DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

United States Earthquakes, 1981

By

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Carl W. Stover, Editor

Introduction

This publication describes all earthquakes that were reported felt in the United States and nearby territories in 1981. Its purpose is to provide a continuous history of U.S. earthquakes for studying seismic risk, evaluating nuclear powerplant sites, designing earthquake-resistive structures, and answering inquiries from the scientific and general public.

The publication is composed of four major chapters: "Earthquake Descriptions," which includes a summary of macroseismic data reported for each earthquake and a chronological list of earthquakes by State (table 1); "Network Operations," which summarizes the results from local seismic networks; "Miscellaneous Activities," which contains information on crustal movement studies, tsunamis, and principal earthquakes of the world (table 10), and "Strong-Motion Seismograph Data" (table 11). The intensity and macroseismic data in "Earthquake Descriptions" are compiled from questionnaire canvasses (see next paragraph), newspaper articles, and reports prepared by other government organizations, State institutions, local organizations, and individuals. Each description includes date, origin time, hypocenter, and the source of the hypocenter computation, magnitude, maximum intensity (Modified Mercalli), and/or macroseismic effects reported in the area.

The USGS collects intensity information primarily by mailing questionnaires, "Earthquake Report" forms, to postmasters in the earthquake area. Postmasters complete the forms and return them to the USGS, where they are evaluated and intensities are assigned. For damaging earthquakes, the questionnaires are supplemented by USGS field investigations. The USGS publishes preliminary intensity data in its quarterly circular, Earthquakes in the United States. The final information is published in the United States Earthquakes series, issued annually since 1928. Copies of earlier issues can be obtained from either the Superintendent of Documents, U.S. Covernment Printing Office, Washington, D.C. 20402 or the National Geophysical Data Center, NOAA/EDIS, Boulder, Colorado 80303.

DISCUSSION OF TABLES

The earthquake parameters in tables 1 and 10 include date, origin time, hypocenter (epicenter and focal depth), and magnitude. Table 1 also contains the maximum observed Modified Mercalli (MM) intensity. The origin time and date are listed in Universal Coordinated Time (UTC). The epicenters were taken principally from those published in the USGS Preliminary Determination of Epicenters, Monthly Listings or Earthquakes in the United States. These data have been updated and new data added from subsequent publications of universities or State agencies who operate seismic networks. The accuracy of the epicenters is that claimed by the institution supplying the hypocenter and is not necessarily the accuracy indicated by the number of decimals listed. The epicenters located by the USGS have a varying degree of accuracy, usually two-tenths of a degree or less, however, some are accurate only to about one-half of a degree. See Preliminary Determination of Epicenters, Monthly Listing, for an explanation of the accuracy of USGS hypocenters. Depths are listed to the nearest kilometer.

Magnitudes listed in the tables were furnished by cooperating institutions or determined by the USGS. The computational sources are indicated by letter codes identified in headnotes to the tables.

EPICENTER AND ISOSEISMAL MAPS

Figures 1-3 are computer plots of all earthquake epicenters in the conterminous United States, Alaska, and Hawaii listed in table 1. Each earthquake epicenter is indicated by a small circle or square.

Figures 4-6 are computer plots of 1981 earthquake epicenters in the conterminous United States, Alaska, and Hawaii by Modified Mercalli (MM) intensity. Maximum intensities are represented by Arabic numerals at the epicentral locations. Earthquakes of intensity I-IV are represented by solid circles.

The USGS coordinates the collection of all types of earthquake information, with the special objective of correlating instrumentally determined earthquake locations with noninstrumental locations indicated by intensity data.

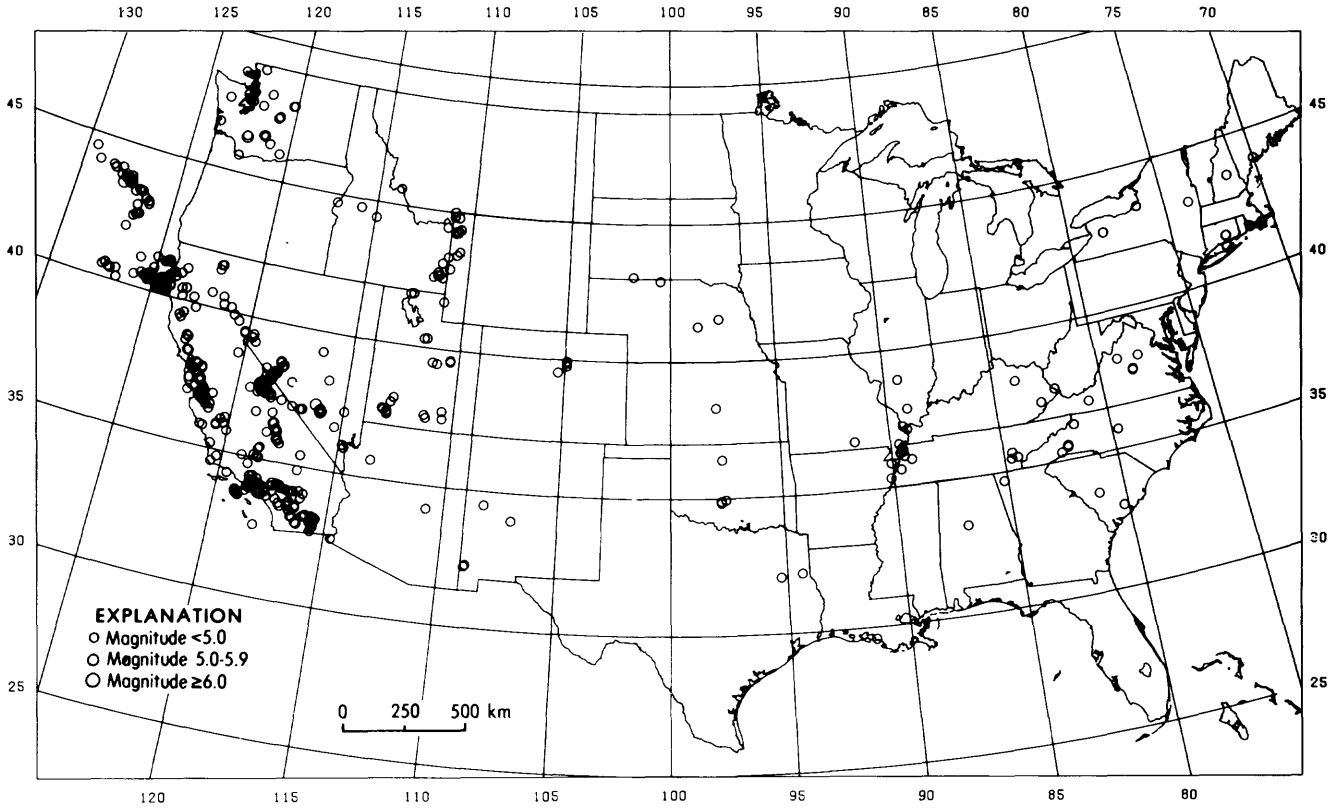

FIGURE 1.--Earthquake epicenters in the conterminous United States for 1981.

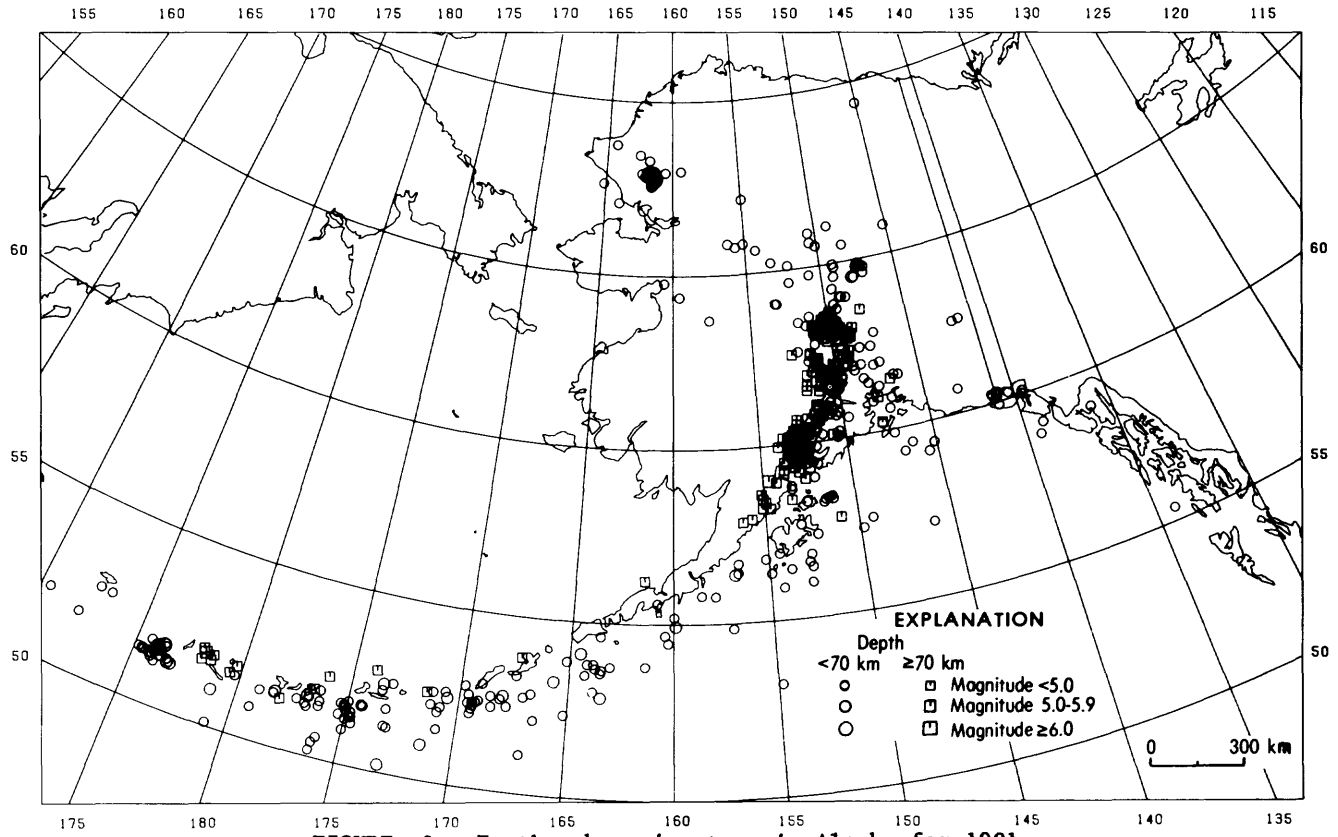

FIGURE 2.--Earthquake epicenters in Alaska for 1981.

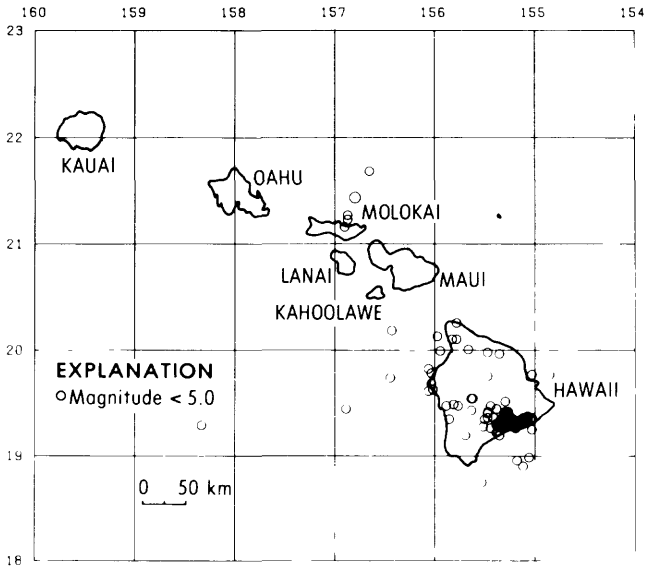

FIGURE 3.--Earthquake epicenters in Hawaii for 1981.

This correlation is achieved through regional investigations of earthquakes by local organizations and the USGS. Primary data are gathered by a mail canvass of the epicentral area using questionnaire cards; also, a field survey is sometimes done for damaging events. When returned and analyzed, this information is used to prepare isoseismal maps which show the areal pattern of intensity associated with individual earthquakes.

The selection of intensity or isoseismal maps shown in the Earthquake Descriptions is governed largely by the size of the area affected. This means that sharp, localized shocks of intensity VI (which often occur in California) may not be represented by these maps, whereas more widely felt earthquakes of intensity V and VI (which are characteristic of the Eastern and Central States) often will be illustrated because of the larger felt areas. Arabic numerals on these computer-plotted maps represent the maximum MM intensities at sampled localities. Isoseismal contours are a generalization of intensity data and are extrapolated in regions that have few observations. The contours do not include each intensity observation.

MAGNITUDE AND INTENSITY RATINGS

Magnitude, a measure of the "size" of an earthquake, is roughly related to the energy release at the focus of an earthquake. 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 6 shallow-focus earthquake represents elastic-wave energy about 30 times greater than that generated by a magnitude 5 earthquake, 900 times greater than that of a magnitude 4 shock, and so forth. Many factors enter into the determination of earthquake magnitude, including earthquake focal depth, frequency content of the sampled energy, and the earthquake radiation pattern. Magnitude values calculated by the USGS are based on the following formulas:

$$MS = \log (A/T) + 1.66 \log D + 3.3, \quad (1)$$

as adopted by the International Association of Seismology and Physics of the Earth's Interior (IASPEI; Bath, 1966, p. 153), where A is the maximum vertical surface-wave ground amplitude, in micrometers; T is the period, in seconds, and $18 \leq T \leq 22$; and D is the distance in geocentric degrees (station to epicenter), and $20° \leq D \leq 160°$. No depth correction is made for depth less than 50 km, and no MS magnitudes are computed for depths greater than 50 km.

$$mb = \log (A/T) + Q(D,h), \quad (2)$$

as defined by Gutenberg and Richter (1956), except that T, the period in seconds, is restricted to $0.1 \leq T \leq 3.0$, and A, the ground amplitude in micrometers, is not necessarily the maximum of the P-wave group. Q is a function of distance D and depth h, where $D \geq 5°$.

$$ML = \log A - \log A_0, \quad (3)$$

as defined by Richter (1958, p. 340), where A is the maximum trace amplitude in millimeters, written by a Wood-Anderson torsion seismometer, and $\log A_0$ is a standard value as a function of distance, where the distance is ≤ 600 km. ML values are also calculated from other seismometers by conversion of recorded ground motion to the expected response of the torsion seismometer. ML magnitudes are listed for events with depths less than 70 km.

$$mbLg = 3.75 + 0.90(\log D) + \log (A/T) \quad 0.5° \leq D \leq 4°, \quad (4)$$

$$mbLg = 3.30 + 1.66(\log D) + \log(A/T) \quad 4° \leq D \leq 30°,$$

as proposed by Nuttli (1973), where A/T is expressed in micrometers per second, calculated from the vertical-component 1-second Lg waves, and D is the distance in geocentric degrees.

MD is used in this publication for the duration or coda length magnitude. MD is usually computed from the difference, in seconds, between Pn or Pg-wave arrival time and the time the final coda amplitude decreases to the background-noise amplitude. These magnitudes are normally correlated with ML or mbLg so that resulting magnitudes are compatible. Thus the formulas vary for different geographic regions and seismograph systems.

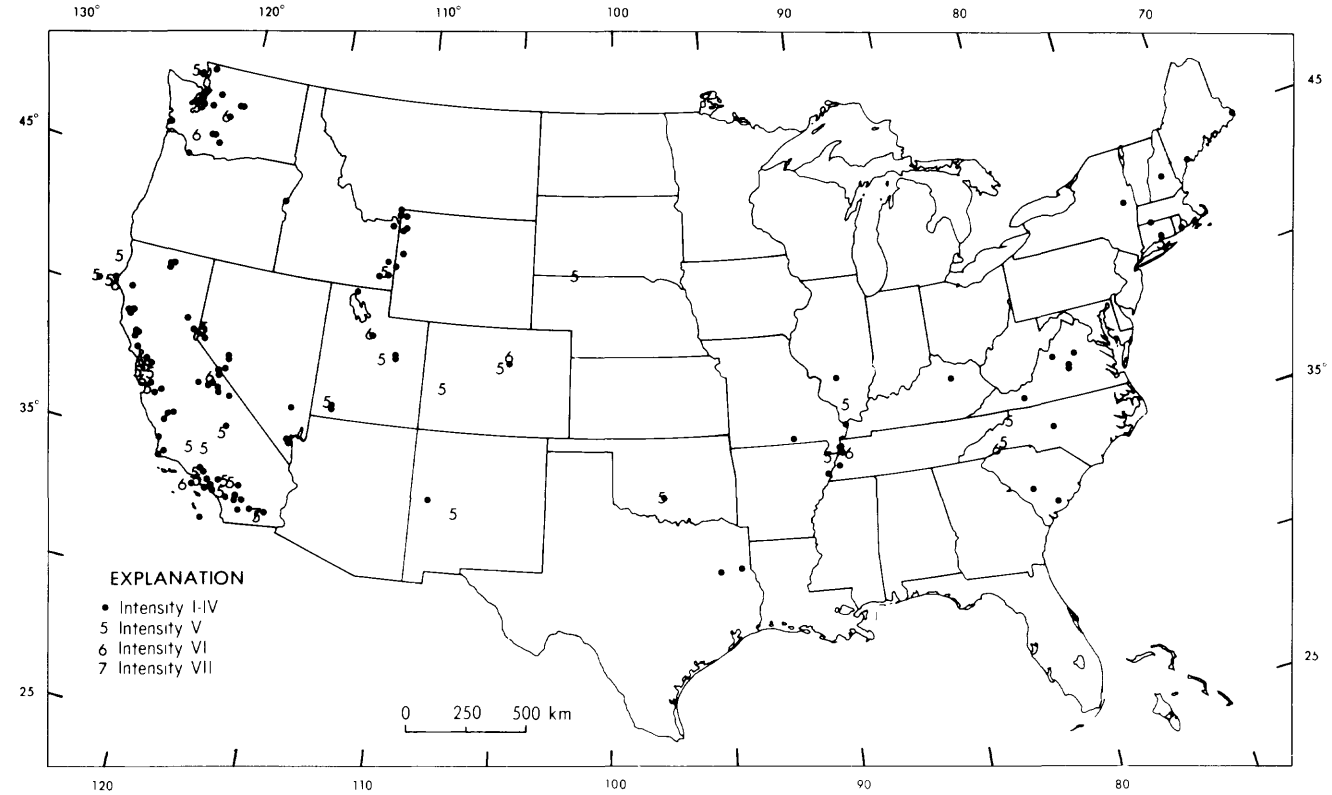

FIGURE 4.--Plot of earthquakes in the conterminous United States that were felt or caused damage in 1981.

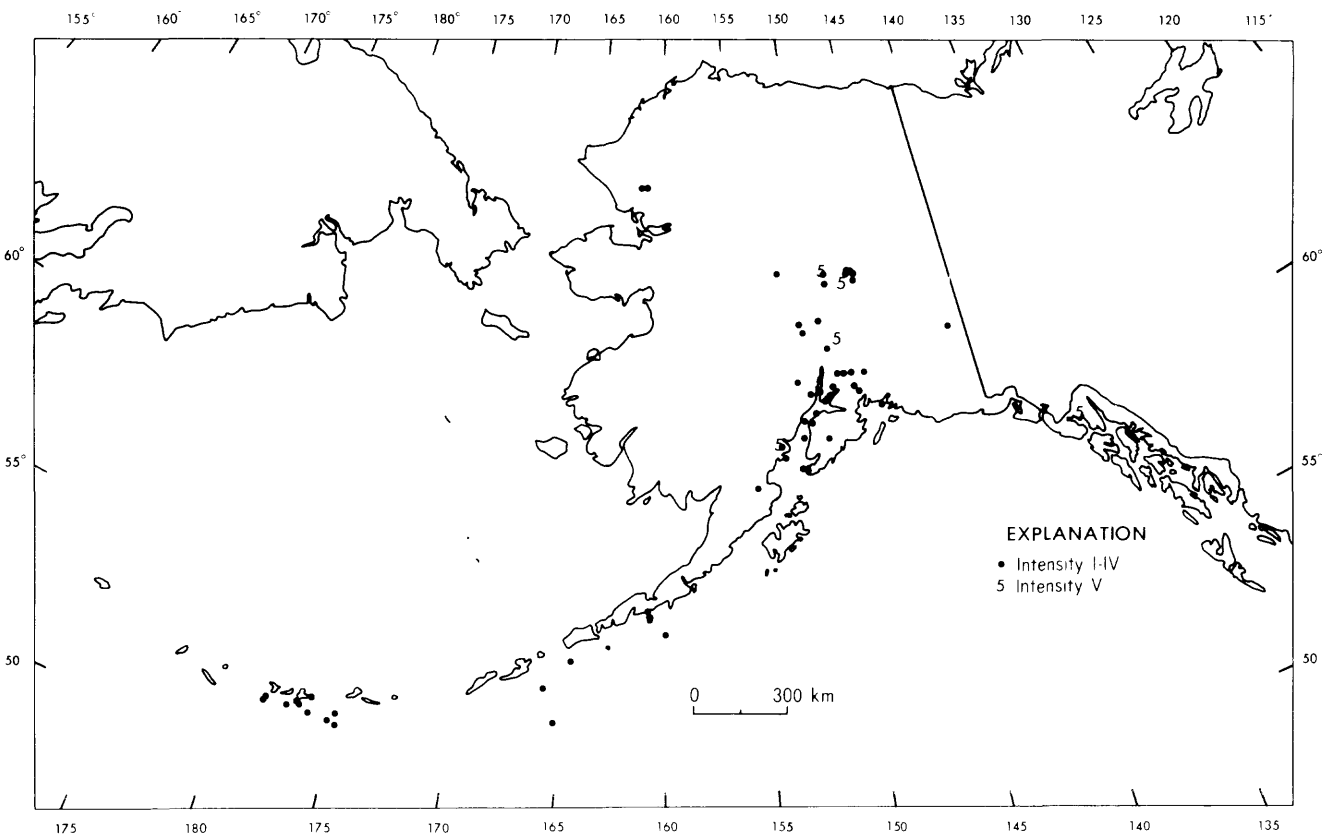

FIGURE 5.--Plot of earthquakes in Alaska that were felt or caused damage in 1981.

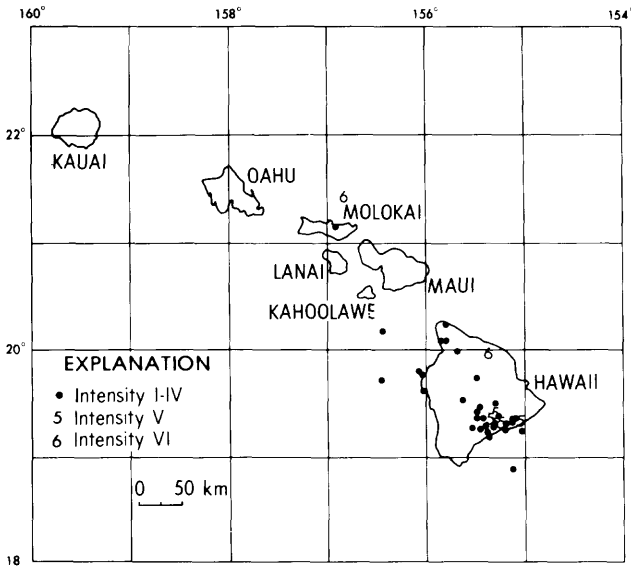

FIGURE 6.--Plot of earthquakes in Hawaii that were felt or caused damage in 1981.

Intensity, as applied to earthquakes, represents a quantity determined from the effects on people, manmade objects, and the Earth's surface (landslides, ground fissures). Intensities are assigned according to the descriptions listed in the Modified Mercalli Intensity Scale of 1931 (Wood and Neumann, 1931). There are 12 discrete steps in the MM scale (see next section). An earthquake in a populated area will have different intensities at different localities, owing to the distance from the focus of the earthquake, type of focal mechanism, local geological conditions, structural design of buildings, and the earthquake magnitude.

The text of this publication gives the intensity at locations where the earthquake was reported felt and summaries of the strongest effects. Each earthquake is further characterized by its maximum intensity, which is given in the text and in table 1. All earthquake questionnaires or descriptions that contain minimal or sketchy information are listed only as "FELT". This does not imply that the earthquake was felt at a low intensity level, but indicates that the available data is not sufficient for assigning a valid intensity value.

Although the Modified Mercalli Intensity Scale is in many instances inadequate for present-day requirements, the scale has been the guide used by the USGS and will continue to be so used until a new scale has been devised and has acceptance in the engineering and seismological communities.

MODIFIED MERCALLI INTENSITY SCALE OF 1931

Adapted from Sieberg's Mercalli-Cancani scale, modified and condensed.

I. Not felt - or, except rarely under especially favorable circumstances. Under certain conditions, at and outside the boundary of the area in which a great shock is felt: sometimes birds, animals, reported uneasy or disturbed; sometimes dizziness or nausea experienced; sometimes trees, structures, liquids, bodies of water, may sway--doors may swing, very slowly.

II. Felt indoors by few, especially on upper floors, or by sensitive, or nervous persons. Also, as in grade I, but often more noticeably: sometimes hanging objects may swing, especially when delicately suspended; sometimes trees, structures, liquids, bodies of water, may sway, doors may swing, very slowly; sometimes birds, animals, reported uneasy or disturbed; sometimes dizziness or nausea experienced.

III. Felt indoors by several, motion usually rapid vibration. Sometimes not recognized to be an earthquake at first. Duration estimated in some cases. Vibration like that due to passing of light, or lightly loaded trucks, or heavy trucks some distance away. Hanging objects may swing slightly. Movements may be appreciable on upper levels of tall structures. Rocked standing motor cars slightly.

IV. Felt indoors by many, outdoors by few. Awakened few, especially light sleepers. Frightened no one, unless apprehensive from previous experience. Vibration like that due to passing of heavy or heavily loaded trucks. Sensation like heavy body striking building or falling of heavy objects inside. Rattling of dishes, windows, doors; glassware and crockery clink and clash. Creaking of walls, frame, especially in the upper range of this grade. Hanging objects swung, in numerous instances. Disturbed liquids in open vessels slightly. Rocked standing motor cars noticeably.

V. Felt indoors by practically all, outdoors by many or most: outdoors direction estimated. Awakened many, or most. Frightened few--slight excitement, a few ran outdoors. Buildings trembled throughout. Broke dishes, glassware, to

some extent. Cracked windows--in some cases, but not generally. Overturned vases, small or unstable objects, in many instances, with occasional fall. Hanging objects, doors, swing generally or considerably. Knocked pictures against walls, or swung them out of place. Opened, or closed, doors, shutters, abruptly. Pendulum clocks stopped, started or ran fast, or slow. Moved small objects, furnishings, the latter to slight extent. Spilled liquids in small amounts from well-filled open containers. Trees, bushes, shaken slightly.

VI. Felt by all, indoors and outdoors. Frightened many, excitement general, some alarm, many ran outdoors. Awakened all. Persons made to move unsteadily. Trees, bushes, shaken slightly to moderately. Liquid set in strong motion. Small bells rang--church, chapel, school, etc. Damage slight in poorly built buildings. Fall of plaster in small amount. Cracked plaster somewhat, especially fine cracks chimneys in some instances. Broke dishes, glassware, in considerable quantity, also some windows. Fall of knick-knacks, books, pictures. Overturned furniture in many instances. Moved furnishings of moderately heavy kind.

VII. Frightened all--general alarm, all ran outdoors. Some, or many, found it difficult to stand. Noticed by persons driving motor cars. Trees and bushes shaken moderately to strongly. Waves on ponds, lakes, and running water. Water turbid from mud stirred up. Incaving to some extent of sand or gravel stream banks. Rang large church bells, etc. Suspended objects made to quiver. Damage negligible in buildings of good design and construction, slight to moderate in well-built ordinary buildings, considerable in poorly built or badly designed buildings, adobe houses, old walls (especially where laid up without mortar), spires, etc. Cracked chimneys to considerable extent, walls to some extent. Fall of plaster in considerable to large amount, also some stucco. Broke numerous windows, furniture to some extent. Shook down loosened brickwork and tiles. Broke weak chimneys at the roof-line (sometimes damaging roofs). Fall of cornices from towers and high buildings. Dislodged bricks and stones. Overturned heavy furniture, with damage from breaking. Damage considerable to concrete irrigation ditches.

VIII. Fright general--alarm approaches panic. Disturbed persons driving motor cars. Trees shaken strongly--branches, trunks, broken off, especially palm trees. Ejected sand and mud in small amounts. Changes: temporary, permanent; in flow of springs and wells; dry wells renewed flow; in temperature of spring and well waters. Damage slight in structures (brick) built especially to withstand earthquakes. Considerable in ordinary substantial buildings, partial collapse: racked, tumbled down, wooden houses in some cases; threw out panel walls in frame structures, broke off decayed piling. Fall of walls. Cracked, broke, solid stone walls seriously. Wet ground to some extent, also ground on steep slopes. Twisting, fall, of chimneys, columns, monuments, also factory stacks, towers. Moved conspicuously, overturned, very heavy furniture.

IX. Panic general. Cracked ground conspicuously. Damage considerable in (masonry) structures built especially to withstand earthquakes: Threw out of plumb some wood-frame houses built especially to withstand earthquakes; great in substantial (masonry) buildings, some collapse in large part; or wholly shifted frame buildings off foundations, racked frames; serious to reservoirs; underground pipes sometimes broken.

X. Cracked ground, especially when loose and wet, up to widths of several inches; fissures up to a yard in width ran parallel to canal and stream banks. Landslides considerable from river banks and steep coasts. Shifted sand and mud horizontally on beaches and flat land. Changed level of water in wells. Threw water on banks of canals, lakes, rivers, etc. Damage serious to dams, dikes, embankments. Severe to well-built wooden structures and bridges, some destroyed. Developed dangerous cracks in excellent brick walls. Destroyed most masonry and frame structures, also their foundations. Bent railroad rails slightly. Tore apart, or crushed endwise, pipe lines buried in earth. Open cracks and broad wavy folds in cement pavements and asphalt road surfaces.

XI. Disturbances in ground many and widespread varying with ground material. Broad fissures, earth slumps, and land slips in soft, wet ground. Ejected water in large amounts charged with sand and mud. Caused sea-waves ("tidal" waves) of significant magnitude. Damage severe to wood-frame structures, especially near shock centers. Great to dams, dikes, embankments often for long distances. Few, if any (masonry) structures remained standing. Destroyed large well-built bridges by the wrecking of supporting piers, or pillars. Affected yielding wooden bridges less. Bent railroad rails greatly, and thrust them endwise. Put

pipe lines buried in earth completely out of service.

XII. Damage total--practically all works of construction damaged greatly or destroyed. Disturbances in ground great and varied, numerous shearing cracks. Landslides, falls of rock of significant character, slumping of river banks, etc., numerous and extensive. Wrenched loose, tore off, large rock masses. Fault slips in firm rock, with notable horizontal and vertical offset displacements. Water channels, surface and underground, disturbed and modified greatly. Dammed lakes, produced waterfalls, deflected rivers, etc. Waves seen on ground surfaces (actually seen, probably, in some cases). Distorted lines of sight and level. Threw objects upward into the air.

COLLABORATORS

Active cooperation in earthquake investigations in the United States is provided by several seismological collaborators. The following served as collaborators to the USGS during 1981.

Alaska.--Staff of NOAA-Alaska Tsunami Warning Center, Palmer.

Arizona.--Marc Sbar, University of Arizona, Tucson.

California (northern).--Bruce A. Bolt, University of California, Berkeley.

California (southern).--Clarence R. Allen, California Institute of Technology, Pasadena.

Connecticut.--Robert Miller, University of Connecticut, Groton.

Delaware.--Kenneth D. Woodruff, University of Delaware, Newark.

Florida and Georgia.--Leland T. Long, Georgia Institute of Technology, Atlanta.

Hawaii.--Robert Koyanagi, USGS, Hawaiian Volcano Observatory, Hawaii National Park.

Idaho.--James K. Applegate, Boise State University, Boise.

Indiana.--Robert F. Blakely, Department of Natural Resources, Geological Survey, Bloomington.

Iowa.--J. P. Kopp, Loras College, Dubuque.

Kansas.--Henry V. Beck, Kansas State University, Manhattan, and Don W. Steeples, Kansas Geological Survey, Lawrence.

Kentucky.--Ronald L. Street, University of Kentucky, Lexington.

Minnesota.--Harold Mooney, University of Minnesota, Minneapolis.

Missouri, Illinois, Arkansas area.--Otto Nuttli and Robert B. Herrmann, Saint Louis University, Saint Louis.

Montana.--Anthony Qamar, University of Montana, Missoula.

Nevada.--Alan S. Ryall, University of Nevada, Reno.

New England.--John E. Ebel, Boston College, Weston, Mass.

New York.--Lynn R. Sykes, Lamont-Doherty Geological Observatory, Palisades.

Ohio.--Edward J. Walter, John Carroll University, Cleveland.

Oklahoma.--James E. Lawson, Jr., Oklahoma Geological Survey, Leonard.

Pennsylvania.--Benjamin F. Howell, Jr., Pennsylvania State University, University Park.

South Carolina.--Pradeep Talwani, University of South Carolina, Columbia, and Joyce Bagwell, Baptist College at Charleston, Charleston.

Tennessee.--Arch C. Johnston, Tennessee Earthquake Information Center, Memphis.

Texas.--G. R. Keller, University of Texas, El Paso.

Utah.--R. B. Smith, University of Utah, Salt Lake City.

Virginia.--G. A. Bollinger, Virginia Polytechnic Institute and State University, Blacksburg.

Washington.--Robert S. Crosson, University of Washington, Seattle.

Wyoming.--R. A. Hutchinson, National Park Service, Yellowstone National Park.

Earthquake Descriptions

This section lists all earthquakes alphabetically by State. The origin time of earthquake occurrence is given in Universal Coordinated Time (UTC). Times are expressed continuously from midnight to midnight, or 0 to 24 hours.

Sources of noninstrumental information (macroseismic data) in this publication include questionnaire canvasses conducted by the USGS; newspaper articles; bulletins of the Seismological Society of America; and special earthquake reports of other organizations. Instrumental data are provided by the USGS, National Earthquake Information Service and universities that operate seismic networks.

Roman numerals in the earthquake descriptions refer to the Modified Mercalli Intensity Scale of 1931 (see page 5), 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. All earthquake questionnaires or press reports that contain only minimal information without enough detail from which to assign an intensity are listed as "Felt."

[The following symbols are used to indicate authority for arrival or origin times, epicenters, and/or magnitudes: (A) University of Alaska, College; (B) University of California, Berkeley; (C) Los Alamos National Laboratory, New Mexico; (D) University of Montana, Missoula; (E) U.S. Department of Energy, Las Vegas, Nevada; (G) U.S. Geological Survey, Golden, Colorado, or Menlo Park, California; (H) U.S. Geological Survey, Hawaiian Volcano Observatory, Hawaii National Park; (J) Weston Observatory, Weston, Mass.; (K) Tennessee Earthquake Information Center, Memphis; (L) Lamont-Doherty Geological Observatory, Palisades, N.Y.; (M) NOAA, Alaska Tsunami Warning Center, Palmer; (O) Seismological Service of Canada, Ottawa; (P) California Institute of Technology, Pasadena; (R) University of Nevada, Reno; (S) St. Louis University, St. Louis, Mo.; (T) Oklahoma Geological Survey, Leonard; (U) University of Utah, Salt Lake City; (V) Virginia Polytechnic Institute and State University, Blacksburg; (W) University of Washington, Seattle; (Y) Baptist College, Charleston, S.C.; (Z) Bollinger and others, 1982. Normal depth = 33 km. Leaders (...) indicate information is not available]

ALASKA

4 January (G) Andreanof Islands, Aleutian Islands
- Origin time: 17 34 36.2
- Epicenter: 51.45 N., 176.28 W.
- Depth: 50 km
- Magnitude: 4.5 mb(G), 4.0 ML(M)
- Intensity III: Adak (M).

ALASKA--Continued

19 January (G) Central Alaska
- Origin time: 21 20 04.2
- Epicenter: 63.28 N., 151.07 W.
- Depth: 124 km
- Magnitude: 4.5 mb(G)
- Intensity III: Anchorage and Palmer (M).

30 January (G) Rat Islands, Aleutian Islands
- Origin time: 08 52 44.1
- Epicenter: 51.74 N., 176.27 E.
- Depth: Normal
- Magnitude: 6.3 mb(G), 7.0 MS(G), 7.1 MS(B), 6.3 mb(B), 7.1 ML(M), 6.7 MS(P)
- Intensity V: Shemya Air Force Base (hanging objects swung moderately, small objects overturned and fell, glassware and dishes broken, few windows cracked, felt by many).

30 January (G) Rat Islands, Aleutian Islands
- Origin time: 14 49 22.3
- Epicenter: 51.57 N., 176.08 E.
- Depth: 19 km
- Magnitude: 5.6 mb(G), 5.3 MS(G), 5.5 MS(B)
- Intensity III: Shemya (M).

13 February (G) Andreanof Islands, Aleutian Islands
- Origin time: 16 46 23.1
- Epicenter: 51.87 N., 176.29 W.
- Depth: 65 km
- Magnitude: 4.5 mb(G)
- Intensity III: Adak (M).

23 February (G) Southern Alaska
- Origin time: 13 03 07.6
- Epicenter: 60.20 N., 150.35 W.
- Depth: 46 km
- Magnitude: 4.5 mb(G), 4.3 ML(M)
- Intensity IV: Homer, Kenai (M), Moose Pass (M), Seward (M).

24 February (G) Central Alaska
- Origin time: 22 04 18.5
- Epicenter: 64.96 N., 149.11 W.
- Depth: 23 km
- Magnitude: 4.4 mb(G), 4.5 ML(M)
- Intensity V: Minto (A).
- Intensity IV: Ester, Fairbanks, Manley Hot Springs (A).
- Intensity III: Fort Wainwright, Nenana.

2 March (G) Central Alaska
Origin time: 14 30 40.6
Epicenter: 63.55 N., 151.20 W.
Depth: 25 km
Magnitude: 4.3 mb(G), 4.6 ML(M)
Intensity IV: Medfra.

8 March (A) Central Alaska
Origin time: 19 06 56.9
Epicenter: 64.81 N., 147.63 W.
Depth: 10 km
Magnitude: 2.4 ML(A)
Intensity III: Fairbanks (A).

8 March (A) Central Alaska
Origin time: 19 09 39.4
Epicenter: 64.85 N., 147.51 W.
Depth: 11 km
Magnitude: 2.6 ML(A)
Intensity III: Fairbanks (A).

15 March (G) Alaska Peninsula
Origin time: 07 48 29.2
Epicenter: 55.58 N., 160.83 W.
Depth: 41 km
Magnitude: 4.8 mb(G), 4.5 ML(M)

Felt at Sand Point (L).

21 March (G) Alaska Peninsula
Origin time: 23 01 37.4
Epicenter: 58.97 N., 154.70 W.
Depth: 136 km
Magnitude: 5.0 mb(G)
Intensity IV: Clam Gulch, Homer.
Intensity III: Kenai.
Intensity II: Tyonek.
Felt: Anchorage (M), Kodiak (M), Soldotna (M).

2 April (G) Central Alaska
Origin time: 16 10 43.7
Epicenter: 62.63 N., 141.92 W.
Depth: Normal.
Magnitude: 4.5 mb(G), 4.3 ML(M)

Felt at Northway (M).

8 April (G) Southern Alaska
Origin time: 06 28 37.4
Epicenter: 61.41 N., 148.22 W.
Depth: 24 km
Magnitude: 3.5 ML(M)
Intensity III: Butte (M).
Intensity II: Anchorage (M), Palmer (M).

22 April (G) Andreanof Islands, Aleutian Islands
Origin time: 09 30 46.6
Epicenter: 51.64 N., 176.80 W.
Depth: 62 km
Magnitude: 4.6 mb(G)
Intensity IV: Adak (M).

ALASKA--Continued

23 April (G) Southern Alaska
Origin time: 23 52 36.7
Epicenter: 62.94 N., 148.92 W.
Depth: 81 km
Magnitude: 4.5 mb(G)
Intensity V: Eagle River (few items thrown from store shelves, few small objects overturned and fell, few windows cracked, felt by many).
Intensity IV: Anchorage (M), Cantwell, Gold Creek (M), Sutton.
Intensity III: Skwentna.

24 April (G) Kenai Peninsula
Origin time: 07 52 52.9
Epicenter: 59.35 N., 151.83 W.
Depth: Normal.
Magnitude: 4.0 mb(G), 4.2 ML(M)

Felt at Homer (M).

30 April (G) Southern Alaska
Origin time: 01 11 38.0
Epicenter: 61.96 N., 148.91 W.
Depth: 52 km
Magnitude: 3.6 mb(G), 2.9 ML(M)

Felt at Palmer (M).

5 May (G) Southern Alaska
Origin time: 21 28 01.6
Epicenter: 61.66 N., 149.66 W.
Depth: 64 km
Magnitude: 4.4 mb(G)

The earthquake damaged a pipeline leading from a storage tank to a terminal at the Port of Anchorage and 168 gallons of diesel fuel was spilled (press report).

Intensity IV: Anchorage, Butte (M), Chickaloon (M), Chugiak, Hope, Knik (M), Palmer, Sutton, Wasilla (M), Willow.
Intensity III: Elmendorf Air Force Base, Fort Richards, Moose Pass, Skwentna, Talkeetna, Tyonek.

18 May (G) Andreanof Islands, Aleutian Islands
Origin time: 02 40 10.7
Epicenter: 51.30 N., 175.03 W.
Depth: 37 km
Magnitude: 5.0 mb(G), 5.0 MS(G), 4.6 ML(M)
Intensity III: Adak (M).

18 May (G) Andreanof Islands, Aleutian Islands
Origin time: 07 56 53.5
Epicenter: 51.65 N., 175.04 W.
Depth: 44 km

Magnitude: 4.7 mb(G)
Intensity III: Adak (M).

21 May (G) Southern Alaska
Origin time: 20 29 31.5
Epicenter: 59.78 N., 152.92 W.
Depth: 117 km
Magnitude: 4.6 mb(G)

Felt over the entire Kenai Peninsula and at Anchorage (M).

30 May (G) Kenai Peninsula
Origin time: 20 56 06.0
Epicenter: 60.80 N., 151.65 W.
Depth: 82 km
Magnitude: 4.3 mb(G)

Felt at Anchorage (M).

5 June (G) Southern Alaska
Origin time: 07 09 19.1
Epicenter: 52.28 N., 165.20 W.
Depth: Normal.
Magnitude: 5.5 mb(G), 4.9 ML(M)
Intensity III: Palmer.

22 June (G) Southeastern Alaska
Origin time: 04 16 42.8
Epicenter: 58.99 N., 136.17 W.
Depth: 27 km
Magnitude: 4.4 mb(G), 3.6 MS(G), 4.5 ML(M)
Intensity V:
United States--
Alaska--
Gustavus (few windows cracked, some glassware broken, few small objects overturned and fell, few items thrown from store shelves).
Haines (few windows cracked, felt by many).
Skagway (hairline cracks in plaster walls, small objects overturned, few items thrown from store shelves).
Intensity IV:
United States--
Alaska--Tenakee Springs.
Intensity III:
Canada--
Yukon Territory--Whitehorse.
Felt:
United States--
Alaska--Douglas, Glacier Bay area (M).

25 June (G) Alaska Peninsula
Origin time: 01 36 36.5
Epicenter: 54.94 N., 159.91 W.
Depth: Normal.
Magnitude: 4.8 mb(G), 5.2 ML(M)
Intensity II: Sand Point (M).

ALASKA--Continued

4 July (G) Northwestern Alaska
Origin time: 07 45 02.3
Epicenter: 67.71 N., 161.64 W.
Depth: Normal.
Magnitude: 4.8 mb(G), 4.9 MS(G)

Felt in the Kotzebue area (M).

4 July (G) Andreanof Islands, Aleutian Islands
Origin time: 16 53 07.3
Epicenter: 51.50 N., 177.34 W.
Depth: 51 km
Magnitude: 4.7 mb(G), 4.4 ML(M)

Felt on Adak (M).

9 July (G) Southern Alaska
Origin time: 16 43 48.8
Epicenter: 61.58 N., 148.38 W.
Depth: Normal.
Magnitude: 2.2 ML(M)

Felt at Chickaloon (M).

10 July (G) Andreanof Islands, Aleutian Islands
Origin time: 01 39 31.0
Epicenter: 51.65 N., 176.87 W.
Depth: 55 km
Magnitude: 5.0 mb(G)
Intensity IV: Adak (M).

12 July (G) Northwestern Alaska
Origin time: 01 27 56.3
Epicenter: 67.71 N., 161.20 W.
Depth: Normal.
Magnitude: 5.2 mb(G), 5.0 MS(G)
Intensity III: Kotzebue.

13 July (G) Southern Alaska
Origin time: 18 27 01.2
Epicenter: 59.42 N., 152.04 W.
Depth: 28 km
Magnitude: 3.4 ML(M)
Intensity III: Homer and Seldovia (M).

26 July (G) Kenai Peninsula
Origin time: 22 33 58.7
Epicenter: 60.94 N., 150.85 W.
Depth: 72 km
Magnitude: 4.6 mb(G)
Intensity III: Anchorage (press report).

27 July (G) Central Alaska
Origin time: 13 31 13.6
Epicenter: 64.86 N., 149.07 W.
Depth: 23 km
Magnitude: 4.3 ML(M)
Intensity IV: Nenana.
Intensity III: Fairbanks (M).

1 August (G) Southern Alaska
Origin time: 01 42 16.4
Epicenter: 60.14 N., 153.18 W.
Depth: 114 km
Magnitude: 5.2 mb(G)
Intensity V: The most common effects at the places listed below were few small objects overturned and fell; windows, doors, and dishes rattled; felt by many.
Clam Gulch (few items thrown from store shelves), Eagle River, Sterling, Sutton.
Intensity IV: Anchorage, Chugiak, Cooper Landing, Copper Center, Homer, Huffman, Kasilof, Kenai, Larsen Bay, Moose Pass, Nikishka, Ninilchik, Port Graham, Seldovia, Skwentna.
Intensity III: Egegik, Elmendorf Air Force Base, Ouzinkie, Pedro Bay, Seward, Soldotna, Tyonek, Willow.
Intensity II: Kodiak, Palmer (M).
Felt: Anchor Point, Valdez (M).

13 August (G) Southern Alaska
Origin time: 15 42 50.5
Epicenter: 61.57 N., 150.60 W.
Depth: 75 km
Magnitude: None computed.
Intensity IV: Anchorage (press report).
Felt: Big Lake, Chugiak, Eagle River, and Wasilla (press report).

22 August (G) Southern Alaska
Origin time: 05 58 21.0
Epicenter: 61.53 N., 151.04 W.
Depth: 72 km
Magnitude: 4.3 mb(G)
Intensity III: Anchorage (M).

24 August (G) Andreanof Islands, Aleutian Islands
Origin time: 15 46 27.6
Epicenter: 51.51 N., 178.35 W.
Depth: 56 km
Magnitude: 5.2 mb(G)
Intensity III: Adak (M).

28 August (G) Southern Alaska
Origin time: 09 04 24.7
Epicenter: 61.74 N., 150.45 W.
Depth: 71 km
Magnitude: 5.1 mb(G)
Intensity V: The most common effects at the places listed below were few items thrown from store shelves; few small objects overturned and fell; windows, doors, and dishes rattled; felt by and awakened many.
Chugiak, Nikishka (few glassware broken), Palmer (press report), Valdez (few windows cracked), Willow.
Intensity IV: Anchorage, Cantwell, Chitina, Cooper Landing, Eagle River, Homer, Sutton, Tyonek.
Intensity III: Ester, McKinley Park, Whittier.
Intensity II: Fairbanks (A).
Felt: Sterling.

ALASKA--Continued

28 August Southern Alaska
Origin time: 21 48
Epicenter: Not located.
Depth: None computed.
Magnitude: None computed.
Intensity IV: Kenai, Skwentna, Sutton.

3 September (G) Andreanof Islands, Aleutian Islands
Origin time: 18 44 13.4
Epicenter: 51.38 N., 175.30 W.
Depth: Normal.
Magnitude: 4.7 mb(G), 4.1 ML(M)
Intensity III: Adak (M).

8 September (G) Andreanof Islands, Aleutian Islands
Origin time: 07 01 16.9
Epicenter: 51.47 N., 178.37 W.
Depth: 55 km
Magnitude: 4.9 mb(G)

Felt on Adak (M).

10 September (G) Southern Alaska
Origin time: 01 30 38.7
Epicenter: 62.76 N., 149.64 W.
Depth: 101 km
Magnitude: 4.3 mb(G)

Felt at Fairbanks and Palmer (A).

10 September (G) Central Alaska
Origin time: 11 06 23.6
Epicenter: 65.09 N., 152.22 W.
Depth: 15 km
Magnitude: 4.2 mb(G), 4.0 ML(M)

Intensity IV: Tanana (A).

26 September (G) Southern Alaska
Origin time: 17 43 09.6
Epicenter: 62.01 N., 149.25 W.
Depth: 58 km
Magnitude: 4.7 mb(G)

Felt at Anchorage (M), Gold Creek (M), Matanuska-Susitna Valley (press report), Palmer (M), Talkeetna (M).

27 September (G) Central Alaska
Origin time: 15 15 12.9
Epicenter: 64.75 N., 147.12 W.
Depth: 22 km
Magnitude: 3.8 ML(M)

Intensity IV: Fairbanks (one dish and one lamp fell; windows, doors, and dishes rattled; hanging objects swung slightly; felt by and awakened many), Eielson AFB (dressers moved).

6 October (A) Central Alaska
Origin time: 18 35 35.5
Epicenter: 64.79 N., 147.35 W.
Depth: 16 km
Magnitude: 2.5 ML(A)
Intensity IV: Fairbanks, North Pole (A).

6 October (G) Central Alaska
Origin Time: 19 44 59.4
Epicenter: 63.58 N., 149.96 W.
Depth: 28 km
Magnitude: 4.7 mb(G), 4.4 ML(M)
Intensity II: Fairbanks.

16 October (G) Southern Alaska
Origin time: 07 52 50.4
Epicenter: 60.91 N., 147.01 W.
Depth: Normal
Magnitude: 4.2 mb(G), 4.2 ML(M)

Felt at Anchorage, Cordova, and Valdez (M).

9 November (G) Fox Islands, Aleutian Islands
Origin time: 16 45 06.0
Epicenter: 53.22 N., 165.75 W.
Depth: Normal
Magnitude: 5.5 mb(G), 5.3 MS(G), 5.4 MS(B)
Intensity IV: Unalaska (M).

14 November (G) Unimak Island region
Origin time: 00 43 03.3
Epicenter: 54.07 N., 164.54 W.
Depth: 66 km
Magnitude: 5.1 mb(G)
Intensity III: Cold Bay.

16 November (G) Southern Alaska
Origin time: 23 49 48.0
Epicenter: 60.11 N., 153.12 W.
Depth: 126 km
Magnitude: 4.5 mb(G)
Intensity II: Homer (M).

17 November (G) Kenai Peninsula
Origin time: 11 28 40.8
Epicenter: 60.31 N., 151.74 W.
Depth: 74 km
Magnitude: 4.8 mb(G)
Intensity IV: Clam Gulch, Cooper Landing, Girdwood, Homer, Kasilof, Kenai, Ninilchik, Soldotna, Sterling, Tyonek.
Intensity III: Anchor Point, Anchorage, Nikishka, Whittier.
Intensity II: Palmer (M).

ALASKA--Continued

18 November (G) Central Alaska
Origin time: 06 16 08.5
Epicenter: 64.58 N., 149.21 W.
Depth: 10 km
Magnitude: 3.4 ML(M)
Intensity IV: Nenana (M).
Intensity II: Fairbanks (M).
Felt: Chena Ridge (press report).

19 November (G) Southern Alaska
Origin time: 01 45 33.7
Epicenter: 61.40 N., 149.96 W.
Depth: 45 km
Magnitude: 2.8 ML(M)
Intensity III: Anchorage (M).

23 November (G) Kenai Peninsula
Origin time: 07 27 34.6
Epicenter: 60.69 N., 151.19 W.
Depth: 86 km
Magnitude: None computed
Intensity III: Anchorage and Kenai (M).

6 December (G) Southern Alaska
Origin time: 17 27 41.6
Epicenter: 61.97 N., 148.40 W.
Depth: 63 km
Magnitude: 4.6 mb(G)
Intensity IV: Sheep Mountain Lodge and Big Lake (M).

7 December (G) Southern Alaska
Origin time: 17 45 40.1
Epicenter: 61.90 N., 147.65 W.
Depth: Normal
Magnitude: 2.9 ML(M)
Intensity III: Chickaloon and Sheep Mountain (M).

8 December (G) Central Alaska
Origin time: 14 06 59.0
Epicenter: 64.83 N., 147.49 W.
Depth: 15 km
Magnitude: 3.0 ML(M)
Intensity III: Fairbanks.

18 December (G) Southern Alaska
Origin time: 14 20 45.5
Epicenter: 61.29 N., 150.20 W.
Depth: Normal
Magnitude: 2.1 ML(M)
Intensity III: Alaska Railroad Dispatch, Anchorage (M).

20 December (G) Southern Alaska
Origin time: 10 52 06.4
Epicenter: 61.27 N., 150.30 W.
Depth: 65 km
Magnitude: None computed.
Intensity III: Anchorage (M).

ALASKA--Continued

21 December (A) Central Alaska
Origin Time: 23 07 35.3
Epicenter: 64.55 N., 147.19 W.
Depth: 1 km
Magnitude: 2.3 ML(A)
Intensity III: Harding Lake area.

28 December (G) Alaska Peninsula Region
Origin Time: 10 28 16.1
Epicenter: 54.67 N., 160.41 W.
Depth: Normal
Magnitude: 3.8 ML(M)

Felt at Sand Point.

30 December (A) Central Alaska
Origin time: 13 47 27.2
Epicenter: 64.50 N., 147.95 W.
Depth: 17 km
Magnitude: 3.9 mb(G), 4.2 ML(M)
Intensity IV: Ester, Fairbanks, Fort Wainwright.

30 December (A) Central Alaska
Origin time: 14 00 34.0
Epicenter: 64.49 N., 147.95 W.
Depth: 15 km
Magnitude: 4.9 mb(G), 4.6 MS(G), 5.2 ML(M)

Felt from Delta Junction to the Ester-Fairbanks area (M). This is one of a series of 80 events beginning on December 30, 1981 and lasting into January, 1982 (Gedney and others, 1982).

Intensity V: Ester (few small objects overturned; windows, doors, and dishes rattled; felt by many).
Intensity IV: Fairbanks, Fort Wainwright, North Pole, Usibelli.
Intensity III: Minto.
Felt: Eielson Air Force Base.

31 December (G) Southern Alaska
Origin time: 12 15 54.5
Epicenter: 61.91 N., 151.76 W.
Depth: 128 km
Magnitude: 4.1 mb(G)

Felt at Houston and Wasilla (M).

ARIZONA

5 April (U) Southwestern Utah
Origin time: 05 40 40.0

See Utah listing.

ARIZONA--Continued

28 December (G) Southern Nevada
Origin time: 22 45 42.1

See Nevada listing.

ARKANSAS

29 April (K) Northeastern Arkansas
Origin time: 15 09 32.9
Epicenter: 35.34 N., 90.14 W.
Depth: 8 km
Magnitude: 2.8 Mn(G), 2.7 MD(K), 3.0 Mn(S)

Felt at the Wapanocca National Wildlife Refuge, Arkansas, and at Shelby Forest State Park, Tennessee (K).

26 June (K) Northeastern Arkansas
Origin time: 08 33 27.0
Epicenter: 35.85 N., 90.07 W.
Depth: 9 km
Magnitude: 3.6 Mn(G), 3.4 MD(K), 3.5 Mn(S)
Intensity V:
Blytheville (few windows cracked; windows, doors, and dishes rattled; felt by and awakened few).
Dell (few small objects overturned and fell, hanging pictures swung, felt by and awakened many).
Roseland (one broken window--press report).
Intensity IV: Burdette, Leachville, Luxora.
Intensity III: Dearman (K).

7 August (K) Western Tennessee
Origin time: 11 53 41.8

See Tennessee listing.

CALIFORNIA

1 January (B) California-Nevada border region
Origin time: 18 22 22.5

See Nevada listing.

2 January (B) Northern California
Origin time: 18 12 46.0
Epicenter: 39.73 N., 120.53 W.
Depth: 27 km
Magnitude: 3.5 ML(B)

Felt at Graeagle, Loyalton, and Quincy (press report).

3 January (P) Southern California
Origin time: 13 34 44.6
Epicenter: 34.56 N., 120.47 W.
Depth: 13 km
Magnitude: 2.5 ML(P)

Felt at Lompoc (P).

5 January (B) Central California
Origin time: 02 52 18.3
Epicenter: 37.95 N., 122.07 W.
Depth: 9 km
Magnitude: 2.8 ML(B)

Felt in central Contra Costa County (press report).

Intensity III: Concord (press report), Pleasant Hill (press report), Martinez (press report), Walnut Creek.

7 January (B) Central California
Origin time: 11 42 33.1
Epicenter: 36.86 N., 121.62 W.
Depth: 7 km
Magnitude: 4.3 mb(G), 4.5 ML(B)
Intensity V: The most common effects at the places listed below were hairline cracks in plaster and drywall, few windows cracked, small objects overturned and fell, hanging pictures out of place, felt by and awakened many.
Ben Lomond, Boulder Creek, Freedom, Monterey, Moss Landing, Pacific Grove, San Martin, Soquel.
Intensity IV: Aptos, Aromas, Capitola, Castroville, Davenport, Felton, Gilroy, Half Moon Bay, Hercules, La Honda, Morgan Hill, Mount Hermon, Oakland, Pescadero, Redwood Estates, Ross, Salinas, San Carlos, San Jose, San Juan Bautista (press report), Santa Cruz, Sunnyvale, Watsonville.
Intensity III: Bolinas, Chualar, Marina, San Mateo, Seaside, South San Francisco.
Intensity II: Byron, Hollister, Patterson.
Felt: Daly City (Westlake district--press report).

8 January (P) Southern California
Origin time: 14 52 14.7
Epicenter: 33.94 N., 118.68 W.
Depth: 12 km
Magnitude: 3.3 ML(P)
Intensity IV: Malibu (press report), North Hollywood (press report), Redondo Beach (press report), Santa Monica, Topanga.
Intensity III: Marina Del Rey, Venice.
Felt: Canoga Park, West Los Angeles, and Westchester (P).

CALIFORNIA--Continued

9 January (B) Northern California
Origin time: 12 44 35.4
Epicenter: 41.59 N., 121.95 W.
Depth: 8 km
Magnitude: 3.3 ML(B)

This is one of a series of earthquakes in this area beginning on January 7 that totaled more than 100 events by January 14.

Felt at Tennant (B).

10 January (B) Northern California
Origin time: 00 36 15.5
Epicenter: 41.60 N., 121.90 W.
Depth: 8 km
Magnitude: 3.6 ML(B)

Felt at Tennant (B).

10 January (P) Southern California
Origin time: 06 34 33.1
Epicenter: 34.13 N., 118.25 W.
Depth: 9 km
Magnitude: 2.3 ML(P)

Felt at Glendale (P).

11 January (B) Central California
Origin time: 04 44 32.5
Epicenter: 35.92 N., 120.54 W.
Depth: 8 km
Magnitude: 3.1 ML(B), 3.2 ML(P)

Felt at Paso Robles (B) and San Luis Obispo (P).

12 January (B) Northern California
Origin time: 11 46 01.1
Epicenter: 41.42 N., 121.97 W.
Depth: 8 km
Magnitude: 3.0 ML(B)

Felt at Tennant (B).

15 January (B) Central California
Origin time: 12 47 51.6
Epicenter: 37.38 N., 121.72 W.
Depth: 9 km
Magnitude: 4.8 mb(G), 4.0 MS(G), 4.8 ML(B)

This earthquake was felt over an area of approximately 18,700 km^2 and was described as "sharp" in the Salinas-Hollister area and mild and "rolling" in San Francisco (fig. 7).

Intensity V: The most common effects at the places listed below were few items

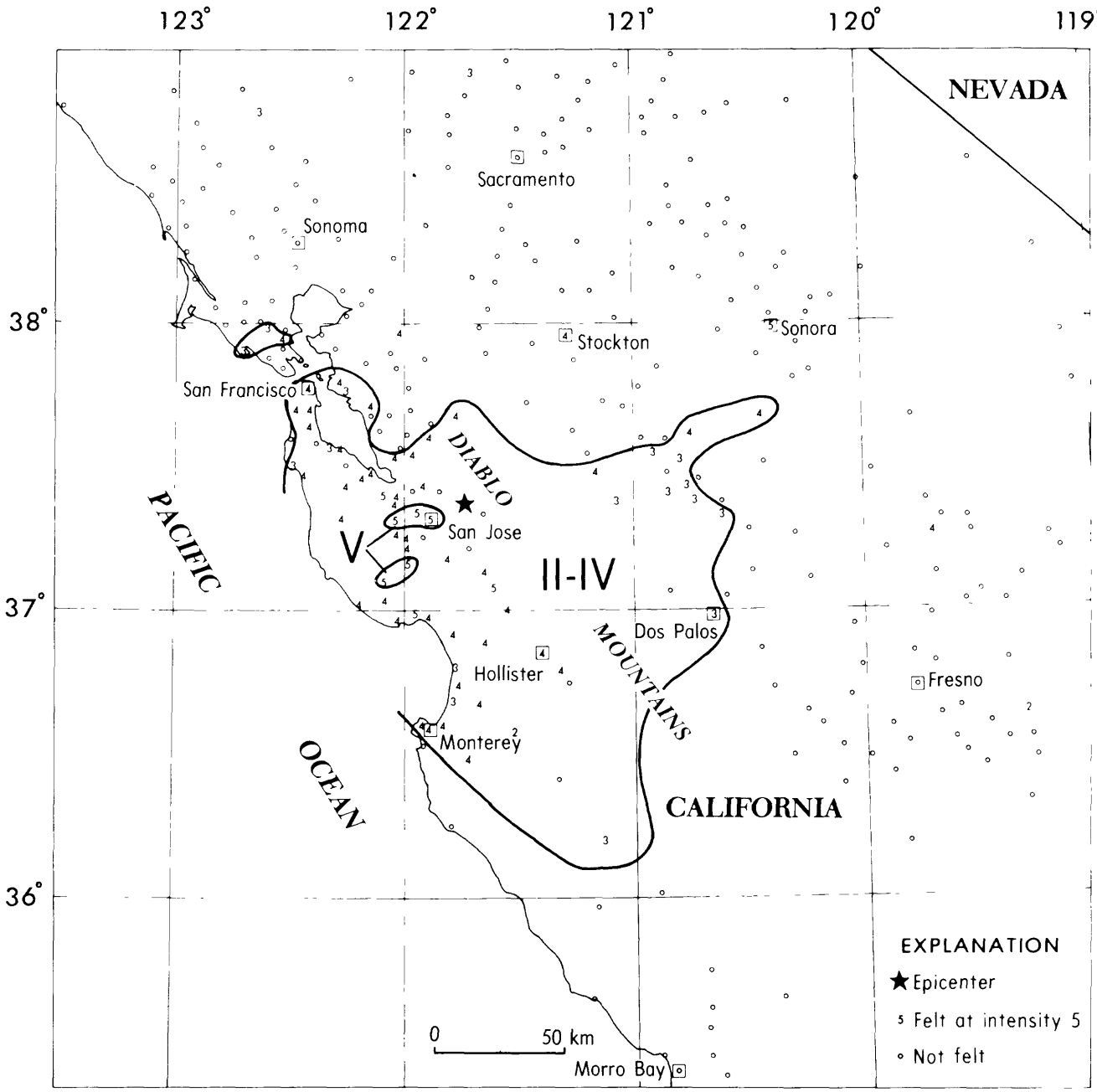

FIGURE 7.--Isoseismal map for the central California earthquake of 15 January 1981, 12 47 51.6 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

thrown from store shelves, small objects overturned and fell, hanging pictures swung, felt by and awakened many. Ben Lomond, Cupertino, Mountain View (hanging pictures fell), Redwood Estates, San Jose (hairline cracks in plaster walls), San Martin, Santa Clara, Sonora (few windows cracked), Soquel.
Intensity IV: Aptos, Aromas, Brisbane, Capitola, Carmel Valley, Castroville, Coarsegold, Concord, Daly City, Davenport, East Palo Alto, Felton, Foster City, Fremont, Gilroy, Half Moon Bay, Hickman, Hollister (knocked out power in some areas for a couple of minutes--press report), La Grange, La Honda, Livermore, Los Gatos, Menlo Park, Milpitas, Moffett Field (telegraphic report), Monte Sereno, Monterey, Morgan Hill, Mount Hermon, New Almaden, Newark, Oakland, Pacific Grove, Patterson, Redwood City, Ross, Salinas (radio station KDON was knocked off the air for a few seconds--press report), San Francisco, San Leandro, Santa Cruz, Saratoga, Scotts Valley, Seaside, South San Francisco, Stockton, Sunnyvale, Sunol, Tres Pinos, Watsonville.
Intensity III: Alameda, Atwater, Bolinas, Crows Landing, Delhi, Denair, Dos Palos, El Granada, Fairfax, Hilmar, Keyes, King City, Livingston, Marina, Middletown, Moss Landing, Robbins, San Mateo.
Intensity II: Chualar, Orange Cove.
Felt: Berkeley (B), Merced (press report), Modesto (B).

17 January (B) Central California
Origin time: 00 09 36.9
Epicenter: 35.93 N., 120.54 W.
Depth: 12 km
Magnitude: 3.4 ML(P), 3.1 ML(B)

Felt at Cholame and Parkfield.

23 January (P) Southern California
Origin time: 08 47 11.9
Epicenter: 34.04 N., 116.64 W.
Depth: 5 km.
Magnitude: 2.9 ML(P)
Intensity IV: Morongo Valley.
Intensity III: Yucca Valley.

26 January (P) Southern California
Origin time: 10 20 57.7
Epicenter: 33.91 N., 117.54 W.
Depth: 15 km
Magnitude: 2.9 ML(P)

Felt at Riverside (P).

27 January (P) Imperial Valley area
Origin time: 04 47 33.5

CALIFORNIA--Continued

Epicenter: 33.25 N., 115.97 W.
Depth: 0 km
Magnitude: 2.8 ML(P)

Felt in the Imperial Valley (P).

27 January (B) Central California
Origin time: 22 10 53.9
Epicenter: 36.84 N., 121.63 W.
Depth: 7 km
Magnitude: 4.1 ML(B)
Intensity V: San Jose (few windows cracked, small objects overturned and fell, glassware and dishes broken, hanging objects swung slightly, felt by many).
Intensity IV: Aromas, Freedom, Moss Landing.
Intensity III: Los Gatos, Soquel, Watsonville.
Intensity II: Castroville, Mount Hamilton, New Almaden.
Felt: Gilroy, Hollister (B), Monterey (B).

28 January (P) Southern California
Origin time: 04 00 16.5
Epicenter: 34.04 N., 118.35 W.
Depth: 12 km
Magnitude: 3.0 ML(P)

Felt at Culver City, Echo Park, Hollywood, and the Wilshire district of Los Angeles (press report).

28 January (B) Owens Valley area
Origin time: 20 08 50.7

See Nevada listing.

30 January (P) Southern California
Origin time: 01 54 13.4
Epicenter: 33.92 N., 118.50 W.
Depth: 5 km
Magnitude: 3.2 ML(P)
Intensity V: West Los Angeles (books were knocked from shelves and furniture was jostled--press report).
Intensity IV: Malibu.
Intensity III: Venice.
Felt: Pasadena (P), Santa Monica (P).

31 January (B) Central California
Origin time: 05 23 20.6
Epicenter: 36.24 N., 120.24 W.
Depth: 10 km
Magnitude: 3.5 ML(B), 3.4 ML(P)
Intensity IV: Coalinga.

31 January (B) Central California
Origin time: 06 30 15.4
Epicenter: 37.17 N., 121.54 W.
Depth: 4 km
Magnitude: 3.4 ML(B)

Felt at Gilroy and Morgan Hill (B).

1 February (P) Southern California
Origin time: 11 30 06.9
Epicenter: 33.51 N., 116.77 W.
Depth: 3 km
Magnitude: 3.7 ML(P)
Intensity IV: Palomar Mountain.

5 February (P) Southern California
Origin time: 13 38 10.9
Epicenter: 33.50 N., 116.78 W.
Depth: 4 km
Magnitude: 3.2 ML(P)

Felt at Hemet (P).

11 February (G) Central California
Origin time: 00 07 54.4
Epicenter: 37.89 N., 122.00 W.
Depth: 8 km
Magnitude: 2.6 ML(B)

Felt in Contra Costa County (press report) and at Walnut Creek (B).

21 February (B) Central California
Origin time: 04 15 53.0
Epicenter: 36.84 N., 121.65 W.
Depth: 8 km
Magnitude: 3.0 ML(B)

Felt at Salinas (B).

21 February (P) Southern California
Origin time: 22 56 16.5
Epicenter: 33.66 N., 116.76 W.
Depth: 14 km
Magnitude: 3.4 ML(P)

Felt at Palm Springs (P).

23 February (B) Central California
Origin time: 02 00 48.7
Epicenter: 37.12 N., 121.52 W.
Depth: 4 km
Magnitude: 3.1 ML(B)

Felt in the Coyote Lake area (B).

23 February (B) Central California
Origin time: 06 12 51.2
Epicenter: 35.19 N., 120.64 W.
Depth: 1 km
Magnitude: 3.2 ML(B), 3.4 ML(P)

CALIFORNIA--Continued

Felt at Arroyo Grande, Grover City, and San Luis Obispo (P).

23 February (B) Central California
Origin time: 13 07 08.8
Epicenter: 36.12 N., 120.40 W.
Depth: 9 km
Magnitude: 3.0 ML(B)

Felt at Coalinga (B).

24 February (B) Central California
Origin time: 02 56 10.5
Epicenter: 36.88 N., 121.61 W.
Depth: 4 km
Magnitude: 2.8 ML(B)

Felt at Salinas (B).

24 February (B) Central California
Origin time: 09 12 00.7
Epicenter: 36.85 N., 121.63 W.
Depth: 6 km
Magnitude: 3.1 ML(B)

Felt at Salinas (B).

24 February (P) Southern California
Origin time: 20 49 35.1
Epicenter: 33.95 N., 118.67 W.
Depth: 6 km
Magnitude: 2.4 ML(P).

Felt at Redondo Beach (P).

27 February (P) Southern California
Origin time: 15 11 12.6
Epicenter: 34.17 N., 118.60 W.
Depth: 16 km
Magnitude: 3.5 ML(P)
Intensity V: Mission Hills (few windows cracked, few small objects overturned and fell, glassware and dishes broken, hanging pictures swung).
Intensity IV: Altadena, Calabasas Park, Canoga Park, Granada Hills, North Hollywood, Northridge, Santa Monica, Simi Valley, Topanga, Van Nuys.
Intensity III: Beverly Hills, Burbank (press report), Encino, Glendale (press report), Montrose, San Fernando, South Pasadena, Venice.
Intensity II: Castaic.
Felt: La Crescenta (P), Malibu (press report), West Los Angeles (press report).

3 March (B) Central California
Origin time: 10 45 12.9
Epicenter: 37.56 N., 121.94 W.
Depth: 10 km

Magnitude: 4.2 mb(G), 4.0 MS(G), 4.4 ML(B)

This earthquake was felt over an area of approximately 4,900 km^2 from Monterey to Marin County (fig. 8). There was a roaring sound and rolling motion interrupted by a sharp jolt associated with the quake.

Intensity VI: Fremont (a rockslide blocked the Niles Canyon Road 1 1/2 miles east of Mission Boulevard between Fremont and Sunol, but workers quickly cleared away the debris. A worker at a 7-Eleven Store reported wine bottles, soda pop, medicine, books, and coffee pots were knocked from shelves. Burglar alarms were set off when store windows were broken out--press reports).

Intensity V: The most common effects at the places listed below were hairline cracks in plaster walls, few windows cracked, few items thrown from store shelves, small objects overturned and fell, felt by and awakened many. Alviso, Los Gatos, Menlo Park, Millbrae, Milpitas, Sunol.

Intensity IV: Aptos, Bolinas, Boulder Creek, Castro Valley, Daly City, Diablo, Dillon Beach, Fairfax, Foster City, Half Moon Bay, Holy City, La Honda, Loma Mar, Los Altos, Mill Valley, Moffatt Field (telegraphic report), Monterey, Moraga, Morgan Hill, Newark, Oakland, Penngrove, Pleasanton, Port Costa, Redwood City, Redwood Estates, Ross, San Carlos, San Francisco, San Gregorio, San Jose, San Lorenzo, San Mateo, Santa Clara, Sunnyvale, Tres Pinos, Union City.

Intensity III: Brisbane, Brookdale, East Palo Alto, El Granada, Freestone, Glen Ellen, New Almaden, Point Reyes, San Francisco Airport, Waterford, Woodacre.

Intensity II: Capitola, Hickman.

Felt: Hayward (press report), Mount Hamilton, Richmond (press report).

3 March (P) Imperial Valley
Origin time: 12 02 52.7
Epicenter: 32.91 N., 115.54 W.
Depth: 6 km
Magnitude: 2.3 ML(P)

Felt at Brawley (P).

5 March (B) Owens Valley area
Origin time: 05 28 54.9
Epicenter: 37.56 N., 118.90 W.
Depth: 13 km
Magnitude: 4.3 mb(C), 4.2 ML(B), 3.9 ML(P)

CALIFORNIA--Continued

Felt in northern Inyo and southern Mono Counties (press report).

Intensity IV: Bishop, Grant Grove area of Kings Canyon National Park, Mammoth Lakes, Piedra, Shaver Lake.

Intensity III: Big Creek, Fish Camp, Mariposa, Oakhurst, Wawona.

Intensity II: Prather.

5 March (B) Owens Valley area
Origin time: 15 07 39.3
Epicenter: 37.64 N., 118.92 W.
Depth: 9 km
Magnitude: 3.6 ML(B), 3.7 ML(P)

Felt in northern Inyo and southern Mono Counties (press report).

Intensity III: Wawona.

8 March (P) Imperial Valley area
Origin time: 11 11 42.9
Epicenter: 33.06 N., 115.61 W.
Depth: 7 km
Magnitude: 3.1 ML(P)

Felt in the Imperial Valley (P).

8 March (P) Imperial Valley
Origin time: 11 17 09.2
Epicenter: 33.07 N., 115.60 W.
Depth: 8 km
Magnitude: 3.5 ML(P)

Many people were awakened in the Imperial Valley (press report).

Intensity V: Westmorland (few small objects overturned; hanging pictures swung; buildings trembled; windows, doors, and dishes rattled; felt by and awakened many).

Intensity IV: El Centro.

10 March (B) Owens Valley area
Origin time: 23 29 28.6
Epicenter: 37.29 N., 118.35 W.
Depth: 27 km
Magnitude: 3.6 ML(B), 3.4 ML(P)
Intensity III: Bishop.

10 March (B) Central California
Origin time: 23 56 34.3
Epicenter: 36.87 N., 121.65 W.
Depth: 7 km
Magnitude: 3.3 ML(B)

Felt at Salinas and Watsonville (B).

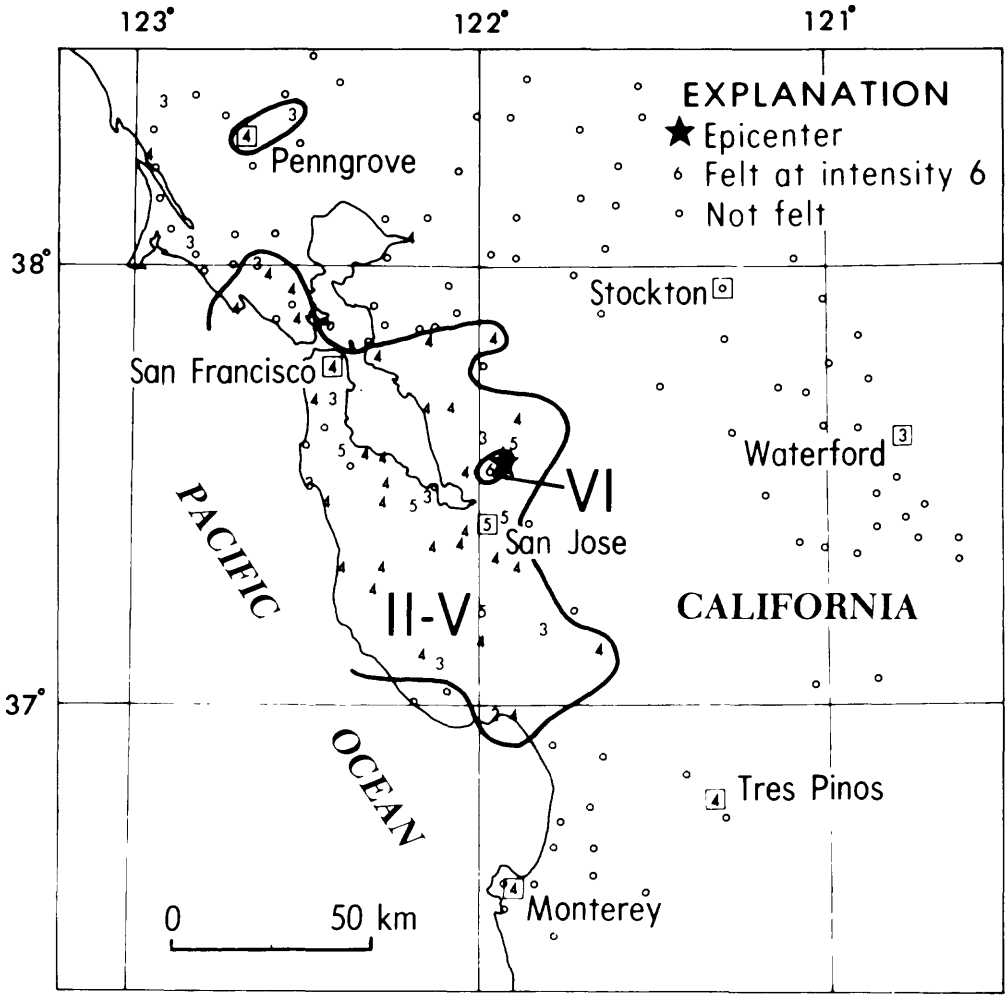

FIGURE 8.--Isoseismal map for the central California earthquake of 3 March 1981, 10 45 12.9 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

12 March (P) Imperial Valley area
Origin time: 03 58 54.8
Epicenter: 33.23 N., 115.54 W.
Depth: 5 km
Magnitude: 2.5 ML(P)

Felt in the Imperial Valley (P).

12 March (P) Imperial Valley area
Origin time: 14 06 42.7
Epicenter: 33.23 N., 115.54 W.
Depth: 5 km
Magnitude: 3.2 ML(P)

Felt at Brawley (P).

16 March (B) Owens Valley area
Origin time: 04 53 53.2
Epicenter: 37.63 N., 118.86 W.
Depth: 4 km
Magnitude: 3.5 ML(B), 3.8 ML(P)

Felt in the Mammoth Lakes area (B).

