GEOLOGICAL SURVEY CIRCULAR 819–C

Earthquakes in the United States, July-September 1978

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1980

United States Department of the Interior

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Geological Survey

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INTRODUCTION

The earthquake information in this publication supplements that published in the NEIS (National Earthquake Information Service) publications, PDE ("Preliminary Determination of Epicenters") and "Preliminary Determination of Epicenters, Monthly Listing," to the extent of providing detailed felt and intensity data, as well as isoseismal maps for U.S. earthquakes. The purpose is to provide a complete listing of macroseismic effects of earthquakes, which can be used in risk studies, nuclear power plant site evaluations, seismicity studies, and answering inquiries by the public.

This publication contains two major sections. The first (table 1) is a tabular listing of earthquakes in chronological order by State, consisting of the following basic information: date, origin time, hypocenter, magnitude, maximum intensity, and computational source of the hypocenter. The second section consists of five maps, two photographs, and table 2, which lists detailed intensity information. The list of earthquakes in table 1 was compiled from those located in Alaska or off the coasts that were published in the PDE; from hypocenters located in the conterminous United States using the U.S. Geological Survey program SEDAS; from hypocenters in California above magnitude 3.0, supplied by California Institute of Technology, Pasadena, the University of California, Berkeley, and other offices of the U.S. Geological Survey; from hypocenters in Hawaii supplied by the Hawaiian Volcano Observatory; and from any others that were felt or that caused damage, regardless of magnitude or availability of a hypocenter. Known or suspected explosions are also listed.

The intensities and macroseismic data were compiled from information obtained through questionnaires, from newspaper articles, and with the cooperation of other Government agencies, State institutions, local organizations, and individuals. (See "Acknowledgments" for a list of collaborators.) Figure 1 is the questionnaire in current use by the NEIS. Other versions of this questionnaire are used by State agencies, engineering firms, and other Government agencies to collect intensity data. Anyone wishing to submit felt or damage information on earthquakes for inclusion in future reports should send it to the National Earthquake Information Service, Stop 967, Box 25046, Denver Federal Center, Denver, CO 80225. Copies of the current "Earthquake Report" questionnaire can be obtained at this address.

The primary method used by the NEIS to collect macroseismic information is a questionnaire canvass using the "Earthquake Report" forms, which are mailed to postmasters in the area affected by the earthquake. The postmasters complete the forms and return them to the NEIS, where they are evaluated and an intensity value is assigned. The intensity observations are mapped and contoured by isoseismals. Isoseismal contours present a generalization of intensity data and an extrapolation of these data to regions from which there are no observations; they do not necessarily account for every individual observation.

The data in table 2 will be included in the "Earthquake Description" section of "United States Earthquakes," an annual publication, to which later data from other sources may be added for the purpose of updating and completeness. "United States Earthquakes" is published jointly by the U.S. Geological Survey, Department of the Interior, and the Environmental Data Service, National Oceanic and Atmospheric Administration, Department of Commerce.

DISCUSSION OF TABLES

The parameters for the earthquakes in table 1 and table 2 include the date, origin time, hypocenter (epicenter and focal depth), magnitude, intensity, and hypocenter source. The origin time and date are listed in Universal

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EARTHQUAKE REPORT

Form Approved
OMB No. 42-R1700

Please answer this questionnaire and return as soon as possible

1. **Was an earthquake felt by anyone in your town near the date and time indicated on the opposite page?**
   ☐ No: Please refold and tape for return mail.
   ☐ Yes: Date_____ Time_____ ☐ AM ☐ PM ☐ Standard time ☐ Daylight time

Name of person filling out form _____

Address_____

City_____ County_____

State_____ Zip code_____

If you felt the earthquake, complete the following section. If others felt the earthquake but you did not, skip the personal report and complete the community report.

PERSONAL REPORT

2a. Did you personally feel the earthquake? 1☐ Yes ☐ No
b. Were you awakened by the earthquake? 2☐ Yes ☐ No
c. Were you frightened by the earthquake? 3☐ Yes ☐ No
d. Were you at 4☐ Home 5☐ Work 6☐ Other? _____
e. Town and zip code of your location at time of earthquake _____
f. Check your activity when the earthquake occurred:
   7☐ Walking 8☐ Sleeping 9☐ Lying down 10☐ Standing
   11☐ Driving (car in motion) 12☐ Sitting 13☐ Other_____
g. Were you 14☐ Inside or 15☐ Outside?
h. If inside, on what floor were you? 16 ____
i. Vibration could be described as 17☐ Light 18☐ Heavy
j. Was there earth noise? ☐ No 19☐ Faint 20☐ Moderate 21☐ Loud
k. Direction of noise ☐ North ☐ South ☐ East ☐ West
l. Estimated duration of shaking 22☐ Sudden, sharp (less than 10 secs) 23☐ Long (30-60 secs) 24☐ Short (10-30 secs)

Continue on to next section which should include personal as well as reported observations.

COMMUNITY REPORT

Town and zip code_____
DO NOT INCLUDE EFFECTS FROM OTHER COMMUNITIES/TOWNS
Check one box for each question that is applicable.

3a. The earthquake was felt by ☐ No one 25☐ Few 26☐ Several 27☐ Many 28☐ All?
b. This earthquake awakened ☐ No one 29☐ Few 30☐ Several 31☐ Many 32☐ All?
c. This earthquake frightened ☐ No one 33☐ Few 34☐ Several 35☐ Many 36☐ All?

4. What indoor physical effects were noted in your community?
   Windows, doors, dishes rattled 37☐ Yes ☐ No
   Buildings creaked 38☐ Yes ☐ No
   Building trembled (shook) 39☐ Slightly 40☐ Strongly
   Hanging pictures (more than one) 41☐ Swung 42☐ Out of place 43☐ Fallen
   Liquid in small containers 44☐ Spilled 45☐ Slightly disturbed
   Windows 46☐ Few cracked 47☐ Some broken 48☐ Many broken
   Were small objects (dishes, knick-knacks, lamps) ☐ Unmoved 49☐ Moved 50☐ Overturned 51☐ Broken?
   Were light furniture or small appliances ☐ Unmoved 52☐ Moved 53☐ Overturned 54☐ Damaged seriously
   Were heavy furniture or appliances ☐ Unmoved 55☐ Overturned 56☐ Moved 57☐ Damaged seriously
   Did hanging objects or doors swing? 58☐ Slightly 59☐ Moderately 60☐ Violently
   Can you estimate direction? ☐ North/South ☐ East/West ☐ Other_____
   Pendulum clocks 61☐ Stopped 62☐ Started 63☐ Faster or slower

Continued on the reverse side

FIGURE 1.--Example of the "Earthquake Report" form used for evaluating the intensities of earthquakes. A, front side.

5. Indicate effects of the following types to interior walls if any:

Plaster/stucco	64 ☐ Large cracks	65 ☐ Fell in large amounts
Dry wall	66 ☐ Large cracks	67 ☐ Fell in large amounts
Ceiling tiles	68 ☐ Large cracks	69 ☐ Fell in large amounts

6. What outdoor physical effects were noted in your community?

Trees and bushes shaken	70 ☐ Slightly	71 ☐ Moderately	72 ☐ Strongly
Standing vehicles rocked	73 ☐ Slightly	74 ☐ Moderately	
Moving vehicles rocked	75 ☐ Slightly	76 ☐ Moderately	
Water splashed onto sides of lakes, ponds, swimming pools	77 ☐ Yes	☐ No	
Elevated water tanks	78 ☐ Cracked	79 ☐ Twisted	80 ☐ Fallen (thrown down)
Industrial cooling units	81 ☐ Displaced	82 ☐ Rotated	83 ☐ Fallen
Tombstones	84 ☐ Displaced 87 ☐ Fallen	85 ☐ Cracked	86 ☐ Rotated
Chimneys	88 ☐ Bricks loosened 91 ☐ Broken at roof line	89 ☐ Twisted 92 ☐ Bricks fallen	90 ☐ Fallen
Railroad tracks bent	93 ☐ Slightly	94 ☐ Greatly	
Stone or brick fences /walls	95 ☐ Open cracks	96 ☐ Fallen	97 ☐ Destroyed
Underground pipes	98 ☐ Broken	99 ☐ Out of service	
Highways or streets	100 ☐ Large cracks	101 ☐ Large displacements	
Sidewalks	102 ☐ Large cracks	103 ☐ Large displacements	

7a. Check below any structural damage to buildings.

Foundation	104 ☐ Cracked	105 ☐ Destroyed	
Interior walls	106 ☐ Split 107 ☐ Fallen	108 ☐ Separated from ceiling or floor	
Exterior walls	109 ☐ Large Cracks	110 ☐ Bulged outward	
	111 ☐ Partial collapse	112 ☐ Total collapse	
Building	113 ☐ Moved on foundation	114 ☐ Shifted off foundation	

b. What type of construction was the building that showed this damage?

115 ☐ Wood 116 ☐ Stone 117 ☐ Brick veneer 118 ☐ Other _____
119 ☐ Brick 120 ☐ Cinderblock 121 ☐ Reinforced concrete 122 ☐ Mobile home

c. What was the type of ground under the building?

☐ Don't know 123 ☐ Sandy soil 124 ☐ Marshy 125 ☐ Fill
126 ☐ Hard rock 127 ☐ Clay soil 128 ☐ Sandstone, limestone, shale

d. Was the ground: 129 ☐ Level 130 ☐ Sloping 131 ☐ Steep?

e. Check the approximate age of the building:

132 ☐ Built before 1935 133 ☐ Built 1935-65 134 ☐ Built after 1965

8. Check below any structural damage to

Bridges/Overpasses	135 ☐ Concrete	136 ☐ Wood	137 ☐ Steel	138 ☐ Other_____
Damage was	139 ☐ Slight	140 ☐ Moderate		141 ☐ Severe
Dams	142 ☐ Concrete	143 ☐ Large earthen		
Damage was	144 ☐ Slight	145 ☐ Moderate		146 ☐ Severe

9. What geologic effects were noted in your community?

Ground cracks	147 ☐ Wet ground	148 ☐ Steep slopes	149 ☐ Dry and level ground
Landslides	150 ☐ Small	151 ☐ Large	
Slumping	152 ☐ River bank	153 ☐ Road fill	154 ☐ Land fill
Were springs or well water disturbed?		155 ☐ Level changed 157 ☐ Muddied	156 ☐ Flow disturbed ☐ Don't know
Were rivers or lakes changed?		158 ☐ Yes ☐ No	☐ Don't know

10a. What percentage of buildings were damaged?

Within 2 city blocks of your location	☐ None		159 ☐ Few (about 5%)
	160 ☐ Many(about 50%)		161 ☐ Most (about 75%)
b. In area covered by your zip code	☐ None		162 ☐ Few (about 5%)
	163 ☐ Many (about 50%)		164 ☐ Most (about 75%)

Thank you for your time and information. **Refold this card** and tape for return mail.

FIGURE 1.--Example of the "Earthquake Report" form used for evaluating the intensities of earthquakes. B, reverse side.

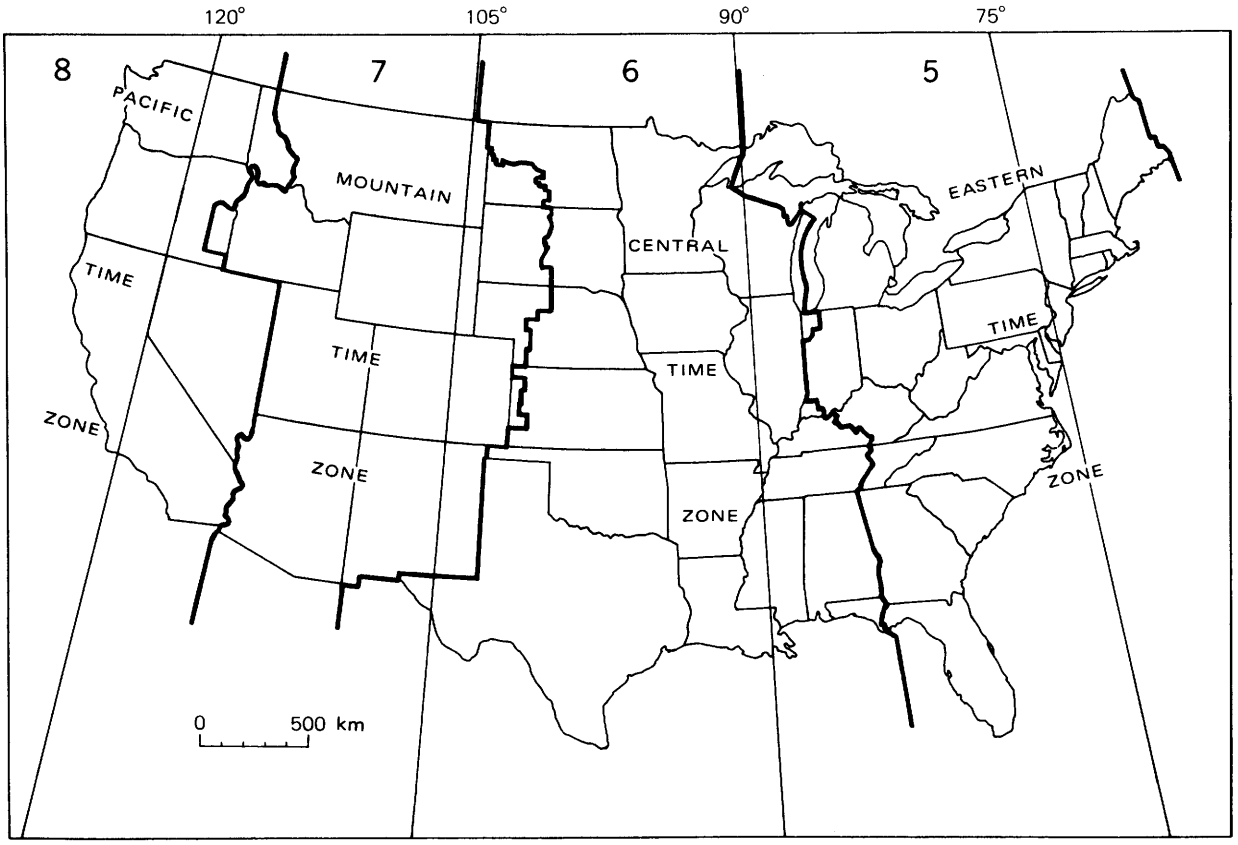

FIGURE 2.--Standard time zones of the conterminous United States. The number in each zone shows the number of hours to be subtracted from Universal Coordinated Time to convert to local standard time. (Subtract 1 hour less for local daylight-saving time.)

Coordinated Time (UTC) and local standard time based on the time-zone maps in figures 2 and 3. The epicenters, which were taken from those published in the PDE, or from other sources as noted, are listed here to two decimals. 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 NEIS have a varying degree of accuracy, usually two-tenths of a degree or less, depending on their continental or oceanic location. The oceanic hypocenters are less accurate than those on the continent, even though both are listed to two decimals. Depths are listed to the nearest whole kilometer.

Figures 4-6 are maps summarizing the earthquake activity for the conterminous United States, Alaska, and Hawaii for the period July-September 1978. The magnitudes plotted in these figures are based on ML or mbLg; if neither was computed, then on MS; and finally on mb, when it was the only magnitude computed.

The magnitude values listed in tables 1 and 2 were furnished by cooperating institutions or determined by the NEIS. The computational sources are labeled according to the assigned letter codes shown in headnotes to tables 1 and 2; the letter follows the value listed under the column heading "Magnitude." In table 1 the absence of a letter code indicates that the NEIS is the source. In table 2 the magnitude source is the same as the location source unless indicated otherwise, by an alphabetic character to the right of the magnitude value. The magnitude values calculated by the NEIS are based on the following formulas:

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

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 $20^\circ \leq D \leq 160^\circ$. No depth correction is made for depths less than 50 km.

