GEOLOGICAL SURVEY CIRCULAR 819–A

Earthquakes in the United States, January–March 1978

Earthquakes in the United States, January–March 1978

By C. W. Stover, J. H. Minsch, and B. G. Reagor

GEOLOGICAL SURVEY CIRCULAR 819–A

1980

United States Department of the Interior
CECIL D. ANDRUS, *Secretary*

Geological Survey
H. William Menard, *Director*

Free on application to Branch of Distribution, U.S. Geological Survey, 1200 South Eads Street, Arlington, VA 22202

CONTENTS

ILLUSTRATIONS

TABLES

Earthquakes in the United States, January-March 1978

By C. W. Stover, J. H. Minsch, and B. G. Reagor

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 three maps 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 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

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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	85	Cracked	86	Rotated
	87	Fallen				
Chimneys	88	Bricks loosened	89	Twisted	90	Fallen
	91	Broken at roof line			92	Bricks 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	156	Flow disturbed
			157	Muddied		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.

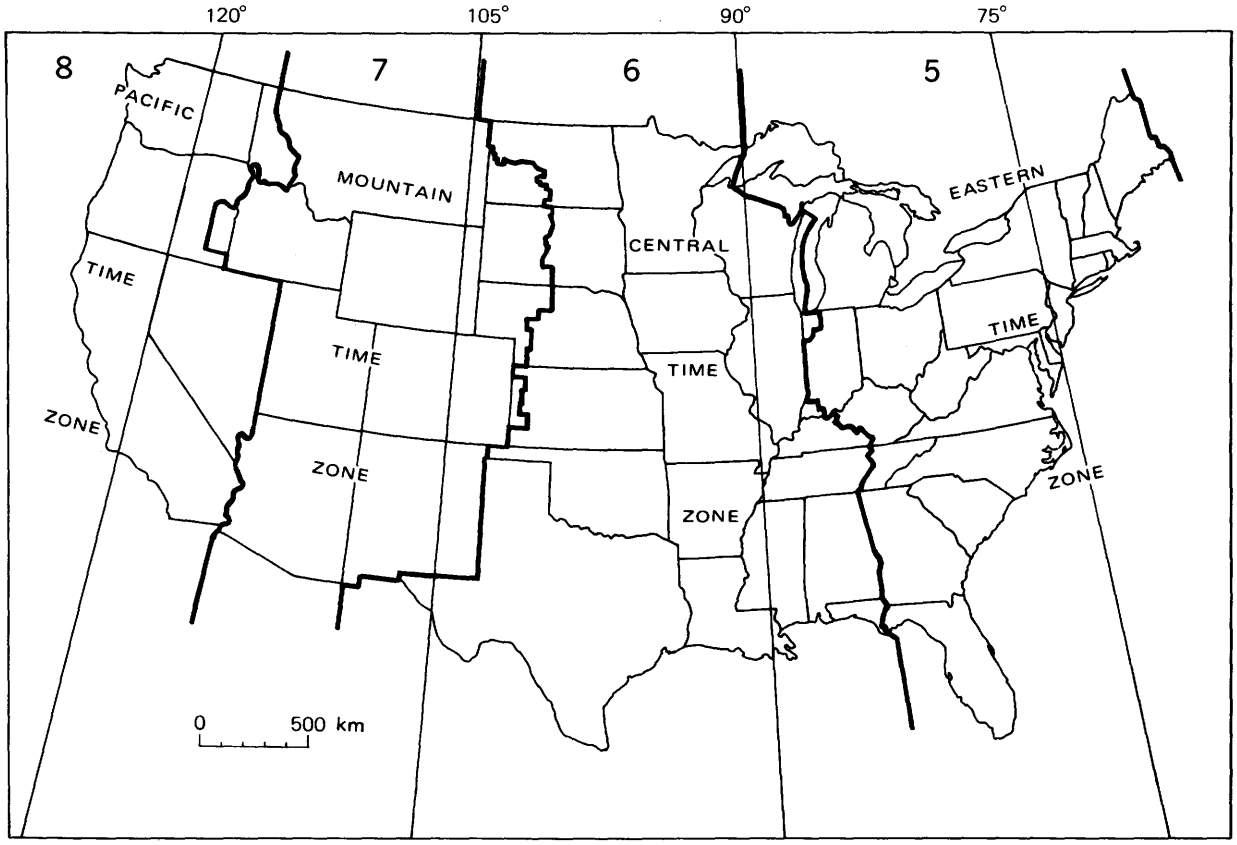

FIGURE 2.—Standard time zones of the conterminous United States. The number in each zone shows the number of hours to be subtracted from Universal Coordinated Time to convert to local standard time. (Subtract 1 hour less for local daylight-saving time.)

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 January-March 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 horizontal surface-wave ground amplitude, in micrometers; T is the period, in seconds, and $18 \leq T \leq 22$; and D is the distance, in geocentric degrees (station to epicenter), and $20° \leq D \leq 160°$. No depth correction is made for depths less than 50 km.

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

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 $D \geq 5°$.

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

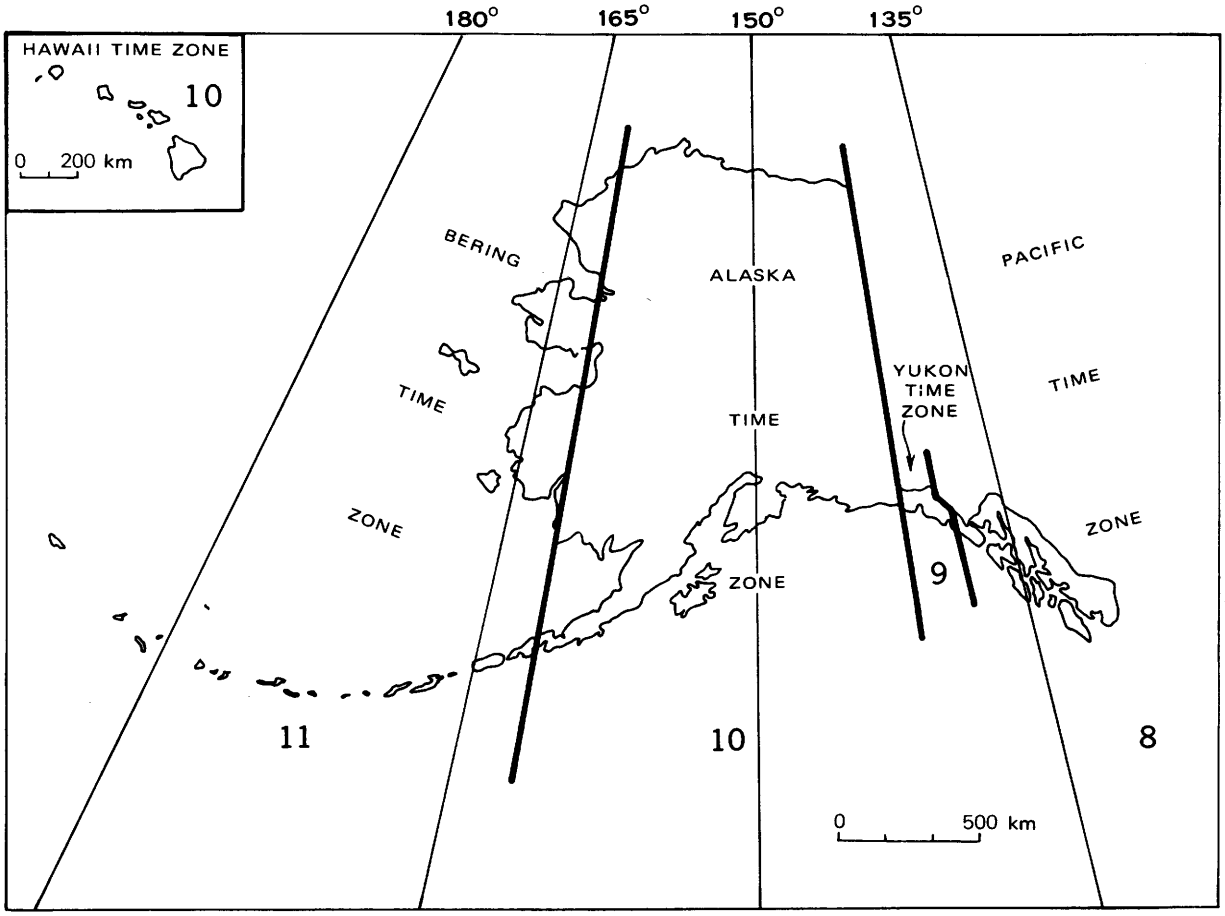

FIGURE 3.—Standard time zones of Alaska and Hawaii. The number in each zone shows the number of hours to be subtracted from Universal Coordinated Time to convert to local standard time. (Subtract 1 hour less for local daylight-saving time.)

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.

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

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

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 an Intensity II. These reports are filed in the offices of the NEIS or in government archives and are available for detailed study.

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

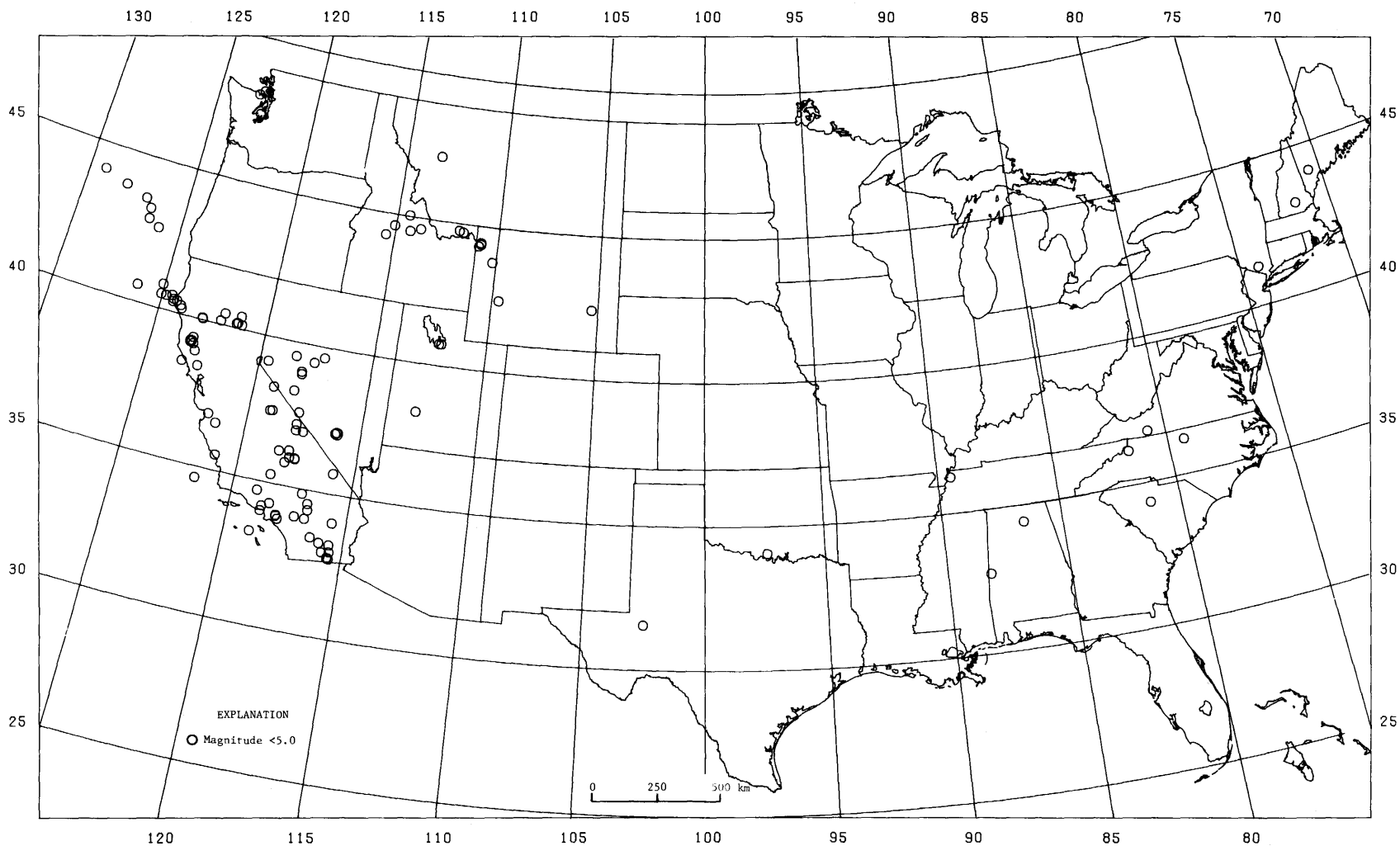

FIGURE 4.--Earthquake epicenters in the conterminous United States for January-March 1978, plotted from table 1.