18 March (P) Southern California
Origin time: 06 07 11.9
Epicenter: 34.09 N., 117.00 W.
Depth: 11 km
Magnitude: 3.7 ML(P)

Intensity V: The most common effects at the places listed below were a few cracked windows, few items thrown from store shelves, few small objects overturned and fell, glassware and dishes broken, hanging objects swung slightly, felt by many and awakened several.
Angelus Oaks, Big Bear City, Desert Hot Springs (hairline cracks in plaster and dry wall), Mentone.
Intensity IV: Beaumont, Fawnskin, Forest Falls, Hemet, Idyllwild, Lake Arrowhead, Loma Linda, Perris, Riverside, San Bernardino, White Water.
Intensity III: Bloomington, Blue Jay, Crestline, Green Valley Lake, Highland, Landers, Lucerne Valley, Patton, Morongo Valley, Quail Valley, Redlands (press report), Twin Peaks, Yucaipa.
Intensity II: Calimesa, North Palm Springs.

21 March (B) Northern California
Origin time: 05 38 46.6
Epicenter: 40.60 N., 124.42 W.
Depth: 24 km
Magnitude: 4.0 ML(B)
Intensity III: Rio Dell.

24 March (B) Owens Valley area
Origin Time: 04 09 09.2
Epicenter: 37.51 N., 118.77 W.

CALIFORNIA--Continued

Depth: 11 km
Magnitude: 3.5 ML(B), 3.3 ML(P)

Felt in the Mammoth Lakes area (B).

25 March (B) Owens Valley area
Origin time: 04 01 43.8
Epicenter: 37.55 N., 118.89 W.
Depth: 10 km
Magnitude: 3.7 ML(B), 3.6 ML(P)

Felt in the Mammoth Lakes area (B).

28 March (B) Northern California
Origin time: 05 04 36.9
Epicenter: 39.40 N., 120.16 W.
Depth: 16 km
Magnitude: 3.8 ML(B)

Felt at Soda Springs and Truckee (B).

11 April (B) Central California
Origin time: 23 47 10.9
Epicenter: 37.77 N., 121.76 W.
Depth: 12 km
Magnitude: 3.4 ML(B)

Felt at Antioch (B), Brentwood (press report), Byron (B), Concord (B), Danville (B), Dublin (B), Livermore (B), Pleasanton (B), San Ramon (B), and Walnut Creek (B).

19 April (P) Southern California
Origin time: 09 02 10.7
Epicenter: 35.83 N., 117.77 W.
Depth: 9 km
Magnitude: 4.5 mb(G), 4.2 ML(P)

This was the first in a swarm of quakes in this area (press report).

Intensity V: Trona (elevated water tanks cracked, hairline cracks in plaster and and dry wall, few items thrown from store shelves, light furniture overturned, few windows cracked).
Intensity IV: Inyokern, Kernville, Pearsonville, Ridgecrest.
Intensity III: Bakersfield, California Hot Springs, Lake Isabella.

19 April (P) Southern California
Origin time: 09 02 49.7
Epicenter: 35.85 N., 117.78 W.
Depth: 8 km
Magnitude: 4.4 mb(G), 4.4 ML(P)

The intensity data could not be differentiated from the earthquake at 09 02 10.7, thus the effects listed above apply equally to this event.

22 April (P) Imperial Valley
Origin time: 06 28 50.9
Epicenter: 33.10 N., 115.65 W.
Depth: 9 km
Magnitude: 3.4 ML(P)

This was the largest earthquake in a swarm occurring in the Imperial Valley beginning on April 21 (press report).

Intensity V:
Calexico (hairline cracks in plaster walls, few small objects overturned, felt by all).
Westmorland (few items thrown from store shelves, few small objects overturned and fell).
Intensity IV: El Centro, Heber, Niland.
Intensity II: Brawley (press report), Imperial.

23 April (P) Imperial Valley
Origin time: 06 15 52.0
Epicenter: 32.75 N., 115.62 W.
Depth: 8 km
Magnitude: 3.0 ML(P)

Felt at El Centro (P).

25 April (P) Imperial Valley
Origin time: 02 11 55.3
Epicenter: 33.11 N., 115.63 W.
Depth: 5 km
Magnitude: 4.1 ML(P)

This was the strongest earthquake in a swarm in this area that occurred on April 25 and 26.

Felt at Brawley, El Centro, and Westmorland (press report).

25 April (P) Imperial Valley
Origin time: 07 03 14.1
Epicenter: 33.10 N., 115.63 W.
Depth: 5 km
Magnitude: 4.4 mb(G), 3.9 ML(P)

Felt in the Imperial Valley (telephone report).

25 April (P) Owens Valley area
Origin time: 07 41 07.0
Epicenter: 37.68 N., 118.96 W.
Depth: 5 km
Magnitude: 3.6 ML(B), 3.9 ML(P)

Felt at Mammoth Lakes (P).

25 April (B) Central California
Origin time: 19 41 37.4

CALIFORNIA--Continued

Epicenter: 37.10 N., 121.87 W.
Depth: 11 km
Magnitude: 4.4 mb(G), 4.1 ML(B)

This earthquake was felt throughout the San Francisco Bay area, San Jose, and Monterey Bay area (B).

Intensity VI: Watsonville (foundation cracked, few items thrown from store shelves, glassware and dishes broken).
Intensity V:
Capitola (few items thrown from store shelves, few small objects overturned and fell, felt by many).
Santa Cruz (china broken, vase knocked of and broken--press report).
Soquel (mobile home moved off its foundation--press report).
Intensity IV: Aptos, Ben Lomond, Boulder Creek, Carmel Valley, Felton, Los Gatos, Monterey, New Almaden, Salinas, San Gregorio.
Intensity III: Davenport, Morgan Hill, Moss Landing, Pittsburg, Pleasanton, Redwood City, Redwood Estates.
Intensity II: Daly City, Hollister, Holy City, San Francisco.
Felt: Mount Eden, San Jose (B).

26 April (P) Imperial Valley
Origin time: 12 09 28.4
Epicenter: 33.10 N., 115.63 W.
Depth: 4 km
Magnitude: 5.5 mb(G), 6.0 MS(G), 5.7 ML(P), 6.3 ML(B)

This earthquake was the largest in a swarm of at least 40 quakes which occurred in this area from April 24-28. It was felt over an area of approximately 73,500 km^2 of California and Arizona (fig. 9). No injuries were reported, but several people reported being jolted out of their beds. The maximum intensity of VII was assigned to Westmorland and Calipatria based mostly on extensive building damage. The preliminary estimates of property loss range from 1-3 million dollars. Much of the information listed below was taken from Barnhard and others (1982).

Twelve buildings in Westmorland were severely damaged; an additional 30 sustained minor damage; and 70% of the town's 900 homes, many built of adobe and red brick, were damaged. City officials ordered the demolition of ten downtown buildings that were damaged beyond repair and five homes were condemned. Six mobile homes were knocked off their foundations

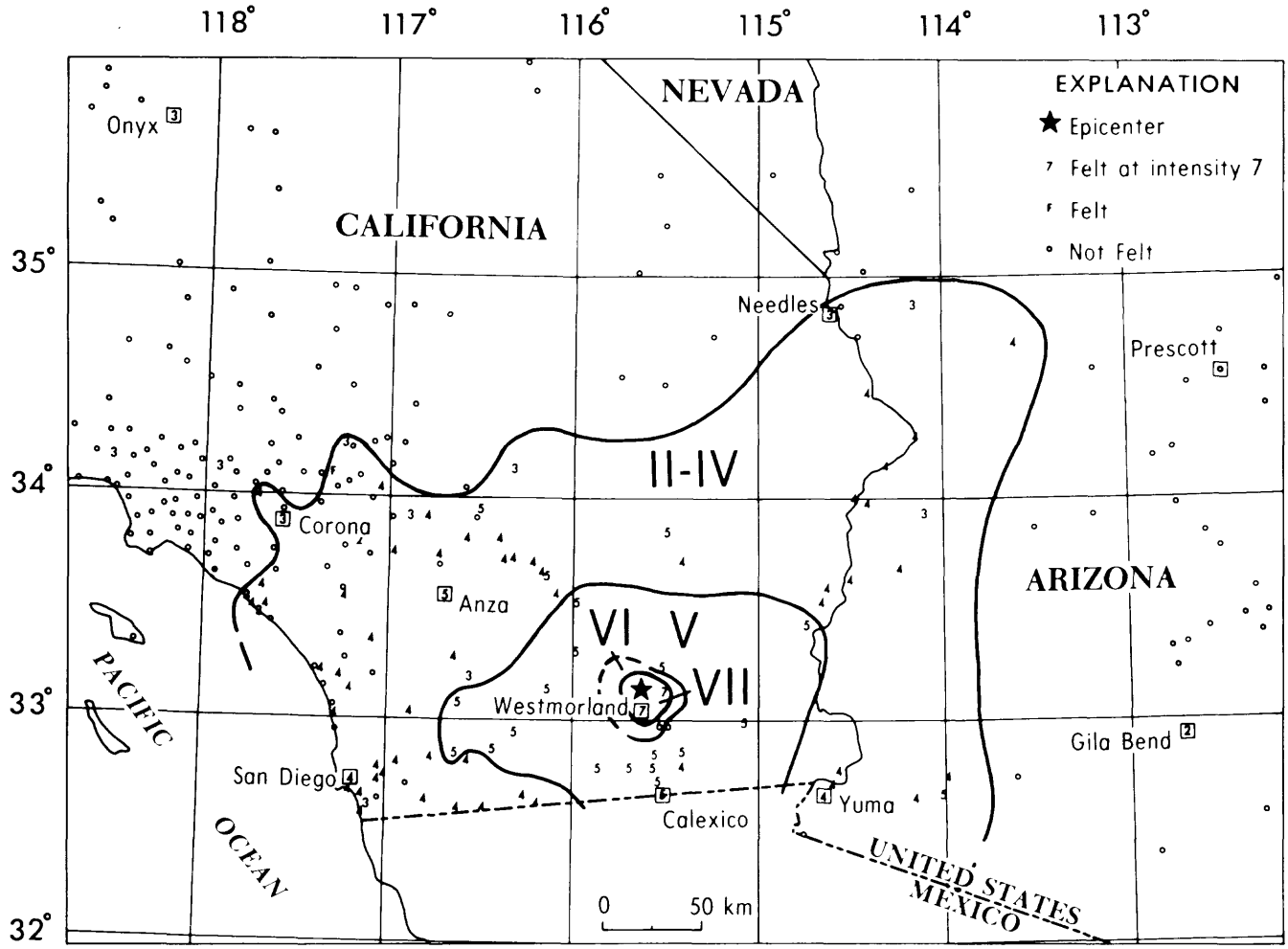

FIGURE 9.--Isoseismal map for the Imperial Valley, California earthquake of 26 April 1981, 12 09 28.4 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

CALIFORNIA--Continued

and nine homes suffered minor damage to their foundations, porches, and walls. At least 300 homes lost electricity for 1 hour after the quake when lines and relays were knocked out. Pipes connecting four water filtration vats to the city water system were broken; as a result water supply to Westmorland was interrupted for 10 hours after the quake. Two of the legs on the water storage tower bowed and the tower was leaking. At the municipal waste water treatment plant the quake knocked a giant stirrer, called a clarifier, off its axis. The sewage plant sustained an estimated $40,000 damage. Total damage at Westmorland was estimated at $1.5 million.

CALIFORNIA--Continued

Subsidence was reported on several rural roads in the area and scores of "mudpots," puddles of oozing soil, formed in nearby fields. One country road west of Westmorland collapsed, producing a 2-foot drop-off. On State Highway 111 near Calipatria a 1-inch crack appeared on the road with another 1-inch crack running parallel to the highway for about 600 yards (press reports).

Primary damage in rural areas consisted of broken unreinforced, concrete-lined irrigation canals. The total estimated cost of repair to canals was placed at approximately $100,000 according to the Imperial

FIGURE 10.--Photograph of damage to Vail Irrigation Canal, located between Calipatria and Westmorland (photo provided by Imperial Valley Press).

CALIFORNIA--Continued

Valley Irrigation District. Concrete on two stretches of the Vail Canal, totalling about 700 feet between Calipatria and Westmorland, cracked and the earthen embankment beneath the cracked concrete washed away (fig. 10). Also, several bridges sustained cracking and chipping of concrete. Ground and road pavement cracks were widespread.

The California Division of Mines and Geology (McJunkin and Kaliakin, 1981) reported a peak vertical acceleration (spike) of 0.80 g and peak horizontal accelerations of 0.49 g and 0.39 g were recorded on the strong-motion instruments at Westmorland's fire station.

Intensity VII: The most common effects at the places listed below were foundations cracked and destroyed, large cracks and partial collapse of exterior adobe and wood walls, interior walls fell, underground pipes broke, large cracks in highways and sidewalks, stone walls fell, hairline cracks in dry wall, large cracks in plaster walls, chimneys fell, some windows broken out, many small

CALIFORNIA--Continued

objects overturned and fell, many dishes and glassware broken, many items fell from store shelves, felt by and awakened all. Damage reports listed below are from Barnhard and others (1982).

California--

Calipatria--

The Herald Newspaper office on Main Street sustained moderate cracking of plaster walls and some plaster fell. Heavy furniture and shelves moved and trays of steel type-set were thrown down.

At Main Street and Sorenson Avenue bricks were thrown down from the parapet of the two-story brick drugstore.

On the north side of Main Street east of Sorenson Avenue bricks from the parapet of a one-story unreinforced concrete building fell onto the roof of the Farmers Business Service building causing it to collapse.

A grocery store, opposite the above-listed building on Main Street, lost merchandise valued at $2,000. A small amount of plaster fell from an interior wall.

FIGURE 11.--Photograph of damage to Porter's Fountain, Westmorland (photo provided by Imperial Valley Press).

CALIFORNIA--Continued

Damaged fuel tanks at Railroad Avenue and North Street spilled 2,000 to 3,000 gallons of fuel.

Route 86, the town's main street, was closed for fear that buildings along it might collapse. Concrete pillars holding up cantilevered upper stories of a number of the buildings had begun to crack (press reports).

Westmorland--

An adobe building (231, 239 and 241 West Main Street) was damaged beyond repair. The west wall fell on the roof of the adjoining building. The east wall collapsed entirely allowing the roof to fall in.

The Westmorland fire station on West Main Street had a crack open about 1/2 inch in the brick veneer of the northwest corner.

Porter's Fountain (Main and F Street) was badly damaged. Concrete columns at the corners of the building tilted outward towards the street and separated from the upper story of the building (fig. 11). Subsequently, the building was torn down.

The hotel at 178 Main Street had damage to a structural column which tilted outward leaving a 6-inch separation between the wall and the remainder of the building.

Westmorland City Hall sustained relatively minor exterior damage in the form of tile loss on the roof and a cracked chimney. Interior damage was restricted to minor wall cracks.

A dwelling at 263 First Street had a cracked living room floor and extensive cracks in the plaster walls. The west wall of the kitchen had a crack from ceiling to floor along vertical joints.

An adobe dwelling at 271 North Street had the walls shift about 2 inches causing severe cracking.

An adobe storage shed at 152 West Sixth Street was destroyed when the west wall and roof collapsed.

A building at Seventh and H Streets was badly damaged when the rear wall and a portion of the roof collapsed. The front wall was cracked and windows were broken.

An adobe building at 162 East Third Street was so badly damaged it was

CALIFORNIA--Continued

FIGURE 12.--Photograph of damage to adobe building at 162 East Third Street, Westmorland (photo provided by Imperial Valley Press).

CALIFORNIA--Continued

condemned (fig. 12). The foundation collapsed in the rear and the east wall collapsed. Severe cracking occurred in all the walls.

The laundromat at 100 North Center Street was damaged when the front wall separated about 2 inches from the south wall. The north wall was also cracked and windows were jarred loose from their frames.

At St. Joseph's Church three plaster statues were thrown to the floor and broken and a bell fell 20 feet from the steeple to the ground.

Intensity VI:

California--Brawley (Bottles and canned goods were thrown from grocery shelves, doors were knocked out of alignment, some cracks in exterior walls, many pictures fell off walls, television sets were knocked over in homes, and tiles were shaken off roofs. The Mayfair Market lost $3,000-$4,000 in merchandise).

Intensity V: The most common effects at the places listed below were hairline cracks in plaster and dry wall, few items thrown from store shelves, few small objects overturned and fell, few windows cracked, hanging pictures swung

CALIFORNIA--Continued

and some out of place, felt by all and awakened many.

Arizona--Tacna.

California--Agua Caliente Springs (Canebrake Canyon), Alamorio, Anza, Calexico, Descanso, Desert Hot Springs, Eagle Mountain, El Centro (natural gas line broke--press report), Glamis, Heber, Imperial, Julian, Mount Laguna, Niland, North Shore, Ocotillo, Palo Verde, Perrys Corner, Plaster City, Salton City, Seeley, Thermal.

Intensity IV:

Arizona--Ehrenberg, Martinez Lake, Parker, Poston, Quartzsite, Roll, Wellton, Wikieup, Yuma.

California--Alpine, Bard, Blythe, Boulevard, Cabazon, Campo, Cardiff-by-the-sea, Chino, Coachella, Coronado, Desert Center, Desert Hot Springs, Dulzura, Guatay, Havasu Lake, Hemet, Holtville, Idyllwild, Imperial Beach, Indian Wells, Indio, Jacumba, La Mesa, Laguna Niguel, Lemon Grove, Lindbergh Field (San Diego), Lost Lake, Mecca, Mission Viejo, Murrieta, National City, Pala, Palm Desert, Palm Springs, Parker Dam, Pine Valley, Potrero, Ramona, Ripley, San Diego (College Heights, Morena, Pacific Beach, University Heights), San

Juan Capistrano, San Luis Rey, San Marcos, Santee, Spring Valley, Tecate, Thousand Palms, Vista, Warner Springs, Winterhaven, Yucaipa.
Intensity III:
Arizona--Bouse, Riviera.
California--Azusa, Banning, Cedar Glen, Chula Vista, Corona, Dana Point, Encino, Joshua Tree, Laguna Beach, Needles, Onyx, Ranchita.
Intensity II:
Arizona--Gila Bend, Stanfield.
California--Nuevo.
Felt:
California--San Bernardino (press report).

28 April (B) California-Nevada border region
Origin time: 22 54 49.9

See Nevada listing.

29 April (B) Lake Tahoe area
Origin time: 11 55 52.6

See Nevada listing.

4 May (P) Southern California
Origin time: 06 44 38.2
Epicenter: 34.31 N., 118.32 W.
Depth: 8 km
Magnitude: 2.1 ML(P)

Felt at Sunland (P).

6 May (P) Southern California
Origin time: 05 56 58.9
Epicenter: 33.74 N., 118.03 W.
Depth: 14 km
Magnitude: 3.1 ML(P)

Felt at Seal Beach (P) and in northern Orange County (press report).

7 May (B) California-Nevada border region
Origin time: 01 02.37.8
Epicenter: 37.94 N., 118.53 W.
Depth: 18 km
Magnitude: 4.4 mb(G), 4.5 ML(B), 4.6 ML(P)
Intensity IV:
California--Bishop, Hume, Huntington Lake, Kings Canyon National Park, Lakeshore.
Intensity III:
California--Benton.
Nevada--Dyer.
Felt:
California--Mammoth Lakes (P), Toms Place.

11 May (B) Central California
Origin time: 11 50 28.8
Epicenter: 37.73 N., 122.13 W.

Depth: 12 km
Magnitude: 2.6 ML(B)
Intensity IV: San Leandro.
Felt: Alameda (B), Emeryville (B), San Lorenzo (B).

18 May (G) Central California
Origin time: 14 39 15.2
Epicenter: 37.89 N., 122.00 W.
Depth: 9 km
Magnitude: 2.8 ML(B)
Intensity III: Clayton.
Felt: Concord (B), Lafayette (B), Oakland (B), Walnut Creek (B).

18 May (P) Central California
Origin time: 21 32 48.5
Epicenter: 37.23 N., 117.88 W.
Depth: 5 km
Magnitude: 3.3 ML(P)
Intensity IV: Deep Springs.
Intensity III: Independence.

20 May (B) Central California
Origin time: 17 21 31.2
Epicenter: 36.98 N., 121.03 W.
Depth: 8 km
Magnitude: 3.9 ML(B)

Felt at Los Banos and San Luis Reservoir area (B).

26 May (G) Northern California
Origin time: 11 41 10.2
Epicenter: 40.38 N., 124.35 W.
Depth: 21 km
Magnitude: 4.3 mb(G), 4.6 ML(B)

The dominance of intensity IV results from reports of people being awakened, since this earthquake occurred at night; otherwise this event was reported as not felt.

Intensity IV: Arcata, Bayside, Blue Lake, Bridgeville, Carlotta, Eureka, Fields Landing, Fortuna, Honeydew, Kneeland, Loleta, McKinleyville, Miranda, Petrolia, Piercy, Redway, Rio Dell, Salmon Creek Road, Scotia, Weott.

3 June (P) Southern California
Origin time: 05 29 03.5
Epicenter: 34.15 N., 117.61 W.
Depth: 13 km
Magnitude: 3.2 ML(P)

Felt in western San Bernardino and nothern Riverside counties (press report).

Intensity IV: Etiwanda.
Intensity III: Ontario.

Felt: Fontana (press report), Rancho Cucamonga (P).

4 June (P) Imperial Valley
Origin time: 06 24 56.3
Epicenter: 32.96 N., 115.54 W.
Depth: 15 km
Magnitude: 2.7 ML(P)

Felt in the Imperial Valley (P).

4 June (P) Southern California
Origin time: 11 51 33.2
Epicenter: 33.67 N., 117.37 W.
Depth: 12 km
Magnitude: 3.6 ML(P)

Intensity V: Lake Elsinore (few small objects overturned and fell, felt by and awakened many, building trembled strongly).
Intensity IV: Bonsall, Homeland, Murrieta, Norco, Nuevo, Perris, Silverado, Sunnymead, Vista, Wildomar.
Intensity III: Corona, Riverside.
Felt: San Clemente.

4 June (B) Northern California
Origin time: 12 23 14.2
Epicenter: 39.39 N., 123.24 W.
Depth: 9 km
Magnitude: 3.5 ML(B)
Intensity IV: Redwood Valley, Ukiah, Willits.
Felt: Potter Valley (press report).

4 June (P) Southern California
Origin time: 14 26 35.6
Epicenter: 33.67 N., 117.37 W.
Depth: 12 km
Magnitude: 2.9 ML(P)

Felt in Riverside County (P).

8 June (B) Central California
Origin time: 03 09 05.5
Epicenter: 36.74 N., 121.36 W.
Depth: 10 km
Magnitude: 4.3 ML(B)

Widely felt in Merced, Monterey, and San Benito Counties.

Intensity IV: Castroville, Chualar, Salinas, Tres Pinos.
Intensity III: Dos Palos, Hollister, Marina, Paicines, Seaside, Watsonville.
Felt: Carmel, Monterey Bay area (press report), San Francisco (B).

CALIFORNIA--Continued

12 June (P) Southern California
Origin time: 06 06 07.3
Epicenter: 34.36 N., 118.66 W.
Depth: 15 km
Magnitude: 3.9 ML(P)

Felt from Santa Monica to the Antelope Valley north of Los Angeles (press report).

Intensity IV: Agoura, Canyon Country, Chatsworth, Saugus, Simi Valley, Sylmar.
Intensity III: Canoga Park, Granada Hills, Green Valley, Lebec, Leona Valley, Piru, Reseda, Sun Valley, Thousand Oaks.
Felt: Antelope Valley, Pasadena, San Fernando Valley, Santa Clarita Valley, and Santa Monica (P).

12 June (P) Southern California
Origin time: 11 02 46.4
Epicenter: 33.25 N., 115.98 W.
Depth: 4 km
Magnitude: 3.6 ML(P)

Felt at Salton City (press report).

22 June (P) Southern California
Origin time: 04 57 47.3
Epicenter: 35.10 N., 118.52 W.
Depth: 5 km
Magnitude: 4.0 ML(P), 4.1 ML(B)
Intensity V: Arvin (hairline cracks in plaster walls, few small objects overturned and fell), Tehachapi (few small objects overturned and fell, few windows cracked, building trembled strongly).
Intensity IV: Keene, Lamont.
Intensity III: Frazier Park, Leona Valley.
Felt: Bakersfield (P), Mojave (press report).

22 June (P) Southern California
Origin time: 18 03 10.7
Epicenter: 33.76 N., 118.16 W.
Depth: 16 km
Magnitude: 2.5 ML(P)

Felt at Long Beach and Seal Beach (P).

25 June (B) Northern California
Origin time: 11 37 07.0
Epicenter: 40.18 N., 124.44 W.
Depth: 8 km
Magnitude: 3.6 ML(B)
Intensity IV: Rio Dell.

28 June (B) Central California
Origin time: 16 33 57.3
Epicenter: 37.41 N., 121.79 W.
Depth: 5 km
Magnitude: 2.5 ML(B)

Felt in eastern San Jose (press report).

30 June (B) Owens Valley area
Origin time: 08 31 51.4
Epicenter: 37.56 N., 118.89 W.
Depth: 7 km
Magnitude: 3.7 ML(B), 3.6 ML(P)

Felt at Mammoth Lakes (B).

3 July (P) Southern California
Origin time: 13 45 31.9
Epicenter: 34.03 N., 118.18 W.
Depth: 14 km
Magnitude: 2.4 ML(P)
Intensity III: Los Angeles (press report).

6 July (P) Southern California
Origin time: 19 53 44.1
Epicenter: 33.87 N., 117.86 W.
Depth: 6 km
Magnitude: 3.2 ML(P)
Intensity IV: Placentia, Yorba Linda.
Intensity III: Brea, Garden Grove.
Felt: Fullerton (press report) and Orange County (P).

9 July (P) Owens Valley area
Origin time: 13 30 46.2
Epicenter: 37.72 N., 118.89 W.
Depth: 10 km
Magnitude: 3.1 ML(P)

Felt at Mammoth Lakes (P).

9 July (P) Owens Valley area
Origin time: 13 31 17.8
Epicenter: 37.72 N., 118.87 W.
Depth: 8 km
Magnitude: 3.3 ML(P)

Felt at Mammoth Lakes (P).

9 July (P) Owens Valley area
Origin time: 14 52 35.9
Epicenter: 37.65 N., 118.96 W.
Depth: 5 km
Magnitude: 3.2 ML(P)

Felt at Mammoth Lakes (P)

10 July (P) Imperial Valley
Origin time: 11 33 53.2
Epicenter: 33.26 N., 115.98 W.
Depth: 4 km
Magnitude: 2.6 ML(P)

Felt at San Diego (P).

17 July (B) Northern California
Origin time: 16 37 32.6

CALIFORNIA--Continued

Epicenter: 40.20 N., 124.25 W.
Depth: 13 km
Magnitude: 4.9 mb(G), 4.1 MS(G), 4.6 ML(B)

Felt in Humboldt, Mendocino, and Sonoma Counties (press report). At Honeydew about 10 sheep were observed running like they were being chased just seconds before the earthquake.

Intensity VI:
Honeydew (light furniture overturned, many small objects overturned and fell, many glassware and dishes broken, many items thrown from store shelves, hanging pictures fell, felt by all).
Intensity V: The most common effects at the places listed below were few items thrown from store shelves, few small objects overturned and fell, few glassware and dishes broken.
Petrolia, Phillipsville, Rio Dell, Scotia.
Intensity IV: Alderpoint, Blocksburg, Bridgeville, Eureka, Ferndale, Fields Landing, Hydesville, Loleta, Miranda, Rio Dell, Weott, Whitethorn.
Intensity III: Bayside, Bodega Bay (press report), Fortuna, Garberville, Redcrest, Redway, Samoa, Wildwood, Zenia.

24 July (G) California-Mexico border region
Origin time: 11 38 48.4
Epicenter: 32.08 N., 116.27 W.
Depth: 10 km
Magnitude: 4.3 mb(G), 4.6 ML(P)
Intensity V:
California--Descanso (few glassware and dishes broken; windows, doors, and dishes rattled).
Intensity IV:
California--Alpine, Campo, El Cajon, Escondido, Jacumba, Lemon Grove, Mount Laguna, San Diego, Santa Ysabel.
Intensity III:
California--Boulevard, Calexico, Potrero.
Felt:
Mexico--Tecate (press report).

26 July (P) Southern California
Origin time: 06 13 09.4
Epicenter: 35.13 N., 118.64 W.
Depth: 5 km
Magnitude: 3.7 ML(P)

Felt at Bear Valley (P).

29 July (P) Southern California
Origin time: 21 28 08.2
Epicenter: 33.14 N., 116.51 W.
Depth: 5 km

Magnitude: 3.4 ML(P)
Intensity III: Lake Cuyamaca.

29 July (P) Southern California
Origin time: 23 39 57.1
Epicenter: 33.80 N., 118.72 W.
Depth: 1 km
Magnitude: 3.9 ML(P)

This is the largest in a swarm of earthquakes which occurred in this area on July 29-30.

Intensity III: Hawthorne, Malibu, Seal Beach.
Felt: Century City (P), Hermosa Beach (press report), Pasadena (P), Redondo Beach (P), Santa Monica (P).

30 July (P) Southern California
Origin time: 01 56 55.2
Epicenter: 33.79 N., 118.74 W.
Depth: 2 km
Magnitude: 3.7 ML(P)

Felt in the South Bay area (press report).

30 July (P) Southern California
Origin time: 11 56 01.0
Epicenter: 33.80 N., 118.73 W.
Depth: 8 km
Magnitude: 3.6 ML(P)

Felt at Hermosa Beach (P).

4 August (B) Central California
Origin time: 13 27 10.2
Epicenter: 36.71 N., 121.40 W.
Depth: 3 km
Magnitude: 3.1 ML(B)
Intensity IV: Tres Pinos.
Felt: Hollister (B).

6 August (P) Southern California
Origin time: 11 10 12.7
Epicenter: 34.80 N., 120.24 W.
Depth: 0 km
Magnitude: 3.7 ML(P)
Intensity IV: Los Alamos, Santa Maria (press report).
Felt: San Luis Obispo County (press report).

9 August (B) Owens Valley area
Origin time: 15 52 03.2
Epicenter: 37.62 N., 118.93 W.
Depth: 7 km
Magnitude: 3.5 ML(B)

Felt in the Mammoth Lakes area (B).

CALIFORNIA--Continued

12 August (P) Southern California
Origin time: 22 58 35.2
Epicenter: 34.13 N., 118.63 W.
Depth: 4 km
Magnitude: 2.7 ML(P)
Intensity II: Woodland Hills (press report).

13 August (B) Owens Valley area
Origin time: 20 31 22.6
Epicenter: 37.53 N., 118.89 W.
Depth: 2 km
Magnitude: 3.6 ML(B)

Felt in the Mammoth Lakes area.

14 August (P) Southern California
Origin time: 01 09 34.3
Epicenter: 33.97 N., 118.59 W.
Depth: 4 km
Magnitude: 3.4 ML(P)
Intensity IV: Santa Monica (press report).

14 August (B) Central California
Origin time: 12 49 59.7
Epicenter: 36.78 N., 121.29 W.
Depth: 9 km
Magnitude: 4.2 ML(B)
Intensity IV: Carmel Valley, Monterey, Paicines, Redwood Estates, San Juan Bautista.
Felt: Hollister (B).

16 August (P) Southern California
Origin time: 11 23 29.2
Epicenter: 34.12 N., 117.17 W.
Depth: 8 km
Magnitude: 3.2 ML(P)

Felt at San Bernardino (P).

19 August (P) Southern California
Origin time: 12 02 00.6
Epicenter: 33.56 N., 117.21 W.
Depth: 5 km
Magnitude: 2.8 ML(P)

Felt at Sun City (P).

22 August (B) Owens Valley area
Origin time: 20 54 23.8
Epicenter: 37.62 N., 118.89 W.
Depth: 8 km
Magnitude: 3.5 ML(B), 3.9 ML(P)

Felt in the Mammoth Lakes area (B).

24 August (B) Owens Valley area
Origin time: 04 52 18.3

Epicenter: 37.62 N., 118.89 W.
Depth: 8 km
Magnitude: 3.9 ML(B), 4.1 ML(P)
Intensity IV: June Lake, Mammoth Lakes.
Intensity III: Lakeshore.

27 August (B) Central California
Origin time: 10 01 24.7
Epicenter: 37.84 N., 121.79 W.
Depth: 12 km
Magnitude: 2.9 ML(B)

Felt at Dublin and San Ramon (B).

4 September (P) Southern California
Origin time: 00 28 53.3
Epicenter: 33.15 N., 116.56 W.
Depth: 15 km
Magnitude: 3.9 ML(P)

This is the first of two quakes in this area. A sound like an explosion was heard at the time of the first quake.

Intensity IV: Campo, Nuevo, Pala, Poway, Santa Ysabel, Warner Springs.
Intensity III: Julian, Lake Cuyamaca, San Marcos, Valley Center.
Felt: Escondido (P), Mount Laguna, Palm Springs (press report), San Diego (press report).

4 September (P) Southern California
Origin time: 00 39 25.5
Epicenter: 33.15 N., 116.56 W.
Depth: 15 km
Magnitude: 3.8 ML(P)

Felt at Escondido (P) and at Julian, Palm Springs, and San Diego (press reports).

9 September (B) Central California
Origin time: 06 54 04.7
Epicenter: 36.77 N., 121.56 W.
Depth: 7 km
Magnitude: 2.9 ML(B)

Felt at Salinas (B).

12 September (P) Southern California
Origin time: 21 23 07.5
Epicenter: 34.15 N., 117.27 W.
Depth: 8 km
Magnitude: 3.6 ML(P)

This was the first and largest in a swarm of eight quakes which were felt in the San Bernardino area on September 12-16.

CALIFORNIA--Continued

Intensity V:
Highland (foundation cracked, pendulum clock stopped, few windows cracked).
Intensity IV: Colton, Redlands, Rimforest, San Bernardino, Skyforest, Yucaipa.
Intensity III: Loma Linda, Mentone, Patton.
Intensity II: Forest Falls.

13 September (P) Southern California
Origin time: 19 59 48.5
Epicenter: 34.15 N., 117.27 W.
Depth: 5 km
Magnitude: 3.1 ML(P)

Felt at San Bernardino (press report).

14 September (P) Southern California
Origin time: 09 07 17.6
Epicenter: 34.15 N., 117.28 W.
Depth: 12 km
Magnitude: 2.5 ML(P)

Felt at San Bernardino (press report).

14 September (P) Southern California
Origin time: 18 42 03.5
Epicenter: 34.16 N., 117.27 W.
Depth: 4 km
Magnitude: 2.6 ML(P)

Felt at San Bernardino (press report).

15 September (P) Southern California
Origin time: 01 54 14.9
Epicenter: 34.15 N., 117.27 W.
Depth: 3 km
Magnitude: 2.5 ML(P)

Felt at San Bernardino (press report).

16 September (P) Southern California
Origin time: 07 57 13.8
Epicenter: 34.16 N., 117.26 W.
Depth: 9 km
Magnitude: 3.3 ML(P)

Felt at San Bernardino (press report).

16 September (P) Southern California
Origin time: 08 01 56.1
Epicenter: 34.16 N., 117.26 W.
Depth: 3 km
Magnitude: 2.2 ML(P)

Felt at San Bernardino (press report).

16 September (P) Southern California
Origin time: 13 57 42.7
Epicenter: 34.16 N., 117.26 W.
Depth: 4 km
Magnitude: 2.6 ML(P)

Felt at San Bernardino (press report).

17 September (P) Owens Valley area
Origin time: 12 36 04.3
Epicenter: 37.62 N., 118.91 W.
Depth: 15 km
Magnitude: 3.7 ML(B), 3.6 ML(P)
Intensity III: Mammoth Lakes (press report).
Felt: Bishop (P).

23 September (G) Central California
Origin time: 10 32 48.4
Epicenter: 38.67 N., 122.82 W.
Depth: 3 km
Magnitude: 2.5 ML(B), 2.4 MD(G)
Intensity IV: Healdsburg and Santa Rosa (press report).

24 September (B) Central California
Origin time: 14 00 26.4
Epicenter: 36.79 N., 121.57 W.
Depth: 5 km
Magnitude: 3.2 ML(B)

Felt at Salinas (B).

25 September (B) Owens Valley area
Origin time: 06 48 53.2
Epicenter: 37.54 N., 118.88 W.
Depth: 10 km
Magnitude: 3.8 ML(B), 3.8 ML(P)
Intensity IV: Lakeshore.
Felt: Mammoth Lakes area (B).

25 September (P) Southern California
Origin time: 14 13 38.0
Epicenter: 34.02 N., 116.85 W.
Depth: 21 km
Magnitude: 3.3 ML(P)

Felt at Banning (P).

28 September (B) Central California
Origin time: 07 34 39.3
Epicenter: 36.80 N., 121.56 W.
Depth: 7 km
Magnitude: 4.2 mb(G), 3.4 MS(G), 4.0 ML(B)
Intensity IV: Big Sur, Castroville, Chualar, Hollister, Soledad, Salinas, San Juan Bautista, Tres Pinos.
Intensity III: Carmel Valley.
Intensity II: Paicines.
Felt: Watsonville (B).

30 September (P) Owens Valley area
Origin time: 11 53 27.0
Epicenter: 37.62 N., 118.88 W.
Depth: 6 km
Magnitude: 5.6 mb(G), 5.8 MS(G), 5.9 ML(B), 5.8 ML(P)

CALIFORNIA--Continued

This earthquake was felt over an area of approximately 92,000 km^2 of California and Nevada (fig. 13). It was the first and largest in a swarm of earthquakes in this area. The quake knocked out power at the Mono County Sheriff's substation for 1 hour, and briefly in Crowley Lake, and at the Mammoth Lakes airport. Phone service was also interrupted in Mammoth Lakes. The quake caused rockslides in Convict Canyon and there were football-sized rocks found on the roads near Tioga Pass (Yosemite).

Intensity VI:
California--Mammoth Lakes (Small landslides, chimneys cracked, hairline cracks in plaster and dry wall, few windows cracked, few items thrown from store shelves, felt by all and awakened many. At the Hot Creek Fish Hatchery near Mammoth Lakes gas lines were broken, flowing spring water was muddied, and 200,000 fingerling rainbow trout were dumped from troughs and killed. A shopping center under construction had broken windows and damaged walls--press report).
Intensity V: The most common effects at the places listed below were few windows cracked, few items thrown from store shelves, few small objects overturned and fell, few glassware and dishes broken, water splashed onto sides of lakes and swimming pools, felt by and awakened many.
California--Auberry (small landslides), Bishop (power outages), Crowley Lake, Fresno, Friant, Kaweah, La Grange (hairline cracks in plaster walls), Madera, Merced, Modesto (press report), Orange Cove, Piedra, Pioneer, Riverdale, Shaver Lake, Sonora, Three Rivers (one woman was knocked out of bed--press report), Tom's Place, Traver, Tulare, Vernalis, Wishon, Yosemite National Park (burglar alarms went off in the park valley and a lot of rocks fell--press report).
Intensity IV:
California--Angels Camp, Armona, Arnold, Atwater, Avery, Badger, Bakersfield, Bass Lake, Benton, Big Creek, Big Oak Flat, Biola, Bodfish, Burrel, Caliente, Camino, Camptonville, Cantua Creek, Caruthers, Chinese Camp, Clements, Coalinga, Coarsegold, Copperopolis, Corcoran, Del Rey, Dinuba, Dos Palos, Ducor, Dunlap, El Nido, El Portal, Escalon, Fish Camp, French Camp, Galt, Garden Valley, Georgetown, Grant Grove

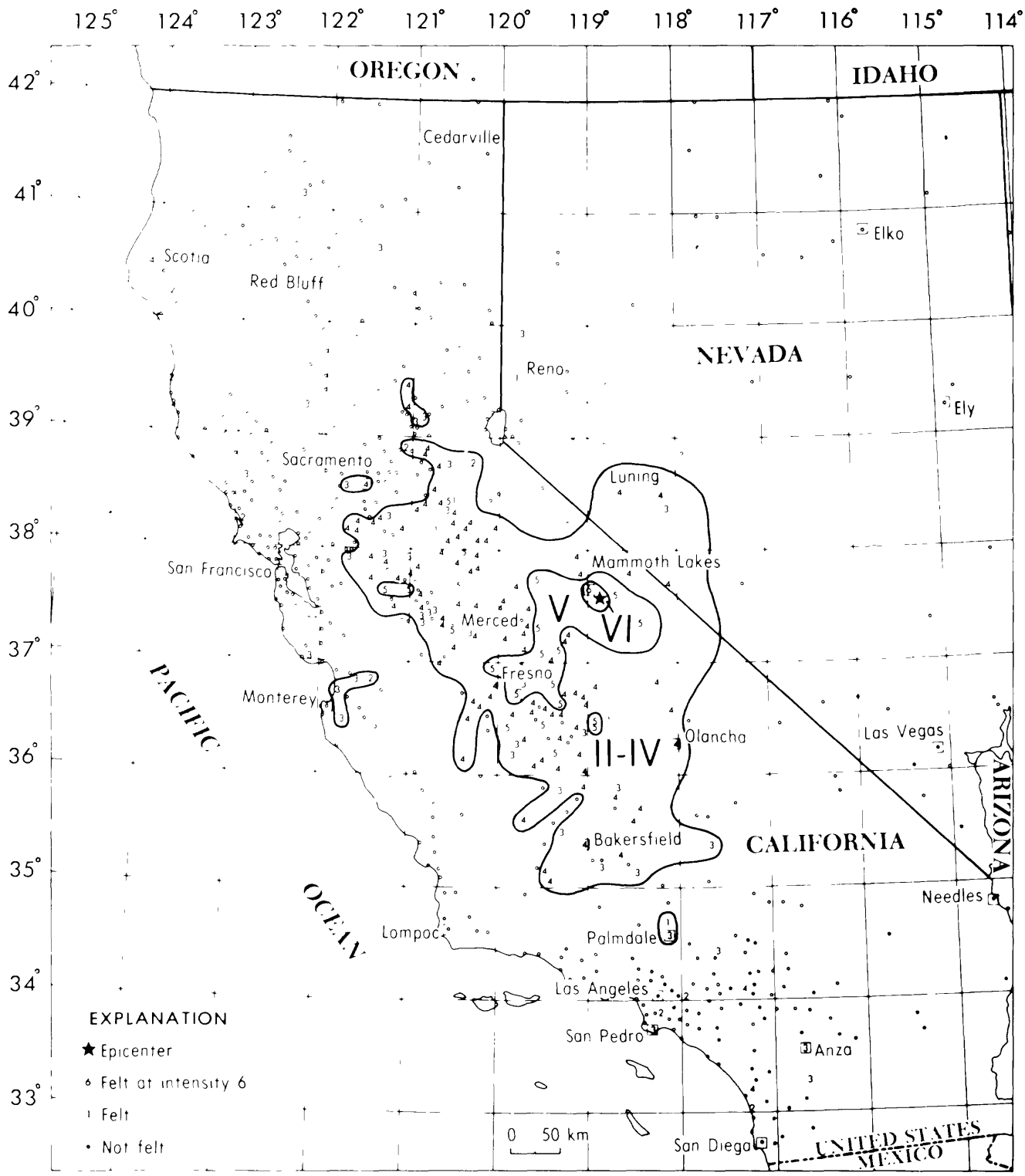

FIGURE 13.--Isoseismal map for the Owens Valley area, California, earthquake of 30 September 1981, 11 53 27.0 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

(Kings Canyon National Park), Groveland, Hanford, Hathaway Pines, Holt, Hornitos, Hughson, Hume, Independence, Ione, Isleton, June Lake, Kerman, Kern River Valley, Lakeshore, Le Grand, Lee Vining, Lindsay, Lone Pine, Long Barn, Lost Hills, Maricopa, Mariposa, Midpines, Miramonte, Mi-Wuk Village, Moccasin, Mountain Ranch, Murphys, Nevada City, Oakhurst, Olancha, O'Neals, Orosi, Patterson, Pine Grove, Pinecrest (4 miles west), Porterville, Posey, Prather, Rail Road Flat, Raymond, Reedley, Rio Vista, Ripon, River Pines, Ryde, Sacramento, San Bernardino, San Joaquin, Scotia, Selma, Snelling, Squaw Valley, Strawberry, Sultana, Sutter Creek, Taft, Thornton, Tipton, Tollhouse, Tracy, Tranquillity, Tuolumne, Turlock, Twain Harte, Vallecito, Valley Home, Visalia, Vista, Waukena, Wilseyville, Winton, Wofford Heights, Woodlake.

Nevada--Dyer (Fish Lake Valley), Hawthorne, Luning.

Intensity III:

California--Albion, Anza, Arvin, Ballico, Barton, Brentwood, Byron, California Hot Springs, Carmel Valley, Castella, Castroville, Chicago Park, Davis (press report), Delhi, Earlimart, Farmington, Felton, French Gulch, Glencoe, Gold Run, Healdsburg, Herald, Hilmar, Johannesburg, Lemoncove, Lemoore, Maxwell, Old Station, Palmdale, Phelan, Planada, Pollock Pines, San Juan Bautista, San Pedro, Shafter, Stevinson, Stockton (press report), Stratford, Tehachapi, Warner Springs.

Nevada--Babbitt, Gardnerville, Mina.

Intensity II:

California--Auburn, Cardiff-by-the-sea, Compton (press report), Fort Bragg, Hollister, Kyburz, La Puente, Miranda, Tomales.

Felt:

California--Lancaster (press report), San Andreas, Sequoia National Park, West Point.

Nevada--Reno (B).

30 September (B) Owens Valley area

Origin time: 12 22 55.6
Epicenter: 37.61 N., 118.85 W.
Depth: 10 km
Magnitude: 3.6 ML(B)

Felt at Mammoth Lakes (B).

30 September (P) Owens Valley area

Origin time: 13 05 48.2
Epicenter: 37.66 N., 118.86 W.
Depth: 3 km
Magnitude: 4.7 mb(G), 4.9 ML(B), 4.6 ML(P)

The data for this event are incomplete because many reports combined the effects of this earthquake with the earlier event at 11 53 27.0.

Intensity V: The most common effects at the places listed below were few items thrown from store shelves; few small objects overturned and fell; hanging pictures swung; windows, doors, and dishes rattled.

California--Bishop (hanging pictures fell), Mammoth Lakes (few windows cracked, few glassware and dishes broken, hairline cracks in plaster and dry wall), Piedra, Traver, Yosemite National Park.

Intensity IV:

California--Ahwahnee, Armona, Arnold, Auberry, Bass Lake, Big Creek, Cantua Creek, Chinese Camp, Clovis, Coarsegold, Cutler, Earlimart, Firebaugh, Foresthill, French Camp, Friant, Georgetown, Groveland, Hanford, Hathaway Pines, Independence, Ione, Madera, Orosi, Pioneer, Porterville, Prather, River Pines, Selma, Shaver Lake, Sierra, Strathmore, Tipton, Waukena, Wilseyville, Woodlake.

Nevada--Dyer (Fish Lake Valley).

Intensity III:

California--Atwater, Biola, California Hot Springs, El Portal, Fresno, Glencoe, Hilmar, Lemoncove, Lindsay, Lost Hills, Pollock Pines, San Joaquin, Tollhouse, Tranquillity, Visalia.

Nevada--Mina.

Intensity II:

California--Glennville.

Felt:

California--San Andreas, Sequoia National Park, West Point, Wofford Heights.

30 September (P) Owens Valley area

Origin time: 14 33 45.9
Epicenter: 37.67 N., 118.87 W.
Depth: 6 km
Magnitude: 3.9 ML(B), 3.6 ML(P)

Felt at Mammoth Lakes (telephone report).

30 September (P) Owens Valley area
Origin time: 14 40 13.2
Epicenter: 37.66 N., 118.89 W.
Depth: 6 km
Magnitude: 3.6 ML(B), 3.5 ML(P)

Felt at Mammoth Lakes (B).

30 September (P) Owens Valley area
Origin time: 14 50 07.0
Epicenter: 37.61 N., 118.91 W.
Depth: 6 km
Magnitude: 4.5 ML(B), 4.0 ML(P)

Felt at Mammoth Lakes (B).

30 September (P) Owens Valley area
Origin time: 15 20 48.2
Epicenter: 37.69 N., 118.87 W.
Depth: 6 km
Magnitude: 3.6 ML(B), 3.3 ML(P)

Felt at Mammoth Lakes (B).

30 September (P) Owens Valley area
Origin time: 16 34 32.0
Epicenter: 37.58 N., 118.92 W.
Depth: 3 km
Magnitude: 4.0 ML(B), 3.3 ML(P)

Felt at Mammoth Lakes (B).

30 September (P) Owens Valley area
Origin time: 19 35 12.3
Epicenter: 37.56 N., 118.82 W.
Depth: 6 km
Magnitude: 4.2 ML(B), 3.6 ML(P)

Felt at Mammoth Lakes (B).

30 September (P) Owens Valley area
Origin time: 19 48 20.5
Epicenter: 37.63 N., 118.89 W.
Depth: 6 km
Magnitude: 3.5 ML(B), 3.2 ML(P)

Felt at Mammoth Lakes (B).

1 October (B) Owens Valley area
Origin time: 01 04 15.6
Epicenter: 37.59 N., 118.79 W.
Depth: 10 km
Magnitude: 3.6 ML(B)

Felt in the Mammoth Lakes area (B).

1 October (B) Owens Valley area
Origin time: 07 02 04.5
Epicenter: 37.50 N., 118.87 W.

CALIFORNIA--Continued

Depth: 10 km
Magnitude: 3.6 mb(G), 4.5 ML(B)

Felt in the Mammoth Lakes area (B).

1 October (B) Owens Valley area
Origin time: 09 13 57.4
Epicenter: 37.46 N., 118.82 W.
Depth: 10 km
Magnitude: 3.5 ML(B)

Felt in the Mammoth Lakes area.

1 October (B) Owens Valley area
Origin time: 13 22 36.1
Epicenter: 37.57 N., 118.80 W.
Depth: 10 km
Magnitude: 3.7 ML(B)

Felt in the Mammoth Lakes area (B).

1 October (B) Owens Valley area
Origin time: 22 05 08.2
Epicenter: 37.49 N., 118.89 W.
Depth: 17 km
Magnitude: 3.5 ML(B)

Felt in the Mammoth Lakes area.

2 October (B) Owens Valley area
Origin time: 07 37 22.1
Epicenter: 37.61 N., 118.85 W.
Depth: 10 km
Magnitude: 4.1 ML(B)

Felt in the Mammoth Lakes area (B).

2 October (B) Owens Valley area
Origin time: 16 14 23.4
Epicenter: 37.61 N., 118.83 W.
Depth: 10 km
Magnitude: 3.5 ML(B)

Felt in the Mammoth Lakes area (B).

3 October (B) Owens Valley area
Origin time: 01 20 37.3
Epicenter: 37.57 N., 118.81 W.
Depth: 10 km
Magnitude: 4.0 ML(B)

Felt in the Mammoth Lakes area (B).

3 October (B) Owens Valley area
Origin time: 14 40 55.0
Epicenter: 37.56 N., 118.87 W.
Depth: 10 km
Magnitude: 3.8 ML(B)

Felt in the Mammoth Lakes area (B).

6 October (B) Northern California
Origin time: 07 16 11.2
Epicenter: 40.42 N., 123.52 W.
Depth: 5 km
Magnitude: 2.7 ML(B)
Intensity IV: Miranda.

9 October (B) Owens Valley area
Origin time: 11 01 00.1
Epicenter: 37.64 N., 118.88 W.
Depth: 7 km
Magnitude: 3.6 ML(B)

Felt in the Mammoth Lakes area (B).

9 October (B) Owens Valley area
Origin time: 11 17 26.0
Epicenter: 37.55 N., 118.80 W.
Depth: 4 km
Magnitude: 3.6 ML(B)

Felt in the Mammoth Lakes area (B).

9 October (B) Central California
Origin time: 18 55 28.9
Epicenter: 38.77 N., 122.68 W.
Depth: 5 km
Magnitude: 3.2 ML(B)

Felt at Cobb Mountain (B).

10 October (B) Northern California
Origin time: 12 13 17.6
Epicenter: 40.56 N., 122.10 W.
Depth: 5 km
Magnitude: 3.2 ML(B)

Felt at Redding (B).

20 October (P) Southern California
Origin time: 12 40 55.6
Epicenter: 33.52 N., 116.45 W.
Depth: 9 km
Magnitude: 2.9 ML(P)
Intensity IV: Palm Desert (press report).
Felt: Palm Springs and Coachella Valley (P).

21 October (P) Southern California
Origin time: 05 37 44.7
Epicenter: 33.51 N., 116.76 W.
Depth: 5 km
Magnitude: 3.4 ML(P)

Felt at Hemet (P).

26 October (P) Owens Valley area
Origin time: 14 58 01.6
Epicenter: 37.41 N., 118.50 W.
Depth: 11 km

CALIFORNIA--Continued

Magnitude: 3.1 ML(B), 2.9 ML(P)
Intensity III: Bishop (press report).

28 October (P) Southern California
Origin time: 14 17 08.9
Epicenter: 34.34 N., 118.52 W.
Depth: 5 km
Magnitude: 3.1 ML(P)
Intensity III: Granada Hills, Van Nuys.
Felt: San Fernando.

31 October (B) Northern California
Origin time: 08 59 06.6
Epicenter: 38.81 N., 122.81 W.
Depth: 2 km
Magnitude: 3.1 ML(B)

Felt at Cobb (B).

5 November (B) Owens Valley area
Origin time: 03 30 16.6
Epicenter: 37.54 N., 118.83 W.
Depth: 7 km
Magnitude: 3.5 ML(B)

Felt in the Mammoth Lakes area (B).

9 November (P) Imperial Valley
Origin time: 15 54 40.5
Epicenter: 32.84 N., 115.63 W.
Depth: 6 km
Magnitude: 2.9 ML(P)
Intensity IV El Centro (press report).

10 November (P) Southern California
Origin time: 22 34 35.5
Epicenter: 35.02 N., 119.14 W.
Depth: 3 km
Magnitude: 4.7 mb(G), 4.5 ML(P), 4.9 ML(B)
Intensity V: The most common effects at the places listed below were few items thrown from store shelves; few small objects overturned and fell; windows, doors, and dishes rattled. Mettler, Pumpkin Center, Ventura.
Intensity IV: Caliente, Cuyama, Delkern, Fellows, Frazier Park, Leona Valley, Oxnard, Taft, Tehachapi.
Intensity III: Arvin, Bakersfield, DiGiorgio, Huntington Beach, Inyokern, Lamont, Lebec, Lost Hills, McKittrick, Northridge, Pasadena, Simi Valley, Upland.
Intensity II: Edison, Fillmore.
Felt: Beverly Hills (P), Covina (P), Encino (P), Lake Hughes, Los Angeles (press report), northwest Los Angeles County (P), Santa Barbara (press report), Thousand Oaks (P), Van Nuys (P), Wheeler Ridge (press report).

10 November (P) Southern California
Origin time: 22 37 05.0
Epicenter: 35.01 N., 119.18 W.
Depth: 9 km
Magnitude: 4.2 ML(P)

Felt at Mettler and Wheeler Ridge (press report).

11 November (P) Southern California
Origin time: 01 19 09.2
Epicenter: 33.70 N., 117.78 W.
Depth: 5 km
Magnitude: 2.3 ML(P)

Felt at Silverado (press report).

13 November (B) Owens Valley area
Origin time: 03 00 00.0
Epicenter: 37.62 N., 118.95 W.
Depth: 7 km
Magnitude: 3.9 ML(B)

Felt in the Mammoth Lakes area (B).

13 November (B) Owens Valley area
Origin time: 03 07 47.7
Epicenter: 37.63 N., 118.96 W.
Depth: 10 km
Magnitude: 3.7 ML(B)

Felt in the Mammoth Lakes area (B).

14 November (P) Southern California
Origin time: 17 57 44.5
Epicenter: 34.07 N., 118.02 W.
Depth: 11 km
Magnitude: 1.9 ML(P)

Felt at El Monte (P).

18 November (B) Central California
Origin time: 16 15 49.0
Epicenter: 37.47 N., 119.41 W.
Depth: 27 km
Magnitude: 3.9 ML(B)

Felt in Yosemite National Park (B).

7 December (B) Northern California
Origin time: 21 32 37.4
Epicenter: 39.58 N., 123.22 W.
Depth: 5 km
Magnitude: 2.6 ML(B)
Intensity IV: Willits (water splashed onto sides of swimming pools and lakes, small objects moved, buildings trembled strongly, felt by many).

CALIFORNIA--Continued

10 December (B) Owens Valley area
Origin time: 09 33 19.7
Epicenter: 37.38 N., 118.43 W.
Depth: 28 km
Magnitude: 3.5 ML(B), 3.0 ML(P)

Felt at Bishop (P), and in Inyo and Mono Counties (press report).

10 December (B) Central California
Origin time: 11 57 37.0
Epicenter: 38.80 N., 122.79 W.
Depth: 2 km
Magnitude: 3.3 ML(B)

Felt at Clear Lake Highlands, Cobb, and Middletown (B).

12 December (B) Central California
Origin time: 15 11 09.3
Epicenter: 37.38 N., 122.27 W.
Depth: 9 km
Magnitude: 3.7 ML(B)

Felt in San Mateo and Santa Cruz Counties.

Intensity V: San Carlos (few small objects overturned and fell, buildings trembled strongly, felt by many and awakened several).
Intensity IV: Belmont, El Granada, Half Moon Bay, La Honda, Menlo Park, Palo Alto, Pescadero, Redwood City, San Mateo, South San Francisco (press report).
Felt: San Francisco (press report).

15 December (P) Owens Valley area
Origin time: 08 05 33.9
Epicenter: 36.10 N., 117.83 W.
Depth: 4 km
Magnitude: 3.8 ML(P), 4.0 ML(B)
Intensity IV: Darwin, Kernville.

16 December (P) Southern California
Origin time: 14 33 46.2
Epicenter: 33.76 N., 118.04 W.
Depth: 6 km
Magnitude: 2.2 ML(P)

Felt at Los Alamitos and Long Beach (P).

18 December (B) Central California
Origin time: 14 41 44.9
Epicenter: 38.30 N., 122.61 W.
Depth: 7 km
Magnitude: 3.1 ML(B)
Intensity IV: Glen Ellen, Petaluma.
Intensity III: Eldridge, Sonoma.
Felt: Santa Rosa (B).

CALIFORNIA--Continued

20 December (B) Central California
Origin time: 07 41 49.7
Epicenter: 38.29 N., 122.64 W.
Depth: 4 km
Magnitude: 3.0 ML(B)

Felt at Petaluma and Santa Rosa (B).

20 December (G) Northern California
Origin time: 10 25 29.5
Epicenter: 38.29 N., 122.58 W.
Depth: 5 km
Magnitude: 2.6 ML(B)

Felt in the Santa Rosa area (B).

20 December (G) Northern California
Origin time: 15 29 56.1
Epicenter: 38.30 N., 122.61 W.
Depth: 6 km
Magnitude: 2.7 ML(B)

Felt in the Santa Rosa area (B).

30 December (B) Northern California
Origin time: 02 12 26.3
Epicenter: 39.51 N., 123.39 W.
Depth: 1 km
Magnitude: 2.6 ML(B)
Intensity IV: Willits.

CALIFORNIA--Off the coast

15 March (B) Northern California
Origin time: 06 07 45.9
Epicenter: 40.39 N., 125.16 W.
Depth: 8 km
Magnitude: 4.5 mb(G), 4.5 MS(G), 4.7 ML(B)
Intensity III: Rio Dell.

30 March (B) Northern California
Origin time: 12 38 48.2
Epicenter: 40.33 N., 124.73 W.
Depth: 8 km
Magnitude: 4.4 mb(G), 4.3 ML(B)
Intensity IV: Loleta, Petrolia, Rio Dell.
Felt: Eureka (B).

13 April (B) Northern California
Origin time: 22 16 16.5
Epicenter: 40.30 N., 124.61 W.
Depth: 23 km
Magnitude: 4.3 mb(G), 4.3 ML(B)

Felt at Arcata, Miranda, and Petrolia (B).

17 April (B) Northern California
Origin time: 01 31 40.0

CALIFORNIA--Off the coast--Continued

Epicenter: 40.39 N., 125.35 W.
Depth: 8 km
Magnitude: 4.3 mb(G), 4.2 ML(B)
Intensity V: Arcata (few items thrown fro store shelves, few small objects overturned and fell, few windows cracked).
Intensity III: Miranda.

14 June (B) Northern California
Origin time: 23 53 57.6
Epicenter: 40.33 N., 124.75 W.
Depth: 24 km
Magnitude: 4.5 mb(G), 4.4 MS(G), 4.3 ML(B)
Intensity IV: Ferndale (B), Fortuna (B), Rio Dell.
Felt: Carlotta (B), Eel River Valley (B), Hydesville (B), Loleta (B).

21 June (B) Northern California
Origin time: 06 20 35.1
Epicenter: 40.24 N., 124.81 W.
Depth: 8 km
Magnitude: 4.4 mb(G), 4.0 ML(B)
Intensity IV: Blocksburg, Carlotta, Miranda, Petrolia, Phillipsville, Rio Dell, Scotia.
Intensity III: Bridgeville, Garberville, Loleta.

2 July (B) Northern California
Origin time: 08 10 51.9
Epicenter: 41.29 N., 124.43 W.
Depth: 15 km
Magnitude: 4.4 mb(G), 3.5 MS(G), 4.5 ML(B)
Intensity V:
Eureka (few small objects overturned, hanging pictures swung out of place, one man on the third floor of the post office reported being knocked to the floor while trying to stand, felt by many).
Trinidad (few small objects overturned, felt by many).
Intensity IV: Arcata, Bayside, Blue Lake, Carlotta, Hoopa, Hyampom, Kneeland, Loleta, McKinleyville, Phillipsville, Rio Dell, Salyer, Samoa, Scotia, Westhaven.
Intensity III: Willow Creek.

11 July (P) Southern California
Origin time: 21 50 29.4
Epicenter: 32.63 N., 118.08 W.
Depth: 5 km
Magnitude: 4.3 mb(G), 4.3 ML(P)
Intensity IV: Coronado.
Intensity III: Avalon, Costa Mesa, Cypress, San Diego (Lindbergh Field), Spring Valley, Tustin.
Intensity II: San Pedro.

4 September (P) Southern California
Origin time: 15 50 50.3
Epicenter: 33.67 N., 119.11 W.
Depth: 5 km
Magnitude: 5.4 mb(G), 5.9 MS(G), 5.3 ML(P), 5.6 ML(B)

This is the largest earthquake to occur in this area since the 1971 quake in the San Fernando Valley. It was felt in southern California from San Luis Obispo to the Mexican border. Telephone service in some areas was disrupted briefly, burglar alarms were set off, and elevators were knocked out of service. Amtrak trains between Los Angeles and San Diego were halted temporarily while authorities inspected bridges along the route, but no damage was found. The felt area for this earthquake, not including any possible disturbance offshore, was approximately 33,000 km² (fig. 14).

Intensity VI: Marina del Rey (some windows broken, interior and exterior walls cracked, light furniture overturned, few glassware broken, small objects overturned and fell, felt by all).

Intensity V: The most common effects at the places listed below were hairline cracks in plaster and dry wall, few items thrown from store shelves, few small objects overturned and fell, few glassware and dishes broken, few windows cracked, felt by many.
Avalon.
Bell.
Buellton.
Carpinteria.
East Irvine.
Florence.
La Mirada.
Lennox.
Lomita.
Long Beach.
Los Alamitos.
Los Angeles (Telephone service was disrupted and one elevator was knocked out of service. The 55-story Security Pacific Bank building swayed and many people reported feeling dizzy. The 365-foot-high Vincent Thomas Bridge which connects Los Angeles with Terminal Island swayed, but was not damaged--press report).
Manhattan Beach.
Palos Verdes Peninsula.
Paramount.
Pomona.
Port Hueneme.
Rosemead (a chimney was reported cracked).

CALIFORNIA--Off the coast--Continued

San Diego (Lindbergh Field).
San Pedro (concrete patio had a quarter-inch wide crack for 20 or 30 feet -- press report).
Santa Ana (Two new cracks were found in the Orange County Hall of Administration building).
Santa Catalina Island (one observer described the earthquake as: " a real sharp jolt, then it kind of rolled after that and the lights started swinging"--press report),
Santa Monica (hundreds of automobile burglar alarms were triggered in parking lots along the beaches--press report).
Sherman Oaks ($50 of merchandise fell off shelves at the Hughes Market--press report).
Simi Valley.

Intensity IV: Agoura, Altadena, Arcadia, Atwood, Bakersfield, Bellflower, Brea, Burbank, Calabasas, Camarillo, Canoga Park, Cantil, Casmalia, Colton, Compton, Costa Mesa, Cucamonga, Culver City, Cuyama, Cypress, Downey, El Monte, El Toro Marine Corps Air Station, Encino, Fillmore, Gardena, Glendale, Goleta, Halcyon, Hawthorne, Hermosa Beach, Huntington Beach, Huntington Park, La Canada, La Crescenta (press report), La Habra, Laguna Beach, Laguna Niguel, Lakewood, Lancaster, Lawndale, Lebec, Leona Valley, Long Beach (Signal Hill), Los Alamos, Los Olivos, Lynwood, Malibu, Maricopa, Mission Viejo, Monrovia, Montebello, Monterey Park, Montrose, Moorpark, Mount Baldy, Newhall, Northridge, Norwalk, Oakview, Ojai, Orange, Oxnard, Palm Springs, Pasadena, Pico Rivera, Piru, Placentia, Quail Valley, Redondo Beach, Reseda, Rosamond, San Clemente, San Marcos, San Nicolas Island, Santa Barbara (The Harbor Patrol office was briefly evacuated but no injuries or damage were reported--press report), Santa Maria, Santa Paula, Santa Ynez, Seal Beach, Sepulveda, Somis, South El Monte, South Gate, South Pasadena, Summerland, Sun Valley, Sunland, Sylmar, Thousand Oaks, Torrance, Trabuco Canyon, Trona, Tustin, Universal City, Vandenberg Air Force Base, Venice, Ventura, Vernon, Walnut, Westminster, Whittier, Wilmington, Wrightwood, Yorba Linda.

Intensity III: Alta Loma, Anaheim, Baldwin Park, Beverly Hills, Castaic, Chino, City of Industry, Covina, Creston, Etiwanda, Fallbrook, Fellows, Fullerton, Garden Grove, Green Valley, Guadalupe, Hazard, Helendale, Irvine, La Verne, Laguna Hills, Lake Hughes, Lakeview, Lompoc, Maywood, Mettler, Midway City, Mission Hills, Mur-

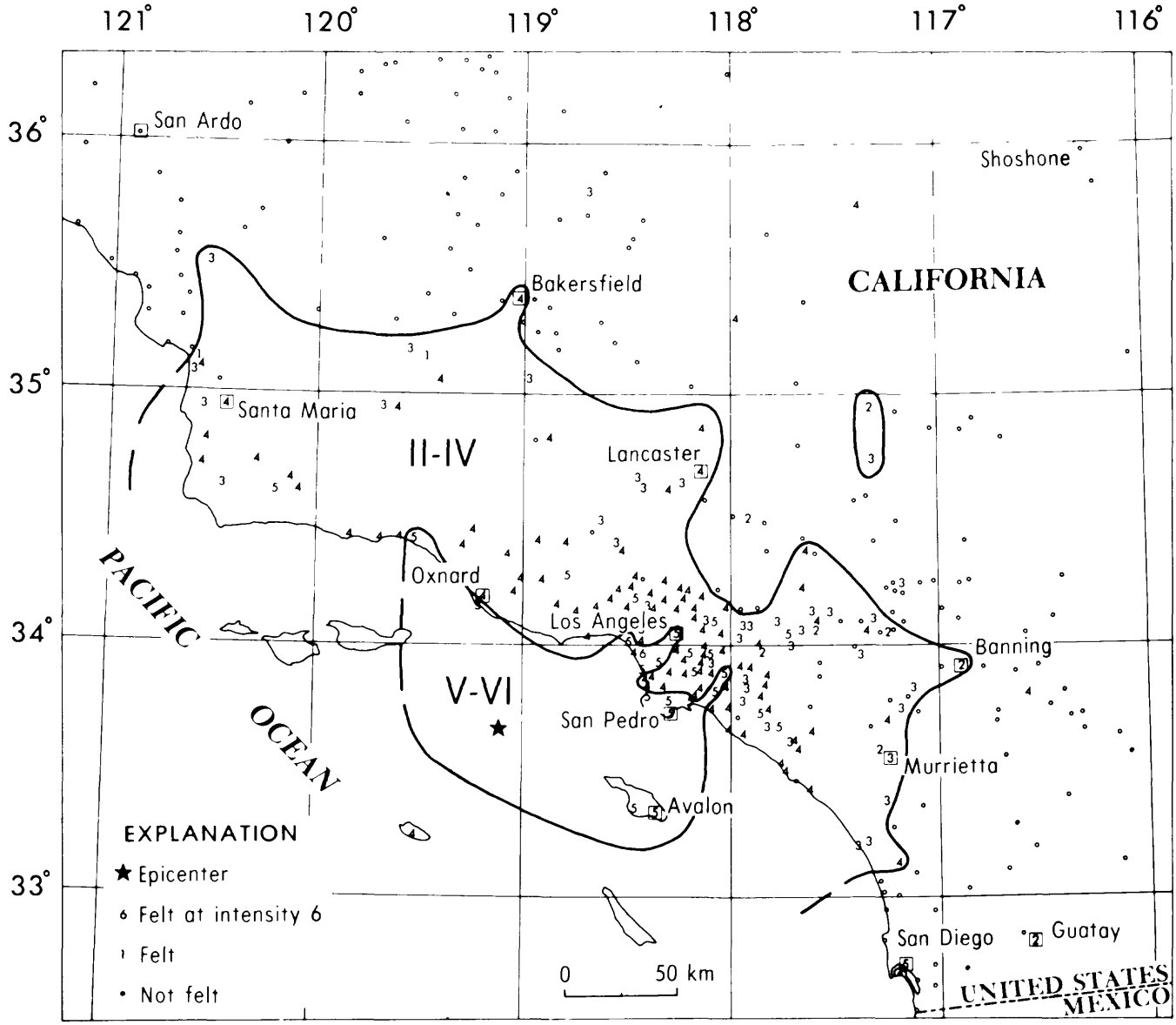

FIGURE 14.--Isoseismal map for the southern California earthquake of 4 September 1981, 15 50 50.3 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

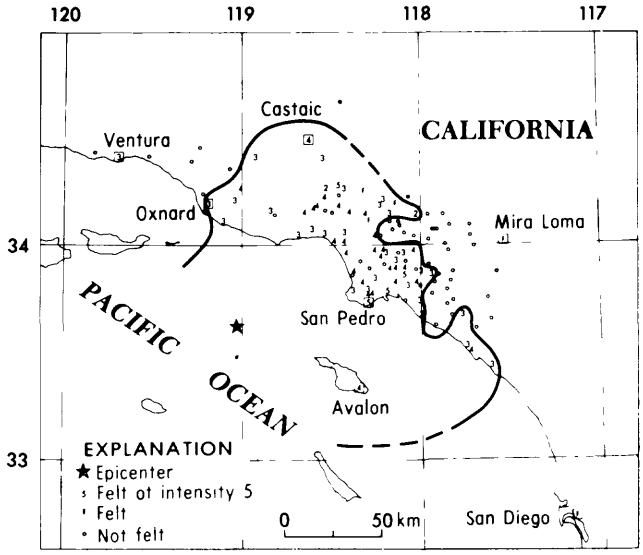

FIGURE 15.--Intensity map for the southern California earthquake of 23 October 1981, 17 28 16.9 UTC. Arabic numerals are used to represent Modified Mercalli intensities at specific sites.

CALIFORNIA--Off the coast--Continued

rieta, New Cuyama, North Hollywood, Oceano, Oceanside, Ontario, Posey, Quartz Hill, Riverside, Romoland, San Bernardino, San Diego, San Diego Naval Air Station, San Fernando, San Gabriel, San Joaquin, San Luis Rey, Santa Fe Springs, Saugus, Skyforest, Stanton, Sunset Beach, Woodland Hills.

Intensity II: Banning, Bryn Mawr, Diamond Bar, Guasti, Guatay, March Air Force Base, Pearblossom, Pine Valley, South Whittier, Wildomar.

Felt: Arroyo Grande (press report), Taft (press report).

5 September (P) Southern California
Origin time: 00 41 48.4
Epicenter: 33.63 N., 119.11 W.
Depth: 8 km
Magnitude: 3.8 ML(P)

Felt at Santa Monica (P).

11 September (P) Southern California
Origin time: 05 58 24.0
Epicenter: 33.73 N., 119.19 W.
Depth: 6 km
Magnitude: 3.9 ML(P)

Felt at Agoura (P).

CALIFORNIA--Off the coast--Continued

16 September (B) Northern California
Origin time: 12 41 14.2
Epicenter: 40.31 N., 124.61 W.
Depth: 25 km
Magnitude: 4.8 mb(G), 3.9 MS(G), 4.7 ML(B)

Intensity V: The most common effects at the places listed below were few small objects overturned and fell; windows, doors, and dishes rattled; felt by and awakened many.
Miranda, Redway, Weott (few windows cracked, hairline cracks in plaster and dry wall), Whitehorn.

Intensity IV: Alderpoint, Branscomb, Bridgeville, Carlotta, Eureka, Garberville, Leggett, Loleta, Miranda, Phillipsville, Piercy, Redcrest, Rio Dell, Salmon Creek Road, Scotia.

Intensity III: Blue Lake, Fields Landing.

Felt: Ferndale (B), Petrolia (B).

16 September (B) Northern California
Origin time: 12 45 58.5
Epicenter: 40.24 N., 124.53 W.
Depth: 21 km
Magnitude: 3.6 ML(B)

Felt in the coastal areas (B).

21 September (P) Southern California
Origin time: 10 08 08.5
Epicenter: 33.64 N., 119.04 W.
Depth: 12 km
Magnitude: 3.1 ML(P)

Felt at Los Angeles (P).

23 October (P) Southern California
Origin time: 17 28 16.9
Epicenter: 33.63 N., 119.02 W.
Depth: 12 km
Magnitude: 4.7 mb(G), 4.6 ML(P), 4.3 ML(B)

This earthquake was felt over approximately 6,000 km^2 of the land area of Los Angeles, Orange, and Ventura Counties (fig. 15).

Intensity V: The most common effects at the places listed below were few small objects overturned and fell, water splashed onto sides of lakes and swimming pools, and felt by many.
Artesia (hairline cracks in plaster and drywall), Long Beach, Mission Hills, San Pedro.

Intensity IV: Avalon, Bellflower, Calabasas, Canoga Park, Castaic, Cole, Culver City, Cypress, Glendale, Huntington Park, Laguna Niguel, Lakewood, Lawndale, Lomita,

Los Angeles, Manhattan Beach, Marina del Rey, Maywood, North Hollywood, Northridge, Norwalk, Paramount, Reseda, San Fernando, Santa Monica, Somis, Southgate, Torrance, Universal City, Van Nuys, Venice, Whittier, Wilmington.
Intensity III: Arleta, Bell, Beverly Hills, Buena Park, Calabasas Park, Camarillo, Compton, Downey, El Camino College, East Irvine, Fillmore, Florence, Fullerton, Harbor City, Huntington Beach, La Canada, Los Alamitos, Malibu, Montrose, Oxnard, Pacific Palisades, Palos Verdes Peninsula, Pasadena, Point Mugu, Redondo Beach, San Clemente, Saugus, Sepulveda, South Laguna, South Whittier, Thousand Oaks, Topanga, Ventura, Westminster.
Intensity II: Arcadia, Granada Hills, Santa Barbara (press report), Sun Valley, Sunland.
Felt: Altadena (press report), Mira Loma (press report), San Diego (P).

23 October (P) Southern California
Origin time: 19 15 52.5
Epicenter: 33.64 N., 119.06 W.
Depth: 6 km
Magnitude: 4.6 mb(G), 4.6 ML(P), 4.3 ML(B)

This event occurred in the same region as the one at 17 28 16.9, listed above, with about the same magnitude and felt over a similar area. Most reports tend to describe the effects as a repeat of the earlier shaking which had a maximum intensity of V.

Intensity IV: San Juan Capistrano.
Intensity III: Costa Mesa, Glendale, Laguna Niguel, Ventura.
Felt: Burbank (P) La Brea (P), Mira Loma (press report), Oxnard (press report), Pasadena (P), San Diego (press report), Santa Barbara (press report), Santa Monica (press report), Studio City (P), Valencia (press report).

4 November (P) Southern California
Origin time: 11 54 56.1
Epicenter: 33.91 N., 118.64 W.
Depth: 6 km
Magnitude: 2.7 ML(P)

Felt at Los Angeles (P).

11 November (B) Northern California
Origin time: 17 46 08.9
Epicenter: 40.31 N., 124.64 W.
Depth: 24 km
Magnitude: 3.7 mb(G), 4.0 ML(B)

CALIFORNIA--Off the coast--Continued

Intensity IV: Whitehorn.
Intensity III: Alderpoint, Fields Landing, Honeydew.

11 December (P) Southern California
Origin time: 18 42 19.5
Epicenter: 33.68 N., 119.11 W.
Depth: 10 km
Magnitude: 2.8 ML(P)

Felt in the beach area of Santa Monica (press report).

14 December (P) Southern California
Origin time: 11 32 59.3
Epicenter: 33.70 N., 119.15 W.
Depth: 5 km
Magnitude: 3.9 ML(P)

Felt in the beach area of Santa Monica (press report).

COLORADO

24 March (G) Northern Colorado
Origin time: 13 03 40.0
Epicenter: 39.75 N., 104.94 W.
Depth: 5 km
Magnitude: 2.8 ML(G)

Felt in the Thornton-Northglenn area (press report).

2 April (Z) Northern Colorado
Origin time: 16 10 06.4
Epicenter: 39.91 N., 104.95 W.
Depth: 9 km
Magnitude: 4.3 mb(G), 3.8 ML(G), 4.5 Mn(T)

This earthquake was felt over approximately 7,000 km^2 of Denver and the surrounding area (figs. 16 and 17). It is located in the area of the 1967 Rocky Mountain Arsenal earthquakes. Five aftershocks were located by Bollinger and others (1982).

Intensity VI:
Commerce City--At the Adams City Senior High School there were many large cracks in the plaster walls of the second floor in the section of the building that was built in the 1930's. Cracks occurred both at corners and in the center of the walls. One diagonal crack extended through the wall into the next classroom.
Thornton--The most common effects reported were hairline cracks in plaster and

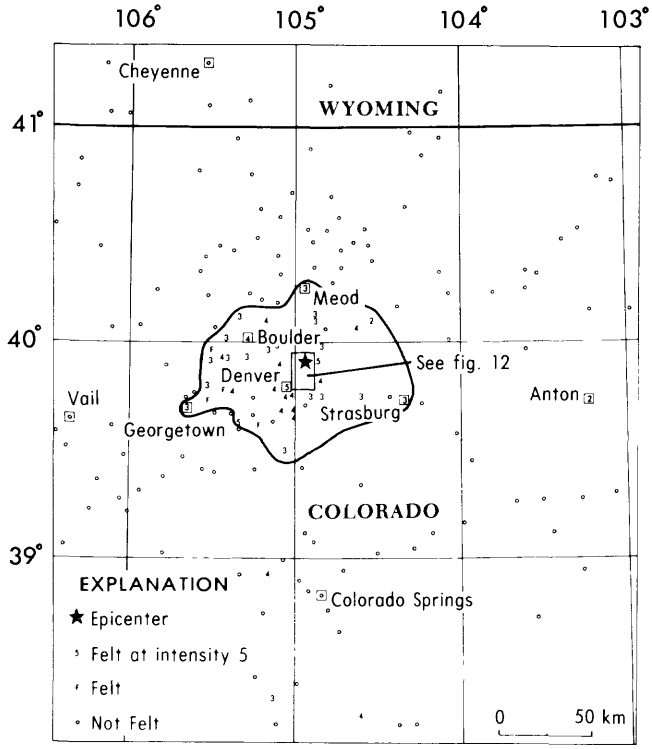

FIGURE 16.--Intensity map for the northern Colorado earthquake of 2 April 1981, 16 10 06.4 UTC. Arabic numerals are used to represent these intensities at specific sites.