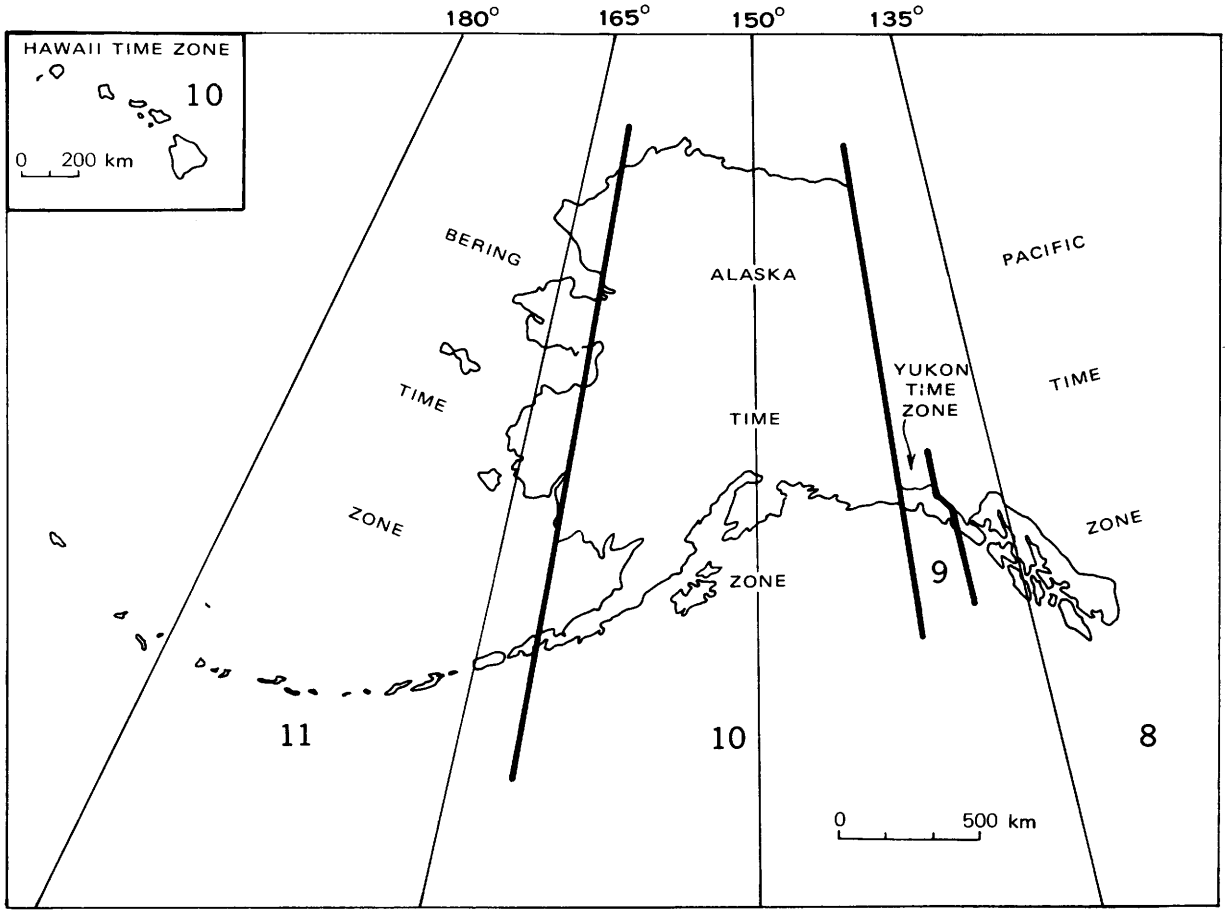

FIGURE 3.--Standard time zones of Alaska and Hawaii. The number in each zone shows the number of hours to be subtracted from Universal Coordinated Time to convert to local standard time. (Subtract 1 hour less for local daylight-saving time.)

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

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 $D \geq 5^\circ$.

$$ML=\log A-\log A_o, \qquad (3)$$

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_o is a standard value as a function of distance, where the distance is $\leq$600 km. ML values are also calculated from other seismometers by conversion of recorded ground motion to the expected response of the torsion seismometer.

$$mbLg=3.75+0.90(\log D)+\log(A/T) \qquad (4)$$
$$0.5^\circ \leq D \leq 4^\circ,$$

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

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.

All of the intensity values (indicated by Roman numerals) listed in this summary were derived, using the Modified Mercalli Intensity Scale of 1931 (Wood and Neumann, 1931) shown below, from the evaluation of "Earthquake Report" forms; from field reports by U.S. Geological Survey personnel, engineering firms, or universities; and from detailed macroseismic data communicated to the NEIS by people in the area affected by the earthquake. All earthquake reports received which contain minimal information are assigned

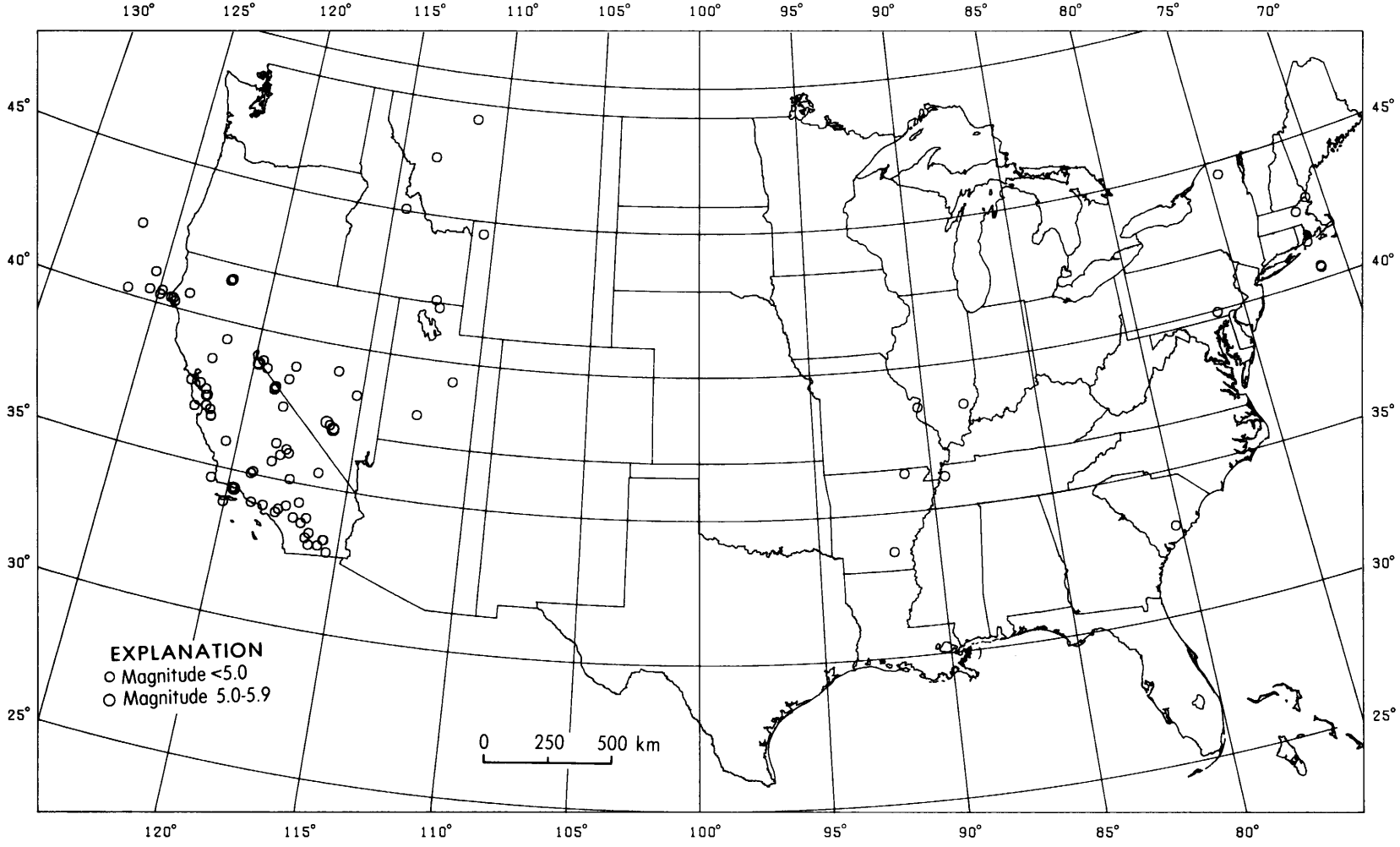

FIGURE 4.--Earthquake epicenters in the conterminous United States for July-September 1978, plotted from table 1.

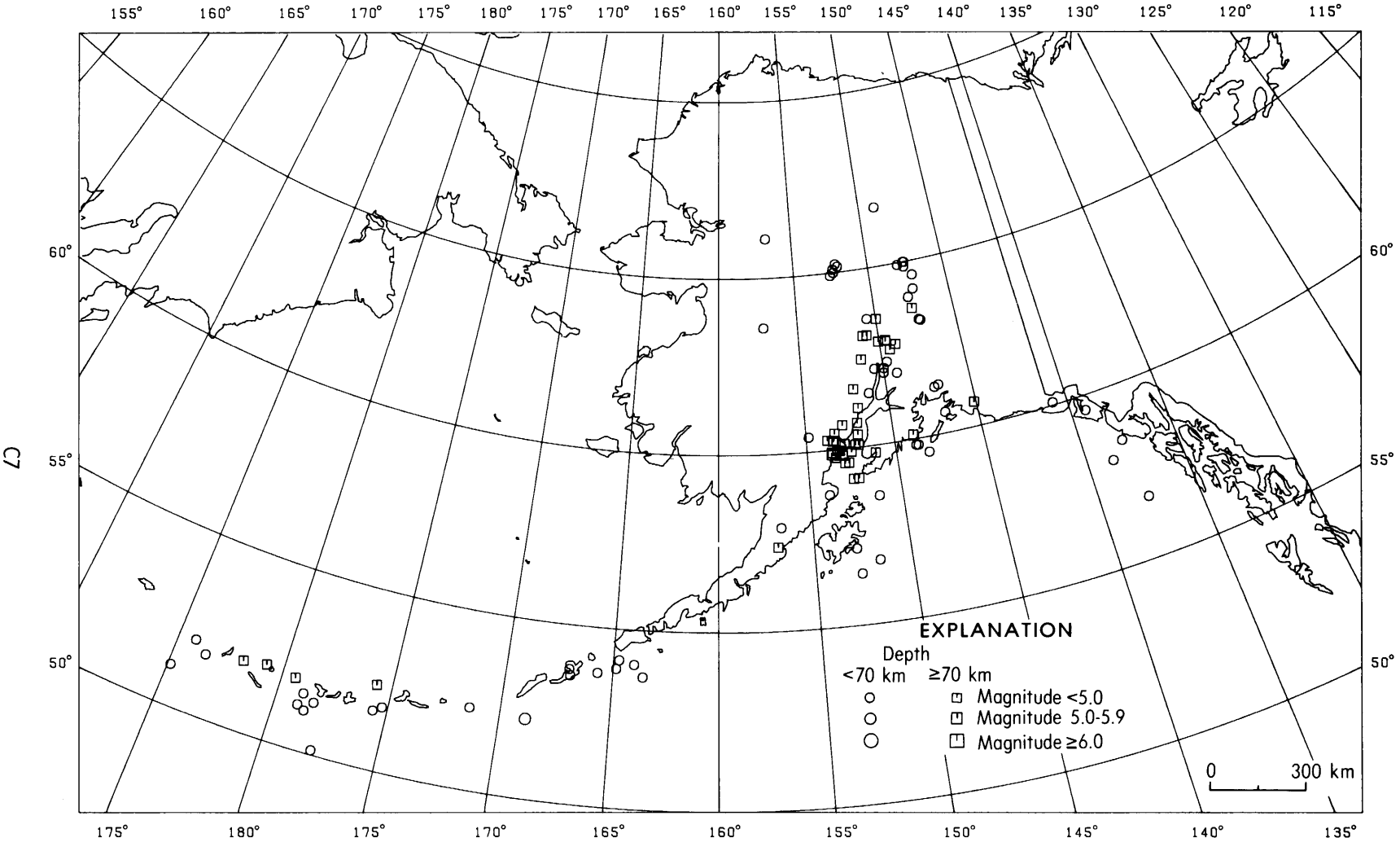

FIGURE 5.--Earthquake epicenters in Alaska for July-September 1978, plotted from table 1.

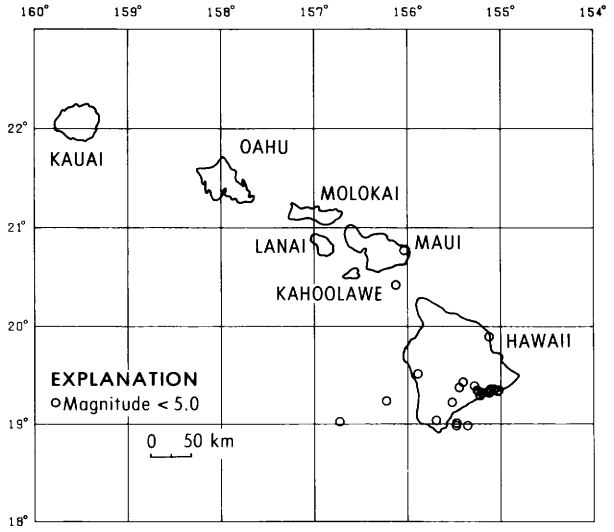

FIGURE 6.--Earthquake epicenters in Hawaii for July-September 1978, plotted from table 1.

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.

Table 1.--*Summary of U.S. earthquakes for July-September 1978*

[Sources of the hypocenters and magnitudes: (A) Geophysical Institute, University of Alaska, Fairbanks; (B) University of California, Berkeley; (D) University of Montana, Missoula; (E) U.S. Department of Energy, Las Vegas, Nevada; (G) U.S. Geological Survey, National Earthquake Information Service; (H) U.S. Geological Survey, Hawaiian Volcano Observatory; (J) Weston Observatory, Massachusetts; (K) Lee, W. H. K., and others, 1978; (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; (U) University of Utah, Salt Lake City; (V) Virginia Polytechnic Institute and State University, Blacksburg. N, Normal depth; UTC, Universal Coordinated Time. For names of local time zones, see figures 2 and 3. Leaders (...) indicate no information available]

