 km., mag. 4.5, P. Aftershock of San Fernando earthquake. Felt at Burbank (strong), Redondo Beach, and West Covina.

Feb. 9: 21:30 and 22:30. Felt at Colton. "Rapid succession of aftershocks and large cluster of minor aftershocks felt around 21:30 and 22:30."

Feb. 10: 05:49:53.7 (13:49). Epicenter 34°23.9′ N., 118°25.1′ W., southern California, at a depth of about 10 km., mag. 4.3, P. Aftershock of San Fernando earthquake. Felt at Burbank (13 aftershocks were reported felt during the day) and Victorville (slight tremor; time given as 06:00).

Feb. 11: Aftershocks of San Fernando earthquake. Observer at Burbank reported at least five slight aftershocks were felt during the day.

Feb. 11: 06:10. Int. **V** at Imperial Beach. "Few plaster cracks reported in school buildings."

Feb. 11: 23:26. Int. **II** at Ferndale.

Feb. 12: Aftershocks of San Fernando earthquake. Four slight aftershocks felt at Burbank.

Feb. 14: 05:44:49.5 (13:44). Epicenter 34°18.0′ N., 118°30.7′ W., southern California, at a depth of about 1 km., mag. 3.8, P. Aftershock of San Fernando earthquake. Press reported the shock was felt over much of the southern California coastal area. The Van Norman Dam was jarred by the shock, but no new damage was reported. The Granada Hills area was briefly blacked out.

Feb. 14: 09:53:58.6 (17:53). Epicenter 34°19.3′ N., 118°17.4′ W., southern California, at a depth of about 4 km., mag. 3.4, P. Aftershock of San Fernando earthquake. Felt at Burbank.

Feb. 15: 00:04:49.8 (08:04), 00:46:54.8 (08:46), 05:03:42.6 (13:03). Epicenter (1) 34°28.3′ N., 118°24.6′ W.; (2) 34°24.4′ N., 118°26.5′ W.; (3) 34°25.6′ N., 118°26.1′ W., southern California, at depths of about 13, 8, and 10 km., respectively, mag. 3.9, 3.4, and 3.4, respectively, P. Aftershocks of San Fernando earthquake. Felt in northern San Fernando Valley. Shocks at 00:04 and 00:46 were felt at Burbank. Also, a shock was felt in the Silver Lake area of Los Angeles sometime in the morning.

Feb. 15: 20:37:04.5 (Feb. 16, 04:37), 23:08:26.0 (Feb. 16, 07:08). Epicenter (1) 34°17.2′ N., 118°32.6′ W., (2) 34°24.1′ N., 118°27.2′ W., southern California, at depths of about 13 and 9.6 km., respectively, mag. 3.5 and 3.3, respectively, P. Aftershocks of San Fernando earthquake. Felt in the Los Angeles area. Shock at 20:37 felt at Burbank.

Feb. 16: 03:20. Int **II** at Grass Valley. "Slight movement of some kind."

Feb. 16: 06:39:18.9 (14:39), 08:54:39.5 (16:54). Epicenter (1) 34° 20.1′ N., 118°17.9′ W.; (2) 34°24.8′ N., 118°23.8′ W., southern California, at depths of about 10 and 11 km., respectively, mag. 3.1 and 2.9, respectively, P. Aftershocks of San Fernando earthquake. Felt in the Los Angeles area.

Feb. 17: Between 01:00 and 03:30. Int. **IV** at Santa Ana.

Feb. 17: 02:15:40.5 (10:15). Epicenter 34°21.5′ N., 118°18.4′ W., southern California, at a depth of about 5 km., mag. 3.5, P. Aftershock of San Fernando earthquake. Felt at Burbank.

Feb. 18: 01:21:52.8 (09:21). Epicenter 34°20.8′ N., 118°20.8′ W., southern California, at a depth of about 5 km., mag. 3.0, P. Aftershock of San Fernando earthquake. Felt at Burbank.

Feb. 18: 04:16:32 (12:16). Epicenter 37°29′ N., 118°29′ W., California-Nevada border region, at a depth of about 2 km., mag. 3.3, B. Int. **V** at the Control Gorge Powerplant (about 20.9 km. northwest of Bishop) where many were awakened. Duration about 5 to 6 seconds. Moderate earth noises.

Feb. 18: 09:15. Felt slightly at Lucia (on coast about 39 km. south of Big Sur).

Feb. 20: 04:01 and 04:03. Felt at Pasadena.

Feb. 20: 04:57:43.5 (12:57). Epicenter 37°59′ N., 118°37′ W., California-Nevada border region, at a depth of 2 km., mag. 3.9, B. Int. **IV** at the Control Gorge Powerplant (about 20.9 km. northwest of Bishop).

Feb. 20: 15:04. Felt at Pasadena.

Feb. 20: 15:15:57.6 (23:15). Epicenter

34°15.7′ N., 118°32.6′ W., southern California, at a depth of about 6 km., mag. 3.7, P. Aftershock of San Fernando earthquake. Int. V at Santa Monica. Small objects shifted; furniture moved. "I noticed a rush to leave the building (Santa Monica Public Library). Shocks are coming 'thick and fast.' " Felt slightly at Burbank.

Feb. 20: 21:50:52.6 (Feb. 21, 05:50). Epicenter 34°23.8′ N., 118°26.3′ W., southern California, at a depth of about 7 km., mag. 4.7, P. Aftershock of San Fernando earthquake. Int. IV at Burbank, Covina, Etiwanda ("numerous small shocks before and after Feb. 20"), Fillmore, Laguna Beach, Los Angeles, Port Hueneme, Seal Beach, and Sunset Beach. Also felt at Anaheim, Fullerton, Manhattan Beach, Santa Ana, and Ventura.

Feb. 20: 23:15:11.7 (Feb. 21, 07:15). Epicenter 34°23.5′ N., 118°25.6′ W., southern California, at a depth of about 7 km., mag. 4.5, P. Int. IV at Covina and Fillmore. Also felt in the Los Angeles area.

Feb. 21: 06:06:05.4 (14:06). Epicenter 34°23.9′ N., 118°26.7′ W., southern California, at a depth of about 6 km., mag. 3.5, P. Aftershock of San Fernando earthquake. Felt at Burbank.

Feb. 22: 10:13:12.6 (18:13). Epicenter 34°12.1′ N., 118°21.3′ W., southern California, at a depth of about 10 km., mag. 3.0, P. Aftershock of San Fernando earthquake. Felt at Burbank.

Feb. 22: 12:39:13.2 (20:39). Epicenter 37°05.6′ N., 121°58.5′ W., central California, at a depth of about 11 km., mag. 2.8, B. Int. II at Capitola. Also felt at Boulder Creek.

Feb. 22: 16:07:39.2 (Feb. 23, 00:07), 16:11:45.9 (Feb. 23, 00:11). Epicenter (1) 33°30.1′ N., 116°25.8′ W.; (2) 33°26.3′ N., 116°36.4′ W., southern California, at a depth of about 8 km., mag. 4.2 and 3.4, respectively, P. Press reported the shocks were felt as far as San Diego. Int. III at Etiwanda. Also felt at Palm Springs.

Feb. 22: 22:24:44.0 (Feb. 23, 06:24). Epicenter 34°18.6′ N., 118°18.9′ W., southern California, at a depth of about 6 km., mag. 3.0, P. Aftershock of San Fernando earthquake. Felt at Burbank.

Feb. 23: 10:04:17 (18:04). Epicenter 40.2° N., 124.5° W., near coast of northern California, at a depth of about 2 km., mag. 3.3, B. Int. IV at Eureka and Ferndale.

Feb. 23: 21:31:38.1 (Feb. 24, 05:31). Epicenter 34°23.7′ N., 118°19.7′ W., southern California, at a depth of about 3 km., mag. 3.5, P. Aftershock of San Fernando earthquake. Int. IV at Van Nuys. Also felt at Burbank.

Feb. 24: 21:53. Felt at Burbank.

Feb. 25: 12:27:58.7 (20:27). Epicenter 34°20.2′ N., 118°21.8′ W., southern California, at a depth of about 2 km., mag. 3.5, P. Aftershock of San Fernando earthquake. Felt at Burbank.

Feb. 26: 16:31:37.7 (Feb. 27, 00:31). Epicenter 40°16′ N., 124°50′ W., off coast of northern California, at a depth of about 2 km., mag. 5.2, B. V. Felt over approximately 11,440 sq. km. (4,400 sq. mi.), principally along the coastal area of Humboldt and Mendocino Counties, from McKinleyville north of Eureka south to Fort Bragg, a distance of about 177 km. Only two places reported any damage: Three small windows cracked at Ferndale; one crack in sheetrock at Honeydew. Utility lines and poles swayed at Ferndale; cars swayed. At the Howe Ranch (about 6 km. due west of Scotia), tall trees swayed strongly; truck shook strongly. On top of a hill the ground rose in swells; difficult for man to keep on his feet. At Bear Harbor Ranch, near Shelter Cove, noticeable settling of rock formations was observed. Int. V effects also were observed at Carlotta, Eureka, Ferndale, Fields Landing, Fort Seward, Honeydew, Loleta, Miranda, Phillipsville, Rio Dell, Scotia, Shelter Cove, and in Yager area (about 8 km. north of Bridgeville). Int. IV at Alderpoint, Bayside, Bridgeville (about 6 km. north-northwest of), Dos Rios, Fort Bragg, Fortuna, Garberville, Korbel, Leggett, Petrolia, Samoa, Upper Mattole, and Whitethorn. Int. I—III at Arcata, Blocksburg, Branscomb, Harris, Salyer, Showers Pass area (about 11 km. northeast of Bridgeville),

Weott, Westport, and Zenia.

Feb. 28: 14:51:34.6 (22:51). Epicenter 34°17.3′ N., 118°18.2′ W., southern California, at a depth of about 8 km., mag. 2.8, P. Aftershock of San Fernando earthquake. Felt at Burbank.

Mar. 1: 00:21:02.9 (08:21), 00:28:02.4 (08:28, main shock), 00:39:56.5 (08:39), 01:45:11.0 (09:45), 02:31:26.2 (10:31).Epicenter (1) 37.9° N., 118.2° W.; (2) 37.9° N., 118.2° W.; (3) 37.9° N., 118.2° W.; (4) 37.9° N., 118.2° W; (5) 37.9° N., 118.2° W., California-Nevada border region, at a depth of 15 km., mag. of main shock 4.2 (m_b). Int. IV (00:28) at Dyer, Nev. Telephone reports to the Seismographic Station at the University of Nevada indicated three shocks were felt at Dyer (Gray's Store) and five were felt at the Maintenance Station.

Mar. 1: 19:46:29.3 (Mar. 2, 03:46). Epicenter 33°56.0′ N., 117°51.5′ W., southern California, at a depth of about 12 km., mag. 3.7, P. Int. IV at Etiwanda, Pomona, Santa Ana, Walnut, and West Covina.

Mar. 3: 04:05:16.0 (12:05). Epicenter 35°39.6′ N., 118°22.7′ W., central California, at a depth of about 4 km., mag. 4.0, P. V. Felt over approximately 9,100 sq. km. (3,500 sq. mi.) of Kern and Tulare Counties, principally in the Lake Isabella area of northern Kern County. Some residents of Wofford Heights reported plaster cracked. Int. V effects were also observed at Bodfish, California Hot Springs, Johnsondale, Kernville (Lake Isabella area), Posey, Springville, and Wofford Heights, with no damage reported. Int. IV at Mojave, Piute Mountain area (about 21 km. southeast of Bodfish), Sequoia National Park, and Woodville. Int. I-III at Shafter and Terra Bella. Also reported felt at Bakersfield.

Mar. 4: 08:45 (about). Felt in Mar Vista district of West Los Angeles.

Mar. 5: 03:30, 21:53:27.6 (Mar. 6, 05:53). Epicenter 34°21.5′ N., 118°27.6′ W., southern California, at a depth of about 11 km., mag. 3.4, P. Aftershock of San Fernando earthquake. Int. III at Sepulveda (21:53). Both shocks were felt at Burbank.

Mar. 6: 17:33:40.5 (Mar. 7, 01:33). Epicenter 34°21.1′ N., 118°27.3′ W., southern California, at a depth of about 3 km., mag. 4.5, P. Aftershock of San Fernando earthquake. Press reported the shock rocked the San Fernando Valley area, causing momentary concern, but no damage was reported. Int. IV at Burbank and Sepulveda. Also felt in downtown Los Angeles.

Mar. 6: 22:56:37.7 (Mar. 7, 06:56). Epicenter 34°22.6′ N., 118°26.0′ W., southern California, at a depth of about 5 km., mag. 3.9, P. Aftershock of San Fernando earthquake. Int. IV at Sepulveda. Also felt at Burbank.

Mar. 7: 07:25. Felt at Burbank.

Mar. 7: 13:36:12.2 (21:36). Epicenter 34°22.1′ N., 118°24.3′ W., southern California, at a depth of about 10 km., mag. 3.3, P. Aftershock of San Fernando earthquake. Felt at Burbank.

Mar. 8: 10:31:46.1 (18:31). Epicenter 36°47.6′ N., 112°08.6′ W., near coast of central California, in Monterey Bay, at a depth of about 9 km., mag. 4.1, B. Press reported the shock was felt strongly at Monterey and Salinas. Int. IV at Brookdale; III at Capitola. Also felt at Carmel, Los Altos, Oakland, and San Francisco.

Mar. 8: 15:08:07.7 (23:08). Epicenter 35°40.0′ N., 118°24.2′ W., central California, at a depth of about 6 km., mag. 4.1, P. V. Felt generally over approximately 10,400 sq. km. (4,000 sq. mi.), principally in the Lake Isabella area of northern Kern County; beyond the limits of the generally felt area, the shock was reported felt at Miramonte in southeastern Fresno County, and at Pond and Strathmore in western Kern County. No damage was reported. At Bodfish, some stores had items knocked from shelves, small items fell in homes, lamps tipped over; lights dimmed for a moment; loud explosivelike earth noises. Int. V also was reported at California Hot Springs, Kernville, Miracle Hot Springs, Onyx, Posey, and Wofford Heights. Int. IV at California City, Little Lake, Miramonte, Mojave, Piute Mountain area (about 21 km. southeast of Bodfish), Porterville, Springville, Strathmore, and Weldon. Int. I-III at Car-

tago, Johnsondale, Keeler, Pond, and Shafter.

Mar. 9: 07:35:16.2 (15:35). Epicenter 36°48.0′ N., 122°08.7′ W., near coast of central California, in Monterey Bay, at a depth of about 9 km., mag. 4.6, B. **V**. Felt in scattered communities over a narrow coastal zone, from Berkeley and San Francisco to King City, an area of about 9,100 sq. km. (3,500 sq. mi.). No damage was reported. Int. V at Aptos, Boulder Creek, Carmel Valley, Corralitos, Felton, Monterey, Redwood Estates, and Scotts Valley. Int. IV at Berkeley, Capitola, Carmel, Coyote, Davenport, Fort Ord, King City, Moss Landing (Pacific Gas and Electric Powerplant), Mount Hermon, Salinas, San Jose, Santa Cruz, and Seaside. Int. I-III at Ben Lomond, Burlingame, Gilroy, Harris Ranch (about 11 km. south of Hollister), La Honda, Milpitas, Oakland, Pescadero, Salinas (about 14 km. south of), San Francisco, and Woodside. Also felt in the Los Altos Hills area near San Jose.

Mar. 9: 15:15:48.6 (23:15). Epicenter 34°15′ N., 118°23′ W., southern California, at a depth of about 5 km., mag. 2.9, P. Aftershock of San Fernando earthquake. Int. **IV** at Sepulveda. Also felt at Burbank.

Mar. 10: 05:00 (about). Felt at Burbank.

Mar. 11: 07:12:01.6 (15:12). Epicenter 34°07.9′ N., 118°06.9′ W., southern California, at a depth of about 1 km., mag. 2.3, P. Felt in Pasadena area.

Mar. 11: 09:36. Int. **IV** at the Control Gorge Powerplant (about 21 km. northwest of Bishop).

Mar. 14: (In late a.m.). Felt at Burbank.

Mar. 15: 10:15 (about). Int. **III** at Capitola.

Mar. 21: 14:55, 14:58, 16:00 (about). Int. **IV** (first two shocks) about 10 km. south of Paicines. Small shock at 16:00.

Mar. 22: 22:17:13.8 (Mar. 23, 06:17). Epicenter 34°12.2′ N., 118°10.1′ W., southern California, at a depth of about 8 km., mag. 1.9, P. Felt at Altadena and Pasadena.

Mar. 25: 14:54:09.9 (22:54). Epicenter 34°21.4′ N., 118°28.5′ W., southern California, at a depth of about 5 km., mag. 4.2, P. Aftershock of San Fernando earthquake. **V**. Press reported lights went out at the San Fernando State College (Northridge area) and students left classrooms. A 22-story office building in the Wilshire District swayed for several seconds. Also rather strongly felt at Burbank.

Mar. 28: 09:16:25.1 (17:16). Epicenter 34°21.3′ N., 118°28.4′ W., southern California, at a depth of about 6 km., mag. 3.7, P. Aftershock of San Fernando earthquake. Felt in the Los Angeles area. Also felt at Burbank.

Mar. 30: 00:54:43.3 (08:54). Epicenter 34°17.7′ N., 118°27.8′ W., southern California, at a depth of about 3 km., mag. 4.1, P. Aftershock of San Fernando earthquake. **V**. Press reported power and communications equipment failed briefly at the Devonshire Division Station in the Granada Hills area. Also felt in the San Fernando-Sylmar area. No damage was reported.

Mar. 30: 13:11. Int. **IV** at Keene.

Mar. 31: 06:43:52.0 (14:43). Epicenter 40.3° N., 124.2° W., northern California, at a depth of "0" km., mag. 4.1, B. Int. **IV** at Eureka and Ferndale; III at Rio Dell. Also felt at McKinleyville.

Mar. 31: 06:52:22.5 (14:52). Epicenter 34°17.1′ N., 118°30.9′ W., southern California, at a depth of about 2 km., mag. 4.6, P. This was the most damaging aftershock of the San Fernando earthquake. **VII**. Felt over approximately 16,380 sq. km. (6,300 sq. mi.) of Los Angeles, Orange, Kern, Riverside, San Bernardino, Santa Barbara, and Ventura Counties (fig. 6). Principal damage occurred in the Granada Hills-Northridge-Porter Ranch area in the west end of the San Fernando Valley of western Los Angeles County. Press reported six persons were injured when they jumped out of bed onto broken glass. Dislodged gas heaters caused six fires, but all were quickly extinguished by firemen. It was reported that more than 300 homes and business establishments were damaged. Foundations cracked; walls shifted; many chimneys were damaged and many windows broke. Many outdoor concrete garden walls fell. Some waterlines were damaged. Brief power outage. Two hundred chimneys and 300 walls (garden walls) were damaged or destroyed

within a half mile of the intersection of Wilbur Avenue and Kenya Street, in the south Porter Ranch area north of Devonshire Street. "The 48-inch Granada Trunkline, a main water service line, which was out of service for 10 days after the February 9 shock, was leaking again. A 6-inch cast-iron distribution line in Cabriole Street, between Reseda Boulevard and Wilbur Avenue, snapped. Several homes had water leaks. Most of the damage to waterlines seemed to be between Reseda Boulevard and Tampa Avenue, a distance of about a mile east and west, and between San Fernando Mission Road and Rinaldi Street, a few hundred feet north and south. Overall damage was relatively minor." (Department of Water and Power as reported to the press).

Granada Hills.—Felt by all in community; awakened and frightened many. Press reported about 25 homes in the Granada Hills area had cracked foundations and shifted walls. Many outdoor concrete garden walls fell. Windows in homes and stores broke. Power was knocked out briefly in a small area when a bank of transformers was damaged at the Los Angeles Department of Water and Power's Rinaldi Station in Granada Hills. Ground cracked; water was disturbed. Plaster cracked. Furniture shifted. Small objects shifted, overturned, and fell. Lew and others[29] reported the following at Patrick Henry Junior High School:

"The aftershock of March 31, 1971, caused little additional damage. There were a few new plaster cracks, a few damaged ceiling tiles, and some additional flaking of concrete on the previously damaged arcade columns. It is possible that the aftershock could have caused collapse of the arcade if it had not been shored. The damaged arcade has been removed. The entire school is in use."

On the Lower Van Norman Reservoir grounds, at the bottom of the dam on its west end (reservoir keeper's house), no damage was noted, but one person was thrown off balance and fell; buffet on north wall would have fallen had it not been held. "Very hard jolting movement; seemed as strong as the February 9 shock, but didn't last as long. Rapid horizontal and vertical movement." Loud earth noises.

Northridge.—Inside of house was wrecked at 11363 Yolanda Avenue. Three television sets toppled and broke; china cabinet overturned. Glass doors broke. Newly replaced block garden wall collapsed (press). Lew and others[29] reported the following at Northridge Hospital (on Roscoe Blvd., near Reseda):

"The aftershocks of March 31 caused additional damage to the brick veneer. During the aftershock large pieces of the brick veneer were spalled off from the wall, exposing the reinforcement in the shear wall. The building, however, remained in full use after both the February 9 earthquake and the March 31 aftershock." Beckford Avenue School (north of Devonshire and west of Reseda Blvd.): "There was no damage caused by the main shock of February 9, 1971; however, the March 31, 1971, aftershock caused considerable nonstructural damage. Much of the ceiling tile and T-bars at the perimeter of the rooms fell. Most diffuser lenses on the light fixtures fell. One of the portable classroom buildings moved approximately 2 inches. All damaged ceiling sections were removed and the school was reopened. There was extensive damage and collapse of chimneys and masonry garden walls in the residential area directly adjacent to and surrounding the school." Castlebay Lane School: "Repairs were under way when the aftershock of March 31,1971, occurred, causing additional ceramic veneer to fall from the wall, damage to corridor T-bar ceilings which had already been repaired, and extensive cracking of interior plaster at the joints of the gypsumboard lath."

Porter Ranch.—Felt by, awakened, and frightened all in community. Ground cracks; landslides; disturbed water. Chimneys cracked, twisted, and overturned. "Much plaster damage. Damage moderate to great on

[29]See footnote 5 on p. 32.

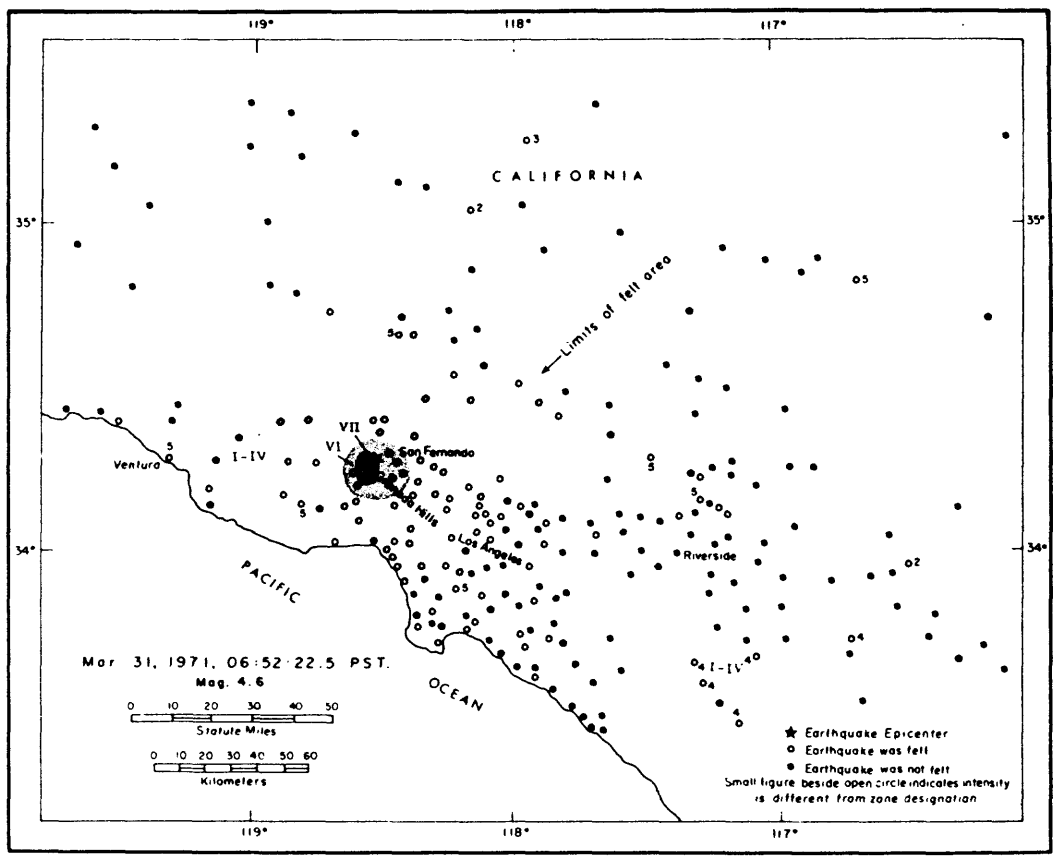

FIGURE 6.—Area affected by southern California earthquake of March 31.

stucco; some wood beams are cracked or twisted. We saw a large cloud of boiling red dust to north of us (observer's home at 19530 Pine Valley Ave., west section of Porter Ranch, northwest of Porter Valley Country Club, near Tampa Ave.) in uninhabited area. The dust cloud was visible for almost 5 minutes." Water sloshed from swimming pools. Furniture overturned; small objects fell. Hanging objects swung violently north-south. Man driving thought he had a flat tire. Loud earth noises. Ground motion was described as a jarring, twisting movement.

INTENSITY VI:

Chatsworth.—Felt by and frightened many, Plaster cracked and broke. Small objects shifted. Trees and bushes shook; vehicles rocked. Hanging objects swung moderately east-west.

North Hollywood.—Felt by all. Water main broke. Hanging objects swung moderately east-west. A man at Sherman Way and Laurel Canyon reported the truck he was sitting in bounced up and down.

Pacoima.—Felt by, awakened, and frightened all in community. Chimneys cracked and twisted. Plaster cracked. Damage slight. Furniture shifted; small objects shifted and fell. Hanging objects swung violently. Building had rolling motion. Moderate earth noises.

Reseda.—Felt by and awakened all; frightened many. Plaster cracked, broke, and fell. Small objects overturned. Trees and bushes shook; vehicles rocked. Hanging objects swung moderately east-west. Moderate earth noises.

Sepulveda.—Felt by and awakened all in community. Plaster cracked, some fell; chimney cracks increased and garage cracks widened. Damage slight. Lamp post swayed violently, seemed to move east-west about 0.3 to 0.4 m. Small objects shifted, overturned, and fell; few glasses broke. Hanging objects swung north-south. "House rocked north-south for about 15 seconds, then stopped, but instantly started heavy rocking again for another 15 seconds." Vehicles rocked.

Sylmar.—Felt by, awakened, and frightened many in community. Few interior and exterior stucco cracks over windows and doors; some previously damaged plaster fell. Movement of outdoor patio caused crack. "With each aftershock we notice new hairline cracks in interior and exterior walls." Damage slight. Furniture shifted; small objects shifted. Hanging objects swung moderately east-west. Trees and bushes shook slightly; vehicles rocked. Moderate earth noises. One observer reported the shock was felt by all who were repairing previously damaged houses, but described it as gentle shake of mild intensity; another reported she was walking outside and barely felt the shock.

INTENSITY V:

Agua Dulce (about 22 km. northeast of Saugus), Altadena (plaster cracked; damage slight), Bear Divide Ranger Station (Little Tujunga Road-Bear Canyon area, about 2.7 km. north-northeast of Pacoima Dam). Beverly Hills, Burbank, Calabasas, Canoga Park (surface cracks in stucco; damage slight), Compton (plaster cracked; damage slight), Covina, Culver City, Downey, El Segundo, Fillmore, Glendale (minor plaster cracks), Honby (east of Saugus; existing plaster cracks opened slightly; additional cracks in exterior stucco), Inglewood, Kagel Canyon area (east of San Fernando; driveway cracks widened; few additional cracks in stucco; damage slight), Lake Hughes, Lytle Creek area (not felt by people interviewed by postmaster, but rocks were reported on road out of Lytle Creek), Marina Del Rey, Mission Hills (damage slight; no details), Newberry Springs (plaster cracked; water pipes broke; damage slight), Newhall (further minor separation of old wood paneling; damage slight), Piru, San Fernando (enlarged existing plaster cracks; additional cracks in concrete around brick; damage slight), San Marino, Santa Monica, Saugus (damage slight; no details), Sherman Oaks, South Pasadena, Sunset Beach, Sun Valley, Thousand Oaks, Topanga, Tujunga, Venice (plaster cracked), Ventura, Waterman (San Bernardino area), and Westwood (West Los Angeles area).

INTENSITY IV:

East Highlands, Elsinore, Florence, Fullerton, Idyllwild, Lake Elizabeth (southeast of Lake Hughes), Leona Valley, Littlerock, Los Angeles, Malibu, Monrovia, Moorpark, Newbury Park, Oxnard, Pearblossom, (about 6 km. south of), Rialto, Santa Paula, Simi, South San Gabriel, Sunland, Temecula, Verdugo City, Westminster, Wildomar, Winchester, and Woodland Hills.

INTENSITY I–III:

Acton, Bellflower, Cantil, Carpinteria, Crestline, Desert Hot Springs, Hacienda Heights, Highland, La Canada, La Puente, Long Beach, Midway City, Mojave, Montclair, Monterey Park, Mount Wilson, Newport Beach, Palos Verdes Peninsula, Pasadena, Rosemead, Sandberg (Sandberg Ranch), San Gabriel, San Pedro, Santa Ana, South Gate, Torrance, and Valyermo.

Mar. 31: 09:03:36.1 (17:03). Epicenter 37°40′ N., 122°32′ W., near coast of central California, at a depth of about 8 km., mag. 3.2, B. **IV**. Press reported the shock was felt by scores of people at Daly City, Pacifica, San Bruno, and San Francisco.

Mar. 31: 17:54:36.1 (Apr. 1, 01:54). Epicenter 34°13′ N., 118°33.3′ W., southern California, at a depth of about 10 km., mag. 3.4, P. Int. **IV** at Fillmore.

Apr. 1: 07:03:03.8 (15:03), 13:15:37.2 (21:15), 13:18:35.6 (21:18), 13:55:48.5 (21:55), 21:40:25.0 (Apr. 2, 05:40). Epicenter

(1) 34°24.7′ N., 118°25.2′ W.; (2) 34°20.5′ N., 118°28.8′ W.; (3) 34°23.7′ N., 118°25.7′ W.; (4) 34°14.2′ N., 118°34.0′ W.; (5) 34°17.0′ N., 118°31.7′ W., southern California, at depths of about 7, 2, 7, 7, and 3 km., respectively, mag. 4.2, 3.2, 3.5, 2.9, and 4.0, respectively, P. Aftershocks of San Fernando earthquake. All shocks were felt in the San Fernando Valley. No damage was reported. The shock at 07:03 was int. **IV** at North Hollywood; III at Burbank. Also felt at Fairmont Reservoir (near Lake Hughes) and at Sepulveda (four shocks felt). The shock at 21:40 was int. III at West Los Angeles; also felt at Burbank.

Apr. 2: 00:10. Int. **IV** at Scotia.

Apr. 3: 18:22:40.0 (Apr. 4, 02:22). Epicenter 40.7° N., 124.5° W., off coast of northern California, at a depth of 2 km., mag. 3.6, B. Int. **IV** at Eureka. Also felt at McKinleyville.

Apr. 9: 15:00:29.0 (23:00). Epicenter 32°31.1′ N., 117°04.6′ W., California-Mexico border region, at a depth of about 8 km., mag. 3.3, P. Int. **III** at Imperial Beach.

Apr. 15: 03:14:32.0 (11:14), 08:04:16.2 (16:04). Epicenter (1) 34°15.9′ N., 118°34.6′ W.; (2) 34°14.1′ N., 118°33.2′ W., southern California, at depths of about 4 and 10 km., respectively, mag. 4.2 and 3.3, respectively, P. Aftershocks of San Fernando earthquake. V. Press reported the shock at 03:14 jarred wide parts of Los Angeles County and portions of Orange County. Police at the Devonshire Division (Granada Hills area) reported numerous calls were received describing a concussionlike motion. At Sepulveda, slight plaster cracking occurred around chimney; loud rumble preceded shock; house rocked north-south. Int. IV at Calabasas, South Gate, and West Los Angeles; III at Burbank. Second shock also was reported felt.

Apr. 16: 04:58:31.7 (12:58). Epicenter 36°48.0′ N., 122°11.0′ W., near coast of central California, in Monterey Bay, at a depth of about 8 km., mag. 4.5, B. V. Felt principally in the Monterey Bay region. Other than enlarged cracks in ceiling at Big Basin State Park (about 8 km. northwest of Boulder Creek), the principal effect was awakening of people. Int. V at Aptos, Ben Lomond, Big Basin State Park, Big Sur, Boulder Creek, Capitola, Corralitos, Jamesburg area (Search Ranch), La Selva Beach, Marina, Monterey, Monterey Bay Academy (Watsonville), Moss Landing, Mount Madonna State Park (about 13 km. northwest of Gilroy), Pacific Grove, Scotts Valley, Seaside, and Soquel. Int. IV at Carmel, Carmel Valley, Castroville, Fort Ord, Freedom, Gilroy, Gonzales, Hollister, Los Gatos, Mount Hermon, Salinas, San Juan Bautista, Santa Cruz, and Spreckels. Int. II at Watsonville.

Apr. 18: 22:30:10.0 (Apr. 19, 06:30). Epicenter 40°49.0′ N., 123°31.0′ W., northern California, at a depth of about 2 km., mag. 3.8, B. Int. **IV** at Bridgeville, Eureka, and Rio Dell; III at Ferndale.

Apr. 21: 01:58. Int. **II** at Control Gorge Powerplant (about 24 km. northwest of Bishop).

Apr. 25: 06:48:06.5 (14:48). Epicenter 34°22.1′ N., 118°18.9′ W., southern California, at a depth of about 2 km., mag. 4.0, P. Aftershock of San Fernando earthquake. V. Felt by all in community at Sepulveda; awakened and frightened many. Press reported several police stations in the San Fernando Valley and West Los Angeles areas also had reports of the shock being felt. Int. IV at Burbank and in West Los Angeles area; III at Altadena. Also felt at Canoga Park and Claremont.

Apr. 26: 05:30:26.4 (13:30). Epicenter 33°50.8′ N., 117°58.5′ W., southern California, at a depth of about 8 km., mag. 2.7, P. Felt at Long Beach.

Apr. 26: 21:01:47.7 (Apr. 27, 05:01), 21:32:39.0 (Apr. 27, 05:32). Epicenter (1) 39°25.8′ N., 120°15.6′ W.; (2) 39°30.0′ N., 120°12.2′ W., northern California, at depths of 5 and 2 km., respectively, mag. 4.4 and 3.8, respectively, B. V. The main shock at 21:01 was felt over about 13,000 sq. km. (5,000 sq. mi.) of California and western Nevada, principally in the region northwest of Lake Tahoe, in western Nevada, and Placer and Sierra Counties, Calif. Only very slight

damage was reported: At Sierra City, mortar was slightly crushed where tall brick fireplace joins wall of house. At Sierraville (about 16 km. northwest of epicenter), sheetrock seams were slightly cracked in corners of rooms. Rocks reportedly fell at Norden (west of Truckee). At Grizzly Valley Dam (about 32 km. north by west of Sierraville), about 8 cu.m. of rock and decomposed granite fell from a steep slope above the lower control house access road. At Frenchman's Dam (about 24 km. east of Grizzly Valley Dam), it was reported no damage or disturbances were observed except that a crack may have opened very slightly in the concrete of the spillway's left retaining wall.

INTENSITY V:

Boca Dam (about 11 km. northeast of Truckee).—Felt by, awakened, and frightened all in community. Small objects shifted, overturned, and fell. Hanging objects swung moderately south-north. Loud, booming earth noises. At 21:32 a moderate north-south rocking lasted about 45 seconds.

Calpine.—Felt by all. One jolt.

Floriston.—Felt by and frightened many in community. Both shocks felt. Rumbling earth noises preceded first shock.

Homewood.—Felt by and awakened all in home, many in community.

Iowa Hill.—Felt by and awakened many in community. Very slight shock at 21:32.

Johnsville.—Felt by all in community.

Loyalton.—Felt by and awakened many in community. Hanging objects swung moderately north-south.

Norden.—Felt by all in community. Rocks fell on roads. Loud earth noises. Three shocks. Heavy shock on Donner Pass.

Sattley.—Felt by all and frightened many in community. Hanging objects swung moderately north-south. Loud earth noises like heavy wind approaching. Light shock at 21:32. In sec. 30, T.21N., R.14E. (rural route, Sattley), frying pan slid out of cupboard. Pet mountain lion frightened.

Sierra City.—Felt by and frightened many in community. Slight crushing of mortar where tall brick fireplace chimney joins side wall of house. Hanging objects swung moderately south-north. Loud, rumbling earth noises, like jet planes, heard before and after each felt earth motion.

Sierraville.—Felt by all and frightened many in community. Sheetrock seams slightly cracked in corners of rooms. Loud earth noises like strong blast of wind approaching. Shock at 21:32 also felt. Slight shock felt at 04:20 on April 27.

Soda Springs.—Felt by many; awakened all and frightened few in community. Loud earth noises.

Tahoe City.—Awakened many and frightened few. Strongly felt (press).

Truckee (Truckee Ranger Station, sec. 10, T.17N., R.16E.).—Felt by many and frightened few in community. Furniture moved in east direction. Damage slight (no details). Both shocks felt.

INTENSITY V IN NEVADA:

Verdi (about 16 km. west of Reno).—Felt by, awakened, and frightened many in community. Hanging objects swung moderately west-east.

INTENSITY IV:

Alta (both shocks felt), Beckwourth, Big Bend Ranger Station (west of Soda Springs, sec. 28, T.17N., R.13E.), Blairsden, Camptonville, Downieville, Emigrant Gap, Foresthill and Foresthill Ranger Station (At the ranger station, the second shock seemed stronger; street-light pole shook.), Genessee, Gold Run, Greenville and Greenville Ranger Station, Kings Beach, Meadow Valley, Meeks Bay, Placerville, Portola, Quincy, Strawberry Valley, Tahoe Vista, Taylorsville, Vinton, and Washington.

INTENSITY IV IN NEVADA

Reno and Silver City.

INTENSITY I–III:

Baxter (both shocks felt), Carnelian Bay, Grass Valley, Pollock Pines, and Woodleaf.

INTENSITY I–III IN NEVADA:
Fernley.

Apr. 27: 04:20. Slight shock felt at Sierraville.

Apr. 29: 05:23:40.1 (13:23). Epicenter 34°20.7′ N., 118°26.9′ W., southern California, at a depth of about 10 km., mag. 3.2, P. Aftershock of San Fernando earthquake. Reported felt (no location given).

Apr. 30: 20:25:26.6 (May 1, 04:25). Epicenter 34°26.0′ N., 118°24.1′ W., southern California, at a depth of about 5 km., mag. 3.6, P. Aftershock of San Fernando earthquake. Felt at Burbank.

May 2: 03:42:45.1 (11:42). Epicenter 34°14.3′ N., 118°28.4′ W., southern California, at a depth of about 11 km., mag. 3.0, P. Aftershock of San Fernando earthquake. Int. **IV** at West Los Angeles. Also felt in San Fernando Valley.

May 3: (No time given). Int. **IV** at Downieville.

May 9: 16:52:01.8 (May 10, 00:52). Epicenter 37°52.7′ N., 122°15.9′ W., central California, at a depth of about 14 km., mag. 2.8, B. Felt at El Cerrito, Oakland, and Richmond.

May 12: 17:39:13.5 (May 13, 01:39). Epicenter 37°51.5′ N., 122°15.4′ W., central California, at a depth of about 14 km., mag. 2.8, B. Int. **IV** at Berkeley.

May 18: 05:16:55.2 (13:16). Epicenter 34°24.2′ N., 118°24.5′ W., southern California, at a depth of about 11 km., mag. 3.2, P. Aftershock of San Fernando earthquake. Reported felt (no location given).

May 20: 03:27:03.7 (11:27). Epicenter 37°31.0′ N., 118°31.0′ W., California-Nevada border region, at a depth of about 2 km., mag. 3.2, B. Int. **IV** at Control Gorge Powerplant about 24 km. northwest of Bishop.

May 24: 04:37:11.0 (12:37). Epicenter 34°24.3′ N., 118°25.3′ W., southern California, at a depth of about 15 km., mag. 3.5, P. Aftershock of San Fernando earthquake. Reported felt (no location given).

May 25: 02:02:52.9 (10:02). Epicenter 33°07.3′ N., 116°21.0′ W., southern California, at a depth of about 8 km., mag. 4.1, P. Reported felt at El Cajon, Escondido, Jamul, La Mesa, and in metropolitan San Diego. No damage was reported.

May 31: 06:42:36.0 (14:42). Epicenter 33°39.9′ N., 118°07.5′ W., southern California, at a depth of about 9 km., mag. 2.6, P. Felt at West Los Angeles. Also felt in the Beverly Hills-Culver City area.

May 31: 07:59:52.1 (15:59). Epicenter 34°05.3′ N., 118°19.5′ W., southern California, at a depth of about 8 km., mag. 2.0, P. Int. **III** in the Windsor Hills area (north of Inglewood). Also felt in the Beverly Hills-Culver City area.

June 1: 01:25:09.2 (09:25). Epicenter 34°22.3′ N., 118°23.4′ W., southern California, at a depth of about 17 km., mag. 3.5, P. Aftershock of San Fernando earthquake. Felt at Burbank.

June 8: 13:43:17.5 (21:43). Epicenter 37°36.1′ N., 122°01.2′ W., central California, at a depth of 6 km., mag. 3.2, B. V. Felt over a small area of southwest Alameda County, principally in the Alvarado-Union City area where many were frightened; some thought a bomb had exploded. Press reported two windows were cracked at the Manuel White School, and that a new crack in the floor of the auditorium at the Alvarado School was possibly caused by the earthquake. A woman on Tamarack Drive reported two bedroom windows were broken. A fireman at the Decoto Fire Station said a few minor cracks appeared in the building. Small, light objects fell at 1824 Whipple Road. At the White Front warehouse at 1600 Whipple Road, it felt as if a truck had hit the building. At Hayward, felt by all; frightened few; small objects shifted. Int. IV at Fremont, Newark, and Niles; I-III at Castro Valley, Mount Eden, and Mission San Jose.

June 15: 23:48:34.5 (June 16, 07:48). Epicenter 34°09.2′ N., 118°09.0′ W., southern California, at a depth of about 8 km., mag. 2.5, P Int. **IV** at Altadena. Also felt at Pasadena.

June 17: 07:21:15.0 (15:21). Epicenter 40°17′ N., 124°23′ W., near coast of northern California, at a depth of about 15 km., mag.

3.5, B. Int. **III** at Ferndale.

June 19: 00:17:58.5 (08:17). Epicenter 36°56.3′ N., 121°38.5′ W., central California, at a depth of 8 km., mag. 3.7, B. **V**. Felt by all in community at Corralitos (about 16 km. west of Gilroy); awakened many; frightened few. Sharp cracking noise; then rocking and moderate rumbling. Felt by, awakened, and frightened many at Gilroy. A strong jolt; brief duration. Loud earth noises like a sonic boom. Int. IV at Aromas, Mount Madonna State Park (about 13 km. northwest of Gilroy), and Watsonville. Int. I-III about 6 km. north of Aptos, Morgan Hill, and Santa Cruz.

June 20: 21:04:11.2 (June 21, 05:04). Epicenter 34°06.5′ N., 118°10.4′ W., southern California, at a depth of about 5 km., mag. 2.0, P. Felt at Altadena.

June 21: 01:19:21.8 (09:19), 01:30:00.0 (09:30), 02:07:41.7 (10:07), 08:01:08.5 (16:01), 11:45, 16:24:25.0 (June 22, 00:24). Epicenter (1) 34°13.4′ N., 118°14.0′ W.; (2) 34°15.0′ N., 118°17.0′ W.; (3) 34°12.2′ N.; 118°12.4′ W.; (4) 34°16.4′ N., 118°31.9′ W.; (5) 34°12.9′ N., 118°12.7′ W., southern California, at depths of about 1, 8, 2, 4, and 6 km., respectively, mag. 2.0, 1.5, 1.8, 4.0, and 3.1, respectively, P. **VI**. Press reported two schools originally damaged in the February 9 earthquake suffered additional damage. More beams were cracked at Frost Junior High School, at Granada Hills, and at Castle Bay Lane School (under construction) at Northridge. Water sloshed from swimming pools. Refrigerator toppled in home. Telephone service was disrupted in one area of the San Fernando Valley. Int. V at Sepulveda (plaster cracked; damage slight). Observer at Sepulveda reported: "I did not feel any other shocks (other than 08:01) during the day but the neighbors did." Workmen at the Olive View Hospital vacated the building for a while. Int. III at Burbank (08:01); shock also felt at 16:24. Press reported the shock at 08:01 was slightly felt in the Santa Monica Bay area.