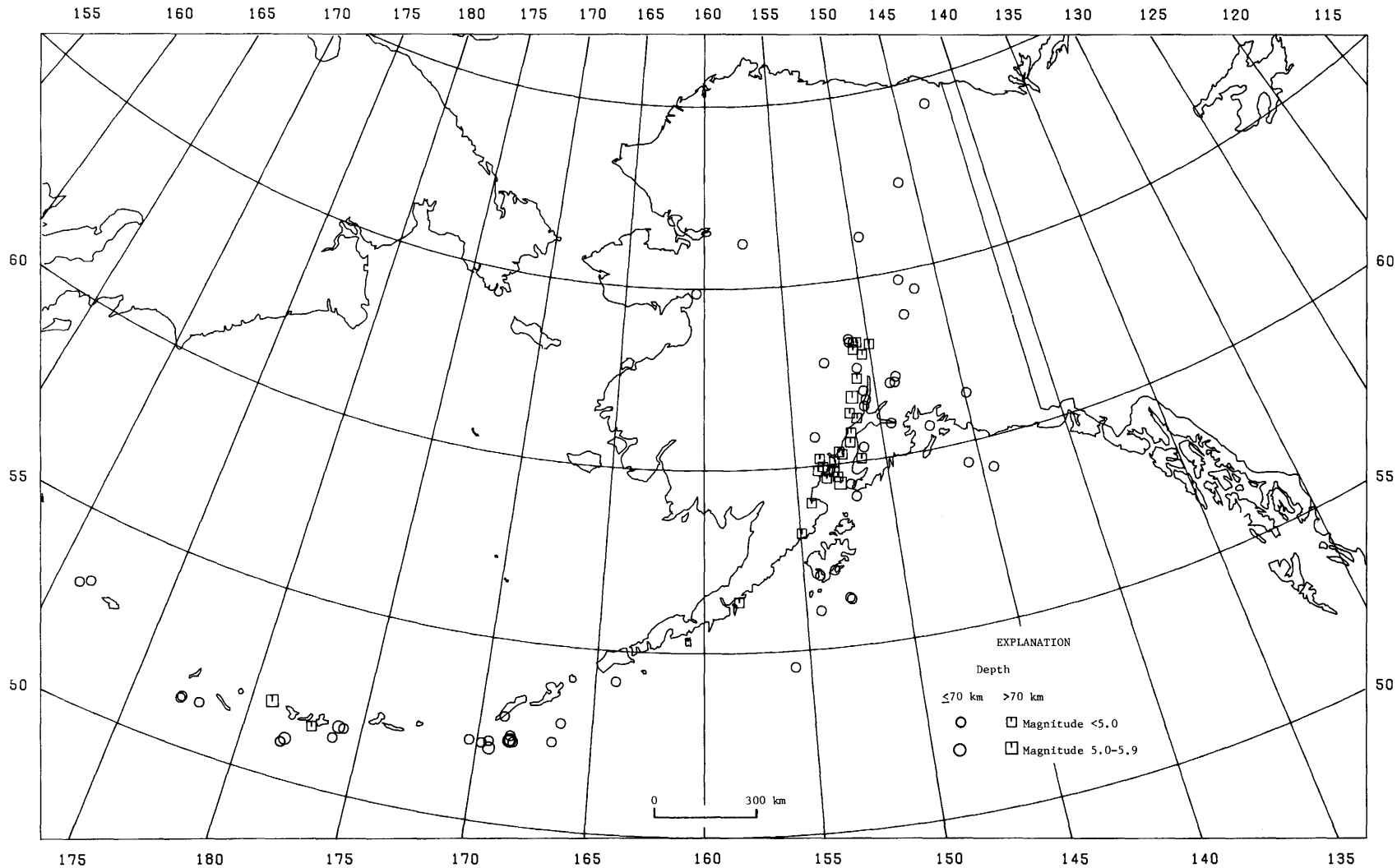

FIGURE 5.—Earthquake epicenters in Alaska for January-March 1978, plotted from table 1.

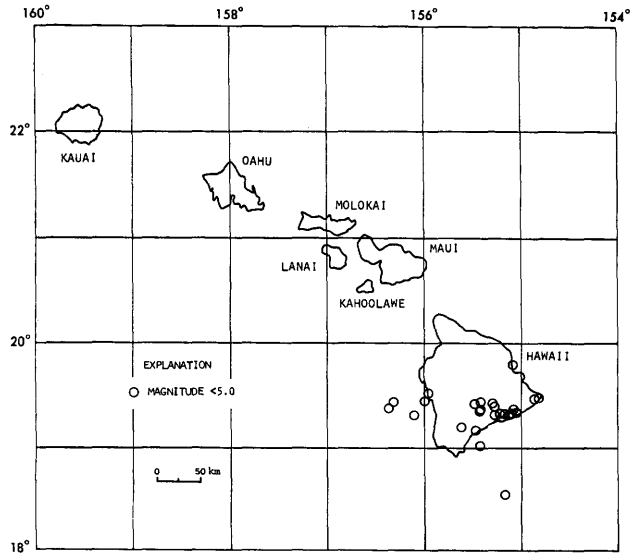

FIGURE 6.—Earthquake epicenters in Hawaii for January-March 1978, plotted from table 1.

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 January-March 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; (L) Lamont-Doherty Geological Observatory, Palisades, N.Y.; (M) National Oceanic and Atmospheric Administration, Alaska Tsunami Warning Center, Palmer; (P) California Institute of Technology, Pasadena; (S) St. Louis University, St. Louis, Missouri; (T) University of Oklahoma, Leonard; (U) University of Utah, Salt Lake City; (V) Virginia Polytechnic Institute and State University, Blacksburg; (W) University of Washington, Seattle. 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
							ALABAMA								
JAN.	8	11	34	23.6	32.76 N.	88.24 W.	5	...	...	3.0G	...	G	JAN.	8	05 A.M. CST
MAR.	1	04	8	26.6	34.42 N.	86.61 W.	5	...	...	2.5G	III	G	FEB.	28	10 P.M. CST
							ALASKA								
JAN.	2	04	23	11.0	60.81 N.	151.72 W.	87	4.0	...	...	...	G	JAN.	1	06 P.M. AST
JAN.	2	20	57	38.2	51.10 N.	178.15 W.	33N	5.1	...	...	...	G	JAN.	2	09 A.M. BST
JAN.	3	20	07	43.4	64.43 N.	146.56 W.	23	...	...	3.9M	...	G	JAN.	3	10 A.M. AST
JAN.	5	19	56	09.8	61.33 N.	151.65 W.	110	4.4	...	...	III	G	JAN.	5	09 A.M. AST
JAN.	5	21	00	13.2	56.02 N.	154.27 W.	33N	4.9	...	4.1M	...	G	JAN.	5	11 A.M. AST
JAN.	6	07	08	43.8	51.78 N.	176.01 W.	63	5.3	...	...	IV	G	JAN.	5	08 P.M. BST
JAN.	6	21	59	01.1	60.91 N.	149.38 W.	45	4.6	...	4.9M	V	G	JAN.	6	11 A.M. AST
JAN.	7	20	48	45.0	61.91 N.	150.67 W.	67	...	...	...	...	G	JAN.	7	10 A.M. AST
JAN.	8	22	13	57.1	57.11 N.	153.41 W.	26	4.8	...	...	...	G	JAN.	8	12 P.M. AST
JAN.	9	07	06	05.8	62.00 N.	148.82 W.	9	...	...	3.5M	III	G	JAN.	8	09 P.M. AST
JAN.	9	22	18	14.6	51.61 N.	177.17 W.	121	3.9	...	...	II	G	JAN.	9	11 A.M. BST
JAN.	10	12	09	16.4	64.74 N.	147.44 W.	24	...	...	2.8M	III	A	JAN.	10	02 A.M. AST
JAN.	13	23	33	25.2	60.54 N.	151.83 W.	79	...	...	...	...	G	JAN.	13	01 P.M. AST
JAN.	14	20	30	38.7	54.17 N.	164.09 W.	40	4.8	...	...	...	G	JAN.	14	09 A.M. BST
JAN.	15	21	08	58.7	59.16 N.	144.39 W.	33N	4.7	...	3.7M	...	G	JAN.	15	11 A.M. AST
JAN.	17	18	49	45.0	63.26 N.	150.90 W.	33N	...	...	3.0M	...	G	JAN.	17	08 A.M. AST
JAN.	18	04	51	51.1	52.18 N.	170.35 W.	33N	4.6	...	...	...	G	JAN.	17	05 P.M. BST
JAN.	18	17	04	18.1	52.92 N.	166.43 W.	70	...	...	...	IV	G	JAN.	18	06 A.M. BST
JAN.	19	16	24	48.2	63.15 N.	149.92 W.	103	...	...	...	...	G	JAN.	19	06 A.M. AST
JAN.	21	22	49	37.7	66.24 N.	157.40 W.	33N	...	...	4.1M	...	G	JAN.	21	12 P.M. AST
JAN.	22	02	02	54.0	60.24 N.	152.33 W.	115	...	...	...	III	G	JAN.	21	04 P.M. AST
JAN.	22	08	09	28.4	51.30 N.	177.90 E.	32	5.2	4.7	...	...	G	JAN.	21	09 P.M. BST
JAN.	23	13	46	54.2	61.65 N.	150.63 W.	52	...	...	...	...	G	JAN.	23	03 A.M. AST
JAN.	25	09	20	21.4	69.30 N.	142.83 W.	5	...	...	...	...	G	JAN.	24	11 P.M. AST
JAN.	25	11	32	06.6	60.64 N.	147.27 W.	33N	...	...	3.7M	...	G	JAN.	25	01 A.M. AST
JAN.	25	21	43	03.6	52.13 N.	169.81 W.	21	5.0	4.2	...	...	G	JAN.	25	10 A.M. BST
JAN.	26	03	10	55.8	54.56 N.	155.73 W.	33N	4.7	...	...	...	G	JAN.	25	05 P.M. AST
JAN.	27	18	52	59.2	60.37 N.	151.12 W.	70	4.7	...	...	III	G	JAN.	27	08 A.M. AST
JAN.	28	02	19	39.4	63.25 N.	150.68 W.	120	...	...	...	...	G	JAN.	27	04 P.M. AST
JAN.	28	02	25	01.6	63.06 N.	150.96 W.	126	4.4	...	...	...	G	JAN.	27	04 P.M. AST
JAN.	28	18	53	06.8	60.07 N.	151.33 W.	77	4.5	...	...	III	G	JAN.	28	08 A.M. AST
JAN.	29	12	58	48.8	62.90 N.	150.48 W.	114	3.4	...	...	...	G	JAN.	29	02 A.M. AST
FEB.	2	21	49	02.1	62.01 N.	149.06 W.	49	...	...	...	...	G	FEB.	2	11 A.M. AST
FEB.	4	05	00	34.7	62.26 N.	150.96 W.	79	...	...	...	...	G	FEB.	3	07 P.M. AST
FEB.	5	12	40	26.1	58.18 N.	154.92 W.	133	...	...	...	...	G	FEB.	5	02 A.M. AST
FEB.	6	07	00	50.0	59.79 N.	152.90 W.	117	...	...	...	...	G	FEB.	5	09 P.M. AST
FEB.	10	13	18	43.3	62.16 N.	148.71 W.	33N	...	...	3.0M	...	G	FEB.	10	03 A.M. AST
FEB.	11	12	10	27.6	53.07 N.	171.03 E.	33N	5.2	4.7	...	...	G	FEB.	11	01 A.M. BST
FEB.	12	08	56	38.9	59.45 N.	152.62 W.	72	5.4	...	...	V	G	FEB.	11	10 P.M. AST
FEB.	13	01	16	54.3	59.86 N.	153.76 W.	131	4.9	...	...	...	G	FEB.	12	03 P.M. AST