Date (1978)	Origin time (UTC) hr	min	s	Lat	Long	Depth (km)	Magnitude mb	MS	ML or mbLg	Maximum intensity	Hypocenter source	Local time Date	Hour
ALASKA													
JULY 1	14	26	48.7	63.12 N.	150.71 W.	135	...	...	...	...	G	JULY 1	04 A.M. AST
JULY 8	06	27	46.6	51.26 N.	178.98 W.	67	4.9	...	...	...	G	JULY 7	07 P.M. BST
JULY 10	00	14	31.9	53.70 N.	163.60 W.	33N	4.9	4.3	...	...	G	JULY 9	01 P.M. BST
JULY 12	06	30	11.4	51.60 N.	178.85 W.	56	4.4	...	...	...	G	JULY 11	07 P.M. BST
JULY 12	18	53	35.8	56.70 N.	137.50 W.	38	4.1	...	...	...	G	JULY 12	10 A.M. PST
JULY 13	13	25	19.7	52.24 N.	168.82 W.	33N	5.8	5.6	...	...	G	JULY 13	02 A.M. BST
JULY 13	15	27	33.5	62.11 N.	149.95 W.	40	...	...	3.5M	II	G	JULY 13	05 A.M. AST
JULY 13	15	24	57.9	62.88 N.	149.61 W.	94	...	...	...	...	G	JULY 13	05 A.M. AST
JULY 15	08	50	30.6	63.53 N.	149.97 W.	125	...	...	...	...	G	JULY 14	10 P.M. AST
JULY 15	12	21	13.0	59.59 N.	152.67 W.	103	4.1	...	...	...	G	JULY 15	02 A.M. AST
JULY 16	05	03	02.3	63.57 N.	150.52 W.	31	...	...	3.5M	III	G	JULY 15	07 P.M. AST
JULY 16	19	28	10.8	62.89 N.	149.59 W.	95	...	...	...	...	G	JULY 16	09 A.M. AST
JULY 17	05	18	36.8	63.59 N.	157.13 W.	33N	...	...	4.3M	...	G	JULY 16	07 P.M. AST
JULY 18	21	18	40.7	61.98 N.	149.99 W.	33N	...	...	2.9M	...	G	JULY 18	11 A.M. AST
JULY 19	09	32	08.6	56.77 N.	151.65 W.	33N	5.7	5.5	4.9M	...	G	JULY 18	11 P.M. AST
JULY 19	18	53	32.4	57.17 N.	152.79 W.	33N	...	...	3.0M	II	G	JULY 19	08 A.M. AST
JULY 20	05	44	39.2	60.68 N.	152.83 W.	149	...	...	...	...	G	JULY 19	07 P.M. AST
JULY 20	18	15	08.7	51.13 N.	175.14 E.	33N	5.2	4.6	...	...	G	JULY 20	07 A.M. BST
JULY 20	20	02	41.5	51.15 N.	178.61 W.	68	3.9	...	...	...	G	JULY 20	09 A.M. BST
JULY 21	06	10	08.0	60.07 N.	152.02 W.	73	...	...	...	...	G	JULY 20	08 P.M. AST
JULY 21	09	41	38.8	60.25 N.	153.42 W.	188	...	...	...	...	G	JULY 20	11 P.M. AST
JULY 21	20	50	30.8	51.43 N.	178.29 W.	54	4.9	...	...	...	G	JULY 21	09 A.M. BST
JULY 23	00	24	54.4	52.01 N.	175.78 E.	61	4.4	...	...	...	G	JULY 22	01 P.M. BST
JULY 23	15	19	35.5	63.31 N.	147.26 W.	33N	5.0	...	4.8M	III	G	JULY 23	05 A.M. AST
JULY 23	17	03	27.9	63.29 N.	147.18 W.	33N	...	...	4.1A	...	G	JULY 23	07 A.M. AST
JULY 25	22	58	27.4	53.89 N.	164.86 W.	33N	4.7	...	...	...	G	JULY 25	11 A.M. BST
JULY 26	14	04	30.2	58.57 N.	151.23 W.	33N	...	...	3.3M	...	G	JULY 26	04 A.M. AST
JULY 26	19	42	45.3	62.75 N.	149.02 W.	89	...	...	...	...	G	JULY 26	09 A.M. AST
JULY 27	04	14	48.0	60.14 N.	152.81 W.	117	...	...	...	...	G	JULY 26	06 P.M. AST
JULY 27	06	31	21.3	59.58 N.	139.18 W.	33N	...	...	3.2M	...	G	JULY 26	09 P.M. YST
JULY 27	14	18	48.0	65.00 N.	147.60 W.	20	...	...	3.8A	IV	G	JULY 27	04 A.M. AST
JULY 27	15	51	42.2	64.85 N.	147.59 W.	10	...	...	3.6A	III	G	JULY 27	05 A.M. AST
JULY 27	17	11	21.1	64.93 N.	148.02 W.	10	...	...	3.7A	III	G	JULY 27	07 A.M. AST
JULY 29	16	31	15.4	50.13 N.	177.85 W.	33N	4.5	...	...	...	G	JULY 29	05 A.M. BST
JULY 31	09	45	55.4	62.45 N.	151.23 W.	86	...	...	...	...	G	JULY 30	11 P.M. AST
AUG. 2	10	12	12.5	51.65 N.	175.65 W.	49	4.8	...	...	...	G	AUG. 1	11 P.M. BST
AUG. 3	06	33	30.9	59.78 N.	151.15 W.	89	...	...	...	III	G	AUG. 2	08 P.M. AST
AUG. 3	07	59	36.8	58.45 N.	137.79 W.	33N	4.5	...	...	...	G	AUG. 2	11 P.M. PST
AUG. 4	02	07	33.0	62.14 N.	150.53 W.	33N	...	...	3.9A	...	G	AUG. 3	04 P.M. AST
AUG. 4	09	13	50.5	59.82 N.	148.69 W.	33N	4.4	...	4.3M	...	G	AUG. 3	11 P.M. AST
AUG. 5	23	19	39.2	60.68 N.	151.98 W.	105	...	...	...	...	G	AUG. 5	01 P.M. AST
AUG. 8	01	50	05.9	53.76 N.	167.07 W.	33N	4.3	...	...	...	G	AUG. 7	02 P.M. BST
AUG. 8	04	35	06.5	52.30 N.	171.41 W.	43	4.8	3.8	...	...	G	AUG. 7	05 P.M. BST
AUG. 8	05	39	04.5	62.90 N.	149.56 W.	106	...	...	...	...	G	AUG. 7	07 P.M. AST
AUG. 8	09	30	03.3	61.39 N.	146.91 W.	53	4.3	...	...	V	G	AUG. 7	11 P.M. AST
AUG. 9	03	16	04.0	59.83 N.	148.80 W.	33N	4.0	...	3.1M	...	G	AUG. 8	05 P.M. AST
AUG. 9	07	45	37.0	59.59 N.	152.89 W.	114	...	...	...	...	G	AUG. 8	09 P.M. AST
AUG. 10	14	01	32.3	60.41 N.	154.84 W.	33N	...	...	3.4M	...	G	AUG. 10	04 A.M. AST
AUG. 11	09	00	20.9	60.58 N.	146.86 W.	33N	...	...	3.1M	...	G	AUG. 10	11 P.M. AST
AUG. 13	00	49	41.0	62.28 N.	149.71 W.	65	4.1	...	...	IV	G	AUG. 12	02 P.M. AST
AUG. 13	20	57	37.5	60.68 N.	145.10 W.	102	...	...	...	...	G	AUG. 13	10 A.M. AST
AUG. 14	01	59	02.8	60.23 N.	153.47 W.	184	4.4	...	...	...	G	AUG. 13	03 P.M. AST
AUG. 16	12	11	48.9	66.10 N.	156.73 W.	33N	...	...	3.6M	...	G	AUG. 16	02 A.M. AST
AUG. 17	07	06	52.4	66.67 N.	148.84 W.	29	...	...	3.7M	...	G	AUG. 16	09 P.M. AST
AUG. 18	01	27	13.8	62.61 N.	149.39 W.	89	...	...	...	...	G	AUG. 17	03 P.M. AST
AUG. 18	18	52	28.4	59.89 N.	153.53 W.	123	5.4	...	...	VI	G	AUG. 18	08 A.M. AST
AUG. 19	03	58	55.4	56.44 N.	152.67 W.	26	4.6	...	4.1M	...	G	AUG. 18	05 P.M. AST
AUG. 19	19	55	26.0	62.88 N.	150.02 W.	139	...	...	...	...	G	AUG. 19	09 A.M. AST

Table 1.--*Summary of U.S. earthquakes for July-September 1978*--Continued

Date (1978)	Origin time (UTC) hr	min	s	Lat	Long	Depth (km)	Magnitude mb	MS	ML or mbLg	Maximum intensity	Hypocenter source	Local time Date	Hour
ALASKA--Continued													
AUG. 19	19	24	33.9	64.19 N.	147.29 W.	33N	...	...	3.5M	...	G	AUG. 19	09 A.M. AST
AUG. 19	21	28	25.3	59.97 N.	153.26 W.	136	4.3	...	...	...	G	AUG. 19	11 A.M. AST
AUG. 21	15	18	59.6	57.90 N.	156.64 W.	14	...	...	4.4M	...	G	AUG. 21	05 A.M. AST
AUG. 22	03	20	07.2	61.65 N.	151.96 W.	123	4.0	...	...	...	G	AUG. 21	05 P.M. AST
AUG. 22	04	13	55.3	65.16 N.	151.99 W.	14	...	...	4.0M	II	G	AUG. 21	06 P.M. AST
AUG. 22	09	53	24.2	65.23 N.	152.12 W.	17	...	...	3.8M	II	G	AUG. 21	11 P.M. AST
AUG. 22	10	12	02.8	64.92 N.	152.53 W.	1	...	...	3.8A	II	A	AUG. 22	00 A.M. AST
AUG. 22	10	29	08.0	64.99 N.	152.31 W.	1	...	...	3.4A	II	A	AUG. 22	00 A.M. AST
AUG. 23	20	59	05.7	51.74 N.	176.43 E.	54	5.4	4.8	...	...	G	AUG. 23	09 A.M. BST
AUG. 24	01	31	54.2	60.13 N.	148.90 W.	71	...	...	...	...	G	AUG. 23	03 P.M. AST
AUG. 25	02	53	25.9	53.60 N.	167.01 W.	49	4.9	...	...	...	G	AUG. 24	03 P.M. BST
AUG. 25	04	09	43.8	59.92 N.	153.54 W.	153	...	...	...	...	G	AUG. 24	06 P.M. AST
AUG. 25	05	56	50.5	54.14 N.	164.76 W.	64	4.8	...	...	...	G	AUG. 24	06 P.M. BST
AUG. 25	09	08	47.8	63.11 N.	150.94 W.	153	...	...	...	...	G	AUG. 24	11 P.M. AST
AUG. 26	13	44	31.2	65.08 N.	152.36 W.	33N	...	...	3.3A	II	G	AUG. 26	03 A.M. AST
AUG. 27	03	14	07.1	60.08 N.	140.81 W.	17	3.4	...	3.6M	...	G	AUG. 26	06 P.M. YST
AUG. 29	06	11	23.2	58.73 N.	153.92 W.	33N	...	...	3.1M	...	G	AUG. 28	08 P.M. AST
AUG. 29	23	06	41.9	60.27 N.	153.77 W.	212	...	...	...	...	G	AUG. 29	01 P.M. AST
SEPT. 1	10	19	51.6	57.99 N.	138.63 W.	33N	4.1	...	...	...	G	SEPT. 1	01 A.M. YST
SEPT. 1	17	38	52.3	59.76 N.	153.41 W.	139	4.2	...	...	...	G	SEPT. 1	07 A.M. AST
SEPT. 1	19	51	20.8	59.12 N.	152.52 W.	77	3.7	...	...	...	G	SEPT. 1	09 A.M. AST
SEPT. 3	06	27	05.4	64.58 N.	147.16 W.	11	...	...	3.9A	II	A	SEPT. 2	08 P.M. AST
SEPT. 3	18	53	07.5	53.75 N.	165.73 W.	33N	4.2	...	...	...	G	SEPT. 3	07 A.M. BST
SEPT. 4	16	05	38.5	59.56 N.	148.13 W.	52	3.6	...	...	...	G	SEPT. 4	06 A.M. AST
SEPT. 7	05	54	35.0	54.04 N.	164.02 W.	40	5.1	4.6	...	...	G	SEPT. 6	06 P.M. BST
SEPT. 9	07	08	20.3	60.08 N.	152.21 W.	103	...	...	...	...	G	SEPT. 8	09 P.M. AST
SEPT. 11	14	18	10.6	61.48 N.	151.05 W.	69	...	...	...	...	G	SEPT. 11	04 A.M. AST
SEPT. 12	08	52	29.3	51.94 N.	178.13 E.	143	4.8	...	...	...	G	SEPT. 11	09 P.M. BST
SEPT. 13	05	24	13.9	59.90 N.	152.46 W.	117	...	...	...	...	G	SEPT. 12	07 P.M. AST
SEPT. 13	15	06	42.9	60.36 N.	151.99 W.	106	...	...	...	...	G	SEPT. 13	05 A.M. AST
SEPT. 15	18	08	38.8	59.96 N.	153.11 W.	128	4.7	...	...	...	G	SEPT. 15	08 A.M. AST
SEPT. 16	11	06	53.6	52.38 N.	175.74 W.	167	4.2	...	...	...	G	SEPT. 16	00 A.M. BST
SEPT. 18	17	02	54.9	63.66 N.	147.59 W.	88	...	...	...	IV	G	SEPT. 18	07 A.M. AST
SEPT. 19	08	37	56.0	61.34 N.	147.18 W.	32	...	...	3.9M	III	G	SEPT. 18	10 P.M. AST
SEPT. 20	11	46	05.9	61.92 N.	149.23 W.	8	...	...	3.8M	IV	G	SEPT. 20	01 A.M. AST
SEPT. 21	14	45	19.6	61.11 N.	151.81 W.	81	4.5	...	...	IV	G	SEPT. 21	04 A.M. AST
SEPT. 22	08	00	21.9	51.94 N.	179.37 W.	90	4.5	...	...	...	G	SEPT. 21	09 P.M. BST
SEPT. 22	10	35	35.4	59.82 N.	152.99 W.	114	...	...	...	...	G	SEPT. 22	00 A.M. AST
SEPT. 22	18	14	29.2	60.46 N.	153.34 W.	186	...	...	...	...	G	SEPT. 22	08 A.M. AST
SEPT. 25	00	26	49.5	59.13 N.	152.22 W.	76	...	...	...	...	G	SEPT. 24	02 P.M. AST
SEPT. 25	09	37	01.9	51.79 N.	175.28 W.	62	4.6	...	...	II	G	SEPT. 24	10 P.M. BST
SEPT. 25	09	25	08.4	52.05 N.	179.18 E.	130	4.9	...	...	...	G	SEPT. 24	10 P.M. BST
SEPT. 26	16	08	18.6	64.99 N.	147.55 W.	27	3.7	...	3.9M	III	G	SEPT. 26	06 A.M. AST
SEPT. 28	22	41	33.8	57.36 N.	156.88 W.	115	4.2	...	...	...	G	SEPT. 28	12 P.M. AST
SEPT. 28	23	53	13.7	63.99 N.	147.71 W.	33N	4.4	...	4.5M	III	G	SEPT. 28	01 P.M. AST
ARKANSAS													
SEPT. 23	07	33	57.5	33.65 N.	91.89 W.	2	...	...	3.1S	IV	S	SEPT. 23	01 A.M. CST
SEPT. 23	21	56	26.3	36.31 N.	91.14 W.	10	...	...	2.8G	...	S	SEPT. 23	03 P.M. CST
CALIFORNIA													
JULY 2	11	57	57.0	36.90 N.	122.18 W.	10	...	...	4.2B	V	B	JULY 2	03 A.M. PST
JULY 5	10	47	55.6	33.88 N.	116.50 W.	1	...	...	3.8P	V	P	JULY 5	02 A.M. PST
JULY 7	20	05	26.9	36.90 N.	121.49 W.	10	...	...	3.0B	...	B	JULY 7	12 P.M. PST
JULY 10	02	55	25.4	35.85 N.	118.08 W.	5	...	...	3.0P	...	P	JULY 9	06 P.M. PST
JULY 10	09	02	27.4	33.38 N.	116.30 W.	5	...	...	3.0P	...	P	JULY 10	01 A.M. PST
JULY 11	10	14	55.0	40.23 N.	124.17 W.	20	...	...	3.2B	...	B	JULY 11	02 A.M. PST
JULY 11	19	05	48.2	35.02 N.	119.17 W.	5	...	...	3.2P	...	P	JULY 11	11 A.M. PST
JULY 12	12	17	03.2	33.23 N.	115.67 W.	5	...	...	3.0P	...	P	JULY 12	04 A.M. PST
JULY 15	07	24	42.1	40.32 N.	124.30 W.	17	...	...	3.1B	...	B	JULY 14	11 P.M. PST
JULY 17	14	46	13.5	35.50 N.	116.32 W.	5	...	...	4.0P	...	P	JULY 17	06 A.M. PST