June 22: 02:41:19.0 (10:41). Epicenter 33°44.9′ N., 117°28.7′ W., southern California, at a depth of about 8 km., mag. 4.2, P. Epicenter near Glen Ivy Hot Springs between Corona and Elsinore in western Riverside County. V. Felt principally in Riverside and Orange Counties, but also felt in scattered communities of San Bernardino, San Diego, and Los Angeles Counties. A press report stated plaster fell from a porch at Santa Ana. Residents of Elsinore said there was considerable wave action on Lake Elsinore. Water sloshed out of swimming pool at the Western White House in San Clemente and security alarms were activated. Security alarms also were activated in several other Orange County cities. Int. V at Bonsall, Bryn Mawr, Corona, Dana Point, Elsinore, El Toro, Escondido, Fontana, Homeland, Perris, Riverside, Rubidoux, San Juan Capistrano, Silverado, Sunnymead, Temecula, Trabuco Canyon, and Wildomar. Int. IV at Big Bear City, Chino, Cucamonga, East Highlands, Etiwanda, Fallbrook, Fullerton, Gilman Hot Springs, Glendora, Guatay, Hemet, Idyllwild, La Canada, Lynwood, Lytle Creek, Maywood, Moreno, Newport Beach, Nuevo, San Bernardino, Villa Park, Vista, Westminster, and Winchester. Int. I-III at Desert Hot Springs, Laguna Beach, Lake Arrowhead, San Jacinto, Sierra Madre, Temple City, and Whittier.

June 22: 17:34:00.2 (June 23, 01:34). Epicenter 34°06.4′ N., 117°22.0′ W., southern California, at a depth of about 17 km., mag. 3.0, P. Felt at San Bernardino.

June 26: 05:58:12.4 (13:58). Epicenter 37°37.8′ N., 122°30.7′ W., near coast of central California, at a depth of about 9 km., mag. 2.7, B. Felt at Daly City and Pacifica.

June 26: 13:20:08.3 (21:20). Epicenter 34°21.2′ N., 118°20.0′ W., southern California, at a depth of about 10 km., mag. 2.8, P. Aftershock of San Fernando earthquake. Felt at San Fernando.

July 2: 01:18:32.7 (09:18). Epicenter 34°14.8′ N., 117°31.9′ W., southern California, at a depth of about 8 km., mag. 3.5, P.

Int. **IV** at Etiwanda.

July 7: 21:34:00.9 (July 8, 05:34). Epicenter 36°52.1′ N., 121°37.7′ W., central California, at a depth of about 6 km., mag. 3.2, B. Int. **IV** at Harris Ranch (about 11 km. south of Hollister).

July 16: 08:39:12.0 (16:39). Epicenter 33°59.0′ N., 118°21.4′ W., southern California, at a depth of about 13 km., mag. 2.6, P. Felt at Culver City. At Manhattan Beach, furnace cover and wall decoration rattled but no motion was felt.

July 21: 19:18:00.0 (July 22, 03:18). Epicenter 34°27.8′ N., 118°27.1′ W., southern California, at a depth of about 13 km., mag. 3.3, P. Felt at Saugus.

July 25: 01:13:28.9 (09:13). Epicenter 37°41.6′ N., 122°30.5′ W., near coast of central California, at a depth of about 3 km., mag. 3.4, B. Int. **IV** at Daly City and San Francisco. Also felt at Berkeley.

July 25: 09:31:29.9 (17:31). Epicenter 34°00.3′ N., 117°14.0′ W., southern California, at a depth of about 8 km., mag. 3.1, P. Felt at San Bernardino.

July 31—Aug. 1: July 31: 17:36:25.7 (Aug. 1, 01:36), 22:08:21.1 (Aug. 1, 06:08), 22:11:13.6 (Aug. 1, 06:11), 22:37:48.5 (Aug. 1, 06:37); Aug. 1: 00:36:27.7 (08:36), 20:44:44.0 (Aug. 2, 04:44). Epicenter (1) 36°48.8′ N., 120°02.2′ W.; (2) 36°49.5′ N., 120°02.4′ W.; (3) 36°52.1′ N., 120°00.9′ W.; (4) 36°48.2′ N., 120°01.9′ W.; (5) 36°47.8′ N., 120°01.5′ W.; (6) 36°49.2′ N., 120°01.9′ W., central California, all at a depth of about 1 km., mag. 2.6, 2.8, 2.6, 2.5, 2.7, and 3.1, respectively, B. **V**. The main shock of the series at 20:44 on August 1 was felt by many and shifted furniture at Biola, about 10 km. northwest of Kerman. Moderate earth noises were heard. Int. IV at Kerman. Observer at Biola reported: "Shock also felt on July 31 at about 20:44, perhaps a little earlier. People in the community felt 3 or 4 shocks on Saturday night, July 31." Berkeley Seismographic Station reported that 12 other shocks with magnitudes less than 3 occurred in this area during the next 2 days.

Aug. 6: 14:29:48.3 (22:29). Epicenter 39°30.3′ N., 122°06.5′ W., northern California, at a depth of about 8 km., mag. 3.8, B. Int. **IV** at Berry Creek, Chico, Colusa, Glenn, Gridley, and Willows. Int. I-III at Biggs, Durham, Forest Ranch, Maxwell, Meridian, and Princeton.

Aug. 7: (No time given). Light tremor felt at Loyalton (press).

Aug. 17: 20:01:36.5 (Aug. 18, 04:01). Epicenter 37°50.1′ N., 121°57.8′ W., central California, at a depth of about 15 km., mag. 2.9, B. Int. **IV** at Danville. Also felt at Berkeley.

Aug. 22: 06:45:18.2 (14:45). Epicenter 34°10.5′ N., 118°16.1′ W., southern California, at a depth of about 11 km., mag. 2.6, P. Felt at Los Angeles in the Silver Lake District.

Aug. 23: 20:45:47.0 (Aug. 24, 04:45). Epicenter 33°50.0′ N., 118°10.0′ W., southern California, at a depth of about 8 km., mag. 2.7, P. Felt at Long Beach.

Aug. 24: 13:09:31.2 (21:09). Epicenter 34°24.6′ N., 118°23.4′ W., southern California, at a depth of about 10 km., mag. 3.2, P. Aftershock of San Fernando earthquake. Reported felt (no location given).

Sept. 4: 05:28:40.3 (13:28). Epicenter 36°56.7′ N., 121°37.0′ W., central California, at a depth of about 6 km., mag. 2.8, B. Int. **IV** at Freedom; II about 6 km. north of Aptos.

Sept. 9: 22:40:37.5. About 63 km. off coast of Arcata; poorly recorded; mag. 3.5, B. Int. **IV** at Bayside; II at Ferndale.

Sept. 12: 11:32:38.0 (19:32). Epicenter 41°17.9′ N., 123°40.4′ W., northern California, at a depth of about 20 km., mag. 4.6, B. **V**. Felt over about 7,800 sq. km. (3,000 sq. mi.) in areas of Del Norte, Humboldt, and Siskiyou Counties. Small objects fell at

Gasquet Ranger Station (sec. 20, T.17N., R.2E.). At Happy Camp Ranger Station (Happy Camp), a shelf fell and broke jars of food. Felt by all and frightened few in community at Hoopa. Felt by all in community at Loleta; loud earth noises. Windows cracked slightly at Scott Bar Mountain Lookout (sec. 15, T.44N., R.11W.). Int. IV at Arcata, Ferndale, Kneeland, Orleans, Somesbar, and Willow Creek. Int. I-III at Eureka and Rio Dell. Also felt at Fortuna, Klamath Glen (about 6 km. southeast of Klamath), McKinleyville, Orick, Trinidad, and Waddington (about 6 km. southeast of Ferndale).

Sept. 16: 03:41:17.0 (11:41). Epicenter 34°05.0′ N., 118°20.0′ W., southern California, at a depth of about 8 km., mag. 2.5, P. Felt at Los Angeles in the Wilshire District.

Sept. 17: 10:43:34.1 (18:43), 13:34:35.6 (21:34). Epicenter (1) 37°51.4′ N., 122°15.7′ W.; (2) 37°51.3′ N., 122°15.0′ W., central California, at a depth of 11 km., mag. 2.8 and 2.7, respectively, B. First shock was felt at Berkeley, Oakland, and San Francisco; second shock was felt at Berkeley.

Sept. 17: 12:11:30.6 (20:11). Epicenter 40.2° N., 124.8° W., off coast of northern California, at a depth of about 17 km., mag. 3.8, B. Int. **IV** at Ferndale and Garberville; III at Eureka.

Sept. 20: 07:48:20.8 (15:48). Epicenter 40°17.6′ N., 124°49.9′ W., off coast of northern California, at a depth of about 19 km., mag. 4.1, B. Int. **IV** at Ferndale.

Sept. 27: 12:59:03.8 (20:59). Epicenter 34°14.9′ N., 119°21.6′ W., southern California, at a depth of about 2 km., mag. 3.1, P. Felt at Ventura.

Sept. 27: 19:53:19.9 (Sept. 28, 03:53). Epicenter 33°57.8′ N., 117°52.0′ W., southern California, at a depth of about 6 km., mag. 3.2, P. Press reported the shock was felt in parts of Los Angeles and Orange Counties. Int. **IV** at Anaheim, City Of Industry, and Whittier, where it was reported that police and sheriff's offices were flooded with calls. Small aftershocks were reported. Also felt at Brea, Fullerton, La Habra, Orange, and Santa Ana.

Sept. 30: 14:46:11.3 (22:46). Epicenter 33°02.3′ N., 115°49.2′ W., southern California, at a depth of about 8 km., mag. 5.1, P. The epicenter is about 16 km. west of Brawley on the Superstition Hills fault in the Imperial Valley. **VI**. Felt over an area of about 16,900 sq. km. (6,500 sq. mi.). Outside this main felt area the shock was felt with slight intensity at Laguna Hills, Leucadia, San Diego, San Onofre Nuclear Generating Plant, and at Ehrenberg, Ariz. Press reported a few small aftershocks were felt in the epicentral area, but none at Brawley. At a home about 11 km. west of Westmorland, on Highway 86, a woman was very frightened; some dishes fell and a vase "went clear across the room." A person outside said, "It raised the dirt right up." Some food fell off shelves at another home near the epicenter. A woman about 11 km. northwest of Brawley reported violent shakes. She was knocked off her feet and dishes fell to the floor.

INTENSITY V:

Brawley, Calipatria, El Centro, Heber, Imperial, Ocotillo, and Westmorland.

INTENSITY IV:

Borrego Springs (sec. 36, T.10S., R.5E.), Boulevard, Calexico, Cathedral City, Holtville, Idyllwild, Indio, Jacumba, Mecca, Miramar (Naval Air Station), Niland, Ocotillo Wells (near; at Desert Ironwoods Motel), Palm Desert, Pine Valley, Potrero, Ranchita, Rancho Mirage, Tecate, Warner Springs, and Winchester.

INTENSITY I–III.

Anza, Cabazon (in area of San Gorgonio Pass), Calimesa, Gilman Hot Springs, Guatay, Laguna Hills, La Quinta, Leucadia, Mount Laguna, Palm Springs, Plaster City, San Jacinto, San Onofre (San Onofre Nuclear Generating Station), Santa Ysabel,

Santee, and Wildomar.

INTENSITY I–III IN ARIZONA:

Ehrenberg.

Oct. 2: 13:25:29.5 (21:25). Epicenter 35°40.0′ N., 118°26.5′ W., central California, at a depth of about 8 km., mag. 3.1, P. Int. **IV** at Bodfish; II at Kernville and Mojave.

Oct. 2: 19:24:43.3 (Oct. 3, 03:24). Epicenter 34°12.7′ N., 117°29.7′ W., southern California, at a depth of about 8 km., mag. 3.0. Int. **IV** at Etiwanda and Lytle Creek.

Oct. 6: 06:43:30.6 (14:43). Epicenter 35°51.3′ N., 120°22.5′ W., central California, at a depth of about 9 km., mag. 3.4, B. Int. **IV** at Cholame (Alley Ranch), Parkfield (Durham Ranch), and Shandon.

Oct. 10: 06:51:26.7 (14:51). Epicenter 40°18.1′ N., 124°41.1′ W., off coast of northern California, at a depth of 12 km., mag. 3.3, B. Int. **IV** at Petrolia; III at Ferndale.

Oct. 10: 07:26:35.9 (15:26). Epicenter 33°44.6′ N., 117°30.6′ W., southern California, at a depth of about 8 km., mag. 3.5, P. Int. **IV** at Riverside.

Oct. 12: 19:52. Int. **III** at Leucadia.

Oct. 13: 09:41:05.8 (17:41). Epicenter 38°19.6′ N., 122°38.7′ W., northern California, at a depth of about 10 km., mag. 3.5, B. Int. **IV** at Cotati, Glen Ellen, and Penngrove. Also felt at Rohnert Park and San Francisco.

Oct. 16: 04:49. Int. **II** at Ferndale.

Oct. 18: 13:08:29.6 (21:08). Epicenter 33°52.7′ N., 116°31.9′ W., southern California, at a depth of about 8 km., mag. 3.1, P. Felt at Palm Springs.

Oct. 21: 14:09:45.4 (22:09). Epicenter 35°58.8′ N., 120°59.2′ W., central California, at a depth of 9 km., mag. 3.7, B. **V**. Felt by many at San Ardo. Small objects shifted. Int. IV at Jolon, King City, Lockwood, Mee Ranch, Pine Canyon, and San Lucas.

Oct. 23: 00:57:05.2 (08:57). Epicenter 34°47.5′ N., 118°56.2′ W., southern California, at a depth of about 8 km., mag. 2.7, P. Int. **II** at Frazier Park.

Oct. 25: 10:39:34.2 (18:39). Epicenter 34°20.5′ N., 118°25.0′ W., southern California, at a depth of about 16 km., mag. 2.8, P. Aftershock of San Fernando earthquake. Felt at Newhall.

Oct. 26: 18:38:39.6 (Oct. 27, 02:38). Epicenter 34°19.8′ N., 118°26.2′ W., southern California, at a depth of about 8 km., mag. 2.6, P. Aftershock of San Fernando earthquake. Felt at Newhall.

Oct. 27: 22:29:10.9 (Oct. 28, 06:29). Epicenter 34°19.7′ N., 118°16.0′ W., southern California, at a depth of about 8 km., mag. 2.7, P. Felt at Glendale and Pasadena.

Oct. 29: 16:53:59.4 (Oct. 30, 00:53). Epicenter 39°31.7′ N., 123°09.0′ W., northern California, at a depth of about 12 km., mag. 3.1, B. Felt at the Pacific Gas and Electric Mendocino Substation, about 3 km. north of Calpella.

Oct. 30: 19:08:37.0 (Oct. 31, 03:08). Epicenter 35°40.9′ N., 118°18.9′ W., central California, at a depth of about 8 km., mag. 3.3, P. Felt at Lake Isabella.

Nov. 4: 00:22:09.0 (08:22), 11:17:32.8 (19:17). Epicenter (1) 34°19.0′ N., 118°28.4′ W.; (2) 34°25.6′ N., 118°26.8′ W., southern California, at depths of about 8 and 20 km., respectively, mag. 2.6 and 3.0, respectively, P. Aftershocks of San Fernando earthquake. Reported felt (no location given).

Nov. 11: 23:32:49.5 (Nov. 12, 07:32). Epicenter 40°15.6′ N., 124°29.8′ W., off coast of northern California, at a depth of about 17 km., mag. 3.8, B. Int. **IV** at Eureka (Humboldt Hill), Ferndale, Petrolia, and Rio Dell.

Nov. 17: 05:01:01.7 (13:01). Epicenter 34°29.2′ N., 118°25.1′ W., southern California, at a depth of about 4 km., mag. 2.9, P. Aftershock of San Fernando earthquake. Felt at Saugus.

Nov. 17: 20:03:52.4 (Nov. 18, 04:03).

Epicenter 36°14.5′ N., 120°50.6′ W., central California, at a depth of about 7 km., mag. 3.4, B. Int. **IV** at King City and at the Mee Ranch (intersection of Highways 25 and 198). Int. II at Priest Valley.

Nov. 18: 05:49:34.8 (13:49). Epicenter 34°25.4′ N., 118°26.3′ W., southern California, at a depth of about 8 km., mag. 2.3, P. Felt at Saugus.

Nov. 20: 05:59:02.6 (13:59), 06:26:03.0 (14:26). Epicenter (1) 40°17.0′ N., 124°46.7′ W.; (2) 40°18.4′ N., 124°46.1′ W., off coast of Cape Mendocino, at a depth of 25 km., mag. 4.9 and 3.3, respectively, B. **V**. Widely felt along the coastal area of Humboldt County. Press told of objects falling from shelves from Ferndale to Eureka. No damage was reported. Int. V at Alderpoint, Carlotta, Eureka, Ferndale, Fields Landing, Fortuna, Honeydew, Loleta, Miranda, Petrolia (very slight shock at 06:26), Redcrest, Rio Dell, Samoa, Scotia, and Whitethorn. Int. IV at Bayside, Bridgeville, Fort Seward, Hydesville, and Phillipsville.

Nov. 24: 03:19:59.4 (11:19). Epicenter 34°29.6′ N., 118°24.7′ W., southern California, at a depth of about 19 km., mag. 3.0, P. Felt at Newhall.

Nov. 24: 10:13:22.0 (18:13). Epicenter 35°41.0′ N., 118°21.0′ W., central California, at a depth of about 8 km., mag. 4.0, P. **V**. Felt by all and frightened few in community at Weldon. Strong rocking motion. Vehicles rocked. Int. IV at Bodfish, Caliente, Glennville, Kernville, Lake Isabella, Miracle Hot Springs, Onyx (two shocks followed in about 10 minutes), and Wofford Heights. Int. I-III at Camp Nelson, Johannesburg, and Posey.

Nov. 25: 22:55. Int. **II** at Frazier Park.

Nov. 26: 09:13:18.0 (17:13). Epicenter 33°57.3′ N., 118°19.8′ W., southern California, at a depth of about 8 km., mag. 3.0, P. Int. **IV** at Manhattan Beach and Maywood. Also felt at La Mirada and Los Angeles in the Exposition Park, Westwood, and Wilshire areas.

Dec. 2: 19:04:57.4 (Dec. 3, 03:04). Epicenter 34°25.0′ N., 118°25.8′ W., southern California, at a depth of about 20 km., mag. 3.0, P. Aftershock of San Fernando earthquake. Felt at Pacoima.

Dec. 3: 13:31:27.0 (21:31). Epicenter 33°55.0′ N., 118°20.0′ W., southern California, at a depth of about 8 km., mag. 2.3, P. Felt at West Los Angeles.

Dec. 11: 13:35:12.4 (21:35), 21:53:36.9 (Dec. 12, 05:53). Epicenter 37°45.4′ N., 122°09.0′ W., central California, at depths of about 9 and 7 km., respectively, mag. 3.4 and 3.1, respectively, B. Int. **IV** at Berkeley (shock also felt at 21:53), Castro Valley (also 21:53), Hayward, Moraga (Saint Mary's College), Oakland (shock also felt at 21:53), Piedmont, and San Leandro (slight shock at 21:53). Int. I-III at San Mateo. Also felt at Walnut Creek.

Dec. 13: 05:07:37.7 (13:07). Epicenter 40°21.8′ N., 121°31.8′ W., northern California, at a depth of about 2 km., mag. 3.6, B. Int. **IV** at Camp Tehama, about 5 km. east of Mill Creek.

Dec. 13: 12:44:40.0 (20:44). Epicenter 34°46.9′ N., 118°52.2′ W., southern California, at a depth of about 8 km., mag. 3.5, P. **V**. Felt by and frightened many at Lebec. Int. III at Frazier Park.

Dec. 19: 06:12:53.7 (14:12). Epicenter 36°40.1′ N., 121°20.9′ W., central California, at a depth of 5 km., mag. 3.2, B. Int. **IV** at Harris Ranch about 11 km. south of Hollister.

Dec. 21: 00:40:19.0 (08:40). Epicenter 34°47.0′ N., 118°54.0′ W., southern California, at a depth of about 8 km., mag. 3.0, P. Felt at Frazier Park.

Dec. 24: 03:34:45.8 (11:34). Epicenter 34°24.8′ N., 118°26.0′ W., southern California, at a depth of about 8 km., mag. 3.5, P. Felt at Saugus.

Dec. 28: 14:20, 14:32, 14:33:52.9 (22:33), 14:38:55.4 (22:38), 14:57:04.0 (22:57), 16:25:35.6 (main shock) (Dec. 29, 00:25), 16:38, 17:35:36.3 (Dec. 29, 01:35), 17:37:13.6 (Dec. 29, 01:37). Epicenter (1) 36°41.0′ N., 121°22.2′ W.; (2) 36°40.8′ N., 121°22.4′ W.; (3) 36°41.1′ N., 121°21.4′ W.; (4) 36°40.3′ N., 121°21.5′ W.; (5) 36°41.0′ N., 121°21.9′ W.; (6) 36°40.8′ N., 121°22.2′ W., central California, all at a depth of about 6 km., mag.

3.7, 3.1, 2.8, 3.9, 2.7, and 3.7, respectively, B. V. Reports are for the main shock at 16:25 unless otherwise stated. Felt by all and frightened few at the Almaden Winery, about 14 km. south of Hollister on Cienega Road (other shocks felt at 14:20, one about 15 seconds later, 16:38, 17:35, and 17:37). Felt by all at Hollister (also several earlier light shocks felt). Plaster cracked slightly and objects fell from shelves at the Libby Ranch, about 4 km. southwest of Paicines. Felt by all and frightened few in community at Paicines; small objects overturned (seven shocks felt). About 10 km. south of Paicines on Live Oak Road, "slight cracks around plasterboard." Int. IV at several ranches in the Cienega Road area south of Hollister (at Harris Ranch; shocks also felt at 14:32, 14:33, 14:38, 14:57, and 17:37), and Salinas (three shocks felt). Int. I-III at Carmel, Carmel Valley (17:37 only), Chualar, Jamesburg (Search Ranch), King City, Marina, San Juan Bautista, and Tres Pinos.

WASHINGTON AND OREGON

[All times are Pacific standard. If an epicenter is quoted, Greenwich mean time is given in parentheses.]

Jan. 14: 00:29:35.8 (08:29). Epicenter 47.4° N., 123.6° W., Washington, at a depth of about 30 km., mag. 3.8, S. Int. **IV** at La Grande, Milton, Olympia, Port Orchard, and Potlatch; II at Littlerock. Also felt at Tacoma.

July 13: 15:29:25.2 (23:29). Epicenter 44.8° N., 117.9° W., Oregon, at a depth of about 33 km., mag. 3.9. Int. **IV** at Haines and vicinity. Also felt at North Powder about 13 km. north of Haines.

Oct. 25: 10:52:49.3 (18:52). Epicenter 46.7° N., 119.5° W., Washington, at a depth of 3 km., mag. 3.2. Felt at Hanford.

Dec. 27: 23:49:59.6 (Dec. 28, 07:49). Epicenter 47°34.6′ N., 122°13.0′ W., Washington, at a depth of about 27 km., mag. 4.4, S. Felt over about 4,700 sq. km. (1,800 sq. mi.) of southeast Puget Sound areas of King and Pierce Counties. Int. **IV** at Auburn, Black Diamond, Buckley, Cumberland, Dash Point, Dockton, Elbe, Kapowsin, Kent, Milton, North Bend, Preston, Ravensdale, South Prairie, Seattle, Selleck, Tacoma, Vashon, and Wilkeson. Int. I-III at Burton, Orting, and Palmer.

ALASKA

[All times are Alaska standard (150° meridian). If an epicenter is quoted, Greenwich mean time is given in parentheses.]

Jan. 4: 19:55:34.0 (Jan. 5, 05:55). Epicenter 61.4° N., 147.5° W., southern Alaska, at a depth of 46 km., mag. 4.5 (m_b). Felt at Anchorage.

Jan. 5: 04:45:32.8. Mag. 3.5 (Palmer). Felt at Anchorage.

Jan. 6: 16:49:57.5 (Jan. 7, 02:49). Epicenter 52.4° N., 173.3° W., Andreanof Islands, at a depth of 87 km., mag. 5.8 (m_b). Int. **IV** on Adak Island.

Jan. 8: 12:49:54.6. Mag. 4.0 (Adak). Int. **I** on Adak Island.

Jan. 16: 07:44. Felt in Fairbanks area.

Jan. 25: 06:08:15.1 (16:08). Epicenter 51.5° N., 177.7° W., Andreanof Islands, at a depth of 38 km., mag. 6.3 (M_S). Int. **IV** on Atka Island. Felt strongly on Adak Island.

Jan. 25: 12:35:32.1. Mag. 3.0 (College). Int. **III** at College.

Jan. 26: 09:32:04.9 (19:32). Epicenter 51.7° N., 174.9° W., Andreanof Islands, at a depth of 36 km., mag. 5.5 (M_S). Int. **III** on Adak and Atka Islands.

Jan. 29: 13:38:11.6 (College). Felt in Fairbanks area.

Feb. 1: 04:59:12.6 (14:59). Epicenter 62.3° N., 145.7° W., central Alaska, at a depth of 15 km., mag. 4.6. Int. **V** at Gulkana where many were awakened and small objects shifted.

Feb. 1: 16:16:30.3 (Feb. 2, 02:16). Epicenter 62.2° N., 151.2° W., central Alaska, at a depth of 79 km., mag. 3.5 (m_b). Felt at Talkeetna.

Feb. 3: 09:42:48.8, 09:52:25.4 (College). Felt in Fairbanks area.

Feb. 4: 10:42:57.3 (College). Felt in Fairbanks area.

Feb. 6: 16:29:28.2 (Feb. 7, 02:29), 16:33:39.1 (Adak). Epicenter 51.4° N., 176.7° W., Andreanof Islands, at a depth of 50 km. mag. 6.0(m_b). Int. **V** on Adak Island (minor damage). Second shock also felt.

Feb. 6: 16:42:04.5 (Feb. 7, 02:42). Epicenter 51.2° N., 177.1° W., Andreanof Islands, at a depth of 49 km., mag. 5.8(m_b). Int. **III** on Adak Island.

Feb. 6: 17:03:18.3 (Feb. 7, 03:03). Epicenter 51.7° N., 177.3° W., Andreanof Islands, at a depth of 52 km., mag. 4.5 (m_b). Int. **I** on Adak Island.

Feb. 6: 17:19:12.2 (Feb. 7, 03:19). Epicenter 51.2° N., 177.0° W., Andreanof Islands, at a depth of 21 km., mag. 5.2 (m_b). Int. **I** on Adak Island.

Feb. 6: 17:20:59.9 (Feb. 7, 03:20). Epicenter 51.1° N., 177.0° W., Andreanof Islands, at a depth of 43 km., mag. 5.4 (m_b). Int. **II** on Adak Island.

Feb. 7: 16:29:11.4 (Feb. 8, 02:29). Epicenter 51.3° N., 178.8° W., Andreanof Islands, at a depth of 44 km., mag. 5.2 (m_b). Int. **I** on Adak Island.

Feb. 17: 23:52:22.2 (College). Int. **IV** at College; also felt at Fairbanks.

Feb. 22: 19:50. Felt in Fairbanks area.

Mar. 1: 23:42:12.6 (Mar. 2, 09:42). Epicenter 51.8° N., 176.8° W., Andreanof Islands, at a depth of 59 km., mag. 4.5 (m_b). Int. **I** on Adak Island.

Mar. 10: 01:58:01.4. Mag. 3.5 (Adak). Int. **I** on Adak Island.

Mar. 11: 05:25:45.9 (15:25). Epicenter 59.3° N., 146.7° W., Gulf of Alaska, at a depth of 18 km., mag. 5.1. Int. **II** on Middleton Island.

Mar. 18: 17:32:19.4. Mag. 4.5 (Adak). Int. **I** on Adak Island.

Mar. 24: 17:31:53.6 (Mar. 25, 03:31). Epicenter 50.5° N., 176.8° W., Andreanof Islands, at a depth of 11 km., mag. 4.5. Int. **I** on Adak Island.

Mar. 25: 07:43:15.0. Mag. 5.0 (Palmer). Int. **I** at Yakutat.

Mar. 26: 07:35:18.0 (17:35). Epicenter 60.3° N., 141.0° W., southeastern Alaska, at a depth of 7 km., mag. 5.9. Int. **IV** at Yakutat.

Mar. 27: 07:09:52.3 (17:09). Epicenter 52.6° N., 174.5° W., Andreanof Islands, at a depth of 138 km., mag. 5.6 (m_b). Int. **I** on Adak Island.

Mar. 30: 01:30:38.9 (11:30). Epicenter 51.2° N., 177.5° W., Andreanof Islands, at a depth of 20 km., mag. 5.1. Int. **III** on Adak Island.

Mar. 31: 21:39:29.7 (Apr. 1, 07:39). Epicenter 60.1° N., 149.2° W., Kenai Peninsula, at a depth of 16 km., mag. 4.0. Int. **IV** at Seward.

Apr. 2: 04:50:49.8 (14:50). Epicenter 61.4° N., 150.1° W., southern Alaska, at a depth of 47 km., mag. 3.7. Felt at Anchorage.

Apr. 8:14:51:13.4 (Apr. 9, 00:51). Epicenter 51.5° N., 178.8° E., Rat Islands, at a depth of 55 km., mag. 4.9 (m_b). Int. **III** on Amchitka Island.

Apr. 13: 10:18:21.2. Mag. 3.7 (Adak). Int. **I** on Adak Island.

Apr. 14: 05:18:12.6 (15:18). Epicenter 64.9° N., 147.7° W., central Alaska, at a depth of 24 km., mag. 4.1. **V**. Awakened many at Fort Wainwright and College.

Apr. 15: 01:38:32.8 (11:38). Epicenter 62.2° N., 150.7° W., central Alaska, at a depth of 27 km., mag. 3.3. Int. **I** at Talkeetna.

Apr. 16: 10:38:50.3 (20:38). Epicenter 64.6° N., 147.1° W., central Alaska, at a depth of 25 km., mag. 4.2. Felt at Harding Lake and North Pole.

Apr. 24: 07:48:42.2. Mag. 3.2 (Palmer). Felt at Palmer.

Apr. 30: 04:05:49.0 (14:05). Epicenter 51.7° N., 179.9° E., Rat Islands, at a depth of 93 km., mag. 5.2 (m_b). Int. **IV** on Amchitka Island.

Apr. 30: 05:48:06.5 (15:48). Epicenter 52.8° N., 172.5° E., Near Islands, at a depth of 37 km., mag. 5.0(M_S). Int. **II** on Attu and Shemya Islands.

Apr. 30: 20:49:54.7 (May 1, 06:49). Epicenter 64.9° N., 148.0° W., central Alaska, at a depth of 26 km., mag. 3.3. Int. **IV** at College, Fairbanks, and Fort Wainwright.

May 1: 20:08:27.3 (May 2, 06:08). Epicenter 51.4° N., 177.2° W., Andreanof Islands, at a depth of 43 km., mag. 7.1(M_S). Int. **IV** on

Adak and III on Amchitka. A 9-cm. tsunami (peak to trough) was recorded on Adak Island.

May 1: 23:08:59.2 (May 2, 09:08). Epicenter 51.5° N., 177.2° W., Andreanof Islands, at a depth of 47 km., mag. 5.3 (m_b). Int. **III** on Adak Island.

May 3: 01:26:23.7 (College). Int. **III** at College.

May 10: 12:58:05.2 (22:58). Epicenter 51.4° N., 177.2° W., Andreanof Islands, at a depth of 50 km., mag. 3.5 (m_b). Int. **II** on Adak Island.

May 10: 13:02:20.7 (Palmer). Felt on Adak Island.

May 12: 15:02:00.0 (College). Int. **IV** at College.

May 17: 20:34:54.4 (May 18, 06:34). Epicenter 61.7° N., 149.6° W., southern Alaska, at a depth of 9 km., mag. 2.9. Int. **II** at Palmer, Wasilla, and Willow. Int. I at Anchorage.

May 18: 04:13:46.9 (14:13). Epicenter 60.0° N., 151.9° W., Kenai Peninsula, at a depth of 74 km., mag. 3.9 (m_b). Int. **II** at Homer (NOAA Weather Service Office).

May 21: 08:56:43.7 (18:56). Epicenter 52.5° N., 173.2° W., Andreanof Islands, at a depth of 36 km., mag. 5.7. Int. **II** on Adak Island.

May 30: 18:55:08.7. Mag. 3.5 (Adak). Int. **I** on Adak Island.

June 2: 09:06:32.9 (19:06). Epicenter 61.0° N., 151.3° W., southern Alaska, at a depth of 29 km., mag. 5.5. Int. **IV** at Anchorage, II at Kenai, and I at Palmer.

June 7: 06:02:04.1 (16:02). Epicenter 51.5° N., 176.9° W., Andreanof Islands, at a depth of 49 km., mag. 4.3 (m_b). Int. **I** on Adak Island.

June 7: 06:06:15.7 (Palmer). Int. **I** on Adak Island.

June 11: 03:58:37.7 (13:58). Epicenter 51.5° N., 176.1° E., Rat Islands, at a depth of 32 km., mag. 6.5 (M_S). Int. **IV** on Shemya Island.

June 12: 04:00:34.0 (College). Int. **IV** at College and Fort Wainwright.

June 17: 11:00:38.9 (21:00). Epicenter 61.8° N., 149.8° W., southern Alaska, at a depth of 65 km., mag. 3.8. Int. **I** at Palmer.

June 20: 23:36:52.6 (June 21, 09:36) Epicenter 51.7° N., 177.2° W., Andreanof Islands, at a depth of 57 km., mag. 4.6 (m_b). Int. **II** on Adak Island.

June 29: 04:03:19.0 (14:03). Epicenter 54.6° N., 161.6° W., Alaska Peninsula, at a depth of 24 km., mag. 5.1. Int. **IV** at Cold Bay and King Cove.

June 29: 10:01:23.2 (20:01). Epicenter 61.4° N., 145.2° W., southern Alaska, at a depth of 33 km., mag. 4.5. Int. **I** at Cordova and McCarthy.

July 11: 23:03 (College). Int. **IV** at Summit.

July 14: 14:24:02.3 (July 15, 00:24). Epicenter 54.2° N., 133.7° W., Queen Charlotte Islands region, at a depth of 33 km., mag. 5.3 (m_b). Felt at Sitka and Ketchikan.

July 25: 05:41:21.3 (15:41). Epicenter 52.2° N., 173.1° E., Near Islands, at a depth of 28 km., mag. 6.3 (M_S). Int. **I** on Shemya Island. Foreshock felt at 04:54.

July 26: 06:17:35.6 (16:17). Epicenter 63.3° N., 149.7° W., central Alaska, at a depth of 33 km., mag. 4.1 (m_b). Int. **IV** at Cantwell and Summit.

July 29: 20:05:56.7 (Adak). Int. **I** on Adak Island.

Aug. 5: 03:51:08.3 (13:51). Epicenter 55.7° N., 165.0° W., Fox Islands, at a depth of 33 km., mag. 5.2 (m_b). **V**. Furniture shifted at Cold Bay; awakened all in home. Bookcase swayed out from wall.

Aug. 5: 10:44:12.6 (20:44). Epicenter 51.4° N., 176.7° W., Andreanof Islands, at a depth of 40 km., mag. 4.1 (m_b). Int. **II** on Adak Island.

Aug. 10: 04:42:24.6 (14:42). Epicenter 65.5° N., 150.0° W., Alaska, at a depth of 33 km., mag. 4.3. Felt at College.

Aug. 13: 02:51:09.0 (12:51). Epicenter 51.8° N., 176.5° W., Andreanof Islands, at a depth of 59 km., mag. 4.1 (m_b). Int. **II** on Adak Island.

Aug. 21: 12:43:38.4 (22:43). Epicenter 54.3° N., 162.5° W., Alaska Peninsula, at a depth of 33 km., mag. 5.2 (m_b). Int. **III** at

Cold Bay.

Aug. 26: 04:05:29.0 (Adak). Int. **I** on Adak Island.

Aug. 27: 04:05:13.7 (14:05). Epicenter 51.4° N., 177.8° W., Andreanof Islands, at a depth of 52 km., mag. 5.0 (m_b). Int. **I** on Adak Island.

Sept. 4: 05:53:25.4 (15:53). Epicenter 55.0° N., 163.4° W., Unimak Island region, at a depth of 107 km., mag. 5.8 (m_b). Int. **IV** at Cold Bay.

Sept. 5: 19:56:14.9 (Sept. 6, 05:56). Epicenter 64.8° N., 147.7° W., central Alaska, at a depth of 24 km., mag. 3.2. Felt at Fairbanks.

Sept. 16: 13:27:45.5 (23:27). Epicenter 51.8° N., 175.6° W., Andreanof Islands, at a depth of 64 km., mag. 4.6 (m_b). Int. **I** on Adak Island.

Sept. 17: 16:12:39.3 (Sept. 18, 02:12). Epicenter 51.9° N., 178.6° E., Rat Islands, at a depth of 112 km., mag. 4.6 (m_b). Felt on Amchitka Island.

Sept. 18: 23:24:07.3 (Sept. 19, 09:24). Epicenter 51.8° N., 176.9° W., Andreanof Islands, at a depth of 57 km., mag. 4.8. Int. **III** on Adak Island.

Sept. 19: 09:41 (College). Int. **IV** at Manley Hot Springs. Also felt at College.

Sept. 20: 10:15. Felt at Manley Hot Springs.

Sept. 23: 18:25. Int. **IV** at Lake Minchumina.

Sept. 30: 01:52:36.6 (11:52). Epicenter 51.3° N., 178.8° E., Rat Islands, at a depth of 41 km., mag. 5.0 (m_b). Felt on Amchitka Island.

Oct. 12: 06:45:35.0 (16:45). Epicenter 52.6° N., 174.2° E., Near Islands, at a depth of 29 km., mag. 4.4 (m_b). Int. **V** on Shemya Island.

Oct. 13: 04:01:47.3 (14:01). Epicenter 51.9° N., 179.6° W., Andreanof Islands, at a depth of 95 km., mag. 5.3 (m_b). Int. **I** on Adak Island.

Oct. 15: 08:26:12.8 (18:26). Epicenter 50.5° N., 176.7° W., Andreanof Islands, at a depth of 16 km., mag. 4.7. Int. **I** on Adak Island.

Oct. 29: 03:16:36.2 (13:16). Epicenter 60.2° N., 153.5° W., southern Alaska, at a depth of 141 km., mag. 4.7 (m_b). Felt at Homer.

Nov. 3: 05:44:58.6 (15:44). Epicenter 52.0° N., 177.3° W., Andreanof Islands, at a depth of 97 km., mag. 4.4 (m_b). Int. **I** on Adak Island.

Nov. 6: 12:00:00.1 (22:00). Epicenter 51.1° N., 179.1° E., Rat Islands, at a depth of 2 km., mag. 5.7 (M_S). CANNIKIN underground explosion. Int. **IV** on Adak Island.

Nov. 14: 23:32:02.2 (Nov. 15, 09:32). Epicenter 51.7° N., 176.1° W., Andreanof Islands, at a depth of 54 km., mag. 5.2 (m_b). Int. **IV** on Adak Island.

Nov. 21: 14:46:11.1 (Nov. 22, 00:46). Epicenter 52.3° N., 174.3° E., Near Islands, at a depth of 43 km., mag. 5.5(M_S). Int. **IV** on Shemya Island.

Nov. 23: 00:02:00.6 (10:02). Epicenter 51.9° N., 176.2° W., Andreanof Islands, at a depth of 68 km., mag. 4.8 (m_b). Int. **V** on Atka Island; IV on Adak Island.

Nov. 24: 09:35:29.1 (19:35). Epicenter 52.9° N., 159.2° E., off east coast of Kamchatka, at a depth of 106 km., mag. 7.3, P. Int. **IV** on Shemya Island.

Nov. 24: 12:36:45.1. Mag. 3.8 (Adak). Int. **I** on Adak Island.

Nov. 29: 05:24:52.3 (15:24). Epicenter 64.8° N., 147.3° W., central Alaska, at a depth of 25 km., mag. 3.1. Int. **IV** at College.

Nov. 29: 20:43:56.5 (Nov. 30, 06:43). Epicenter 51.1° N., 179.5° E., Rat Islands, at a depth of 44 km., mag. 4.7(M_S). Int. **III** on Amchitka Island.

Nov. 29: 22:50:56.0 (Palmer). Int. **II** at Palmer.

Nov. 30: 22:03:57.7 (Dec. 1, 08:03). Epicenter 61.7° N., 149.3° W., southern Alaska, at a depth of 24 km., mag. 3.1. Int. **IV** at Palmer; III at Anchorage.

Dec. 2: 21:27:25.8 (Dec. 3, 07:27). Epicenter 51.6° N., 177.2° W., Andreanof Islands, at a depth of 63 km., mag. 4.8. Int. **III** on Adak Island.

Dec. 8: 03:00:15.0 (13:00). Epicenter 51.7° N., 178.4° E., Rat Islands, at a depth of 81 km., mag. 5.2 (m_b). Int. **II** on Amchitka; I on

Adak Island.

Dec. 8: 14:23:24.4 (Sitka). Int. **IV** at Sitka.

Dec. 16: 14:05:19.1 (Dec. 17, 00:05). Epicenter 55.1° N., 161.2° W., Alaska Peninsula, at a depth of 33 km., mag. 4.3 (m_b). Int. **III** at King Cove.

Dec. 23: 10:18:36.3 (20:18). Epicenter 60.7° N., 151.6° W., Kenai Peninsula, at a depth of 67 km., mag. 3.7 (m_b). Int. **III** at Kenai, II at Anchorage, and I at Palmer.

Dec. 26: 03:19:02.0 (13:19). Epicenter 50.6° N., 175.1° W., Andreanof Islands, at a depth of 33 km., mag. 5.2 (m_b). Int. **II** on Adak Island.

Dec. 30: 07:56:03.5 (17:56). Epicenter 61.1° N., 150.4° W., southern Alaska, at a depth of 41 km., mag. 3.7. Int. **IV** at Anchorage; I at Palmer.

Dec. 31: 09:51:18.8 (19:51). Epicenter 51.9° N., 179.9° W., Andreanof Islands, at a depth of 99 km., mag. 5.4 (m_b). Int. **II** on Adak Island.

HAWAII[1]

[All times are Hawaiian standard. If an epicenter is quoted, Greenwich mean time is given in parentheses.]

Feb. 3: 01:56:04.9 (11:56). Epicenter 19°20.8′ N., 155°01.9′ W., at a depth of 6 km., mag. 3.8. Felt at Hilo, Keaau, and Mountain View.

Feb. 19: 21:44:53.7 (Feb. 20, 07:44). Epicenter 19°47.1′ N., 155°46.3′ W., at a depth of "0" km., mag. 3.5. Felt at Honokaa, Kapapala Ranch, and Kealakekua.

Mar. 16: 20:53:33.0 (Mar. 17, 06:53). Epicenter 19°50.7′ N., 155°33.5′ W., at a depth of 13 km., mag. 3.5. Felt at Honokaa, Kukuihaele, and Paauilo.

Mar. 31: 01:08:56.6 (11:08). Epicenter 20°16.5′ N., 156°13.4′ W., at a depth of 14 km., mag. 3.8. Felt at Kamuela.

Apr. 21: 00:06:22.8 (10:06). Epicenter 19°12.8′ N., 155°26.1′ W., at a depth of 3 km., mag. 3.6. Felt at Kapapala Ranch.

Apr. 25: 08:03:01.7 (18:03). Epicenter 19°22.5′ N., 155°15.2′ W., at a depth of 10 km., mag. 4.0. Felt at Glenwood and Hilo.

Apr. 25: 23:56:13.1 (Apr. 26, 09:56). Epicenter 19°23.3′ N., 155°16.3′ W., at a depth of 24 km., mag. 4.6. Felt Islandwide.

May 13: 20:29:06.2 (May 14, 06:29). Epicenter 19°53′ N., 156°21′ W., at a depth of 13 km., mag. 4.0. Felt at Honokaa, Kainaliu, and Kamuela.

June 26: 10:12:41.2 (20:12). Epicenter 20°13.5′ N., 155°34.4′ W., at a depth of 55 km., mag. 3.6. Felt at Kamuela.

July 2: 17:26:04.5 (July 3, 03:26). Epicenter 19°45′ N., 153°50′ W., at a depth of 13 km., mag. 4.5. Felt at Hilo and Kamuela.