Table 1.--Summary of U.S. earthquakes for January-March 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						
FEB. 16	14 52 42.0	59.43 N.	145.63 W.	52	4.0	4.7	...	...	G	FEB. 16	04 A.M. AST
FEB. 16	18 33 42.3	52.38 N.	166.75 W.	33	4.6	...	...	...	G	FEB. 16	07 A.M. BST
FEB. 16	20 53 49.0	61.31 N.	144.89 W.	33N	...	...	4.1M	IV	G	FEB. 16	10 A.M. AST
FEB. 19	06 28 57.6	63.36 N.	151.17 W.	50	...	...	3.6M	...	G	FEB. 18	08 P.M. AST
FEB. 19	14 30 04.3	51.96 N.	178.44 W.	48	4.1	...	...	...	G	FEB. 19	03 A.M. BST
FEB. 20	03 43 11.6	51.32 N.	177.12 E.	37	4.2	...	...	...	G	FEB. 19	04 P.M. BST
FEB. 20	03 45 39.4	51.26 N.	177.10 E.	44	4.8	...	...	...	G	FEB. 19	04 P.M. BST
FEB. 21	05 31 26.6	62.78 N.	152.78 W.	33N	3.5	...	...	...	G	FEB. 20	07 P.M. AST
FEB. 22	21 55 57.3	51.46 N.	176.17 W.	56	4.1	...	...	...	G	FEB. 22	10 A.M. BST
FEB. 26	10 52 37.8	60.07 N.	152.85 W.	125	4.4	...	...	...	G	FEB. 26	00 A.M. AST
MAR. 1	11 58 47.6	66.09 N.	149.49 W.	33N	...	...	3.5M	...	G	MAR. 1	01 A.M. AST
MAR. 2	01 48 33.7	61.19 N.	151.27 W.	97	...	...	...	...	G	MAR. 1	03 P.M. AST
MAR. 2	10 56 19.3	53.23 N.	171.49 E.	33N	4.3	...	...	...	G	MAR. 1	11 P.M. BST
MAR. 2	14 41 40.7	56.39 N.	158.28 W.	88	4.9	...	...	...	G	MAR. 2	04 A.M. AST
MAR. 3	18 48 36.7	56.32 N.	152.80 W.	35	4.5	...	...	...	G	MAR. 3	08 A.M. AST
MAR. 4	07 34 10.7	52.93 N.	168.95 W.	48	4.4	...	...	...	G	MAR. 3	08 P.M. BST
MAR. 4	10 23 01.4	56.26 N.	152.72 W.	20	4.6	...	...	...	G	MAR. 4	00 A.M. AST
MAR. 5	00 33 26.8	59.96 N.	153.50 W.	155	4.5	...	...	...	G	MAR. 4	02 P.M. AST
MAR. 6	18 40 23.6	51.76 N.	175.81 W.	65	4.7	...	...	II	G	MAR. 6	07 A.M. BST
MAR. 6	20 47 25.6	59.00 N.	154.27 W.	138	...	...	...	...	G	MAR. 6	10 A.M. AST
MAR. 7	01 53 13.8	59.65 N.	152.71 W.	102	...	...	...	...	G	MAR. 6	03 P.M. AST
MAR. 10	02 34 35.0	60.79 N.	153.77 W.	44	...	...	3.5M	...	G	MAR. 9	04 P.M. AST
MAR. 11	13 30 06.4	59.41 N.	152.08 W.	68	...	...	...	...	G	MAR. 11	03 A.M. AST
MAR. 12	03 15 19.2	61.48 N.	150.76 W.	46	...	...	...	...	G	MAR. 11	05 P.M. AST
MAR. 14	02 30 23.6	51.97 N.	179.11 W.	102	5.1	...	...	...	G	MAR. 13	03 P.M. BST
MAR. 15	15 01 51.4	52.26 N.	168.44 W.	20	4.7	...	...	...	G	MAR. 15	04 A.M. BST
MAR. 16	02 00 50.4	52.27 N.	168.59 W.	38	5.1	...	...	...	G	MAR. 15	03 P.M. BST
MAR. 16	02 09 38.4	52.30 N.	168.62 W.	49	5.5	5.3	...	...	G	MAR. 15	03 P.M. BST
MAR. 16	02 31 10.5	52.43 N.	168.59 W.	51	4.6	...	...	...	G	MAR. 15	03 P.M. BST
MAR. 16	03 29 59.6	52.31 N.	168.58 W.	33N	5.0	...	...	...	G	MAR. 15	04 P.M. BST
MAR. 18	16 12 35.3	59.63 N.	153.34 W.	126	...	...	...	...	G	MAR. 18	06 A.M. AST
MAR. 18	21 26 38.8	62.55 N.	150.88 W.	34	...	...	3.3M	...	G	MAR. 18	11 A.M. AST
MAR. 19	03 37 05.3	63.78 N.	147.50 W.	11	3.4	...	3.5M	...	G	MAR. 18	05 P.M. AST
MAR. 20	03 59 05.0	60.18 N.	153.61 W.	153	4.9	...	...	II	G	MAR. 19	05 P.M. AST
MAR. 20	08 15 37.5	59.84 N.	153.24 W.	134	3.8	...	...	III	G	MAR. 19	10 P.M. AST
MAR. 22	15 45 20.3	64.88 N.	160.48 W.	33N	4.7	...	3.8M	...	G	MAR. 22	05 A.M. AST
MAR. 23	07 23 13.4	52.01 N.	169.47 W.	23	5.6	5.8	...	...	G	MAR. 22	08 P.M. BST
MAR. 24	05 22 09.9	52.22 N.	169.52 W.	33	4.7	...	...	...	G	MAR. 23	06 P.M. BST
MAR. 25	06 20 19.3	57.00 N.	154.17 W.	33N	4.0	...	...	...	G	MAR. 24	08 P.M. AST
MAR. 26	09 30 29.5	63.28 N.	151.12 W.	33N	...	...	3.4M	...	G	MAR. 25	11 P.M. AST
MAR. 26	20 08 12.2	67.36 N.	146.07 W.	33N	...	...	...	...	G	MAR. 26	10 A.M. AST
MAR. 28	10 28 50.8	59.05 N.	151.83 W.	33N	...	...	...	...	G	MAR. 28	00 A.M. AST
MAR. 31	00 19 06.2	60.33 N.	152.52 W.	128	4.5	...	...	...	G	MAR. 30	02 P.M. AST
MAR. 31	00 38 13.4	61.77 N.	151.41 W.	90	5.1	...	...	V	G	MAR. 30	02 P.M. AST
					CALIFORNIA						
JAN. 4	12 23 0.5	40.65 N.	124.77 W.	27	...	...	3.7B	IV	B	JAN. 4	04 A.M. PST
JAN. 5	10 52 21.2	36.25 N.	117.93 W.	2	...	...	3.3P	...	P	JAN. 5	02 A.M. PST
JAN. 6	06 11 42.4	36.18 N.	118.38 W.	5	...	...	3.2B	...	G	JAN. 5	10 P.M. PST
JAN. 6	10 42 44.8	39.42 N.	123.33 W.	14	...	...	2.9B	V	B	JAN. 6	02 A.M. PST
JAN. 10	08 21 35.8	36.63 N.	121.31 W.	4	...	...	3.0B	...	B	JAN. 10	00 A.M. PST
JAN. 10	22 10 31.3	40.10 N.	121.09 W.	5	...	...	3.4B	...	B	JAN. 10	02 P.M. PST
JAN. 14	15 45 45.6	38.81 N.	122.79 W.	5	...	...	3.1B	III	B	JAN. 14	07 A.M. PST
JAN. 14	16 13 8.9	40.32 N.	124.07 W.	5	...	...	3.0B	...	B	JAN. 14	08 A.M. PST
JAN. 15	09 47 2.4	35.80 N.	118.03 W.	5	...	...	3.4P	...	P	JAN. 15	01 A.M. PST
JAN. 15	10 5 12.7	37.52 N.	119.04 W.	5	...	...	3.3B	...	B	JAN. 15	02 A.M. PST
JAN. 15	12 29 0.9	37.48 N.	119.03 W.	10	...	...	3.8B	...	B	JAN. 15	04 A.M. PST
JAN. 15	14 38 26.2	39.14 N.	123.25 W.	5	...	...	3.0B	IV	B	JAN. 15	06 A.M. PST
JAN. 17	20 59 12.9	39.15 N.	123.26 W.	8	...	...	2.9B	V	B	JAN. 17	12 P.M. PST
JAN. 21	11 20 40.5	40.26 N.	121.28 W.	15	...	...	2.9B	...	B	JAN. 21	03 A.M. PST
JAN. 21	11 26 9.4	40.25 N.	121.27 W.	11	...	...	2.6B	...	B	JAN. 21	03 A.M. PST

Table 1.--Summary of U.S. earthquakes for January-March 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							
JAN. 24	08 13 21.7	33.27 N.	116.00 W.	5	...	...	3.3P	...	P	JAN. 24	00 A.M. PST
JAN. 24	12 26 44.2	34.68 N.	118.93 W.	5	...	...	3.0P	...	P	JAN. 24	04 A.M. PST
JAN. 25	10 40 50.0	34.32 N.	118.33 W.	5	...	...	2.7P	III	P	JAN. 25	02 A.M. PST
JAN. 28	08 49 02.5	39.40 N.	123.35 W.	5	...	...	2.5B	V	B	JAN. 28	00 A.M. PST
JAN. 29	01 55 49.8	37.18 N.	117.85 W.	11	...	...	2.9B	...	B	JAN. 28	05 P.M. PST
JAN. 29	02 56 9.0	34.03 N.	115.62 W.	4	...	...	3.4B	...	P	JAN. 28	06 P.M. PST
JAN. 31	14 18 10.0	34.18 N.	118.63 W.	6	...	...	2.1P	III	P	JAN. 31	06 A.M. PST
FEB. 2	14 8 44.6	32.97 N.	115.85 W.	2	...	...	3.0P	...	P	FEB. 2	06 A.M. PST
FEB. 5	09 53 41.5	34.32 N.	116.72 W.	5	...	...	3.6P	...	P	FEB. 5	01 A.M. PST
FEB. 6	00 39 25.8	34.03 N.	116.78 W.	6	...	...	3.1P	III	P	FEB. 5	04 P.M. PST
FEB. 6	01 1 28.9	34.03 N.	116.78 W.	6	...	...	3.3P	III	P	FEB. 5	05 P.M. PST
FEB. 6	12 57 14.2	33.25 N.	115.57 W.	4	...	...	3.4P	V	P	FEB. 6	04 A.M. PST
FEB. 7	13 39 22.7	39.41 N.	123.17 W.	5	...	...	2.7B	V	B	FEB. 7	05 A.M. PST
FEB. 8	20 8 21.2	36.91 N.	121.70 W.	14	...	...	3.0B	...	B	FEB. 8	12 P.M. PST
FEB. 11	01 45 30.5	33.02 N.	115.53 W.	7	...	...	2.5P	II	P	FEB. 10	05 P.M. PST
FEB. 11	01 45 51.0	33.02 N.	115.53 W.	5	...	...	2.5P	II	P	FEB. 10	05 P.M. PST
FEB. 11	02 25 51.4	33.02 N.	115.53 W.	6	...	...	3.1P	III	P	FEB. 10	06 P.M. PST
FEB. 13	06 8 46.5	40.23 N.	122.11 W.	15	...	...	3.3B	...	B	FEB. 12	10 P.M. PST
FEB. 13	18 4 6.3	34.02 N.	117.22 W.	6	...	...	2.9P	II	P	FEB. 13	10 A.M. PST
FEB. 14	16 33 46.9	38.41 N.	122.65 W.	8	...	...	2.8B	II	B	FEB. 14	08 A.M. PST
FEB. 14	20 3 9.5	38.42 N.	122.66 W.	9	...	...	2.5B	II	B	FEB. 14	12 P.M. PST
FEB. 14	21 3 55.4	40.30 N.	124.27 W.	10	...	...	4.0B	IV	B	FEB. 14	01 P.M. PST
FEB. 16	10 54 35.3	33.42 N.	116.40 W.	5	...	...	3.0P	...	P	FEB. 16	02 A.M. PST
FEB. 17	07 35 26.7	40.10 N.	121.43 W.	10	...	...	3.0B	...	B	FEB. 16	11 P.M. PST
FEB. 17	10 13 45.2	35.72 N.	115.92 W.	4	...	...	3.0P	...	P	FEB. 17	02 A.M. PST
FEB 20	23 38 54.3	35.65 N.	121.04 W.	5	...	...	3.1B	...	B	FEB. 20	03 P.M. PST
FEB. 23	10 14 6.1	38.29 N.	119.11 W.	7	...	...	3.2B	...	B	FEB. 23	02 A.M. PST
FEB. 23	16 43 3.7	32.82 N.	115.60 W.	19	...	...	3.6P	V	P	FEB. 23	08 A.M. PST
FEB. 28	16 20 52.1	40.51 N.	121.93 W.	5	...	...	3.0B	...	B	FEB. 28	08 A.M. PST
MAR. 1	04 54 31.2	34.53 N.	116.77 W.	5	...	...	4.4P	VI	P	FEB. 28	08 P.M. PST
MAR. 3	18 37 24.0	36.02 N.	117.63 W.	3	...	...	3.0P	...	P	MAR. 3	10 A.M. PST
MAR. 7	15 28 33.7	36.00 N.	117.63 W.	5	...	...	3.3P	...	P	MAR. 7	07 A.M. PST
MAR. 8	14 49 34.9	33.83 N.	117.88 W.	5	...	...	2.9P	IV	P	MAR. 8	06 A.M. PST
MAR. 13	16 38 15.7	33.93 N.	117.98 W.	4	...	...	3.2P	VI	P	MAR. 13	08 A.M. PST
MAR. 14	16 9 51.2	33.95 N.	117.97 W.	4	...	...	2.5P	IV	P	MAR. 14	08 A.M. PST
MAR. 14	23 59 55.0	34.00 N.	118.68 W.	12	...	...	3.2P	...	P	MAR. 14	03 P.M. PST
MAR. 15	04 2 49.4	32.78 N.	115.53 W.	5	...	...	2.9P	III	P	MAR. 14	08 P.M. PST
MAR. 15	04 9 39.7	32.78 N.	115.57 W.	5	...	...	3.2P	III	P	MAR. 14	08 P.M. PST
MAR. 18	08 20 36.5	35.32 N.	118.52 W.	5	...	...	3.5P	...	P	MAR. 18	00 A.M. PST
MAR. 20	00 7 56.7	36.00 N.	117.87 W.	1	...	...	3.0P	III	P	MAR. 19	04 P.M. PST
MAR. 21	14 5 12.1	40.44 N.	124.45 W.	11	...	...	3.5B	IV	B	MAR. 21	06 A.M. PST
MAR. 21	20 17 6.8	40.44 N.	124.46 W.	13	...	...	3.4B	...	B	MAR. 21	12 P.M. PST
MAR. 22	06 33 17.3	40.12 N.	122.95 W.	5	...	...	3.2B	...	B	MAR. 21	10 P.M. PST
MAR. 22	08 40 35.3	40.09 N.	122.95 W.	14	...	...	3.2B	...	B	MAR. 22	00 A.M. PST
MAR. 26	00 27 4.8	39.21 N.	123.17 W.	9	4.9	...	4.4B	VI	B	MAR. 25	04 P.M. PST
MAR. 26	00 34 11.9	39.21 N.	123.14 W.	5	...	...	3.1B	IV	B	MAR. 25	04 P.M. PST
MAR. 26	01 19 10.0	39.20 N.	123.17 W.	10	3.6	...	3.6B	IV	B	MAR. 25	05 P.M. PST
MAR. 26	02 29 16.9	39.21 N.	123.17 W.	5	...	...	3.3B	IV	B	MAR. 25	06 P.M. PST
MAR. 26	04 28 18.6	39.23 N.	123.19 W.	3	...	...	3.5B	IV	B	MAR. 25	08 P.M. PST
MAR. 26	10 56 22.4	36.93 N.	117.46 W.	5	...	...	3.2B	...	B	MAR. 26	02 A.M. PST
MAR. 27	04 27 1.1	34.85 N.	117.08 W.	5	...	...	3.1P	...	P	MAR. 26	08 P.M. PST
MAR. 27	04 29 13.9	37.00 N.	117.83 W.	2	...	...	3.1B	...	B	MAR. 26	08 P.M. PST
MAR. 27	08 44 3.0	40.43 N.	124.31 W.	14	...	...	3.2B	V	G	MAR. 27	00 A.M. PST
MAR. 27	16 15 33.6	39.19 N.	123.16 W.	8	...	...	3.0B	...	B	MAR. 27	08 A.M. PST
MAR. 31	01 3 27.7	38.48 N.	123.34 W.	7	4.1	...	3.6B	...	B	MAR. 30	05 P.M. PST