Table 1.--*Summary of U.S. earthquakes for July-September 1978*--Continued

Date (1978)	Origin time (UTC) hr	min	s	Lat	Long	Depth (km)	Magnitude mb	MS	ML or mbLg	Maximum intensity	Hypocenter source	Local time Date	Hour
CALIFORNIA--Continued													
JULY 18	19	09	03.7	36.99 N.	121.67 W.	5	...	...	2.9B	IV	B	JULY 18	11 A.M. PST
JULY 20	23	25	57.3	35.97 N.	117.75 W.	5	...	...	3.1P	...	P	JULY 20	03 P.M. PST
JULY 21	13	24	41.9	34.05 N.	118.90 W.	13	...	...	3.0P	III	P	JULY 21	05 A.M. PST
JULY 23	07	25	33.4	34.60 N.	120.77 W.	5	...	...	3.0P	...	P	JULY 22	11 P.M. PST
JULY 23	07	33	35.6	39.40 N.	121.46 W.	5	...	...	3.3B	III	B	JULY 22	11 P.M. PST
JULY 23	14	38	42.4	35.93 N.	120.51 W.	12	...	...	3.2B	II	B	JULY 23	06 A.M. PST
JULY 26	00	38	53.6	34.35 N.	116.92 W.	6	...	...	3.8P	IV	P	JULY 25	04 P.M. PST
JULY 31	09	15	44.3	37.71 N.	122.14 W.	9	...	...	3.0B	IV	B	JULY 31	01 A.M. PST
AUG. 1	09	09	00.4	41.47 N.	121.86 W.	2	...	...	3.4B	...	B	AUG. 1	01 A.M. PST
AUG. 1	09	05	10.2	41.40 N.	121.91 W.	2	...	...	4.2B	...	B	AUG. 1	01 A.M. PST
AUG. 1	09	38	16.6	41.43 N.	121.89 W.	2	3.9	3.5	3.9B	...	B	AUG. 1	01 A.M. PST
AUG. 1	09	02	34.5	41.45 N.	121.88 W.	2	4.5	...	4.6B	V	B	AUG. 1	01 A.M. PST
AUG. 1	09	46	44.6	41.46 N.	121.87 W.	2	4.3	5.1	4.5B	...	B	AUG. 1	01 A.M. PST
AUG. 1	09	35	50.6	41.41 N.	121.91 W.	2	...	...	3.5B	...	B	AUG. 1	01 A.M. PST
AUG. 1	10	47	27.0	41.44 N.	121.88 W.	2	...	...	3.3B	...	B	AUG. 1	02 A.M. PST
AUG. 1	10	26	32.5	41.46 N.	121.87 W.	2	4.3	3.6	4.2B	...	B	AUG. 1	02 A.M. PST
AUG. 1	11	11	43.9	41.41 N.	121.91 W.	2	...	...	3.1B	...	B	AUG. 1	03 A.M. PST
AUG. 1	11	22	43.0	41.40 N.	121.92 W.	2	...	...	3.2B	...	B	AUG. 1	03 A.M. PST
AUG. 1	14	16	10.5	41.43 N.	121.89 W.	2	...	...	3.6B	...	B	AUG. 1	06 A.M. PST
AUG. 1	15	53	20.5	41.44 N.	121.89 W.	2	...	...	3.9B	...	B	AUG. 1	07 A.M. PST
AUG. 1	18	34	11.4	41.45 N.	121.86 W.	2	...	...	3.3B	...	B	AUG. 1	10 A.M. PST
AUG. 1	18	22	15.7	41.43 N.	121.89 W.	2	...	...	3.3B	...	B	AUG. 1	10 A.M. PST
AUG. 1	21	02	36.9	41.44 N.	121.88 W.	2	...	...	3.3B	...	B	AUG. 1	01 P.M. PST
AUG. 2	00	6	58.0	41.42 N.	121.90 W.	2	...	...	3.8B	...	B	AUG. 1	04 P.M. PST
AUG. 2	02	15	34.0	41.42 N.	121.89 W.	2	4.1	...	3.4B	...	B	AUG. 1	06 P.M. PST
AUG. 2	06	31	13.4	33.00 N.	115.85 W.	3	...	...	3.1P	...	P	AUG. 1	10 P.M. PST
AUG. 2	14	31	47.0	41.43 N.	121.89 W.	2	...	...	3.4B	...	B	AUG. 2	06 A.M. PST
AUG. 3	04	30	42.1	33.67 N.	116.70 W.	5	...	...	3.5P	IV	P	AUG. 2	08 P.M. PST
AUG. 3	21	11	39.3	36.22 N.	118.33 W.	5	...	...	3.2P	...	P	AUG. 3	01 P.M. PST
AUG. 4	05	18	52.9	41.44 N.	121.88 W.	2	...	...	3.5B	...	B	AUG. 3	09 P.M. PST
AUG. 8	18	02	29.1	36.22 N.	118.33 W.	5	...	...	3.0P	...	P	AUG. 8	10 A.M. PST
AUG. 11	00	47	30.1	34.15 N.	117.45 W.	4	...	...	4.0P	IV	P	AUG. 10	04 P.M. PST
AUG. 13	05	57	05.0	41.43 N.	121.89 W.	2	...	...	4.1B	...	B	AUG. 12	09 P.M. PST
AUG. 13	05	58	22.0	41.43 N.	121.89 W.	2	4.1	...	4.3B	...	B	AUG. 12	09 P.M. PST
AUG. 13	05	55	48.0	41.43 N.	121.89 W.	2	4.3	4.1	4.3B	IV	B	AUG. 12	09 P.M. PST
AUG. 13	06	21	32.0	41.44 N.	121.88 W.	2	...	...	3.3B	...	B	AUG. 12	10 P.M. PST
AUG. 13	07	03	18.1	41.48 N.	121.85 W.	2	3.7	...	3.3B	...	B	AUG. 12	11 P.M. PST
AUG. 13	22	54	52.4	34.37 N.	119.72 W.	12	5.5	5.6	5.1P	VII	K	AUG. 13	02 P.M. PST
AUG. 13	23	11	01.7	34.40 N.	119.76 W.	13	...	...	3.4P	II	K	AUG. 13	03 P.M. PST
AUG. 13	23	15	02.5	34.41 N.	119.77 W.	13	...	...	3.1P	II	K	AUG. 13	03 P.M. PST
AUG. 13	23	56	03.0	34.41 N.	119.80 W.	10	...	...	3.1K	...	K	AUG. 13	03 P.M. PST
AUG. 13	23	23	25.9	34.41 N.	119.78 W.	12	...	...	3.0K	...	K	AUG. 13	03 P.M. PST
AUG. 13	23	08	27.1	34.40 N.	119.78 W.	12	...	...	3.1K	...	K	AUG. 13	03 P.M. PST
AUG. 13	23	23	53.8	34.40 N.	119.74 W.	12	...	...	3.4P	II	K	AUG. 13	03 P.M. PST
AUG. 14	01	02	35.1	34.40 N.	119.72 W.	14	...	...	3.1P	II	K	AUG. 13	05 P.M. PST
AUG. 14	16	09	45.8	36.10 N.	117.87 W.	5	...	...	3.4P	...	P	AUG. 14	08 A.M. PST
AUG. 14	21	52	41.6	41.42 N.	121.90 W.	2	4.2	4.0	4.2B	...	B	AUG. 14	01 P.M. PST
AUG. 15	00	22	50.9	32.82 N.	115.47 W.	14	...	...	3.3P	...	P	AUG. 14	04 P.M. PST
AUG. 15	01	23	45.2	35.10 N.	119.08 W.	5	...	...	3.3P	...	P	AUG. 14	05 P.M. PST
AUG. 15	04	16	52.4	41.45 N.	121.88 W.	2	...	...	3.3B	...	B	AUG. 14	08 P.M. PST
AUG. 15	04	32	52.8	41.43 N.	121.89 W.	2	...	...	3.4B	...	B	AUG. 14	08 P.M. PST
AUG. 16	07	45	32.4	40.33 N.	124.39 W.	23	...	...	3.8B	IV	B	AUG. 15	11 P.M. PST
AUG. 16	13	35	11.6	34.41 N.	119.80 W.	11	...	...	3.5P	IV	P	AUG. 16	05 A.M. PST
AUG. 17	07	51	40.0	41.44 N.	121.89 W.	2	...	...	3.3B	...	B	AUG. 16	11 P.M. PST
AUG. 19	17	35	09.7	41.46 N.	121.86 W.	2	...	...	3.9B	...	B	AUG. 19	09 A.M. PST
AUG. 20	08	28	23.6	41.43 N.	121.89 W.	2	...	...	3.1B	...	B	AUG. 20	00 A.M. PST
AUG. 20	09	47	47.0	41.42 N.	121.90 W.	2	...	...	3.6B	...	B	AUG. 20	01 A.M. PST
AUG. 20	10	11	31.3	41.44 N.	121.89 W.	2	...	...	3.1B	...	B	AUG. 20	02 A.M. PST
AUG. 21	13	08	35.4	41.46 N.	121.86 W.	2	...	...	3.2B	...	B	AUG. 21	05 A.M. PST
AUG. 24	19	08	32.7	35.08 N.	117.50 W.	5	...	...	3.3P	...	P	AUG. 24	11 A.M. PST
AUG. 25	01	35	49.8	38.06 N.	118.89 W.	8	...	...	3.2B	...	B	AUG. 24	05 P.M. PST
AUG. 25	10	50	31.8	38.11 N.	118.92 W.	5	...	...	3.1B	...	G	AUG. 25	02 A.M. PST
AUG. 28	03	32	18.4	37.55 N.	121.86 W.	11	...	...	2.8B	IV	B	AUG. 27	07 P.M. PST
AUG. 28	19	07	27.3	38.16 N.	118.87 W.	5	...	...	3.2B	...	G	AUG. 28	11 A.M. PST
AUG. 29	00	18	45.3	37.35 N.	121.72 W.	7	...	...	3.8B	IV	B	AUG. 28	04 P.M. PST

Table 1.--*Summary of U.S. earthquakes for July-September 1978*--Continued

Date (1978)	Origin time (UTC) hr	min	s	Lat	Long	Depth (km)	Magnitude mb	MS	ML or mbLg	Maximum intensity	Hypocenter source	Local time Date	Hour
CALIFORNIA--Continued													
AUG. 29	00	14	46.4	37.36 N.	121.72 W.	8	...	...	4.1B	VI	B	AUG. 28	04 P.M. PST
AUG. 29	06	04	49.8	34.38 N.	119.77 W.	5	...	...	2.8P	II	P	AUG. 28	10 P.M. PST
AUG. 29	10	51	46.0	34.38 N.	119.80 W.	5	...	...	2.5P	II	P	AUG. 29	02 A.M. PST
AUG. 29	15	43	46.5	33.18 N.	116.42 W.	5	...	...	3.2P	...	P	AUG. 29	07 A.M. PST
AUG. 30	02	26	40.2	33.22 N.	115.65 W.	4	...	...	3.0P	...	P	AUG. 29	06 P.M. PST
AUG. 31	00	6	55.9	38.05 N.	118.90 W.	5	...	...	3.0B	...	G	AUG. 30	04 P.M. PST
SEPT. 1	09	31	25.4	37.34 N.	121.78 W.	8	...	...	3.3B	II	B	SEPT. 1	01 A.M. PST
SEPT. 3	11	25	53.7	38.82 N.	119.80 W.	20	...	...	3.1B	...	B	SEPT. 3	03 A.M. PST
SEPT. 3	18	10	46.5	33.99 N.	117.72 W.	6	...	...	3.8P	IV	P	SEPT. 3	10 A.M. PST
SEPT. 4	04	52	32.3	38.82 N.	119.81 W.	18	3.9	...	4.6B	V	B	SEPT. 3	08 P.M. PST
SEPT. 4	04	59	55.6	38.82 N.	119.83 W.	14	...	...	3.2B	...	B	SEPT. 3	08 P.M. PST
SEPT. 4	12	00	57.9	38.82 N.	119.81 W.	20	...	...	3.0B	...	B	SEPT. 4	04 A.M. PST
SEPT. 4	21	05	18.3	35.57 N.	118.40 W.	4	...	...	3.0P	...	P	SEPT. 4	01 P.M. PST
SEPT. 4	21	54	53.2	38.81 N.	119.82 W.	19	4.7	...	5.3B	VI	B	SEPT. 4	01 P.M. PST
SEPT. 4	22	37	26.0	38.81 N.	119.82 W.	14	...	...	3.1B	...	B	SEPT. 4	02 P.M. PST
SEPT. 4	22	03	35.5	38.81 N.	119.82 W.	16	...	...	4.1B	...	B	SEPT. 4	02 P.M. PST
SEPT. 4	22	11	53.3	38.82 N.	119.83 W.	13	...	...	3.0B	...	B	SEPT. 4	02 P.M. PST
SEPT. 8	16	59	47.8	38.64 N.	121.91 W.	17	4.4	...	4.2B	V	B	SEPT. 8	08 A.M. PST
SEPT. 11	11	00	30.3	38.81 N.	119.84 W.	16	...	...	3.1B	...	B	SEPT. 11	03 A.M. PST
SEPT. 12	11	57	55.4	34.38 N.	119.77 W.	6	...	...	3.6P	V	P	SEPT. 12	03 A.M. PST
SEPT. 17	15	08	02.3	36.67 N.	121.36 W.	8	...	...	3.0B	...	B	SEPT. 17	07 A.M. PST
SEPT. 17	15	06	05.0	36.68 N.	121.37 W.	7	...	...	3.3B	...	B	SEPT. 17	07 A.M. PST
SEPT. 17	15	38	33.1	36.68 N.	121.36 W.	6	...	...	3.9B	IV	B	SEPT. 17	07 A.M. PST
SEPT. 17	16	00	26.2	36.67 N.	121.36 W.	6	...	...	3.8B	...	B	SEPT. 17	08 A.M. PST
SEPT. 19	15	52	41.5	37.73 N.	122.56 W.	8	...	...	2.9B	II	B	SEPT. 19	07 A.M. PST
SEPT. 20	09	53	24.3	37.54 N.	118.37 W.	3	...	...	3.7B	...	B	SEPT. 20	01 A.M. PST
SEPT. 21	03	18	57.1	36.99 N.	121.68 W.	8	...	...	2.9B	III	B	SEPT. 20	07 P.M. PST
SEPT. 22	03	26	19.8	40.63 N.	123.63 W.	20	3.7	...	3.7B	III	B	SEPT. 21	07 P.M. PST
SEPT. 22	03	13	26.8	33.87 N.	117.83 W.	4	...	...	2.9P	II	P	SEPT. 21	07 P.M. PST
SEPT. 24	02	04	27.5	34.38 N.	119.73 W.	4	...	...	3.6P	IV	P	SEPT. 23	06 P.M. PST
SEPT. 26	05	35	03.9	34.03 N.	118.40 W.	6	...	...	2.1P	II	P	SEPT. 25	09 P.M. PST
SEPT. 28	23	13	53.4	32.97 N.	116.25 W.	5	...	...	3.8P	...	P	SEPT. 28	03 P.M. PST
SEPT. 29	13	49	32.8	33.80 N.	117.07 W.	6	...	...	2.9P	...	P	SEPT. 29	05 A.M. PST
CALIFORNIA--OFF THE COAST													
JULY 3	08	15	04.0	33.87 N.	120.08 W.	5	...	...	3.2P	...	P	JULY 3	00 A.M. PST
JULY 11	06	53	05.2	40.33 N.	124.94 W.	10	4.1	...	3.8B	...	B	JULY 10	10 P.M. PST
AUG. 3	00	45	30.4	40.26 N.	126.41 W.	15	4.0	...	3.5B	...	G	AUG. 2	04 P.M. PST
AUG. 20	18	42	04.3	40.48 N.	124.86 W.	20	...	...	3.3B	...	B	AUG. 20	10 A.M. PST
SEPT. 10	01	09	35.8	40.41 N.	125.44 W.	5	...	...	4.0B	...	B	SEPT. 9	05 P.M. PST
SEPT. 25	02	10	51.0	41.06 N.	125.38 W.	5	4.6	4.3	4.6B	...	B	SEPT. 24	06 P.M. PST
HAWAII													
JULY 1	19	18	13.3	19.32 N.	155.12 W.	7	...	...	3.9H	IV	H	JULY 1	09 A.M. HST
JULY 4	07	05	16.3	19.35 N.	155.08 W.	9	...	...	3.0H	III	H	JULY 3	09 P.M. HST
JULY 7	21	31	21.5	19.03 N.	156.72 W.	26	...	...	3.3H	...	H	JULY 7	11 A.M. HST
JULY 9	23	07	56.9	19.37 N.	155.10 W.	9	...	...	3.1H	III	H	JULY 9	01 P.M. HST
JULY 14	12	56	37.2	19.35 N.	155.25 W.	10	...	...	3.2H	III	H	JULY 14	02 A.M. HST
JULY 16	18	29	41.8	19.35 N.	155.02 W.	8	...	...	3.3H	IV	H	JULY 16	08 A.M. HST
AUG. 6	06	00	23.4	19.43 N.	155.40 W.	10	...	...	3.0H	...	H	AUG. 5	08 P.M. HST
AUG. 9	07	10	10.3	19.30 N.	155.22 W.	10	...	...	3.4H	III	H	AUG. 8	09 P.M. HST
AUG. 12	01	08	51.4	20.77 N.	156.03 W	16	...	...	3.1H	...	H	AUG. 11	03 P.M. HST
AUG. 12	10	52	50.5	19.33 N.	155.11 W.	10	...	...	3.1H	IV	H	AUG. 12	00 A.M. HST
AUG. 18	14	32	42.0	19.23 N.	155.52 W.	31	...	...	3.4H	...	H	AUG. 18	04 A.M. HST
AUG. 23	21	48	53.1	19.33 N.	155.13 W.	8	...	...	3.1H	...	H	AUG. 23	11 A.M. HST
AUG. 29	21	44	08.9	19.32 N.	155.20 W.	10	...	...	3.1H	II	H	AUG. 29	11 A.M. HST
AUG. 30	22	40	15.7	19.34 N.	155.03 W.	7	...	...	3.1H	III	H	AUG. 30	12 P.M. HST
AUG. 31	23	07	21.4	19.01 N.	155.48 W.	35	4.5	...	4.0H	IV	H	AUG. 31	01 P.M. HST
SEPT. 1	00	14	53.5	18.99 N.	155.48 W.	37	...	...	3.0H	...	H	AUG. 31	02 P.M. HST
SEPT. 3	14	26	10.5	19.32 N.	155.20 W.	9	...	...	3.0H	III	H	SEPT. 3	04 A.M. HST
SEPT. 5	06	14	44.1	19.32 N.	155.14 W.	9	...	...	3.1H	...	H	SEPT. 4	08 P.M. HST
SEPT. 5	16	18	18.2	19.32 N.	155.13 W.	10	...	...	3.2H	...	H	SEPT. 5	06 A.M. HST
SEPT. 5	20	26	46.8	19.33 N.	155.23 W.	10	...	...	3.7H	IV	H	SEPT. 5	10 A.M. HST