July 3: 09:16:15.5 (19:16). Epicenter 19°24.2′ N., 155°24.2′ W., at a depth of 8 km., mag. 3.9. Felt at Hilo.

July 7: 20:16:48.5 (July 8, 06:16). Epicenter 19°37.7′ N., 156°05.2′ W., at a depth of 38 km., mag. 4.2. Felt Islandwide.

July 28: 20:15:09.7 (July 29, 06:15). Epicenter 19°22.1′ N., 155°05.7′ W., at a depth of 3 km., mag. 3.5. Felt at Hilo and Kurtistown.

Aug. 1: 01:38:23.3 (11:38). Epicenter 19°28.6′ N., 155°53.2′ W., at a depth of 10 km., mag. 3.7. Felt at Kealakekua.

Aug. 3: 14:09:14.8 (Aug. 4, 00:09). Epicenter 19°18.1′ N., 155°13.3′ W., at a depth of 6 km., mag. 3.8. Felt at Volcano.

Aug. 4: 01:36:45.2 (11:36). Epicenter 20°07.2′ N., 155°49.0′ W., at a depth of 25 km., mag. 4.2. Felt at Kamuela and Kealakekua.

Aug. 15: 15:36:08.8 (Aug. 16, 01:38). Epicenter 19°20.8′ N., 155°16.3′ W., at a depth of 34 km., mag. 4.9. Felt Islandwide.

Aug. 15: 22:18:37.3 (Aug. 16, 08:18). Epicenter 19°18.4′ N., 155°13.4′ W., at a depth of 9 km., mag. 4.0. Felt at Hilo, Pahoa, and Volcano.

Sept. 7: 19:56:07.2 (Sept. 8, 05:56). Epicenter 19°18.0′ N., 155°13.3′ W., at a depth of 5 km., mag. 3.8. Felt at Hilo and Volcano.

Sept. 26: 02:56:47.8 (12:56). Epicenter 19°23.0′ N., 155°24.3′ W., at a depth of 3 km., mag. 3.5. Felt at Hilo and Kapapala

[1]Prepared by Hawaiian Volcano Observatory, U.S. Department of the Interior, Geological Survey, Hawaii National Park, Hawaii

Ranch.

Oct. 11: 23:04:13.7 (Oct. 12, 09:04). Epicenter 18°50.3′ N., 155°12.2′ W., at a depth of 13 km., mag. 3.5. Felt at Kapapala Ranch.

Oct. 12: 08:49:30.1 (18:49). Epicenter 18°53.1′ N., 155°13.8′ W., at a depth of 13 km., mag. 3.5. Felt at Kapapala Ranch.

Dec. 2: 05:40:08.7 (15:40). Epicenter 19°18.2′ N., 155°13.1′ W., at a depth of 9 km., mag. 3.6. Felt at Glenwood, Hilo, Pahoa, and Volcano.

Dec. 5: 14:47:10.9 (Dec. 6, 00:47). Epicenter 19°20.5′ N., 155°13.5′ W., at a depth of 30 km., mag. 3.5. Felt at Volcano.

Dec. 9: 02:16:57.0 (12:16). Epicenter 19°20.4′ N., 155°06.7′ W., at a depth of 10 km., mag. 4.3. Felt at Hilo, Kulani Camp, Mountain View, and Volcano.

Dec. 23: 22:02:18.3 (Dec. 24, 08:02). Epicenter 18°50.9′ N., 155°19.4′ W., at a depth of 31 km., mag. 4.1. Felt at Hilo and Kapapala Ranch.

Dec. 24: 08:00:56.2 (18:00). Epicenter 18°45.3′ N., 155°17.0′ W., at a depth of 8 km., mag. 3.9. Felt at Kapapala Ranch.

Dec. 24: 16:11:11.5 (Dec. 25, 02:11). Epicenter 19°09.2′ N., 155°19.7′ W., at a depth of "0" km., mag. 4.0. Felt at Kapapala Ranch.

Dec. 24: 17:38:10.9 (Dec. 25, 03:38). Epicenter 19°10.5′ N., 155°20.2′ W., at a depth of "0" km., mag. 4.1. Felt at Hilo and Kapapala Ranch.

Dec. 26: 01:14:01.2 (11:14). Epicenter 19°14.4′ N., 155°23.5′ W., at a depth of 9 km., mag. 4.2. Felt at Hilo and Kapapala Ranch.

Dec. 26: 02:37:28.9 (12:37). Epicenter 19°12.4′ N., 155°20.9′ W., at a depth of "0" km., mag. 3.5. Felt at Kapapala Ranch.

Dec. 26: 11:24:06.2 (21:24). Epicenter 19°10.6′ N., 155°20.0′ W., at a depth of "0" km., mag. 4.6. Felt at Hilo, Kapapala Ranch, and Kealakekua.

Dec. 26: 16:07:43.2 (Dec. 27, 02:07). Epicenter 19°08.4′ N., 155°34.1′ W., at a depth of about "0"km., mag. 3.9. Felt at Kapapala Ranch.

Dec. 26: 21:31:28.1 (Dec. 27, 07:31). Epicenter 19°14.1′ N., 155°21.2′ W., at a depth of 3 km., mag. 3.9. Felt at Kapapala Ranch.

Dec. 26: 21:46:45.7 (Dec. 27, 07:46). Epicenter 19°14.0′ N., 155°20.7′ W., at a depth of 3 km., mag. 3.7. Felt at Kapapala Ranch.

Dec. 27: 07:22:37.4 (17:22). Epicenter 19°13.4′ N., 155°21.2′ W., at a depth of "0" km., mag. 3.6. Felt at Kapapala Ranch.

Dec. 27: 15:11:51.0 (Dec. 28, 01:11). Epicenter 19°14.6′ N., 155°21.7′ W., at a depth of "0" km., mag. 4.6. Felt at Hilo, Kapapala Ranch, Mountain View, Pahala, and Volcano.

Dec. 27: 16:13:09.5 (Dec. 28, 02:13). Epicenter 19°14.4′ N., 155°22.4′ W., at a depth of "0" km., mag. 3.5. Felt at Glenwood.

Dec. 27: 17:09:54.3 (Dec. 28, 03:09). Epicenter 19°15.8′ N., 155°21.9′ W., at a depth of 5 km., mag. 4.0. Felt at Hilo and Kapapala Ranch.

Dec. 28: 16:59:16.3 (Dec. 29, 02:59). Epicenter 19°13.6′ N., 155°21.7′ W., at a depth of "0" km., mag. 4.6. Felt Islandwide.

Dec. 29: 00:42:01.5 (10:42). Epicenter 19°14.0′ N., 155°21.2′ W., at a depth of "0" km., mag. 4.1. Felt at Kapapala Ranch.

Dec. 29: 01:38:41.4 (11:38). Epicenter 19°13.7′ N., 155°20.7′ W., at a depth of "0" km., mag. 4.7. Felt at Hilo, Kapapala Ranch, Paauilo, and Volcano.

PANAMA CANAL ZONE

[All times are eastern standard. If an epicenter is quoted, Greenwich mean time is given in parentheses.]

Jan. 19: 23:45:00.1 (Jan. 20, 04:45). Epicenter 8.8° N., 79.2° W., Panama, at a depth of 33 km., mag. 5.6 (M_S). Damage at Balboa. Probably felt at Balboa Heights.

Jan. 20: 04:15:12.7 (BHP). Int. **II** in Canal Zone and at Panama.

Jan. 27: 08:35:09.2 (BHP). Int. **II** in Canal Zone and at Panama.

Jan. 29: 15:42:19.8 (BHP). Int. **II** in Canal Zone and at Panama.

Feb. 3: 08:58:22.0 (BHP). Int. **II** in Canal Zone and at Panama.

Mar. 7: 19:13:14.2 (BHP). Int. **I** at Balboa Heights.

Mar. 8: 11:28:09.4 (16:28). Epicenter 7.2° N., 81.6° W., Panama, at a depth of 17 km., mag. 5.0 (m_b). Int. **I** at Balboa Heights.

Mar. 9: 08:18:02.1 (13:18). Epicenter 7.3° N., 81.5° W., Panama, at a depth of 24 km., mag. 4.8 (m_b). Int. **I** at Balboa Heights.

June 5: 09:20:42.3 (14:20). Epicenter 9.3° N., 84.2° W., Costa Rica, at a depth of 26 km., mag. 5.1. (M_S). Int. **III** at Balboa Heights.

June 6: 05:38:05.3 (10:38). Epicenter 8.6° N., 79.3° W., Panama, at a depth of 35 km., mag. 4.1 (m_b). Int. **II** at Balboa Heights.

PUERTO RICO

[All times are 60th meridian. If an epicenter is quoted, Greenwich mean time is given in parentheses.]

Mar. 25: 00:40. Int. **IV** at Ramey Air Force Base.

Apr. 8: 18:01:16.7 (San Juan). Felt 13 km. north of Cayey.

June 11: 08:56:04.3 (12:56). Epicenter 18.0° N., 69.8° W., Dominican Republic region, at a depth of 57 km., mag. 6.5, P. Heavy property damage and some injuries in Santo Domingo. Felt on Puerto Rico (**V**), Guadeloupe, and in northern Venezuela. In Puerto Rico, int. V at Adjuntas, Aguas Buenas, Caguas, Gurabo, Juana Diaz, Lares, Las Piedras, Ponce, and Utuado. Int. IV at Arecibo, Carolina, Cayey, Comerio, Guayama, Mayaguez, Naranjito, and Patillas. Int. I-III at Aguadilla, Cabo Rojo, Isla Verde International Airport, Rio Grande, Roosevelt Roads (Ceiba), San German, Santurce, and Vieques Island.

VIRGIN ISLANDS

No earthquakes were reported felt in the Virgin Islands during 1971.

TABLE 1.—*Instrumentally determined locations of earthquakes and related phenomena that occurred in the United States during 1971*

[Source: *Preliminary Determination of Epicenters Monthly Listing*, published by NOAA-National Ocean Survey through May 1971 issue, and by NOAA-Environmental Research Laboratories June 1971—December 1971.]

Date	Origin time[1] G M T			Geographic coordinates		Region and comments[2]	Depth[3]	Magnitude[4]			SD[5]	No. of stations[6]
	hr.	min	sec	N Lat. degrees	W Long degrees		km.	m_b	M_S	M_L		
Jan 1	04	45	29 0	59 6	144 6	Gulf of Alaska	16	5.2		5 3	0.8	49
1	06	50	52 5*	47 8	128.6	Off coast of Washington	N	4.5			1.2	9
1	11	55	03 5	53.0	167 0	Fox Islands	61	4.6			0.8	39
2	19	09	49 8	59 5	144.9	Gulf of Alaska	24	4.9			0.6	30
11	01	55	37 8	52 5	169 5	Fox Islands	40	4.5			0.9	19
13	05	19	53.0*	60.1	153.1	Southern Alaska	88	3.8			1.0	11
14	02	28	39 4*	33 5	116 7	Southern California. Mag. 3.5. P	10G				0.7	6
14	14	43	02 1*	39 8	122.9	Northern California. Mag. 3.0. B	N				1.5	6
15	13	41	39 3	64 1	148.2	Central Alaska	118	3.5			0.7	10
16	00	53	53 7P	35.5	118 4	Central California 35°29 1′ N., 118°21.7′ W. Mag. 3.6	8				0.0	13
16	04	09	19 9P	33 4	116 4	Southern California. 33°26.6′ N., 116°24.4′ W Mag. 3 6	8				0.0	10
18	00	46	38 9	35 5	120 0	Central California. Mag 3 0. P	8G				0.6	9
18	06	53	13 3	54.3	164.0	Unimak Island region	58	4.8			1.2	27
19	02	36	13 0P	33.9	116 8	Southern California. 35°56.8′ N., 116°46 2′ W Mag. 3.7	8	4.0			0.0	10
20	01	19	12 8	58.9	137.2	Southeastern Alaska	N·	4.0			1.5	21
20	02	07	34.3	63 3	151 0	Central Alaska	131D	4.6			0.9	32
20	10	27	30 1	51.7	180 0	Rat Islands	28	4.4			0.8	22
21	01	57	18.8*	66.4	163.9	Alaska	N				1.5	9
21	05	38	21 8*	35 7	117 6	Central California. Mag. 3.4. P	8G				1.9	6
22	14	39	55.1*	44.1	114.6	Western Idaho	N	3.8			1.7	6
23	00	53	11.1	36 4	118.2	Central California Mag 3.1. P	8G				1.1	11
23	09	27	07 0	34 2	116 4	Southern California. Mag. 3.2. P	8G				0.3	8
23	14	50	43.4*	63.6	147.1	Central Alaska	N	3.6		3.7	0.9	8
23	15	12	14.7	63.1	150.8	. . . . do	112	4.5			1.3	13
23	22	07	35 0*	32.5	115.7	California-Mexico border region. Mag 4.5. P	8G	5.1			1.4	9
24	20	37	37.1*	37.4	112.5	Utah	5G			2.4	0.6	5
24	23	16	31 1	56 4	153.0	Kodiak Island region	38	5.2	5.1		1.1	40
25	01	34	39 6*	40.2	124.5	Near coast of northern California. Mag. 3.4. B	N	4.2			1.6	7
26	10	17	05.4G	46.9	119.6	Washington. 46°54.4′ N., 119°34.1′ W	5			2.3	0.0	15
26	19	45	53.1	51.5	174.9	Andreanof Islands	50	4.3			0.8	14

See footnotes at end of table

TABLE 1.—*Instrumentally determined locations of earthquakes and related phenomena that occurred in the United States during 1971*—Continued

Date	Origin time[1] G.M.T hr.	min.	sec	Geographic coordinates N Lat. degrees	W Long degrees	Region and comments[2]	Depth[3] km	Magnitude[4] m_b	M_S	M_L	SDS	No. of stations[6]
Jan 26	21	52	24 8	51 6	175 0	Andreanof Islands	55	4 3			0.7	25
27	18	23	30 6	51 4	175 0	. . . . do	51	4.3			0.7	22
28	05	06	44.3	66 6	142.0	Alaska	N				1.1	14
29	05	36	20.0	34.1	117.1	Southern California Mag. 3 2, P	6				0.4	11
29	07	58	52.9	60.7	143 7	Southern Alaska	N	3.7		3.9	1.3	10
29	13	29	23.5	56 8	152 3	Kodiak Island region	64	4.5		3 8	0.8	20
30	04	43	44 0*	56.7	152 2	. . . . do	39	4.4			1.1	19
30	07	32	33.0*	52 9	174.9	Andreanof Islands	222				0.3	12
30	19	25	50 6*	44 0	128.3	Off coast of Oregon	N	4.4			1.7	15
31	11	23	04.6P	34.0	117.0	Southern California. 34°00′ N., 116°57′ W. Mag. 3.0	9				0.6	7
31	12	22	48.6	35 9	120.5	Central California Mag. 4.0, P; 3.8, B	16	4.0			0.7	23
31	15	44	53 8*	51.2	177 7	Andreanof Islands	28	4.2			0.9	18
Feb. 1	05	19	23.4	51.7	172 9	Andreanof Islands. Mag 6, P	40	5.5	5.8		0.8	119
1	07	36	54 4*	51.9	172.9	Andreanof Islands	48	3.9			0.9	14
1	14	59	12 6	62.3	145.7	Central Alaska	15	4.6		4 6	1.0	29
1	22	16	03.6E	37 4	120.0	Central California. Probable blast. Mag. 3.4, P; 3.2, B.	0G	3.2			0.7	16
2	00	27	09.5*	51.8	173.2	Andreanof Islands	50G	4.2			0.8	19
2	00	48	55.3	51.8	173.2	. . . . do	40	5.2			0.9	55
2	00	56	45.5	18.2	68.4	Mona Passage	102	4.8			0.7	25
2	01	47	44.0	18.2	68.4	. . . . do	93	3.8			1.0	10
2	18	53	15.1*	51.9	173.4	Andreanof Islands	45	4.3			0.6	10
3	03	16	58.5	44.9	111.0	Hebgen Lake, Mont., region	15G				1.4	8
3	11	25	48.9	44.9	111.0	. . . . do	15G				1.2	10
3	16	35	18.4*	51.7	173.3	Andreanof Islands	60	4.0			1.0	8
3	19	52	40.6	45 1	110.9	Montana	15G	4.9			1.4	14
7	02	50	49.3	51.1	177.1	Andreanof Islands	N	4.9			0.9	34
7	02	53	09 1	51 2	176.9	. . . . do	N	5.4			1.0	80
7	03	00	39 2	51.4	177.1	. . . . do	51	4.5			0.9	19
7	03	12	05.8*	51.2	176 8	. . . . do	59	4.5			0.6	10
7	03	18	57.3*	51.1	177.0	. . . . do	33	4.3			0.9	16

Feb	7	03	39	07 3*	51 1	177 1	. . . . do	51	4.3			1.1	13
	7	04	01	58 5	51 2	177 0	. . . . do	51	4.6			0.8	27
	7	05	08	44 6	51 3	176 9	. . . . do	60	4.3			0.9	23
	7	08	19	19.3	51.7	177.2	. . . . do	57	4.2			1.0	15
	7	23	34	12 8	51 2	176 7	. . . . do	48	4.4			0.8	17
	7	23	45	25 7	51.5	176.8	. . . . do	61	4.5			1.1	19
	8	00	04	30 9*	51 2	176 7	. . . . do	48	4.3			0.6	15
	8	01	03	14.4	51 5	176.6	. . . . do	64	4.6			1.3	26
	8	04	00	05.2	51.5	176.7	. . . . do	65	4.1			0.8	15
	8	04	43	00.5*	51 4	177.0	. . . . do	54	4.2			0.9	21
	8	06	39	17.8	51.3	176.5	. . . . do	52	4.4			1.1	22
	8	19	21	11.9*	51.2	176 8	. . . . do	42	4.1			1.4	11
	9	14	10	21.5P	34.4	118 3	Southern California. 34°21.7′ N., 118°18.4′ W. Mag. 5.1. Numerous aftershocks through March are not included in this list.	5					13
	10	10	07	05 2*	51 3	177 0	Andreanof Islands	46	4.2			0.7	16
	11	00	13	55.9	60.1	147.2	Southern Alaska	24	4.2		4.1	0.8	19
	11	05	57	07.9	59 9	147 6	Gulf of Alaska	N			3.4	0.9	7
	11	10	36	59.6*	51.8	173 5	Andreanof Islands	43	3.8			1.0	15
	11	12	55	53.8	51 2	177.2	. . . . do	50G	5.5	5.2		1.0	15
	12	05	16	35.7	51 3	179.1	. . . . do	40	4.8			0.9	46
	12	17	04	01.1*	37 1	115.0	Southern Nevada	15G				0.9	14
	13	17	29	53.9	51.2	179.4	Andreanof Islands	42	4.4			0.7	16
	14	07	37	57 3	37.3	116.5	Southern Nevada	6				0.2	11
	16	09	37	05 6*	51 3	177.6	Andreanof Islands	47	3.7			1.0	16
	18	03	55	18 1	35 4	118 3	Central California. Mag. 3 0. P	8G				0.9	16
	18	11	28	13 7*	36 2	105 7	New Mexico	5G	3.7			0.5	5
	18	12	16	32 4	37.5	118.5	California-Nevada border region	8G	3.7			0.8	16
	18	15	56	50 1	60.5	153.3	Southern Alaska	145	4.4			1.0	20
	18	19	29	46 7E	39.7	78.2	West Virginia. Unconfirmed blast. 39°39 7′ N., 78°12.7′ W.	0					9
	19	04	43	43 8	63 2	150.5	Central Alaska	115	4.0			1.1	16
	19	23	11	41 7*E	37 1	83 2	Kentucky. Probable blast	0G				0.9	5
	20	10	48	34.7	39.2	118.1	Nevada	4	4.2			0.2	7
	21	16	08	09 1	62 6	151.3	Central Alaska	91	4.2			1.0	27
	21	18	10	34 6	63.1	150 3	. . . . do	115	4.7			1.2	14
	22	06	04	17.8*	19.3	67.9	Mona Passage	N	4.5			0.6	11

See footnotes at end of table

TABLE 1.—*Instrumentally determined locations of earthquakes and related phenomena that occurred in the United States during 1971*—Continued

Date	Origin time[1] GMT hr.	min.	sec	Geographic coordinates N Lat. degrees	W. Long. degrees	Region and comments[2]	Depth[3] km.	Magnitude[4] m_b	M_S	M_L	SD[5]	No. of stations[6]
Feb 22	13	57	14.0	36.1	117.8	California-Nevada border region	8G				0.8	14
22	18	58	28.7*	63.0	152.3	Central Alaska	N			3.8	0.8	7
23	06	38	06.0	38.7	112.0	Utah	10G				0.6	9
23	11	09	55.9	56.3	149.7	Gulf of Alaska	N	4.1			0.9	20
24	07	08	22.8	39.4	110.2	Utah	5G			3.6	0.7	10
24	08	03	19.0*	63.2	149.2	Central Alaska	N			3.4	0.3	5
24	18	39	04.5*	59.0	152.4	Southern Alaska	49	4.1		3.4	0.5	8
24	22	22	30.8	57.6	154.0	Kodiak Island region	36D	4.6			0.8	20
24	23	22	15.6*	50.9	177.4	Andreanof Islands	16	4.6			1.3	16
25	06	40	44.3	52.1	169.5	Fox Islands	32	5.3			1.0	48
25	15	50	56.3*	43.2	126.6	Off coast of Oregon	N	5.0			1.1	12
26	03	56	04.9	38.0	118.6	California-Nevada border region. Mag. 3¾, B	6	4.2			1.0	16
27	01	56	36.1*	40.3	125.0	Off coast of northern California. Mag. 3.8, B	N	4.3			0.9	10
27	19	02	44.9*	52.0	173.3E	Near Islands	35	4.8			0.8	39
27	20	41	14.5*	51.2	178.3	Andreanof Islands	37	4.4			0.5	12
28	05	19	42.7	59.1	151.9	Kenai Peninsula	52	3.5		3.7	0.9	8
28	07	21	38.3	51.3	177.0	Andreanof Islands	56	4.9			0.7	32
28	08	27	17.5	52.8	171.4E	Near Islands	24	4.6			0.9	40
28	18	33	44.7	63.5	150.6	Central Alaska	109	3.7			0.6	8
Mar 1	05	47	50.1	37.9	118.1	California-Nevada border region. Mag. 3.7, B	15G	3.8			1.0	15
1	06	18	54.1	37.9	118.2	California-Nevada border region	15G				0.8	10
1	08	21	02.9	37.9	118.2	. . . . do	15G				0.4	8
1	08	39	56.5	37.9	118.2	. . . . do	15G				0.8	10
1	09	45	11.0	37.9	118.2	. . . . do	15				0.4	9
1	10	31	26.2	37.9	118.1	. . . . do	15G				1.2	9
2	12	46	36.4	63.4	149.8	Central Alaska	111	4.8			0.9	20
3	14	46	30.7	25.9	109.9	Gulf of California	34	5.3	5.4		1.2	64
5	17	19	10.0E	40.6	78.2	Pennsylvania Limestone quarry blast 40°37.4′ N., 78°10.0′ W.	0					6
7	01	25	18.4*	19.4	66.2	Puerto Rico region	40	4.5			0.8	10
9	08	08	53.9	64.0	149.8	Central Alaska	140	4.3			0.9	16

Mar	9	10	38	16.1	57.7	153.9	Kodiak Island region	53	4.3		0.8	22
	9	10	56	36.0	64.0	149.8	Central Alaska	138	4.0		0.8	13
	10	07	10	05.6	7.5	81.5	Panama	N	4.4		1.1	19
	11	01	36	25.8*	7.3	81.4	. . . . do	N	3.8		1.0	10
	11	06	00	28.3*	7.2	81.4	. . . . do	N	4.1		1.2	12
	12	08	56	04.0	47.7	113.9	Montana	32	4.3		1.4	7
	14	18	14	12.2*	36.5	110.4	Eastern Arizona. Probable coal bump	5G			1.1	5
	15	03	00	40.7*	39.7	120.1	Northern California. Mag. 3.5, B	10G	4.5		0.4	7
	15	14	45	52.9*	39.2	118.0	Nevada	10G			0.5	5
	17	09	27	34.7	37.3	116.6	Southern Nevada	1			0.4	13
	19	20	03	46.4	40.4	117.1	Nevada	10G	4.0		1.3	6
	20	19	45	52.3	60.2	150.6	Kenai Peninsula	41	3.9		0.7	11
	22	09	45	51.8*	39.4	117.9	Nevada	10G			1.3	5
	23	21	45	16.2	60.0	152.5	Southern Alaska	138			0.6	10
	25	10	17	15.3*	36.7	115.8	California-Nevada border region	10G			0.4	8
	25	23	27	01.1	62.9	150.6	Central Alaska	109			0.1	7
	27	04	39	11.7	36.8	112.4	Western Arizona	5G		2.6	0.8	5
	29	18	47	27.1	38.0	114.1	Nevada	10		2.3	1.0	6
	31	14	43	37.4*	41.0	125.7	Off coast of northern California	N	4.7		1.0	12
Apr.	1	04	06	37.8	51.4	178.3	Andreanof Islands	53	4.2		0.8	21
	1	05	05	11.0E	37.4	81.6	West Virginia. Rockburst. 37°21'53" N., 81°37'44" W.	0			0.0	16
	1	17	16	17.2	60.3	153.0	Southern Alaska	111	4.4		0.8	24
	3	11	39	13.5	51.2	179.2	Andreanof Islands	50	4.5		1.0	19
	5	09	04	42.8	53.4	170.6	Fox Islands. Mag. 5.9, P; 6.1, B	153	5.8		0.9	147
	5	14	53	16.8	65.9	156.3	Alaska	35		4.8	0.7	13
	7	22	16	22.8	61.4	146.7	Southern Alaska	59			1.0	12
	8	05	26	00.2	58.8	153.8	Kodiak Island region	26	4.1	3.8	0.9	14
	9	04	42	56.7	60.0	152.9	Southern Alaska	136			0.7	13
	10	00	36	44.0	52.1	169.9	Fox Islands	51	4.8		0.9	45
	10	10	18	30.6	62.1	149.6	Central Alaska	76			0.6	14
	11	18	03	47.2*	59.6	153.0	Southern Alaska	107			0.9	12
	12	12	06	38.5	60.1	152.8	. . . . do	89	4.0		0.7	15
	12	12	10	34.7	51.3	177.1	Andreanof Islands	52	4.8		0.8	35
	13	14	00	50.9*	35.8	90.1	Arkansas	N			0.2	5
	13	21	08	43.5	60.3	150.8	Kenai Peninsula	44	3.9		0.7	12

See footnotes at end of table.

TABLE 1.—*Instrumentally determined locations of earthquakes and related phenomena that occurred in the United States during 1971*—Continued

Date	Origin time[1] G.M.T.			Geographic coordinates		Region and comments[2]	Depth[3]	Magnitude[4]			SD[5]	No. of stations[6]
	hr	min	sec	N. Lat. degrees	W. Long. degrees		km	m_b	M_S	M_L		
Apr. 15	18	04	16.2P	34.3	118.6	Southern California. 34°15.7′ N., 118°33.6′ W. Mag. 3.3	8				0.0	13
15	20	01	19.5	34.6	117.1	Southern California	8G				0.3	10
17	04	43	55.9*	62.2	153.1	Central Alaska	N			3.3	1.0	11
17	19	46	27.2*	59.7	152.6	Southern Alaska	75	4.0			0.9	14
17	22	37	17.2*	63.5	150.8	Central Alaska	N				1.2	10
18	22	27	28.4P	34.5	118.7	Southern California. 34°27.5′ N., 118°40.9′ W. Mag. 3.7	20				0.0	16
19	10	41	06.4P	33.3	116.2	Southern California. 33°15.9′ N., 116°12.4′ W. Mag. 3.8	8	4.4			0.0	15
19	21	07	39.5	61.8	151.9	Southern Alaska	101				0.6	12
20	00	24	59.5*	60.7	151.3	Kenai Peninsula	50				1.3	9
20	01	17	53.3	66.3	157.5	Alaska	N				0.9	9
21	06	42	16.3	53.9	161.5	South of Alaska	21	5.1	5.4		1.1	91
21	08	52	02.6	44.8	111.3	Hebgen Lake, Mont., region	15G	3.9			0.7	10
22	07	03	40.1	38.4	118.1	California-Nevada border region	20				0.9	13
22	08	27	29.2*	60.1	153.1	Southern Alaska	N	3.7		3.6	1.2	8
22	19	40	28.8	60.1	153.0	. . . . do	110	5.1			1.3	18
22	19	45	39.6*	68.1	160.5	Alaska	N	4.5			1.3	13
23	10	49	29.4	44.6	129.1	Off coast of Oregon	N	4.9	4.5		1.3	24
23	11	52	32.1	44.6	129.3	. . . . do	N	4.7			1.2	20
23	17	02	59.4*	61.2	152.2	Southern Alaska	118				0.6	9
24	00	39	15.9	60.5	139.0	Southeastern Alaska	N	5.1		4.3	1.2	14
24	01	15	58.8*	52.4	172.2E.	Near Islands	53	4.5			1.0	11
25	04	40	42.0	60.4	152.4	Southern Alaska	107				1.2	9
25	22	31	00.0*	51.9	170.9	Fox Islands	52	3.5			0.5	8
27	06	55	59.9	33.7	120.1	Off coast of California. Mag. 3.7. P	16	3.9			0.7	15
27	22	28	45.2	52.1	172.2E.	Rat Islands	138	4.6			1.0	38
28	11	36	52.7*	35.8	105.6	New Mexico	5G	4.0		3.0	0.9	7
29	07	20	57.1	60.2	147.7	Southern Alaska	N				1.4	7
29	15	26	35.2	53.2	170.6E.	Near Islands	27	5.1			0.9	72
29	19	00	00.0A	37.1	116.3	Southern Nevada. Nevada Test Site. 37°07′20.8″ N., 116°19′58.9″ W.	0	5.1			0.0	13
30	20	46	20.0*	39.5	118.3	Nevada	5G				1.0	5

May	1	02	11	20.4	36.6	110.5	Eastern Arizona. Probable coal bump	5G			2.2	0.9	7
	1	03	11	19.9	36.5	113.4	Western Arizona	5G			2.9	0.6	12
	1	04	16	21.1P	34.4	116.6	Southern California. 34°22.6′ N., 116°34.9′ W. Mag. 3.4	8				0.0	17
	1	04	25	26.3P	34.4	118.4	Southern California. 34°24.2′ N., 118°25.0′ W. Mag. 3.5	8				0.0	24
	1	12	22	55.7*	39.5	118.3	Nevada	10G	4.0			0.3	7
	1	23	01	27.4	62.9	150.9	Central Alaska	97	3.7			0.8	9
	2	06	24	37.7*	51.4	177.0	Andreanof Islands	49	4.6			0.6	12
	2	07	29	33.7*	51.3	176.9	. . . . do	46	4.3			0.6	12
	2	08	31	50.4	51.2	176.8	. . . . do	54	4.3			0.8	17
	3	13	45	52.9	60.5	151.9	Kenai Peninsula	71	3.8			1.0	11
	3	21	24	02.1*	51.7	177.0	Andreanof Islands	52	4.3			0.8	9
	4	01	10	21.2*	37.3	117.0	California-Nevada border region	6				0.3	11
	5	10	32	44.4	61.7	151.5	Southern Alaska	75	4.1			0.7	14
	5	12	13	32.6*	51.8	179.4	Andreanof Islands	94	4.5			0.5	21
	6	02	59	58.9	51.5	177.3	. . . . do	49	4.8			0.9	45
	6	16	57	18.1*	36.4	113.1	Western Arizona	5G			2.2	1.1	7
	6	22	32	36.4*	36.5	114.5	Southern Nevada	5G			2.8	0.6	11
	8	03	30	29.1*	51.4	178.8E.	Rat Islands	55	4.0			0.7	24
	9	08	29	29.0	37.1	117.4	California-Nevada border region	5G				0.8	12
	10	00	01	16.3	52.2	171.0	Fox Islands	48	5.3	5.1		1.0	108
	14	01	55	01.1	51.7	177.3	Andreanof Islands	60	4.9			0.7	30
	14	13	17	27.9	51.0	175.9E.	Rat Islands	21	4.6			1.0	30
	14	14	53	00.1*	39.0	118.1	Nevada	5G	4.2			0.4	5
	14	15	00	35.1	62.5	151.1	Central Alaska	82	4.3			1.0	20
	14	20	43	57.3	60.4	147.8	Southern Alaska	34	3.8		3.5	1.0	8
	16	16	50	57.4	63.1	148.3	Central Alaska	77	4.1			0.5	8
	17	00	55	50.8	52.6	173.4	Andreanof Islands	53	4.9			1.0	43
	17	02	34	28.5*	50.3	176.7E.	Rat Islands	8	4.3			1.0	25
	17	09	11	43.7*	42.5	126.4	Off coast of Oregon	N	4.9			1.2	11
	18	15	23	25.0*	56.6	156.7	Alaska Peninsula	66	4.2			1.0	12
	18	17	34	12.1	60.0	149.9	Kenai Peninsula	83				0.8	8
	20	02	35	36.6	52.2	173.3	Andreanof Islands	74	5.5			0.9	120
	20	07	52	43.8*	42.2	126.9	Off coast of Oregon	N	4.7	4.5		1.3	13
	20	08	01	08.6*	42.3	126.3	. . . . do	N	5.0	5.0		1.5	22
	21	19	22	30.3*	52.5	173.3	Andreanof Islands	N	4.2			0.7	14

See footnotes at end of table.

TABLE 1.—*Instrumentally determined locations of earthquakes and related phenomena that occurred in the United States during 1971*—Continued

Date	Origin time[1] G.M.T hr	min.	sec.	Geographic coordinates N Lat. degrees	W Long. degrees	Region and comments[2]	Depth[3] km.	Magnitude[4] m_b	M_S	M_L	SD[5]	No. of stations[6]
May 21	19	24	44.8	52.5	173.3	Andreanof Islands	40	4.7			0.9	39
22	10	07	04.1	51.9	173.1	. . . . do	48	4.8			1.0	33
23	17	43	22.1	7.6	78.0	Panama	10	4.5			1.2	10
23	21	31	51.6*	35.0	113.9	Western Arizona	5G			3.0	0.8	6
24	04	10	32.6*	36.2	117.6	California-Nevada border region	5G				1.2	12
25	11	40	04.7	51.6	174.3	Andreanof Islands	24	4.9			0.9	40
27	22	28	28.1*	52.8	170.1E	Near Islands	15	4.8			1.3	19
28	05	45	17.9	60.7	151.7	Kenai Peninsula	100				0.5	8
29	02	35	37.2*	41.9	126.7	Off coast of northern California	14	4.7			1.0	19
29	03	18	43.4P	34.4	118.3	Southern California. 34°21.5′ N., 118°15.9′ W. Mag. 3.0	7				0.0	9
30	03	08	56.8	53.3	173.7	Andreanof Islands	235	4.6			1.0	34
30	08	58	56.6	47.7	114.1	Montana	5G	4.2		2.9	0.7	8
30	12	23	57.2	58.9	152.4	Kodiak Island region	49	3.9			0.9	9
31	08	48	09.4	60.1	152.5	Southern Alaska	78	4.0			1.1	11
June 2	11	52	01.1P	34.3	118.5	Southern California. 34°19.4′ N., 118°31.3′ W. Mag. 3.4	8	4.2			0.0	11
3	03	04	42.0*	47.7	114.2	Montana	5G				0.7	6
3	06	58	56.3P	34.5	118.5	Southern California. 34°28.5′ N., 118°28.1′ W. Mag. 3.5	13	3.4			0.0	9
4	23	22	50.3	51.6	171.3	Fox Islands	N	4.9			1.1	67
5	01	30	24 0*	51.7	171.5	. . . . do	63	3.8			0.7	14
6	04	00	21 7	53.9	171.9	. . . . do	272	5.2			0.9	73
6	18	21	04.1	53.0	170.9	. . . . do	97	4.7			0.8	51
9	21	09	48.3	56.7	156.5	Alaska Peninsula	56	5.2			0.8	53
9	23	08	03.7	51.2	178.7E	Rat Islands	37	4.3			0.5	31
10	17	28	35.9	52.2	170.6	Fox Islands	41	5.3			0.9	62
11	15	21	27.9	51.3	179.3	Andreanof Islands	5.1				0.9	46
12	19	18	48.5	18.9	64.3	Virgin Islands	43	5.0			0.7	47
12	21	00	43.7	19.4	66.5	Puerto Rico region	N	4.5			0.9	16
15	18	00	59.5	51.1	178.0	Andreanof Islands	46	4.8			0.9	44
15	18	22	35.9*	40.4	125.5	Off coast of northern California. Mag. 3.7, B	N	4.6			1.0	13
16	14	50	00.0A	37.0	116.0	Southern Nevada, Nevada Test Site. 37°01′59.4″ N., 116°00′49.2″ W. Mag. 4.2, B	0	4.9			0.0	23

June	16	18	21	22.0*	62.7	152.3	Central Alaska	N	3.9		3.8	0.9	8
	17	18	17	05.8*	37.1	118.3	California-Nevada border region	5G				0.8	6
	17	22	59	46.8	60.0	152.9	Southern Alaska	126				0.4	8
	18	17	40	33.1*	68.5	147.6	Alaska	N	4.7			1.1	10
	20	12	41	39.6	35.7	120.4	Central California. Mag. 3.3. P	8G	4.1			0.9	15
	21	08	03	58.2*	51.6	178.8E.	Rat Islands	21				0.1	12
	21	08	37	31.8*	51.6	178.8E.	. . . . do	22				0.2	11
	21	09	59	30.3	51.6	178.8E.	. . . . do	89				0.1	9
	21	16	39	32.4	51.6	178.8E.	. . . . do	24				0.2	11
	21	17	24	36.4	51.6	178.8E.	. . . . do	25				0.2	11
	21	19	24	06.5P	33.9	115.7	Southern California. 33°53.5′ N., 115°42.9′ W. Mag. 3.3	8				0.0	8
	21	20	00	19.8	51.6	178.9E.	Rat Islands	21				0.2	12
	21	23	31	25.9	51.6	178.8E.	. . . . do	20				0.2	11
	22	01	55	08.8P	32.7	116.0	California-Mexico border region. 32°42′ N., 115°57.1′ W. Mag. 3.5	8				0.0	8
	22	13	17	48.7	63.7	150.0	Central Alaska	132	3.8			0.5	8
	22	23	58	39.0P	34.4	118.5	Southern California. 34°25.4′ N., 118°30.5′ W. Mag. 3.0	8				0.0	7
	23	02	22	34.5	58.4	151.9	Kodiak Island region	29	4.2			1.0	8
	23	05	01	50.5*	44.0	110.4	Yellowstone National Park, Wyo.	15G				0.7	5
	23	06	08	34.1	38.7	112.6	Utah	5G	4.6		3.3	0.8	10
	23	11	46	53.5	51.1	178.3E.	Rat Islands	79				0.3	12
	23	15	30	00.0A	37.0	116.0	Southern Nevada. Nevada Test Site. 37°01′19.1″ N., 116°01′21.6″ W.	0	4.8			0.0	40
	23	19	15	03.2*	51.6	178.8E.	Rat Islands	24				0.5	12
	23	22	44	34.8*	51.6	178.9E.	. . . . do	78				0.1	12
	24	04	19	56.1*	63.2	150.0	Central Alaska	N				0.4	5
	24	14	00	00.2A	37.1	116.1	Southern Nevada. Nevada Test Site. 37°08′48.1″ N., 116°04′00.6″ W.	0	5.2			0.0	61
	24	14	05	45.6	48.3	113.1	Montana	5G			4.0	0.7	11
	24	15	47	52.7	51.5	179.0E.	Rat Islands	68				0.1	13
	24	17	01	30.1*	51.6	178.8E.	. . . . do	22				0.1	12
	25	05	55	32.1*	61.5	150.0	Southern Alaska	48			2.9	0.3	6
	26	05	19	00.3P	35.9	116.7	Central California. 35°52.4′ N., 116°43.0′ W. Mag. 3.3	8				0.0	15
	27	08	31	18.9	19.1	67.9	Mona Passage	48	4.9			0.9	52
	27	17	15	39.2	52.0	170.5	Fox Islands	18	5.2			1.0	68
	28	06	28	49.1*	52.6	170.5	. . . . do	26	3.9			1.3	10

See footnotes at end of table

TABLE 1.—*Instrumentally determined locations of earthquakes and related phenomena that occurred in the United States during 1971*—Continued

Date	Origin time[1] GMT hr	min	sec.	Geographic coordinates N Lat. degrees	W Long degrees	Region and comments[2]	Depth[3] km	Magnitude[4] m_b	M_S	M_L	SD[5]	No. of stations[6]
June 28	08	25	12.4	52.2	170.5	Fox Islands	42	3.7			0.6	11
28	12	39	22.5*	45.8	112.8	Montana	5G				1.3	6
28	16	39	05.3	61.6	150.6	Southern Alaska	62				0.6	8
July 2	06	34	44.4	53.0	171.4E	Near Islands	39	5.1			0.9	70
4	14	42	30.2	51.7	174.1	Andreanof Islands	26	4.9		4.5	0.8	48
4	18	41	38.3	51.6	174.1	. . . . do	31	4.8		4.6	0.7	44
5	02	50	50.3	61.4	147.8	Southern Alaska	48	3.6			1.0	13
6	13	28	26.9	51.2	179.2	Andreanof Islands	34	4.1			0.5	16
6	19	22	39.4	37.5	116.6	Southern Nevada	5G	3.6			0.9	12
8	14	00	00.1A	37.1	116.1	Southern Nevada, Nevada Test Site 37°06'36.4" N., 116°03'05.1" W. Mag. 5¼, B	0	5.5				110
8	14	39	56.8	19.1	64.4	Virgin Islands	N	4.6			0.9	18
9	08	38	32.6	51.2	176.2E	Rat Islands	42	4.2			0.5	25
9	23	01	51.4	52.5	169.5	Fox Islands	41	4.2			0.6	18
10	09	54	41.9	19.3	64.7	Virgin Islands	N	4.3			1.0	11
10	17	22	37.2*	40.4	109.6	Utah	8	3.8			1.2	7
11	14	26	59.0*	19.1	64.6	Virgin Islands	N	4.0			0.9	8
12	15	49	11.4	52.0	173.2E	Near Islands	25	5.3			0.9	92
12	16	36	59.6	51.8	175.3	Andreanof Islands	47	4.5			0.7	24
12	22	57	06.9	51.6	174.1	. . . . do	14	5.0			0.9	63
14	14	48	41.2	47.8	114.4	Montana	5G				0.9	7
14	15	40	48.6*	60.0	152.7	Southern Alaska	82	4.0			1.1	13
15	05	36	11.6	60.1	153.3	. . . . do	150	4.4			0.7	14
15	10	38	50.0P	34.2	117.5	Southern California, 34°14.1' N., 117°27.7' W. Mag. 3.0	10					9
16	04	31	28.4*	59.3	154.2	Southern Alaska	N			3.5	0.7	12
17	03	39	15.4	55.3	161.5	Alaska Peninsula	N	4.3			0.9	23
19	22	53	40.5	62.7	148.0	Central Alaska	43				0.6	11
21	00	53	21.5*	52.2	170.4	Fox Islands	34	3.7			1.1	9
21	04	04	15.8	52.1	170.5	. . . . do	N	4.2			0.9	21
21	09	14	26.1B	36.2	120.9	Central California, 36°12.9' N., 120°52.7' W. Mag. 3.3	8	4.2				15

July	21	11	36	12.7	60.5	149.7	Kenai Peninsula	38	3.3		3.2	1.1	8
	21	12	03	41.4	52.0	170.5	Fox Islands	39	4.9	5.7		1.1	37
	24	02	14	37.2*	38.1	118.9	California-Nevada border region	5	4.2			1.2	13
	24	02	55	24.9*	47.9	114.5	Montana	5G				1.2	5
	24	11	01	03.9*	47.8	114.3	. . . . do	5G				1.0	7
	24	11	43	02.6*	47.8	114.3	. . . . do	5G	4.3		2.8	1.3	8
	24	23	15	22.4*	62.1	151.0	Central Alaska	57			3.1	0.3	11
	25	15	33	58.9	52.0	172.9E.	Near Islands	16	4.8			0.9	41
	25	15	51	04.6	51.9	173.3E.	. . . . do	N	4.8			1.1	25
	25	15	56	04.4	52.0	173.2E.	. . . . do	22	4.7			0.8	29
	25	18	13	26.9*	52.0	172.9E.	. . . . do	33	4.6			0.9	26
	25	18	26	37.5	52.4	173.5	Andreanof Islands	83	4.8			0.9	31
	25	20	49	53.4	52.1	173.0E.	Near Islands	27	4.8			0.8	32
	25	23	20	59.5	52.0	172.9E.	. . . . do	25	4.6			0.7	23
	25	23	47	16.0	52.0	173.2E.	. . . . do	36	4.7			1.0	32
	27	03	17	46.1	52.1	173.0E.	. . . . do	38	4.8			0.8	36
	27	20	28	52.4	51.2	179.4E.	Rat Islands	42	4.9			1.0	45
	28	04	35	01.2*	52.5	173.1E.	Near Islands	54	4.2			0.9	15
	29	14	40	44.6	61.6	146.2	Southern Alaska	63				1.0	12
	29	16	11	40.0*	51.4	177.4	Andreanof Islands	42	4.2			1.0	16
	29	22	18	20.1	52.1	173.4E.	Near Islands	42	5.6	5.6		0.9	93
	30	00	07	22.4	52.1	173.5E.	. . . . do	45	4.9	4.7		0.9	45
	30	01	45	50.6*	31.7	103.0	West Texas	10G	3.0			2.5	5
	30	02	07	52.1*	62.1	151.4	Central Alaska	81	4.2			0.7	20
	30	10	36	26.6	63.7	149.6	. . . . do	33	3.4			0.7	13
	31	14	53	49.0*	31.7	103.1	West Texas	10G	3.4			1.8	5
Aug.	1	18	52	35.0H	18.2	154.2	Hawaii. 18.2° N., 154.2° W. Mag. 4½-5	10	4.8				43
	2	18	49	11.7*	60.5	152.1	Southern Alaska	120				0.7	13
	3	18	36	47.3*	60.1	152.8	. . . . do	82	3.8			0.6	13
	4	18	24	05.4	52.4	168.6	Fox Islands	33	4.3			0.8	38
	5	20	46	36.7	36.9	116.0	California-Nevada border region	4	3.9			0.6	14
	5	22	41	41.7	36.9	116.0	. . . . do	5				0.4	13
	7	04	28	38.2P	34.4	118.4	Southern California. 34°24.5′ N., 118°26.9′ W. Mag. 3.2	9					10
	8	02	32	06.5*	36.9	116.0	California-Nevada border region	5G	3.7			0.8	10
	8	12	02	48.3*	61.8	150.5	Southern Alaska	30			3.0	0.3	8

See footnotes at end of table.