Table 1.--Summary of U.S. earthquakes for January-March 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—OFF THE COAST															
JAN.	2	06	39	19.5	40.86 N.	125.23 W.	16	3.9	4.1	4.1B	...	B	JAN.	1	10 P.M. PST
JAN.	11	18	25	34.3	40.60 N.	126.20 W.	5	...	...	3.8B	...	B	JAN.	11	10 A.M. PST
JAN.	12	08	53	50.5	40.90 N.	125.75 W.	5	...	...	3.0B	...	B	JAN.	12	00 A.M. PST
JAN.	18	16	8	39.2	40.53 N.	124.83 W.	25	...	...	3.7B	...	B	JAN.	18	08 A.M. PST
JAN.	24	13	2	3.9	34.61 N.	121.62 W.	10	...	...	3.0B	...	G	JAN.	24	05 A.M. PST
JAN.	27	16	50	50.3	33.25 N.	118.95 W.	14	...	...	3.3P	...	P	JAN.	27	08 A.M. PST
JAN.	29	05	51	04.8	40.20 N.	124.60 W.	5	...	...	3.2B	...	B	JAN.	28	09 P.M. PST
JAN.	29	06	1	22.0	40.41 N.	124.93 W.	22	...	...	3.6B	...	B	JAN.	28	10 P.M. PST
FLORIDA															
JAN.	12	21	10		NEAR HAINES CITY		.	...	...	...	IV	.	JAN.	12	04 P.M. EST
HAWAII															
JAN.	4	18	42	27.2	19.33 N.	155.18 W.	10	...	...	3.7H	IV	H	JAN.	4	08 A.M. HST
JAN.	5	13	58	46.6	19.32 N.	155.27 W.	10	...	...	3.2H	IV	H	JAN.	5	03 A.M. HST
JAN.	11	08	33	11.3	19.33 N.	155.22 W.	10	...	...	3.8H	IV	H	JAN.	10	10 P.M. HST
JAN.	13	00	34	06.1	19.53 N.	155.95 W.	10	...	...	3.0H	III	H	JAN.	12	02 P.M. HST
JAN.	20	01	52	10.0	19.80 N.	155.09 W.	37	...	...	3.0H	...	H	JAN.	19	03 P.M. HST
JAN.	22	15	41	32.7	19.32 N.	155.12 W.	9	...	...	3.3H	...	H	JAN.	22	05 A.M. HST
JAN.	23	06	21	38.5	19.33 N.	155.06 W.	9	...	...	3.7H	IV	H	JAN.	22	08 P.M. HST
JAN.	23	06	28	26.9	19.34 N.	155.07 W.	9	...	...	3.6H	IV	H	JAN.	23	08 P.M. HST
JAN.	25	01	18	16.8	19.33 N.	155.10 W.	9	...	...	3.2H	III	H	JAN.	24	03 P.M. HST
JAN.	30	10	38	02.5	19.38 N.	156.36 W.	5	...	...	3.2H	...	H	JAN.	30	00 A.M. HST
FEB.	2	21	03	47.7	19.33 N.	155.23 W.	33	...	...	3.3H	...	H	FEB.	2	11 A.M. HST
FEB.	3	02	21	21.6	19.33 N.	155.13 W.	9	...	...	3.0H	...	H	FEB.	2	04 P.M. HST
FEB.	3	05	32	45.8	19.43 N.	155.30 W.	16	...	...	3.5H	IV	H	FEB.	2	07 P.M. HST
FEB.	12	15	06	14.4	19.20 N.	155.62 W.	11	...	...	3.1H	...	H	FEB.	12	05 A.M. HST
FEB.	14	20	05	06.2	19.40 N.	155.28 W.	15	...	...	3.4H	III	H	FEB.	14	10 A.M. HST
FEB.	15	16	37	32.6	19.32 N.	156.11 W.	17	...	...	3.0H	...	H	FEB.	15	06 A.M. HST
FEB.	19	00	51	59.6	19.32 N.	155.14 W.	9	...	...	3.0H	...	H	FEB.	18	02 P.M. HST
FEB.	19	21	49	47.6	19.02 N.	155.42 W.	42	...	...	3.1H	...	H	FEB.	19	11 A.M. HST
FEB.	21	11	56	55.7	19.37 N.	155.09 W.	8	...	...	3.3H	...	H	FEB.	21	01 A.M. HST
FEB.	23	16	06	11.0	19.33 N.	155.10 W.	9	...	...	3.1H	...	H	FEB.	23	06 A.M. HST
FEB.	24	18	37	04.6	19.45 N.	155.99 W.	21	...	...	3.1H	...	H	FEB.	24	08 A.M. HST
FEB.	25	08	55	27.2	19.44 N.	156.32 W.	17	...	...	3.2H	III	H	FEB.	24	10 P.M. HST
MAR.	2	10	51	02.9	19.33 N.	155.22 W.	9	...	...	3.7H	IV	H	MAR.	2	00 A.M. HST
MAR.	10	15	24	43.2	19.33 N.	155.13 W.	10	...	...	3.1H	...	H	MAR.	10	05 A.M. HST
MAR.	17	12	29	01.5	19.44 N.	155.42 W.	9	...	...	3.2H	...	H	MAR.	17	02 A.M. HST
MAR.	17	12	46	13.9	19.33 N.	155.22 W.	10	...	...	3.0H	...	H	MAR.	17	02 A.M. HST
MAR.	21	05	13	25.4	19.37 N.	155.42 W.	12	...	...	3.3H	III	H	MAR.	20	07 P.M. HST
MAR.	24	23	06	30.0	19.47 N.	154.88 W.	44	...	...	3.0H	...	H	MAR.	24	01 P.M. HST
MAR.	27	05	12	56.9	19.17 N.	155.48 W.	37	...	...	3.0H	...	H	MAR.	26	07 P.M. HST
MAR.	27	21	31	08.4	19.35 N.	155.43 W.	11	...	...	3.1H	...	H	MAR.	27	11 A.M. HST
MAR.	28	07	57	50.6	19.48 N.	154.83 W.	7	...	...	3.1H	...	H	MAR.	27	09 P.M. HST
MAR.	29	01	42	46.2	18.55 N.	155.18 W.	13	...	...	3.4H	...	H	MAR.	28	03 P.M. HST
MAR.	31	15	23	41.3	19.42 N.	155.48 W.	11	...	...	3.3H	...	H	MAR.	31	05 A.M. HST
IDAHO															
FEB.	13	17	35	36.9	45.06 N.	114.44 W.	5	...	...	3.3G	...	G	FEB.	13	10 A.M. MST
FEB.	22	00	37	1.1	44.61 N.	115.06 W.	5	3.9	...	3.8G	...	G	FEB.	21	05 P.M. MST
FEB.	25	21	22	21.2	44.64 N.	113.80 W.	5	...	...	...	...	G	FEB.	25	02 P.M. MST
MAR.	19	02	33	48.7	44.50 N.	114.33 W.	5	...	...	3.2G	...	G	MAR.	18	07 P.M. MST
MAR.	22	14	30	17.0	44.28 N.	115.47 W.	5	4.5	...	4.1G	...	G	MAR.	22	07 A.M. MST
MAINE															
JAN.	4	19	28	10.8	44.04 N.	70.51 W.	0	...	...	3.2J	IV	J	JAN.	4	02 P.M. EST