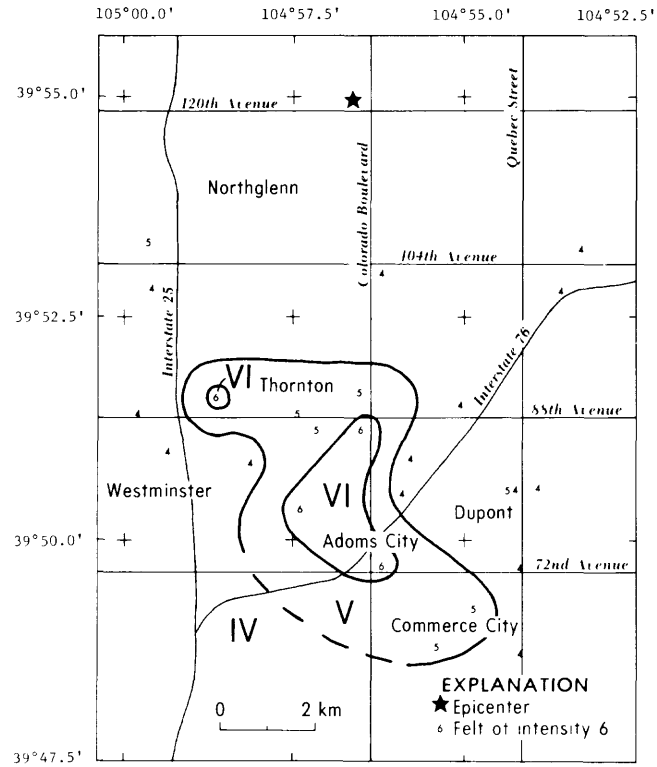

FIGURE 17.--Isoseismal map for the epicentral area of the northern Colorado earthquake of 2 April 1981, 16 10 06.4 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

drywall, hanging pictures fell, buildings shook strongly, and felt by many. The Thornton City Hall had 2-foot-long hairline cracks in the basement walls and the fire alarms were tripped. At KR Lighting Supply, across from the Thornton City Hall, built in the 1950's, there were cracks in the east and west facing walls (cinderblock) and cracks that followed the mortar seams around windows and doors. Part of the west facing wall was also slightly pushed outward. One window was cracked. The Thornton vehicle maintenance shop, located at the site of the old sewage disposal plant on East 88th Avenue, had 1/4" cracks between the juncture of the ceiling and a circular reinforced concrete wall and had many cracks in the wallboard at the corners of doorways where there were joints. At the Number 1 Auto Parts Store at 2401 E. 88th Avenue many items fell onto the floor. One employee who lived 3 blocks away said all his wife's plants were knocked to the floor.

Between Commerce City and Thornton at York Street and East 78th Avenue the Assumption Catholic School had cracks in the plaster walls of some of the classrooms.

Intensity V: The most common effects at the places listed below were few small objects overturned and fell; few items thrown from store shelves; windows, doors, and dishes rattled; and hanging objects swung slightly.

Adams City.

Commerce City (Suspended ceiling tiles fell at the Metropolitan National Bank at 6565 East 73rd; and there was damage at a store at 64th Avenue and Ivy Street).

Denver (4301 W. 53rd Avenue).

Evergreen.

Henderson.

Northglenn (few windows cracked and hairline cracks in plaster walls).

Thornton (Meadows Elementary School at Monroe and East 91st Avenue).

Intensity IV: Arvada, Boulder, Broomfield, Denver (Loretto, Montclair, 3003 Tejon Street, Westwood, Windsor Gardens), Divide, Dupont (Post Office, service station at Rosemary Street and East 80th Avenue, store at Olive Street and East 80th Avenue), Eastlake, Edgewater, Englewood, Golden Gate Canyon, Hazeltine Heights, Hudson, Lakewood (press report), Mesa, Niwot, Pinecliffe, Rocky Mountain Arsenal, Thornton (104th Avenue and Riverdale Road).
Intensity III: Aurora, Boulder Canyon (6 miles west of Boulder--telephone report), Brighton, Central City, Golden (Coal Creek Canyon) Dacono, Denver (Alcott, Cherry Creek, Downtown, Merchandise Mart, North Pecos, Park Hill), Eagle, Eldorado Springs, Erie, Firestone, Georgetown, Golden, Jamestown, Lafayette, Lakewood, Louisville, Louviers, Lowry Air Force Base, Mead, Rollinsville, Strasburg, Sugarloaf Road in Boulder County (telephone report), Watkins, Wondervu.
Intensity II: Anton, Keenesburg.
Felt: Black Hawk (telephone report), Eldorado Canyon (telephone report), Idaho Springs (press report), Nederland (telephone report), Stapleton International Airport (press report), Westminster (telephone report).

16 September (G) Northern Colorado
Origin time: 19 58 38.9
Epicenter: 39.88 N., 104.91 W.
Depth: 5 km
Magnitude: 2.1 ML(G)
Intensity IV: Denver (Park Hill--press report).
Felt: Commerce City, Thornton, and parts of Denver (press report).

2 November (G) Central Colorado
Origin time: 03 03 00.2
Epicenter: 39.52 N., 105.30 W.
Depth: 1 km
Magnitude: 2.8 ML(G), 3.1 Mn(T)
Intensity V: Morrison--South Turkey Creek Canyon about 3 miles east of Aspen Park (few cracked windows and broken glassware, few small objects overturned and fallen, felt by many).
Pine Junction--about 4 miles southwest of Conifer (few small objects overturned and fallen, hanging pictures out of place, felt by many).
Intensity IV: Aspen Park, Bailey, Conifer, Double Header Mountain Estates (3 miles east of Aspen Park), Elk Creek Fire Station (near Conifer), Evergreen (2 reports of small objects overturned and fallen), 5 miles southwest of Evergreen, Littleton (Critchell and McKinney Ranch subdivision), Morrison (town), Morrison (8 miles southwest on Highway 285), Morrison (the Homestead Mountain area), Phillipsburg (and 3 miles south), Pine, Shaffer's Crossing (4 miles southwest of Conifer), Tiny Town.
Intensity III: Bailey (1 mile south and 3 miles northeast), Elk Creek Meadows (near Bailey), Evergreen (1 mile southeast, 3.2 miles southwest, and 4 miles southwest), Foxton, Idledale, Indian Hills, Kittredge, Morrison (Hilldale Pines), Phillipsburg (5 miles south), Shawnee.
Intensity II: Golden, Golden (Lookout Mountain).
Felt: Idaho Springs, (press report).

9 December Central Colorado
Origin time: 02 45 36.2
Epicenter: Not located.
Depth: None computed.
Magnitude: None computed.

This earthquake is an aftershock of the event on November 2. It was felt at Evergreen.

CONNECTICUT

4 August (J) Southern Connecticut
Origin time: 02 01 37.2
Epicenter: 41.54 N., 72.47 W.
Depth: 0 km
Magnitude: 2.2 Mn(J)

This earthquake is the largest of a series of 500 events detected near Moodus, Connecticut from August through October (Ebel and others, 1982). Some of the events with magnitudes less than 1 were felt.

Intensity III: Moodus

21 October (J) Long Island Sound
Origin time: 16 49 06.7

See New York listing.

HAWAII

2 January (H) Island of Hawaii
Origin time: 17 42 08.0
Epicenter: 19.30 N., 155.23 W.

Depth: 10 km
Magnitude: 3.6 ML(H)
Intensity II: Hilo, Papaikou, Volcano.

3 January (H) Island of Hawaii
Origin time: 13 04 40.1
Epicenter: 20.26 N., 155.78 W.
Depth: 28 km
Magnitude: 3.9 ML(H)
Intensity III: Ahualoa, Kohala.
Intensity II: Kamuela.

7 January (H) Island of Hawaii
Origin time: 04 14 05.4
Epicenter: 18.90 N., 155.12 W.
Depth: 52 km
Magnitude: 4.1 ML(H)
Intensity III: Hilo.

12 January (H) Island of Hawaii
Origin time: 14 18 10.6
Epicenter: 19.36 N., 155.30 W.
Depth: 31 km
Magnitude: 4.4 mb(G), 4.5 ML(H)

Felt on the islands of Hawaii, Maui, Molokai, and Oahu.

Intensity V: Hilo, Kapapala, Volcano.
Intensity IV: Captain Cook, Hakalau, Hawi, Holualoa, Honokaa, Honomu, Kapaau, Keaau, Kurtistown, Laupahoehoe, Mountain View, Naalehu, Ninole, Ookala, Pahala, Papaaloa, Papaikou, Pepeekeo, Puna areas.
Intensity III: Kohala, Kona, Kualapuu, Paauhau, Paauilo, Paia, Honalo.
Intensity II: Island of Oahu.

12 January (H) Island of Hawaii
Origin time: 14 30 17.1
Epicenter: 19.29 N., 155.31 W.
Depth: 33 km
Magnitude: 4.0 ML(H)
Intensity IV: Hilo, Kapapala, Volcano.
Intensity III: Pahala, Puna areas.
Intensity II: Honokaa, Kohala, Kona.

12 January (H) Island of Hawaii
Origin time: 15 07 48.9
Epicenter: 19.33 N., 155.28 W.
Depth: 33 km
Magnitude: 4.0 ML(H)
Intensity IV: Hilo, Kapapala, Volcano.
Intensity III: Pahala, Puna areas.
Intensity II: Honokaa, Kohala, Kona.

12 January (H) Island of Hawaii
Origin time: 21 21 41.1
Epicenter: 19.52 N., 155.30 W.
Depth: 33 km
Magnitude: 4.1 mb(G), 4.3 ML(H)

HAWAII--Continued

Intensity IV: Bradshaw Army Airfield, Hilo, Kapapala, Volcano.
Intensity III: Pahala, Puna areas.
Intensity II: Honokaa, Kamuela, Kohala, Kona.

14 January (H) Island of Hawaii
Origin time: 04 13 31.5
Epicenter: 19.35 N., 155.26 W.
Depth: 15 km
Magnitude: 3.1 ML(H)
Intensity III: Volcano.
Intensity II: Glenwood, Keokea.

14 January (H) Island of Hawaii
Origin time: 04 20 16.5
Epicenter: 19.37 N., 155.32 W.
Depth: 29 km
Magnitude: 4.5 mb(G), 4.3 ML(H)

The earthquake may have been the cause of a break in a main water line in Ainako. Some shear pins in the United Kingdom telescope atop Mauna Kea were broken (press report).

Intensity V: Hilo, Pahala, Puna areas, Volcano.
Intensity IV: Ahualoa, Hamakua, Honokaa, Kamuela, Kona, Punaluu.
Intensity III: Kohala.

16 January (H) Island of Hawaii
Origin time: 00 37 12.0
Epicenter: 19.32 N., 155.29 W.
Depth: 34 km
Magnitude: 3.8 ML(H)
Intensity V: Hilo, Volcano.
Intensity IV: Hamakua, Kau, Puna areas.
Intensity III: Kamuela, Kona.

18 January (H) Island of Hawaii
Origin time: 11 25 53.5
Epicenter: 19.42 N., 155.28 W.
Depth: 2 km
Magnitude: 3.4 ML(H)
Intensity V: Hawaii Volcanoes National Park, Volcano.

20 January (H) Island of Hawaii
Origin time: 04 21 40.4
Epicenter: 19.31 N., 155.22 W.
Depth: 9 km
Magnitude: 3.0 ML(H)
Intensity II: Hilo.

22 January (H) Island of Hawaii
Origin time: 13 39 02.5
Epicenter: 19.78 N., 156.03 W.
Depth: 41 km

Magnitude: 3.8 ML(H)
Intensity III: Kona.

25 January (H) Island of Hawaii
Origin time: 01 30 34.5
Epicenter: 19.36 N., 155.25 W.
Depth: 9 km
Magnitude: 3.4 ML(H)
Intensity II: Volcano.

9 February (H) Island of Hawaii
Origin time: 16 02 44.0
Epicenter: 19.54 N., 155.62 W.
Depth: 11 km
Magnitude: 3.8 ML(H)
Intensity III: Kona, Volcano Golf Course.

14 February (H) Island of Hawaii
Origin time: 05 52 44.2
Epicenter: 19.30 N., 155.39 W.
Depth: 6 km
Magnitude: 3.3 ML(H)
Intensity IV: Kapapala.
Intensity III: Pahala, Volcano.

1 March (H) Island of Hawaii
Origin time: 17 01 21.3
Epicenter: 19.36 N., 155.03 W.
Depth: 9 km
Magnitude: 4.7 mb(G), 4.3 ML(H)
Intensity IV: Hilo, Volcano.
Intensity III: Hawaiian Ocean View Estates, Kau, Kona, Papaikou, Puna areas.

5 March (H) Island of Hawaii
Origin time: 01 56 45.7
Epicenter: 19.42 N., 155.47 W.
Depth: 11 km
Magnitude: 4.1 ML(H)
Intensity IV: Hawaiian Volcano Observatory, Volcano.
Intensity III: Hilo, Pahala, Puna areas.
Intensity II: Hawaiian Ocean View Estates, Kona, Papaikou.

5 March (H) Island of Hawaii
Origin time: 02 00 27.2
Epicenter: 19.42 N., 155.47 W.
Depth: 11 km
Magnitude: 3.4 ML(H)
Intensity III: Volcano.

5 March (G) Near Island of Molokai
Origin time: 14 09 40.8
Epicenter: 21.43 N., 156.80 W.
Depth: 0 km
Magnitude: 5.0 mb(G), 5.1 ML(H)

The press reported four breaks and some cracks in the pipe that carries water from Waikolu Valley to Kalaupapa.

HAWAII--Continued

Intensity VI:
Molokai--Near Kalaupapa (cracked underground water pipes).
Intensity V: The most common effects at the places listed below were few items thrown from store shelves, few small objects overturned and fell, glassware and dishes broken, hanging pictures swung, felt by and awakened many.
Molokai--Hoolehua, Kualapuu, Kaunakakai (press report).
Oahu--Honolulu (Wailae-Kahala, Waikiki), Kailua, Waihiawa.
Intensity IV:
Hawaii--Hawi, Honokaa, Kurtistown, Mountainview.
Lanai--Lanai City.
Maui--Kahului, Lahaina, Pukalani, Wailuku.
Oahu--Aiea, Ewa Beach, Honolulu (Aina Haina, Makiki), Kaneohe, Kunia, Laie, Waianae.
Intensity III:
Hawaii--Papaikou, Waimea.
Oahu--Hauula, Kahuku, Waialua.
Intensity II:
Hawaii--Captain Cook, Kapaau, Volcano.

6 March (G) Near Island of Molokai
Origin time: 02 43 36.4
Epicenter: 21.16 N., 156.91 W.
Depth: 0 km
Magnitude: 4.5 mb(G), 4.9 ML(H)
Intensity III: Island of Molokai.
Felt: Honolulu.

7 March (H) Island of Hawaii
Origin time: 03 56 00.7
Epicenter: 19.74 N., 156.44 W.
Depth: 15 km
Magnitude: 4.0 ML(H)
Intensity IV: Kona.
Intensity III: Waimea.

9 March (H) Island of Hawaii
Origin time: 13 27 45.2
Epicenter: 19.35 N., 155.05 W.
Depth: 9 km
Magnitude: 3.3 ML(H)
Intensity III: Hilo.
Intensity II: Mountain View.

11 March (H) Island of Hawaii
Origin time: 23 23 09.0
Epicenter: 19.37 N., 155.03 W.
Depth: 6 km
Magnitude: 3.1 ML(H)
Intensity III: Hilo.

12 March (H) Island of Hawaii
Origin time: 08 37 44.9

Epicenter: 19.25 N., 155.03 W.
Depth: 44 km
Magnitude: 3.7 ML(H)
Intensity III: Glenwood, Hilo, Volcano.

15 March (H) Island of Hawaii
Origin time: 08 23 21.3
Epicenter: 19.37 N., 155.23 W.
Depth: 31 km
Magnitude: 3.2 ML(H)
Intensity III: Hilo, Volcano.

16 March (H) Island of Hawaii
Origin time: 06 17 19.6
Epicenter: 19.37 N., 155.23 W.
Depth: 31 km
Magnitude: 4.0 ML(H)
Intensity IV: Hawaii Volcanoes National Park, Hilo.
Intensity III: Glenwood, Mountain View, Pahala, Volcano.
Intensity II: Nanawali, Waimea.

25 March (H) Island of Hawaii
Origin time: 16 25 05.3
Epicenter: 19.76 N., 155.47 W.
Depth: 17 km
Magnitude: 3.3 ML(H)
Intensity III: Waimea.
Intensity II: Hilo.

26 March (H) Island of Hawaii
Origin time: 11 55 40.2
Epicenter: 19.35 N., 155.08 W.
Depth: 9 km
Magnitude: 3.2 ML(H)
Intensity II: Hilo.

30 March (H) Island of Hawaii
Origin time: 19 06 14.0
Epicenter: 19.33 N., 155.33 W.
Depth: 9 km
Magnitude: 3.6 ML(H)
Intensity III: Hawaii Volcanoes National Park.

18 April (H) Island of Hawaii
Origin time: 06 26 19.4
Epicenter: 19.34 N., 155.28 W.
Depth: 2 km
Magnitude: 3.7 ML(H)
Intensity III: Volcano.

23 April (H) Island of Hawaii
Origin time: 13 44 34.2
Epicenter: 19.38 N., 155.07 W.
Depth: 9 km
Magnitude: 3.4 ML(H)
Intensity III: Hilo.
Intensity II: Papaikou.

HAWAII--Continued

27 April (H) Island of Hawaii
Origin time: 21 29 21.5
Epicenter: 19.27 N., 155.19 W.
Depth: 3 km
Magnitude: 3.4 ML(H)
Intensity III: Hilo.

28 April (H) Island of Hawaii
Origin time: 18 46 29.3
Epicenter: 19.32 N., 155.18 W.
Depth: 10 km
Magnitude: 3.0 ML(H)
Intensity III: Hilo.

30 April (H) Island of Hawaii
Origin time: 11 15 33.4
Epicenter: 19.39 N., 155.28 W.
Depth: 3 km
Magnitude: 3.1 ML(H)
Intensity IV: Hawaii Volcanoes National Park.
Intensity III: Volcano.

2 May (H) Island of Hawaii
Origin time: 12 36 07.5
Epicenter: 19.30 N., 155.22 W.
Depth: 11 km
Magnitude: 3.8 ML(H)
Intensity III: Hilo, Keaau, Papaikou.

2 May (H) Island of Hawaii
Origin time: 17 10 46.3
Epicenter: 19.33 N., 155.13 W.
Depth: 9 km
Magnitude: 3.2 ML(H)
Intensity II: Hilo.

7 May (H) Island of Hawaii
Origin time: 12 47 59.7
Epicenter: 19.33 N., 155.22 W.
Depth: 9 km
Magnitude: 3.2 ML(H)
Intensity II: Volcano.

14 May (H) Island of Hawaii
Origin time: 21 16 06.8
Epicenter: 19.35 N., 155.22 W.
Depth: 9 km
Magnitude: 3.0 ML(H)
Intensity III: Volcano.

17 May (H) Island of Hawaii
Origin time: 19 21 45.6
Epicenter: 19.33 N., 155.23 W.
Depth: 10 km
Magnitude: 3.2 ML(H)
Intensity II: Volcano.

25 May (H) Island of Hawaii
Origin time: 12 11 19.1
Epicenter: 19.33 N., 155.22 W.

Depth: 9 km
Magnitude: 3.1 ML(H)
Intensity III: Volcano.

6 June (H) Island of Hawaii
Origin time: 20 32 25.2
Epicenter: 19.39 N., 155.28 W.
Depth: 3 km
Magnitude: 3.1 ML(H)
Intensity III: Hawaiian Volcano Observatory.

9 June (H) Island of Hawaii
Origin time: 07 12 07.8
Epicenter: 19.36 N., 155.12 W.
Depth: 8 km
Magnitude: 3.4 ML(H)
Intensity III: Volcano.

16 June (H) Island of Hawaii
Origin time: 01 43 22.7
Epicenter: 19.35 N., 155.22 W.
Depth: 10 km
Magnitude: 3.5 ML(H)
Intensity III: Volcano.

30 June (H) Island of Hawaii
Origin time: 21 46 25.7
Epicenter: 19.32 N., 155.22 W.
Depth: 11 km
Magnitude: 3.5 ML(H)
Intensity II: Hawaiian Volcano Observatory, Hilo, Pahoa, Volcano.

2 July (H) Island of Hawaii
Origin time: 12 31 54.7
Epicenter: 19.32 N., 155.19 W.
Depth: 10 km
Magnitude: 3.6 ML(H)
Intensity III: Hilo, Papaikou, Volcano.

3 July (H) Island of Hawaii
Origin time: 23 28 42.6
Epicenter: 19.39 N., 155.28 W.
Depth: 3 km
Magnitude: 3.1 ML(H)
Intensity IV: Hawaiian Volcano Observatory.
Intensity II: Volcano.

20 July (H) Island of Hawaii
Origin time: 16 12 46.4
Epicenter: 19.33 N., 155.22 W.
Depth: 10 km
Magnitude: 3.9 ML(H)
Intensity IV: Hilo.
Intensity III: Pahala, Volcano.
Intensity II: Captain Cook, Kealakekua.

21 July (H) Island of Hawaii
Origin time: 17 59 16.5
Epicenter: 19.27 N., 155.45 W.
Depth: 10 km

HAWAII--Continued

Magnitude: 3.9 ML(H)
Intensity IV: Pahala.
Intensity III: Hawaiian Ocean View Estates, Hilo, Volcano.
Intensity II: Captain Cook.

28 July (H) Island of Hawaii
Origin time: 03 15 16.0
Epicenter: 19.32 N., 155.19 W.
Depth: 10 km
Magnitude: 3.3 ML(H)
Intensity III: Volcano.

28 July (H) Island of Hawaii
Origin time: 20 00 44.9
Epicenter: 19.34 N., 155.03 W.
Depth: 9 km
Magnitude: 4.1 ML(H)
Intensity V: Kalapana, Wahaula.
Intensity IV: Glenwood, Hawaiian Acres, Paradise Park.

28 July (H) Island of Hawaii
Origin time: 20 18 33.9
Epicenter: 19.37 N., 155.03 W.
Depth: 8 km
Magnitude: 3.3 ML(H)
Intensity IV: Puna.
Intensity III: Glenwood, Hilo.

30 July (H) Island of Hawaii
Origin time: 01 57 50.0
Epicenter: 19.36 N., 155.25 W.
Depth: 10 km
Magnitude: 3.4 ML(H)
Intensity II: Volcano.

2 August (H) Island of Hawaii
Origin time: 18 48 16.2
Epicenter: 20.11 N., 155.78 W.
Depth: 23 km
Magnitude: 3.0 ML(H)
Intensity III: Ahualoa.

4 August (H) Island of Hawaii
Origin time: 17 47 50.6
Epicenter: 19.47 N., 155.45 W.
Depth: 9 km
Magnitude: 3.0 ML(H)
Intensity II: Hawaiian Volcano Observatory.

10 August (H) Island of Hawaii
Origin time: 15 32 19.6
Epicenter: 19.38 N., 155.27 W.
Depth: 1 km
Magnitude: 3.1 ML(H)
Intensity III: Volcano.

10 August (H) Island of Hawaii
Origin time: 15 42 09.4
Epicenter: 19.38 N., 155.28 W.

Depth: 2 km
Magnitude: 4.2 ML(H)
Intensity IV: Hawaii Volcanoes National Park, Volcano.

10 August (H) Island of Hawaii
Origin time: 16 05 58.2
Epicenter: 19.38 N., 155.27 W.
Depth: 2 km
Magnitude: 3.1 ML(H)
Intensity III: Volcano.

10 August (H) Island of Hawaii
Origin time: 16 23 39.3
Epicenter: 19.31 N., 155.28 W.
Depth: 5 km
Magnitude: 3.6 ML(H)
Intensity III: Volcano.
Intensity II: Hilo.

10 August (H) Island of Hawaii
Origin time: 17 23 12.9
Epicenter: 19.32 N., 155.34 W.
Depth: 8 km
Magnitude: 3.4 ML(H)
Intensity III: Pahala.
Intensity II: Volcano.

10 August (H) Island of Hawaii
Origin time: 17 47 51.7
Epicenter: 19.31 N., 155.35 W.
Depth: 1 km
Magnitude: 3.4 ML(H)
Intensity III: Pahala.
Intensity II: Volcano.

10 August (H) Island of Hawaii
Origin time: 18 20 08.7
Epicenter: 19.32 N., 155.35 W.
Depth: 5 km
Magnitude: 4.4 mb(G), 4.2 ML(H)
Intensity IV: Pahala.
Intensity III: Hawaii Volcanoes National Park, Volcano.
Felt: Hilo.

10 August (H) Island of Hawaii
Origin time: 18 41 40.0
Epicenter: 19.33 N., 155.33 W.
Depth: 3 km
Magnitude: 3.1 ML(H)
Intensity III: Pahala.

10 August (H) Island of Hawaii
Origin time: 19 40 35.0
Epicenter: 19.31 N., 155.36 W.
Depth: 4 km
Magnitude: 4.7 mb(G), 4.5 ML(H)
Intensity IV: Pahala.
Intensity III: Volcano.

HAWAII--Continued

10 August (H) Island of Hawaii
Origin time: 20 43 59.0
Epicenter: 19.33 N., 155.31 W.
Depth: 6 km
Magnitude: 3.1 ML(H)
Intensity III: Pahala.

10 August (H) Island of Hawaii
Origin time: 23 02 57.8
Epicenter: 19.35 N., 155.34 W.
Depth: 0 km
Magnitude: 3.2 ML(H)
Intensity III: Pahala.

10 August (H) Island of Hawaii
Origin time: 23 29 11.3
Epicenter: 19.30 N., 155.36 W.
Depth: 7 km
Magnitude: 3.6 ML(H)
Intensity III: Pahala.

11 August (H) Island of Hawaii
Origin time: 04 53 46.6
Epicenter: 19.30 N., 155.39 W.
Depth: 5 km
Magnitude: 3.6 ML(H)
Intensity III: Pahala, Volcano.

11 August (H) Island of Hawaii
Origin time: 05 17 17.2
Epicenter: 19.32 N., 155.32 W.
Depth: 4 km
Magnitude: 3.3 ML(H)
Intensity III: Pahala, Volcano.

11 August (H) Island of Hawaii
Origin time: 05 23 43.4
Epicenter: 19.24 N., 155.37 W.
Depth: 3 km
Magnitude: 3.3 ML(H)
Intensity III: Volcano.

12 August (H) Island of Hawaii
Origin time: 04 20 42.4
Epicenter: 19.20 N., 155.35 W.
Depth: 7 km
Magnitude: 3.3 ML(H)
Intensity III: Pahala.

17 August (H) Island of Hawaii
Origin time: 01 14 32.7
Epicenter: 19.40 N., 155.28 W.
Depth: 15 km
Magnitude: 3.4 ML(H)
Intensity III: Glenwood, Hawaii Volcanoes National Park, Hawaiian Volcano Observatory, Volcano.

22 August (H) Island of Hawaii
Origin time: 22 05 20.3
Epicenter: 20.18 N., 156.43 W.

Depth: 10 km
Magnitude: 4.3 mb(G), 4.4 ML(H)
Intensity IV:
Island of Maui--Kahului, Wailuku.
Intensity III:
Island of Hawaii--Ahualoa, Kamuela, Kohala, Kona.
Island of Maui--Hana, Kula.

7 September (H) Island of Hawaii
Origin time: 08 21 46.2
Epicenter: 19.63 N., 156.02 W.
Depth: 42 km
Magnitude: 3.3 ML(H)
Intensity III: Ahualoa.

7 September (H) Island of Hawaii
Origin time: 08 34 47.6
Epicenter: 19.42 N., 155.29 W.
Depth: 10 km
Magnitude: 3.3 ML(H)
Intensity III: Pahala.

22 September (H) Island of Hawaii
Origin time: 14 49 24.0
Epicenter: 19.33 N., 155.13 W.
Depth: 9 km
Magnitude: 3.3 ML(H)
Intensity III: Hilo.
Felt: Puna (press report).

22 September (H) Island of Hawaii
Origin time: 16 50 23.7
Epicenter: 19.32 N., 155.12 W.
Depth: 10 km
Magnitude: 3.9 ML(H)
Intensity IV: Hilo.
Intensity III: Puna.

27 September (H) Island of Hawaii
Origin time: 11 50 00.6
Epicenter: 19.37 N., 155.42 W.
Depth: 11 km
Magnitude: 3.4 ML(H)
Intensity III: Pahala, South Point.

30 September (H) Island of Hawaii
Origin time: 17 04 45.7
Epicenter: 19.31 N., 155.23 W.
Depth: 10 km
Magnitude: 3.9 ML(H)
Intensity IV: Hawaiian Acres, Hilo.
Intensity III: Pahala.
Intensity II: Hualalai, Volcano.
Felt: North Kohala and Puna (press report).

2 October (H) Island of Hawaii
Origin time: 15 44 34.3
Epicenter: 19.34 N., 155.12 W.
Depth: 9 km

HAWAII--Continued

Magnitude: 3.1 ML(H)
Intensity III: Hilo.

5 October (H) Island of Hawaii
Origin time: 01 42 28.0
Epicenter: 19.28 N., 155.52 W.
Depth: 28 km
Magnitude: 3.7 ML(H)
Intensity III: Pahala.

14 October (H) Island of Hawaii
Origin time: 05 11 22.8
Epicenter: 19.28 N., 155.36 W.
Depth: 9 km
Magnitude: 3.1 ML(H)
Intensity II: Pahala.

15 October (H) Island of Hawaii
Origin time: 00 38 20.5
Epicenter: 20.00 N., 155.67 W.
Depth: 14 km
Magnitude: 3.1 ML(H)
Intensity III: Waimea.

28 October (H) Island of Hawaii
Origin time: 09 33 32.3
Epicenter: 19.38 N., 155.28 W.
Depth: 33 km
Magnitude: 4.2 mb(G), 4.0 ML(H)
Intensity V: Volcano.
Intensity IV: Glenwood, Hilo.
Intensity III: Kona, Pahala.

7 November (H) Island of Hawaii
Origin time: 17 23 46.8
Epicenter: 19.33 N., 155.22 W.
Depth: 10 km
Magnitude: 3.1 ML(H)
Intensity III: Volcano.

10 November (H) Island of Hawaii
Origin time: 13 02 56.6
Epicenter: 19.34 N., 155.22 W.
Depth: 10 km
Magnitude: 5.3 mb(G), 4.4 ML(H)
Intensity V: Hilo, Opihikao (few items thrown from store shelves--press report).
Intensity IV: Glenwood, Volcano.
Intensity III: Pahala.
Intensity II: Captain Cook.

10 November (H) Island of Hawaii
Origin time: 13 31 02.6
Epicenter: 19.34 N., 155.21 W.
Depth: 9 km
Magnitude: 3.4 ML(H)
Intensity III: Hilo.

16 November (H) Island of Hawaii
Origin time: 06 23 59.4
Epicenter: 19.97 N., 155.35 W.

Depth: 10 km
Magnitude: 3.0 ML(H)
Intensity III: Kukaiau, Paauilo.
Intensity II: Ahualoa, Honokaa.

16 November (H) Island of Hawaii
Origin time: 12 26 40.2
Epicenter: 19.96 N., 155.36 W.
Depth: 12 km
Magnitude: 3.4 ML(H)
Intensity III: Kukaiau, Paauilo.
Intensity II: Ahualoa, Honokaa.

19 November (H) Island of Hawaii
Origin time: 08 29 54.8
Epicenter: 19.37 N., 155.48 W.
Depth: 11 km
Magnitude: 3.6 ML(H)
Intensity IV: Pahala.
Intensity III: Hilo, Volcano.

20 November (H) Island of Hawaii
Origin time: 05 32 58.1
Epicenter: 19.96 N., 155.35 W.
Depth: 12 km
Magnitude: 3.8 ML(H)
Intensity VI: Waimea.
Intensity V: Kukuihaele.
Intensity IV: Ahualoa, Honokaa.
Intensity III: Hilo.

20 November (H) Island of Hawaii
Origin time: 17 42 52.4
Epicenter: 19.37 N., 155.08 W.
Depth: 9 km
Magnitude: 3.4 ML(H)
Intensity IV: Kalapana.
Intensity III: Hilo, Volcano.

28 November (H) Island of Hawaii
Origin time: 19 17 18.4
Epicenter: 19.97 N., 155.35 W.
Depth: 10 km
Magnitude: 3.4 ML(H)
Intensity III: Waimea.
Intensity II: Ahualoa.

1 December (H) Island of Hawaii
Origin time: 06 07 09.7
Epicenter: 19.36 N., 155.08 W.
Depth: 9 km
Magnitude: 3.4 ML(H)
Intensity III: Hilo.

7 December (H) Island of Hawaii
Origin time: 19 07 29.1
Epicenter: 19.32 N., 155.22 W.
Depth: 9 km
Magnitude: 3.2 ML(H)
Intensity III: Volcano.

HAWAII--Continued

8 December (H) Island of Hawaii
Origin time: 03 39 27.2
Epicenter: 19.82 N., 156.07 W.
Depth: 41 km
Magnitude: 4.0 ML(H)
Intensity IV: Kona.
Intensity III: Ahualoa, Honokaa.

13 December (H) Island of Hawaii
Origin time: 04 23 13.3
Epicenter: 19.33 N., 155.09 W.
Depth: 10 km
Magnitude: 3.7 ML(H)
Intensity III: Hilo.

14 December (H) Island of Hawaii
Origin time: 00 20 21.3
Epicenter: 19.33 N., 155.14 W.
Depth: 9 km
Magnitude: 3.3 ML(H)
Intensity III: Kurtistown.

17 December (H) Island of Hawaii
Origin time: 06 21 51.5
Epicenter: 19.33 N., 155.12 W.
Depth: 9 km
Magnitude: 3.4 ML(H)
Intensity III: Hilo.

23 December (H) Island of Hawaii
Origin time: 17 11 14.6
Epicenter: 20.10 N., 155.82 W.
Depth: 28 km
Magnitude: 3.0 ML(H)
Intensity II: Ahualoa.

IDAHO

9 February (G) Southeastern Idaho
Origin time: 22 53 36.7
Epicenter: 43.12 N., 111.36 W.
Depth: 5 km
Magnitude: 3.0 ML(G)
Intensity III: Wayan.

14 February (W) Southwestern Washington
Origin time: 06 09 27.2

See Washington listing.

15 April (G) Hebgen Lake region
Origin time: 18 46 37.8
Epicenter: 44.40 N., 111.29 W.
Depth: 5 km
Magnitude: 3.8 ML(G)
Intensity III: West Yellowstone, Montana.

6 May (U) Southwestern Utah
Origin time: 19 26 01.9

IDAHO--Continued

See Wyoming listing.

27 May (G) Southeastern Idaho
Origin time: 05 46 15.9
Epicenter: 42.59 N., 111.73 W.
Depth: 5 km
Magnitude: 3.1 ML(G)
Intensity IV: Grace.

29 September (G) Western Idaho
Origin time: 05 39 48.1
Epicenter: 44.69 N., 116.99 W.
Depth: 5 km
Magnitude: 3.3 ML(G), 3.5 ML(D)
Intensity IV: Cambridge.

30 September (U) Southeastern Idaho
Origin time: 04 17 32.7
Epicenter: 42.54 N., 111.22 W.
Depth: 7 km
Magnitude: 3.7 mb(G), 3.9 ML(G), 3.8 ML(U)
Intensity IV: Bern, Dingle.
Intensity III: Geneva, Georgetown (press report), Ovid, Paris, St. Charles, Thatcher.
Intensity II: Montpelier.

9 December (U) Southeastern Idaho
Origin time: 08 15 05.2
Epicenter: 42.63 N., 111.43 W.
Depth: 7 km
Magnitude: 4.3 mb(G), 4.1 ML(U)
Intensity V: Conda (few items thrown from store shelves, small objects fell, and windows, doors and dishes rattled), Soda Springs (hairline cracks in plaster and drywall, small objects fell and windows, doors and dishes rattled).
Intensity IV: Paris.
Intensity III: Lava Hot Springs.
Intensity II: Pocatello.

9 December (U) Southeastern Idaho
Origin time: 08 43 33.0
Epicenter: 42.64 N., 111.46 W.
Depth: 7 km
Magnitude: 3.2 ML(U)

Felt at Soda Springs.

ILLINOIS

11 February (S) Kentucky-Illinois border region
Origin time: 14 42 57.4

See Kentucky listing.

ILLINOIS--Continued

8 April (S) Southern Illinois
Origin time: 01 53 13.0
Epicenter: 38.87 N., 89.38 W.
Depth: 1 km
Magnitude: 3.5 Mn(S), 3.0 MD(K)

Felt at Greenville and Vandalia (press report).

9 June (S) Southern Illinois
Origin time: 14 15 47.7
Epicenter: 37.82 N., 89.02 W.
Depth: 20 km
Magnitude: 3.4 Mn(S), 3.0 MD(K)
Intensity V: Carterville (a few cracked windows, a few glassware or dishes broken, and a few small objects overturned and fell).
Intensity III: Cobden, Ewing, Herrin, Johnston City, Zeigler.
Intensity II: Thompsonville, Valier.
Felt: Cambria (press report), Carbondale (S), Herrin (S), Marion (press report).

KENTUCKY

14 January (K) Northeastern Kentucky
Origin time: 21 10 33.9
Epicenter: 38.20 N., 83.91 W.
Depth: 11 km
Magnitude: 1.5 MD(K)

This earthquake was felt in East Union, Mount Sterling, North Middletown, and Sherburne and heard in the southeast portions of Nicholas County (press report). It was also felt by a few near Sharpsburg and Owingsville (K).

11 February (S) Kentucky-Illinois border region
Origin time: 14 42 57.6
Epicenter: 37.05 N., 89.13 W.
Depth: 2 km
Magnitude: 2.7 Mn(S)
Intensity IV:
Illinois--Cairo, Mound City.
Kentucky--Barlow, Wickliffe.
Intensity III:
Illinois--Cache, Mounds.
Felt:
Illinois--Unity (press report).
Kentucky--Ballard County (press report), Barton (S), Olmsted (press report).

7 December (V) Eastern Kentucky
Origin time: 20 01 10.6

KENTUCKY--Continued

Epicenter: 37.28 N., 82.91 W.
Depth: 1 km
Magnitude: None Computed.

An explosion in a coal mine about 3 miles south of Topmost. Eight miners were killed (press report).

LOUISIANA

13 February Southern Louisiana
Origin time: 02 15
Epicenter: Not located.
Depth: None computed.
Magnitude: None computed.
Intensity IV: New Iberia.
Intensity III: Gonzales.
Intensity II: Baton Rouge, Saint Amant.

MAINE

4 January (J) Southwestern Maine
Origin time: 09 17 10.2
Epicenter: 43.89 N., 70.01 W.
Depth: 0 km
Magnitude: 2.6 Mn(J), 2.6 Mn(L)

Felt at Brunswick (J).

MASSACHUSETTS

3 April (J) Southeastern Rhode Island
Origin time: 09 24 12.5

See Rhode Island listing.

12 September (J) Southeastern Massachusetts
Origin time: 02 44 45.4
Epicenter: 41.57 N., 70.61 W.
Depth: 3 km
Magnitude: 2.1 Mn(J)
Intensity II: Falmouth.

MISSISSIPPI

7 August (K) Western Tennessee
Origin time: 11 53 41.8

See Tennessee listing.

MISSOURI

25 May (S) Southern Missouri
Origin time: 22 50 18.2
Epicenter: 36.76 N., 91.63 W.
Depth: 1 km
Magnitude: 2.6 Mn(T), 3.0 Mn(S), 2.6 MD(K)
Intensity III: Alton, Brandsville.

7 August (K) Western Tennessee
Origin time: 11 53 41.8

See Tennessee listing.

MONTANA

15 April (G) Hebgen Lake region
Origin time: 18 46 37.8

See Idaho listing.

22 May (G) Yellowstone National Park
Origin time: 07 56 41.0

See Wyoming listing.

NEVADA

1 January (B) California-Nevada border region
Origin time: 18 22 22.5
Epicenter: 38.09 N., 118.56 W.
Depth: 17 km
Magnitude: 4.1 ML(B), 4.0 ML(P)

Felt in the Mono Lake area, California (B).

15 January (E) Southern Nevada
Origin time: 20 25 00.090
Epicenter: 37.09 N., 116.04 W.
Depth: 0 km
Magnitude: 5.6 mb(G), 5.5 ML(B)

Nevada Test Site explosion "BASEBALL" at 37°05'13.52" N., 116°02'41.10" W., surface elevation 1254 m, depth of burial 564 m.

28 January (B) Owens Valley area
Origin time: 20 08 50.7
Epicenter: 38.20 N., 118.34 W.
Depth: 15 km
Magnitude: 4.5 mb(G), 4.6 ML(B), 4.6 ML(P)
Intensity IV:
Nevada--Luning, Mina.
Felt:
California--Mono Lake (B).

5 February (E) Southern Nevada
Origin time: 18 00 00.117
Epicenter: 37.01 N., 116.03 W.
Depth: 0 km
Magnitude: 3.2 ML(G)

Nevada Test Site explosion 'CLAIRETTE' at 37°00'39.22" N., 116°01'55.86" W., surface elevation 1210 m, depth of burial 354 m.

25 February (E) Southern Nevada
Origin time: 15 00 00.8
Epicenter: 37.18 N., 116.08 W.
Depth: 0 km
Magnitude: 3.0 ML(G)

Nevada Test Site explosion "SECO" at 37°10'54.83" N., 116°05'03.29" W., surface elevation 1383 m, depth of burial 229 m.

12 March (G) Southern Nevada
Origin time: 17 28 08.8
Epicenter: 36.03 N., 114.84 W.
Depth: 2 km
Magnitude: 2.8 ML(G)

Felt at Boulder City (telephone report).

13 March (G) Southern Nevada
Origin time: 00 09 06.6
Epicenter: 35.95 N., 114.80 W.
Depth: 2 km
Magnitude: 3.2 ML(G), 3.3 ML(P)

Felt at Boulder City (telephone report).

28 April (B) California-Nevada border region
Origin time: 22 54 49.9
Epicenter: 38.06 N., 118.59 W.
Depth: 10 km
Magnitude: 4.2 mb(G), 4.6 ML(B), 4.8 ML(P)
Intensity IV:
California--Benton, Topaz.
Intensity III:
California--Lee Vining.
Nevada--Goldfield, Hawthorne.
Intensity II:
California--Big Oak Flat.
Felt:
California--Mono Lake (P).

29 April (B) Lake Tahoe area
Origin time: 11 55 52.6
Epicenter: 39.27 N., 119.76 W.
Depth: 7 km
Magnitude: 4.2 ML(B)

Intensity V: The most common effects at the places listed below were few small objects overturned and fell, few items thrown from store shelves, hanging pictures swung.
Nevada--Carson City, Crystal Bay (few windows cracked, hairline cracks in plaster and dry wall), Incline Village.
Intensity IV:
California--Carnelian Bay, Floriston, Iowa Hill, Sierraville, Soda Springs, Truckee.
Nevada--Dayton, Gardnerville, Minden, Reno, Silver City, Virginia City, Washoe City (press report), Yerington.
Intensity II:
California--Kyburz.
Nevada--Smith.
Intensity II:
Nevada--Silver Springs.
Felt:
California--Alta, Auburn (B), Grass Valley (B), South Lake Tahoe (B), Topaz.
Nevada--Glenbrook.

30 April (E) Southern Nevada
Origin time: 14 35 00.0
Epicenter: 37.18 N., 116.09 W.
Depth: 0 km
Magnitude: 3.4 ML(P)

Nevada Test Site explosion "VIDE" at 37°10'38.40" N., 116°05'05.14" W., surface elevation 1373 m, depth of burial 323 m.

7 May (B) California-Nevada border region
Origin time: 01 02 37.9

See California listing.

29 May (E) Southern Nevada
Origin time: 16 00 00.0
Epicenter: 37.10 N., 116.00 W.
Depth: 0 km
Magnitude: 4.2 mb(G), 4.5 ML(B)

Nevada Test Site explosion "ALIGOTE" at 37°06'06.67" N., 116°00'14.63" W., surface elevation 1338 m, depth of burial 320 m.

6 June (E) Southern Nevada
Origin time: 18 00 00.0
Epicenter: 37.30 N., 116.33 W.
Depth: 0 km
Magnitude: 5.5 mb(G), 4.2 MS(G), 5.4 ML(B)

Nevada Test Site explosion "HARZER" at 37°18'12.23" N., 116°19'32.15" W., surface elevation 2100 m, depth of burial 637 m.

10 July (E) Southern Nevada
Origin time: 14 00 00.096
Epicenter: 37.13 N., 116.03 W.

Depth: 0 km
Magnitude: 4.2 ML(B)

Nevada Test Site explosion "NIZA" at 37°07'42.97" N., 116°02'01.59" W., surface elevation 1293 m, depth of burial 341 m.

16 July (E) Southern Nevada
Origin time: 15 00 00.096
Epicenter: 37.09 N., 116.02 W.
Depth: 0 km
Magnitude: 3.3 ML(G)

Nevada Test Site explosion "PINEAU" at 37°05'19.31" N., 116°01'09.73" W., surface elevation 1286 m, depth of burial 204 m.

5 August (E) Southern Nevada
Origin time: 13 41 00.086
Epicenter: 37.15 N., 116.04 W.
Depth: 0 km
Magnitude: 2.8 ML(G)

Nevada Test Site explosion "HAVARTI" at 37°09'13.47" N., 116°02'06.27" W., surface elevation 1310 m, depth of burial 200 m.

27 August (E) Southern Nevada
Origin time: 14 31 00.088
Epicenter: 37.16 N., 116.07 W.
Depth: 0 km
Magnitude: 4.3 ML(B)

Nevada Test Site explosion "ISLAY" at 37°09'37.50" N., 116°03'59.48" W., surface elevation 1323 m, depth of burial 294 m.

4 September (E) Southern Nevada
Origin time: 15 00 00.103
Epicenter: 37.06 N., 116.05 W.
Depth: 0 km
Magnitude: 3.8 ML(B)

Nevada Test Site explosion "TREBIANO" at 37°03'29.11" N., 116°02'53.06" W., surface elevation 1238 m, depth of burial 305 m.

12 September (B) California-Nevada border region
Origin time: 18 12 58.7
Epicenter: 38.09 N., 118.62 W.
Depth: 11 km
Magnitude: 4.4 ML(B), 4.3 ML(P)

Felt in the Mono Lake area (B).

24 September (E) Southern Nevada
Origin time: 15 00 00.089
Epicenter: 37.01 N., 116.02 W.
Depth: 0 km
Magnitude: 3.5 ML(G)

NEVADA--Continued

Nevada Test Site explosion "CERNADA" at 37°00'30.67" N., 116°01'25.68" W., surface elevation 1208 m, depth of burial 213 m.

30 September (G) Western Nevada
Origin time: 03 14 03.5
Epicenter: 39.15 N., 119.59 W.
Depth: 8 km
Magnitude: 3.4 ML(B)
Intensity IV: Carson City.
Intensity III: Minden, Schurz.
Felt: Reno (press report), Virginia City (telephone report).

30 September (B) Owens Valley area
Origin time: 11 53 26.9

See California listing.

30 September (B) Owens Valley area
Origin time: 13 05 48.5

See California listing.

1 October (E) Southern Nevada
Origin time: 19 00 00.103
Epicenter: 37.08 N., 116.01 W.
Depth: 0 km
Magnitude: 4.9 mb(G), 5.0 ML(B), 5.2 ML(P)

Nevada Test Site explosion "PALIZA" at 37°04'53.82" N., 116°00'31.51" W., surface elevation 1287 m, depth of burial 472 m.

4 November (R) Western Nevada
Origin time: 11 47 18.9
Epicenter: 39.42 N., 119.72 W.
Depth: 2 km
Magnitude: 3.3 ML(B)
Intensity V: Reno (few small objects overturned and fell; hanging pictures swung; windows, doors, and dishes rattled).
Intensity III: Silver City.
Intensity II: Carson City.

11 November (E) Southern Nevada
Origin time: 20 00 00.036
Epicenter: 37.08 N., 116.07 W.
Depth: 0 km
Magnitude: 4.8 mb(G), 4.8 ML(B), 5.0 ML(P)

Nevada Test Site explosion "TILCI" at 37°04'34.76" N., 116°04'06.57" W., surface elevation 1259 m, depth of burial 445 m.

12 November (E) Southern Nevada
Origin time: 15 00 00.100
Epicenter: 37.11 N., 116.05 W.

Depth: 0 km
Magnitude: 5.3 mb(G), 4.4 MS(G), 5.5 ML(B), 5.3 ML(P)

Nevada Test Site explosion "ROUSANNE" at 37°06'29.35" N., 116°02'56.31" W., surface elevation 1270 m, depth of burial 518 m.

1 December (B) Western Nevada
Origin time: 16 18 51.0
Epicenter: 38.61 N., 118.07 W.
Depth: 10 km
Magnitude: 4.4 ML(B)
Intensity V: Luning (few items thrown from store shelves, few small objects overturned and fell, buildings trembled strongly, felt by all and awakened many).
Intensity IV: Mina.
Intensity II: Gabbs.

3 December (E) Southern Nevada
Origin time: 15 00 00.098
Epicenter: 37.15 N., 116.07 W.
Depth: 0 km
Magnitude: 4.6 mb(G), 4.9 ML(B)

Nevada Test Site explosion "AKAVI" at 37°08'54.35" N., 116°04'15.01" W., surface elevation 1320 m, depth of burial 494 m.

7 December (B) Western Nevada
Origin time: 07 47 52.7
Epicenter: 38.61 N., 118.22 W.
Depth: 12 km
Magnitude: 4.0 ML(B)
Intensity IV: Luning, Mina.
Intensity III: Hawthorne.

13 December (B) Western Nevada
Origin time: 01 20 01.8
Epicenter: 38.64 N., 118.21 W.
Depth: 10 km
Magnitude: 3.7 ML(B)

Felt at Luning and Mina (B).

16 December (E) Southern Nevada
Origin time: 21 05 00.093
Epicenter: 37.12 N., 116.12 W.
Depth: 0 km
Magnitude: 4.4 mb(G), 4.4 ML(B)

Nevada Test Site explosion "CABOC" at 37°06'52.29" N., 116°07'22.36" W., surface elevation 1375 m, depth of burial 335 m.

19 December (B) Western Nevada
Origin time: 20 56 53.7
Epicenter: 38.62 N., 118.25 W.

Depth: 13 km
Magnitude: 4.3 ML(B)

Felt at Luning and Mina (B).

28 December (G) Southern Nevada
Origin time: 22 45 42.1
Epicenter: 37.21 N., 114.98 W.
Depth: 5 km
Magnitude: 3.6 ML(G)
Intensity IV:
Arizona--Temple Bar.
Nevada--Blue Diamond, Henderson, Las Vegas, North Las Vegas, Pioche.
Utah--Toquerville.
Felt:
Nevada--Alamo and Boulder City (press report).

NEW HAMPSHIRE

28 June (J) Central New Hampshire
Origin time: 22 42 35.1
Epicenter: 43.57 N., 71.55 W.
Depth: 0 km
Magnitude: 3.1 Mn(J), 3.1 Mn(L)

Felt in the Lake Winnisquam region (press report).

NEW MEXICO

9 May (G) Southwestern New Mexico
Origin time: 12 35 50.8
Epicenter: 33.99 N., 107.03 W.
Depth: 5 km
Magnitude: 3.1 ML(G), 2.9 MD(C)
Intensity V: Socorro (hairline cracks in plaster, few small objects overturned, hanging pictures swung).
Intensity III: San Antonio.
Intensity II: Lemitar.

4 December (G) Western New Mexico
Origin time: 08 51 24.2
Epicenter: 34.46 N., 108.23 W.
Depth: 5 km
Magnitude: 2.8 ML(G)

Felt south of Grants (telephone report).

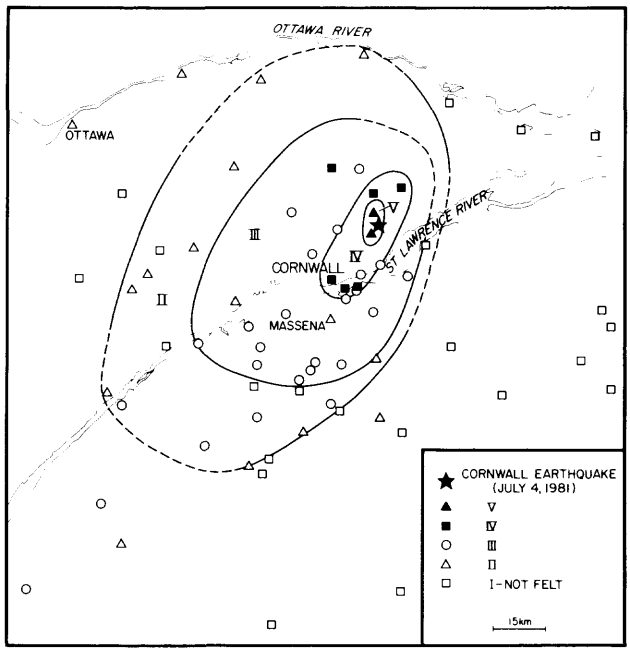

FIGURE 18.--Isoseismal map for the southern Ontario, Canada earthquake of 4 July 1981, 23 16 33.0 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals (from Schlesinger-Miller and others, 1981).

NEW YORK

4 July (L) Southern Ontario, Canada
Origin time: 23 16 33.0
Epicenter: 45.11 N., 74.61 W.
Depth: 16 km
Magnitude: 3.3 Mn(L), 3.7 Mn(0)

There were two earthquakes recorded on July 4 at 23 16 33.0 and at 23 19 17.5, but the intensity data could only be associated with the first quake. Within the next 4 days, 20 additional quakes occurred ranging in size from magnitude 0.5 to 3.3 (Schlesinger-Miller and others, 1981). Figure 18 shows the extent of the felt area.

Intensity V: The most common effects at the places listed below were few small objects overturned and fell; few glassware and dishes were broken; windows, doors, and dishes rattled.
New York--Brushton (a few small objects overturned), St. Regis Falls and Waddington (a few small objects overturned and fell and some glassware was broken).
Intensity IV:
New York--Fort Covington, Hogansburg, Lawrenceville, West Bangor, Winthrop.

NEW YORK—Continued

Intensity III:
New York--Bangor, Chase Mills, Chateaugay, Dickinson Center, Helena, Lisbon, Malone, Moira, North Bangor.
Felt:
New York--Brasher Falls, Louisville, Malone, Massena (press report).
Canada--Ottawa, Ontario.

5 July (L) Southern Ontario, Canada
Origin time: 21 47 23.9
Epicenter: 45.11 N., 74.61 W.
Depth: 16 km
Magnitude: 3.3 Mn(L), 3.3 MD(L)
Intensity IV:
New York--West Bangor.
Intensity III:
New York--Burke.
Felt:
Canada--Cornwall, Ontario (press report).
New York--Franklin and St. Lawrence County (press report).

21 October (L) Long Island Sound
Origin time: 16 49 07.0
Epicenter: 41.13 N., 72.56 W.
Depth: 6 km
Magnitude: 3.8 Mn(J), 3.4 ML(J), 3.5 MD(L)

Felt in southern Connecticut, Long Island and vicinity, New York, and western Rhode Island. This is the first event to be located instrumentally within the Sound (Pulli and Godkin, 1981). The extent of the felt area mapped by Schlesinger-Miller, Lamont-Doherty Geological Observatory is shown on the intensity map in figure 19; however, it does not reflect all the intensity values listed below.

Intensity V: The most common effects at the places listed below were hairline cracks in plaster and drywall, few items thrown from store shelves, few small objects overturned and fell, few glassware and dishes broken, few windows cracked, felt by many.
Connecticut--Centerbrook, Chester, East Lymes (foundation cracked), Essex, Gales Ferry, Middle Haddam, Moodus, Mystic, Old Saybrook, Seymour, South Lyme, Stratford.
New York--Mastic Beach (a chandelier fell and dishes fell from shelves--press report), south shore of Suffolk County (dishes fell from shelves--press report).

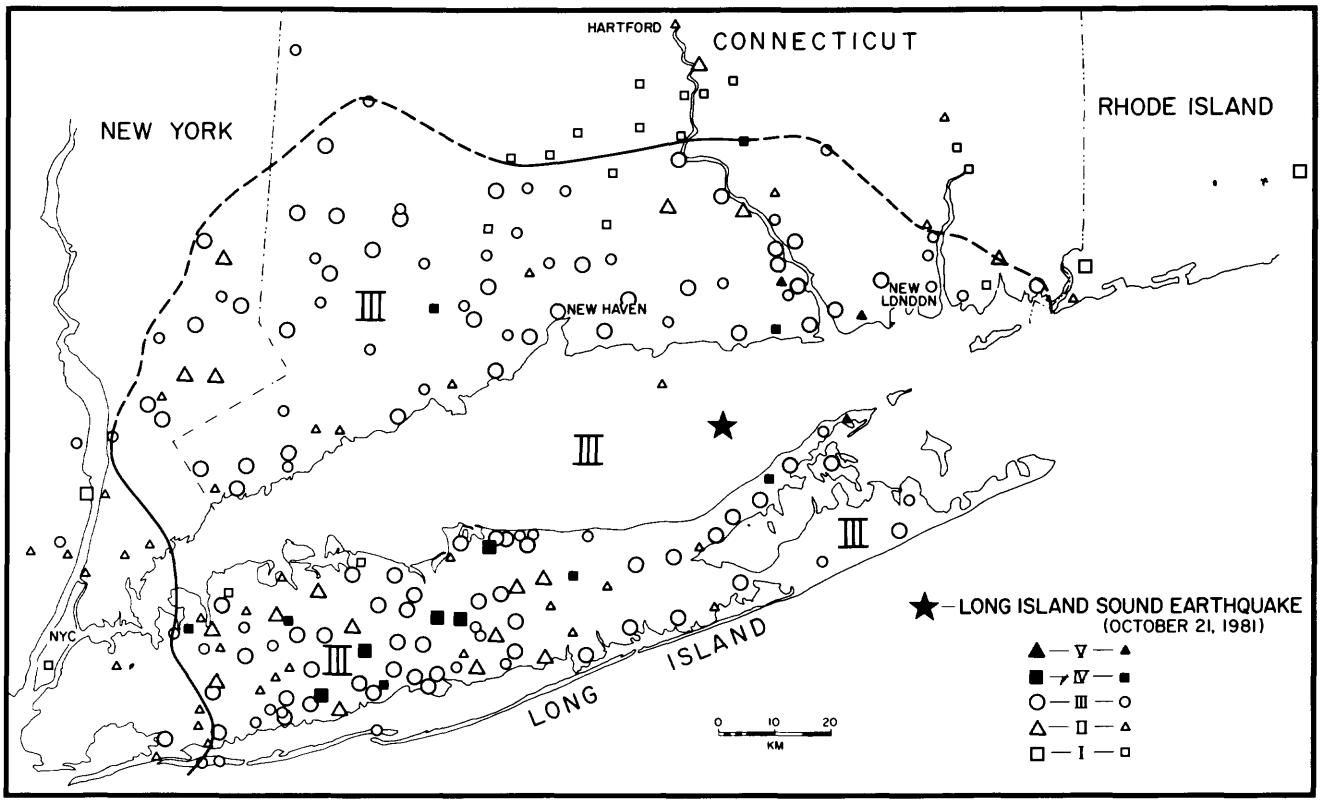

FIGURE 19.--Intensity survey of the October 21, 1981, earthquake in Long Island Sound, N.Y. Larger symbols represent the modal values of reported intensities for a given locality, and smaller symbols represent either single reports or reports from localities for which there was no well-defined mode (provided by Schlesinger-Miller, Lamont-Doherty Geological Observatory).

NEW YORK--Continued

Intensity IV:
Connecticut--Clinton, Deep River, Derby, East Hampton, Groton, Guilford, Haddam, Hadlyme, Madison, Monroe, Saybrook (press report), Westbrook (press report).
New York--Great Kills (press report), Hauppauge (press report), Todt Hill (press report).

Intensity III:
Connecticut--Colchester, East Haddam, Haddam, Higganum, Ivoryton, Portland, New Haven (press report), New London, Niantic, Northford, Quaker Hill, Stevenson.
New York--Commack, East Chester, Greenburg, Orient Point, Port Chester, Riverhead, Rye, Sea Cliff, Yorktown (all from press reports).

NEW YORK--Continued

Intensity II:
Connecticut--Old Mystic.
New York--Shelter Island, Waterbury, and West Hempstead (press reports).

Felt:
Connecticut--Danbury (press report), Middletown (press report), Norwich (press report), Uncasville, Waterbury (press report).
Rhode Island--Western tip.

14 December (L) Eastern New York
Origin time: 18 31 38.3
Epicenter: 43.08 N., 73.83 W.
Depth: 2 km
Magnitude: 2.3 MD(L), 1.7 Mn(L)

Felt at Saratoga Springs (L).

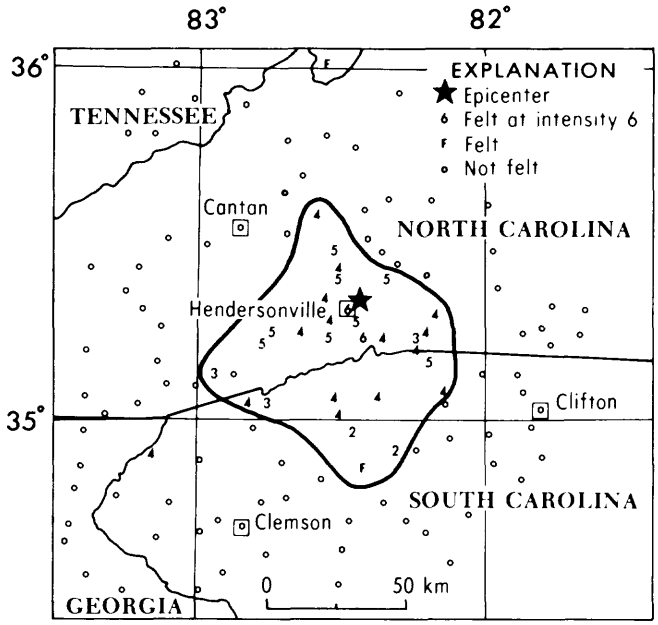

FIGURE 20.--Intensity map for the western North Carolina earthquake of 5 May 1981, 21 21 57.9 UTC. Arabic numerals are used to represent these intensities at specific sites.

NORTH CAROLINA

4 March (G) Central North Carolina
Origin time: 20 44 42.6
Epicenter: 35.71 N., 79.75 W.
Depth: 5 km
Magnitude: 2.8 Mn(V)

A loud explosion-like sound was heard at the time of this earthquake.

Intensity IV: Cedar Falls, Central Falls.
Intensity III: Franklinville, North Asheboro.

9 April (G) Western North Carolina
Origin time: 07 10 31.4
Epicenter: 35.48 N., 82.07 W.
Depth: 5 km
Magnitude: 3.0 Mn(G), 3.2 MD(K)
Intensity V:
Burnsville (few windows cracked, small objects overturned and fell).
Old Fort (few small objects overturned, felt by and awakened many).
Intensity IV: Candler, Forest City, Marion, Mill Spring, Spindale, Sugar Hill (press report), Union Mills.
Intensity II: Edneyville.
Felt: Dysartsville, Glenwood (press report), Old Fort Mountain (press report).

NORTH CAROLINA--Continued

5 May (K) Eastern North Carolina
Origin time: 21 21 57.9
Epicenter: 35.33 N., 82.43 W.
Depth: 13 km
Magnitude: 3.5 Mn(V), 3.3 MD(K)

There was a noise that sounded like a sonic boom associated with this earthquake (press report). It was felt over an area of approximately 4,000 km^2 of North Carolina, South Carolina, Tennessee, and Virginia (fig. 20). Several wells were muddied in the vicinity of Dana, North Carolina (K).

Intensity VI:
North Carolina--
Hendersonville (concrete on patio cracked and sidewalk shifted 2 inches, washing machines moved--press report; a few cracked windows, merchandise thrown off store shelves, and glassware broken).
Zirconia (foundation cracked, hairline cracks in plaster and dry wall, many items thrown from store shelves, few windows cracked, felt by all).
Intensity V: The most common effects at the places listed below were some merchandise thrown from store shelves, a few cracked windows and a few small objects overturned and fell.
North Carolina--Balfour, Brevard, Edneyville, Etowah, Flat Rock, Naples, Pisgah Forest (hairline cracks in plaster and dry wall), Skyland, Tuxedo.
South Carolina--Landrum.
Intensity IV:
North Carolina--Arden, Asheville (Grace), Columbus, Dana, East Flat Rock, Fletcher, Horse Shoe, Mill Spring, Mountain Home, Penrose, Rosman, Saluda, Tryon.
South Carolina--Cleveland, Gramling, Marietta, Mountain Rest, Tigerville.
Intensity III:
North Carolina--Cedar Mountain, Lake Toxaway, Lynn, Marion.
Intensity II:
South Carolina--Taylors, Travelers Rest.
Felt:
North Carolina--Slick Rock Mountain (press report).
South Carolina--Greenville-Spartansburg area (V).
Tennessee--Flag Pond (K).
Virginia--Bondtown (K), Tacoma (K).

NORTH CAROLINA--Continued

3 June (G) Northeastern North Carolina
Origin time: 20 54 22.4
Epicenter: 36.21 N., 81.65 W.
Depth: 1 km
Magnitude: 3.0 Mn(V), 2.3 MD(K)

The "Watauga Democrat" in Boone, North Carolina, reported a quarry blast at about the same time this event was reported felt.

Intensity V: Boone (few items thrown from store shelves, a few glassware and dishes were broken, hanging pictures fell, many small objects overturned and fell).
Intensity II: Tiplett.

OKLAHOMA

11 July (T) Southern Oklahoma
Origin time: 20 19 23.7
Epicenter: 34.88 N., 97.75 W.
Depth: 5 km
Magnitude: 2.2 Mn(T)
Intensity II: Bradley (T).

11 July (T) Southern Oklahoma
Origin time: 21 09 21.8
Epicenter: 34.85 N., 97.73 W.
Depth: 5 km
Magnitude: 3.5 Mn(T)
Intensity V: Three km west of Lindsay (knocked pictures off wall and a shelf).
Intensity IV: Bradley, Erin Springs (T).
Intensity III: Lindsay.
Felt: Alex.

OREGON

14 February (W) Southwestern Washington
Origin time: 06 09 27.2

See Washington listing.

13 May (W) Southwestern Washington
Origin time: 05 00 36.2

See Washington listing.

28 May (W) Southern Washington
Origin time: 09 10 46.0

See Washington listing.

PUERTO RICO

14 September (G) Mona Passage
Origin time: 12 44 29.8
Epicenter: 18.32 N., 68.89 W.
Depth: 170 km
Magnitude: 5.9 mb(G), 6.4 mb(P)

Felt in the Dominican Republic, Puerto Rico, and Virgin Islands.

Intensity VI: Western Puerto Rico (telephone report).
Intensity V: Ponce, Puerto Rico (press report).
Intensity III: Bayamon and San Juan, Puerto Rico and Saint Thomas, Virgin Islands (press report).

23 September (G) East of Puerto Rico
Origin time: 08 44 07.0
Epicenter: 18.09 N., 65.23 W.
Depth: 33 km
Magnitude: None computed.

Felt in the Virgin Islands.

RHODE ISLAND

3 April (J) Southeastern Rhode Island
Origin time: 09 24 12.5
Epicenter: 41.59 N., 71.22 W.
Depth: 1 km
Magnitude: 2.7 Mn(J)

This earthquake was felt throughout the East Bay of Rhode Island and in the neighboring areas of Massachusetts (press report).

Intensity V:
Rhode Island--Jamestown (few small objects overturned and fell; windows, doors, and dishes rattled).
Intensity IV:
Massachusetts--Dartmouth, East Freetown, Fall River, Westport.
Rhode Island--Adamsville, Little Compton, Middletown (press report), Newport, Portsmouth, Saunderstown, Tiverton, Warwick.
Felt:
Massachusetts--Fairhaven (press report).
Rhode Island--Barrington (press report), Bristol (press report), Providence, Warren (press report), Wickford (press report).

21 October (J) Long Island Sound
Origin time: 16 49 06.7

See New York listing.

SOUTH CAROLINA

21 February (G) Southern South Carolina
Origin time: 04 48 26.5
Epicenter: 33.60 N., 81.17 W.
Depth: 1 km
Magnitude: 2.0 MD(G)
Intensity II: Bowman (Y).

19 March (G) Southern South Carolina
Origin time: 04 33 55.7
Epicenter: 32.96 N., 80.19 W.
Depth: 6 km
Magnitude: 2.5 Mn(G), 2.3 MD(G)
Intensity III: Goose Creek, Ladsom (press report), Summerville.

5 May (K) Eastern North Carolina
Origin time: 21 21 57.9

See North Carolina listing.

SOUTH DAKOTA

13 September (G) Southern South Dakota
Origin time: 22 16 29.7
Epicenter: 43.04 N., 101.85 W.
Depth: 5 km
Magnitude: 3.4 Mn(T)
Intensity V: Tuthill (few small objects overturned and fell, few glassware and dishes were broken).
Intensity IV: Cedar Butte, Martin, Vetal.
Intensity III: Saint Francis.
Intensity II: Kadoka.

TENNESSEE

2 January (K) Northwestern Tennessee
Origin time: 14 31 23.0
Epicenter: 36.36 N., 89.51 W.
Depth: 5 km
Magnitude: 2.3 MD(K), 2.0 Mn(S)

This is the first and largest event in a swarm of earthquakes occurring from January 2 to January 5 (Zollweg, 1981).

Intensity IV: Ridgely.
Felt: Madie and Gratio (K).

3 January (K) Northwestern Tennessee
Origin time: 19 05 21.2
Epicenter: 36.29 N., 89.49 W.
Depth: 5 km
Magnitude: 1.8 MD(K), 1.6 Mn(S)

Felt at Ridgely and heard at Madie (K).

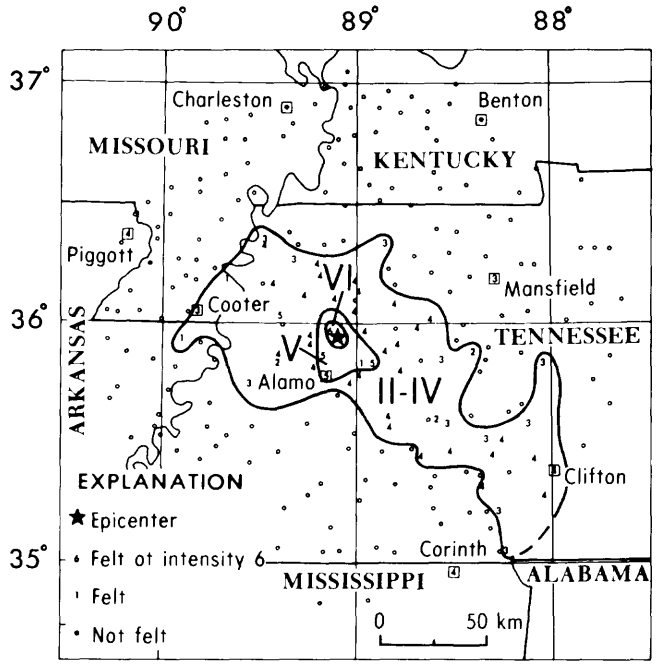

FIGURE 21.--Isoseismal map for the western Tennessee earthquake of 7 August 1981, 11 53 41.8 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

TENNESSEE--Continued

8 February (K) Southwestern Tennessee
Origin time: 16 52 58.5
Epicenter: 35.62 N., 89.60 W.
Depth: 5 km
Magnitude: 3.0 Mn(G), 2.8 MD(S), 3.9 MD(K)
Intensity IV: Covington.
Intensity III: Mason.
Felt: Brighton, Hollygrove, and Rialto (K).

29 April (K) Northeastern Arkansas
Origin time: 15 09 32.9

See Arkansas listing.

5 May (K) Eastern North Carolina
Origin time: 21 21 57.9

See North Carolina listing.

29 May (K) Northwestern Tennessee
Origin time: 14 56 12.2
Epicenter: 36.28 N., 89.49 W.

TENNESSEE--Continued

Depth: 4 km
Magnitude: 2.3 MD(K), 2.3 Mn(S)

Felt at Ridgely (K).

7 August (K) Western Tennessee
Origin time: 11 53 41.8
Epicenter: 35.95 N., 89.12 W.
Depth: 10 km
Magnitude: 4.0 Mn(S), 4.0 Mn(V), 4.0 MD(K)

This earthquake was felt over an area of approximately 10,000 km^2 of Arkansas, Mississippi, Missouri, and Tennessee (fig. 21).

Intensity VI:
Tennessee--Eaton (two concrete patios were cracked and tile was cracked in one bathroom, felt by all).
Intensity V: The most common effects at the places listed below were few small objects overturned and fell; few windows cracked; windows, doors, and dishes rattled.
Tennessee--Alamo, Crockett Mills, Dyersburg, Humboldt.
Intensity IV:
Arkansas--Piggott.
Mississippi--Corinth.
Tennessee--Atwood, Bath Springs, Bemis, Bogota, Bradford, Clifton, Dyer, Friendship, Fruitdale, Gadsden, Gibson, Halls, Henderson, Jacks Creek, Jackson, Kenton, Maury City, Medina, Milan, Morris Chapel, Newbern, Obion, Olive Hill, Rutherford, Sardis, Scotts Hill, Tigrett, Trenton, Trezevant, Trimble, Wynnburg, Yorkville.
Intensity III:
Missouri--Cooter.
Tennessee--Cedar Grove, Decaturville, Elbridge, Huron, Lenox, Mansfield, Martin, Oakfield, Pickwick Dam, Reagan, Ripley, Savannah, Spring Creek, Sugar Tree, Tiptonville.
Intensity II:
Tennessee--Clarksburg, Gates, Luray.
Felt:
Arkansas--Blytheville (press report).
Missouri--Caruthersville (press report).
Tennessee--Brazil (S), Frog Jump (S), Humboldt (press report).

22 October (K) Northwestern Tennessee
Origin time: 10 33 29.3
Epicenter: 36.30 N., 89.44 W.
Depth: 3 km
Magnitude: 2.5 MD(K)

Felt at Ridgely (K).

TENNESSEE--Continued

8 November (S) Northwestern Tennessee
Origin time: 17 11 19.0
Epicenter: 36.10 N., 89.39 W.
Depth: 12 km
Magnitude: 3.0 Mn(G), 2.5 Mn(T), 2.9 MD(K)
Intensity IV: Dyersburg, Newbern.
Intensity III: Gates, Maury City, Wynnburg.

TEXAS

9 June (G) Eastern Texas
Origin time: 01 46 33.1
Epicenter: 32.14 N., 94.40 W.
Depth: 5 km
Magnitude: 3.0 Mn(T)
Intensity IV: Center, northern end of the Toledo Bend Reservoir (K).

6 November (G) Eastern Texas
Origin time: 12 36 40.5
Epicenter: 32.02 N., 95.26 W.
Depth: 5 km
Magnitude: 3.2 Mn(T), 2.9 MD(K)
Intensity IV: Jacksonville (press report), Mount Enterprise (press report), New Summerfield.

UTAH

16 January (U) Southwestern Utah
Origin time: 10 26 30.1
Epicenter: 37.45 N., 113.10 W.
Depth: 2 km
Magnitude: 3.5 ML(U)
Intensity IV: Cedar City, Kanarraville, New Harmony.
Intensity III: Rockville, Tropic, Virgin.

16 January (U) Southwestern Utah
Origin time: 14 50 45.9
Epicenter: 37.44 N., 113.10 W.
Depth: 2 km
Magnitude: 3.3 ML(U)
Intensity IV: Glendale, Kanarraville, New Harmony, Rockville, Virgin.
Intensity III: Tropic.
Intensity II: Cedar City.

1 February (U) Southwestern Utah
Origin time: 02 21 47.5
Epicenter: 37.57 N., 113.24 W.
Depth: 0 km
Magnitude: 3.7 ML(U)

Felt at Cedar City and Kanarraville (U).

20 February (U) Northern Utah
Origin time: 09 13 01.8
Epicenter: 40.33 N., 111.74 W.
Depth: 2 km
Magnitude: 4.7 mb(G), 3.9 ML(U)
Intensity VI: Orem (foundation cracked, hairline cracks in plaster and dry wall, trees and bushes shook slightly, few items thrown from store shelves, few small objects overturned and fell, felt by all and awakened many).
Intensity V: Provo (a hairline crack in a cinderblock wall at the Ming Center expanded to 1 inch--press report).
Intensity IV: American Fork, Lehi, Payson, Pleasant Grove, Salt Lake City, Santaquin, Springville.
Felt: Draper and Riverton (press report).

5 April (U) Southwestern Utah
Origin time: 05 40 40.5
Epicenter: 37.63 N., 113.30 W.
Depth: 1 km
Magnitude: 4.2 mb(G), 4.6 ML(U)

Intensity V: The most common effects at the places listed below were few items thrown from store shelves, few small objects overturned and fell, hanging pictures out of place, felt by many.
Utah--Cedar City (few windows cracked), Kanarraville, New Harmony (hanging pictures fell), Springdale.
Intensity IV:
Utah--Antimony, Beryl, Cannonville, Henrieville, La Verkin, Milford, Newcastle, Rockville, Rubys Inn, Summit, Tropic.
Intensity III:
Utah--Kanab, Leeds, Orderville, Toquerville.
Intensity II:
Utah--Hurricane.
Felt:
Arizona--Colorado City (press report).
Utah--Ivins (press report), Kane County (press report), St. George (press report).

11 April (U) Northern Utah
Origin time: 08 08 02.6
Epicenter: 41.86 N., 112.66 W.
Depth: 0 km
Magnitude: 3.1 ML(U)
Intensity IV:
Utah--Snowville.
Felt:
Idaho--Stone (telephone report).

14 May (U) Northern Utah
Origin time: 05 11 04.9

UTAH--Continued

Epicenter: 39.47 N., 111.06 W.
Depth: 7 km
Magnitude: 4.5 mb(G), 3.5 ML(U), 4.0 ML(G)
Intensity V: Orem (hairline cracks in plaster walls, few items thrown from store shelves, few small objects overturned and fell, felt by and awakened many).
Intensity IV: Elsinore, Goshen, Sigurd.
Intensity III: Hiawatha.

9 June (U) Central Utah
Origin time: 19 12 20.1
Epicenter: 39.50 N., 111.27 W.
Depth: 7 km
Magnitude: 2.8 ML(U)

Possible explosion.

21 September (U) Northeastern Utah
Origin time: 08 01 33.8
Epicenter: 39.58 N., 110.40 W.
Depth: 7 km
Magnitude: 3.2 ML(U), 3.5 ML(G)
Intensity IV: East Carbon.
Intensity III: Sunnyside.

22 September (U) Northeastern Utah
Origin time: 05 04 00.0
Epicenter: 39.59 N., 110.42 W.
Depth: 7 km
Magnitude: 3.0 ML(U)

Felt at East Carbon (U).

17 December (U) Central Utah
Origin time: 10 47 43.8
Epicenter: 40.31 N., 111.63 W.
Depth: 2 km
Magnitude: 2.1 ML(U)
Intensity IV: Edgemont and Orem (press report).
Felt: Provo and Utah Counties (press report).

28 December (G) Southern Nevada
Origin time: 22 45 42.1

See Nevada listing.

VIRGINIA

11 February (V) Central Virginia
Origin time: 13 44 16.4
Epicenter: 37.72 N., 78.44 W.
Depth: 6 km
Magnitude: 3.4 Mn(V)

This earthquake was felt over an area of approximately 900 km² and was the first and largest event in a series of four earthquakes which occured in this area on February 11-12 (Sibol and Bollinger, 1981).