TABLE 1.—*Instrumentally determined locations of earthquakes and related phenomena that occurred in the United States during 1971*—Continued

Date	Origin time[1] G.M.T. hr	min.	sec.	Geographic coordinates N. Lat. degrees	W. Long. degrees	Region and comments[2]	Depth[3] km.	Magnitude[4] m_b	M_S	M_L	SD[5]	No. of stations[6]
Aug. 9	01	52	16.9	36.9	116 0	California-Nevada border region	5G				0.9	10
9	21	33	56.2	61.3	151.1	Southern Alaska	75				0.7	12
10	23	08	56.9	61.8	150.0	. . . . do	34	3.3		3.0	0.7	10
10	23	14	16.8*	51.0	178.6	Andreanof Islands	31	4.1			0.9	16
14	22	42	18.3*	63.6	150.7	Central Alaska	159				0.6	10
16	01	36	37.7	58.6	155.2	Alaska Peninsula	126	3.5			1.0	13
17	06	26	46.1	35.7	119 5	Central California. Mag. 3.3, P	8G				0.8	12
18	14	00	00.0A	37.1	116 0	Southern Nevada, Nevada Test Site. 37°03′25.9″ N., 116°02′10.8″ W. Mag. 5.2, B	0	5.4				88
20	00	32	50.6*	38 8	119.1	California-Nevada border region. Mag. 3.7, B	5G	4.4			0.3	8
20	19	00	05.7*	63.7	149.5	Central Alaska	33				0.3	10
21	03	55	36.3	18.3	67.7	Mona Passage	85	4.5			0.7	15
21	22	35	50.2*	62.8	149.7	Central Alaska	97				0.2	12
22	16	40	37.2*	60.2	152.0	Southern Alaska	123				0.3	10
23	19	50	40.7*	62.9	150 6	Central Alaska	91				0.4	11
23	22	35	27.4*	47 8	114.5	Montana	5G	4.1		2.8	1.4	6
24	19	06	28 0*	59.7	152.8	Southern Alaska	117				0.7	13
24	22	34	51 3	59.9	152 6	. . . . do	73	3.8			0.6	19
25	23	00	33 4P	33.0	116.3	Southern California. 33°00 5′ N., 116°16.7′ W. Mag. 3.7	8					12
26	02	47	49 8	19.0	67.7	Mona Passage	53	4.8			0.9	43
28	17	49	53.1	38.2	115.9	Nevada	10G			3.4	0.4	13
28	18	15	59 4*	38.2	115.8	. . . . do	10G				0.4	9
Sept. 1	05	27	12.9	59.8	152.7	Southern Alaska	81	3.9			0.7	16
5	03	15	05 1	61.4	146.9	. . . . do	44	3.7			1.3	17
9	07	55	57.2*	61.0	152.8	. . . . do	159				0.6	12
9	14	31	18 9*	61 6	149 9	. . . . do	40				0.8	7
12	23	46	10 1	63.6	150.9	Central Alaska	8	3.8			0.6	11
17	00	39	34.9	60.9	151'5	Kenai Peninsula	93			4.1	0.6	10
18	13	53	35.8	38.1	118.3	California-Nevada border region	10G				0.9	13
18	22	39	58 3	60.0	147 4	Southern Alaska	16	3.3			0.8	9

Sept	19	00	58	35.9*	39.4	118.9	Nevada	10G	4.5		3.1	0.5	6
	20	06	44	14.2	56.4	153.0	Kodiak Island region	N	5.2	5.3		1.0	66
	20	20	54	13.9	56.4	153.1	. . . . do	37	4.8	4.8		0.9	31
	20	22	50	32.7*	56.3	153.0	. . . . do	N	4.5			0.7	13
	23	13	31	13.4	53.7	164.8	Uuimak Island region	45	5.3			0.8	61
	27	10	06	16.1*	51.6	177.8E.	Rat Islands	71	4.0			0.5	16
	29	03	10	18.1	51.2	177.4	Andreanof Islands	36	4.5			0.7	22
	29	14	00	00.0A	37.0	116.0	Southern Nevada. Nevada Test Site. 37°00'39.7" N., 116°00'26.4" W	0	4.4				30
	29	22	10	23.5*	63.1	149.2	Central Alaska	103				0.6	11
	29	23	07	27.4P	32.8	118.4	Off coast of California. 32°50.6' N., 118°21.3' W. Mag. 3.0	8					4
	30	20	27	58.3	18.1	64.5	Virgin Islands	152	4.9			0.6	32
	30	22	52	56.2P	32.9	115.8	California-Mexico border region. 32°54' N., 115°48' W. Mag. 3.3	8					5
	30	22	55	06.0P	32.7	115.9	California-Mexico border region. 32°44' N., 115°51' W. Mag. 3.2	7					5
	30	23	57	31.9P	32.9	115.8	California-Mexico border region. 32°52' N., 115°50' W. Mag. 3.6	7	4.0				12
Oct.	1	05	40	12.7*	40.5	127.3	Off coast of northern California. Mag. 4. B	N	4.6			0.9	14
	2	14	46	43.3*	60.2	153.2	Southern Alaska	82	3.8			0.8	13
	2	19	38	55.0	36.1	120.2	Central California. Mag. 3.4. P; 3.5. B.	10G				1.2	15
	3	05	12	48.4P	35.0	116.8	Central California. 35°02' N., 116°50' W. Mag. 3.3	10					18
	3	06	00	57.3*	60.5	147.4	Southern Alaska	N			3.2	0.9	11
	3	23	17	26.4	51.8	173.3	Andreanof Islands	31	4.3			0.5	32
	4	18	48	20.6*	53.0	167.3	Fox Islands	46	3.8			0.8	9
	5	00	09	07.0*	52.0	172.7E.	Near Islands	18	4.5			0.7	19
	5	01	40	07.9	52.0	170.5	Fox Islands	50	4.5			0.8	30
	5	06	47	01.3*	63.6	147.7	Central Alaska	N			3.1	0.6	7
	5	19	14	55.2	60.1	153.7	Southern Alaska	162	4.1			0.9	16
	6	06	49	15.4P	33.0	115.8	Southern California. 33°02' N., 115°48' W. Mag. 3.7	10					17
	6	11	37	54.9	52.1	178.2E.	Rat Islands	139	4.9			0.6	50
	7	09	27	57.3	36.9	116.0	California-Nevada border region	1	3.9			1.0	11
	8	14	30	00.1A	37.1	116.0	Southern Nevada. Nevada Test Site. 37°06'49.6" N., 116°02'14.4" W. Mag. 4.7. B	0	4.7				33
	9	12	39	54.1	60.6	150.7	Kenai Peninsula	58				1.2	11
	9	17	52	16.4*	58.2	156.2	Alaska Peninsula	165	3.4			1.1	17
	11	18	48	38.6	63.2	148.2	Central Alaska	81	3.9			0.6	18
	12	13	27	08.8*	50.9	179.3E.	Rat Islands	31	4.0			0.4	19

See footnotes at end of table.

TABLE 1.—*Instrumentally determined locations of earthquakes and related phenomena that occurred in the United States during 1971*—Continued

Date	Origin time[1] G.M.T. hr	min	sec.	Geographic coordinates N Lat. degrees	W Long degrees	Region and comments[2]	Depth[3] km.	Magnitude[4] m_b	M_S	M_L	SD[5]	No. of stations[6]
Oct 12	18	05	02.1	56.7	152.0	Kodiak Island region	33	4.7			0.8	21
13	08	11	20.0	62.7	149.9	Central Alaska	N			3.3	0.8	13
13	16	02	47.1*	56.9	152.2	Kodiak Island region	64	3.8			0.4	10
13	21	22	41.9*	63.1	149.5	Central Alaska	N				0.4	6
14	14	30	03.1*	37.2	116.1	Southern Nevada	N	4.4			1.2	9
14	21	07	41.8	52.5	169.5	Fox Islands	42	4.5			0.9	27
14	21	11	52.8*	56.8	152.0	Kodiak Island region	47	4.6			0.8	9
16	01	01	15.9*	47.4	115.5	Montana	15G				1.5	6
16	02	46	32.6*	60.3	153.4	Southern Alaska	142	3.5			0.6	16
16	10	49	17.0*	58.5	153.8	Kodiak Island region	86	3.9			0.2	7
16	23	41	32.3*	60.0	153.4	Southern Alaska	149				0.7	11
18	11	34	12.5	62.2	149.1	Central Alaska	33				0.9	11
18	17	19	01.3	63.2	150.6	. . . . do	144				0.4	12
19	00	07	02.5	64.2	148.6	. . . . do	5				0.7	11
19	11	02	37.7	52.7	167.0	Fox Islands	22	5.6			0.9	129
19	13	45	50.0	52.0	175.9E	Rat Islands	58	4.4			0.8	26
19	18	51	09.1	61.6	150.2	Southern Alaska	50	3.9			0.5	13
20	07	04	29.3	63.2	150.8	Central Alaska	138				0.5	11
21	10	18	34.9*	62.7	150.9	. . . . do . .	110				0.3	11
21	22	31	23.3P	33.1	118.4	Southern California. 33°07′ N., 118°22′ W. Mag. 3.1	7					6
22	02	00	54.7P	34.3	116.9	Southern California. 34°17′ N., 116°51′ W. Mag. 3.0	8					13
22	09	55	39.4P	35.7	118.3	Central California 35°40′ N., 118°20′ W. Mag. 3.7	8					22
22	15	04	44.7*	62.6	151.2	Central Alaska	97				0.4	11
22	23	10	59.0	63.1	151.1	. . . . do	133	4.6			0.8	27
23	06	01	19.7*	51.1	179.0E	Rat Islands	31	3.8			0.8	14
23	16	00	17.4*	62.0	149.7	Central Alaska	72				0.8	11
24	06	28	56.3*	58.2	155.1	Alaska Peninsula	100	3.8			0.9	14
24	09	01	11.3	60.4	147.9	Southern Alaska	73				0.5	13
24	16	45	33.4*	51.2	179.9E.	Rat Islands	54	4.0			0.2	14
24	21	42	30.3	63.0	149.4	Central Alaska	81				0.4	13

Oct.	25	02	58	00.6*	61.6	149.9	Southern Alaska	42			3.0	0.6	11
	25	07	55	50.3	63.6	147.6	Central Alaska	2			3.4	0.8	13
	25	09	48	05.0*	63.2	150.8	. . . . do	134				0.5	11
	26	00	36	57.9	52.0	175.2	Andreanof Islands	60	4.7			0.5	17
	26	07	32	22.9	59.8	152.3	Southern Alaska	116	3.6			0.5	14
	26	18	51	35.3*	59.4	145.2	Gulf of Alaska	47	3.5			1.1	17
	26	20	32	17.3*	61.8	147.0	Southern Alaska	39				0.7	8
Nov.	1	06	24	44.0	59.7	152.1	. . . . do	57	4.2			0.9	15
	1	14	22	03.1B	36.6	121.2	Central California. 36°34.3′ N., 121°12.6′ W. Mag. 3.3	7					6
	3	04	08	21.6	61.5	147.6	Southern Alaska	23			3.6	0.9	14
	4	18	17	52.4	64.1	148.4	Central Alaska	124	4.3			0.5	14
	8	11	54	12.2A	51.5	179.1E.	Rat Islands. CANNIKIN collapse	2	4.9	4.9			39
	9	16	49	36.0*	61.0	150.8	Southern Alaska	N			3.2	1.3	10
	9	21	20	02.8*	60.0	152.5	. . . . do	85				0.4	9
	10	11	14	09.6	37.7	113.1	Utah	5G			3.0	0.9	12
	10	11	24	34.3	37.7	113.1	. . . . do	5G			2.9	0.9	13
	10	13	38	14.3	37.7	113.1	. . . . do	5G			2.6	1.1	12
	10	13	46	55.0*	37.7	113.1	. . . . do	5G			2.2	0.6	8
	10	14	43	58.0	37.8	113.1	. . . . do	5G			3.5	0.4	18
	10	16	08	36.9	37.7	113.0	. . . . do	5G			3.0	1.1	13
	10	19	07	33.6*	37.7	113.1	. . . . do	5G			2.3	1.1	6
	10	19	41	33.4	37.8	113.0	. . . . do	5G			3.5	0.5	14
	11	10	07	14.6	61.7	152.1	Southern Alaska	117				0.5	14
	12	16	23	10.4	60.1	153.5	. . . . do	134	4.4			0.8	15
	12	19	36	53.5	51.8	176.0E.	Rat Islands	71	4.3			1.0	25
	13	13	47	54.0	60.3	152.6	Southern Alaska	111				0.5	10
	14	12	08	20.0	59.4	146.0	Gulf of Alaska	35	4.5		4.2	1.1	21
	15	04	04	16.4	39.0	118.3	Nevada	5G	4.1			0.2	9
	15	14	16	21.8B	36.6	121.3	Central California. 36°38.4′ N., 121°19.5′ W. Mag. 3.3	5					5
	15	23	36	24.3P	35.1	119.1	Central California. 35°04′ N., 119°08′ W. Mag. 3.0	10					9
	18	04	03	52.4B	36.2	120.9	Central California. 36°13.6′ N., 120°52.2′ W. Mag. 3.4	7	3.1				6
	19	13	04	32.2*	61.9	151.0	Southern Alaska	64				0.6	15
	20	02	11	26.1*	39.0	118.3	Nevada	5G				0.7	5
	20	06	13	51.5*	60.4	148.0	Kenai Peninsula	N			3.0	1.1	14
	20	20	10	29.7P	34.4	117.4	Southern California. 34°24.1′ N., 117°25.5′ W. Mag. 3.0	10					13

See footnotes at end of table.

TABLE 1.—*Instrumentally determined locations of earthquakes and related phenomena that occurred in the United States during 1971*—Continued

Date	Origin time[1] G.M.T. hr	min.	sec.	Geographic coordinates N. Lat. degrees	W. Long. degrees	Region and comments[2]	Depth[3] km.	Magnitude[4] m_b	M_S	M_L	SD[5]	No. of stations[6]
Nov. 21	01	43	53.2*	63.0	150.9	Central Alaska	126				0.7	12
21	08	02	49.5*	47.9	114.3	Montana	5G				0.6	5
21	21	10	56.0	51.4	176.4	Andreanof Islands	54	4.3			0.9	19
21	22	09	09.7*	39.0	118.4	Nevada	10G				0.4	6
22	10	39	27.4*	39.0	118.4	. . . . do	10G	4.0			0.9	7
22	10	50	31.1*	37.2	115.3	Southern Nevada	10G				0.7	10
23	10	48	56.4	62.2	153.5	Central Alaska	N			3.7	1.2	15
24	04	12	53.9*	67.3	155.1	Alaska	62	4.5			0.6	11
24	08	03	42.9	60.2	151.8	Kenai Peninsula	60	4.0			0.7	17
24	20	15	19.8P	35.9	117.1	Central California. 35°51.5′ N., 117°07.0′ W. Mag. 3.8	10					9
25	00	34	55.8	61.7	150.0	Southern Alaska	45			2.7	0.9	14
25	10	12	47.5*	51.0	177.9	Andreanof Islands	22	4.2			0.9	11
25	10	59	06.4	56.4	160.7	Alaska Peninsula	136	5.3			0.8	75
25	16	41	42.4	62.6	149.2	Central Alaska	74	3.9			0.7	15
25	18	27	27.8*	37.7	115.3	Southern Nevada	10G				1.6	10
26	07	29	27.3	62.1	148.1	Central Alaska	21			2.4	0.8	9
27	18	14	36.9	63.2	150.6	. . . . do	152				0.6	11
29	11	14	20.0	52.3	174.2E.	Near Islands	51	4.3			0.7	20
30	07	49	09.6	51.0	179.5E.	Rat Islands	40	4.4			0.5	28
30	14	17	58.0	50.8	179.4E.	. . . . do	35	4.1			0.6	17
30	14	58	55.3	51.0	179.5E.	. . . . do	43	4.1			0.6	21
30	15	45	03.4*	37.1	116.1	Southern Nevada. Mag. 4.3. B	39	4.7			1.1	19
Dec. 2	08	20	11.9*	63.1	150.6	Central Alaska	94				0.5	6
2	14	58	26.4	60.4	153.3	Southern Alaska	135	3.7			0.6	15
2	23	06	24.9	53.7	163.6	Unimak Island region	N	4.7			0.7	27
3	05	35	02.3*	42.3	110.4	Wyoming	5G	4.1			0.9	9
3	07	44	59.0	42.5	110.3	. . . . do	5G	4.2			0.9	12
3	13	47	55.3	61.6	150.1	Southern Alaska	48				0.9	14
3	16	06	12.4*	51.7	178.8E.	Rat Islands	85				0.2	17
4	01	12	51.7	63.0	151.0	Central Alaska	146				0.4	8

Dec.	4	10	54	15.1	63.6	150.0	. . . . do	150				0.6	14
	5	02	09	09 6	62.9	148.6	. . . . do	63				0 4	7
	6	11	04	44.7	52.2	179.7E.	Rat Islands	169	5.0			0.7	42
	6	17	29	21.8	67.1	157.0	Alaska	N	4.4			0.8	17
	7	16	12	00.7*	51.8	179.2	Andreanof Islands	19	3.8			0.2	10
	8	00	57	44.7*	64.8	146.9	Central Alaska	29			3.5	0.9	13
	8	16	39	55.7	63.5	151.1	. . . . do	33			3.2	0.8	12
	8	19	00	53.8	51.0	170.9	Fox Islands	N	4.1			0.7	17
	9	00	22	23.6	60.1	153.1	Southern Alaska	104	4.1			0.9	13
	9	09	10	38.4	61.0	152.7	. . . . do	121				0.8	15
	9	19	45	32.3P	35.7	118.4	Central California. 35°43′ N., 118°21′ W. Mag. 3.5	8					13
	10	04	34	09.9	62.8	149.2	Central Alaska	92				0.4	14
	13	20	44	39.7P	34.8	118.9	Southern California. 34°49′ N., 118°53′ W. Mag. 3.6	8					14
	14	02	29	26.7	52.8	172.0E.	Near Islands	38	4.9			1.0	56
	14	21	09	59.2A	37.1	116.1	Southern Nevada. Nevada Test Site. 37°07′26.2″ N., 116°05′46.4″ W. Mag. 4.4, B	0	4.7				38
	15	12	58	14.5*	36.8	111.8	Eastern Arizona	5G			3.0	1.1	8
	18	14	00	37.1*	61.0	147 1	Southern Alaska	50				0.4	7
	20	08	34	40.0B	36.7	121.4	Central California. 36°40.4′ N., 121°21.9′ W. Mag. 3.6	5	4.4				8
	20	13	32	39.8*	51.9	178.0E	Rat Islands	144	4.3			0.6	24
	21	12	56	19.9*	51.5	178.4	Andreanof Islands	8	4.0			1.2	12
	22	13	23	49.4*	58.0	154.5	Alaska Peninsula	69	3.7			0.9	10
	23	07	03	09.0*	60 3	141.8	Southeastern Alaska	N	3.6		4.1	1.5	12
	23	09	40	10.7*	47.8	114.2	Montana	5G				0.4	5
	24	20	46	46.1P	34.2	117.5	Southern California. 34°11′ N., 117°30′ W. Mag. 3.1	10					7
	25	06	36	47.1	53.9	163.6	Unimak Island region	N	4.3			1.3	25
	26	01	55	13.8	61.0	146.3	Southern Alaska	6	4.0		4.1	1.0	17
	26	06	03	56.0	37.4	114.5	Southern Nevada	14	4.1		4.2	0.6	26
	26	06	50	50.3	52.7	174.2	Andreanof Islands	157	4.5			0.9	38
	26	06	59	16.3	34.7	121.5	Off coast of California. Mag. 4.1, P, 4.1, B	8	4.3			0.2	12
	26	09	37	31.2	59.8	153.0	Southern Alaska	95	4.7			0.9	18
	26	17	32	06.2P	36.2	118.1	Central California. 36°13′ N., 118°05′ W. Mag. 3.1	10					11
	29	06	59	30.8*	58.3	150.9	Gulf of Alaska	34			3.2	1.1	9
	29	23	06	50.8*	66.6	148.9	Alaska	N			3.6	0.8	7
	30	19	06	42.3	53.0	167.6	Fox Islands	27	4.9	4.7		0.9	51

See footnotes at end of table.

TABLE 1.—*Instrumentally determined locations of earthquakes and related phenomena that occurred in the United States during 1971*—Continued

Date	Origin time[1] G.M.T. hr.	min.	sec.	Geographic coordinates N. Lat. degrees	W. Long. degrees	Region and comments[2]	Depth[3] km.	Magnitude[4] m_b	M_S	M_L	SD[5]	No. of stations[6]
Dec 30	21	47	39.0	50.4	175.6	Andreanof Islands	8	4.8			0.8	36
31	08	44	47.1*	54.9	164.4	Unimak Island region	N	4.7			1.2	20
31	22	23	41.7	53.1	167.8	Fox Islands	52	4.2			0.7	20

[1]Symbols following the origin time are as follows:

* The epicenter has been determined from incomplete, or less reliable, data and is not considered as accurate as the computed solution appears to indicate.

A Underground explosion under the direction of the U.S. Atomic Energy Commission.

B Parameters of hypocenter in "Region and comments" column were furnished by the University of California, Berkeley.

E Explosion or suspected explosion.

G Parameters of hypocenter in "Region and comments" column were furnished by the U.S. Geological Survey.

H Parameters of hypocenter in "Region and comments" column were furnished by the Hawaiian Volcano Observatory, U.S. Geological Survey, Hawaii National Park.

P Parameters of hypocenter in "Region and comments" column were supplied by the California Institute of Technology, Pasadena.

[2]Abbreviations following magnitudes are as follows:

B University of California, Berkeley.

P California Institute of Technology, Pasadena.

[3]Abbreviations in this column are as follows:

N Indicates the depth was restrained at 33 km. for earthquakes whose character on seismograms indicates a shallow focus, but whose depth is not determined satisfactorily by the data.

D Indicates the depth was restrained by the computer program based on two or more compatible *pP* phase arrival times.

G Indicates the depth was restrained, based on evidence from available seismograms, by an ERL geophysicist.

[4]Magnitudes computed by ERL (Environmental Research Laboratories) are as follows:

m_b Computed from body wave on seismogram.

M_S Computed from surface wave on seismogram.

M_L Computed only for local earthquakes.

[5]Standard deviation of seismic stations used in computing hypocenter.

[6]Number of stations reporting *P* or *P'* phases used in computation.

TABLE 2.—*Principal earthquakes of the world during 1971*

Listed in this section are (1) earthquakes of magnitude greater than 6¾, and those of smaller magnitude which were locally destructive and caused casualties; (2) earthquakes of unusual interest. Source: *Preliminary Determination of Epicenters Monthly Listing,* published by NOAA—National Ocean Survey through May 1971 issue and by NOAA—Environmental Research Laboratories June 1971 through December 1971.

Date	Origin time G.M.T.			Region	Geographic coordinates		Remarks*
					Lat.	Long.	
	hr	*min*	*sec*		*degrees*	*degrees*	
Jan. 3	17	35	40.2	South Atlantic Ridge	55.5 S.	2.6 W.	Depth 33 km. Mag. 7.1 (M_S).
10	07	17	03.7	West New Guinea	3.1 S.	139.7 E.	Felt widely on New Guinea. Damage at Djajapura, Sentani, and Genjem, West Irian, and in Northeast New Guinea. Earth slumps, fissures, and sand and mudflows in Genjem. Depth 33 km. Mag. 8.1 (M_S).
16	09	00	20.2	Republic of the Congo ...	1.4 S.	28.6 E.	1 killed and damage in Masisi area. Depth 18 km. Mag. 5.0 (m_b).
Feb. 4	15	33	28.6	Northern Sumatra	0.7 N.	98.8 E.	Damage in northern Sumatra. Felt at Singapore. Depth 33 km. Mag. 7.1 (M_S).
6	18	09	09.1	Central Italy	42.5 N.	11.8 E.	18 dead, 100 injured, and major damage in Tuscania area. Depth 33 km. Mag. 4.6 (m_b).
8	21	04	21.8	South Shetland Islands ...	63.5 S.	61.2 W.	Felt on Argentine Island. Depth 33 km. Mag. 7.0 (M_S).
9	14	00	41.6	Southern California	34.4 N.	118.4 W.	65 dead, many injured, estimated damage 1/2 to 1 billion dollars. Total lateral extent of complex surface faulting about 12 km. Surface rupture centered about 12 km. south of epicenter, with overall trend S.70°E. Northern block was thrust southwestward over southern block, with maximum displacement about 2 m. Acceleration of 1*g* measured on a steep mountain ridge. Depth 13 km. Mag. 6.5 (M_S); 6.4, P.
May 2	06	08	27.3	Andreanof Islands	51.4 N.	177.2 W.	Felt on Adak and Amchitka. Tsunami (0.06 m.) at Adak. Depth 43 km. Mag. 7.1 (M_S).
12	06	25	13.0	Turkey	37.6 N.	29.8 E.	100 killed, many injured, and major damage in Burdur area. Depth 23 km. Mag. 5.9 (M_S).
22	16	43	58.7	. . . . do	38.8 N.	40.5 E.	1,000 dead, many injured, and major property damage at Bingol and nearby villages. Felt in 11 provinces of eastern Anatolia. Depth 3 km. Mag. 6.7 (M_S)

See footnotes at end of table

TABLE 2.—*Principal earthquakes of the world during 1971*—Continued

Date	Origin time G M T.			Region	Geographic coordinates		Remarks*
					Lat	Long	
	hr.	*min.*	*sec*		*degrees*	*degrees*	
June 16	14	44	22.5	Java	7.2 S.	109.1 E.	1 killed, 6 injured, and property damage in central Java. Depth 35 km. Mag. 5.3 (m_b).
17	21	00	40.9	Northern Chile	25.5 S.	69.2 W.	1 killed and damage at Catalina. Felt at Antofagasta. Depth 93 km. Mag. 7.0, P.
July 9	03	03	18.7	Near coast of central Chile	32.5 S.	71.2 W.	83 killed, 447 injured, and widespread property damage Tsunami (1.2 m.) at Valparaiso. Depth 58 km. Mag. 7.5, P.
14	06	11	29.1	New Ireland region	5.5 S.	153.9 E.	Felt at Rabaul, New Britain. Tsunami generated. One drowned on New Britain. Damage on New Ireland and Bougainville. Depth 47 km. Mag. 7.9 (M_S).
15	01	33	22.3	Northern Italy	44.8 N.	10.3 E.	2 killed. Damage at Parma. Felt throughout northern Italy. Depth 8 km. Mag. 5.2 (m_b).
19	00	14	45.3	New Ireland region	5.7 S.	153.8 E.	Depth 42 km. Mag. 7.1 (M_S).
26	01	23	21.3	. . . do	4.9 S.	153.2 E.	Felt at Rabaul, New Britain. Tsunami (height 6.5 m.) in Rabaul Harbor caused flood damage along waterfront. Damage also reported on southern New Ireland. Also felt in East New Guinea. Depth 48 km. Mag. 7.9 (M_S).
27	02	02	49.6	Peru-Ecuador border region.	2.7 S.	77.4 W.	1 killed in Guayaquil. Several injured and moderate damage in southern Ecuador. Felt from Lima, Peru, to Bogota, Colombia. Depth 135 km. Mag. 7.5, P.
Aug. 2	07	24	56 8	Hokkaido, Japan, region	41.4 N	143.5 E.	Felt on Hokkaido and northern Honshu. Tsunami (0.4 m.) at Hiroo. Depth 51 km. Mag. 7.0, P.
5	01	58	51.7	Central Mid-Atlantic Ridge.	0.9 S	22.1 W.	Depth 33 km. Mag. 7.0 (M_S).
9	02	54	36.7	Iran	36.3 N	52.7 E.	1 killed, 39 injured, significant damage. Depth 27 km. Mag. 5.3 (M_S)
Sept. 5	18	35	25.0	Sakhalin Island	46.5 N	141.2 E.	Felt on Moneron Island, southern Sakhalin, and northern Hokkaido. Tsunami (1 m.) reported on Moneron Island. Depth 9 km. Mag. 7.1 (M_S).
16	06	22	37.6	Banda Sea	5.9 S.	130.7 E.	Depth 115 km. Mag. 7.0, P.
25	04	36	14.0	East New Guinea region	6.5 S.	146.6 E.	Felt in Popondetta area. Depth 115 km. Mag. 7.0, P.

See footnotes at end of table

TABLE 2.—*Principal earthquakes of the world during 1971*—Continued

Date	Origin time G.M.T.			Region	Geographic coordinates		Remarks*
					Lat.	Long.	
	hr.	*min.*	*sec.*		*degrees*	*degrees*	
Oct. 15	10	33	46.7	Peru	14.1 S.	73.3 W.	5 killed and major damage in Apurimac. Depth 54 km. Mag. 5.7 (m_b).
27	17	58	36.9	New Hebrides Islands	15.5 S.	167.2 E.	1 killed, several injured, major damage on Espiritu Santo. Also felt at Port Vila. Depth 40 km. Mag. 7.1 (M_S)
Nov. 21	05	57	11.9	Santa Cruz Islands	11.8 S.	166.5 E.	Depth 115 km. Mag. 7.1, P.
24	19	35	29.1	Off east coast of Kamchatka.	52.9 N.	159.2 E.	Felt on Shemya Island, Alaska. Depth 106 km. Mag. 7.3, P.
Dec. 15	08	29	55.3	. . . .do	56.0 N.	163.3 E.	Tsunami (0.18 m.) on Attu, Alaska Depth 33 km. Mag. 7.8 (M_S).

*Magnitudes computed by ERL (Environmental Research Laboratories) are as follows. (M_S)—Computed from surface wave on seismogram. (m_b)—Computed from body wave on seismogram. A magnitude value followed by P has been computed by California Institute of Technology, Pasadena.

Miscellaneous Activities

HORIZONTAL CONTROL SURVEYS FOR CRUSTAL MOVEMENT STUDIES[1]

In 1971, surveys for the study of horizontal movements in the earth's crust were made by NOAA's National Geodetic Survey in the following areas of California.

Aqueduct Surveys.—The cooperative project with the California Department of Water Resources was continued during 1971. Resurveys were accomplished at six sites along the aqueduct route.

At three of the sites—BARREL, CAST, and QUAIL—the results did not indicate any significant changes from previous surveys. A resurvey was completed at the BARREL site about 2 days before the San Fernando earthquake of February 9 and the observations were repeated a few days following the earthquake. This site is about 35 km. northeast of the reported epicenter, on the San Andreas fault, and results of the two surveys were in very close agreement. The CAST site, about 25 km. northwest of the epicenter, also was reobserved a few days following the earthquake. Tentative plans have been made to establish another site in this area on the San Gabriel fault, as there is a question about whether or not the present CAST site straddles the fault.

Results at TEM site, located on the San Andreas fault, show that right-lateral movement continues. For the 7-year interval, the annual rate of movement is approximately 8 mm.

Surveys at sites DEVIL and HUGHES were under way at the end of 1971.

San Fernando-Saugus Area.—Meade and Miller[2] give a complete analysis of the results of the preearthquake and postearthquake surveys in the San Fernando area.

In cooperation with the surveys for the San Fernando earthquake study, a survey was conducted to establish precise locations for several stations in the area of Castaic Dam. Results of this survey will be useful for future earthquake studies in this area.

VERTICAL CRUSTAL MOVEMENTS[3]

Vertical movement surveys in an earthquake area are concerned principally with widespread vertical deformations resulting from shock waves, not actual breaks in the surface which can occur only along a fault. The magnitude and extent of such crustal movements are determined by comparing results of leveling surveys made before and after an earthquake.

Several areas in California are known to undergo continuing subsidence where, for

[1]Prepared by B K. Meade, National Geodetic Survey, National Ocean Survey, National Oceanic and Atmospheric Administration, Rockville, Md.

[2]"Horizontal Crustal Movements Determined from Surveys After San Fernando Earthquake," *San Fernando, California, Earthquake of February 9, 1971, Vol. III, Geological and Geophysical Studies,* U. S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Research Laboratories (in press).

[3]Prepared by Nancy L. Morrison, National Geodetic Survey, National Ocean Survey, National Oceanic and Atmospheric Administration, Rockville, Md.

various reasons, there is a widespread lowering of the land surface, with respect to mean sea level, because of compaction of sediments. Past leveling also has indicated that areas of upheaval, such as that associated with mountain-building, may exist. Therefore, any analysis of apparent movement must attempt to separate this tectonic movement from abrupt elevation changes caused by seismic activity.

Adjustment and analysis indicate that significant vertical crustal movements, as a result of the San Fernando earthquake of February 9, 1971, fall within an ellipse centered near the Olive View Hospital and defined by a semimajor axis of 10 km. oriented in a NW.-SE. direction, and a semiminor axis of 5.5 km. oriented in a NE.-SW. direction. The semimajor axis runs east of Van Norman Lake, and a profile of displacements along the level line reaches a local peak of +0.615 m. ±15 mm. A profile of the level line beginning at Granada Hills, passing a short distance south of the Olive View Hospital and north of Hansen Lake to Tujunga, records the maximum movements—+1.460 m. ±16 mm. and +1.510 m. ±16 mm. This maximum uplift area is followed by a small zone of fairly large downthrusts. Considered together, this defines an area of subsidence to the east and south of the vicinity of Van Norman Lake and a region of uplift to the west and north.

Upheaval near Castaic Junction of +0.030 m. ±18 mm. reaches a local maximum of +0.141 m. ±18 mm. north of Saugus, and subsidence from Pacoima to Sun Valley serves to round out the ellipse of movements.

Pockets of movement outside the ellipse also were indicated by the analysis, but these most likely are areas of continuing gradual movements.

TSUNAMIS[4]

Seven tsunamis were reported to the National Oceanic and Atmospheric Administration during 1971, including four that were recorded on National Ocean Survey tide gages.

On May 2, an earthquake in the Andreanof Islands (51.4° N., 177.2° W.) generated a minor tsunami that was recorded at Adak, Alaska, with a maximum amplitude of 0.06 m. The Alaska Regional Tsunami Warning System issued a tsunami warning and the Pacific Tsunami Warning Center issued a watch.

An earthquake on July 9 near the coast of central Chile (32.5°S., 71.2° W.) generated a tsunami which was recorded at Valparaiso with a maximum amplitude of 1.2 m.

The New Ireland earthquake of July 14 (5.5° S., 153.9° E.) generated a tsunami that caused one death and property damage on New Ireland and Bougainville. Maximum wave amplitudes (in meters) reported to NOAA from the epicentral area were 3.05 on the end of New Ireland; 3.05 at Pomio, New Britain; 1.50 at Rabaul; and 0.61 at Sohano on Buka Passage. Representative maximum wave heights recorded elsewhere were: Kwajalein, 0.24; Truk, 0.06; Wake Island, 0.06; Honolulu, Hawaii, 0.09; Kahului, Hawaii, 0.24; Crescent City, Calif., 0.15; and Attu, Alaska, 0.06. The Pacific Tsunami Warning Center issued a tsunami watch.

A second earthquake in the New Ireland area (4.9° S., 153.2° E.) on July 26 generated waves reported to be 6.50 m. crest to trough in Rabaul Harbor, causing flood damage along the waterfront. On southern New Ireland, waves penetrated 0.8 km. (½ mile) inshore and damaged plantations. Wave heights to approximately 0.50 m. were reported from northern New Ireland and eastern Papua. Representative maximum wave heights (in meters) recorded elsewhere included: Kwajalein, 0.24; Truk, 0.09; Wake Island, 0.06; Midway, 0.12; Honolulu, Hawaii, 0.12; Kahului, Hawaii, 0.30; Los Angeles, Calif., 0.09; Crescent City, Calif., 0.15; and Attu, Alaska, 0.06. A tsunami watch was again issued by the Pacific Tsunami Warning Center.

[4]Prepared by Mark G. Spaeth, Office of Oceanography, National Weather Service, National Oceanic and Atmospheric Administration, Silver Spring, Md.

On August 2, an earthquake in the Hokkaido, Japan, region (41.4° N., 143.5° E.) caused a minor tsunami that was recorded with a maximum amplitude of 0.18 m. at Miyako, 0.12 m. at Ofunato, 0.30 m. at Hachinohe, 0.26 m. at Urakawa, and 0.40 m. at Hiroo.

The September 5 Sakhalin earthquake (46.5° N., 141.2° E.) caused a tsunami which was reported to be 1 m. on Moneron Island; 0.50 m. at Nevel'sk, Sakhalin; and 0.62 m. at Wakkanai, Japan.

An earthquake near the east coast of Kamchatka on December 15 (56.0° N., 163.3° E.) generated a tsunami that was recorded at a number of tide stations. Messages relayed from Khabarovsk by the Japanese Meteorological Agency reported the following wave heights (in meters) in the Kuril Islands: Paramusir Island, 10.10; Shumshu Island, 3.60; and Matua Island, 5.10. Maximum heights (in meters) recorded at United States tide stations included: Attu, Alaska, 0.18; Wake Island, 0.09; Hilo, Hawaii, 0.18; and Kahului, Hawaii, 0.15. A tsunami watch was issued by the Pacific Tsunami Warning Center.

FLUCTUATIONS IN WELL-WATER LEVELS[5]

In 1943, the Coast and Geodetic Survey (now the National Ocean Survey) first published the section on well-water fluctuations in its annual *United States Earthquakes* series. Data for the years 1944-49 appeared in the 1949 issue. From 1950 to the present, the material has been published annually.

Table 3 lists fluctuations in well-water caused principally by earthquakes. Table 4 lists the date, time, and location of specific events that may have been associated with the fluctuations noted in table 3. Also included are the states where the fluctuations were recorded.

Complete information on earthquakes possibly associated with tabulations in table 3 may be obtained from the biweekly *Preliminary Determination of Epicenters* listings, published by the National Earthquake Information Center.

[5]Prepared by K.B. Rennick, Water Data Projects Office, Water Resources Division, Geological Survey, U.S. Department of the Interior, Denver, Colo.