Table 1.--*Summary of U.S. earthquakes for July-September 1978*--Continued

Date (1978)	Origin time (UTC) hr	min	s	Lat	Long	Depth (km)	Magnitude mb	MS	ML or mbLg	Maximum intensity	Hypocenter source	Local time Date	Hour
HAWAII--Continued													
SEPT. 7	14	42	54.3	19.24 N.	156.22 W.	8	...	...	3.2H	...	H	SEPT. 7	04 A.M. HST
SEPT. 7	21	37	46.0	19.37 N.	155.07 W.	7	...	...	3.2H	...	H	SEPT. 7	11 A.M. HST
SEPT. 11	11	21	57.6	18.99 N.	155.35 W.	50	...	...	3.6H	...	H	SEPT. 11	01 A.M. HST
SEPT. 12	06	16	06.1	19.33 N.	155.11 W.	10	...	...	4.1H	IV	H	SEPT. 11	08 P.M. HST
SEPT. 15	17	15	55.7	20.43 N.	156.12 W.	17	...	...	3.0H	...	H	SEPT. 15	07 A.M. HST
SEPT. 19	09	44	29.2	19.39 N.	155.28 W.	4	...	...	3.2H	III	H	SEPT. 18	11 P.M. HST
SEPT. 19	18	43	44.1	19.04 N.	155.69 W.	43	...	...	3.2H	...	H	SEPT. 19	08 A.M. HST
SEPT. 20	01	41	08.7	19.44 N.	155.40 W.	9	...	...	3.3H	IV	H	SEPT. 19	03 P.M. HST
SEPT. 20	23	20	27.0	19.52 N.	155.88 W.	9	...	...	3.1H	IV	H	SEPT. 20	01 P.M. HST
SEPT. 21	12	15	12.6	19.89 N.	155.12 W	43	...	...	3.1H	...	H	SEPT. 21	02 A.M. HST
SEPT. 24	02	35	48.7	17.20 N.	153.83 W.	7	...	...	3.9H	...	H	SEPT. 23	04 P.M. HST
SEPT. 26	06	02	33.4	18.99 N.	155.35 W.	39	...	...	3.0H	...	H	SEPT. 25	08 P.M. HST
SEPT. 30	23	56	13.3	19.38 N.	155.45 W.	9	...	...	3.2H	IV	H	SEPT. 30	01 P.M. HST
IDAHO													
JULY 19	04	17	30.6	45.09 N.	114.42 W.	5	...	...	3.6G	...	G	JULY 18	08 P.M. PST
SEPT. 28	08	58	20.7	42.10 N.	112.33 W.	5	...	...	2.7G	IV	G	SEPT. 28	01 A.M. MST
ILLINOIS													
AUG. 29	07	05	50.3	38.53 N.	88.22 W.	17	...	...	2.4S	II	S	AUG. 29	01 A.M. CST
MASSACHUSETTS													
SEPT. 1	03	33	43.6	42.48 N.	71.46 W.	0	...	...	2.0J	III	J	AUG. 31	10 P.M. EST
MISSOURI													
SEPT. 20	12	24	08.8	38.57 N.	90.28 W.	2	...	...	3.1S	V	S	SEPT. 20	06 A.M. CST
MONTANA													
AUG. 30	16	33	21.2	48.49 N.	111.48 W.	5	...	...	3.1B	...	B	AUG. 30	09 A.M. MST
SEPT. 14	03	30	46.6	46.99 N.	113.31 W.	5	...	...	3.0D	...	G	SEPT. 13	08 P.M. MST
NEVADA													
JULY 6	22	21	22.0	39.11 N.	116.22 W.	10	...	...	3.8G	IV	G	JULY 6	02 P.M. PST
JULY 7	13	59	59.3	37.10 N.	116.01 W.	2	4.0	...	4.3B	...	G	JULY 7	05 A.M. PST
JULY 12	14	54	45.1	38.51 N.	118.33 W.	5	...	...	3.3B	...	G	JULY 12	06 A.M. PST
JULY 12	17	00	00.1	37.08 N.	116.04 W.	0	5.5	4.1	5.4B	...	E	JULY 12	09 A.M. PST
JULY 29	22	32	07.1	38.40 N.	115.24 W.	5	3.9	...	4.2G	II	G	JULY 29	02 P.M. PST
JULY 30	01	32	23.2	38.72 N.	119.39 W.	5	...	...	3.0B	...	G	JULY 29	05 P.M. PST
AUG. 31	14	00	00.2	37.28 N.	116.36 W.	0	5.6	...	5.5B	...	E	AUG. 31	06 A.M. PST
SEPT. 5	22	28	50.3	38.98 N.	118.16 W.	5	...	...	3.6B	...	G	SEPT. 5	02 P.M. PST
SEPT. 13	15	15	00.2	37.21 N.	116.21 W.	0	4.6	...	4.6B	...	E	SEPT. 13	07 A.M. PST
SEPT. 22	19	38	13.0	38.95 N.	119.64 W.	5	...	...	3.2B	...	B	SEPT. 22	11 A.M. PST
SEPT. 27	17	00	00.0	37.08 N.	116.05 W.	0	5.0	...	5.0B	...	E	SEPT. 27	09 A.M. PST
SEPT. 27	17	20	00.0	37.07 N.	116.02 W.	0	5.7	4.1	5.5B	...	E	SEPT. 27	09 A.M. PST
NEW HAMPSHIRE													
AUG. 25	20	01	30.5	42.87 N.	70.83 W.	0	...	...	2.3J	III	J	AUG. 25	03 P.M. EST
NEW YORK													
JULY 26	04	17	08.7	40.40 N.	71.11 W.	0	...	...	2.8J	...	J	JULY 25	11 P.M. EST
AUG. 10	21	12	11.6	40.46 N.	71.13 W.	29	...	...	3.5J	...	J	AUG. 10	04 P.M. EST
AUG. 21	08	47	10.9	44.52 N.	74.51 W.	1	...	...	3.1L	...	L	AUG. 21	03 A.M. EST

Table 1.--*Summary of U.S. earthquakes for July-September 1978*--Continued

Date (1978)	Origin time (UTC) hr	min	s	Lat	Long	Depth (km)	Magnitude mb	MS	ML or mbLg	Maximum intensity	Hypocenter source	Local time Date	Hour
OREGON--OFF THE COAST													
JULY 9	23	50	05.5	42.54 N.	126.63 W.	15	4.0	...	...	...	G	JULY 9	03 P.M. PST
PENNSYLVANIA													
JULY 16	06	39	37.8	39.92 N.	76.26 W.	5	...	...	2.9V	V	V	JULY 16	01 A.M. EST
RHODE ISLAND													
SEPT. 3	12	41	14.4	41.36 N.	71.37 W.	0	...	...	2.8J	...	J	SEPT. 3	07 A.M. EST
SOUTH CAROLINA													
SEPT. 7	22	53	22.3	33.07 N.	80.22 W.	11	...	...	2.7G	IV	G	SEPT. 7	05 P.M. EST
TENNESSEE													
AUG. 31	00	31	00.3	36.09 N.	89.42 W.	4	...	...	3.5S	V	S	AUG. 30	06 P.M. CST
UTAH													
JULY 29	14	04	03.2	41.85 N.	112.13 W.	7	...	...	3.1U	IV	U	JULY 29	07 A.M. MST
AUG. 30	15	34	38.8	38.03 N.	112.49 W.	7	...	...	2.9U	...	U	AUG. 30	08 A.M. MST
SEPT. 23	08	20	06.6	39.32 N.	111.09 W.	2	...	...	3.0U	...	U	SEPT. 23	01 A.M. MST
WYOMING													
JULY 15	08	26		YELLOWSTONE NAT. PARK .			...	...	...	IV	.	JULY 15	01 A.M. MST
JULY 21	10	01		YELLOWSTONE NAT. PARK .			...	...	...	IV	.	JULY 21	03 A.M. MST
AUG. 21	12	14		YELLOWSTONE NAT. PARK .			...	...	...	III	.	AUG. 21	05 A.M. MST
AUG. 21	13	14		YELLOWSTONE NAT. PARK .			...	...	...	III	.	AUG. 21	06 A.M. MST
SEPT. 15	13	45	44.8	44.56 N.	110.49 W.	5	...	...	2.5G	IV	G	SEPT. 15	06 A.M. MST

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*

[Sources of the hypocenters and magnitudes: (A) Geophysical Institute, University of Alaska, Fairbanks; (B) University of California, Berkeley; (E) U.S. Department of Energy, Las Vegas, Nevada; (G) U.S. Geological Survey, National Earthquake Information Service; (H) U.S. Geological Survey, Hawaiian Volcano Observatory; (J) Weston Observatory, Massachusetts; (K) Lee, W. H. K., and others, 1978; (M) National Oceanic and Atmospheric Administration, Alaska Tsunami Warning Center, Palmer; (O) Earth Physics Branch, Ottawa, Canada; (P) California Institute of Technology, Pasadena; (S) St. Louis University, St. Louis, Missouri; (U) University of Utah, Salt Lake City; (V) Virginia Polytechnic Institute and State University, Blacksburg; (W) University of Washington, Seattle. Dates and origin times are listed in Universal Coordinated Time (UTC) giving the hour, minute, and second. Epicenters are shown in decimal degrees. Only earthquakes with intensity data and explosions are listed]

Alaska

13 July (G) Southern Alaska
- Origin time: 15 27 33.5
- Epicenter: 62.11 N., 149.95 W.
- Depth: 40 km
- Magnitude: 3.5 ML(M)
- Intensity II: Palmer (M).

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

Alaska--Continued

16 July (G) Central Alaska
- Origin time: 05 03 02.3
- Epicenter: 63.57 N., 150.52 W.
- Depth: 31 km
- Magnitude: 3.5 ML(M)
- Intensity III: McKinley Park (M).

19 July (G) Kodiak Island region
- Origin time: 18 53 32.4
- Epicenter: 57.17 N., 152.79 W.
- Depth: Normal.
- Magnitude: 3.0 ML(M)
- Intensity II: Chugiak (M), Eagle River (M), Susitna Flats--15 km north of Anchorage (A).

23 July (G) Central Alaska
- Origin time: 15 19 35.5
- Epicenter: 63.31 N., 147.26 W.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

Alaska--Continued

Depth: Normal.
Magnitude: 5.0 mb, 4.8 ML(M)
Intensity III: Throughout central Alaska (M).

27 July (G) Central Alaska
Origin time: 14 18 48.0
Epicenter: 65.00 N., 147.60 W.
Depth: 20 km
Magnitude: 3.8 ML(A)
Intensity IV: Fairbanks.

27 July (G) Central Alaska
Origin time: 15 51 42.2
Epicenter: 64.85 N., 147.59 W.
Depth: 10 km
Magnitude: 3.6 ML(A)
Intensity III: Fairbanks (press report).

27 July (G) Central Alaska
Origin time: 17 11 21.1
Epicenter: 64.93 N., 148.02 W.
Depth: 10 km
Magnitude: 3.7 ML(A)
Intensity III: Fairbanks (press report).

3 August (G) Kenai Peninsula
Origin time: 06 33 30.9
Epicenter: 59.78 N., 151.15 W.
Depth: 89 km
Magnitude: None computed.
Intensity III: Homer (M).

8 August (G) Southern Alaska
Origin time: 09 30 03.3
Epicenter: 61.39 N., 146.91 W.
Depth: 53 km
Magnitude: 5.3 mb
Intensity V: Palmer (few windows cracked).
Intensity IV: Delta Junction, Glennallen, Valdez, Whittier.
Intensity III: Anchorage (M), Girdwood.
Intensity II: Chugiak.

13 August (G) Southern Alaska
Origin time: 00 49 41.0
Epicenter: 62.28 N., 149.71 W.
Depth: 65 km
Magnitude: 4.1 mb
Intensity IV: Anchorage, Chugiak, Skwentna.
Intensity III: Big Lake (M), Palmer (M), Wasilla (M).

18 August (G) Southern Alaska
Origin time: 18 52 28.4
Epicenter: 59.89 N., 153.53 W.
Depth: 123 km

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

Alaska--Continued

Magnitude: 5.4 mb, 5.7 mb(B)
Intensity VI: Clam Gulch (cracked plasterboard, hairline cracks in exterior cinderblock walls, small objects shifted).
Intensity V: Sterling.
Intensity IV: Anchorage, Chugiak, Cooper Landing, Eagle River, Girdwood, Homer, Kenai, Larsen Bay, Moose Pass, Port Lions, Seldovia, Skwentna, Tyonek, Whittier.
Intensity III: Cordova (M), Healey (M), King Salmon (M), Kodiak (M), Soldotna, Spenard, Willow.
Intensity II: Fairbanks (M), Nikishka.

22 August (G) Central Alaska
Origin time: 04 13 55.3
Epicenter: 65.16 N., 151.99 W.
Depth: 14 km
Magnitude: 4.0 ML(M)
Intensity II: Tanana (M).

22 August (G) Central Alaska
Origin time: 09 53 24.2
Epicenter: 65.23 N., 152.12 W.
Depth: 17 km
Magnitude: 3.8 ML(M)
Intensity II: Tanana (M).

22 August (A) Central Alaska
Origin time: 10 12 02.8
Epicenter: 64.92 N., 152.53 W.
Depth: 1 km
Magnitude: 3.8 ML(A)
Intensity II: Tanana.

22 August (A) Central Alaska
Origin time: 10 29 08.0
Epicenter: 64.99 N., 152.31 W.
Depth: 1 km
Magnitude: 3.4 ML(A)
Intensity II: Tanana.

26 August (G) Central Alaska
Origin time: 13 44 31.2
Epicenter: 65.08 N., 152.36 W.
Depth: Normal.
Magnitude: 3.3 ML(A)
Intensity II: Tanana (M).

3 September (A) Central Alaska
Origin time: 06 27 05.4
Epicenter: 64.58 N., 147.16 W.
Depth: 11 km
Magnitude: 3.9 ML
Intensity II: Eielson AFB (A), Fairbanks (A).

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

Alaska--Continued

18 September (G) Central Alaska
Origin time: 17 02 54.9
Epicenter: 63.66 N., 147.59 W.
Depth: 88 km
Magnitude: None computed.
Intensity IV: Cantwell, Usibelli.
Intensity II: Talkeetna (A), Willow (A).

19 September (G) Southern Alaska
Origin time: 08 37 56.0
Epicenter: 61.34 N., 147.18 W.
Depth: 32 km
Magnitude: 3.9 ML(M)
Intensity III: Anchorage to Valdez (A).
Intensity II: Gakona, Valdez.

20 September (G) Southern Alaska
Origin time: 11 46 05.9
Epicenter: 61.92 N., 149.23 W.
Depth: 8 km
Magnitude: 3.8 ML(M)
Intensity IV: Girdwood, Palmer, Sutton.
Intensity II: Anchorage (M), Independence Mine area (M), Skwentna.

21 September (G) Southern Alaska
Origin time: 14 45 19.6
Epicenter: 61.11 N., 151.81 W.
Depth: 81 km
Magnitude: 4.5 mb
Intensity IV: Anchorage (M), Eagle River (M), Girdwood, Kenai, Palmer, Soldotna, Sterling.
Intensity II: Sutton.

25 September (G) Andreanof Islands, Aleutian Islands
Origin time: 09 37 01.9
Epicenter: 51.79 N., 175.28 W.
Depth: 62 km
Magnitude: 4.6 mb
Intensity II: Adak (telephone report).

26 September (G) Central Alaska
Origin time: 16 08 18.6
Epicenter: 64.99 N., 147.55 W.
Depth: 27 km
Magnitude: 3.7 mb, 3.9 ML(M)
Intensity III: Eielson AFB (A), Fairbanks, North Pole (A).

28 September (G) Central Alaska
Origin time: 23 53 13.7
Epicenter: 63.99 N. 147.71 W.
Depth: Normal.
Magnitude: 4.4 mb, 4.5 ML(M)
Intensity III: Big Delta (M), Delta Junction (A), Fairbanks (M), Healey (M), Nenana (M), North Pole (M), Solcha (A).

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

Arkansas

31 August (S) New Madrid, Missouri region
Origin time: 00 31 00.3

See Tennessee listing.

23 September (S) Southern Arkansas
Origin time: 07 33 57.5
Epicenter: 33.65 N., 91.89 W.
Depth: 2 km
Magnitude: 3.1 mbLg
Intensity IV: Wilmar.

California

2 July (B) Northern California
Origin time: 11 57 57.0
Epicenter: 36.90 N., 122.18 W.
Depth: 10 km
Magnitude: 4.2 ML
Intensity V: Capitola (small objects fell), Watsonville (small objects fell).
Intensity IV: Aptos, Boulder Creek, Davenport, East Santa Cruz, Felton, Mount Herman, Pescadero, Salinas, Santa Cruz.
Intensity II: Brookdale, Santa Clara.

5 July (P) Southern California
Origin time: 10 47 55.6
Epicenter: 33.88 N., 116.50 W.
Depth: 1 km
Magnitude: 3.8 ML
Intensity V: North Palm Springs (small objects fell, few windows cracked, light furniture shifted).
Intensity IV: Banning, Desert Hot Springs (press report), Indio, Landers, Palm Springs.

18 July (B) Central California
Origin time: 19 09 03.7
Epicenter: 36.99 N., 121.67 W.
Depth: 5 km
Magnitude: 2.9 ML
Intensity IV: Corralitos.
Intensity III: Watsonville.

21 July (P) Southern California
Origin time: 13 24 41.9
Epicenter: 34.05 N., 118.90 W.
Depth: 13 km
Magnitude: 3.0 ML
Intensity III: Newbury Park (P), Redondo Beach (P).

23 July (B) Northern California
Origin time: 07 33 35.6
Epicenter: 39.40 N., 121.46 W.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued

Depth: 5 km
Magnitude: 3.3 ML
Intensity III: Nevada City, Oroville.

23 July (B) Central California
Origin time: 14 38 42.4
Epicenter: 35.93 N., 120.51 W.
Depth: 12 km
Magnitude: 3.2 ML
Intensity II: Bradley.

26 July (P) Southern California
Origin time: 00 38 53.6
Epicenter: 34.35 N., 116.92 W.
Depth: 6 km
Magnitude: 3.8 ML
Intensity IV: Apple Valley, Big Bear City, Big Bear Lake, Green Valley Lake.
Intensity III: Fawnskin, Lucerne Valley, San Bernardino.