Intensity IV: Arvonia, Bremo Bluff, Diana Mills, Cold Hills, Jaggert, Keen, New Canton, Palmyra, Scottsville.
Intensity III: Antioch, Centenary, Esmont, Farmville, Howardsville, Richmond, Warren, Woodridge.
Intensity II: Gladstone, Madisonville, South Boston, Warsaw.

11 February (V) Central Virginia
Origin time: 13 50 31.4
Epicenter: 37.75 N., 78.41 W.
Depth: 10 km
Magnitude: 3.2 Mn(V)
Intensity IV: New Canton.
Intensity III: Arvonia, Esmont, Howardsville, Palmyra, Warren.
Felt: Antioch, Centenary, Keen, Scottsville.

11 February (V) Central Virginia
Origin time: 13 51 38.6
Epicenter: 37.72 N., 78.45 W.
Depth: 7 km
Magnitude: 2.9 Mn(V)
Intensity III: Howardsville, New Canton.
Intensity II: Arvonia.
Felt: Antioch, Centenary, Keen, Scottsville.

5 May (K) Eastern North Carolina
Origin time: 21 21 57.9

See North Carolina listing.

30 July (V) Central Virginia
Origin time: 11 59 48.5
Epicenter: 38.19 N., 78.09 W.
Depth: 6 km
Magnitude: 1.4 MD(V)
Intensity III: Orange and Unionville (V).

23 November (V) Northern Virginia
Origin time: 13 14 51.0
Epicenter: 38.24 N., 79.09 W.
Depth: 10 km
Magnitude: 2.1 MD(V)
Intensity IV: Staunton.
Felt: Churchville, Frank's Mill (telephone report).

4 December (V) Southwestern Virginia
Origin time: 02 35 56.2

Epicenter: 36.98 N., 80.78 W.
Depth: 8 km
Magnitude: 2.1 Mn(V)

Felt at Pulaski (V).

WASHINGTON

13 January (W) Northwestern Washington
Origin time: 01 21 41.1
Epicenter: 48.63 N., 123.12 W.
Depth: 14 km
Magnitude: 3.0 ML(G), 3.3 MD(W)
Intensity V: The most common effects at the places listed below were windows, doors, and dishes rattled; felt by many.
Eastsound (small objects overturned, few items thrown from store shelves).
Waldron (few windows cracked).
Intensity IV: Friday Harbor, Roche Harbor, Shaw Island.
Intensity III: Deer Harbor, San Juan Island (press report).
Intensity II: Lummi Island.

23 January (W) Northwestern Washington
Origin time: 16 46 47.4
Epicenter: 47.61 N., 122.43 W.
Depth: 22 km
Magnitude: 2.9 ML(G), 3.0 MD(W)

Intensity III: Queen Anne district of Seattle and near Alki Point (press report).

28 January (W) Western Washington
Origin time: 21 35 41.5
Epicenter: 47.56 N., 121.78 W.
Depth: 13 km
Magnitude: 2.7 MD(W)

Felt near North Bend (W).

2 February (W) Southern Washington
Origin time: 01 23 18.6
Epicenter: 46.26 N., 121.00 W.
Depth: 4 km
Magnitude: 3.9 mb(G), 4.0 ML(G), 4.0 MD(W)
Intensity IV: White Swan.

14 February (W) Southwestern Washington
Origin time: 06 09 27.3
Epicenter: 46.35 N., 122.24 W.
Depth: 7 km
Magnitude: 5.1 mb(G), 4.8 MS(G), 5.5 ML(G), 5.2 MD(W)

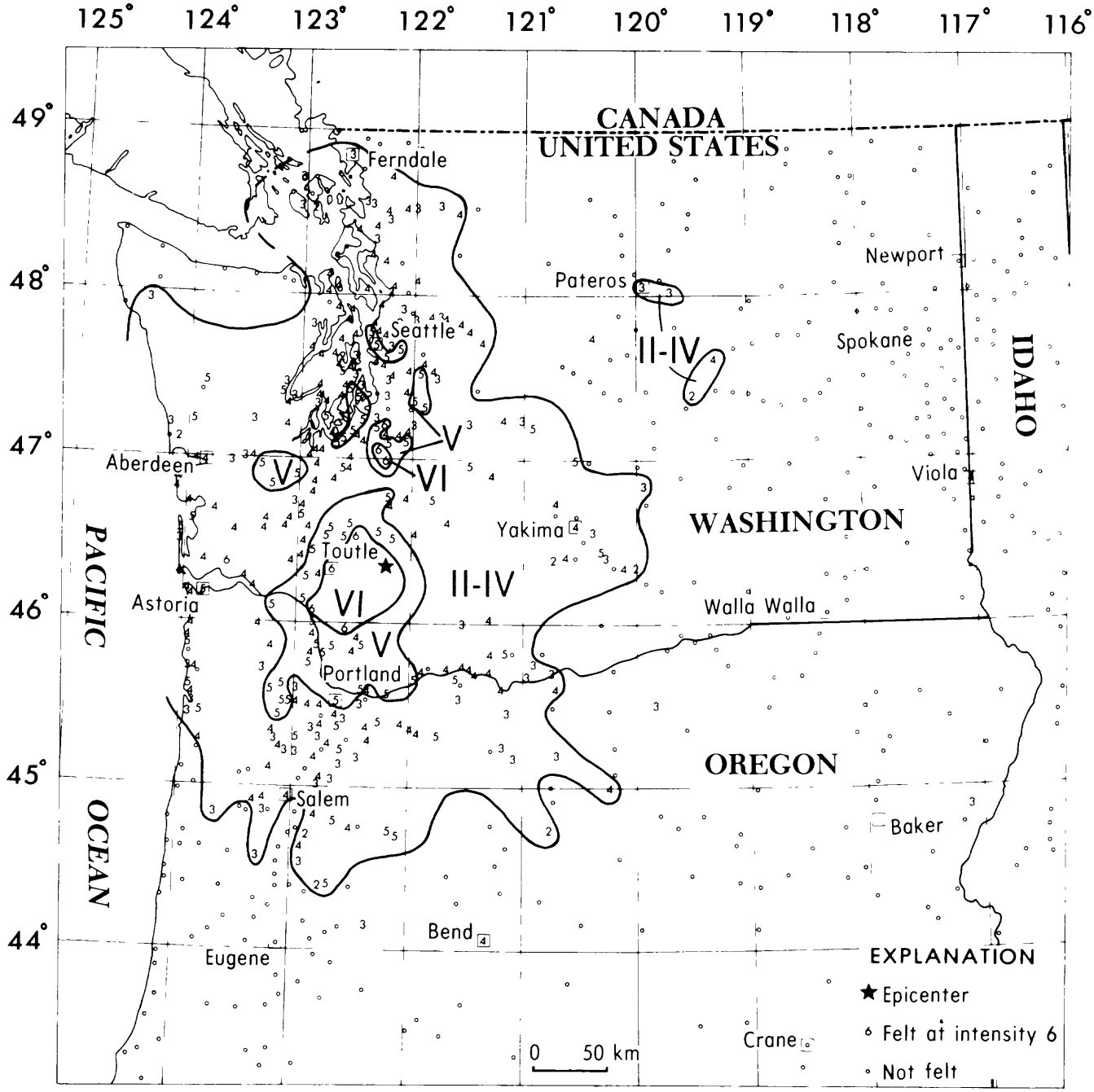

FIGURE 22.--Isoseismal map for the southwestern Washington earthquake of 14 February 1981, 06 09 27.3 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

This earthquake was felt over an area of approximately 104,000 km² of Oregon and Washington (fig. 22).

Intensity VI: The most common effects at the places listed below were foundations cracked, hairline cracks in plaster and drywall, light furniture overturned, many small objects overturned and fell, few glassware and dishes broken, few windows cracked, felt by all and awakened many.

Washington--
Ariel (large cracks in sidewalks).
Carrolls.
Graham (water splashed onto sides of lakes and swimming pools, chimneys cracked).
Grays River (chimneys cracked).
Hazel Dell--suburb of Vancouver (plaster fell off ceilings and windows broke--press report).
Kapowsin (report of chimneys broken at roof line).
Kidd Valley--8 miles east of Toutle (at the Antique Shed Store pottery was broken, figurines crashed inside a display case, and 300 maps fell to the floor--press report).
Mossyrock (chimneys twisted, open cracks in stone walls).
Sumner (few items thrown from store shelves).

Intensity V: The most common effects at the places listed below were hairline cracks in plaster and dry wall, few items thrown from store shelves, few small objects overturned and fell, few dishes broken, few windows cracked, hanging pictures out of place, felt by many and awakened several).

Oregon--Astoria, Banks, Bridal Veil, Clatskanie, Cornelius, Detroit, Forest Grove, Foster, Gales Creek, Gaston, Gladstone, Government Camp, Idanha, Mehama, Mulino, Newberg, Oak Grove, Portland, Rockaway, Saint Helens, Sandy, Scappoose, Tillamook, Tolovana Park, West Linn.

Washington--Bay Center, Brush Prairie, Buena, Camas, Carbonado, Castle Rock, Chehalis, Cinebar, Cle Elum, Crystal Mountain, Dockton, DuPont, Elbe, Ellensburg, Ethel, Glenoma, Hoodsport, Humptulips, Kalama, Klickitat, La Center, Lakebay, Lakewood Center, Littlerock, Longmire, Longview, Malone, Medina, Morton, North Bonneville, North Fort Lewis, Oakville, Olalla, Onalaska, Orting, Oysterville, Palmer, Port Orchard, Preston, Puyallup, Quinault, Ravensdale, Redmond, Richmond Beach, Ridgefield, Salkum, Seattle-Tacoma Airport, Silver Creek, Toledo, Tacoma (lamps on the Tacoma Narrows Bridge shattered--press report), Vancouver (press report), Wilkeson, Yacolt, Yelm.

WASHINGTON--Continued

Intensity IV:

Idaho--Viola.

Oregon--Aloha, Amity, Beaver, Beaverton, Bend, Birkenfeld, Brightwood, Canby, Cannon Beach, Cascade Locks, Columbia City, Crabtree, Dallas, Deer Island, Eagle Creek, Estacada, Fossil, Garibaldi, Hammond, Hillsboro, Hubbard, Lafayette, Lake Oswego, Mill City, Milwaukie, Mosier, Nehalem, Rhododendron, Rickreall, Saint Benedict, Salem, Seaside, Sublimity, The Dalles, Tiller, Tualatin, Vernonia, Warren, Warrenton, Wasco, Welches, West Slope, Yamhill.

Washington--Aberdeen, Acme, Adna, Allyn, Amboy, Anderson Island, Appleton, Ardenvoir, Ashford, Baring, Belfair, Bingen, Bremerton, Brinnon, Brownstown, Buckley, Bucoda, Cathlamet, Centralia, Chimacum, Cook, Coulee City, Curtis, Doty, East Olympia, Easton, Edmonds, Elma, Everett (press report), Fall City, Fort Lewis (telegraphic report), Glenwood, Gold Bar, Goose Prairie, Granite Falls, Grayland, Hadlock, Hansville, Heisson, Hoquiam, Ilwaco, Index, Indianola, Issaquah, Kelso, Kenmore, La Conner, Lacey, Lakeview, Langley, Lebam, Lyle, Lyman, Manchester, Maple Valley, Marysville, McChord Air Force Base (telegraphic report), McKenna, McMillin, Mercer Island, Mineral, Mount Vernon, Mountlake Terrace, Mukilteo, Naches, Napavine, Naselle, Nordland, Olympia, Outlook, Packwood, Pe Ell, Port Gamble, Port Ludlow, Port Townsend, Poulsbo, Rainier, Randle, Raymond, Renton, Retsil, Rockport, Rosburg, Roy, Ryderwood, Seabeck, Seattle, Sedro Woolley, Shelton, Silvana, Silver Lake, Silverdale, Skamokawa, Skykomish, Snoqualmie, South Cle Elum, South Prairie, Spanaway, Stanwood, Stevenson, Sultan, Suquamish, Tenino, Tokeland, Tumwater, Underwood, Union, Vader, Vashon Island (press report), Vaughn, Washougal, Wauna, Winlock, Woodinville, Yakima.

Intensity III:

Oregon--Bay City, Blue River, Carlton, Clackamas, Colton, Corvallis, Dayton, Dufur, Dundee, Gresham, Halfway, Harbor, Hood River, Ione, Kent, Lebanon, Manzanita, Maupin, Molalla, Monmouth, Mount Hood, Netarts, North Plains, Oceanside, Rufus, Saint Paul, Scotts Mills, Sea-

side, Sherwood, Silverton, Stayton, Timber, Tygh Valley, Valsetz, Wilsonville.
Washington--Aloha, Bainbridge Island, Beverly, Bow, Bridgeport, Centerville, Clearlake, Concrete, Conway, Coupeville, Dallesport, Edison, Enumclaw, Ferndale, Forks, Fox Island, Friday Harbor, Galvin, Grapeview, Hamilton, Kent, Kirkland, Lester, Lilliwaup, Matlock, Milton, Moclips, Monroe, Montesano, Moxee City, Nahcotta, North Bend, Pateros, Quilcene, Ronald, Satsop, Seaview, Skyway, Snohomish, Southworth, Startup, Sultan, Tahuya, Trout Lake, Vashon, Waldron, Westport, Wishram, Zillah.

Intensity II:
Oregon--Ashwood, Blue River, Scio, Sweet Home.
Washington--Clearview, Copalis Crossing, Lopez, Soap Lake, Sunnyside, Tracyton, White Swan.

Felt:
Canada--Southern British Columbia (press report), Vancouver Island (press report).
Oregon--Eugene (press report), Medford (press report), Springfield (press report).
Washington--Battleground, Capitol Hill (press report), Lake City (press report), Paradise, Queen Anne (press report), Rochester.

14 February (W) Southwestern Washington
Origin time: 06 50 58.9
Epicenter: 46.35 N., 122.25 W.
Depth: 11 km
Magnitude: 3.0 ML(G), 3.5 MD(W)

Felt in Kidd Valley 8 miles east of Toutle (W).

14 February (W) Southwestern Washington
Origin time: 06 53 18.1
Epicenter: 46.33 N., 122.24 W.
Depth: 13 km
Magnitude 2.9 ML(G), 3.4 MD(W)

Felt in Kidd Valley 8 miles east of Toutle (W).

14 February (W) Southwestern Washington
Origin time: 08 43 45.9
Epicenter: 46.36 N., 122.25 W.
Depth: 11 km
Magnitude: 4.6 mb(G), 3.4 ML(G), 3.8 MD(W)

Felt in Kidd Valley 8 miles east of Toutle (press report).

WASHINGTON--Continued

14 February (W) Southwestern Washington
Origin time: 09 05 51.6
Epicenter: 46.36 N., 122.24 N.
Depth: 9 km
Magnitude: 2.8 MD(W)

Felt in Kidd Valley 8 miles east of Toutle (press report).

14 February (W) Southwestern Washington
Origin time: 15 00 11.3
Epicenter: 46.35 N., 122.25 W.
Depth: 10 km
Magnitude: 3.0 MD(W)

Felt in Kidd Valley 8 miles east of Toutle (press report).

14 February (W) Southwestern Washington
Origin time: 21 27 43.9
Epicenter: 46.34 N., 122.24 W.
Depth: 7 km
Magnitude: 3.6 ML(G), 3.8 MD(W)

Intensity V: Vancouver (two broken windows--press report).
Felt: Kelso, Kidd Valley (8 miles east of Toutle), Longview, Mercer Island, and in Cowlitz County (press reports).

18 February (W) Central Washington
Origin time: 06 09 38.7
Epicenter: 47.21 N., 120.90 W.
Depth: 0 km
Magnitude: 4.2 ML(G), 4.2 MD(W)

This earthquake was felt over an area of approximately 9,300 km^2 (fig. 23). There were reports of a sharp crack or explosion type of sound associated with the quake.

Intensity VI:
Cle Elum (chimney bricks fell, telephone service disrupted and broken dishes--press report).
Puyallup (some windows broken out, water splashed onto sides of lakes and swimming pools, hairline cracks in dry wall, felt by and awakened several. The validity of this data is questionable but is listed as reported.).
South Cle Elum (chimney bricks fell, felt by and awakened many).

Intensity V: The most common effects at the places listed below were hairline cracks in plaster and drywall, trees and bushes shook slightly, few items thrown from store shelves, few small objects overturned and fell, glassware and dishes

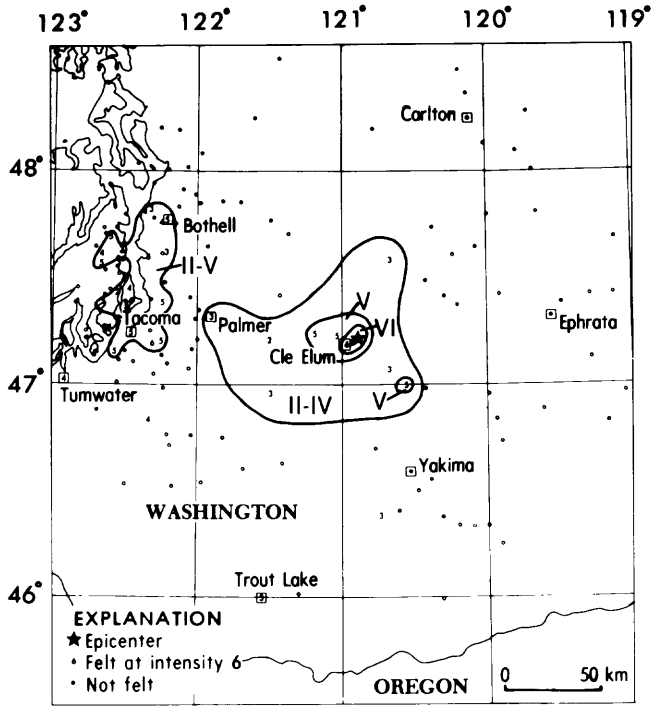

FIGURE 23.--Isoseismal map for the central Washington earthquake of 18 February 1981, 06 09 38.7 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

WASHINGTON--Continued

broken, few windows cracked, hanging pictures swung, felt by many and awakened several).
Bothell, Bremerton, Dockton, Easton, Ellensburg (pictures fell--press report), Kent, Ronald, Seattle (Ballard, East Union, and Lake City areas), Sumner, Tacoma, Union, Wauna.

Intensity IV: Burton, Edmonds, Kenmore, La Grande, Long Beach, Tracyton, Tumwater, Vashon, West Seattle.

Intensity III: Bellevue, Crystal Mountain, Leavenworth, Lynnwood, Palmer, Proctor, Thorp, Trout Lake, White Swan, Winslow.

Intensity II: Lester, Olalla.

Felt: Port Orchard.

6 March (G) Central Washington
Origin time: 14 19 05.8
Epicenter: 47.26 N., 120.84 W.
Depth: 5 km
Magnitude: 2.9 ML(G), 2.9 MD(W)
Intensity III: Roslyn, South Cle Elum.
Intensity II: Ronald

WASHINGTON--Continued

15 March (W) Northwestern Washington
Origin time: 07 24 06.2
Epicenter: 47.99 N., 121.50 W.
Depth: 5 km
Magnitude: 3.4 ML(G), 3.6 MD(W)

Felt at Darrington, Granite Falls, Kenmore, Marysville, and Redmond (press report). Many residents were awakened in King and Snohomish Counties (press report).

1 May (W) Southwestern Washington
Origin time: 10 06 23.1
Epicenter: 46.37 N., 122.25 W.
Depth: 11 km
Magnitude: 2.9 ML(G), 3.1 MD(W)
Intensity IV: Elbe.
Felt: Elk Lake area (press report).

13 May (W) Southwestern Washington
Origin time: 05 00 36.3
Epicenter: 46.37 N., 122.26 W.
Depth: 10 km
Magnitude: 4.1 mb(G), 4.1 ML(G), 4.5 MD(W)

Intensity V:
Washington--Ariel (There were reports of hairline cracks in dry wall and hanging pictures swung. This report also listed cracked and broken chimneys and cracked foundations. However, this was discounted because the same report stated there was no damage to buildings).

Intensity IV:
Washington--Amboy, Ashford, Cinebar, Dockton, Glenoma, Hockinson, Longview, Mineral, Morton, Mossyrock, Packwood, Randle, Silver Creek, Silver Lake, Toutle, White Salmon.

Intensity III:
Oregon--Rainier.
Washington--Cathlamet, Elbe, La Center, Napavine, Oakville, Olalla, Ryderwood, Yacolt.

Intensity II:
Washington--Carrolls, Centralia, Salkum, Seahurst, Tacoma, Tahuya.

27 May (W) Southwestern Washington
Origin time: 10 02 44.1
Epicenter: 46.37 N., 122.26 W.
Depth: 11 km
Magnitude: 2.7 ML(G), 3.2 MD(W)

Felt at Camp Baker and Camp 12 on the north side of Mt. St. Helens (press report).

28 May (W) Southern Washington
Origin time: 08 56 02.8
Epicenter: 46.53 N., 121.42 W.

Depth: 3 km
Magnitude: 4.3 mb(G), 3.7 ML(G), 4.6 MD(W)
Intensity IV: Mineral, White Pass.
Felt: Packwood and Randle (press report).

28 May (W) Southern Washington
Origin time: 09 10 46.1
Epicenter: 46.53 N., 121.41 W.
Depth: 3 km
Magnitude: 4.8 mb(G), 4.3 MS(G), 4.3 ML(G), 5.0 MD(W)
Intensity IV:
Washington--Cinebar, Elbe, Ephrata (press report), Glenoma, Longmire, Morton, Moses Lake (press report), Packwood, Randle, Toutle, White Pass.
Intensity III:
Washington--Ashford, Klickitat.
Intensity II:
Washington--Tacoma.
Felt:
Oregon--Portland (W).
Washington--Seattle (Capitol Hill--W), Kelso (press report), Longview (W), Olympia (press report), Othello (W).

23 June (W) Northwestern Washington
Origin time: 00 05 28.2
Epicenter: 48.87 N., 122.13 W.
Depth: 13 km
Magnitude: 3.1 ML(G), 3.4 MD(W)

Felt at Bellingham (W) and at Demming, Everson and Van Zandt (press report).

23 June (W) Northwestern Washington
Origin time: 00 06 27.7
Epicenter: 48.83 N., 122.15 W.
Depth: 9 km
Magnitude: 2.3 MD(W)

Felt at Bellingham, Everson, and Van Zandt (W).

22 July (W) Central Washington
Origin time: 06 05 50.6
Epicenter: 47.78 N., 120.27 W.
Depth: 4 km
Magnitude: 3.0 MD(W)
Intensity III: Entiat.

23 August (W) Southwestern Washington
Origin time: 16 22 17.4
Epicenter: 46.36 N., 122.25 W.
Depth: 8 km
Magnitude: 3.4 MD(W)

Felt at Randle and Glenoma (press report).

WASHINGTON--Continued

6 September (W) Southwestern Washington
Origin time: 19 34 46.0
Epicenter: 46.67 N., 123.87 W.
Depth: 35 km
Magnitude: 3.1 ML(G), 3.3 MD(W)
Intensity IV: South Bend (W).
Intensity III: Oysterville, Tokeland.

25 October (W) Central Washington
Origin time: 03 21 03.6
Epicenter: 47.76 N., 120.17 W.
Depth: 0 km
Magnitude: 2.4 ML(G), 3.2 MD(W)

Felt in the Chelan area (press report).

8 November (W) Southwestern Washington
Origin time: 07 54 01.1
Epicenter: 45.60 N., 122.49 W.
Depth: 7 km
Magnitude: 2.4 MD(W)

Felt at Camas.

12 November (W) Northwestern Washington
Origin time: 18 10 25.0
Epicenter: 47.94 N., 122.42 W.
Depth: 26 km
Magnitude: 3.9 ML(G), 3.7 MD(W)
Intensity IV: Everett (press report), Freeland, Gold Bar, Langley, Seattle (Lynnwood--press report), Marysville, Monroe, Mulkilteo, Nordland, Port Ludlow, Poulsbo, Seattle, Silvana, Woodinville.
Intensity III: Clinton, Conway, Granite Falls, Hansville, Keyport, Kingston, Lake Stevens, Northgate, Oak Harbor, Port Gamble, Snohomish.
Intensity II: Quilcene, Rollingbay.
Felt: Bainbridge Island, Bangor (W), Bellevue (W), Bellingham (W), Bothell (W), Camano Island (W), Indianola, Issaquah (W), Lakewood, Mill Creek (W), Port Orchard (W), Port Townsend (W), Seattle (Queen Anne, Ravenna Park, University of Washington (W)), Sultan (W).

26 November (W) Western Washington
Origin time: 12 30 00.7
Epicenter: 47.65 N., 122.62 W.
Depth: 22 km
Magnitude: 3.1 ML(G), 3.5 MD(W)
Intensity IV: Fox Island, Indianola, Port Orchard, Seabeck.
Intensity III: Bremerton, Milton, Tahuya.
Felt: East Union, Shelton.

6 March (G) Yellowstone National Park
Origin time: 13 44 42.4
Epicenter: 44.39 N., 110.57 W.
Depth: 1 km
Magnitude: 1.5 ML(G)
Intensity III: Grant Village.

12 March (G) Yellowstone National Park
Origin time: 14 12 02.2
Epicenter: 44.27 N., 110.76 W.
Depth: 1 km
Magnitude: 3.8 ML(G)

This event was the first of a swarm of more than 200 events recorded on the Old Faithful seismograph.

Intensity IV: Grant Village and Old Faithful.

12 March (G) Yellowstone National Park
Origin time: 14 19 38.2
Epicenter: 44.29 N., 110.76 W.
Depth: 2 km
Magnitude: 3.1 ML(G)
Intensity II: Grant Village and Old Faithful.

12 March (G) Yellowstone National Park
Origin time: 14 22 44.6
Epicenter: 44.30 N., 110.76 W.
Depth: 4 km
Magnitude: 2.5 ML(G)
Intensity III: Grant Village.

12 March (G) Yellowstone National Park
Origin time: 14 29 32.1
Epicenter: 44.29 N., 110.75 W.
Depth: 4 km
Magnitude: 2.6 ML(G)
Intensity III: Old Faithful.

12 March (G) Yellowstone National Park
Origin time: 14 48 13.7
Epicenter: 44.28 N., 110.76 W.
Depth: 2 km
Magnitude: 3.0 ML(G)
Intensity III: Grant Village and Old Faithful.

12 March (G) Yellowstone National Park
Origin time: 15 00 22.4
Epicenter: 44.26 N., 110.75 W.
Depth: 1 km
Magnitude: 2.6 ML(G)
Intensity III: Grant Village and Old Faithful.

12 March (G) Yellowstone National Park
Origin time: 15 12 02.2
Epicenter: 44.29 N., 110.75 W.

Depth: 1 km
Magnitude: 2.5 ML(G)
Intensity II: Old Faithful.

12 March (G) Yellowstone National Park
Origin time: 15 55 41.9
Epicenter: 44.28 N., 110.76 W.
Depth: 1 km
Magnitude: 3.4 ML(G)
Intensity III: Grant Village and Old Faithful.

12 March (G) Yellowstone National Park
Origin time: 17 09 09.0
Epicenter: 44.29 N., 110.75 W.
Depth: 1 km
Magnitude: 3.1 ML(G)
Intensity III: Old Faithful.

6 May (U) Western Wyoming
Origin time: 19 26 03.1
Epicenter: 43.43 N., 110.66 W.
Depth: 7 km
Magnitude: 3.7 ML(G)
Intensity IV:
Wyoming--Jackson.
Intensity III:
Idaho--Palisades.
Intensity II:
Wyoming--Teton Village.

22 May (G) Yellowstone National Park
Origin time: 07 56 41.0
Epicenter: 44.83 N., 111.00 W.
Depth: 7 km
Magnitude: 4.2 ML(G)
Intensity IV:
Montana--West Yellowstone, Hebgen Lake Dam (30 km northwest of West Yellowstone), Duck Creek area (13 km north of West Yellowstone).
Intensity III:
Wyoming--Madison Junction.

8 October (G) Yellowstone National Park
Origin time: 16 49 32.2
Epicenter: 44.23 N., 110.79 W.
Depth: 1 km
Magnitude: 3.0 ML(G)
Intensity III: Old Faithful.

18 October (G) Yellowstone National Park
Origin time: 10 10 40.2
Epicenter: 44.78 N., 110.71 W.
Depth: 1 km
Magnitude: 2.1 MD(G)
Intensity IV: Norris Geyser Basin.

15 November (G) Yellowstone National Park
Origin time: 02 36 21.6
Epicenter: 44.97 N., 110.99 W.

Depth: None computed.
Magnitude: 3.0 MD(G).
Intensity III: Madison Junction.
Intensity II: Old Faithful.

15 December (U) Western Wyoming
Origin time: 14 17 59.1
Epicenter: 42.89 N., 110.97 W.
Depth: 7 km
Magnitude: 2.4 ML(U), 2.9 ML(G)

WYOMING--Continued

Felt at Grover.

15 December (U) Western Wyoming
Origin time: 15 36 20.8
Epicenter: 42.89 N., 110.92 W.
Depth: 7 km
Magnitude: 2.4 ML(U), 2.9 ML(G)

Felt at Grover.

Table 1.--*Summary of U. S. earthquakes for 1981*

[The following symbols are used to indicate authority for arrival or origin times, epicenters, and/or magnitudes: (A) University of Alaska, College; (B) University of California, Berkeley; (E) U.S. Department of Energy, Las Vegas, Nevada; (G) U.S. Geological Survey, Golden, Colorado, or Menlo Park, California; (H) U.S. Geological Survey, Hawaiian Volcano Observatory; (J) Weston Observatory, Massachusetts; (K) Tennessee Earthquake Information Center, Memphis; (L) Lamont-Doherty Geological Observatory, Palisades, N.Y.; (M) National Oceanic and Atmospheric Administration, Alaska Tsunami Warning Center, Palmer; (P) California Institute of Technology, Pasadena; (S) St. Louis University, St. Louis, Missouri; (T) Oklahoma Geological Survey, Leonard; (U) University of Utah, Salt Lake; (V) Virginia Polytechnic Institute and State University, Blacksburg; (W) University of Washington, Seattle; (Y) Kansas Geological Survey, Lawrence; (Z) Bollinger and others, 1982. N, Normal depth. Leaders (...) indicate information is not available]