TABLE 3.—*Fluctuations in well-water levels during 1971*

County and/or well number	Date	Time at recorder (Greenwich mean time)	Depth to water before disturbance	Water-level fluctuations		
				From prequake level		Double amplitude
				Upward	Downward	
ALASKA						
			feet	*feet*	*feet*	*feet*
AK 1022	Jan. 10	0800±	41.23	0.01	0.04	0.05
GEORGIA						
Charlton 27E2	Jan. 10	0717	16.52	0.08	0.08	0.16
Decatur 9F520	Jan. 10	0717	47.86	.05	.05	.10
Dougherty 13L3	Jan. 10	0717	37.47	.07	.08	.15
Long 33M4	Jan. 10	0717	39.05	.12	.12	.24
McIntosh 35M13	Jan. 10	0717	10.48	.13	.06	.19
Decatur 9F520	Feb. 9	1400	47.85	.03	.07	.10
Dougherty 13L3	Feb. 9	1400	36.39	.05	.05	.10
McIntosh 35M13	Feb. 9	1400	10.52	.02	.01	.03
Thomas 14E15	Feb. 9	1400	197.54	.08	.12	.20
Charlton 27E2	July 9	0303	65.39	.07	.07	.14
Decatur 9F520	July 9	0303	44.62	.03	.03	.06
Dougherty 13L3	July 9	0303	28.47	.07	.07	.14
Long 33M4	July 9	0303	39.68	.04	.08	.12
McIntosh 35M13	July 9	0303	9.98	.06	.04	.10
Thomas 14E15	July 9	0303	197.74	.20	.20	.40
Charlton 27E2	July 14	0611	65.03	05	0	.05
Decatur 9F520	July 14	0611	44.73	.03	.03	.06
Dougherty 13L3	July 14	0611	28.14	.05	03	.08
Long 33M4	July 14	0611	39.65	.01	.04	.05
McIntosh 35M13	July 14	0611	9.89	.01	.07	.08
Thomas 14E15	July 14	0611	197.56	.21	.21	.42
Charlton 27E2	July 25	0123	64.90	.01	.03	.04
Dougherty 13L3	July 25	0123	27.45	.03	.03	.06
Thomas 14E15	July 25	0123	197.92	.08	.08	16
Dougherty 13L3	July 27	0202	27 37	.02	.02	.04
Thomas 14E15	July 27	0202	198 04	.06	.06	.12
Do	Aug. 2	0724	198.05	.01	02	03
McIntosh 35M13	Aug. 5	0158	10.36	02	.01	03
Thomas 14E15	Aug 5	0158	198.07	.05	.05	.10
Decatur 9F520	Sept. 30	0817	46 75	.03	.03	06
Dougherty 13L3	Sept 30	0817	28.84	.07	.07	.14
Thomas 14E15	Sept 30	0817	198.08	.05	.08	13
Decatur 9F520	Dec. 15	0829	47.58	.10	08	.18
Dougherty 13L3	Dec. 15	0829	31.30	.17	.15	.32
Long 33M4	Dec. 15	0829	40.07	.05	05	.10
McIntosh 35M13	Dec 15	0829	10.94	.08	.05	.13
Thomas 14E15	Dec 15	0829	198.28	.31	35	.66
IDAHO						
Elmore 2S-5E-36bbb1	Jan 10	0650	285.12	0.05	0	0.05
Madison 7N-38E-23dba1	Jan 10	0800	40 77	.09	.08	.17

See footnotes at end of table

TABLE 3.—*Fluctuations in well-water levels during 1971*—Continued

County and/or well number	Date	Time at recorder (Greenwich mean time)	Depth to water before disturbance	Water-level fluctuations		
				From prequake level		Double amplitude
				Upward	Downward	
IDAHO—Continued						
			feet	*feet*	*feet*	*feet*
Twin Falls 14S-15E-28bad2	Jan. 10	0810	105.73	0.04	0.03	0.07
Cassia 13S-21E-18bbc1	Jan. 10	0850	565.86	.08	.05	.13
Jefferson 7N-34E-4cdc1	Jan. 14	2310	8.10	.02	.03	.05
Butte 5N-31E-28ccc1	Feb. 8	2250	260.69	.02	.03	.05
Jefferson 7N-36E-22abd4	Feb. 9	1200[1]	5.44	.05	.06	.11
Custer 9N-21E-14bbc1	Feb. 9	1245	82.48	.01	.02	.03
Blaine 1S-19E-3ccb2	Feb. 9	1300[1]	16.40	.09	.07	.16
Minidoka 7S-25E-19bab1	Feb. 9	1300-1500[1]	241.02	.10	.12	.22
Minidoka 8S-23E-2baa1	Feb 9	1300-1500[1]	205.62	.05	.05	.10
Minidoka 8S-25E-24bdc1	Feb. 9	1300-1500[1]	142.16	.08	.08	.16
Lincoln 5S-17E-26aca1	Feb. 9	1330[1]	193.98	.08	.11	.19
Butte 6N-25E-3aaa1	Feb 9	1340	72.42	.06	.05	.11
Twin Falls 11S-17E-25ddd2	Feb. 9	1345	91.35	.02	.02	.04
Elmore 2S-5E-36bbb1	Feb. 9	1345	285.45	.14	.18	.32
Canyon 5N-5W-24dbb1	Feb. 9	1345	10 59	.02	.02	.04
Butte 4N-30E-7adb1	Feb. 9	1355	315.10	.20	.22	.42
Blaine 2S-20E-1acc2	Feb. 9	1400[1]	149.00	.05	.04	.09
Butte 3N-29E-14adb1	Feb 9	1405	452.02	.22	.30	.52
Madison 7N-38E-23dba1	Feb. 9	1410	41 85	.35	.33	.68
Twin Falls 14S-15E-28bad2	Feb. 9	1410	105.68	.04	.09	.13
Butte 4N-26E-32ccb1 (Formerly 4N-26E-32cba1)	Feb 9	1410	199.64	.02	.03	.05
Jefferson 5N-32E-36add1	Feb. 9	1420	327 37	.06	.09	.15
Teton 4N-45E-13ada1	Feb. 9	1425	197.13	.08	.08	.16
Bingham 2N-31E-35dcc1	Feb 9	1425	584 11	.09	.09	.18
Cassia 13S-21E-18bbc1	Feb 9	1445	565.83	07	.14	.21
Jerome 8S-19E-5dab1	Feb. 9	1450	271.79	.04	.04	.08
Jefferson 7N-34E-4cdc1	Feb. 9	1455	7.10	.20	.22	.42
Butte 5N-31E-28ccc1	Feb 9	1455	260.73	.13	.25	.38
Butte 4N-30E-7adb1	Mar 13	2350	315 51	01	.03	.04
Madison 7N-38E-23dba1	Mar 13	2410	42.52	06	05	.11
Do	Apr 14	1150	43 12	.05	.02	.07
Do	May 2	0630	43 17	.04	.03	.07
Twin Falls 11S-20E-21dcb1	May 2	0630-0830[1]	71 29	03	.03	.06
Butte 5N-31E-28ccc1	May 2	0715	260.98	.07	.08	15
Minidoka 8S-23E-2baa1	May 7	0200[1]	205.23	.03	.03	.06
Minidoka 7S-24E-2add1	July 9	0300-0500[1]	211 48	.03	03	06
Madison 7N-38E-23dba1	July 9	0340	39.94	.13	.13	.26
Elmore 2S-5E-36bbb1	July 9	0350	284 92	02	03	05
Butte 3N-29E-14adb1	July 9	0350	452 24	02	.03	.05
Teton 4N-45E-13ada1	July 9	0410	129 00	05	03	.08
Butte 4N-30E-7adb1	July 9	0415	313 92	10	14	.24
Butte 5N-31E-28ccc1	July 9	0410	260 38	.12	18	.30
Lincoln 5S-17E-26aca1	July 13	1900-2100[1]	186.35	01	02	.03
Teton 4N-45E-13ada1	July 14	0700	131 20	11	.13	24
Elmore 2S-5E-36bbb1	July 14	0700	285 02	02	.04	06

See footnotes at end of table

TABLE 3.—*Fluctuations in well-water levels during 1971*—Continued

County and/or well number	Date		Time at recorder (Greenwich mean time)	Depth to water before disturbance	Water-level fluctuations		
					From prequake level		Double amplitude
					Upward	Downward	
IDAHO—Continued							
				feet	*feet*	*feet*	*feet*
Madison 7N-38E-23dba1	July	14	0700	39.69	0.07	0.11	0.18
Cassia 13S-21E-18bbc1	July	14	0700	566.26	.05	.05	.10
Madison 7N-38E-23dba1	July	14	0720	39.69	.09	.12	.21
Butte 5N-31E-28ccc1	July	14	0730	260.44	.29	.32	.61
Butte 4N-30E-7adb1	July	14	0740	313.77	.08	.10	.18
Butte 5N-31E-28ccc1	July	19	0100	260.42	.04	.01	.05
Gooding 8S-14E-16cbb1	July	22	2235	38.52	.06	.05	.11
Blaine 8S-26E-33bcb1	July	25	2200-2400[1]	104.77	.02	.01	.03
Madison 7N-38E-23dba1	July	26	0200	39.18	.04	.05	.09
Butte 4N-30E-7adb1	July	26	0215	313.27	.03	.06	.09
Teton 4N-45E-13ada1	July	26	0215	138.45	.06	.06	.12
Madison 7N-38E-23dba1	July	26	0220	39.18	.04	.06	.10
Do	July	26	0240	39.18	.03	.05	.08
Butte 5N-31E-28ccc1	July	26	0300	260.22	.13	.11	.24
Madison 7N-38E-23dba1	July	26	0320	39.18	.02	.04	.06
Butte 5N-31E-28ccc1	July	27	0215	260.22	.04	.03	.07
Madison 7N-38E-23dba1	July	27	0230	39.14	.02	.02	.04
Butte 5N-31E-28ccc1	Aug.	2	0815	260.28	.02	.02	.04
Do	Aug.	5	0215	260.19	.03	.06	.09
Madison 7N-38E-23dba1	Aug.	5	0315	38.86	.02	.04	.06
Butte 5N-31E-28ccc1	Sept.	5	1815	259.81	.04	.02	.06
Madison 7N-38E-23dba1	Sept.	5	1930	38.21	.04	.03	.07
Butte 4N-30E-7adb1	Sept.	30	0820	311.12	.05	.08	.13
Butte 3N-29E-14adb1	Sept.	30	0830	451.43	.06	.08	.14
Butte 5N-31E-28ccc1	Sept.	30	0840	259.13	.06	.05	.11
Elmore 2S-5E-36bbb1	Sept.	30	0840	284.62	.02	.04	.06
Butte 5N-31E-28ccc1	Nov.	24	2020	258.03	.06	.05	.11
Madison 7N-38E-23dba1	Dec.	15	0825	40.50	.27	.28	.55
Butte 3N-29E-14adb1	Dec.	15	0825	450.80	.02	.03	.05
INDIANA							
Ma 32	Jan.	3	1840-1855	10.40	0.01	0.01	0.02
Dw 4	Jan.	10	0710-0720	48.86	.01	0	.01
Pu 6	Jan.	10	0710-0730	10.45	.03	0	.03
Sh 2	Jan.	10	0710-0750	19.48	.01	.02	.03
Ma 32	Jan.	19	0320-0325	10.38	.02	.03	.05
Do	Feb.	5	0730-0735	9.74	.01	.02	.03
Do	Feb	7	0300-0320	9.59	.01	.02	.03
Dw 4	Feb.	9	1400-1405	48.94	0	.02	.02
Ma 32	Feb	9	1400-1420	10.01	.07	.10	.17
Pu 6	Feb.	9	1415-1420	11.29	0	.03	.03
Sh 2	Feb.	9	1415-1420	19.66	0	.02	.02
Ma 32	Mar.	14	0010-0015	9.62	.01	.02	.03
Do	Mar.	26	1735-1740	9.84		.01	.01

See footnotes at end of table

TABLE 3.—*Fluctuations in well-water levels during 1971*—Continued

County and/or well number	Date	Time at recorder (Greenwich mean time)	Depth to water before disturbance	Water-level fluctuations		
				From prequake level		Double amplitude
				Upward	Downward	
INDIANA—Continued						
			feet	*feet*	*feet*	*feet*
Pu 6	May 2	0625-0630	10.68	0.01	0.01	0.02
Ma 32	May 2	0640-0710	10.21	.05	.04	.09
Do	June 11	1440-1450	11.21	.01	.02	.03
Do	June 17	2140-2210	11.56	.01	.01	.02
Dw 4	July 9	0250-0300	49.00	.01	.01	.02
Sh 2	July 9	0310-0320	19.43	.01	.03	.04
Pu 6	July 9	0320-0330	10.92	.03	.03	.06
Dw 4	July 14	0600-0615	49.02	.02	.01	.03
Ma 32	July 14	0600-0645	11.87	.06	.06	.12
Sh 2	July 14	0635-0705	19.25	.01	.02	.03
Pu 6	July 14	0700-0720	10.38	.04	.04	.08
Ma 32	July 19	0005-0015	11.64	.01	0	.01
Pu 6	July 26	0110-0120	11.20	0	.01	.01
Sh 2	July 26	0135-0150	19.54	0	.01	.01
Ma 32	July 26	0220-0345	11.51	.05	.03	.08
Sh 2	July 27	0130-0140	19.63	0	.01	.01
Ma 32	July 27	0210-0230	11.84	.03	.03	.06
Do	Aug. 5	0230-0240	11.62	.01	.01	.02
Do	Aug. 20	2200-2205	12.06	.01	0	.01
Sh 2	Sept. 30	0800-0810	20.99	.02	0	.02
Dw 4	Sept. 30	0815-0825	48.87	.01	.01	.02
Sh 2	Dec. 15	0740-0805	19.86	.03	.01	.04
Pu 6	Dec. 15	0820-0830	12.84	.02	.02	.04
NEVADA						
S17/50-36dc1	Jan. 10	0745	2.64	0.02	0.03	0.05
Do	Jan. 10	0805	2.63	.19	.19	.38
Do	Jan. 19	0320	2.42	.02	.02	.04
Do	Feb. 5	0745	2.47	.03	.02	.05
Do	Feb. 8	2150	2.42	02	.01	.03
Do	Mar. 14	0015	2.47	.07	.08	.15
Do	June 11	1320	2.57	.02	.02	.04
Do	June 24	1400	2.75	.02	.03	.05
Do	July 8	1340	2.96	.05	.07	.12
Do	July 9	0300	2.86	.09	.12	.21
S19/60-9bcc1	July 14	0600	117.60	.09	.08	.17
S17/50-36dc1	July 14	0640	2.94	.16	.20	.36
Do	July 19	0100	2.89	.02	.03	.05
Do	July 26	0200	2.98	.10	.08	.18
Do	July 27	0230	3.01	.05	.02	.07
Do	Aug. 18	1345	3.15	.02	.04	.06
Do	Aug. 20	2150	3.21	.03	.01	.04
Do	Sept 5	1900	3.31	.02	.02	.04

See footnotes at end of table.

TABLE 3.—*Fluctuations in well-water levels during 1971*—Continued

County and/or well number	Date		Time at recorder (Greenwich mean time)	Depth to water before disturbance	Water-level fluctuations		
					From prequake level		Double amplitude
					Upward	Downward	
WISCONSIN							
				feet	*feet*	*feet*	*feet*
MI-120	Jan.	3	1845	92.747	0.019	0.011	0.030
Lf-57	Jan.	3	1845	110.76	.05	0	.05
MI-120	Jan.	10	0750	92.478	.150	.126	.276
Lf-57	Jan.	10	0800	110.80	.16	.22	.38
Sb-19	Jan.	10	0800	2.51	.04	.02	.06
Fl-12	Jan.	10	0815	67.88	.02	0	.02
Lf-57	Jan.	19	0330	111.07	.03	.04	.07
MI-120	Jan.	19	0335	92.449	.004	.007	.011
Do	Feb.	4	1650	91.892	.022	0	.022
Lf-57	Feb.	4	1650	110.57	.02	.01	.03
Do	Feb.	5	0800	109.65	.02	.03	.05
MI-120	Feb.	5	0800	91.210	.035	.003	.038
Do	Feb.	7	0315	91.994	.004	.017	.021
Lf-57	Feb.	7	0330	111.03	.03	.04	.07
Do	Feb.	8	2200	110.91	.02	0	.02
MI-120	Feb.	8	2215	91.801	.010	.008	.018
Do	Feb.	9	1430	91 796	.023	.070	.093
Lf-57	Feb.	9	1430	110.91	.27	.32	.59
MI-120	Mar.	14	0020	91.150	.008	.014	.022
Do	May	2	0645	90.350	.023	.020	.043
Do	June	11	1300	91.070	.011	0	.011
Lf-57	June	11	1300	111.39	.04	.01	.05
Do	June	11	1415	111.37	.03	.02	.05
MI-120	June	11	1420	91.059	.019	.002	.021
Lf-57	June	17	2100	111.45	.02	.01	.03
MI-120	June	17	2115	91.242	.012	.015	.027
Lf-57	July	9	0330	109.59	.11	.18	.29
MI-120	July	14	0630	90.623	.063	.107	.170
Lf-57	July	14	0645	109.43	.13	.12	.25
MI-120	July	19	0100	90.349	0	.014	.014
Lf-57	July	19	0115	109.14	.04	.04	.08
MI-120	July	26	0145	90.109	050	.048	.098
Lf-57	July	26	0200	109.39	.05	09	.14
MI-120	July	27	0215	90 242	.026	.014	.040
Lf-57	July	27	0230	109 54	.02	.04	.06
MI-120	Aug.	2	0730	90.226	007	.011	.018
Lf-57	Aug.	2	0830	109 48	03	.05	.08
MI-120	Aug.	5	0200	90 025	037	.014	.051
Lf-57	Aug.	5	0300	109.65	03	.06	.09
Do	Sept.	5	1845	109.18	.07	.03	.10
MI-120	Sept	5	1900	89.680	.014	.009	.023
Lf-57	Sept	30	0800	109 21	.26	.22	.48
MI-120	Sept.	30	0815	90 567	037	.032	.069
Lf-57	Oct.	4	0145	109.34	0	.06	.06
Do	Oct.	27	1845	108 77	01	.05	06
MI-120	Oct	27	1850	90 442	.010	.008	.018

See footnotes at end of table.

TABLE 3.—*Fluctuations in well-water levels during 1971*—Continued

County and/or well number	Date	Time at recorder (Greenwich mean time)	Depth to water before disturbance	Water-level fluctuations		
				From prequake level		Double amplitude
				Upward	Downward	
WISCONSIN—Continued						
			feet	*feet*	*feet*	*feet*
Lf-57	Oct. 28	1830	109.55	0.02	0	0.02
Do	Nov. 24	1930	109.47	.03	.03	.06
Ml-120	Nov. 24	2005	90.811	.007	.013	.020
Lf-57	Dec. 15	0915	108.87	.32	.21	.53
Ml-120	Dec. 15	0915	89.716	.134	.069	.203

[1]Time of occurrence for monthly gage believed to be accurate to ±1 hour. Time for all other gages believed to be accurate to ±½ hour.

(Page 112 follows)

TABLE 4.—*Earthquakes in 1971 believed to have caused fluctuations in well-water levels*

Date	Origin time G M T			Location	States recording fluctuations
	hr	min	sec		
Jan 3	17	35	40.2	South Atlantic Ridge	Indiana and Wisconsin.
10	07	17	03.7	West New Guinea	Alaska, Georgia, Idaho, Indiana, Nevada, and Wisconsin.
14	22	46	30.8	.....do	Idaho.
19	03	16	53.6	Gulf of California	Indiana, Nevada, and Wisconsin.
Feb 5	07	33	29.1	Queen Charlotte Islands	Do.
7	03	20	59.9	Andreanof Islands	Indiana.
8	21	04	21.8	South Shetland Islands	Nevada and Wisconsin.
9	14	00	41.6	Southern California	Georgia, Idaho, Indiana, and Wisconsin.
Mar. 13	23	51	35.5	Vancouver Island region	Idaho, Indiana, Nevada, and Wisconsin.
26	17	35	18.0	Southeastern Alaska	Indiana.
Apr 14	11	38	42.1	Baja California	Idaho.
May 2	06	08	27.3	Andreanof Islands	Idaho, Indiana, and Wisconsin.
7	00	21	13.9	Celebes	Idaho.
June 11	13	58	37.7	Rat Islands	Indiana.
11	12	56	04.3	Dominican Republic	Nevada and Wisconsin.
17	21	00	40.9	Northern Chile	Indiana and Wisconsin.
24	14	00	00.2	Southern Nevada. Nevada Test Site	Nevada.
July 8	14	00	00.1	.....do	Do.
9	03	03	18.7	Near coast of central Chile	Georgia, Idaho, Indiana, Nevada, and Wisconsin.
13	18	51	32.1	Montana	Idaho.
14	06	11	29.1	New Ireland region	Georgia, Idaho, Indiana, and Wisconsin
19	00	14	45.3	.....do	Idaho, Indiana, and Nevada.
22	22	07	19.3	Honshu, Japan	Idaho.
26	01	23	21.3	New Ireland region	Georgia, Idaho, Indiana, Nevada, and Wisconsin.
27	02	02	49.6	Peru-Ecuador border region	Do.
Aug 2	07	24	56.8	Hokkaido, Japan, region	Georgia, Idaho, and Wisconsin.
5	01	58	51.7	Central Mid-Atlantic Ridge	Georgia, Idaho, Indiana, and Wisconsin
18	14	00	00.0	Southern Nevada. Nevada Test Site	Nevada.
20	21	36	09.6	Chiapas, Mexico	Indiana and Nevada.
Sept 5	18	35	25.0	Sakhalin Island	Idaho, Nevada, and Wisconsin
30	08	17	54.6	Gulf of California	Georgia, Idaho, Indiana, and Wisconsin
Oct 27	17	58	36.9	New Hebrides Islands	Wisconsin.
28	18	00	00.5	.....do	Do
Nov 24	19	35	29.1	Off east coast of Kamchatka	Idaho and Wisconsin.
Dec 15	08	29	55.3	Near east coast of Kamchatka	Georgia, Idaho, Indiana, and Wisconsin.

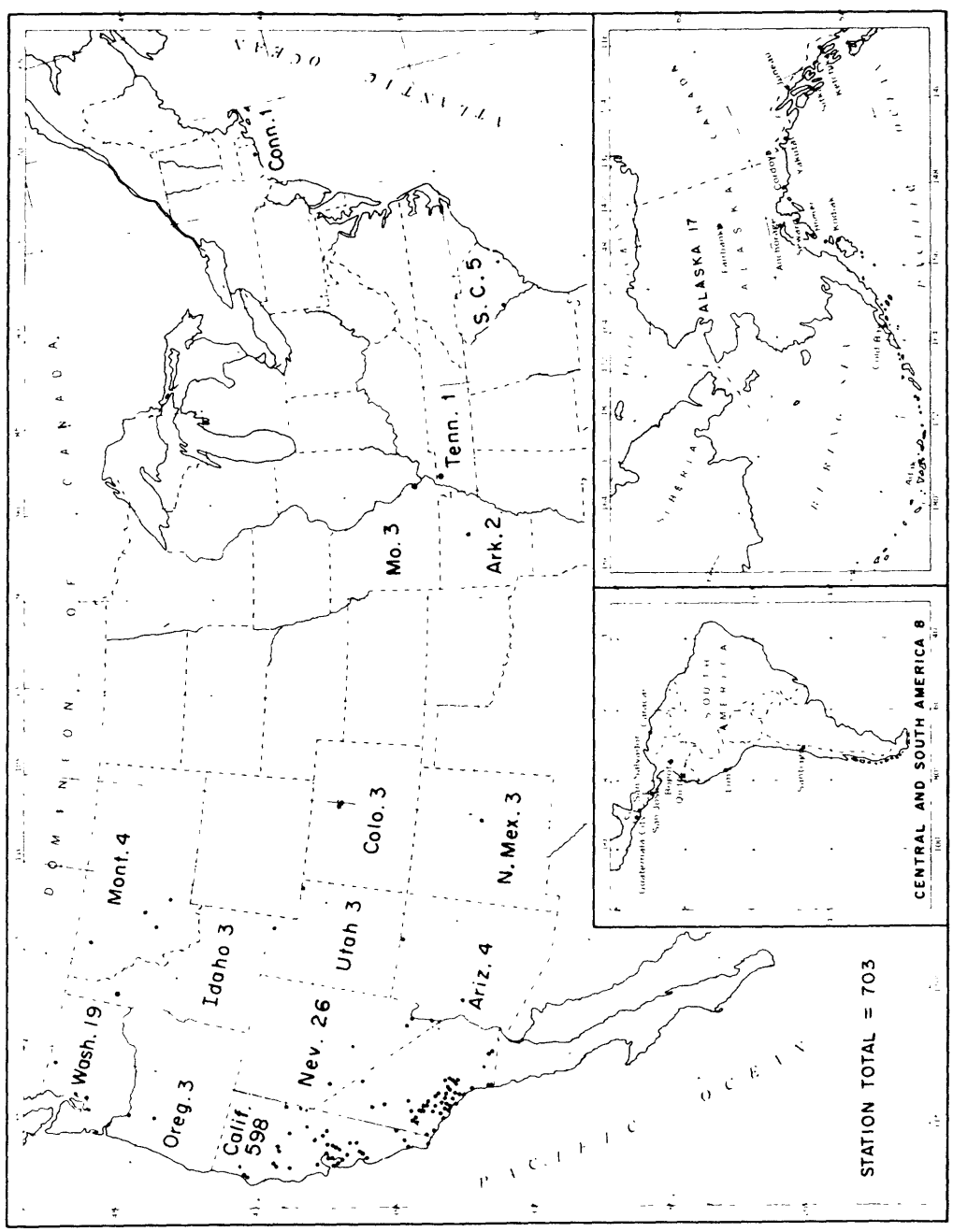

FIGURE 7.—NOAA strong-motion accelerograph network (as of June 30, 1972).

Strong-Motion Seismograph Data[1]

INTRODUCTION

The NOAA Seismological Field Survey has conducted an engineering seismology program in the United States and Latin America since 1932. The Survey, with cooperation of state and municipal governments, private industry, and state and private educational institutions, has installed and maintained strong-motion seismographs and analyzed the seismograms. Results of these analyses have been published in Government bulletins and scientific journals, and the records, either originals or copies, have been made available to research scientists.

A list of strong-motion stations in the United States and Central and South America is available from the Seismological Field Survey (address in footnote 1). This list, which gives the geographic location of each station, instrumental constants, and, in some instances, the local geology, has been cataloged through 1971. The format is similar to that included in this paper. The approximately 400 seismoscope sites are also in the process of being listed in computer format.

The number of strong-motion accelerographs in the United States and Central and South America has risen from 75 in 1963 to 574 in December 1971. With the exception of six ½*g* instruments, all accelerographs are capable of recording acceleration pulses as large as 1*g* without going off scale. Figure 7 shows the locations of accelerographs in the network operated by the Seismological Field Survey. The rapid growth in the network is attributable largely to the development of modern low-cost accelerographs, to the cooperative programs instituted with the State of California Department of Water Resources, Army Corps of Engineers, and California Institute of Technology, and to numerous cities that have adopted building code provisions requiring three accelerographs in most structures taller than six stories.

Notes pertinent to this engineering seismology program may be found in preceding issues of the *United States Earthquakes* series, and in *Publication 41–2, Earthquake Investigations in the Western United States, 1931–1964*, U.S. Department of Commerce, Coast and Geodetic Survey, Washington, D.C., 1965 (out of print). The latter is much broader in scope, containing data on structural and ground vibrations and detailed descriptions of the many activities that constitute the seismological program as a whole.

INTERPRETATION OF RECORDS

Table 5 presents a complete listing of all earthquakes recorded in 1971 and the number

[1]Prepared by Glenn Converse, Seismological Field Survey, Environmental Research Laboratories, National Oceanic and Atmospheric Administration, 890 Main Street, San Francisco, Calif. Appreciation is extended to Virgilio Perez, Stephen Schwartz, Richard P. Maley, B.J. Morrill, and Charles F. Knudson of the Seismological Field Survey for their assistance in preparing this section.

of records obtained on strong-motion instruments. Table 6 gives all pertinent instrument data for each accelerograph or displacement meter that was activated by an earthquake. Site station numbers with a designation of 9,000 or greater are temporary stations. For stations in the Southern Hemisphere, a minus sign precedes the latitude orientation. Where known, the geology of the site is noted. Also included in this table are the date of occurrence of an earthquake, its location and magnitude, and the maximum Modified Mercalli intensity. For each station, the epicentral distance (in kilometers), the length of actual earthquake record (in seconds), the peak acceleration (in fractions of g) or displacement (in centimeters), the approximate period (in seconds) of this peak, the duration (in seconds) and the number of cycles of acceleration which exceeded $0.2g$, and the approximate number of recorded aftershocks, both on the main record and on subsequent records, are listed.

The accelerations and displacements are values derived from direct scaling of maximum amplitudes from the original records. Periods are approximated by measuring and doubling the time between zeros of that cycle with the maximum acceleration or displacement. Only accelerations greater than $0.01g$ and displacements greater than 0.1 cm. were measured. Because a great many sites experienced high accelerations during the February 9 earthquake, the number of seconds of acceleration exceeding $0.2g$ and the approximate number of cycles in that duration were measured and tabulated. Generally, accelerations exceeding $0.2g$ occurred only on one section of the record; if

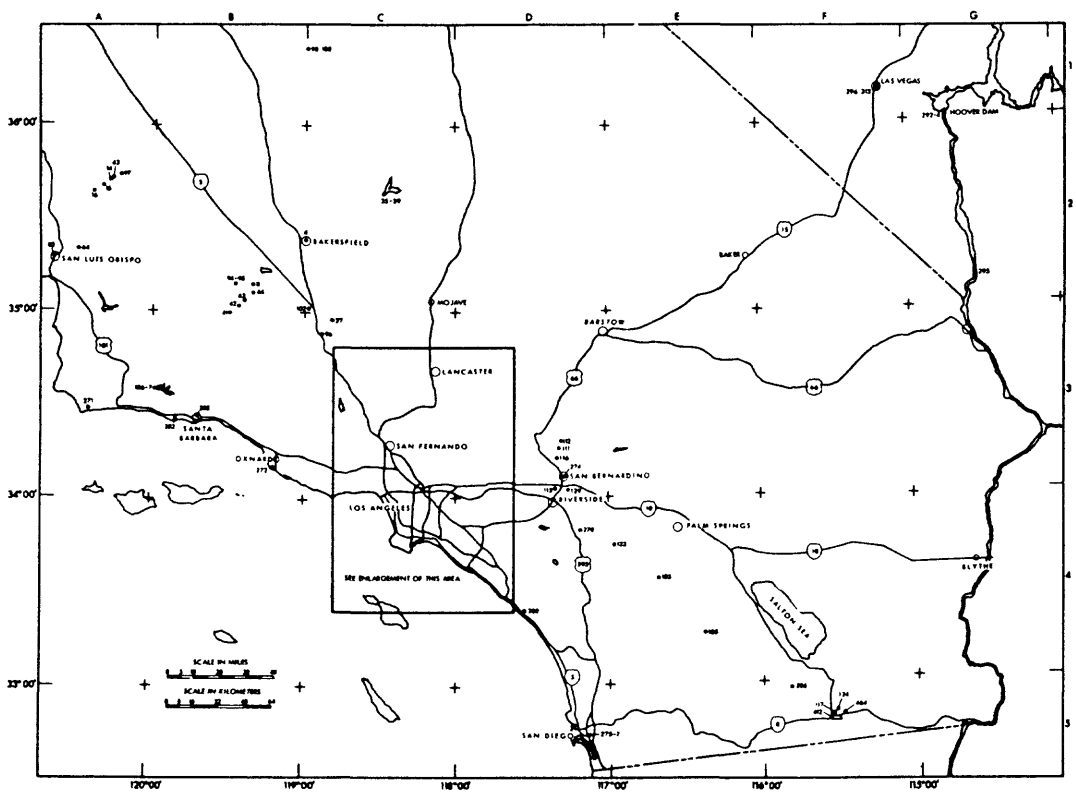

FIGURE 8.—Accelerograph stations in central and southern California during San Fernando earthquake.

two or more sections existed, only the longer section was tabulated (see figs. 8, 9, and 10 for instrument locations).

Following the February 9 main event, numerous aftershocks occurred. During the 400 seconds the Pacoima Dam instrument was recording, more than 30 aftershocks were registered. Several instruments located within

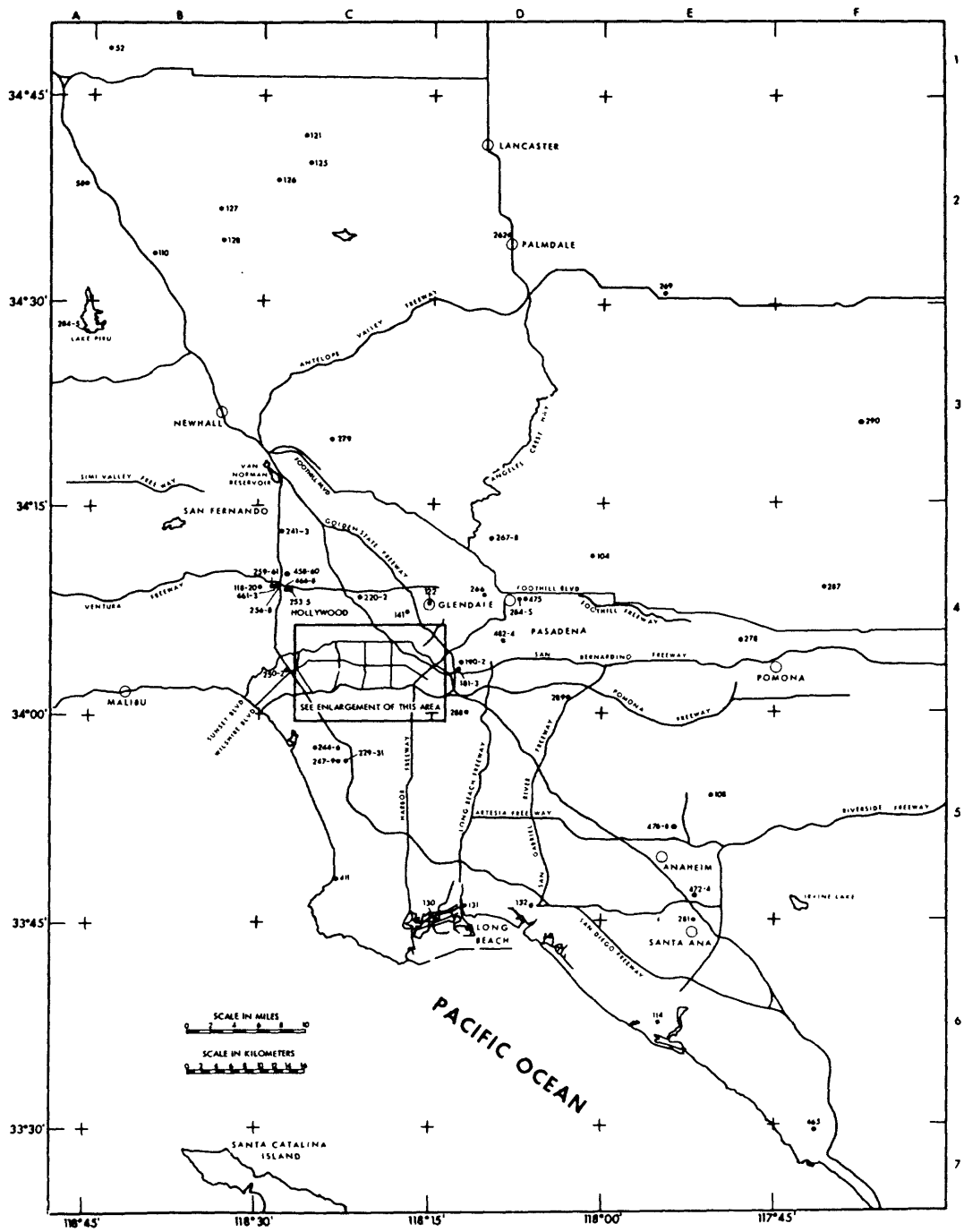

FIGURE 9.—Accelerograph stations in extended Los Angeles area during San Fernando earthquake.

a radius of 25 to 35 km. from the epicenter recorded 15 aftershock events within the first several days following the main event. Approximately 800 aftershock records were registered; of these, roughly 600 appeared on the original records, the remainder having been recorded after the instruments were serviced and the original records removed. Because the strong-motion accelerographs do not record absolute time, origin time, date, and epicentral location cannot be attributed to most of the aftershock records.

Three buildings which housed instruments received some structural damage (noted by (SD) in the epicentral distance column). These were at 1640 Marengo, 8244 Orion, and 15250 Ventura. All three buildings were situated on alluvium of at least several hundred feet thickness. If one takes into account sites with similar geology, such as 15107 Van Owen and 14724 Ventura where no structural damage occurred, no apparent correlation between structural damage and peak acceleration and/or duration of acceleration greater than 0.2*g* can be found. Of some interest is the severe shaking received by the three sites closest to fault breakage. These were Pacoima Dam (listed under San Fernando), 8244 Orion, and 15107 Van Owen, situated 4, 8, and 13 km., respectively, from surface faulting. Note the large number of seconds of acceleration greater than 0.2*g* and the high number of cycles in that interval (for the latter two sites, the roof records exhibit the strongest shaking).

This compilation of strong-motion results includes seismoscope records of the February 9 earthquake. While a few other seismoscopes registered events during 1971, the records were of minor importance and are not in-

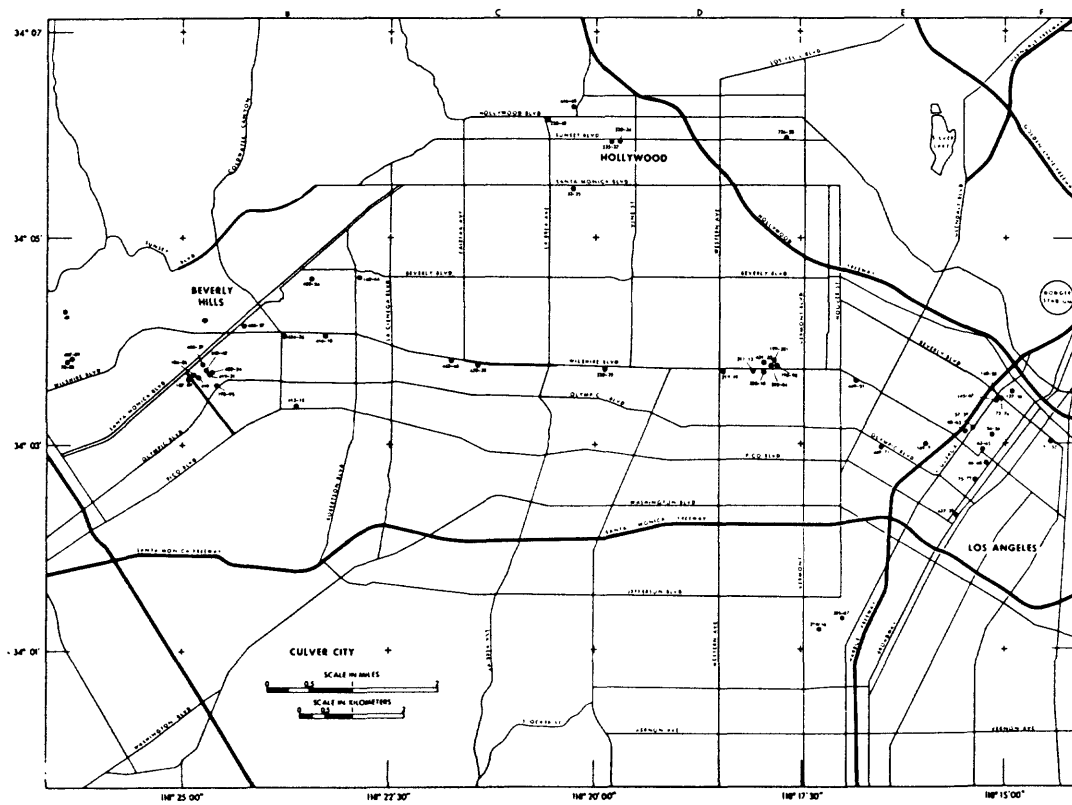

FIGURE 10.—Accelerograph stations in central Los Angeles during San Fernando earthquake.

cluded.

From the 150 seismoscopes in the region of faulting of the February 9 event, 144 usable records were obtained. Two records (Pacoima and Dry Canyon) were partially destroyed when the earthquake motion exceeded the design limits of the instruments and the recording plates were dislodged. However, these incomplete records do provide useful information on the nature of the motion during the first few seconds of record.

Figure 11 is a map showing the seismoscope site locations in the southern California network. Table 7 lists by geographical area all recovered seismoscope records. Included in this table are the distance of the station from the epicenter (in kilometers) and the azimuth (in degrees) measured clockwise from the north. The maximum relative displacement response spectrum value S_d and its azimuthal direction measured clockwise from the north are tabulated in the last two columns.

The map of figure 12 shows in graphical form the magnitude and direction of the maximum seismoscope response of each station. The length of the line segment centered at the station point is proportional to the S_d value, while the direction is that of the corresponding maximum relative displacement. Two line segments indicate that there are two seismoscopes at a station, such as on the abutment and crest of a dam.

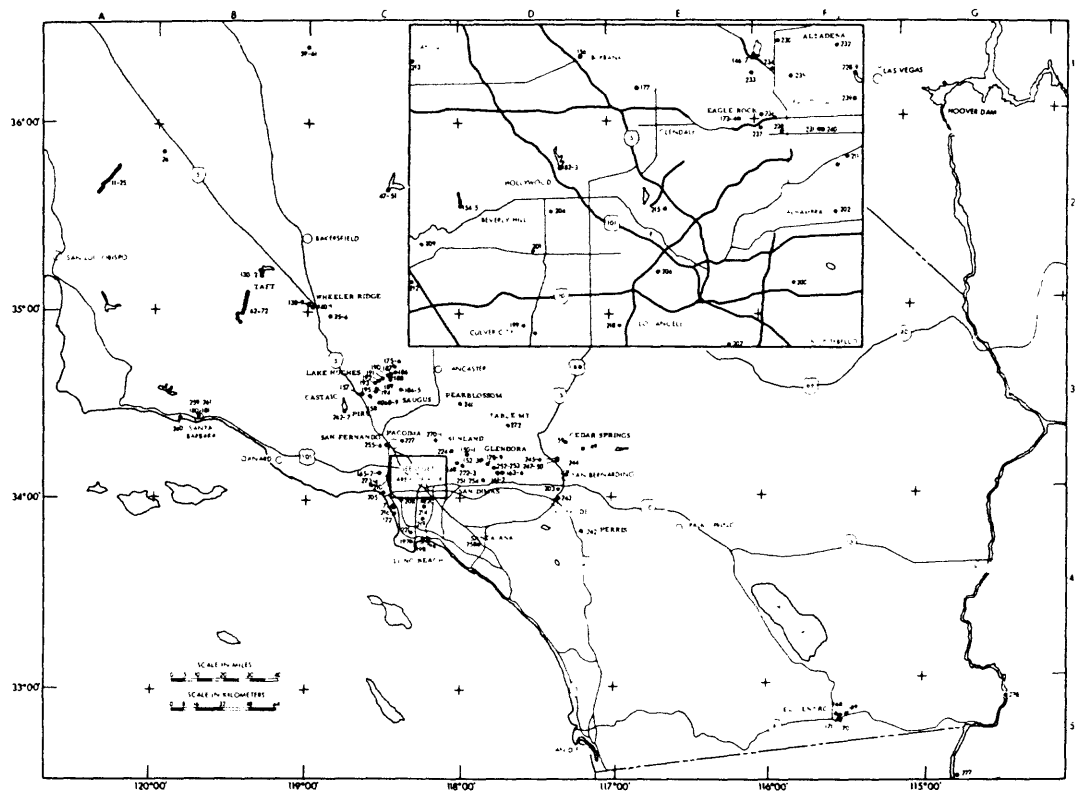

FIGURE 11.—Seismoscope location map for southern California network during San Fernando earthquake

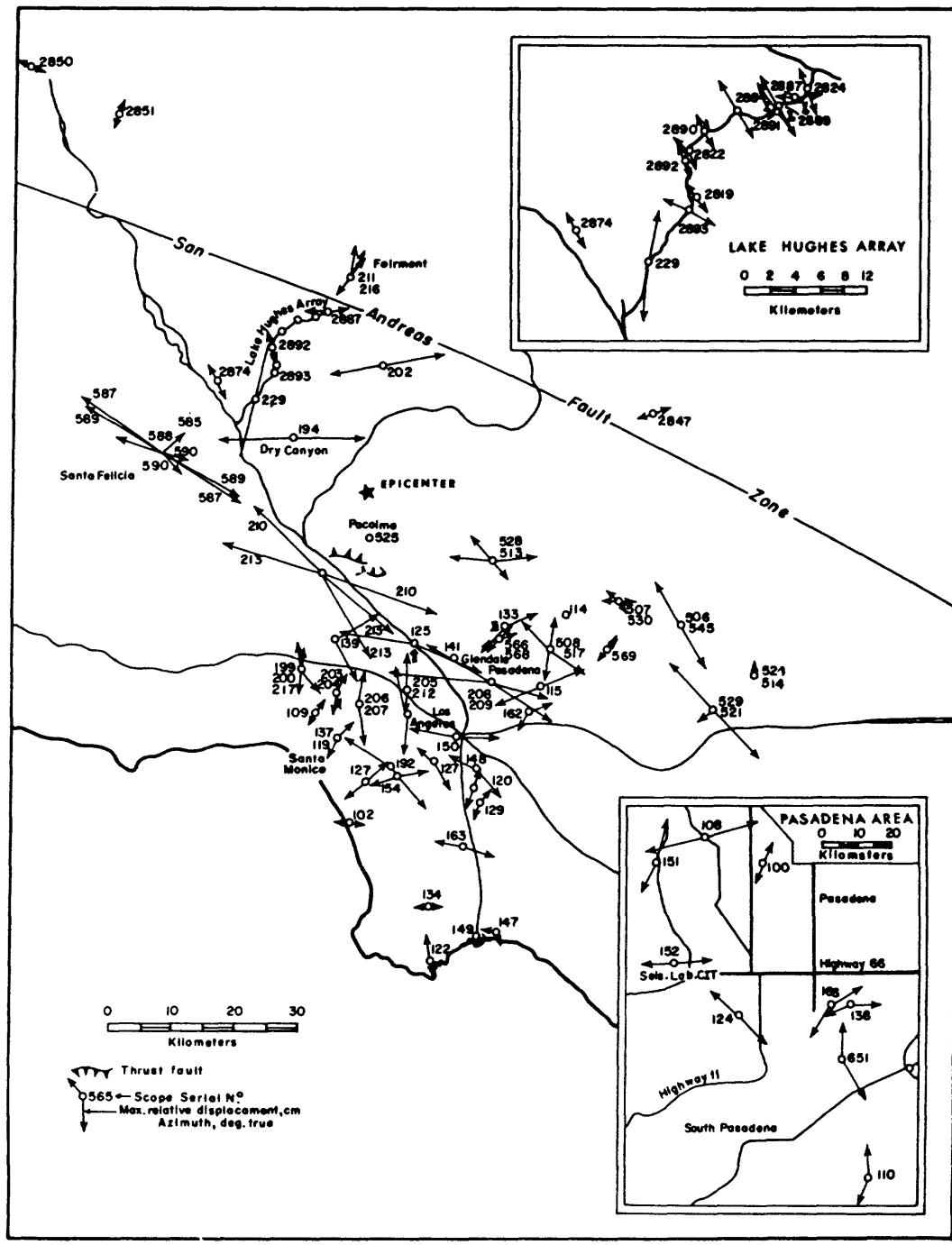

FIGURE 12.—Magnitude and direction of maximum seismoscope response of each station during San Fernando earthquake.

REFERENCES

1. Maley, R.P. and Cloud, W.K., "Strong-Motion Accelerograph Records," *Strong-Motion Instrumental Data [on the] San Fernando Earthquake, February 9, 1971,* Earthquake Engineering Research Laboratory, California Institute of Technology, Pasadena, and Seismological Field Survey, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, San Francisco, Sept. 1971, pp. 1-53.

2. Morrill, B.J., "Seismoscope Results," *Strong-Motion Instrumental Data [on the] San Fernando Earthquake, February 9, 1971,* Earthquake Engineering Research Laboratory, California Institute of Technology, Pasadena, and Seismological Field Survey, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, San Francisco, Sept. 1971, pp. 72-124.