31 July (B) Northern California
Origin time: 09 15 44.3
Epicenter: 37.71 N., 122.14 W.
Depth: 9 km
Magnitude: 3.0 ML
Intensity IV: Danville (press report).
Intensity III: Castro Valley (press report), Hayward (press report), Lafayette (B), Oakland (B), San Leandro (press report), San Lorenzo (press report).

1 August (B) Northern California
Origin time: 09 02 34.5
Epicenter: 41.45 N., 121.88 W.
Depth: 2 km
Magnitude: 4.5 mb(G), 4.6 ML

This is the largest event in a series of earthquakes which occurred in this area over a period of several months, six of which were felt within the following 7 hours. The magnitude 4.3 event at 09 46 44.6 was felt at about the same intensity as this one, but because it occurred only 44 minutes later, the intensity data for the separate events could not be differentiated. Most of these earthquakes that were over magnitude 3.0 were felt by Forest Service personnel. The intensities listed below are associated with this event, the largest in the series, but may also include data from the following event at 09 46 44.6.

Surface fractures were associated with this activity. The ruptures occurred along the Stephens Pass fault (Bennett and others, 1979), a 2-km-long fault trending north from a point 260 m south of Stephens Pass Road, at a point about 31 km northeast of McCloud.

Intensity V: Dunsmuir (heavy furniture shifted).
Intensity IV: Bieber, Big Bend, Dorris, Edgewood, Etna, Gazelle, Klamath River, Macdoel, McCloud, Mount Hebron, Mount Shasta, Scott Bar, Tennant, Weed.

3 August (P) Southern California
Origin time: 04 30 42.1
Epicenter: 33.67 N., 116.70 W.
Depth: 5 km
Magnitude: 3.5 ML
Intensity IV: Palm Springs.
Intensity II: Idyllwild (P).

11 August (P) Southern California
Origin time: 00 47 30.1
Epicenter: 34.15 N., 117.45 W.
Depth: 4 km
Magnitude: 4.0 ML
Intensity IV: Arlington, Bloomington, Brea, Bryn Mawr, Colton, Compton, Crestline, Del Rosa, Etiwanda, Fawnskin, Fontana, Glendale, Lake Arrowhead, Lakewood, Llano, Loma Linda, Los Angeles, Mount Baldy, Norton AFB, Pacific Palisades, Redlands, Rimforest, Riverside, Rubidoux, San Bernardino, Santa Fe Springs, Sunnymead, Wrightwood.
Intensity III: Bellflower, Canoga Park, Cedarpines Park, Leona Valley, Northridge, Palm Springs, Pasadena (press report), Sylmar, Westside.
Intensity II: Blue Jay, El Toro Marine Air Station, Montrose, Ontario, Saugus, Toluca Lake.

13 August (B) Northern California
Origin time: 05 55 48.0
Epicenter: 41.43 N., 121.89 W.
Depth: 2 km
Magnitude: 4.3 mb(G), 4.1 MS(G), 4.3 ML
Intensity IV: Horse Creek, McCloud, Weed.
Intensity II: Forks of Salmon.

13 August (K) Southern California
Origin time: 22 54 52.4
Epicenter: 34.37 N., 119.72 W.
Depth: 12 km
Magnitude: 5.5 mb(G), 5.6 MS(G), 5.1 ML, 5.7 ML(B)

The damage described below was taken from a report by Miller and Felszeghy, 1978.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued

About 65 people were injured, but there were no fatalities. The worst damage (intensity VII) occurred at the University of California Santa Barbara (UCSB) campus, at Goleta, and at Santa Barbara. At the UCSB campus several of the multistory, reinforced-concrete structures sustained moderate diagonal cracking of the shear walls in the lower stories. Instruments and supplies were destroyed in some laboratories. Damage occurred to light fixtures, ceilings, and plaster throughout the campus. Similar but less severe damage occurred in the commercial district of Goleta and in the Santa Barbara area. The damage loss is estimated at $7.31 million.

A Southern Pacific Transportation Company freight-train derailment occurred west of Goleta near Winchester Canyon Road in an area of cut-and-fill roadbed (fig. 7). The 49 empty and 9 loaded cars travelling at about 50 mph derailed when passing over a "kink" in the tracks, apparently the result of roadbed-fill failure; 30 of the cars were derailed and a section of the track was damaged.

A total of three overpasses crossing U.S. Highway 101, all steel-reinforced concrete structures located in the Goleta area, suffered significant earthquake damage. These overpasses are: the adjacent curving bridges on Ward Memorial Road, the one at Glen Annie Road, and the one at the western end of Hollister Avenue just east of the railroad derailment. The most extensive damage was sustained by the Ward Memorial bridges, which were subjected to considerable transverse motion that shifted the superstructures relative to the abutments causing the concrete to crack and spall in a number of places. Most of the Ward Memorial Road bridges' bents sustained damage that ranged from light cracking and incipient spalling, to localized deep spalling that exposed reinforcement bars.

The earthquake caused several rock slides on San Marcos Pass Road, the section of State Highway 154 that runs northwest through the Santa Ynez Mountains from U.S. Highway 101 between Goleta and Santa Barbara. Most of the slides occurred on roadcuts where there were steep inclines. Extension fractures opened in at least one area on a steep slope which forms the shoulder of the highway. Some minor slides occurred along the cliffs at the coastline and off the roads in the Santa Ynez Mountains.

Porcella and others (1979) reported that eight accelerograms were recovered from strong-motion stations at Santa Barbara, Goleta, Cochuma Dam, and UCSB campus. The highest accelerations that were recorded at the three-story North Hall building on the UCSB campus were 0.44 g, 0.66 g, and 0.99 g, for the ground, third floor, and roof levels, respectively.

Due to an error, the affected area of this earthquake was insufficiently canvassed with USGS questionnaires; as a result, the isoseismal map shown in figure 8 does not have as much intensity data as would normally be collected. However, the data is extensive enough to show this earthquake was felt over an area of approximately 25,000 sq km along the southern California coast.

Intensity VII:

Goleta-University of California Santa Barbara area--There was significant earthquake damage to buildings within an 8-km radius of the UCSB campus. On campus there was extensive cracking of reinforced-concrete shear walls in the Biological Sciences II Building, Engineering Building, Library III, University Center, Anacapa Residence Hall, Santa Cruz Residence Hall, and North Hall. Mechanical equipment on or near the roof tops of multistory buildings suffered considerable damage from building movement during the earthquake. A few very old adobe or wood-frame buildings were seriously damaged.

The Air Traffic Control Tower at the airport, a steel-frame structure with lateral reinforcement, was shaken so that it sustained an estimated permanent deflection of 1.3 to 2.5 cm. Two other buildings sustained cracked concrete-floor slabs, with shifted wood columns and walls in one. Damage to the hangars consisted of buckled diagonal steel bracings and failure of some of the structural connections at the supports for the large sliding doors.

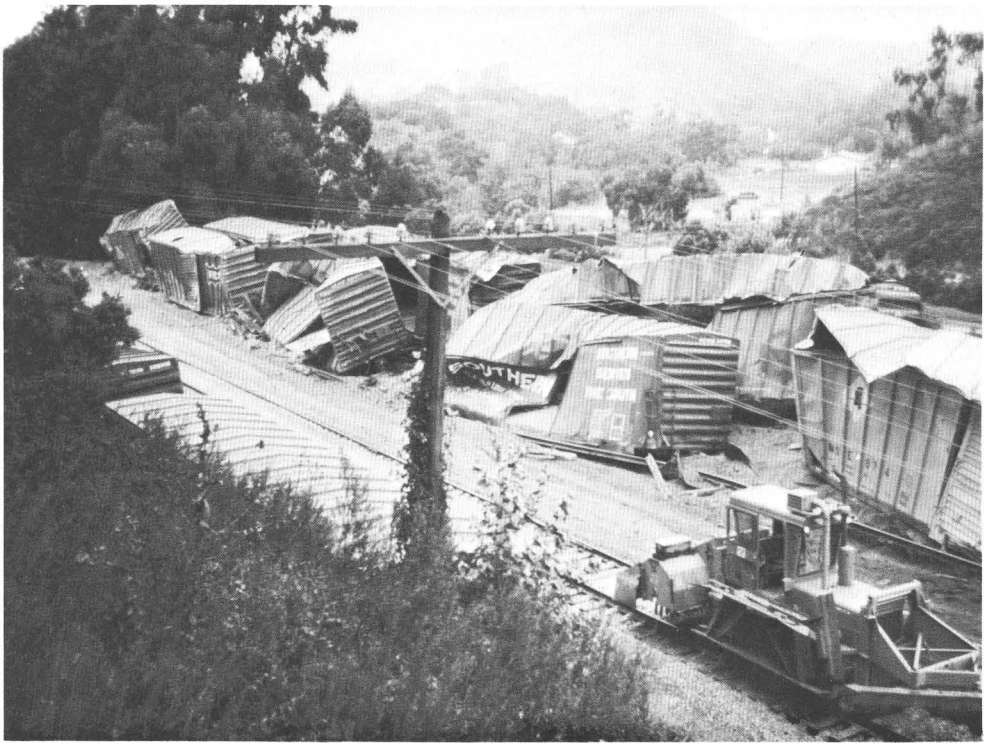

FIGURE 7.--Southern Pacific Transportation Company freight train derailment west of Goleta, Calif.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued
The Ward Memorial Road bridges were damaged by the shifting of the ground, which caused the bridge decks to impact at several expansion joints and resulted in cracked and spalled concrete. The bridges were temporarily closed.
The most common damage to residential and small commercial buildings consisted of cracked and fallen plaster and stucco, differential settlement of foundations, failure of unreinforced chimneys, fallen hot water heaters, dislodgement of air-conditioning ducts, dislodgement of tiles and panels from suspended acoustical ceilings, lighting fixtures loosened or fallen, and glass broken. A common type of damage to mobile homes is shown in figure 9. The mobile homes were thrown off their mounts, crumpling the skirts around the base and dislodging the contents of the home.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued
The most widespread type of damage was breakage of household belongings and store merchandise that toppled from shelves. In homes, cupboards and refrigerators were thrown open, spilling their contents. Liquor stores and supermarkets sustained heavy losses from breakage. About one-third of the UCSB library's 1.2 million books were thrown to the floor. The UCSB laboratories suffered much damage and glass breakage when wall cabinets broke loose and fell, spilling their contents.
Santa Barbara--Several multistory buildings sustained diagonal cracks in their reinforced-concrete shear walls, particularly in the lower floors. The Freitas Building at 200 E. Carrillo Street and the Santa Barbara Court House Building suffered some damage. The Santa Barbara County Administration Building at

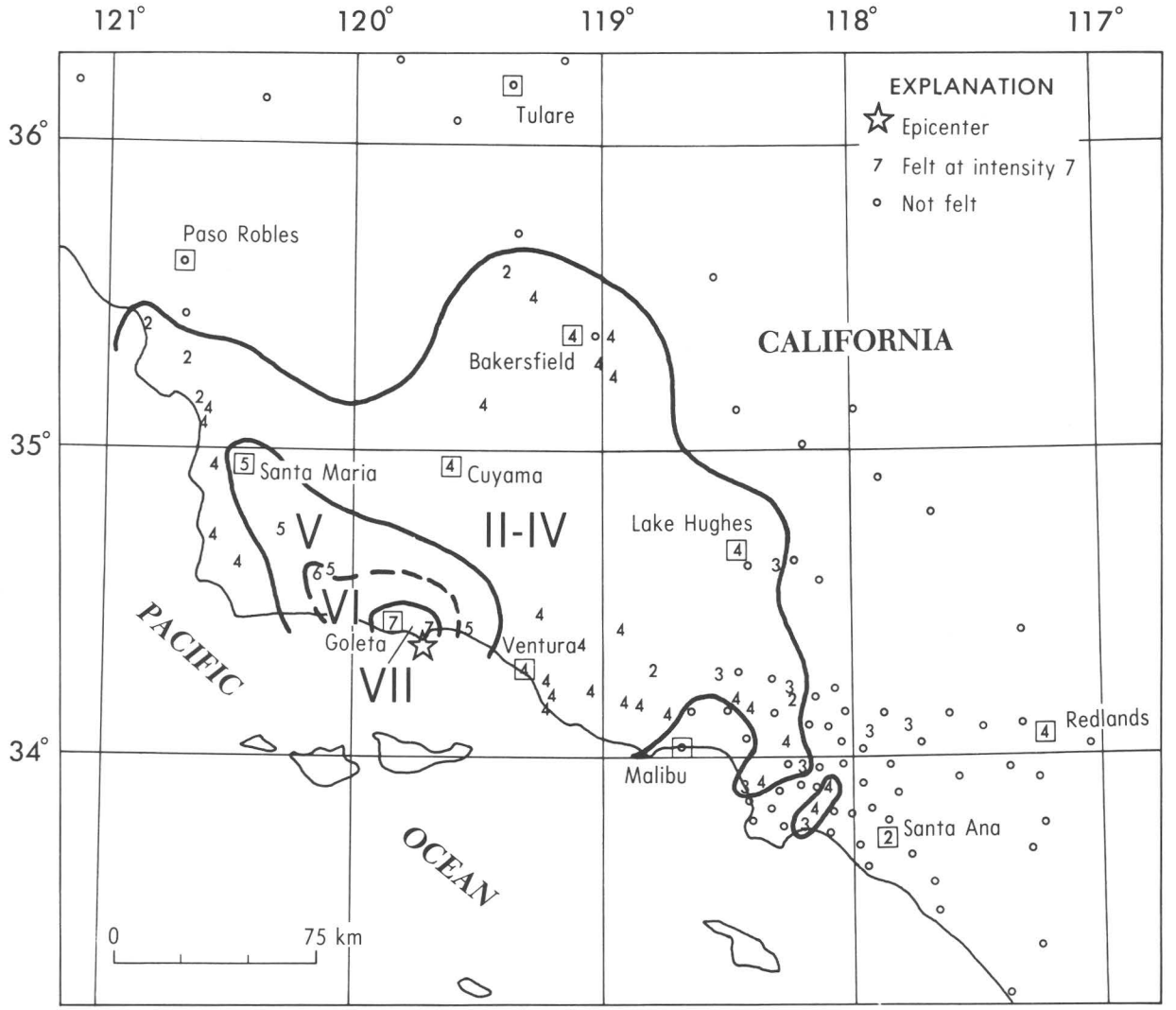

FIGURE 8.--Isoseismal map for the southern California earthquake of 13 August 1978, 22 54 53.5 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued

Anacapa and Anapamu Streets suffered diagonal tension cracks in some of the columns on the north side of the building. The roof of an unoccupied restaurant that was being remodeled at 100 W. Anapamu Street collapsed. The floating dock at Marina No. 1 was damaged by the movement of the concrete support piles which were buried 3.6 m into the mud. Several water mains were broken. There was widespread breakage and damage to household belongings or store merchandise as described for the Goleta area above.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued

Intensity VI: Solvang (cracked drywall, hairline cracks in exterior walls, stone or brick fences cracked, few windows cracked, small objects shifted, vehicles rocked moderately, felt by all).

Intensity V: Carpenteria, Los Alamos, Santa Maria, Santa Ynez.

FIGURE 9.--Damage to mobile home near Goleta, Calif.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued

Intensity IV: Agoura, Arroyo Grande, Artesia, Bakersfield, Camarillo, Cuyama, East Ventura, Fillmore, Grover City, Guadalupe, Halcyon, Hawthorne, Hillcrest Center, Lake Hughes, Lakewood, Lamont, Lompoc, Montalvo, Newbury Park, Norwalk, Oxnard, Palms, Pineside, Port Hueneme, Pumpkin Center, Oceano, Ojai, Redlands, Santa Paula, Shafter, Sherman Oaks, Studio City, Taft, Thousand Oaks, Van Nuys, Vandenburg AFB, Ventura.

Intensity III: Bellflower, Granada Hills, La Crescenta, La Verne, Leona Valley, Long Beach, Manhattan Beach, West Covina.

Intensity II: Montrose, Morro Bay, Pismo Beach, San Luis Obispo, Santa Ana (Marine Corps Air Station), Simi Valley, Wasco.

13 August (K) Southern California
Origin time: 23 11 01.7
Epicenter: 34.40 N., 119.76 W.
Depth: 13 km
Magnitude: 3.4 ML(P), 3.3 ML
Intensity II: Santa Barbara area.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued

13 August (K) Southern California
Origin time: 23 15 02.5
Epicenter: 34.41 N., 119.77 W.
Depth: 13 km
Magnitude: 3.1 ML(P), 3.0 ML
Intensity II: Santa Barbara area.

13 August (K) Southern California
Origin time: 23 23 53.8
Epicenter: 34.40 N., 119.74 W.
Depth: 12 km
Magnitude: 3.4 ML(P), 2.9 ML
Intensity II: Santa Barbara area.

14 August (K) Southern California
Origin time: 01 02 35.1
Epicenter: 34.40 N., 119.72 W.
Depth: 14 km
Magnitude: 3.1 ML(P), 2.7 ML
Intensity II: Santa Barbara area.