Date (1981)	Origin time (UTC)			Lat	Long	Depth	Magnitude			Maximum intensity	Hypocenter source	Local time	
	hr	min	sec	(°)	(°)	(km)	mb	MS	ML, Mn or MD			Date	Hour
ALABAMA													
DEC. 9	03	29	34.5	33.24 N.	87.02 W.	3	...	...	2.6K	...	K	DEC. 8	09 P.M. CST
ALASKA													
JAN. 3	19	05	57.5	59.61 N.	153.28 W.	131	...	...	...	...	G	JAN. 3	09 A.M. AST
JAN. 4	17	34	36.2	51.45 N.	176.28 W.	50	4.5	...	4.0M	III	G	JAN. 4	06 A.M. BST
JAN. 5	06	03	58.2	51.43 N.	179.03 W.	61	4.7	...	...	...	G	JAN. 4	07 P.M. BST
JAN. 5	22	01	43.9	61.99 N.	151.36 W.	102	...	...	...	...	G	JAN. 5	12 P.M. AST
JAN. 6	21	51	51.9	52.50 N.	171.54 W.	76	4.7	...	...	...	G	JAN. 6	10 A.M. BST
JAN. 7	04	54	43.1	62.01 N.	150.83 W.	63	...	...	...	...	G	JAN. 6	06 P.M. AST
JAN. 7	16	44	09.4	56.36 N.	154.88 W.	33N	4.8	...	4.5M	...	G	JAN. 7	06 A.M. AST
JAN. 8	12	50	41.6	61.71 N.	151.23 W.	111	4.0	...	...	...	G	JAN. 8	02 A.M. AST
JAN. 12	00	39	29.5	54.44 N.	160.25 W.	20	4.5	...	4.3M	...	G	JAN. 11	02 P.M. AST
JAN. 12	16	33	23.9	52.83 N.	166.79 W.	15	5.0	4.6	...	...	G	JAN. 12	05 A.M. BST
JAN. 12	21	01	25.2	52.10 N.	166.54 W.	33N	4.2	...	...	...	G	JAN. 12	10 A.M. BST
JAN. 14	10	17	27.8	52.98 N.	169.05 W.	33N	4.5	...	...	...	G	JAN. 13	11 P.M. BST
JAN. 14	15	06	43.8	52.08 N.	169.50 W.	21	4.8	4.5	...	...	G	JAN. 14	04 A.M. BST
JAN. 17	07	48	28.9	60.97 N.	151.42 W.	82	...	...	...	...	G	JAN. 16	09 P.M. AST
JAN. 18	01	08	39.6	63.12 N.	150.92 W.	152	...	...	...	...	G	JAN. 17	03 P.M. AST
JAN. 18	12	35	05.6	55.18 N.	159.94 W.	47	4.8	...	...	...	G	JAN. 18	02 A.M. AST
JAN. 19	04	16	30.2	54.82 N.	157.01 W.	33N	4.7	...	4.9M	...	G	JAN. 18	06 P.M. AST
JAN. 19	09	28	55.7	63.12 N.	151.02 W.	130	...	...	...	...	G	JAN. 18	11 P.M. AST
JAN. 19	21	20	04.2	63.28 N.	151.07 W.	124	4.5	...	...	III	G	JAN. 19	11 A.M. AST
JAN. 20	06	20	59.3	57.91 N.	155.78 W.	84	4.7	...	...	...	G	JAN. 19	08 P.M. AST
JAN. 20	15	05	41.2	62.98 N.	150.08 W.	100	3.6	...	...	...	G	JAN. 20	05 A.M. AST
JAN. 20	15	36	54.7	55.36 N.	134.06 W.	15	3.8	...	...	...	G	JAN. 20	07 A.M. PST
JAN. 24	14	44	04.1	62.33 N.	149.60 W.	85	...	...	...	...	G	JAN. 24	04 A.M. AST
JAN. 24	18	56	32.1	62.21 N.	149.10 W.	81	...	...	...	...	G	JAN. 24	08 A.M. AST
JAN. 25	15	39	44.7	65.24 N.	153.28 W.	33N	...	...	...	...	G	JAN. 25	05 A.M. AST
JAN. 25	18	22	28.3	60.26 N.	153.14 W.	142	...	...	...	...	G	JAN. 25	08 A.M. AST
JAN. 26	13	54	32.9	64.74 N.	150.79 W.	33N	...	...	2.8M	...	G	JAN. 26	03 A.M. AST
JAN. 26	18	24	52.1	60.06 N.	150.39 W.	56	4.0	...	...	...	G	JAN. 26	08 A.M. AST
JAN. 29	00	43	36.9	63.99 N.	148.66 W.	33N	...	...	3.0M	...	G	JAN. 28	02 P.M. AST
JAN. 29	06	11	05.9	53.48 N.	164.32 W.	33N	4.6	...	4.3M	...	G	JAN. 28	07 P.M. BST
JAN. 30	08	52	44.1	51.74 N.	176.27 E.	33N	6.3	7.0	7.1M	V	G	JAN. 29	09 P.M. BST
JAN. 30	09	12	19.4	51.68 N.	176.00 E.	21	5.4	...	...	...	G	JAN. 29	10 P.M. BST
JAN. 30	12	39	39.4	51.32 N.	175.79 E.	33N	4.2	...	...	...	G	JAN. 30	01 A.M. BST
JAN. 30	14	04	09.4	51.74 N.	176.07 E.	33N	4.6	...	...	...	G	JAN. 30	03 A.M. BST
JAN. 30	14	49	22.3	51.57 N.	176.08 E.	19	5.6	5.3	...	III	G	JAN. 30	03 A.M. BST
JAN. 30	17	57	46.5	51.24 N.	176.00 E.	33N	4.7	4.0	...	...	G	JAN. 30	06 A.M. BST
JAN. 30	18	40	11.7	51.40 N.	176.19 E.	26	4.4	4.6	...	...	G	JAN. 30	07 A.M. BST
JAN. 30	21	04	16.6	51.63 N.	176.07 E.	33N	4.1	...	...	...	G	JAN. 30	10 A.M. BST
JAN. 31	06	25	55.0	51.43 N.	175.80 E.	25	4.6	...	4.5M	...	G	JAN. 30	07 P.M. BST
JAN. 31	13	06	29.5	51.37 N.	178.08 W.	76	4.0	...	...	...	G	JAN. 31	02 A.M. BST
JAN. 31	23	59	07.2	58.99 N.	152.09 W.	62	4.8	...	...	...	G	JAN. 31	01 P.M. AST
FEB. 1	13	17	11.3	51.34 N.	176.78 E.	23	5.6	5.5	...	...	G	FEB. 1	02 A.M. BST
FEB. 1	18	29	47.2	51.35 N.	176.69 E.	36	4.9	...	4.4M	...	G	FEB. 1	07 A.M. BST
FEB. 4	04	42	55.2	52.83 N.	163.51 W.	33N	4.8	...	5.1M	...	G	FEB. 3	05 P.M. BST
FEB. 4	05	13	19.0	51.34 N.	176.62 E.	33N	5.4	5.0	...	...	G	FEB. 3	06 P.M. BST
FEB. 4	06	06	34.4	51.41 N.	176.56 E.	33N	4.4	...	...	...	G	FEB. 3	07 P.M. BST
FEB. 5	08	43	19.6	57.58 N.	149.24 W.	33N	4.1	...	3.2M	...	G	FEB. 4	10 P.M. AST
FEB. 5	10	52	02.3	50.17 N.	176.27 W.	33N	5.7	5.0	4.6M	...	G	FEB. 4	11 P.M. BST
FEB. 7	03	59	11.8	60.65 N.	143.06 W.	33N	...	...	3.7M	...	G	FEB. 6	05 P.M. AST
FEB. 7	05	42	55.4	60.72 N.	150.69 W.	65	...	...	...	...	G	FEB. 6	07 P.M. AST
FEB. 8	04	46	38.4	64.35 N.	159.55 W.	33N	3.9	...	4.4M	...	G	FEB. 7	06 P.M. AST
FEB. 9	14	35	21.1	60.08 N.	153.26 W.	149	...	...	...	...	G	FEB. 9	04 A.M. AST
FEB. 11	16	02	26.7	59.32 N.	153.12 W.	109	4.1	...	...	...	G	FEB. 11	06 A.M. AST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
						ALASKA--Continued							
FEB. 12	10	56	34.6	56.76 N.	155.13 W.	45	4.5	...	3.4M	...	G	FEB. 12	00 A.M. AST
FEB. 12	23	34	25.9	59.03 N.	138.95 W.	15	3.8	...	...	...	G	FEB. 12	02 P.M. YST
FEB. 13	01	02	57.5	60.21 N.	141.34 W.	15	...	...	4.0M	...	G	FEB. 12	03 P.M. AST
FEB. 13	10	57	31.5	50.56 N.	176.07 W.	33N	4.0	...	3.4M	...	G	FEB. 12	11 P.M. BST
FEB. 13	16	46	23.1	51.87 N.	176.29 W.	65	4.5	...	...	III	G	FEB. 13	05 A.M. BST
FEB. 13	20	17	27.0	52.82 N.	173.96 W.	151	4.7	...	...	...	G	FEB. 13	09 A.M. BST
FEB. 15	01	38	50.7	65.95 N.	150.49 W.	69	...	...	...	...	G	FEB. 14	03 P.M. AST
FEB. 15	08	31	53.9	61.85 N.	150.37 W.	18	...	...	3.1M	...	G	FEB. 14	10 P.M. AST
FEB. 15	12	39	50.4	57.87 N.	156.24 W.	140	4.0	...	...	...	G	FEB. 15	02 A.M. AST
FEB. 15	13	06	24.9	50.98 N.	171.45 W.	33N	5.1	...	...	...	G	FEB. 15	02 A.M. BST
FEB. 15	14	26	15.3	51.51 N.	170.87 W.	53	4.4	...	...	...	G	FEB. 15	03 A.M. BST
FEB. 16	10	00	42.2	58.40 N.	154.92 W.	89	3.9	...	...	...	G	FEB. 16	00 A.M. AST
FEB. 16	18	11	41.4	65.68 N.	150.50 W.	33N	...	...	3.0M	...	G	FEB. 16	08 A.M. AST
FEB. 17	02	41	00.3	63.20 N.	150.73 W.	123	4.8	...	...	...	G	FEB. 16	04 P.M. AST
FEB. 18	23	44	20.6	50.90 N.	179.25 W.	35	4.7	...	...	...	G	FEB. 18	12 P.M. BST
FEB. 19	10	43	42.0	57.34 N.	149.84 W.	33N	4.1	...	...	...	G	FEB. 19	00 A.M. AST
FEB. 19	10	47	04.5	51.75 N.	178.10 E.	97	4.3	...	...	...	G	FEB. 18	11 P.M. BST
FEB. 20	06	17	41.1	51.97 N.	178.16 E.	137	5.0	...	...	...	G	FEB. 19	07 P.M. BST
FEB. 20	09	11	15.6	63.11 N.	149.61 W.	105	...	...	...	...	G	FEB. 19	11 P.M. AST
FEB. 22	09	51	16.9	62.30 N.	151.60 W.	32	...	...	3.1M	...	G	FEB. 21	11 P.M. AST
FEB. 23	03	07	33.1	62.28 N.	151.17 W.	97	...	...	...	...	G	FEB. 22	05 P.M. AST
FEB. 23	06	26	30.1	52.17 N.	171.26 W.	33N	4.6	...	...	...	G	FEB. 22	07 P.M. BST
FEB. 23	13	03	07.6	60.20 N.	150.35 W.	46	4.5	...	4.3M	IV	G	FEB. 23	03 A.M. AST
FEB. 24	22	04	18.5	64.96 N.	149.11 W.	23	4.4	...	4.5M	V	G	FEB. 24	12 P.M. AST
FEB. 25	18	13	48.5	50.42 N.	176.18 W.	33N	4.9	...	4.4M	...	G	FEB. 25	07 A.M. BST
FEB. 27	07	50	29.5	64.59 N.	152.17 W.	33N	...	...	...	...	G	FEB. 26	09 P.M. AST
FEB. 27	16	36	56.6	51.81 N.	176.37 E.	49	5.1	4.0	4.8M	...	G	FEB. 27	05 A.M. BST
MAR. 2	14	30	40.6	63.55 N.	151.20 W.	25	4.3	...	4.6M	IV	G	MAR. 2	04 A.M. AST
MAR. 3	12	07	39.0	63.21 N.	150.57 W.	142	...	...	...	...	G	MAR. 3	02 A.M. AST
MAR. 5	20	05	35.7	69.35 N.	145.07 W.	33N	...	...	3.4M	...	G	MAR. 5	10 A.M. AST
MAR. 5	21	07	22.2	56.58 N.	152.90 W.	33N	4.9	4.0	3.8M	...	G	MAR. 5	11 A.M. AST
MAR. 6	06	44	31.2	60.05 N.	152.41 W.	104	3.9	...	...	...	G	MAR. 5	08 P.M. AST
MAR. 8	00	42	36.8	53.80 N.	164.17 W.	48	4.4	...	...	...	G	MAR. 7	01 P.M. BST
MAR. 8	07	06	41.2	59.31 N.	153.21 W.	114	...	...	...	...	G	MAR. 7	09 P.M. AST
MAR. 8	19	06	56.9	64.81 N.	147.63 W.	10	...	...	2.4A	III	A	MAR. 8	09 A.M. AST
MAR. 8	19	09	39.4	64.85 N.	147.51 W.	11	...	...	2.6A	III	A	MAR. 8	09 A.M. AST
MAR. 9	16	51	51.6	60.09 N.	153.40 W.	143	...	...	...	...	G	MAR. 9	06 A.M. AST
MAR. 13	04	59	34.1	63.08 N.	150.04 W.	33N	...	...	3.0M	...	G	MAR. 12	06 P.M. AST
MAR. 13	17	28	06.1	62.80 N.	150.27 W.	119	...	...	...	...	G	MAR. 13	07 A.M. AST
MAR. 13	23	13	39.8	62.80 N.	147.35 W.	70	...	...	...	...	G	MAR. 13	01 P.M. AST
MAR. 15	07	48	29.2	55.58 N.	160.83 W.	41	4.8	...	4.5M	FELT	G	MAR. 14	09 P.M. AST
MAR. 17	23	33	18.7	62.44 N.	148.31 W.	32	3.6	...	3.1M	...	G	MAR. 17	01 P.M. AST
MAR. 19	05	55	59.6	63.55 N.	147.90 W.	80	...	...	...	...	G	MAR. 18	07 P.M. AST
MAR. 19	18	35	54.7	59.46 N.	153.74 W.	124	...	...	...	...	G	MAR. 19	08 A.M. AST
MAR. 21	23	01	37.4	58.97 N.	154.70 W.	136	5.0	...	...	IV	G	MAR. 21	01 P.M. AST
MAR. 22	10	41	45.1	51.68 N.	175.15 W.	42	4.4	...	4.2M	...	G	MAR. 21	11 P.M. BST
MAR. 23	02	21	32.3	60.01 N.	153.39 W.	167	...	...	...	...	G	MAR. 22	04 P.M. AST
MAR. 24	18	18	05.0	52.41 N.	167.80 W.	33N	4.5	...	4.1M	...	G	MAR. 24	07 A.M. BST
MAR. 24	18	21	27.9	52.67 N.	168.04 W.	33N	5.5	5.3	5.5M	...	G	MAR. 24	07 A.M. BST
MAR. 24	18	58	51.5	60.97 N.	147.75 W.	90	...	...	...	...	G	MAR. 24	08 A.M. AST
MAR. 26	01	56	07.6	62.43 N.	147.64 W.	33N	...	...	3.3M	...	G	MAR. 25	03 P.M. AST
MAR. 26	10	13	48.2	51.74 N.	176.41 E.	59	4.4	...	...	...	G	MAR. 25	11 P.M. BST
MAR. 28	09	20	44.0	58.94 N.	154.26 W.	133	...	...	...	...	G	MAR. 27	11 P.M. AST
MAR. 28	09	48	10.5	63.82 N.	149.51 W.	33N	...	...	3.0M	...	G	MAR. 27	11 P.M. AST
MAR. 29	13	33	09.9	51.46 N.	175.45 E.	33N	5.1	3.9	4.7M	...	G	MAR. 29	02 A.M. BST
MAR. 29	14	25	36.7	51.50 N.	175.34 E.	39	4.6	...	4.5M	...	G	MAR. 29	03 A.M. BST
MAR. 29	15	57	39.6	51.46 N.	175.34 E.	29	4.8	...	3.9M	...	G	MAR. 29	04 A.M. BST
MAR. 31	05	59	11.3	58.72 N.	153.46 W.	69	4.1	...	...	...	G	MAR. 30	07 P.M. AST
APR. 2	16	10	43.7	62.63 N.	141.92 W.	33N	4.5	...	4.3M	FELT	G	APR. 2	06 A.M. AST
APR. 3	02	10	12.1	64.00 N.	148.97 W.	33N	...	...	2.7M	...	G	APR. 2	04 P.M. AST
APR. 3	22	14	01.2	59.89 N.	153.46 W.	156	...	...	...	...	G	APR. 3	12 P.M. AST
APR. 4	15	21	04.2	53.72 N.	163.06 W.	16	4.8	...	4.0M	...	G	APR. 4	04 A.M. BST
APR. 4	17	33	50.3	60.18 N.	141.28 W.	15	3.7	...	3.7M	...	G	APR. 4	07 A.M. AST
APR. 4	23	17	31.3	51.50 N.	175.21 E.	33N	4.6	...	3.6M	...	G	APR. 4	12 P.M. BST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)		Long (°)		Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
ALASKA--Continued															
APR. 5	21	31	40.4	58.38	N.	153.49	W.	76	4.4	...	...	...	G	APR. 5	11 A.M. AST
APR. 7	02	12	07.7	59.89	N.	152.81	W.	120	...	...	...	...	G	APR. 6	04 P.M. AST
APR. 8	06	28	37.4	61.41	N.	148.22	W.	24	...	...	3.5M	III	G	APR. 7	08 P.M. AST
APR. 10	06	50	20.1	66.05	N.	149.09	W.	33N	...	...	4.5M	...	G	APR. 9	08 P.M. AST
APR. 11	02	36	46.4	60.56	N.	149.72	W.	67	3.8	...	...	...	G	APR. 10	04 P.M. AST
APR. 11	23	28	25.6	52.85	N.	169.79	W.	33N	4.2	...	3.7M	...	G	APR. 11	12 P.M. BST
APR. 12	19	09	02.1	60.11	N.	153.15	W.	152	...	...	...	...	G	APR. 12	09 A.M. AST
APR. 14	16	00	42.2	52.23	N.	169.41	W.	38	4.6	...	...	...	G	APR. 14	05 A.M. BST
APR. 15	08	14	16.9	60.60	N.	151.60	W.	83	4.1	...	...	...	G	APR. 14	10 P.M. AST
APR. 16	09	21	46.7	63.16	N.	150.57	W.	127	...	...	...	...	G	APR. 15	11 P.M. AST
APR. 17	15	59	05.3	52.48	N.	173.53	W.	33N	5.0	4.7	5.3M	...	G	APR. 17	04 A.M. BST
APR. 17	17	52	16.3	52.08	N.	178.08	E.	137	4.3	...	...	...	G	APR. 17	06 A.M. BST
APR. 17	23	29	18.4	58.19	N.	154.73	W.	91	4.6	...	...	...	G	APR. 17	01 P.M. AST
APR. 19	11	10	25.2	62.58	N.	142.36	W.	33N	...	...	3.3M	...	G	APR. 19	01 A.M. AST
APR. 19	13	29	38.0	58.72	N.	139.26	W.	15	3.7	...	3.7M	...	G	APR. 19	04 A.M. YST
APR. 21	16	11	13.8	60.77	N.	151.19	W.	77	...	...	...	...	G	APR. 21	06 A.M. AST
APR. 22	09	30	46.6	51.64	N.	176.80	W.	62	4.6	...	...	IV	G	APR. 21	10 P.M. BST
APR. 23	23	20	26.0	56.47	N.	152.72	W.	33N	4.4	...	...	...	G	APR. 23	01 P.M. AST
APR. 23	23	52	36.7	62.94	N.	148.92	W.	81	4.5	...	...	V	G	APR. 23	01 P.M. AST
APR. 24	01	38	53.8	62.47	N.	151.40	W.	92	...	...	...	...	G	APR. 23	03 P.M. AST
APR. 24	07	52	52.9	59.35	N.	151.83	W.	33N	4.0	...	4.2M	FELT	G	APR. 23	09 P.M. AST
APR. 24	21	29	43.6	60.52	N.	152.77	W.	135	4.0	...	...	...	G	APR. 24	11 A.M. AST
APR. 27	23	59	46.5	52.33	N.	168.50	W.	33N	4.7	...	4.1M	...	G	APR. 27	12 P.M. BST
APR. 30	01	11	38.0	61.96	N.	148.91	W.	52	3.6	...	2.9M	FELT	G	APR. 29	03 P.M. AST
APR. 30	02	52	13.5	53.31	N.	167.49	W.	33N	4.1	...	3.7M	...	G	APR. 29	03 P.M. BST
APR. 30	16	44	09.5	59.42	N.	152.91	W.	129	4.3	...	...	...	G	APR. 30	06 A.M. AST
APR. 30	21	18	10.3	63.22	N.	149.62	W.	110	...	...	...	...	G	APR. 30	11 A.M. AST
APR. 30	23	12	25.4	52.58	N.	173.14	E.	41	4.7	...	4.0M	...	G	APR. 30	12 P.M. BST
MAY 3	19	15	32.1	59.42	N.	153.08	W.	115	3.8	...	...	...	G	MAY 3	09 A.M. AST
MAY 3	21	04	43.9	59.99	N.	153.43	W.	142	4.0	...	...	...	G	MAY 3	11 A.M. AST
MAY 5	21	28	01.6	61.66	N.	149.66	W.	64	4.4	...	...	IV	G	MAY 5	11 A.M. AST
MAY 7	17	18	44.6	51.31	N.	173.25	W.	33N	4.4	...	...	...	G	MAY 7	06 A.M. BST
MAY 10	19	12	28.3	61.51	N.	146.36	W.	33N	...	...	3.0M	...	G	MAY 10	09 A.M. AST
MAY 10	22	52	43.6	56.23	N.	161.46	W.	202	4.3	...	...	...	G	MAY 10	11 A.M. BST
MAY 14	00	51	36.3	59.92	N.	141.04	W.	15	...	...	4.0M	...	G	MAY 13	02 P.M. AST
MAY 15	14	07	24.4	60.04	N.	150.46	W.	64	...	...	...	...	G	MAY 15	04 A.M. AST
MAY 15	18	14	24.9	58.25	N.	151.75	W.	14	3.8	...	3.1M	...	G	MAY 15	08 A.M. AST
MAY 16	14	38	16.3	61.93	N.	150.64	W.	81	...	...	...	...	G	MAY 16	04 A.M. AST
MAY 16	22	24	51.5	51.47	N.	175.92	E.	52	4.4	...	4.5M	...	G	MAY 16	11 A.M. BST
MAY 17	09	00	02.5	53.68	N.	163.80	W.	35	4.4	...	4.2M	...	G	MAY 16	10 P.M. BST
MAY 18	02	40	10.7	51.30	N.	175.03	W.	37	5.0	5.0	4.6M	III	G	MAY 17	03 P.M. BST
MAY 18	04	38	56.7	51.67	N.	175.29	W.	33N	4.3	...	...	...	G	MAY 17	05 P.M. BST
MAY 18	06	36	04.0	50.95	N.	175.00	W.	51	4.3	...	...	...	G	MAY 17	07 P.M. BST
MAY 18	07	56	53.5	51.65	N.	175.04	W.	44	4.7	...	...	III	G	MAY 17	08 P.M. BST
MAY 18	08	05	37.0	51.21	N.	174.72	W.	33N	3.9	...	...	...	G	MAY 17	09 P.M. BST
MAY 18	09	01	41.1	51.77	N.	174.99	W.	52	4.3	...	...	...	G	MAY 17	10 P.M. BST
MAY 18	14	30	57.9	51.61	N.	175.06	W.	47	4.5	4.4	...	...	G	MAY 18	03 A.M. BST
MAY 18	18	02	10.5	51.49	N.	175.02	W.	48	4.6	...	...	...	G	MAY 18	07 A.M. BST
MAY 19	20	19	38.1	51.50	N.	175.00	W.	43	4.4	...	...	...	G	MAY 19	09 A.M. BST
MAY 20	15	05	40.1	62.35	N.	150.98	W.	95	3.7	...	...	...	G	MAY 20	05 A.M. AST
MAY 21	20	29	31.5	59.78	N.	152.92	W.	117	4.6	...	...	FELT	G	MAY 21	10 A.M. AST
MAY 23	19	14	00.7	61.84	N.	150.94	W.	77	...	...	...	...	G	MAY 23	09 A.M. AST
MAY 25	02	30	18.6	65.78	N.	155.62	W.	33N	...	...	3.6M	...	G	MAY 24	04 P.M. AST
MAY 28	19	08	20.8	60.17	N.	152.82	W.	115	4.1	...	...	...	G	MAY 28	09 A.M. AST
MAY 30	12	44	51.6	59.86	N.	152.96	W.	133	...	...	...	...	G	MAY 30	02 A.M. AST
MAY 30	20	56	06.0	60.80	N.	151.65	W.	82	4.3	...	...	FELT	G	MAY 30	10 A.M. AST
JUNE 1	10	51	08.6	51.82	N.	175.66	E.	33N	4.7	...	...	...	G	MAY 31	11 P.M. BST
JUNE 5	04	04	37.7	61.71	N.	149.62	W.	56	...	...	...	...	G	JUNE 4	06 P.M. AST
JUNE 5	07	09	19.1	52.28	N.	165.20	W.	33N	5.5	...	4.9M	III	G	JUNE 4	08 P.M. BST
JUNE 5	12	53	37.7	63.24	N.	149.57	W.	109	...	...	...	...	G	JUNE 5	02 A.M. AST
JUNE 5	16	44	58.5	63.10	N.	150.47	W.	133	...	...	...	...	G	JUNE 5	06 A.M. AST
JUNE 7	10	52	53.2	62.49	N.	151.43	W.	101	...	...	...	...	G	JUNE 7	00 A.M. AST
JUNE 7	17	52	33.9	53.83	N.	165.13	W.	33N	5.0	...	4.6M	...	G	JUNE 7	06 A.M. BST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
ALASKA--Continued													
JUNE 7	19	42	24.9	59.25 N.	153.74 W.	134	...	...	...	...	G	JUNE 7	09 A.M. AST
JUNE 9	01	46	30.0	51.62 N.	176.17 E.	33N	4.6	...	5.4M	...	G	JUNE 8	02 P.M. BST
JUNE 10	02	50	24.4	58.31 N.	152.65 W.	33N	4.1	...	3.4M	...	G	JUNE 9	04 P.M. AST
JUNE 10	22	59	10.5	60.67 N.	152.09 W.	117	4.1	...	...	...	G	JUNE 10	12 P.M. AST
JUNE 11	04	54	43.3	63.00 N.	150.95 W.	107	3.8	...	...	...	G	JUNE 10	06 P.M. AST
JUNE 13	13	21	14.7	53.63 N.	163.53 W.	23	5.0	4.4	4.7M	...	G	JUNE 13	02 A.M. BST
JUNE 14	04	56	23.1	63.32 N.	151.48 W.	11	...	...	3.2M	...	G	JUNE 13	06 P.M. AST
JUNE 15	01	59	40.4	59.90 N.	147.25 W.	33N	...	...	3.7M	...	G	JUNE 14	03 P.M. AST
JUNE 16	01	32	34.4	60.23 N.	147.84 W.	113	...	...	...	...	G	JUNE 15	03 P.M. AST
JUNE 17	09	55	57.2	61.41 N.	146.81 W.	72	...	...	...	...	G	JUNE 16	11 P.M. AST
JUNE 18	17	23	51.1	56.80 N.	152.78 W.	33N	4.6	...	3.7M	...	G	JUNE 18	07 A.M. AST
JUNE 21	03	47	43.4	52.31 N.	176.08 W.	164	4.2	...	...	...	G	JUNE 20	04 P.M. BST
JUNE 21	16	07	57.7	56.88 N.	154.42 W.	33N	4.3	...	4.3M	...	G	JUNE 21	06 A.M. AST
JUNE 22	04	16	42.8	58.99 N.	136.17 W.	27	4.4	3.6	4.5M	V	G	JUNE 21	08 P.M. PST
JUNE 22	08	09	22.5	52.73 N.	167.09 W.	43	4.9	...	...	...	G	JUNE 21	09 P.M. BST
JUNE 25	01	36	36.5	54.94 N.	159.91 W.	33N	4.8	...	5.2M	II	G	JUNE 24	03 P.M. AST
JUNE 25	13	23	26.5	59.31 N.	153.24 W.	111	4.7	...	...	...	G	JUNE 25	03 A.M. AST
JUNE 26	12	40	21.0	51.60 N.	179.76 E.	63	4.8	...	...	...	G	JUNE 26	01 A.M. BST
JUNE 27	10	43	25.4	62.43 N.	149.03 W.	88	...	...	...	...	G	JUNE 27	00 A.M. AST
JUNE 27	22	59	47.9	53.57 N.	163.55 W.	31	4.5	4.0	4.5M	...	G	JUNE 27	11 A.M. BST
JUNE 28	02	37	46.7	59.87 N.	151.79 W.	33N	...	...	3.4M	...	G	JUNE 27	04 P.M. AST
JUNE 28	04	36	38.0	60.18 N.	140.28 W.	15	4.5	...	4.4M	...	G	JUNE 27	07 P.M. YST
JUNE 29	05	37	36.6	61.27 N.	147.56 W.	68	...	...	...	...	G	JUNE 28	07 P.M. AST
JUNE 29	07	36	44.8	50.12 N.	179.06 E.	22	4.4	4.7	...	...	G	JUNE 28	08 P.M. BST
JUNE 29	16	28	15.9	59.79 N.	153.18 W.	130	...	...	...	...	G	JUNE 29	06 A.M. AST
JUNE 30	02	19	48.1	61.47 N.	151.86 W.	109	...	...	...	...	G	JUNE 29	04 P.M. AST
JULY 1	19	00	18.3	59.15 N.	153.77 W.	121	...	...	...	...	G	JULY 1	09 A.M. AST
JULY 2	11	46	16.8	57.15 N.	146.10 W.	33N	4.3	...	...	...	G	JULY 2	01 A.M. AST
JULY 2	13	25	19.9	59.41 N.	152.53 W.	152	4.4	...	...	...	G	JULY 2	03 A.M. AST
JULY 3	10	08	11.9	61.05 N.	151.47 W.	72	3.8	...	...	...	G	JULY 3	00 A.M. AST
JULY 4	07	45	02.3	67.71 N.	161.64 W.	33N	4.8	4.9	...	FELT	G	JULY 3	08 P.M. BST
JULY 4	08	21	07.0	67.95 N.	162.33 W.	33N	...	...	...	...	G	JULY 3	09 P.M. BST
JULY 4	16	53	07.3	51.50 N.	177.34 W.	51	4.7	...	4.4M	FELT	G	JULY 4	05 A.M. BST
JULY 5	02	31	07.8	58.32 N.	151.22 W.	33N	...	...	3.4M	...	G	JULY 4	04 P.M. AST
JULY 6	01	22	03.2	67.95 N.	160.57 W.	33N	4.7	...	...	...	G	JULY 5	03 P.M. AST
JULY 7	09	19	25.0	67.67 N.	161.24 W.	33N	...	...	3.6M	...	G	JULY 6	10 P.M. BST
JULY 7	09	46	57.4	67.77 N.	161.40 W.	33N	4.6	...	3.9M	...	G	JULY 6	10 P.M. BST
JULY 8	17	19	12.8	59.28 N.	146.86 W.	33N	...	...	3.5M	...	G	JULY 8	07 A.M. AST
JULY 9	16	43	48.8	61.58 N.	148.38 W.	33N	...	...	2.2M	FELT	G	JULY 9	06 A.M. AST
JULY 10	01	39	31.0	51.65 N.	176.87 W.	55	5.0	...	...	IV	G	JULY 9	02 P.M. BST
JULY 10	09	06	05.9	60.60 N.	151.40 W.	80	3.8	...	...	...	G	JULY 9	11 P.M. AST
JULY 11	08	58	07.9	52.41 N.	170.58 W.	52	5.0	...	...	...	G	JULY 10	09 P.M. BST
JULY 12	01	27	56.3	67.71 N.	161.20 W.	33N	5.2	5.0	...	III	G	JULY 11	02 P.M. BST
JULY 12	01	58	53.4	67.75 N.	161.63 W.	33N	...	...	3.5M	...	G	JULY 11	02 P.M. BST
JULY 12	03	44	33.1	67.96 N.	161.76 W.	33N	4.0	...	3.7M	...	G	JULY 11	04 P.M. BST
JULY 12	10	42	42.3	67.90 N.	161.75 W.	33N	...	...	3.3M	...	G	JULY 11	11 P.M. BST
JULY 12	14	33	54.1	67.64 N.	161.60 W.	33N	4.8	4.3	...	...	G	JULY 12	03 A.M. BST
JULY 12	17	03	25.5	52.45 N.	169.12 W.	39	5.2	4.7	...	...	G	JULY 12	06 A.M. BST
JULY 13	05	58	01.1	67.79 N.	161.46 W.	12	4.9	4.3	...	...	G	JULY 12	06 P.M. BST
JULY 13	09	11	33.4	67.81 N.	161.43 W.	33N	...	...	...	...	G	JULY 12	10 P.M. BST
JULY 13	16	10	42.8	67.96 N.	161.54 W.	33N	...	...	3.9M	...	G	JULY 13	05 A.M. BST
JULY 13	18	27	01.2	59.42 N.	152.04 W.	28	...	...	3.4M	III	G	JULY 13	08 A.M. AST
JULY 13	22	10	02.4	50.21 N.	173.16 W.	6	5.5	4.7	5.3M	...	G	JULY 13	11 A.M. BST
JULY 14	01	27	36.3	52.30 N.	169.41 W.	28	4.7	4.6	...	...	G	JULY 13	02 P.M. BST
JULY 15	07	51	55.1	51.49 N.	174.79 W.	41	4.9	...	...	...	G	JULY 14	08 P.M. BST
JULY 15	08	25	37.0	51.37 N.	174.78 W.	39	5.0	...	4.9M	...	G	JULY 14	09 P.M. BST
JULY 15	08	46	47.7	48.59 N.	175.59 W.	33N	...	...	...	...	G	JULY 14	09 P.M. BST
JULY 15	13	05	40.0	51.35 N.	174.82 W.	36	5.0	...	4.5M	...	G	JULY 15	02 A.M. BST
JULY 16	04	22	04.3	67.82 N.	161.17 W.	33N	4.5	...	4.1M	...	G	JULY 15	05 P.M. BST
JULY 19	02	45	51.7	60.73 N.	150.17 W.	33N	...	...	3.3M	...	G	JULY 18	04 P.M. AST
JULY 19	09	20	27.0	63.29 N.	149.62 W.	17	4.2	...	4.2M	...	G	JULY 18	11 P.M. AST
JULY 19	15	35	01.4	61.51 N.	150.68 W.	62	...	...	...	...	G	JULY 19	05 A.M. AST
JULY 19	23	38	58.0	60.66 N.	152.75 W.	125	3.8	...	...	...	G	JULY 19	01 P.M. AST
JULY 20	14	08	57.9	62.02 N.	149.82 W.	66	...	...	...	...	G	JULY 20	04 A.M. AST
JULY 21	03	17	20.5	59.28 N.	152.27 W.	84	4.5	...	...	...	G	JULY 20	05 P.M. AST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Ma or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
					ALASKA--Continued								
JULY 23	10	13	55.7	63.21 N.	150.68 W.	135	...	...	...	...	G	JULY 23	00 A.M. AST
JULY 23	13	37	15.0	63.67 N.	157.70 W.	33N	...	...	...	...	G	JULY 23	03 A.M. AST
JULY 23	13	37	43.6	60.18 N.	151.31 W.	33N	...	...	...	...	G	JULY 23	03 A.M. AST
JULY 24	06	36	55.0	63.51 N.	150.20 W.	141	...	...	...	...	G	JULY 23	08 P.M. AST
JULY 24	13	44	19.8	63.13 N.	149.35 W.	114	...	...	...	...	G	JULY 24	03 A.M. AST
JULY 25	01	16	25.7	63.66 N.	149.37 W.	33N	...	...	3.4M	...	G	JULY 24	03 P.M. AST
JULY 25	18	31	58.7	67.79 N.	161.55 W.	33N	...	...	4.1M	...	G	JULY 25	07 A.M. BST
JULY 25	23	49	02.6	58.38 N.	151.50 W.	33N	4.5	...	4.6M	...	G	JULY 25	01 P.M. AST
JULY 26	21	19	08.0	63.43 N.	151.96 W.	33N	...	...	3.0M	...	G	JULY 26	11 A.M. AST
JULY 26	22	33	58.7	60.94 N.	150.85 W.	72	4.6	...	...	III	G	JULY 26	12 P.M. AST
JULY 27	02	24	56.5	58.78 N.	153.38 W.	33N	...	...	3.1M	...	G	JULY 26	04 P.M. AST
JULY 27	13	31	13.6	64.86 N.	149.07 W.	23	...	...	4.3M	IV	G	JULY 27	03 A.M. AST
JULY 27	23	05	19.3	63.38 N.	149.94 W.	116	4.4	...	...	...	G	JULY 27	01 P.M. AST
JULY 29	09	22	58.8	67.97 N.	161.41 W.	33N	...	...	...	...	G	JULY 28	10 P.M. BST
JULY 30	14	31	22.4	62.82 N.	148.79 W.	109	...	...	...	...	G	JULY 30	04 A.M. AST
AUG. 1	01	42	16.4	60.14 N.	153.18 W.	114	5.2	...	...	V	G	JULY 31	03 P.M. AST
AUG. 2	06	40	25.6	52.60 N.	168.13 W.	33N	4.4	...	...	...	G	AUG. 1	07 P.M. BST
AUG. 3	05	26	07.2	67.78 N.	161.53 W.	33N	...	...	3.2M	...	G	AUG. 2	06 P.M. BST
AUG. 5	10	21	50.8	59.58 N.	152.61 W.	101	...	...	...	...	G	AUG. 5	00 A.M. AST
AUG. 5	23	25	02.1	61.47 N.	150.40 W.	47	...	...	3.2M	...	G	AUG. 5	01 P.M. AST
AUG. 7	11	31	15.9	60.39 N.	153.03 W.	133	...	...	...	...	G	AUG. 7	01 A.M. AST
AUG. 7	17	57	18.8	61.85 N.	149.81 W.	54	...	...	...	...	G	AUG. 7	07 A.M. AST
AUG. 8	17	14	43.7	65.49 N.	148.33 W.	33N	...	...	3.8M	...	G	AUG. 8	07 A.M. AST
AUG. 8	21	32	06.1	51.96 N.	178.60 E.	105	4.9	...	...	...	G	AUG. 8	10 A.M. BST
AUG. 8	22	24	15.2	63.08 N.	150.94 W.	153	...	...	...	...	G	AUG. 8	12 P.M. AST
AUG. 9	19	54	43.3	52.13 N.	170.87 W.	38	4.5	...	4.4M	...	G	AUG. 9	08 A.M. BST
AUG. 11	21	27	48.7	59.78 N.	152.43 W.	121	...	...	...	...	G	AUG. 11	11 A.M. AST
AUG. 12	05	34	12.0	60.08 N.	153.29 W.	145	...	...	...	...	G	AUG. 11	07 P.M. AST
AUG. 13	15	42	50.5	61.57 N.	150.60 W.	75	...	...	...	IV	G	AUG. 13	05 A.M. AST
AUG. 15	10	30	56.9	56.38 N.	156.78 W.	53	5.1	...	...	...	G	AUG. 15	00 A.M. AST
AUG. 15	11	22	28.2	56.40 N.	156.68 W.	33N	...	...	3.7M	...	G	AUG. 15	01 A.M. AST
AUG. 15	18	05	50.4	63.38 N.	149.88 W.	122	...	...	...	...	G	AUG. 15	08 A.M. AST
AUG. 16	04	23	18.8	59.81 N.	152.41 W.	90	...	...	...	...	G	AUG. 15	06 P.M. AST
AUG. 16	15	30	05.9	51.59 N.	176.25 W.	52	4.5	...	...	...	G	AUG. 16	04 A.M. BST
AUG. 18	22	55	35.3	55.77 N.	158.60 W.	61	4.4	...	...	...	G	AUG. 18	12 P.M. AST
AUG. 22	05	58	21.0	61.53 N.	151.04 W.	72	4.3	...	...	III	G	AUG. 21	07 P.M. AST
AUG. 23	10	58	15.6	60.19 N.	153.65 W.	195	...	...	...	...	G	AUG. 23	00 A.M. AST
AUG. 24	01	43	38.7	55.94 N.	154.34 W.	33N	4.3	...	4.7M	...	G	AUG. 23	03 P.M. AST
AUG. 24	15	46	27.6	51.51 N.	178.35 W.	56	5.2	...	...	III	G	AUG. 24	04 A.M. BST
AUG. 25	09	23	55.6	59.52 N.	146.30 W.	33N	...	...	3.4M	...	G	AUG. 24	11 P.M. AST
AUG. 26	09	16	14.8	59.69 N.	152.25 W.	33N	...	...	3.0M	...	G	AUG. 25	11 P.M. AST
AUG. 27	01	50	02.2	59.84 N.	153.24 W.	126	...	...	...	...	G	AUG. 26	03 P.M. AST
AUG. 28	03	56	16.5	61.59 N.	151.88 W.	101	...	...	...	...	G	AUG. 27	05 P.M. AST
AUG. 28	04	46	57.5	64.02 N.	153.15 W.	33N	...	...	3.0M	...	G	AUG. 27	06 P.M. AST
AUG. 28	04	49	38.8	64.05 N.	153.30 W.	33N	...	...	3.6M	...	G	AUG. 27	06 P.M. AST
AUG. 28	09	04	24.7	61.74 N.	150.45 W.	71	5.1	...	...	V	G	AUG. 27	11 P.M. AST
AUG. 28	12	36	51.3	52.42 N.	169.28 W.	39	5.1	4.3	...	...	G	AUG. 28	01 A.M. BST
AUG. 29	15	48	19.6	63.15 N.	150.97 W.	137	...	...	...	...	G	AUG. 29	05 A.M. AST
AUG. 30	18	01	53.1	59.64 N.	152.37 W.	106	...	...	...	...	G	AUG. 30	08 A.M. AST
AUG. 30	19	47	27.9	55.99 N.	152.80 W.	33N	...	...	3.2M	...	G	AUG. 30	09 A.M. AST
AUG. 31	12	14	00.9	56.42 N.	153.82 W.	33N	...	...	3.4M	...	G	AUG. 31	02 A.M. AST
AUG. 31	12	47	03.0	68.72 N.	164.36 W.	33N	...	...	...	...	G	AUG. 31	01 A.M. BST
SEPT. 1	04	09	00.0	63.08 N.	150.66 W.	133	...	...	...	...	G	AUG. 31	06 P.M. AST
SEPT. 1	15	34	06.8	63.31 N.	149.46 W.	33N	...	...	...	...	G	SEPT. 1	05 A.M. AST
SEPT. 2	12	16	58.9	67.62 N.	165.20 W.	33N	...	...	...	...	G	SEPT. 2	01 A.M. BST
SEPT. 2	14	41	06.4	53.79 N.	161.36 W.	33N	4.8	4.8	4.5M	...	G	SEPT. 2	03 A.M. BST
SEPT. 3	18	44	13.4	51.38 N.	175.30 W.	33N	4.7	...	4.1M	III	G	SEPT. 3	07 A.M. BST
SEPT. 3	22	26	28.2	67.11 N.	154.96 W.	10	...	...	3.1M	...	G	SEPT. 3	12 P.M. AST
SEPT. 4	05	52	02.7	63.63 N.	149.85 W.	144	...	...	...	...	G	SEPT. 3	07 P.M. AST
SEPT. 5	23	33	22.5	58.99 N.	152.60 W.	87	...	...	...	...	G	SEPT. 5	01 P.M. AST
SEPT. 6	13	20	20.1	56.67 N.	156.61 W.	49	4.4	...	4.8M	...	G	SEPT. 6	03 A.M. AST
SEPT. 7	04	55	23.6	62.58 N.	152.19 W.	18	4.3	...	3.5M	...	G	SEPT. 6	06 P.M. AST
SEPT. 7	09	57	10.8	60.22 N.	152.16 W.	119	...	...	...	...	G	SEPT. 6	11 P.M. AST
SEPT. 8	02	53	26.7	51.64 N.	179.51 E.	86	4.5	...	...	...	G	SEPT. 7	03 P.M. BST
SEPT. 8	07	01	16.9	51.47 N.	178.37 W.	55	4.9	...	...	FELT	G	SEPT. 7	08 P.M. BST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)		Long (°)		Depth (km)	Magnitude mb	MS	MI Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
ALASKA--Continued															
SEPT. 8	13	50	51.9	62.27	N.	149.43	W.	33N	...	...	3.0M	...	G	SEPT. 8	03 A.M. AST
SEPT. 9	18	00	01.8	60.36	N.	152.26	W.	131	...	...	...	...	G	SEPT. 9	08 A.M. AST
SEPT. 10	01	30	38.7	62.76	N.	149.64	W.	101	4.3	...	...	FELT	G	SEPT. 9	03 P.M. AST
SEPT. 10	11	06	23.6	65.09	N.	152.22	W.	15	4.2	...	4.0M	IV	G	SEPT. 10	01 A.M. AST
SEPT. 11	05	02	30.8	60.07	N.	139.57	W.	33N	4.2	...	4.1M	...	G	SEPT. 10	08 P.M. YST
SEPT. 11	05	51	22.6	59.37	N.	145.10	W.	33N	4.0	...	3.7M	...	G	SEPT. 10	07 P.M. AST
SEPT. 11	08	39	50.1	60.27	N.	140.93	W.	15	4.0	...	4.4M	...	G	SEPT. 10	11 P.M. YST
SEPT. 12	22	08	46.4	52.52	N.	171.28	W.	33N	4.3	...	...	...	G	SEPT. 12	11 A.M. BST
SEPT. 13	20	11	43.3	54.58	N.	163.62	W.	33N	...	...	4.0M	...	G	SEPT. 13	09 A.M. BST
SEPT. 14	02	13	53.5	61.05	N.	150.66	W.	56	...	...	...	...	G	SEPT. 13	04 P.M. AST
SEPT. 14	07	39	37.8	51.82	N.	178.47	E.	107	4.7	...	...	...	G	SEPT. 13	08 P.M. BST
SEPT. 15	13	05	19.3	51.71	N.	172.05	E.	33N	4.5	...	4.2M	...	G	SEPT. 15	02 A.M. BST
SEPT. 16	00	29	27.5	62.50	N.	149.47	W.	33N	...	...	3.1M	...	G	SEPT. 15	02 P.M. AST
SEPT. 16	10	10	18.9	62.88	N.	150.38	W.	101	4.1	...	...	...	G	SEPT. 16	00 A.M. AST
SEPT. 16	12	11	05.2	63.08	N.	150.95	W.	132	4.4	...	...	...	G	SEPT. 16	02 A.M. AST
SEPT. 17	00	18	55.3	60.02	N.	139.62	W.	23	3.8	...	4.3M	...	G	SEPT. 16	03 P.M. YST
SEPT. 18	15	15	19.8	62.06	N.	149.40	W.	33N	...	...	3.0M	...	G	SEPT. 18	05 A.M. AST
SEPT. 21	07	04	42.6	62.09	N.	149.97	W.	33N	...	...	3.2M	...	G	SEPT. 20	09 P.M. AST
SEPT. 21	12	08	51.5	62.77	N.	149.58	W.	109	...	...	...	...	G	SEPT. 21	02 A.M. AST
SEPT. 21	21	43	20.7	62.36	N.	151.06	W.	116	...	...	...	...	G	SEPT. 21	11 A.M. AST
SEPT. 23	07	38	52.0	59.15	N.	145.50	W.	33N	...	...	3.2M	...	G	SEPT. 22	09 P.M. AST
SEPT. 24	12	41	32.6	67.08	N.	163.96	W.	33N	4.3	...	4.1M	...	G	SEPT. 24	01 A.M. BST
SEPT. 25	06	42	46.8	51.09	N.	167.05	W.	33N	4.5	...	...	...	G	SEPT. 24	07 P.M. BST
SEPT. 25	22	56	13.1	51.41	N.	176.89	W.	47	4.2	...	...	...	G	SEPT. 25	11 A.M. BST
SEPT. 26	10	48	53.4	61.51	N.	146.62	W.	55	...	...	...	...	G	SEPT. 26	00 A.M. AST
SEPT. 26	17	43	09.6	62.01	N.	149.25	W.	58	4.7	...	...	FELT	G	SEPT. 26	07 A.M. AST
SEPT. 27	06	46	43.8	63.60	N.	149.81	W.	153	...	...	...	...	G	SEPT. 26	08 P.M. AST
SEPT. 27	12	12	48.3	58.59	N.	155.12	W.	154	...	...	...	...	G	SEPT. 27	02 A.M. AST
SEPT. 27	15	15	12.9	64.75	N.	147.12	W.	22	...	...	3.8M	IV	G	SEPT. 27	05 A.M. AST
SEPT. 27	16	59	03.5	68.45	N.	162.46	W.	33N	3.9	...	3.7M	...	G	SEPT. 27	05 A.M. BST
SEPT. 27	19	48	11.7	61.98	N.	150.87	W.	73	3.7	...	...	...	G	SEPT. 27	09 A.M. AST
SEPT. 28	19	20	54.6	68.29	N.	161.81	W.	33N	...	...	4.4M	...	G	SEPT. 28	08 A.M. BST
OCT. 1	15	12	19.6	67.90	N.	161.88	W.	33N	...	...	3.4M	...	G	OCT. 1	04 A.M. BST
OCT. 2	08	13	23.0	61.54	N.	149.91	W.	52	...	...	3.3M	...	G	OCT. 1	10 P.M. AST
OCT. 3	04	16	04.4	52.60	N.	170.67	W.	46	4.6	...	...	...	G	OCT. 2	05 P.M. BST
OCT. 3	12	03	03.5	59.15	N.	152.90	W.	113	...	...	...	...	G	OCT. 3	02 A.M. AST
OCT. 4	11	17	30.5	51.87	N.	176.57	W.	88	4.5	...	...	...	G	OCT. 4	00 A.M. BST
OCT. 5	13	05	24.2	62.17	N.	151.08	W.	105	4.2	...	...	...	G	OCT. 5	03 A.M. AST
OCT. 6	07	40	13.1	51.45	N.	175.72	E.	23	5.2	4.3	5.1M	...	G	OCT. 5	08 P.M. BST
OCT. 6	18	35	35.5	64.79	N.	147.35	W.	16	...	...	2.5A	IV	A	OCT. 6	08 A.M. AST
OCT. 6	19	44	59.4	63.58	N.	149.96	W.	28	4.7	...	4.4M	II	G	OCT. 6	09 A.M. AST
OCT. 7	02	08	35.5	60.11	N.	141.06	W.	15	4.1	...	3.9M	...	G	OCT. 6	04 P.M. AST
OCT. 8	01	16	12.3	61.84	N.	148.86	W.	26	...	...	3.1M	...	G	OCT. 7	03 P.M. AST
OCT. 8	07	58	08.9	58.38	N.	151.29	W.	33N	...	...	...	...	G	OCT. 7	09 P.M. AST
OCT. 9	09	19	48.6	52.30	N.	173.59	W.	68	4.6	...	...	...	G	OCT. 8	10 P.M. BST
OCT. 9	19	23	59.4	61.96	N.	147.25	W.	65	3.7	...	...	...	G	OCT. 9	09 A.M. AST
OCT. 11	03	33	19.7	60.84	N.	150.94	W.	33N	...	...	3.4M	...	G	OCT. 10	05 P.M. AST
OCT. 13	00	37	58.1	53.82	N.	167.34	W.	111	4.5	...	...	...	G	OCT. 12	01 P.M. BST
OCT. 13	09	27	23.9	58.46	N.	155.12	W.	121	...	...	...	...	G	OCT. 12	11 P.M. AST
OCT. 14	11	03	19.6	60.36	N.	152.08	W.	120	...	...	...	...	G	OCT. 14	01 A.M. AST
OCT. 14	13	59	36.3	67.84	N.	162.06	W.	15	...	...	...	...	G	OCT. 14	02 A.M. BST
OCT. 15	21	36	28.1	57.75	N.	150.92	W.	150	...	...	...	...	G	OCT. 15	11 A.M. AST
OCT. 16	07	52	50.4	60.91	N.	147.01	W.	33N	4.2	...	4.2M	FELT	G	OCT. 15	09 P.M. AST
OCT. 16	11	22	49.2	60.23	N.	140.92	W.	15	...	...	4.5M	...	G	OCT. 16	02 A.M. YST
OCT. 16	14	36	34.4	60.21	N.	140.98	W.	15	...	...	3.7M	...	G	OCT. 16	05 A.M. YST
OCT. 16	14	43	21.3	60.26	N.	140.98	W.	15	4.4	...	4.5M	...	G	OCT. 16	05 A.M. YST
OCT. 16	17	39	00.1	60.21	N.	140.94	W.	15	...	...	3.8M	...	G	OCT. 16	08 A.M. YST
OCT. 18	10	41	31.2	67.93	N.	161.93	W.	15	...	...	3.9M	...	G	OCT. 17	11 P.M. BST
OCT. 18	12	36	47.5	60.37	N.	151.64	W.	90	...	...	...	...	G	OCT. 18	02 A.M. AST
OCT. 18	14	57	31.7	67.83	N.	161.76	W.	15	...	...	3.7M	...	G	OCT. 18	03 A.M. BST
OCT. 18	15	44	50.4	67.93	N.	161.91	W.	15	...	...	3.9M	...	G	OCT. 18	04 A.M. BST
OCT. 18	19	31	40.0	67.81	N.	161.88	W.	15	...	...	3.3M	...	G	OCT. 18	08 A.M. BST
OCT. 19	01	46	16.0	60.24	N.	152.34	W.	127	...	...	...	...	G	OCT. 18	03 P.M. AST
OCT. 19	03	53	27.8	67.88	N.	161.65	W.	15	4.2	...	4.1M	...	G	OCT. 18	04 P.M. BST
OCT. 19	04	35	45.3	67.80	N.	161.68	W.	15	...	...	2.9M	...	G	OCT. 18	05 P.M. BST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
ALASKA--Continued													
OCT. 19	07	06	58.3	67.58 N.	161.45 W.	15	...	...	3.0M	...	G	OCT. 18	08 P.M. BST
OCT. 19	08	02	19.6	67.89 N.	161.75 W.	15	...	...	3.3M	...	G	OCT. 18	09 P.M. BST
OCT. 19	09	32	58.6	67.84 N.	161.89 W.	15	...	...	3.4M	...	G	OCT. 18	10 P.M. BST
OCT. 19	14	28	37.0	67.79 N.	161.50 W.	15	4.8	4.6	4.3M	...	G	OCT. 19	03 A.M. BST
OCT. 19	15	00	18.0	68.00 N.	161.93 W.	15	...	...	3.6M	...	G	OCT. 19	04 A.M. BST
OCT. 19	15	09	57.6	67.98 N.	161.69 W.	15	...	...	3.9M	...	G	OCT. 19	04 A.M. BST
OCT. 19	15	49	44.4	65.87 N.	156.21 W.	33N	...	...	4.2M	...	G	OCT. 19	05 A.M. AST
OCT. 22	20	22	17.4	51.33 N.	176.82 W.	41	3.9	...	...	...	G	OCT. 22	09 A.M. BST
OCT. 24	04	50	14.0	61.53 N.	150.61 W.	33N	...	...	3.2M	...	G	OCT. 23	06 P.M. AST
OCT. 24	07	01	31.6	51.31 N.	173.06 W.	33N	...	...	3.9M	...	G	OCT. 23	08 P.M. BST
OCT. 24	08	11	17.9	51.82 N.	173.23 W.	41	4.7	...	4.4M	...	G	OCT. 23	09 P.M. BST
OCT. 24	20	00	32.2	60.65 N.	150.40 W.	53	...	...	4.5M	...	G	OCT. 24	10 A.M. AST
OCT. 25	00	56	45.2	57.66 N.	153.16 W.	64	4.6	...	...	...	G	OCT. 24	02 P.M. AST
OCT. 25	12	19	14.1	52.59 N.	169.59 W.	51	4.5	...	...	...	G	OCT. 25	01 A.M. BST
OCT. 26	02	37	02.1	59.67 N.	152.66 W.	108	...	...	...	...	G	OCT. 25	04 P.M. AST
OCT. 26	09	26	00.2	63.55 N.	149.99 W.	33N	...	...	3.7M	...	G	OCT. 25	11 P.M. AST
OCT. 28	03	56	08.2	63.10 N.	149.45 W.	104	...	...	...	...	G	OCT. 27	05 P.M. AST
OCT. 30	04	42	13.7	64.76 N.	160.55 W.	33N	...	...	3.2M	...	G	OCT. 29	06 P.M. AST
OCT. 31	06	44	13.8	53.00 N.	163.87 W.	33N	4.5	...	4.5M	...	G	OCT. 30	07 P.M. BST
NOV. 1	06	37	39.7	52.02 N.	170.42 E.	33N	4.4	...	...	...	G	OCT. 31	07 P.M. BST
NOV. 2	12	18	58.0	61.70 N.	150.68 W.	57	...	...	3.2M	...	G	NOV. 2	02 A.M. AST
NOV. 3	04	03	12.7	60.00 N.	152.64 W.	117	4.2	...	...	...	G	NOV. 2	06 P.M. AST
NOV. 3	20	02	34.6	61.44 N.	151.15 W.	79	...	...	...	...	G	NOV. 3	10 A.M. AST
NOV. 4	02	42	02.9	67.98 N.	159.38 W.	33N	...	...	3.1M	...	G	NOV. 3	04 P.M. AST
NOV. 4	05	25	01.9	51.99 N.	170.92 W.	41	4.9	3.9	...	...	G	NOV. 3	06 P.M. BST
NOV. 4	23	17	47.1	63.01 N.	150.54 W.	110	...	...	...	...	G	NOV. 4	01 P.M. AST
NOV. 5	19	46	56.2	67.56 N.	161.55 W.	15	...	...	3.2M	...	G	NOV. 5	08 A.M. BST
NOV. 8	11	13	02.2	51.73 N.	174.28 W.	33N	4.7	4.3	4.0M	...	G	NOV. 8	00 A.M. BST
NOV. 8	22	36	24.0	51.79 N.	174.41 W.	33N	4.5	...	3.8M	...	G	NOV. 8	11 A.M. BST
NOV. 9	00	07	52.8	58.23 N.	155.10 W.	129	4.7	...	...	...	G	NOV. 8	02 P.M. AST
NOV. 9	04	59	34.7	64.27 N.	149.43 W.	33N	...	...	3.9M	...	G	NOV. 8	06 P.M. AST
NOV. 9	16	45	06.0	53.22 N.	165.75 W.	33N	5.5	5.3	...	IV	G	NOV. 9	05 A.M. BST
NOV. 10	03	07	16.1	52.39 N.	169.38 W.	41	4.6	...	...	...	G	NOV. 9	04 P.M. BST
NOV. 13	10	03	01.1	60.61 N.	147.21 W.	33N	...	...	2.6M	...	G	NOV. 13	00 A.M. AST
NOV. 13	12	12	59.7	52.64 N.	168.63 W.	33N	4.4	...	...	...	G	NOV. 13	01 A.M. BST
NOV. 13	18	10	29.3	60.13 N.	150.73 W.	79	...	...	...	...	G	NOV. 13	08 A.M. AST
NOV. 14	00	43	03.3	54.07 N.	164.54 W.	66	5.1	...	...	III	G	NOV. 13	01 P.M. BST
NOV. 15	18	49	08.0	67.93 N.	161.77 W.	15	...	...	3.2M	...	G	NOV. 15	07 A.M. BST
NOV. 15	21	05	55.7	68.00 N.	161.85 W.	15	...	...	3.4M	...	G	NOV. 15	10 A.M. BST
NOV. 16	06	47	57.0	51.75 N.	174.38 W.	33N	4.3	...	...	...	G	NOV. 15	07 P.M. BST
NOV. 16	23	49	48.0	60.11 N.	153.12 W.	126	4.5	...	...	II	G	NOV. 16	01 P.M. AST
NOV. 17	11	28	40.8	60.31 N.	151.74 W.	74	4.8	...	...	IV	G	NOV. 17	01 A.M. AST
NOV. 18	06	16	08.5	64.58 N.	149.21 W.	10	...	...	3.4M	IV	G	NOV. 17	08 P.M. AST
NOV. 18	11	19	14.1	62.25 N.	149.16 W.	73	...	...	...	...	G	NOV. 18	01 A.M. AST
NOV. 18	19	34	46.7	53.81 N.	163.90 W.	60	4.7	...	...	...	G	NOV. 18	08 A.M. BST
NOV. 19	01	45	33.7	61.40 N.	149.96 W.	45	...	...	2.8M	III	G	NOV. 18	03 P.M. AST
NOV. 19	04	20	07.6	52.57 N.	172.56 E.	39	4.9	4.5	4.7M	...	G	NOV. 18	05 P.M. BST
NOV. 22	12	51	17.3	63.04 N.	150.84 W.	143	...	...	...	...	G	NOV. 22	02 A.M. AST
NOV. 22	17	55	06.6	60.86 N.	150.61 W.	85	...	...	...	...	G	NOV. 22	07 A.M. AST
NOV. 23	07	27	34.6	60.69 N.	151.19 W.	86	...	...	...	III	G	NOV. 22	09 P.M. AST
NOV. 25	02	43	41.2	52.52 N.	173.17 W.	33N	4.7	...	4.7M	...	G	NOV. 24	03 P.M. BST
NOV. 29	05	18	18.9	65.81 N.	145.16 W.	33N	...	...	3.2M	...	G	NOV. 28	07 P.M. AST
NOV. 29	22	27	54.5	63.08 N.	148.54 W.	107	...	...	...	...	G	NOV. 29	12 P.M. AST
NOV. 30	01	14	45.8	58.32 N.	151.68 W.	33N	...	...	4.0M	...	G	NOV. 29	03 P.M. AST
NOV. 30	04	29	30.8	63.41 N.	150.36 W.	150	...	...	...	...	G	NOV. 29	06 P.M. AST
NOV. 30	14	48	35.9	60.20 N.	147.84 W.	33N	...	...	3.8M	...	G	NOV. 30	04 A.M. AST
DEC. 1	20	05	09.3	51.04 N.	178.87 E.	42	4.6	...	5.2M	...	G	DEC. 1	09 A.M. BST
DEC. 4	13	51	02.9	62.91 N.	148.75 W.	93	...	...	...	...	G	DEC. 4	03 A.M. AST
DEC. 5	05	45	00.4	63.44 N.	150.39 W.	126	...	...	...	...	G	DEC. 4	07 P.M. AST
DEC. 6	04	41	48.0	60.02 N.	153.35 W.	137	4.3	...	...	...	G	DEC. 5	06 P.M. AST
DEC. 6	17	27	41.6	61.97 N.	148.40 W.	63	4.6	...	...	IV	G	DEC. 6	07 A.M. AST
DEC. 7	14	42	58.1	57.35 N.	152.26 W.	33N	4.8	3.9	4.1M	...	G	DEC. 7	04 A.M. AST
DEC. 7	17	45	40.1	61.90 N.	147.65 W.	33N	...	...	2.9M	III	G	DEC. 7	07 A.M. AST
DEC. 8	14	06	59.0	64.83 N.	147.49 W.	15	...	...	3.0M	III	G	DEC. 8	04 A.M. AST
DEC. 8	18	04	40.9	62.77 N.	151.06 W.	33N	...	...	3.1M	...	G	DEC. 8	08 A.M. AST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
ALASKA--Continued													
DEC. 9	12	22	17.6	53.19 N.	154.83 W.	33N	4.9	...	4.9M	...	G	DEC. 9	02 A.M. AST
DEC. 10	02	26	23.6	51.88 N.	179.72 E.	109	4.6	...	...	...	G	DEC. 9	03 P.M. BST
DEC. 10	05	45	16.1	63.17 N.	150.75 W.	161	...	...	...	...	G	DEC. 9	07 P.M. AST
DEC. 11	06	43	41.4	60.86 N.	148.09 W.	33N	...	...	3.1M	...	G	DEC. 10	08 P.M. AST
DEC. 13	03	46	53.1	62.80 N.	149.03 W.	88	...	...	...	...	G	DEC. 12	05 P.M. AST
DEC. 14	09	17	35.0	62.51 N.	152.56 W.	158	...	...	...	...	G	DEC. 13	11 P.M. AST
DEC. 14	21	13	10.8	59.95 N.	153.93 W.	198	...	...	...	...	G	DEC. 14	11 A.M. AST
DEC. 15	21	34	52.4	65.65 N.	154.25 W.	33N	...	...	3.5M	...	G	DEC. 15	11 A.M. AST
DEC. 16	08	06	33.3	65.54 N.	150.05 W.	33N	...	...	3.4M	...	G	DEC. 15	10 P.M. AST
DEC. 17	00	34	42.9	65.82 N.	155.06 W.	33N	...	...	2.6M	...	G	DEC. 16	02 P.M. AST
DEC. 18	14	20	45.5	61.29 N.	150.20 W.	33N	...	...	2.1M	III	G	DEC. 18	04 A.M. AST
DEC. 20	10	52	06.4	61.27 N.	150.30 W.	65	...	...	...	III	G	DEC. 20	00 A.M. AST
DEC. 20	14	13	47.3	59.97 N.	152.93 W.	122	...	...	...	...	G	DEC. 20	04 A.M. AST
DEC. 21	23	07	35.3	64.55 N.	147.19 W.	1	...	...	2.3A	III	A	DEC. 21	01 P.M. AST
DEC. 22	04	31	34.6	59.96 N.	152.84 W.	125	...	...	...	...	G	DEC. 21	06 P.M. AST
DEC. 24	01	08	24.4	63.99 N.	148.88 W.	33N	...	...	2.7M	...	G	DEC. 23	03 P.M. AST
DEC. 25	22	26	38.6	59.65 N.	152.81 W.	107	4.3	...	...	...	G	DEC. 25	12 P.M. AST
DEC. 28	10	28	16.1	54.67 N.	160.41 W.	33N	...	...	3.8M	FELT	G	DEC. 28	00 A.M. AST
DEC. 28	22	01	50.1	63.11 N.	150.82 W.	151	...	...	...	...	G	DEC. 28	12 P.M. AST
DEC. 30	08	09	44.1	52.39 N.	169.59 W.	45	4.8	...	...	...	G	DEC. 29	09 P.M. BST
DEC. 30	13	31	50.7	64.50 N.	147.96 W.	15	...	...	...	...	G	DEC. 30	03 A.M. AST
DEC. 30	13	38	41.5	55.80 N.	157.84 W.	33N	...	...	4.0M	...	G	DEC. 30	03 A.M. AST
DEC. 30	13	46	18.1	64.50 N.	147.96 W.	15	...	...	...	...	G	DEC. 30	03 A.M. AST
DEC. 30	13	47	27.2	64.50 N.	147.95 W.	17	3.9	...	4.2M	IV	A	DEC. 30	03 A.M. AST
DEC. 30	13	59	52.8	64.50 N.	147.93 W.	15	...	...	...	...	G	DEC. 30	03 A.M. AST
DEC. 30	14	00	34.0	64.49 N.	147.95 W.	15	4.9	4.6	5.2M	V	A	DEC. 30	04 A.M. AST
DEC. 30	14	07	58.0	64.50 N.	147.91 W.	15	...	...	...	...	G	DEC. 30	04 A.M. AST
DEC. 30	14	11	28.1	64.50 N.	147.93 W.	15	...	...	...	...	G	DEC. 30	04 A.M. AST
DEC. 31	12	15	54.5	61.91 N.	151.76 W.	128	4.1	...	...	FELT	G	DEC. 31	02 A.M. AST
ARIZONA													
JAN. 12	08	59	13.2	35.66 N.	113.47 W.	5	...	...	3.5G	...	G	JAN. 12	01 A.M. MST
JAN. 18	23	48	40.3	34.15 N.	110.79 W.	5	...	...	3.0G	...	G	JAN. 18	04 P.M. MST
MAR. 16	06	12	50.7	32.57 N.	114.69 W.	5	...	...	3.1P	...	P	MAR. 15	10 P.M. PST
ARKANSAS													
APR. 29	15	09	32.9	35.34 N.	90.14 W.	8	...	...	2.8G	FELT	K	APR. 29	09 A.M. CST
JUNE 26	08	33	27.0	35.85 N.	90.07 W.	9	...	...	3.6G	V	K	JUNE 26	02 A.M. CST
CALIFORNIA													
JAN. 2	00	42	37.0	37.55 N.	118.89 W.	5	...	...	3.0P	...	P	JAN. 1	04 P.M. PST
JAN. 2	15	03	09.5	36.03 N.	118.29 W.	5	...	...	3.3P	...	P	JAN. 2	07 A.M. PST
JAN. 2	18	12	46.0	39.73 N.	120.53 W.	27	...	...	3.5B	FELT	B	JAN. 2	10 A.M. PST
JAN. 3	13	34	44.6	34.56 N.	120.47 W.	13	...	...	2.5P	FELT	P	JAN. 3	05 P.M. PST
JAN. 5	02	52	18.3	37.95 N.	122.07 W.	9	...	...	2.8B	III	B	JAN. 4	06 P.M. PST
JAN. 7	11	42	33.1	36.86 N.	121.62 W.	7	4.3	...	4.5B	V	B	JAN. 7	03 A.M. PST
JAN. 7	18	34	35.8	36.86 N.	121.61 W.	6	...	...	2.9B	...	B	JAN. 7	10 A.M. PST
JAN. 8	14	52	14.7	33.94 N.	118.68 W.	12	...	...	3.3P	IV	P	JAN. 8	06 A.M. PST
JAN. 9	06	45	53.0	41.60 N.	121.86 W.	8	...	...	3.4B	...	B	JAN. 8	10 P.M. PST
JAN. 9	12	44	35.4	41.59 N.	121.95 W.	8	...	...	3.3B	FELT	B	JAN. 9	04 A.M. PST
JAN. 10	00	36	15.5	41.60 N.	121.90 W.	8	...	...	3.6B	FELT	B	JAN. 9	04 P.M. PST
JAN. 10	06	34	33.1	34.13 N.	118.25 W.	9	...	...	2.3P	FELT	P	JAN. 9	10 P.M. PST
JAN. 10	14	19	41.7	37.64 N.	118.85 W.	6	...	...	3.3P	...	P	JAN. 10	06 A.M. PST
JAN. 11	04	44	32.5	35.92 N.	120.54 W.	8	...	...	3.1B	FELT	B	JAN. 10	08 P.M. PST
JAN. 12	02	22	07.8	41.41 N.	121.99 W.	8	...	...	3.0B	...	B	JAN. 11	06 P.M. PST
JAN. 12	11	46	01.1	41.42 N.	121.97 W.	8	...	...	3.0B	FELT	B	JAN. 12	03 A.M. PST
JAN. 12	20	42	00.3	37.55 N.	118.85 W.	6	...	...	3.1P	...	P	JAN. 12	12 P.M. PST
JAN. 13	04	21	36.7	37.64 N.	118.91 W.	6	...	...	3.1P	...	P	JAN. 12	08 P.M. PST
JAN. 15	12	47	51.6	37.38 N.	121.72 W.	9	4.8	4.0	4.8B	V	B	JAN. 15	04 A.M. PST
JAN. 15	12	50	46.9	37.37 N.	121.73 W.	8	...	...	3.0B	...	B	JAN. 15	04 A.M. PST
JAN. 15	15	17	04.3	37.64 N.	118.87 W.	6	...	...	3.0P	...	P	JAN. 15	07 A.M. PST
JAN. 15	17	02	54.8	37.63 N.	118.86 W.	4	...	...	3.0P	...	P	JAN. 15	09 A.M. PST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
CALIFORNIA--Continued													
JAN. 16	07	01	16.3	37.60 N.	118.89 W.	6	...	...	3.2P	...	P	JAN. 15	11 P.M. PST
JAN. 17	00	09	36.9	35.93 N.	120.54 W.	12	...	...	3.1B	FELT	B	JAN. 16	04 P.M. PST
JAN. 18	20	19	55.7	33.50 N.	116.77 W.	4	...	...	3.7P	...	P	JAN. 18	12 P.M. PST
JAN. 23	04	41	12.2	37.13 N.	117.38 W.	9	...	...	3.7P	...	P	JAN. 22	08 P.M. PST
JAN. 23	08	47	11.9	34.04 N.	116.64 W.	5	...	...	2.9P	IV	P	JAN. 23	00 A.M. PST
JAN. 23	22	13	03.6	33.13 N.	115.62 W.	7	...	...	3.0P	...	P	JAN. 23	02 P.M. PST
JAN. 25	12	05	28.6	37.66 N.	118.98 W.	5	...	...	3.1P	...	P	JAN. 25	04 A.M. PST
JAN. 26	10	20	57.7	33.91 N.	117.54 W.	15	...	...	2.9P	FELT	P	JAN. 26	02 A.M. PST
JAN. 27	04	47	33.5	33.25 N.	115.97 W.	0	...	...	2.8P	FELT	P	JAN. 26	08 P.M. PST
JAN. 27	22	10	53.9	36.84 N.	121.63 W.	7	...	...	4.1B	V	B	JAN. 27	02 P.M. PST
JAN. 28	04	00	16.5	34.04 N.	118.35 W.	12	...	...	3.0P	FELT	P	JAN. 27	08 P.M. PST
JAN. 29	08	41	32.4	40.19 N.	121.44 W.	2	...	...	3.3B	...	B	JAN. 29	00 A.M. PST
JAN. 30	01	54	13.4	33.92 N.	118.50 W.	5	...	...	3.2P	V	P	JAN. 29	05 P.M. PST
JAN. 31	05	23	20.6	36.24 N.	120.24 W.	10	...	...	3.5B	IV	B	JAN. 30	09 P.M. PST
JAN. 31	06	30	15.4	37.17 N.	121.54 W.	4	...	...	3.4B	FELT	B	JAN. 30	10 P.M. PST
FEB. 1	11	30	06.9	33.51 N.	116.77 W.	3	...	...	3.7P	IV	P	FEB. 1	03 A.M. PST
FEB. 1	19	27	07.8	33.50 N.	116.78 W.	2	...	...	3.4P	...	P	FEB. 1	11 A.M. PST
FEB. 2	09	15	15.9	37.42 N.	118.68 W.	5	...	...	3.1P	...	P	FEB. 2	01 A.M. PST
FEB. 5	13	38	10.9	33.50 N.	116.78 W.	4	...	...	3.2P	FELT	P	FEB. 5	05 A.M. PST
FEB. 5	18	57	24.9	33.51 N.	116.77 W.	3	...	...	3.3P	...	P	FEB. 5	10 A.M. PST
FEB. 6	08	13	33.0	37.58 N.	118.91 W.	5	...	...	3.3P	...	P	FEB. 6	00 A.M. PST
FEB. 6	08	44	39.5	37.57 N.	118.90 W.	5	...	...	3.4P	...	P	FEB. 6	00 A.M. PST
FEB. 7	07	00	35.9	40.75 N.	124.26 W.	21	...	...	3.0B	...	B	FEB. 6	11 P.M. PST
FEB. 11	00	07	54.4	37.89 N.	122.00 W.	8	...	...	2.6B	FELT	B	FEB. 10	04 P.M. PST
FEB. 11	04	41	05.7	36.00 N.	120.24 W.	7	...	...	3.5B	...	B	FEB. 10	08 P.M. PST
FEB. 11	08	47	28.4	37.86 N.	121.78 W.	14	...	...	3.0B	...	B	FEB. 11	00 A.M. PST
FEB. 13	15	01	45.3	37.60 N.	118.90 W.	5	...	...	3.3P	...	P	FEB. 13	07 A.M. PST
FEB. 18	10	49	24.2	36.77 N.	118.17 W.	5	...	...	3.0P	...	P	FEB. 18	02 A.M. PST
FEB. 21	04	15	53.0	36.84 N.	121.65 W.	8	...	...	3.0B	FELT	B	FEB. 20	08 P.M. PST
FEB. 21	14	04	43.3	36.90 N.	122.19 W.	8	...	...	3.0B	...	B	FEB. 21	06 A.M. PST
FEB. 21	15	09	51.9	33.51 N.	116.46 W.	9	...	...	3.3P	...	P	FEB. 21	07 A.M. PST
FEB. 21	21	45	40.2	33.22 N.	116.07 W.	1	...	...	3.0P	...	P	FEB. 21	01 P.M. PST
FEB. 21	22	56	16.5	33.66 N.	116.76 W.	14	...	...	3.4P	FELT	P	FEB. 21	02 P.M. PST
FEB. 23	02	00	48.7	37.12 N.	121.52 W.	4	...	...	3.1B	FELT	B	FEB. 22	06 P.M. PST
FEB. 23	06	12	51.2	35.19 N.	120.64 W.	1	...	...	3.2P	FELT	B	FEB. 22	10 P.M. PST
FEB. 23	13	07	08.8	36.12 N.	120.40 W.	9	...	...	3.0B	FELT	B	FEB. 23	05 A.M. PST
FEB. 23	23	48	59.5	37.55 N.	118.83 W.	0	...	...	3.0P	...	P	FEB. 23	03 P.M. PST
FEB. 24	02	56	10.5	36.88 N.	121.61 W.	4	...	...	2.8B	FELT	B	FEB. 23	06 P.M. PST
FEB. 24	09	12	00.7	36.85 N.	121.63 W.	6	...	...	3.1B	FELT	B	FEB. 24	01 A.M. PST
FEB. 24	20	29	58.5	37.63 N.	118.92 W.	3	...	...	3.0P	...	P	FEB. 24	12 P.M. PST
FEB. 24	20	49	35.1	33.95 N.	118.67 W.	6	...	...	2.4P	FELT	P	FEB. 24	12 P.M. PST
FEB. 27	15	11	12.6	34.17 N.	118.60 W.	16	...	...	3.5P	V	P	FEB. 27	07 A.M. PST
FEB. 28	07	46	34.6	37.61 N.	118.88 W.	5	...	...	3.2P	...	P	FEB. 27	11 P.M. PST
MAR. 3	10	45	12.9	37.56 N.	121.94 W.	10	4.2	4.0	4.4B	VI	B	MAR. 3	02 A.M. PST
MAR. 3	10	57	19.5	37.56 N.	121.94 W.	10	...	...	3.0B	...	B	MAR. 3	02 A.M. PST
MAR. 3	12	02	52.7	32.91 N.	115.54 W.	6	...	...	2.3P	FELT	P	MAR. 3	04 A.M. PST
MAR. 3	15	02	24.3	37.52 N.	118.78 W.	5	...	...	3.0P	...	P	MAR. 3	07 A.M. PST
MAR. 5	05	28	54.9	37.56 N.	118.90 W.	13	4.3	...	4.2B	IV	B	MAR. 4	09 P.M. PST
MAR. 5	15	07	39.3	37.64 N.	118.92 W.	9	...	...	3.6B	III	B	MAR. 5	07 A.M. PST
MAR. 8	11	11	42.9	33.06 N.	115.61 W.	7	...	...	3.1P	FELT	P	MAR. 8	03 A.M. PST
MAR. 8	11	17	09.2	33.07 N.	115.60 W.	8	...	...	3.5P	V	P	MAR. 8	03 A.M. PST
MAR. 10	23	29	28.6	37.29 N.	118.35 W.	27	...	...	3.6B	III	B	MAR. 10	03 P.M. PST
MAR. 10	23	56	34.3	36.87 N.	121.65 W.	7	...	...	3.3B	FELT	B	MAR. 10	03 P.M. PST
MAR. 12	03	58	54.8	33.23 N.	115.54 W.	5	...	...	2.5P	FELT	P	MAR. 11	07 P.M. PST
MAR. 12	14	06	42.7	33.23 N.	115.54 W.	5	...	...	3.2P	FELT	P	MAR. 12	06 A.M. PST
MAR. 15	11	21	39.3	37.84 N.	121.78 W.	14	...	...	2.8B	...	B	MAR. 15	03 A.M. PST
MAR. 16	03	28	15.1	35.66 N.	117.60 W.	5	...	...	3.0P	...	P	MAR. 15	07 P.M. PST
MAR. 16	04	53	53.2	37.63 N.	118.86 W.	4	...	...	3.5B	FELT	B	MAR. 15	08 P.M. PST
MAR. 16	13	10	57.3	36.62 N.	115.30 W.	5	...	...	3.0P	...	P	MAR. 16	05 A.M. PST
MAR. 18	06	07	11.9	34.09 N.	117.00 W.	11	...	...	3.7P	V	P	MAR. 17	10 P.M. PST
MAR. 21	05	38	46.6	40.60 N.	124.42 W.	24	...	...	4.0B	III	B	MAR. 20	09 P.M. PST
MAR. 21	19	05	04.9	37.64 N.	118.86 W.	5	...	...	3.5P	...	P	MAR. 21	11 A.M. PST
MAR. 24	04	09	09.2	37.51 N.	118.77 W.	11	...	...	3.5B	FELT	B	MAR. 23	08 P.M. PST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
CALIFORNIA--Continued													
MAR. 25	00	06	13.0	37.82 N.	118.96 W.	3	...	...	3.2P	...	P	MAR. 24	04 P.M. PST
MAR. 25	04	01	43.8	37.55 N.	118.89 W.	10	...	...	3.7B	FELT	B	MAR. 24	08 P.M. PST
MAR. 28	04	39	59.1	39.40 N.	120.19 W.	15	...	...	3.5B	...	B	MAR. 27	08 P.M. PST
MAR. 28	05	04	36.9	39.40 N.	120.16 W.	16	...	...	3.8B	FELT	B	MAR. 27	09 P.M. PST
MAR. 29	11	53	30.0	37.57 N.	118.87 W.	6	...	...	3.0P	...	P	MAR. 29	03 A.M. PST
MAR. 30	15	05	13.2	37.48 N.	118.87 W.	6	...	...	3.0P	...	P	MAR. 30	07 A.M. PST
APR. 1	02	05	14.6	33.58 N.	116.83 W.	11	...	...	3.3P	...	P	MAR. 31	06 P.M. PST
APR. 3	08	06	22.1	39.41 N.	120.17 W.	20	...	...	3.1B	...	B	APR. 3	00 A.M. PST
APR. 7	06	23	28.2	32.94 N.	116.33 W.	10	...	...	3.1P	...	P	APR. 6	10 P.M. PST
APR. 8	15	32	45.3	40.19 N.	121.05 W.	4	...	...	3.3B	...	B	APR. 8	07 A.M. PST
APR. 9	18	21	16.1	37.69 N.	118.97 W.	2	...	...	3.3P	...	P	APR. 9	10 A.M. PST
APR. 11	21	47	43.4	35.36 N.	118.49 W.	1	...	...	3.1P	...	P	APR. 11	01 P.M. PST
APR. 11	23	47	10.9	37.77 N.	121.76 W.	12	...	...	3.4B	FELT	B	APR. 11	03 P.M. PST
APR. 12	16	27	05.7	37.70 N.	118.87 W.	6	...	...	3.0P	...	P	APR. 12	08 A.M. PST
APR. 13	02	24	52.8	37.67 N.	118.87 W.	6	...	...	3.2P	...	P	APR. 12	06 P.M. PST
APR. 13	02	37	48.0	37.70 N.	118.86 W.	6	...	...	3.4P	...	P	APR. 12	06 P.M. PST
APR. 13	07	37	56.6	37.56 N.	118.88 W.	6	...	...	3.2P	...	P	APR. 12	11 P.M. PST
APR. 19	08	46	49.5	35.83 N.	117.78 W.	5	4.4	...	3.7P	...	P	APR. 19	00 A.M. PST
APR. 19	08	54	04.7	35.84 N.	117.77 W.	11	...	...	3.4P	...	P	APR. 19	00 A.M. PST
APR. 19	09	02	10.7	35.83 N.	117.77 W.	9	4.5	...	4.2P	V	P	APR. 19	01 A.M. PST
APR. 19	09	02	49.7	35.85 N.	117.78 W.	8	4.4	...	4.4P	V	P	APR. 19	01 A.M. PST
APR. 19	09	19	57.1	35.83 N.	117.78 W.	11	4.3	...	4.0P	...	P	APR. 19	01 A.M. PST
APR. 20	01	37	42.1	33.35 N.	116.71 W.	12	...	...	3.6P	...	P	APR. 19	05 P.M. PST
APR. 20	19	21	09.7	37.47 N.	118.87 W.	13	...	...	3.0P	...	P	APR. 20	11 A.M. PST
APR. 21	03	44	33.3	37.65 N.	118.96 W.	10	...	...	3.3P	...	P	APR. 20	07 P.M. PST
APR. 21	03	45	14.1	37.66 N.	118.97 W.	10	...	...	3.2P	...	P	APR. 20	07 P.M. PST
APR. 21	03	56	24.5	37.67 N.	118.96 W.	6	...	...	3.1P	...	P	APR. 20	07 P.M. PST
APR. 21	03	57	46.4	37.64 N.	118.95 W.	6	...	...	3.4P	...	P	APR. 20	07 P.M. PST
APR. 22	06	28	50.9	33.10 N.	115.65 W.	9	...	...	3.4P	V	P	APR. 21	10 P.M. PST
APR. 23	03	35	27.5	35.84 N.	117.78 W.	2	...	...	3.6P	...	P	APR. 22	07 P.M. PST
APR. 23	06	15	52.0	32.75 N.	115.62 W.	8	...	...	3.0P	FELT	P	APR. 22	10 P.M. PST
APR. 25	02	11	55.3	33.11 N.	115.63 W.	5	...	...	4.1P	FELT	P	APR. 24	06 P.M. PST
APR. 25	02	13	37.1	33.10 N.	115.64 W.	5	...	...	3.2P	...	P	APR. 24	06 P.M. PST
APR. 25	03	42	40.8	33.11 N.	115.62 W.	6	...	...	3.1P	...	P	APR. 24	07 P.M. PST
APR. 25	07	03	14.1	33.10 N.	115.63 W.	5	4.4	...	3.9P	FELT	P	APR. 24	11 P.M. PST
APR. 25	07	41	07.0	37.68 N.	118.96 W.	5	...	...	3.9P	FELT	P	APR. 24	11 P.M. PST
APR. 25	13	36	46.1	33.10 N.	115.63 W.	6	...	...	3.2P	...	P	APR. 25	05 A.M. PST
APR. 25	13	54	24.0	33.10 N.	115.63 W.	10	...	...	3.2P	...	P	APR. 25	05 A.M. PST
APR. 25	14	35	15.3	35.79 N.	121.13 W.	5	...	...	3.1B	...	B	APR. 25	06 A.M. PST
APR. 25	17	24	04.5	33.10 N.	115.62 W.	5	...	...	3.3P	...	P	APR. 25	09 A.M. PST
APR. 25	17	43	40.6	33.10 N.	115.62 W.	8	...	...	3.0P	...	P	APR. 25	09 A.M. PST
APR. 25	19	41	37.4	37.10 N.	121.87 W.	11	4.4	...	4.1B	VI	B	APR. 25	11 A.M. PST
APR. 26	04	27	24.3	33.08 N.	115.64 W.	9	...	...	3.2P	...	P	APR. 25	08 P.M. PST
APR. 26	10	58	09.2	33.10 N.	115.62 W.	6	...	...	3.7P	...	P	APR. 26	02 A.M. PST
APR. 26	11	04	33.5	33.10 N.	115.62 W.	5	...	...	3.3P	...	P	APR. 26	03 A.M. PST
APR. 26	12	00	13.3	33.11 N.	115.64 W.	5	...	...	3.0P	...	P	APR. 26	04 A.M. PST
APR. 26	12	01	59.8	33.11 N.	115.64 W.	4	...	...	3.8P	...	P	APR. 26	04 A.M. PST
APR. 26	12	05	57.4	33.10 N.	115.63 W.	4	4.2	...	4.0P	...	P	APR. 26	04 A.M. PST
APR. 26	12	09	28.4	33.10 N.	115.63 W.	4	5.5	6.0	5.7P	VII	P	APR. 26	04 A.M. PST
APR. 26	12	27	57.1	33.05 N.	115.68 W.	14	...	...	3.1P	...	P	APR. 26	04 A.M. PST
APR. 26	12	28	07.9	33.10 N.	115.67 W.	11	...	...	3.4P	...	P	APR. 26	04 A.M. PST
APR. 26	12	28	36.5	33.03 N.	115.68 W.	6	...	...	3.4P	...	P	APR. 26	04 A.M. PST
APR. 26	12	40	43.4	33.08 N.	115.68 W.	6	...	...	4.2P	...	P	APR. 26	04 A.M. PST
APR. 26	12	57	43.1	33.13 N.	115.60 W.	8	...	...	3.1P	...	P	APR. 26	04 A.M. PST
APR. 26	12	59	21.1	33.08 N.	115.69 W.	2	...	...	3.4P	...	P	APR. 26	04 A.M. PST
APR. 26	13	03	13.4	33.12 N.	115.59 W.	8	...	...	3.8P	...	P	APR. 26	05 A.M. PST
APR. 26	13	09	01.0	33.12 N.	115.57 W.	6	...	...	3.0P	...	P	APR. 26	05 A.M. PST
APR. 26	15	22	14.1	33.12 N.	115.61 W.	11	...	...	3.6P	...	P	APR. 26	07 A.M. PST
APR. 26	15	43	57.3	33.12 N.	115.58 W.	6	...	...	3.7P	...	P	APR. 26	07 A.M. PST
APR. 26	16	33	09.1	33.11 N.	115.65 W.	5	...	...	3.7P	...	P	APR. 26	08 A.M. PST
APR. 26	17	42	26.5	33.18 N.	115.63 W.	6	...	...	3.5P	...	P	APR. 26	09 A.M. PST
APR. 26	20	38	44.8	33.12 N.	115.61 W.	10	...	...	3.1P	...	P	APR. 26	12 P.M. PST
APR. 26	20	56	22.7	33.12 N.	115.59 W.	8	...	...	3.2P	...	P	APR. 26	12 P.M. PST
APR. 26	21	58	54.9	33.10 N.	115.63 W.	5	...	...	3.1P	...	P	APR. 26	01 P.M. PST
APR. 27	02	55	49.7	33.11 N.	115.61 W.	10	...	...	3.4P	...	P	APR. 26	06 P.M. PST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
CALIFORNIA--Continued													
APR. 27	10	40	49.5	33.03 N.	115.70 W.	7	...	...	3.0P	...	P	APR. 27	02 A.M. PST
APR. 27	16	48	30.7	33.08 N.	115.69 W.	5	...	...	3.2P	...	P	APR. 27	08 A.M. PST
APR. 30	15	18	00.0	33.18 N.	115.49 W.	14	...	...	3.0P	...	P	APR. 30	07 A.M. PST
APR. 30	20	09	46.1	33.51 N.	116.49 W.	15	...	...	3.2P	...	P	APR. 30	12 P.M. PST
MAY 2	02	11	05.7	35.84 N.	117.78 W.	7	...	...	3.4P	...	P	MAY 1	06 P.M. PST
MAY 2	21	50	20.7	32.93 N.	116.30 W.	8	...	...	3.4P	...	P	MAY 2	01 P.M. PST
MAY 3	16	27	59.3	37.57 N.	118.64 W.	6	...	...	3.2P	...	P	MAY 3	08 A.M. PST
MAY 4	06	44	38.2	34.31 N.	118.32 W.	8	...	...	2.1P	FELT	P	MAY 3	10 P.M. PST
MAY 4	18	41	03.1	33.49 N.	116.46 W.	14	...	...	3.1P	...	P	MAY 4	10 A.M. PST
MAY 5	13	59	06.2	36.40 N.	118.05 W.	1	...	...	3.3P	...	P	MAY 5	05 A.M. PST
MAY 5	14	34	53.0	36.41 N.	118.04 W.	2	...	...	3.2P	...	P	MAY 5	06 A.M. PST
MAY 6	05	56	58.9	33.74 N.	118.03 W.	14	...	...	3.1P	FELT	P	MAY 5	09 P.M. PST
MAY 7	01	02	37.8	37.94 N.	118.53 W.	18	4.4	...	4.5B	IV	B	MAY 6	05 P.M. PST
MAY 7	01	03	28.8	37.50 N.	118.92 W.	6	...	...	3.7P	...	P	MAY 6	05 P.M. PST
MAY 7	01	04	03.9	37.50 N.	118.92 W.	6	...	...	3.4P	...	P	MAY 6	05 P.M. PST
MAY 7	09	16	08.4	37.50 N.	118.74 W.	6	...	...	3.1P	...	P	MAY 7	01 A.M. PST
MAY 9	08	39	45.9	37.67 N.	118.94 W.	8	...	...	3.1P	...	P	MAY 9	00 A.M. PST
MAY 9	22	58	13.1	32.95 N.	115.53 W.	11	...	...	3.0P	...	P	MAY 9	02 P.M. PST
MAY 10	21	06	26.1	37.57 N.	118.88 W.	6	...	...	3.1P	...	P	MAY 10	01 P.M. PST
MAY 11	02	52	13.5	41.16 N.	123.50 W.	8	...	...	3.3B	...	B	MAY 10	06 P.M. PST
MAY 11	11	50	28.8	37.73 N.	122.13 W.	12	...	...	2.6B	IV	B	MAY 11	03 A.M. PST
MAY 17	17	10	26.5	40.47 N.	121.54 W.	6	...	...	3.1B	...	B	MAY 17	09 A.M. PST
MAY 17	19	17	26.6	36.97 N.	121.45 W.	4	...	...	3.0B	...	B	MAY 17	11 A.M. PST
MAY 18	14	39	15.2	37.89 N.	122.00 W.	9	...	...	2.8B	III	B	MAY 18	06 A.M. PST
MAY 18	21	32	48.5	37.23 N.	117.88 W.	5	...	...	3.3P	IV	P	MAY 18	01 P.M. PST
MAY 19	16	44	31.2	40.22 N.	122.88 W.	8	...	...	3.4B	...	B	MAY 19	08 A.M. PST
MAY 20	17	21	31.2	36.98 N.	121.03 W.	8	...	...	3.9B	FELT	B	MAY 20	09 A.M. PST
MAY 23	18	50	21.2	36.11 N.	117.87 W.	0	...	...	3.2P	...	P	MAY 23	10 A.M. PST
MAY 26	11	41	10.2	40.38 N.	124.35 W.	21	4.3	...	4.6B	IV	B	MAY 26	03 A.M. PST
MAY 26	12	12	16.2	40.42 N.	124.14 W.	8	...	...	3.5B	...	B	MAY 26	04 A.M. PST
MAY 31	03	36	37.6	40.94 N.	123.71 W.	8	...	...	3.7B	...	B	MAY 30	07 P.M. PST
JUNE 1	23	46	56.5	37.66 N.	118.99 W.	6	...	...	3.4P	...	P	JUNE 1	03 P.M. PST
JUNE 3	05	29	03.5	34.15 N.	117.61 W.	13	...	...	3.2P	IV	P	JUNE 2	09 P.M. PST
JUNE 4	06	24	56.3	32.96 N.	115.54 W.	15	...	...	2.7P	FELT	P	JUNE 3	10 P.M. PST
JUNE 4	11	51	33.2	33.67 N.	117.37 W.	12	...	...	3.6P	V	P	JUNE 4	03 A.M. PST
JUNE 4	12	23	14.2	39.39 N.	123.24 W.	9	...	...	3.5B	IV	B	JUNE 4	04 A.M. PST
JUNE 4	14	26	35.6	33.67 N.	117.37 W.	12	...	...	2.9P	FELT	P	JUNE 4	06 A.M. PST
JUNE 6	05	54	30.5	35.76 N.	117.71 W.	8	...	...	3.2P	...	P	JUNE 5	09 P.M. PST
JUNE 6	06	37	27.2	37.55 N.	118.90 W.	7	...	...	3.3P	...	P	JUNE 5	10 P.M. PST
JUNE 6	06	56	04.7	37.53 N.	118.91 W.	6	...	...	3.1P	...	P	JUNE 5	10 P.M. PST
JUNE 8	03	09	05.5	36.74 N.	121.36 W.	10	...	...	4.3B	IV	B	JUNE 7	07 P.M. PST
JUNE 8	21	43	00.3	33.25 N.	115.98 W.	4	...	...	3.0P	...	P	JUNE 8	01 P.M. PST
JUNE 11	14	14	10.6	38.60 N.	120.29 W.	24	...	...	3.2B	...	B	JUNE 11	06 A.M. PST
JUNE 12	02	58	20.8	35.07 N.	118.42 W.	5	...	...	3.4P	...	P	JUNE 11	06 P.M. PST
JUNE 12	04	17	59.5	35.75 N.	120.04 W.	7	...	...	3.0P	...	P	JUNE 11	08 P.M. PST
JUNE 12	06	06	07.3	34.36 N.	118.66 W.	15	...	...	3.9P	IV	P	JUNE 11	10 P.M. PST
JUNE 12	11	02	46.4	33.25 N.	115.98 W.	4	...	...	3.6P	FELT	P	JUNE 12	03 A.M. PST
JUNE 12	19	22	38.1	37.62 N.	118.89 W.	4	...	...	3.0P	...	P	JUNE 12	11 A.M. PST
JUNE 16	12	16	19.2	33.87 N.	116.25 W.	3	...	...	3.2P	...	P	JUNE 16	04 A.M. PST
JUNE 16	14	27	29.1	33.22 N.	115.94 W.	2	...	...	3.2P	...	P	JUNE 16	06 A.M. PST
JUNE 21	04	56	01.8	37.55 N.	118.88 W.	6	...	...	3.1P	...	P	JUNE 20	08 P.M. PST
JUNE 22	04	57	47.3	35.10 N.	118.52 W.	5	...	...	4.0P	V	P	JUNE 21	08 P.M. PST
JUNE 22	05	08	50.0	37.64 N.	118.89 W.	6	...	...	3.2P	...	P	JUNE 21	09 P.M. PST
JUNE 22	07	31	46.1	33.24 N.	115.97 W.	3	...	...	3.2P	...	P	JUNE 21	11 P.M. PST
JUNE 22	18	03	10.7	33.76 N.	118.16 W.	16	...	...	2.5P	FELT	P	JUNE 22	10 A.M. PST
JUNE 22	19	54	38.6	37.55 N.	118.90 W.	4	...	...	3.1P	...	P	JUNE 22	11 A.M. PST
JUNE 25	11	37	07.0	40.18 N.	124.44 W.	8	...	...	3.6B	IV	B	JUNE 25	03 A.M. PST
JUNE 26	01	43	27.2	36.56 N.	121.22 W.	7	...	...	3.1B	...	B	JUNE 25	05 P.M. PST
JUNE 26	13	27	35.8	37.54 N.	118.94 W.	2	...	...	3.4B	...	B	JUNE 26	05 A.M. PST
JUNE 27	13	58	45.1	40.29 N.	124.35 W.	8	...	...	3.8B	...	B	JUNE 27	05 A.M. PST
JUNE 28	08	33	15.3	37.66 N.	118.86 W.	5	...	...	3.2P	...	P	JUNE 28	00 A.M. PST
JUNE 28	09	04	51.3	37.67 N.	118.87 W.	3	...	...	3.1P	...	P	JUNE 28	01 A.M. PST
JUNE 28	16	33	57.3	37.41 N.	121.79 W.	5	...	...	2.5B	FELT	B	JUNE 28	08 A.M. PST
JUNE 29	05	59	48.5	34.75 N.	118.80 W.	15	...	...	3.0P	...	P	JUNE 28	09 P.M. PST
JUNE 30	02	30	51.4	37.67 N.	118.91 W.	6	...	...	3.2P	...	P	JUNE 29	06 P.M. PST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Ms or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
CALIFORNIA--Continued													
JUNE 30	08	31	51.4	37.56 N.	118.89 W.	7	...	...	3.7B	FELT	B	JUNE 30	00 A.M. PST
JUNE 30	08	32	53.0	37.59 N.	118.88 W.	8	...	...	3.4P	...	P	JUNE 30	00 A.M. PST
JUNE 30	08	56	39.7	37.58 N.	118.92 W.	4	...	...	3.0P	...	P	JUNE 30	00 A.M. PST
JUNE 30	09	36	27.4	37.58 N.	118.89 W.	5	...	...	3.0P	...	P	JUNE 30	01 A.M. PST
JUNE 30	19	59	58.9	37.65 N.	118.91 W.	6	...	...	3.3P	...	P	JUNE 30	11 A.M. PST
JUNE 30	21	36	31.1	37.64 N.	118.90 W.	6	...	...	3.4P	...	P	JUNE 30	01 P.M. PST
JULY 1	13	17	36.5	37.67 N.	118.91 W.	6	...	...	3.3P	...	P	JULY 1	05 A.M. PST
JULY 2	01	28	23.3	39.88 N.	122.68 W.	15	...	...	3.1B	...	B	JULY 1	05 P.M. PST
JULY 2	12	42	10.3	37.65 N.	118.99 W.	6	...	...	3.2P	...	P	JULY 2	04 A.M. PST
JULY 2	13	48	58.0	37.64 N.	118.88 W.	6	...	...	3.0P	...	P	JULY 2	05 A.M. PST
JULY 3	03	12	44.2	33.26 N.	115.98 W.	5	...	...	3.0P	...	P	JULY 2	07 P.M. PST
JULY 3	06	49	20.2	40.91 N.	124.11 W.	25	...	...	3.1B	...	B	JULY 2	10 P.M. PST
JULY 3	13	45	31.9	34.03 N.	118.18 W.	14	...	...	2.4P	III	P	JULY 3	05 A.M. PST
JULY 5	00	31	16.3	33.67 N.	117.37 W.	9	...	...	3.1P	...	P	JULY 4	04 P.M. PST
JULY 5	10	30	48.7	35.76 N.	117.72 W.	5	...	...	3.2P	...	P	JULY 5	02 A.M. PST
JULY 5	12	31	00.5	35.76 N.	117.71 W.	5	...	...	3.0P	...	P	JULY 5	04 A.M. PST
JULY 5	13	33	50.8	35.76 N.	117.72 W.	5	...	...	3.0P	...	P	JULY 5	05 A.M. PST
JULY 5	17	45	24.4	35.76 N.	117.73 W.	7	...	...	3.3P	...	P	JULY 5	09 A.M. PST
JULY 6	19	53	44.1	33.87 N.	117.86 W.	6	...	...	3.2P	IV	P	JULY 6	11 A.M. PST
JULY 9	13	30	46.2	37.72 N.	118.89 W.	10	...	...	3.1P	FELT	P	JULY 9	05 A.M. PST
JULY 9	13	31	17.8	37.72 N.	118.87 W.	8	...	...	3.3P	FELT	P	JULY 9	05 A.M. PST
JULY 9	14	52	35.9	37.65 N.	118.96 W.	5	...	...	3.2P	FELT	P	JULY 9	06 A.M. PST
JULY 9	16	47	09.6	37.71 N.	119.05 W.	6	...	...	3.0P	...	P	JULY 9	08 A.M. PST
JULY 9	23	18	29.0	37.67 N.	118.96 W.	6	...	...	3.5P	...	P	JULY 9	03 P.M. PST
JULY 10	03	31	22.8	37.67 N.	118.99 W.	5	...	...	3.5P	...	P	JULY 9	07 P.M. PST
JULY 10	03	49	37.7	37.71 N.	118.98 W.	21	...	...	3.3P	...	P	JULY 9	07 P.M. PST
JULY 10	04	47	39.7	37.66 N.	118.95 W.	9	...	...	3.1P	...	P	JULY 9	08 P.M. PST
JULY 10	04	48	20.5	37.65 N.	118.98 W.	9	...	...	3.1P	...	P	JULY 9	08 P.M. PST
JULY 10	06	55	40.1	37.66 N.	118.95 W.	8	...	...	3.3P	...	P	JULY 9	10 P.M. PST
JULY 10	11	26	29.2	37.67 N.	118.96 W.	6	...	...	3.3P	...	P	JULY 10	03 A.M. PST
JULY 10	11	33	53.2	33.26 N.	115.98 W.	4	...	...	2.6P	FELT	P	JULY 10	03 A.M. PST
JULY 10	11	35	53.6	37.58 N.	118.75 W.	5	...	...	3.1P	...	P	JULY 10	03 A.M. PST
JULY 10	16	36	51.8	37.69 N.	118.96 W.	6	...	...	3.3P	...	P	JULY 10	08 A.M. PST
JULY 10	20	27	49.5	37.69 N.	118.96 W.	6	...	...	3.5P	...	P	JULY 10	12 P.M. PST
JULY 11	01	02	23.0	37.72 N.	118.93 W.	6	...	...	3.3P	...	P	JULY 10	05 P.M. PST
JULY 11	07	09	45.6	37.58 N.	118.81 W.	11	...	...	3.1P	...	P	JULY 10	11 P.M. PST
JULY 11	22	44	53.8	37.63 N.	118.96 W.	3	...	...	3.0P	...	P	JULY 11	02 P.M. PST
JULY 12	19	33	50.7	37.71 N.	118.91 W.	6	...	...	3.0P	...	P	JULY 12	11 P.M. PST
JULY 13	16	37	09.7	38.03 N.	118.76 W.	5	...	...	3.3B	...	B	JULY 13	08 A.M. PST
JULY 17	16	37	32.6	40.20 N.	124.25 W.	13	4.9	4.1	4.6B	VI	B	JULY 17	08 A.M. PST
JULY 18	08	51	23.6	36.82 N.	121.56 W.	3	...	...	3.0B	...	B	JULY 18	00 A.M. PST
JULY 21	04	31	17.3	34.29 N.	119.63 W.	6	...	...	3.1P	...	P	JULY 20	08 P.M. PST
JULY 25	06	24	21.5	33.48 N.	116.78 W.	0	...	...	3.1P	...	P	JULY 24	10 P.M. PST
JULY 25	20	05	54.7	36.11 N.	117.81 W.	6	...	...	3.0P	...	P	JULY 25	12 P.M. PST
JULY 25	21	48	13.5	36.56 N.	121.06 W.	10	...	...	3.0B	...	B	JULY 25	01 P.M. PST
JULY 26	06	13	09.4	35.13 N.	118.64 W.	5	...	...	3.7P	FELT	P	JULY 25	10 P.M. PST
JULY 29	21	28	08.2	33.14 N.	116.51 W.	5	...	...	3.4P	III	P	JULY 29	01 P.M. PST
JULY 29	23	37	48.9	33.80 N.	118.74 W.	4	...	...	3.3P	...	P	JULY 29	03 P.M. PST
JULY 29	23	39	57.1	33.80 N.	118.72 W.	1	...	...	3.9P	III	P	JULY 29	03 P.M. PST
JULY 30	01	56	55.2	33.79 N.	118.74 W.	2	...	...	3.7P	FELT	P	JULY 29	05 P.M. PST
JULY 30	11	56	01.0	33.80 N.	118.73 W.	8	...	...	3.6P	FELT	P	JULY 30	03 A.M. PST
JULY 31	10	04	33.5	37.64 N.	118.96 W.	6	...	...	3.1P	...	P	JULY 31	02 A.M. PST
JULY 31	10	16	25.2	37.67 N.	118.99 W.	6	...	...	3.0P	...	P	JULY 31	02 A.M. PST
AUG. 1	06	42	14.6	33.78 N.	118.73 W.	6	...	...	3.2P	...	P	JULY 31	10 P.M. PST
AUG. 4	13	27	10.2	36.71 N.	121.40 W.	3	...	...	3.1B	IV	B	AUG. 4	05 A.M. PST
AUG. 5	16	56	12.7	35.39 N.	116.59 W.	11	...	...	3.0P	...	P	AUG. 5	08 A.M. PST
AUG. 6	11	10	12.7	34.80 N.	120.24 W.	0	...	...	3.7P	IV	P	AUG. 6	03 A.M. PST
AUG. 6	22	31	09.2	37.55 N.	118.84 W.	6	...	...	3.5P	...	P	AUG. 6	02 P.M. PST
AUG. 9	15	52	03.2	37.62 N.	118.93 W.	7	...	...	3.5B	FELT	B	AUG. 9	07 A.M. PST
AUG. 9	15	59	31.8	37.62 N.	118.94 W.	6	...	...	3.2P	...	P	AUG. 9	07 A.M. PST
AUG. 9	16	01	10.9	37.63 N.	118.93 W.	6	...	...	3.5P	...	P	AUG. 9	08 A.M. PST
AUG. 9	16	01	41.0	37.47 N.	118.82 W.	6	...	...	3.1P	...	P	AUG. 9	08 A.M. PST
AUG. 9	16	05	54.1	37.63 N.	118.94 W.	6	...	...	3.0P	...	P	AUG. 9	08 A.M. PST
AUG. 12	10	20	29.2	37.40 N.	119.03 W.	6	...	...	3.2P	...	P	AUG. 12	02 A.M. PST
AUG. 12	22	58	35.2	34.13 N.	118.63 W.	4	...	...	2.7P	II	P	AUG. 12	02 P.M. PST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
CALIFORNIA--Continued													
AUG. 13	20	31	22.6	37.53 N.	118.89 W.	2	...	...	3.6B	FELT	B	AUG. 13	12 P.M. PST
AUG. 14	01	09	34.3	33.97 N.	118.59 W.	4	...	...	3.4P	IV	P	AUG. 13	05 P.M. PST
AUG. 14	12	49	59.7	36.78 N.	121.29 W.	9	...	...	4.2B	IV	B	AUG. 14	04 A.M. PST
AUG. 16	11	23	29.2	34.12 N.	117.17 W.	8	...	...	3.2P	FELT	P	AUG. 16	03 A.M. PST
AUG. 18	09	23	54.6	33.80 N.	118.74 W.	4	...	...	3.5P	...	P	AUG. 18	01 A.M. PST
AUG. 18	15	31	14.7	34.08 N.	116.42 W.	11	...	...	3.0P	...	P	AUG. 18	07 A.M. PST
AUG. 19	12	02	00.6	33.56 N.	117.21 W.	5	...	...	2.8P	FELT	P	AUG. 19	04 A.M. PST
AUG. 21	12	00	35.0	36.82 N.	121.58 W.	3	...	...	2.9B	...	B	AUG. 21	04 A.M. PST
AUG. 22	12	30	57.8	38.83 N.	122.79 W.	3	...	...	3.3B	...	B	AUG. 22	04 A.M. PST
AUG. 22	19	31	44.7	40.26 N.	124.40 W.	25	...	...	3.2B	...	B	AUG. 22	11 A.M. PST
AUG. 22	20	54	23.8	37.62 N.	118.89 W.	8	...	...	3.5B	FELT	B	AUG. 22	12 P.M. PST
AUG. 23	04	32	29.8	37.95 N.	117.56 W.	6	...	...	3.1P	...	P	AUG. 22	08 P.M. PST
AUG. 24	04	52	18.3	37.62 N.	118.89 W.	8	...	...	3.9B	IV	B	AUG. 23	08 P.M. PST
AUG. 24	11	37	28.3	37.66 N.	118.90 W.	6	...	...	3.1P	...	P	AUG. 24	03 A.M. PST
AUG. 24	12	58	23.7	37.68 N.	118.92 W.	6	...	...	3.0P	...	P	AUG. 24	04 A.M. PST
AUG. 25	07	29	22.9	37.62 N.	118.90 W.	6	...	...	3.5P	...	P	AUG. 24	11 P.M. PST
AUG. 27	10	01	24.7	37.84 N.	121.79 W.	12	...	...	2.9B	FELT	B	AUG. 27	02 A.M. PST
AUG. 28	01	42	01.9	33.29 N.	115.68 W.	4	...	...	3.4P	...	P	AUG. 27	05 P.M. PST
AUG. 29	18	57	36.7	39.90 N.	120.85 W.	10	...	...	3.1B	...	B	AUG. 29	10 A.M. PST
AUG. 30	03	31	25.7	40.47 N.	123.32 W.	25	...	...	3.2B	...	B	AUG. 29	07 P.M. PST
AUG. 30	09	31	57.4	37.68 N.	118.97 W.	6	...	...	3.0P	...	P	AUG. 30	01 A.M. PST
SEPT. 1	13	43	42.2	37.65 N.	118.80 W.	6	...	...	3.0P	...	P	SEPT. 1	05 A.M. PST
SEPT. 4	00	28	53.3	33.15 N.	116.56 W.	15	...	...	3.9P	IV	P	SEPT. 3	04 P.M. PST
SEPT. 4	00	39	25.5	33.15 N.	116.56 W.	15	...	...	3.8P	FELT	P	SEPT. 3	04 P.M. PST
SEPT. 5	09	56	05.7	37.66 N.	118.90 W.	2	...	...	3.1P	...	P	SEPT. 5	01 A.M. PST
SEPT. 8	12	34	43.1	38.03 N.	118.78 W.	4	...	...	3.7B	...	B	SEPT. 8	04 A.M. PST
SEPT. 9	06	54	04.7	36.77 N.	121.56 W.	7	...	...	2.9B	FELT	B	SEPT. 8	10 P.M. PST
SEPT. 12	21	23	07.5	34.15 N.	117.27 W.	8	...	...	3.6P	V	P	SEPT. 12	01 P.M. PST
SEPT. 13	19	59	48.5	34.15 N.	117.27 W.	5	...	...	3.1P	FELT	P	SEPT. 13	11 A.M. PST
SEPT. 14	08	19	39.0	36.66 N.	121.33 W.	4	...	...	3.3B	...	B	SEPT. 14	00 A.M. PST
SEPT. 14	09	07	17.6	34.15 N.	117.28 W.	12	...	...	2.5P	FELT	P	SEPT. 14	01 A.M. PST
SEPT. 14	18	42	03.5	34.16 N.	117.27 W.	4	...	...	2.6P	FELT	P	SEPT. 14	10 A.M. PST
SEPT. 15	01	54	14.9	34.15 N.	117.27 W.	3	...	...	2.5P	FELT	P	SEPT. 14	05 P.M. PST
SEPT. 15	22	07	03.3	40.77 N.	123.94 W.	25	...	...	3.2B	...	B	SEPT. 15	02 P.M. PST
SEPT. 16	07	57	13.8	34.16 N.	117.26 W.	9	...	...	3.3P	FELT	P	SEPT. 15	11 P.M. PST
SEPT. 16	07	57	42.5	34.17 N.	117.27 W.	4	...	...	3.0P	...	P	SEPT. 15	11 P.M. PST
SEPT. 16	08	01	56.1	34.16 N.	117.26 W.	3	...	...	2.2P	FELT	P	SEPT. 16	00 A.M. PST
SEPT. 16	13	57	42.7	34.16 N.	117.26 W.	4	...	...	2.6P	FELT	P	SEPT. 16	05 A.M. PST
SEPT. 17	02	59	16.8	35.83 N.	121.28 W.	1	...	...	3.1B	...	B	SEPT. 16	06 P.M. PST
SEPT. 17	11	32	38.0	37.65 N.	118.84 W.	10	...	...	3.0P	...	P	SEPT. 17	03 A.M. PST
SEPT. 17	12	36	04.3	37.62 N.	118.91 W.	15	...	...	3.6P	III	P	SEPT. 17	04 A.M. PST
SEPT. 18	11	04	18.0	37.63 N.	118.85 W.	4	...	...	3.4P	...	P	SEPT. 18	03 A.M. PST
SEPT. 23	10	32	48.4	38.67 N.	122.82 W.	3	...	...	2.5B	IV	G	SEPT. 23	02 A.M. PST
SEPT. 24	14	00	26.4	36.79 N.	121.57 W.	5	...	...	3.2B	FELT	B	SEPT. 24	06 A.M. PST
SEPT. 25	06	48	53.2	37.54 N.	118.88 W.	10	...	...	3.8B	IV	B	SEPT. 24	10 P.M. PST
SEPT. 25	14	13	38.0	34.02 N.	116.85 W.	21	...	...	3.3P	FELT	P	SEPT. 25	06 A.M. PST
SEPT. 27	21	25	57.4	37.56 N.	118.86 W.	6	...	...	3.4P	...	P	SEPT. 27	01 P.M. PST
SEPT. 28	07	34	39.3	36.80 N.	121.56 W.	7	4.2	3.4	4.0B	IV	B	SEPT. 27	11 P.M. PST
SEPT. 28	10	57	39.6	33.46 N.	117.10 W.	9	...	...	3.4P	...	P	SEPT. 28	02 A.M. PST
SEPT. 30	11	53	27.0	37.62 N.	118.88 W.	6	5.6	5.8	5.8P	VI	P	SEPT. 30	03 A.M. PST
SEPT. 30	12	06	04.9	37.60 N.	118.85 W.	6	...	...	3.0P	...	P	SEPT. 30	04 A.M. PST
SEPT. 30	12	15	48.0	37.68 N.	118.91 W.	5	...	...	3.3P	...	P	SEPT. 30	04 A.M. PST
SEPT. 30	12	22	25.7	37.65 N.	118.91 W.	5	...	...	3.3B	...	P	SEPT. 30	04 A.M. PST
SEPT. 30	12	22	55.6	37.61 N.	118.85 W.	10	...	...	3.6B	FELT	B	SEPT. 30	04 A.M. PST
SEPT. 30	12	25	20.9	37.70 N.	118.88 W.	5	...	...	3.3P	...	P	SEPT. 30	04 A.M. PST
SEPT. 30	12	48	40.0	37.64 N.	118.92 W.	6	...	...	3.3P	...	P	SEPT. 30	04 A.M. PST
SEPT. 30	13	05	48.2	37.66 N.	118.86 W.	3	4.7	...	4.6P	V	P	SEPT. 30	05 A.M. PST
SEPT. 30	13	18	45.4	37.63 N.	118.88 W.	6	...	...	2.9P	...	P	SEPT. 30	05 A.M. PST
SEPT. 30	13	49	27.3	37.65 N.	118.88 W.	6	...	...	3.2P	...	P	SEPT. 30	05 A.M. PST
SEPT. 30	14	09	15.9	37.70 N.	118.90 W.	6	...	...	3.0P	...	P	SEPT. 30	06 A.M. PST
SEPT. 30	14	24	38.1	37.63 N.	118.88 W.	6	...	...	3.0P	...	P	SEPT. 30	06 A.M. PST
SEPT. 30	14	27	07.0	37.64 N.	118.86 W.	6	...	...	3.0P	...	P	SEPT. 30	06 A.M. PST
SEPT. 30	14	33	45.9	37.67 N.	118.87 W.	6	...	...	3.6P	FELT	P	SEPT. 30	06 A.M. PST
SEPT. 30	14	39	15.5	36.69 N.	118.89 W.	6	...	...	3.3P	...	P	SEPT. 30	06 A.M. PST
SEPT. 30	14	40	13.2	37.66 N.	118.89 W.	6	...	...	3.5P	FELT	P	SEPT. 30	06 A.M. PST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
CALIFORNIA--Continued													
SEPT. 30	14	50	07.0	37.61 N.	118.91 W.	6	...	...	4.0P	FELT	P	SEPT. 30	06 A.M. PST
SEPT. 30	15	06	34.0	37.69 N.	118.87 W.	6	...	...	3.3P	...	P	SEPT. 30	07 A.M. PST
SEPT. 30	15	11	07.4	37.71 N.	118.89 W.	6	...	...	3.0P	...	P	SEPT. 30	07 A.M. PST
SEPT. 30	15	20	48.3	37.69 N.	118.87 W.	6	...	...	3.3P	FELT	P	SEPT. 30	07 A.M. PST
SEPT. 30	15	46	24.4	37.69 N.	118.87 W.	6	...	...	3.0P	...	P	SEPT. 30	07 A.M. PST
SEPT. 30	16	09	29.0	37.50 N.	118.83 W.	6	...	...	3.0P	...	P	SEPT. 30	08 A.M. PST
SEPT. 30	16	34	32.0	37.58 N.	118.92 W.	3	...	...	3.3P	FELT	P	SEPT. 30	08 A.M. PST
SEPT. 30	16	49	33.5	37.67 N.	118.87 W.	3	...	...	3.4P	...	P	SEPT. 30	08 A.M. PST
SEPT. 30	18	16	22.5	37.68 N.	118.91 W.	6	...	...	3.4P	...	P	SEPT. 30	10 A.M. PST
SEPT. 30	19	35	12.3	37.56 N.	118.82 W.	6	...	...	3.6P	FELT	P	SEPT. 30	11 A.M. PST
SEPT. 30	19	48	20.5	37.63 N.	118.89 W.	6	...	...	3.2P	FELT	P	SEPT. 30	11 A.M. PST
SEPT. 30	21	25	10.3	37.68 N.	118.88 W.	6	...	...	3.2P	...	P	SEPT. 30	01 P.M. PST
SEPT. 30	21	25	37.2	37.50 N.	118.83 W.	6	...	...	3.2P	...	P	SEPT. 30	01 P.M. PST
SEPT. 30	21	25	59.0	37.69 N.	118.88 W.	6	...	...	3.4P	...	P	SEPT. 30	01 P.M. PST
SEPT. 30	23	05	58.0	37.57 N.	118.86 W.	6	...	...	3.7P	...	P	SEPT. 30	03 P.M. PST
OCT. 1	01	04	15.6	37.59 N.	118.79 W.	10	...	...	3.6B	FELT	B	SEPT. 30	05 P.M. PST
OCT. 1	07	02	04.5	37.50 N.	118.87 W.	10	3.6	...	4.5B	FELT	B	SEPT. 30	11 P.M. PST
OCT. 1	09	13	57.4	37.46 N.	118.82 W.	10	...	...	3.5B	FELT	B	OCT. 1	01 A.M. PST
OCT. 1	13	22	36.1	37.57 N.	118.80 W.	10	...	...	3.7B	FELT	B	OCT. 1	05 A.M. PST
OCT. 1	15	00	17.9	37.57 N.	118.91 W.	8	...	...	3.4B	...	B	OCT. 1	07 A.M. PST
OCT. 1	18	16	47.2	37.58 N.	118.83 W.	6	...	...	3.2B	...	B	OCT. 1	10 A.M. PST
OCT. 1	22	05	08.2	37.49 N.	118.89 W.	17	...	...	3.5B	FELT	B	OCT. 1	02 P.M. PST
OCT. 2	07	37	22.1	37.61 N.	118.85 W.	10	...	...	4.1B	FELT	B	OCT. 1	11 P.M. PST
OCT. 2	07	45	03.0	37.64 N.	118.88 W.	5	...	...	3.1B	...	B	OCT. 1	11 P.M. PST
OCT. 2	16	14	23.4	37.61 N.	118.83 W.	10	...	...	3.5B	FELT	B	OCT. 2	08 A.M. PST
OCT. 2	18	18	13.3	37.65 N.	118.89 W.	5	...	...	3.4B	...	B	OCT. 2	10 A.M. PST
OCT. 3	01	20	37.3	37.57 N.	118.81 W.	10	...	...	4.0B	FELT	B	OCT. 2	05 P.M. PST
OCT. 3	07	23	32.6	37.57 N.	118.83 W.	5	...	...	3.1B	...	B	OCT. 2	11 P.M. PST
OCT. 3	14	40	55.0	37.56 N.	118.87 W.	10	...	...	3.8B	FELT	B	OCT. 3	06 A.M. PST
OCT. 4	00	30	41.2	37.48 N.	118.92 W.	5	...	...	3.1B	...	B	OCT. 3	04 P.M. PST
OCT. 4	04	27	36.9	37.61 N.	118.87 W.	9	...	...	3.0B	...	B	OCT. 3	08 P.M. PST
OCT. 4	06	32	51.3	37.63 N.	118.89 W.	4	...	...	3.3B	...	B	OCT. 3	10 P.M. PST
OCT. 5	17	43	22.4	34.23 N.	117.44 W.	12	...	...	3.0P	...	P	OCT. 5	09 A.M. PST
OCT. 6	05	46	12.2	37.51 N.	118.92 W.	7	...	...	3.1B	...	B	OCT. 5	09 P.M. PST
OCT. 6	07	16	11.2	40.42 N.	123.52 W.	5	...	...	2.7B	IV	B	OCT. 5	11 P.M. PST
OCT. 6	23	36	39.0	37.58 N.	118.87 W.	2	...	...	3.0B	...	B	OCT. 6	03 P.M. PST
OCT. 9	11	01	00.1	37.64 N.	118.88 W.	7	...	...	3.6B	FELT	B	OCT. 9	03 A.M. PST
OCT. 9	11	17	26.0	37.55 N.	118.80 W.	4	...	...	3.6B	FELT	B	OCT. 9	03 A.M. PST
OCT. 9	17	50	22.1	37.57 N.	118.83 W.	5	...	...	3.2B	...	B	OCT. 9	09 A.M. PST
OCT. 9	18	55	28.9	38.77 N.	122.68 W.	5	...	...	3.2B	FELT	B	OCT. 9	10 A.M. PST
OCT. 10	12	13	17.6	40.56 N.	122.10 W.	5	...	...	3.2B	FELT	B	OCT. 10	04 A.M. PST
OCT. 13	04	44	48.7	37.57 N.	118.93 W.	7	...	...	3.0B	...	B	OCT. 12	08 P.M. PST
OCT. 13	20	14	03.0	34.03 N.	116.15 W.	8	...	...	3.4P	...	P	OCT. 13	12 P.M. PST
OCT. 16	22	03	16.1	37.54 N.	118.89 W.	27	...	...	3.2B	...	B	OCT. 16	02 P.M. PST
OCT. 17	19	47	21.8	33.24 N.	116.07 W.	5	...	...	3.9P	...	P	OCT. 17	11 A.M. PST
OCT. 17	19	54	35.0	33.24 N.	116.07 W.	8	...	...	3.2P	...	P	OCT. 17	11 A.M. PST
OCT. 19	23	34	37.3	40.17 N.	123.46 W.	24	...	...	3.0B	...	B	OCT. 19	03 P.M. PST
OCT. 20	02	25	20.0	37.63 N.	118.86 W.	28	...	...	3.3B	...	B	OCT. 19	06 P.M. PST
OCT. 20	12	40	55.6	33.52 N.	116.45 W.	9	...	...	2.9P	IV	P	OCT. 20	04 A.M. PST
OCT. 21	05	37	44.7	33.51 N.	116.76 W.	5	...	...	3.4P	FELT	P	OCT. 20	09 P.M. PST
OCT. 26	14	58	01.6	37.41 N.	118.50 W.	11	...	...	2.9P	III	P	OCT. 26	06 A.M. PST
OCT. 28	14	17	08.9	34.34 N.	118.52 W.	5	...	...	3.1P	III	P	OCT. 28	06 A.M. PST
OCT. 31	08	59	06.6	38.81 N.	122.81 W.	2	...	...	3.1B	FELT	B	OCT. 31	00 A.M. PST
NOV. 5	03	30	16.6	37.54 N.	118.83 W.	7	...	...	3.5B	FELT	B	NOV. 4	07 P.M. PST
NOV. 9	15	54	40.5	32.84 N.	115.63 W.	6	...	...	2.9P	IV	P	NOV. 9	07 A.M. PST
NOV. 10	07	33	07.3	37.61 N.	118.94 W.	5	...	...	3.1B	...	B	NOV. 9	11 P.M. PST
NOV. 10	19	17	48.6	37.62 N.	118.90 W.	12	...	...	3.4B	...	B	NOV. 10	11 A.M. PST
NOV. 10	22	34	35.5	35.02 N.	119.14 W.	3	4.7	...	4.5P	V	P	NOV. 10	02 P.M. PST
NOV. 10	22	37	05.0	35.01 N.	119.18 W.	9	...	...	4.2P	FELT	P	NOV. 10	02 P.M. PST
NOV. 11	00	29	44.4	35.02 N.	119.16 W.	2	...	...	3.4P	...	P	NOV. 10	04 P.M. PST
NOV. 11	00	30	56.6	35.02 N.	119.16 W.	2	...	...	3.2P	...	P	NOV. 10	04 P.M. PST
NOV. 11	01	19	09.2	33.70 N.	117.78 W.	5	...	...	2.3P	FELT	P	NOV. 10	05 P.M. PST
NOV. 11	20	25	10.2	35.77 N.	117.72 W.	7	...	...	3.2P	...	P	NOV. 11	12 P.M. PST
NOV. 13	03	00	00.0	37.62 N.	118.95 W.	7	...	...	3.9B	FELT	B	NOV. 12	07 P.M. PST
NOV. 13	03	07	47.7	37.63 N.	118.96 W.	10	...	...	3.7B	FELT	B	NOV. 12	07 P.M. PST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
CALIFORNIA--Continued													
NOV. 13	03	50	21.9	37.64 N.	118.96 W.	5	...	...	3.2B	...	B	NOV. 12	07 P.M. PST
NOV. 14	17	57	44.5	34.07 N.	118.02 W.	11	...	...	1.9P	FELT	P	NOV. 14	09 A.M. PST
NOV. 16	07	29	53.6	36.42 N.	121.05 W.	7	...	...	3.2B	...	B	NOV. 15	11 P.M. PST
NOV. 16	12	01	45.5	35.05 N.	119.16 W.	5	...	...	3.2P	...	P	NOV. 16	04 A.M. PST
NOV. 16	19	47	06.1	37.05 N.	121.48 W.	6	...	...	2.9B	...	B	NOV. 16	11 A.M. PST
NOV. 18	16	15	49.0	37.47 N.	119.41 W.	27	...	...	3.9B	FELT	B	NOV. 18	08 A.M. PST
NOV. 24	09	20	17.7	34.85 N.	116.65 W.	6	...	...	3.4P	...	P	NOV. 24	01 A.M. PST
DEC. 2	02	57	30.0	37.59 N.	118.89 W.	9	...	...	3.0P	...	B	DEC. 1	06 P.M. PST
DEC. 7	21	32	37.4	39.58 N.	123.22 W.	5	...	...	2.6B	IV	B	DEC. 7	01 P.M. PST
DEC. 10	09	33	19.7	37.38 N.	118.43 W.	28	...	...	3.5B	FELT	B	DEC. 10	01 A.M. PST
DEC. 10	11	57	37.0	38.80 N.	122.79 W.	2	...	...	3.3B	FELT	B	DEC. 10	03 A.M. PST
DEC. 12	05	07	09.6	35.44 N.	118.48 W.	2	...	...	3.1P	...	P	DEC. 11	09 P.M. PST
DEC. 12	15	11	09.3	37.38 N.	122.27 W.	9	...	...	3.7B	V	B	DEC. 12	07 A.M. PST
DEC. 15	08	05	33.9	36.10 N.	117.83 W.	4	...	...	3.8P	IV	P	DEC. 15	00 A.M. PST
DEC. 16	01	34	52.3	36.20 N.	117.89 W.	3	...	...	3.8P	...	P	DEC. 15	05 P.M. PST
DEC. 16	14	33	46.2	33.76 N.	118.04 W.	6	...	...	2.2P	FELT	P	DEC. 16	06 A.M. PST
DEC. 18	14	41	44.9	38.30 N.	122.61 W.	7	...	...	3.1B	IV	B	DEC. 18	06 A.M. PST
DEC. 20	07	41	49.7	38.29 N.	122.64 W.	4	...	...	3.0B	FELT	B	DEC. 19	11 P.M. PST
DEC. 20	10	25	29.5	38.29 N.	122.58 W.	5	...	...	2.6B	FELT	G	DEC. 20	02 A.M. PST
DEC. 20	15	29	56.1	38.30 N.	122.61 W.	6	...	...	2.7B	FELT	B	DEC. 20	07 A.M. PST
DEC. 24	02	22	07.7	34.02 N.	116.77 W.	20	...	...	3.3P	...	P	DEC. 23	06 P.M. PST
DEC. 27	20	24	15.5	34.25 N.	117.62 W.	9	...	...	3.2P	...	P	DEC. 27	12 P.M. PST
DEC. 30	02	12	26.3	39.51 N.	123.39 W.	1	...	...	2.6B	IV	B	DEC. 29	06 P.M. PST
CALIFORNIA--OFF THE COAST													
JAN. 4	09	29	45.5	41.30 N.	125.08 W.	20	3.5	...	3.4B	...	B	JAN. 4	01 A.M. PST
JAN. 5	08	37	46.3	40.29 N.	124.75 W.	10	...	...	3.3B	...	B	JAN. 5	00 A.M. PST
FEB. 19	05	56	35.7	40.87 N.	125.10 W.	8	...	...	3.6B	...	B	FEB. 18	09 P.M. PST
MAR. 2	17	09	39.2	40.56 N.	125.69 W.	8	...	...	3.6B	...	B	MAR. 2	09 A.M. PST
MAR. 8	05	35	30.1	40.42 N.	124.53 W.	8	...	...	3.5B	...	B	MAR. 7	09 P.M. PST
MAR. 9	06	26	20.6	40.36 N.	124.61 W.	8	...	...	3.5B	...	B	MAR. 8	10 P.M. PST
MAR. 9	06	39	38.2	40.35 N.	124.59 W.	8	...	...	3.3B	...	B	MAR. 8	10 P.M. PST
MAR. 13	21	22	20.6	40.31 N.	124.70 W.	23	...	...	3.7B	...	B	MAR. 13	01 P.M. PST
MAR. 15	06	07	45.9	40.39 N.	125.16 W.	8	4.5	4.5	4.7B	III	B	MAR. 14	10 P.M. PST
MAR. 15	10	55	35.2	40.37 N.	124.46 W.	22	...	...	3.0B	...	B	MAR. 15	02 A.M. PST
MAR. 27	16	16	36.7	40.47 N.	126.92 W.	8	...	...	4.2B	...	B	MAR. 27	08 A.M. PST
MAR. 30	12	38	48.2	40.33 N.	124.73 W.	8	4.4	...	4.3B	IV	B	MAR. 30	04 A.M. PST
MAR. 30	15	00	39.5	40.36 N.	124.56 W.	19	...	...	3.1B	...	B	MAR. 30	07 A.M. PST
MAR. 31	02	10	35.9	40.32 N.	124.68 W.	8	4.0	...	4.0B	...	B	MAR. 30	06 P.M. PST
APR. 13	22	16	16.5	40.30 N.	124.61 W.	23	4.3	...	4.3B	FELT	B	APR. 13	02 P.M. PST
APR. 17	01	31	40.0	40.39 N.	125.35 W.	8	4.3	...	4.2B	V	B	APR. 16	05 P.M. PST
APR. 18	13	17	37.1	40.39 N.	124.73 W.	8	...	...	3.8B	...	B	APR. 18	05 A.M. PST
APR. 20	23	44	54.6	40.33 N.	124.65 W.	8	...	...	3.5B	...	B	APR. 20	03 P.M. PST
MAY 5	06	03	51.9	40.35 N.	124.57 W.	8	...	...	3.4B	...	B	MAY 4	10 P.M. PST
MAY 9	18	11	51.2	40.52 N.	125.51 W.	8	...	...	3.8B	...	B	MAY 9	10 A.M. PST
MAY 17	01	12	01.6	40.15 N.	126.76 W.	5	...	...	3.7B	...	B	MAY 16	05 P.M. PST
MAY 22	01	18	58.3	41.24 N.	124.57 W.	16	...	...	4.2B	...	B	MAY 21	05 P.M. PST
JUNE 14	23	53	57.6	40.33 N.	124.75 W.	24	4.5	4.4	4.3B	IV	B	JUNE 14	03 P.M. PST
JUNE 21	06	20	35.1	40.24 N.	124.81 W.	8	4.4	...	4.0B	IV	B	JUNE 20	10 P.M. PST
JUNE 21	10	10	44.6	40.27 N.	124.52 W.	22	...	...	3.1B	...	B	JUNE 21	02 A.M. PST
JUNE 23	21	50	20.6	40.45 N.	125.26 W.	8	4.0	...	4.0B	...	B	JUNE 23	01 P.M. PST
JUNE 24	07	36	24.0	40.44 N.	125.97 W.	8	...	...	3.2B	...	B	JUNE 23	11 P.M. PST
JUNE 24	14	15	24.8	40.33 N.	124.78 W.	23	...	...	3.5B	...	B	JUNE 24	06 A.M. PST
JUNE 25	18	49	38.4	40.54 N.	127.49 W.	10	3.5	...	...	...	G	JUNE 25	10 A.M. PST
JUNE 25	18	59	39.5	40.49 N.	127.56 W.	10	...	...	...	...	G	JUNE 25	10 A.M. PST
JULY 2	08	10	51.9	41.29 N.	124.43 W.	15	4.4	3.5	4.5B	V	B	JULY 2	00 A.M. PST
JULY 2	08	22	11.6	41.25 N.	124.46 W.	1	4.6	...	3.9B	...	B	JULY 2	00 A.M. PST
JULY 11	19	24	07.7	40.66 N.	125.16 W.	15	4.4	...	3.8B	...	B	JULY 11	11 A.M. PST
JULY 11	21	50	29.4	32.63 N.	118.08 W.	5	4.3	...	4.3P	IV	P	JULY 11	01 P.M. PST
AUG. 7	17	51	43.7	40.41 N.	124.97 W.	17	...	...	3.2B	...	B	AUG. 7	09 A.M. PST
SEPT. 4	15	50	50.3	33.67 N.	119.11 W.	5	5.4	5.9	5.3P	VI	P	SEPT. 4	07 A.M. PST
SEPT. 4	15	57	42.9	33.65 N.	119.08 W.	5	...	...	3.6P	...	P	SEPT. 4	07 A.M. PST
SEPT. 4	17	04	59.7	33.62 N.	119.03 W.	6	...	...	3.3P	...	P	SEPT. 4	09 A.M. PST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
CALIFORNIA OFF THE COAST--Continued													
SEPT. 4	17	22	08.4	33.61 N.	119.01 W.	6	...	...	3.0P	...	P	SEPT. 4	09 A.M. PST
SEPT. 5	00	41	48.4	33.63 N.	119.11 W.	8	...	...	3.8P	FELT	P	SEPT. 4	04 P.M. PST
SEPT. 5	03	41	49.4	33.63 N.	119.01 W.	11	...	...	3.1P	...	P	SEPT. 6	07 P.M. PST
SEPT. 5	04	02	57.6	33.66 N.	119.13 W.	8	...	...	3.6P,	...	P	SEPT. 4	08 P.M. PST
SEPT. 5	04	18	47.5	33.62 N.	119.05 W.	8	...	...	3.1P	...	P	SEPT. 4	08 P.M. PST
SEPT. 6	09	17	00.6	33.72 N.	119.18 W.	6	...	...	3.7P	...	P	SEPT. 6	01 A.M. PST
SEPT. 6	18	30	31.1	33.66 N.	119.08 W.	5	...	...	3.1P	...	P	SEPT. 6	10 A.M. PST
SEPT. 10	05	45	55.5	33.69 N.	119.14 W.	6	...	...	3.4P	...	P	SEPT. 9	09 P.M. PST
SEPT. 10	18	08	01.5	33.68 N.	119.13 W.	9	...	...	3.2P	...	P	SEPT. 10	10 A.M. PST
SEPT. 11	05	58	24.0	33.73 N.	119.19 W.	6	...	...	3.9P	FELT	P	SEPT. 10	09 P.M. PST
SEPT. 15	19	56	12.5	33.63 N.	119.01 W.	8	...	...	3.2P	...	P	SEPT. 15	11 A.M. PST
SEPT. 16	01	16	59.7	33.56 N.	118.97 W.	18	...	...	3.2P	...	P	SEPT. 15	05 P.M. PST
SEPT. 16	01	19	11.2	33.56 N.	118.98 W.	20	...	...	3.8P	...	P	SEPT. 15	05 P.M. PST
SEPT. 16	12	41	14.2	40.31 N.	124.61 W.	25	4.8	3.9	4.7B	V	B	SEPT. 16	04 A.M. PST
SEPT. 16	12	45	58.5	40.24 N.	124.53 W.	21	...	...	3.6B	FELT	B	SEPT. 16	04 A.M. PST
SEPT. 18	23	34	00.4	40.35 N.	124.63 W.	25	...	...	3.3B	...	B	SEPT. 18	03 P.M. PST
SEPT. 21	10	08	08.5	33.64 N.	119.04 W.	12	...	...	3.1P	FELT	P	SEPT. 21	02 A.M. PST
SEPT. 21	11	21	08.2	40.29 N.	124.59 W.	9	...	...	3.4B	...	B	SEPT. 21	03 A.M. PST
SEPT. 22	06	01	31.1	40.31 N.	124.65 W.	25	...	...	3.3B	...	B	SEPT. 21	10 P.M. PST
SEPT. 26	20	23	37.0	40.39 N.	127.20 W.	25	...	...	4.0B	...	B	SEPT. 26	12 P.M. PST
OCT. 11	18	10	12.6	33.65 N.	119.05 W.	7	...	...	3.7P	...	P	OCT. 11	10 A.M. PST
OCT. 12	00	45	40.6	41.11 N.	125.88 W.	25	...	...	4.1B	...	B	OCT. 11	04 P.M. PST
OCT. 16	04	07	33.9	33.61 N.	119.01 W.	7	...	...	3.2P	...	P	OCT. 15	08 P.M. PST
OCT. 17	03	26	36.4	40.45 N.	125.31 W.	5	...	...	3.0B	...	B	OCT. 16	07 P.M. PST
OCT. 21	07	06	18.7	40.45 N.	125.40 W.	5	...	...	3.4B	...	B	OCT. 20	11 P.M. PST
OCT. 23	17	28	16.9	33.63 N.	119.02 W.	12	4.7	...	4.6P	V	P	OCT. 23	09 A.M. PST
OCT. 23	19	15	52.5	33.64 N.	119.06 W.	6	4.6	...	4.6P	V	P	OCT. 23	11 A.M. PST
OCT. 24	16	10	46.9	40.28 N.	124.76 W.	22	...	...	3.1B	...	B	OCT. 24	08 A.M. PST
OCT. 25	17	18	01.8	40.33 N.	124.64 W.	25	3.6	...	3.8B	...	B	OCT. 25	09 A.M. PST
OCT. 29	03	17	17.8	40.45 N.	127.28 W.	25	4.3	3.6	4.3B	...	B	OCT. 28	07 P.M. PST
OCT. 29	12	30	58.3	40.31 N.	124.58 W.	25	...	...	3.2B	...	B	OCT. 29	04 A.M. PST
OCT. 30	17	07	25.8	33.62 N.	119.00 W.	6	...	...	3.7P	...	P	OCT. 30	09 A.M. PST
OCT. 31	23	14	32.7	33.64 N.	119.05 W.	12	...	...	3.3P	...	P	OCT. 31	03 P.M. PST
NOV. 2	05	08	05.9	33.62 N.	119.00 W.	6	...	...	3.1P	...	P	NOV. 1	09 P.M. PST
NOV. 2	21	33	39.8	40.42 N.	124.84 W.	23	...	...	3.2B	...	B	NOV. 2	01 P.M. PST
NOV. 4	11	54	56.1	33.91 N.	118.64 W.	6	...	...	2.7P	FELT	P	NOV. 4	03 A.M. PST
NOV. 5	20	21	47.9	41.22 N.	124.62 W.	25	...	...	3.4B	...	B	NOV. 5	12 P.M. PST
NOV. 10	08	58	03.5	40.29 N.	124.70 W.	20	...	...	3.3B	...	B	NOV. 10	00 A.M. PST
NOV. 11	17	46	08.9	40.31 N.	124.64 W.	24	3.7	...	4.0B	IV	B	NOV. 11	09 A.M. PST
NOV. 17	02	53	40.4	33.71 N.	119.15 W.	16	...	...	3.1P	...	P	NOV. 16	06 P.M. PST
NOV. 20	23	59	04.5	40.61 N.	124.62 W.	21	...	...	3.8B	...	B	NOV. 20	03 P.M. PST
NOV. 24	18	37	28.9	40.37 N.	124.61 W.	25	...	...	3.2B	...	B	NOV. 24	10 A.M. PST
DEC. 2	18	48	30.8	40.63 N.	125.31 W.	25	...	...	3.7B	...	B	DEC. 2	10 A.M. PST
DEC. 9	22	58	23.0	33.69 N.	119.14 W.	16	...	...	3.5P	...	P	DEC. 9	02 P.M. PST
DEC. 11	18	42	19.5	33.68 N.	119.11 W.	10	...	...	2.8P	FELT	P	DEC. 11	10 A.M. PST
DEC. 12	01	16	35.1	40.61 N.	124.49 W.	23	...	...	3.0B	...	B	DEC. 11	05 P.M. PST
DEC. 14	11	32	59.3	33.70 N.	119.15 W.	5	...	...	3.9P	FELT	P	DEC. 14	03 A.M. PST
COLORADO													
MAR. 24	13	03	40.0	39.75 N.	104.94 W.	5	...	...	2.8G	FELT	G	MAR. 24	06 A.M. MST
APR. 2	16	10	06.4	39.91 N.	104.95 W.	9	4.3	...	3.8G	VI	Z	APR. 2	09 A.M. MST
SEPT. 16	19	58	38.9	39.88 N.	104.91 W.	5	...	...	2.1G	IV	G	SEPT. 16	12 P.M. MST
NOV. 2	03	03	00.2	39.52 N.	105.30 W.	1	...	...	2.8G	V	G	NOV. 1	08 P.M. MST
CONNECTICUT													
AUG. 4	02	01	37.2	41.54 N.	72.47 W.	0	...	...	2.2J	III	J	AUG. 3	10 P.M. EST
GEORGIA													
SEPT. 4	17	21	44.6	34.64 N.	85.17 W.	4	...	...	2.6K	...	K	SEPT. 4	12 P.M. EST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
						HAWAII							
JAN. 2	08	31	49.5	19.35 N.	155:50 W.	30	...	...	3.4H	...	H	JAN. 1	10 P.M. HST
JAN. 2	17	42	08.0	19.30 N.	155.23 W.	10	...	...	3.6H	II	H	JAN. 2	07 A.M. HST
JAN. 3	13	04	40.1	20.26 N.	155.78 W.	28	...	...	3.9H	III	H	JAN. 3	03 A.M. HST
JAN. 5	16	04	37.1	19.45 N.	155.39 W.	8	...	...	3.1H	...	H	JAN. 5	06 A.M. HST
JAN. 7	04	14	05.4	18.90 N.	155.12 W.	52	...	...	4.1H	III	H	JAN. 6	06 P.M. HST
JAN. 7	20	16	46.4	19.42 N.	155.27 W.	16	...	...	3.4H	...	H	JAN. 7	10 A.M. HST
JAN. 12	14	18	10.6	19.36 N.	155.30 W.	31	4.4	...	4.5H	V	H	JAN. 12	04 A.M. HST
JAN. 12	14	30	17.1	19.29 N.	155.31 W.	33	...	...	4.0H	IV	H	JAN. 12	04 A.M. HST
JAN. 12	15	07	48.9	19.33 N.	155.28 W.	33	...	...	4.0H	IV	H	JAN. 12	05 A.M. HST
JAN. 12	21	21	41.1	19.52 N.	155.30 W.	33	4.1	...	4.3H	IV	H	JAN. 12	11 A.M. HST
JAN. 14	04	13	31.5	19.35 N.	155.26 W.	15	...	...	3.1H	III	H	JAN. 13	06 P.M. HST
JAN. 14	04	20	16.5	19.37 N.	155.32 W.	29	4.5	...	4.3H	V	H	JAN. 13	06 P.M. HST
JAN. 15	00	36	53.0	19.43 N.	155.63 W.	0	...	...	3.1H	...	H	JAN. 14	02 P.M. HST
JAN. 15	09	16	34.3	19.30 N.	158.33 W.	15	...	...	3.3H	...	H	JAN. 14	11 P.M. HST
JAN. 16	00	37	12.0	19.32 N.	155.29 W.	34	...	...	3.8H	V	H	JAN. 15	02 P.M. HST
JAN. 18	11	25	53.5	19.42 N.	155.28 W.	2	...	...	3.4H	V	H	JAN. 18	01 A.M. HST
JAN. 20	04	21	40.4	19.31 N.	155.22 W.	9	...	...	3.0H	II	H	JAN. 19	06 P.M. HST
JAN. 22	13	39	02.5	19.78 N.	156.03 W.	41	...	...	3.8H	III	H	JAN. 22	03 A.M. HST
JAN. 25	01	30	34.5	19.36 N.	155.25 W.	9	...	...	3.4H	II	H	JAN. 24	03 P.M. HST
FEB. 9	06	03	59.9	19.35 N.	155.85 W.	11	...	...	3.0H	...	H	FEB. 8	08 P.M. HST
FEB. 9	16	02	44.0	19.54 N.	155.62 W.	11	...	...	3.8H	III	H	FEB. 9	06 A.M. HST
FEB. 9	23	34	11.1	19.55 N.	155.63 W.	10	...	...	3.0H	...	H	FEB. 9	01 P.M. HST
FEB. 11	05	34	02.1	19.33 N.	155.13 W.	9	...	...	3.0H	...	H	FEB. 10	07 P.M. HST
FEB. 11	14	44	31.2	19.30 N.	155.38 W.	3	...	...	3.0H	...	H	FEB. 11	04 A.M. HST
FEB. 14	05	52	44.2	19.30 N.	155.39 W.	6	...	...	3.3H	IV	H	FEB. 13	07 P.M. HST
FEB. 19	06	07	49.7	19.31 N.	155.39 W.	6	...	...	3.5H	...	H	FEB. 18	08 P.M. HST
FEB. 21	21	37	12.1	19.33 N.	155.11 W.	9	...	...	3.1H	...	H	FEB. 21	11 A.M. HST
FEB. 24	23	45	57.5	19.33 N.	155.19 W.	8	...	...	3.0H	...	H	FEB. 24	01 P.M. HST
FEB. 25	02	11	42.3	20.13 N.	155.98 W.	53	...	...	3.1H	...	H	FEB. 24	04 P.M. HST
FEB. 25	10	20	27.4	19.33 N.	155.21 W.	9	...	...	3.0H	...	H	FEB. 25	00 A.M. HST
MAR. 1	17	01	21.3	19.36 N.	155.03 W.	9	4.7	...	4.3H	IV	H	MAR. 1	07 A.M. HST
MAR. 2	08	19	45.2	19.33 N.	155.13 W.	9	...	...	3.0H	...	H	MAR. 1	10 P.M. HST
MAR. 5	01	56	45.7	19.42 N.	155.47 W.	11	...	...	4.1H	IV	H	MAR. 4	03 P.M. HST
MAR. 5	02	00	27.2	19.42 N.	155.47 W.	11	...	...	3.4H	III	H	MAR. 4	04 P.M. HST
MAR. 5	14	09	40.8	21.43 N.	156.80 W.	0	5.0	...	5.1H	VI	G	MAR. 5	04 A.M. HST
MAR. 5	14	16	15.7	21.27 N.	156.87 W.	1	...	...	3.4H	...	H	MAR. 5	04 A.M. HST
MAR. 6	02	43	36.4	21.16 N.	156.91 W.	0	4.5	...	4.9H	III	G	MAR. 5	04 P.M. HST
MAR. 6	15	19	08.1	21.68 N.	156.66 W.	15	...	...	3.6H	...	H	MAR. 6	05 A.M. HST
MAR. 6	19	57	46.9	19.35 N.	155.50 W.	11	...	...	3.1H	...	H	MAR. 6	09 A.M. HST
MAR. 7	03	56	00.7	19.74 N.	156.44 W.	15	...	...	4.0H	IV	H	MAR. 6	05 P.M. HST
MAR. 9	13	27	45.2	19.35 N.	155.05 W.	9	...	...	3.3H	III	H	MAR. 9	03 A.M. HST
MAR. 11	23	23	09.0	19.37 N.	155.03 W.	6	...	...	3.1H	III	H	MAR. 11	01 P.M. HST
MAR. 12	08	37	44.9	19.25 N.	155.03 W.	44	...	...	3.7H	III	H	MAR. 11	10 P.M. HST
MAR. 15	06	26	14.5	19.30 N.	155.39 W.	7	...	...	3.1H	...	H	MAR. 14	08 P.M. HST
MAR. 15	08	23	21.3	19.37 N.	155.23 W.	31	...	...	3.2H	III	H	MAR. 14	10 P.M. HST
MAR. 16	06	17	19.6	19.37 N.	155.23 W.	31	...	...	4.0H	IV	H	MAR. 15	08 P.M. HST
MAR. 18	05	43	17.8	19.69 N.	156.03 W.	9	...	...	3.0H	...	H	MAR. 17	07 P.M. HST
MAR. 25	16	25	05.3	19.76 N.	155.47 W.	17	...	...	3.3H	III	H	MAR. 25	06 A.M. HST
MAR. 26	11	55	40.2	19.35 N.	155.08 W.	9	...	...	3.2H	II	H	MAR. 26	01 A.M. HST
MAR. 30	19	06	14.0	19.33 N.	155.33 W.	9	...	...	3.6H	III	H	MAR. 30	09 A.M. HST
APR. 1	10	00	39.4	21.23 N.	156.87 W.	0	...	...	3.7H	...	H	APR. 1	00 A.M. HST
APR. 2	12	49	11.2	19.33 N.	155.20 W.	9	...	...	3.0H	...	H	APR. 2	02 A.M. HST
APR. 18	06	26	19.4	19.34 N.	155.28 W.	2	...	...	3.7H	III	H	APR. 17	08 P.M. HST
APR. 23	13	44	34.2	19.38 N.	155.07 W.	9	...	...	3.4H	III	H	APR. 23	03 A.M. HST
APR. 24	08	48	41.0	19.33 N.	155.12 W.	9	...	...	3.1H	...	H	APR. 23	10 P.M. HST
APR. 27	14	57	53.6	19.32 N.	155.12 W.	9	...	...	3.0H	...	H	APR. 27	04 A.M. HST
APR. 27	21	29	21.5	19.27 N.	155.19 W.	3	...	...	3.4H	III	H	APR. 27	11 A.M. HST
APR. 28	18	46	29.3	19.32 N.	155.18 W.	10	...	...	3.0H	III	H	APR. 28	08 A.M. HST
APR. 30	11	15	33.4	19.39 N.	155.28 W.	3	...	...	3.1H	IV	H	APR. 30	01 A.M. HST
MAY 2	12	36	07.5	19.30 N.	155.22 W.	11	...	...	3.8H	III	H	MAY 2	02 A.M. HST
MAY 2	17	10	46.3	19.33 N.	155.13 W.	9	...	...	3.2H	II	H	MAY 2	07 A.M. HST
MAY 7	12	47	59.7	19.33 N.	155.22 W.	9	...	...	3.2H	II	H	MAY 7	02 A.M. HST
MAY 12	21	40	03.1	19.33 N.	155.19 W.	9	...	...	3.0H	...	H	MAY 12	11 A.M. HST
MAY 14	07	03	30.2	19.33 N.	155.23 W.	10	...	...	3.4H	...	H	MAY 13	09 P.M. HST
MAY 14	21	16	06.8	19.35 N.	155.22 W.	9	...	...	3.0H	III	H	MAY 14	11 A.M. HST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
HAWAII--Continued													
MAY 17	19	21	45.6	19.33 N.	155.23 W.	10	...	...	3.2H	II	H	MAY 17	09 A.M. HST
MAY 21	10	57	39.8	19.20 N.	155.70 W.	7	...	...	3.5H	...	H	MAY 21	00 A.M. HST
MAY 22	23	44	44.8	18.75 N.	155.53 W.	26	...	...	3.8H	...	H	MAY 22	01 P.M. HST
MAY 25	12	11	19.1	19.33 N.	155.22 W.	9	...	...	3.1H	III	H	MAY 25	02 A.M. HST
MAY 26	10	10	04.6	19.33 N.	155.13 W.	8	...	...	3.0H	...	H	MAY 26	00 A.M. HST
JUNE 1	03	25	25.8	19.48 N.	155.77 W.	10	...	...	3.2H	...	H	MAY 31	05 P.M. HST
JUNE 1	08	32	00.1	19.45 N.	156.89 W.	31	...	...	3.0H	...	H	MAY 31	10 P.M. HST
JUNE 2	20	24	21.9	19.37 N.	155.48 W.	10	...	...	3.2H	...	H	JUNE 2	10 A.M. HST
JUNE 3	11	55	20.1	19.35 N.	155.10 W.	9	...	...	3.1H	...	H	JUNE 3	01 A.M. HST
JUNE 6	20	32	25.2	19.39 N.	155.28 W.	3	...	...	3.1H	III	H	JUNE 6	10 A.M. HST
JUNE 9	07	12	07.8	19.36 N.	155.12 W.	8	...	...	3.4H	III	H	JUNE 8	09 P.M. HST
JUNE 16	01	43	22.7	19.35 N.	155.22 W.	10	...	...	3.5H	III	H	JUNE 15	03 P.M. HST
JUNE 17	19	12	41.1	19.36 N.	155.25 W.	9	...	...	3.0H	...	H	JUNE 17	09 A.M. HST
JUNE 21	02	27	16.2	19.30 N.	155.26 W.	9	...	...	3.0H	...	H	JUNE 20	04 P.M. HST
JUNE 21	11	14	37.3	19.33 N.	155.13 W.	9	...	...	3.0H	...	H	JUNE 21	01 A.M. HST
JUNE 30	21	46	25.7	19.32 N.	155.22 W.	11	...	...	3.5H	II	H	JUNE 30	11 A.M. HST
JULY 2	12	31	54.7	19.32 N.	155.19 W.	10	...	...	3.6H	III	H	JULY 2	02 A.M. HST
JULY 3	23	28	42.6	19.39 N.	155.28 W.	3	...	...	3.1H	IV	H	JULY 3	01 P.M. HST
JULY 6	20	30	38.6	19.34 N.	155.20 W.	10	...	...	3.0H	...	H	JULY 6	10 A.M. HST
JULY 10	01	12	21.2	19.43 N.	155.63 W.	4	...	...	3.0H	...	H	JULY 9	03 P.M. HST
JULY 17	13	03	15.8	19.39 N.	155.28 W.	3	...	...	3.1H	...	H	JULY 17	03 A.M. HST
JULY 20	16	12	46.4	19.33 N.	155.22 W.	10	...	...	3.9H	IV	H	JULY 20	06 A.M. HST
JULY 21	17	59	16.5	19.27 N.	155.45 W.	10	...	...	3.9H	IV	H	JULY 21	07 A.M. HST
JULY 23	11	38	17.5	18.95 N.	155.18 W.	46	...	...	3.0H	...	H	JULY 23	01 A.M. HST
JULY 24	21	37	42.2	19.40 N.	155.48 W.	10	...	...	3.0H	...	H	JULY 24	11 A.M. HST
JULY 28	03	15	16.0	19.32 N.	155.19 W.	10	...	...	3.3H	III	H	JULY 27	05 P.M. HST
JULY 28	20	00	44.9	19.34 N.	155.03 W.	9	...	...	4.1H	V	H	JULY 28	10 A.M. HST
JULY 28	20	18	33.9	19.37 N.	155.03 W.	8	...	...	3.3H	IV	H	JULY 28	10 A.M. HST
JULY 30	01	57	50.0	19.36 N.	155.25 W.	10	...	...	3.4H	II	H	JULY 29	03 P.M. HST
AUG. 1	20	34	02.3	19.33 N.	155.13 W.	10	...	...	3.0H	...	H	AUG. 1	10 A.M. HST
AUG. 2	18	48	16.2	20.11 N.	155.78 W.	23	...	...	3.0H	III	H	AUG. 2	08 A.M. HST
AUG. 4	17	47	50.6	19.47 N.	155.45 W.	9	...	...	3.0H	II	H	AUG. 4	07 A.M. HST
AUG. 6	23	00	18.0	19.77 N.	155.03 W.	40	...	...	3.2H	...	H	AUG. 6	01 P.M. HST
AUG. 10	15	32	19.6	19.38 N.	155.27 W.	1	...	...	3.1H	III	H	AUG. 10	05 A.M. HST
AUG. 10	15	42	09.4	19.38 N.	155.28 W.	2	...	...	4.2H	IV	H	AUG. 10	05 A.M. HST
AUG. 10	16	05	58.2	19.38 N.	155.27 W.	2	...	...	3.1H	III	H	AUG. 10	06 A.M. HST
AUG. 10	16	23	39.3	19.31 N.	155.28 W.	5	...	...	3.6H	III	H	AUG. 10	06 A.M. HST
AUG. 10	17	23	12.9	19.32 N.	155.34 W.	8	...	...	3.4H	III	H	AUG. 10	07 A.M. HST
AUG. 10	17	47	51.7	19.31 N.	155.35 W.	1	...	...	3.4H	III	H	AUG. 10	07 A.M. HST
AUG. 10	18	20	08.7	19.32 N.	155.35 W.	5	4.4	...	4.2H	IV	H	AUG. 10	08 A.M. HST
AUG. 10	18	41	40.0	19.33 N.	155.33 W.	3	...	...	3.1H	III	H	AUG. 10	08 A.M. HST
AUG. 10	19	40	35.0	19.31 N.	155.36 W.	4	4.7	...	4.5H	IV	H	AUG. 10	09 A.M. HST
AUG. 10	20	43	59.0	19.33 N.	155.31 W.	6	...	...	3.1H	III	H	AUG. 10	10 A.M. HST
AUG. 10	23	02	57.8	19.35 N.	155.34 W.	0	...	...	3.2H	III	H	AUG. 10	01 P.M. HST
AUG. 10	23	29	11.3	19.30 N.	155.36 W.	7	...	...	3.6H	III	H	AUG. 10	01 P.M. HST
AUG. 11	04	53	46.6	19.30 N.	155.39 W.	5	...	...	3.6H	III	H	AUG. 10	06 P.M. HST
AUG. 11	05	17	17.2	19.32 N.	155.32 W.	4	...	...	3.3H	III	H	AUG. 10	07 P.M. HST
AUG. 11	05	23	43.4	19.24 N.	155.37 W.	3	...	...	3.3H	III	H	AUG. 10	07 P.M. HST
AUG. 11	06	46	29.0	19.31 N.	155.38 W.	3	...	...	3.0H	...	H	AUG. 10	08 P.M. HST
AUG. 11	13	53	36.3	19.29 N.	155.38 W.	6	...	...	3.3H	...	H	AUG. 11	03 A.M. HST
AUG. 11	18	47	29.8	19.23 N.	155.38 W.	9	...	...	3.1H	...	H	AUG. 11	08 A.M. HST
AUG. 12	04	20	42.4	19.20 N.	155.35 W.	7	...	...	3.3H	III	H	AUG. 11	06 P.M. HST
AUG. 14	18	02	18.1	19.98 N.	155.47 W.	24	...	...	3.0H	...	H	AUG. 14	08 A.M. HST
AUG. 15	09	51	36.8	19.99 N.	155.95 W.	15	...	...	3.2H	...	H	AUG. 14	11 P.M. HST
AUG. 17	01	14	32.7	19.40 N.	155.28 W.	15	...	...	3.4H	III	H	AUG. 16	03 P.M. HST
AUG. 19	12	38	47.3	19.32 N.	155.13 W.	9	...	...	3.5H	...	H	AUG. 19	02 A.M. HST
AUG. 22	22	05	20.3	20.18 N.	156.43 W.	10	4.3	...	4.4H	IV	G	AUG. 22	12 P.M. HST
SEPT. 1	20	42	17.6	19.77 N.	154.86 W.	42	...	...	3.1H	...	H	SEPT. 1	10 A.M. HST
SEPT. 7	08	21	46.2	19.63 N.	156.02 W.	42	...	...	3.3H	III	H	SEPT. 6	10 P.M. HST
SEPT. 7	08	34	47.6	19.42 N.	155.29 W.	10	...	...	3.3H	III	H	SEPT. 6	10 P.M. HST
SEPT. 22	13	55	01.7	19.33 N.	155.12 W.	9	...	...	3.1H	...	H	SEPT. 22	03 A.M. HST
SEPT. 22	14	49	24.0	19.33 N.	155.13 W.	9	...	...	3.3H	III	H	SEPT. 22	04 A.M. HST
SEPT. 22	16	50	23.7	19.32 N.	155.12 W.	10	...	...	3.9H	IV	H	SEPT. 22	06 A.M. HST
SEPT. 27	11	50	00.6	19.37 N.	155.42 W.	11	...	...	3.4H	III	H	SEPT. 27	01 A.M. HST
SEPT. 28	22	07	31.4	19.43 N.	155.63 W.	2	...	...	3.8H	...	H	SEPT. 28	12 P.M. HST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
HAWAII--Continued													
SEPT. 28	22	25	07.4	19.49 N.	155.81 W.	8	...	...	3.1H	...	H	SEPT. 28	12 P.M. HST
SEPT. 30	17	04	45.7	19.31 N.	155.23 W.	10	...	...	3.9H	IV	H	SEPT. 30	07 A.M. HST
OCT. 2	07	39	18.9	19.34 N.	155.03 W.	7	...	...	3.1H	...	H	OCT. 1	09 P.M. HST
OCT. 2	15	44	34.3	19.34 N.	155.12 W.	9	...	...	3.1H	III	H	OCT. 2	05 A.M. HST
OCT. 2	21	43	40.5	19.34 N.	155.12 W.	9	...	...	3.1H	...	H	OCT. 2	11 A.M. HST
OCT. 5	01	42	28.0	19.28 N.	155.52 W.	28	...	...	3.7H	III	H	OCT. 4	03 P.M. HST
OCT. 7	09	35	43.4	19.31 N.	155.23 W.	10	...	...	3.0H	...	H	OCT. 6	11 P.M. HST
OCT. 11	17	21	19.0	19.62 N.	156.07 W.	38	...	...	3.0H	...	H	OCT. 11	07 A.M. HST
OCT. 14	05	11	22.8	19.28 N.	155.36 W.	9	...	...	3.1H	II	H	OCT. 13	07 P.M. HST
OCT. 15	00	38	20.5	20.00 N.	155.67 W.	14	...	...	3.1H	III	H	OCT. 14	02 P.M. HST
OCT. 15	11	00	00.2	18.98 N.	155.06 W.	35	...	...	3.3H	...	H	OCT. 15	01 A.M. HST
OCT. 19	20	08	35.6	19.33 N.	155.18 W.	9	...	...	3.0H	...	H	OCT. 19	10 A.M. HST
OCT. 23	07	56	08.9	19.32 N.	155.15 W.	10	...	...	3.3H	...	H	OCT. 22	09 P.M. HST
OCT. 28	09	33	32.3	19.38 N.	155.28 W.	33	4.2	...	4.0H	V	H	OCT. 27	11 P.M. HST
NOV. 2	02	05	50.6	19.48 N.	155.88 W.	11	...	...	3.1H	...	H	NOV. 1	04 P.M. HST
NOV. 7	17	23	46.8	19.33 N.	155.22 W.	10	...	...	3.1H	III	H	NOV. 7	07 A.M. HST
NOV. 10	13	02	56.6	19.34 N.	155.22 W.	10	5.3	...	4.4H	V	H	NOV. 10	03 A.M. HST
NOV. 10	13	31	02.6	19.34 N.	155.21 W.	9	...	...	3.4H	III	H	NOV. 10	03 A.M. HST
NOV. 16	06	23	59.4	19.97 N.	155.35 W.	10	...	...	3.0H	III	H	NOV. 15	08 P.M. HST
NOV. 16	12	26	40.2	19.96 N.	155.36 W.	12	...	...	3.4H	III	H	NOV. 16	02 A.M. HST
NOV. 17	05	10	09.5	19.28 N.	155.37 W.	8	...	...	3.0H	...	H	NOV. 16	07 P.M. HST
NOV. 19	08	29	54.8	19.37 N.	155.48 W.	11	...	...	3.6H	IV	H	NOV. 18	10 P.M. HST
NOV. 20	05	32	58.1	19.96 N.	155.35 W.	12	...	...	3.8H	VI	H	NOV. 19	07 P.M. HST
NOV. 20	17	42	52.4	19.37 N.	155.08 W.	9	...	...	3.4H	IV	H	NOV. 20	07 A.M. HST
NOV. 28	19	17	18.4	19.97 N.	155.35 W.	10	...	...	3.4H	III	H	NOV. 28	09 A.M. HST
DEC. 1	06	07	09.7	19.36 N.	155.08 W.	9	...	...	3.4H	III	H	NOV. 30	08 P.M. HST
DEC. 5	22	26	30.9	19.33 N.	155.13 W.	8	...	...	3.3H	...	H	DEC. 5	12 P.M. HST
DEC. 7	19	07	29.1	19.32 N.	155.22 W.	9	...	...	3.2H	III	H	DEC. 7	09 A.M. HST
DEC. 8	03	39	27.2	19.82 N.	156.07 W.	41	...	...	4.0H	IV	H	DEC. 7	05 P.M. HST
DEC. 13	04	23	13.3	19.33 N.	155.09 W.	10	...	...	3.7H	III	H	DEC. 12	06 P.M. HST
DEC. 13	13	22	28.8	19.35 N.	155.07 W.	8	...	...	3.0H	...	H	DEC. 13	03 A.M. HST
DEC. 14	00	20	21.3	19.33 N.	155.14 W.	9	...	...	3.3H	III	H	DEC. 13	02 P.M. HST
DEC. 17	06	21	51.5	19.33 N.	155.12 W.	9	...	...	3.4H	III	H	DEC. 16	08 P.M. HST
DEC. 20	15	08	02.6	19.34 N.	155.17 W.	9	...	...	3.1H	...	H	DEC. 20	05 A.M. HST
DEC. 22	05	15	15.6	19.33 N.	155.12 W.	9	...	...	3.2H	...	H	DEC. 21	07 P.M. HST
DEC. 23	17	11	14.6	20.10 N.	155.82 W.	28	...	...	3.0H	II	H	DEC. 23	07 A.M. HST
DEC. 28	02	09	30.4	19.28 N.	155.37 W.	8	...	...	3.2H	...	H	DEC. 27	04 P.M. HST
IDAHO													
FEB. 9	22	53	36.7	43.12 N.	111.36 W.	5	...	...	3.0G	III	G	FEB. 9	03 P.M. MST
MAR. 2	21	58	46.9	45.57 N.	113.88 W.	5	...	...	3.5G	...	G	MAR. 2	02 P.M. MST
MAR. 26	00	21	28.2	43.36 N.	111.11 W.	5	...	...	3.0G	...	G	MAR. 25	05 P.M. MST
APR. 15	18	46	37.8	44.40 N.	111.29 W.	5	...	...	3.8G	III	G	APR. 15	11 A.M. MST
MAY 27	05	46	15.9	42.59 N.	111.73 W.	5	...	...	3.1G	IV	G	MAY 26	10 P.M. MST
JUNE 6	23	47	39.8	44.67 N.	115.80 W.	5	...	...	3.4G	...	G	JUNE 6	03 P.M. PST
SEPT. 5	22	09	33.2	44.44 N.	114.95 W.	5	...	...	3.2G	...	G	SEPT. 5	03 P.M. MST
SEPT. 29	05	39	48.1	44.69 N.	116.99 W.	5	...	...	3.3G	IV	G	SEPT. 28	10 P.M. MST
SEPT. 30	04	17	32.7	42.54 N.	111.22 W.	7	3.7	...	3.8U	IV	U	SEPT. 29	09 P.M. MST
DEC. 9	07	56	56.2	42.65 N.	111.45 W.	7	...	...	3.0U	...	U	DEC. 9	00 A.M. MST
DEC. 9	08	15	05.2	42.63 N.	111.43 W.	7	4.3	...	4.1U	V	U	DEC. 9	01 A.M. MST
DEC. 9	08	43	33.0	42.64 N.	111.46 W.	7	...	...	3.2U	FELT	U	DEC. 9	01 A.M. MST
DEC. 9	15	03	18.7	42.65 N.	111.43 W.	7	...	...	2.9U	...	U	DEC. 9	08 A.M. MST
DEC. 18	00	17	10.7	42.77 N.	111.51 W.	7	...	...	2.7U	...	U	DEC. 17	05 P.M. MST
ILLINOIS													
APR. 8	01	53	13.0	38.87 N.	89.38 W.	1	...	...	3.5S	FELT	S	APR. 7	07 P.M. CST
JUNE 9	14	15	47.7	37.82 N.	89.02 W.	20	...	...	3.4S	V	S	JUNE 9	08 A.M. CST
DEC. 27	21	10	42.7	37.17 N.	89.32 W.	2	...	...	2.6K	...	K	DEC. 27	03 P.M. CST
KANSAS													
AUG. 1	01	58	44.5	38.34 N.	97.93 W.	10	...	...	2.7Y	...	Y	JULY 31	07 P.M. CST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
KENTUCKY													
JAN. 14	21	10	33.9	38.20 N.	83.91 W.	11	...	...	1.5K	FELT	K	JAN. 14	04 P.M. EST
FEB. 11	14	42	57.6	37.05 N.	89.13 W.	2	...	...	2.7S	IV	S	FEB. 11	08 A.M. CST
NOV. 30	17	33	11.0	37.63 N.	82.20 W.	7	...	...	2.5K	...	K	NOV. 30	12 P.M. EST
DEC. 7	20	01	10.6	37.28 N.	82.91 W.	1	...	...	...	...	V	DEC. 7	03 P.M. EST
LOUISIANA													
FEB. 18	06	33	48.2	29.56 N.	91.46 W.	5	...	...	3.0K	...	K	FEB. 18	00 A.M. CST
MAINE													
JAN. 4	09	17	10.2	43.89 N.	70.01 W.	0	...	...	2.6J	FELT	J	JAN. 4	04 A.M. EST
MASSACHUSETTS													
SEPT. 12	02	44	45.4	41.57 N.	70.61 W.	3	...	...	2.1J	II	J	SEPT. 11	09 P.M. EST
MISSOURI													
MAY 25	22	50	18.2	36.76 N.	91.63 W.	1	...	...	3.0S	III	S	MAY 25	04 P.M. CST
SEPT. 30	14	28	37.0	36.56 N.	89.65 W.	8	...	...	2.5S	...	S	SEPT. 30	08 A.M. CST
NEBRASKA													
JUNE 26	18	55	02.2	41.52 N.	97.63 W.	4	...	...	2.7Y	...	Y	JUNE 26	01 P.M. CST
SEPT. 7	00	38	09.1	42.89 N.	100.52 W.	5	...	...	3.1T	...	G	SEPT. 6	06 P.M. CST
OCT. 9	21	54	25.6	41.26 N.	98.70 W.	5	...	...	2.5Y	...	Y	OCT. 9	03 P.M. CST
NEVADA													
JAN. 1	18	22	22.5	38.09 N.	118.56 W.	17	...	...	4.1B	FELT	B	JAN. 1	10 A.M. PST
JAN. 10	00	04	15.6	38.15 N.	118.51 W.	5	...	...	3.2P	...	P	JAN. 9	04 P.M. PST
JAN. 11	18	25	38.3	38.19 N.	118.38 W.	17	...	...	3.5B	...	B	JAN. 11	10 A.M. PST
JAN. 13	18	33	45.6	38.03 N.	118.58 W.	4	...	...	3.0P	...	P	JAN. 13	10 A.M. PST
JAN. 15	20	25	00.1	37.09 N.	116.05 W.	0	5.6	...	5.5B	...	E	JAN. 15	12 P.M. PST
JAN. 16	17	30	36.0	38.22 N.	118.45 W.	5	...	...	3.0P	...	P	JAN. 16	09 A.M. PST
JAN. 24	16	14	18.7	38.23 N.	118.43 W.	5	...	...	3.0P	...	P	JAN. 24	08 A.M. PST
JAN. 28	20	08	50.7	38.20 N.	118.34 W.	15	4.5	...	4.6B	IV	B	JAN. 28	12 P.M. PST
FEB. 5	18	00	00.1	37.01 N.	116.03 W.	0	...	...	3.2G	...	E	FEB. 5	10 A.M. PST
FEB. 11	14	23	31.6	38.30 N.	118.84 W.	5	...	...	3.1P	...	P	FEB. 11	06 A.M. PST
FEB. 25	15	00	00.8	37.18 N.	116.08 W.	0	...	...	3.0G	...	E	FEB. 25	07 A.M. PST
MAR. 10	17	19	24.7	38.49 N.	118.06 W.	11	...	...	3.0P	...	P	MAR. 10	09 A.M. PST
MAR. 12	17	28	08.8	36.03 N.	114.84 W.	2	...	...	2.8G	FELT	G	MAR. 12	09 A.M. PST
MAR. 13	00	09	06.6	35.95 N.	114.80 W.	2	...	...	3.2G	FELT	G	MAR. 12	04 P.M. PST
MAR. 23	08	52	30.3	38.23 N.	118.33 W.	14	...	...	3.5B	...	B	MAR. 23	00 A.M. PST
APR. 11	04	13	24.0	38.06 N.	118.59 W.	10	...	...	3.6B	...	B	APR. 10	08 P.M. PST
APR. 11	21	21	32.9	37.97 N.	118.46 W.	8	...	...	3.2P	...	P	APR. 11	01 P.M. PST
APR. 18	00	35	40.5	38.09 N.	118.56 W.	25	...	...	3.6B	...	B	APR. 17	04 P.M. PST
APR. 28	22	54	49.9	38.06 N.	118.59 W.	10	4.2	...	4.6B	IV	B	APR. 28	02 P.M. PST
APR. 29	11	55	52.6	39.27 N.	119.76 W.	7	...	...	4.2B	V	B	APR. 29	03 A.M. PST
APR. 30	14	35	00.0	37.18 N.	116.08 W.	0	...	...	3.4P	...	E	APR. 30	06 A.M. PST
MAY 1	01	31	05.6	38.45 N.	118.12 W.	6	...	...	3.2P	...	P	APR. 30	05 P.M. PST
MAY 7	02	18	28.4	37.95 N.	118.53 W.	6	...	...	3.8P	...	P	MAY 6	06 P.M. PST
MAY 29	16	00	00.0	37.10 N.	116.00 W.	0	4.2	...	4.5B	...	E	MAY 29	08 A.M. PST
JUNE 6	18	00	00.0	37.30 N.	116.33 W.	0	5.5	4.2	5.4B	...	E	JUNE 6	10 A.M. PST
JUNE 11	18	00	43.5	38.26 N.	115.91 W.	5	...	...	3.6G	...	G	JUNE 11	10 A.M. PST
JULY 10	14	00	00.0	37.13 N.	116.03 W.	0	...	...	4.2B	...	E	JULY 10	06 A.M. PST
JULY 16	15	00	00.1	37.09 N.	116.02 W.	0	...	...	3.3G	...	E	JULY 16	07 A.M. PST
AUG. 5	13	41	00.0	37.15 N.	116.04 W.	0	...	...	2.8G	...	E	AUG. 5	05 A.M. PST
AUG. 27	14	31	00.0	37.16 N.	116.07 W.	0	...	...	4.3B	...	E	AUG. 27	06 A.M. PST
SEPT. 4	15	00	00.1	37.06 N.	116.05 W.	0	...	...	3.8B	...	E	SEPT. 4	07 A.M. PST
SEPT. 12	18	12	58.7	38.09 N.	118.62 W.	11	...	...	4.4B	FELT	B	SEPT. 12	10 A.M. PST
SEPT. 24	15	00	00.0	37.01 N.	116.02 W.	0	...	...	3.5G	...	E	SEPT. 24	07 A.M. PST
SEPT. 30	03	14	03.5	39.15 N.	119.59 W.	8	...	...	3.4B	IV	G	SEPT. 29	07 P.M. PST
OCT. 1	19	00	00.1	37.08 N.	116.01 W.	0	4.9	...	5.0B	...	E	OCT. 1	11 A.M. PST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Ma or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
NEVADA--Continued													
OCT. 13	14	47	53.9	37.07 N.	116.94 W.	6	...	...	3.4P	...	P	OCT. 13	06 A.M. PST
OCT. 13	19	51	12.9	37.05 N.	116.97 W.	5	...	...	3.1P	...	P	OCT. 13	11 A.M. PST
OCT. 15	04	21	10.6	37.06 N.	116.95 W.	1	...	...	3.7P	...	P	OCT. 14	08 P.M. PST
NOV. 4	11	47	18.9	39.42 N.	119.72 W.	2	...	...	3.3B	V	R	NOV. 4	03 A.M. PST
NOV. 11	20	00	00.0	37.08 N.	116.07 W.	0	4.8	...	4.8B	...	E	NOV. 11	12 P.M. PST
NOV. 12	15	00	00.1	37.11 N.	116.05 W.	0	5.3	4.4	5.5B	...	E	NOV. 12	07 A.M. PST
NOV. 19	18	01	55.8	39.26 N.	116.39 W.	5	...	...	3.5G	...	G	NOV. 19	10 A.M. PST
NOV. 19	21	40	53.4	37.07 N.	116.89 W.	6	...	...	3.1P	...	P	NOV. 19	01 P.M. PST
DEC. 1	16	18	51.0	38.61 N.	118.07 W.	10	...	...	4.4B	V	B	DEC. 1	08 A.M. PST
DEC. 3	15	00	00.1	37.15 N.	116.07 W.	0	4.6	...	4.9B	...	E	DEC. 3	07 A.M. PST
DEC. 7	07	47	52.7	38.61 N.	118.22 W.	12	...	...	4.0B	IV	B	DEC. 6	11 P.M. PST
DEC. 13	01	20	01.8	38.64 N.	118.21 W.	10	...	...	3.7B	FELT	B	DEC. 12	05 P.M. PST
DEC. 16	21	05	00.1	37.12 N.	116.12 W.	0	4.4	...	4.4B	...	E	DEC. 16	01 P.M. PST
DEC. 19	20	56	53.7	38.62 N.	118.25 W.	13	...	...	4.3B	FELT	B	DEC. 19	12 P.M. PST
DEC. 28	22	45	42.2	37.21 N.	114.98 W.	5	...	...	3.6G	IV	G	DEC. 28	02 P.M. PST
NEW HAMPSHIRE													
JUNE 28	22	42	35.1	43.57 N.	71.55 W.	0	...	...	3.1J	FELT	J	JUNE 28	05 P.M. EST
NEW MEXICO													
MAY 4	10	55	29.7	32.24 N.	108.88 W.	5	...	...	3.0G	...	G	MAY 4	03 A.M. MST
MAY 7	01	38	17.8	32.20 N.	108.90 W.	5	...	...	3.2G	...	G	MAY 6	06 P.M. MST
MAY 9	12	35	50.8	33.99 N.	107.03 W.	5	...	...	3.1G	V	G	MAY 9	05 A.M. MST
DEC. 4	08	51	24.2	34.46 N.	108.23 W.	5	...	...	2.8G	FELT	G	DEC. 4	01 A.M. MST
NEW YORK													
MAR. 31	21	05	14.2	42.86 N.	78.26 W.	6	...	...	2.8L	...	L	MAR. 31	04 P.M. EST
SEPT. 16	14	41	33.8	43.43 N.	76.39 W.	9	...	...	2.6L	...	L	SEPT. 16	09 A.M. EST
OCT. 21	16	49	07.0	41.13 N.	72.56 W.	6	...	...	3.8J	V	L	OCT. 21	11 A.M. EST
DEC. 14	18	31	38.3	43.08 N.	73.83 W.	2	...	...	2.3L	FELT	L	DEC. 14	01 P.M. EST
NORTH CAROLINA													
MAR. 4	20	44	42.6	35.71 N.	79.75 W.	5	...	...	2.8V	IV	G	MAR. 4	03 P.M. EST
APR. 9	07	10	31.4	35.48 N.	82.07 W.	5	...	...	3.0G	V	G	APR. 9	02 A.M. EST
APR. 9	12	02	37.4	35.50 N.	82.11 W.	7	...	...	2.7K	...	K	APR. 9	07 A.M. EST
APR. 10	06	04	59.8	35.51 N.	82.06 W.	1	...	...	2.5K	...	K	APR. 10	01 A.M. EST
MAY 5	21	21	57.9	35.33 N.	82.43 W.	13	...	...	3.5V	VI	K	MAY 5	04 P.M. EST
JUNE 3	20	54	22.4	36.21 N.	81.65 W.	1	...	...	3.0V	V	G	JUNE 3	03 P.M. EST
OKLAHOMA													
JULY 1	22	43	30.1	34.95 N.	97.55 W.	5	...	...	2.5T	...	T	JULY 1	04 P.M. CST
JULY 11	20	19	23.7	34.88 N.	97.75 W.	5	...	...	2.2T	II	T	JULY 11	02 P.M. CST
JULY 11	21	09	21.8	34.85 N.	97.73 W.	5	...	...	3.5T	V	T	JULY 11	03 P.M. CST
DEC. 17	05	44	54.7	36.39 N.	97.66 W.	5	...	...	2.9T	...	T	DEC. 16	11 P.M. CST
OREGON--OFF THE COAST													
JAN. 7	04	34	25.9	43.03 N.	126.18 W.	15	3.9	...	...	...	G	JAN. 6	08 P.M. PST
JAN. 20	10	32	15.2	44.11 N.	129.19 W.	15	4.6	3.9	...	...	G	JAN. 20	02 A.M. PST
FEB. 3	04	19	21.4	44.55 N.	129.57 W.	15	4.0	...	...	...	G	FEB. 2	08 P.M. PST
APR. 2	14	02	56.8	42.58 N.	126.53 W.	10	4.4	...	...	...	G	APR. 2	06 A.M. PST
APR. 19	18	32	28.3	43.94 N.	128.31 W.	10	4.5	...	...	...	G	APR. 19	10 A.M. PST
APR. 20	08	51	49.5	44.04 N.	128.46 W.	10	4.5	...	...	...	G	APR. 20	00 A.M. PST
APR. 24	21	23	08.4	42.56 N.	126.67 W.	10	4.3	...	...	...	G	APR. 24	01 P.M. PST
MAY 10	04	13	31.4	43.41 N.	126.72 W.	10	4.9	4.6	4.8B	...	G	MAY 9	08 P.M. PST
MAY 29	04	35	20.7	43.42 N.	126.84 W.	10	4.1	...	...	...	G	MAY 28	08 P.M. PST
MAY 31	03	56	48.9	43.71 N.	127.39 W.	10	4.3	...	...	...	G	MAY 30	07 P.M. PST
JUNE 6	10	57	54.2	43.44 N.	126.71 W.	10	4.1	...	...	...	G	JUNE 6	02 A.M. PST
JUNE 10	13	39	29.2	43.71 N.	127.65 W.	10	4.2	...	...	...	G	JUNE 10	05 A.M. PST
JUNE 19	00	41	10.7	43.18 N.	126.39 W.	10	4.3	...	...	...	G	JUNE 18	04 P.M. PST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
OREGON--OFF THE COAST--Continued													
JULY 6	17	40	54.1	43.34 N.	127.06 W.	10	3.6	...	...	...	G	JULY 6	09 A.M. PST
SEPT. 21	10	58	27.8	44.03 N.	127.97 W.	10	3.7	...	...	...	G	SEPT. 21	02 A.M. PST
SEPT. 21	13	28	00.3	42.89 N.	126.73 W.	10	4.2	...	...	...	G	SEPT. 21	05 A.M. PST
SEPT. 25	23	10	34.5	43.60 N.	127.41 W.	10	4.4	...	...	...	G	SEPT. 25	03 P.M. PST
OCT. 20	18	35	46.7	43.10 N.	126.26 W.	10	4.1	...	...	...	G	OCT. 20	10 A.M. PST
NOV. 3	13	47	34.1	43.54 N.	127.71 W.	10	6.0	6.2	5.8B	...	G	NOV. 3	05 A.M. PST
NOV. 8	08	31	24.0	43.71 N.	127.66 W.	10	...	...	...	...	G	NOV. 8	00 A.M. PST
NOV. 11	02	49	00.8	43.82 N.	127.35 W.	10	...	...	...	...	G	NOV. 10	06 P.M. PST
NOV. 16	13	03	55.3	43.80 N.	127.90 W.	10	4.0	...	...	...	G	NOV. 16	05 A.M. PST
NOV. 22	11	37	56.6	43.60 N.	127.34 W.	10	5.0	5.3	...	...	G	NOV. 22	03 A.M. PST
DEC. 8	20	05	26.0	42.50 N.	126.83 W.	10	...	...	...	...	G	DEC. 8	12 P.M. PST
DEC. 14	16	14	11.7	42.03 N.	127.01 W.	10	4.5	...	...	...	G	DEC. 14	08 A.M. PST
DEC. 20	20	30	06.8	43.82 N.	127.68 W.	10	4.5	...	...	...	G	DEC. 20	12 P.M. PST
DEC. 21	10	57	49.9	43.66 N.	127.40 W.	10	4.6	...	...	...	G	DEC. 21	02 A.M. PST
RHODE ISLAND													
APR. 3	09	24	12.5	41.59 N.	71.22 W.	1	...	...	2.7J	V	J	APR. 3	04 A.M. EST
SOUTH CAROLINA													
FEB. 21	04	48	26.5	33.60 N.	81.17 W.	1	...	...	2.0G	II	G	FEB. 20	11 P.M. EST
MAR. 19	04	33	55.7	32.96 N.	80.19 W.	6	...	...	2.5G	III	G	MAR. 18	11 P.M. EST
SOUTH DAKOTA													
SEPT. 13	22	16	29.7	43.04 N.	101.85 W.	5	...	...	3.4T	V	G	SEPT. 13	03 P.M. MST
TENNESSEE													
JAN. 2	14	31	23.0	36.36 N.	89.51 W.	5	...	...	2.3K	IV	K	JAN. 2	08 A.M. CST
JAN. 3	19	05	21.2	36.29 N.	89.49 W.	5	...	...	1.8K	FELT	K	JAN. 3	01 P.M. CST
FEB. 8	16	52	58.5	35.62 N.	89.60 W.	5	...	...	3.0G	IV	K	FEB. 8	10 A.M. CST
APR. 2	06	32	40.9	35.43 N.	84.38 W.	3	...	...	2.6K	...	K	APR. 2	01 A.M. EST
APR. 25	16	30	30.8	36.24 N.	89.59 W.	6	...	...	2.6S	...	S	APR. 25	10 A.M. CST
MAY 29	14	56	12.2	36.28 N.	89.49 W.	4	...	...	2.3K	FELT	K	MAY 29	08 A.M. CST
AUG. 7	11	53	41.8	35.95 N.	89.12 W.	10	...	...	4.0S	VI	K	AUG. 7	05 A.M. CST
OCT. 22	10	33	29.3	36.30 N.	89.44 W.	3	...	...	2.5K	FELT	K	OCT. 22	04 A.M. CST
NOV. 8	17	11	19.0	36.10 N.	89.39 W.	12	...	...	3.0G	IV	S	NOV. 8	11 A.M. CST
NOV. 25	11	54	26.0	35.64 N.	84.63 W.	3	...	...	2.7K	...	K	NOV. 25	06 A.M. EST
TEXAS													
JUNE 9	01	46	33.1	32.14 N.	94.40 W.	5	...	...	3.0T	IV	G	JUNE 8	07 P.M. CST
NOV. 6	12	36	40.5	32.02 N.	95.26 W.	5	...	...	3.2T	IV	G	NOV. 6	06 A.M. CST
UTAH													
JAN. 16	10	26	30.1	37.45 N.	113.10 W.	2	...	...	3.5U	IV	U	JAN. 16	03 A.M. MST
JAN. 16	11	38	29.9	37.53 N.	113.10 W.	2	...	...	2.5U	...	U	JAN. 16	04 A.M. MST
JAN. 16	14	50	45.9	37.44 N.	113.10 W.	2	...	...	3.3U	IV	U	JAN. 16	07 A.M. MST
FEB. 1	02	21	47.5	37.57 N.	113.24 W.	0	...	...	3.7U	FELT	U	FEB. 0	07 P.M. MST
FEB. 4	03	42	14.5	37.58 N.	113.29 W.	1	...	...	2.6U	...	U	FEB. 3	08 P.M. MST
FEB. 5	14	32	45.1	37.55 N.	113.25 W.	4	...	...	2.8U	...	U	FEB. 5	07 A.M. MST
FEB. 20	09	13	01.8	40.33 N.	111.74 W.	2	4.7	...	3.9U	VI	U	FEB. 20	02 A.M. MST
MAR. 31	20	40	45.8	41.70 N.	111.06 W.	0	...	...	3.1U	...	U	MAR. 31	01 P.M. MST
APR. 5	05	40	40.5	37.63 N.	113.30 W.	1	4.2	...	4.5U	V	U	APR. 4	10 P.M. MST
APR. 9	23	41	31.3	37.75 N.	110.59 W.	7	...	...	2.8U	...	U	APR. 9	04 P.M. MST
APR. 11	05	19	49.0	41.85 N.	112.66 W.	3	...	...	2.9U	...	U	APR. 10	10 P.M. MST
APR. 11	08	08	02.6	41.86 N.	112.66 W.	0	...	...	3.1U	IV	U	APR. 11	01 A.M. MST
MAY 14	05	11	04.9	39.47 N.	111.06 W.	7	4.5	...	3.5U	V	U	MAY 13	10 P.M. MST
MAY 29	03	09	17.0	37.45 N.	111.27 W.	7	...	...	2.6U	...	U	MAY 28	08 P.M. MST
JUNE 9	19	12	20.1	39.50 N.	111.27 W.	7	...	...	2.8U	...	U	JUNE 9	12 P.M. MST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML, Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
UTAH--Continued													
JULY 14	19	30	07.6	37.55 N.	111.34 W.	7	...	...	2.9U	...	U	JULY 14	12 P.M. MST
AUG 8	06	20	17.1	38.07 N.	112.81 W.	0	...	...	3.3U	...	U	AUG. 7	11 P.M. MST
AUG. 28	21	19	09.0	37.87 N.	112.93 W.	7	...	...	2.5U	...	U	AUG. 28	02 P.M. MST
SEPT. 10	07	55	09.9	37.49 N.	110.53 W.	7	...	...	3.1U	...	U	SEPT. 10	00 A.M. MST
SEPT. 21	08	01	33.8	39.58 N.	110.40 W.	7	...	...	3.2U	IV	U	SEPT. 21	01 A.M. MST
SEPT. 22	05	02	59.7	39.59 N.	110.42 W.	7	...	...	3.0U	...	U	SEPT. 21	10 P.M. MST
SEPT. 22	05	04	00.0	39.59 N.	110.42 W.	7	...	...	3.0U	FELT	U	SEPT. 21	10 A.M. MST
DEC. 17	10	47	43.8	40.31 N.	111.63 W.	2	...	...	2.2U	IV	U	DEC. 17	03 A.M. MST
DEC. 29	04	03	04.6	41.90 N.	112.55 W.	8	...	...	2.8U	...	U	DEC. 28	09 P.M. MST
DEC. 29	11	39	21.3	41.89 N.	112.54 W.	0	...	...	3.1U	...	U	DEC. 29	04 A.M. MST
VIRGINIA													
FEB. 11	13	44	16.4	37.72 N.	78.44 W.	6	...	...	3.4V	IV	V	FEB. 11	08 A.M. EST
FEB. 11	13	50	31.4	37.75 N.	78.41 W.	10	...	...	3.2V	IV	V	FEB. 11	08 A.M. EST
FEB. 11	13	51	38.6	37.72 N.	78.45 W.	7	...	...	2.9V	III	V	FEB. 11	08 A.M. EST
JULY 30	11	59	48.5	38.19 N.	78.09 W.	6	...	...	1.4V	III	V	JULY 30	06 A.M. EST
NOV. 23	13	14	51.0	38.24 N.	79.09 W.	10	...	...	2.1V	IV	V	NOV. 23	08 A.M. EST
DEC. 4	02	35	56.2	36.98 N.	80.78 W.	8	...	...	2.1V	FELT	V	DEC. 3	09 P.M. EST
WASHINGTON													
JAN. 13	01	21	41.1	48.63 N.	123.12 W.	14	...	...	3.0G	V	W	JAN. 12	05 P.M. PST
JAN. 23	16	46	47.4	47.61 N.	122.43 W.	22	...	...	2.9G	III	W	JAN. 23	08 A.M. PST
JAN. 28	21	35	41.5	47.56 N.	121.78 W.	13	...	...	2.7W	FELT	W	JAN. 28	01 P.M. PST
FEB. 2	01	23	18.6	46.26 N.	121.00 W.	4	3.9	...	4.0G	IV	W	FEB. 1	05 P.M. PST
FEB. 14	06	09	27.3	46.35 N.	122.24 W.	7	5.1	4.8	5.5G	VI	W	FEB. 13	10 P.M. PST
FEB. 14	06	13	11.3	46.33 N.	122.24 W.	10	...	...	3.8W	...	W	FEB. 13	10 P.M. PST
FEB. 14	06	50	58.9	46.35 N.	122.25 W.	11	...	...	3.0G	FELT	W	FEB. 13	10 P.M. PST
FEB. 14	06	53	18.1	46.33 N.	122.24 W.	13	...	...	2.9G	FELT	W	FEB. 13	10 P.M. PST
FEB. 14	07	07	26.6	46.33 N.	122.24 W.	11	...	...	2.9W	...	W	FEB. 13	11 P.M. PST
FEB. 14	08	43	45.9	46.36 N.	122.25 W.	11	4.6	...	3.4G	FELT	W	FEB. 14	00 A.M. PST
FEB. 14	09	05	51.6	46.36 N.	122.24 W.	9	...	...	2.8W	FELT	W	FEB. 14	01 A.M. PST
FEB. 14	09	53	10.6	46.34 N.	122.24 W.	8	...	...	3.0W	...	W	FEB. 14	01 A.M. PST
FEB. 14	15	00	11.3	46.35 N.	122.25 W.	10	...	...	3.0W	FELT	W	FEB. 14	07 A.M. PST
FEB. 14	21	27	43.9	46.34 N.	122.24 W.	7	...	...	3.6G	V	W	FEB. 14	01 P.M. PST
FEB. 15	22	45	47.8	46.33 N.	122.24 W.	9	...	...	2.9W	...	W	FEB. 15	02 P.M. PST
FEB. 16	10	26	15.0	46.33 N.	122.24 W.	9	...	...	3.1W	...	W	FEB. 16	02 A.M. PST
FEB. 18	06	09	38.7	47.21 N.	120.90 W.	0	...	...	4.2G	VI	W	FEB. 17	10 P.M. PST
MAR. 2	11	34	24.8	47.21 N.	120.91 W.	0	...	...	2.8W	...	W	MAR. 2	03 A.M. PST
MAR. 6	14	19	05.8	47.26 N.	120.84 W.	5	...	...	2.9G	III	G	MAR. 6	06 A.M. PST
MAR. 15	07	24	06.2	47.99 N.	121.50 W.	5	...	...	3.4G	FELT	W	MAR. 14	11 P.M. PST
MAY 1	10	06	23.1	46.37 N.	122.25 W.	11	...	...	2.9G	IV	W	MAY 1	02 A.M. PST
MAY 13	05	00	36.3	46.37 N.	122.26 W.	10	4.1	...	4.1G	V	W	MAY 12	09 P.M. PST
MAY 13	05	04	30.4	46.37 N.	122.26 W.	10	...	...	3.0W	...	W	MAY 12	09 P.M. PST
MAY 27	10	02	44.1	46.37 N.	122.26 W.	11	...	...	2.7G	FELT	W	MAY 27	02 A.M. PST
MAY 28	08	56	02.8	46.53 N.	121.42 W.	3	4.3	...	3.7G	IV	W	MAY 28	00 A.M. PST
MAY 28	09	10	46.1	46.53 N.	121.41 W.	3	4.8	4.3	4.3G	IV	W	MAY 28	01 A.M. PST
MAY 29	17	20	16.5	46.52 N.	121.40 W.	0	...	...	2.9W	...	W	MAY 29	09 A.M. PST
JUNE 14	13	12	57.8	45.95 N.	120.49 W.	14	...	...	3.1G	...	W	JUNE 14	05 A.M. PST
JUNE 23	00	05	28.2	48.87 N.	122.13 W.	13	...	...	3.1G	FELT	W	JUNE 22	04 P.M. PST
JUNE 23	00	06	27.7	48.83 N.	122.15 W.	9	...	...	2.3W	FELT	W	JUNE 22	04 P.M. PST
JULY 4	20	26	31.0	47.83 N.	122.75 W.	51	...	...	2.8W	...	W	JULY 4	12 P.M. PST
JULY 11	01	09	12.5	46.37 N.	122.25 W.	9	...	...	3.1W	...	W	JULY 10	05 P.M. PST
JULY 22	06	05	50.6	47.78 N.	120.27 W.	4	...	...	3.0W	III	W	JULY 21	10 P.M. PST
AUG. 6	12	32	28.7	46.49 N.	121.35 W.	0	...	...	2.8W	...	W	AUG. 6	04 A.M. PST
AUG. 21	20	13	13.3	47.58 N.	123.65 W.	42	...	...	2.8W	...	W	AUG. 21	12 P.M. PST
AUG. 23	16	22	17.4	46.36 N.	122.25 W.	8	...	...	3.4W	FELT	W	AUG. 22	08 A.M. PST
SEPT. 6	19	34	46.0	46.67 N.	123.87 W.	35	...	...	3.1G	IV	W	SEPT. 6	11 A.M. PST
OCT. 25	03	21	03.6	47.76 N.	120.17 W.	0	...	...	2.4G	FELT	W	OCT. 24	07 P.M. PST
NOV. 8	07	54	01.1	45.60 N.	122.49 W.	7	...	...	2.4W	FELT	W	NOV. 7	11 P.M. PST
NOV. 12	18	10	25.0	47.94 N.	122.42 W.	26	...	...	3.9G	IV	W	NOV. 12	10 A.M. PST
NOV. 26	12	30	00.7	47.65 N.	122.62 W.	22	...	...	3.1G	IV	W	NOV. 26	04 A.M. PST