TABLE 5.—*Occurrence of earthquakes and number of records for 1971*

Date	Location	Number
Feb. 9	San Fernando, Calif.	241
26	Off Cape Mendocino, Calif.	2
Mar. 3	Near Isabella, Calif.	5
8	.....do	5
9	Monterey Bay, Calif.	1
Apr. 26	Near Truckee, Calif.	1
Jan.-May	Andreanof Islands, Alaska	3
May 1	.....do	1
July 9	Near coast of central Chile	1
Sept. 12	Near Crescent City, Calif.	1
30	Imperial Valley, Calif.	4
Nov. 20	Off Cape Mendocino, Calif.	2
29	Off coast of Peru	1
Dec. 11	Near Hayward, Calif.	3
28	Near Hollister, Calif.	1

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9, 38°24.7′ N., 118°24.0′ W., Mag. 6.4. Int. XI						
482	Alhambra	34.09N	SMA-1	L 346	West	1.60
	900 S. Fremont	118.15W	LA-179	V 348	Down	1.75
	(Basement)	(A&SI)		T 350	South	1.78
483	Alhambra	34.09N	SMA-1	L 345	West	1.80
	900 S. Fremont	118.15W	LA-187	V 355	Down	1.75
	(6th Floor)			T 349	South	1.70
484	Alhambra	34.09N	SMA-1	L 212	West	1.70
	900 S. Fremont	118.15W	LA-165	V 260	Down	1.75
	(12th Floor)			T 322	South	1.80
103	Anza	33.56N	RFT-250	L 180	N 45 E	2.01
	Anza Post Office	116.67W	CT-181	V 217	Down	1.91
	(Storage Room)	(A)		T 204	N 45 W	1.92
104	Arcadia	34.19N	AR-240	L 389	N 03 E	7.66
	Santa Anita Dam	118.02W	FC-183	V 297	Down	7.51
	(Abutment)	(GD)		T 266	N 87 W	7.61
1004	Bakersfield	35.37N	S-M	V 342	Up	12.7
	Harvey Auditorium	119.02W	FS-29	L 352	South	12.5
	(Basement)	(A)		T 353	West	12.3
			DM	Right	South	
			18	Left	West	
452	Beverly Hills	34.08N	SMA-1	L 176	North	1.66
	435 N. Oakhurst	118.39W	LA-109	V 117	Down	1.58
	(Basement)	(A)		T 174	West	1.69
453	Beverly Hills	34.08N	SMA-1	L 167	North	1.70
	435 N. Oakhurst	118.39W	LA-105	V 165	Down	1.70
	(5th Floor)			T 130	West	1.60
454	Beverly Hills	34.08N	SMA-1	L 132	North	1.71
	435 N. Oakhurst	118.39W	LA-107	V 140	Down	1.56
	(Roof, 11th Level)			T 122	West	1.76
455	Beverly Hills	34.08N	SMA-1	L 308	N 50 E	1.83
	450 N. Roxbury	118.41W	LA-151	V 284	Down	1.86
	(1st Floor)	(A)		T 288	N 40 W	1.80
456	Beverly Hills	34.08N	SMA-1	L 313	N 50 E	1.81
	450 N. Roxbury	118.41W	LA-153	V 327	Down	1.86
	(5th Floor)			T 318	N 40 W	1.69
457	Beverly Hills	34.08N	SMA-1	L 311	N 50 E	1.66
	450 N. Roxbury	118.41W	LA-152	V 321	Down	1.84
	(10th Floor)			T 241	N 40 W	1.81
506	Beverly Hills	34.06N	SMA-1	L 232	East	1.77
	8383 Wilshire	118.37W	LA-170	V 325	Down	1.80
	(Basement)	(A)		T 289	North	1.58
507	Beverly Hills	34.06N	SMA-1	L 296	East	1.66
	8383 Wilshire	118.37W	LA-175	V 285	Down	1.61
	(5th Floor)			T 328	North	1.44
508	Beverly Hills	34.06N	SMA-1	L 184	East	1.76
	8383 Wilshire	118.37W	LA-120	V 173	Down	1.34
	(Roof, 11th Level)			T 164	North	1.74

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist.[4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl[4,6]		Accl. Gt. 0.2g[4]		Num. Aftshk.[4,6]
					Per. sec.	Accl. g	Dur. sec.	Cycle	
0.037	10	47.6	42	45	0.3	0.13			4/1
.039	11	46.3			.2	.09			
.038	11	50.0			.2	.11			
.039	10	47.6		45	.5	.15			4/2
.039	10	46.3			.2	.11			
.038	11	47.6			.4	.14			
.038	8	47.6		45	2.0	.17			4/1
.039	12	46.3			.3	.18			
038	9	50.5			2.2	.15			
.047	12	36.5	178	44	.2	.03			1/
.046	8	36.4			.2	.01			
047	10	35.0			.2	.04			
051	9	119	42	29	.1	.18			
052	10	110			.1	.07			
.051	10	117			.2	.24	0.1	0.5	
067	9	114.5	122	101	.4	.01			
065	11	119			.3	01			
064	11	120.5			5	.01			
9.7	8	1			7.5	1.3*			
10.0	13	1			9.2	.9*			
.036	6	51.5	36	27	.4	.06			
038	7	44			.5	.04			
.041	8	40.5			2	.09			
037	5	51		27	.5	13			
039	5	45			.1	.05			
036	6	49.5			.5	.14			
037	8	51		27	.6	.24	3.0	5.0	
036	6	48			.2	.10			
038	10	49 5			.4	.25	7.0	16.5	
041	9	44	37	48	.1	.20			6/
039	9	49 5			.2	.04			
039	9	45.5			.2	.17			
039	9	48		48	.2	.22	1	.5	6/
041	7	45			2	10			
039	7	45 5			2	.21	1 0	4 5	
038	7	49		48	5	30	6 7	18 0	6/
039	7	49			1	12			
040	7	45 5			.4	.22	2 6	10.0	
038	8	49 5	37	NI					/1
039	9	48 1							
038	8	44 1							
039	9	48 0		NI					/1
039	9	42 7							
038	9	40 2							
036	7	54 7		NI					/1
034	7	46 7							
038	6	48 6							

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
416	Beverly Hills	34.07N	MO-2	A	South	1.54
	9100 Wilshire	118.39W	LA-148	B	East	1.49
	(Basement)	(A)		V	Up	2.44
417	Beverly Hills	34.07N	MO-2	B	East	1.51
	9100 Wilshire	118.39W	LA-133	A	South	1.42
	(5th Floor)			V	Up	2.30
418	Beverly Hills	34.07N	MO-2	B	East	1.58
	9100 Wilshire	118.39W	LA-107	A	South	1.56
	(Roof, 11th Level)			V	Up	2.39
434	Beverly Hills	34.07N	SMA-1	L 217	East	1.91
	9450 Wilshire	118.40W	LA-138	V 213	Down	1.92
	(Basement, P-3)	(A)		T 206	North	1.94
435	Beverly Hills	34.07N	SMA-1	L 195	East	1.76
	9450 Wilshire	118.40W	LA-137	V 196	Down	1.82
	(4th Floor)			T 204	North	1.68
436	Beverly Hills	34.07N	SMA-1	L 200	East	1.86
	9450 Wilshire	118.40W	LA-139	V 215	Down	1.76
	(Roof, 13th Level)			T 216	North	1.86
105	Borrego Springs	33.26N	RFT-250	L 167	S 45 W	1.89
	Borrego Fire Dept.	116.37W	FS-157	V 224	Down	1.88
	Hdq Bldg. (Grd. Level)	(A)		T 229	S 45 E	1.59
1011	Buena Vista	35.16N	AR-240	L 135	South	6.5
	Taft	119.35W	CW-107	V 133	Down	7.8
	(Freefield)	(A)	(SR)	T 169	East	7.3
106	Cachuma Dam	34.58N	S-M	V 361	Up	11.9
	(Crest)	119.98W	BR-4	L 362	North	11.2
		(SH)	with	T 363	East	10.9
			CDMs	L 14	South	
				T 15	East	
107	Cachuma Dam	34.58N	S-M	V 364	Up	11.1
	(Valve House)	119.98W	FS-33	L 365	North	11.4
				T 366	East	12.2
108	Carbon Canyon Dam	33.92N	RFT-250	L 101	S 40 W	1.90
	(Crest)	117.84W	AE-131	V 102	Down	1.80
		(AVSIP)		T 104	S 50 E	1.95
110	Castaic	34.56N	AR-240	L 165	N 21 E	8.1
	Old Ridge Route	118.66W	CW-124	V 159	Down	7.9
	(Freefield)	(SA)		T 172	N 69 W	7.6
111	Cedar Springs	34.28N	AR-240	L 250	S 05 W	7.6
	Allen Ranch	117.33W	CW-135	V 288	Down	7.6
	(Grd. Level)	(GR)		T 231	S 85 E	7.6
112	Cedar Springs	34.31N	AR-240	L 501	S 36 W	7.6
	Pump Plant	117.30W	CW-187	V 484	Down	7.6
		(A)		T 312	S 54 E	7.6
1013	Cholame-Shandon	35.73N	AR-240	L 210	N 51 E	8.4
	Array No. 2	120.29W	CW-133	V 254	Down	7.9
	(Freefield)	(A)		T 228	N 39 W	7.7
1014	Cholame-Shandon	35.70N	AR-240	L 252	N 51 E	7.6
	Array No. 5	120.33W	CW-134	V 156	Down	7.4
	(Freefield)	(A)		T 162	N 39 W	8.2

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist. [4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6]		Accl Gt. 0.2g[4]		Num. Aftshk.[4,6]
					Per. sec.	Accl. g	Dur. sec.	Cycle	
0.035	10	51	37	42	0.2	0.12			1/
.035	10	49			.3	.16			
.036	10	76			.2	.04			
.036	10	47		NTM		.13			1/
035	10	47				.15			
.036	10	71				.08			
.034	10	55		PR					
034	10	54							
035	10	79							
039	9	50.5	37	NR					
.040	10	48.5							
.038	8	54							
038	10	49 5		NR					
039	9	48.5							
039	7	47							
.040	7	47		NR					
.038	8	49.5							
040	8	47							
047	11	34 5	230	26	.4	.01			
.048	12	32.9			.2	.01			
.047	12	29 0			.3	.01			
051	9 0	101	122	73	3	.01			
056	10 6	101			3	---			
056	24	94			3	.01			
063	9	118	147	NR					
061	11	117							
060	10	118							
2 20	10	0 8							
2 50	10	0 8							
061	10	117		NR					
062	10	119							
063	10	122							
047	10	34 7	74	43	3	07			
046	10	34 3			2	04			
047	11	35 6			2	07			
050	10	123	29		3	39	2 7	11 0	6/
050	8	123			2	18			
050	13	123			2	32	3 5	14 0	
058	10	92	98	29	1	02			
061	10	81			1	.01			
057	10	94			2	02			
055	10	101	101	15	2	03			
055	11	101			2	01			
051	11	119			2	03			
067	10	76	227	46	3	01			
057	8	98				---			
056	8	100			3	01			
061	8 5	103.		NT					
058	11 4	102							
058	10	100							

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
1015	Cholame-Shandon	35.67N	AR-240	L 313	N 51 E	7.4
	Array No. 8	120.36W	CW-166	V 396	Down	7.2
	(Freefield)	(A)		T 368	N 39 W	7.2
1016	Cholame-Shandon	35.64N	AR-240	L 241	N 51 E	7.6
	Array No. 12	120.40W	CW-136	V 140	Down	7.4
	(Freefield)	(A)		T 237	N 39 W	7.5
1097	Cholame-Shandon	35.75N	AR-240	L 201	N 51 E	7.5
	Array, Temblor II	120.26W	CW-139	V 214	Down	7.5
	(Freefield)	(A)		T 200	N 39 W	7.2
113	Colton	34.06N	S-M	V 253	Up	13.1
	S. Calif. Edison Co.	117 32W	FS-38	L 254	East	14.0
	Substation	(A)		T 255	South	13.4
	(Grd. Level)		DM	Right	West	
			FS-16	Left	North	
114	Costa Mesa	33.64N	AR-240	L 291	South	7.62
	666 W 19th	117.93W	CT-184	V 340	Down	7.50
	(Grd Floor)	(T)		T 275	East	7.56
116	Devils Canyon	34 20N	AR-240	L 136	S 25 W	8.1
	San Bernardino	117.33W	CW-108	V 137	Down	7.4
	(Filter Plant, Grd. Floor)	(LGN)		T 186	S 65 E	8.1
412	El Centro	32.78N	RFT-250	L 241	S 52 W	1.97
	Community Hospital	115 57W	CT-182	V 280	Down	1.93
	(Grd. Floor)	(A)		T 279	S 38 E	1.97
117	El Centro	32.88N	S-M	V 208	Up	12.8
	Imperial Valley	115 55W	FS-32	L 206	South	13.4
	Irrigation District	(A)	with	T 207	West	12 8
	Sub-Station		CDMs	L 28	South	
	(Basement)			T 29	East	
464	El Centro	32.80N	RFT-250	L 168	S 52 W	1.96
	Meadows Union School	115 47W	FS-156	V 198	Down	1.91
	(Grd. Floor)	(A)		T 213	S 38 E	2 01
572	Fairmont Station	34 70N	S-M	V 339	Up	16 6
	Fairmont Reservoir	118 43W	FS-79	L 340	N 34 W	17.4
	(Abutment)	(GR)	with	T 341	N 56 E	16.7
			CDMs	L 81	N 34 W	
				T 80	S 56 W	
476	Fullerton	33 88N	SMA-1	L 124	West	1 69
	2600 Nutwood	117 88W	LA-113	V 139	Down	1 72
	(Basement)	(A)		T 177	South	1.69
477	Fullerton	33 88N	SMA-1	L 137	West	1.76
	2600 Nutwood	117 88W	LA-110	V 120	Down	1 68
	(10th Floor, West)			T 182	South	1 68
478	Fullerton	33 88N	SMA-1	L 116	West	1 74
	2600 Nutwood	117 88W	LA-116	V 159	Down	1 36
	(10th Floor, Center)			T 144	South	1 90

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist. [4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6]		Accl. Gt. 0.2g[4]		Num. Aftshk.[4,6]
					Per. sec.	Accl. g	Dur. sec.	Cycle	
0.051	10	118		42	0.3	0.01			
.052	10	109			.3	---			
.052	10.3	113			.3	.01			
.060	8	91		NT					
.057	6	94							
.057	10	99							
.060	8	85	225	NT					
.060	11	85							
.058	11	88.							
.066	10	120	104	12	.2	.03			
.066	10	125			.2	.04			
.065	10	124			.3	.04			
9.78	10	1				NI			
9.85	10	1				NI			
.054	10	105.3	96	143	.3	.02			
.054	10	103.7			.2	.01			
.055	11	100.7			.5	.04			
.051	10	124	99	NT					
.051	10	114							
.053	10	116							
.048	11	34	320	68		---			
.049	11	32				---			
.047	9	36				---			
.064	10	121	320	NT					
.065	12	124							
.064	10	121							
6.20	10	1							
5.50	10	1							
.047	14	36	320	NT					
.047	14	35							
.048	14	35							
.076	11	115	36	85	.4	.08			3/
.076	12	119			.2	.17			
.076	12	114			.2	.15			
3.58	10	1			.6	1.7*			
4.12	10	1			.7	1 1*			
036	7	52 6	74	35	.3	.04			/3
.038	9	48 1			.2	.02			
036	8	52 6			.4	04			
.038	7	49.3		35	.7	.11			/3
036	7	52.1			.2	.04			
.036	7	52.1			6	.13			
036	9	54.2		35	.7	.09			/1
.033	9	67 6			2	02			
.039	8	50 3			.7	15			

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
122	Glendale	34.14N	AR-240	L 106	S 72 E	15.0
	633 E. Broadway (Basement)	118.21W	GL-216	V 121	Down	15.0
	Municipal Service Bldg.	(A)		T 105	N 18 E	15.0
1052	Gorman	34.81N	AR-240	L 404	North	7.62
	Oso Pumping Plant	118.72W	CW-194	V 401	Down	7.53
	(Freefield)	(A)		T 450	West	7.56
1027	Grapevine	34.94N	AR-240	L 382	South	7.44
	Edmonston Pumping Plant	118.82W	CW-167	V 287	Down	5.16
	(Freefield)	(AVGN)		T 333	East	7.56
123	Hemet	33.73N	RFT-250	L 193	S 45 W	1.96
	Hemet Fire Station	116.98W	FS-159	V 225	Down	1.96
	(Hose Storage Room)	(A)		T 226	S 45 E	1.88
2002	Hoover Dam	36.02N	S-M	V 331	Up	19.7
	(1215 Gallery)	114.74W	BR-B1	L 332	S 45 E	19.4
		(VB)	with	T 333	S 45 W	19.3
			CDMs	L 22	S 45 E	
				T 23	N 45 E	
2003	Hoover Dam	36.02N	S-M	V 328	Up	20.3
	(Intake Tower)	114.74W	BR-B2	L 329	N 45 W	22.0
			with	T 330	N 45 E	21.6
			CDMs	L 24	N 45 W	
				T 25	S 45 W	
2004	Hoover Dam	36.02N	S-M	V 334	Up	18.3
	(Oil House)	114.74W	BR-B3	L 335	N 45 W	20.3
			with	T 336	N 45 E	20.0
			CDMs	L 20	N 45 W	
				T 21	S 45 W	
124	Imperial	32.83N	RFT-250	L 192	S 52 W	1.97
	Imperial Valley College	115.50W	CT-188	V 221	Down	1.92
	Adm. Bldg (Grd Floor)			T 222	N 38 E	1.89
1035	Isabella Dam	35.65N	RFT-250	L 54	N 14 E	1.9
	(Spillway Gallery)	118.48W	AE-108	V 44	Down	1.9
		(GR)		T 53	N 76 W	1.9
1036	Isabella Dam	35.65N	RFT-250	L 26	N 14 E	1.75
	(Crest)	118.48W	AE-109	V 41	Down	2.05
				T 45	N 76 W	1.69
1037	Isabella Dam	35.64N	RFT-250	L 48	N 14 E	1.82
	(Aux Crest)	118.47W	AE-110	V 58	Down	1.74
			(GR&A)	T 59	N 76 W	1.83
1038	Isabella Dam	35.64N	RFT-250	L 62	N 14 E	1.82
	(Control Tower)	118.47W	AE-111	V 60	Down	1.92
				T 25	N 76 W	1.88
1039	Isabella Dam	35.64N	RFT-250	L 36	N 14 E	1.91
	(Aux Abutment)	118.47W	AE-112	V 63	Down	1.95
				T 33	N 76 W	1.82

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist. [4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6] Per. sec.	Max. accl.[4,6] Accl. g	Accl Gt. 0.2g[4] Dur. sec.	Accl Gt. 0.2g[4] Cycle	Num. Aftshk.[4,6]
0.062	10	123	32	34	0.7	0.28	2.7	4.5	1/
.062	10	123			.2	.14			
.059	12	126			.5	.23	1.0	2.0	
.053	10	108	55	10	.2	.09			
.057	10	95			.2	.03			
.054	10	105			.2	.09			
054	10	116	73	NTM		.02			
.052	7	108				.05			
052	8	116				.07			
.046	11	37.3	139	54	.1	.05			
049	12	32.9			.3	.03			
.046	8	35.8			.2	.04			
082	11	118	369	82		---			
.080	9	122				---			
.080	11	123				---			
2.88	9	1 0			1.4	--*			
3.09	11	1.0			2.9	.1*			
.083	8	120		78		---			
085	8	124			.9	---			
085	8	122			.9	---			
3 1	9	1.1			.9	.1*			
3.2	9	1.0			.9	.2*			
080	7	116		101		---			
080	8	127				---			
081	9	123				---			
3 3	10	1			1.5	.1*			
3 6	10	1			2.4	.1*			
047	9	35.9	308	NT					
048	10	33 6							
.046	10	36 0							
045	10	37	140	53		---			
048	10	33				---			
045	10	37				---			
044	8	36 4		56	.4	.01			
044	9	42 7			.2	---			
042	8	38 6			4	.01			
046	8	31 8		55	3	01			
048	10	33 1			3	---			
048	9	32 0			3	01			
047	10	33 2		52	5	01			
046	8	36 6			3	---			
048	8	32 9			5	01			
047	8	35		56	2	01			
047	8	35			2	---			
048	10	33			.2	01			

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
125	Lake Hughes Array	34.68N	AR-240	L 219	S 21 W	7.6
	Station No. 1	118.44W	CW-132	V 207	Down	7.6
	Fire Stn. No. 78 (Grd. Level)	(GR)		T 248	N 69 W	7.6
126	Lake Hughes Array	34.64N	RFT-250	L 253	S 21 W	1.90
	Station No. 4	118.48W	FS-164	V 250	Down	1.90
	(Freefield)	(GRW)		T 267	S 69 E	1.90
127	Lake Hughes Array	34.61N	AR-240	L 330	N 21 E	7.6
	Station No 9	118.56W	CW-162	V 294	Down	7.6
	Warm Springs Camp	(GN)		T 354	N 69 W	7 6
128	Lake Hughes Array	34.57N	AR-240	L 461	N 21 E	7.6
	Stn. No. 12, Elizabeth Lk.	118.56W	CW-217	V 421	Down	7.6
	Guard Stn. (Grd. Level)	(AVSA)		T 406	N 69 W	7.6
129	Loma Linda	34.05N	RFT-250	L 246	East	2.03
	Loma Linda University	117.26W	CT-187	V 265	Down	1.85
	Medical Center (Basement)	(A)		T 287	North	1.95
132	Long Beach	33.78N	RFT-250	V 227	N 76 W	1.90
	Long Beach State College	118.11W	CT-184	V 227	Down	1.87
	(Grd. Level)	(SSC)		T 230	S 14 W	1.93
130	Long Beach	33.76N	S-M	V1004	Up	14.2
	Terminal Island	118.23W	FS-13	L1005	S 69 W	14.1
	S. Cal. Edison (Grd. Level)	(A)		T1006	N 21 W	13 3
131	Long Beach	33.77N	S-M	V 265	Up	13.0
	Utilities Bldg.	118.19W	FS-4	L 266	North	13.0
	(Basement)	(A)	with	T 267	East	13.2
			CDMs	L 10	South	
				T 11	East	
247	Los Angeles	33.95N	MO-2	A	North	1.65
	9841 Airport	118.39W	LA-88	B	West	1.72
	(Basement)	(A)		V	Up	2.35
248	Los Angeles	33.95N	MO-2	A	North	1.62
	9841 Airport	118.39W	LA-71	B	West	1.58
	(7th Floor)			V	Up	2.31
249	Los Angeles	33.95N	MO-2	A	North	1.60
	9841 Airport	118 39W	LA-98	B	West	1.60
	(15th Floor)			V	Up	2.40
184	Los Angeles	34.06N	MO-2	B	N 44 E	1.58
	1900 Ave of Stars	118.42W	LA-121	A	S 46 E	1.58
	(Basement)	(SS)		V	Up	2.31
185	Los Angeles	34.06N	MO-2	B	N 44 E	1.52
	1900 Ave of Stars	118.42W	LA-144	A	S 46 E	1.32
	(16th Floor)			V	Up	2.31
186	Los Angeles	34.06N	MO-2	B	N 44 E	1.54
	1900 Ave. of Stars	118.42W	LA-197	A	S 46 E	1.54
	(Roof, 29th Level)			V	Up	2.36
187	Los Angeles	34.06N	AR-240	L 182	N 46 W	7.6
	1901 Ave. of Stars	118.42W	LA-278	V 194	Down	7.6
	(Sub-Basement)	(SS)		T 185	S 44 W	7.6

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist.[4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6]		Accl. Gt. 0.2g[4]		Num. Aftshk.[4,6]
					Per. sec.	Accl. g	Dur. sec.	Cycle	
0.062	11	80	31	60	0.7	0.17			
.059	11	88			.1	.12			
.060	11	85			.5	.12			
.048	10	34	29	38	.2	.16			1/
.048	10	34			.2	.16			
.048	10	34			.2	.19			
.050	12	123	29	35	.1	.15			
.052	11	113			.1	.12			
.052	10	113			.1	.16			
.052	11	112	25	36	.2	.37	1.4	6.0	1/1
.055	10	102			.1	.18			
.053	10	111			.2	.28	1.6	7.0	
048	11	37.1	111	PR					
.045	8	36.8							
.046	11	35.0							
.046	12	36.2	73	150	.5	.04			2/
.046	11	35.6			.3	.02			
.047	8	35.2			.2	.02			
068	8	121	71		.5	.02			
068	10	120			.2	.03			
.067	10	116			.4	.03			
.066	8	118	72	70	.2	.02			
.066	10	121			.3	.03			
.066	10	119			.3	.02			
2.01	10	0.9			1.8	1.5*			
2.21	10	0.9			1.8	2.0*			
.030	10	72	49	49	.3	.03			
.030	10	76			.4	.03			
.030	10	103			.2	.01			
030	10	71		NR					
030	10	69							
.030	10	101							
030	10	70		49	1.6	.10			
030	10	70			1.4	.09			
030	10	105			.2	.05			
030	10	69	38	39	3	10			
030	10	69			.2	08			
030	10	101			2	.06			
.030	10	67		PR					
030	10	58							
.030	10	101							
030	10	68		40	9	16			
030	10	68			.5	12			
030	10	104			.3	.35	6.7	24.0	
051	10	116	38	61	.2	.12			1/
.051	10	118			.2	.07			
.051	10	119			.1	.17			

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
188	Los Angeles	34.06N	AR-240	L 183	N 46 W	7.6
	1901 Ave. of Stars	118.42W	LA-283	V 184	Down	7.6
	(9th Floor)			T 191	S 44 W	7.6
189	Los Angeles	34.06N	AR-240	L 187	N 46 W	7.6
	1901 Ave. of Stars	118.42W	LA-275	V 190	Down	7.6
	(21st Floor)			T 181	S 44 W	7.6
413	Los Angeles	34.06N	MO-2	B	N 31 W	1.54
	1177 Beverly Dr.	118.40W	LA-170	A	N 59 E	1.57
	(Basement)	(A)		V	Up	2.38
414	Los Angeles	34.06N	MO-2	B	N 31 W	1.50
	1177 Beverly Dr	118 40W	LA-176	A	N 59 E	1.51
	(3d Floor)			V	Up	2.28
415	Los Angeles	34.06N	MO-2	B	N 31 W	1.51
	1177 Beverly Dr.	118.40W	LA-131	A	N 59 E	1.52
	(7th Floor)			V	Up	2.32
229	Los Angeles	33 95N	MO-2	A	East	1.63
	5260 Century	118.37W	LA-72	B	North	1.61
	(1st Floor)	(A)		V	Up	2.31
230	Los Angeles	33.95N	MO-2	A	East	1.63
	5260 Century	118.37W	LA-76	B	North	1.57
	(4th Floor)			V	Up	2.46
231	Los Angeles	33.95N	MO-2	A	East	1 57
	5260 Century	118.37W	LA-63	B	North	1.58
	(Roof, 8th Level)			V	Up	2.45
410	Los Angeles	34.06N	AR-240	L 119	N 46 W	15.2
	Century City	118.42W	CT-176	V 118	Down	15.2
	(Grd. Level)	(A)		T 114	S 44 W	15 2
425	Los Angeles	34.06N	SMA-1	L 324	S 36 E	1.98
	1800 Century Park East	118.41W	LA-141	V 231	Down	1.80
	(Basement)	(SS)		T 233	N 54 E	1.80
426	Los Angeles	34.06N	SMA-1	L 227	S 36 E	1.85
	1800 Century Park East	118.41W	LA-140	V 229	Down	1.78
	(5th Floor)			T 226	N 54 E	1.95
427	Los Angeles	34.06N	SMA-1	L 219	S 36 E	1 73
	1800 Century Park East	118 41W	LA-135	V 218	Down	1.82
	(Penthouse, 16th Floor)			T 208	N 54 E	1 69
440	Los Angeles	34.06N	SMA-1	L 185	N 54 E	1.92
	1880 Century Park East	118.41W	LA-121	V 118	Down	1.64
	(Basement)	(SS)		T 121	N 36 W	1.82
441	Los Angeles	34.06N	SMA-1	L 166	N 54 E	1.85
	1880 Century Park East	118.41W	LA-115	V 160	Down	1.74
	(7th Floor)			T 181	N 36 W	1.87
442	Los Angeles	34 06N	SMA-1	L 131	N 54 E	1.85
	1880 Century Park East	118.41W	LA-111	V 147	Down	1.68
	(Penthouse, 17th Floor)			T 124	N 36 W	1.53

See footnotes at end of table.

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist.[4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6]		Accl Gt. 0.2g[4]		Num. Aftshk.[4,6]
					Per. sec.	Accl. g	Dur. sec.	Cycle	
0.050	9	122		60	0.3	0.18			1/
.051	9	116			.3	.14			
.049	9	131			.3	.11			
.050	9	124		PR					1/
.048	9	136							
.050	9	123							
.034	10	54	39	45	.5	.12			
.034	10	55			.4	.11			
.034	10	83			.1	.07			
.035	10	49		NR					
.035	10	50							
.035	10	75							
.035	10	50		NR					
.034	10	53							
034	10	81							
.030	10	72	49	49	.2	.06			
.030	10	72			5	06			
030	10	101			2	.02			
.030	10	72		52	1.3	04			
.030	10	69			.4	07			
.030	10	108			1	.04			
.030	10	69		50	1.6	09			
030	10	69			1 8	06			
.030	10	108			.2	08			
.066	10	141	38	NR					
065	9	145							
065	8	145							
.041	9	47 5	38	49	3	.08			5/3
.042	6	45 0			3	07			
039	6	41 5			.4	.10			
.040	8	46.5		49	.3	.21	0.9	3.0	5/3
.041	7	43.0			.2	16			
040	7	49 0			4	22	.9	2.0	
040	6	43.5		49	3	28	4 2	13 5	5/3
041	8	44.0			.2	31	5 7	31 0	
039	5	44 5			4	28	5 6	16.0	
040	8	48 5	38	57	3	11			6/1
037	9	48 5			1	07			
041	10	44			3	.13			
042	10	43		57	3	10			12/1
040	8	44			2	12			
043	10	42 5			3	14			
035	10	60 9		57	4	.10			10/1
034	7	58 6			3	27	1 2	4.5	
033	7	56 6			4	12			

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
419	Los Angeles	34.06N	RFT-250	L 476	S 36 E	1.85
	1888 Century Park East	118.41W	LA-273	V 505	Down	1.90
	(Basement)	(SS)		T 517	N 54 E	1.87
420	Los Angeles	34.06N	RFT-250	L 441	S 36 E	1.87
	1888 Century Park East	118.41W	LA-269	V 499	Down	1.90
	(14th Floor)			T 489	N 54 E	1.86
421	Los Angeles	34.06N	RFT-250	L 469	S 36 E	1.87
	1888 Century Park East	118.41W	LA-268	V 440	Down	1.90
	(21st Floor)			T 465	N 54 E	1.89
422	Los Angeles	34.06N	RFT-250	L 511	S 36 E	1.90
	1888 Century Park East	118.41W	LA-280	V 506	Down	1.90
	(Parking Ramp, Basement)	(SS)		T 444	N 54 E	1.83
423	Los Angeles	34.06N	RFT-250	L 518	S 36 E	1.87
	1888 Century Park East	118.41W	LA-265	V 452	Down	1.90
	(Parking Ramp, 5th Floor)			T 460	N 54 E	1.86
424	Los Angeles	34.06N	RFT-250	L 496	S 36 E	1.84
	1888 Century Park East	118.41W	LA-275	V 457	Down	1.90
	(Parking Ramp, Roof, 9)			T 462	N 54 E	1.89
193	Los Angeles	34.06N	MO-2	B	N 40 W	1.63
	2080 Century Park East	118.41W	LA-115	A	N 50 E	1.66
	(Basement)	(A)		V	Up	2.33
194	Los Angeles	34.06N	MO-2	B	N 40 W	1.56
	2080 Century Park East	118.41W	LA-184	A	N 50 E	1.60
	(10th Floor)			V	Up	2.37
195	Los Angeles	34.06N	MO-2	B	N 40 W	1.55
	2080 Century Park East	118.41W	LA-199	A	N 50 E	1.54
	(Roof)			V	Up	2.43
145	Los Angeles	34.06N	MO-2	B	S 37 W	1.51
	222 Figueroa	118.25W	LA-110	A	N 53 W	1.53
	(1st Floor)	(AVSH)		V	Up	2.32
146	Los Angeles	34.06N	MO-2	B	S 37 W	1.48
	222 Figueroa	118.25W	LA-192	A	N 53 W	1.52
	(12th Floor)			V	Up	2.36
147	Los Angeles	34.06N	MO-2	B	S 37 W	1.55
	222 Figueroa	118.25W	LA-160	A	N 53 W	1.54
	(20th Floor)			V	Up	2.44
148	Los Angeles	34.05N	MO-2	A	S 53 E	1.61
	234 Figueroa	118.25W	LA-54	B	N 37 E	1.62
	(Basement)	(AVSH)		V	Up	2.46
149	Los Angeles	34.05N	MO-2	B	N 37 E	1.62
	234 Figueroa	118.25W	LA-55	A	S 53 E	1.66
	(12th Floor)			V	Up	2.36
150	Los Angeles	34.05N	MO-2	A	S 53 E	1.65
	234 Figueroa	118.25W	LA-62	B	N 37 E	1.62
	(Roof, 18th Level)			V	Up	2.36

See footnotes at end of table

Period[4] *sec.*	Damping[4]	Stat. mag.[4]	Epic. dist [4,6] *km*[6]	Recd. leng.[4,6] *sec.*	Max. accl.[4,6]		Accl. Gt. 0.2*g*[4]		Num. Aftshk.[4,6]
					Per. *sec.*	Accl. *g*	Dur. *sec.*	Cycle	
0.049	11	31	38	NR					
.051	13	29							
.049	11	31							
.051	8	29		NTM		0.06			
.049	9	32				.19			
.050	9	30				.14			
.050	9	30		NTM		.08			
.047	10	35				.35		5.0	
.047	10	35				.15			
.051	10	29	38	NR					
.047	10	35							
.051	10	28							
.048	11	33		57	0.3	.18			4/
.049	9	32			.2	.09			
.048	11	33			.3	.12			
.048	7	32		57	.3	.38	6.0	23.5	4/
.049	10	32			.2	.11			
048	10	33			.3	.31	3.8	13.5	
.030	10	72	38	NR					
.030	10	73							
.030	10	102							
.030	10	68		NR					
.030	10	70							
.030	10	104							
030	10	68		42	.3	18			
.030	10	68			.2	.36	.3	.5	
.030	10	107			.2	.23	.2	.5	
.030	10	66	41	42	.4	.12			1/
.030	10	67			.5	.15			
.030	10	102			.2	.04			
.030	10	65		PR					1/
.030	10	67							
030	10	104							
030	10	68		40	4	.31	4.7	14.0	1/
.030	10	68			1.1	.40	7.2	10.5	
030	10	107			.3	.09			
030	10	71	41	47	.2	.17			
030	10	71			.3	20			
030	10	108			5	06			
030	10	71		NR					
030	10	73							
030	10	104							
030	10	72		47	.7	.44	6.4	13 0	
030	10	71			3	.50	8.8	25.5	
030	10	104			.2	.17			

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
157	Los Angeles	34.05N	AR-240	L 444	N 52 W	7.6
	445 Figueroa	118.26W	LA-208	V 460	Down	7.6
	(Sub-Basement)	(SH)		T 417	S 38 W	7.6
158	Los Angeles	34.05N	AR-240	L 403	N 52 W	7.6
	445 Figueroa	118.26W	LA-231	V 502	Down	7.6
	(19th Floor)			T 433	S 38 W	7 6
159	Los Angeles	34.05N	AR-240	L 507	N 52 W	7.6
	445 Figueroa	118.26W	LA-232	V 505	Down	7.6
	(39th Floor)			T 438	S 38 W	7.6
151	Los Angeles	34.05N	AR-240	L 205	N 36 E	7.6
	250 E. First	118.24W	LA-287	V 207	Down	7.6
	(Basement)	(A)		T 241	N 54 W	7.6
152	Los Angeles	34.05N	AR-240	L 233	N 36 E	7.6
	250 E First	118.24W	LA-294	V 202	Down	7.6
	(8th Floor)			T 205	N 54 W	7.6
153	Los Angeles	34.05N	AR-240	L 189	N 36 E	7.6
	250 E. First	118.24W	LA-295	V 224	Down	7.6
	(17th Floor)			T 215	N 54 W	7.6
172	Los Angeles	34.06N	MO-2	A	N 37 E	1.59
	800 W. First	118.25W	LA-59	B	N 53 W	1.60
	(1st Floor)	(SI)		V	Up	2.36
173	Los Angeles	34.06N	MO-2	A	N 37 E	1.57
	800 W. First	118.25W	LA-60	B	N 53 W	1.97
	(16th Floor)			V	Up	2.39
174	Los Angeles	34.06N	MO-2	A	N 37 E	1.61
	800 W. First	118.25W	LA-81	B	N 53 W	1.56
	(33d Floor)			V	Up	2.36
160	Los Angeles	34.05N	MO-2	A	N 30 W	1.58
	533 S. Fremont	118.26W	LA-73	B	S 60 W	1.68
	(Basement)	(A)		V	Up	2.40
161	Los Angeles	34.05N	MO-2	A	N 30 W	1.57
	533 S. Fremont	118.26W	LA-93	B	S 60 W	1.63
	(6th Floor)			V	Up	2.44
162	Los Angeles	34.05N	MO-2	A	N 30 W	1.57
	533 S. Fremont	118.26W	LA-77	B	S 60 W	1.58
	(11th Floor)			V	Up	2.50
169	Los Angeles	34.05N	RFT-250	L 177	S 30 W	2.04
	750 Garland	118.27W	LA-153	V 205	Down	1.95
	(Grd. Floor)	(A)		T 216	N 60 W	1.93
170	Los Angeles	34.05N	RFT-250	L 161	S 30 W	1.91
	750 Garland	118.27W	LA-152	V 172	Down	1.99
	(2d Floor)			T 171	N 60 W	1.88
171	Los Angeles	34.05N	RFT-250	L 160	S 30 W	1.97
	750 Garland	118.27W	LA-151	V 170	Down	1.97
	(6th Floor)			T 169	N 60 W	1.96

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist.[4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6]		Accl Gt. 0.2g[4]		Num. Aftshk.[4,6]
					Per. sec.	Accl. g	Dur. sec.	Cycle	
0.054	12	106	41	250	0.4	0.14			3/
.051	10	119			.2	.06			
.055	10	102			.3	.13			
.055	10	102		250	.4	.21	0.7	0.5	3/
.055	10	102			.3	.12			
.053	11	111			3	.13			
.050	12	123		NR					
.050	12	123							
.050	10	123							
.049	10	127	41	51	.1	.09			
.048	11	131			.1	.04			
.049	10	129			.2	.13			
.049	10	130		51	.4	.21	.2	.5	
.048	11	131			.1	.07			
.049	11	126			.9	.17			
.047	10	139		51	.6	.16			
.047	11	137			.2	.21	.1	.5	
.046	10	142			.6	.18			
.030	10	70	41	NTM		.09			2/
.030	10	70				.15			
.030	10	104				.06			
.030	10	69		48	.8	.11			2/
030	10	86			1.2	.18			
.030	10	105			.2	.15			
030	10	71		54	1.4	.19			2/
030	10	68			.9	.31	2.0	2.0	
.030	10	104			.2	.22	.3	1.5	
.030	10	69	41	53	.3	.21	.2	.5	
.030	10	74			.3	.23	.2	.5	
.030	10	105			.3	.08			
.030	10	69		53	.2	.34	.7	2.5	
.030	10	72			4	.31	.8	2.5	
.030	10	107			.2	.16			
030	10	69		PR					
030	10	69							
030	10	110							
047	9	37 2	41	PR					/2
048	9	34 1							
048	9	33 8							
046	18	36 4		93	3	22	.1	.5	11/2
047	9	36 3			1	.10			
047	18	34 3			.3	.16			
048	13	34 5		91	8	.30	3.6	3 5	11/2
046	10	37 5			2	15			
047	10	35 8			1.0	23	.5	5	

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
154	Los Angeles	34.05N	RFT-250	L 85	S 37 W	1.9
	420 S. Grand	118.25W	LA-125	V 81	Down	1.9
	(Basement)	(SH&SI)		T 86	S 53 E	1.9
155	Los Angeles	34.05N	RFT-250	L 170	S 37 W	1.9
	420 S. Grand	118.25W	LA-124	V 73	Down	1.9
	(8th Floor)			T 69	S 53 E	1.9
156	Los Angeles	34.05N	RFT-250	L 84	S 37 W	1.9
	420 S. Grand	118.25W	LA-126	V 89	Down	1.9
	(15th Floor)			T 79	S 53 E	1.9
141	Los Angeles	34.12N	RFT-250	L 165	South	1.9
	Griffith Observatory	118.30W	FS-158	V 190	Down	1.91
	(Moon Room)	(GR)		T 199	East	1.97
407	Los Angeles	34.06N	MO-2	B	N 76 W	1.51
	930 Hilgard	118.44W	LA-166	A	N 14 E	1.53
	(Basement)	(A)		V	Up	2.34
408	Los Angeles	34.06N	MO-2	B	N 76 W	1.50
	930 Hilgard	118.44W	LA-200	A	N 14 E	1.55
	(8th Floor)			V	Up	2.38
409	Los Angeles	34.06N	MO-2	B	N 76 W	1.54
	930 Hilgard	118.44W	LA-158	A	N 14 E	1.57
	(15th Floor)			V	Up	2.28
437	Los Angeles	34.04N	RFT-250	L 503	S 53 E	1.89
	1150 S Hill	118.26W	LA-277	V 443	Down	1.90
	(Basement)	(SG&SH)		T 473	N 37 E	1.89
438	Los Angeles	34.04N	RFT-250	L 494	S 53 E	1.85
	1150 S. Hill	118.26W	LA-271	V 449	Down	1.90
	(5th Floor)			T 510	N 37 E	1.85
439	Los Angeles	34.04N	RFT-250	L 495	S 53 E	1.88
	1150 S. Hill	118.26W	LA-276	V 519	Down	1.90
	(10th Floor)			T 439	N 37 E	1.81
238	Los Angeles	34.10N	AR-240	L 137	East	7.6
	7080 Hollywood Blvd.	118.34W	LA-269	V 144	Down	7.6
	(Basement)	(A)		T 143	North	7.6
239	Los Angeles	34.10N	AR-240	L 152	East	7.6
	7080 Hollywood Blvd.	118.34W	LA-270	V 154	Down	7.6
	(6th Floor)			T 148	North	7.6
240	Los Angeles	34.10N	AR-240	L 142	East	7.6
	7080 Hollywood Blvd	118.34W	LA-267	V 141	Down	7.6
	(12th Floor)			T 146	North	7.6
133	Los Angeles	34.08N	S-M	V 217	Up	12.8
	Hollywood Storage	118.33W	FS-22	L 216	East	13.3
	(Basement)	(A)		T 215	South	12.4
134	Los Angeles	34.08N	S-M	V 193	Up	6.3
	Hollywood Storage	118.33W	FS-40	L 192	South	6.7
	(Penthouse, 15th Floor)			T 191	West	6.5

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist.[4,5] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6] Per. sec.	Max. accl.[4,6] Accl. g	Accl. Gt. 0.2g[4] Dur. sec.	Accl. Gt. 0.2g[4] Cycle	Num. Aftshk.[4,6]
0.045	9	38	41	90	0.2	0.12			7/
.046	8	36			.1	.07			-
.046	9	36			.4	.17			
.046	6	36		PR					1/
.046	10	36							
.047	9	35							
.048	6	33		89	.7	.23	0.3	0.5	7/
.047	13	35			.2	.23	.1	.5	
.047	10	35			.9	.32	4.7	6.5	
.046	13	36.2	33	48	.4	.18			8/
.046	14	36.4			.2	.12			
.047	13	35.9			.3	.16			
.035	10	50	38	PR					
.035	10	50							
.034	10	77							
.034	10	52		PR					/5
.034	10	54							
.034	10	83							
.035	10	51		278	.2	.15			1/5
.037	10	55			.9	.20			
.037	10	80			.1	.16			
.052	9	28	42	88	.4	.12			2/
.050	8	31			.2	05			
.047	8	35			.4	.09			
.049	10	31		88	.8	.11			2/
.052	10	28			.2	.09			
.049	9	31			.4	.10			
.048	12	33		88	2.1	.14			2/
.049	9	32			.2	.15			
.047	8	33			2.5	.11			
.044	9.0	156	34	36	.3	.11			
.044	9.5	159			.2	.06			
.045	10	149			.3	10			
.049	11	127		36	.6	.19			
.047	9	140			.2	.16			
.050	10	122			.5	.12			
.048	9	131		36	.8	.21	.4	.5	
.048	10	134			.2	.22	.1	.5	
.047	8	137			4	.12			
.065	10	121	35	79	3	.06			4/2
.066	10	122			3	15			
.064	7	122			.4	.11			
.045	8	121		NR					/2
.046	8	123							
.045	8	125							