16 August (B) Northern California
Origin time: 07 45 32.4
Epicenter: 40.33 N., 124.39 W.
Depth: 21 km
Magnitude: 3.8 ML

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued

Intensity IV: Fortuna, Rio Dell.
Intensity III: Eureka, Ferndale, Freshwater, Scotia.

16 August (K) Southern California
Origin time: 13 35 11.6
Epicenter: 34.41 N., 119.80 W.
Depth: 11 km
Magnitude: 3.5 ML(P), 3.2 ML
Intensity IV: Goleta (University of California Santa Barbara campus), Los Olivos, Oxnard, New Cuyama, Santa Barbara.
Intensity II: Ventura.

19 August (P) Baja California
Origin time: 09 31 07.3
Epicenter: 32.42 N., 116.83 W.
Depth: 5 km
Magnitude: 4.1 ML
Intensity V: Tecate (light furniture shifted; small objects shifted; windows, doors, and dishes rattled, few awakened).
Intensity IV: Alpine, Bonita, Bostonia, Boulevard, Campo, Chula Vista, Dulzura, El Cajon, Guatay, Imperial Beach, Jamul, La Jolla, Lakeside, La Mesa, Lemon Grove, Pine Valley, Ramona, San Diego, San Diego (Lindbergh Field), San Diego (Montgomery Field), Santee, University City.
Intensity II: San Ysidro.

28 August (B) Central California
Origin time: 03 32 18.4
Epicenter: 37.55 N., 121.86 W.
Depth: 11 km
Magnitude: 2.8 ML
Intensity IV: Fremont, Mountain View, Warm Springs (all reported windows, doors, and dishes rattled; buildings creaked or trembled).
Intensity III: San Leandro.
Intensity II: Livermore (press report), Pleasanton, Redwood, Walnut Creek (press report).

29 August (B) Northern California
Origin time: 00 14 46.4
Epicenter: 37.36 N., 121.72 W.
Depth: 8 km
Magnitude: 4.1 ML
Intensity VI: San Jose--east side of the city (acoustical ceiling tiles fell in an East Side supermarket; at 3720 Sierra Road cracks opened in the walls and ceilings, and the walls were lifted 1.7 cm from the floor; in Eastridge a small amount of glassware was broken--press report).

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued

Intensity V: Hayward (small objects broken; windows, doors, and dishes rattled), Mount Hamilton--Lick Observatory (small cracks in dry-wall, hairline cracks in exterior walls), San Jose (Cambrian Park--small objects overturned).
Intensity IV: Boulder Creek, Burlingame, Felton, Moffett Field NAS, Mountain View, Oakland, Santa Clara, Sunnyvale, Union City, Vallejo.
Intensity III: Fremont (B), Milpitas, Pacifica.
Intensity II: Alameda, Belmont, Livermore (press report), Newark (press report), Santa Cruz, Stockton (Airport Control Tower).

29 August (B) Northern California
Origin time: 00 18 45.3
Epicenter: 37.35 N., 121.72 W.
Depth: 7 km
Magnitude: 3.8 ML
Intensity IV: Mount Hamilton--Lick Observatory.
Intensity III: Fremont (B), San Jose (press report), San Jose (Cambridge Park).

29 August (P) Southern California
Origin time: 06 04 49.8
Epicenter: 34.38 N., 119.77 W.
Depth: 5 km
Magnitude: 2.8 ML
Intensity II: Santa Barbara (P).

29 August (P) Southern California
Origin time: 10 51 46.0
Epicenter: 34.38 N., 119.80 W.
Depth: 5 km
Magnitude: 2.5 ML
Intensity II: Santa Barbara (P).

1 September (B) Northern California
Origin time: 09 31 25.4
Epicenter: 37.34 N., 121.78 W.
Depth: 8 km
Magnitude: 3.3 ML
Intensity II: San Jose (B).

3 September (P) Southern California
Origin time: 18 10 46.5
Epicenter: 33.95 N., 117.72 W.
Depth: 6 km
Magnitude: 3.8 ML
Intensity IV: La Puente, Pomona, Riverside, Yorba Linda.
Intensity III: Los Serranos.
Intensity II: Anaheim (press report),

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued

Chino, Diamond Bar, East Los Angeles County (P), North Orange County (P), Redlands, South San Bernardino.

4 September (B) Lake Tahoe region
Origin time: 04 52 32.3
Epicenter: 38.82 N., 119.81 W.
Depth: 18 km
Magnitude: 3.9 mb(G), 4.6 ML

Only the Topaz and eastern Amador County intensity data are from USGS questionnaires, all the other intensities are based on press reports.

Intensity V:
California--South Lake Tahoe (few broken dishes).
Intensity IV:
California--Eastern Amador County, in the Lake Tahoe Sierra region.
Nevada--Gardnerville, Stateline, Topaz.
Intensity III:
California--Grass Valley, Ione, Jackson, Leek Springs (El Dorado National Forest), Placerville, Pollock Pines, Tahoe City, Truckee.
Nevada--Carson City, Incline Village, Minden, Zephyr Cove.
Intensity II:
California--Stockton, Strawberry.

4 September (B) Lake Tahoe region
Origin time: 21 54 53.2
Epicenter: 38.81 N., 119.82 W.
Depth: 19 km
Magnitude: 4.7 mb(G), 5.3 ML

This is the largest magnitude event of a series of earthquakes on September 3 and 4 in the area south of Lake Tahoe. It was felt over an area of approximately 45,500 sq km of California and Nevada (fig. 10).

Intensity VI:
California--Mt. Aukum (dry wall cracked, hairline cracks in exterior walls, water splashed onto sides of lakes and pools).
Nevada--Genoa (plaster and dry wall cracked; hairline cracks in exterior walls; windows, doors, and dishes rattled; vehicles rocked slightly; buildings shook).
Intensity V:
California--Bear Valley (heavy furniture shifted; small objects shifted; pictures fell; buildings shook; windows, doors, and dishes rattled), Camp Connell (light furniture shifted; small objects shifted; hanging pictures swung; buildings shook; windows, doors, and dishes rattled), Glencoe (heavy furniture shifted; hanging pictures swung; buildings shook; windows, doors, and dishes rattled), South Lake Tahoe (small objects fell; water in small containers slightly disturbed; buildings shook; windows, doors, and dishes rattled), Topaz (small objects fell, buildings shook; windows, doors, and dishes rattled). Twin Bridges (light furniture shifted; small objects fell; hanging pictures swung; buildings shook; windows, doors, and dishes rattled).
Nevada--Minden (light furniure shifted; small objects overturned, fell, and broke; water in small containers spilled; hanging pictures swung out of place; buildings shook; windows, doors, and dishes rattled).
Intensity IV:
California--Alta, Altaville, Amador City, Angels Camp, Arnold, Baxter, Camino, Carnelian Bay, Chicago Park, Citrus Heights, Coleville, Colfax, Cool, Diamond Springs, Dobbins, Douglas Flat, Echo Lake area, El Portal, Fiddletown, Floriston, Foresthill, Georgetown, Gold Run, Hathaway Pines, Homewood, Ione, Jackson, Kyburz, Linden, Long Barn, Lotus, Mammoth Lakes, Mariposa, Markleville, Mi-Wuk Village, Mokelumne Hill, Mono Vista, Mountain Ranch, Murphys, Pacific House, Penn Valley, Pine Grove, Pollock Pines, Rail Road Flat, River Pines, Sheep Ranch, Sierraville, Soda Springs, Sonora, Standard, Stateline (press report), Strawberry, Sutter Creek, Tahoe City, Tahoe Vista, between Tamarak Lake and Echo Lake, Truckee, Tuolumne, Twain Harte, Valley Springs, Wallace, Washington, Wawona, White Pines, Winters.
Nevada--Carson City, Dayton, Fallon, Gardnerville, Glenbrook, Reno, Schurz, Silver City, Smith, Zephyr Cove.
Intensity III:
California--Alleghany, Blairsden, Chilcoot, Copperopolis, Grass Valley (press report), La Porte, Pioneer, Placerville (press report), Sacramento (Foothill Farms), San Andreas, Shingle Springs, Sloughhouse, Smithflat, Stockton, Valley Home, Volcano, West Point, Wilton.
Nevada--Incline Village, Wellington

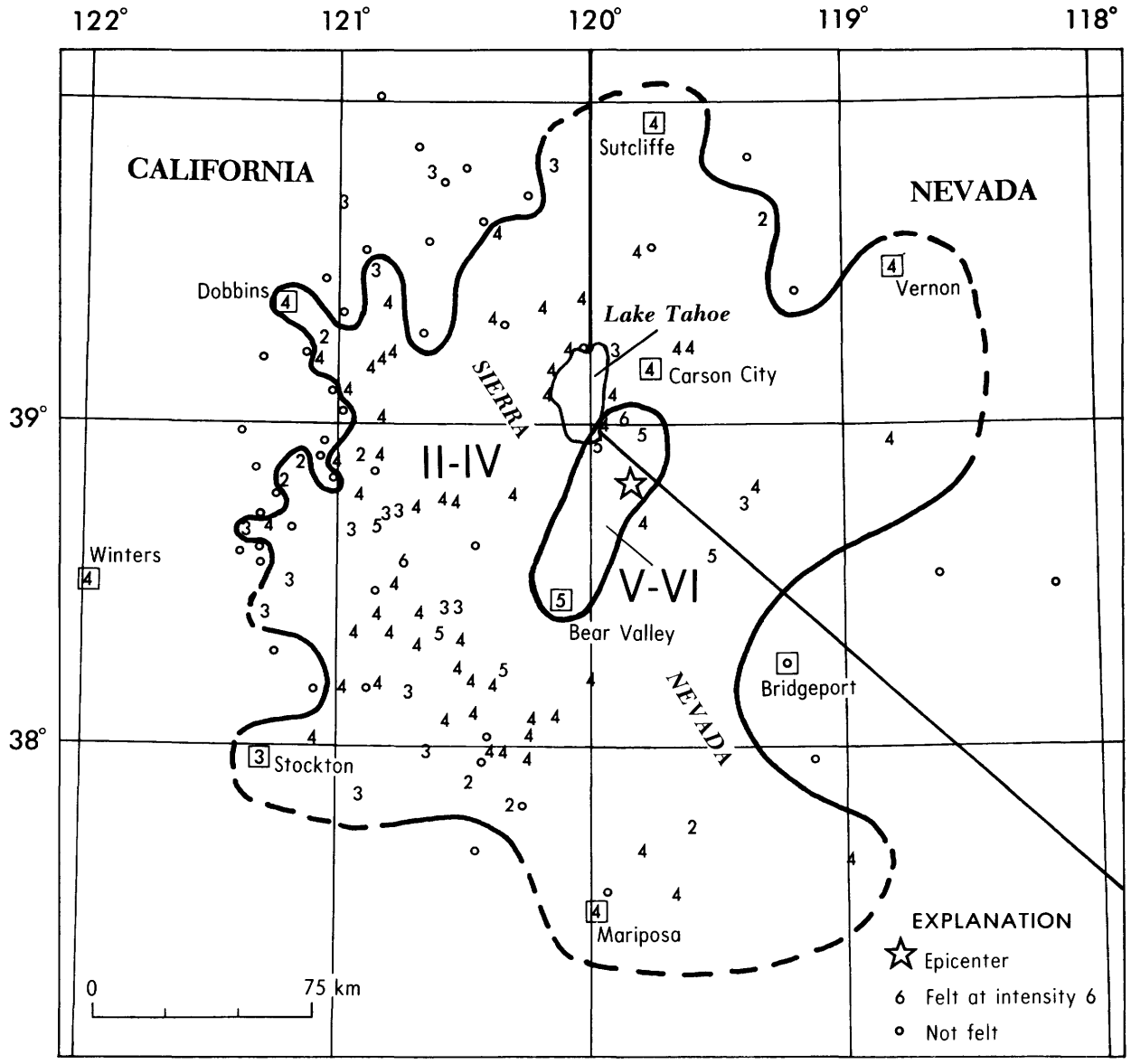

FIGURE 10.—Isoseismal map for the Lake Tahoe earthquake of 4 September 1978, 21 54 53.2 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued

Intensity II:
California--Avery, Chinese Camp, Dutch Flat, Greenwood, Loomis, Moccasin, Nevada City, Newcastle, Yosemite Lodge.
Nevada--Wadsworth.

8 September (B) Northern California
Origin time: 16 59 47.8
Epicenter: 38.64 N., 121.91 W.
Depth: 17 km
Magnitude: 4.4 mb(G), 4.2 ML

This earthquake was felt over an area of approximately 4,500 sq km of northern California (fig. 11).

Intensity V: Madison (light furniture and small objects shifted; windows, doors, and dishes rattled; buildings shook; pictures swung), North Highlands (few windows cracked; windows, doors, and dishes rattled).
Intensity IV: Brooks, Capay, Citrus Heights, College City, Davis, Dixon, Esparto, Liberty Farms, Rescue, Sacramento, Steele Park, Vacaville, Winters (press report), Woodbridge, Woodland, Yolo, Zamora.
Intensity III: Courtland, Fairfield (press report), Loma Mar, Napa (press report), Robbins, Sonoma (press report), Yountville.
Intensity II: Benecia, Cobb, Elmira, Galt, Graton, Lucerne, Meridian, West Sacramento.

12 September (P) Southern California
Origin time: 11 57 55.4
Epicenter: 34.38 N., 119.77 W.
Depth: 6 km
Magnitude: 3.6 ML
Intensity V: Santa Barbara (few windows cracked; light furniture and small objects shifted; hairline cracks in exterior walls; windows, doors, and dishes rattled).
Intensity IV: Goleta, Solvang, Summerland.

17 September (B) Central California
Origin time: 15 38 33.1
Epicenter: 36.68 N., 121.36 W.
Depth: 6 km
Magnitude: 3.9 ML
Intensity IV: San Juan Bautista.

19 September (B) Northern California
Origin time: 15 52 41.5
Epicenter: 37.73 N., 122.56 W.

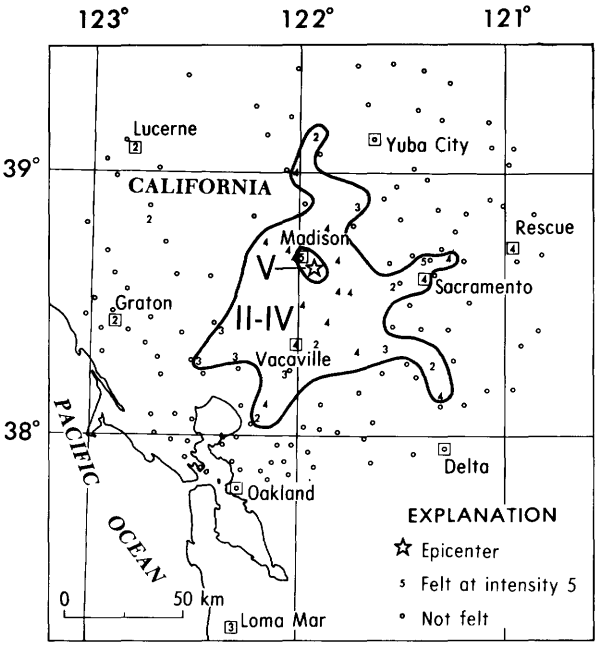

FIGURE 11.--Isoseismal map for the northern California earthquake of 8 September 1978, 16 59 47.8 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued

Depth: 8 km
Magnitude: 2.9 ML
Intensity II: Daly City.

21 September (B) Central California
Origin time: 03 18 57.1
Epicenter: 36.99 N., 121.68 W.
Depth: 8 km
Magnitude: 2.9 ML
Intensity III: Gilroy (B), Monterey (B), Santa Cruz (B), Watsonville (B).

22 September (P) Southern California
Origin time: 03 13 26.8
Epicenter: 33.87 N., 117.83 W.
Depth: 4 km
Magnitude: 2.9 ML
Intensity II: Anaheim.

22 September (B) Northern California
Origin time: 03 26 19.8
Epicenter: 40.63 N., 123.63 W.
Depth: 20 km
Magnitude: 3.7 mb(G), 3.7 ML
Intensity III: Rio Dell.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

California--Continued

24 September (P) Southern California
Origin time: 02 04 27.5
Epicenter: 34.38 N., 119.73 W.
Depth: 4 km
Magnitude: 3.6 ML
Intensity IV: Goleta, Isla Vista, Santa Barbara.

26 September (P) Southern California
Origin time: 05 35 03.9
Epicenter: 34.03 N., 118.40 W.
Depth: 6 km
Magnitude: 2.1 ML
Intensity II: Beverly Hills (P).

Delaware

16 July (G) Southeastern Pennsylvania
Origin time: 06 39 37.8

See Pennsylvania listing.

Hawaii

The locations shown below followed by (H) designate intensity values assigned by the Hawaiian Volcano Observatory.