Table 1.--*Summary of U. S. earthquakes for 1981*--Continued

Date (1981)	Origin time (UTC) hr	min	sec	Lat (°)	Long (°)	Depth (km)	Magnitude mb	MS	ML Mn or MD	Maximum intensity	Hypocenter source	Local time Date	Hour
						WYOMING							
MAR. 6	13	44	42.4	44.39 N.	110.57 W.	1	...	...	1.5G	III	G	MAR. 6	06 A.M. MST
MAR. 12	14	12	02.2	44.27 N.	110.76 W.	1	...	...	3.8G	IV	G	MAR. 12	07 A.M. MST
MAR. 12	14	19	38.2	44.29 N.	110.76 W.	2	...	...	3.1G	II	G	MAR. 12	07 A.M. MST
MAR. 12	14	22	44.6	44.30 N.	110.76 W.	4	...	...	2.5G	III	G	MAR. 12	07 A.M. MST
MAR. 12	14	23	55.2	44.29 N.	110.75 W.	5	...	...	2.5G	...	G	MAR. 12	07 A.M. MST
MAR. 12	14	29	32.1	44.29 N.	110.75 W.	4	...	...	2.6G	III	G	MAR. 12	07 A.M. MST
MAR. 12	14	41	12.6	44.27 N.	110.75 W.	0	...	...	2.6G	...	G	MAR. 12	07 A.M. MST
MAR. 12	14	48	13.7	44.28 N.	110.76 W.	2	...	...	3.0G	III	G	MAR. 12	07 A.M. MST
MAR. 12	15	00	22.4	44.26 N.	110.75 W.	1	...	...	2.6G	III	G	MAR. 12	08 A.M. MST
MAR. 12	15	12	02.2	44.29 N.	110.75 W.	1	...	...	2.5G	II	G	MAR. 12	08 A.M. MST
MAR. 12	15	55	41.9	44.28 N.	110.76 W.	1	...	...	3.4G	III	G	MAR. 12	08 A.M. MST
MAR. 12	17	09	09.0	44.29 N.	110.75 W.	1	...	...	3.1G	III	G	MAR. 12	10 A.M. MST
MAY 6	19	26	03.1	43.43 N.	110.66 W.	7	...	...	3.7G	IV	U	MAY 6	12 P.M. MST
MAY 12	10	18	13.1	43.72 N.	110.39 W.	7	...	...	3.0G	...	U	MAY 12	03 A.M. MST
MAY 22	07	56	41.0	44.83 N.	111.00 W.	7	...	...	4.2G	IV	C	MAY 22	00 A.M. MST
OCT. 8	16	49	32.2	44.23 N.	110.79 W.	1	...	...	3.0G	III	G	OCT. 8	09 A.M. MST
OCT. 18	10	10	40.2	44.78 N.	110.71 W.	1	...	...	2.1G	IV	G	OCT. 18	03 A.M. MST
NOV. 15	02	36	21.6	44.97 N.	110.99 W.		...	...	3.0G	III	G	NOV. 14	07 P.M. MST
DEC. 15	14	17	59.1	42.89 N.	110.97 W.	7	...	...	2.4U	FELT	U	DEC. 15	07 A.M. MST
DEC. 15	15	36	20.8	42.89 N.	110.92 W.	7	...	...	2.4U	FELT	U	DEC. 15	08 A.M. MST

Network Operations

SHUMAGIN SEISMIC GAP, EASTERN ALEUTIANS, ALASKA EARTHQUAKES, 1981

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Since 1973, Lamont-Doherty Geological Observatory has operated a short-period, high-gain seismic network in the Shumagin Islands region in the eastern Aleutians. The purpose of operating the network is to collect data that can be applied for basic seismotectonic studies as well as for evaluating and forecasting of seismic and volcanic hazards.

In figure 24, all the earthquakes located by the Shumagin network from 1973 to 1981 are plotted. Data from seismic stations shown in figure 25 were used to calculate both hypocenter and local magnitude values. This seismicity is associated with the subduction of the Pacific Plate underneath the North American Plate which takes place at an average convergence rate of 7.7 cm/yr (Minster and Jordan, 1978). The largest clusters of shallow seismicity (depth less than 40 km) are located on the shelf between the inner wall of the trench and the Alaska Peninsula. These clusters cut across both the Shumagin Islands and the Sanak Basin forming an approximate east-west trend.

A depth cross section where the earthquake locations are projected on a plane striking north northwest across the Shumagin Islands is shown in figure 24b. At shallow depths, there is a seismic quiescence along the main thrust zone (the locked portion of the plate boundary) and high level of activity at the lower edge of the main thrust zone. There is also a higher rate of seismicity within the upper plate along the shelf indicating the possible existence of imbricate thrust faults. The seismicity deeper than 40 km defines a Benioff zone, which is the subducted part of the Pacific Plate. The level of activity in the upper plane of the Benioff zone is higher than in the lower plane.

During 1981 the Shumagin network located 438 earthquakes (figure 25). Four of these earthquakes were felt at Sand Point or Cold Bay, which are the two towns located within the Shumagin network:

March 15, 1981--07h-48m: located 22 km southwest of the station NGI at 43 km depth. The event had a PDE magnitude of 4.8 (mb) and was felt at Sand Point.

June 25, 1981--07h 36m: located 10 km north of the station CNB at 30 km depth. The event had a PMR magnitude of 5.2 (ML) and was felt at Cold Bay.

November 14, 1981--00h 43m: located 150 km south-southwest of station FPS at 80 km depth. The event had a local magnitude of 5.0 (Ml) and was felt at Cold Bay.

December 28, 1981--10h 28m: located 48 km south of station NGI at 30 km depth. The event had a local magnitude of 3.7 (ML) and was felt as sudden shaking of short duration at Sand Point.

The Shumagin Network (fig. 25) consists of 12 remote stations plus 4 stations in the Pavlof Volcano subarray, four repeater stations stations and the local station at Sand Point (SAN). Each remote station has a single, short-period vertical seismometer except San Diego Bay (SGB), Chernabura (CNB), Pavlof Volcano (PVV) and Black Hills (BLH) which are three-component stations. The analog signals from the high gain remote stations have a dynamic range of approximately 42 to 60 db, and are transmitted via radio links to a central recording site at Sand Point. Within the region of the Shumagin Network there are now 12 strong-motion accelerographs (Kinemetrics SMA-1, 1g), 10 of which are co-located with remote stations of the network. Further, these ten SMA's are connected to the telemetry system so that a 400 Hz trigger signal is sent to the central recording site that (in addition to an internal time code recorded on the accelerogram) allows us to know the exact time at which the SMA began recording a given earthquake.