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
135	Los Angeles	34.08N	S-M	V 214	Up	12.9
	Hollywood Storage	118.33W	FS-1	L 213	East	12.1
	(Adjacent P.E. Lot)			T 212	South	13.2
214	Los Angeles	34.02N	AR-240	L 124	N 61 W	7.6
	3663 S. Hoover, U.S.C.	118.29W	LA-259	V 122	Down	7.6
	(Vivian Hall, Basement)	(A)		T 123	S 29 W	7.6
215	Los Angeles	34.02N	AR-240	L 119	N 61 W	7.6
	3663 S. Hoover, U.S.C.	118.29W	LA-261	V 120	Down	7.6
	(Vivian Hall, 4th Floor)			T 121	S 29 W	7.6
216	Los Angeles	34.02N	AR-240	L 114	N 61 W	7.6
	3663 S. Hoover, U.S.C.	118.29W	LA-263	V 115	Down	7.6
	(Vivian Hall, 7th Floor)			T 117	S 29 W	7.6
220	Los Angeles	34.14N	RFT-250	L 162	North	1.95
	3838 Lankershim	118.36W	LA-155	V 174	Down	1.98
	(Basement)	(SA&SH)		T 173	West	1.98
221	Los Angeles	34.14N	RFT-250	L 163	North	1.98
	3838 Lankershim	118.36W	LA-154	V 182	Down	1.98
	(11th Floor)			T 183	West	1.97
222	Los Angeles	34.14N	RFT-250	L-158	North	1.89
	3838 Lankershim	118.36W	LA-150	V 143	Down	1.96
	(21st Floor)			T 151	West	1.91
244	Los Angeles	33.96N	RFT-250	L 175	S 45 W	1.79
	8639 Lincoln	118.42W	LA-169	V 191	Down	1.99
	(Basement)	(T&SH)		T 211	S 45 E	1.90
245	Los Angeles	33.96N	RFT-250	L 197	S 45 W	1.80
	8639 Lincoln	118.42W	LA-170	V 214	Down	1.87
	(6th Floor)			T 220	S 45 E	2.02
246	Los Angeles	33.96N	RFT-250	L 244	S 45 W	1.88
	8639 Lincoln	118.42W	LA-168	V 200	Down	1.99
	(12th Floor)			T 201	S 45 E	1.86
181	Los Angeles	34.06N	AR-240	L 420	N 38 W	7.6
	1640 Marengo	118.21W	LA-235	V 419	Down	7.6
	(1st Floor)	(A)		T 434	S 52 W	7.6
182	Los Angeles	34.06N	AR-240	L 440	N 38 W	7.6
	1640 Marengo	118.21W	LA-229	V 427	Down	7.6
	(4th Floor)			T 448	S 52 W	7.6
183	Los Angeles	34.06N	AR-240	L 471	N 38 W	7.6
	1640 Marengo	118.21W	LA-230	V 449	Down	7.6
	(Penthouse, 8th Level)			T 447	S 52 W	7.6
431	Los Angeles	34.06N	SMA-1	L 162	North	1.61
	616 S. Normandie	118.30W	LA-117	V 141	Down	1.72
	(Basement)	(A&SI)		T 150	West	1.66
432	Los Angeles	34.06N	SMA-1	L 138	North	1.80
	616 S. Normandie	118.30W	LA-118	V 172	Down	1.62
	(8th Floor)			T 171	West	1.62

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist.[4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6] Per. sec.	Max. accl.[4,6] Accl. g	Accl. Gt. 0.2g[4] Dur. sec.	Accl. Gt. 0.2g[4] Cycle	Num. Aftshk.[4,6]
0.065	9	122		79	0.1	0.12			13/
.065	8	121			.2	.22	0.3	1.0	
.066	10	120			.4	.19			
.055	11	101	42	NR					
.056	11	97							
.053	10	111							
.056	10	99		NR					
.058	10	92							
.057	12	96							
.052	11	112		NR					
.052	10	112							
.052	10	112							
.046	9	37.1	30	64	.2	.18			5/2
.047	10	36.1			.2	.09			
.047	10	36.1			.3	.13			
.047	10	36.1		PR					5/2
.048	10	34.6							
.048	9	34.5							
.047	9	34.5		64	.4	.10			5/2
.047	9	35.8			.2	.23	.8	4.0	
.047	10	34.9			.3	.21	.1	.5	
.045	10	35.6	48	86	.8	.04			1/1
.047	10	36.3			.3	.04			
.047	12	34.7			.4	.04			
.047	13	32.8		86	.6	10			1/1
.045	9	37.2			.3	05			
.047	9	36.9			.8	.10			
.046	10	35.8		86	.6	.12			1/1
.047	7	36.3			.3	.06			
.047	9	33.9			.8	.12			
.051	11	119	42	105	.2	.14			5/2
.048	10	126			2	.08			
.053	12	111	(SD)		2	.14			
.055	11	101		105	.2	.20			5/2
.051	11	119			.1	12			
.051	10	119			.2	26	9	3.0	
052	10	112		105	.2	24	8	2.0	5/2
.054	10	106			1	13			
.052	12	112			2	44	7.6	13 5	
.038	6	45	39	19PR	.6	10			1/1
.040	8	43.5			.2	05			
.038	6	46			2	11			
.039	8	48		43	3	22	1 0	1 0	1/1
.037	6	48			2	10			
037	8	48			4	14			

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
433	Los Angeles	34.06N	SMA-1	L 179	North	1.60
	616 S. Normandie	118.30W	LA-119	V 128	Down	1.82
	(Roof, 18th Floor)			T 113	West	1.76
166	Los Angeles	34.05N	AR-240	L 132	S 37 W	7.6
	646 S. Olive	118.25W	LA-262	V 133	Down	7.6
	(Basement)	(A)		T 131	S 53 E	7.6
167	Los Angeles	34.05N	AR-240	L 129	S 37 W	7.6
	646 S. Olive	118.25W	LA-266	V 130	Down	7.6
	(4th Level)			T 128	S 53 E	7.6
168	Los Angeles	34.05N	AR-240	L 126	S 37 W	7.6
	646 S. Olive	118.25W	LA-265	V 127	Down	7.6
	(Roof, 8th Level)			T 174	S 53 E	7.6
175	Los Angeles	34.05N	AR-240	L 429	S 37 W	7.6
	808 Olive	118.26W	LA-198	V 455	Down	7.6
	(Street Level)	(A)		T 466	S 53 E	7.6
176	Los Angeles	34.05N	AR-240	L 293	S 53 E	7.6
	808 Olive	118.26W	LA-226	V 430	Down	7.6
	(4th Level)			T 443	N 37 E	7.6
177	Los Angeles	34.05N	AR-240	L 403	S 37 W	7 6
	808 Olive	118.26W	LA-206	V 457	Down	7.6
	(8th Level)			T 410	S 53 E	7.6
469	Los Angeles	34.05N	SMA-1	L 314	N 28 E	1.70
	1625 W. Olympic	118.27W	LA-146	V 252	Down	1 92
	(Grd Floor)	(A)		T 253	N 62 W	1 80
470	Los Angeles	34.05N	SMA-1	L 258	N 28 E	1 93
	1625 W. Olympic	118.27W	LA-147	V 256	Down	1.72
	(6th Floor)			T 257	N 62 W	1.82
471	Los Angeles	34.05N	SMA-1	L 250	N 28 E	1 82
	1625 W Olympic	118.27W	LA-145	V 246	Down	1 81
	(10th Floor)			T 247	N 62 W	1 91
446	Los Angeles	34.10N	MO-2	A	South	1.47
	1760 N Orchid	118.34W	LA-152	B	East	1.52
	(Grd Floor)	(A)		V	Up	2 34
447	Los Angeles	34 10N	MO-2	B	East	1 52
	1760 N Orchid	118 34W	LA-135	A	South	1 47
	(12th Floor)			V	Up	2 34
488	Los Angeles	34 10N	MO-2	B	East	1 57
	1760 N Orchid	118.34W	LA-132	A	South	1 54
	(23d Floor)			V	Up	2 42
241	Los Angeles	34.22N	AR-240	L 527	North	7 6
	8244 Orion	118 47W	LA-190	V 516	Down	7 6
	(1st Floor)	(A)		T 523	West	7.6
242	Los Angeles	34.22N	AR-240	L 520	North	7 6
	8244 Orion	118.47W	LA-210	V 518	Down	7 6
	(4th Floor)			T 511	West	7 6

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist.[4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6]		Accl. Gt. 0.2g[4]		Num. Aftshk.[4,6]
					Per. sec.	Accl. g	Dur. sec.	Cycle	
0.037	7	47		43	1.3	0.31	12.9	15.0	1/1
.040	8	48.5			.1	.20			
.038	7	49.5			.4	.23	5.3	10.5	
.047	10	139	42	56	.2	.22	.1	.5	6/
.045	10	150			.1	.08			
.046	10	144			.2	.25	.1	.5	
.046	10	143		56	.4	.25	2.1	6.5	6/
.048	10	135			.1	.12			
.050	10	124			.4	.26	.2	.5	
.049	9.6	129		56	.5	.38	5.6	22.5	6/
.049	9.5	130			.1	.26	.1	1.0	
.049	10	130			.2	.48	5.2	28.0	
.054	10	105	42	149	.5	.14			7/
.055	10	101			.6	.09			
.054	10	105			.6	.13			
.052	10	112		149	.4	.26	.4	1.0	7/1
.055	11	101			.2	.19			
.055	10	101			.2	.16			
.054	10	106		149	.4	.25	1.5	4.5	7/1
.059	11	87			.2	.24	.1	.5	
.056	10	97			.3	.44	5.7	21.0	
.043	9	46	41	49	.3	.14			7/2
.041	9	40.8			.1	.16			
.040	10	45.3			.4	.27	.5	2.0	
.041	10	46.3		14PR	.4	.18			3/2
.039	8	45.6			.2	.14			
.039	10	48.2			.6	.22	.6	.5	
.039	10	48.2		64	1.3	.23	6.3	5.5	7/2
.038	8	50.5			.1	.23	.1	.5	
.039	8	50.6			1.2	.28	4.2	2.5	
.034	10	51.3	34	43	.2	.16			2/
.034	10	53.0			.2	.13			
.034	10	81.6			.2	.07			
.034	10	53.0		41	.6	.14			2/
.034	10	51.3			.2	.08			
.034	10	81.6			.3	.14			
.035	10	51.7		39	.4	20			2/1
.035	10	50.7			.2	.11			
.035	10	79.6			.2	.19	.1	.5	
.054	10	105	20	86	.6	.27	.3	.5	2/3
.053	9	110			.3	17			
.053	10	110	(SD)		3	.14			
.055	10	111	8KM	86	.3	.20			2/3
.052	9	111			.3	.23	.3	1.0	
052	10	111			3	24	.2	.5	

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
243	Los Angeles	34.22N	AR-240	L 512	North	7.6
	8244 Orion	118.47W	LA-199	V 453	Down	7.6
	(Roof, 8th Level)			T 521	West	7.6
142	Los Angeles	34.12N	AR-240	L 530	S 02 W	7.6
	120 N. Robertson	118.38W	LA-239	V 534	Down	7.6
	(2d Basement)	(A)		T 533	S 88 E	7.6
143	Los Angeles	34.12N	AR-240	L 539	S 02 W	7.6
	120 N. Robertson	118.38W	LA-237	V 535	Down	7.6
	(4th Floor)			T 538	S 88 E	7.6
144	Los Angeles	34.12N	AR-240	L 532	S 02 W	7.6
	120 N. Robertson	118.38W	LA-238	V 536	Down	7.6
	(9th Floor)			T 528	S 88 E	7.6
250	Los Angeles	34.05N	MO-2	B	S 55 W	1.58
	11661 San Vicente	118.46W	LA-141	A	N 35 W	1.49
	(G-2 Level)	(A)		V	Up	2.33
251	Los Angeles	34.05N	MO-2	B	S 55 W	1.53
	11661 San Vicente	118.46W	LA-172	A	N 35 W	1.58
	(5th Floor)			V	Up	2.38
252	Los Angeles	34.05N	MO-2	B	S 55 W	1.55
	11661 San Vicente	118.46W	LA-198	A	N 35 W	1.55
	(Roof, 11th Level)			V	Up	2.41
163	Los Angeles	34.05N	RFT-250	L 137	N 52 W	1.9
	611 W. 6th Street	118.25W	LA-139	V 142	Down	1.9
	(Basement)	(A)		T 139	N 38 E	1.9
164	Los Angeles	34.05N	RFT-250	L 123	N 52 W	1.9
	611 W. 6th Street	118.25W	LA-146	V 127	Down	1.9
	(24th Floor)			T 115	N 38 E	1.9
165	Los Angeles	34.05N	RFT-250	L 78	N 52 W	1.9
	611 W. 6th Street	118.25W	LA-122	V 74	Down	1.9
	(42d Floor)			T 75	N 38 E	1.9
199	Los Angeles	34.06N	AR-240	L 426	South	7.6
	3407 W. 6th Street	118.30W	LA-225	V 506	Down	7.6
	(Basement)	(A)		T 397	East	7.6
200	Los Angeles	34.06N	AR-240	L 362	South	7.6
	3407 W 6th Street	118.30W	LA-223	V 342	Down	7.6
	(4th Floor)			T 415	East	7.6
201	Los Angeles	34.06N	AR-240	L 404	South	7.6
	3407 W. 6th Street	118.30W	LA-233	V 509	Down	7.6
	(Penthouse, 8th Floor)			T 439	East	7.6
226	Los Angeles	34.10N	AR-240	L 155	S 89 W	7.6
	4867 Sunset Blvd.	118.29W	LA-260	V	Down	7.6
	(Basement)	(AVSI)		T 166	S 01 E	7.6
227	Los Angeles	34.10N	AR-240	L 175	S 89 W	7.6
	4867 Sunset Blvd.	118.29W	LA-286	V 172	Down	7.6
	(3d Floor)			T 139	S 01 E	7.6

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist. [4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6]		Accl Gt. 0.2g[4]		Num. Aftshk.[4,6]
					Per. sec.	Accl. g	Dur. sec.	Cycle	
0.053	11	107		86	0.3	0.39	11.0	20.5	2/3
.053	10	108			.1	.22	3.9	27.0	
.053	12	111			.3	.31	9.4	19.5	
.055	11	102	36	68	.4	.09			4/
054	10	104			.2	.03			
.054	10	105			.6	.09			
.053	10	109		68	.3	.18			4/
.054	9	106		NR					
.057	9	98			.2	.18			
.056	11	98.5		68	.4	.33	3.0	10.5	4/
.056	11	98.5			.2	.12			
.054	10	105			.6	.28	4.9	9.5	
.030	10	69	42	NR					
.030	10	65							
030	10	102							
.030	10	67		42	.5	.09			2/
.030	10	69			.2	.08			
.030	10	104			.2	.11			
.030	10	68		43	.5	.11			2/
.030	10	68			3	.13			
.030	10	106			.2	.16			
.045	10	37	41	52	.2	10			1/
.045	10	37			.2	.06			
.045	10	37			3	.11			
.048	10	33		NR					
.048	10	33							
048	10	33							
048	10	33		52	4	.11			1/
046	10	35			.2	.11			
.046	10	35			.9	18			
.049	12	125	39	66	2	.17			1/
.051	12	119			.1	.06			
.051	10	119			.1	.19			
.053	12	111		66	.3	.22	1 8	7 5	1/
055	13	102			.2	10			
056	10	97			2	21	1	5	
.053	10	111		66	7	29	1 7	2 0	1/
054	10	106			.2	26	1 9	11 0	
053	12	111			.6	21	1 2	1 5	
.049	10	127	35	47	6	.17			2/
048	10	131			1	.13			
.049	10	129			.2	.17			
.049	10	127		47	2	.30	1	.5	2/
.049	10	134			1	13			
.051	11	119			5	.22	3	5	

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
228	Los Angeles	34.10N	AR-240	L 171	S 89 W	7.6
	4867 Sunset Blvd.	118.29W	LA-282	V 169	Down	7.6
	(8th Floor)			T	S 01 E	7.6
232	Los Angeles	34.10N	MO-2	B	East	1.54
	6430 Sunset Blvd.	118.33W	LA-56	A	South	1.57
	(1st Floor)	(A)		V	Up	2.43
233	Los Angeles	34.10N	MO-2	B	East	1.61
	6430 Sunset Blvd.	118.33W	LA-90	A	South	1.63
	(7th Floor)			V	Up	2.44
234	Los Angeles	34.10N	MO-2	B	East	1.57
	6430 Sunset Blvd.	118.33W	LA-94	A	South	1.57
	(15th Floor)			V	Up	2.46
235	Los Angeles	34.10N	MO-2	B	East	1.49
	6464 Sunset Blvd.	118.33W	LA-123	A	South	1.52
	(Basement)	(A)		V	Up	2.40
236	Los Angeles	34.10N	MO-2	B	East	1.55
	6464 Sunset Blvd.	118.33W	LA-108	A	South	1.55
	(6th Floor)			V	Up	2.33
237	Los Angeles	34.10N	MO-2	B	East	1.57
	6464 Sunset Blvd.	118.33W	LA-116	A	South	1.52
	(12th Floor)			V	Up	2.44
178	Los Angeles	34.06N	AR-240	L 553	N 78 W	7.6
	945 Tiverton	118.44W	LA-245	V 531	Down	7.6
	(Sub-Basement)	(A)		T 557	S 12 W	7.6
179	Los Angeles	34.06N	AR-240	L 555	N 78 W	7.6
	945 Tiverton	118.44W	LA-244	V 561	Down	7.6
	(8th Floor)			T 537	S 12 W	7.6
180	Los Angeles	34.06N	AR-240	L 554	N 78 W	7.6
	945 Tiverton	118.44W	LA-243	V 540	Down	7.6
	(14th Floor)			T 560	S 12 W	7.6
140	Los Angeles	34.07N	S-M	V 262	Up	21.0
	U.C.L.A	118.45W	FS-20	L 263	North	21.0
	Reactor Lab.	(AVSRJ	with	T 264	West	22.0
	(Grd. Level)		CDMs	L 71	South	
				T 60	West	
205	Los Angeles	34.02N	MO-2	A	N 61 E	1.63
	3440 Univ. St., U.S.C	118.28W	LA-97	B	N 29 W	1.57
	Phillips Hall (Basement)	(A&CSH)		V	Up	2.53
206	Los Angeles	34.02N	MO-2	A	N 61 E	1.55
	3440 Univ. St., U.S.C.	118.28W	LA-89	B	N 29 W	1.57
	Phillips Hall (5th Floor)			V	Up	2.42
207	Los Angeles	34.02N	MO-2	A	N 61 E	1.62
	3440 Univ. St., U.S.C.	118.28W	LA-105	B	N 29 W	1.53
	Phillips Hall, Roof (13)			V	Up	2.62
9002	Los Angeles	34.29N	SMA-1	V 546	Down	1.67
	Van Norman Dam	118.48W	GS-214	L 543	North	1.69
	Meter House	(A)		T 521	West	1.78

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist. [4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6]		Accl. Gt. 0.2g[4]		Num. Aftshk.[4,6]
					Per. sec.	Accl. g	Dur. sec.	Cycle	
0.057	10	93		45	0.4	0.45	6.7	17.5	2/
.054	10	107			.1	.20			
.053	10	111			.4	.46	5.2	18.0	
.030	10	68	34	226	.2	.14			3/
.030	10	69			.2	.19			
.030	10	107			.1	.09			
.030	10	71		NR					
.030	10	72							
.030	10	107.							
.030	10	69		NR					
.030	10	69							
.030	10	108							
.030	10	65	34	230	.3	.12			4/
.030	10	67			.5	.11			
.030	10	105			.2	.08			
.030	10	68		PR					/3
.030	10	68							
.030	10	102							
.030	10	69		297	1.0	27	.5	.5	4/1
.030	10	67			.6	.24	.3	.5	
.030	10	107			2	.29	1	5	
.054	10	106	38	NR					
055	10	100							
.054	10	104							
060	9	85		NTM		.12			15/
.053	9	108				.10			
057	10	93				.23		.5	
054	10	106		NTM		.14			15/
055	10	100				.15			
054	10	104				.18			
084	10	120	37	80	.2	.07			3/1
084	10	119			2	.10			
084	9	123			1	.09			
4 8	11	1 0			2 1	3.2*			
4 7	10	1 0			1.8	3.4*			
030	10	72	42	51	6	.08			
030	10	69			.3	.06			
030	10	111			.3	.05			
030	10	68		41	.8	13			
030	10	69			.2	14			
030	10	106			.2	.08			
030	10	71		53	1.0	24	8 3	9 5	
.030	10	67			1.1	.21	1 1	1 0	
030	10	115			.2	09			
25 9	9	42	15	NI					/5
26 2	10	43							
25 7	10	45							

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
458	Los Angeles	34.20N	RFT-250	L 497	West	1.87
	15107 Van Owen	118.46W	LA-267	V 512	Down	1.90
	(Basement)	(A)		T 463	South	1.91
459	Los Angeles	34.20N	RFT-250	L 508	West	1.89
	15107 Van Owen	118.46W	LA-270	V 454	Down	1.90
	(4th Floor)			T 516	South	1.84
460	Los Angeles	34.20N	RFT-250	L 478	West	1.96
	15107 Van Owen	118.46W	LA-254	V 522	Down	1.90
	(Roof, 8th Level)			T 470	South	1.97
253	Los Angeles	34.15N	MO-2	B	S 12 W	1.51
	14724 Ventura	118.46W	LA-165	A	N 78 W	1.53
	(1st Floor)	(A)		V	Up	2.36
254	Los Angeles	34.15N	MO-2	B	S 12 W	1.57
	14724 Ventura	118.46W	LA-129	A	N 78 W	1.57
	(6th Floor)			V	Up	2.42
255	Los Angeles	34.15N	MO-2	B	S 12 W	1.52
	14724 Ventura	118.46W	LA-188	A	N 78 W	1.55
	(Penthouse, 13th Floor)			V	Up	2.34
466	Los Angeles	34 15N	SMA-1	L 360	N 11 E	1.98
	15250 Ventura	118 46W	LA-185	V 359	Down	1.70
	(Basement)	(A)		T 416	N 79 W	1 78
467	Los Angeles	34 15N	SMA-1	L 354	N 11 E	1.80
	15250 Ventura	118 46W	LA-184	V 389	Down	1.71
	(7th Floor)			T 364	N 79 W	1.88
468	Los Angeles	34.15N	SMA-1	L 411	N 11 E	1.92
	15250 Ventura	118.46W	LA-183	V 399	Down	1.91
	(Roof, 13th Level)			T 408	N 79 W	1 70
256	Los Angeles	34.16N	MO-2	A	N 12 E	1 62
	15433 Ventura	118.47W	LA-102	B	N 78 W	1.62
	(Basement)	(A)		V	Up	2.54
257	Los Angeles	34.16N	MO-2	A	N 12 E	1.57
	15433 Ventura	118.47W	LA-104	B	N 78 W	1.53
	(7th Floor)			V	Up	2.48
258	Los Angeles	34.16N	MO-2	A	N 12 E	1 60
	15433 Ventura	118 47W	LA-86	B	N 78 W	1 63
	(13th Floor)			V	Up	2.37
461	Los Angeles	34 16N	SMA-1	L 410	S 09 W	2 00
	15910 Ventura	118 48W	LA-182	V 358	Down	1 95
	(Basement)	(A)		T 392	S 81 E	2.09
462	Los Angeles	34 16N	SMA-1	L 357	S 09 W	1 74
	15910 Ventura	118 48W	LA-181	V 351	Down	1 90
	(9th Floor)			T 290	S 81 E	1.93
463	Los Angeles	34 16N	SMA-1	L 403	S 09 W	1.87
	15910 Ventura	118 48W	LA-180	V 378	Down	1.95
	(Roof, 19th Level)			T 406	S 81 E	1 67

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat mag[4]	Epic. dist.[4,6] km[6]	Recd. leng.[4,6] sec.	Max. accel[4,6]		Accel Gt. 0.2g[4]		Num. Aftshk.[4,6]
					Per. sec.	Accel g	Dur sec.	Cycle	
0.054	9	26	24	50	0.3	0.11			15/5
053	9	27			.4	.12			
.055	9	25			.3	.12			
.052	11	28	13KM	98	.3	.23	0.1	0.5	15/5
.049	9	32			.2	.19			
.046	10	35			.9	.26	.5	.5	
.048	7	34		51	.4	.34	11.9	40.0	15/5
.052	11	28			.3	.17			
.048	9	. 34			1.0	.38	15.8	41.0	
.030	10	66	28	40	.3	.26	.5	2.0	4/3
.030	10	67			.3	.19			
030	10	104			.2	09			
030	10	69		40	.2	.36	10.4	42.0	4/3
.030	10	69			2	.27	.5	2.0	
.030	10	104			.1	.11			
.030	10	69		40	.3	.32	10 6	45.0	4/3
.030	10	68			.2	.21	.4	2.0	
.030	10	103		NR					
.041	13	47 7	28	40	.2	.23	.1	.5	/1
.038	10	47.7			1	10			
.039	10	47.7	(SD)		.3	.14			
.039	11	48.1		40	2	.25	1	.5	/1
.039	10	45.4			1	18			
.040	10	47.7			3	.21	2	.5	
.039	10	51.0		40	3	26	.2	.5	/1
040	10	48.0			1	.13			
.038	11	47.7			4	18			
030	10	67	28	NR					/9
030	10	67							
030	10	112							
.030	10	69		18	.2	.24	.1	.5	8/8
030	10	67			3	17			
030	10	109			1	15			
030	10	70		32PR	1 3	27	1 9	1.5	8/8
030	10	72			1 7	23	1 7	1 0	
030	10	104			1	07			
041	10	49 5	28	56	4	13			15/4
041	12	48			3	11			
041	14	50			4	15			
038	10	49		56	1 3	18			15/9
040	11	48			2	22	1	5	
041	12	46			8	13			
040	10	47		56	9	22	1 2	1 5	15/9
039	10	51 5			2	21	1	5	
038	10	46.5			1 2	23	6	5	

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
259	Los Angeles	34.16N	MO-2	A	N 09 E	1.54
	16055 Ventura	118.48W	LA-164	B	N 81 W	1.54
	(1st Floor)	(AVSS)		V	Up	2.31
260	Los Angeles	34.16N	MO-2	B	N 81 W	1.51
	16055 Ventura	118.48W	LA-175	A	N 09 E	1.47
	(6th Floor)			V	Up	2.36
261	Los Angeles	34.16N	MO-2	A	N 09 E	1.51
	16055 Ventura	118.48W	LA-137	B	N 81 W	1.57
	(Roof, 13th Level)			V	Up	2.34
118	Los Angeles	34.16N	AR-240	L 425	S 10 W	7.6
	16661 Ventura	118.50W	LA-203	V 413	Down	7.6
	(Basement)	(A)		T 470	S 80 E	7.6
119	Los Angeles	34.16N	AR-240	L 412	N 80 W	7.6
	16661 Ventura	118.50W	LA-203	V 414	Down	7.6
	(4th Floor)			T 482	S 10 W	7.6
120	Los Angeles	34.16N	AR-240	L 493	N 80 W	7.6
	16661 Ventura	118.50W	LA-200	V 418	Down	7.6
	(8th Floor)			T 463	S 10 W	7.6
137	Los Angeles	34.05N	AR-240	L 323	N 50 W	7.6
	Water and Power Bldg.	118.25W	DW-152	V 346	Down	7.6
	(B Level)	(SI)		T 288	S 40 W	7.6
138	Los Angeles	34.05N	AR-240	L 242	N 50 W	7.6
	Water and Power Bldg.	118 25W	DW-150	V 233	Down	7.6
	(7th Floor)			T 316	S 40 W	7.6
139	Los Angeles	34.05N	AR-240	L 285	N 50 W	7.6
	Water and Power Bldg.	118.25W	DW-151	V 290	Down	7.6
	(15th Floor)			T 310	S 40 W	7.6
449	Los Angeles	34.06N	SMA-1	L 178	N 29 E	1.96
	2500 Wilshire	118.28W	LA-130	V 194	Down	1.85
	(Basement)	(A&SI)		T 207	N 61 W	2.00
450	Los Angeles	34.06N	SMA-1	L 198	N 29 E	2.02
	2500 Wilshire	118.28W	LA-129	V 210	Down	2.00
	(8th Floor)			T 214	N 61 W	1.90
451	Los Angeles	34.06N	SMA-1	L 211	N 29 E	1.92
	2500 Wilshire	118.28W	LA-131	V 193	Down	1.90
	(Roof, 14th Level)			T 191	N 61 W	2.04
196	Los Angeles	34 06N	AR-240	L 230	South	7 6
	3345 Wilshire	118.30W	LA-300	V 199	Down	7 6
	(Basement)	(A)		T 209	East	7 6
197	Los Angeles	34 06N	AR-240	L 193	South	7.6
	3345 Wilshire	118 30W	LA-298	V 212	Down	7.6
	(2d Floor)			T 225	East	7.6
198	Los Angeles	34 06N	AR-240	L 221	South	7 6
	3345 Wilshire	118 30W	LA-299	V 222	Down	7 6
	(12th Floor)			T 220	East	7 6

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic dist.[4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6] Per. sec.	Max. accl.[4,6] Accl. g	Accl Gt. 0.2g[4] Dur sec.	Accl Gt. 0.2g[4] Cycle	Num. Aftshk.[4,6]
0.030	10	68	0.28	NR					
030	10	68							
.030	10	101							
.030	10	69		NR					
.030	10	68							
.030	10	106							
.030	10	66		NR					/2
030	10	69							
.030	10	103							
.059	11	125	28	NR					
.052	10	114							
.049	11	125							
052	10	114		NR					
.051	10	119							
.055	12	101							
.051	10	119		NR					
.057	10	96							
.052	11	124							
.052	10	115	41	170	0.8	0.14			4/
053	10	108			2	.08			
.054	9	106			.2	20			
.057	13	95.7		250+	5	17			4/
.056	10	99			2	10			
.051	10	117			6	.13			
.052	10	113		240	5	16			4/
.052	10	111			2	.17			
052	9	113			3.3	12			
039	7	52	40	25	.2	.10			
039	9	49			1	04			
.041	9	48			.1	.10			
.039	9	54		25	2	13			
.040	9	50.5			.2	07			
.039	7	50 5			5	16			
.040	10	47		25	8	20			
.040	6	47			3	14			
039	5	54.5			1 2	19			
047	9 5	138	39	42	5	12			
047	9 5	140			.1	07			
.047	10.1	138			4	09			
049	8.5	128		42	.2	17			
049	9.1	128		NR					
049	9.6	126			3	11			
048	9.1	134		42	1 0	21	0 5	0.5	
047	9 8	141			1	12			
048	9.7	132			1 0	25	8 0	8 0	

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
202	Los Angeles	34.06N	MO-2	B	South	1.59
	3411 Wilshire	118.30W	LA-61	A	West	1.64
	(5th Basement)	(SI)		V	Up	2.30
203	Los Angeles	34.06N	MO-2	B	South	1.59
	3411 Wilshire	118.30W	LA-68	A	West	1.61
	(13th Floor)			V	Up	2.48
204	Los Angeles	34.06N	MO-2	B	South	1.54
	3411 Wilshire	118.30W	LA-32	A	West	1.65
	(Penthouse, 32d Floor)			V	Up	2.47
208	Los Angeles	34.06N	AR-240	L 572	West	7.6
	3470 Wilshire	118.30W	LA-248	V 568	Down	7.6
	(Sub-Basement)	(A)		T 571	South	7.6
209	Los Angeles	34.06N	AR-240	L 549	West	7.6
	3470 Wilshire	118.30W	LA-246	V 563	Down	7.6
	(5th Floor)			T 551	South	7.6
210	Los Angeles	34.06N	AR-240	L 228	West	7.6
	3470 Wilshire	118.30W	LA-297	V 213	Down	7.6
	(11th Floor)			T 223	South	7.6
211	Los Angeles	34.06N	MO-2	B	West	1 58
	3550 Wilshire	118.30W	LA-194	A	North	1.52
	(Basement)	(A)		V	Up	2.35
212	Los Angeles	34.06N	MO-2	B	West	1.51
	3550 Wilshire	118.30W	LA-186	A	North	1.58
	(11th Floor)			V	Up	2.32
213	Los Angeles	34.06N	MO-2	B	West	1.54
	3550 Wilshire	118.30W	LA-193	A	North	1.49
	(21st Floor)			V	Up	2.40
217	Los Angeles	34.06N	AR-240	L 513	West	7.6
	3710 Wilshire	118.31W	LA-221	V 514	Down	7.6
	(Basement)	(A)		T 524	South	7.6
218	Los Angeles	34.06N	AR-240	L 526	West	7.6
	3710 Wilshire	118.31W	LA-219	V 517	Down	7.6
	(5th Floor)			T 525	South	7.6
219	Los Angeles	34.06N	AR-240	L 515	West	7.6
	3710 Wilshire	118.31W	LA-220	V 522	Down	7.6
	(10th Floor)			T 519	South	7 6
223	Los Angeles	34.06N	AR-240	L 176	N 15 E	7.6
	4680 Wilshire	118.33W	LA-268	V 138	Down	7.6
	(Basement)	(A)		T 145	N 75 W	7.6
224	Los Angeles	34.06N	AR-240	L 173	N 15 E	7 6
	4680 Wilshire	118.33W	LA-284	V 168	Down	7.6
	(3d Floor)			T 170	N 75 W	7.6
225	Los Angeles	34.06N	AR-240	L 177	N 15 E	7.6
	4680 Wilshire	118.33W	LA-279	V 178	Down	7.6
	(6th Floor)			T 180	N 75 W	7.6

See footnotes at end of table

Period[4] *sec.*	Damping[4]	Stat mag[4]	Epic. dist.[4,6] *km*[6]	Recd. leng.[4,6] *sec.*	Max. accl.[4,6]		Accl Gt. 0.2*g*[4]		Num. Aftshk.[4,6]
					Per. *sec.*	Accl. *g*	Dur. *sec.*	Cycle	
0.030	10	70	39	46	0.2	0.11			
.030	10	72			.2	.14			
.030	10	101			.1	.07			
.030	10	70		PR					
.030	10	71							
.030	10	109							
.030	10	68		PR					
030	10	72							
.030	10	108							
.056	12	98	39	64	.3	.12			2/
054	9	106			.2	.05			
.055	10	104			.3	.15			
.053	10	108		64	.3	.24	0.1	0.5	2/
053	10	108			.1	.10			
058	9	90			.3	.21	.1	.5	
.048	9	131		64	.9	.22	4.3	4.0	2/
.047	9	136			.1	.16			
.050	9	123			1.1	.23	4.0	3.0	
030	10	69	39	83	.2	.13			
.030	10	67			.4	18			
030	10	103			.1	.06			
.030	10	66		NR					/2
.030	10	69							
.030	10	102							
030	10	68		NR					/4
.030	10	65							
030	10	105							
.058	10	92	39	40	4	17			
053	10	111			.2	.08			
055	11	102			.5	16			
052	12	112		40	.3	.27	2.0	6.0	
.054	10	106			.2	.10			
053	12	111			3	.16			
055	10	102		40	5	23	2	5	
056	11	99			.3	17			
054	10	106			6	.37	5 4	8 0	
048	10	135	38	60	4	12			2/
047	10	137			4	.08			
047	10	137			6	09			
049	10	126		60	2	22	1	5	2/
050	10	124			.1	.13			
047	10	136			1	.18			
046	10	147		60	4	.24	4	1 0	2/
045	10	150			1	16			
048	10	135			6	30	5 1	8.0	

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
428	Los Angeles	34.06N	MO-2	B	S 07 W	1.52
	5900 Wilshire	118.36W	LA-112	A	N 83 W	1.50
	(Basement)	(AVAS)		V	Up	2.39
429	Los Angeles	34.06N	MO-2	B	S 07 W	1.55
	5900 Wilshire	118.36W	LA-161	A	N 83 W	1.49
	(16th Floor)			V	Up	2.37
430	Los Angeles	34.06N	MO-2	B	S 07 W	1.50
	5900 Wilshire	118.36W	LA-178	A	N 83 W	1.47
	(Penthouse)			V	Up	2.30
443	Los Angeles	34.06N	MO-2	B	N 82 W	1.57
	6200 Wilshire	118.36W	LA-173	A	N 08 E	1.49
	(Grd. Floor)	(AVAS)		V	Up	2.33
444	Los Angeles	34.06N	MO-2	B	N 82 W	1.49
	6200 Wilshire	118.36W	LA-185	A	N 08 E	1.50
	(10th Floor)			V	Up	2.34
445	Los Angeles	34.06N	MO-2	B	N 82 W	1.57
	6200 Wilshire	118.36W	LA-127	A	N 08 W	1.50
	(17th Floor)			V	Up	2.32
190	Los Angeles	34.06N	AR-240	L 208	S 28 W	7.6
	2011 Zonal	118.20W	LA-296	V 206	Down	7.6
	(Basement)	(SH)		T 219	S 62 E	7.6
191	Los Angeles	34.06N	AR-240	L 211	S 28 W	7.6
	2011 Zonal	118.20W	LA-292	V 227	Down	7.6
	(5th Floor)			T 218	S 62 E	7.6
192	Los Angeles	34.06N	AR-240	L 188	S 28 W	7.6
	2011 Zonal	118.20W	LA-302	V 250	Down	7.6
	(9th Floor)			T 125	S 62 E	7.6
1041	Maricopa Array	35.00N	RFT-250	L 248	S 40 W	1.81
	Station 1	119.48W	CW-191	V 262	Down	1.84
	(Freefield)	(SAP)	(SR)	T 294	S 50 E	1.82
1042	Maricopa Array	35.04N	RFT-250	L 252	S 40 W	1.87
	Station 2	119.43W	CW-192	V 281	Down	1.86
	(Freefield)	(SAP)	(SR)	T 261	S 50 E	1.85
1043	Maricopa Array	35.08N	RFT-250	L 238	S 40 W	1.87
	Station 3	119.40W	CW-194	V 269	Down	1.85
	(Freefield)	(SAP)	(SR)	T 270	S 50 E	2.00
1044	Maricopa Array	35.13N	RFT-250	L 243	S 40 W	1.95
	Station 4	119.37W	CW-162	V 291	Down	1.92
	(Freefield)	(SAP)	(SR)	T 289	S 50 E	1.95
472	Orange	33.78N	RFT-250	L 490	West	1.83
	1 City Blvd	117.89W	LA-272	V 450	Down	1.77
	(Basement)	(A&SH)		T 459	South	1.83
473	Orange	33.78N	RFT-250	L 502	West	1.76
	1 City Blvd	117.89W	LA-274	V 493	Down	1.84
	(10th Floor)			T 437	South	1.89

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist. [4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6]		Accl Gt. 0.2g[4]		Num. Aftshk.[4,6]
					Per. sec.	Accl. g	Dur. sec.	Cycle	
0.034	10	53	38	20	0.2	0.07			
.035	10	49			.4	.07			
.036	10	74			.7	.03			
.034	10	54		14	.3	.10			
.034	10	52			.2	.12			
.034	10	83			.3	.08			
.034	10	52		50	4.6	.14			
.034	10	51			2.2	.17			
.035	10	76			.4	.15			
.034	10	55	38	40	.6	.13			
.035	10	49			.3	13			
.035	10	77			.2	04			
.034	10	52		40	.3	.15			
.035	10	49			.4	.28	0.8	1.5	
.035	10	77			.3	.07			
.034	10	55		40	1.6	.26	.7	1.5	
.035	10	49			.5	.30	.3	.5	
.035	10	81			.4	.07			
047	9.6	138	42	33	.4	.08			
.048	10 3	131			.1	.06			
048	9.5	134			.4	.07			
.047	9.4	141		33	.2	16			
.046	9.8	142			.2	.08			
.048	9.5	132			.2	18			
.049	10.0	130		33	.6	.20			
.048	10.4	133			.1	.12			
.049	12.4	128			.5	.21	.1	.5	
.046	8	36.4	119	35		---			
.046	8	35 0				---			
.046	10	36.6				---			
.048		34.5		29		---			
048	9	34.3				---			
047	8	5.6				---			
044	7	41.0		29	.2	.01			
043	8	40.3			.2	---			
.045	8	39 8			3	01			
043	9 6	43.9		50	.2	.01			
.044	9.2	39 5			.2	.01			
.044	10	39.5			.2	.01			
047	10	33.3	83	159	4	.02			2/
.045	9	35 0			.3	01			
047	11	33.3			.3	02			
045	9	34.7		159	.3	05			2/
.050	9	29.8			.2	02			
049	10	37.6			3	04			

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
474	Orange	33.78N	RFT-250	L 507	West	1.84
	1 City Blvd.	117.89W	LA-266	V 513	Down	1.90
	(19th Floor)			T 448	South	1.80
262	Palmdale	34.58N	RFT-250	L 259	S 60 E	1.89
	Fire Station	118.11W	CT-189	V 283	Down	1.86
	(Storage Room)	(A)		T 264	S 30 W	1.93
411	Palos Verdes	33.80N	RFT-250	L 13	S 25 E	3.8
	Palos Verdes Estates	118.38W	CT-138	V 10	Down	3.8
	2516 Via Tejon (Basement)	(SV)		T 11	N 65 E	3.8
475	Pasadena	34.14N	SMA-1	L 186	East	1.78
	C.I.T. Athenaeum	118.12W	CT-124	V 169	Down	1.71
	(Basement)	(A&GR)		T 180	North	1.73
264	Pasadena	34.14N	RFT-250	L 235	East	1.90
	C.I.T.	118.13W	CT-198	V 308	Down	1.90
	Millikan (Basement)	(A&GR)		T 290	North	1.90
265	Pasadena	34.14N	RFT-250	L 194	East	1.90
	C I.T	118.13W	CT-200	V 212	Down	1.90
	Millikan (10th Floor)			T 187	North	1.90
266	Pasadena	34.15N	RFT-250	L 250	West	1.90
	C.I.T.	118.17W	CT-193	V 282	Down	1.90
	Seismo. Lab. (Basement)	(GRW)		T 276	South	1.90
267	Pasadena	34 20N	RFT-250	L 255	S 08 W	1.90
	J.P.L	118.17W	CT-195	V 274	Down	1 90
	(Basement)	(SG)		T 271	S 82 E	1.90
268	Pasadena	34.20N	RFT-250	L 181	S 08 W	1.90
	J.P L	118.17W	CT-199	V 189	Down	1.90
	(9th Floor)			T 203	S 82 E	1.90
269	Pear Blossom	34.51N	AR-240	L 472	North	7.6
	Pear Blossom Pumping Plant	117 92W	CW-215	V 494	Down	7.6
	(Freefield)	(A&SR)		T 489	West	7.6
270	Perris	33 85N	AR-240	L 462	S 07 W	7.6
	Perris Reservoir	117.19W	CW-218	V 504	Down	7.6
	(Freefield)	(AVGR)		T 446	S 83 E	7.6
271	Point Conception	34.46N	AR-240	L 134	N 63 E	7.6
	S. Cal Edison	120.41W	CE-264	V 135	Down	7.6
	(Freefield)	(SH)		T 136	N 27 W	7 6
272	Port Hueneme	34.15N	S-M	V1001	Up	19.6
	Navy Laboratory	119 20W	NL-N1	L1002	South	19.5
	(Grd Floor)	(A)	with	T1003	West	19.8
			CDMs	L 33	North	
				T 32	West	
1058	Pyramid	34 64N	RFT-250	L 206	N 53 E	1.90
	(Freefield)	118 76W	CW-160	V 188	Down	1.90
		(SH)		T 218	N 37 W	1.90

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist. [4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6] Per. sec.	Max. accl.[4,6] Accl. g	Accl. Gt. 0.2g[4] Dur. sec.	Accl. Gt. 0.2g[4] Cycle	Num. Aftshk.[4,6]
0.046	9	35.2		159	1.1	0.08			2/
.042	8	34.7			.2	.04			
.045	7	35.7			.4	.06			
.046	8	36.0	33	58	.2	.11			
.047	10	33.9			.1	.08			
.048	11	33.8			.2	.13			
.068	8	33	67	70	.4	.04			
.068	9	40			.2	.01			
.068	9	33			.2	.02			
.039	10	47.2	37	29	.4	.11			
.038	7	47.7			.2	.10			
.038	10	48.3			.4	.10			
.050	10	34	37	100	4	.18			11/7
050	10	34			.4	.12			
.050	10	34			.3	.22	0.1	0.5	
.050	10	34		100	1 0	.34	7.7	9 0	11/9
.050	10	34			.3	14			
.050	10	34			.6	.33	1.1	2.0	
.050	10	34	34	101	1	11			6/2
.050	10	34			1	.08			
.050	10	34			2	.19			
.050	10	34	29	114	4	.17			11/8
.050	10	34			3	13			
.050	10	34			3	21	1	.5	
.050	10	34		114	3	.21	.6	1.5	11/9
050	10	34			.2	.26	4.2	26.5	
.050	10	34			.4	38	1.4	3.5	
.054	11	103	46	27	.1	.10			
.055	10	99			1	06			
.052	10	114			.1	.15			
.054	10	105	127	NT					
.051	10	117							
.050	10	123							
.047	8	138	188	NT					
.047	9	140							
.047	8	140							
.081	10	118	78	119	3	01			
080	9	120			.3	03			
.081	10	119			7	.02			
2 33	10	1.0			.8	1 6*			
2.50	10	1 0			1 1	7*			
046	9		44	NR					
.047	9	35							
.046	9	36							