Table 1.--Summary of U.S. earthquakes for January-March 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
				MONTANA							
JAN. 14	16 53 50.3	44.77 N.	111.94 W.	5	...	...	3.6G	II	G	JAN. 14	09 A.M. MST
MAR. 24	18 35 3.3	47.22 N.	113.33 W.	5	...	...	3.8G	...	G	MAR. 24	11 A.M. MST
MAR. 29	03 53 26.6	44.73 N.	111.74 W.	5	...	...	3.0D	...	G	MAR. 28	08 P.M. MST
				NEVADA							
JAN. 13	03 39 37.0	39.42 N.	117.60 W.	5	...	...	4.1B	V	G	JAN. 12	07 P.M. PST
JAN. 18	06 37 2.7	37.63 N.	117.84 W.	1	...	...	3.4B	...	B	JAN. 17	10 P.M. PST
JAN. 18	08 53 32.3	37.63 N.	117.84 W.	2	...	...	3.7B	...	B	JAN. 18	00 A.M. PST
JAN. 21	17 22 23.5	39.15 N.	119.62 W.	5	...	...	3.0B	...	G	JAN. 21	09 A.M. PST
JAN. 24	22 45 26.7	39.04 N.	118.07 W.	12	...	...	3.0G	...	G	JAN. 24	02 P.M. PST
FEB. 13	21 53 0.8	37.14 N.	116.04 W.	2	3.8	...	4.0B	...	G	FEB. 13	01 P.M. PST
FEB. 14	04 35 24.0	39.63 N.	117.18 W.	5	4.4	...	4.8B	V	G	FEB. 13	08 P.M. PST
FEB. 15	09 25 31.6	39.53 N.	118.45 W.	11	...	...	3.7B	...	G	FEB. 15	01 A.M. PST
FEB. 23	17 0 0.2	37.12 N.	116.06 W.	0	5.7	...	5.4B	...	E	FEB. 23	09 A.M. PST
MAR. 5	22 46 18.2	38.94 N.	118.03 W.	5	4.0	...	4.6B	V	G	MAR. 5	02 P.M. PST
MAR. 15	03 9 14.9	38.35 N.	118.22 W.	5	...	...	3.2G	IV	G	MAR. 14	07 P.M. PST
MAR. 16	15 0 0.9	37.11 N.	116.11 W.	2	3.9	...	4.4B	...	G	MAR. 16	07 A.M. PST
MAR. 23	16 30 0.2	37.10 N.	116.05 W.	0	5.7	...	5.5B	...	E	MAR. 23	08 A.M. PST
				NEW HAMPSHIRE							
MAR. 31	14 27 57.0	43.10 N.	71.63 W.	0	...	...	2.7J	...	J	MAR. 31	09 A.M. EST
				NEW YORK							
MAR. 5	07 53 25.6	41.35 N.	74.15 W.	5	...	...	2.1L	III	L	MAR. 5	02 A.M. EST
				NORTH CAROLINA							
FEB. 25	03 53 27.7	36.19 N.	79.30 W.	8	...	...	2.2V	IV	V	FEB. 24	10 P.M. EST
MAR. 22	15 52 26.7	36.20 N.	81.73 W.	1	...	...	2.9V	...	V	MAR. 22	10 A.M. EST
				OKLAHOMA							
MAR. 9	06 30 51.2	34.07 N.	97.40 W.	5	...	...	2.5T	II	T	MAR. 9	00 A.M. CST
				OREGON--OFF THE COAST							
JAN. 4	16 15 5.6	43.26 N.	126.63 W.	13	4.5	...	...	...	G	JAN. 4	08 A.M. PST
FEB. 1	05 7 29.0	43.84 N.	128.05 W.	24	4.7	...	...	...	G	JAN. 31	09 P.M. PST
FEB. 6	09 55 50.8	43.55 N.	126.96 W.	21	4.1	...	...	...	G	FEB. 6	01 A.M. PST
FEB. 16	12 0 22.2	42.68 N.	126.03 W.	15	5.0	4.5	4.8B	...	G	FEB. 16	04 A.M. PST
FEB. 23	12 45 1.5	44.10 N.	129.25 W.	15	4.3	3.7	...	...	G	FEB. 23	04 A.M. PST
FEB. 24	06 58 36.9	42.91 N.	126.57 W.	15	4.5	4.2	...	...	G	FEB. 23	10 P.M. PST
				SOUTH CAROLINA							
JAN. 25	08 29 39.0	34.30 N.	81.24 W.	1	...	...	2.6G	...	G	JAN. 25	03 A.M. EST
				TENNESSEE							
JAN. 18	23 46 26.1	36.25 N.	89.42 W.	5	...	...	2.6S	III	S	JAN. 18	05 P.M. CST
				TEXAS							
MAR. 2	10 4 52.7	31.56 N.	102.51 W.	11	...	...	3.5G	III	G	MAR. 2	04 A.M. CST
				UTAH							
FEB. 24	19 49 48.8	38.33 N.	112.83 W.	1	...	...	3.0U	...	U	FEB. 24	12 P.M. MST
FEB. 28	00 20 6.5	40.76 N.	112.20 W.	14	...	...	2.7U	V	U	FEB. 27	05 P.M. MST

Table 1.--Summary of U.S. earthquakes for January-March 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
					UTAH--Continued								
MAR.	9	06 30 51.8	40.76 N.	112.08 W.	9	...	...	3.3U	VI	U	MAR.	8	11 P.M. MST
MAR.	9	06 46 20.0	40.77 N.	112.08 W.	7	...	...	2.5U	IV	U	MAR.	8	11 P.M. MST
MAR.	13	13 35 43.4	40.76 N.	112.08 W.	13	...	...	2.8U	IV	U	MAR.	13	06 A.M. MST
					VIRGINIA								
MAR.	17	18 26 34.5	36.75 N.	80.74 W.	7	...	...	2.8V	IV	V	MAR.	17	01 P.M. EST
					WASHINGTON								
MAR.	5	18 13 35.9	48.06 N.	123.00 W.	57	4.0	...	3.3G	IV	W	MAR.	5	10 A.M. PST
MAR.	11	15 52 11.2	47.42 N.	122.71 W.	25	...	...	4.8G	VI	W	MAR.	11	07 A.M. PST
MAR.	29	12 16 38.4	48.20 N.	122.76 W.	24	...	...	2.7G	IV	W	MAR.	29	04 A.M. PST
MAR.	31	08 3 0.2	47.42 N.	122.72 W.	23	...	...	4.2G	V	W	MAR.	31	00 A.M. PST
					WYOMING								
JAN.	16	03 50 3.1	42.43 N.	105.31 W.	5	...	...	3.0G	III	G	JAN.	15	08 P.M. MST
FEB.	2	00 36 25.6	44.39 N.	110.81 W.	5	3.6	...	3.4G	III	G	FEB.	1	05 P.M. MST
FEB.	2	12 35 56.2	44.38 N.	110.83 W.	4	...	...	3.1G	III	G	FEB.	2	05 A.M. MST
FEB.	7	05 3 10.4	42.50 N.	109.70 W.	30	...	...	3.3G	...	G	FEB.	6	10 P.M. MST
MAR.	7	01 10 47.6	44.43 N.	110.84 W.	5	3.7	...	3.5G	V	G	MAR.	6	06 P.M. MST
MAR.	7	07 39 33.1	44.30 N.	110.92 W.	5	3.8	...	3.1G	IV	G	MAR.	7	00 A.M. MST
MAR.	10	07 47 12.6	43.80 N.	110.18 W.	5	...	...	3.2G	...	G	MAR.	10	00 A.M. MST

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 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; (L) Lamont-Doherty Geological Observatory, Palisades, New York; (M) National Oceanic and Atmospheric Administration, Alaska Tsunami Warning Center, Palmer; (O) Earth Physics Branch, Seismological Service of Canada, Ottawa; (P) California Institute of Technology, Pasadena; (S) St. Louis University, St. Louis, Missouri; (T) University of Oklahoma, Leonard; (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]

Alabama

1 March (G) Northern Alabama
- Origin time: 04 08 26.6
- Epicenter: 34.42 N., 86.61 W.
- Depth: 5 km
- Magnitude: 2.5 mbLg
- Intensity III: Huntsville area (V).

Alaska

5 January (G) Southern Alaska
- Origin time: 19 56 09.8
- Epicenter: 61.33 N., 151.65 W.
- Depth: 110 km
- Magnitude: 4.4 mb
- Intensity III: Anchorage (M), Wasilla (M).
- Intensity II: Palmer (M).

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

Alaska--Continued

6 January (G) Andreanof Islands, Aleutian Islands
Origin time: 07 08 43.8
Epicenter: 51.78 N., 176.01 W.
Depth: 63 km
Magnitude: 5.3 mb
Intensity IV: Adak (M).

6 January (G) Kenai Peninsula
Origin time: 21 59 01.1
Epicenter: 60.91 N., 149.38 W.
Depth: 45 km
Magnitude: 4.6 mb, 4.9 ML(M)
Intensity V: Girdwood (small objects fell, not broken).
Intensity IV: Anchorage, Chugiak, Clam Gulch, Cooper Landing, Eagle River, Kenai, Ouzinkie, Seward, Soldotna, Whittier.
Intensity III: Elmendorf AFB, Moose Pass, Palmer.

9 January (G) Southern Alaska
Origin time: 07 06 05.8
Epicenter: 62.00 N., 148.82 W.
Depth: 9 km
Magnitude: 3.5 ML(M)
Intensity III: Anchorage, Lower Susitna Valley, Matanuska.

9 January (G) Andreanof Islands, Aleutian Islands
Origin time: 22 18 14.6
Epicenter: 51.61 N., 177.17 W.
Depth: 121 km
Magnitude: 3.9 mb
Intensity II: Adak (M).

10 January (A) Central Alaska
Origin time: 12 09 16.4
Epicenter: 64.74 N., 147.44 W.
Depth: 24 km
Magnitude: 2.8 ML(M)
Intensity III: Fairbanks.

18 January (G) Fox Islands, Aleutian Islands
Origin time: 17 04 18.1
Epicenter: 52.92 N., 166.43 W.
Depth: 70 km
Magnitude: None computed.
Intensity IV: Unalaska (M).

22 January (G) Cook Inlet
Origin time: 02 02 54.0
Epicenter: 60.24 N., 152.33 W.
Depth: 115 km
Magnitude: None computed.
Intensity III: Anchorage (M).

27 January (G) Kenai Peninsula
Origin time: 18 52 59.2
Epicenter: 60.37 N., 151.12 W.
Depth: 70 km

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

Alaska--Continued

Magnitude: 4.7 mb
Intensity III: Anchorage (M), Eagle River (M), Kenai (M), Soldotna (M).

28 January (G) Kenai Peninsula
Origin time: 18 53 06.8
Epicenter: 60.07 N., 151.33 W.
Depth: 77 km
Magnitude: 4.5 mb
Intensity III: Kenai (M), Nikishka (M).
Intensity II: Anchorage (M).

12 February (G) Cook Inlet
Origin time: 08 56 38.9
Epicenter: 59.45 N., 152.62 W.
Depth: 72 km
Magnitude: 5.4 mb
Intensity V: Anchor Point, Homer, Ouzinkie.
Intensity IV: Seldovia.
Intensity III: Kodiak, Kokhanok, Port Graham.
Intensity II: English Bay (M), Homer (M), King Salmon (M).

16 February (G) Southern Alaska
Origin time: 20 53 49.0
Epicenter: 61.31 N., 144.89 W.
Depth: Normal.
Magnitude: 4.1 ML(M)
Intensity IV: Chitina.

6 March (G) Andreanof Islands, Aleutian Islands
Origin time: 18 40 23.6
Epicenter: 51.76 N., 175.81 W.
Depth: 65 km
Magnitude: 4.7 mb
Intensity II: Adak (M).

20 March (G) Southern Alaska
Origin time: 03 59 05.0
Epicenter: 60.18 N., 153.61 W.
Depth: 153 km
Magnitude: 4.9 mb
Intensity II: Anchorage (M), Homer (M).

20 March (G) Southern Alaska
Origin time: 08 15 37.5
Epicenter: 59.84 N., 153.24 W.
Depth: 134 km
Magnitude: 3.8 mb
Intensity III: Soldotna (M).
Intensity II: Homer (M), Kenai (M).

31 March (G) Southern Alaska
Origin time: 00 38 13.4
Epicenter: 61.77 N., 151.41 W.
Depth: 90 km
Magnitude: 5.1 mb
Intensity V: Cooper Landing (hanging pictures swung; buildings creaked), Skwentna (hanging pictures swung; windows,

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

Alaska--Continued

doors, dishes rattled; buildings creaked), Wasilla (hanging pictures swung; windows, doors, dishes rattled; buildings creaked).
Intensity IV: Anchorage (M), Chugiak, Girdwood, Kasilof, Kenai, Talkeetna, Tyonek, Whittier, Willow.
Intensity III: Elmendorf AFB, Homer (M), Moose Pass, Palmer (M).

Arizona

10 March (P) Baja California
Origin time: 20 34 36.2
Epicenter: 32.33 N., 115.03 W.
Depth: 5 km
Magnitude: 3.5 ML
Intensity III: Yuma (telephone report).

11 March (G) Baja California
Origin time: 23 57 46.8
Epicenter: 32.26 N., 115.12 W.
Depth: 5 km
Magnitude: 4.8 mb, 5.0 ML(P)

This earthquake destroyed approximately 30 houses, cracked dozens of buildings, and interrupted electric power and telephone communications in the cities of San Luis, Sonora, and Luis Sanchez, Mexico.

Intensity VI: Arizona--Yuma (cracked plaster).
Intensity III: California--El Centro (press report).

12 March (G) Baja California
Origin time: 00 30 15.7
Epicenter: 32.23 N., 115.14 W.
Depth: 5 km
Magnitude: 4.5 mb, 4.7 ML(P)
Intensity IV: Arizona--Yuma.
Intensity III: California--southern Imperial Valley (telephone report).

12 March (G) Baja California
Origin time: 18 42 24.3
Epicenter: 32.26 N., 115.11 W.
Depth: 5 km
Magnitude: 4.9 mb, 4.9 ML(P)
Intensity VI:
Arizona--Yuma (cracked plaster, cracked streets).
Intensity IV:
Arizona--Somerton.
California--Imperial, Winterhaven.

16 March (P) Baja California
Origin time: 01 51 10.1
Epicenter: 32.30 N., 115.12 W.

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

Arizona--Continued

Depth: 5 km
Magnitude: 4.2 mb(G), 4.2 ML
Intensity IV: Yuma.

California

4 January (B) Northern California
Origin time: 12 23 02.7
Epicenter: 40.57 N., 124.55 W.
Depth: 29 km
Magnitude: 3.5 ML
Intensity IV: Ferndale, Fortuna.
Intensity III: Eel River Valley.