In early 1981 a digital data acquisition system replaced the aging develocorder as the main recording device at Sand Point (SAN in fig. 25). The high-gain, short-period seismic signals are digitized at a rate of 100 samples per second and up to 32 channels can be recorded by the nine-track digital (12 bit) tape recorder. An on-line digital event detector monitors 12 channels and if an event is declared, the detector starts the tape recorder. The digital tape recorder records the event with 20 second pre-event and 60 second post-event memory. A time code (GMT-date and time) from a satellite receiver is injected into the multiplexed data stream at one second intervals. In addition to

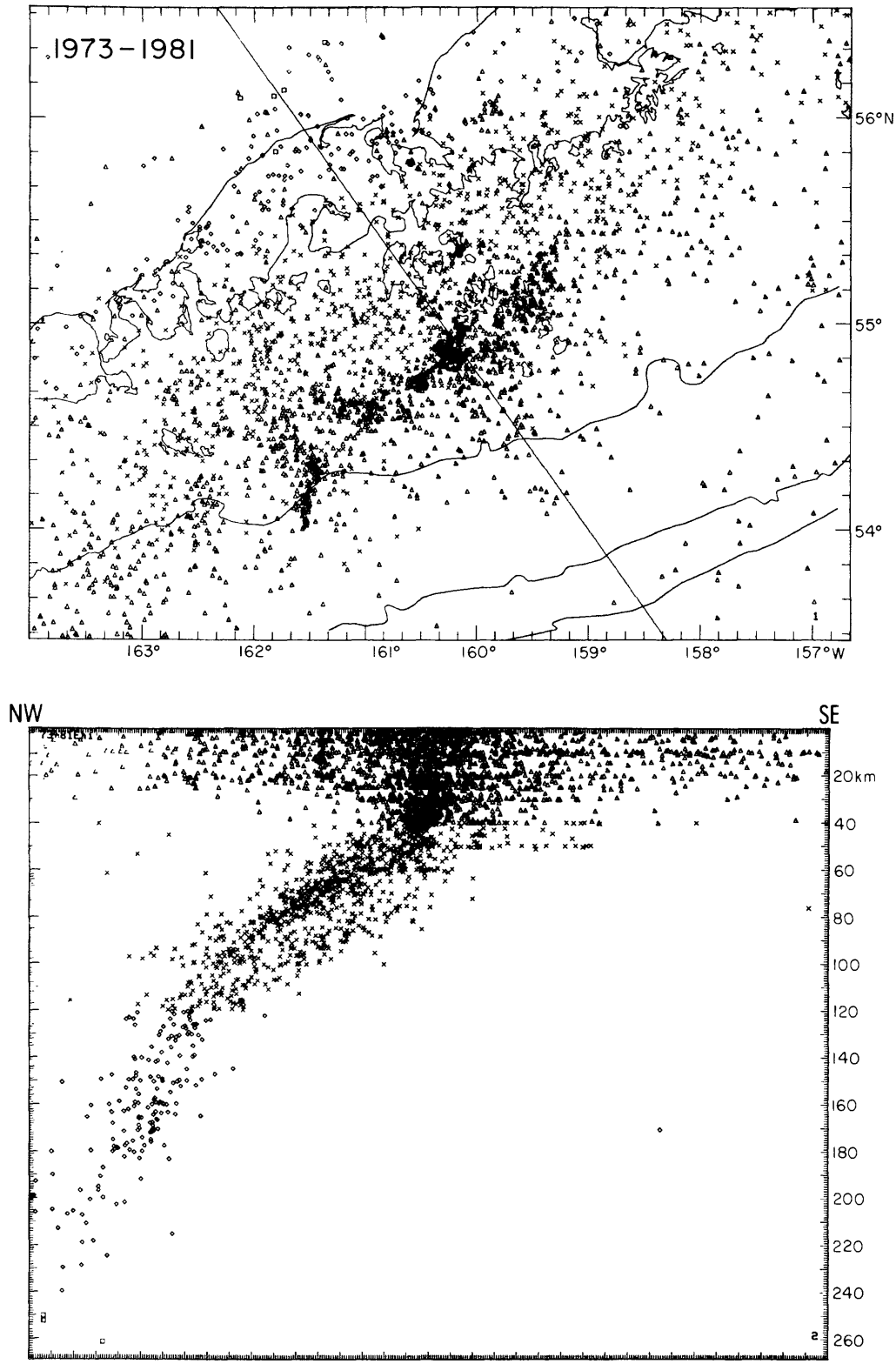

FIGURE 24.--All the earthquakes located by the Shumagin network from 1973 to 1981; (a) above, an epicentral map that shows dense clusters of seismicity between the shelf and the inner wall of the trench; (b) below, a cross section striking north-northwest. The different symbols indicate different depth ranges.

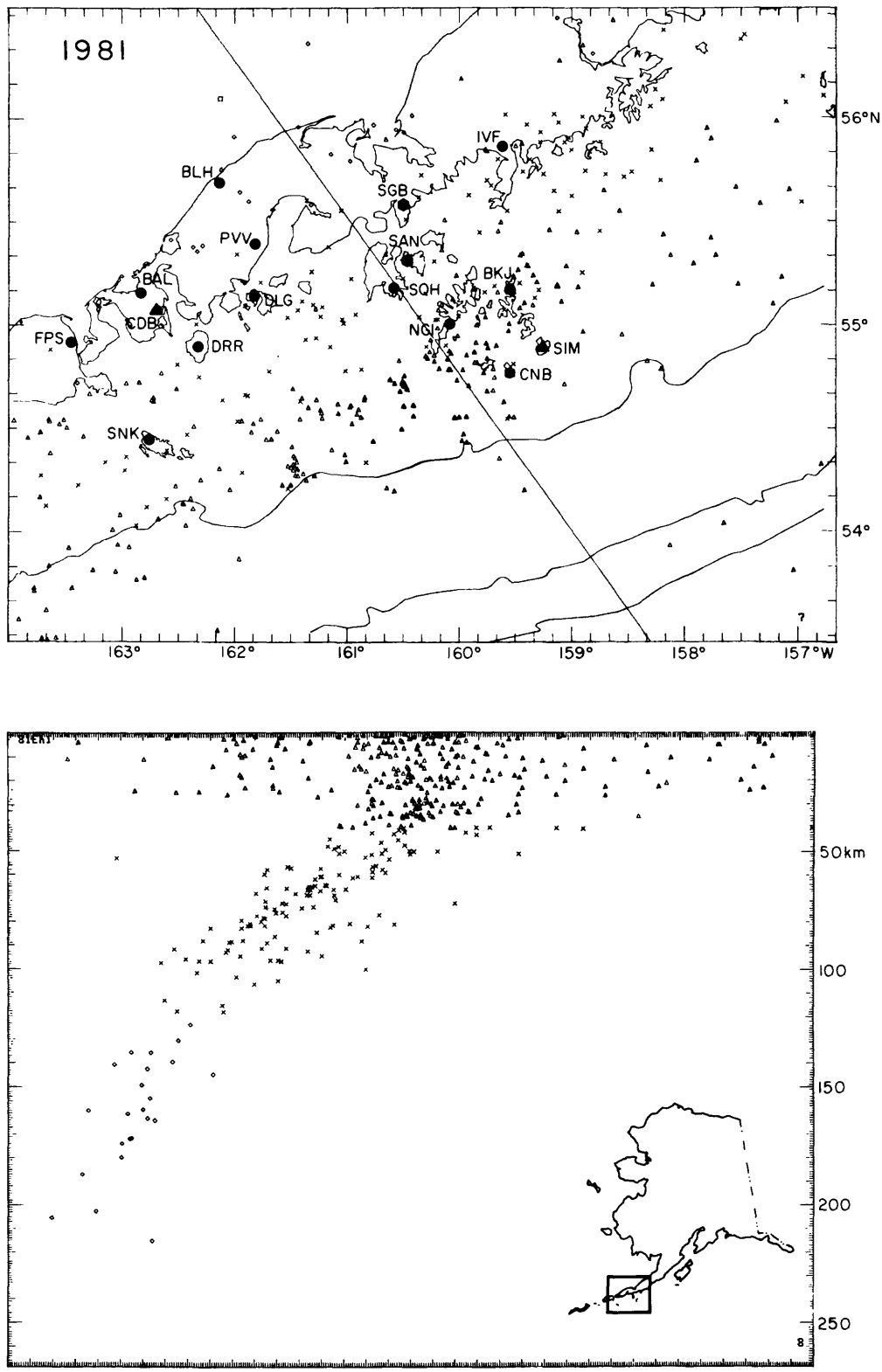

FIGURE 25.--Seismicity located by the Shumagin Network during 1981. Note the generally scattered activity and lack of clustering. The seismic stations (solid circles) in the Shumagin Network are shown in the map.

the seismic signals, the 400 Hz tones from the SMA trigger units are detected on-line and their onset time is recorded by the printer linked to the system. The digital event detector can be accessed from L-DGO via modems (from the L-DGO seismology computer in New York) and the adjustable (STA)/(LTA) ratios can be reset. Moreover, stations can be remotely deleted or added to the event detector. Eight helicorders that record continuously are operated at Sand Point to ensure that the event-triggered recording system operates correctly.

NORTHERN AND CENTRAL CALIFORNIA EARTHQUAKES, 1981

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The Seismographic Stations operated a network of 19 stations during 1981. One instrumental addition (DWWSSN) located at Jamestown (JAS) is of particular interest. This on-site digital recording system (DRS) was installed at Jamestown in September 1980 and telemetered to Berkeley during 1981. The DRS continuously records a three-component long-period channel at one sample per second for each component and records, in an event-detect mode, a three-component, intermediate-period channel at 10 samples per second for each component, and a vertical short-period channel at 20 samples per second. The DRS records the filtered output of Teledyne 210 and 200 seismometers operating with 16-bit resolution on 1600 bpi magnetic tape.

During 1981, about 4800 occurrences of seismic events were catalogued on summary sheets and 970 teleseisms and 440 local earthquakes were analyzed. The Bulletin of Seismographic Stations, Volume 51, Nos. 1 and 2 (Kin-Yip Chun and others, 1982), contains location and magnitude information for 154 earthquakes ($3.0 \leq ML \leq 4.8$) located in northern and central California and adjoining regions and for 24 earthquakes ($3.5 \leq ML \leq 5.9$) located in the Mammoth Lakes area during 1981. The largest recorded earthquake in northern-central California was the ML = 5.9 located at Mammoth Lakes.

As part of our seismicity monitoring program (related to earthquake prediction), the cumulative number of earthquakes versus local Richter magnitude (ML) was computed. The data base consists of 895 earthquakes ($3.0 \leq ML \leq 5.9$) listed in The Bulletin of the Seismographic Stations, in a 280,000 km² region in northern and central California during the decade of 1 January 1967 to 31 December 1976. The region is bounded on the north and east by the California

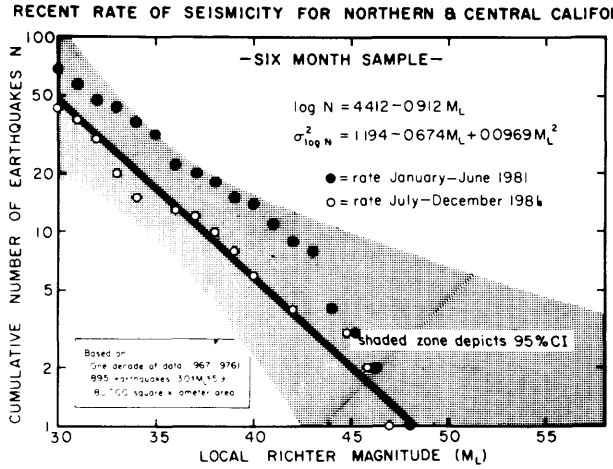

FIGURE 26.--Seismicity rate in 1981 for northern and central California.

border, on the southeast by a general line between 38° N.-119° W. and 35° N.-121° W., on the southwest by a line connecting 35° N.-121° W. and 39° N.-125° W., and on the west by 125° W. longitude. The earthquakes were grouped into 20 consecutive 6-month intervals for analysis and the average cumulative number of earthquakes N (total number with magnitude $\geq$ ML) in a 6-month interval is given by:

$$\log N = 4.412 - 0.912\ ML$$

valid for $3.0 \leq ML \leq 5.9$.

The shaded zone (see fig. 26) depicts the 95 percent confidence interval for log N. Hence the approximate interoccurrence for earthquakes of magnitude ML or greater in the 280,000 km² area is:

ML	Interoccurrence
3.0	4 days
3.5	11 days
4.0	1 month
4.5	3 months
5.0	8 months
5.5	2 years
6.0	5 years

The solid circles give the cumulative number of earthquakes (68 earthquakes $3.0 \leq ML \leq 4.8$) in the first six months of 1981. The open circles give the cumulative number of earthquakes (43 earthquakes, $3.0 \leq ML \leq 4.7$) in the last six months of 1981. Thus the rate of seismicity for the first and last half of 1981 is not significantly different from the average semi-annual rate of seismicity over the past decade.

Only one significant earthquake sequence, near Mammoth Lakes, occurred in the region during 1981. In this sequence (an aftershock

sequence of the main shocks occurring in May 1980), 24 earthquakes ($3.5 \leq ML \leq 5.9$) occurred and were analyzed. The largest earthquake (ML = 5.9) was felt throughout Eastern California and Western Nevada and caused rockslides in Convict Canyon area, power outage in Bishop, and minor damage in the Mammoth Lakes area. The most significant earthquake (ML = 4.8) occurring in the coastal area of central California was located northeast of San Jose and was felt throughout the San Francisco-San Jose bay area with only minor damage reported.

SOUTHERN CALIFORNIA EARTHQUAKES, 1981

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Over 15,000 earthquakes were located during 1981, using the CEDAR on-line computer system and associated off-line processing system. The largest 5708 of these are shown in the seismicity map in figure 27.

Two sequences were of special interest: 1) the "Westmorland" swarm which took place in April 1981 in the Imperial Valley, and 2) the Catalina escarpment earthquake of October 4, 1981 and its aftershocks.

There were 155 events of ML 2.5 and greater in the Westmorland sequence, which developed in a swarm-like manner from a small cluster to cover an area 25 km long in a matter of two weeks. The stereo plot in figure 28 shows that the sequence was spatially very complex, with at least 5 distinct fault planes involved. Twenty-five shocks were large enough for reliable fault plane solutions; all were primarily strike-slip. The largest shock (ML 5.7) did considerable damage in the town of Westmorland.

The September 4, 1981 offshore shock was widely felt in southern California on the day of the Los Angeles bicentennial. The largest shock had a local magnitude of ML 5.3, and there were 71 aftershocks of ML 2.4 and greater aligned with the Catalina escarpment. Two of the aftershocks on October 23, 1981 had magnitudes of ML 4.6 and were also widely felt.

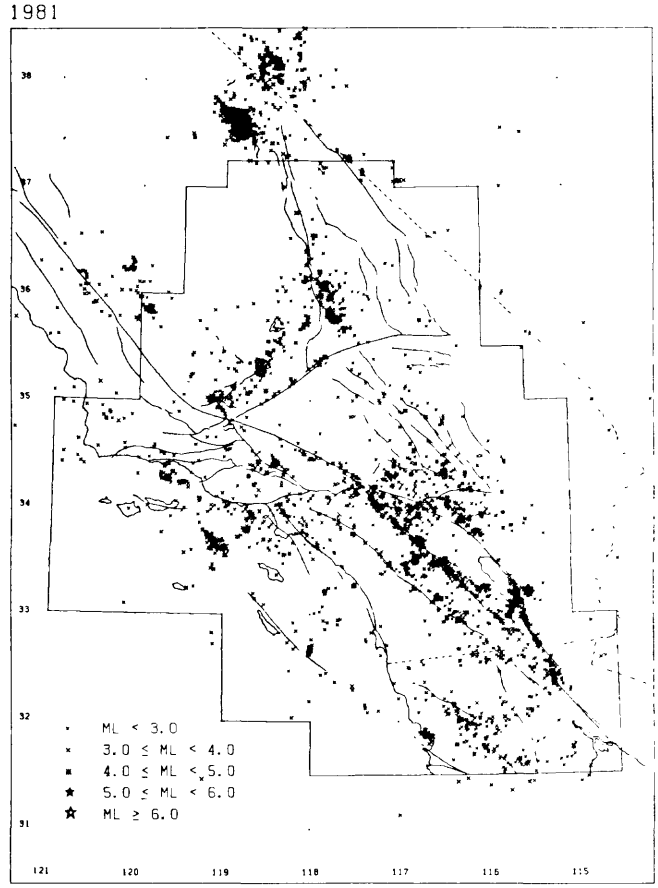

FIGURE 27.--The largest 5708 earthquakes located by the Southern California network in 1981.

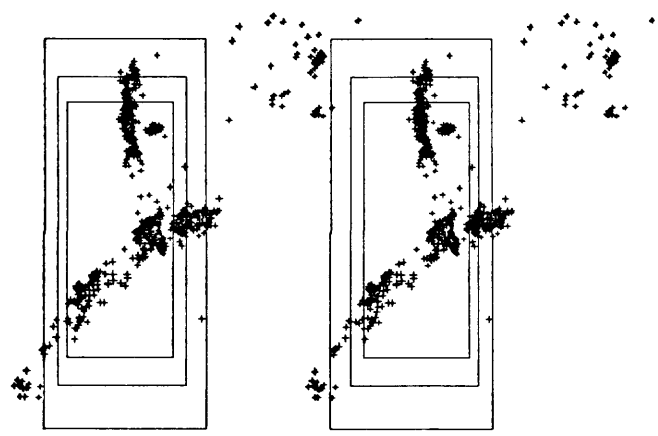

FIGURE 28.--Stereo plot of master-event locations for the Westmorland sequence. The boxes are 0.2° wide in the north-south direction and 0.1° in the east-west, and at depths of 0, 5, and 10 km.

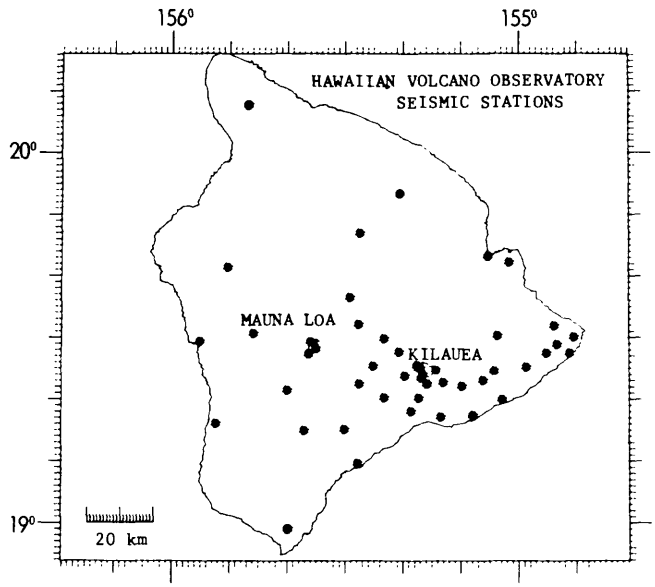

FIGURE 29.--Seismometer network on the island of Hawaii.

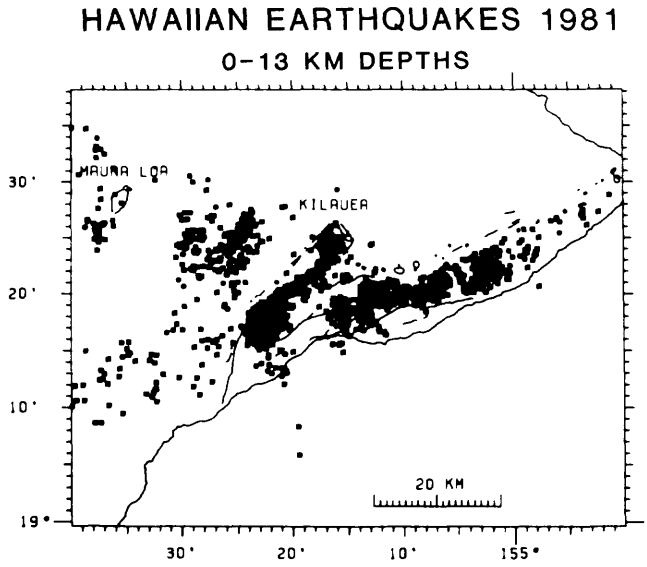

FIGURE 30.--Earthquakes located near Kilauea Volcano with depths from 0-13 km during 1981.

HAWAII EARTHQUAKES, 1981

By Fred W. Klein
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The emphasis during 1981 by the Hawaiian Volcano Observatory (HVO) in both station coverage and detailed data analysis was on the highly active south side of the island of Hawaii. Hundreds of earthquakes too small to locate were counted daily, and the set of located earthquakes in the Kilauea region is nearly complete above magnitude about 2.0. Many smaller events were also located. Substantial effort was made to locate earthquakes elsewhere on the island and within about 150 km of the island. Such coverage cannot be as complete as on Kilauea Volcano, but all events above magnitude 3.5 were located. Over 4023 earthquakes were located by HVO during 1981.

HVO maintains an extensive telemetering seismometer network on the island of Hawaii (fig. 29). In December 1981 the seismometer network consisted of 48 stations spread over an area with a diameter of 125 km on the island of Hawaii. Of these 48 stations, 2 were low-gain multi-component stations (optical), 8 are three-component, and 38 are vertical only. All seismometer signals from the short-period network are telemetered to the observatory for recording on analog magnetic tape. The earthquakes to be located are digitized from analog tape on an Eclipse computer in a semi-automatic procedure. Seismograms are timed and events located and plotted interactively on computer, resulting in final earthquake locations within two days after the events occur.

In addition, optical seismographs are maintained at Uwekahuna (HVO), Hilo, Hawaii, and on Oahu. These less-sensitive records are used primarily for amplitude measurements to supplement readings from the high-gain stations. Long-period Press-Ewing seismographs record in three components in the Uwekahuna vault. The paper (optical) records, the 16 mm develocorder microfilm, and the digital seismograms are archived at HVO.

Kilauea Volcano and its adjacent flanks (fig. 30) accounted for most of the earthquakes located during 1981. The major seismic events during 1981 were intrusions of magma from Kilauea's summit caldera (above center, fig. 30) into its Southwest rift zone. The intrusions did not culminate in eruptions and magma did not reach the surface. Magma instead broke underground along the rift zone and emplaced a new dike there. A slowly propagating intrusion began on January 25, and took about one month to reach 18 km downrift. A larger and more rapid intrusion into the southwest rift occurred during August 10-12, and required about 18 hours to penetrate 18 km laterally. Two smaller intrusions occurred on January 20 and January 25, but were confined to Kilauea caldera. These intrusions caused hundreds of small earthquakes generally between 2 and 4 km depth (diagonal band of earthquakes in the center of fig. 30).

In addition to "volcanic" swarm earthquakes associated with intrusions, Kilauea produces a generally steady occurrence of "tectonic" earthquakes on its flanks. Two principal seismic zones of tectonic earthquakes are visible in figure 30 : south of Kilauea's east rift zone, and the Kaoiki fault zone between Kilauea and

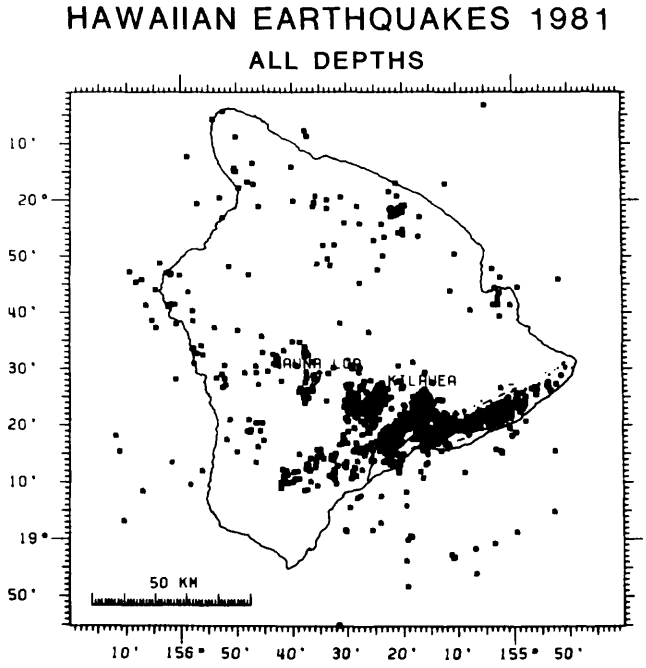

FIGURE 31.--Earthquakes located on and near the island of Hawaii during 1981.

Mauna Loa. These flank earthquakes generally are between 6 and 10 km depth, and several magnitude 4.0 or larger events occur there each year.

A few crustal earthquakes (0-13 km depth) occurred adjacent to Mauna Loa's summit caldera (fig. 30). Like similar earthquakes at Kilauea, these Mauna Loa events result from the slow but steady inflation of the summit magma reservoir between eruptions.

Sparse earthquakes were widely scattered around Hawaii Island during 1981 (fig. 31). These earthquakes extend from the surface to 55 km depth, and generally are beneath the island or not far offshore. The principal offshore seismic area is south of the island, including the active submarine volcano Loihi, located about 40 km due south of Kilauea. An important cause of the seismicity around Hawaii Island is the deformation of the upper lithosphere under the weight of the volcanic pile produced by the growth of the island.

KANSAS AND NEBRASKA EARTHQUAKES, 1981

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Network operations in Kansas continued with 10 stations in 1981. Event parameters are listed in table 2. Station locations are shown in Steeples (1981) in United States Earthquakes, 1979.

Figure 32 shows plus signs plotted for events located by the Kansas network during 1981. A notable trend of epicenters has developed in a northeastward direction across Nebraska. This trend would not be expected on the basis of either historical earthquakes or dominant geologic structure. Known faults copied from various sources in the literature are plotted as line segments in figure 32.

There is no indication that any of these earthquakes were felt, although the absence of felt reports does not mean none of them were felt.

CENTRAL MISSISSIPPI VALLEY EARTHQUAKES, 1981

By W. Stauder, R. Herrmann, S. Singh, R. Perry, R. Dwyer, M. Meremonte, V. Masih, L. Himes, E. Haug, S. Morrissey, L. Hausmann, and M. Whittington
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During 1981, 275 earthquakes were located and 247 other nonlocatable earthquakes were detected by a thirty-three station regional telemetered microearthquake network operated by Saint Louis University under contract for the U.S. Geological Survey and Nuclear Regulatory Commission. Figure 33 shows 271 earthquakes located within a 4° x 5° region centered on 36.5° N. and 89.5° W. Seismograph stations are denoted by the triangles together with the station code. The magnitudes are indicated by the size of the open symbols. Figure 34 shows the locations and magnitudes of the 247 earthquakes located within a 1.5° x 1.5° region centered at 36.25° N. and 89.75° W. Figures 35 and 36 are similar to figures 33 and 34, but the epicenter symbols are scaled according to focal depth.

Beginning this year, the network was used to locate 102 teleseismic events by assuming a plane wave across the network and using the travel time curves to determine the back azimuth and dtd-delta. Therefore, by assuming a focal depth of 15 km and using spherical geometry, epicentral coordinates can be determined given delta and back azimuth. Arrival time information for the teleseismic P phases will be published in the earthquake bulletin for the first quarter of the following year.

Table 2.--*Kansas earthquakes, 1981*

DATE	ORIGIN		LAT N	LONG W	DEPTH	MAG	NO	GAP	DMIN	RMS	ERH	ERZ	Q
810217	553	2.87	39-22.74	98-44.20	8.67	1.8	9	325	89.3	0.43	5.8	8.3	D
810313	1242	16.68	40-53.44	99-41.67	5.00	2.4	10	214	228 1	1.20	20.3	24.4	D
810320	5 9	48.17	40-10.31	100-19.60	1.75	1.9	5	177	4.5	0.09	0.2	1.5	C
810420	1818	13.48	41- 2.14	97-49.68	5.00	2.4	9	175	118.2	0.37	3.6	4.5	D
810530	9 7	10.35	39-21.66	94-51.61	0.46	1.9	17	230	73.4	0.43	2.5	1.0	D
810620	516	51.44	38-42.73	98-22.76	11.89	1.8	13	186	72.6	0.68	3.9	4.1	D
810626	1855	2.20	41-31.02	97-37.95	4.21	2.7	15	255	74.3	0.60	3.8	6.4	D
810708	641	15.11	39- 4.83	96- 2.03	5.00	1.7	5	169	24.8	0.07	1.3	9.8	D
810717	1241	57.77	41-34.06	97-18.80	5.00	1.9	5	197	125.5	0.31	3.0	6.1	D
810801	158	44.50	38-20.55	97-55.84	10.00	2.7	14	158	73.5	0.54	3.1	3.8	D
811009	2154	25.58	41-15.83	98-41.88	5.00	2.5	21	205	142.2	0.60	4.6	5.3	D
811127	1 8	26.13	37- 2.85	98-50.92	5.00	2.0	14	127	47.0	0.78	4.7	7.2	D
811208	620	42.00	40-26.84	99-44.61	5.00	2.2	11	230	62.6	0.74	7.0	6.5	D
811217	544	54.21	36-23.80	97-35.67	10.64	2.4	15	236	136.6	0.39	2.9	2.1	D

(Explanation of Table 2)

The microearthquakes are listed in chronological order under the following headings:

DATE: year, month, day

ORIGIN: hour, minute, seconds, hundredths of seconds

LAT N: degrees, minutes, hundredths of minutes north

LONG W: degrees, minutes, hundredths of minutes west

DEPTH: calculated in kilometers or fixed at 5.00 km

MAG: duration magnitude calculated according to equation derived at Oklahoma Geological Observatory

NO: number of P- and S-arrivals used in hypocenter solution

GAP: largest azimuthal separation between stations measured from the epicenter

DMIN: epicentral distance in kilometers to nearest station

RMS: root-mean-square error of the time residuals

[RMS = $(\Sigma_i R_i^2/NO^{\frac{1}{2}})$ where R_i is the observed seismic-wave travel time less the computed time at the i^{th} station

ERH: standard error of the epicenter in kilometers

[ERH = $(SDX^2 \& SDY^2)^{\frac{1}{2}}$] where SDX and SDY are the standard errors in latitude and longitude, respectively, of the epicenter

ERZ: standard error of depth in kilometers (asterisks are used if greater than 999 km). This is not a good estimate of depth uncertainty in a sparse network.

Q: quality of the event. In a dense network, values are A, B, C, D. Only C and D quality solution are obtained because of the sparseness of the network. Q is based upon GAP, ERH, ERZ, DMIN, RMS, and NO.

The significant earthquakes during 1981 include the following:

1. January 02, 1981, 1431 UTC, 36.28° N., 89.51° W.: felt in Madie, Gratio, and Ridgely, TN area as reported by Tennessee Earthquake Information Center (TEIC). mb3Hz = 2.6 (FVM).

2. February 11, 1981, 1442 UTC, 37.05° N., 89.13° W.; felt in Cairo and Unity, IL and in Barton and Wickliffe, KY. Cairo police reported strong shaking. mb3HZ = 3.0 (FVM).

3. April 08, 1981, 0153 UTC, 38.87° N., 89.38° W.: felt in Greenville, IL area as reported by Greenville Police Department. mb3Hz = 3.56 (FVM).

4. May 25, 1981, 2250 UTC, 36.76° N., 91.63° W.: felt in Braidsville, MO and neighboring region as reported by TEIC. mb3Hz =3.38 (FVM).

5. June 09, 1981, 1415 UTC, 37.82° N., 89.02° W.: felt in Herrin and Carbondale, IL as reported by the National Earthquake Information Service. mb3Hz = 3.13 (FVM).

6. June 26, 1981, 0833 UTC, 35.85° N., 90.08° W.; felt in Roseland, Dearmann, and Dell, AR area as reported by TEIC. mb3Hz = 3.36 (FVM).

7. August 07, 1981, 1153 UTC, 36.03° N., 89.18° W.: felt in Brazil and Frog Jump, TN region as reported by TEIC. mb3Hz = 4.1 (FVM).

SOUTHERN MISSISSIPPI VALLEY AND THE SOUTHERN APPALACHIAN EARTHQUAKES, 1981

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Memphis State University
Memphis, Tennessee

The Tennessee Earthquake Information Center (TEIC) operates two seismic networks: the Southern Appalachian Regional Seismic Network (SARSN) and the Memphis Area Regional Seismic Network (MARSN). SARSN is planned to be a 16 station network; at the end of 1981 it consisted of seven stations located in the States of Tennessee, North Carolina, and Georgia (fig. 37). MARSN consists of ten stations located in the states of Tennessee, Arkansas, Alabama, and Mississippi (fig. 38).

MARSN is designed to monitor seismic activity in the southern portion of the New Madrid seismic zone and the lower Mississippi embayment. Instrumentation consists of four Geotech S-13 seismometers (OLY, PWLA, EBZ, STAR) and three Kinemetrics Ranger seismometers (WLA, LGAR, PGM); all are vertical short period (1.0 sec.) seismometers. SFTN is a three-component Mark Products L-15, 8 Hz borehole seismometer located at the 486 foot level of an abandoned water test well. MPH, located at TEIC, is a three-component Sprengnether long period seismograph. CRI-S is a test site to compare surface-vs-downhole recordings; at the end of 1981, it was only partially installed (surface component) with a Geotech HS-10 seismometer. SARSN network stations all have Geotech S-13 vertical short period seismometers. Data for both networks are telemetered via radio to central receiving sites, then brought to TEIC over leased telephoned lines. All short period data are recorded in analog form on 16mm develocorder film or pen and ink paper records.

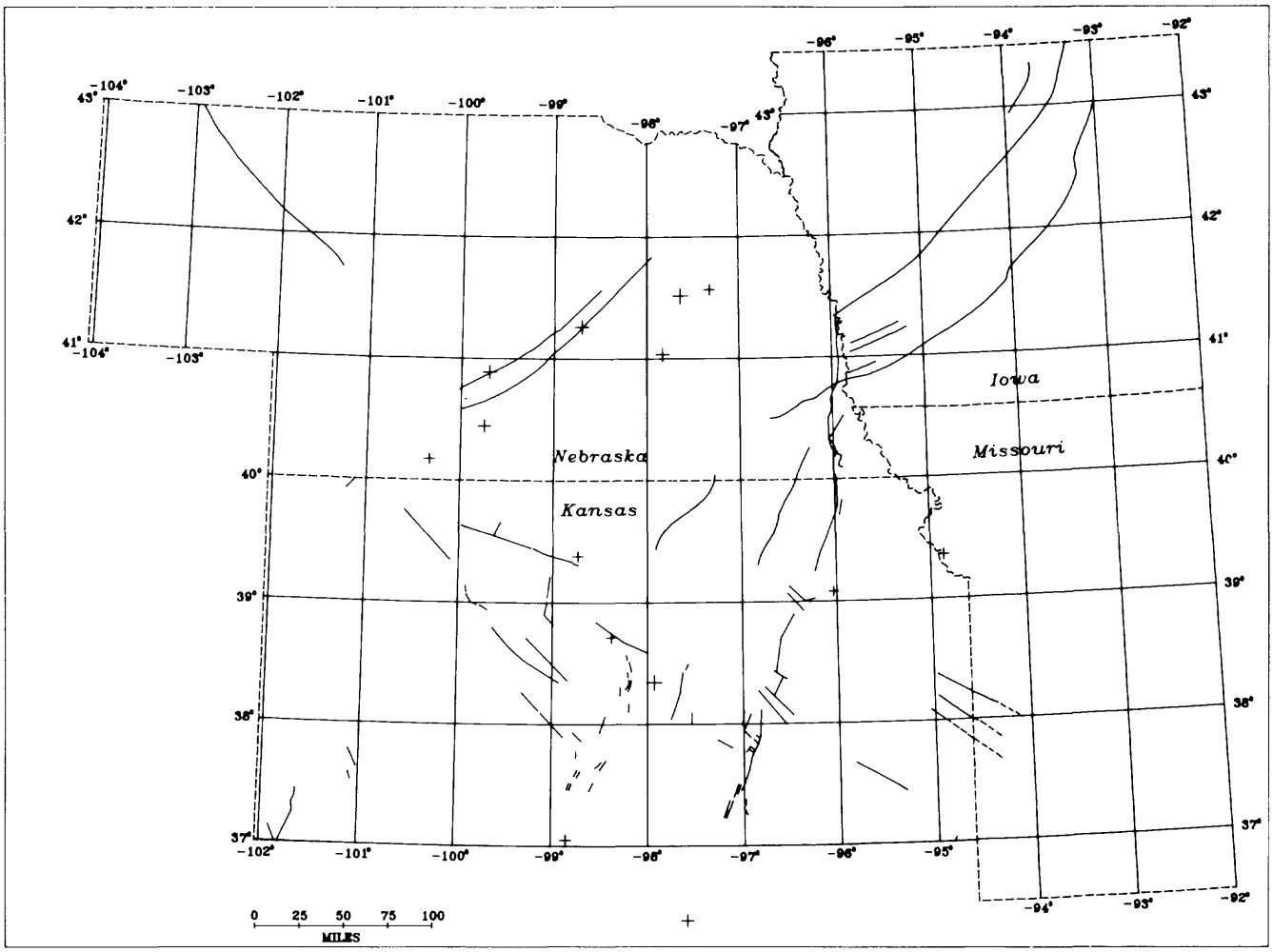

FIGURE 32.--Locations of earthquakes in Kansas and Nebraska for 1981 are depicted by plus signs. Faults are represented by line segments.

All events recorded by a sufficient number of MARSN and SARSN stations are located using FASTHYPO (Herrmann, 1979). Figure 39 represents 20 events located by MARSN during 1981. Not included in this figure are more than 100 New Madrid events for which better locations are available from St. Louis University. However, eleven events occurred in the New Madrid seismic zone which were not included in the St. Louis bulletin data and are presented here in figure 39 and table 3 for informational purposes. (Note: MARSN New Madrid locations are accurate to between 6 to 12 km, with latitude showing the greatest error. Depths usually must be restricted.)

Figure 40 represents the locations of 25 events located by SARSN, during 1981. More detailed information is published in the TEIC Quarterly Seismological Bulletin along with special reports on significant events. Subscriptions are available upon request from TEIC.

EARTHQUAKE MONITORING IN NEVADA AND EASTERN CALIFORNIA, 1981

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During 1981 the University of Nevada Seismological Laboratory operated a 44-station seismic telemetry network in the western Great Basin-eastern Sierra Nevada region, Nevada and eastern California. Of the 44 stations six recorded three components of ground motion and the other 38 had only vertical-component instruments. Data from the stations were telemetered to the Laboratory's data center in Reno over radio and telephone links, and were recorded on analog tape; key stations were also monitored on helicorders. Events selected from the Helicorder

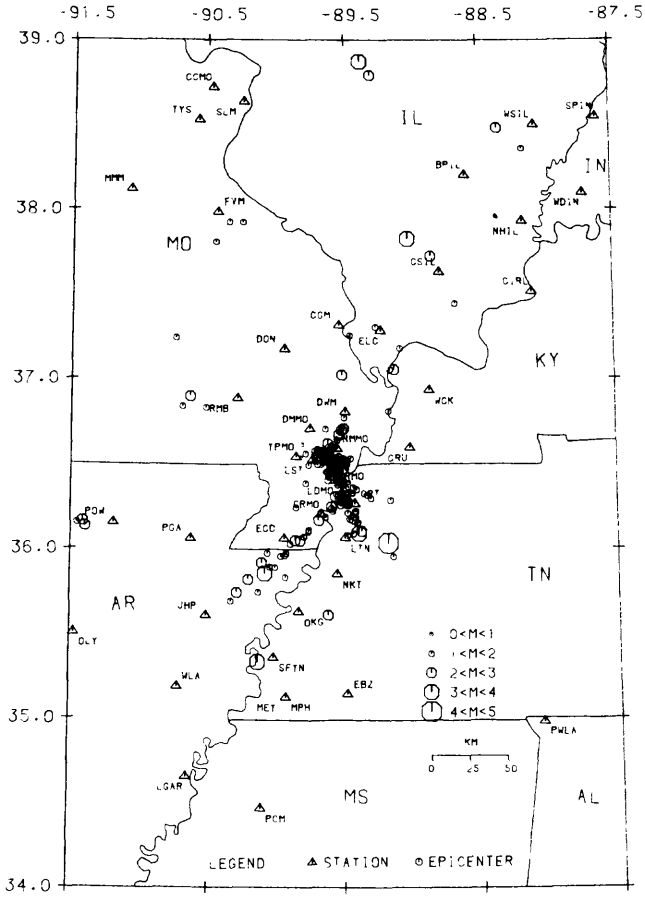

FIGURE 33.--Central Mississippi Valley earthquakes during 1981 within a 4° x 5° region centered at 36.5° N. and 89.5° W.

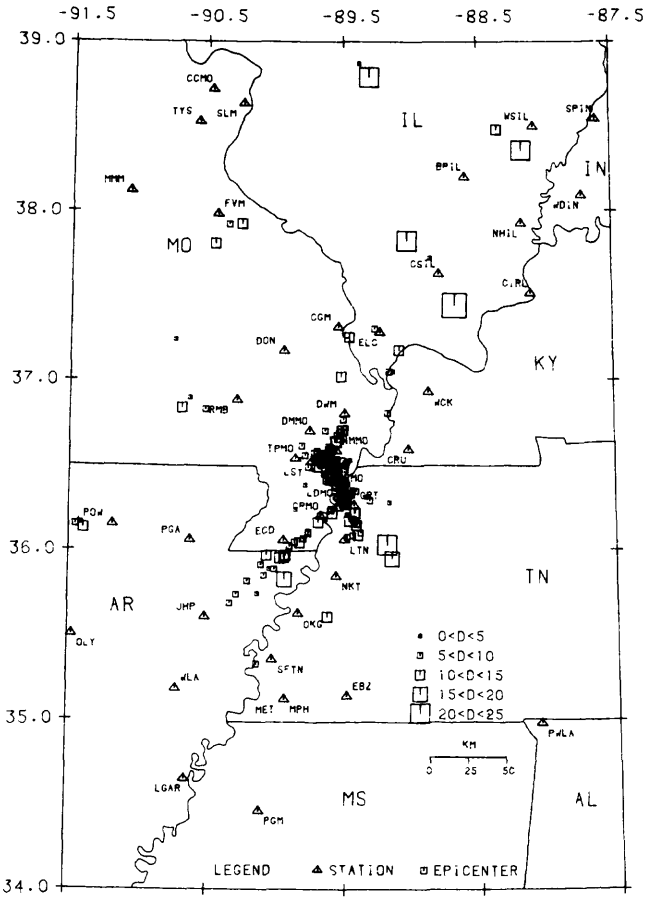

FIGURE 35.--Central Mississippi Valley earthquakes during 1981 within a 4° x 5° region centered at 36.5° N. and 89.5° W. (epicenter symbols are scaled according to focal depth).

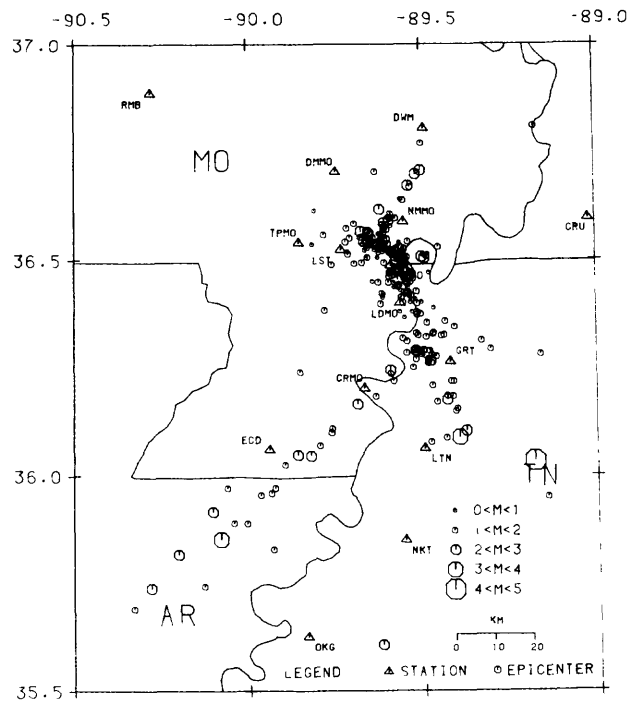

FIGURE 34.--Central Mississippi Valley earthquakes during 1981 within a 1.5° x 1.5° region centered at 36.25° N. and 89.75° W.

records were played out onto strip-chart recordings at a time scale of 1cm/sec, and the same events were dubbed onto library tapes. In the playback process switch-selectable subnetworks of 16 stations were used and for small events only one or two playbacks were made.

Figure 41 shows a map with 684 events that were located for the 1981 period using the HYPO71 algorithm of Lee and Lahr (1975). The most significant activity in 1981 continued to be in the Mammoth Lakes area, where a major earthquake swarm has been in progress since October 1978. So far this sequence has produced four events with ML 6+, and magmatic activity within Long Valley caldera has been evidenced by surface uplift (Savage and Clark, 1982), new fumarole activity and spasmodic tremor (Ryall and Ryall, 1981; 1983). The largest earthquake in the entire region during 1981 had ML 5.9 at 11h 53m GMT on September 30, and was located 10 km southeast of the town of Mammoth Lakes and 5 km south of Long Valley caldera (37.571° N., 118.877° W.; arrow on fig. 42). This earthquake was felt as far west as Fresno, California, and as far north as Virginia City, Nevada (near

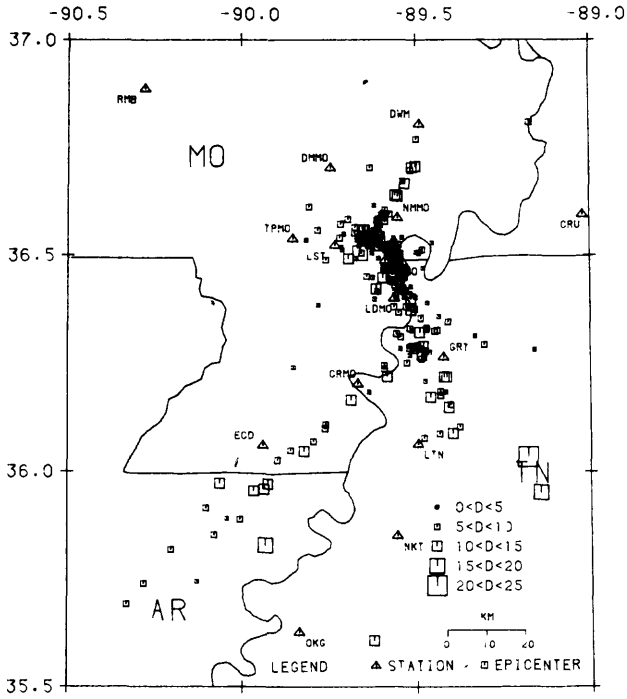

FIGURE 36.--Central Mississippi Valley earthquakes during 1981 with in a 1.5° x 1.5° region centered at 36.25° N. and 89.75° W. (epicenter symbols are scaled according to focal depth).

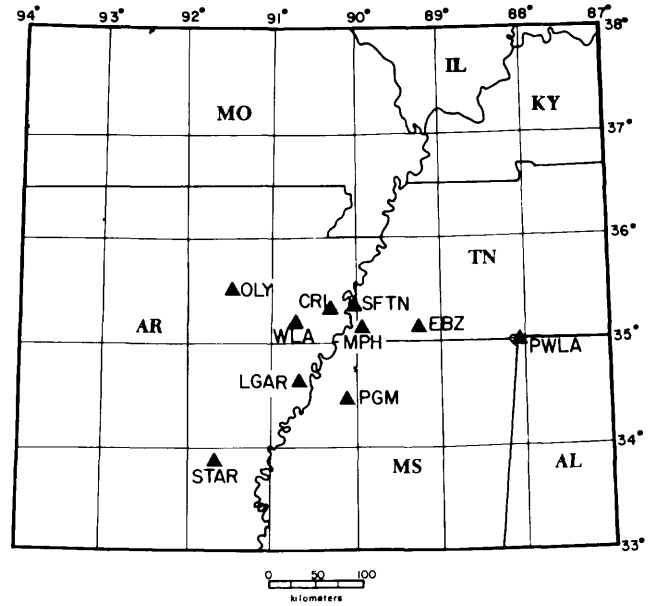

FIGURE 38.--Memphis area Regional Seismic Network, 1981.

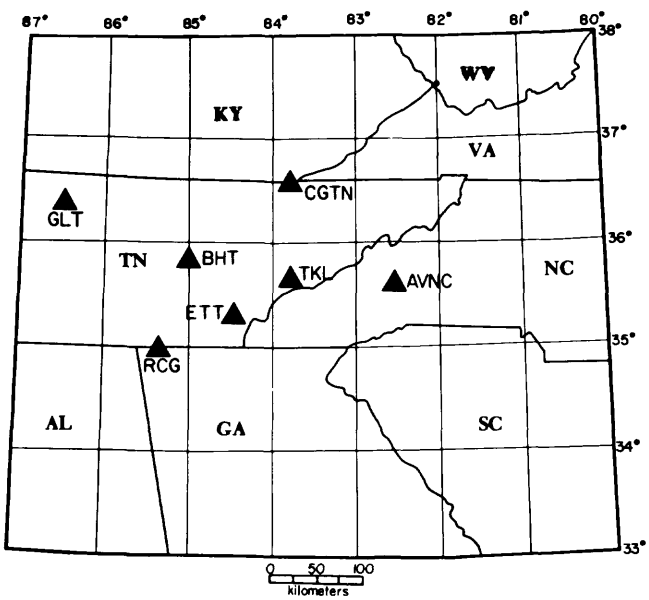

FIGURE 37.--Southern Appalachian Regional Seismic Network, 1981.

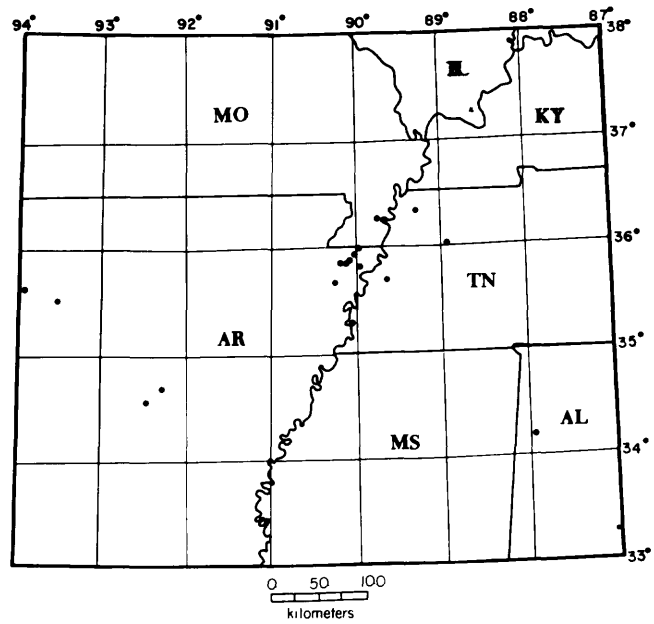

FIGURE 39.-- Central United States earthquakes 1981 (listed in table 3).

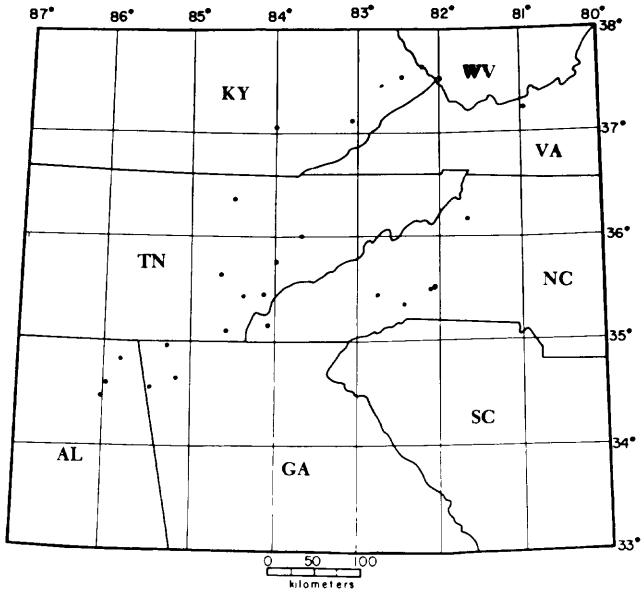

FIGURE 40.--Southern Appalachia earthquakes, 1981 (listed in table 3).

Reno). Aftershock activity continued for about 10 days, included 41 events with ML $\geq$ 3.0 and occurred in a 17 km-long north-south zone extending into the caldera (fig. 42).

Also of note in this area was the occurrence of several episodes of spasmodic tremor, with a typical episode consisting of hundreds of microearthquakes occurring over a period of 1-2 hours. The most intensive swarms of this type occurred on July 9-10 and August 9. As with previous bursts of spasmodic tremor these swarms were located in a small area just east of the town of Mammoth Lakes in the southwestern part of Long Valley caldera (fig. 42).

Seismicity in the Mono Lake-Excelsior Mountains area also continued at a high level during 1981, with several clusters of moderate shocks occurring along a zone from Mono Lake to Luning (25 km NW of Mina, fig. 41). This zone accounted for eight earthquakes with ML $\geq$ 4. The largest shocks in the Mono-Excelsior area occurred on January 28, April 28 and December 19; they had ML 4.7, 4.6 and 4.5, respectively, and were located in Teel's Marsh (50 km NE of Mono Lake), Adobe Hills (30 km NE of Mono Lake), and near Luning (25 km NW of Mina).

As noted by Ryall (1982) an anomalously high level of seismicity has been occurring around the so-called "White Mountains gap" (Wallace, 1978), between the rupture zones of the 1872 (M = 8+) Owens Valley earthquake and the 1932 (M = 7.3) Cedar Mountains shock. This activity is in a zone from Bishop to Mono Lake to Mina to Dyer; the circular pattern is similar to that observed in other regions before large shocks and suggests relatively high potential for a major shock in the White Mountains gap.

Table 3

DATE	ORIGIN TIME	MAG (DUR)	LAT	LONG	DEPTH
	Central United States				
01-09-81	09:48 57.2	1.4	35.92	90.03	5.0R
02-16-81	23:58:45.5	2.0	35.69	89.64	5.0R
03-01-81	08 54 20.1	1.1	35.80	89.98	1.5
06-20-81	07:58:40.4	1.2	35.99	89.98	7.6
06-21-81	20:30 26.1	1.3	35 83	90 20	23 8
07-13-81	21:01:06.1	1.3	34.69	92.30	6.4
07-14-81	00:49 12.3	1.2	36.32	89 76	10.0R
08-02-81	00 43 18.3	1 8	35 52	93.53	2.0R
08-05-81	16:27 41.5	1.6	34 58	92.48	8.7
08-07-81	12:12:48.6	0.6	36.04	88 92	2.0R
08-18-81	22:31:11.1	1.5	35.86	90.09	7.1
08-26-81	04:05:34.5	2.4	34 17	87.93	5.0R
08-31-81	02:28.17.5	1.3	35.89	90.15	9.73
10-01-81	04:06:16.4	1 8	35 65	93.91	5.0R
10-06-81	18:25 02.1	1.4	36.32	89.30	3.1
10-11-81	23:23:38.2	1.2	35.28	90 08	12.4
10-15-81	04:27.21.1	1.2	36.29	89.67	5.0R
10-22-81	21:40:56.1	1.3	36.29	89.70	9.2
12-09-81	03:29.34.5	2.6	33.24	87 02	3.0R
12-30-81	09 16 58.7	1.7	35.67	90 28	3 6
	Southern Appalachian				
04-02-81	06:32:40.9	2.6	35.43	84.38	3.0R
04-08-81	07 10:31.6	3.2(V)	35.52	82.06	4.6
04-09-81	12:02:37.4	2.7	35.50	82.11	6.8
04-10-81	06:04:59.8	2.5	35.51	82.06	1.1
05-05-81	21:21:57.9	3.3(V)	35.33	82.43	13.2
05-17-81	13:33:02.2	1.2	35.77	83.98	9.0
06-03-81	20:54:22.9	2.3	36.18	81.67	1.2
06-06-81	00:58:27.3	2.1	37.54	82.49	10.0R
06-12-81	03:34:07.8	2.1	37.11	83 07	12.0R
06-16-81	18:24:38.7	2.0	36.00	83.69	5.0R
07-26-81	08:59:21.7	1.7	35.46	82.77	15.0R
07-31-81	08:36:14.6	1.9	36.37	84.49	5.0R
09-04-81	17:21:44.6	2.6	34.64	85 17	3.51
09-14-81	17:13:33.4	1.6	34.60	85.98	14.3
09-28-81	18:03:35.1	1.9	34.57	85.44	5.0R
11-25-81	11:54:26.0	2.7	35.64	84.63	2.7
11-30-81	17:33:11.0	2.5	37.63	82.20	6.7
12-02-81	00:34:43.8	2.0	34.49	86.01	10.0R
12-04-81	04:46:21.4	1.5	35.18	84.09	5.0R
12-04-81	02:36:54.0	2.0	37.24	80.95	8.0R
12-13-81	09:42:31.3	0.8	34.96	85.27	31.9
12-18-81	13:19:05.3	1.3	35.11	84.58	15.0R
12-23-81	16:10:12.4	1.5	34.81	85.82	7.4
12-25-81	16:03:31.3	1.7	35.46	84.17	7.0R
12-31-81	13:15:29.6	1.7	37.07	84.07	5.0R

NEW ENGLAND EARTHQUAKES, 1981

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During 1981 Boston College-Weston Observatory continued its monitoring of New England seismicity. During the year a network of 36 stations, all but one remote, constituted the network. A quarterly bulletin reporting the

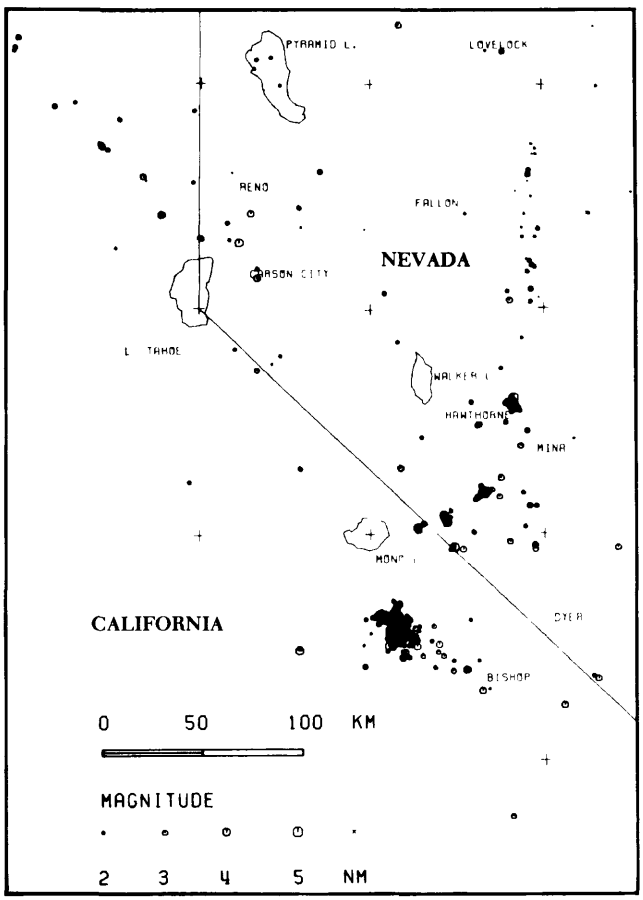

FIGURE 41.--Map of western Nevada and eastern California showing earthquakes during 1981.

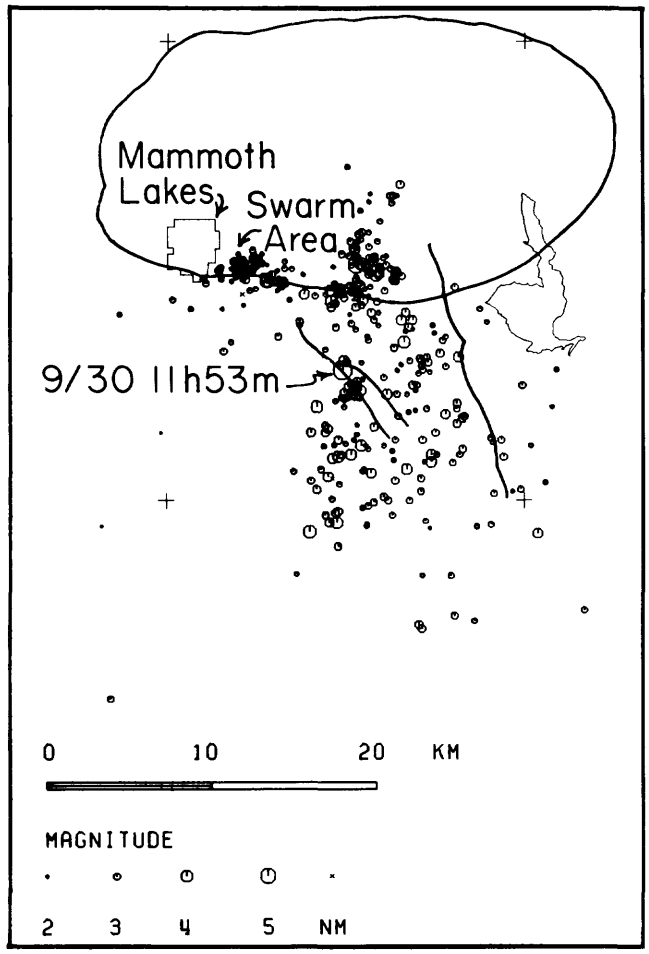

FIGURE 42.--Map of the Mammoth Lakes area showing earthquakes for 1981. Heavy lines indicate mapped faults and the boundary of Long Valley caldera, light lines outline the town of Mammoth Lakes and Lake Crowley. The largest earthquake during 1981 is indicated by an arrow, with date and hour.

seismicity of northeastern United States in cooperation with the Massachusetts Institute of Technology Network and other local seismic networks has been published at Weston Observatory since 1975.

In the course of the year the replacement of home-made VCO and amplifier units for the Weston network was completed. This has resulted in a reduction of noise, allowing an increase of gain at these stations. The first steps in developing a digital recording ability were taken during the year and a program for the detection and location of earthquakes was being developed.

Weston Observatory began computing the local magnitudes (ML) for northeastern United States and Canadian earthquakes during the year. The records from a pair of Wood-Anderson torsion seismometers, which Weston Observatory has been operating since 1967, were used. To take into account the difference in attenuation between southern California and northeastern United States, corrections were computed to the Richter ML formula. The local magnitudes for 56 northeastern United States and Canadian earthquakes were calculated using this corrected formula. In general, the ML values tend to be 0.4 units smaller than the Mn and Mc values for these events. The ML formula will be applied to all future recorded events.

On October 21, 1981, an earthquake of magnitude 3.4 and of maximum intensity IV was recorded in Long Island Sound. This was the first instrumentally detected and located event to occur in Long Island Sound. A fault-plane solution shows thrust faulting on NE-SW trending fault planes.

During this year an intense microearthquake swarm occurred near Moodus, Connecticut. More than 500 events, with magnitudes ranging from less than -2 to 2.1, occurred in this swarm from August to mid-October. The depths of all events were 2 km or less. This area has been the site

of persistent small earthquake activity throughout the historical record, and even before. Moodus was regarded by the native Indians as a sacred site, and they attributed the seismic activity to the wrath of their gods.

There were about 50 local earthquakes of magnitude less than 3 and greater than -1.2 recorded at Weston Observatory, as well as 2 earthquakes of magnitude 3 or greater (fig. 43, tables 4 and 5). There were three areas that showed significant seismic activity during the year. The area around Laconia, New Hampshire became active in June, that around Moodus, Connecticut in August, and the Dover-Foxcroft, Maine area during much of the year.

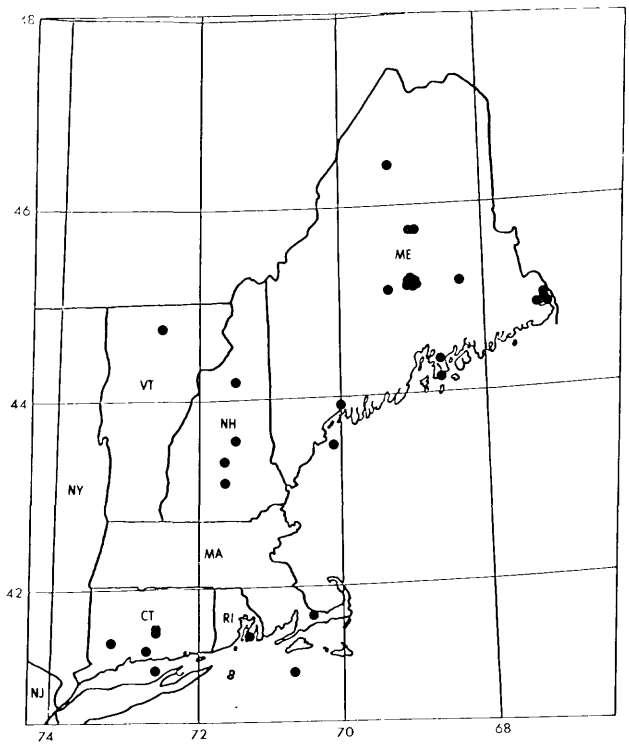

FIGURE 43.--New England seismicity, 1981.

Table 4.--*Earthquakes M < 3.0 in New England, 1981*

	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
ME	4	2	0	3
NH	1	-	1	1
VT	-	-	-	1
MA	-	2	-	-
RI	1	-	-	-
CT	-	-	2	3

Table 5.--*Earthquakes M ≥ 3.0 in New England, 1981*

Date	Time	Lat(N)	Long(W)	Mn	MD	
81 Jun 28	2242	43.57	71.55	3.1	3.0	West of Laconia, NH
81 Oct 21	1649	41.15	71.55	3.8	3.6	Long Island Sound

EARTHQUAKES IN NEW YORK STATE AND ADJACENT AREAS, 1981

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Lamont-Doherty Geological Observatory operates a seismic network of 36 single-component short period seismic stations (plus 1 three-component station) in the states of New York, New Jersey, and Vermont. Fifty-four earthquakes were located in 1981 in New York State and adjacent areas of neighboring states and Canadian provinces (fig. 44). Earthquakes above magnitude 2 in New York and New Jersey are listed in table 6. Interesting events which occurred this year include the following:

1. March 31: Two earthquakes were located in Attica, N.Y., (the larger a 2.4 Mc - coda length magnitude), following a two year period of seismic quiescence in this area of intermittent activity.

2. May 18: A 2.2 Mc earthquake was located in Ramsey, N.J. a few kilometers west of the surface trace of the Ramapo fault. It was 7 kilometers deep and felt by only a handful of people.

3. July 4 and 5: Two earthquakes, each 3.3 Mc, were located near Williamstown, Ontario, 18 km from the U.S. border, not far from the magnitude 5.9 earthquake near Massena N.Y. in 1944. Both 1981 events were felt in many towns in the northern Adirondacks, N.Y. Also, sixteen smaller shocks occurred within four days of the first shock.

4. August 10: In Mineville, N.Y. a 3.0 Mc earthquake occurred. This is the largest of six events recorded near Mineville during the year. Prior to 1981, no earthquakes had been located there by the L-DGO network.

5. September 16: Southeast of Oswego, N.Y. there was a 3.2 Mc earthquake. Very few, if any, historic earthquakes have been documented in this area. The September earthquake was not felt, which is unusual for an event this size, and suggests that small earthquakes here may not have been noticed before instrumental monitoring began.

6. October 21: A 3.5 Mc earthquake centered beneath Long Island Sound was widely felt in southern Connecticut and Long Island. The total felt area was approximately 8,000 square miles. No aftershocks were recorded.

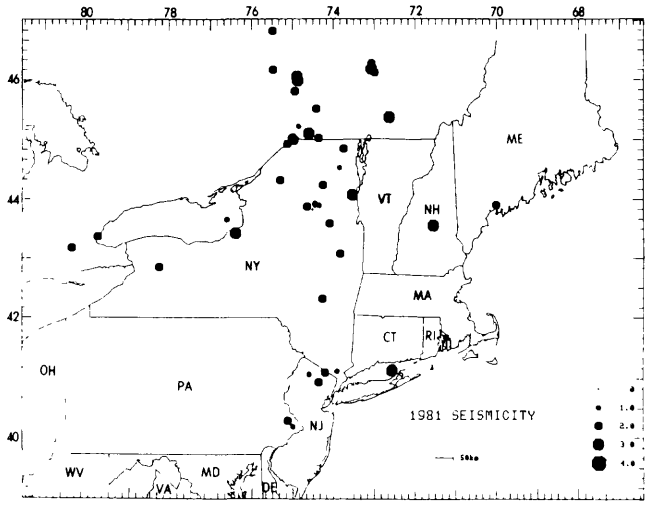

FIGURE 44.--Earthquakes located by the Lamont-Doherty seismic network during 1981.

Table 6.--*Earthquakes M ≥ 2.0 in New York and New Jersey, 1981*

Date	Origin Time (UTC) Hr. Min.	Location	Lat. N deg min	Long. W deg min	Mag Mc
Mar. 31	21 05	NY, Attica	42 51	78 15	2.4
May 12	04 26	NY, Massena	44 56	75 08	2.4
May 18	07 22	NJ, Ramsey	41 06	74 12	2.2
Jun. 17	21 03	NY, Tupper Lake	44 14	74 16	2.2
Jun. 21	02 09	NY, Edwards	44 19	75 18	2.4
Aug. 10	23 06	NY, Mineville	44 05	73 32	3.0
Aug. 18	00 25	NY, Windham	42 19	74 16	2.1
Aug. 21	05 22	NY, Bakers Mills	43 36	74 05	2.1
Sep. 03	21 36	NY, Raquette Lake	43 52	74 39	2.5
Sep. 16	14 41	NY, SE of Oswego	43 26	76 23	3.2
Oct. 21	16 49	NY, Long Island Sound	41 06	72 34	3.5
Dec. 14	16 31	NY, Saratoga Springs	43 05	73 50	2.3
Dec. 26	22 37	NY, Altona	44 51	73 45	2.6

OKLAHOMA EARTHQUAKES, 1981

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and

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A statewide network of 11 seismograph stations is recording seismological data in Oklahoma (fig. 45). The Oklahoma Geophysical Observatory station, TUL, has been recording earthquake data since December 1961. The Observatory, located near Leonard, Oklahoma, in southern Tulsa County, operates seven seismometers, three long period and four short period, which are installed in a vault detached from the main building. The seismic responses at TUL are recorded on 14 paper-drum recorders; 16 seismograms are recorded on 16-mm film. Seven semi-permanent, volunteer-operated seismograph stations and three radio-telemetry stations constitute Oklahoma's regional network. The installation and maintenance of these stations are being supported by the U. S. Nuclear Regulatory Commission. The regional seismograph network supplements the existing seismological capability at the Oklahoma Geophysical Observatory by providing more accurate location and detection of earthquake activity in Oklahoma.

Each of the seven volunteer-operated seismograph stations consists of a Geotech S-13 short-period, vertical seismometer; a Sprengnether MEQ-800-B unit, including amplifier, filters, ink-recording unit and a clock; and a Kinemetrics time-signal-radio receiver for high-frequency WWV time signals. Each radio-telemetry system consists of one Geotech S-13 seismometer and one Monitron and/or Emheiser Rand telemetry unit. The telemetry unit amplifies the seismometer output and uses this output to frequency-modulate an audiotone. A 500-milliwatt, crystal-controlled transmitter limits the line-of-site transmission to 80 km. Seismographs from the radiotelemetry stations are recorded at the Oklahoma Geophysical Observatory.

From January 1, 1981, to December 31, 1981, station coverage was relatively uniform. The Cedar Creek station, CDO, was closed March 25, 1981. A new station was installed near Bethel, BHO, in McCurtain County on March 30, 1981.

The El Reno area, in central Canadian County, was selected for detailed microearthquake studies. A five-station array, using Sprengnether DR-100 portable trigger-digital systems, was installed in December 1980 and July 1981 (table 8, fig. 46).

In 1981, 57 Oklahoma earthquakes were located (table 7, fig. 47) by the Oklahoma Geophysical Observatory staff. The listing represents only those earthquakes that could be located by using three or more seismograph records. Two earthquakes were reported felt by people living in the vicinity of an earthquake epicenter.

Twenty-four earthquakes occurred in a 30-km-wide zone that extends 50 km southward from Blanchard through McClain, Grady, and northern Garvin Counties. In Grady County, a swarm of 12 earthquakes occurred on July 11. The earthquake activity culminated with felt earthquakes having mbLg magnitudes of 2.2 and 3.5. The last earthquake of the swarm, which was the largest of the

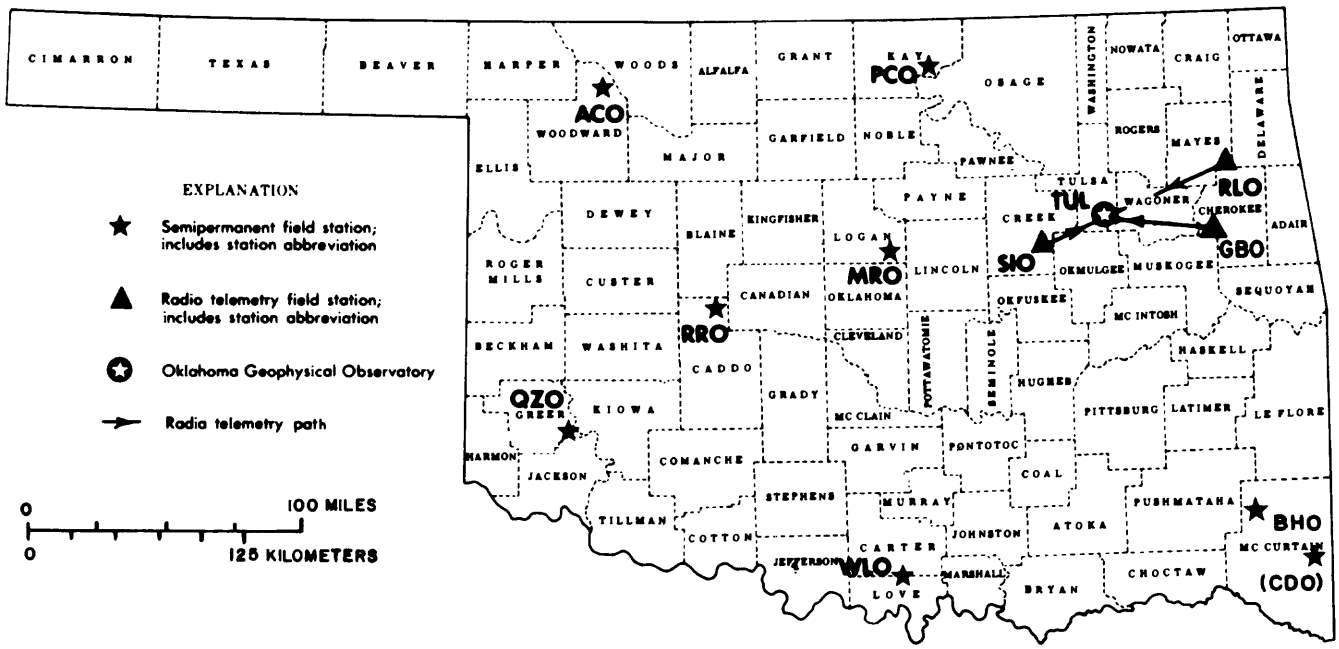

FIGURE 45.--Active seismograph stations in Oklahoma during 1981.

Table 7.--*Stations in El Reno array on December 31, 1981*

Name	Abbreviation	Symbol	Latitude (°N)	Longitude (°W)	Opening date
Shell Creek	SCE 1	S	35.438507	97.813971	Dec 17, 1980
Minco	MNE 1	M	35.330972	97.891114	Dec 18, 1980
Pleasant View	PVE 1	P	35.440365	97.896780	Dec 31, 1980
Union City	UCE 1	U	35.422204	98.029665	Jul 22, 1981
John's Creek	JCE 1	J	35.581219	97.900337	Jul 23, 1981

year, was felt with MM intensity IV in Bradley, Erin Springs, and Lindsay. Three km west of Lindsay, where pictures were knocked off a wall, the intensity reached MM V. The McClain, Grady-Northern Garvin County region was the site of the greatest earthquake activity in 1981, even without counting the July 11 swarm.

Nine earthquakes occurred in Canadian County in 1981. None of these events were reported felt. Three earthquake-event numbers--341,343, and 383--in Garfield and Grant Counties plot in close proximity to the Nemaha Uplift structures.

The first known earthquakes occurred in Custer County (February 20) and Osage County (July 25). Thus far, 58 Oklahoma counties have had at least one earthquake located within their boundaries.