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
1064	Salinas Dam	35.34N	AR-240	L 178	N 24 E	8.76
	Santa Margarita	120.50W	SL-285	V 192	Down	8.01
	(Spillway)	(SR)		T 186	N 66 W	7.79
274	San Bernardino	34.10N	RFT-250	L 129	East	1.90
	Hall of Records	117.28W	CT-140	V 128	Down	1.90
	(Basement)	(A)		T 130	North	1.90
275	San Diego	32.72N	RFT-250	L 237	East	1.88
	S.D. Gas and Electric	117.16W	SD-209	V 297	Down	1.94
	(Basement)	(T)		T 302	North	2.02
276	San Diego	32.72N	RFT-250	L 242	East	2.05
	S.D. Gas and Electric	117.16W	SD-206	V 307	Down	1.95
	(Roof)			T 304	North	1.86
277	San Diego	32.70N	S-M	V 322	Up	20.3
	Light and Power Co.	117.15W	FS-5	L 323	East	19.5
	(Service Bldg.)	(AVSR)		T 324	South	20.1
278	San Dimas	34.09N	AR-240	L 351	N 55 E	7.6
	Puddingstone Dam	117.81W	FC-178	V 321	Down	7.6
	(Abutment)	(VS)		T 268	N 35 W	7.6
279	San Fernando	34.34N	AR-240	L 355	N 76 W	7.61
	Pacoima Dam	118 40W	FC-179	V 311	Down	7 55
	(Abutment)	(DGN)		T 352	S 14 W	7.69
465	San Juan Capistrano	33.49N	RFT-250	L 179	N 33 E	1 99
	32010 Del Obispo	117 67W	CT-180	V 234	Down	1 97
	City Hall (Grd. Floor)	(A)		T 233	N 57 W	1 91
1083	San Luis Obispo	35 28N	S-M	V 295	Up	18.3
	City Recreation Bldg.	120.66W	FS-2	L 296	S 54 W	18.8
	(Basement)	(CLVSH)		T 297	N 36 W	18.6
280	San Onofre	33.37N	AR-240	L 329	N 33 E	7.6
	SCE Nuclear Powerplant	117.56W	CE-153	V 304	Down	7.6
	(Basement)	(SAP)		T 392	N 57 W	7.6
9001	Sand Canyon	34.26N	SMA-1	V 287	Down	1.91
	LA County Fire Sta.	118.39W	GS-168	L 344	N 45 E	1 79
	(Grd. Floor)	(A)		T 262	N 45 W	1.87
281	Santa Ana	33.75N	S-M	V1022	Up	11 5
	Orange County	117 87W	FS-11	L1023	South	11 9
	Engineering Bldg	(A)	with	T1024	West	11 7
	(Basement)		CDMs	L B	S 04 E	
				T A	N 86 E	
282	Santa Barbara	34.41N	RFT-250	L 256	East	1.90
	Univ of Calif	119 85W	CT-183	V 266	Down	1.90
	Fluid Mech Lab (Basement)	(AVSA)		T 293	North	1.90
284	Santa Felicia Dam	34 46N	AR-240	L 547	S 82 W	7.6
	(Outlet Works)	118 75W	UW-242	V 541	Down	7.6
		(SA&SH)		T 543	S 08 E	7.6
285	Santa Felicia Dam	34 46N	AR-240	L 545	S 75 W	7 6
	(Crest)	118.75W	UW-241	V 546	Down	7 6
				T 544	S 15 E	7 6

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag[4]	Epic. dist[4,6] km[6]	Recd. leng.[4,6] sec.	Max acc[4,6]		Accel Gt 0.2g[4]		Num. Aftshk[4,6]
					Per. sec.	Accl. g	Dur. sec.	Cycle	
0 048	10	132	209	NT					
.050	13	120							
051	10	120							
.052	9	28	104	55	0.2	0.05			
051	10	30			2	.02			
051	11	30			.4	.04			
045	9	37.4	216	28	4	.01			
045	15	38.6			.3	---			
047	11	36 9			.4	01			
049	10	35.9		NR					
.048	10	32.7							
050	9	30.0							
080	9	124	216	99		---			
079	11	122				01			
080	9	124				01			
052	10	110	62	34	3	09			
051	10	117			1	05			
051	10	114			1	05			
052	12	113	8	399	2	1 25	19 4	64 0	30/2
052	13	115			3	72	8 7	73 0	
050	13	121	4KM		3	1 24	8 2	46.5	
047	10	36	120	106	.2	04			1/
.048	10	33			6	02			
048	13	33			3	03			
080	11	114	219	NT					
079	10	120							
080	11	116							
053	10	114	135	49	.2	01			
052	10	113			.2	01			
052	10	115			4	02			
037	8	54	16	NI					/7
036	9	55							
037	8	54							
064	9	112	86	94	2	02			
063	9	117			2	03			
064	9	113			3	03			
1 7	10	1 0			6 0	1 5*			
1 74	10	1 0			7 2	1 0*			
046	10	34	133	62	3	02			
047	10	34			3	01			
048	10	34			2	01			
055	10	103	33	50PR	1	24	3	2 5	
054	9	105			1	09			
054	9	107			1	23	5	4 5	
055	8	100		63	6	18			
054	9	106			4	07			
054	10	104			6	22	3	5	

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
San Fernando, Calif., Earthquake of February 9—Continued						
286	Superstition Mountain	32.95N	RFT-250	L 249	S 30 W	2.00
	A.F. Camera Site	115.82W	CT-196	V 299	Down	1.98
	(Grd. Level)	(GR)		T 275	S 60 E	1.91
1094	Taft	35.15N	AR-240	L 147	S 21 W	7.6
	Lincoln School	119.46W	CA-271	V 149	Down	7.6
	(Shop Roof)	(AVSAP)		T 153	S 69 E	7.6
1095	Taft	35.15N	S-M	V 298	Up	19.4
	Lincoln School	119.46W	FS-6	L 299	N 21 E	20.6
	(Tunnel)			T 300	S 69 E	20.6
1096	Tejon	34.87N	AR-240	L 177	East	7.6
	Fort Tejon	118.92W	CW-115	V 163	Down	7.6
	(CWR Site)			T 181	North	7.6
1098	Terminus Dam	36.42N	RFT-250	L 49	S 83 E	1.98
	Lemon Cove	119.00W	AE-106	V 38	Down	1.87
	(Crest)	(MC)		T 37	N 07 E	1.65
1099	Terminus Dam	36.42N	RFT-250	L 52	S 83 E	1.91
	Lemon Cove	119.00W	AE-107	V 55	Down	1.87
	(N. Abutment)			T 65	N 07 E	1.83
1100	Terminus Dam	36.41N	RFT-250	L 56	S 83 E	1.93
	Lemon Cove	119.00W	AE-105	V 27	Down	1.63
	(Control Tower)			T 57	N 07 E	1.79
287	Upland	34.17N	RFT-250	L 98	North	1.89
	San Antonio Dam	117.68W	AE-132	V 96	Down	1.84
	(Crest)	(AVGR)		T 94	West	1.82
288	Vernon	34.00N	S-M	V 256	Up	12.90
	CMD Terminal Bldg.	118.20W	FS-41	L 257	S 07 W	13.20
	(Basement)	(A)		T 258	N 83 W	13.20
1102	Wheeler Ridge	35.03N	AR-240	L 178	South	7.7
	(Freefield)	118.99W	CW-112	V 193	Down	6.5
		(A)		T 164	East	7.6
289	Whittier	34.02N	RFT-250	L 97	S 53 W	1.90
	Whittier Narrows Dam	118.05W	AE-130	V 95	Down	1.90
	(Crest)	(A)		T 99	S 37 E	1.90
9003	Wrightwood	34.36N	SMA-1	L 426	S 25 W	1.66
	6074 Park Dr	117.63W	LA-232	V 442	Down	1.80
	(Basement)	(AVIMC)		T 445	S 65 E	1.79
290	Wrightwood	34.36N	RFT-250	L 209	S 25 W	1.99
	6074 Park Dr	117.63W	CT-186	V 231	Down	1.97
	(Basement)	(AVIMC)		T 232	S 65 E	1.93
February 26 Earthquake Off Cape Mendocino, Calif., 40°16′ N., 125°50′ W., Mag 5.2, Int. V						
1022	Eureka	40.80N	S-M	V 250	Up	11.1
	Federal Building	124.16W	FS-30	L 251	N 79 E	13.2
	(Basement)			T 252	S 11 E	13.4

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist.[4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6] Per. sec.	Max. accl.[4,6] Accl. g	Accl. Gt. 0.2g[4] Dur. sec.	Accl. Gt. 0.2g[4] Cycle	Num. Aftshk.[4,6]
0.048	9	35.0	286	NT					
.049	8	33.2							
.047	8	34.9							
.048	10	135	128	65	0.2	0.02			
.047	10	137			.1	.01			
.047	10	138			.1	.01			
.082	10	115		82	.3	.01			
.082	9	122			.3	.02			
.082	9	122			.4	.01			
.052	13	114	71	10	.1	.02			
.051	13	119			.1	.01			
.053	11	109			.2	.03			
.047	10	36.1	229	36	.5	.01			
.047	10	34.1				---			
.048	6	28.9				---			
.048	8	33.4		20		---			
.047	9	34.1				---			
.048	10	32.0				---			
.047	9	35		22	.5	---			
.047	8	30				---			
.048	8	31				---			
.047	10	34.5	71	30	.3	.08			
.046	9	35.0			.2	.03			
.045	10	36.2			.3	.06			
.063	10	125	46	77	.2	.05			1/
.064	10	126			.3	.09			
.065	7	125			.5	.11			
.05	10	113	89	58	.1	.02			
.05	10	118			.1	.01			
.05	10	120			.2	.03			
.048	10	34	52	57	.2	.10			2/
.048	10	34			.1	.05			
.048	10	34			.2	.10			
.038	8	46.3	70	19	.3	.05			
.039	8	48 0			.1	.04			
.039	8	47.7			2	.03			
.046	10	37.9	70	30	3	.04			
.047	9	35.9			.1	.02			
.047	10	35.2			.3	.04			
0.066	5.5	115	83	105	0.2	---			
.066	10	121			.4	---			
.067	10	121			.4	---			

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
February 26 Earthquake Off Cape Mendocino, Calif.—Continued						
1023	Ferndale City Hall (Grd. Level Pier)	40.58N 124.26W	S-M FS-23 DM 13	V 247 L 248 T 249 Right Left	Up S 44 W N 46 W S 46 E S 44 W	13.8 13.3 12.3
March 3 Earthquake Near Isabella, Calif., 35°39.6′ N., 118°22.7′ W., Mag. 4.0. Int. V						
1035	Isabella Dam (Spillway Gallery)	35.65N 118.48W (GR)	RFT-250 AE-108	L 54 V 44 T 53	N 14 E Down N 76 W	1.9 1.9 1.9
1036	Isabella Dam (Crest)	35.65N 118.48W	RFT-250 AE-109	L 26 V 41 T 45	N 14 E Down N 76 W	1.75 2.05 1.69
1037	Isabella Dam (Aux. Crest)	35.64N 118.47W (GR&A)	RFT-250 AE-110	L 48 V 58 T 59	N 14 E Down N 76 W	1.82 1.74 1.83
1038	Isabella Dam (Control Tower)	35.64N 118.47W	RFT-250 AE-111	L 62 V 60 T 25	N 14 E Down N 76 W	1.82 1.92 1.88
1039	Isabella Dam (Aux. Abutment)	35.64N 118.47W	RFT-250 AE-112	L 36 V 63 T 33	N 14 E Down N 76 W	1.91 1.95 1.82
March 8 Earthquake Near Isabella, Calif., 35°40.0′ N., 118°24.2′ W., Mag. 4.1. Int. V						
1035	Isabella Dam (Spillway Gallery)	35.65N 118.48W (GR)	RFT-250 AE-108	L 54 V 44 T 53	N 14 E Down N 76 W	1.9 1.9 1.9
1036	Isabella Dam (Crest)	35.65N 118.48W	RFT-250 AE-109	L 26 V 41 T 45	N 14 E Down N 76 W	1.75 2.05 1.69
1037	Isabella Dam (Aux. Crest)	35.64N 118.47W (GR&A)	RFT-250 AE-110	L 48 V 58 T 59	N 14 E Down N 76 W	1.82 1.74 1.83
1038	Isabella Dam (Control Tower)	35.64N 118.47W	RFT-250 AE-111	L 62 V 60 T 25	N 14 E Down N 76 W	1.82 1.92 1.88
1039	Isabella Dam (Aux. Abutment)	35.64N 118.47W	RFT-250 AE-112	L 36 V 63 T 33	N 14 E Down N 76 W	1.91 1.95 1.82

See footnotes at end of table.

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic. dist.[4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl[4,6] Per. sec.	Max. accl[4,6] Accl. g	Accl Gt. 0.2g[4] Dur. sec.	Accl Gt. 0.2g[4] Cycle	Num. Aftshk.[4,6]
0.068	9	125	67	81	0.4	0.01			
.067	9	125			.2	.04			
.065	10	123			.1	.03			
9.3	10	1			1.1	.3*			
9.8	12	1			1.0	.3*			
0.045	10	37		10	0.1	---			1/
.048	10	33			.1	---			
.045	10	37			.1	---			
.044	8	36.4		10	.2	.04			1/
.044	9	42.7			.2	.03			
.042	8	38.6			.2	.05			
.046	8	31.8		10	.2	.05			1/
.048	10	33.1			.2	.02			
.048	9	32.0			.2	.04			
.047	10	33.2		9	.2	.01			1/
.046	8	36.6			.2	---			
.048	8	32.9			.2	.01			
.047	8	35		10	.2	.02			
.047	8	35			.2	.01			
.048	10	33			.2	.04			
0.045	10	37		9	0.1	---			
048	10	33			.1	---			
045	10	37			.1	---			
044	8	36.4		9	.2	.04			
.044	9	42 7			.2	.05			
.042	8	38.6			.2	.06			
046	8	31 8		9	.2	.08			
048	10	33.1			2	04			
048	9	32.0			2	.04			
047	10	33.2		9	2	02			1/
046	8	36.6			2	.01			
.048	8	32.9			.2	.03			
047	8	35		9	2	05			
.047	8	35			2	.03			
048	10	33			2	11			

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
March 9 Earthquake in Monterey Bay, Calif., 36°48.0′ N., 122°08.7′ W., Mag. 4.6. Int. V						
1028	Hollister City Hall (Half-Basement)	36.85N 121.40W	S-M FS-24 with CDMs	V 238 L 239 T 240 L 6 T 5	Up S 01 W N 89 W N 01 E N 89 W	13.8 12.9 12.7
April 26 Earthquake Near Truckee, Calif., 39°25.8′ N., 120°15.6′ W., Mag. 4.4. Int. V						
1166	Stampede Dam (Crest)	39.48N 120.10W	SMA-1 BR-174	L 297 V 223 T 332	S 13 W Down S 77 E	1.86 1.84 1.86
Three Earthquakes Between January and May, Vicinity of Andreanof Islands, Alaska						
3001	Adak, Alaska U.S.Naval Base (Seismic Vault)	51.88N 176.58W	AR-240 FS-141	L 235 V 409 T 232	North Down West	8.2 6.5 7.5
3001	Adak, Alaska U.S. Naval Base (Seismic vault)	51.88N 176.58W	AR-240 FS-141	L 235 V 409 T 232	North Down West	8.2 6.5 7.5
3001	Adak, Alaska U.S. Naval Base (Seismic Vault)	51.88N 176.58W	AR-240 FS-141	L 235 V 409 T 232	North Down West	8.2 6.5 7.5
May 1 Earthquake in Andreanof Islands, Alaska, 51.4° N., 177.2° W., Mag. 7.1. Int. IV						
3001	Adak, Alaska U.S. Naval Base (Seismic vault)	51.88N 176.58W	AR-240 FS-141	L 235 V 409 T 232	North Down West	8.2 6.5 7.5
July 9 Earthquake Near Coast of Central Chile, 32.5° S., 71.2° W., Mag. 6.6						
3508	Santiago, Chile University of Chile	33.47S 70.67W	S-M FS-5(	V 271 L 272	Up S 80 W	13.0 13.0
September 12 Earthquake Near Crescent City, Calif., 41°17.9′ N., 123°40.4′ W., Mag. 4.6. Int. V						
1023	Ferndale City Hall (Grd Level Pier)	40.58N 124.26W	S-M FS-23 DM 13	V 247 L 248 T 249 Right Left	Up S 44 W N 46 W S 46 E S 44 W	13.8 13.3 12.3

See footnotes at end of table

Period[4] sec.	Damping[4]	Stat mag.[4]	Epic dist [4,6] km[6]	Recd leng [4,6] sec.	Max. accl.[4,6] Per. sec.	Max. accl.[4,6] Accl. g	Accl Gt. 0.2g[4] Dur sec.	Accl Gt. 0.2g[4] Cycle	Num. Aftshk.[4,6]
0.067	9.5	123	64	84	1.0	---			
.065	12	124				---			
.065	8.5	122			1.1	---			
2.10	10	1.0			1.1	0.1*			
2.22	11.5				1.1	.1*			
0.039	8	50.0	15	24	0.1	---			
.039	8.8	50.0			.1	---			
.038	8.0	53.6			.1	---			
0.055	10	107		28	0.2	0.03			
.051	10	100			.2	.03			
.055	10	100			.4	.04			
.055	10	107		13	.2	.02			
.051	10	100			.2	.01			
.055	10	100			.2	.03			
.055	10	107		15	.2	.01			
.051	10	100			.4	---			
.055	10	100			4	.04			
0.055	10	107	70	49	0.2	0.10			
.051	10	100			.2	.07			
.055	10	100			.2	.19			
0.065	8	137	120	125	0.1	0.06			
.066	9	128			.1	.13			
.064	7	137			.1	.18			
0.068	9	125	94	78	0.3	---			2/
.067	9	125			.2	0.04			
.065	10	123			.2	.05			
9.3	10	1			.7	.1*			
9.8	12	1			.6	.1*			

TABLE 6—*Compilation of strong-motion accelerograph data for 1971*—Continued

Stn. no.	Station	Coordinates, geology[1]	Instruments[2,3]	Components[4]	Orientation[4,5]	Sensitivity[4]
September 30 Earthquake in Imperial Valley, Calif., 33°02.0′ N., 115°49.2′ W., Mag. 5.1. Int. VI						
412	El Centro	32.78N	RFT-250	L 241	S 52 W	1.97
	Community Hospital	115.57W	CT-182	V 280	Down	1.93
	(Grd. Floor)	(A)		T 279	S 38 E	1.97
117	El Centro	32.88N	S-M	V 208	Up	12.8
	Imperial Valley	115.55W	FS-32	L 206	South	13.4
	Irrigation District	(A)	with	T 207	West	12.8
	Sub-Station		CDMs	L 28	South	
	(Basement)			T 29	East	
464	El Centro	32.80N	RFT-250	L 168	S 52 W	1.96
	Meadows Union School	115.47W	FS-156	V 198	Down	1.91
	(Grd. Floor)	(A)		T 213	S 38 E	2.01
124	Imperial	32.83N	RFT-250	L 192	S 52 W	1.97
	Imperial Valley College	115.50W	CT-188	V 221	Down	1.92
	Adm. Bldg. (Grd. Floor)			T 222	N 38 E	1.89
November 20 Earthquake Off Cape Mendocino, Calif., 40°17.0′ N., 124°46.7′ W., Mag. 4.9. Int. V						
1112	Butler Valley	40.79N	SMA-1	L 844	S 66 W	4.59
	Abutment	123.88W	AE-315	V 851	Down	3.81
	(Freefield)			T 848	S 24 E	2.87
1023	Ferndale	40.58N	S-M	V 247	Up	13.8
	City Hall	124.26W	FS-23	L 248	S 44 W	13.3
	(Grd. Level Pier)			T 249	N 46 W	12.3
			DM	Right	S 46 E	
			13	Left	S 44 W	
November 29 Earthquake Off Coast of Peru, 11.2° S., 77.8° W., Mag. 5.3						
3504	Lima, Peru	12.07S	S-M	V 205	Up	12.4
	Instituto Geofisico	77.03W	FS-44	L 204	N 82 W	12.9
				T 203	N 08 E	12.9
December 11 Earthquake Near Hayward, Calif., 37°45.4′ N., 122°09.0′ W., Mag. 3.4. Int. IV						
1129	Hayward	37.68N	SMA-1	L1214	N 48 E	1.88
	City Hall	122.08W	HA-429	V1228	Down	1.80
	22300 Foothill (Mall)			T1232	N 42 W	1.86
1130	Hayward	37.68N	SMA-1	L1203	N 48 E	1.86
	City Hall	122.08W	HA-431	V1184	Down	1.88
	22300 Foothill (6th Floor)			T1206	N 42 W	1.88
1131	Hayward	37.68N	SMA-1	L1208	N 48 E	1.72
	City Hall	122.08W	HA-430	V1212	Down	1.95
	(11th Floor)			T1213	N 42 W	1.83
December 28 Earthquake Near Hollister, Calif., 36°40.8′ N., 121°22.2′ W., Mag. 3.7. Int. V						
1028	Hollister	36.85N	S-M	V 238	Up	13.8
	City Hall	121.40W	FS-24	L 239	S 01 W	12.9
	(Half-Basement)		with	T 240	N 89 W	12.7
			CDMs	L 6	N 01 E	
				T 5	N 89 W	

See footnotes on next page.

Period[4] sec.	Damping[4]	Stat. mag.[4]	Epic dist.[4,6] km[6]	Recd. leng.[4,6] sec.	Max. accl.[4,6] Per sec.	Max. accl.[4,6] Accl. g	Accl Gt. 0.2g[4] Dur. sec.	Accl Gt. 0.2g[4] Cycle	Num. Aftshk.[4,6]
0.048	11	34	46	24	0.1	0.03			
.049	11	32			.1	---			
.047	9	36			.1	.01			
.064	10	121	37	66	.1	---			
.065	12	124			.2	.01			
.064	10	121			.2	---			
6.20	10	1			.9	.1*			
5.50	10	1			1.0	.2*			
.047	14	36	48	6	.1	.01			2/
.047	14	35			.1	---			
.048	14	35			.1	.02			
.047	9	35.9	44	26	.1	.01			
.048	10	33.6			.1	---			
.046	10	36.0			.1	.01			
0.058	18	54.4	95	21	0.3	---			
.056	9	49.4			.3	---			
.052	10	43.0			.4	---			
.068	9	125	55	91	4	0.01			
.067	9	125			.5	.03			
.065	10	123			.2	.02			
9.3	10	1		NR					
9.8	12	1		NR					
0.065	8	118	125	62	0.1	0.03			
.065	11	123			.1	.06			
.066	8	120			.1	.09			
0.037	7	55 4	9	16		---			
035	8	59 2				---			
036	9 4	57 8				---			
.037	11	53 6		16	0.2	---			
035	7	62 6			2	---			
.037	7.3	53.6			4	---			
.038	9	48.0		16	2	---			
.034	7.8	64.2			2	---			
.036	9.4	56.9			4	---			
.067	9 5	123	19	103	0.8	---			
.065	12	124			.9	---			
065	8.5	122			1 0	---			
2.10	10	1.0			8	0.1*			
2.22	11 5	1 0			8	1*			

[1]Geology notation:

(1),(2)	=	Thick layer of (1) over (2).
(1)&(2)	=	(1) and (2).
A	=	Alluvium.
AS	=	Asphaltic sands.
AV	=	Alluvium veneer.
AVAS	=	AV over asphaltic sands.
AVGN	=	AV over gneiss.
AVGR	=	AV over granite.
AVIMC	=	AV over igneous metamorphic complex.
AVSA	=	AV over sandstone.
AVSAP	=	AV over poorly cemented sandstone.
AVSH	=	AV over shale.
AVSI	=	AV over siltstone.
AVSIP	=	AV over poorly cemented siltstone.
AVSR	=	AV over sedimentary rock.
AVSS	=	AV over siltstone and sandstone.
CSH	=	Clay and shale.
CLVSH	=	Clay-loam veneer over shale.
DGN	=	Highly jointed diorite gneiss.
GD	=	Granite diorite complex.
GN	=	Gneiss.
GR	=	Granite.
GRW	=	Weathered granite.
LGN	=	Limestone-gneiss complex.
MC	=	Metamorphic complex.
SA	=	Sandstone
SAP	=	Poorly cemented sandstone.
SG	=	Gravelly sand
SH	=	Shale
SI	=	Siltstone.
SR	=	Sedimentary rock
SS	=	Silt and sand layers.
SSC	=	Unconsolidated silt, sand, and clay.
SV	=	Shallow sands over shale-volcanic complex.
T	=	Terrace deposits.
VB	=	Volcanic breccia over basalt.
VS	=	Volcanic clastics and intrusions with associated shales

[2]Instrument type code

(S-M)	Strong-motion seismograph (FS Standard).
(AR)	Teledyne Model AR-240.
(DM)	FS 10-second displacement meter.
(RFT)	Teledyne Model RFT-250
(MO)	New Zealand Model MO-2
(SMA)	Kinemetrics Model SMA-1

[2]Instrument type code: (continued).

(SR)	Simultaneous radio starting and timing.
(DH)	Down-hole instruments.
(RM)	Teledyne Model RMT-280.
(PR)	Peak recording accelerometer.

[3]Owner code:

(LA)	Los Angeles Building Code.
(FS)	Seismological Field Survey.
CW)	Calif. Dept. of Water Resources Cooperative Project.
(CT)	California Institute of Technology.
(AT)	Atomic Energy Commission.
(BR)	Bureau of Reclamation.
(CA)	Calif. State Office of Architecture and Construction.
(FC)	Los Angeles Flood Control District.
(RC)	Redwood City.
(UC)	University of California.
(PT)	Pacific Telephone and Telegraph Co.
(DW)	Los Angeles Dept. of Water and Power.
(CE)	Southern California Edison Co.
(AE)	Corps of Engineers, U.S. Army.
(BA)	Bank of America.
(BT)	Bay Area Rapid Transit District.
(CC)	Contra Costa Junior College District.
(BP)	Bethlehem Pacific Steel Co.
(SW)	City of Seattle Dept. of Water and Power.
(SD)	San Diego Gas and Electric Co.
(SR)	Santa Rosa.
(PA)	Palo Alto
(WL)	Woodward-Lundgren.
(SU)	Sacramento Municipal Utility District.
(CY)	Conn. Yankee Atomic Power Co.
(NL)	U.S. Navy Research and Evaluation Lab.
(GL)	Glendale.
(SL)	San Luis Obispo County Flood Control District.
(LR)	Livermore Radiation Lab.
(BH)	Beverly Hills Ordinance.
(BE)	Berkeley Ordinance.
(GS)	Geological Survey, FS Cooperative Project.
(RA)	SF Redevelopment Agency.
(HD)	California State Division of Highways.
(SN)	Savannah River Nuclear Project.
(GW)	Great Western.
(BK)	Bakersfield Ordinance.
(HA)	Hayward Ordinance.
(UW)	United Water Conservation District.
(FF)	Fireman's Fund.
(EK)	Eastman Kodak.

[4]Definitions:

Component	=	Refers to seismometers housed within instruments. Components are indicated by number and position. Letters V, L, and T indicate vertical, longitudinal, and transverse with respect to axis perpendicular to recording paper.
Orientation	=	Direction of displacement of seismometer pendulum for trace up on the record.
Sensitivity	=	Centimeters of trace deflection from position of rest for acceleration of gravity.
Period	=	Free period of seismometer in seconds.
Damping	=	Average damping ratio.
Stat. mag.	=	Static (optical) magnification.
Epic. dist.	=	Epicentral distance to station in kilometers.
Recd. leng.	=	Length of main shock record in seconds.
Max. accl.	=	Maximum absolute acceleration in gravity units.
Per.	=	Period of maximum acceleration in seconds.
Accl. gt. 02g	=	Acceleration greater than .2 gravity unit.
Dur./Cycle	=	Duration, in seconds, and number of cycles.
Num. Aftshk.	=	Number of recorded aftershocks.

[5]Strong-motion seismograph pendulum directions:

Assuming the following conventions

1. Trace up is when the trace on the record is away from the observer when viewed with the record progressing from left to right and with the emulsion side up.
2. Pendulum direction is the direction of motion of the pendulum with respect to the observer when the observer is facing the direction from recorder to seismometers.

Directions of Pendulum for Trace Up

Seismographs	*Component*		*Direction*
SFS Standard	(Accel.)	Vertical	Up
		Longitudinal	Toward
		Transverse	Left
	(CDM)	Longitudinal	Toward
		Transverse	Right
UED AR-240	(Accel.)	Longitudinal	Away
		Vertical	Down
		Transverse	Left
FS Model II	(Accel.)	Vertical	Up
		Longitudinal	Away
		Transverse	Right
	(CDM)	Longitudinal	Toward
		Transverse	Left
RFT-250	(Accel.)	Longitudinal	Away
		Vertical	Down
		Transverse	Left
MO-2	(Accel.)	Vertical	Up
		Longitudinal (B)	45 Left
		Transverse (A)	45 Right
SMA-1	(Accel.)	Longitudinal	Toward
		Vertical	Down
		Transverse	Right

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[6]Record notation:

PST	=	Pacific standard time (= GMT-8 hours).
MM	=	Modified Mercalli Intensity Scale (= I—XII).
NI	=	Not installed.
NT	=	Not triggered.
NR	=	No record.
PR	=	Partial record.
NTM	=	No time mark.
---	=	Acceleration less than 0.01g.
*	=	Maximum displacement in centimeters.
A/B	=	A is number of aftershocks on main record; B is number on later records.
(SD)	=	Significant structural damage.
XXKM	=	Number of kilometers from surface faulting.

TABLE 7—*Compilation of California seismoscope stations and data for San Fernando earthquake of February 9, 1971*

City and building or site	Site no.[1]	Instrument no.	Map location	Location from epicenter		Max. relative displacement	
				Direction[2] (N—C. W.) *degrees*	Distance *km.*	Direction[2] (N—C. W.) *degrees*	S_d[3] *cm.*
Altadena:							
Devils Gate Reservoir (crest)	146	566	E-1	135	31.4	047	1.22
Devils Gate Reservoir (left bank)	147	568	E-1	139	31.4	074	1.29
Residence, 1972 Skyview Drive	232	117	E-1	131	35.0	359	2.72
Arcadia:							
Santa Anita Reservoir	148	565	C-3	124	42.1	230	0.66
Arrowhead:							
U.S. Forest Service	149	107	D-3	103	105.9	360	0.78
Azusa:							
Cogswell Reservoir (crest)	150	507	D-3	113	43.6	088	1.12
Cogswell Reservoir (right bank)	151	530	D-3	113	43.6	303	0.79
San Gabriel Reservoir (crest)	152	506	D-3	114	54.4	331	3.27
San Gabriel Reservoir (left bank)	153	545	D-3	114	54.4	358	0.16
Beverly Hills:							
Lower Franklin Canyon Reservoir (west abutment)	154	207	D-2	182	33.4	172	1.06
Lower Franklin Canyon Reservoir (main crest)	155	206	D-2	182	33.4	174	2.63
Burbank:							
Burbank High School	156	125	D-1	164	24.9	278	4.85
Castaic:							
North Station	157	229	C-3	310	23.3	195	3.72
Old Ridge Route	158	2874	C-3	306	29.8	360	3.88
Cedar Springs:							
Strong-motion station	159	2867	D-3	098	99.6	022	0.29
Cholame:							
Cholame Array No. 2	15	2855	A-2	310	208.1	240	0.08
Cholame Array No. 5	18	2858	A-2	310	208.1	315	0.08
Cholame Array No. 8	21	2896	A-2	310	208.1	115	0.16
Claremont:							
Live Oak Reservoir (crest)	161	524	D-3	115	68.0	010	0.24
Live Oak Reservoir (left bank)	162	514	D-3	115	68.0	232	0.38
Thompson Creek Reservoir (crest)	163	560	D-3	114	69.6	026	0.75
Thompson Creek Reservoir (left bank)	164	515	D-3	114	69.6	030	0.35

Encino:							
Encino Reservoir (crest)	165	199	C-3	201	30.2	185	1.59
Encino Reservoir (west abutment)	166	217	C-3	201	30.2	178	0.51
Encino Reservoir (tower)	167	200	C-3	201	30.2	140	1.94
El Centro:							
Imperial Valley Irrigation District (accelerograph site)	168	132	F-5	Negligible	Negligible	Negligible	Negligible
El Centro High School	169	158	F-5	Do.	Do.	Do.	Do.
El Centro Steamplant	170	164	F-5	Do.	Do.	Do.	Do.
El Centro Water Works	171	124	F-5	Do.	Do.	Do.	Do.
El Segundo:							
Hyperion Treatment Plant	172	102	C-4	183	52.6	090	0.62
Eagle Rock:							
Eagle Rock Reservoir (west abutment)	173	208	E-2	147	36.2	276	4.17
Eagle Rock Reservoir (main dam crest)	174	209	E-2	147	36.2	300	4.93
Glendale:							
Herbert Hoover High School	177	141	E-1	156	28.2	Off-center (vandalized)	
Glendora:							
Big Dalton Reservoir (crest)	178	520	D-3	115	60.0	100	0.35
Big Dalton Reservoir (left bank)	179	567	D-3	115	60.0	174	0.32
Grapevine:							
Tehachapi Pumping Plant (north site)	35	2851	C-3	327	72.7	187	0.35
Tehachapi Pumping Plant (accelerograph site)	36	2954	C-3	327	72.7	240	0.51
Hollywood:							
Hollywood Reservoir (west abutment)	182	205	D-2	168	31.8	320	1.05
Hollywood Reservoir (main dam crest)	183	198	D-2	169	31.8	275	0.66
Hollywood Reservoir (crest)	. . .	221	D-2	160	36.6	112	3.44
Hollywood Reservoir (right abutment)	. . .	212	D-2	168	36.6	360	2.40
Lake Hughes:							
Lake Hughes Array No. 1 (never installed)	. . .	. . .	C-3	. . .	. . .	. . .	. . .
No. 2	186	2824	C-3	349	30.5	160	1.56
No. 3	187	2887	C-3	347	29.4	080	1.44
No. 4	188	2891	C-3	345	29.1	326	1.91
No. 4a	189	2889	C-3	343	29.2	330	2.37
No. 5	190	2894	C-3	347	29.6	338	1.32
No. 6 (station removed)	. .	. . .	C-3	. . .	. . .	. . .	. . .
No. 7	191	2822	C-3	331	29.3	313	1.13
No. 8	192	2890	C-3	329	29.0	Vandalized	Vandalized

See footnotes at end of table

TABLE 7—*Compilation of California seismoscope stations and data for San Fernando earthquake of February 9, 1971*—Continued

City and building or site	Site no.[1]	Instrument no.	Map location	Location from epicenter		Max. relative displacement	
				Direction[2] (N—C. W.) *degrees*	Distance *km.*	Direction[2] (N—C. W.) *degrees*	S_d[3] *cm.*
Lake Hughes (cont.):							
No. 9	193	2892	C-3	326	28.0	160	0.91
No. 10 (never installed)	. . .	. . .	C-3	. . .	. . .	. . .	. . .
No. 11	194	2819	C-3	324	25.0	134	1.04
No. 12	195	2893	C-3	322	24.4	120	1.82
Lancaster:							
Fairmont Reservior (south abutment)	175	211	C-3	356	34.2	218	1.46
Fairmont Reservoir (main dam crest)	176	216	C-3	356	34.2	010	2.04
Long Beach:							
Municipal Building (accelerograph site)	196	147	C-4	164	72.6	146	0.64
San Pedro High School	197	122	C-4	174	71.8	350	1.83
Terminal Island (accelerograph site)	198	149	C-4	167	73.0	095	0.66
Los Angeles:							
Baldwin Hills Reservoir (east abutment)	199	192	D-3	176	43.4	140	3.52
East Los Angeles Junior College	200	104	F-2	150	46.5	278	2.92
Hancock Park	201	140	D-2	Vandalized	Vandalized	Vandalized	Vandalized
Taylor residence	202	110	F-2	144	44.2	357	2.10
Colton (accelerograph site)	203	143	D-4	121	107.0	004	0.35
Hollywood Storage (accelerograph site)	204	146	D-2	170	35.4	345	3.08
Tauxe residence	205	156	C-4	196	42.3	015	2.29
Edison Building (accelerograph site)	206	150	E-2	160	41.0	280	3.10
Vernon (accelerograph site)	207	148	E-3	158	48.2	138	2.17
Leeds residence	208	123	C-4	179	48.5	146	1.02
UCLA (accelerograph site)	209	137	F-2	187	37.8	080	1.29
Duke residence	210	109	C-3	197	24.1	220	0.73
West Los Angeles Public Library	212	113	C-2	181	39.2	203	1.39
Van Nuys High School	213	139	C-1	192	24.1	060	3.35
Southgate High School	214	129	C-4	160	52.8	037	1.10
Elysian High School	215	162	E-2	144	42.6	070	1.46
Playa Del Rey School	216	127	C-4	181	46.5	049	2.06
Windsor Hills School	217	154	C-4	174	45.4	081	2.06
Museum of Science and Industry	218	157	E-2	166	43.9	152	2.17
Compton School Administration Building	219	163	C-4	166	58.3	110	2.04
Huntington Park City Hall	220	120	C-4	160	49.6	198	1.39

Narbonne High School	221	134	C-4	173	67.8	090	0.35
Maricopa:							
Station B	63	629	B-3	309	117.8	Negligible	Negligible
Monrovia:							
Sawpit Canyon Reservoir (right bank)	222	505	D-3	123	45.0	040	1.00
Sawpit Canyon Reservoir (crest)	223	569	D-3	123	45.0	043	0.81
Mount Wilson:							
Caltech seismograph station	224	114	C-3	121	37.0	. . .	1.06
Pacoima:							
Pacoima Dam	227	525	C-3	180	6.9	Plate thrown off	
Pasadena:							
Eaton Wash Reservoir (base)	228	508	F-1	131	38.2	008	2.10
Eaton Wash Reservoir (crest)	229	517	F-1	131	38.2	122	2.76
Gilman residence	230	133	F-1	134	31.0	226	2.24
Caltech Campus, Millikan Library (accelerograph site)	231	166	F-2	140	38.4	214	2.40
Caltech Campus, Athenaeum	240	138	F-2	139	38.6	247	1.94
Motta residence	233	151	E-1	141	32.2	015	2.69
Muir High School	234	108	F-1	139	33.0	255	3.77
Washington Junior High School	235	100	F-1	138	34.6	205	1.22
Seismological Laboratory	236	152	F-2	143	35.0	083	2.24
San Raphael School	237	126	F-2	144	35.4	Damaged by water	
Garfield School	238	124	F-2	141	35.9	136	2.42
Hale School	239	128	F-1	134	38.3	Damaged by water	
Pearblossom:							
Pearblossom Pumping Plant	241	2847	D-3	074	47.4	072	0.82
Perris:							
Accelerograph station	242	249	D-4	118	129.0	016	0.08
Piru:							
Santa Felicia Dam (toe, S-1)	262	590	C-3	282	33.4	290	2.10
Outlet works, S-2	263	588	C-3	282	33.4	295	1.24
Right abutment, S-3	264	586	C-3	282	33.4	288	1.82
Right crest S-4	265	589	C-3	282	33.4	302	5.63
Dam crest, S-5	266	587	C-3	282	33.4	305	6.28
Left abutment, S-6	267	585	C-3	282	33.4	303	2.30
Riverside:							
Caltech seismograph station	243	142	D-4	114	105.0	Negligible	Negligible

See footnotes at end of table

TABLE 7—*Compilation of California seismoscope stations and data for San Fernando earthquake of February 9, 1971*—Continued

City and building or site	Site no.[1]	Instrument no.	Map location	Location from epicenter		Max. relative displacement	
				Direction[2] (N—C. W.) *degrees*	Distance *km.*	Direction[2] (N—C. W.) *degrees*	S_d[3] *cm.*
San Bernardino							
Post Office	244	144	D-3	108	106.0	004	0.35
Devils Canyon, Site No. 1	245	233	D-3	102	100.0	340	0.44
Site No. 2	246	231	D-3	102	100.0	157	0.46
Site No. 3 (removed)	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Site No. 4	247	227	D-3	102	100.0	355	0.29
Site No. 5	248	241	D-3	102	100.0	009	0.38
Site No. 6	249	237	D-3	102	100.0	017	0.16
Site No. 7	250	232	D-3	102	100.0	345	0.65
San Dimas							
Puddingstone Reservoir (crest)	251	529	D-3	122	64.4	318	4.17
Puddingstone Reservoir (accelerograph site)	254	521	D-3	122	64.4	136	1.29
San Dimas Reservoir (crest)	252	531	D-3	115	63.4	270	0.41
San Dimas Reservoir (left bank)	253	509	D-3	115	63.4	200	0.58
San Fernando							
Lower San Fernando Dam (east abutment)	255	213	C-3	208	14.9	287	6.70
Lower San Fernando Dam (main dam crest)	256	210	C-3	208	14.9	110	7.72
San Marino:							
San Marino City Hall	211	115	F-2	138	41.4	248	3.08
Crotty residence, Shenandoah Road	. . .	651	F-2	140	41.9	150	2.58
Santa Ana:							
Accelerograph site	258	159	D-4	145	87.6	260	0.62
Santa Barbara:							
Accelerograph site	259	500	B-3	Negligible	Negligible	Negligible	Negligible
University of California	260	145	B-3	271	143.8	335	0.35
Santa Barbara Museum	261	116	B-3	Negligible	Negligible	Negligible	Negligible
Goleta, Food Fair Market	180	135	B-3	271	143.8	048	0.57
Goleta, Sylvester residence	181	155	B-3	271	143.8	270	0.19
Santa Monica:							
Santa Ynez Dam (right abutment)	. . .	193	C-3	279	144.9	360	0.66
Santa Ynez Dam (crest)	. . .	195	C-3	279	144.9	269	0.95
Saugus:							
Bouquet Canyon Reservoir (west abutment)	184	201	C-3	008	20.6	Damaged by water	

Bouquet Canyon Reservoir (main dam crest) ...	185	202	C-3	008	20.6	080	3.84
Dry Canyon Reservoir (east abutment)	268	194	C-3	307	14.9	268	4.75
Dry Canyon Reservoir (main dam crest)	269	196	C-3	307	14.9	Plate thrown off	
Sunland:							
Big Tujunga Reservoir (crest)	270	528	C-3	119	22.5	275	2.78
Big Tujunga Reservoir (left bank)	271	513	C-3	119	22.5	317	2.17
Table Mountain:							
Tiltmeter station	272	131	D-3	091	70.4	188	0.29
Taft:							
Buena Vista (accelerograph site)	130	260	B-2	309	117.8	Negligible	Negligible
Buena Vista (north)	131	235	B-2	309	117.8	Do.	Do.
Buena Vista (south)	132	228	B-2	309	117.8	Do.	Do.
Westwood:							
Lower Stone Canyon Reservoir (east abutment) .	273	204	C-3	189	32.2	162	0.73
Lower Stone Canyon Reservoir (main dam crest)	274	203	C-3	189	32.2	190	1.47
Wheeler Ridge:							
Accelerograph station	138	2955	C-2	319	90.4	065	0.22
Wheeler Ridge Pumping Plant	139	2897	C-2	319	90.4	162	0.29
Wind Gap Pumping Plant	140	2850	C-3	319	90.4	107	0.32
Tiltmeter No. 2	141	2849	C-3	319	90.4	080	0.48

[1]Permanent identification number

[2]N—C.W. is north-clockwise

[3]S_d is response spectrum value.

Corrections to Previous Issues

United States Earthquakes, 1933: Page 21, May 13: Time uncertain. Description should be moved to June 13 shock at 12:20 (same page.)

United States Earthquakes, 1967: Page 11, column 2, April 8 earthquake should be moved to Central Region, page 12. Date and time should read "April 7, 23:40:32.2*."

United States Earthquakes, 1968: Page 12 (fig. 3), the dot in Virginia should be the smallest one (int. I—IV; see legend).

Page 15, column 1, the November 25 earthquake should read "Southeastern North Carolina."

Page 41, column 1, the fourth line of description of April 8: 19:48:10.3* should read "58.9* . . ."

Page 51, column 2, the longitude for October 21 earthquake should read "122°18'."

Page 75, column 1, insert "IDAHO" after Well Descriptions heading.

United States Earthquakes, 1969: Page 11, column 2, Montana, add in chronological order "April 5, V."

Page 12, column 1, South Carolina, add "Felt North Carolina earthquake of Dec. 13."