6 January (B) Northern California
Origin time: 10 42 44.9
Epicenter: 39.35 N., 123.16 W.
Depth: 2 km
Magnitude: 3.0 ML
Intensity V: Willits.

14 January (B) Northern California
Origin time: 15 45 44.8
Epicenter: 38.92 N., 122.92 W.
Depth: 11 km
Magnitude: 3.1 ML
Intensity III: Southern Lake County (press report).

15 January (B) Northern California
Origin time: 14 38 26.1
Epicenter: 39.17 N., 123.24 W.
Depth: 2 km
Magnitude: 3.1 ML
Intensity IV: Ukiah (press report).
Intensity III: Willits (press report).

17 January (B) Northern California
Origin time: 20 59 12.6
Epicenter: 39.19 N., 123.24 W.
Depth: 2 km
Magnitude: 2.8 ML
Intensity V: Ukiah (hairline crack in the wall, dishes rattled, buildings swayed--press report).

25 January (P) Southern California
Origin time: 10 40 50.0
Epicenter: 34.32 N., 118.33 W.
Depth: 5 km
Magnitude: 2.7 ML
Intensity III: La Crescenta, Sylmar.

28 January (B) Northern California
Origin time: 08 49 02.5
Epicenter: 39.40 N., 123.35 W.
Depth: 5 km
Magnitude: 2.5 ML(B)
Intensity V: Willits (furniture and small objects moved; people awakened; windows, doors, dishes rattled).

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

California--Continued

31 January (P) Southern California
Origin time: 14 18 10.0
Epicenter: 34.18 N., 118.63 W.
Depth: 6 km
Magnitude: 2.1 ML
Intensity III: Canoga Park, Chatsworth.

6 February (P) Southern California
Origin time: 00 39 25.8
Epicenter: 34.03 N., 116.78 W.
Depth: 6 km
Magnitude: 3.1 ML
Intensity III: Palm Springs.

6 February (P) Southern California
Origin time: 01 01 28.9
Epicenter: 34.03 N., 116.78 W.
Depth: 6 km
Magnitude: 3.3 ML
Intensity III: Palm Springs.

6 February (P) Imperial Valley
Origin time: 12 57 14.2
Epicenter: 33.25 N., 115.57 W.
Depth: 4 km
Magnitude: 3.4 ML
Intensity V: Niland (many awakened; windows, doors, dishes rattled; buildings shook).
Intensity III: Brawley (telephone report).

7 February (B) Northern California
Origin time: 13 39 22.7
Epicenter: 39.41 N., 123.17 W.
Depth: 5 km
Magnitude: 2.7 ML(B)
Intensity V: Willits (many awakened; small objects shifted; buildings shook; windows, doors, dishes rattled).

11 February (P) Imperial Valley
Origin time: 01 45 30.5
Epicenter: 33.02 N., 115.53 W.
Depth: 7 km
Magnitude: 2.5 ML
Intensity II: Brawley.

11 February (P) Imperial Valley
Origin time: 01 45 51.0
Epicenter: 33.02 N., 115.53 W.
Depth: 5 km
Magnitude: 2.5 ML
Intensity II: Brawley.

11 February (P) Imperial Valley
Origin time: 02 25 51.4
Epicenter: 33.02 N., 115.53 W.
Magnitude: 3.1 ML
Depth: 6 km
Intensity III: Brawley.

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

California--Continued

13 February (P) Southern California
Origin time: 18 04 06.3
Epicenter: 34.02 N., 117.22 W.
Depth: 6 km
Magnitude: 2.9 ML
Intensity II: Redlands.

14 February (B) Northern California
Origin time: 16 33 46.8
Epicenter: 38.42 N., 122.66 W.
Depth: 9 km
Magnitude: 2.8 ML
Intensity II: Santa Rosa.

14 February (B) Northern California
Origin time: 20 03 09.5
Epicenter: 38.42 N., 122.66 W.
Depth: 9 km
Magnitude: 2.5 ML
Intensity II: Santa Rosa.

14 February (B) Northern California
Origin time: 21 03 55.8
Epicenter: 40.20 N., 124.00 W.
Depth: 10 km
Magnitude: 3.0 ML
Intensity IV: Rio Dell.
Intensity III: Ferndale, Fortuna.

23 February (P) Imperial Valley
Origin time: 16 43 03.7
Epicenter: 32.82 N., 115.60 W.
Depth: 19 km
Magnitude: 3.6 ML
Intensity V: Seeley (felt by all; windows, doors, dishes rattled; hanging pictures swung, hanging objects swung slightly).
Intensity IV: Imperial.

1 March (P) Southern California
Origin time: 04 54 31.2
Epicenter: 34.53 N., 116.77 W.
Depth: 5 km
Magnitude: 4.4 ML, 4.4 ML(B)
Intensity VI: White Water (cracked plaster; light furniture shifted).
Intensity V: Colton, Fawnskin, Highland.
Intensity IV: Angelus Oaks, Apple Valley, Big Bear City, Bryn Mawr, Chino, Crestline, Etiwanda, Green Valley Lake, Montrose, Mount Baldy, Palomar Mountain, Rimforest, San Bernardino, Twin Peaks.
Intensity III: Barstow, Big Bear Lake, Crest Park, Del Rosa, Lake Arrowhead, Lucerne Valley, Newberry Springs, Norton AFB, Victorville (press report).
Intensity II: Azusa, Blue Jay, Burbank, Daggett, West Covina (press report), Wrightwood.

California--Continued

8 March (P) Southern California
Origin time: 14 49 34.9
Epicenter: 33.83 N., 117.88 W.
Depth: 5 km
Magnitude: 2.9 ML
Intensity IV: Anaheim (Brookhurst Center, Sunkist), Fullerton, Long Beach, Orange, Placentia, Santa Ana, Westminster.
Intensity III: Brea (press report), Buena Park (press report), Cypress (press report), Garden Grove, La Mirada, Midway City, Stanton, Sunny Hills, Tustin (press report), Yorba Linda.

11 March (G) Baja California
Origin time: 23 57 46.8

See Arizona listing.

12 March (G) Baja California
Origin time: 00 30 15.7

See Arizona listing.

12 March (G) Baja California
Origin time: 18 42 24.3

See Arizona listing.

13 March (P) Southern California
Origin time: 16 38 15.7
Epicenter: 33.93 N., 117.98 W.
Depth: 4 km
Magnitude: 3.2 ML
Intensity VI: La Mirada (cracked plaster).
Intensity V: Buena Park, La Habra, Surfside.
Intensity IV: Anaheim (press report), Bellflower, Fullerton, Perry, Pico Rivera, Whittier.
Intensity III: Alhambra, Brea (press report), Compton, Manhattan Beach, Rowland Heights.
Intensity II: La Puente, Norwalk, Santa Ana.

14 March (P) Southern California
Origin time: 16 09 51.2
Epicenter: 33.95 N., 117.97 W.
Depth: 4 km
Magnitude: 2.5 ML
Intensity IV: La Habra.
Intensity III: Fullerton, Santa Fe Springs, Whittier.

15 March (P) Imperial Valley
Origin time: 04 02 49.4
Epicenter: 32.78 N., 115.53 W.
Depth: 5 km
Magnitude: 2.9 ML
Intensity III: El Centro, Imperial (telephone report).

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

California--Continued

15 March (P) Imperial Valley
Origin time: 04 09 39.7
Epicenter: 32.78 N., 115.57 W.
Depth: 5 km
Magnitude: 3.2 ML
Intensity III: El Centro, Imperial (telephone report).

20 March (P) Southern California
Origin time: 00 07 56.7
Epicenter: 36.00 N., 117.87 W.
Depth: 1 km
Magnitude: 3.0 ML, 3.6 ML(B)
Intensity III: Haiwee Reservoir (telephone report).

21 March (B) Northern California
Origin time: 14 05 12.1
Epicenter: 40.44 N., 124.45 W.
Depth: 11 km
Magnitude: 3.5 ML
Intensity IV: Bayside, Loleta, Rio Dell, Scotia.
Intensity III: Ferndale.

26 March (B) Northern California
Origin time: 00 27 04.4
Epicenter: 39.19 N., 123.20 W.
Depth: 10 km
Magnitude: 4.9 mb(G), 4.4 ML

This earthquake was felt over an area of about 8,200 sq km centered in the Ukiah area (fig. 7).

Loss of about $10,000 from glass bottles and containers being thrown to the floor and broken was sustained by grocery and liquor stores in the Ukiah area. This earthquake triggered three accelerographs located at Coyote Dam near Ukiah (Porcella, 1978). The accelerographs are located at the center crest, center toe, and south abutment of the dam. Maximum acceleration recorded at the crest was 0.30 g, at the toe was 0.34 g, and at the south abutment was 0.20 g.

The press reported damage at a new warehouse at the Parducci Winery south of Ukiah. Huge storage tanks in the warehouse, welded to plates on the floor to hold them rigid, contained 200 tons of liquid. The liquid moved and about 1,000 gallons spilled, damaging the tanks. Liquid in free-floating tanks in another building sustained minor spillage, but there was no damage to the tanks. The drop ceiling in the new warehouse was also damaged.

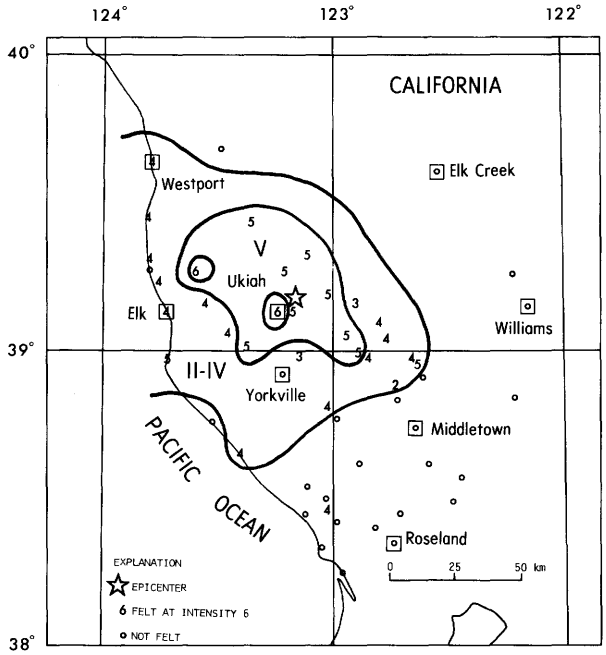

FIGURE 7.--Isoseismal map for the northern California earthquake of 26 March 1978, 00 27 04.4 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are use to represent these intensities at specific sites.

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

California--Continued

Intensity VI: Comptche (windows broken), Ukiah (pictures fell, glass bottles and jars broken in grocery and liquor stores, burglar alarm set off, damage to Parducci Winery).
Intensity V: Boonville, Clearlake Highlands, Finley, Kelseyville, Lakeport, Manchester, Potter Valley, Redwood Valley, Talmage, Willits, Witter Springs.
Intensity IV: Albion, Clearlake Park, Cloverdale, Elk, Fort Bragg, Glenhaven, Lucerne, Mendocino, Monte Rio, Navarro, Philo, Stewarts Point, Westport.
Intensity III: Hopland, Upper Lake.
Intensity II: Loch Lomond.

26 March (B) Northern California
Origin time: 00 34 11.7
Epicenter: 39.22 N., 123.18 W.
Depth: 5 km
Magnitude: 3.1 ML
Intensity IV: Talmage, Ukiah.
Intensity III: Willits.

26 March (B) Northern California
Origin time: 01 19 09.7
Epicenter: 39.19 N., 123.17 W.

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

California--Continued

Depth: 10 km
Magnitude: 3.6 mb(G), 3.6 ML
Intensity IV: Talmage, Ukiah.
Intensity III: Willits.

26 March (B) Northern California
Origin time: 02 29 16.6
Epicenter: 39.20 N., 123.23 W.
Depth: 10 km
Magnitude: 3.3ML
Intensity IV: Talmage, Ukiah.
Intensity III: Willits.

26 March (B) Northern California
Origin time: 04 28 18.7
Epicenter: 39.20 N., 123.21 W.
Depth: 10 km
Magnitude: 3.5 ML
Intensity IV: Talmage, Ukiah.
Intensity III: Comptche, Willits.

27 March (B) Northern California
Origin time: 08 44 03.0
Epicenter: 40.43 N., 124.31 W.
Depth: 14 km
Magnitude: 3.2 ML
Intensity V: Rio Dell.
Intensity IV: Ferndale, Fortuna.
Intensity III: Scotia (press report), Weotl.

Florida

12 January Central Florida
Origin time: 21 10
Epicenter: Not located.
Depth: None computed.
Magnitude: None computed.
Intensity IV: Haines City (press report).