Table 8.--*Oklahoma earthquake catalog for 1981*

Event number	Date and origin time (UTC)		County	Intensity (MM)	Magnitudes 3Hz	bLg	DUR	Latitude (°N.)	Longitude (°W.)	Depth (km)[1]
328	JAN 4	173408 46	CANADIAN		2 3	2 2	2 2	35 664	98 097	5 0R
329	FEB 4	033819 08	CREEK		1 8	1 5	1 8	35 661	96 388	5 0R
330	FEB 18	123347 61	MC CLAIN		2 0	2 0	2 1	34 902	97 491	5 0R
331	FEB 20	022029 71	CUSTER		2 4	2 2	2 3	35 707	99 202	5 0R
332	MAR 8	144708 15	CANADIAN		1 9	1 9	1 9	35 593	98 047	5 0R
333	MAR 8	154057 01	CANADIAN		2 2	2 4	2 3	35 601	97 961	5 0R
334	MAR 25	072219 27	MC CLAIN		1 7	2 0	2 0	34 925	97 412	5 0R
335	APR 25	040722 32	POTTAWATOMIE		1 7	1 5	2 0	35 117	96 903	5 0R
336	APR 27	000403 25	OKMULGEE		2 0		2 1	35 602	95 882	5 0R
337	APR 27	075108 11	POTTAWATOMIE		1 6		1 7	35 293	96 916	5 0R
338	MAY 5	112954 68	ATOKA			1 9	2 1	34 560	95 828	5 0R
339	MAY 15	051352 00	CANADIAN		1 9	1 7	1 9	35 473	97 817	5 0R
340	JUN 10	160523 14	PONTOTOC		2 1	1 7	1 9	34 714	96 684	5 0R
341	JUN 17	050224 82	GRANT		1 9		1 9	36 675	97 625	5 0R
342	JUL 1	224330 07	MC CLAIN		2 3	2 5	2 7	34 953	97 550	5 0R
343	JUL 8	025629 89	GARFIELD		1 4			36 513	97 557	5 0R
344	JUL 8	032830 93	CANADIAN		1 7	1 7	1 7	35 602	98 041	5 0R
345	JUL 9	010039 96	CANADIAN		1 7	1 9	1 7	35 558	98 069	5 0R
346	JUL 9	062028 29	CANADIAN		1 6	1 7	1 5	35 539	98 065	5 0R
347	JUL 9	224711 10	MC CLAIN		2 3		2 4	34 955	97 651	5 0R
348	JUL 10	031656 10	CANADIAN		1 5		1 4	35 514	98 128	5 0R
349	JUL 10	072311 90	MC CLAIN		1 6	1 7	1 8	34 930	97 624	5 0R
350	JUL 10	223918 45	GARVIN		1 8	2 3	1 6	34 544	97 283	5 0R
351	JUL 11	191424 90	GRADY		1 0			34 853	97 732	5 0R
352	JUL 11	192107 63	GRADY		1 7	1 9	1 8	34 858	97 719	5 0R
353	JUL 11	192639 20	GRADY		0 9			34 853	97 732	5 0R
354	JUL 11	192807 25	GRADY		1 1			34 853	97 732	5 0R
355	JUL 11	193038 19	GRADY		1 0			34 853	97 732	5 0R
356	JUL 11	193453 98	GRADY		1 2			34 853	97 732	5 0R
357	JUL 11	193638 40	GRADY		0 9			34 853	97 732	5 0R
358	JUL 11	194447 96	MC CLAIN		1 9	1 9	1 9	34 870	97 669	5 0R
359	JUL 11	200429 21	GRADY		1 8	1 9	1 8	34 919	97 724	5 0R
360	JUL 11	200657 63	GRADY		2 1	2 4	2 3	34 868	97 724	5 0R
361	JUL 11	201923 72	GRADY	2	2 0	2 2	2 2	34 881	97 751	5 0R
362	JUL 11	210921 84	GRADY	5	2 9	3 5	3 0	34 853	97 732	5 0R
363	JUL 12	042649 04	GRADY		1 5	1 6	1 5	34 776	97 676	5 0R
364	JUL 12	182925 53	MC CLAIN		1 9	2 2	1 8	34 947	97 427	5 0R
365	JUL 14	040815 36	OKFUSKEE		0 7			35 418	96 604	5 0R
366	JUL 15	183133 83	GARVIN		2 0	2 3	1 9	34 537	97 350	5 0R
367	JUL 20	095331 08	MC CLAIN		1 9	2 0	2 1	34 971	97 411	5 0R
368	JUL 25	000431 72	OSAGE		1 6		1 5	36 693	96 904	5 0R
369	JUL 26	042303 72	NOBLE		1 7		1 8	36 224	97 232	5 0R
370	JUL 31	232425 91	LATIMER		1 7		2 0	34 709	95 222	5 0R
371	SEP 6	175254 93	WOODS		2 3		2 2	36 480	98 531	5 0R
372	SEP 17	193100 46	JOHNSTON		2 3		1 9	34 481	96 623	5 0R
373	SEP 28	113607 58	ROGER MILLS		1 2		1 8	36 015	99 400	5 0R
374	OCT 24	053542 27	PITTSBURG		1 3		1 7	35 167	95 777	5 0R
375	NOV 5	164722 06	CANADIAN		2 1	2 0	1 9	35 677	97 982	5 0R
376	NOV 6	192825 31	PONTOTOC		2 0		2 2	34 676	96 682	5 0R
377	NOV 9	093655 47	GARVIN		1 9	1 7	1 9	34 796	97 480	5 0R
378	NOV 12	009539 29	CREEK		1 1		1 6	35 668	96 479	5 0R
379	DEC 4	031307 34	GRADY		1 8	2 0	1 9	35 195	97 691	5 0R
380	DEC 4	053140 01	MC CLAIN		2 0	2 2	2 1	35 137	97 659	5 0R
381	DEC 9	215003 65	COMANCHE		1 8		2 1	34 608	98 465	5 0R
382	DEC 17	052253 76	GRADY		2 2	2 0	2 1	35 132	97 852	5 0R
383	DEC 17	054454 70	GARFIELD		2 7	2 9	2 6	36 387	97 661	5 0R
384	DEC 19	024953 21	LOVE		1 2		1 8	33 948	97 495	5 0R

[1] The hypocenter is restrained (R) at an arbitrary depth of 5 0 km, except where indicated, for purposes of computing latitude, longitude, and origin time

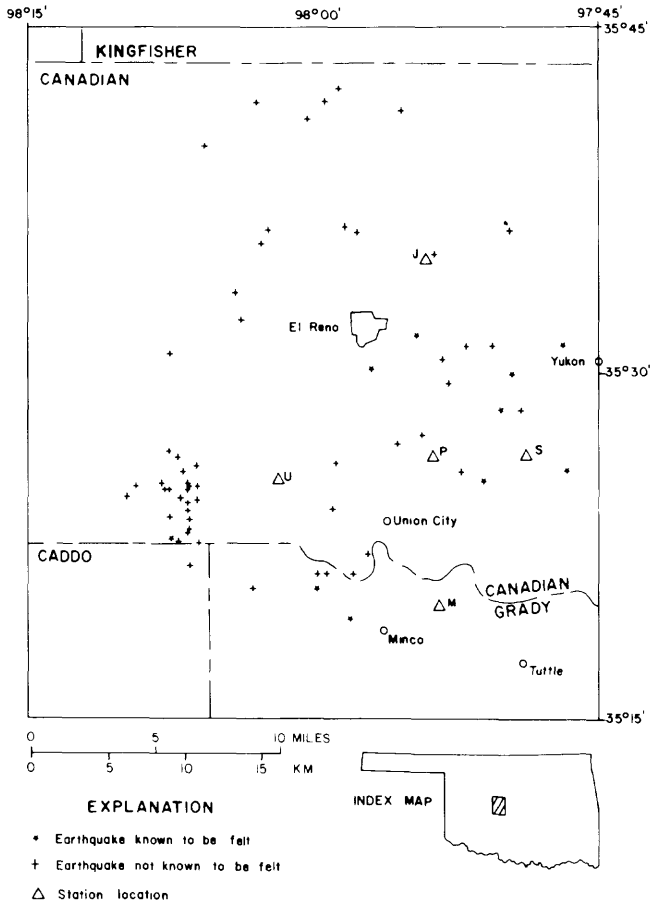

FIGURE 46.--Stations in the El Reno array (P, S, M, U, J) on December 31, 1981, with earthquake data for 1977-1981.

The 1981 earthquake epicentral data, when combined with previous earthquake data, produced at least four seismic trends worthy of discussion.

One trend is located in north-central Oklahoma (fig. 48). The pre-1977 earthquake data (circles) and the 1977-81 earthquake data (triangles) are shown in figure 48. There appears to be a 40-km-wide and 145-km-long earthquake zone that extends northeastward from near El Reno toward Perry (Noble County). Most of the earthquakes within this zone have occurred in the vicinity of the El Reno-Mustang area, which has been the site of numerous earthquakes since 1908. Ten of the 1981 earthquakes plot within this zone. Prior to installation of the statewide earthquake-station network, more than one-half of the known Oklahoma earthquakes occurred in the vicinity of El Reno. However, after the El Reno earthquake of 1952, magnitude 5.5 (mb), no earthquakes were reported for this region until 1978.

The correlation of historical and recent earthquake activity to known structural features remains unclear. Some fault features that cut pre-Pennsylvanian rocks, which are compiled from Jordan (1962), Wheeler (1960) , and unpublished reports, are shown in figure 48. The El Reno-Perry trend appears to cut diagonally across the Nemaha Uplift structures at about a 30° angle. The southern end of this trend appears to be more active than the middle and northern parts. The recent as well as the historical earthquake data seem to support this observation. The installation of a five-seismograph-station array

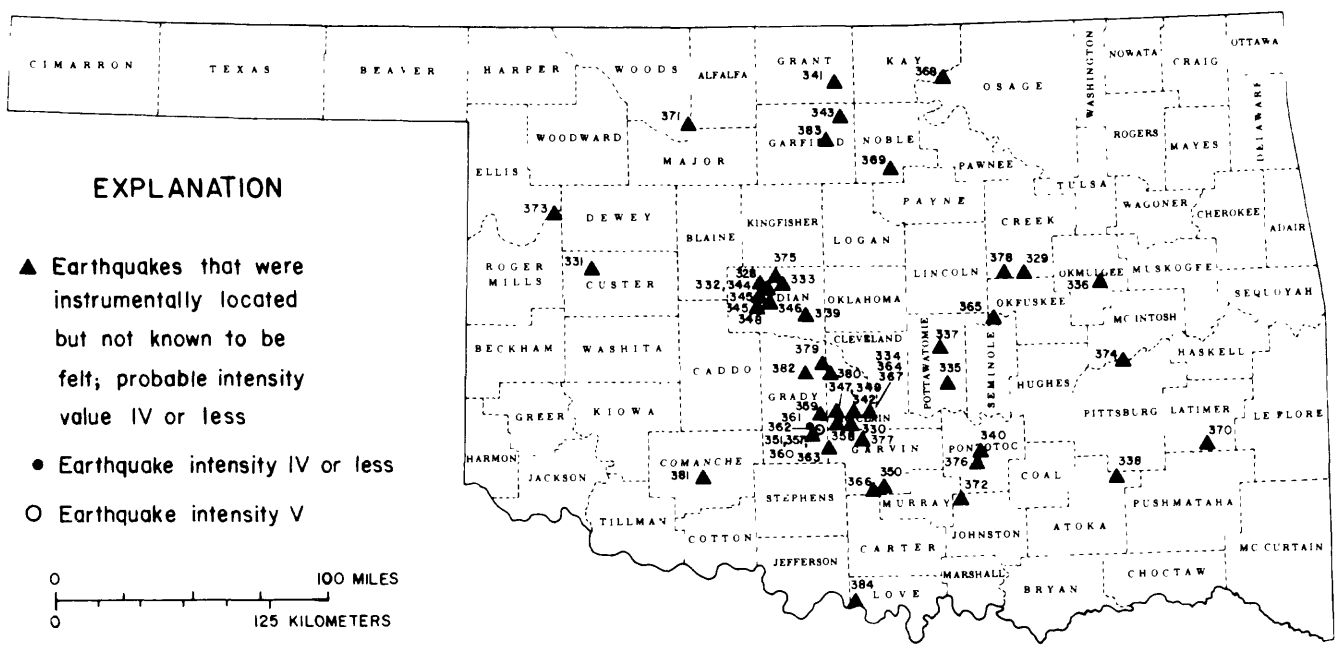

FIGURE 47.--Distribution of Oklahoma earthquakes during 1981. Numbers correspond to event numbers in table 7.

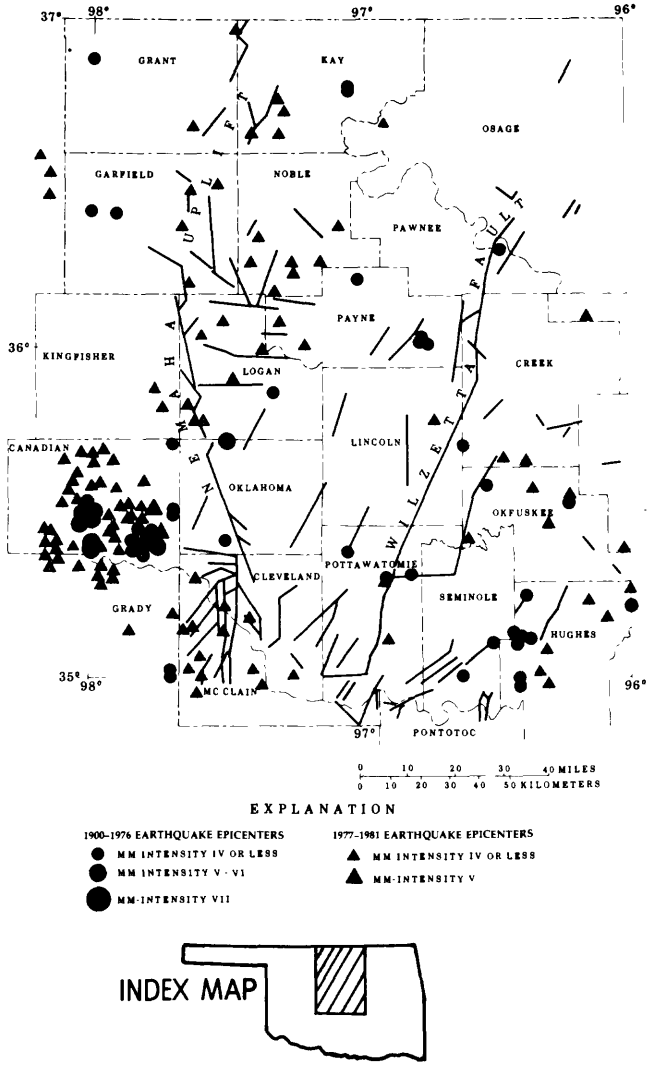

FIGURE 48.--Distribution of faults that cut pre-Pennsylvania strata, and earthquake epicenters for north-central Oklahoma (Wheeler, 1960; Jordan, 1962; unpublished reports).

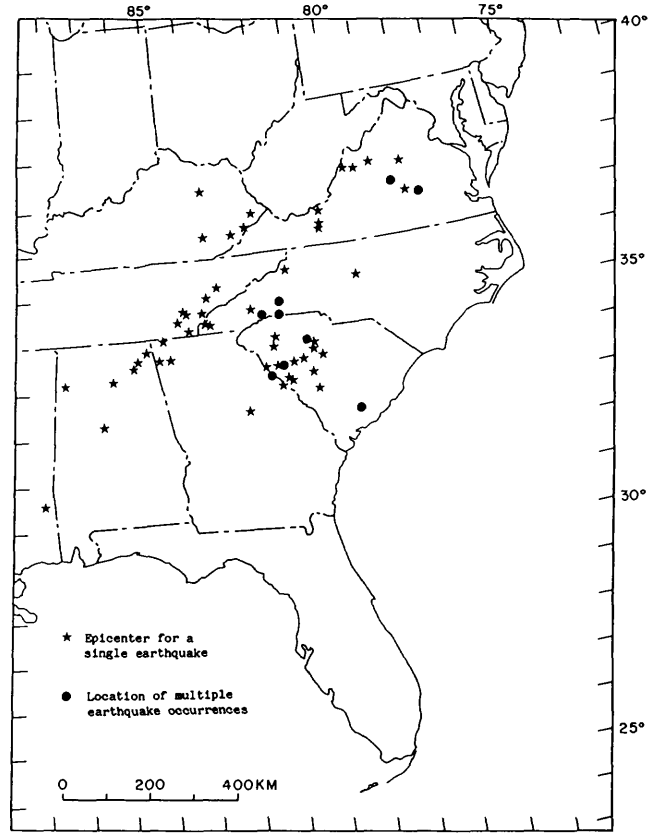

FIGURE 49.--Southeastern United States earthquake epicenters during 1981. Stars represent single events; solid circles indicate multiple earthquake occurrences.

was completed in 1981 southeast of El Reno. It is hoped that additional earthquake data, such as focal-depth determinations, will give us a better understanding of this feature.

A second trend is situated between Norman and Pauls Valley. Twenty-four earthquakes were instrumentally located in this region. This trend closely parallels the McClain County fault zone which is about 40 km wide and 60 km long. Perhaps this very complex fault zone, which contains numerous subparallel faults, is the southernmost extension of the Nemaha Uplift.

In south-central Oklahoma, earthquakes are concentrated in the Wilson area, Carter and Love Counties. Only one earthquake was located in this region in 1981. In the past, this area has also been the site of numerous small earthquakes. A fourth general area of earthquake activity is located along and north of the Ouachita front (Arkoma Basin) in southeastern Oklahoma. Three earthquakes, with (DUR) magnitudes that range from 1.7 to 2.1 were instrumentally detected in this region.

SOUTHEASTERN UNITED STATES EARTHQUAKES, 1981

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A total of 86 earthquakes ($-0.3 \leq M \leq 3.5$) were detected and located within the southeastern United states during 1981 (fig. 49). Ten of those events had a magnitude of at least 3.0 and/or were felt. Additionally, 76 microearthquakes, of magnitude less than 3.0 (and not felt), were located in the region.

The largest event that occurred in the region during 1981 was a magnitude 3.5 event

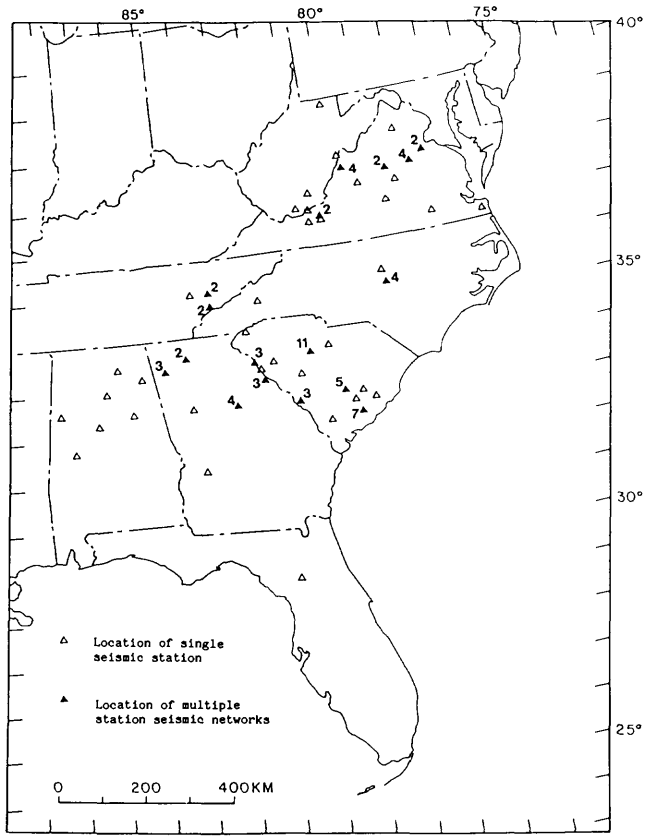

FIGURE 50.--Southeastern United States seismic network stations operating at the close of 1981. Triangles indicate station locations with solid symbols (and numbers) indicating closely spaced multiple stations at a given location.

near the North Carolina/South Carolina border area (table 9). Increased activity was observed in the southern Appalachians, especially in southeastern Tennessee, southwestern North Carolina, northern Georgia, and northeastern Alabama (fig. 49). Of particular interest is an earthquake swarm of three felt events (M = 3.4, 3.2, 2.9) in central Virginia, that occurred within an eight minute period on 11 Feb. 1981 (table 9). This sequence represents the first such activity observed in the area since local network monitoring was instituted in 1978.

A data listing of most of the earthquakes in 1981 was presented in Southeastern United States Seismic Network Bulletins No. 8 and 9. A discussion of the "Detection and Location Capability of the Southeastern United States Seismic Network" by Arthur C. Tarr was presented in issue 9 of the Bulletin. Copies of these reports, and a listing (on either magnetic tape or in printed form; Bulletin 10A) of hypocenters reported in Bulletins 1 - 10, may be obtained by contacting the authors.

Table 9.----*Southeastern United States earthquakes, 1981*

Date (1981)	Origin Time (UTC)	Lat. (°N.)	Long. (°W.)	Depth (Km)	Mag. (MbLg/Md)	State Felt
14 Jan.	21:10:33.9	38.20	83.91	11.0F	1.5	KY
11 Feb.	13:44:16.4	37.72	78.44	5.7	3.4	VA
11 Feb.	13:50:31.4	37.75	78.41	10.1	3.2	VA
11 Feb.	13:51:38.6	37.72	78.45	7.3	2.9	VA
04 Mar.	20:44:42.6	35.71	79.75	5.0	2.8	NC
19 Mar.	04:33:55.4	32.96	80.19	5.9	2.3	SC
09 Apr.	07:10:31.2	35.51	82.05	0.2	3.1	NC
05 May	21:21:56.7	35.33	82.42	10.2	3.5	NC
30 July	11:59:48.5	38.19	78.09	6.0	1.4	VA
23 Nov.	13:14:51.0	38.24	79.10	9.8	2.1	VA

The number of seismograph stations operating in the region varied from 91 to 102. Figure 50 shows the station distribution at the end of 1981.

UTAH EARTHQUAKES, 1981

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The University of Utah Seismograph Stations records a regional seismic network consisting of 60 short-period stations, 12 of these operated and maintained by other agencies. The 1981 network configuration is shown in figure 51 . Station spacing ranges from 15 to 35 kilometers in north-central Utah along the Wasatch fault zone to approximately 30 to 100 kilometers in adjacent areas of central and southwestern Utah and southeastern Idaho. Seismic data are telemetered via radio, telephone, and/or microwave channels to the University of Utah in Salt Lake City. An on-line computer facility provides event detection and digital central recording of the network. In addition to vertical components, three stations have horizontal short-period seismometers. Dugway, Utah (DUG) operates as a WWSSN station. Wood-Anderson type seismographs operate at DUG and Salt Lake City (SLC).

Epicenters for 659 earthquakes located in the Utah region during 1981 are shown in figure 52. Fifteen of these were reported felt ($2.2 \leq ML \leq 4.5$). The largest earthquake of magnitude (ML) 4.5 occurred on April 5, 1981 southwest of Cedar City, Utah near Kanarraville (37.5° N., 113.1° W.). Other significant features of the seismicity pattern during 1981 as shown in Figure 52 include, from north to south:

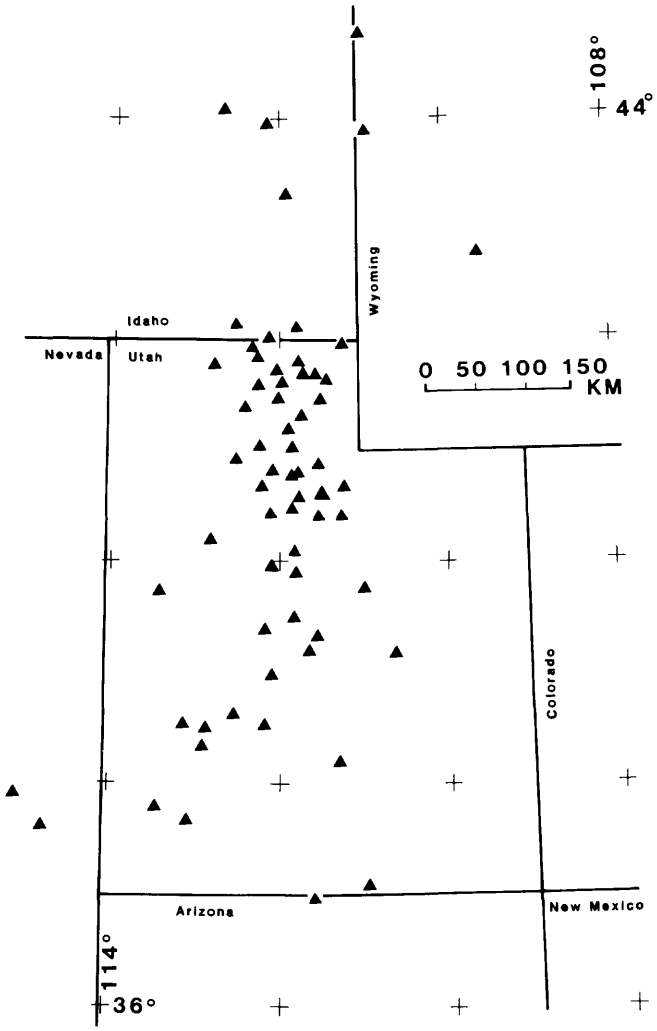

FIGURE 51.--University of Utah seismographic network in 1981.

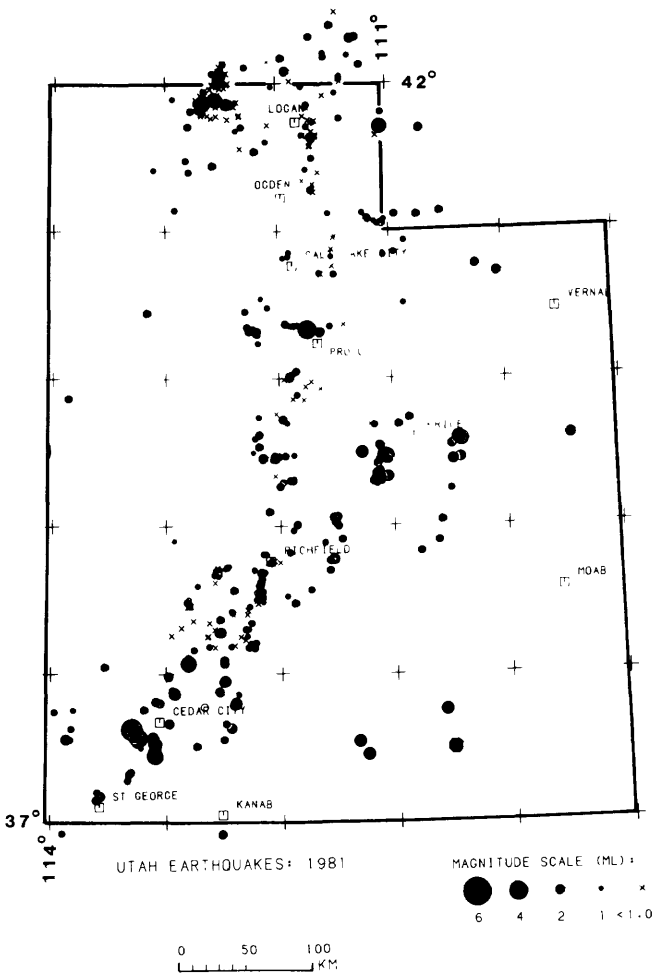

FIGURE 52.--Utah earthquake epicenters during 1981.

1. ongoing, densely clustered activity along the Idaho-Utah border (approximately 42.0° N., 112.5° W.), including late aftershocks of the magnitudes 6.0 Pocatello Valley earthquake of March 1975, as well as several nearby swarms within Hansel Valley;

2. persistent small earthquakes defining a N-S linear trend immediately east of Logan beneath the Bear River Range;

3. a magnitude 3.9 earthquake on February 20 near Provo, Utah that was widely felt throughout Utah Valley;

4. earthquakes in the magnitude 2-3 range SW, NNW, and ESE of Price in central Utah--predominantly related to extensive underground coal mining;

5. scattered small earthquakes throughout south-central and southwestern Utah in a broad NE-SW trending belt encompassing the Elsinore, Tushar, Sevier, and Hurricane fault zones;

6. earthquakes of a swarm sequence (ML $\leq$ 4.5) south of Cedar City near Kanarraville (37.5° N., 113.1° W.) which began in December 1980 and continued through May 1981; and

7. isolated seismic events in the magnitude 2-3 range in southeastern Utah. (The latter shocks are in a region peripheral to the University of Utah's seismic network; their source and precise location are uncertain.)

Details of Utah seismicity and information in bulletin format are available by contacting the University of Utah Seismograph Stations, 704 W. C. Browning Bldg., Salt Lake City, Utah 84112-1183.

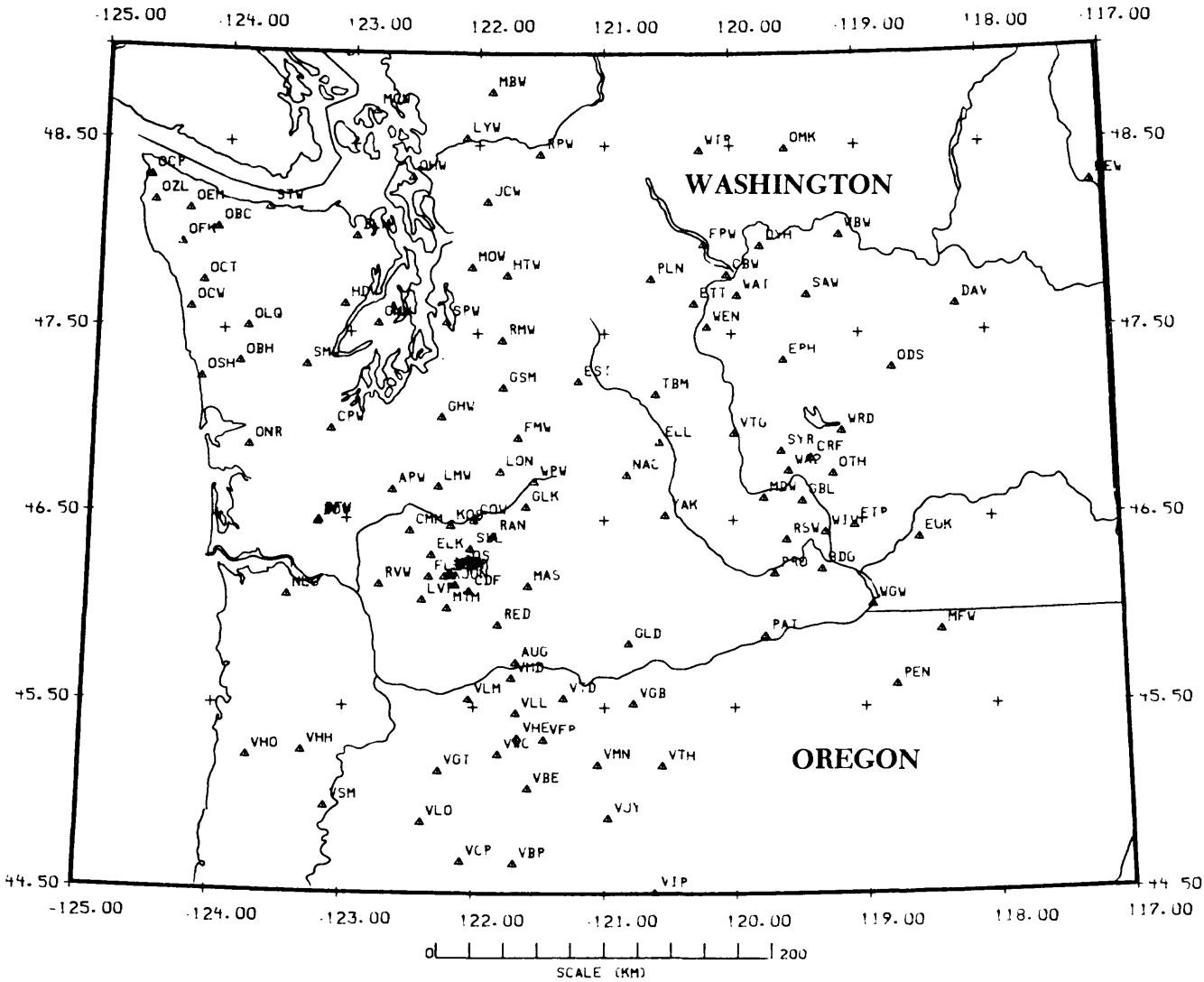

FIGURE 53.--Seismograph stations in Washington and northern Oregon during 1981.

WASHINGTON EARTHQUAKES, 1981

By L. L. Noson, R. S. Crosson, S. D. Malone,
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The University of Washington Geophysics Program monitored as many as 114 seismograph stations in Washington and northern Oregon during 1981 (fig. 53). Monitoring sites were concentrated about known areas of elevated seismicity with a smaller number of stations outside of these areas to provide regional coverage. The network in western Washington was most dense in the vicinity of Mount St. Helens. A less dense regional network was centered on Puget Sound with supplemental sites along the Cascades and in the Olympics. In eastern Washington stations were concentrated near Hanford and Lake Chelan. In northern Oregon one new station was installed late in 1981 to supplement Oregon stations telemetered to the University of Washington beginning in November 1980.

Minor improvements in station coverage and equipment quality were made during the year. Reductions in station sites in the Olympics and near Mount Hood reflected budget restrictions and resulted in decreased network sensitivity in those areas.

Data acquisition and processing has continued relatively unchanged from the procedures followed during the latter part of 1980 (Crosson and others, 1982). All stations received are recorded on a Digital Equipment Corporation PDP 11/34 using a recording system modeled after the Cal Tech CEDAR system (Johnson, 1979) with code modified for the University of Washington by Carl Johnson and Alex Bittenbinder. A subset of stations continue to be recorded on develocorder

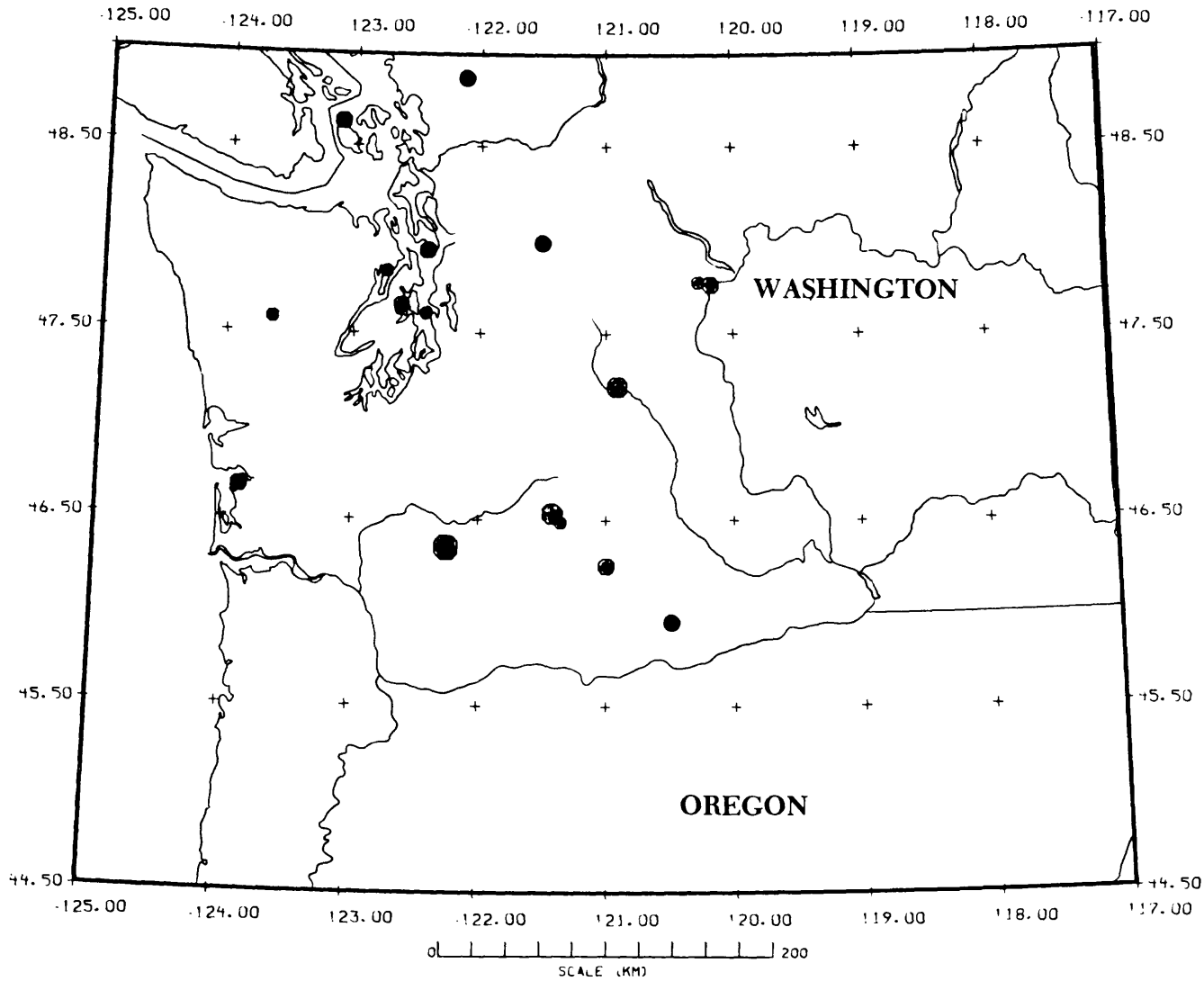

FIGURE 54.--Washington earthquake epicenters during 1981 with magnitudes greater than 2.7.

film and on helicorders. A PDP 11/70 is used for off-line processing of data recorded by the 11/34.

In 1981 an automated P-wave picker provided by the U. S. Geological Survey was installed. All incoming seismic signals are examined by a series of microprocessors which are programmed to recognize typical P-wave signals and report these 'picks' to a supervisor microprocessor. Preliminary epicenters can be computed in less than 5 minutes with the automated P-wave picker.

Approximately 2700 earthquakes were located within Washington and northern Oregon during 1981. Figure 54 is a plot of 1981 earthquakes with ML magnitudes greater than 2.7. Twenty-seven (71%) of these 38 earthquakes occurred in the Cascade Province. Seventeen of the south Cascades earthquakes were aftershocks of a ML = 5.5 event that occurred in the Elk Lake area 15 km northwest of Mount St. Helens on Feb. 14, 1981. It was felt over an area of 105,000 square kilometers and had a maximum intensity of VI. A zone 6 km north-south by 3 km east-west ranging from 5 to 12.5 km in depth was defined by aftershock sequence (Grant and others, 1983). This earthquake was the largest in Washington since the Mb = 6.5 Puget Sound earthquake of April 29, 1965.

In other parts of the Cascades, a ML = 4.0 earthquake occurred in the sparsley populated Toppenish Ridge area east of Mount Adams (Feb. 2), a ML = 4.2 earthquake rattled the Cle Elum area (Feb. 18), and a strong foreshock and main shock (Ml = 4.6 and ML = 5.0 respectively) in the Goat Rocks area southeast of Mount Rainier on May 28 were felt widely.

Compared to previous Washington and northern Oregon seismicity, 1980 and 1981 are notable for the strong increase in activity in the Cascade province. From 1980 to 1981 the distribution of that activity has shifted from concentrations of volcanic earthquakes associated with

strong eruptions of Mount St. Helens to more dispersed tectonic events within the Cascades. During the latter half of 1981, larger magnitude earthquakes in the Puget Sound region again became more frequent than comparable events in the Cascades. This may reflect a return to pre-1980 seismicity patterns.

Of the 2700 earthquakes located in 1981, 1633 (60%) were located in the vicinity of Mount St. Helens. Approximately 70% of those had ML magnitudes less than 1.0. Elsewhere in the state only 36% of located earthquakes had ML magnitudes less than 1.0. The preponderance of smaller magnitude events in the St. Helens area partly reflects the increased station density.

About 625 (23%) of earthquakes located in 1981 occurred in western Washington outside of the St. Helens area; another 244 (10%) occurred within the Cascade Range and the remaining 200 events (~7%) were located in eastern Washington. Eastern Washington earthquakes are characterized by a lower rate, smaller size, and shallower depth (University of Washington, 1982) than those in western Washington.

Miscellaneous Activities

CRUSTAL MOVEMENT STUDIES

Vertical Control Surveys

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Magnetic Error

Geodesists in the Federal Republic of Germany recently discovered that leveling instruments having automatic compensators may be subject to a tilt error. The error is greatest when leveling in the direction of the Earth's magnetic pole, and may amount to 2 mm per km leveled. In particular, the Zeiss Ni 1 was found to be very susceptible to the magnetic influence. Before the error had been discovered, the Ni 1 had been used by the National Geodetic Survey from 1972 to 1980. The Zeiss Company now states future compensators will be manufactured to be insensitive to magnetic fields. However, to determine vertical crustal movements from recent measurements made with the Ni 1 and similar automatic levels, it will be necessary to find a correction procedure which removes the magnetic error.

Each instrument has its own unique level of sensitivity, and therefore it is not appropriate to associate the same magnitude of correction with all instruments of a common manufacturer. Two different correction procedures are being developed. The first is a direct approach relying on a laboratory calibration of the instrument. The level is placed in an artificially induced magnetic field wherein two or more pairs of coils are used to create vectors having a variety of directions and intensities. The instrument's tilt response is recorded each time the induced vector is redirected. From the calibration data, it is possible to develop a correction to an observed height difference which has the following form:

$$Cm = kQ(I)\cos(A-D)S, \qquad (1)$$

k = constant determined by calibration
Q = function determined from recorded data
I = inclination (dip) of the Earth's magnetic vector
S = distance leveled
A = azimuth of the leveling, and
D = declination of the Earth's magnetic vector

The above correction can be applied to leveling data before crustal motions are calculated. However, frequently compensators are replaced or repaired during the life of an instrument. Usually it is only the last compensator that is available for calibration in the laboratory. Previous compensators must be calibrated by a second approach which involves simultaneous adjustment of both the spirit and automatic leveling observations to determine the magnetic error of the automatic levels. Here we assume that spirit levels are not subject to magnetic error. Observations which have already been corrected by use of calibration constants determined in the laboratory may substitute for spirit level observations.

In the adjustment, comparisons are made to arrive at the best estimates of kQ(I) of equation (1). The observation equation is:

$$\Delta h + v = H_2 - H_1 + kQ(I)\cos(A-D)S, \qquad (2)$$

where H_1 and H_2 are unknown heights, and v is the residual.

For a small country or region, we may assume Q(I) is just an unknown constant. For a large country we may assume that Q(I) is a known function. We could, for example, assume that over the range $25° < I < 50°$, $Q(I) = \cos(I)$. For small regions, we solve only for $k' = kQ(I)$, and for large areas we solve only for k.

Finding suitable data sets for calibrations by adjustment is critical to the success of the approach. A data set should be large, and the configuration of affected and unaffected observations should be appropriate for detecting and resolving the error. Selection of data should be restricted to observations which are unlikely to be affected by vertical crustal motion.

In 1983, the Vertical Network Branch established a calibration facility at the NGS Instrumentation and Equipment Section located in Corbin, Virginia, to calibrate level compensators. The first calibrations began in March 1983. The development of calibration techniques by adjustment methods is continuing under a high priority because of the impact the magnetic corrections will have on the redefinition of the heights in the North American Vertical Datum scheduled for completion in the mid 1980's, and on associated studies of recent crustal movements.

New Model for Vertical Crustal Motions

Precise leveling has traditionally been one of the most accurate geodetic measurements. Heights and regional patterns of secular motion have been determined by adjustments of networks of repeated levelings, but coseismic motions were frequently a complication to be avoided. However, recent refinements to the NGS adjustment model now allows simultaneous determination of both secular and coseismic vertical motions. The coseismic motion is modeled using dislocation theory. In addition to the leveling observations, the inputs for determination of coismic motion are the fault center, strike, dip, half-length, the upper and lower depths of the buried fault plane, and the date of earthquake. Strike slip and dip slip are solved for in the adjustment, and the vertical coseismic motion can then be calculated for any point in the study area.

Another new feature of the adjustment model is the possibility of dividing the study area into districts which are bounded by faults or change in crustal structure. Each district is allowed to flex individually with sharp discontinuities in secular motion permitted at boundaries.

The new adjustment software is now being used to model the vertical motion which occurred during the 1964 Alaskan earthquake, and to separate coseismic and secular motion near Puget Sound.

Imperial Valley Study

Vertical motions associated with the 1940 and 1979 Imperial Valley earthquakes were analyzed. It was found that the vertical motions associated with these earthquakes were very similar. Along a profile from El Centro to Holtville at about 32.8° N. latitude, the primary vertical motion associated with both earthquakes was a graben-like subsidence of about 20 cm in a zone a few kilometers wide east of the surface trace of the Imperial fault. Farther to the north the primary vertical motion associated with both earthquakes was subsidence of the fault block lying between the Imperial and Brawley faults.

Horizontal Control Surveys

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The National Geodetic Survey has produced a mathematical model of historical horizontal crustal deformation for the mainland California region south of the 33.5° N. parallel of latitude (fig. 55). Model parameters are estimated from triangulation, trilateration, and astronomic azimuth data observed during the past century. The model relates crustal deformation to the episodic movement experienced during large earthquakes (magnitude greater than 6), secular slip rates on geologic faults, and secular strain rates over large geographic areas. The episodic movement is modeled in accordance with the theory of dislocation in an elastic halfspace. For the secular motion the modeled region has been partitioned into a mosaic of districts that are allowed to individually translate, rotate, and homogeneously deform as a linear function of time. The modeled region is just one of 16 regions to be studied. Together these regions span California. The models serve to maintain the positional accuracy of the National Geodetic Reference System and to assist in the design of future crustal deformation monitoring programs.

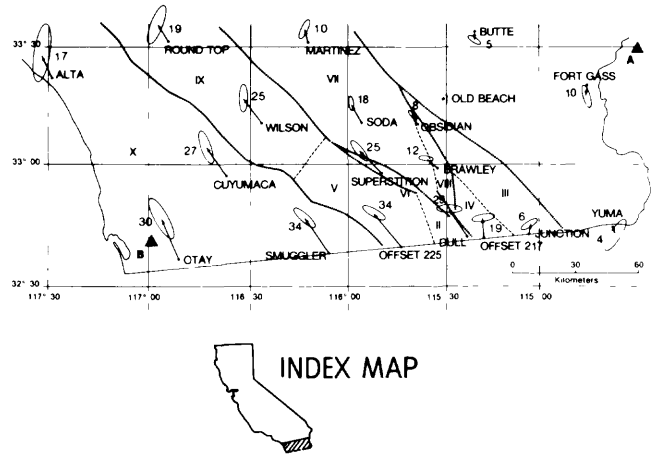

FIGURE 55.--A mathematical model of historical horizontal crustal deformation for California south of latitude 33.5° N.

In figure 55 the vectors represent secular velocities of selected geodetic stations in southern California. The velocities are relative to station OLD BEACH. Units are in mm/yr. Ellipses represent 1-sigma standard-error uncertainties. Roman numerals identify the districts which, according to the model, may individually translate, rotate, and deform homogeneously as a linear function of time. Note that district boundaries often correspond to major geologic faults. Consequently, the relative secular motion between two districts relates to secular slip across the bounding fault. The secular velocity of point B relative to point A is estimated to be 43 $\pm$ 31 mm/yr in the direction N17 $\pm$ 5°W. This value provides a rough estimate for the relative velocity between the Pacific and North American plates.

SPACE TECHNOLOGY

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Introduction

The Federal Program for the Application of Space Technology to Crustal Dynamics and Earthquake Research, initiated in 1980 by the National Oceanic and Atmospheric Administration (NOAA), the National Aeronautics and Space Administration (NASA), the U.S. Geological Survey (USGS), the National Science Foundation (NSF), and the Defense Mapping Agency (DMA), established the Interagency Coordinating Committee for Geodynamics (ICCG). In June 1982, the ICCG published a report entitled "Federal Implementation Plan for the Application of Space Technology to Crustal Dynamics and Earthquake Research" (Bossler, 1982). The plan details the basis, goals, and objectives of the Federal program, outlines the roles and responsibilities of each agency, reviews the status of the space measurement systems [including independent clock astronomical radio interferometry (VLBI), lunar laser ranging to the moon (LLR) and artificial satellites (SLR), and high precision radio observations of the Global Positioning System (GPS) satellites], and establishes specific milestones for 1982-88.

Observational Activities

The geodetic VLBI activities during 1982 were primarily associated with two projects: NOAA's project POLARIS, and the NASA's Crustal Dynamics Project. Under project POLARIS, the Harvard Radio Astronomy Station (HRAS)-Westford Observatory interferometer continued to operate on a schedule of one 24-hour observing session per week. Each session produced estimates of the X-component of polar motion with formal uncertainties of $\pm$ 5 to 10 cm, of UT1-UTC to $\pm$ 0.1 millisecond, and the baseline length to a few centimeters.

The NASA Goddard Space Flight Center and University of Texas continued to routinely produce polar motion and length-of-day values at 5-day intervals throughout 1982, from LAGEOS SLR data. Unfortunately, the change from the large telescope to a new small aperture dedicated LLR system at the McDonald Observatory suffered technical problems which resulted in a break in the LLR Earth rotation time series for the duration of 1982.

Only very limited observation programs were carried out during 1982 with the NASA/Jet Propulsion Laboratory mobile VLBI units, because the Crustal Dynamics Project priorities were on completing the observational system, MV3, and upgrading MV1 and MV2 by the installation of MARK III data acquisition systems. Some revisitations and initial epoch measurements were made at several National Crustal Motion Network (NCMN) stations during October and December observing sessions.

The NASA Crustal Dynamics Project continued to improve the performance of the existing SLR systems by introducing short pulse (subnanosecond) lasers, improved photomultipliers, discriminators, interval timers, and to bring the newer high mobility systems such as MLRS 1 and 2 to operational status. Initial epoch crustal motion observations were made at several NCMN stations in the western United States, and systems were deployed to French Polynesia and Easter Island.

Several efforts to develop geodetic GPS receivers progressed during 1982. The DMA, USGS, and NOAA jointly funded development of a "tri-agency" geodetic receiver, and NASA funded JPL to develop the SERIES receiver. In the private sector, the Macrometrics Corporation began marketing a geodetic GPS receiver. Limited field tests were successfully carried out, attaining decimeter or better agreement with existing geodetic surveys over distances of up to a few tens of kilometers. No problems have been identified that should prevent GPS systems from reaching the few centimeter, and perhaps even subcentimeter, levels as the technique matures.

Results

The most exciting result from the VLBI, SLR, and LLR observations concerns a global scale phenomenon, i.e., the discovery that even the fine structure (periods of weeks) of the changes in the length-of-day are highly correlated to variations in the atmospheric angular momentum. The improved temporal and spatial resolution of the new Earth rotation time series makes it quite clear that variations in length-of-day, and perhaps polar motion, are predominantly associated with atmospheric effects, which will have to be properly accounted for before pre- or post-seismic event signatures can be detected. While this may portend more complex and difficult analyses to extract information about earthquake mechanisms from the Earth rotation data, it does tend to explain past failures in this respect, and offers new hope for eventual success with this endeavor.

On an intercontinental scale, several VLBI measurements between observatories in the United States and the Onsala Space Observatory, Sweden, were made during 1982. The precision of these measurements is still a few centimeters, and the time span of the series of measurements is not yet long enough to reliably detect the expected level of motion, i.e., 1 to 2 cm per year.

More than 90 VLBI measurements of the HRAS-Westford baseline (Texas - Massachusetts) between August 1980 and the close of 1982, reveal no significant change in the length. A continuation of the series of measurements of the Haystack-Owens Valley Radio Observatory baseline (Massachusetts - California) showed similar results. Taken in concert, these measurements suggest that the contemporary large scale rate of distortion of the continental portion of the North American plate is probably less than 1 cm per year.

TSUNAMIS

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National Weather Service
Silver Spring, Maryland 20910

During 1981, three tsunamis were reported to the National Oceanic and Atmospheric Administration (NOAA).

The March 4 earthquake (mag. 6.4 MS) in Greece (38.2° N., 23.3° E.) generated a one meter tsunami that covered the coastal area between Corinth and Loutraki at the end of the Gulf of Corinth.

On May 11 a tsunami was reported at Knysna, Mossel Bay, and Port Elizabeth, South Africa. The actual cause of the tsunami is undetermined, but records show the source was located about 350 km southeast of the Cape of Good Hope. It measured 35 cm at Knysna.

The September 1, Samoa Islands earthquake (15.0° S., 173.1° W., mag. 7.7 MS) generated a tsunami measuring 24 cm at Pago Pago and 21 cm at Apia. Waves of undetermined height were also reported on the islands of Savaii and Manono.

PRINCIPAL EARTHQUAKES OF THE WORLD

Table 10 lists principal world earthquakes for 1981. The list has been included in this annual series since 1941. It includes earthquakes of magnitude 6.8 or greater; those of smaller magnitude that were locally destructive to life and property; and events of unusual interest. The principal source for table 10 is the Preliminary Determination of Epicenters, Monthly Listing.

Table 10.--*Principal earthquakes of the world during 1981*

Date (1981)	Origin time (UTC) hr min sec	Geographic Coordinates Lat. (°)	Long. (°)	Depth (km)	USGS Magnitude mb	MS	Other Magnitude	Region	Remarks
Jan. 18	18 27 24.4	38.640 N.	142.750 E.	33	6.1	6.9	6.6MS(B)	Honshu, Japan	Felt on northern Honshu. Tsunami recorded.
Jan. 19	15 11 01.0	4.576 S.	139.232 E.	33	6.0	6.7	6.7MS(B) 6.7mb(P) 6.8MS(P)	West Irian	Three hundred five killed, some injured and, about 1,000 missing.
Jan. 23	21 13 51.7	30.927 N.	101.098 E.	33	5.7	6.8	6.6MS(P)	Sichuan Province, China	One hundred fifty killed, 300 injured, and extensive damage in the Dawu area.
Jan. 23	21 54 41.6	29.682 S.	60.839 E.	10	6.1	6.8	7.0MS(P)	Southwest Indian Ridge	
Jan. 30	08 52 44.1	51.744 N.	176.274 E.	33	6.3	7.0	6.3mb(B) 7.1MS(B) 7.1ML(M)	Aleutian Islands, Alaska	Felt on Shemya Island.
Feb. 14	17 27 44.3	41.051 N.	14.601 E.	10	4.6		4.9ML(T)	Southern Italy	Four killed, 8 died from heart attacks, and damage reported.
Feb. 18	08 28 20.0	26.625 S.	26.607 E.	33	4.7			Republic of South Africa	Four miners killed in a mine near Orkney. Felt in the Klerksdorp area.
Feb. 24	20 53 38.4	38.222 N.	22.934 E.	33	5.9	6.7	6.7MS(B) 6.8MS(P)	Greece	Sixteen killed, more than 400 injured, and considerable damage in the Athen-Corinth area.
Feb. 25	02 35 53.3	38.125 N.	23.141 E.	33	5.6	6.4	6.4MS(P)	Greece	Casualities and damage.
Mar. 04	21 58 05.9	38.209 N.	23.288 E.	29	6.0	6.4	6.6MS(P) 6.2ML(A)	Greece	One died from a heart attack, 9 injured, and damage in the Athens-Corinth-Khalkis area. Tsunami recorded.
Mar. 07	11 34 43.9	38.186 N.	23.320 E.	33	5.5	4.8	5.7ML(A)	Greece	One killed and damage in the Athens area.
Mar. 10	15 16 19.8	39.481 N.	20.699 E.	31	5.6		5.2ML(A)	Greece	Two killed and 150 homes damaged in western Greece.
Apr. 18	00 32 39.8	13.144 S.	74.376 W.	38	5.3	4.8		Peru	Eight killed, 15 injured, and damage in the Ayacucho area.

Table 10.--*Principal earthquakes of the world during 1981*--Continued

Date (1981)	Origin time (UTC) hr min sec	Geographic Coordinates Lat. (°)	Long. (°)	Depth (km)	USGS Magnitude mb	MS	Other Magnitude	Region	Remarks
Apr. 24	21 50 06.0	13.426 S.	166.421 E.	33	6.1	6.9	7.3MS(B) 6.5MS(P) 6.8mb(P)	Vanuatu Islands	
May 25	05 25 14.4	48.786 S.	164.357 E.	33	6.1	7.6	7.6MS(B) 7.6MS(P)	South of New Zealand	Felt on South Island.
Jun. 11	07 24 25.2	29.913 N.	57.715 E.	33	6.1	6.7	6.9MS(B) 6.7MS(P)	Southern Iran	At least 3,000 killed, many injured, and extensive damage in Kerman Province.
Jun. 13	07 29 10.8	36.176 N.	67.827 E.	24	5.5	5.4		Afghanistan	One killed, 2 injured in Jozjan Province.
Jun. 22	17 53 21.3	13.166 S.	74.522 W.	24	5.1	5.2		Peru	Six killed, some injured, and damage in the Ayacucho area.
Jul. 06	03 08 24.1	22.293 S.	171.742 E.	33	6.9	7.0	7.0MS(B) 6.6MS(P)	Loyalty Islands Region	
Jul. 15	07 59 08.4	17.260 S.	167.601 E.	30	5.6	7.0	7.1MS(B) 6.9MS(P)	Vanuatu Islands	Minor damage in the Shepherd Islands area.
Jul. 28	17 22 24.6	30.013 N.	57.794 E.	33	5.7	7.1	7.3MS(B) 7.3MS(P)	Iran	Fifteen hundred killed, 1,000 injured, 50,000 homeless, and extensive damage in the Kerman region.
Aug. 13	02 58 11.9	44.849 N.	17.312 E.	16	5.4	5.5	5.8ML(T)	Yugoslavia	Forty-four injured and moderate damage in the Banja Luka area.
Sep. 01	09 29 31.5	14.960 S.	173.085 W.	25	7.0	7.7	7.9MS(B) 7.7MS(P)	Samoa Islands Region	Felt (VI) at Apia, Samoa Islands. Twenty-four cm tsunami at Pago Pago (also see DeRycke).
Sep. 12	07 15 54.1	35.693 N.	73.594 E.	33	6.2	5.9	6.0MS(P)	Northwestern Kashmir	At least 220 killed, 2,500 injured, and extensive damage and landslides in the Gilgit area.
Oct. 16	03 25 42.2	33.134 S.	73.074 W.	33	6.2	7.2	7.5MS(B) 7.2MS(P)	Off the coast of Central Chile	One killed in an auto accident. Felt throughout central Chile. Maximum intensity (VI) at Las Cruces and Vina del Mar.

Table 10.--*Principal earthquakes of the world during 1981*--Continued

Date (1981)	Origin time (UTC) hr min sec	Geographic Coordinates Lat. (°)	Long. (°)	Depth (km)	USGS Magnitude mb	MS	Other Magnitude	Region	Remarks
Oct. 18	04 31 02.7	8.117 N.	72.527 W.	54	5.4			Colombia	Fifteen killed, many injured, and extensive damage in the Cucuta, Colombia-San Cristobal, Venezuela area. Landslides reported.
Oct. 25	03 22 15.5	18.048 N.	102.084 W.	33	6.2	7.3	7.4MS(B) 7.2MS(P)	Guerrero, Mexico	Three killed, 28 injured, and damage in Mexico City and Michoacan State. Felt throughout southern Mexico.
Nov. 06	16 47 49.1	3.558 S.	143.790 E.	33	6.2	6.9	6.9MS(B) 6.5MS(P)	Near the coast of Papua New Guinea.	Minor damage (VI) in the Wewak area.
Nov. 07	03 29 51.0	32.199 S.	71.336 W.	65	6.2	6.8	6.5MS(B) 6.5MS(P)	Central Chile	Minor damage (VII) in the La Ligua-Valparaiso area.
Nov. 14	09 05 29.0	23.686 N.	32.604 E.	10	5.1	5.3		Arab Republic of Egypt	Moderate damage in Aswan, surface faulting reported.
Nov. 24	23 30 32.6	22.504 S.	170.635 E.	30	5.6	6.7	6.9MS(B) 6.6MS(P)	Loyalty Islands Region	
Dec. 12	20 26 46.9	29.856 N.	66.962 E.	33	4.6	4.0		Pakistan	Six killed, 12 injured, and moderate damage at Koshkak.
Dec. 19	14 10 50.7	39.243 N.	25.227 E.	10	6.2	7.2	7.5MS(B) 7.6MS(P)	Aegean Sea	Damage on Lesvos and Skiros Islands, Greece and in western Turkey.
Dec. 24	05 33 20.7	29.970 S.	177.610 W.	28	6.0	6.8	7.0MS(B) 6.6MS(P)	Kermadec Islands	
Dec. 26	17 05 32.5	29.934 S.	177.741 W.	33	6.1	7.1	6.6MS(P)	Kermadec Islands	

Strong Motion Seismograph Data

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INTRODUCTION

The first engineering seismology program in the United States was administered by the Seismological Field Survey of the Coast and Geodetic Survey (C&GS). This Program was begun in 1931 and effectively remained the responsibility of the Seismological Field Survey (SFS) for more than 40 years. During this period the SFS was shifted from one acronymic agency to another, including C&GS, ESSA, NOS, NOAA, ERL, ESL, and finally, in 1973, USGS; soon afterwards the SFS became the Seismic Engineering Branch of the USGS. In spite of these numerous high-level administrative changes, the Program has retained a distinct identity and its basic objectives and field-level operations have remained remarkably constant throughout the years.

The current program of strong-motion instrumentation administered by the USGS is supported by the National Science Foundation (Grant CA-114) in cooperation with both private industry and educational institutions, as well as numerous Federal, State and local agencies and organizations. The objectives of the program are to record strong ground motions and the response of representative types of engineered structures during potentially damaging earthquakes and to disseminate processed data and information about the records, sites, and structures to external users in earthquake engineering research and design practice and engineering seismology. The dissemination of this information and data is achieved in various ways.

Preliminary earthquake reports and a summary of recent accelerograph records are presented on a regular basis in Seismic Engineering Program Reports, a USGS Circular. These summaries include a brief description of the earthquake and strong-motion recording station, the results of routine scalings of those records that contain peak accelerations greater than 0.05 g, and photographic reproductions of many of the more significant accelerograms. The program reports also contain abstracts of recent reports, notes on strong-motion information sources and the availability of digitized data, and other information pertinent to the USGS and other strong-motion programs.

Strong-motion event and strong-motion data reports are periodically published as USGS Open-file Reports and include the results of digitization and routine analyses of strong-motion accelerograms that contain peak accelerations greater than 0.10 g or are related to a specific event, particular strong-motion station, or geographic group of stations. The minimum acceleration level is based primarily on the current capability of USGS to process strong-motion records and may vary with both the degree of seismic activity and number of personnel available at any given time. Although maximum acceleration is not directly related to frequency content or duration of strong-motion, the peak acceleration can be readily obtained from an accelerogram and thus the value is commonly used as a general indicator of the potential significance of the record. Detailed information on the availability of digitized data from various sources is published regularly in Seismic Engineering Program Reports.

The Strong-Motion Accelerograph Station List is periodically published as a USGS Open-file Report and includes information on all of the accelerograph stations in the western hemisphere known to the USGS. Because of the ever-changing nature of this information, it is impossible to have a complete list of all of the stations in existence at any one time. Rather, the list is intended to provide that community of persons interested in strong-motion programs with a reasonably complete indication of the current status of the various strong-motion networks. Information presented in this list includes the station name and geographic coordinates, site characteristics, type and size of structure, location of instruments, and the primary sources of data. The current list contains information on approximately 1350 stations located in the United States, Canada, the Caribbean, and throughout Central and South America (Switzer and others, 1981).

Descriptions of strong-motion accelerograph records and the circumstances in which they were recorded are available to anyone involved in earthquake engineering through the computer based Strong-Motion Information Retrieval System (SMIRS). The system provides ready access to information about strong-motion records and the level of processing and analysis that has been performed on them. Information about earthquakes that generated recorded motion and about the sites at which the motion was recorded is also provided. The information has been arranged into several data sets. The three major

data sets are the record descriptions, the earthquake descriptions, and the recording site descriptions. Supplementary data sets include instructions and information about the data base, information about the recording instruments, and identification of the recording instruments, and identification of organizations that own strong-motion instruments, that have additional information about the recording sites, or that archive the original or processed records.

Users may review the information free of charge with an ordinary phone line and a keyboard terminal. Instructions are available from the system so that a user needs to know only how to dial the computer and what to type to enter the retrieval system and begin using it. Once accessed the system will offer a general introduction and will tell the user how to request more detailed instructions; also, the user will be given an opportunity to request a copy of the printed User's Manual (Converse, 1978).

ACCELEROGRAPH DATA

Table 11 is a summary of the 124 records recovered from USGS strong-motion stations during 1981. This number is contrasted with a yearly average of 227 records for the period 1972 to 1980 inclusive. Additionally, many accelerograms were recovered in 1981 at stations operated by the California Division of Mines and Geology's Office of Strong-Motion Studies (OSMS). Recent state legislation has given responsibility to OSMS for the dissemination of that organization's strong-motion data, which are no longer routinely listed in Seismic Engineering Program Reports.

The earthquakes (table 11) are listed in chronological order and include date, time (UTC), general location, geographic coordinates, and magnitude. Information about the recording station consists of the name and location, owner, and geographic coordinates. Record data include S-wave minus trigger time and the orientation, maximum acceleration, and duration of strong-motion (greater than 0.10 g) for each instrument component. Record data are included only when one or a more components recorded at least 0.05 g at ground stations or 0.10 g at upper floors of buildings. The event information has been compiled principally from the Preliminary Determination of Epicenters, published by the Geological Survey.

The only significant strong-motion record set obtained from the USGS network in 1981 was recorded during a magnitude 5.6 earthquake on April 26 near Westmorland in the Imperial Valley, California. The earthquake triggered accelerographs at 22 USGS stations in the region; significant ground accelerations were recorded at the Brawley, Salton Sea, Parachute Test, and Superstition Mountain stations (figure 56, table 11). A summary of data from all USGS stations that includes epicentral distance, S-wave minus trigger time interval, absolute trigger time, peak acceleration, and other comments is available in Maley and Etheredge, 1981.

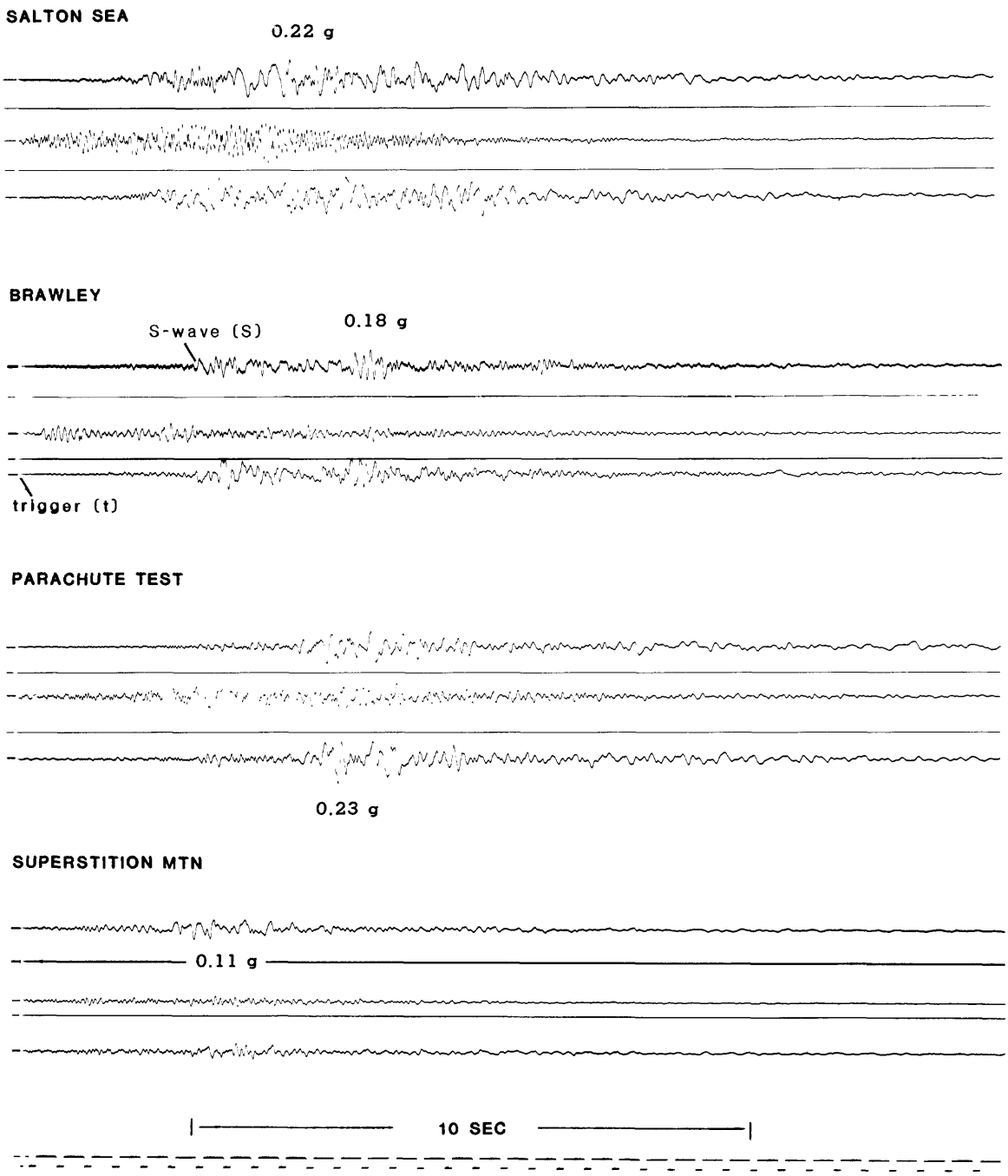

FIGURE 56.--Acceleration recordings greater than 0.10 g from Westmorland, California earthquake (from Maley and Etheredge, 1981).

Table 11.--*Summary of U. S. accelerograph records recovered during 1981*

Event	Station name (owner)[1]	Station coord.	S-t[2] (s)	Direction[3]	Max accl[4] (g)	Duration[5] (s)
14 February 1981 0609 UTC Washington 46.35N, 122.24W Magnitude 5.5	Mud Mountain Dam Crest (ACOE)	47.14° N 121.93° W	*		**	
28 September 1980- 5 March 1981 Hawaii Epicenters and magnitudes unknown	Honokaa, Hawaii Fire Station (USGS)	20.080° N 155.465° W	*		**	
	Note: Four additional records** recovered.					
	Hawaii Nat'l Park, HI Wahaula Util. Center (USGS)	19.329° N 155.031° W	*		**	
	Note: Two additional records** recovered.					
	Mauna Loa, Hawaii NOAA Observatory (USGS)	19.539° N 155.580° W	4.7	030° Up 300°	0.06 .05 .09	- - -
	Note: Two additional records** recovered.					
	Pahala, Hawaii Kau Hospital (USGS)	19.20° N 155.47° W	*	188° Up 098°	.03 .04 .07	- - -
	Note: One additional record** recovered.					
	Waiohinu, Hawaii Kau Baseyard (USGS)	19.070° N 155.615° W	*		**	
5 March 1981 1409 UTC Hawaii 21.02N, 156.99W Magnitude 5.5	Molokai Airport Fire Station (USGS)	21.158° N 157.096° W	2.9	150° Up 060°	.19 .07 .13	0.3 - 2-peaks
10 March 1981 2356 UTC Cent. California 36.86N, 121.67W Magnitude 3.4	Watsonville Array #1 Anzar Road (USGS)	36.885° N 121.589° W	*		**	
2 April 1981 1610 UTC Colorado 39.91N, 104.96W Magnitude 3.8	Denver Regency Inn Basement (USGS)	37.771° N 104.992° W	2.1		**	
26 April 1981 1209 UTC So. California 33.13N, 115.65W Magnitude 5.6	El Centro Station 1 Borchard Ranch (USGS)	32.960° N 115.319° W	2.0	230° Up 140°	0.05 .02 .06	- - -
	El Centro Station 2 Keystone Road (USGS)[+]	32.916° N 115.366° W	2.4		**	

Table 11.--*Summary of U. S. accelerograph records recovered during 1981*--Continued

Event	Station name (owner)[1]	Station coord.	S-t[2] (s)	Direction[3]	Max accl[4] (g)	Duration[5] (s)
	El Centro Station 3 Pine Union School (USGS)†	32.894° N 115.380° W	2.5		**	
	El Centro Station 4 Anderson Road (USGS)†	32.864° N 115.432° W	*		**	
	El Centro Station 5 James Road (USGS)	32.855° N 115.466° W	0.3	230° Up 140	.05 .02 .05	- - -
	El Centro Station 6 Huston Road (USGS)	32.839° N 115.487° W	3.2	230° Up 140°	.05 .03 .05	- - -
	El Centro Station 7 Imperial Valley Coll. (USGS)	32.829° N 115.504° W	*	230° Up 140°	.04 .02 .04	- - -
	El Centro Station 8 Cruickshank Road (USGS)†	32.811° N 115.532° W	1.3	230° Up 140°	.05 .06 .06	- - -
	El Centro Station 9 Commercial Avenue (USGS)† (film record)	32.794° N 115.549° W	2.8		**	
	El Centro Station 9 Commercial Avenue (USGS)† (paper record)	32.794 N 115.549 W	*		**	
	El Centro Station 10 Community Hospital (USGS)†	32.780° N 115.567° W	2.4		**	
	El Centro Station 11 McCabe School (USGS)†	32.752° N 115.594° W	1.8		**	
	El Centro Station 12 Brockman Road (USGS)†	32.718° N 115.637° W	4.2		**	
	El Centro Station 13 Strobel Residence (USGS)	32.709° N 115.683° W	2.9		**	
	El Centro Diff. Array Dogwood Road (USGS) (film record)	32.796° N 115.535° W	1.5	360° Up 270°	0.06 .02 .08	- - -
	Calexico Fire Station Fifth Street (USGS)	32.669° N 115.492° W	5.5		**	
	Holtville Post Office (USGS)	32.812° N 115.377° W	3.1		**	

Table II.--*Summary of U. S. accelerograph records recovered during 1981*--Continued

Event	Station name (owner)[1]	Station coord.	S-t[2] (s)	Direction[3]	Max accl[4] (g)	Duration[5] (s)
	Plaster City Storehouse (USGS)[+]	32.79° N 115.86° W	*		**	
	Salton Sea Wildlife Refuge (USGS)	33.18° N 115.62° W	2.3	315°	.19	5.5
				Up	.22	4.5
				225°	.20	6.2
	Note: Five pre-event** and five post-event records** recovered at Salton Sea Wildlife Refuge.					
	Brawley Municipal Airport (USGS)	32.988° N 115.509° W	3.0	315°	.17	0.6
				Up	.10	1-peak
				225°	.16	2.8
	Superstition Mtn. USN Camera Site (USGS)	32.955° N 115.823° W	2.1	135°	.11	2-peaks
				Up	.05	-
				045°	.08	-
	Parachute Test Site Imler Road (USGS)	32.93° N 115.70° W	3.1	315°	0.16	1.6
				Up	.13	3.9
				225°	.23	2.4
	Coachella Canal Station 1 (USGS)	33.64° N 116.08° W	7.5		**	
	Ocotillo Wells Burro Bend Cafe (USGS)	33.14° N 116.13° W	*		**	
	Borrego Air Ranch Borrego Springs (USGS)	33.19° N 116.28° W	*		**	
5 May 1981 2128 UTC Southern Alaska 61.66N, 149.66W Magnitude 4.4	Anchorage Westward Hotel (USGS)	61.220° N 149.892° W	*		**	
8 June 1981 0309 UTC Central California 36.75N, 121.36W Magnitude 4.2	Bear Valley Sta. 5 Callens Ranch (USGS)	37.673° N 121.195° W	*		**	
	Bear Valley Sta. 12 Williams Ranch (USGS)	36.658° N 121.249° W	3.5		**	
	Hollister City Hall Annex (USGS)	36.85° N 121.40° W	2.9		**	
28 January 1980-25 June 1981 Central California Epicenter and magnitude unknown	Hayward City Hall (CHY)	37.68° N 122.08° W	*			
	Sixth floor				**	
	Eleventh floor				**	

Table 11.--*Summary of U. S. accelerograph records recovered during 1981*--Continued

Event	Station name (owner)[1]	Station coord.	S-t[2] (s)	Direction[3]	Max accl[4] (g)	Duration[5] (s)
14 October 1980- 25 June 1981 Central California Epicenters and magnitudes unknown	Bear Valley Sta. 10 Webb Residence (USGS)	36.532° N 121.143° W	1.6		**	
	Note: Five additional records** recovered.					
26 June 1981 0143 UTC Central California 36.56N, 121.24W Magnitude 3.0	Bear Valley Sta. 10 Webb Residence (USGS)	36.532° N 121.143° W	1.6	310° Up 220°	0.07 .03 .05	- - -
2 July 1981 0923 UTC Central California Epicenter and magnitude unknown	Bear Valley Sta. 10 Webb Residence (USGS)	36.532° N 121.143° W	1.4		**	
25 July 1981 2148 UTC Central California 36.55°N, 121.07°W Magnitude 3.0	Bear Valley Sta. 14 Upper Butts Ranch (USGS)	36.569° N 121.043° W	*		**	
	Bear Valley Sta. 11 Wilkinson Ranch (USGS)	36.608° N 121.109° W	*		**	
11 February 1981- 28 July 1981 So. California Epicenters and magnitude unknown	Diemer Filter Plant (MWD)	33.91° N 117.82° W	0.3			
	Basement				**	
	Reservoir roof				**	
	Note: Two additional records** recovered at reservoir roof.					
14 August 1981 1249 UTC Central California 36.77N, 121.29W Magnitude 4.2	Bear Valley Sta. 12 Williams Ranch (USGS)	36.658° N 121.249° W	3.7		**	
2 February 1981- 1 September 1981 No. California Epicenters and magnitudes unknown	Palo Alto VA Hospital Building 1 (VA)	37.40° N 122.14° W				
	Basement				**	
	Roof				**	
	Note: Two each additional records** recovered at basement and roof.					
25 March 1981- 9 September 1981 Central California Epicenter and magnitude unknown	SAGO Central Harris Ranch (USGS)	36.76° N 121.45° W	*		**	

Table 11.--*Summary of U. S. accelerograph records recovered during 1981*--Continued

Event	Station name (owner)[1]	Station coord.	S-t[2] (s)	Direction[3]	Max accl[4] (g)	Duration[5] (s)
11 September 1981 0502 UTC SE Alaska 60.07N, 139.57W Magnitude 4.1	Bancas Point (USGS)	59.953° N 139.635° W	*	360° Up 270°	0.06 .02 .05	- - -
14 September 1981 0819 UTC Central California 36.66N, 121.33W Magnitude 3.1	Bear Valley Sta. 12 Williams Ranch (USGS)	36.658° N 121.249° W	1.9		**	
6 October 1980- 16 September 1981 Southern Hawaii Epicenters and magnitudes unknown	Mauna Kea, Hawaii State Park Center (USGS) Note: Three additional records** recovered.	19.752° N 155.530° W	*		**	
3 March 1981- 17 September 1981 Southern Hawaii Epicenters and magnitudes unknown	Hawaii Nat'l Park, HI Volcano Observatory (USGS)	19.423° N 155.291° W	*		**	
	Note: Two additonal records** recovered.					
	Hawaii Nat'l Park, HI Wahaula Util. Center (USGS)	19.329° N 155.031° W	1.2		**	
	Note: One additional record** recovered.					
	Mauna Loa, Hawaii NOAA Observatory (USGS)	19.539° N 155.580° W	2.1		**	
17 September 1981 0018 UTC SE Alaska 60.03N, 139.39W Magnitude 4.3	Bancas Point (USGS)	59.953° N 139.635° W	*	360° Up 270°	0.05 .01 .05	- - -
21 May 1981- 19 September 1981 Central Alaska Epicenters and magnitudes unknown	Anchorage New Federal Bldg. (USGS)	61.216° N 149.883° W	9.5			
	Basement				**	
	Anchorage Alaska Hospital (USGS)	61.21° N 149.82° W	*			
	Ground floor				**	
	Fourth floor				**	
	Seventh floor				**	

Table II.--*Summary of U. S. accelerograph records recovered during 1981*--Continued

Event	Station name (owner)[1]	Station coord.	S-t[2] (s)	Direction[3]	Max accl[4] (g)	Duration[5] (s)
	Anchorage Westward Hotel (USGS)	61.220° N 149.892° W	9.4			
	Basement				**	
	Roof				**	
	Note: Two each additional records** recovered at basement and roof.					
	Talkeetna FAA-VOR Bldg. (USGS)	62.30° N 150.10° W	*		**	
15 September 1981-27 September 1981 Central California Epicenter and magnitude unknown	Bear Valley Sta. 12 Williams Ranch (USGS)	36.658° N 121.249° W	1.9		**	
28 September 1981 0734 UTC Central California 36.79N, 121.59W Magnitude 3.9	Bear Valley Sta. 12 Williams Ranch (USGS)	36.658° N 121.249° W	3.8		**	
30 September 1981 1153 UTC Eastern California 37.59N, 118.89W Magnitude 5.9	Lake Success Dam (ACOE)	36.061° N 118.920° W	0.8			
	Downstream				**	
	Left abutment				**	
	Left crest				**	
	Right abutment				**	
	Right crest				**	
	Slope				**	
1 October 1981 1922 UTC Central California Epicenter and magnitude unknown	Bear Valley Sta. 10 Webb Residence (USGS)	36.532° N 121.143° W	1.6		**	
24 August 1979-6 October 1981 Central California Epicenter and magnitude unknown	San Francisco Transamerica Bldg. (TA)	37.795° N 122.401° W	*			
	Sub-basement				**	
	24th floor				**	

Table II.--*Summary of U. S. accelerograph records recovered during 1981*--Continued

Event	Station name (owner)[1]	Station coord.	S-t[2] (s)	Direction[3]	Max accl[4] (g)	Duration[5] (s)
	49th floor				**	
	58th floor				**	
	Note: One additional record** recovered at 58th floor.					
8 October 1981 2020 UTC Southern California Epicenter and magnitude unknown	Pinyon Flat Observ. (USGS)	33.61° N 116.46° W	*		**	
20 October 1981 1241 UTC Southern California 33.52N, 116.45W Magnitude 3.0	Pinyon Flat Observ. (USGS)	33.61° N 116.46° W	*		**	
22 September 1981- 27 October 1981 Central California Epicenter and magnitude unknown	Hollister City Hall Annex (USGS)	36.85° N 121.40° W	3.0		**	
10 June 1981- 10 December 1981 Central California Epicenter and magnitude unknown	Terminus Dam Crest (ACOE)	36.41° N 119.00° W	*		**	

[1] Station owner code:
ACOE - U.S. Army Corps of Engineers.
CHY - City of Hayward.
MWD - Metropolitan Water District of Southern California.
USGS - U.S. Geological Survey.
VA - Veterans Administration.
TA - Transamerica Building.
† - WWVB time code not legible or instrument not equipped with a radio receiver; correlation of accelerogram with event may be questionable.

[2] S-wave arrival minus trigger time (S - t) interval.
* S-t time is questionable or cannot be determined.

[3] Direction of case acceleration for upward trace deflection on accelerogram. Horizontal components are listed as azimuth in degrees clockwise from north. Vertical components are listed as "up" or "down."

[4] Peak acceleration recorded at ground level on one vertical and two orthogonal horizontal components unless otherwise noted.
** Denotes maximum acceleration is less than 0.05 g at ground level or less than 0.10 g at non ground-level stations.

[5] Duration between first and last peaks of acceleration greater than 0.10 g.

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