1 July (H) Island of Hawaii
Origin time: 19 18 13.3
Epicenter: 19.32 N., 155.12 W.
Depth: 7 km
Magnitude: 3.9 ML
Intensity IV: Hilo (H), Puna (H).
Intensity III: Mauna Loa Observatory (H), Pohakuloa (H).
Intensity II: Kohala (H), Kona (H).

4 July (H) Island of Hawaii
Origin time: 07 05 16.3
Epicenter: 19.35 N., 155.08 W.
Depth: 9 km
Magnitude: 3.0 ML
Intensity III: Glenwood (H).

9 July (H) Island of Hawaii
Origin time: 23 07 56.9
Epicenter: 19.37 N., 155.10 W.
Depth: 9 km
Magnitude: 3.1 ML
Intensity III: Hilo (H).

14 July (H) Island of Hawaii
Origin time: 12 56 37.2

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

Hawaii--Continued

Epicenter: 19.35 N., 155.25 W.
Depth: 10 km
Magnitude: 3.2 ML
Intensity III: Volcano (H).

16 July (H) Island of Hawaii
Origin time: 18 29 41.8
Epicenter: 19.35 N., 155.02 W.
Depth: 8 km
Magnitude: 3.3 ML
Intensity IV: Kalapana (H).
Intensity III: Glenwood (H), Hilo (H).

9 August (H) Island of Hawaii
Origin time: 07 10 10.3
Epicenter: 19.30 N., 155.22 W.
Depth: 10 km
Magnitude: 3.4 ML
Intensity III: Glenwood (H), Hilo (H), Kurtistown (H), Mountainview (H), Volcano (H).

12 August (H) Island of Hawaii
Origin time: 10 52 50.5
Epicenter: 19.33 N., 155.11 W.
Depth: 10 km
Magnitude: 3.1 ML
Intensity IV: Hilo (H).
Intensity III: Mountainview (H), Volcano (H).

29 August (H) Island of Hawaii
Origin time: 21 44 08.9
Epicenter: 19.32 N., 155.20 W.
Depth: 10 km
Magnitude: 3.1 ML
Intensity II: Hilo (press report).

30 August (H) Island of Hawaii
Origin time: 22 40 15.7
Epicenter: 19.34 N., 155.03 W.
Depth: 7 km
Magnitude: 3.1 ML
Intensity III: Blacksand Subdivision (H), Hilo (H), Kalapana (H), Volcano (H).

31 August (H) Island of Hawaii
Origin time: 23 07 21.4
Epicenter: 19.01 N., 155.48 W.
Depth: 35 km
Magnitude: 4.0 ML
Intensity IV: Kau (H).
Intensity III: Ahualoa (H), Ainaloa (H), Glenwood (H), Hawaiian Beaches (H), Hawaiian Paradise Park (H), Hawaiian Volcano Observatory (H), Hilo (H), Honokaa (H), Kamuela (H), Volcano Golf Course (H).

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

Hawaii--Continued

3 September (H) Island of Hawaii
Origin time: 14 26 10.5
Epicenter: 19.32 N., 155.20 W.
Depth: 9 km
Magnitude: 3.0 ML
Intensity III: Volcano (H).

5 September (H) Island of Hawaii
Origin time: 20 26 46.8
Epicenter: 19.33 N., 155.23 W.
Depth: 10 km
Magnitude: 3.7 ML
Intensity IV: Hilo (H).
Intensity III: Glenwood (H), Hawaii Volcanoes National Park (H), Hawaiian Volcano Observatory (H), Volcano (H).

12 September (H) Island of Hawaii
Origin time: 06 16 06.1
Epicenter: 19.33 N., 155.11 W.
Depth: 10 km
Magnitude: 4.1 ML
Intensity IV: Glenwood, Hawaii Volcanoes National Park, Hilo, Honomu, Keaau, Kurtistown, Mountainview (H), Ookala, Pahoa (H), Papaaloa, Volcano.
Intensity III: Hakalau (H), Kalapana (H), Naanaleau (H), Papaikou.
Intensity II: Honokaa.

19 September (H) Island of Hawaii
Origin time: 09 44 29.2
Epicenter: 19.39 N., 155.28 W.
Depth: 4 km
Magnitude: 3.2 ML
Intensity III: Namakanipaio (H), Volcano (H).

20 September (H) Island of Hawaii
Origin time: 01 41 08.7
Epicenter: 19.44 N., 155.40 W.
Depth: 9 km
Magnitude: 3.3 ML
Intensity IV: Red Hill (H).

20 September (H) Island of Hawaii
Origin time: 23 20 27.0
Epicenter: 19.52 N., 155.88 W.
Depth: 9 km
Magnitude: 3.1 ML
Intensity IV: Kealakekua (H).

30 September (H) Island of Hawaii
Origin time: 23 56 13.3
Epicenter: 19.38 N., 155.45 W.
Depth: 9 km
Magnitude: 3.2 ML
Intensity IV: Pahala (H).
Intensity III: Glenwood (H), Naalehu (H).
Intensity II: Hilo (H).

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

Idaho

29 July (U) Northern Utah
Origin time: 14 04 03.2

See Utah listing.

28 September (G) Southern Idaho
Origin time: 08 58 20.7
Epicenter: 42.10 N., 112.33 W.
Depth: 5 km
Magnitude: 2.7 ML
Intensity IV: Malad City.

Illinois

29 August (S) Southern Illinois
Origin time: 07 05 50.3
Epicenter: 38.53 N., 88.22 W.
Depth: 17 km
Magnitude: 2.4 mbLg
Intensity II: West Salem.

20 September (S) Eastern Missouri
Origin time: 12 24 08.8

See Missouri listing.

Maryland

16 July (G) Southeastern Pennsylvania
Origin time: 06 39 37.8

See Pennsylvania listing.

Massachusetts

1 September (J) Eastern Massachusetts
Origin time: 03 33 43.6
Epicenter: 42.48 N., 71.46 W.
Depth: 0 km
Magnitude: 2.0 mbLg
Intensity III: Stow.
Intensity II: Acton.

Missouri

31 August (S) New Madrid, Missouri region
Origin time: 00 31 00.3

See Tennessee listing.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

Missouri--Continued

20 September (S) Eastern Missouri
Origin time: 12 24 08.8
Epicenter: 38.57 N., 90.28 W.
Depth: 2 km
Magnitude: 3.1 mbLg, 3.0 mbLg(G)

O. W. Nuttli, St. Louis University, reported two places with minor damage that are not reflected in the intensity values listed below. One was in southeast St. Louis where one of the concrete posts, 76 cm high and 25 cm square, which supported a wooden porch, cracked entirely across and showed evidence of slight displacement. The other occurred at Ladue where a plaster ceiling cracked down the middle.

This earthquake was felt over an area of approximately 3,700 sq km of Illinois and Missouri (fig. 12).

Intensity V:
Illinois--Belleville (plaster cracked in one home, small objects shifted, windows rattled), East Alton (few windows cracked; windows, doors, and dishes rattled).
Missouri--North County (few windows cracked; buildings shook; windows, doors, and dishes rattled).

Intensity IV:
Illinois--Alton, Caseyville, Dupo, East Carondelet, Edwardsville, Elsah, Glen Carbon, Godfrey, Granite City, Lebanon, Litchfield (press report), Lovejoy, Madison, Marine, Moro, National Stock Yards, O'Fallon, Roxana, Smithton, South Roxana, Venice.
Missouri--Affton, Benton Park, Berkeley, Brentwood, Carondelet, Chesterfield, Christian Bechtold, Clayton, Crestwood (press report), Defiance, Ferguson, Florissant, Gravois, Jennings, Lambert Airport, Manchester, Maplewood, Northwest Plaza, Northwood, Olivette, Pierre Laclede, Portage Des Sioux, Richmond Heights, Sappington, St. Ann, St. Charles, St. Louis, St. Peters, University City, Webster Groves, West Alton.

Intensity III:
Illinois--Columbia, Wood River.
Missouri--Des Peres, Fenton.

Intensity II:
Illinois--Chicago (press report), Dow.
Missouri--Grover, Hematite.

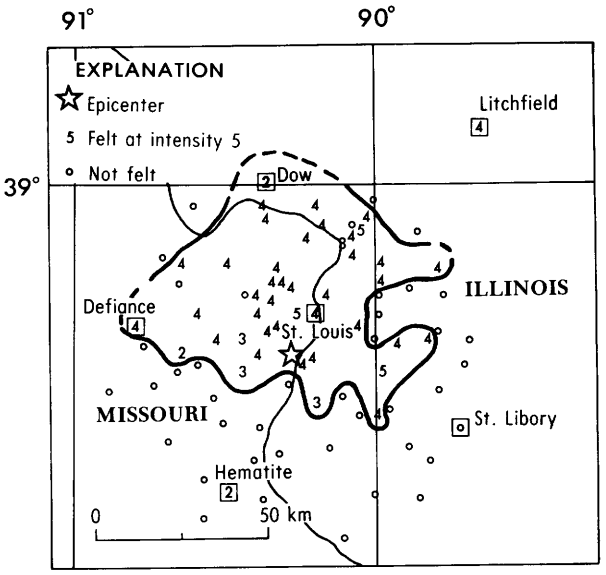

FIGURE 12.--Isoseismal map for the eastern Missouri earthquake of 20 September 1978, 12 24 08.8 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

Nevada

6 July (G) Northern Nevada
Origin time: 22 21 22.0
Epicenter: 39.11 N., 116.22 W.
Depth: 10 km
Magnitude: 3.8 ML
Intensity IV: Eureka.

12 July (E) Southern Nevada
Origin time: 17 00 00.075
Epicenter: 37.079 N., 116.044 W.
Depth: 0 km
Magnitude: 5.5 mb(G), 4.1 MS(G), 5.4 ML(B)

Nevada Test Site explosion "LOWBALL" at 37°04'43.21" N., 116°02'37.63" W., surface elevation 1252 m, depth of burial 564 m.

29 July (G) Central Nevada
Origin time: 22 32 07.1
Epicenter: 38.40 N., 115.24 W.
Depth: 5 km
Magnitude: 3.9 mb, 4.2 ML
Intensity II: Ely (R), Eureka.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

Nevada--Continued

4 September (B) Lake Tahoe region
Origin time: 04 52 31.6

See California listing.

4 September (B) Lake Tahoe region
Origin time: 21 54 52.5

See California listing.

New Hampshire

25 August (J) Southeastern New Hampshire
Origin time: 20 01 30.5
Epicenter: 42.87 N., 70.83 W.
Depth: 0 km
Magnitude: 2.3 mbLg
Intensity III: Seabrook (J).

Pennsylvania

16 July (G) Southeastern Pennsylvania
Origin time: 06 39 37.8
Epicenter: 39.92 N., 76.26 W.
Depth: 5 km
Magnitude: 2.9 mbLg(V), 3.1 mbLg(J)

This earthquake was felt over an area of approximately 1,600 sq km of Pennsylvania, Delaware, and Maryland (fig. 13).

Intensity V:
Pennsylvania--Lancaster (few plaster cracks), New Providence (few plaster cracks).
Intensity IV:
Delaware--Wilmington.
Maryland--Cardiff, Pylesville, Whiteford.
Pennsylvania--Airville, Bart, Bausman, Brogue, Buck, Columbia, Conestoga, Craley, East Prospect, Fawn Grove, Gordonville, Holtwood, Kirkwood, Millersville, Mount Nebo, Mountville, Paradise, Peach Bottom, Penryn, Pequea, Rawlinsville, Red Lion, Refton, Smoketown, Strasburg, Washington Boro, Willow Street, Windsor, Wrightsville (11 km south).
Intensity III:
Maryland--Darlington.
Pennsylvania--Manheim.

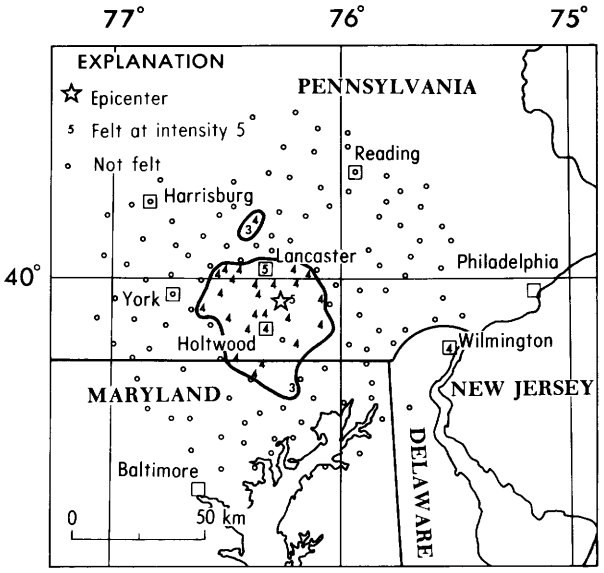

FIGURE 13.--Isoseismal map for the southeastern Pennsylvania earthquake of 16 July 1978, 06 39 37.8 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

South Carolina

7 September (G) Eastern South Carolina
Origin time: 22 53 22.3
Epicenter: 33.07 N., 80.22 W.
Depth: 11 km
Magnitude: 2.7 mbLg
Intensity IV: Summerville--Corey Woods (4.2 km southwest on Highway 17A--windows, doors, and dishes rattled).
Intensity III: Jedburg, Summerville--city area, Summerville--Briarwood (3.2 km south on State Highway 199), College Park (7.8 km east off Interstate 26), Flowertown Village (5.1 km southwest on Highway 17A), King's Grant (8 km south on Highway 642), Knightsville (5.8 km west on Highway 13), Oakdale Subdivision (4 km southwest on Highway 17A), Old Orangeburg Road (5.3 km west on Highway 22), Owen's Circle (5.9 km south on Highway 165), Pine Forest Estates (4 km southwest on Highway 17A), Quail Arbor II (3.8 km south on Highway 165), Quail Arbor V (4.6 km south on Highway 199), Shepard Park (2.2 km west on Highway 17A), Twin Oaks

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

South Carolina--Continued

(1.8 km south off Highway 165), Waring Hall (3.4 km west on Highway 13), Warrington Subdivision (1.3 km west on Highway 13).
Intensity II: Summerville--Old Fort Estates (7.2 km south on Highway 642).

Tennessee

31 August (S) New Madrid, Missouri region
Origin time: 00 31 00.3
Epicenter: 36.09 N., 89.42 W.
Depth: 4 km
Magnitude: 3.5 mbLg
Intensity V:
Tennessee--Dyersburg (S).
Intensity IV:
Arkansas--Leachville.
Missouri--Braggadocio, Hayti, Pascola.
Tennessee--Bogota, Findley, Lenox, Troy.
Intensity III:
Arkansas--Etowah.
Missouri--Caruthersville, Portageville.
Tennessee--Memphis, Samburg, Yorkville.
Intensity II:
Arkansas--Keiser.
Tennessee--Kenton.

Utah

29 July (U) Northern Utah
Origin time: 14 04 03.2
Epicenter: 41.85 N., 112.13 W.
Depth: 7 km
Magnitude: 3.1 ML
Intensity IV:
Idaho--Weston.
Utah--Cornish, Fielding, Howell, Logan, Newton, Plymouth, Portage, Preston, Richmond, Riverside, Smithfield, Trenton.
Intensity III:
Idaho--Franklin.
Utah--Cherry Creek, Collinston, Garland.
Intensity II:
Idaho--Dayton.
Utah--Clarkston.

Table 2.--*Summary of macroseismic data for U.S. earthquakes, July-September 1978*--Continued

Washington

23 August (Q) Vancouver Island, British Columbia
Origin time: 10 37 18.0
Epicenter: 48.38 N., 123.20 W.
Depth: 17 km
Magnitude: 4.4 mb(G), 3.5 ML

Felt at intensity V on Vancouver Island.

Intensity IV: Eastsound, Friday Harbor.
Intensity II: Port Angeles (W).

Wyoming

15 July Yellowstone National Park
Origin time: 08 26
Epicenter: Not located.
Depth: None computed.
Magnitude: None computed.
Intensity IV: Norris.
Intensity III: Canyon Village.

21 July Yellowstone National Park
Origin time: 10 01
Epicenter: Not located.
Depth: None computed.
Magnitude: None computed.
Intensity IV: Grant Village.

21 August Yellowstone National Park
Origin time: 12 14
Epicenter: Not located.
Depth: None computed.
Magnitude: None computed.
Intensity III: Old Faithful (earthquakes at 12:16, 12:27, and 12:32 were also felt at intensity III).

21 August Yellowstone National Park
Origin time: 13 14
Epicenter: Not located.
Depth: None computed.
Magnitude: None computed.

Five other earthquakes were felt at Old Faithful following this one. They were felt at 13:16, 13:27, 13:32, 14:25, and 14:27 (R. A. Hutchinson, Park Geologist).

Intensity III: Old Faithful.

15 September (G) Yellowstone National Park
Origin time: 13 45 44.8
Epicenter: 44.56 N., 110.49 W.
Depth: 5 km
Magnitude: 2.5 ML
Intensity IV: Canyon Village, Fishing Bridge, Lake.

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