Hawaii

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

4 January (H) Island of Hawaii
Origin time: 18 42 27.2
Epicenter: 19.33 N., 155.18 W.
Depth: 10 km
Magnitude: 3.7 ML
Intensity IV: Hilo (H).
Intensity III: Kurtistown (H), Laupahoehoe (H), Volcano (H).

5 January (H) Island of Hawaii
Origin time: 13 58 46.6
Epicenter: 19.32 N., 155.27 W.
Depth: 10 km
Magnitude: 3.2 ML
Intensity IV: Ainahou Ranch (H).

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

Hawaii--Continued

11 January (H) Island of Hawaii
Origin time: 08 33 11.3
Epicenter: 19.33 N., 155.22 W.
Depth: 10 km
Magnitude: 3.8 ML
Intensity IV: Hilo (H).
Intensity III: Glenwood (H), Hamakua (H), Mountain View (H), Puna (H), Volcano (H).

13 January (H) Island of Hawaii
Origin time: 00 34 06.1
Epicenter: 19.53 N., 155.95 W.
Depth: 10 km
Magnitude: 3.0 ML
Intensity III: Kona (H).

23 January (H) Island of Hawaii
Origin time: 06 21 38.5
Epicenter: 19.33 N., 155.06 W.
Depth: 9 km
Magnitude: 3.7 ML
Intensity IV: Glenwood (H), Hilo (H), Kalapana (H), Kurtistown (H), Mountain View (H), Volcano (H).
Intensity III: Papaikou (H).

23 January (H) Island of Hawaii
Origin time: 06 28 26.9
Epicenter: 19.34 N., 155.07 W.
Depth: 9 km
Magnitude: 3.6 ML
Intensity IV: Glenwood (H), Hilo (H), Kurtistown (H), Mountain View (H), Volcano (H).
Intensity III: Papaikou (H).

25 January (H) Island of Hawaii
Origin time: 01 18 16.8
Epicenter: 19.33 N., 155.10 W.
Depth: 9 km
Magnitude: 3.2 ML
Intensity III: Hilo (H).

3 February (H) Island of Hawaii
Origin time: 05 32 45.8
Epicenter: 19.43 N., 155.30 W.
Depth: 16 km
Magnitude: 3.5 ML
Intensity IV: Glenwood (H), Hilo (H), Kurtistown (H), Mountain View (H), Volcano (H).
Intensity III: Honomu (H), Papaikou (H).

14 February (H) Island of Hawaii
Origin time: 20 05 06.2
Epicenter: 19.40 N., 155.28 W.
Depth: 15 km
Magnitude: 3.4 ML
Intensity III: Hawaiian Volcano Observatory (H), Volcano (H).

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

Hawaii—Continued

25 February (H) Island of Hawaii
Origin time: 08 55 27.2
Epicenter: 19.44 N., 156.32 W.
Depth: 17 km
Magnitude: 3.2 ML
Intensity III: Holualoa.

2 March (H) Island of Hawaii
Origin time: 10 51 02.9
Epicenter: 19.33 N., 155.22 W.
Depth: 9 km
Magnitude: 3.7 ML
Intensity IV: Hilo (H), Volcano (H).

21 March (H) Island of Hawaii
Origin time: 05 13 25.4
Epicenter: 19.37 N., 155.42 W.
Depth: 12 km
Magnitude: 3.3 ML
Intensity III: Kukaiau Ranch.

Maine

4 January (J) Southwestern Maine
Origin time: 19 28 10.8
Epicenter: 44.04 N., 70.51 W.
Depth: 0 km
Magnitude: 3.2 mbLg, 3.2 mbLg(L)
Intensity IV: Cisco (J), Naples (press report), Otisfield (press report).
Intensity III: Harrison (J), Oxford (J), Poland (J).
Intensity II: Bridgton (J), Canton (J), Johnson Hill (J), West Poland (J).

Massachusetts

24 March (G) Southwest of Bermuda Islands
Origin time: 00 42 38.2
Epicenter: 29.86 N., 67.39 W.
Depth: 22 km
Magnitude: 6.1 mb, 6.0 MS, 6.1 MS(B), 6.0 MS(P)
Intensity IV:
Massachusetts--New Bedford.
Intensity III:
Massachusetts--Boston (press report).
North Carolina--Asheville (press report), Camp Lejune (press report), Hatteras (press report), Wake County (press report).

Montana

14 January (G) Southwestern Montana
Origin time: 16 53 50.3

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

Montana--Continued

Epicenter: 44.77 N., 111.94 W.
Depth: 5 km
Magnitude: 3.6 ML
Intensity II: Lake Village (Yellowstone National Park).

Nevada

13 January (G) Southern Nevada
Origin time: 03 39 37.0
Epicenter: 39.42 N., 117.60 W.
Depth: 5 km
Magnitude: 4.1 ML(B)
Intensity V: Austin.

14 February (G) Southern Nevada
Origin time: 04 35 24.0
Epicenter: 39.63 N., 117.18 W.
Depth: 5 km
Magnitude: 4.4 mb, 4.8 ML(B)
Intensity V: Austin, Eureka, Round Mountain, Yerington.
Intensity IV: Gabbs.
Intensity II: Manhattan.

23 February (E) Southern Nevada
Origin time: 17 00 00.164
Epicenter: 37.12 N., 116.06 W.
Depth: 0 km
Magnitude: 5.7 mb(G), 5.4 ML(B)

Nevada Test Site explosion "REBLOCHON" at 37° 07′25.24" N., 116°03′49.79" W., surface elevation 1288 m, depth of burial 658 m.

5 March (G) Northern Nevada
Origin time: 22 46 18.2
Epicenter: 38.94 N., 118.03 W.
Depth: 5 km
Magnitude: 4.0 mb, 4.6 ML(B)
Intensity V: Gabbs (small objects fell).

15 March (G) Western Nevada
Origin time: 03 09 14.9
Epicenter: 38.35 N., 118.22 W.
Depth: 5 km
Magnitude: 3.2 ML
Intensity IV: Gabbs, Luning, Mina.

23 March (E) Southern Nevada
Origin time: 16 30 00.200
Epicenter: 37.10 N., 116.05 W.
Depth: 0 km
Magnitude: 5.7 mb(G), 5.5 ML(B)

Nevada Test Site explosion "ICEBERG" at 37° 06′06.39" W., 116°03′04.13" W., surface elevation 1266 m, depth of burial 640 m.

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

New York

18 February (O) Southern Quebec
Origin time: 14 48 25.0
Epicenter: 46.35 N., 74.11 W.
Depth: 7 km
Magnitude: 4.0 mb(G), 4.0 mbLg, 3.8 mbLg(J)
Intensity V:
Quebec--Saint Donat de Montcalm region.
Intensity IV:
New York--Rouses Point.

5 March (L) Southeastern New York
Origin time: 07 53 25.6
Epicenter: 41.35 N., 74.15 W.
Depth: 5 km
Magnitude: 2.1 mbLg
Intensity III: Highland Mills (J).

North Carolina

25 February (V) Northern North Carolina
Origin time: 03 53 27.7
Epicenter: 36.19 N., 79.30 W.
Depth: 8 km
Magnitude: 2.2 mbLg
Intensity IV: Burlington.

22 March (V) Northern North Carolina
Origin time: 15 52 26.7
Epicenter: 36.20 N., 81.73 W.
Depth: 1 km
Magnitude: 2.9 mbLg

Possible explosion (V).

24 March (G) Southwest of Bermuda Islands
Origin time: 00 42 38.2

See Massachusetts listing.

Oklahoma

9 March (T) Southern Oklahoma
Origin time: 06 30 51.2
Epicenter: 34.07 N., 97.40 W.
Depth: 5 km
Magnitude: 2.5 mbLg
Intensity II: Simon area (T).

Tennessee

18 January (S) Western Tennessee
Origin time: 23 46 26.1
Epicenter: 36.25 N., 89.42 W.

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

Tennessee--Continued

Depth: 5 km
Magnitude: 2.6 mbLg
Intensity III: Ridgely (Tennessee Earthquake Information Center).

Texas

2 March (G) Southwestern Texas
Origin time: 10 04 52.7
Epicenter: 31.56 N., 102.51 W.
Depth: 11 km
Magnitude: 3.5 ML
Intensity III: Kermit (telephone report).

Utah

28 February (U) Northern Utah
Origin time: 00 20 06.5
Epicenter: 40.76 N., 112.20 W.
Depth: 14 km
Magnitude: 2.7 ML
Intensity V: Salt Lake City.
Intensity IV: Magna.
Intensity III: Tooele.
Intensity II: Farmington.

9 March (U) Northern Utah
Origin time: 06 30 51.8
Epicenter: 40.76 N., 112.08 W.
Depth: 9 km
Magnitude: 3.3 ML
Intensity VI: Magna (cracks in the exterior wall of fire station no. 2; windows broken, plaster and dry wall cracked).
Intensity V: Salt Lake City.
Intensity IV: Hooper, Murray.
Intensity III: Centerville (press report), Lincoln, Midvale.

9 March (U) Northern Utah
Origin time: 06 46 20.0
Epicenter: 40.77 N., 112.08 W.
Depth: 7 km
Magnitude: 2.5 ML
Intensity IV: Magna (press report).

13 March (U) Northern Utah
Origin time: 13 35 43.4
Epicenter: 40.76 N., 112.08 W.
Depth: 13 km
Magnitude: 2.8 ML
Intensity IV: Magna.
Intensity III: Bountiful (press report), Granger (press report), Salt Lake City (Glendale area and University of Utah Hospital--press report).
Intensity II: Midvale.

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

Virginia

17 March (V) Southwestern Virginia
Origin time: 18 26 34.5
Epicenter: 36.75 N., 80.74 W.
Depth: 7 km
Magnitude: 2.8 mbLg
Intensity IV: Galax, Hillsville, Lambsburg, Laurel Fork, Woodlawn.
Intensity III: Dugspur.
Intensity II: Austinville, Independence.

Washington

5 March (W) Puget Sound area
Origin time: 18 13 35.9
Epicenter: 48.06 N., 123.00 W.
Depth: 57 km
Magnitude: 4.0 mb(G), 3.3 ML(G)
Intensity IV: Nordland.
Intensity III:
British Columbia--Victoria (telephone report).
Washington--North Seattle (telephone report), Oak Harbor (telephone report).
Intensity II: Hansville.

11 March (W) Puget Sound area
Origin time: 15 52 11.2
Epicenter: 47.42 N., 122.71 W.
Depth: 25 km
Magnitude: 4.3 mb(G), 4.8 ML, 3.2 MS(G)

This earthquake was felt over an area of 20,000 sq km of northwest Washington (fig. 8).

Intensity VI: Crystal Mountain Ski Resort (crack in rock and mortar wall at the Summit House; open beams supporting the roof moved 1-2 cm), Freeland (cracked plaster), Grotto (cracked plaster), Longbranch (cracked plaster and windows).
Intensity V: Ashford, Bremerton, Centralia, Dockton, Enumclaw, Everett, Federal Way, Hobart, Issaquah, La Grande, Leavenworth, Olympia, Port Orchard, Poulsbo, Preston, Redondo, Ronald, Seabeck, Seattle, Snoqualmie Pass, South Colby, Tacoma.
Intensity IV: Aberdeen, Allyn, Anderson Island, Baring, Belfair, Blakely Island, Brinnon, Burley, Cinebar, Clearlake, Des Moines, East Olympia, Eatonville, Fort Lewis (Gray Army Airfield), Fox Island, Gig Harbor, Glenoma, Hadlock, Hoodsport, Indianola, Kapowsin, Kent, La Conner, Lakebay, Little Rock, Lyman, Lynnwood, McKenna, Medina, Milton, Mukilteo, Olalla, Olga, Orting, Pacific, Parkland, Port

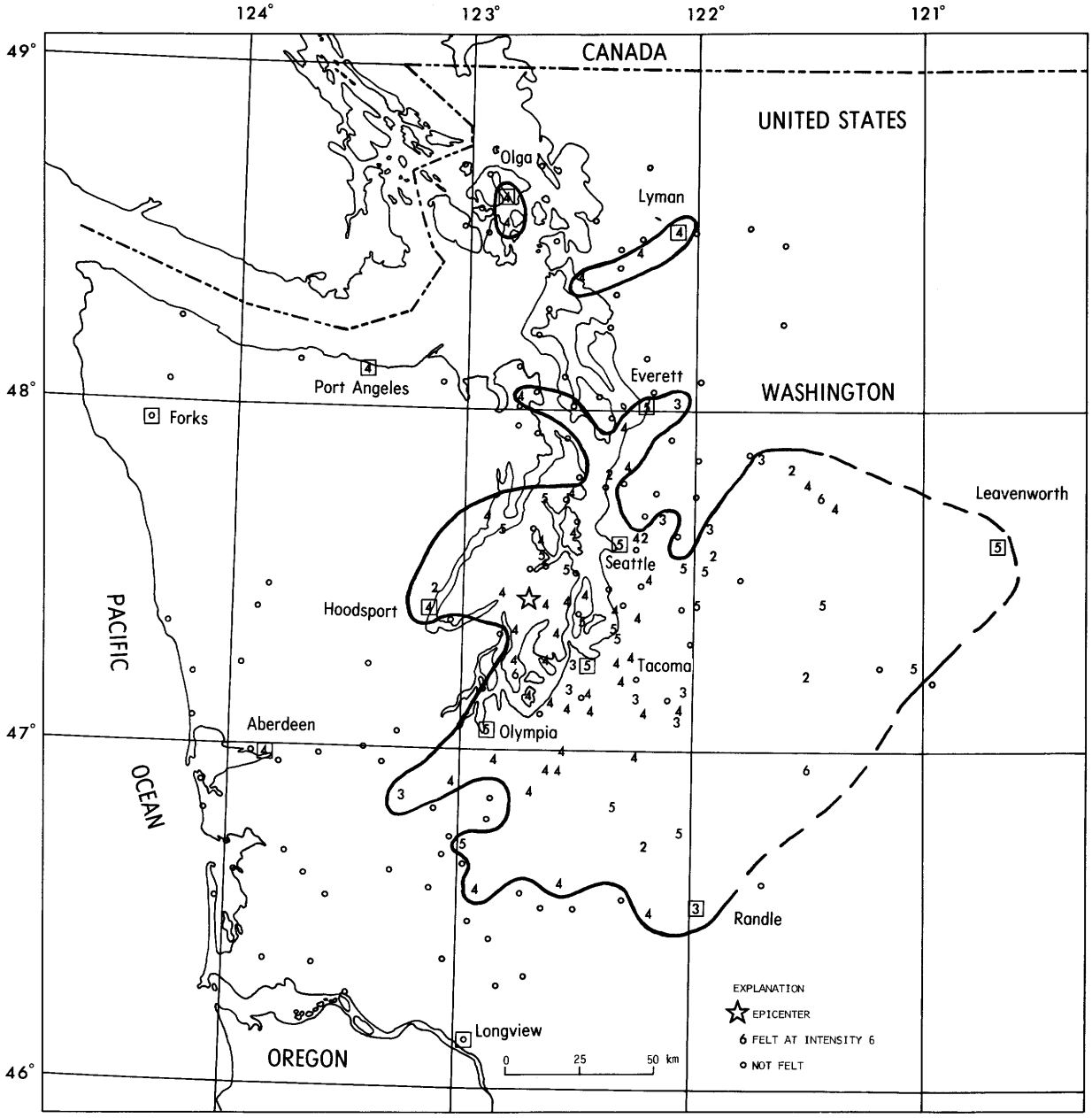

FIGURE 8.—Isoseismal map for the Puget Sound, Washington, earthquake of 11 March 1978, 15 52 11.2 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites. Dashed line indicates the isoseismal is not well defined by the data.

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

Washington--Continued

Angeles, Proctor, Puyallup, Ranier, Renton, Roy, Skykomish, Spanaway, Tillicum, Tracyton, Union, Vashon, Vaughn, Wilkeson, Winslow, Yelon.

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

Washington--Continued

Intensity III: Buckley, Carbonado, Carnation, Fircrest, Fort Lewis, Gold Bar, Lake Stevens, Lakewood Center, McMillin, Napavine, Oakville, Randle, Redmond,

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

Washington--Continued

Wallingford, Wenatchee (press report).
Intensity II: Bellevue, Edmonds, Fall City, Forest Park, Index, Lester, Lilliwaup, Mineral.

29 March (W) Northwest Washington
Origin time: 12 16 38.4
Epicenter: 48.20 N., 122.76 W.
Depth: 24 km
Magnitude: 2.7 ML(G)
Intensity IV: Oak Harbor.

31 March (W) Puget Sound area
Origin time: 08 03 00.2
Epicenter: 47.42 N., 122.72 W.
Depth: 23 km
Magnitude: 4.2 ML(G)

This earthquake was felt over an area of 7,000 sq km of the Puget Sound area (fig. 9).
Intensity V: Bremerton (hairline cracks in exterior walls), Brinnon, Chimacum, Hadlock, Manchester, Olalla, Port Orchard, Port Ludlow, Poulsbo, Quilcene, Rollingbay, Seabeck, Seattle, Tacoma, Tracyton, Union.
Intensity IV: Auburn, Baring, Belfair, Bellevue, Burley, Crystal Mountain, Dockton, Fircrest, Fox Island, Hansville, Index, Indianola, Kapowsin, Kingston, Lilliwaup, Matlock, Medina, Olympia, Puyallup, Ravensdale, Tahuya, Vaughn.
Intensity III: La Grande.
Intensity II: Carnation, Nordland.

Wyoming

13 January Yellowstone National Park

Seven earthquakes were felt in the eastern part of the park from January 13 to 21. The largest magnitude of these quakes was about 1.8 ML. They were felt at Canyon Village and Lake, with the smaller magnitude events only being felt at Lake. Maximum intensity was IV.

16 January (G) Southeast Wyoming
Origin time: 03 50 03.1
Epicenter: 42.43 N., 105.31 W.
Depth: 5 km
Magnitude: 3.0 ML
Intensity III: 14.5 km north of Laramie, Wheatland (telephone report).

Table 2.--Summary of macroseismic data for U.S. earthquakes, January-March 1978

Wyoming--Continued

2 February (G) Yellowstone National Park
Origin time: 00 36 25.6
Epicenter: 44.39 N., 110.81 W.
Depth: 5 km
Magnitude: 3.6 mb, 3.4 ML, 3.6 ML(D)
Intensity III: Old Faithful. (Shocks at 00 49 01.4 and 04 30 25.9 with magnitudes of 2.8 ML and 2.6 ML were also felt.)

2 February (G) Yellowstone National Park
Origin time: 12 35 56.2
Epicenter: 44.38 N., 110.83 W.
Depth: 4 km
Magnitude: 3.3 mb, 3.1 ML, 3.5 ML(D)
Intensity III: Old Faithful.

7 March (G) Yellowstone National Park
Origin time: 01 10 47.6
Epicenter: 44.43 N., 110.84 W.
Depth: 5 km
Magnitude: 3.7 mb, 3.5 ML, 3.8 ML(D)

From March 7 at 01 09 UTC, to 18 30 UTC, a swarm of 129 tremors was felt at Old Faithful. This series was known to have immediately induced minor changes in the thermal activity in the Upper Geyser Basin. These included increased turbidity in Heart Spring and Calida, and more vigorous splashing in Tea Kettle, with a rise in water level.

No changes in thermal activity occurred at the Norris Geyser Basin for 2.5 days after the swarm. But by March 23 Palpitar Spring had drained and the algae had died. At Steamboat Geyser minor eruptions appeared to have greater volume, and on March 28 the geyser had its first major eruption in 9 years. Runoff and sinter deposition at Cistun Springs had shifted from the west side of the pool to the southeast side, where two small trees were dying from the hot water (R. A. Hutchinson, National Park Service, written commun., 1978).

Intensity V: Old Faithful.

7 March (G) Yellowstone National Park
Origin time: 07 39 33.1
Epicenter: 44.30 N., 110.92 W.
Depth: 5 km
Magnitude: 3.8 mb, 3.1 ML
Intensity IV: Old Faithful.

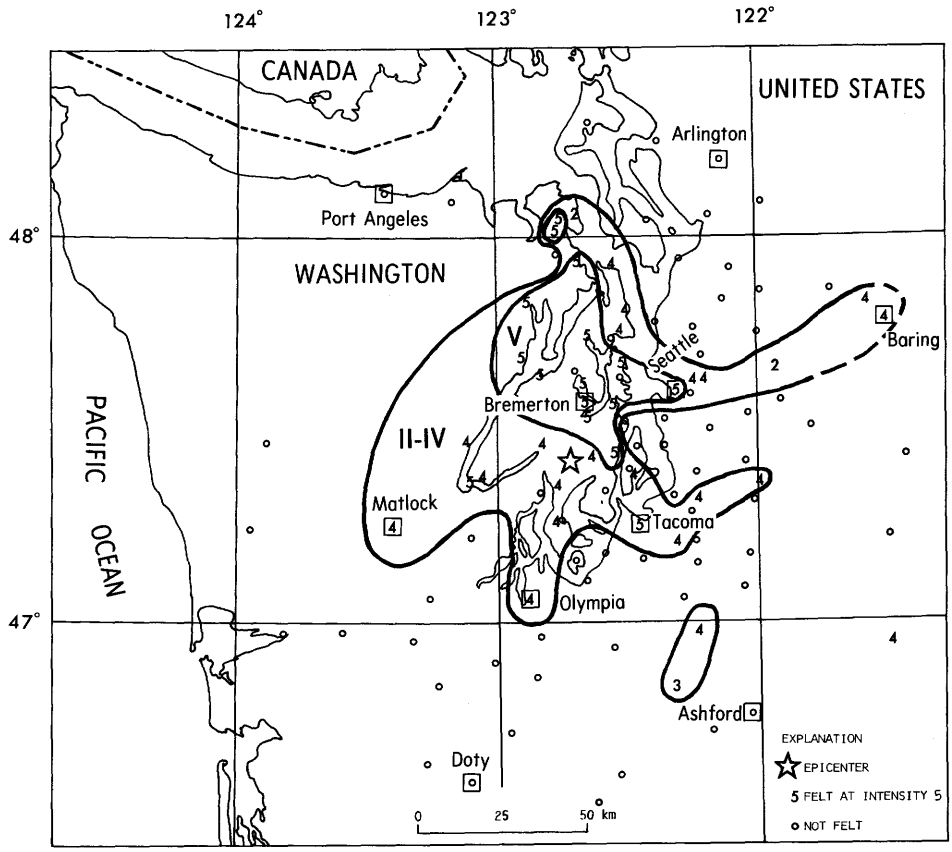

FIGURE 9.--Isoseismal map for the Puget Sound, Washington, earthquake of 31 March 1978. 08 03 00.2 UTC. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals are used to represent these intensities at specific sites. Dashed line indicates the isoseismal is not well definded by the data.

ACKNOWLEDGMENTS

Listed below are the collaborators who furnished data to the National Earthquake Information Service for use in this Circular:

ALASKA: Staff of National Oceanic and Atmospheric Administration, Alaska Tsunami Warning Center, Palmer.

CALIFORNIA: Clarence R. Allen, Seismological Laboratory, California Institute of Technology, Pasadena.
Bruce A. Bolt, Seismograph Station, University of California, Berkeley.

HAWAII: Robert Y. Koyanagi, U.S. Geological Survey, Hawaiian Volcano Observatory, Hawaii National Park.

MASSACHUSETTS: Edward F. Chiburis, Weston Observatory, Weston.

MISSOURI: Otto Nuttli, Department of Geology and Geophysics, St. Louis University, St. Louis.

MONTANA: Anthony Qamar, University of Montana, Missoula.

NEW YORK: Lynn R. Sykes and Yash P. Aggarwal, Lamont-Doherty Geological Observatory, Columbia University, Palisades.

OKLAHOMA: James E. Lawson, Jr., Earth Sciences Observatory, University of Oklahoma, Leonard.

UTAH: Department of Geological and Geophysical Sciences, University of Utah, Salt Lake City.

VIRGINIA: G. A. Bollinger, Department of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg.

WASHINGTON: Robert S. Crosson, Geophysics Program, University of Washington, Seattle.

Acknowledgment is also given to Paula Smith for aid in editing the manuscript, drafting the isoseismal maps, and preparing the computerized manuscript.

REFERENCES CITED

Bath, Markus, 1966, Earthquake energy and magnitude, in Physics and chemistry of the Earth, Volume 7: Oxford and New York, Pergamon Press, p. 115-165.

Gutenberg, B. and Richter, C. F., 1956, Magnitude and energy of earthquakes: Annali di Geofisica, v. 9, no. 1, p. 1-15.

Nuttli, O. W., 1973, Seismic wave attenuation and magnitude relations for eastern North America: Journal of Geophysical Research, v. 78, no. 5, p. 876-885.

Porcella, R. L., 1978, Recent strong-motion records, Seismic Engineering Program report, January-April 1978: U.S. Geological Survey Circular 785-A, p. 1.

Richter, C. F., 1958, Elementary seismology: San Francisco, Calif., W. H. Freeman and Co., Inc., 768 p.

Wood, H. O., and Neumann, F., 1931, Modified Mercalli Intensity Scale of 1931: Bulletin of the Seismological Society of America, v. 21, no. 4, p. 277-283.